Appendix H

Alternative and Options Report

Let's GET Wellington MOVING

27 October 2021

Thorndon Quay Hutt Road

Alternative and Options Report

WAKA KOTAHI NZ TRANSPORT AGENCY
greater WELLINGTON REGIONAL COUNCIL Te Pane Matua Taiao
Absolutely Positively Wellington City Council Me Heke Ki Pōneke

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1 Executive Summary

1.1 Introduction

Thorndon Quay Hutt Road (TQHR) is part of the Let's Get Wellington Moving (LGWM) three-year programme and is being progressed through a Single Stage Business Case (SSBC) process. The priorities for the three-year programme are to make travel by bus to and through the central city faster and more reliable, and to create a better environment for people walking and on bikes. Thorndon Quay and Hutt Road is the busiest bus route outside of the city centre and the busiest route in the city for people cycling to and from work.

The changes to Thorndon Quay and Hutt Road are needed to improve safety, give buses greater priority and provide better walking and cycling facilities. With a growing number of people expected to live and work in the Wellington region, more people will want to walk, cycle or take the bus instead of going by car. Te Ara Tupua, the planned shared path between Ngauranga and Petone, will enable more people to walk and cycle between the Hutt Valley and Wellington.

This report summarises the multi-criteria assessment (MCA) of the shortlist options to arrive at the preferred option. It builds on the options development and shortlisting process documented in the earlier Long List to Short List Report[1].

The report starts with an introduction to LGWM and the TQHR project. It summarises the background to the short list MCA, including the problems, benefits and investment objectives as well as summarising the option development and shortlisting process. Transport modelling undertaken for the short list options is presented. The main body of the report discusses the MCA process for the shortlist options, summarises the public and stakeholder engagement process, followed by presenting indicative cost estimates and a preliminary economic assessment of the short list options. Finally, the report recommends a preferred option to advance in the SSBC.

1.2 Background

1.2.1 Problems

The following problem statements were defined from previous consultation and evidence.

PROBLEM ONE
Unreliable bus travel times result in a poor customer experience for existing and potential bus users which reduces the attractiveness of and ability to grow travel by bus.
PROBLEM TWO
The current state of cycling facilities results in conflict between users, increases risk and limits cycling attractiveness for increasing volumes of cyclists.
PROBLEM THREE
Poor quality of the street environment creates an unpleasant experience for a growing volume of people reducing its attractiveness to walk and spend time in the area.
PROBLEM FOUR
High and growing traffic volumes combined with high speeds increases the likelihood and severity of crashes on Hutt Road.

[1] Thorndon Quay Hutt Road Long to Short List Report, LGWM, November 2020

1.2.2 Benefits of Investment

By addressing the problems, the following potential benefits of investing in transport improvements for the TQHR corridor were identified:

Improve the reliability and attractiveness of bus travel

Improve the quality and safety of walking and cycling facilities

Reduce frequency and severity of crashes along Hutt Road

Improve the place quality of Thorndon Quay

Maintain access for freight and the ferry terminal

1.3 Investment Objectives

The TQHR project has five Investment Objectives which build on the identified problems and benefits for the corridor:

i Improve level of service for bus users including improved access, journey times and reliability. Provide sufficient capacity for growth in public transport

ii Improve level of service, and reduce the safety risk, for people walking and cycling along and across Thorndon Quay and Hutt Road

iii Reduce the frequency and severity of crashes

iv Improve the amenity of Thorndon Quay to support the current and future place aspirations for the corridor/area

v Maintain similar access for people and freight to the ferry terminal

The freight investment objective recognises the need to maintain the freight and people access to the ferry terminal and Centreport while making longer-term investments in other modes along Hutt Road and Thorndon Quay.

1.4 Options Short List

The long list to short list assessment process[2] arrived at four core options for short list assessment. The key elements which make up the short list options include whether to provide bus lanes in southbound direction only or both northbound and southbound, as well whether to provide a unidirectional or bidirectional cycleway along the corridor.

The four short list options (summarised in the table on the following page) also included special vehicle or bus lanes on Hutt Road to improve the level of service for bus users and to maintain similar access for freight to the port from the north. The special vehicle lane is a traffic lane which is expected to be used by buses and trucks for the purpose of this assessment.

The long list assessment found that the provision of a special vehicle or bus lane on Hutt Road added additional risks to right turning traffic and had the potential to mask motorcyclists that would share the lane with buses. Vehicles exiting properties may not see motorcyclists travelling behind or close to buses when they share the lane. To mitigate this risk, a left in / left out option and a service lane suboption were developed and included in the short list as two sub-options to each

[2] Thorndon Quay Hutt Road Long to Short List Report, November 2020

main option (suboptions A and B). Suboption A also included a new roundabout on Aotea Quay to provide a turnaround facility for trucks which may be impacted by the left in / left out arrangement on Hutt Road.

The short list options and suboptions are summarised below.

Table 1: Short List Options

Option	Elements			Common Elements
	Thorndon Quay Bus Lanes	Thorndon Quay Cycle Lanes	Hutt Road Special Vehicle Lanes	
Option 1: Southbound bus lanes with Thorndon Quay bidirectional cycleway	Southbound	Bi-directional	Southbound	▪ Removal of angle parking on Thorndon Quay to improve safety ▪ Speed limit review ▪ Intersection upgrades ▪ Pedestrian Crossing Improvements ▪ Bus stop rebalancing ▪ Thorndon Quay amenity improvements
Option 1A: Southbound bus lanes with Thorndon Quay bidirectional cycleway	Option 1 plus: • Left-in / Left-out on Hutt Road (central median) • Construct a roundabout on Aotea Quay			
Option 1B: Southbound bus lanes with Thorndon Quay bidirectional cycleway	Option 1 plus: • Creation of a service lane on east side of Hutt Road (between Onslow and Kaiwharawhara) • Signalise Kaiwharawhara and Onslow Road intersections			
Option 2: Southbound and Northbound bus lanes with Thorndon Quay unidirectional cycleway	Both directions	Uni-directional	Both directions	
Option 2A: Southbound and Northbound bus lanes with Thorndon Quay unidirectional cycleway	Option 2 plus the same variants as for Option 1A			
Option 2B: Southbound and Northbound bus lanes with Thorndon Quay unidirectional cycleway	Option 2 plus the same variants as for Option 1B			
Option 3: Southbound bus lanes with Thorndon Quay unidirectional cycleway	Southbound	Uni-directional	Southbound	
Option 3A: Southbound bus lanes with Thorndon Quay unidirectional cycleway	Option 3 plus the same variants as for Option 1A			
Option 3B: Southbound bus lanes with Thorndon Quay unidirectional cycleway	Option 3 plus the same variants as for Option 1B			
Option 4: Southbound and Northbound bus lanes with Thorndon Quay bidirectional cycleway	Both directions	Bi-directional	Both directions	
Option 4A: Southbound and Northbound bus lanes	Option 4 plus the same variants as for Option 1A			

Option	Elements			Common Elements
	Thorndon Quay Bus Lanes	Thorndon Quay Cycle Lanes	Hutt Road Special Vehicle Lanes	
with Thorndon Quay bidirectional cycleway				
Option 4B: Southbound and Northbound bus lanes with Thorndon Quay bidirectional cycleway	Option 4 plus the same variants as for Option 1B			

1.5 Multi-Criteria Assessment of Short List Options

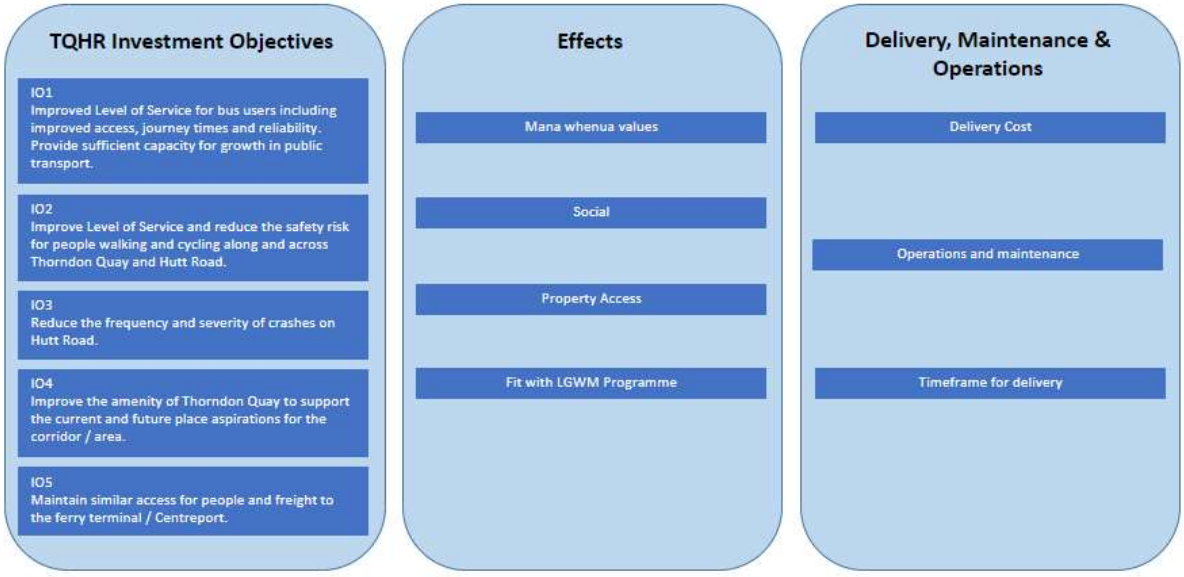
The short list options were taken through an MCA process in two stages. The first (or 'interim') MCA was undertaken in late 2020 to allow development of a technically preferred option to advance while the wider LGWM programme was being reviewed. The second MCA was undertaken in June 2021 to consider engagement feedback and an assessment against mana whenua values, which were still under development when the interim MCA was undertaken.

1.5.1 MCA Criteria

The short list MCA included an assessment of the options against their contribution to the investment objectives, effects and delivery, maintenance and operations criteria.

The main topics included in each of these areas are summarised below (note that mana whenua values were not included in the interim MCA):

Figure 1: MCA Criteria



1.5.2 Interim MCA Summary

The highest scoring options from the interim MCA were Options 4A and 4B.

While Options 4A and 4B scored similarly overall, the provision of a service road (suboption B) was discounted as being more disruptive, fit less with other regional projects and carried larger implementation risk.

The provision of bidirectional or unidirectional cycling facilities was also discussed. It was noted that the provision of a bidirectional cycleway (i.e. Options 1 or 4) should be aligned with the wider LGWM programme as there are bidirectional facilities planned to the north and south of the TQHR corridor. This would provide a consistent cycle path and ease of connection.

It was also noted that while both unidirectional and bidirectional cycle facilities would improve safety and level of service, unidirectional cycleways (Options 2 or 3) scored better for safety, due to less risk with cyclists travelling with the direction of general traffic.

Following the interim MCA workshop, the Technical Advisory Group (TAG) met to discuss a recommended option. The TAG supported the highest scoring option of 4A while noting the additional safety risks inherent with bidirectional cycleways which will require consideration in the design phase.

The TAG recommended that Option 4A was the best option to take forward as the interim preferred option. This decision was supported by the LGWM Programme Steering Group.

1.6 Stakeholder and Public Engagement

Engagement on the preferred option was undertaken from 10 May to 8 June 2021. The engagement strategy and activities were led by LGWM with support from the TQHR project team. Stakeholders and the public were consulted on the interim preferred option for the TQHR project as well as WCC's intention to change angle parking to parallel parking on Thorndon Quay ahead of other changes to improve safety for cycling.

LGWM received 1,613 submissions on the proposal. Of those who submitted, 72% of the respondents said it was important or very important to make improvements for people walking, riding bikes and using the bus on Thorndon Quay and Hutt Road. LGWM produced an engagement summary report[3] which is available on the LGWM website.

Pedestrians, bus users, cyclists, people who use e-scooters as well as people who travel through and visit the area generally felt that the proposal would have a positive impact. Submissions from people who drive cars, trucks, motorcyclists and those that lived in the area or had a disability had a mixed response about the impacts of the proposal. Business owners and people that worked in the area felt that changes would have a negative impact.

Around 70% of respondents said the changes on Hutt Road and the changes on Thorndon Quay would have positive or very positive impacts for people walking, people in buses, and people on bikes. People's feedback was mixed on what they thought the impacts would be for people driving, people who live, work or own a business on these streets, or people with a disability.

There were a number of common themes received from submissions regarding changes to be considered when further developing the proposal. Changes to be considered along Thorndon Quay include:

- The impacts on commercial delivery vehicles

[3] May-June 2021 Hutt Road / Thorndon Quay Engagement, Data Analysis Report, 29 June 2021

- Drop-off parking to be made available
- Safety for pedestrians crossing the street, especially small children
- Impact to businesses in a tough retail environment
- Bus stop locations to be outside or close to key destinations

Changes to be considered along Hutt Road include:

- Allowing safe vehicle access into and out of properties around pedestrians and cyclists
- Increase the width of the bike lane
- Address concerns from businesses about how their customers will access their business if they cannot make a right turn

1.7 Final MCA

Following the close of stakeholder and public engagement, a second MCA workshop was held on 30 June 2021. The purpose of this workshop was to consider the impact of engagement feedback on the interim MCA scores, update scores based on any further information, as well as to incorporate the mana whenua values assessment into the MCA.

-The delivery team noted that since the interim MCA, some preliminary design of Option 4A had progressed, including more detailed evaluation of the available width on Hutt Road and desired width for the various modes. Based on this further work, the delivery team considered that the service lane 'B' suboption does not physically fit within the corridor and property acquisition would be necessary. Discussion at the workshop confirmed that the delivery score for the service lane should be reduced to -5 (the lowest score possible).

As buildings would require alteration or demolition to implement the service lane suboptions, it was agreed that the service lane options, despite the scoring, should no longer be progressed due to the disproportionate cost and effect of land acquisition.

The introduction of the mana whenua values scores and the reduction of the delivery score for the service lane suboptions changed the relativity between options compared to the interim MCA. Options 4A and 4B still scored the highest, similar to the interim MCA. This scoring does not reflect the decision that the service lane suboptions should no longer be progressed. Option 4A is therefore recommended as the preferred option.

1.8 Indicative Costs and Economic Assessment

Indicative costs were assessed for the range of options. The P50 (50th Percentile) costs range from $23M to $28M. The P95 (95th Percentile) costs range from $30M to $41M. The indicative BCR's for the options range from 1.2 to 3.4.

1.9 Conclusion and Next Steps

The interim MCA found that Option 4A was the technically preferred option. Engagement with stakeholders and the public found that this option was supported by the majority of respondents. The final MCA, having considered the engagement feedback and included an assessment of the shortlist options against mana whenua values, also found that Option 4A was the preferred option.

This option includes northbound and southbound peak period bus lanes on Thorndon Quay and peak period special vehicle lanes on Hutt Road to be used by buses and freight (with these lanes reverting to parallel parking off peak), a bidirectional cycleway and a range of other safety improvements for the corridor, as well as a roundabout on Aotea Quay.

This option will be advanced to the SSBC, including preliminary design, more detailed cost estimation and economic assessment and development of the business case.

2 Introduction

This report summarises the alternatives and options assessment as well as the multi-criteria assessment (MCA) of the short list options to arrive at the preferred option. It builds on the options development and shortlisting process documented in the earlier Long List to Short List Report[4].

The report starts with an introduction to Let's Get Wellington Moving (LGWM) and the Thorndon Quay Hutt Road (TQHR) project. It summarises the background to the short list MCA, including the problems, benefits and investment objectives as well as summarising the option development and shortlisting process. Transport modelling undertaken for the short list options is presented. The main body of the report discusses the MCA process for the short list options, summarises the public and stakeholder engagement process, followed by presenting indicative cost estimates and a preliminary economic assessment of the short list options. Finally, the report recommends a preferred option to advance to the SSBC.

2.1 Let's Get Wellington Moving Programme

LGWM is a joint initiative between Wellington City Council, Greater Wellington Regional Council, and Waka Kotahi. LGWM seeks to deliver an integrated transport system that supports the community's aspirations for how Wellington City will look, feel and function. The LGWM focus area is from Ngauranga Gorge to the Airport, including the Wellington Urban Motorway and connections to the central city, hospital, and the eastern and southern suburbs. The LGWM programme objectives are:

2.2 Thorndon Quay Hutt Road Project

TQHR is part of the LGWM three-year programme and is being progressed through a Single Stage Business Case process.

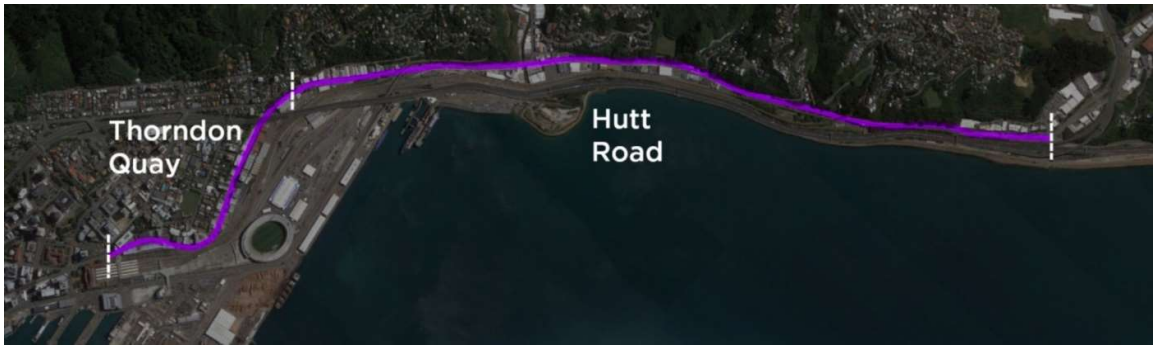
The priorities for the three-year programme are to make travel by bus to and through the central city faster and more reliable, and to create a better environment for people walking and on bikes. Thorndon Quay and Hutt Road is the busiest bus route outside of the city centre and the busiest route in the city for people cycling to and from work.

The changes to Thorndon Quay and Hutt Road are needed to improve safety, give buses greater priority and provide better walking and cycling facilities. With a growing number of people expected to live and work in the Wellington region, more people will want to walk, cycle or take the bus instead of going by car. Te Ara Tupua, the planned shared path between Ngauranga and Petone, will enable more people to walk and cycle between the Hutt Valley and Wellington.

The TQHR project area is shown in Figure 2 below.

[4] Thorndon Quay Hutt Road Long to Short List Report, LGWM, November 2020

Figure 2: TQHR Project Area



3 Background

3.1 Problems

The following problem statements were defined from previous consultation and evidence.

PROBLEM ONE
Unreliable bus travel times result in a poor customer experience for existing and potential bus users which reduces the attractiveness of and ability to grow travel by bus.
PROBLEM TWO
The current state of cycling facilities results in conflict between users, increases risk and limits cycling attractiveness for increasing volumes of cyclists.
PROBLEM THREE
Poor quality of the street environment creates an unpleasant experience for a growing volume of people reducing its attractiveness to walk and spend time in the area.
PROBLEM FOUR
High and growing traffic volumes combined with high speeds increases the likelihood and severity of crashes on Hutt Road.

3.2 Benefits of Investment

By addressing the problems, the following potential benefits of investing in transport improvements for the TQHR corridor were identified:

Improve the reliability and attractiveness of bus travel

Improve the quality and safety of walking and cycling facilities

Reduce frequency and severity of crashes along Hutt Road

Improve the place quality of Thorndon Quay

Maintain access for freight and the ferry terminal

3.3 Investment Objectives

The TQHR project has five Investment Objectives which build on the identified problems and benefits for the corridor:

i Improve level of service for bus users including improved access, journey times and reliability. Provide sufficient capacity for growth in public transport

ii Improve level of service, and reduce the safety risk, for people walking and cycling along and across Thorndon Quay and Hutt Road

iii Reduce the frequency and severity of crashes

iv Improve the amenity of Thorndon Quay to support the current and future place aspirations for the corridor/area

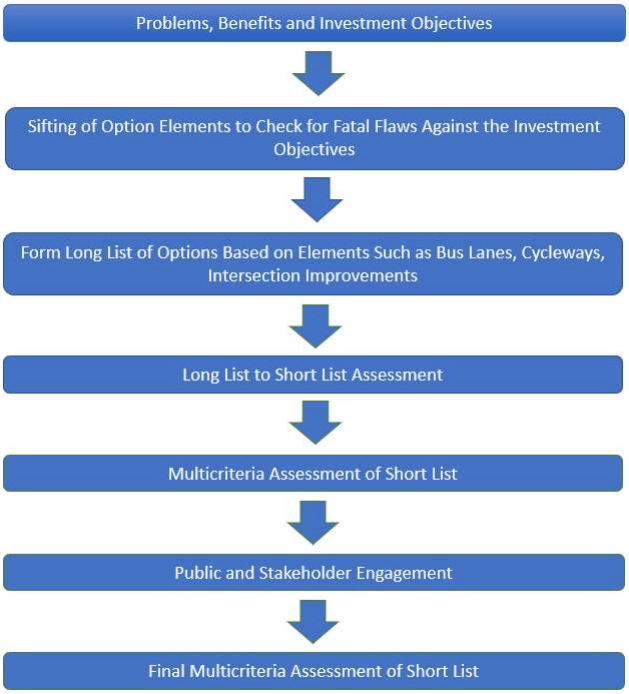
v Maintain similar access for people and freight to the ferry terminal

The freight investment objective recognises the need to maintain the freight and people access to the ferry terminal and Centreport while making longer-term investments in other modes along Hutt Road and Thorndon Quay.

3.4 Options Development, Long List Assessment and Options Short List

The TQHR project used a multi-stage process to develop and assess options. This process is summarised in the diagram below.

Figure 3: Options Development and Assessment Process



The problems, benefits and investment objectives, as well as assessment of evidence and feedback from previous stakeholder engagement was used to develop a long list of elements (for example bus lanes, cycleway options, improvements to intersections and pedestrian crossings) which could be packaged to form options for the TQHR corridor. The long list of elements is documented in the Long List to Short List Report. These elements were checked for fatal flaws against the investment objectives. Some elements did not proceed, such as:

- Removing zebra crossings and replacing with refuge islands. These were excluded because zebra crossings have greater safety benefits.
- Installing traffic signals at the Davis Street intersection. This was excluded because it would increase bus travel times. Introducing further delay on the Thorndon Quay section of the route is not in alignment with the investment objectives which is to improve the level of service for bus users
- Building a roundabout at the Tinakori Road intersection. This was excluded because it would increase bus travel times by introducing delay to flows on Thorndon Quay.

The remaining elements were packaged into a long list of options and then assessed using the LGWM MCA process to arrive at four options for short list assessment. The key elements which make up the short list options include whether to provide bus lanes in southbound direction only or both northbound and southbound, as well whether to provide a unidirectional or bidirectional cycleway along the corridor.

The four short list options also included special vehicle or bus lanes on Hutt Road to improve the level of service for bus users and to maintain similar access for freight to the port from the north. A special vehicle lane is a traffic lane which can be used only by buses, or buses and trucks, or trucks and high occupancy vehicles (buses and cars with multiple occupancy).

The long list assessment found that the provision of a special vehicle or bus lane on Hutt Road added additional risks to right turning traffic and had the potential to mask motorcyclists that would share the lane with buses. Vehicles exiting properties may not see motorcyclists travelling behind or close to buses when they share the lane. To mitigate this risk, a left in / left out option and a service lane suboption were developed and included in the short list as two sub-options to each main option (suboptions A and B). Suboption A also included a new roundabout on Aotea Quay5 to provide a turnaround facility for trucks which may be impacted by the left in / left out arrangement on Hutt Road.

The short list options and suboptions are summarised below. Diagrams of the short list options are contained in Appendix A.

Table 2: Shortlist Options

<table>
<tr><th rowspan="2">Option</th><th colspan="3">Elements</th><th rowspan="2">Common Elements</th></tr>
<tr><th>Thorndon Quay Bus Lanes</th><th>Thorndon Quay Cycle Lanes</th><th>Hutt Road Special Vehicle Lanes</th></tr>
<tr><td>Option 1: Southbound bus lanes with Thorndon Quay bidirectional cycleway</td><td>Southbound</td><td>Bi-directional</td><td>Southbound</td><td rowspan="3">▪ Removal of angle parking on Thorndon Quay to improve safety
▪ Speed limit review
▪ Intersection upgrades</td></tr>
<tr><td>Option 1A: Southbound bus lanes with Thorndon Quay bidirectional cycleway</td><td colspan="3">Option 1 plus:
• Left-in / Left-out on Hutt Road (central median)
• Construct a roundabout on Aotea Quay</td></tr>
<tr><td>Option 1B: Southbound bus lanes with Thorndon</td><td colspan="3">Option 1 plus:</td></tr>
</table>

[5] *It should be noted that, whilst this roundabout requires property acquisition, the disbenefits identified in the long list to short list report for property acquisition do not apply for this property as it does not affect buildings, amenity or vegetation. It was agreed that this option should therefore be short-listed, particularly given the safety and freight benefits of this option.*

Quay bidirectional cycleway	• Creatin of a service lane on east side of Hutt Road (between Onslow and Kaiwharawhara) • Signalise Kaiwharawhara and Onslow Road intersections			▪ Pedestrian Crossing Improvements ▪ Bus stop rebalancing ▪ Thorndon Quay amenity improvements
Option 2: Southbound and Northbound bus lanes with Thorndon Quay unidirectional cycleway	Both directions	Uni-directional	Both directions	
Option 2A: Southbound and Northbound bus lanes with Thorndon Quay unidirectional cycleway	Option 2 plus the same variants as for Option 1A			
Option 2B: Southbound and Northbound bus lanes with Thorndon Quay unidirectional cycleway	Option 2 plus the same variants as for Option 1B			
Option 3: Southbound bus lanes with Thorndon Quay unidirectional cycleway	Southbound	Uni-directional	Southbound	
Option 3A: Southbound bus lanes with Thorndon Quay unidirectional cycleway	Option 3 plus the same variants as for Option 1A			
Option 3B: Southbound bus lanes with Thorndon Quay unidirectional cycleway	Option 3 plus the same variants as for Option 1B			
Option 4: Southbound and Northbound bus lanes with Thorndon Quay bidirectional cycleway	Both directions	Bi-directional	Both directions	
Option 4A: Southbound and Northbound bus lanes with Thorndon Quay bidirectional cycleway	Option 4 plus the same variants as for Option 1A			
Option 4B: Southbound and Northbound bus lanes with Thorndon Quay bidirectional cycleway	Option 4 plus the same variants as for Option 1B			

4 Transport Modelling

A Transport Modelling Report was produced which documents the results of the transport modelling undertaken on the short list options. The Transport Modelling Report is contained in Appendix B.

The following conclusions have been drawn from the short list options modelling:

- The base case for bus travel time is just under 13 minutes. With the do-minimum, by 2036 the travel time for bus will be 21 minutes and 18 minutes for car and trucks[6].

[6] Table 1 of the Traffic Modelling Report (Appendix B)

- There appears to be a strong case for bus priority (southbound) in the morning peak (as per Option 1 and Option 3).
- There appears to be a case for bus priority (northbound) in the evening peak. However, the expected benefit is lower than expected benefits in the southbound morning peak. It is noted that there is potential for peak spreading[7] outside of the AM 7am – 9am peak as well.
- It is expected that with peak period bus priority, the bus journey times will be up to 10-11 minutes, which is lower than currently observed, and in the case of the morning peak period, significantly lower than the do-minimum.
- There doesn't appear to be a strong case for all-day bus priority along the corridor as the level of service (reliability) is expected to remain good in off-peak periods through to 2036. However, on Hutt Road (Ngauranga to Kaiwharawhara) it is worth considering the implementation of a Special Vehicle Lane all-day whilst there is very little congestion outside of peak periods because there is likely to be low impact to the existing traffic using this section of the corridor.
- The type of Special Vehicle Lane is a balancing act between improving reliability for buses, improving reliability for freight, managing the impact of converting a general traffic lane to a Special Vehicle Lane, and providing for a volume of traffic in the Special Vehicle Lane that does not negate its benefits.
- The roundabout at the Aotea Quay/Mainfreight entrance would be beneficial to include under all options to provide an additional access to the Interislander Ferry Terminal.
- Consider additional controlled crossing points along Thorndon Quay to reduce the spacing between the current (which will be upgraded) and proposed crossings at Tinakori Road and the motorway overpass (where bus stops are proposed). More crossings will improve the level of service by reducing the distance to walk to a formal crossing point. The provision of additional crossings is unlikely to have a significant impact on the reliability of public transport along the corridor.
- Uni-directional cycle paths on Thorndon Quay (between the motorway overpass and Thorndon Quay) may result in a poor level of service for cycling and walking due to the constrained width, hence extending the existing bi-directional cycle path is recommended through this section.
- The provision of a bi-directional path along Thorndon Quay provides a good level of service (B/C) and a higher level of service than the uni-directional cycle paths (D/E) using the Danish Cycling Level of Service method. This is primarily due to the path width and the buffer between the cycle path and the road. However, this assessment does not consider the safety implications of a bi-directional cycle path, which is being addressed through the Investment Objective related to safety. The advantage of the uni-directional cycling paths is that they provide access to all properties on both sides of the road, whilst catering for commuters as well. The bi-directional cycle path is expected to provide a higher level of service for commuters, but access to properties on the other side of the road is limited (cyclists cannot legally ride on a footpath).
- The elasticities of the public transport response, the routing in AIMSUN, and the potential impacts outside the modelled periods in both the AIMSUN models and WTSM models are to be further investigated in the SSBC to confirm the assessment of the reliability for trucks.
- It is noted that the model is validated to existing conditions and took into account higher order models as inputs. The modelling did not take into account any changes in behaviour/traffic patterns that have not been accounted for in other models.

[7] Traffic Modelling Report (Appendix B), Page 20, the spreadsheet model considers average conditions over the two-hour peak period

Further modelling will be undertaken in the SSBC to assess the transport performance and impacts of the recommended option.

5 Short List Multi Criteria Assessment

5.1 Introduction

The short list options were taken through an MCA process in two stages. The first (or 'interim') MCA was undertaken in late 2020 to allow development of a technically preferred option to advance while the wider LGWM programme was being reviewed. The second MCA was undertaken in June 2021 to consider engagement feedback and an assessment against mana whenua values, which were still under development when the interim MCA was undertaken.

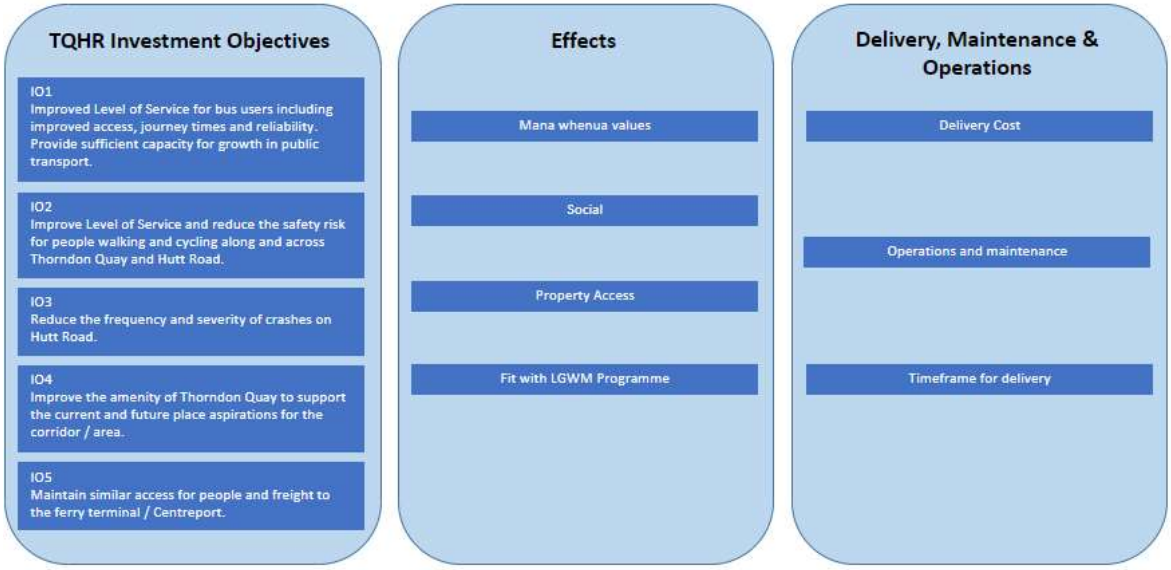
5.2 MCA Criteria

The short list MCA included an assessment of the options against their contribution to the following:

- investment objectives;
- effects; and
- delivery, maintenance and operations.

The main topics included in each of these areas are summarised below:

Figure 4: MCA Criteria



The considerations for each of the MCA criteria include:

- **Investment Objective 1:** Improving the level of service for bus users.
- **Investment Objective 2:** Improving the level of service and safety for those travelling by active transport modes.
- **Investment Objective 3:** Reducing the frequency and severity of crashes on Hutt Road.
- **Investment Objective 4:** Improving the amenity along Thorndon Quay.
- **Investment Objective 5:** Maintaining similar access for people and freight to the ferry terminal and freight hub.

- **Mana Whenua Values:** Alignment with mana whenua values developed for the LGWM programme
- **Social:** Effects on social and economic opportunities along and adjacent to the corridor.
- **Property Access:** Effect of access to properties along the corridor.
- **Fit with LGWM Programme:** Alignment with linked projects such as Golden Mile.
- **Delivery:** Construction impacts.
- **Operations and maintenance:** Impacts on services and maintenance costs.
- **Timeframe for delivery:** Speed of delivery to realise benefits.

5.3 MCA Criteria Review

Subject matter specialists met via a series of small individual workshops to go through the individual criteria with members of the Project Management Team and with TWG members. The individual workshops were centred around these key areas:

- Transportation
- Safety
- Social and Environmental
- Maintenance and Operations

The comments captured through these individual workshops is summarised in Table 3.

Table 3: Summary of the MCA Comments

Criteria	Commentary from Individual Workshops
Investment Objectives	
Investment Objective One	Options were reviewed against bus priority, with a specific focus on where bus priority is needed along the corridor and when it is needed. The morning peaks were considered to be the most beneficial. This was considered across all of the options.
Investment Objective Two	The key commentary captured was around the safety impact of bi-directional and uni-directional cycling. There was general consensus that unidirectional cycling paths are safer than bidirectional cycling paths.
Investment Objective Three	Risks around the interaction of turning vehicles with motorcyclists, cyclists and pedestrians were raised. Mitigation measures such as speed limit reductions and intersection improvements were all key considerations for options.
Investment Objective Four	From an amenity perspective there was in depth discussion around how amenity is managed and the impact of footpath widths, shared paths and planting to soften the corridor.

	The future function of the corridor was also a key consideration including improving the amenity value and balancing the through movement with the sense of place. Median strips with vegetation were considered a positive. Shared paths were considered a positive in that they provide more space for amenity. However, the mixing of potentially high speed cyclists and pedestrians was considered negative.
Investment Objective Five	Freight using the special vehicle lane was positive. There were also considerations around traffic volumes and the roundabout at Aotea Quay.
Effects	
Mana Whenua Values	These were developed by mana whenua and were considered in the final MCA. These are listed in Table 7.
Social	Equitable access was considered important from a social and economic opportunity perspective. Consideration was given to safer protected cycleways. It was noted that bidirectional cycleways – on one side of the road – reduce benefits and access. Other social aspects include building a sense of place and providing connections off the corridor.
Property Access	Property access is directly impacted by cycleways and bus lanes as well as special vehicle lanes. These are all considered within the evaluation of options. This criterion also considered safety and efficiency.
Fit with LGWM Programme	Overall programme objectives of LGWM were considered including improving safety and cycling as well as public transport. Innovating Streets was also an important consideration. It was noted that project delivery was not a differentiator.
Delivery, Maintenance, and Operations	
Delivery	Key considerations were maintaining cyclist and pedestrian flows, impacts to services, and impacts to traffic.
Operations and Maintenance	From an operations and maintenance perspective it was noted that it is much easier to maintain wider footpaths and cycle paths than the road. Maintaining the carriageway is difficult due to the narrow corridor. Further pavement assessments are required.
Timeframe for Delivery	A need for options to fit within a 24-month delivery timeframe for the whole corridor was considered.

5.4 Interim MCA Scoring

The MCA was scored on an 11-point system from -5 to 5, with 0 being no change from current state, positive being an improvement to the current state and negative being worse than the current state. The rationale behind the scores is summarised Table 4.

Table 4: Outcome Summary of MCA Reviews

Criteria	Details
Investment Objectives	
Investment Objective One: • Improve level of service for bus users including improved access, journey times and reliability • Provide sufficient capacity for growth in public transport	All options scored positive as they will improve the level of service for bus users along the corridor. This is because the options allow for journey time and reliability improvements while providing a suitable level of capacity for current and future growth. Bus travel times are estimated to improve by approximately 10 minutes in the southbound direction in the 2036 morning peak period and approximately 1-2 minutes in the northbound direction in the 2036 evening peak period. • **Options 2 and 4 scored highest (score of 4) as they include bus lanes / special vehicle lanes in both the northbound and southbound direction** • Options 1 and 3 scored 3 as they provide bus lanes / special vehicle lanes in the southbound direction only
Investment Objective Two • Improve level of service, and reduce the safety risk, for people walking and cycling along and across Thorndon Quay and Hutt Road	All options improve the level of service, and reduce the safety risk, for people walking and cycling on Thorndon Quay and Hutt Road, as well as capacity for cycling growth. The assessment noted that the increasing lanes may create safety concerns for cyclists, pedestrians and other vehicles to cross. These elements will be further considered during design. While both unidirectional and bidirectional cycle facilities would be an improvement on the existing situation from a safety perspective, unidirectional cycleways (Options 2 or 3) scored better for safety, due to less risk with cyclists travelling with the direction of general traffic. The suboptions A and B scored better than their respective base option as they include measures to manage the risk of crashes between pedestrians and cyclists with vehicle right turn movements on Hutt Road. • **Options 2A, 2B, 3A and 3B ranked the highest with a score of 4** • Options 2 and 3 ranked the second highest with a score of 3 • Options 1A,1B, 4A and 4B had a score of 2 • Options 1 and 4 scored 1
Investment Objective Three	All options were considered to reduce the frequency and severity of crashes on Hutt Road. The assessment noted the provision of a special vehicle or bus lane on Hutt Road added additional risks to right turning traffic and had the potential to mask motorcyclists that would

Criteria	Details
• Reduce the frequency and severity of crashes on Hutt Road	share the lane with buses. Accordingly, the base Options (1, 2, 3 and 4) scored lowest. The suboptions A and B scored better than their respective base option as they included measures to manage the risk of crashes with vehicle right turn movements on Hutt Road. • **Options 1A, 1B, 2A, 2B, 3A, 3B, 4A and 4B ranked the highest with a score of 3** • Options 1, 2, 3 and 4 scored 1
Investment Objective Four • Improve the amenity of Thorndon Quay to support the current and future place aspirations for the corridor/area	All options include amenity improvements for Thorndon Quay to support the current and future place aspirations for the corridor/area. These would vary depending on the option. For example, the scoring was sensitive to footpath widths and area available for amenity improvements (greater width received higher score) and unidirectional vs bidirectional cycleway (bidirectional resulted in less carriageway width which received a higher score). Option 4 and 4A had the most positive effects on character and place value by creating a vibrant street that includes footpath with trees. • **Option 4 and 4A ranked the highest with a score of 4** • Option 1, 1A, and 4B scored 3 • Option 3 and 3A scored 2 • Option 1B, 2, 2A, 2B, and 3B ranked the lowest with a score of 1
Investment Objective Five • Maintain similar access for people and freight to the ferry terminal / CentrePort	All options scored positive as the provision of special vehicle lanes on Hutt Road are expected to improve freight access to the ferry terminal / CentrePort. • **Options 2, 2A, 2B, 4, 4A and 4B ranked the highest with a score of 3, as they include special vehicle lanes in both the northbound and southbound directions** • Options 1, 1A, 1B, 3, 3A and 3B scored 2, as they include special vehicle lanes in the southbound direction only
Implementability	
Social	All options had positive effects on equity and access to social and economic opportunities, such as employment, retail, health, cultural and social connectedness, • **Option 2, 2A, and 2B ranked the highest with a score of 4** • Option 1, 1A, 1B, 3, 3A, 3B, 4, 4A, and 4B scored 3
Property access	Option 1B, 2B, 3B, and 4B provided positive long-term effects on access to and servicing of private buildings (i.e. deliveries, removals, building maintenance) since the service lanes reduce conflicts and provide safe access to properties. However, Option 1, 1A, 2, 2A, 3, 3A, 4, 4A had negative long-term effects on access • **Option 1B, 2B, 3B, and 4B ranked the highest with a score of 4** • Option 1A, 3A, and 4 A scored -2

Criteria	Details
	• Option 1, 2, 2A, 3, and 4 ranked the lowest with a score of -3
Fit with LGWM Programme	All options scored positively as they aligned with linked projects, such as the Golden Mile and City Streets. They provide the flexibility to integrate with linked projects (for example the bidirectional cycleways north and south of Thorndon Quay and Hutt Road), deliver the option incrementally, and scale the level of intervention. • **Option 4A ranked the highest with a score of 5** • Options 1A, 2A, and 4 ranked the second highest with a score of 4 • Option 1, 2, 3A, and 4B scored 3 • Option 1B,2B and 3 scored 2 • Option 3B scored the lowest with a score of 1. While still scoring positive, this option was seen to have the least integration with the wider programme, including providing unidirectional cycleways which will integrate least with bidirectional cycleways north and south of the project as well as the service road which could impact potential connectivity to the Multi-User Ferry Terminal.
Delivery, Maintenance & Operations	
Delivery	All options had negative scores. This was due to impacts on expected duration of delivery and effect on pedestrians, cyclists, bus operations and parking during delivery. It was also due to impacts on parking and access to and servicing of private buildings (i.e. deliveries, removals, building maintenance) during construction. • **Option 1 and 4** ranked **the highest (least negative impacts) with a score of -1** • Option 1A and 4A ranked the second highest with a score of -2 • Option 2 scored -3 • Option 1B, 2A, 2B, 3, 3A, 3B, and 4B ranked the lowest with a score of -4
Operations and maintenance	All options had negative scores due to impacts on public operational costs (maintenance, refuse collection, street cleansing, landscape maintenance), potential ability to accommodate utilities, services repairs and renewals, and flexibility (ie re-route bus services due to major planned and unplanned events and flexibility of future corridor use. • **Option 1, 3, and 4 ranked the highest (least negative impacts) with a score of -1** • Option 1A, 1B, 2, 3A, 3B, 4A, and 4B scored -2 • Option 2A and 2B ranked the lowest with a score of -3
Timeframe for delivery	Option 1 had positive impacts by demonstrating tangible improvements (outputs) within the 2018-21 / 2021-24 NLTP period and the ability to demonstrate tangible improvements (benefits) within the 2018-21 / 2021-24 period. The impacts of Option 1A, 2, 3, and 4

Criteria	Details
	were neutral. Option 1B, 2A, 2B, 3A, 3B, 4A, and 4B had negative impacts. • **Option 1 ranked the highest with a score of 2** • Option 1A, 2, 3, and 4 scored 0 • Option 1B scored -1 • Option 2A, 3A, and 4A scored -2 • Option 2B, 3B, and 4B ranked the lowest with a score of -3

5.5 Interim MCA Workshop Discussion

A workshop was conducted on the 18th of November 2020 to obtain inputs from the partners on the MCA assessment. Key points of discussion from the workshop include:

- Regarding the safety objectives (IO2 and IO3), all options would improve safety for all road users.
- The part-time bus lane may be less safe for pedestrians since they may not expect the buses to utilise the bus lane.
- Uni-directional cycle lanes may create safe crossing issues for cyclists and pedestrians on Hutt Road as well as cycle crossing over at Tinakori Road. The existing crossing point at Kaiwharawhara Road might pose safety challenges for cyclists. From a safety perspective, the unidirectional cycleway was preferred.
- It is noted that this project is focusing on the people who use the corridor and that the project area is the city gateway from the North to the South
- Buses would travel on the bus lanes on Thorndon Quay. Buses and trucks might travel through the special vehicle lane on Hutt Road.
- Multimodal transport and amenity design, such as maximising the footpath, may need to be in place to enable Kaiwharawhara Road to transform from industrial to mixed used since the design can encourage behaviour change that supports sustainability.

The partners generally agreed with the scoring and ranking of the options based on the previous individual workshops to reach a technically preferred option. However, was noted that public and stakeholder engagement were needed prior to confirming the recommended option.

5.6 Interim MCA Scoring Summary

The table below summarises the results of the MCA assessment of the options against investment objectives, effects and delivery, maintenance and operations using an 11-point (+5 - -5) system.

Table 5: MCA Scoring Summary

Option	Contribution to Investment Objectives					Contribution to Effects			Contribution to Delivery, Maintenance and Operations			Total	Option Rank
	IO1 – Bus Reliability / Attractive-ness	IO2 – Walking & Cycling	IO3 – Hutt Road Safety	IO4 – Thorndon Quay Amenity	IO5 – Similar Freight Access*	Social	Property Access	Fit with LGWM Programme	Delivery	Operations and Mainten-ance	Timeframe for Delivery		
Option 1: Southbound bus lanes with Thorndon Quay bidirectional cycleway	3	1	1	3	2	3	-3	3	-1	-1	2	**13**	6
Option 1A: Southbound bus lanes with Thorndon Quay bidirectional cycleway	3	2	3	3	2	3	-2	4	-2	-2	0	**14**	5
Option 1B: Southbound bus lanes with Thorndon Quay bidirectional cycleway	3	2	3	1	2	3	4	2	-4	-2	-1	**13**	6 Equal
Option 2: Southbound and Northbound bus lanes with Thorndon Quay unidirectional cycleway	4	3	1	1	3	4	-3	3	-3	-2	0	**11**	9 Equal
Option 2A: Southbound and Northbound bus lanes with Thorndon Quay unidirectional cycleway	4	4	3	1	3	4	-3	4	-4	-3	-2	**11**	9 Equal
Option 2B: Southbound and Northbound bus lanes with Thorndon Quay unidirectional cycleway	4	4	3	1	3	4	4	2	-4	-3	-3	**15**	3 Equal

Option	Contribution to Investment Objectives					Contribution to Effects			Contribution to Delivery, Maintenance and Operations			Total	Option Rank
	IO1 – Bus Reliability / Attractive-ness	IO2 – Walking & Cycling	IO3 – Hutt Road Safety	IO4 – Thorndon Quay Amenity	IO5 – Similar Freight Access*	Social	Property Access	Fit with LGWM Programme	Delivery	Operations and Mainten-ance	Timeframe for Delivery		
Option 3: Southbound bus lanes with Thorndon Quay unidirectional cycleway	3	3	1	2	2	3	-3	2	-4	-1	0	**8**	12
Option 3A: Southbound bus lanes with Thorndon Quay unidirectional cycleway	3	4	3	2	2	3	-2	3	-4	-2	-2	**10**	11
Option 3B: Southbound bus lanes with Thorndon Quay unidirectional cycleway	3	4	3	1	2	3	4	1	-4	-2	-3	**12**	8
Option 4: Southbound and Northbound bus lanes with Thorndon Quay bidirectional cycleway	4	1	1	4	3	3	-3	4	-1	-1	0	**15**	3 Equal
Option 4A: Southbound and Northbound bus lanes with Thorndon Quay bidirectional cycleway	4	2	3	4	3	3	-2	5	-2	-2	-2	**16**	**1 Equal**
Option 4B: Southbound and Northbound bus lanes with Thorndon Quay bidirectional cycleway	4	2	3	3	3	3	4	3	-4	-2	-3	**16**	**1 Equal**

*the assessment assumes that freight can use the special vehicle lanes on Hutt Road.

5.7 Interim MCA Summary

The highest scoring options from the interim MCA were Options 4A and 4B.

While Options 4A and 4B scored similarly overall, the provision of a service road (suboption B) was discounted as being more disruptive, fits less with other regional projects and carries larger implementation risk.

The provision of bidirectional or unidirectional cycling facilities was also discussed. It was noted that the provision of a bidirectional cycleway (i.e. Options 1 or 4) should be aligned with the wider LGWM programme as there are bidirectional facilities planned to the north and south of the TQHR corridor. This would provide a consistent cycle path and ease of connection.

It was also noted that while both unidirectional and bidirectional cycle facilities would improve safety and level of service, unidirectional cycleways (Options 2 or 3) scored better for safety, due to less risk with cyclists travelling with the direction of general traffic.

Following the MCA workshop, the Technical Advisory Group (TAG) met to discuss a recommended option. The TAG supported the highest scoring option of 4A while noting the additional safety risks inherent with bidirectional cycleways which will require consideration in the design phase.

The TAG recommended that Option 4A was the best option to take forward as the interim preferred option. This decision was supported by the LGWM Programme Steering Group.

6 Public and Stakeholder Engagement

The stakeholder section of this report outlines the consultation and engagement component of the TQHR project and summarises the feedback received.

6.1 Communications and Engagement Approach

Engagement on the preferred option was undertaken from 10 May to 8 June 2021. The engagement strategy and activities were led by LGWM with support from the TQHR project team. Stakeholders and the public were consulted on the technically preferred option for the TQHR project, as well as WCC's intention to change angle parking to parallel parking on Thorndon Quay ahead of other changes to improve safety for cycling.

Engagement material was made available on the LGWM website[8] including description of the proposal and background material. A consultation document was also produced which was available at meetings / open days and was made available in several languages. In addition to information on the TQHR project, WCC also produced a technical report[9] on the intended parking change as well as a draft traffic resolution which was made available on the LGWM website.

The consultation document and engagement material outlined the project objectives, the options evaluation process and the proposal for Thorndon Quay and Hutt Road. Stakeholders and the public were asked for their feedback on how the proposal met their priorities for how the streets were used and what they would like to see included as the proposal is further designed. A summary of the proposals included in the engagement material for Thorndon Quay and Hutt Road are below.

6.1.1 Thorndon Quay Proposal Summary

The proposal for Thorndon Quay will provide part-time bus lanes in both directions and extend the two-way cycle path from Hutt Road to the Lambton interchange at Mulgrave Street. Bus priority will

[8] https://lgwm.nz/our-plan/our-projects/thorndon-quay-and-hutt-road/have-your-say-thorndon-quay-and-hutt-road/

[9] Thorndon Quay parking and crashes analysis report

be provided at Mulgrave Street. The footpaths and street environment will be improved to make it a more pleasant place to visit.

Changes will allow for future growth in the numbers of people taking the bus and cycling, and will encourage more people to walk, shop and spend time on Thorndon Quay. Safety will be improved for everyone by removing the angle parking, providing a dedicated cycle path and improving pedestrian crossings.

Changes to parking will happen in two stages - the initial change in late 2021 is to convert the angle parking to parallel parking, to improve safety for everyone and make it easier for buses to pull into and out of bus stops. Further parking changes may be needed as part of the final street design to provide enough space for buses and bikes, this may include changes to the parking time limits.

The indicative cross section for Thorndon Quay is shown in Figure 5 below.

Figure 5: Thorndon Quay Indicative Cross Section

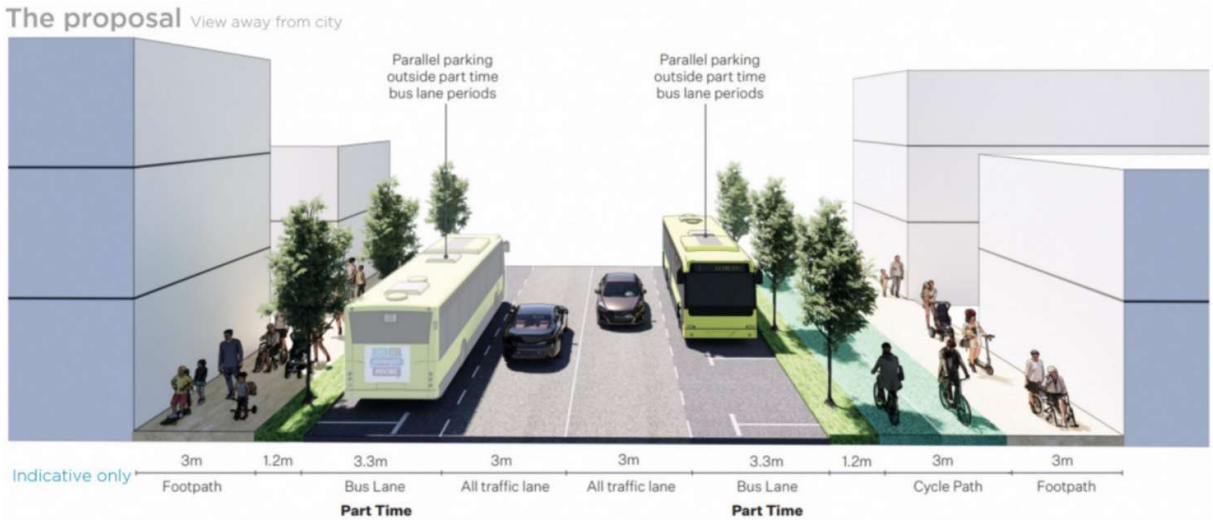
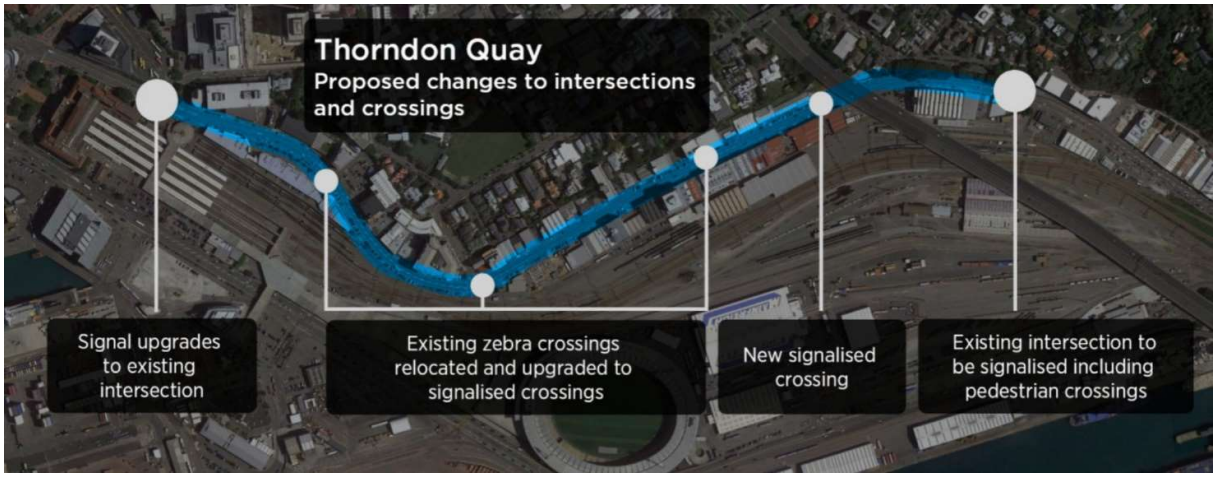


Figure 6 below illustrates proposed changes to intersections and crossings along Thorndon Quay.

Figure 6: Thorndon Quay – Proposed Changes to Intersections and Crossings



6.1.2 Hutt Road Proposal Summary

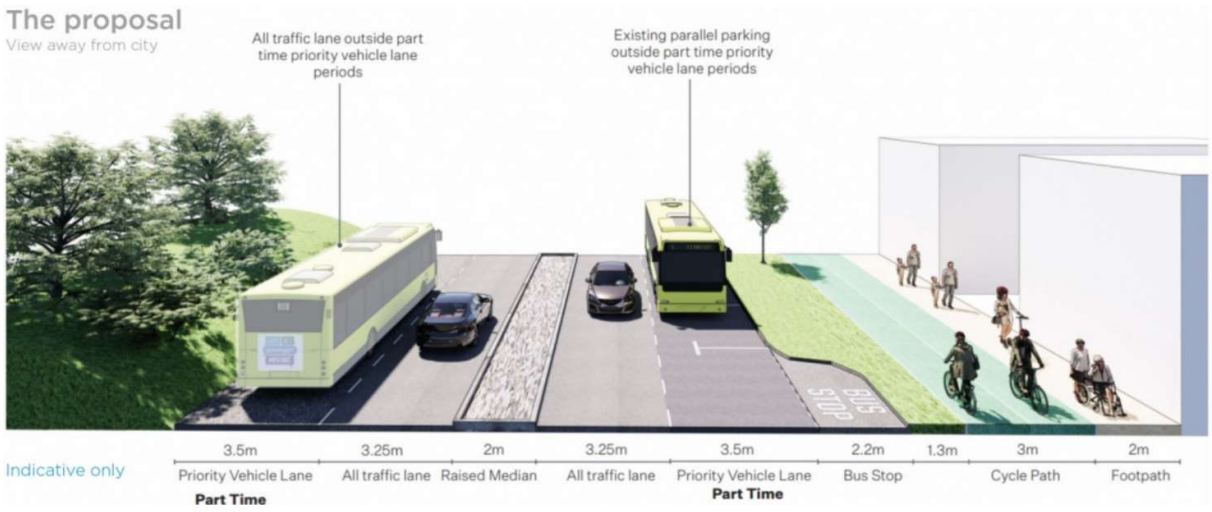
The proposal for Hutt Road includes providing part-time bus lanes in both directions and bus priority at the Ngauranga/Jarden Mile intersection. Bus lanes are proposed in both directions because this will improve bus travel times and reliability during peak hours, making buses a more attractive travel option.

The shared path between the Ngauranga/Jarden Mile intersection and Caltex will be upgraded to a two-way cycle path and dedicated footpath. The new paths will connect with the existing paths on Hutt Road and the bike path will connect with the proposed new cycle path on Thorndon Quay. There will also be a future connection to Te Ara Tupua.

A significant safety risk for everyone, particularly for people walking and cycling, is vehicles turning right across traffic on Hutt Road, between Aotea Quay and Ngauranga, to get into or out of the businesses. To address this, a raised central median is proposed to prevent right turns along this section of Hutt Road.

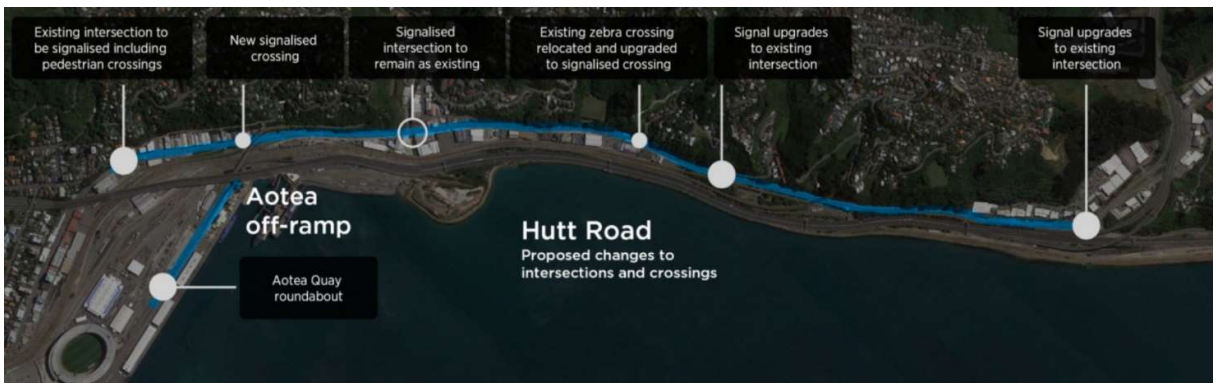
The indicative cross section for Hutt Road is shown in Figure 7 below.

Figure 7: Hutt Road Indicative Cross Section



Proposed changes to intersections and crossings along Hutt Road are shown in Figure 8 below.

Figure 8: MCA Hutt Road – Proposed Changes to Intersections and Crossings



A proposed new roundabout on Aotea Quay (to replace the traffic lights at the KiwiRail container terminal entrance) would give drivers of large vehicles intending to travel north from a business on Hutt Road a safe place to turn.

6.1.3 Engagement Events

A series of stakeholder engagement events were held over the May – June engagement period. These events are summarised in Table 6 below.

Table 6: Stakeholder Engagement Events

Event	Date	Event Information
Stakeholder Briefing	9 May 2021	Online stakeholder event to launch the engagement.
Open Days	21 May 2021	Open Day at Pipitea Marae
	22 May 2021	Open Day at Pipitea Marae
	23 May 2021	Information stand at Harbourside Market, Waitangi Park
	30 May 2021	Information stand at Johnsonville Market, Johnsonville School

6.2 Engagement Feedback

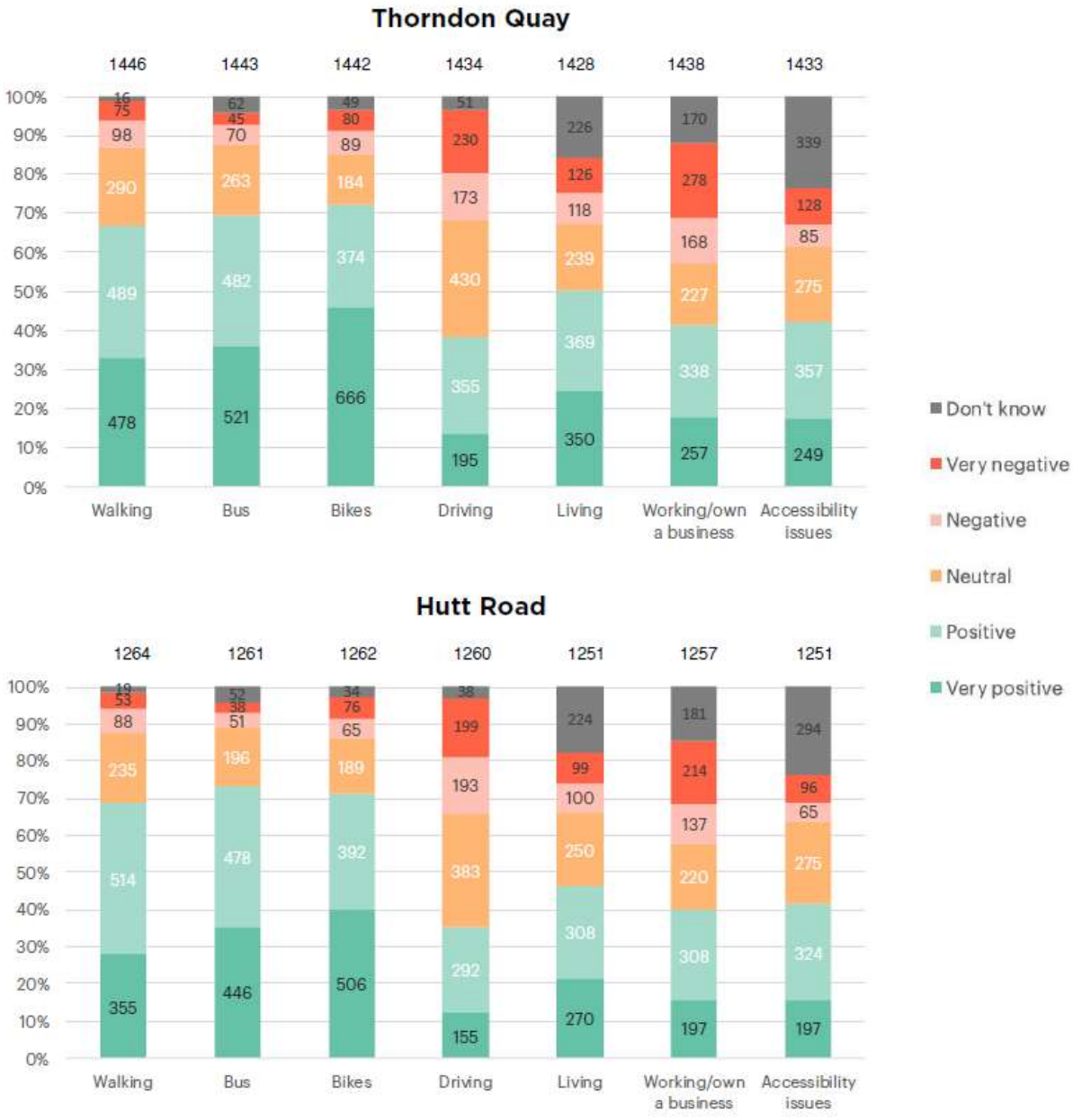
LGWM received 1,613 submissions on the proposal. Of those who submitted, 72% of the respondents said it was important or very important to make improvements for people walking, riding bikes and using the bus on Thorndon Quay and Hutt Road. LGWM produced an engagement summary report[10] which is available on the LGWM website.

Pedestrians, bus users, cyclists, people who use e-scooters as well as people who travel through and visit the area generally felt that the proposal would have a positive impact. Submissions from people who drive cars, trucks, motorcyclists and those that lived in the area or had a disability had a mixed response about the impacts of the proposal. Business owners and people that worked in the area felt that changes would have a negative impact.

Around 70% of respondents said the changes on Hutt Road and the changes on Thorndon Quay would have positive or very positive impacts for people walking, people in buses, and people on bikes. People's feedback was mixed on what they thought the impacts would be for people driving, people who live, work or own a business on these streets, or people with a disability.

[10] May-June 2021 Hutt Road / Thorndon Quay Engagement, Data Analysis Report, 29 June 2021

Figure 9: Engagement Summary – How People Felt About the Proposal



There were a number of common themes received from submissions regarding changes to be considered when further developing the proposal. Changes to be considered along Thorndon Quay include:

- The impacts on commercial delivery vehicles
- Drop-off parking to be made available
- Safety for pedestrians crossing the street, especially small children
- Impact to businesses in a tough retail environment
- Bus stop locations to be outside or close to key destinations.

Changes to be considered along Hutt Road include:

- Allowing safe vehicle access into and out of properties around pedestrians and cyclists
- Increase the width of the bike lane
- Address concerns from businesses about how their customers will access their business if they cannot make a right turn.

People were also asked what they would like to see designed into the streetscape. Responses included bike parking, more greenery and other parking options if on street parking is reduced.

A submission was also received from an organisation called the Thorndon Quay Collective which represents a number of businesses and other Thorndon Quay community members and was established in response to engagement. A key theme from the Thorndon Quay Collective submission is that the loss of and reconfiguration of parking will have an adverse impact on businesses on Thorndon Quay.

In addition to the key themes summarised above, there were many points of detail raised in the submissions that will need to be further considered in the future design phase. Ongoing engagement with stakeholders and properties along the Thorndon Quay and Hutt Road corridor will be important as the project transitions into the design phase.

7 Final MCA

7.1 Introduction

Following engagement, a second MCA workshop was held on 30 June 2021. The purpose of this workshop was to consider the impact of engagement feedback on the interim MCA scores as well as incorporate scoring of the options against mana whenua values into the MCA. The second MCA followed a similar process to the interim MCA, where project team subject matter specialists led assessment groups with LGWM partner organisation specialists to jointly assess and review the scoring for the options ahead of the full workshop. The full workshop was then held with attendance from the specialists, project team members as well as other representatives from the partner organisations to discuss and agree the scoring.

7.2 Mana Whenua Values and Scoring

The June MCA workshop was attended by a representative of mana whenua. The options were scored by mana whenua against their values as summarised in Table 7.

Table 7: Mana Whenua Values

Mana Whenua Values	
Whakapapa - A sense of Place	• Building works restore a healthy relationship with nature • Finished projects tell the story of the place • Native plantings • Urban agriculture
Wai-ora - Respect the Role of Water	• Acknowledge the importance of water • Resurrect the natural water courses • Manage water run off to ensure only purest water flows to the harbour

Pūngao-ora - Energy	• Minimise energy use during construction • Completed projects to aim to be energy neutral
Hau-ora – Optimising Health & Wellbeing	• Prior to construction minimise uncertainty by clear goals and timeline • During construction minimise disturbance to neighbours • Completed projects to use plantings and water flows to provide healthy environments
Whakamahitanga - Use of Materials	• Recycle the maximum of materials disposed of during construction • Build with materials and methods that use the lowest energy possible • Avoid toxic materials that may leach into air or ground water
Manaakitanga – Support a Just and Equitable Society	• Embody our values in these projects • Work with locals to the extent possible • Provide safe and inviting public spaces
Whakāhuatanga - Celebrate Beauty in Design	• Design in a way that lifts the human spirit • Incorporate public art and interpretation to tell the story of what has gone before
Whakamatautautanga	• Monitoring

Mana whenua scored all of the options positive against their values. Option 1B scored the highest with a score of 5. Options 1A, 3B and 4B scored 4. Options 1, 2B, 3A and 4A scored 3. Options 2A, 3 and 4 scored 2. Option 2 scored least with a score of 1.

The implementation of a bus lane on the southbound side was preferred over both directions as the southbound benefits were higher. Without the northbound bus lane, this would provide more ability to influence the design of the footpath on the northbound (or 'beach' side). Mana whenua noted that most of their land interests along the corridor were along this historical beach side.

The 'B' suboptions all scored higher than the 'A' and base options as they were considered to provide an opportunity to improve access and create a neighbourhood space for those properties along Hutt Road.

Mana whenua supported the bidirectional cycleway on the harbourside as it is consistent with other cycle projects north and south of Thorndon Quay and Hutt Road. Mana whenua noted that the change to angle parking to parallel was not considered in their scoring as WCC had already voted in favour of the change at the time of scoring the options.

7.3 Consideration of the Service Road (Suboptions B')

During the MCA workshop, the delivery specialists raised the challenges with implementing the Hutt Road service lane proposed in the 'B' suboptions. The service lane was previously highlighted at the interim MCA workshop as being more disruptive, fits less with other regional projects and carries larger implementation risk.

The delivery team noted that since the interim MCA, further preliminary design of Option 4A had progressed, including more detailed evaluation of the available width on Hutt Road and desired

width for the various modes. Based on this further work, the delivery team considered that the service lane option does not physically fit within the corridor and property acquisition would be necessary. Discussion at the workshop confirmed that the delivery score for the service lane should be reduced to -5 (the lowest score possible).

In the long list assessment, it was established that if property acquisition was needed for an option, it should not be short-listed, particularly if buildings would require alteration or demolition which would be the case on Hutt Road[11]. It was therefore agreed that the service lane options, despite the scoring, should no longer be progressed due to the disproportionate cost and effect of land acquisition.

Other factors for discounting the service lane options included:

- Likely to be a noticeable impact for traffic not able to use the Special Vehicle Lane, and potential issues integrating with any MUFT proposal to connect to the intersection of Hutt Road/Kaiwharawhara Road
- Access and egress for the service lane would be via signal-controlled intersections at Onslow Road and Kaiwharawhara by altering the current intersections to signalised crossroads. There were concerns that this would increase the delay on Hutt Road and hence reduce the level of service for buses and freight as well as general traffic.

7.4 Other Criteria Assessments

The specialist teams for each of the MCA criteria reviewed their scoring from the interim MCA to assess how engagement feedback may affect the scoring. All of the specialist groups determined that the feedback did not alter their scoring or differentiation between options (i.e. changing from bidirectional to unidirectional cycleways or southbound only bus lanes).

The use of the Hutt Road SPV lane was discussed at the workshop. The assessment of the special vehicle lane assumed that freight would be able to use the lane in addition to buses. It was noted that the final use of the special vehicle lane would be determined by the project partners, which could include buses and freight but would not include T2 or T3 vehicles as modelling showed that inclusion of these vehicles in the lane would reduce the benefit for public transport.

The discussion at the workshop noted that the Thorndon Quay Collective submission raised concerns about loss of and reconfiguration of parking. It was noted that the submission strongly addressed the loss of parking issue but did not provide feedback that would differentiate between options. As all options involve the loss of and reconfiguration of on-street parking, the scoring did not change from the interim MCA.

While the scoring for the MCA criteria did not change from the interim MCA as a result of engagement, the workshop noted that there were many detailed points to further discuss with stakeholders and property owners during design. It is anticipated that dialogue between LGWM and stakeholders will continue into the design phase so that stakeholders, users and property owners can have input into the design as it develops.

[11] *The impact would require acquisition of approximately a 5-10m strip of properties along Hutt Road between Onslow Road and Kaiwharawhara Road. The majority of buildings on these properties are built to the street frontage, and therefore would require a highly significant alteration of the areas built environment.*

7.5 Final MCA Scoring

Table 8 below summarises the final MCA scores of the options against investment objectives, effects and delivery, maintenance and operations using an 11-point (+5 - -5) system. As indicated above, the 'B' suboptions were scored -5 for delivery, but this means they are effectively not practical options.

Table 8: Final MCA Scoring Summary

Option	Contribution to Investment Objectives					Contribution to Effects				Contribution to Delivery, Maintenance and Operations			Total	Option Rank
	IO1 – Bus Reliability / Attractive-ness	IO2 – Walking & Cycling	IO3 – Hutt Road Safety	IO4 – Thorndon Quay Amenity	IO5 – Similar Freight Access*	Mana whenua values	Social	Property Access	Fit with LGWM Programme	Delivery	Operations & Mainten-ance	Timeframe for Delivery		
Option 1: Southbound bus lanes with Thorndon Quay bidirectional cycleway	3	1	1	3	2	3	3	-3	3	-1	-1	2	**16**	7
Option 1A: Southbound bus lanes with Thorndon Quay bidirectional cycleway	3	2	3	3	2	4	3	-2	4	-2	-2	0	**18**	3
Option 1B: Southbound bus lanes with Thorndon Quay bidirectional cycleway	3	2	3	1	2	5	3	4	2	-5	-2	-1	**17**	4
Option 2: Southbound and Northbound bus lanes with Thorndon Quay unidirectional cycleway	4	3	1	1	3	1	4	-3	3	-3	-2	0	**12**	11
Option 2A: Southbound and Northbound bus lanes with Thorndon Quay unidirectional cycleway	4	4	3	1	3	2	4	-3	4	-4	-3	-2	**13**	9
Option 2B: Southbound and Northbound bus lanes with	4	4	3	1	3	3	4	4	2	-5	-3	-3	**17**	4

Option	Contribution to Investment Objectives					Contribution to Effects				Contribution to Delivery, Maintenance and Operations			Total	Option Rank
	IO1 – Bus Reliability / Attractive-ness	IO2 – Walking & Cycling	IO3 – Hutt Road Safety	IO4 – Thorndon Quay Amenity	IO5 – Similar Freight Access*	Mana whenua values	Social	Property Access	Fit with LGWM Programme	Delivery	Operations & Mainten-ance	Timeframe for Delivery		
Thorndon Quay unidirectional cycleway														
Option 3: Southbound bus lanes with Thorndon Quay unidirectional cycleway	3	3	1	2	2	2	3	-3	2	-4	-1	0	**10**	12
Option 3A: Southbound bus lanes with Thorndon Quay unidirectional cycleway	3	4	3	2	2	3	3	-2	3	-4	-2	-2	**13**	9
Option 3B: Southbound bus lanes with Thorndon Quay unidirectional cycleway	3	4	3	1	2	4	3	4	1	-5	-2	-3	**15**	8
Option 4: Southbound and Northbound bus lanes with Thorndon Quay bidirectional cycleway	4	1	1	4	3	2	3	-3	4	-1	-1	0	**17**	4
Option 4A: Southbound and Northbound bus lanes with Thorndon Quay bidirectional cycleway	4	2	3	4	3	3	3	-2	5	-2	-2	-2	**19**	**1 Equal**
Option 4B: Southbound and Northbound bus lanes with Thorndon Quay bidirectional cycleway	4	2	3	3	3	4	3	4	3	-5	-2	-3	**19**	**1 Equal**

*the assessment assumes that freight can use the special vehicle lanes on Hutt Road.

The introduction of the mana whenua values scores and the reduction of the delivery score for the service lane options changed the relativity between options compared to the interim MCA. However, Options 4A and 4B still scored the highest, similar to the interim MCA.

During the workshop it was agreed that while Option 4B was tied for the highest score with Option 4A, it should be discounted due to the difficulty to implement a service land within the existing road space. Discounting Option 4B results in Option 4A having the highest score. Accordingly, Option 4A remains the recommended option to advance to preliminary design and the SSBC.

8 Cost Estimates

Indicative Business Case Estimates (IBE) were prepared for the base options (1 to 4), as well an - indicative left-in left-out and service lane option (options 4A and 4B were costed, though as indicated above it was subsequently agreed that Option 4B should be discounted), in accordance with the Waka Kotahi Cost Estimation Manual. These were prepared to give an indicative range of costs for the shortlisted options and suboptions. The indicative estimates do not include property costs. Due to the number of short list options, individual cost estimates were not prepared for all combinations of options and suboptions. The expected indicative cost estimates are provided in Table 9.

Table 9: Expected IBE Cost of the Short List Options

Option	Expected IBE Cost
Option 1	$25,444,000
Option 2	$27,694,000
Option 3	$23,793,000
Option 4	$28,127,000
Option 4A Includes Left-in / Left out on Hutt Road with Aotea Quay Roundabout	$33,089,000
Option 4B Includes Service Lane on Hutt Road with Aotea Quay Roundabout	$32,811,000

Further costing and economic analysis will be undertaken in the SSBC. The IBE summary sheets are contained in Appendix C.

9 Economic Analysis

Preliminary economic analysis was undertaken, primarily based on the corridor modelling that was undertaken (Appendix B).

Broadly, the corridor modelling estimated the average vehicle speeds based on the level of congestion (using volume/capacity speed flow curves) and intersection delays.

From the corridor modelling outputs, the following transport costs were assessed at this stage:

- Travel time and congestion costs
- Vehicle operating costs

- Active mode health benefits
- CO2 emission costs

This preliminary economic analysis was undertaken to provide an indicative understanding of the economic efficiency outcomes for the options assessed. As further discussed below, some benefits were not assessed at this stage and this preliminary analysis has focussed on the primary benefit streams.

The economic analysis was undertaken based on a 40-year evaluation period and a 4% discount rate. As the vehicle volumes differ slightly between options for similar sections, the variable trip method was applied to account for the change in road user surplus and resource cost correction.

9.1 Travel Time and Congestion Costs

The travel time and congestion costs were assessed for each of the sub-sections of the corridor for the morning and afternoon peak periods. These were individually assessed for each user group (i.e. bus passengers, trucks, single occupant, two occupant and three occupant vehicles).

9.2 Vehicle Operating Costs

Base vehicle operating costs were assessed based on the average speeds estimated for each sub-section and by vehicle type.

9.3 Emission Costs

CO_2 emission costs were assessed based on the vehicle type emission tonnage estimated from the base vehicle operating costs applied with the costs of CO_2 emissions prescribed in the Economic Evaluation Manual (EEM) / Monetised Benefits and Costs Manual.

9.4 Active Mode Benefits

The active mode benefits have been estimated based on bus passengers walking and assumed an average length of 280m.

Based on the preliminary run of the Thorndon Quay Cycle Model provided by the WCC, the model suggests an increase in cycle mode share from northern suburbs to the central area by 2%. As further analysis and review will need to be undertaken on the cycle model, a conservative 30% of the health benefits from the estimated demand in this preliminary assessment was applied.

9.5 Safety Benefits

A high-level safety benefits assessment was undertaken. This is largely based on first baselining the safety impacts that are common across all options (e.g. speed reduction), followed by accounting for differences between the options. For this preliminary assessment, the total social crash costs were estimated to be around $2.98 million per annum, or approximately $80 million over a 40-year period. Based on this preliminary assessment, the options were estimated to reduce the crashes by approximately between 20% and 30%.

9.6 Economic Analysis Results and Discussion

The results of the preliminary economic analysis are summarised in the following tables. It should be noted that this analysis only considered the four core options, as well as the Option 4A (recommended option) variant.

Table 10: Preliminary Economic Benefits for the Short List Options

Option	Travel Time ($m)		Safety ($m)	Active Modes ($m)	Others (VOC, CO2 etc) ($m)	Total Benefits ($m)
	Public Transport	Other Vehicles				
Option 1	$25.4	$0.4	$18.2	$23.6	$4.5	$72.1
Option 2	$42.1	-$25.4	$20.2	$23.6	$3.9	$64.5
Option 3	$25.4	$0.4	$23.4	$23.6	$4.5	$77.3
Option 4	$42.1	-$25.4	$13.0	$23.6	$3.9	$57.2
Option 4A	$42.1	-$61.8	$20.2	$23.6	$8.5	$32.6

Table 11: Preliminary Economic Assessment Results for the Short List Options

Option	Discounted Costs ($m)	Benefits ($m)	BCR
Option 1	$27.8	$72.1	2.6
Option 2	$23.5	$64.5	2.7
Option 3	$22.6	$77.3	3.4
Option 4	$23.9	$57.2	2.4
Option 4A	$27.9	$32.6	1.2

The results of the preliminary economic analysis include:

- The BCRs for the options range between 1.2 and 3.4.
- The travel time savings for public transport users outweighs the disbenefits for other vehicle users. Option 4A, which includes the raised median on Hutt Road, indicates that the public transport user benefits are not large enough to offset these disbenefits. The is mainly due to this option performing significantly worse in the afternoon peak period for the light vehicles in the inbound direction on these sub-sections:
    - Ngauranga interchange to Ngauranga stop (from approximately 100 seconds in the 2019 Do Minimum to 240 seconds in the option)
    - Rangiora to Kaiwharawhara (from approximately 80 seconds in the 2019 Do Minimum to 300 seconds in the option)
    - Tinakori Road to Moore Street (from approximately 100 seconds in the 2019 Do Minimum to 160 seconds in the option)

- Travel time benefits of all options start off negative in the modelled 2019 corridor spreadsheet model, turning to positive in the 2036 corridor spreadsheet model (with exception of Option 4A). When these are interpolated, the benefits for these options would turn positive from around year 2024. The disbenefits in 2019 are largely due to the benefits for public transport users being lower than the disbenefits to the light vehicle users, but this is estimated to exceed the disbenefits to the light vehicle users in the 2036 corridor model.

The preliminary economic analysis was undertaken for the main corridor traffic benefits to allow a comparison between options. Whilst the safety and active modes benefits have been included at this stage, these benefits will also need to be further assessed and detailed in the SSBC. The results of this preliminary analysis may also be impacted when wider network impacts have been considered.

As highlighted, the benefits are based on a high-level corridor spreadsheet model. As noted in the transport modelling summary, the elasticities of the public transport response, the routing in AIMSUN, and the potential impacts outside the modelled periods in both the AIMSUN models and WTSM models will need to be further investigated in the SSBC. These could have an impact on the corridor (as well as wider network impact) demand estimated at this stage. Given the impact of this, some benefits have not been included at this stage as they are:

- Relatively smaller in scale compared to some of the benefits from the corridor model;
- Unlikely to be significantly different between the options; and/or
- Highly dependent and sensitive towards the traffic demand on the network.

These benefits will be also be further updated in the SSBC following more detailed modelling on the recommended option. These benefits include:

- Active mode benefits for the corridor
- Safety benefits (or disbenefits). Once more detailed modelling has been undertaken in the next stage to incorporate the public transport elasticities response, routing and non-peak periods, the resulting estimated daily traffic volumes for the network will then be used to estimate the change in road safety benefits.
- Public transport infrastructure and vehicle benefits (if appropriate). These may include the vehicle and/or facilities features benefits.

10 Conclusion and Next Steps

This report documents the assessment of the short list options and summarises the engagement undertaken with stakeholders and public. The interim MCA found that Option 4A was the technically preferred option. This option includes northbound and southbound peak period bus lanes on Thorndon Quay and peak period special vehicle lanes on Hutt Road to be used by buses and freight (with these lanes reverting to parallel parking off peak), a bidirectional cycleway and a range of other safety improvements for the corridor, as well as a roundabout on Aotea Quay.

Whether freight will use the special vehicle lane will be further investigated during the design phase. The provision of a turnaround facility on Aotea Quay as required by Option 4A may remove the need to include freight in the special vehicle lane.

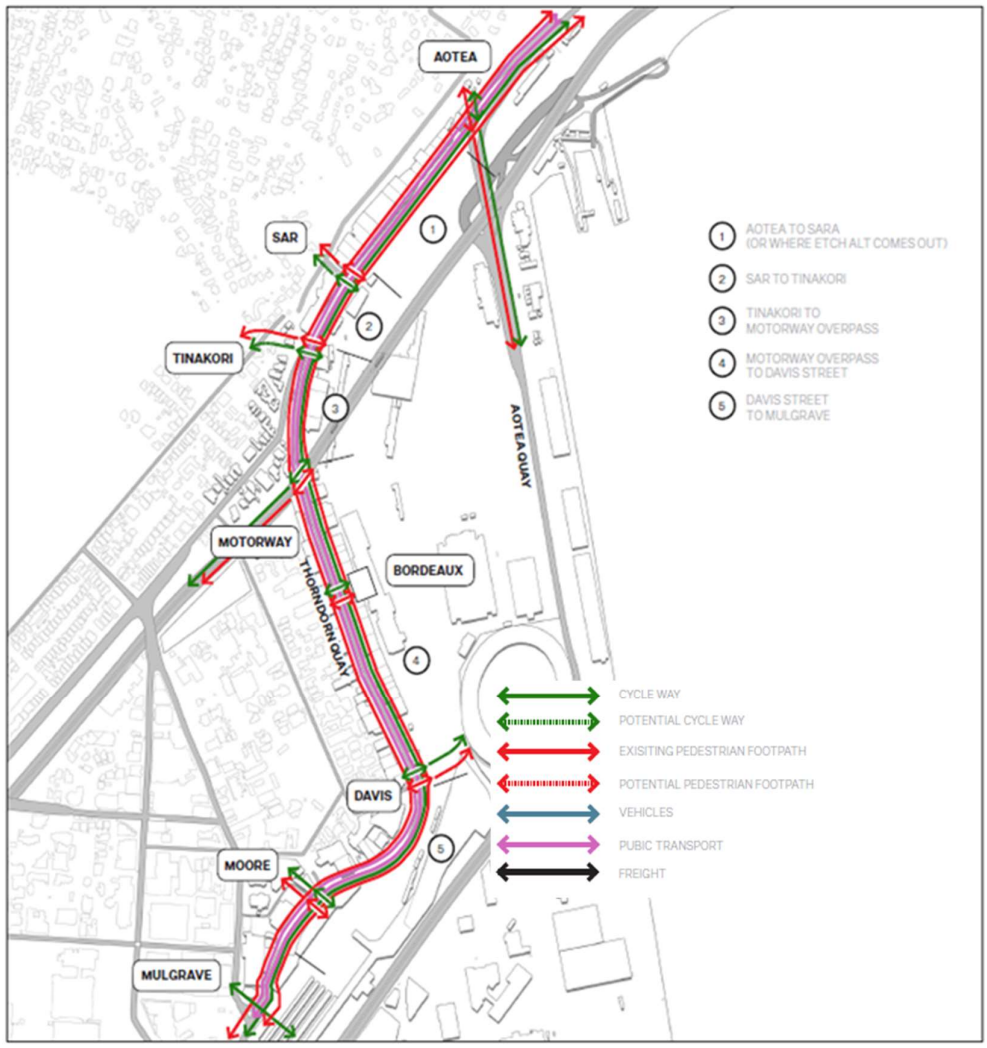
Engagement with stakeholders and the public found that this option was supported by the majority of respondents. The final MCA, having considered the engagement feedback and included an assessment of the short list options against mana whenua values, also found that Option 4A was the preferred option. This option will be advanced to the SSBC, including preliminary design, more detailed cost estimation and economic assessment and development of the business case.

Appendix A

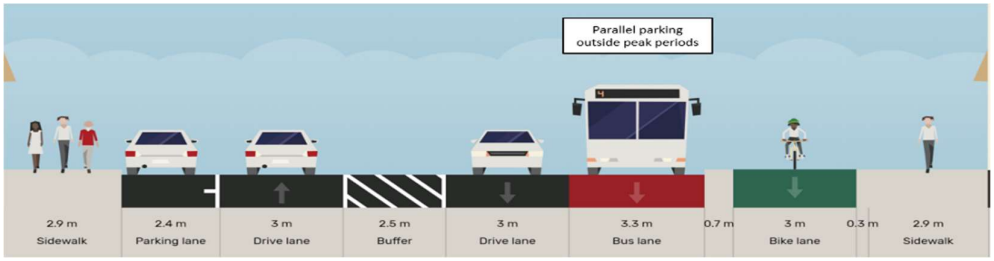
Short List Option Diagrams

Option 1

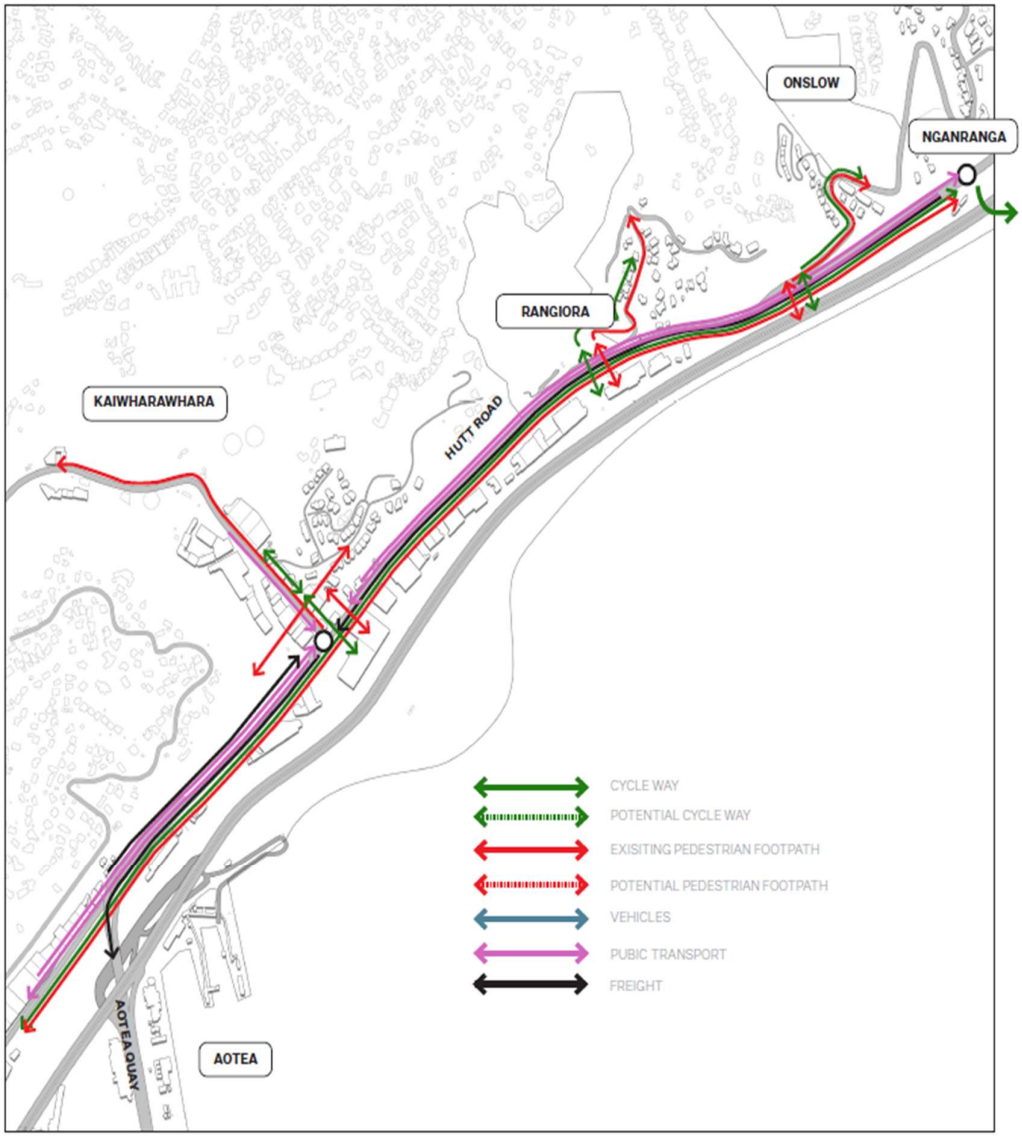
Option 1 provides a peak period southbound special vehicle lane on Hutt Road and southbound bus lane on Thorndon Quay. When not in use, the special vehicle lane / bus lane will be available for parallel parking. A bidirectional cycleway will be provided on the eastern (seaward) side of Hutt Road and Thorndon Quay. Option 1 is summarised in the diagrams below. Note that the dimensions on the cross sections are indicative only.



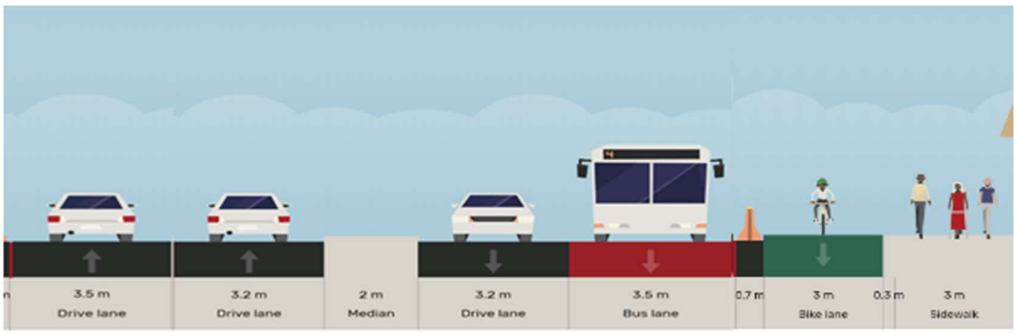
Option 1 - Thorndon Quay Indicative Plan



Option 1 - Thorndon Quay Indicative Cross Section



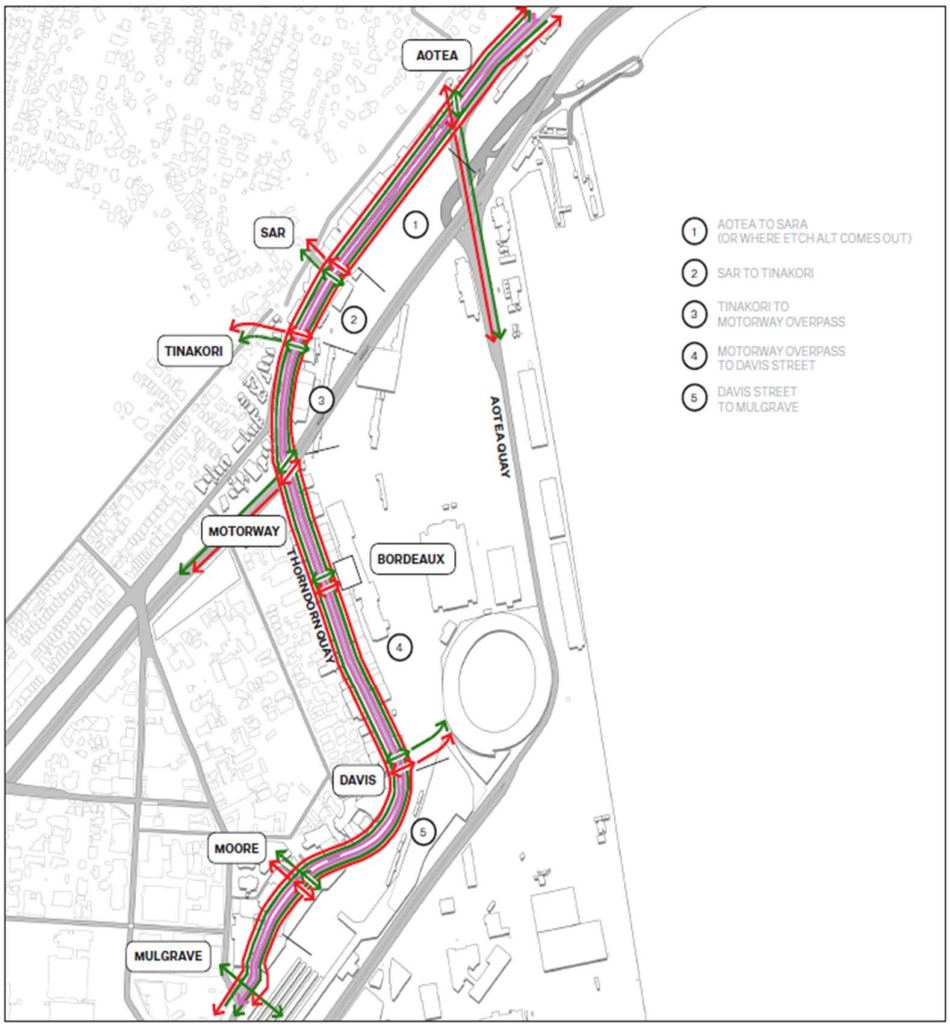
Option 1 - Hutt Road Indicative Plan



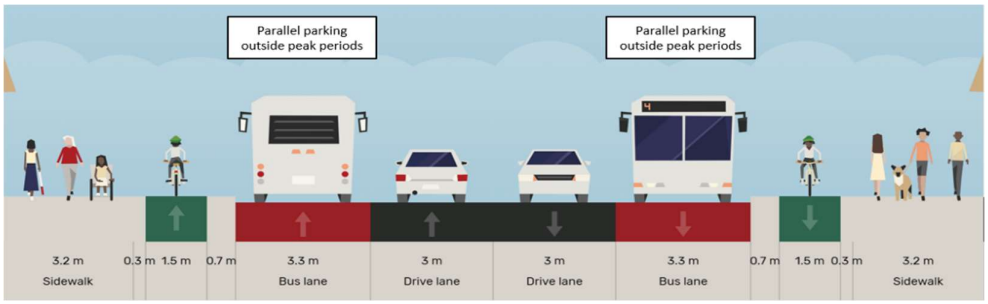
Option 1 - Hutt Road Indicative Cross Section

Option 2

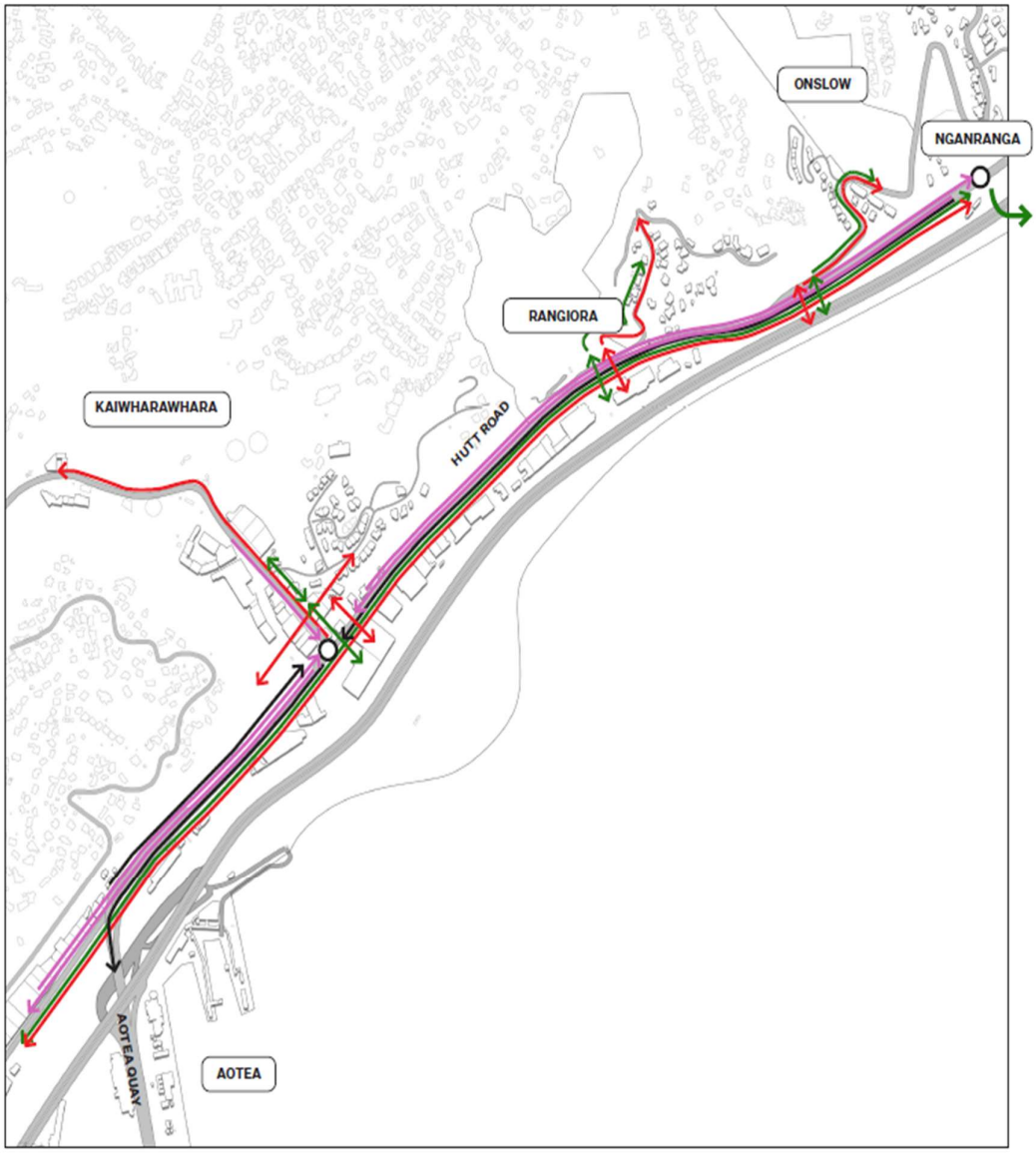
Option 2 provides peak period northbound and southbound special vehicle lanes on Hutt Road and bus lanes on Thorndon Quay. When not in use, the special vehicle lane / bus lane will be available for parallel parking. A unidirectional cycleway (one direction of travel each side) will be provided on Thorndon Quay which will connect to the bidirectional cycleway on Hutt Road. Option 2 is summarised in the diagrams below. Note that the dimensions on the cross sections are indicative only.



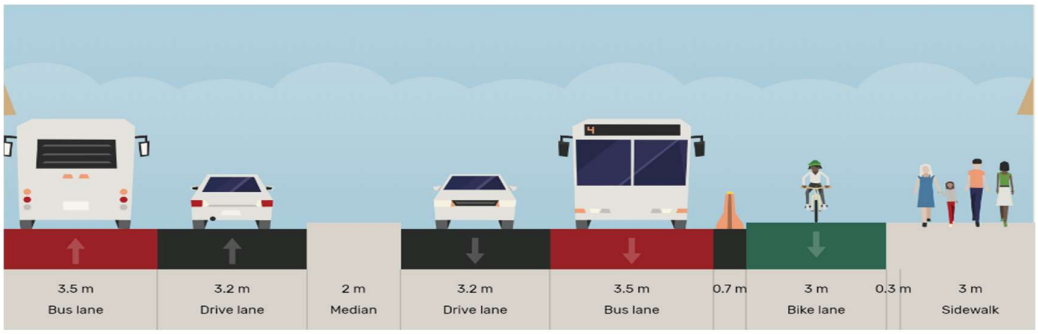
Option 2 - Thorndon Quay Indicative Plan



Option 2 - Thorndon Quay Indicative Cross Section



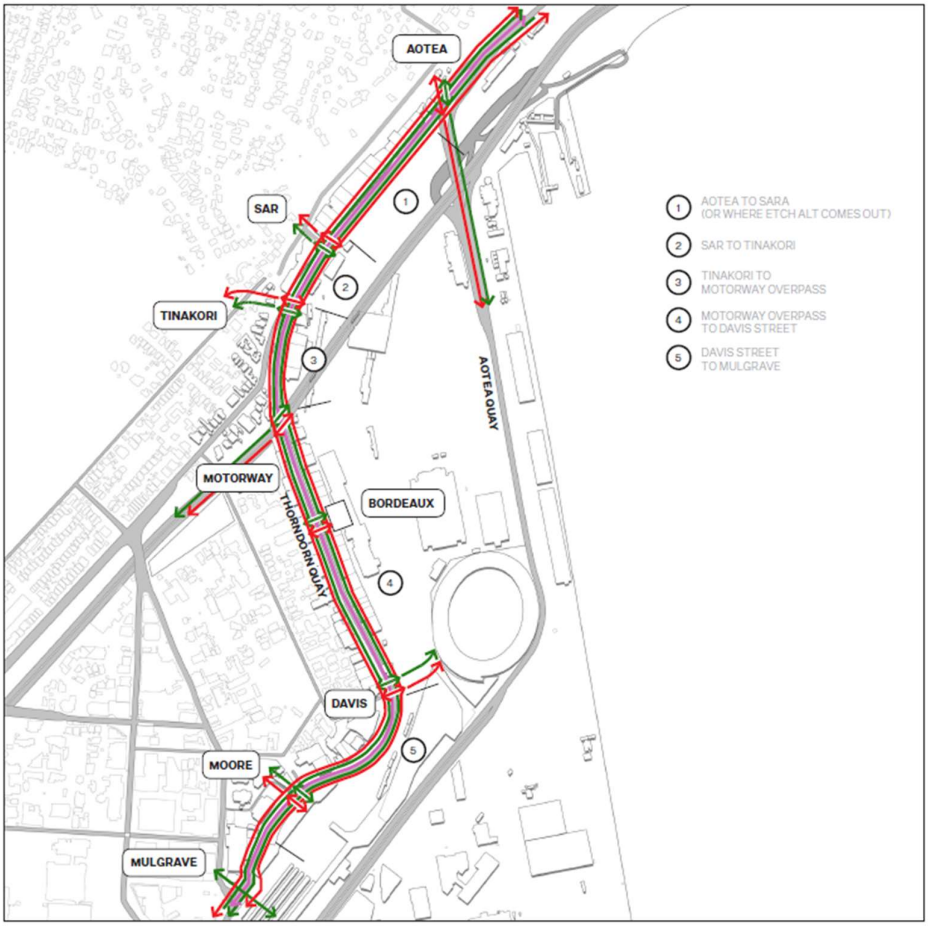
Option 2 - Hutt Road Indicative Plan



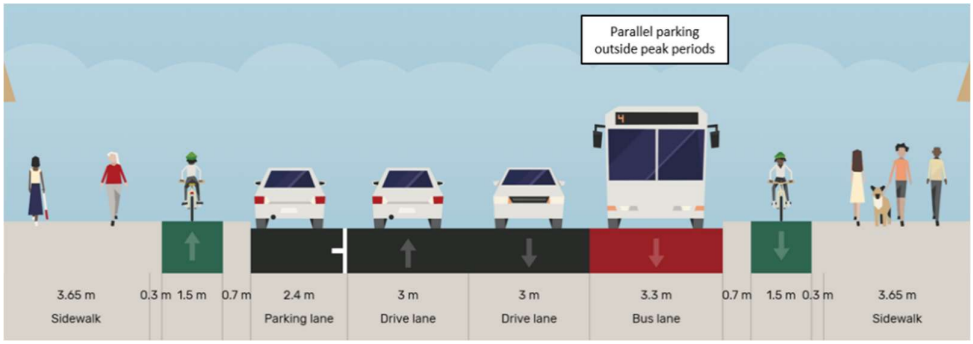
Option 2 - Hutt Road Indicative Cross Section

Option 3

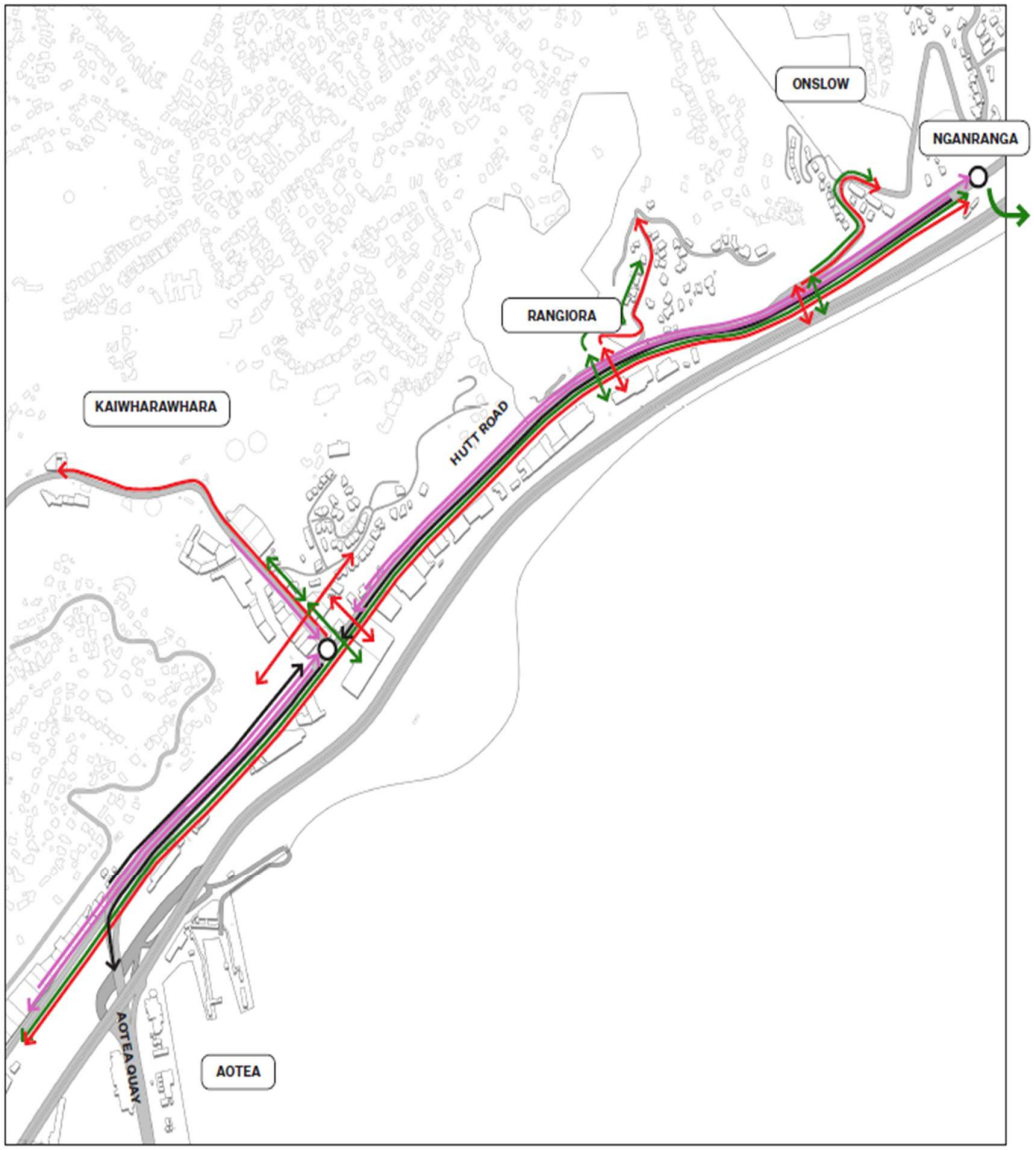
Option 3 provides a peak period southbound special vehicle lane on Hutt Road and southbound bus lane on Thorndon Quay. When not in use, the special vehicle lane / bus lane will be available for parallel parking. A unidirectional cycleway (one direction of travel each side) will be provided on Thorndon Quay which will connect to the bidirectional cycleway on Hutt Road. Option 3 is summarised in the diagrams below. Note that the dimensions on the cross sections are indicative only.



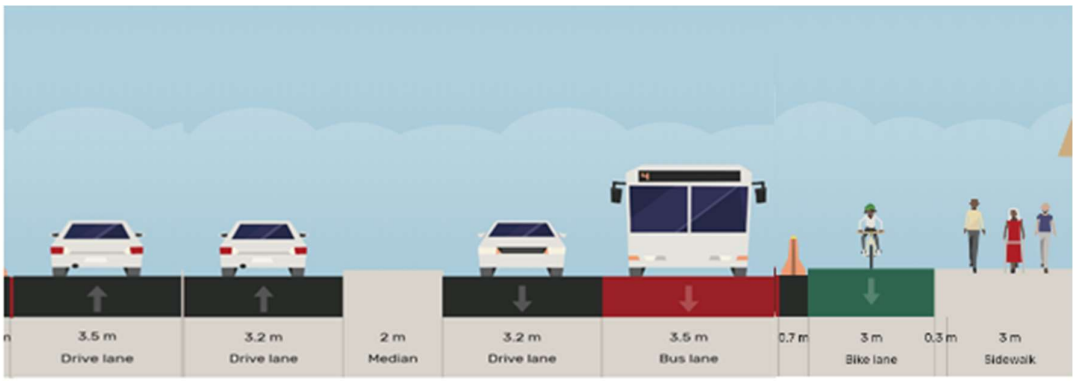
Option 3 - Thorndon Quay Indicative Plan



Option 3 - Thorndon Quay Indicative Cross Section



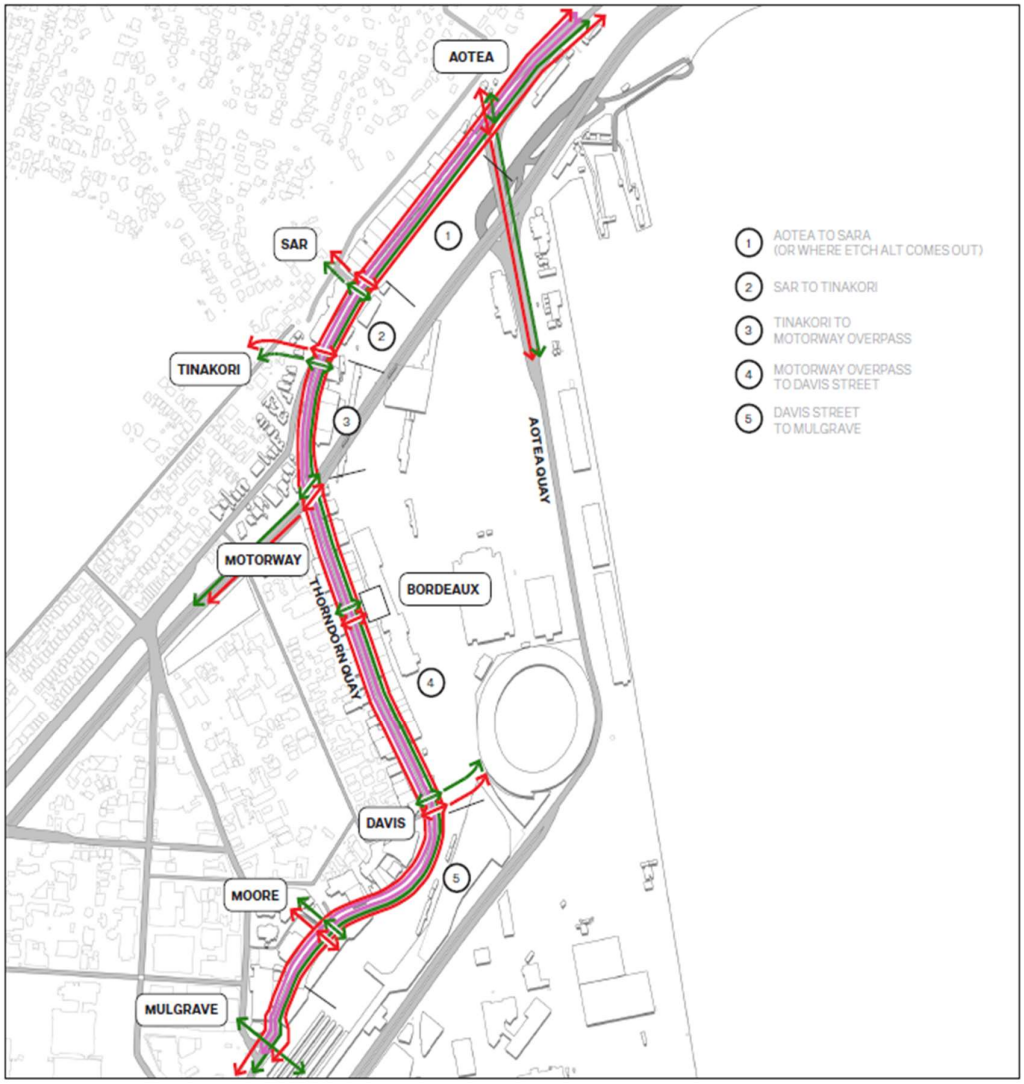
Option 3 - Hutt Road Indicative Plan



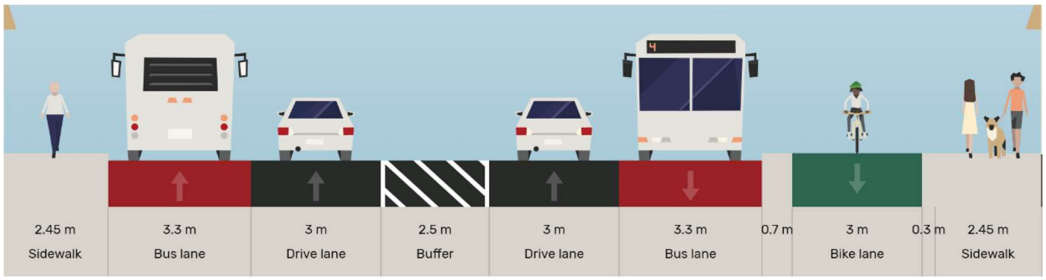
Option 3 - Hutt Road Indicative Cross Section

Option 4

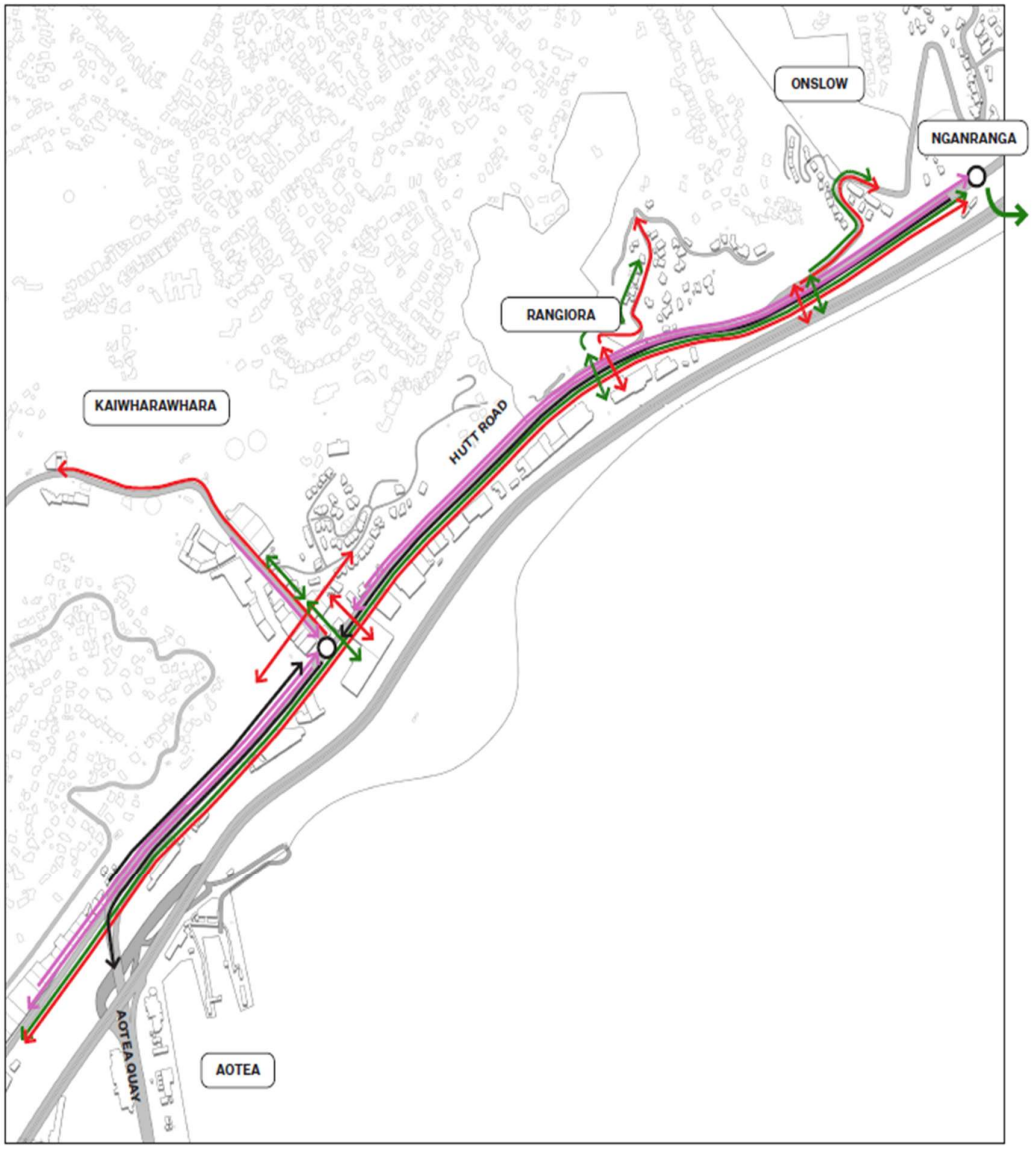
Option 4 provides peak period northbound and southbound special vehicle lanes on Hutt Road and bus lanes on Thorndon Quay. When not in use, the special vehicle lane / bus lane will be available for parallel parking. A bidirectional cycleway will be provided on the eastern (seaward) side of Hutt Road and Thorndon Quay. Option 4 is summarised in the diagrams below. Note that the dimensions on the cross sections are indicative only.



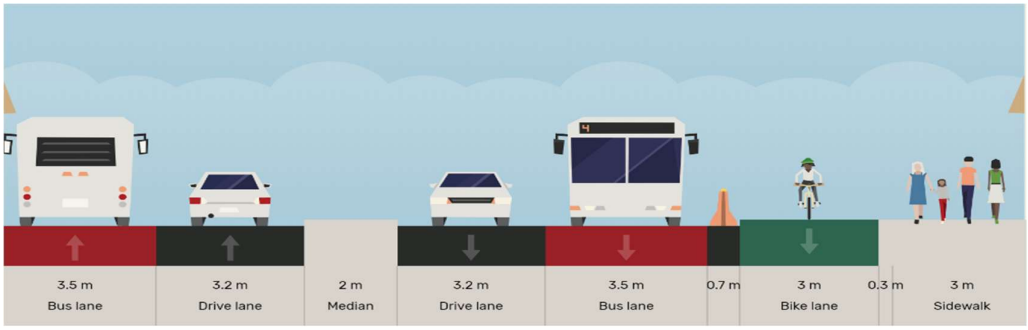
Option 4 - Thorndon Quay Indicative Plan



Option 4 - Thorndon Quay Indicative Cross Section



Option 4 - Hutt Road Indicative Plan



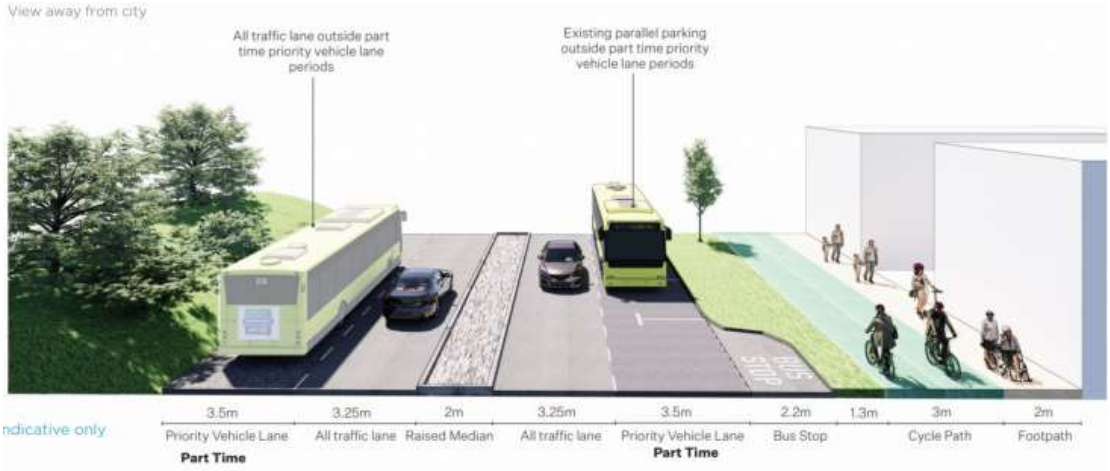
Option 4 - Hutt Road Indicative Cross Section

Suboptions

The long list assessment found that the provision of a special vehicle or bus lane on Hutt Road added additional risks to right turning traffic and had the potential to mask motorcyclists that would share the lane with buses. Vehicles exiting properties may not see motorcyclists travelling behind or close to buses when they share the lane. To mitigate this risk, a left in / left out option and a service lane suboption were developed and included in the short list as two sub-options to each main option (suboptions A and B).

Suboption A

Suboption A includes the provision of a raised median along Hutt Road to restrict turning movements to left-in / left-out. Provision for U-turns will be made at the north and south extents of Hutt Road. Potential locations for mid-block locations would also be investigated. An indicative cross section of Hutt Road with the raised median is shown below.



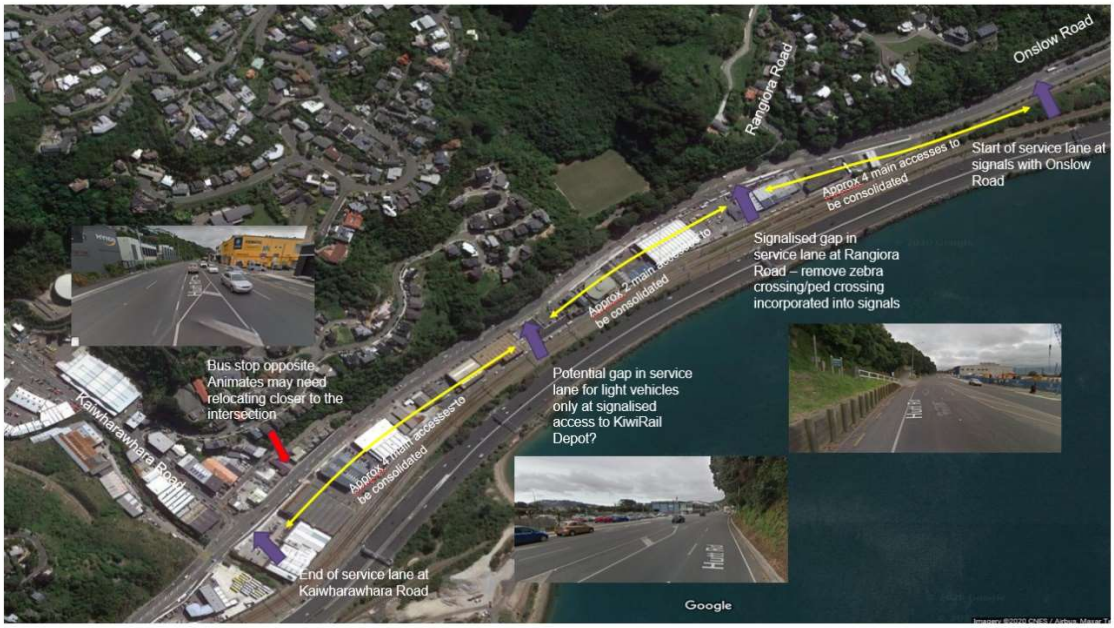
Suboption A: Hutt Road Indicative Cross Section

The diagram below shows the current U-turn area near Glover Street.

Existing U-turn Facility Near Glover Street

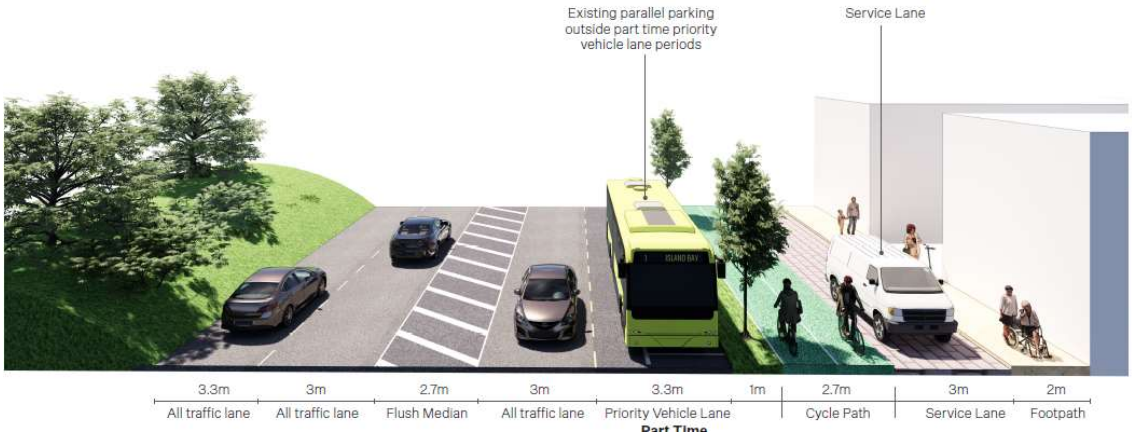
Suboption B

Suboption B includes the provision of a service lane along the eastern side of Hutt Road for property access. The service lane would extend from Onslow Road in the north to Kaiwharawhara Road in the south as shown in the figure below.

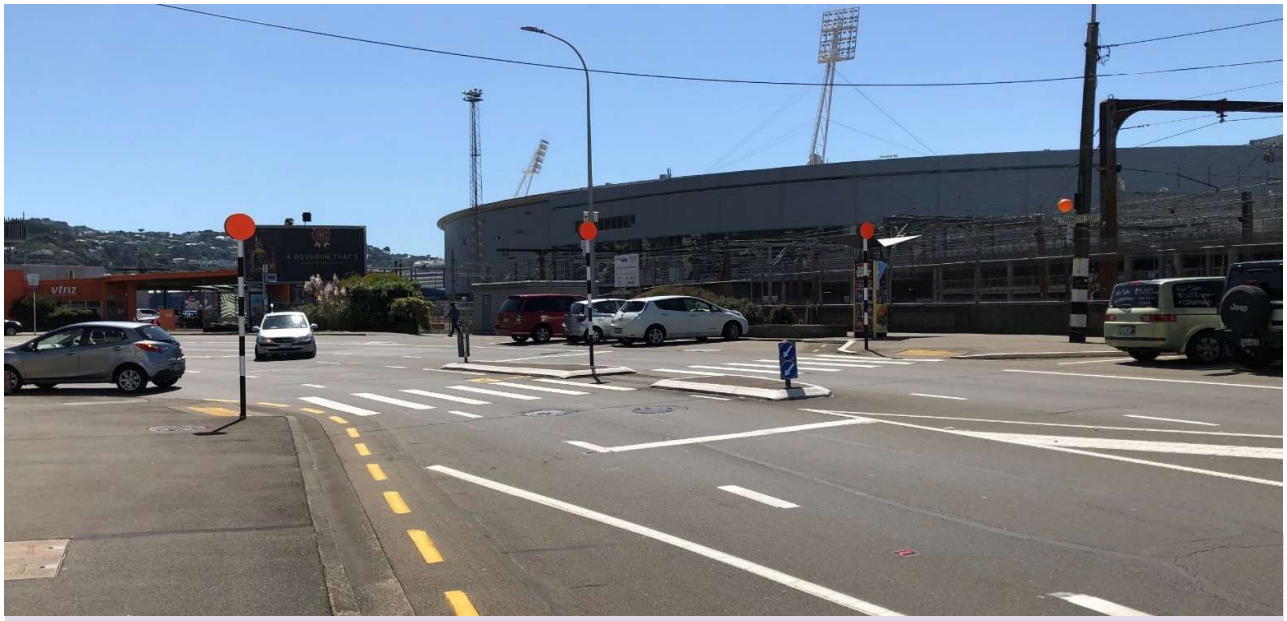


Suboption B: Extent of Service Lane

An indicative cross section for Hutt Road with the service lane is shown in the figure below.



Suboption B: Hutt Road Indicative Cross Section with Service Lane



Appendix B

Traffic Modelling Report

Thorndon Quay and Hutt Road – Single Stage Business Case

Transport Modelling and Analysis

9 November 2020

Let's GET Wellington MOVING

WAKA KOTAHI NZ TRANSPORT AGENCY

greater WELLINGTON REGIONAL COUNCIL Te Pane Matua Taiao

Absolutely Positively Wellington City Council Me Heke Ki Pōneke

Contents

Executive Summary

Overview

This report outlines the transport modelling undertaken for Stage 1 of the Thorndon Quay and Hutt Road – Single Stage Business Case relevant for the options development and assessment. The broad approach is to use a combination of spreadsheet modelling and intersection modelling to provide an indicative level of benefits for options currently being considered. It should be noted, this document describes the indicative modelling only. Stage 2 of the project will assess the preferred option in more detail via a combination of AIMSUN and WTSM models operated by the Wellington Analytics Unit.

Thorndon Quay and Hutt Road are part of the critical northern route to and from Wellington city. Achievable benefits identified early include bus priority, reliability improvements and safety improvements for people cycling between the city and the planned Te Ara Tupua Ngauranga to Petone walking and cycling link.

The objectives of the Thorndon Quay and Hutt Road Single Stage Business Case are to:

1. Improve reliability of bus service equivalent to current daytime speed and variability by 2026 and maintain to 2036;
2. Improve Level of Service (LoS) for non-car modes by 2026 and maintain to 2036 - Walking LoS (C), Cycling LoS (A/B). Public Transport – Sufficient capacity for growth;
3. Reduce the safety risk along Thorndon Quay and Hutt Road for all vulnerable road users and Hutt Road for vehicles by 2030;
4. Amenity aligns with Place and Movement Framework criteria for Thorndon Quay by 2036; and
5. Freight - Maintain similar access (level of service) for people and freight to the ferry terminal / CentrePort.

Options Considered

The corridor options assessed are as follows:

Concept	Elements			Common Elements
	Thorndon Quay Bus Lanes	Thorndon Quay Cycle Lanes	Hutt Road Special Vehicle Lanes	
1	Southbound	Bi-directional	Southbound	▪ Speed limit changes ▪ Intersection upgrades ▪ Pedestrian Crossing Improvements ▪ Bus stop rebalancing ▪ Thorndon Quay amenity ▪ Hutt Road Safety Audit recommendations
2	Both directions	Uni-directional	Both directions	
3	Southbound	Uni-directional	Southbound	
4	Both directions	Bi-directional	Both directions	

Common elements to the proposals which have been incorporated into the modelling include:

- Reduced speeds;
- Signalising existing zebra crossings;
- A new signalised crossing under the motorway overpass;
- Signalising the intersection of Hutt Road, Thorndon Quay and Tinakori Road; and
- Rationalising the bus stops.

Converting a traffic lane to a special vehicle lane on Hutt Road between Kaiwharawhara Road and Aotea Quay has not been modelled, as it has potential for severe congestion between Hutt Road and Kaiwharawhara Road (morning peak) and, Aotea Quay and Hutt Road (evening peak), with wider network effects that may negate the public transport reliability improvements.

A high-level assessment has been undertaken to understand the potential benefits and effects of a service lane or raised median along Hutt Road (near Kaiwharawhara) and a roundabout at Aotea Quay.

Analysis Approach

The analysis conducted has been used to inform the anticipated benefits and effects for:

- Investment Objective 1 – Reliability of bus services;
- Investment Objective 2 – Active mode levels of service; and
- Investment Objective 5 – Freight reliability.

The assessment of motorised modes (buses, cars and trucks) has been undertaken for the morning and evening peak periods in each direction using a spreadsheet model that has been based on the Waka Kotahi Research Report 557, but disaggregated into sections to allow for the different options being considered. The model was validated to within 10% of the journey times for buses and for other traffic. This report presents the design year results (2036) and has been supplemented with SIDRA analysis for the Aotea Quay turnaround, and service lane on Hutt Road (near Kaiwharawhara).

Public transport patronage, route and mode choice, and traffic volume forecasts have been provided from the WTSM and AIMSUN models respectively. The AIMSUN models were developed for 2026, so a 10% uplift was applied to estimate a 2036 scenario. This will be verified following the WSTM tests to compare the do minimum and design option.

The assessment of active modes along the corridor has been undertaken using the Danish Level of Service method, and the crossing level of service has been based on both the crossing spacing and the crossing delay times as per Austroads[1].

[1] Austroads Research Report – Level of Service Metrics (Network Operations Planning)

Results Summary

Bus and Freight Reliability

Table 1 and Table 2 present a summary of travel times between Ngauranga and Mulgrave Street for the options assessed. Different types of Special Vehicle Lanes on Hutt Road were considered due to the potential consequential impact of replacing one of the general traffic lanes with a Special Vehicle Lane. The potential attractiveness of the Special Vehicle Lane for people currently using SH1 has not been analysed at this stage, but it could be substantial. The main body of the report presents more detailed results.

Table 1: Summary results for southbound direction (2036 Morning Peak Period 7am – 9am)

Scenario	Bus Travel Time	Truck Travel Time	Car Travel Time
Base	12.9	10.8	
Do-Minimum (2036)	21.0	18.1	
Bus Lane on Hutt Road (Ngauranga to Kaiwharawhara): **Bus Lane on Hutt Road (Aotea Quay to Tinakori Road) and Thorndon Quay**	10.7	24.5	
HOV Lane (T2 or T3, no Trucks) on Hutt Road (Ngauranga to Kaiwharawhara): **Bus Lane on Hutt Road (Aotea Quay to Tinakori Road) and Thorndon Quay**	10.1 – 11.2	23.3 – 25.1	
HOV Lane (T2 or T3, with Trucks) on Hutt Road (Ngauranga to Kaiwharawhara): **Bus Lane on Hutt Road (Aotea Quay to Tinakori Road) and Thorndon Quay**	11.1 – 20.2	11.0 – 18.5	20.2 – 21.6

Table 2: Summary results for northbound direction (2036 Evening Peak Period 4pm – 6pm)

Scenario	Bus Travel Time	Truck Travel Time	Car Travel Time
Base (Modelled)	11.2	9.6	
Do-Minimum (2036)	11.4	10.6	
Bus Lane on Hutt Road (Ngauranga to Kaiwharawhara): **Bus Lane on Hutt Road (Aotea Quay to Tinakori Road) and Thorndon Quay**	9.8	13.2	
HOV Lane (T2 or T3, no Trucks) on Hutt Road (Ngauranga to Kaiwharawhara): **Bus Lane on Hutt Road (Aotea Quay to Tinakori Road) and Thorndon Quay**	10.0	13.1 – 21.8	
HOV Lane (T2 or T3, with Trucks) on Hutt Road (Ngauranga to Kaiwharawhara): **Bus Lane on Hutt Road (Aotea Quay to Tinakori Road) and Thorndon Quay**	10.4 – 10.6	11.2 – 13.7	13.9 – 16.4

Bus Reliability

The provision of a Special Vehicle Lane on Hutt Road and a bus lane along Thorndon Quay is likely to result in consistent travel times in the order of 10 - 11 minutes through to 2036 in both directions. This is lower than the current observed peak period journey times and similar to the off-peak travel times, where there is very little congestion along the corridor.

In the morning peak period, when compared to the 2036 scenario without bus priority measures (the do-minimum), the potential benefit could be in the order of 10 minutes per bus. In the evening period, the benefits are expected to be in the order of 1 – 2 minutes; however, the caveat is that the model does not account for blocking back from the motorway ramps, and hence the benefits of bus priority are likely to be higher than estimated in this assessment. It is understood that the AIMSUN model includes for this, and therefore will be assessed within Phase 2.

During the day, the future conditions along the corridor are unlikely to significantly impact on the reliability of bus services (subject to parking turnover) that would warrant further consideration of full-time bus lanes or Special Vehicle Lanes along the corridor (particularly along Thorndon Quay).

The exception to the above conclusion is in the morning peak period where a T2 lane with trucks is proposed. The volumes of traffic eligible to use the Special Vehicle Lane on Hutt Road is too high to provide any benefit to any motorised mode travelling southbound through this section. This is also likely to apply for a T2 lane without trucks as cars with more than two

occupants that use SH1 shift to Hutt Road to take advantage of the Special Vehicle Lane. Therefore, it is recommended that a T2 lane (with or without trucks) is not considered further.

This exercise confirms that a Special Vehicle Lane on Hutt Road and a proposed bus lane on Thorndon Quay are likely to provide benefits in the peak direction (southbound in the morning and northbound in the evening). This provides a strong contribution to Investment Objective 1 related to bus reliability, with the southbound direction in the morning peak period expected to provide the greatest benefits.

Freight Reliability

The reliability for trucks appears to be contingent on two aspects:

1. If trucks are eligible to use the Special Vehicle Lane on Hutt Road (Ngauranga to Kaiwharawhara); and
2. If trucks are not permitted to use the Special Vehicle Lane on Hutt Road (Ngauranga to Kaiwharawhara) and are confined to the general traffic lanes.

The use of the bus lanes on Thorndon Quay by trucks has not been considered as it is inconsistent with the street environment, there are likely to be challenges associated with the interaction at bus stops and the entrance to the bus terminal (crossing over the traffic lanes)

If trucks are eligible to use the Special Vehicle Lane on Hutt Road (between Kaiwharawhara and Ngauranga), then the reliability benefits for trucks (particularly in the peaks) are likely to be similar to the estimated public transport benefits in this section of the corridor.

If trucks are not eligible to use the Special Vehicle Lane, then they are likely to be susceptible to the impacts of replacing a general traffic lane with the Special Vehicle Lane (in the peak periods), which are expected to be a combination of:

1. Increased public transport patronage beyond what is forecast in Wellington Transport Strategy Model (WTSM) in the longer term;
2. Re-routing from Hutt Road to SH1 and other routes (such as Ngaio Gorge) beyond what is forecast in WTSM;
3. Re-routing from SH1 for vehicles eligible to use a Special Vehicle Lane on Hutt Road;
4. Peak spreading; and
5. Provision of an alternative route to the Interislander Ferry Terminal via the proposed Aotea Quay roundabout (discussed below).

The WTSM model forecasts reduce the traffic volume significantly, but still require an additional 300 vehicle per hour (~5% of the peak motorway flow) reduction in the demand for Hutt Road; however there isn't the capacity on the motorway through the interchange to accommodate this in the 7am – 9am period and there is limited spare capacity in the 6am – 7am period. However, the combination of the above has the potential to provide a neutral outcome for freight travelling to Aotea Quay, but a range of impacts from neutral to moderate negative for trucks travelling via Thorndon Quay.

This uncertainty in the impacts warrants further investigation in both the elasticities of the public transport response, the routing in AIMSUN, and the potential impacts outside the modelled periods in both the AIMSUN models and WTSM models.

Benefit and Impact of Aotea Quay Roundabout

The potential benefit of the Aotea Quay roundabout is the potential to allow people and trucks travelling to the Interislander Ferry Terminal via SH1, instead of Hutt Road (which is the only route from the north accessible to the ferry terminal), and has the potential to be heavily congested in the morning peak period with the implementation of a Special Vehicle Lane. The work undertaken as part of the Multi-User Ferry Terminal project indicates that this may be in the order of 400 vehicles per hour in the respective morning and evening peaks. The conclusion at this stage is that there is merit in using the AIMSUM models to progress more detailed investigations of the benefits of this inclusion; however it is anticipated that there is a benefit for Interislander travel compared to the scenarios with a Special Vehicle Lane on Hutt Road but without the Aotea Quay roundabout.

Impact of Service Lane

The provision of a service lane along Hutt Road at Kaiwharawhara introduces another traffic signal phase and reduces the overall level of service to poor (F). However, except for a Special Vehicle Lane being a T2 lane (with or without trucks), the Special Vehicle Lane should operate reasonably efficiently, therefore continuing to provide benefits for public transport. If trucks are not able to use the Special Vehicle Lane, then they will be affected by the provision of the service lane to the same level as general traffic.

Furthermore, if the preferred proposal is to connect to a new Multi-User Ferry Terminal at the intersection of Hutt Road and Kaiwharawhara Road, the inclusion of the service lane would result in a 5-phase intersection, which may affect the performance of the Special Vehicle Lane as well. It is recommended that the Phase 2 work undertakes sensitivity testing to determine the impacts.

Active Modes

The assessment for active modes has been undertaken separately for facilities along the corridor and crossing opportunities along the section of the corridor between Aotea Quay and Thorndon Quay. Through the section between the motorway overpass and Tinakori Road, the cycling level of service with uni-directional cycle paths is expected to be poor, primarily due to the constrained width through the section, hence the bi-directional cycleway is preferred.

Walking level of service is expected to be good along the corridor for all options except the concept with bus lanes in both directions, and uni-directional cycle paths.

The levels of service estimated using the Danish Cycling Level of Service Method are provided in Table 3.

Table 3: Active Mode Level of Service along the corridor (Danish Level of Service)

Segment	Northbound		Southbound	
	Walk	Cycle	Walk	Cycle
Existing	D	F	D	F
Concept 1: Southbound bus lane with a bi-directional facility (a) Hutt Road (Aotea Quay to Tinakori Road) and Thorndon Quay (Motorway overpass to Mulgrave Street)	C	F	C	C
Concept 2: Bus Lanes in both directions with uni-directional cycle paths (a) Hutt Road (Aotea Quay to Tinakori Road) and Thorndon Quay (Motorway overpass to Mulgrave Street)	C	D	D	D
Concept 3: Southbound bus lane with uni-directional cycle paths (a) Hutt Road (Aotea Quay to Tinakori Road) and Thorndon Quay (Motorway overpass to Mulgrave Street)	C	E	C	E
Concept 4: Bus lane in both directions with a bi-directional facility (a) Hutt Road (Aotea Quay to Tinakori Road) and Thorndon Quay (Motorway overpass to Mulgrave Street)	C	F	C	B

The active mode level of service for people crossing the road has been evaluated using the level of service metrics provided by Austroads[2] which consider both the crossing delay and the crossing spacing.

The analysis indicates that if pedestrians and buses are prioritised over general traffic, then a 50 second cycle time would provide a good level of service for pedestrians crossing the road and public transport. At a 70 second cycle time (pedestrian delay of 30 seconds), it is anticipated that the reliability of public transport can be maintained for the concepts with no northbound bus lane on Thorndon Quay, but at the expense of increased pedestrian delay.

[2] AP-R575-15: Level of Service Metrics (Network Operations Planning, Figure A1.

The crossing level of service could be improved with additional crossings along the corridor, including under the motorway overpass (next to relocated bus stops), at Tinakori Road and potentially others along Thorndon Quay to provide a 100m spacing. In peak times, with a cycle time of 70 seconds, the level of service for all modes is expected to be good, and in off-peak periods a cycle time of 50 seconds would also result in a good level of service for all modes.

Conclusions and Next Steps

From the analysis undertaken, the following initial conclusions have been developed, and are subject to more detailed assessment in the next stage of the project:

1. There is a very strong case for bus priority (southbound) in the morning peak (as per Concept 1 and Concept 3) as it expected that there will be significant benefits;
2. There is a case for bus priority (northbound) in the evening peak, however the expected benefit is lower than benefits in the southbound morning peak;
3. It is expected that with peak period bus priority, the bus journey times will be in the order of 10-11 minutes which is lower than currently observed, and in the case of the morning peak period, significantly lower than the do-minimum;
4. There doesn't appear to be a strong case for all-day bus priority along the corridor as the level of service (reliability) is expected to remain good in off-peak periods through to 2036. However, along Hutt Road there would likely be a lesser impact to other road users if the Special Vehicle Lane was implemented before congestion develops throughout the day;
5. The type of Special Vehicle Lane is a balancing act between improving reliability for buses, improving reliability for freight, managing the impact of converting a general traffic lane to a Special Vehicle Lane, and ensuring that the volume of traffic in the Special Vehicle Lane does not negate its benefits. As a result, the recommendation at this stage (excluding safety considerations) is to exclude a T2 lane from further investigation;
6. The roundabout at Aotea Quay/Mainfreight entrance should be included under all options to provide an additional access to the Interislander Ferry Terminal, and/or to mitigate potential impacts of restricting right turn movements on Hutt Road if a raised median is implemented. The roundabout at Aotea Quay may negate the need to allow trucks in the Special Vehicle Lane to achieve the investment objective related to access to the Interislander Ferry Terminal;
7. Consider additional controlled crossing points along Thorndon Quay to reduce the spacing between the current (which will be upgraded) and proposed crossings at Tinakori Road and the motorway overpass (where bus stops are proposed). More crossings will improve the level of service by reducing the distance to walk to a formal crossing point. The provision of additional crossings is unlikely to have a significant impact on the reliability of public transport along the corridor;
8. Uni-directional cycle paths on Thorndon Quay (between the motorway overpass and Thorndon Quay) are expected to result in a poor level of service for cycling and walking due to the constrained width, hence extending the existing bi-directional cycle path is recommended;
9. The provision of a bi-directional path along Thorndon Quay provides good level of service (B/C) and a higher level of service than the uni-directional cycle paths (D/E) using the Danish Cycling Level of Service method. This is primarily due to the path width and the buffer between the cycle path and the road. However, this assessment

does not consider the safety implications of a bi-directional cycle path, which is being addressed through the Investment Objective related to safety;

10. The elasticities of the public transport response, the routing in AIMSUN, and the potential impacts outside the modelled periods in both the AIMSUN models and WTSM models are to be further investigated in Stage 2 of the project to confirm the assessment of the reliability for trucks.

Introduction

Overview

This report outlines the transport modelling undertaken for Stage 1 of the Thorndon Quay and Hutt Road – Single Stage Business Case relevant for the options development and assessment. The broad approach is to use a combination of spreadsheet modelling and intersection modelling to provide an indicative level of benefits for options currently being considered. In Stage 2 of the project, the preferred option will be assessed in more detail utilising a combination of AIMSUN and WTSM models operated by the Wellington Analytics Unit.

The Project

The Thorndon Quay and Hutt Road Single Stage Business Case (SSBC) project is one the of LGWM's Early Delivery interventions whose benefits could be delivered relatively quickly and are not constrained by the scope of the larger elements in the programme such as Mass Transit. The project is currently in its first stage of development which is seeking to identify a preferred option to deliver on the investment objectives agreed by the LGWM Steering Group.

Thorndon Quay and Hutt Road are part of the critical northern route to and from Wellington city. Achievable benefits identified early include bus priority, reliability improvements and safety improvements for people cycling between the city and the planned Te Ara Tupua Ngauranga to Petone walking and cycling link.

The objectives of the Thorndon Quay and Hutt Road SSBC are to:

1. Improve reliability of bus service equivalent to current daytime speed and variability by 2026 and maintain to 2036;
2. Improve Level of Service (LoS) for non-car modes by 2026 and maintain to 2036 - Walking LoS (C), Cycling LoS (A/B). Public Transport – Sufficient capacity for growth;
3. Reduce the safety risk along Thorndon Quay and Hutt Road for all vulnerable road users and Hutt Road for vehicles by 2030;
4. Amenity aligns with Place and Movement Framework criteria for Thorndon Quay by 2036; and
5. Freight - Maintain similar access for people and freight to the ferry terminal / CentrePort.

The analysis is intended to provide quantitative outputs to assess the benefits and impacts of the options against:

- Investment Objective 1 – Reliability of bus services;
- Investment Objective 2 – Active mode levels of service; and,
- Investment Objective 5 – Freight reliability.

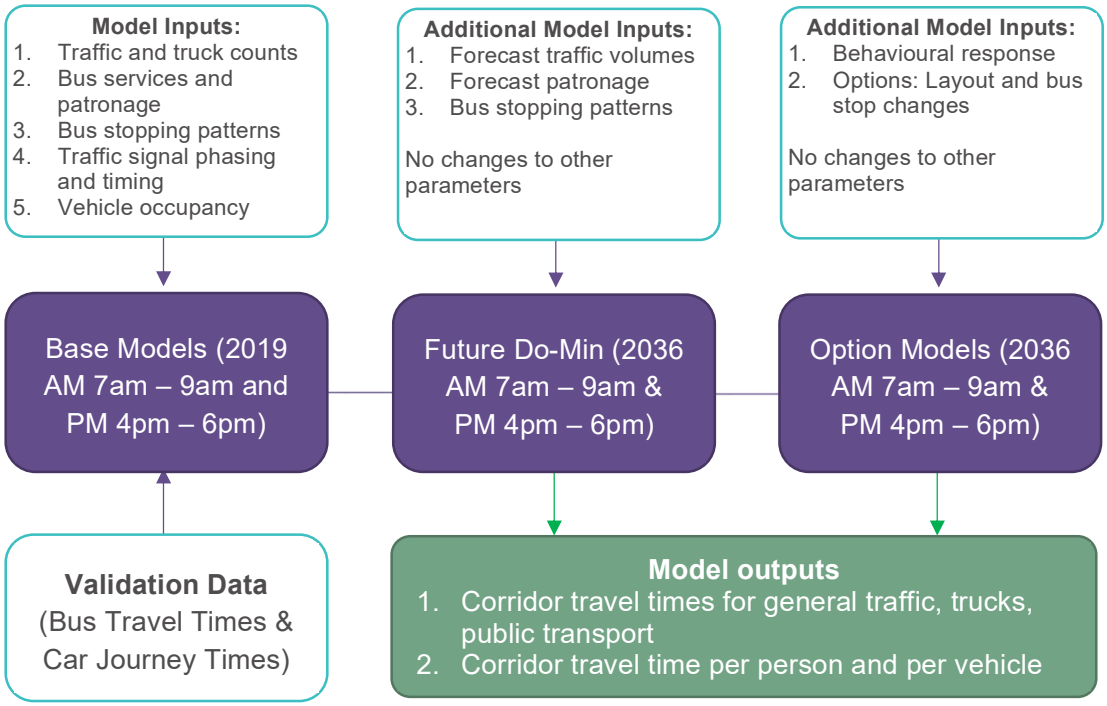
Methodology

Model Development

Overall Approach

The assessment of motorised modes (buses, cars and trucks) has been undertaken using a spreadsheet model based on the Waka Kotahi Research Report 557 but disaggregated into sections to allow for the different options being considered. These models have been developed for the morning and evening 2-hour peaks (7am – 9am and 4pm – 6pm respectively). The overall modelling approach is outlined in Figure 1.

Figure 1:Overall Modelling Approach for the corridor assessments



Base Model Inputs

The base model inputs and source are provided in Table 4.

Table 4: Base Model Inputs

Input	Source
Traffic Counts	SCATS and Tube Counts supplied by WCC and WAU that were reconciled to provide a count set for the morning (7am – 9am) and the evening peak (4pm – 6pm)
Peak Factor (% of traffic in the peak hour out of the 2 hour)	SCATS and Tube Counts supplied by WCC and WAU indicating just over 50% of traffic in the peak hour
Traffic Signal Phasing and Timing	SCATS information supplied by WCC
Bus Patronage	Case for Change and WTSM
Bus Acceleration and Deceleration at stops	Default parameters in the Transit Quality of Service Manual (TRB, 2010)
Dwell Time Per Stop	Case for Change
% of buses stopping at each stop	Case for Change
Gap acceptance for buses to re-enter traffic stream	Wellington Bus Priority Indicative Business Case
Zebra Crossing Delays	Input from TomTom data due to difficulties in modelling zebra crossings
Average Vehicle Occupancy	Cordon survey supplied by WAU. Vehicle occupancy on Hutt Road was estimated using Thorndon Quay (AVO – 1.51) and Aotea Quay (AVO = 1.26) to give a vehicle occupancy of 1.38
% of T2 versus T3	Assumed to be a ratio of 4 T2s: 1 T3 in-line with case studies used in Waka Kotahi Research Report 557. This equates to ~31% T2s and 8% T3s

Model Process

The spreadsheet model calculates the travel times in the kerbside lane (based on the eligibility of vehicles in the kerbside lane) and the other general traffic lanes for each direction and each time period, by adding the segment travel times along the corridor. For general traffic, the segment travel time is the sum of:

- The mid-block travel time; and
- The intersection delay (noting that zebra crossing delay is an input).

For buses the segment travel time is the sum of:

- The mid-block travel time;
- The intersection delay (noting that zebra crossing delay is an input);
- Bus acceleration and deceleration at bus stops;
- Dwell time at bus stops; and
- Re-entry delay where bus stops are indented.

The model processes are provided in Table 5

Table 5: Model Processes

Input	Source
Mid-block travel time	Akcelik speed-flow curves Link capacity set at 1,400 vph for Hutt Road (Ngauranga to Aotea Quay) and 1,000 vph along Thorndon Quay Friction factor (J-Parameter) = 1 The volumes used in the calculations of midblock travel times are the 2-hour volumes * the peak factor.
Intersection Delay	Uses HCM intersection delay formula with the observed traffic signal times – no adjustments except for downstream blocking The volumes used in the calculations of intersection delay are the 2-hour volumes * the peak factor.
Re-entry delay	Gap acceptance for buses to re-enter traffic stream (Source: Wellington Bus Priority Indicative Business Case) and the kerbside lane volume are used to estimate the re-entry delay for indented bus stops.
Weighted average dwell time	Dwell time per stop * % of buses stopping at the stop.
Bus stop acceleration and deceleration	Estimated using default parameters in the Transit Quality of Service Manual and the average speeds estimated from TomTom data provided by Waka Kotahi. This may overestimate the delay where there are slower speeds due to congestion.
Lane assignment	Where there are no Special Vehicle Lanes traffic has been assigned equally to the lanes. Where there is a Special Vehicle Lane, vehicles were assigned to it based on the eligibility, with the remainder assigned to the general traffic lanes. There is a limit in the model that does not allow for higher volumes in the Special Vehicle Lane than the adjacent general traffic lane.
Limits: Capacity	The model includes a function to constrain traffic volumes from passing through to the next section where: 1. The mid-block lane capacity is exceeded 2. The intersection lane capacity is exceeded
Limits: Speeds and Delays	The model includes a function to limit the mid-block travel to 10kph (severe congestion) and a maximum intersection delay of 10 minutes

Model Validation

The spreadsheet models were validated against the observed journey times:

- For buses (using the journey time information for the section between Centennial Highway and the Mulgrave Bus Terminal in the Case for Change (Figure 35 and 36); and
- For general traffic (using journey time information provided from TomTom supplied by Waka Kotahi for the period between March and November 2019).

The results are provided in Table 6 and Table 7. Time distance diagrams are provided in Figure 2 - Figure 5 to demonstrate the alignment between the modelled journey times and the observed journey times at points along the route. The results show that the model is well aligned with the observed journey times, providing confidence that they can be used for forecasting and option testing. Phase 2 of the assessment will build on this information with the use of AIMSUN.

Table 6: Journey Time Validation – Southbound

Route	Observed	Modelled	Difference
Buses – AM	13.3 mins	12.9 mins	-0.4 mins
Buses – PM	9.8 mins	9.8 mins	0 mins
General Traffic – AM	10.7 mins	10.8 mins	+0.1 mins
General Traffic - PM	8.7 mins	7.9 mins	-0.8 mins

Table 7: Journey Time Validation – Northbound

Route	Observed	Modelled	Difference
Buses – AM	9.7 mins	10.1 mins	+0.4 mins
Buses – PM	9.6 mins	11.2 mins	+1.6 mins
General Traffic – AM	8.1 mins	8 mins	-0.1 mins
General Traffic - PM	9.5 mins	9.3 mins	-0.2 mins

Figure 2: Bus journey time profile – modelled vs observed (2019 AM southbound)

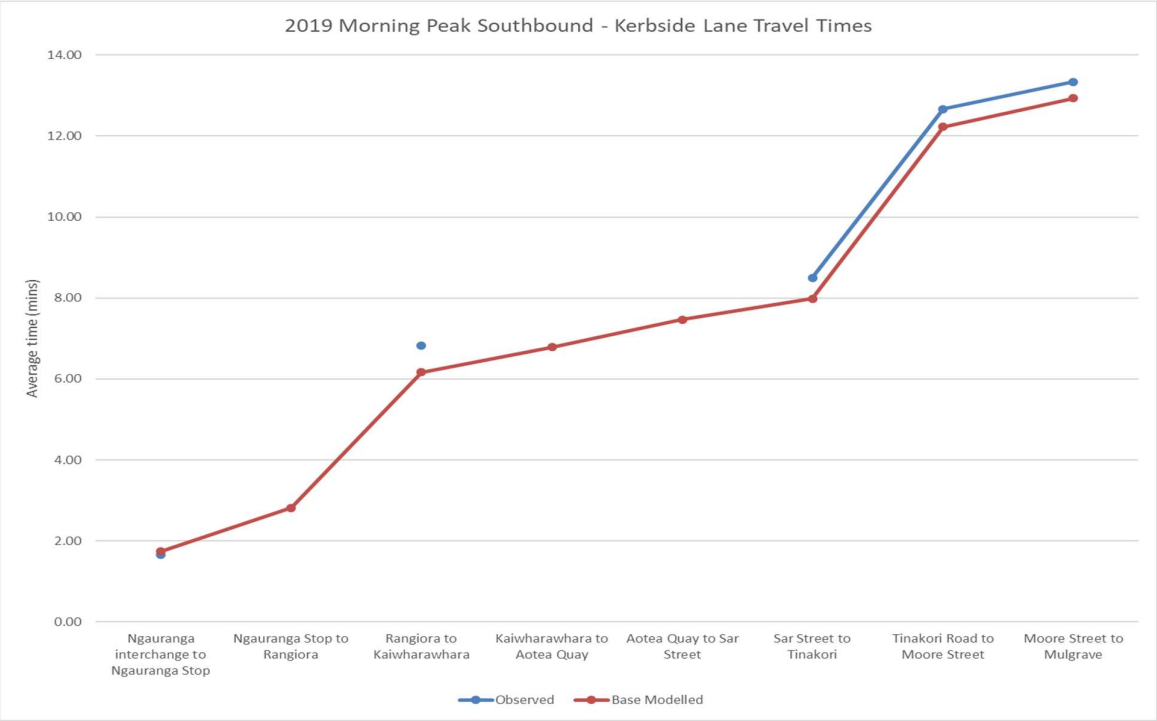


Figure 3: Bus journey time profile – modelled vs observed (2019 PM northbound)

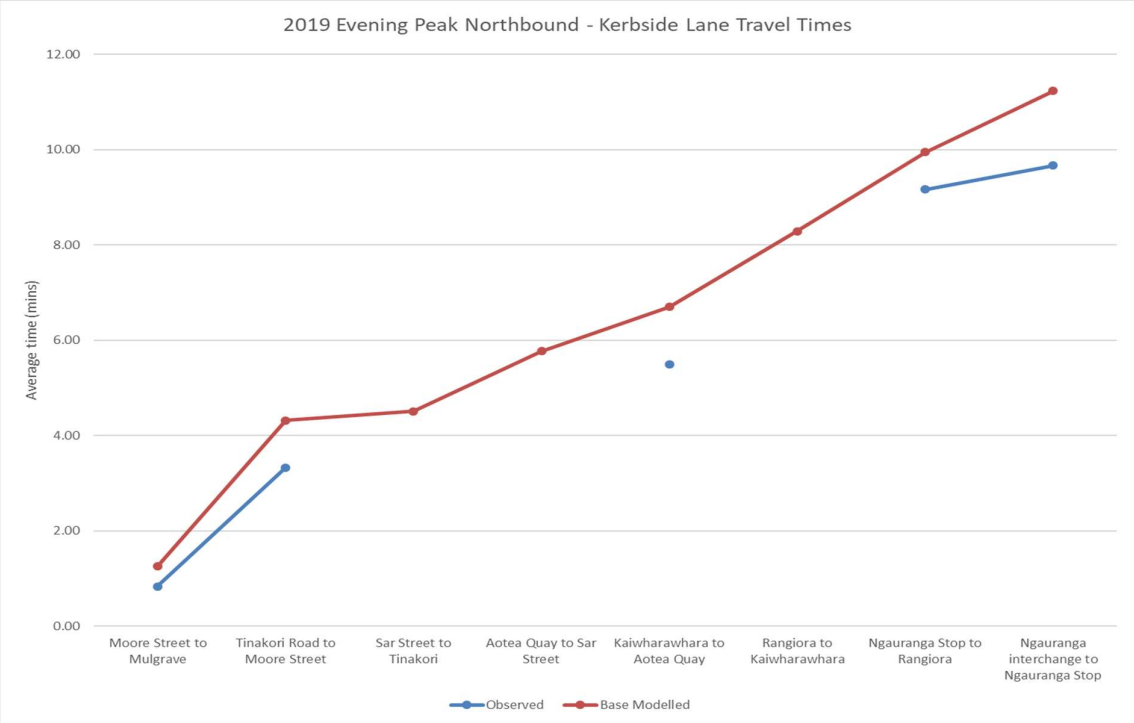


Figure 4: General traffic journey time profile – modelled vs observed (2019 AM southbound)

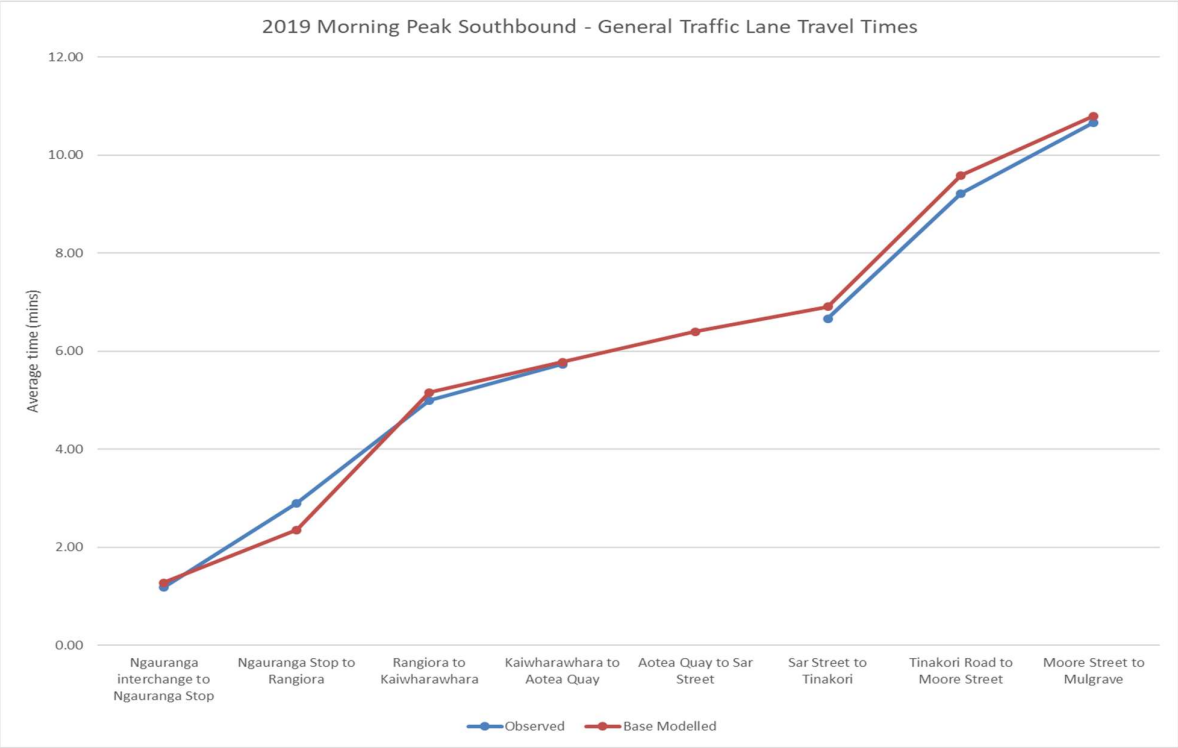
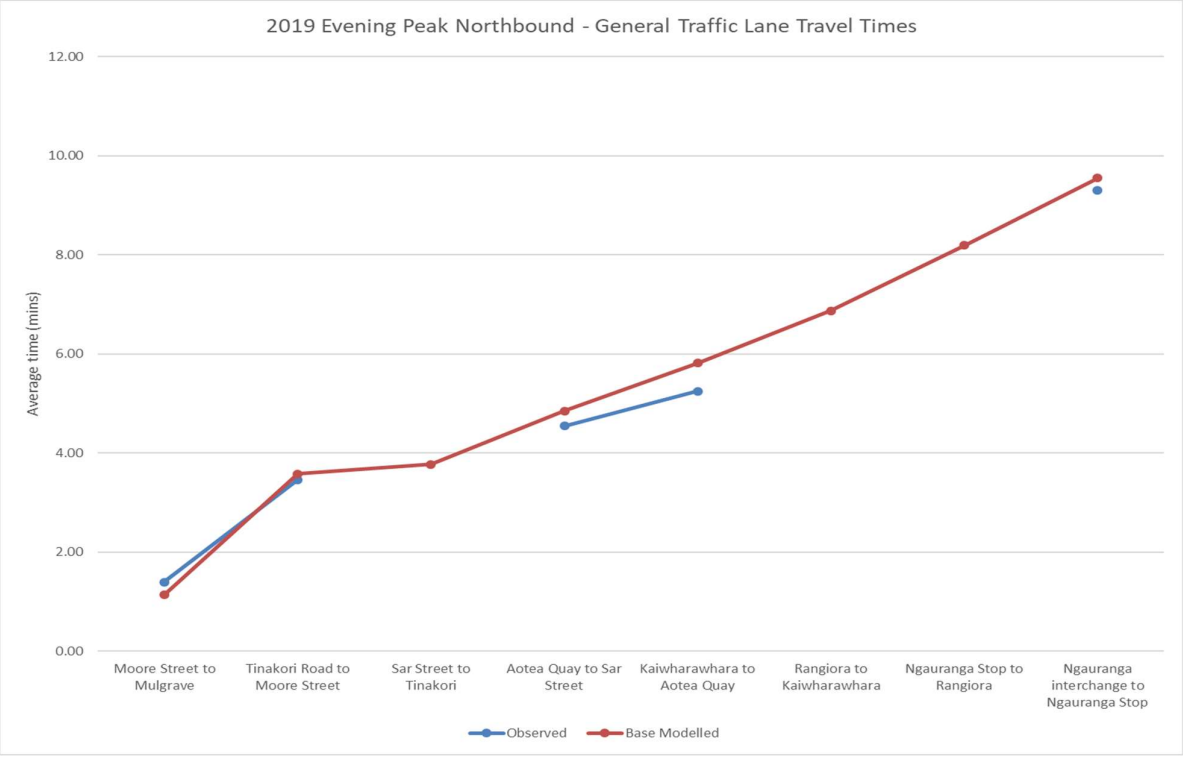


Figure 5: General traffic journey time profile – modelled vs observed (2019 PM northbound)



Limitations

Whilst the modelling approach draws on both the regional models (WTSM) and the AIMSUN models, there are limitations to the spreadsheet and SIDRA modelling that need to be recognised as they lead to the potential over-estimated of congestion for vehicles using the general traffic lane(s):

1. Route choice – the models have been developed to consider the performance of Hutt Road and Thorndon Quay using inputs from the WTSM and AIMSUN models to reflect the demands based on the scenario that includes a bus lane on Hutt Road (southbound between Jarden Mile and Kaiwharawhara). The effect of the congestion has been reflected in the corridor demands and diversion to other corridors (SH1, Onslow Road and Kaiwharawhara Road); however, there is potential for increased congestion to influence the choice of route between SH1 and Hutt Road, which is currently observed;
2. Peak spreading – the spreadsheet models reflect average conditions over the 2-hour period; however, there is the potential for the demand on Hutt Road to be spread over a longer period if the conditions in the peak 2 hour are severely congested;
3. Elasticities of demand – No additional work has been undertaken to test the demand elasticities for public transport patronage. This is explained further in the discussion on bus patronage forecasts.

The implication is in the selection of the Special Vehicle Lane and the knock-on impact to the economic evaluation where an option replaces a general traffic lane with a Special Vehicle Lane on Hutt Road between Jarden Mile and Aotea Quay. These limitations can be addressed in Stage 2 of the project where the final assessments will be completed.

Future Year (2036) Do-Minimum Models

The Do-Minimum model inputs and sources are provided in Table 8.

Table 8: 2036 Do-Minimum Modelled Inputs

Input	Source
Traffic Volume Forecasts	AIMSUN models (2026) plus an assumption that there would be 10% growth over the following 10 years
Peak Factor (% of traffic in the peak hour out of the 2 hour)	SCATS and Tube Counts supplied by WCC and WAU indicating just over 50% of traffic in the peak hour
Bus Patronage	WTSM, noting the discussion in the next section
Dwell Times	Increased proportionally to the bus patronage growth
All other parameters	No change from the base models

Future Year Option Models

Scenarios considered

The scenarios considered for the corridor assessment are as follows:

1. Hutt Road (between Ngauranga and Kaiwharawhara – both directions)
    a. No Special Vehicle Lane (do-minimum);
    b. Bus lane;
    c. T3 lane (no trucks);
    d. T3 Lane (with trucks);
    e. T2 lane (no trucks); and
    f. T2 lane (with trucks).
2. Hutt Road (Kaiwharawhara – Aotea Quay – both directions)
    a. No Special Vehicle Lanes due to the potential wider network impacts for trucks and general traffic, and potential weaving issues that could undermine the benefits of a Special Vehicle Lane.
3. Hutt Road (Aotea Quay to Tinakori Road – both directions) and Thorndon Quay
    a. Bus Lane
        i. On Hutt Road southbound, the existing clearway would be used as the bus lane; and
        ii. On Hutt Road northbound and Thorndon Quay, the existing parking lane and clearway would be used as the bus lane.

Trucks and high occupancy vehicles have not been considered for Thorndon Quay, as the buses travelling in the kerbside lane need to cross over into the bus station at Mulgrave Street, and the provision of a lane that increases capacity for general traffic and trucks is likely to exacerbate existing issues at the Mulgrave Street intersection (in the morning peak period) and on Hutt Road (near Tinakori Road) in the evening peak period.

Bus Patronage Forecasts

Modelled Forecasts

The patronage forecasts have been developed using the Wellington Strategic Transport Models (WTSM) for the scenarios listed in Table 9 for the 2036 AM Peak, Daytime Peak and PM Peak 2 hour periods in each direction (refer to LGWM Model Specification). For the Thorndon Quay and Hutt Road SSBC project, a morning peak period bus lane has been included between Jarden Mile (Ngauranga) to Kaiwharawhara intersection on Hutt Road. The next phase of assessment will require the latest LGWM scenarios in order to update the public transport patronage forecasts.

Table 9: 2036 WTSM Forecast Scenarios

Option	Golden Mile	City Streets	Thorndon Quay/Hutt Road*	MRT	Basin Reserve and Mt Victoria Tunnel	SH1 improvements (Terrace Tunnel to Ngauranga)
Do Minimum						
THQR Project	X	X	X			
Project plus LGWM Anchor Projects (RPI)	X	X	X	X	X	
RPI plus SH1 improvements	X	X	X	X	X	X

Table 10 provides the bus patronage forecasts for Thorndon Quay from the Wellington Strategic Transport Models. The percentages in brackets show the increase compared to the “do-minimum” scenario.

Table 10: Patronage uplift on Thorndon Quay with network improvements

Option	Morning Peak Inbound (2hr)	Daytime Peak Inbound (2hr)	Evening Peak Outbound (2hr)
Base Year (Modelled)	2,610 pax	480 pax	1,850 pax
Do Minimum	3,050 pax	590 pax	2,300 pax
2036 THQR Project	3,550 pax (+16%)	540 pax (-8%)	2,710 (+18%)
2036 THQR Project plus LGWM Anchor Projects (RPI)	3,400 pax (+11%)	760 pax (+30%)	2,680 (+16%)
2036 RPI plus SH1 improvements	3.270 pax (+7%)	740 pax (+26%)	2,550 (+11%)

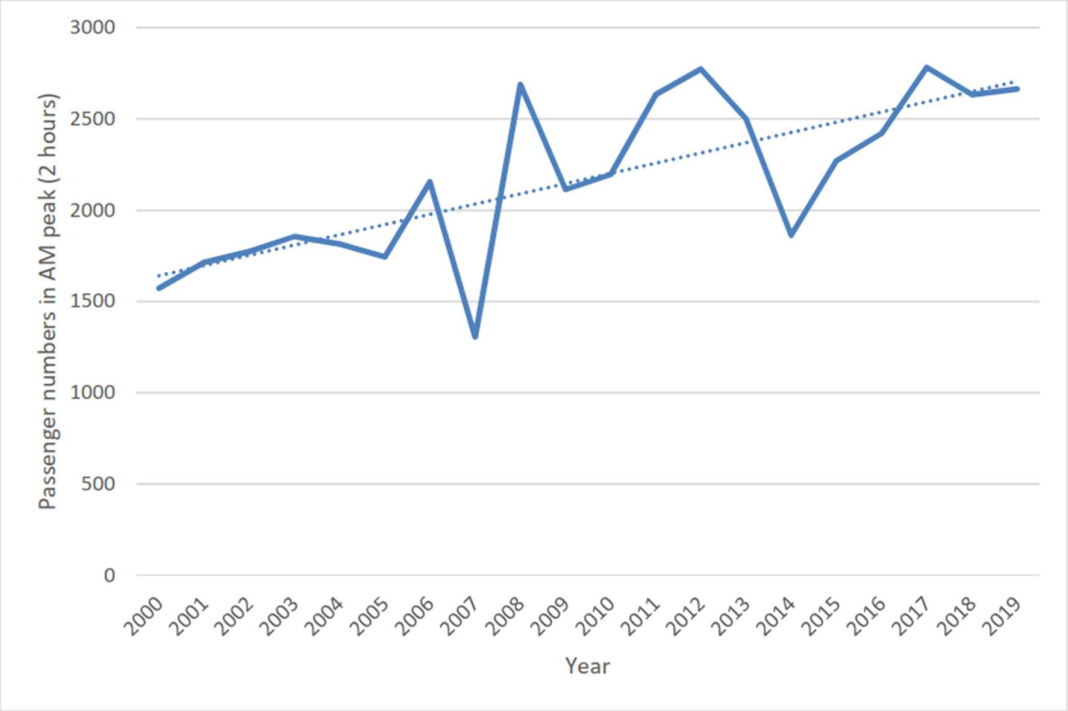
For the purposes of the assessment, the forecasts for the Thorndon Quay and Hutt Road SSBC project have been adopted for the assessment.

There is expected to be a significant increase in public transport across all the scenarios that can be attributed to the Thorndon Quay and Hutt Road SSBC project. It is also interesting to note that the forecast bus patronage on Thorndon Quay is lower with the additional of the anchor projects and additional SH1 improvements. However, the improvements on SH1 (between the Terrace Tunnel and Ngauranga) have an overall impact of less than 10% on bus patronage on Thorndon Quay, when a higher impact could have been expected with improved road access to the Wellington city centre afforded by the improvements to the motorway. This confirms that the Thorndon Quay and Hutt Road SSBC project contributes to the wider LGWM programme even with road improvements.

Sensitivity on Patronage Growth

Figure 6 below shows the historic passenger demands in the AM peak on Thorndon Quay as counted in the annual cordon surveys, which are undertaken in March of each year. The trendline indicates that bus passengers have been increasing by approximately 3% per annum (linear) since 2000.

Figure 6: Historic Public Transport Patronage (Source: Case for Change)



This comparison indicates that bus patronage growth in Wellington has been strong over the last 20 years. This could be attributed to the many bus priority measures implemented in the city centre and improvements to bus routes and services implemented across the wider region.

Table 11 presents a comparison between the modelled bus patronage forecasts and estimates based on historic growth. It indicates that the modelled forecast public transport patronage is approximately half of the estimated patronage estimated from the historic growth.

Table 11: Comparison of extrapolated growth with modelled forecasts on Thorndon Quay

Option	Modelled growth in the WTSM do-minimum scenario	Extrapolated from observed growth (2019 – 2036)
Do Nothing (Modelled: Base Year - 2036)	~3,050 pax (+17%)	~3,640 pax (+35%)

If the bus patronage follows the historic trends, and is double the modelled forecast growth, the potential increase in uplift as a result of the project could also apply. This comparison is provided in Table 12 using the uplifts outlined in Table 10

The implication to the Thorndon Quay and Hutt Road project is predominantly associated with the potential re-allocation of one of the general traffic lanes on Hutt Road as a Special Vehicle Lane (bus lane or high occupancy vehicle lane).

If the bus patronage growth follows the observed trend in the peaks there is the potential for the traffic volume forecasts to be over-estimated, and therefore the impacts to general traffic (and trucks if they are not permitted to use the Special Vehicle Lane) will also be over-estimated. This is discussed further later in the report.

Table 12: Sensitivity Patronage uplift on Thorndon Quay with network improvements

Option	2036 Morning Peak Inbound (2hr)		2036 Evening Peak Outbound (2hr)	
	Modelled	Based on historic growth	Modelled	Based on historic growth
Do Nothing	3,050 pax	3,640 pax	2,300 pax	2,740 pax
THQR Project	3,550 pax	4,220 pax	2,710 pax	3,180 pax

Traffic Volumes - Behavioural Response

In additional to patronage uplifts, the WTSM model results give an indication of the potential reduction in car trips along the corridor in the 2036 morning peak period with a southbound bus lane:

- 26% north of Kaiwharwhara compared with do minimum;
- 12% reduction between Kaiwharawhara – Tinakori; and
- 10% increase on Tinakori, and 21% on Thorndon Quay – all in the morning peak.

These reductions were applied in the southbound direction only approaching Kaiwharawhara intersection in the option where the Special Vehicle Lane on Hutt Road is a bus lane (noting that capacity constraints at Kaiwharawhara prevent traffic from reaching Tinakori Road and Thorndon Quay). For the scenarios where the Special Vehicle Lane is an HOV Lane, the process applied was as follows:

1. apply the reductions above to the forecast volume upstream of Kaiwharawhara Road;
2. estimate the HOV lane usage from the vehicle occupancy information and the forecast volumes;
3. add 1 and 2 to give the total traffic volume where the Special Vehicle Lane on Hutt Road.

The results of the forecast traffic volumes are shown in Figure 7 and Figure 8

Figure 7: Forecast Traffic Demand Southbound (2036 AM Peak Period – 2 hours)

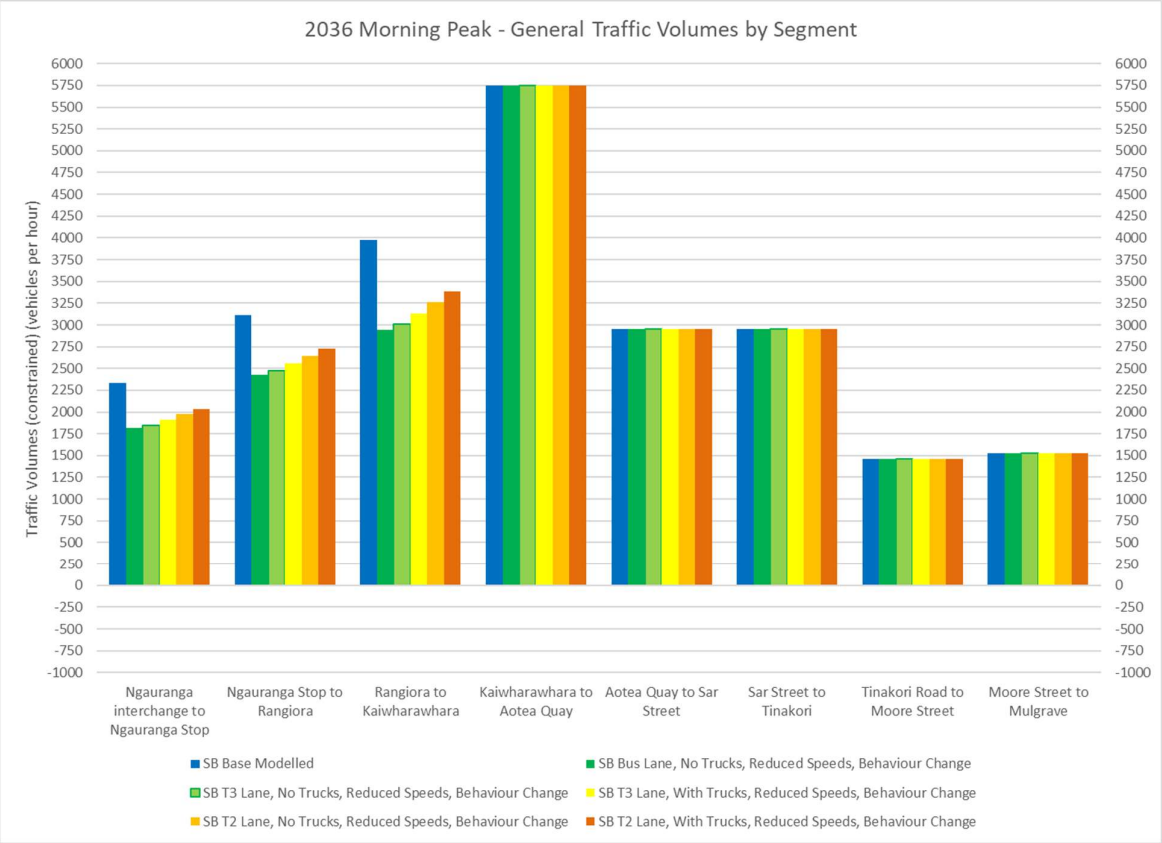
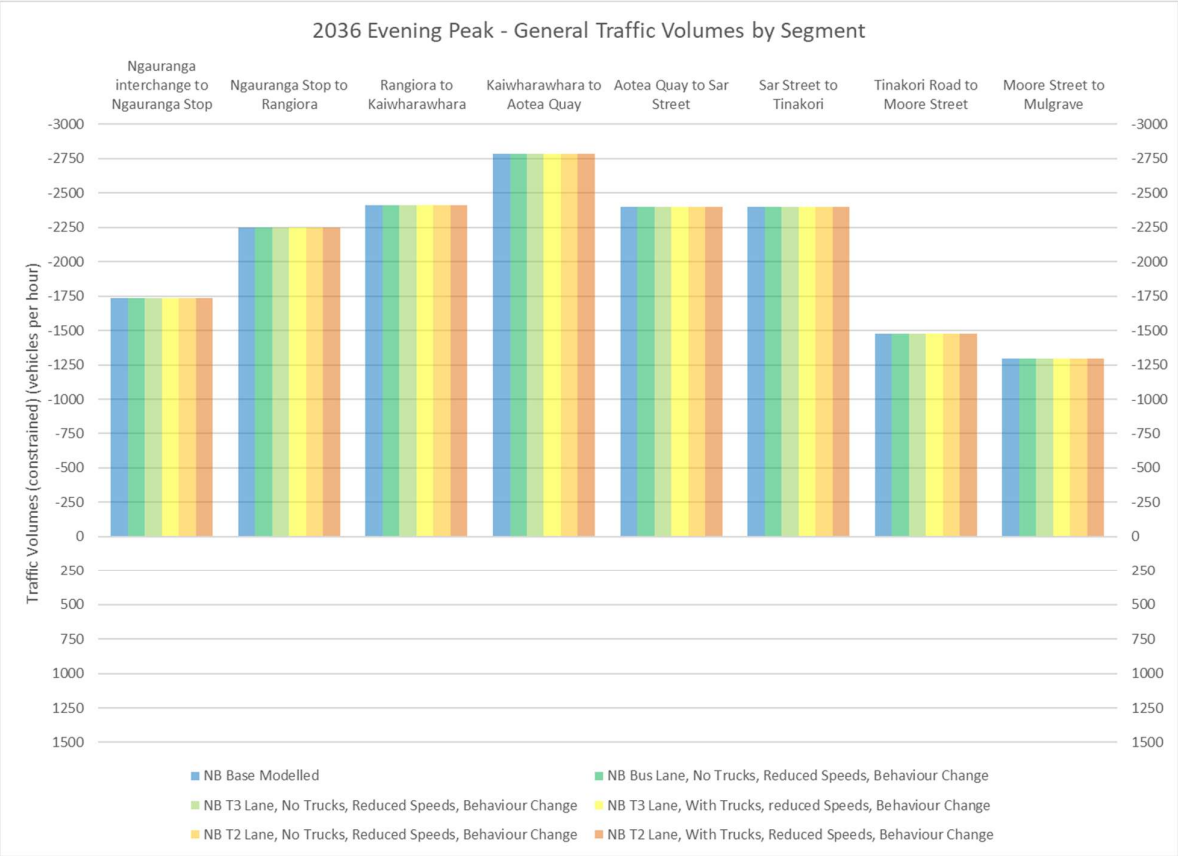


Figure 8: Forecast Traffic Demand Northbound (2036 PM Peak Period – 2 hours)



Corridor Assessments

Journey time summaries

Morning Peak Period

Table 13 summarises the journey times by mode along the corridor with the different scenarios. The ranges provided for the HOV lanes reflect the different use of the lane (T3 – 3 or more occupants or T2 – 2 or more occupants). Figure 9 and Figure 10 show the forecast journey times by segment in both directions.

From the modelling undertaken, the provision of bus priority with either a HOV lane or a Bus Lane along Hutt Road (between Ngauranga and Kaiwharawhara) is expected to provide significant benefits for bus passengers travelling southbound towards the city in the morning peak period.

The exception of the Special Vehicle Lane allowing for T2 plus trucks, is expected to result in the lane carrying similar levels of traffic to the general traffic lanes, therefore offering no benefit for bus passengers. Noting the limitations of the modelling with respect to route choice between SH1 and Hutt Road for high occupant vehicles, the situation where the Special Vehicle Lane is overloaded could also apply to a T2 lane without trucks.

In the northbound direction in the morning peak, it is expected that there is a negligible difference in journey times for all modes travelling along the corridor (less than 1 minute), irrespective of whether there is a Special Vehicle Lane along the corridor with the reduced speeds, crossing improvements and signalising intersections along Thorndon Quay.

Table 13: Southbound Journey Times (2036 Morning Peak Period)

Scenario	Bus Travel Time	Truck Travel Time	Car Travel Time
Base	12.9	10.8	
Do-Minimum (2036)	21.0	18.1	
Bus Lane on Hutt Road (Ngauranga to Kaiwharawhara): **Bus Lane on Hutt Road (Aotea Quay to Tinakori Road) and Thorndon Quay**	10.7	24.5	
HOV Lane (T2 or T3, no Trucks) on Hutt Road (Ngauranga to Kaiwharawhara): **Bus Lane on Hutt Road (Aotea Quay to Tinakori Road) and Thorndon Quay**	10.1 – 11.2	23.3 – 25.1	
HOV Lane (T2 or T3, with Trucks) on Hutt Road (Ngauranga to Kaiwharawhara): **Bus Lane on Hutt Road (Aotea Quay to Tinakori Road) and Thorndon Quay**	11.1 – 20.2	11.0 – 18.5	20.2 – 21.6

The segment by segment journey times for the different Special Vehicle Lane options (Figure 9 and Figure 10) indicate that the intersections of Centennial highway/Jarden Mile/SH2/Hutt Road (Jarden Mile intersection) and Hutt Road/Kaiwharawhara (Kaiwharawhara intersection) intersection are likely to be pinch points for people travelling south into the city, who are not eligible to use the Special Vehicle Lane. This is reflected in the segment travel times in Figure 10 where heavy congestion is reflected at the pinch points (where delays are capped to 10kph speeds in each section).

The modelling of the bus lane has assumed that the bus queue jump lane at the Jarden Mile intersection is in addition to the traffic lanes; whereas the modelling of the HOV lane has assumed that one of the lanes has been converted. At this intersection, there is the ability to "mix and match" (e.g. bus queue jump lane at the intersection, but then a lane converted to an HOV lane through to Kaiwharawhara)' however that flexibility is not available at the Kaiwharawhara intersection which is constrained for space.

Figure 9: Kerbside Lane Travel Times by Segment (2036 Morning Peak 7am – 9am)

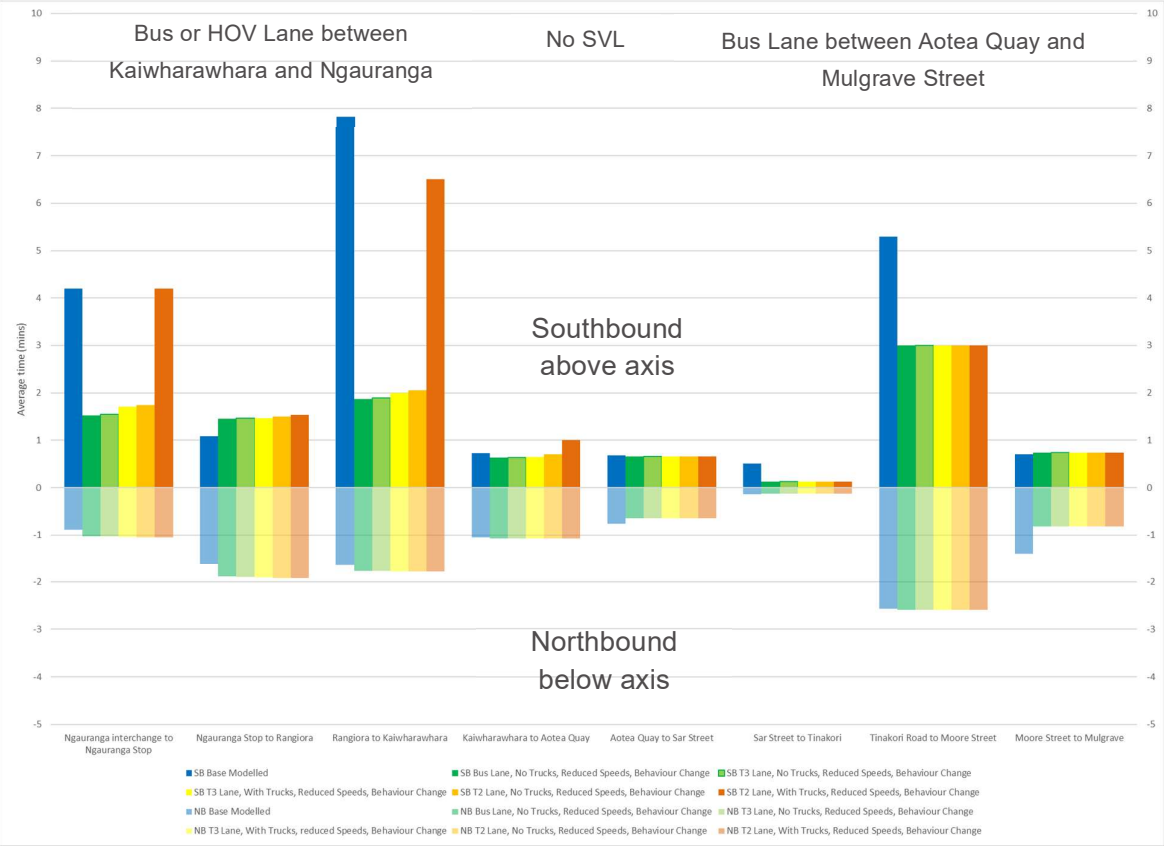
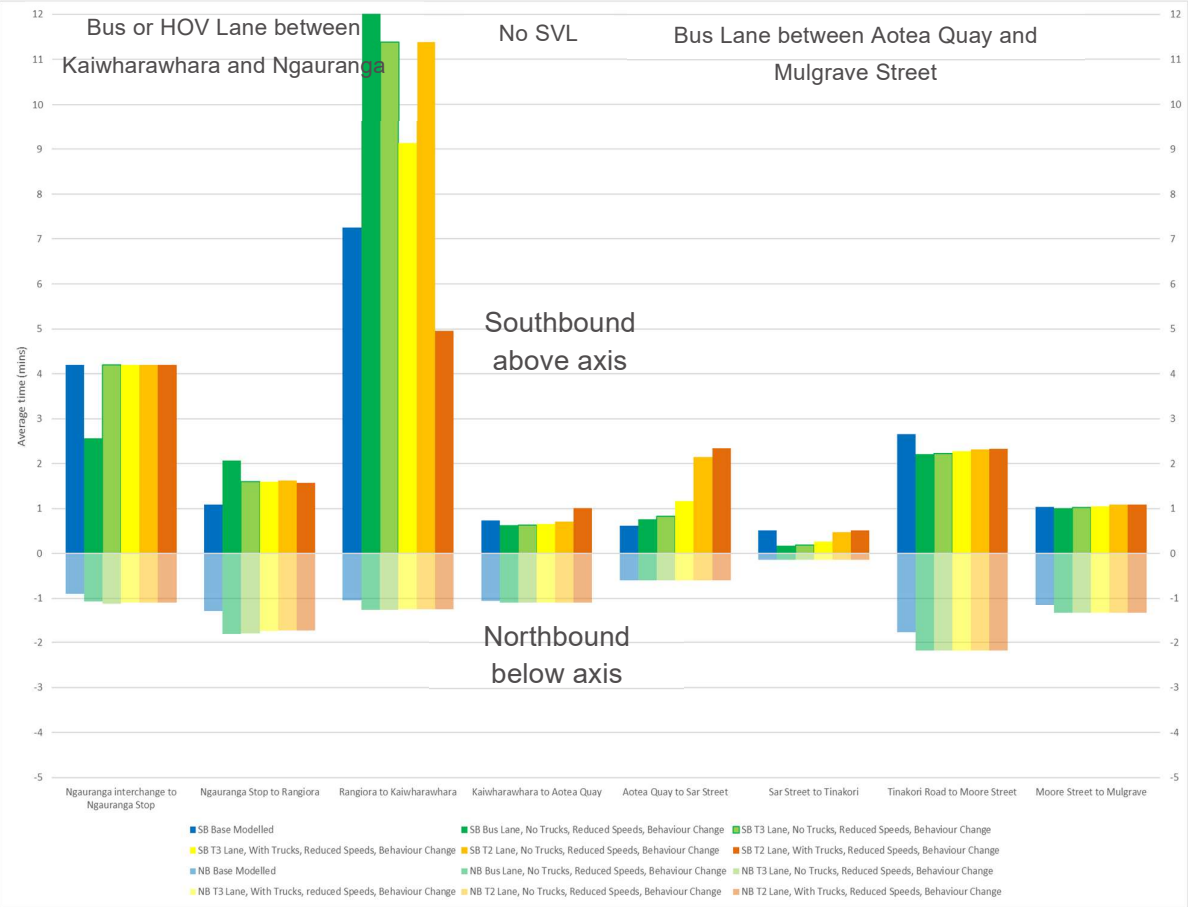


Figure 10: General Traffic Lane Travel Times by Segment (2036 Morning Peak 7am – 9am)



Evening Peak Period

Table 14 summarises the journey times by mode along the corridor with the different scenarios. The ranges provided for the HOV lanes reflect the different use of the lane (T3 – 3 or more occupants or T2 – 2 or more occupants). Figure 11 and Figure 12 show the forecast journey times by segment in both directions.

From the modelling undertaken, the provision of bus priority with either a HOV lane or a Bus Lane along Hutt Road (between Ngauranga and Kaiwharawhara) is expected to secure the reliability of buses travelling along the corridor in the evening peak period.

In the southbound direction in the evening peak, it is expected that there is a negligible difference in journey times for all modes travelling along the corridor, irrespective of whether there is a Special Vehicle Lane along the corridor (less than 1 minute) with the reduced speeds, crossing improvements and signalising intersections along Thorndon Quay.

Table 14: Northbound Journey Times (2036 Evening Peak Period)

Scenario	Bus Travel Time	Truck Travel Time	Car Travel Time
Base (Modelled)	11.2	9.6	
Do-Minimum (2036)	11.4	10.6	
Bus Lane on Hutt Road (Ngauranga to Kaiwharawhara): **Bus Lane on Hutt Road (Aotea Quay to Tinakori Road) and Thorndon Quay**	9.8	13.2	
HOV Lane (T2 or T3, no Trucks) on Hutt Road (Ngauranga to Kaiwharawhara): **Bus Lane on Hutt Road (Aotea Quay to Tinakori Road) and Thorndon Quay**	10.0	13.1 – 21.8	
HOV Lane (T2 or T3, with Trucks) on Hutt Road (Ngauranga to Kaiwharawhara): **Bus Lane on Hutt Road (Aotea Quay to Tinakori Road) and Thorndon Quay**	10.4 – 10.6	11.2 – 13.7	13.9 – 16.4

The segment by segment journey times (Figure 11 and Figure 12) indicate that the intersections of Centennial highway/Jarden Mile/SH2/Hutt Road (Jarden Mile intersection) and Kaiwharawhara is likely to be pinch point for people travelling north away from the city if the lane was a T3 lane (with or without trucks) and carried through the intersection.

The modelling of the bus lane scenario has assumed that the bus queue jump lane at the Jarden Mile intersection and Kaiwharawhara is in addition to the traffic lanes; whereas the modelling of the HOV lane has assumed that one of the lanes has been converted. At these intersections (northbound), there is the ability to “mix and match” (e.g. mid-block HOV lane but two general traffic lanes plus bus queue jump lane at the intersections).

Figure 11: Kerbside Lane Travel Times by Segment (2036 Evening Peak 4pm – 6pm)

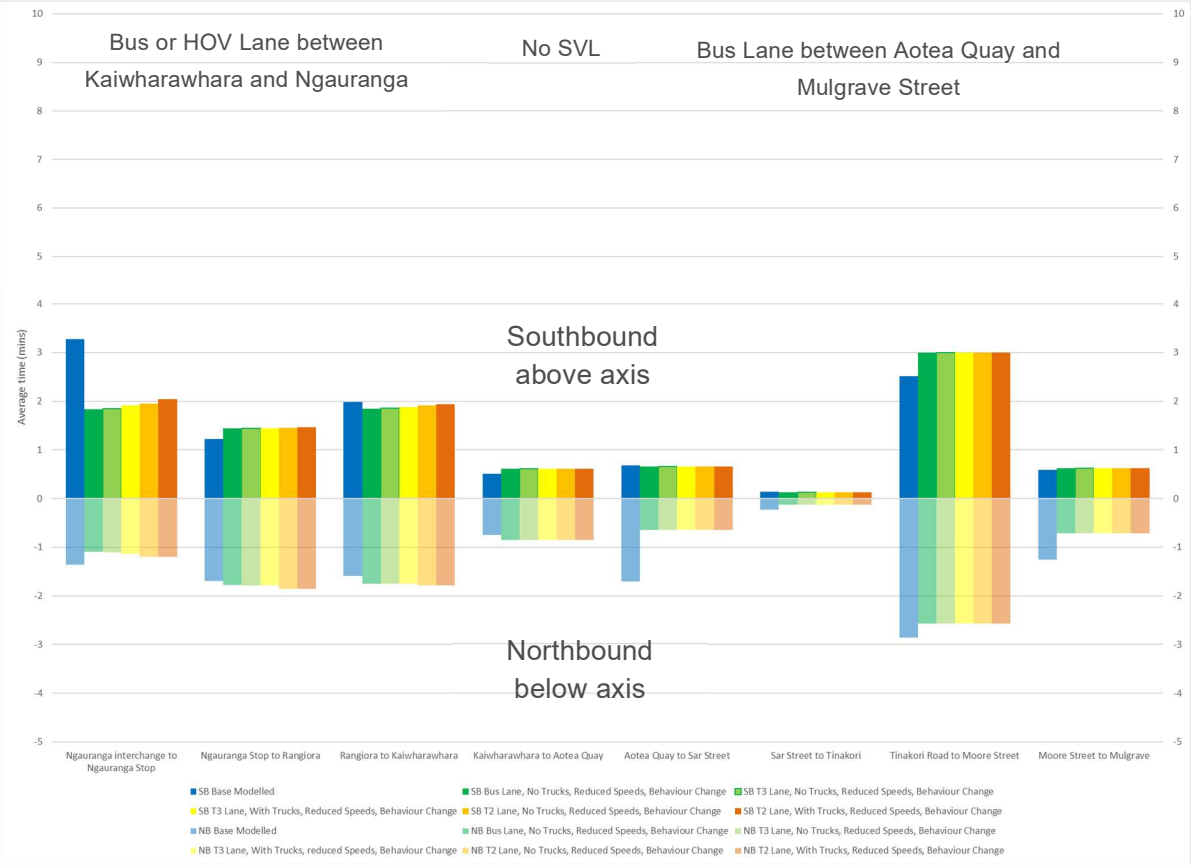
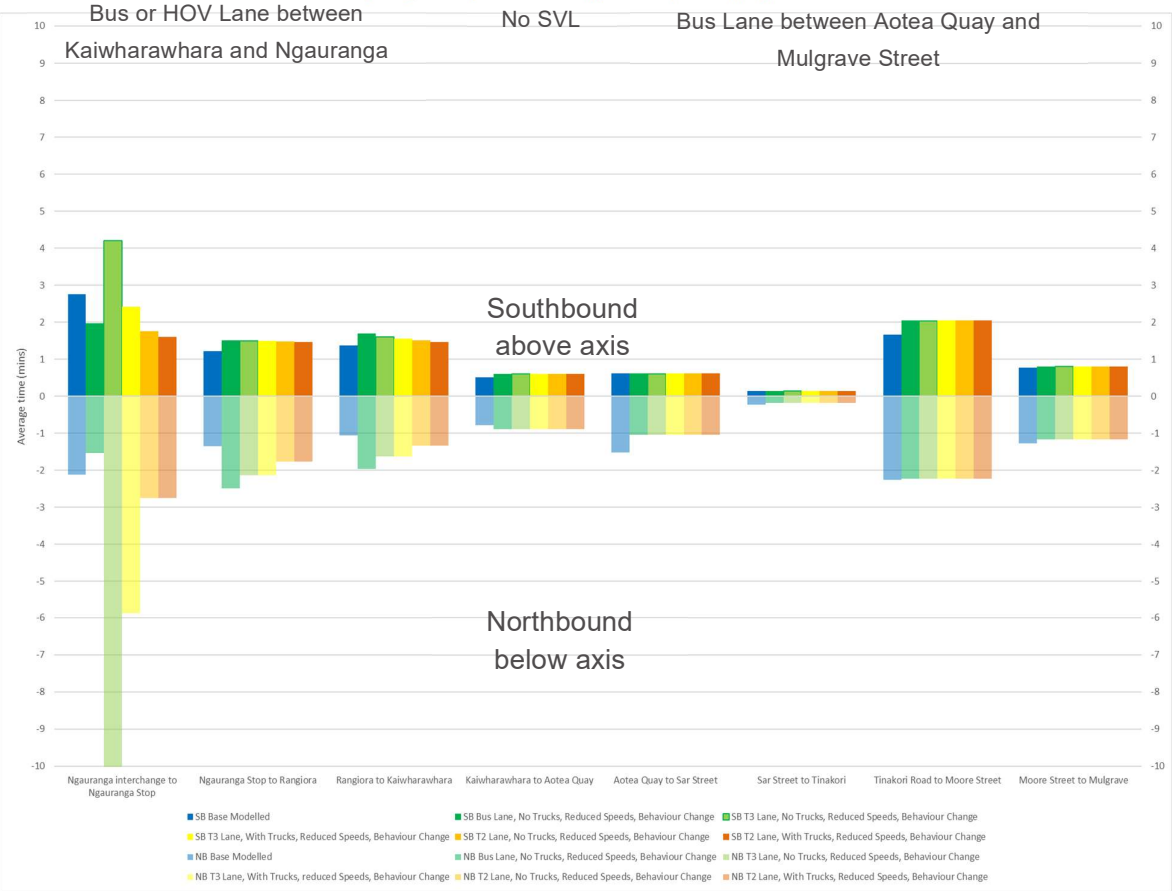


Figure 12: General Lane Travel Times by Segment (2036 Evening Peak 4pm – 6pm)

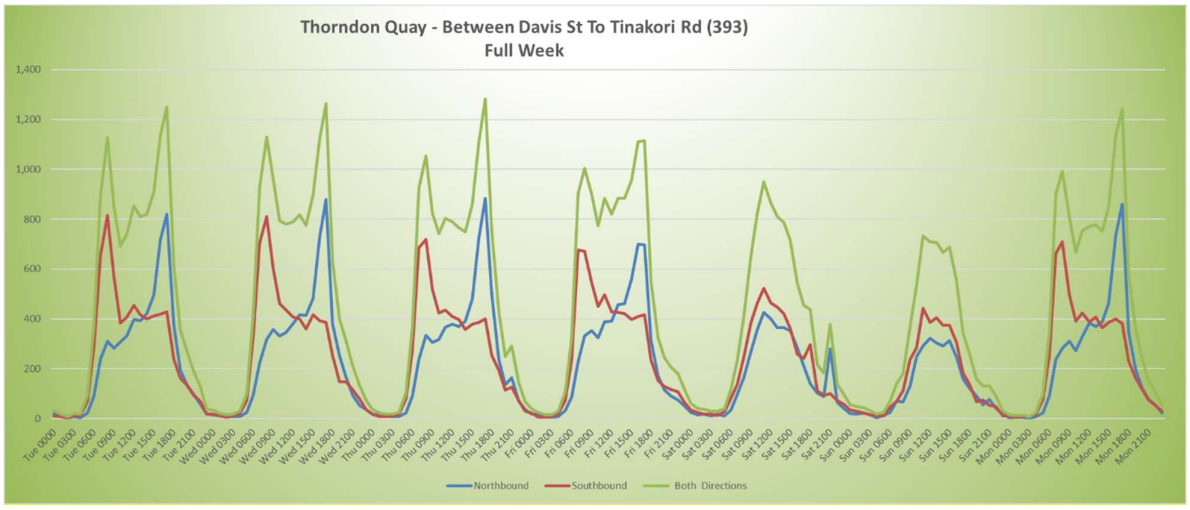


Daytime Peak Period

The daytime peak period has not been explicitly modelled; however, consideration has been given to whether a Special Vehicle Lane is warranted throughout the day. Along Thorndon Quay, the decision comes down to whether a bus lane should be provided at the expense of off-peak parking.

Traffic counts along Thorndon Quay (as shown in Figure 13) indicate that the peak hourly volume during the day is approximately 400 vehicles per hour in each direction.

Figure 13: Thorndon Quay Traffic Counts



The modelled forecasts in AIMSUN (based on the 2026 forecasts plus 10%) indicate that the peak daytime volumes remain fairly stable each direction. The forecasts from the Wellington Strategic Transport Models are similar at an absolute level; however, they indicate a growth of between 11% and 22% above the base year volumes. If there is growth outside of the peak period, it is not expected to have a significant impact on the reliability of buses, trucks and general traffic travelling along the corridor.

To put this in context, the northbound peak hour observed volumes is approximately 800 vehicles per hour with an observed journey time in the order of 3.5 minutes[3] - similar to the daytime peak running period, where the observed volumes are approximately 400 vehicles per hour northbound. This indicates that the reliability of the service does not appear to be a significant issue.

In the evening peak, the modelled forecasts indicate that there may be up to 1 minute saving for buses travelling along Thorndon Quay if a bus lane is implemented, noting that the forecast volumes travelling northbound are not expected to increase significantly, as the intersection with Mulgrave Street limits the amount of traffic that can continue on to Thorndon Quay. It is anticipated that if a bus lane was operating throughout the day northbound, the improvement to bus journey times and reliability would be lower.

In the southbound direction, the case is similar; however, the source of the congestion along the corridor is at the intersections with Mulgrave Street and Featherston Street in the morning peak period, with daytime peak and evening peak bus journey times being similar.

It is unlikely that a full-time bus lane would be justified based on either the bus patronage or the reliability of bus service during the day; however, it is recommended that this be monitored over time, given that there is flexibility in being able to adjust the times of bus lane operation.

[3] Source: Case for Change: Figure 35

Effect of Southbound Service Lane on Hutt Road between Rangiora Avenue and Kaiwharawhara Road

To mitigate the potential risk of crashes associated with the implementation of a priority lane on Hutt Road, and to address the existing crash risk of turning vehicles colliding with cyclists, a service lane is being considered between Onslow Road and Rangiora Avenue. The potential cross section in shown in Figure 14 and Figure 15.

Figure 14: Potential Service Lane Layout on Hutt Road

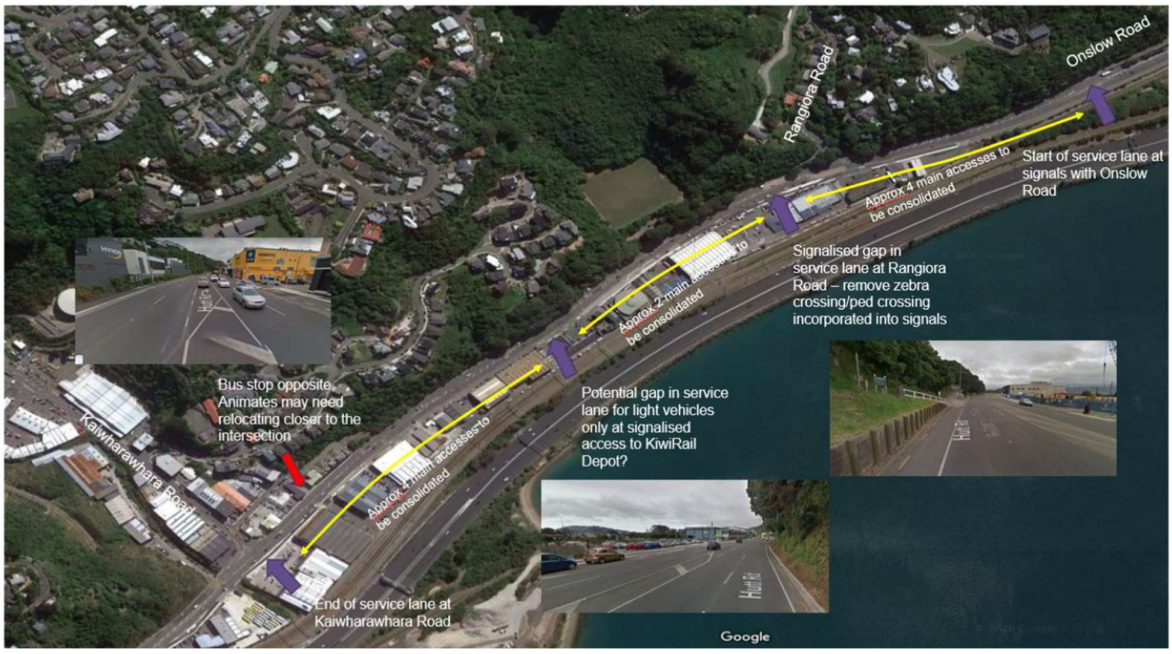
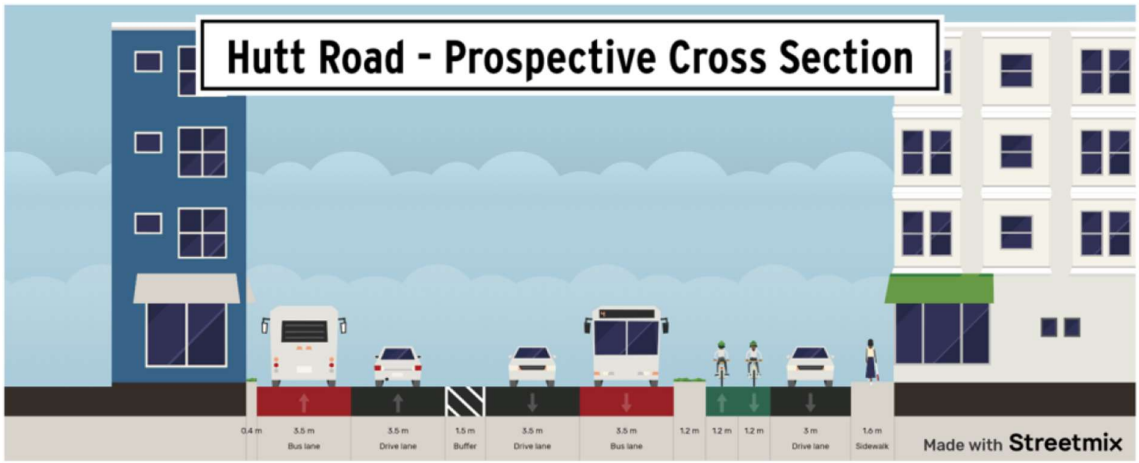


Figure 15: Potential cross section for a service lane on Hutt Road



The proposal allows for entry back on to Hutt Road as the signalised intersection of Hutt Road and Kaiwharawhara Road, adding an additional traffic signal phase at the signalised crossing. This would allow for people leaving the businesses between Kaiwharawhara Road and Rangiora Avenue (including Westminster Street) to continue southbound along Hutt Road, to

turn into Kaiwharawhara Road, or to turn back north along Hutt Road (subject to vehicle tracking for semi-trailers and B-Trains).

The effect of this has been modelled in SIDRA using the existing volumes and turning volumes out of Westminster Street from the AIMSUN base year models to understand the relative level of service, and the kerbside lane capacity (for a Special Vehicle Lane).

It has been assumed that a right turn lane will be provided for traffic turning right from Hutt Road and Kaiwharawhara Road, and that the traffic signal phasing will be the existing phasing plus one new traffic signal phase for the service lane.

Table 15 provides the expected levels of service with and without the service lane. The inclusion of the service lane is expected to have a significant impact on the overall efficiency of the intersection, which is aligned with expectations.

Table 15: Level of Service at the intersection of Hutt Road and Kaiwharawhara Road

Time Period	No Service Lane	With Service Lane
Morning Peak Hour	E	F
Daytime Peak Hour	B	C
Evening Peak Hour	D	F

The effects on a potential Special Vehicle Lane along Hutt Road have been considered by looking at the kerbside lane capacity (outlined in Table 16) with the service lane and comparing it to the estimated use of a Special Vehicle Lane in 2036 (shown in Table 17).

Table 16: Kerbside Lane Capacity with southbound service lane at the intersection of Hutt Road and Kaiwharawhara Road

Time Period	Southbound Kerbside Lane with service lane	Northbound Kerbside Lane with service lane
Morning Peak Hour	780 vph	220 vph
Evening Peak Hour	780 vph	350 vph (affected by left turn slip lane)

Table 17: Estimated Use of Special Vehicle Lane in 2036

Time Period	Special Vehicle Lane Type	Southbound Special Vehicle Lane	Northbound Special Vehicle Lane
Morning Peak Hour	Bus Lane	~35* vph	~20* vph
	T3 (No Trucks)	160 vph	50 vph
	T2 (No Trucks)	675 vph	210 vph
	T3 (with Trucks)	410 vph	115 vph
	T2 (with Trucks)	920 vph	280 vph
Evening Peak Hour	Bus Lane	~20* vph	~35*vph
	T3 (No Trucks)	75 vph	115 vph
	T2 (No Trucks)	300 vph	430 vph
	T3 (with Trucks)	150 vph	220 vph
	T2 (with Trucks)	370 vph	540 vph

Table 17 shows that the addition of a service lane and a signalised exit on to Hutt Road is likely to preclude the use of a T2 lane (with or without Trucks) as the Special Vehicle Lane would be operating over its capacity, which is a typical warrant for a Special Vehicle Lane. Furthermore, there is the potential for the intersection to become a major bottleneck for traffic exiting the city via Hutt Road as the capacity for a single northbound lane (if a lane was converted at the intersection to a Special Vehicle Lane) is likely to be fairly low at ~670 vehicles hour compared to a forecast of 1,500 vehicles per hour.

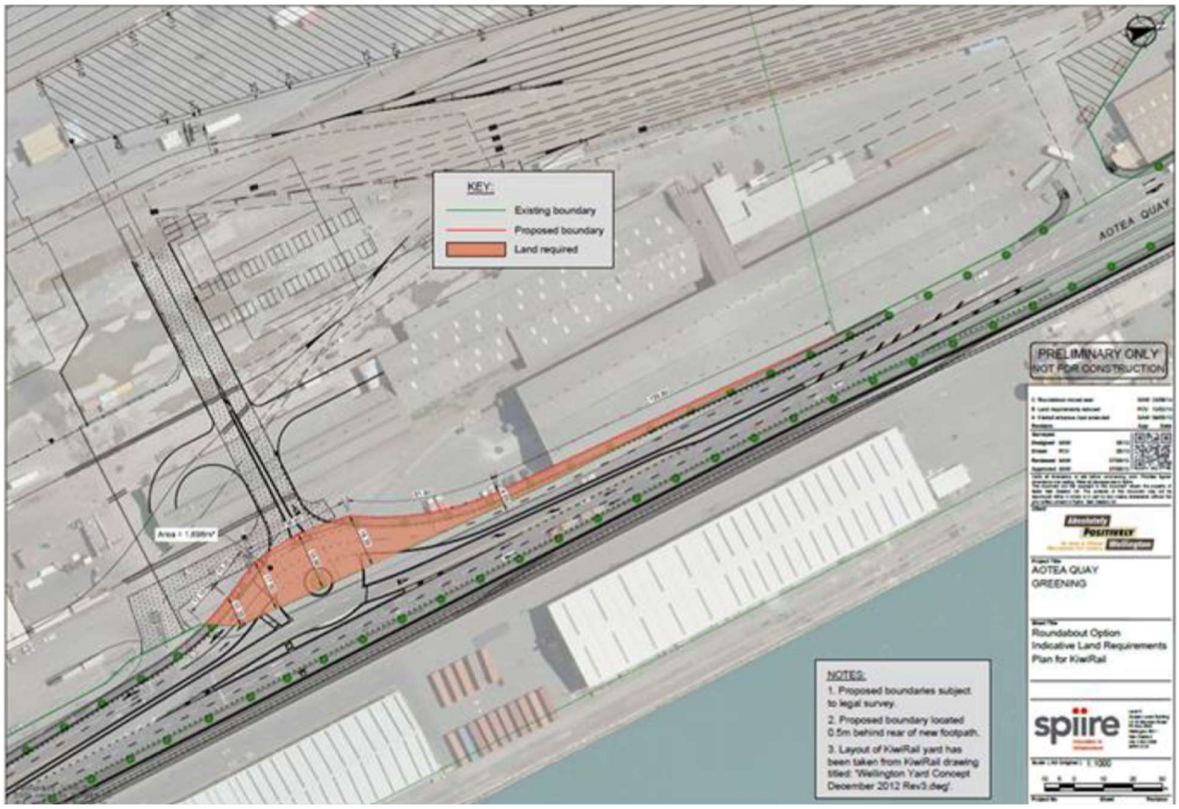
Effect of Roundabout on Aotea Quay

A turnaround facility along Aotea Quay (at the Mainfreight entrance) is being considered for the following purposes:

1. To provide an alternative route (via SH1) for people and trucks travelling to the Interislander ferry terminal whose current access is only available via Hutt Road; and
2. To mitigate the potential left-in-left out restrictions posed by either the service lane (discussed in the previous section) or the provision of a raised median on Hutt Road – both of which are being considered to reduce the safety risk along Hutt Road associated with turning crashes.

The proposed turnaround facility is a roundabout at Aotea Quay as outlined in Figure 16

Figure 16: Proposed Layout for Turnaround facility at Aotea Quay



The effect of this has been modelled in SIDRA using the AIMSUN 2026 volumes plus 10% to estimate what a 2036 scenario could look like. The volume undertaken to U-turn was the Interislander bound traffic in the morning peak period and the modelled counts turning right from Westminster Street forecast in the AIMSUN models.

The results indicate that the roundabout should operate efficiently in the morning peak period for this scenario (Level of Service B), and indicates that there would be sufficient capacity in the roundabout to cater for a significantly higher demand in line with estimated growth in ferry bound traffic.

In the evening peak period, the level of service based on the modelled scenario is expected to be good (Level of Service B); however, northbound travel on Aotea Quay may be adversely affected with increases in ferry terminal traffic as the volume-capacity ratio for this movement is >80%.

It is recommended that the roundabout be included as part of the project as it provides an alternative route for people and trucks accessing the Interislander ferry terminal and can be efficiently managed in the morning peak period. In the evening peak period, a metered roundabout may be more appropriate to manage the efficiency of the roundabout. As a short term measure (prior to further progression of the proposed Multi-User Ferry Terminal), the roundabout appears to be an appropriate treatment.

Commentary on the results

The modelled forecasts have been derived from the Wellington Strategic Transport Models, which are four-stage demand models. At the time of preparing this report, it was understood that the road capacity for Hutt Road was modelled at 1,400 vehicles per hour per lane; however, the capacity at the intersection is the key driver for congestion along the corridor having a capacity of up to 900 vehicles per hour for the through movements plus the right turning traffic into Kaiwharawhara Road (forecast to be ~250 vehicles per 2 hours).

The results indicate that for the peak direction on Hutt Road, the initial impact of displacing up to 900 vehicles per hour to facilitate the implementation of a Special Vehicle Lane is likely to result in increases in congestion along the corridor for general traffic and trucks, if trucks are not permitted to use the Special Vehicle Lane.

This effectively means that to maintain the reliability for freight along Hutt Road, freight must be allowed to use a Special Vehicle Lane, or a demand reduction of the general traffic lane down to just over 1,000 vehicles per hour between 7am and 9am is required.

To reduce the demands for Hutt Road to a “manageable level”, could mean a combination of:

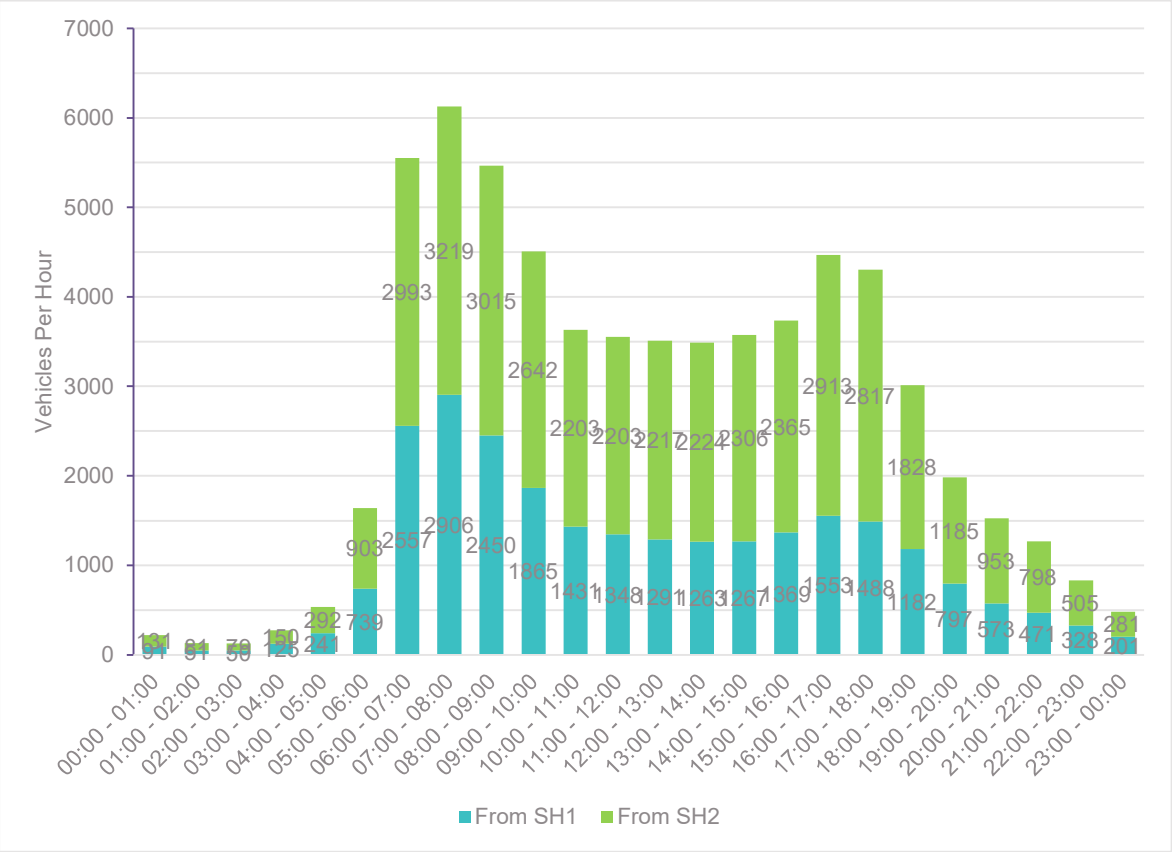
- Increased public transport patronage (noting the difference between modelled forecasts and extrapolated growth in the morning peak period);
- The inclusion of the turnaround at Aotea Quay/ Mainfreight could take up to 400 vehicles in the peak hour off Hutt Road, but noting that not all of this may be realised because of the congestion on SH1. However, journey times from TomTom (supplied by Waka Kotahi) confirm the anecdotal evidence that Hutt Road is being used as an alternative route to the congested SH1 corridor with journey times between Glover Street and Aotea Quay very similar at the height of the peak (approximately 7 mins 15 seconds). In the northbound direction, Hutt Road travel times are consistently slower than the motorway throughout the day (5 mins 15 seconds via the motorway versus 7 minutes via Hutt Road). There is the potential to see greater use of the motorway over Hutt Road in the evening peak period if it is reasonably accessible from ramps other than at Aotea Quay;
- Route choice shift from SH1 - it is estimated that around 6-8% of vehicles using Hutt Road in the morning peak period have 3 or more occupants (~150 vehicles per hour) and 5% on SH1 (~300 vehicles per hour). Hence, given that a T3 lane would be quicker than using the motorway, a shift away from the motorway back to using the Special Vehicle Lane on Hutt Road is conceivable. It is estimated that approximately 30% of vehicles using Hutt Road in the morning peak period have 3 or more occupants (~750 vehicles per hour) and 20% on SH1 (~1200 vehicles per hour). This potential demand for the T2 lane is likely to see it operate over its capacity and not provide any benefit to any motorised mode compared to the current road layouts;
- Route choice and mode shift away from Hutt Road – the effect of the congestion has been reflected in the corridor demands and diversion to other corridors outside of that forecast in the WTSM (SH1, Onslow Road and Kaiwharawhara Road), which indicates a shift of approximately 200 vehicles per hour to Kaiwharawhara Road and SH1, with a reduction at Onslow in the order of 200 vehicles per hour, and an increase of ~300 pax per hour using public transport. These forecasts were incorporated into the

corridor assessments but still leave a level of displaced traffic that could be difficult to effectively manage, particularly with the impacts to trucks;

- Impact of investment in rail - at the time of preparing this report, it is understood that the modelling forecasts provided for the Thorndon Quay and Hutt Road SSBC project include investment in rail (sub-programme named RS2) to provide better access for travel to Wellington from the north (e.g. Johnsonville, communities along the North Island Main Trunk Link, and communities in Upper and Lower Hutt and the Wairarapa). The potential implication is that if this investment is not delivered then both bus patronage and traffic volumes may be higher than forecast. For the Thorndon Quay and Hutt Road SSBC project, this may influence the type of Special Vehicle Lane that is preferred on Hutt Road (e.g. bus lane versus a high occupancy vehicle, and whether trucks should be permitted to use the Special Vehicle Lane), and the economic evaluation specifically related to benefits or disbenefits for general traffic and freight; and

- Peak spreading before and after the typical 7am – 9am peak, which seems like the most likely scenario in the short term. The Waka Kotahi TMS information indicates a peak flow of approximately 6,100 vehicles per hour. In the period between 8am and 9am, the motorway is heavily congested, therefore reducing the throughput down to ~5,400 vehicles per hour (as shown in Figure 17). If the motorway throughput could be sustained at the peak flow, there is the potential to substantially offset the impact of converting one of the general traffic lanes to a Special Vehicle Lane. If the trucks are not permitted to use the Special Vehicle Lane, there is likely to be some impact as it is anticipated that there would be sustained slow conditions on the motorway over a longer period, but not to the same level as estimated from the analysis so far.

Figure 17: Throughout traffic profiles on SH1 (southbound)



The combination of the above "behavioural responses" over and above what has been forecast in WTSM has the potential to provide a neutral outcome for freight travelling to Aotea Quay, but a range of impacts from neutral to moderate negative for trucks travelling via Thorndon Quay.

This uncertainty in the impacts warrants further investigation in both the elasticities of the public transport response, the routing in AIMSUN, and the potential impacts outside the modelled periods in both the AIMSUN models and WTSM models.

Active Modes Assessment

The assessment for active modes has been undertaken separately for facilities along the corridor and crossing opportunities along the section of the corridor between Aotea Quay and Thorndon Quay.

Corridor Facilities

The assessment of the facilities along the corridor has been undertaken based on the Danish Level of Service method (spreadsheet supplied by Waka Kotahi) for the options being considered (as outlined in Table 18). The corridor has been split into different segments in line with the changing road layouts, types of facilities and corridor widths.

Table 18: Segment for active mode levels of service

Segment	Special Vehicle Lane(s)	Cycling
Concept 1: (a) Hutt Road (Aotea Quay to Tinakori Road) and Thorndon Quay (Motorway overpass to Mulgrave Street) (b) Thorndon Quay (Tinakori Road to Motorway overpass)	Southbound only	Bi-directional facility
Concept 2: (a) Hutt Road (Aotea Quay to Tinakori Road) and Thorndon Quay (Motorway overpass to Mulgrave Street) (b) Thorndon Quay (Tinakori Road to Motorway overpass) (narrower)	Both directions	Uni-directional facilities
Concept 3: (a) Hutt Road (Aotea Quay to Tinakori Road) and Thorndon Quay (Motorway overpass to Mulgrave Street) (b) Thorndon Quay (Tinakori Road to Motorway overpass) (narrower)	Southbound only	Uni-directional facilities
Concept 4: (a) Hutt Road (Aotea Quay to Tinakori Road) and Thorndon Quay (Motorway overpass to Mulgrave Street) (b) Thorndon Quay (Tinakori Road to Motorway overpass) (narrower)	Both directions	Bi-directional facility

The levels of service estimated using the Danish Cycling Method are provided in Table 19.

Table 19: Active Mode Level of Service along the corridor (Danish Level of Service)

Segment	Northbound		Southbound	
	Walk	Cycle	Walk	Cycle
Existing	D	F	D	F
Concept 1: Southbound bus lane with a bi-directional facility (b) Hutt Road (Aotea Quay to Tinakori Road) and Thorndon Quay (Motorway overpass to Mulgrave Street)	C	F	C	C
(c) Thorndon Quay (Tinakori Road to Motorway overpass)	D	F	C	C
Concept 2: Bus Lanes in both directions with uni-directional cycle paths (b) Hutt Road (Aotea Quay to Tinakori Road) and Thorndon Quay (Motorway overpass to Mulgrave Street)	C	D	D	D
(c) Thorndon Quay (Tinakori Road to Motorway overpass)	D	E	D	E
Concept 3: Southbound bus lane with uni-directional cycle paths (b) Hutt Road (Aotea Quay to Tinakori Road) and Thorndon Quay (Motorway overpass to Mulgrave Street)	C	E	C	E
(c) Thorndon Quay (Tinakori Road to Motorway overpass)	D	E	D	E
Concept 4: Bus lane in both directions with a bi-directional facility (b) Hutt Road (Aotea Quay to Tinakori Road) and Thorndon Quay (Motorway overpass to Mulgrave Street)	C	F	C	B
(d) Thorndon Quay (Tinakori Road to Motorway overpass)	D	F	C	C

Through the section between the motorway overpass and Tinakori Road, the cycling level of service with uni-directional cycle paths is expected to be poor, primarily due to the constrained width through the section, hence the bi-directional cycleway is preferred through this section.

Using the Danish Level of Service spreadsheet provided, it appears that the level of service for cycling is better with the bus lanes in both directions, which appears to be a little counterintuitive because there is a wider buffer between the cycleway and the road for the southbound only bus lane when compared to the concepts with bus lanes in both directions. Figure 18 provides an indication of what a uni-directional cycle path (next to a bus stop) could look like on Thorndon Quay.

Along Thorndon Quay, this assessment against the Danish Level of Service may not be a differentiating characteristic, as the assessment is based on the Dutch approach to provide cycle tracks on both sides of the road. In the Auckland Region, it is the width of facility and the buffer width that determines the level of service, with a 1.8m uni-directional cycle path meeting the threshold for a Quality of Service 2 facility (similar to Level of Service B), and a 3.0m bi-directional facility (1.5m in each direction) would be a Quality of Service 3 facility.

Walking level of service is expected to be good along the corridor for all except the concept with bus lanes in both directions, and uni-directional cycle paths.

Figure 18: Example from Karangahape Road in Auckland (currently under construction)

Crossing Opportunities

The active mode level of service for people crossing the road has been evaluated using the level of service metrics provided by Austroads[4] which give consideration to both the crossing delay and the crossing spacing (as shown in Figure 19).

Figure 19:Pedestrian crossing level of service

Wait time at crossing (seconds)	0-25	26-50	51-100	101-200	201-400	400+
180+	E+	E+	E	E-	F-	F-
151-180	D-	D-	E+	E	F	F-
121-150	D	D	E+	E	F+	F-
91-120	D+	D+	D-	E+	F+	F
61-90	C-	D+	D	E+	E-	F
46-60	C+	C	D+	D-	E-	F+
31-45	B-	C+	C-	D-	E-	F+
16-30	B	B-	C-	D-	E-	F+
0-15	A-	B	C-	D	E	F+

Spacing (m)*

* Spacing is distance between crossing points

** Total Delay = Wait Time + Walk Time (outside of desired walk path) (Sec)

Total delay**	LOS
0-18	A
19-36	A-
37-48	B+
49-60	B+
61-72	B-
73-90	C+
91-109	C+
110-128	C-
129-161	D+
162-194	D+
195-227	D-
228-292	E+
293-357	E+
358-423	E-
424-491	F+
492-559	F+
560+	F-

Source: VicRoads (2014).

However, research suggests that wait times exceeding 30 seconds lead to people becoming impatient and crossing the road. To understand what this means for Thorndon Quay, signalised crossings have been assessed to understand the vehicle capacity, and threshold to achieve a level of service A for buses (<= 10 seconds per bus) based on an average pedestrian delay of 20 seconds and 30 seconds respectively (shown in Figure 20).

The HCM equation for used to estimate the pedestrian crossing delay (shown below) where C is the cycle time and g_{walk} is the walk time (green man). The walk time has determined by calculating the number of rows of pedestrians waiting to cross the road at a given time, assuming 1sqm per pedestrian and a walk time of 2 seconds per row.

$$delay = (C - g_{walk})^2 / 2C$$

The forecast pedestrian volumes are in the order of 400 people per hour; however, in the morning peak, the intensity of the arrivals at crossing points is higher reflecting people (including school children) alighting buses and crossing the road.

[4] AP-R575-15: Level of Service Metrics (Network Operations Planning, Figure A1.

Figure 20: Level of Service and Capacity Thresholds to achieve desired pedestrian levels of service

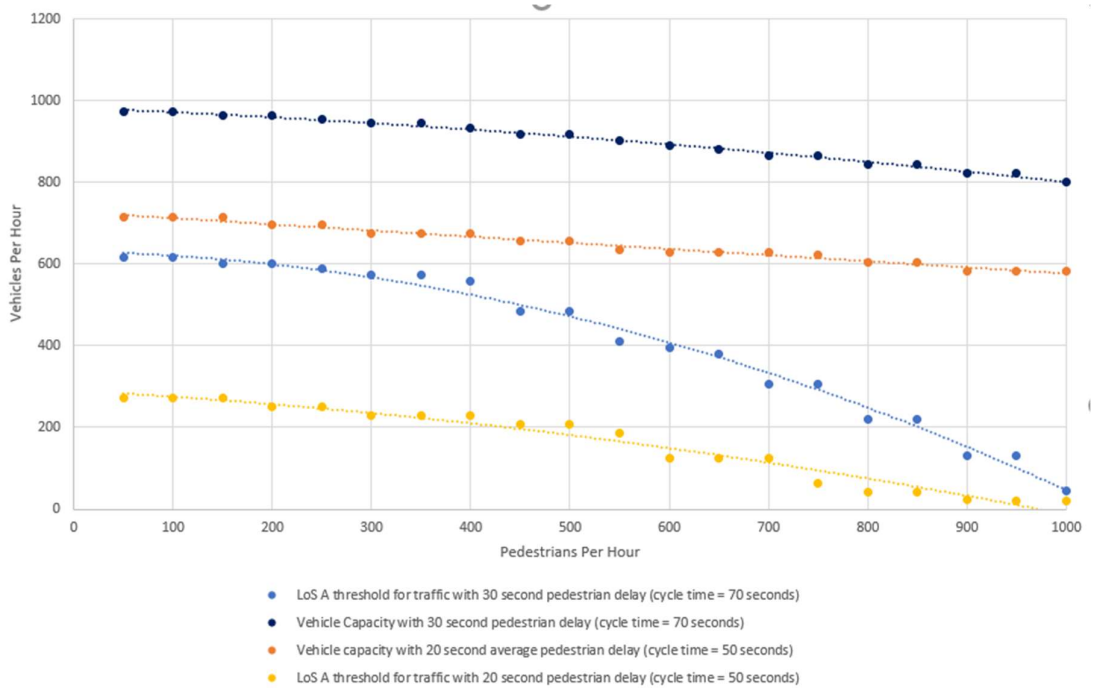


Figure 19 indicates that if pedestrians and buses are prioritised over general traffic, then a 50 second cycle time would provide a good level of service for pedestrians crossing the road and public transport; however during peak periods it is likely that the lower cycle times would result in a greater level of congestion along the corridor, which is particularly relevant for the southbound only scenarios. At a 70 second cycle time (pedestrian delay of 30 seconds), it is anticipated that the peak period traffic demands (and mixed running buses for the southbound bus lane only concepts) could be accommodated, but at the expense of increased pedestrian delay.

The analysis above does not consider signal co-ordination, nor reduced pedestrian delays if the signals are close to the bus stops. Using the Austroads method, the level of service is expected to be D- (compared with the existing LoS D) at the existing crossings primarily due to the crossing spacing. For signalised crossings adjacent to bus stops, it is anticipated that a level of service B is achievable as the stops are close to the crossing.

The crossing level of service could be improved with additional crossings along the corridor, including under the motorway overpass (next to relocated bus stops), at Tinakori Road and potentially others along Thorndon Quay to provide a 100m spacing. In peak times, with a cycle time of 70 seconds, the level of service for all modes is expected to be good, and in off-peak periods a cycle time of 50 seconds would also result in a good level of service for all modes.

Conclusions and Recommendations

Bus Reliability

The provision of a Special Vehicle Lane on Hutt Road and a bus lane along Thorndon Quay is likely to result in consistent travel times in the order of 10 - 11 minutes through to 2036 in both directions. This is lower than the current observed peak period journey times and similar to the off-peak travel times, where there is very little congestion along the corridor.

In the morning peak period, when compared to the 2036 scenario without bus priority measures (the do-minimum), the potential benefit could be in the order of 10 minutes per bus. In the evening period, the benefits are expected to be in the order of 1 – 2 minutes; however, the caveat is that the model does not account for blocking back from the motorway ramps, and hence the benefits of bus priority are likely to be higher than estimated in this assessment. In the counter peak direction, the expected benefits of the bus priority measures are likely to be less than a minute.

During the day, the future conditions along the corridor are unlikely to significantly impact on the reliability of bus services (subject to parking turnover) that would warrant further consideration of full-time bus lanes or Special Vehicle Lanes along the corridor (particularly along Thorndon Quay).

The exception to the above conclusion is in the morning peak period where a T2 lane with trucks is proposed. The volumes of traffic eligible to use the Special Vehicle Lane on Hutt Road is too high to provide any benefit to any motorised mode travelling southbound through this section. This is also likely to apply for a T2 lane without trucks as cars with more than two occupants that use SH1 shift to Hutt Road to take advantage of the Special Vehicle Lane. Therefore, it is recommended that a T2 lane (with or without trucks) is not considered further.

Freight Reliability

The reliability for trucks appears to be contingent on two aspects:

1. If trucks are eligible to use the Special Vehicle Lane on Hutt Road (Ngauranga to Kaiwharawhara); and
2. If trucks are not permitted to use the Special Vehicle Lane on Hutt Road (Ngauranga to Kaiwharawhara) and are confined to the general traffic lanes.

The use of the bus lanes on Thorndon Quay by trucks has not been considered as it is inconsistent with the street environment. There are likely to be challenges associated with the interaction at bus stops and the entrance to the bus terminal (crossing over the traffic lanes).

If trucks are eligible to use the Special Vehicle Lane on Hutt Road (between Kaiwharawhara and Ngauranga), then the reliability benefits for trucks (particularly in the peaks) are likely to be similar to the estimated public transport benefits in this section of the corridor .

If trucks are not eligible to use the Special Vehicle Lane, then they are likely to be susceptible to the impacts of replacing a general traffic lane with the Special Vehicle Lane (in the peak periods), which are expected to be a combination of:

1. Increased public transport patronage beyond what is forecast in Wellington Transport Strategy Model (WTSM) in the longer term;
2. Re-routing from Hutt Road to SH1 and other routes (such as Ngaio Gorge) beyond what is forecast in WTSM;
3. Re-routing from SH1 for vehicles eligible to use a Special Vehicle Lane on Hutt Road;
4. Peak spreading; and
5. Provision of an alternative route to the Interislander Ferry Terminal via the proposed Aotea Quay roundabout (discussed below).

The WTSM model forecasts reduce the traffic volume significantly, but still require an additional 300 vehicle per hour (~5% of the peak motorway flow) reduction in the demand for Hutt Road; however there isn't the capacity on the motorway through the interchange to accommodate this in the 7am – 9am period and there is limited spare capacity in the 6am – 7am period. However, the combination of the above has the potential to provide a neutral outcome for freight travelling to Aotea Quay, but a range of impacts from neutral to moderate negative for trucks travelling via Thorndon Quay

This uncertainty in the impacts warrants further investigation in both the elasticities of the public transport response, the routing in AIMSUN, and the potential impacts outside the modelled periods in both the AIMSUN models and WTSM models.

Benefit and Impact of Aotea Quay Roundabout

The potential benefit of the Aotea Quay roundabout is the potential to allow people and trucks travelling to the Interislander Ferry Terminal via SH1, instead of Hutt Road (which is the only route from the north accessible to the ferry terminal), and has the potential to be heavily congested in the morning peak period with the implementation of a Special Vehicle Lane. The work undertaken as part of the Multi-User Ferry Terminal project indicates that this may be in the order of 400 vehicles per hour in the respective morning and evening peaks. The conclusion at this stage is that there is merit in progressing to more detailed investigation of the benefits of this inclusion, using the AIMSUN models; however it is anticipated that there is a benefit for Interislander travel compared to the scenarios with a Special Vehicle Lane on Hutt Road but without the Aotea Quay roundabout.

Impact of Service Lane

The provision of a service lane along Hutt Road at Kaiwharawhara introduces another traffic signal phase and reduces the overall level of service to poor (F). However, except for a Special Vehicle Lane being a T2 lane (with or without trucks), the Special Vehicle Lane should

operate reasonably efficiently, therefore continuing to provide benefits for public transport. If trucks are not able to use the Special Vehicle Lane, then they will be affected by the provision of the service lane to the same level as general traffic.

Furthermore, if the preferred proposal is to connect to a new Multi-User Ferry Terminal at the intersection of Hutt Road and Kaiwharawhara Road, the inclusion of the service lane would result in a 5-phase intersection, which may affect the performance of the Special Vehicle Lane as well. It is recommended that the Phase 2 work addresses this in more detail, including the integration of options being considered by the Multi-User Ferry Terminal project.

Active Modes

The assessment for active modes has been undertaken separately for facilities along the corridor and crossing opportunities along the section of the corridor between Aotea Quay and Thorndon Quay. Through the section between the motorway overpass and Tinakori Road, the cycling level of service with uni-directional cycle paths is expected to be poor, primarily due to the constrained width through the section, hence the bi-directional cycleway is preferred.

The assessment indicates that a lower level of service is delivered with the uni-directional cycle paths compared with the bi-directional cycle paths. Walking level of service is expected to be good along the corridor for all options except the concept with bus lanes in both directions, and uni-directional cycle paths.

Recommendations

From the analysis undertaken, the following initial conclusions have been developed and are subject to more detailed assessment in the next stage of the project:

1. There is a very strong case for bus priority (southbound) in the morning peak (as per Concept 1 and Concept 3) as it expected that there will be significant benefits;
2. There is a case for bus priority (northbound) in the evening peak, however the expected benefit is lower than benefits in the southbound morning peak;
3. It is expected that with peak period bus priority, the bus journey times will be in the order of 10-11 minutes which is lower than currently observed, and in the case of the morning peak period, significantly lower than the do-minimum;
4. There doesn't appear to be a strong case for all-day bus priority along the corridor as the level of service (reliability) is expected to remain good in off-peak periods through to 2036. However, along Hutt Road there would likely be a lesser impact to other road users if the Special Vehicle Lane was implemented before congestion develops throughout the day;
5. The type of Special Vehicle Lane is a balancing act between improving reliability for buses, improving reliability for freight, managing the impact of converting a general traffic lane to a Special Vehicle Lane, and ensuring that the volume of traffic in the Special Vehicle Lane does not negate its benefits. As a result, the recommendation at this stage (excluding safety considerations) is to exclude a T2 lane from further investigation;
6. The roundabout at Aotea Quay/Mainfreight entrance should be included under all options to provide an additional access to the Interislander Ferry Terminal, and/or to mitigate potential impacts of restricting right turn movements on Hutt Road if a raised median is implemented. The roundabout at Aotea Quay may negate the need to allow

trucks in the Special Vehicle Lane to achieve the investment objective related to access to the Interislander Ferry Terminal;

7. Consider additional controlled crossing points along Thorndon Quay to reduce the spacing between the current (which will be upgraded) and proposed crossings at Tinakori Road and the motorway overpass (where bus stops are proposed). More crossings will improve the level of service by reducing the distance to walk to a formal crossing point. The provision of additional crossings is unlikely to have a significant impact on the reliability of public transport along the corridor;
8. Uni-directional cycle paths on Thorndon Quay (between the motorway overpass and Thorndon Quay) are expected to result in a poor level of service for cycling and walking due to the constrained width, hence extending the existing bi-directional cycle path is recommended;
9. The provision of a bi-directional path along Thorndon Quay provides good level of service (B/C) and a higher level of service than the uni-directional cycle paths (D/E) using the Danish Cycling Level of Service method. This is primarily due to the path width and the buffer between the cycle path and the road. However, this assessment does not consider the safety implications of a bi-directional cycle path, which is being addressed through the Investment Objective related to safety;
10. The elasticities of the public transport response, the routing in AIMSUN, and the potential impacts outside the modelled periods in both the AIMSUN models and WTSM models are to be further investigated in Stage 2 of the project to confirm the assessment of the reliability for trucks, and;
11. Refine intersection layouts during Stage 2 of the project.

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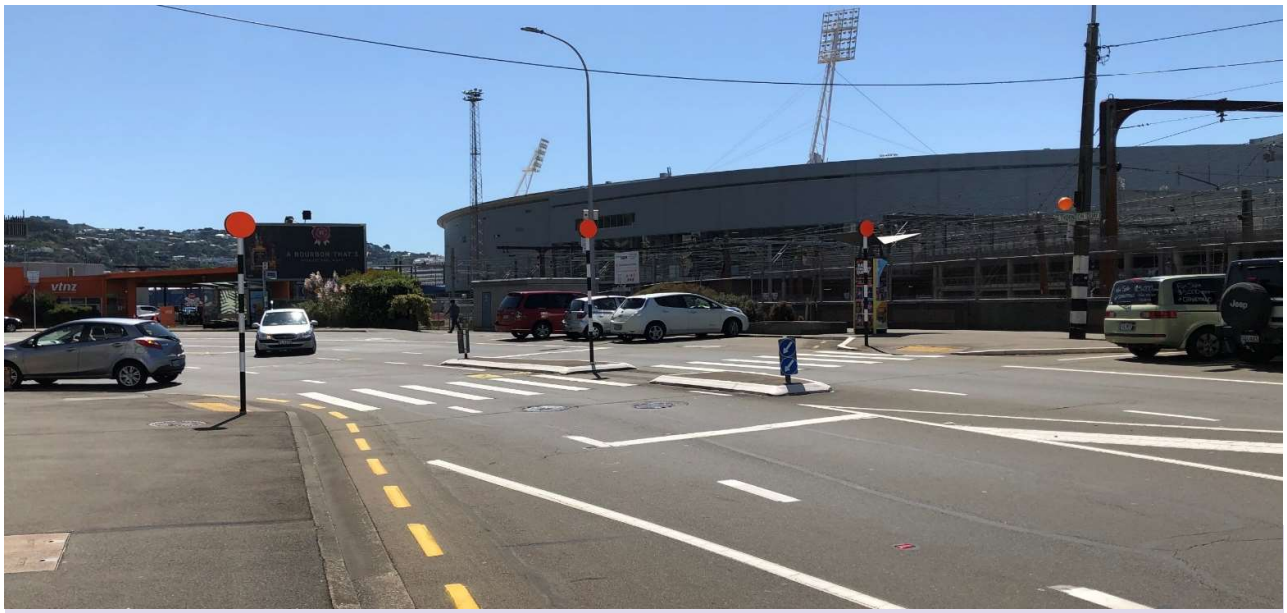

Appendix C

Indicative Cost Estimates

Project Estimate - Form B

Project Name: Thorndon Quay Hutt Road - Concept 1

IBE

Indicative Business Case Estimate

Item	Description	Base Estimate	Contingency	Funding Risk Contingency
A	**Nett Project Property Cost**	**Excluded**	**Excluded**	**Excluded**
	Project Development Phase			
	- Consultancy Fees	Excluded		
	- NZTA Managed Costs	Excluded		
B	**Total Project Development**	**Excluded**	**Excluded**	**Excluded**
	Pre-Implementation Phase			
	- Consultancy Fees	987,680		
	- NZTA Managed Costs	764,578		
C	**Total Pre-implementation**	**1,752,258**	**525,677**	**341,690**
	Implementation Phase			
	Implementation Fees			
	- Consultancy Fees	692,429		
	- NZTA Managed Costs	1,278,776		
	- Consent Monitoring Fees	220,000		
	Sub Total Base Implementation Fees	**2,192,000**	**657,600**	**427,440**
	Physical Works			
1	Environmental Compliance	51,000		
2	Earthworks/Site Preparation /Earthworks	493,100		
3	Ground Improvements	Nil		
4	Drainage	485,400		
5	Pavement and Surfacing	2,736,080		
6	Bridges	Nil		
7	Retaining Walls	Nil		
8	Traffic Services	2,737,005		
9	Service Relocations	Exclud.		
10	Landscaping	5,628,000		
11	Traffic Management and Temporary Works	1,167,200		
12	Preliminary and General	2,330,000		
13	Extraordinary Construction Costs	Nil		
	Sub Total Base Physical Works	**15,628,000**	**4,688,400**	**3,047,460**
D	**Total for Implementation Phase**	**17,820,000**	**5,346,000**	**3,474,900**
E	**Project Base Estimate (A+B+C+D)**	**19,572,258**		

F	**Contingency** (Assessed/Analysed)	**(A+B+C+D)**	**5,871,677**
G	**Project Expected Estimate**	**(E+F)**	**25,444,000**
Nett Project Property Cost Expected Estimate			**Excluded**
Project Development Phase Expected Estimate			**Excluded**
Pre-implementation phase Expected Estimate			2,277,935
Implementation Phase Expected Estimate			23,166,000

H	**Funding Risk Contingency** (Assessed/Analysed)	**(A+B+C+D)**	**3,816,590**
I	**95th percentile Project Estimate**	**(G+H)**	**29,270,000**
Nett Project Property Cost 95th percentile Estimate			**Excluded**
Project Development Phase 95th percentile Estimate			**Excluded**
Pre-implementation Phase 95th percentile Estimate			2,619,626
Implementation Phase 95th percentile Estimate			26,640,900

Date of Estimate 04/11/2020	**Cost Index (Qtr/Year) 4 2020**
Estimate prepared Gaya Paranisamy	**Signed**
Estimate verified Carl Viljoen	**Signed**
Estimate external peer review by	**Signed**
Estimate accepted by NZTA	**Signed**

Note: (1) These estimates are exclusive of escalation and GST.

Project Estimate - Form B

Project Name: Thorndon Quay Hutt Road - Concept 2

IBE

Indicative Business Case Estimate

Item	Description	Base Estimate	Contingency	Funding Risk Contingency
A	**Nett Project Property Cost**	**Excluded**	**Excluded**	**Excluded**
	Project Development Phase			
	- Consultancy Fees	Excluded		
	- NZTA Managed Costs	Excluded		
B	**Total Project Development**	**Excluded**	**Excluded**	**Excluded**
	Pre-Implementation Phase			
	- Consultancy Fees	942,980		
	- NZTA Managed Costs	764,578		
C	**Total Pre-implementation**	**1,707,558**	**512,267**	**332,974**
	Implementation Phase			
	Implementation Fees			
	- Consultancy Fees	741,118		
	- NZTA Managed Costs	3,749,976		
	- Consent Monitoring Fees	220,000		
	Sub Total Base Implementation Fees	**4,712,000**	**512,267**	**783,640**
	Physical Works			
1	Environmental Compliance	54,000		
2	Earthworks/Site Preparation /Earthworks	492,560		
3	Ground Improvements	Nil		
4	Drainage	485,400		
5	Pavement and Surfacing	2,179,020		
6	Bridges	Nil		
7	Retaining Walls	Nil		
8	Traffic Services	3,788,845		
9	Service Relocations	Exclud.		
10	Landscaping	4,212,000		
11	Traffic Management and Temporary Works	1,167,200		
12	Preliminary and General	2,503,000		
13	Extraordinary Construction Costs	Nil		
	Sub Total Base Physical Works	**14,883,000**	**4,464,900**	**2,902,185**
D	**Total for Implementation Phase**	**19,595,000**	**5,878,500**	**3,821,025**
E	**Project Base Estimate** (A+B+C+D)	**21,302,558**		

F	**Contingency** (Assessed/Analysed)	**(A+B+C+D)**	**6,390,767**
G	**Project Expected Estimate**	**(E+F)**	**27,694,000**
Nett Project Property Cost Expected Estimate			**Excluded**
Project Development Phase Expected Estimate			**Excluded**
Pre-implementation phase Expected Estimate			2,219,825
Implementation Phase Expected Estimate			24,573,000

H	**Funding Risk Contingency** (Assessed/Analysed)	**(A+B+C+D)**	**4,153,999**
I	**95th percentile Project Estimate**	**(G+H)**	**31,850,000**
Nett Project Property Cost 95th percentile Estimate			**Excluded**
Project Development Phase 95th percentile Estimate			**Excluded**
Pre-implementation Phase 95th percentile Estimate			2,552,799
Implementation Phase 95th percentile Estimate			28,257,993

Date of Estimate 04/11/2020	**Cost Index (Qtr/Year) 4 2020**
Estimate prepared Gaya Paranisamy	**Signed**
Estimate verified Carl Viljoen	**Signed**
Estimate external peer review by	**Signed**
Estimate accepted by NZTA	**Signed**

Note: (1) These estimates are exclusive of escalation and GST.

Project Estimate - Form B

Project Name: Thorndon Quay Hutt Road - Concept 3

IBE

Indicative Business Case Estimate

Item	Description	Base Estimate	Contingency	Funding Risk Contingency
A	**Nett Project Property Cost**	**Excluded**	**Excluded**	**Excluded**
	Project Development Phase			
	- Consultancy Fees	Excluded		
	- NZTA Managed Costs	Excluded		
B	**Total Project Development**	**Excluded**	**Excluded**	**Excluded**
	Pre-Implementation Phase			
	- Consultancy Fees	902,720		
	- NZTA Managed Costs	764,578		
C	**Total Pre-implementation**	**1,667,298**	**500,189**	**325,123**
	Implementation Phase			
	Implementation Fees			
	- Consultancy Fees	692,429		
	- NZTA Managed Costs	1,509,796		
	- Consent Monitoring Fees	220,000		
	Sub Total Base Implementation Fees	**2,423,000**	**500,189**	**438,478**
	Physical Works			
1	Environmental Compliance	51,000		
2	Earthworks/Site Preparation /Earthworks	493,100		
3	Ground Improvements	Nil		
4	Drainage	485,400		
5	Pavement and Surfacing	2,736,080		
6	Bridges	Nil		
7	Retaining Walls	Nil		
8	Traffic Services	2,737,005		
9	Service Relocations	Exclud.		
10	Landscaping	4,212,000		
11	Traffic Management and Temporary Works	1,167,200		
12	Preliminary and General	2,330,000		
13	Extraordinary Construction Costs	Nil		
	Sub Total Base Physical Works	**14,212,000**	**4,263,600**	**2,771,340**
D	**Total for Implementation Phase**	**16,635,000**	**4,990,500**	**3,243,825**
E	**Project Base Estimate** (A+B+C+D)	**18,302,298**		

F	**Contingency** (Assessed/Analysed)	**(A+B+C+D)**	**5,490,689**
G	**Project Expected Estimate**	**(E+F)**	**23,793,000**
Nett Project Property Cost Expected Estimate			**Excluded**
Project Development Phase Expected Estimate			**Excluded**
Pre-implementation phase Expected Estimate			2,167,487
Implementation Phase Expected Estimate			21,399,000

H	**Funding Risk Contingency** (Assessed/Analysed)	**(A+B+C+D)**	**3,568,948**
I	**95th percentile Project Estimate**	**(G+H)**	**27,370,000**
Nett Project Property Cost 95th percentile Estimate			**Excluded**
Project Development Phase 95th percentile Estimate			**Excluded**
Pre-implementation Phase 95th percentile Estimate			2,492,611
Implementation Phase 95th percentile Estimate			24,608,608

Date of Estimate 04/11/2020	**Cost Index (Qtr/Year) 4 2020**
Estimate prepared Gaya Paranisamy	**Signed**
Estimate verified Carl Viljoen	**Signed**
Estimate external peer review by	**Signed**
Estimate accepted by NZTA	**Signed**

Note: (1) These estimates are exclusive of escalation and GST.

Project Estimate - Form B

Project Name: Thorndon Quay Hutt Road - Concept 4

IBE

Indicative Business Case Estimate

Item	Description	Base Estimate	Contingency	Funding Risk Contingency
A	**Nett Project Property Cost**	**Excluded**	**Excluded**	**Excluded**
	Project Development Phase			
	- Consultancy Fees	Excluded		
	- NZTA Managed Costs	Excluded		
B	**Total Project Development**	**Excluded**	**Excluded**	**Excluded**
	Pre-Implementation Phase			
	- Consultancy Fees	958,040		
	- NZTA Managed Costs	764,578		
C	**Total Pre-implementation**	**1,722,618**	**516,785**	**335,911**
	Implementation Phase			
	Implementation Fees			
	- Consultancy Fees	756,586		
	- NZTA Managed Costs	3,801,776		
	- Consent Monitoring Fees	220,000		
	Sub Total Base Implementation Fees	**4,779,000**	**516,785**	**794,368**
	Physical Works			
1	Environmental Compliance	54,000		
2	Earthworks/Site Preparation /Earthworks	492,560		
3	Ground Improvements	Nil		
4	Drainage	429,400		
5	Pavement and Surfacing	2,100,910		
6	Bridges	Nil		
7	Retaining Walls	Nil		
8	Traffic Services	4,116,305		
9	Service Relocations	Exclud.		
10	Landscaping	4,212,000		
11	Traffic Management and Temporary Works	1,167,200		
12	Preliminary and General	2,561,000		
13	Extraordinary Construction Costs	Nil		
	Sub Total Base Physical Works	**15,134,000**	**4,540,200**	**2,951,130**
D	**Total for Implementation Phase**	**19,913,000**	**5,973,900**	**3,883,035**
E	**Project Base Estimate** (A+B+C+D)	**21,635,618**		

F	**Contingency** (Assessed/Analysed)	**(A+B+C+D)**	**6,490,685**
G	**Project Expected Estimate**	**(E+F)**	**28,127,000**
Nett Project Property Cost Expected Estimate			**Excluded**
Project Development Phase Expected Estimate			**Excluded**
Pre-implementation phase Expected Estimate			2,239,403
Implementation Phase Expected Estimate			24,970,000

H	**Funding Risk Contingency** (Assessed/Analysed)	**(A+B+C+D)**	**4,218,946**
I	**95th percentile Project Estimate**	**(G+H)**	**32,350,000**
Nett Project Property Cost 95th percentile Estimate			**Excluded**
Project Development Phase 95th percentile Estimate			**Excluded**
Pre-implementation Phase 95th percentile Estimate			2,575,314
Implementation Phase 95th percentile Estimate			28,715,483

Date of Estimate 04/11/2020	**Cost Index (Qtr/Year) 4 2020**
Estimate prepared Gaya Paranisamy	**Signed**
Estimate verified Carl Viljoen	**Signed**
Estimate external peer review by	**Signed**
Estimate accepted by NZTA	**Signed**

Note: (1) These estimates are exclusive of escalation and GST.

Project Estimate - Form B

Project Name: Thorndon Quay Hutt Road - Concept 5

IBE

Indicative Business Case Estimate

Item	Description	Base Estimate	Contingency	Funding Risk Contingency
A	**Nett Project Property Cost**	**700,000**	**210,000**	**136,500**
	Project Development Phase			
	- Consultancy Fees	Excluded		
	- NZTA Managed Costs	Excluded		
B	**Total Project Development**	**Excluded**	**Excluded**	**Excluded**
	Pre-Implementation Phase			
	- Consultancy Fees	1,125,200		
	- NZTA Managed Costs	764,578		
C	**Total Pre-implementation**	**1,889,778**	**566,933**	**368,507**
	Implementation Phase			
	Implementation Fees			
	- Consultancy Fees	938,973		
	- NZTA Managed Costs	4,413,776		
	- Consent Monitoring Fees	290,000		
	Sub Total Base Implementation Fees	**5,643,000**	**1,692,900**	**1,100,385**
	Physical Works			
1	Environmental Compliance	87,000		
2	Earthworks/Site Preparation /Earthworks	1,015,960		
3	Ground Improvements	Nil		
4	Drainage	722,400		
5	Pavement and Surfacing	3,478,110		
6	Bridges	Nil		
7	Retaining Walls	Nil		
8	Traffic Services	3,809,355		
9	Service Relocations	Exclud.		
10	Landscaping	4,212,000		
11	Traffic Management and Temporary Works	1,411,500		
12	Preliminary and General	3,183,000		
13	Extraordinary Construction Costs	Nil		
	Sub Total Base Physical Works	**17,920,000**	**5,376,000**	**3,494,400**
D	**Total for Implementation Phase**	**23,563,000**	**7,068,900**	**4,594,785**
E	**Project Base Estimate (A+B+C+D)**	**25,452,778**		

F	**Contingency** (Assessed/Analysed)	**(A+B+C+D)**	**7,635,833**
G	**Project Expected Estimate**	**(E+F)**	**33,089,000**
Nett Project Property Cost Expected Estimate			910,000
Project Development Phase Expected Estimate			**Excluded**
Pre-implementation phase Expected Estimate			2,456,711
Implementation Phase Expected Estimate			30,631,900

H	**Funding Risk Contingency** (Assessed/Analysed)	**(A+B+C+D)**	**4,963,292**
I	**95th percentile Project Estimate**	**(G+H)**	**38,060,000**
Nett Project Property Cost 95th percentile Estimate			1,046,500
Project Development Phase 95th percentile Estimate			**Excluded**
Pre-implementation Phase 95th percentile Estimate			2,826,000
Implementation Phase 95th percentile Estimate			35,227,000

Date of Estimate 04/11/2020	**Cost Index (Qtr/Year) 4 2020**
Estimate prepared Gaya Paranisamy	**Signed**
Estimate verified Carl Viljoen	**Signed**
Estimate external peer review by	**Signed**
Estimate accepted by NZTA	**Signed**

Note: (1) These estimates are exclusive of escalation and GST.

Project Estimate - Form B

Project Name: Thorndon Quay Hutt Road - Concept 6

IBE

Indicative Business Case Estimate

Item	Description	Base Estimate	Contingency	Funding Risk Contingency
A	**Nett Project Property Cost**	**700,000**	**210,000**	**136,500**
	Project Development Phase			
	- Consultancy Fees	Excluded		
	- NZTA Managed Costs	Excluded		
B	**Total Project Development**	**Excluded**	**Excluded**	**Excluded**
	Pre-Implementation Phase			
	- Consultancy Fees	1,094,480		
	- NZTA Managed Costs	764,578		
C	**Total Pre-implementation**	**1,859,058**	**557,717**	**362,516**
	Implementation Phase			
	Implementation Fees			
	- Consultancy Fees	904,266		
	- NZTA Managed Costs	4,289,776		
	- Consent Monitoring Fees	238,000		
	Sub Total Base Implementation Fees	**5,433,000**	**1,629,900**	**1,059,435**
	Physical Works			
1	Environmental Compliance	69,000		
2	Earthworks/Site Preparation /Earthworks	492,560		
3	Ground Improvements	Nil		
4	Drainage	429,400		
5	Pavement and Surfacing	2,602,910		
6	Bridges	Nil		
7	Retaining Walls	Nil		
8	Traffic Services	5,012,305		
9	Service Relocations	Exclud.		
10	Landscaping	4,212,000		
11	Traffic Management and Temporary Works	1,529,200		
12	Preliminary and General	3,060,000		
13	Extraordinary Construction Costs	Nil		
	Sub Total Base Physical Works	**17,408,000**	**5,222,400**	**3,394,560**
D	**Total for Implementation Phase**	**22,841,000**	**6,852,300**	**4,453,995**
E	**Project Base Estimate (A+B+C+D)**	**25,400,058**		

F	**Contingency** (Assessed/Analysed)	**(A+B+C+D)**	**7,410,017**
G	**Project Expected Estimate**	**(E+F)**	**32,811,000**
Nett Project Property Cost Expected Estimate			910,000
Project Development Phase Expected Estimate			**Excluded**
Pre-implementation phase Expected Estimate			2,416,775
Implementation Phase Expected Estimate			29,694,000

H	**Funding Risk Contingency** (Assessed/Analysed)	**(A+B+C+D)**	**4,816,511**
I	**95th percentile Project Estimate**	**(G+H)**	**37,630,000**
Nett Project Property Cost 95th percentile Estimate			1,046,500
Project Development Phase 95th percentile Estimate			**Excluded**
Pre-implementation Phase 95th percentile Estimate			2,779,292
Implementation Phase 95th percentile Estimate			34,147,295

Date of Estimate 04/11/2020	**Cost Index (Qtr/Year) 4 2020**
Estimate prepared Gaya Paranisamy	**Signed**
Estimate verified Carl Viljoen	**Signed**
Estimate external peer review by	**Signed**
Estimate accepted by NZTA	**Signed**

Note: (1) These estimates are exclusive of escalation and GST.

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