SH1 Wellington Corridor Improvements

Initial Technical Report

New Zealand Transport Agency

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New Zealand Government

NZ TRANSPORT AGENCY WAKA KOTAHI

More information

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Document Version History

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APPENDIX A:	Long Tunnel Feasibility Assessment Report	Released as Document 6
	Long Tunnel Geotechnical Feasibility Assessment	Released as Document 7
	Long Tunnel Construction Programme	Withheld in full under section 9(2)(ba)(ii)
APPENDIX B:	Modelling Report	Withheld in full under section 9(2)(ba)(ii)
APPENDIX C:	Option Assessment Framework	Withheld in full under section 9(2)(ba)(ii)
	Initial Specialist Briefing	Withheld in full under section 9(2)(ba)(ii)
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APPENDIX D:	Final Scoring Record	Withheld in full under section 9(2)(ba)(ii)
	Social and Environmental Criteria Assessment	Withheld in full under section 9(2)(ba)(ii)
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APPENDIX F:	Economic Evaluation Assumptions and Summary	Withheld in full under section 9(2)(ba)(ii)

1 INTRODUCTION

1.1 Overview

The NZ Transport Agency is undertaking investigations into improvements to the State Highway 1 (SH1) corridor through/around the Wellington central city to develop a transport network that enables people and freight to move around efficiently, quickly, and safely.

The scope of this work is underpinned by the direction set out in the Government Policy Statement on Land Transport 2024 (GPS). Core to this is the re-introduction of the Roads of National Significance (RoNS) programme, which includes the Mt Victoria Tunnel and Basin Reserve Upgrade projects.

Previous investigations up to December 2023 involved the Mt Victoria Tunnel and Basin Reserve Upgrade projects as part of a programme which also included new mass rapid transit infrastructure from the railway station to Island Bay along with continuous bus priority to the eastern suburbs. The scope of the current work is to review these projects as a stand-alone scheme aligned to the priorities in the new GPS.

In addition to reviewing the Mt Victoria Tunnel and Basin Reserve Upgrade projects, the NZ Transport Agency is also investigating a previously considered option as an alternate to the Mt Victoria Tunnel and Basin Reserve Upgrade, namely a 4km tunnel running from the Terrace Tunnel to Kilbirnie, referred to as the Long Tunnel. The Long Tunnel option is significantly less developed relative to the Mt Victoria Tunnel and Basin Reserve Upgrade option. To allow the consideration and comparison of both the Mt Victoria Tunnel and Basin Reserve Upgrade, and Long Tunnel options, it is necessary to further develop both of those options to enable a fair comparison in relation to key metrics such as project development and construction timeframes, indicative cost, project outcomes and Benefit to Cost Ratio (BCR).

To achieve the above, a targeted cross-disciplinary team of suppliers has been procured to further investigate and develop both options, and their sub-options, to inform an initial decision on the preferred pathway forward in mid-2024.

For the avoidance of doubt, this is not a business case document. It summarises the work undertaken to initially scope the Long Tunnel and Mt Victoria Tunnel and Basin Reserve Upgrade options to enable a decision to be made on which direction to pursue.

1.2 Report Structure

The report is structured as follows:

- **Section 2:** Overview of the existing transport corridor
- **Section 3:** Project objective and benefits sought
- **Section 4:** Case for change – what if we do nothing?
- **Section 5:** High-level summary of each option
- **Section 6:** Option development summary and the design layout for each option
- **Section 7:** Transport modelling undertaken and the key outputs
- **Section 8:** Option assessment framework and assessment results
- **Section 9:** Cost and Benefit to Cost Ratio (BCR), Risks, as well as Funding and Financing.
- **Section 10:** Risks
- **Section 11:** Investigation summary

Other workstreams have been undertaken in parallel with this technical report but are not reported here. This includes elements such as funding and financing, commercial deliverability and scoping future phases.

2 CORRIDOR CONTEXT

2.1 Study Area

Figure 1 provides an overview of the study area showing SH1 and key destinations.

Figure 1: Wellington Corridor Improvements Study Area

2.2 Corridor Background

As the capital city, Wellington is a significant contributor to New Zealand's economy. In 2023, the economy of Wellington city grew 0.7%[1], even though GDP nationally dropped by 0.2%. The economic success of New Zealand relies on Wellington providing a solid foundation, and future economic growth and productivity will be compromised if access to the region's key destinations between the airport, ports and the central city continues to decline.

[1] https://gem.infometrics.co.nz/wellington-city

Transport routes to access the central city and key regional destinations are limited in number and constrained by the geography of the harbour and hills. The compact urban form resulting from this challenging topography has helped encourage relatively high use of public transport, walking, and cycling as modes of travel. However, reliance on a small number of corridors creates issues for accessibility and resilience.

SH1 is a key element of the transport system as it serves two functions through the central city. The route positioning provides a strategic corridor to key regional destinations such as the employment and education facilities, as well as the regional airport, hospital, and ports. Furthermore, it acts as an important connection for east-west movements and distributes traffic within the local network, including the city streets.

This dual function, coupled with very high demand, means that SH1 does not operate efficiently. The form of the route, outside of the tunnels, is a central city street with regular intersections, parking and driveways which does not enable efficient and reliable journeys.

Previous work in 2020 identified the following three problems for the strategic highway corridor:

- **Growing travel demand along constrained corridors is resulting in poor and declining levels of service for all modes:** The transport system, including SH1, is operating at capacity and the peak hours are spreading resulting in less efficient journeys, rat running, poor travel environments and is limiting potential growth for Wellington. Furthermore, the location of population growth (northern suburbs and across the wider region) will place more strain along the strategic highway corridor compared to other parts of the network.
- **High volumes of traffic conflict with other modes across the corridor creating safety issues and reducing amenity**: There are more trips crossing the highway corridor than there are travelling along it, which creates safety and efficiency issues for both sets of users using all modes of travel.
- **High traffic volumes through vulnerable corridors results in disrupted journeys for people and freight from unplanned events:** The transport system provides a limited number of alternative routes for unplanned events such as vehicle crashes, rail service outages, and severe weather. The system, including SH1, is particularly vulnerable to natural hazards, including seismic events, with several active fault lines in the area.

The Mt Victoria Tunnel and Basin Reserve are, in turn, fundamental elements of State Highway 1 providing the main access route between the city and destinations to the south and east. In previous work, detailed options assessments were undertaken to explore the most viable solution for improving the movements, layout, and infrastructure around the Mt Victoria Tunnel and Basin Reserve.

3 PROJECT OBJECTIVES

At its meeting on 8 March 2024, the Steering Group agreed that this project should have a singular objective. However, it is noted that consistency with previous phases is important from an alternatives assessment perspective. Accordingly, the themes of the Objectives of the previous phases have been translated into three areas for continued reporting:

- Investment Objective: Sets direction for the project. Is a Key Criterion in the decision-making framework
- Benefit with Minimum Standard: Does not set direction of project, or impact option development. Is not a Key Criterion in the decision-making framework, but outcomes are reported for information. Establishes a minimum level of service for every option.
- Co-benefit: Does not set direction of project, or impact option development. Is not a Key Criterion in the decision-making framework, but outcomes are reported for information.

3.1 Investment Objective

The agreed investment objective for this project is outlined below. It is recognised that this objective will be updated and refined once a preferred pathway is agreed.

To provide more efficient and reliable access to support regional and economic growth.

3.2 Benefits

The other benefits which will be sought and measured are outlined below. These align with the objectives from the previous phase of the Basin Reserve and Mt Victoria Tunnel projects.

- Safety (Benefit with minimum standard – being no reduction in safety)
- Resilience (Benefit with minimum standard – being no reduction in resilience)
- Travel Choice (Co-benefit)
- Urban Development (Co-benefit)

These aspects are reflected in the case for change in the next section, and in the option assessment process outlined later in this report.

4 CASE FOR CHANGE

4.1 Overview

The key transportation routes used to access the central city and the region's key destinations are limited in number and constrained by Wellington's topographic and geographic characteristics. These routes, specifically the state highway and the area around the Mt Victoria Tunnel and Basin Reserve, are already operating at capacity for significant periods throughout the day, not limited to peak periods. While the compact urban form of the city encourages relatively high use of public transport and active modes, this also means that all modes share the same constrained corridors, and, in some instances, the same lanes as general traffic.

With further population growth forecast over the next two decades, the capacity constraints on the transport network are likely to have a much greater impact on the economic performance of the city, regardless of where in the city this growth occurs. Growth, coupled with limited capacity and congestion, will result in longer and more unreliable journey times and reduced access to a range of economic and social opportunities in Wellington city and the wider region.

4.2 What If We Do Nothing?

If we **do not** invest in a transport system that enables efficient and reliable journeys, we will have:

Reduced access, coupled with longer and more unreliable journey times:

SH1 through Wellington city currently services around 40,000 vehicles per day[2] and travel demand will continue to rise in line with Wellington's population forecasts. Even a small increase in demand will exacerbate the heavy congestion that already exists along this strategic corridor – the main route for accessing the central city and key regional destinations. Congestion on SH1 will force more traffic onto alternative routes that are not designed for higher volumes of traffic. This will lead to longer and more unreliable journey times, longer peak periods and rat running.

Freight journeys will also become longer and more unreliable, which will comprise access to / from the region's airport and ports. This will result in various challenges and consequences at the local, regional, and national scale, including delivery delays, higher operational costs, as well as disruptions to the entire supply chain.

Combining long and unreliable journey times with reduced access to the region's key destinations, such as employment centres, airport and ports, will result in reduced economic growth and productivity.

Limited growth and liveability:

Due to Wellington's topographic and geographic constraints, growth of the central city cannot occur sustainably without suitable infrastructure to support it. An inefficient transport network is likely to limit growth, and / or growth will occur in a way that results in an inefficient use of land. This will lead to undesirable land-use integration / town planning outcomes, which exacerbates the existing and future transport issues. For example, development in and around the eastern and southern suburbs may be limited without an efficient and reliable connection to Wellington's central city and wider region.

To bypass the congested areas, people will be forced to use local roads which are not designed for higher traffic volumes. This will comprise the city's liveability and reduce the attractiveness of the local streets where people live, work, and spend leisure time.

Growing demand and congestion will reduce the amenity along the SH1 corridor and reduce the ability for Wellington to attract urban development through Te Aro. Furthermore, the difficulty of travelling in and around the central city, coupled with the ease of working from home, could encourage people to move out of the city, away from their primary education and employment centres.

Growth further away from education and employment centres will result in increased development costs, increased infrastructure costs, increased travel costs and reduced social and economic benefits in the city centre.

[2] State highway traffic monitoring – annual average daily traffic (nzta.govt.nz)

Reduced safety and resilience:

Higher volumes of traffic will increase the risk and severity of conflicts with active travel and public transport movements across the corridors, increasing safety and efficiency issues for all transport modes. This will reduce user confidence in active modes and public transport and more people will travel in private vehicles, exacerbating the congestion that already exists along the corridors.

As journeys involving the state highway become less safe and efficient, general traffic will look for alternative such as the Waterfront Quays and around Oriental Bay to Evans Parade – which are heavily utilised by active modes and public transport. Traffic along these routes will increase conflicts between modes and lead to reduced safety, declining levels of service, and discourage the use of active modes and public transport along these routes.

The limited number and constrained nature of the transport corridors mean the entire transport network is vulnerable when an unplanned event occurs. For example, a serious crash occurred on SH1 near the Basin Reserve during the morning peak hour in March 2024, which caused substantial queues and delays for commuter traffic[3]. Without the future provision of alternative routes, Wellington will continue to be impacted by the accessibility and resilience issues that are already present along the entire transport network. This situation will worsen in the future as higher traffic volumes and congestion will increase the risk and severity of crashes occurring on the city's transport network.

Government strategic priorities:

Boosting economic growth and productivity is a fundamental aspect of the central government's plan to rebuild New Zealand's economy. Improving SH1 aligns strongly with priorities in the GPS on Land Transport – including reducing journey times, increasing resilience along the SH1 corridor, and improving the safety for all modes.

[3] UPDATE: Serious crash State Highway 1 - Wellington CBD | Waka Kotahi NZ Transport Agency (nzta.govt.nz)

5 OPTION OVERVIEW

5.1 Option Development Process

The scope of work for this investigation involved updating the Mt Victoria Tunnel and Basin Reserve options and developing Long Tunnel options.

Options for the Long Tunnel and the Mt Victoria Tunnel and Basin Reserve Upgrade were investigated during the IBC stage of previous work. While the latter option was progressed to the DBC stage, the former was discounted due to the cost and carbon impacts of delivering both a Long Tunnel as well as new mass rapid transit infrastructure. The Long Tunnel option, therefore, has been significantly less developed relative to the options for the Mt Victoria Tunnel and Basin Reserve.

The following sections provide more detail on the options that have been developed.

5.2 Options Overview

The three overarching Core options are:

- Parallel Mt Victoria Tunnel and upgrading the Basin Reserve.
- Diagonal Mt Victoria Tunnel and upgrading the Basin Reserve
- Long Tunnel

5.2.1 Parallel Mt Victoria Tunnel and upgrading the Basin Reserve

s 9(2)(ba)(ii)

5.2.2 Diagonal Mt Victoria Tunnel and upgrading the Basin Reserve

s 9(2)(ba)(ii)

5.2.3 Long Tunnel

This core option comprises the following elements:

- Terrace Tunnel:
  - s 9(2)(ba)(ii)
  - s 9(2)(ba)(ii)

- Long Tunnel:
  - New twin bored long tunnel (2.8km) from south of the Terrace Tunnel to Kilbirnie
  - Two general traffic lanes in each direction
  - Grade separation of SH1 through Kilbirnie

5.2.4 Option Development

Initial design feasibility, testing and modelling of these Core options was undertaken, s 9(2)(ba)(ii) . These interventions were identified and added to the Core options to create options entitled "Core plus Essential Elements".

The technical investigations also found that s 9(2)(ba)(ii)

These options are summarised in Table 1 below.

Table 1: Summary of Options

Option	Parallel Tunnel / Basin Reserve	Diagonal Tunnel / Basin Reserve	Long Tunnel
Core	s 9(2)(ba)(ii)		Long Tunnel only
Plus Essential Elements			Plus downstream improvements Plus southbound off-ramp to Adelaide Road
Part of the Wider Programme[4]			Plus public transport improvements

High-level representations of each of the s 9(2)(options are provided below to demonstrate the key differences in layouts between each option.

These options were approved by the Steering Group on 4 April 2024 as the options that would be subject to investigation and assessment.

[4] The wider programme also includes the core and essential elements.

5.2.5 Parallel Tunnel and Basin Reserve Upgrade

5.2.6 Diagonal Tunnel and Basin Reserve Upgrade

5.2.7 Long Tunnel

Table 4 provides a description for the Long Tunnel options and Figure 5 shows a high-level overview of the option layouts.

Table 4: Description of the Long Tunnel Options

Option	Option Description
Core	New tunnels with no intermediary connectivity
Plus Downstream Improvements	Intersection improvements along Cobham Drive (SH1)
Plus Southbound Off-ramp to Adelaide Road	Southbound off-ramp into Adelaide Road and regional hospital
Part of Wider Programme	Enhanced bus to the east, second public transport spine, general PT improvements, parking changes

Figure 4: Layout for the Long Tunnel Options.

6 OPTION DEVELOPMENT AND DESIGN

6.1 Option Development Process

Figure 2 provides an overview of the option development process. After the scope of the initial options was agreed, two rounds of development and assessment were undertaken.

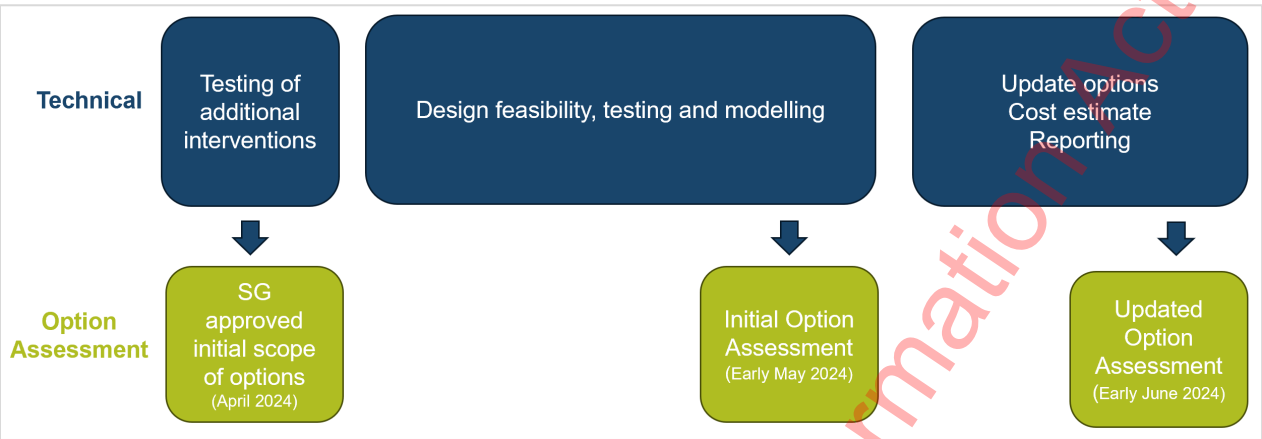


Figure 5: High-level Option Development and Assessment Process

This process enabled the options to be refined based on the new project objective, new traffic modelling (based on changed to traffic demands) and the initial specialist assessments, and for the Steering Group to approve the scope and design prior to the final assessments.

The options were continually refined during this process to develop layouts that were feasible, obtained the required outcomes and represented efficient solutions. This resulted in changes to the layouts developed in previous phases.

As this wasn't a full optioneering process, further refinement and optimisation will be possible through the Investment Case and Pre-implementation phases to maximise outcomes and minimise impacts.

The scope and design of the options that were used in the final assessments are outlined below.

6.2 Option Design

6.2.1 Parallel Mt Victoria Tunnel and Basin Reserve

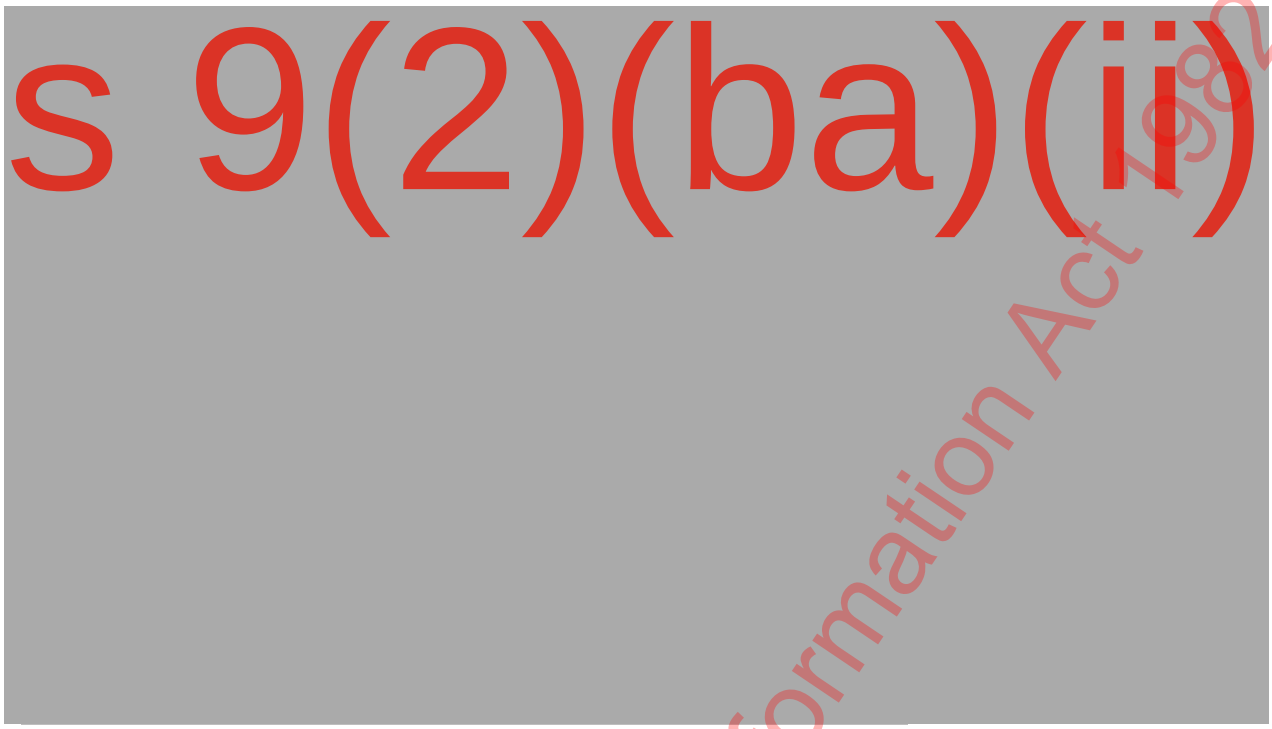
6.2.1.1 Basin Reserve

s 9(2)(ba)(ii)

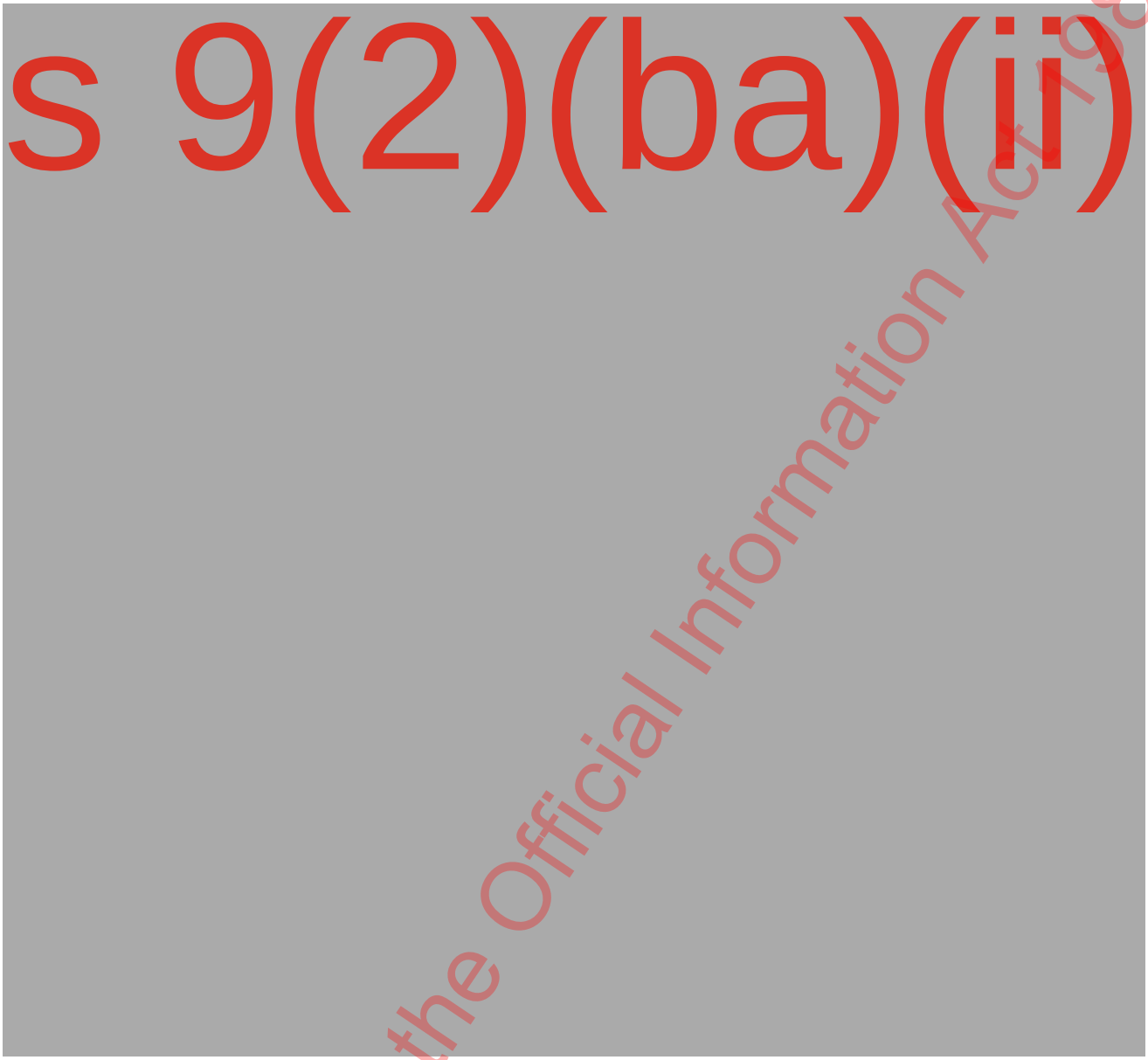
s 9(2)(ba)(ii)

6.2.1.2 Parallel Mt Victoria Tunnel

s 9(2)(ba)(ii)



6.2.2 Diagonal Mt Victoria Tunnel and Basin Reserve



6.2.3 Long Tunnel

As outlined above, whilst the Mt Victoria Tunnel duplication and Basin Reserve Upgrade projects had been subject to significant optioneering and design development during the previous phase, no such work had been undertaken on the long tunnel.

Accordingly WSP were brought into the team to develop the long tunnel option up to a stage that it could be assessed and compared to the Mt Victoria Tunnel and Basin Reserve Options. The focus of the WSP team was to identify a technically feasible solution and develop it in such a way that it could be assessed by technical specialists and costed by independent estimators.

It should be noted that the focus was not to identify the best performing Long Tunnel option. If the Long Tunnel is chosen to progress, the design will need further refinement in subsequent phases to optimise performance and reduce impacts.

s 9(2)(ba)(ii)

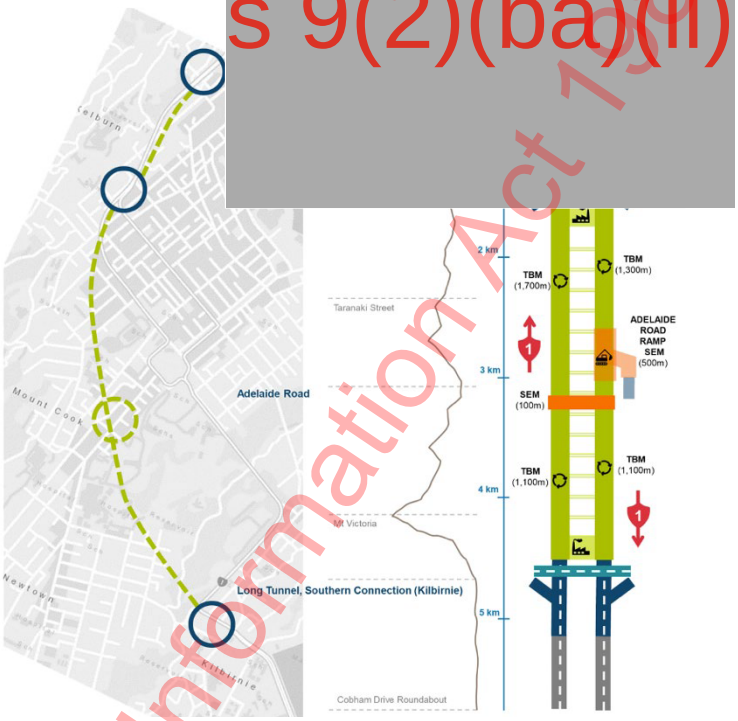


Figure 9: Layout for the Long Tunnel.

The Long Tunnel Feasibility Assessment Report (See Appendix A) outlines the design process and the concept design for a feasible option. The option that was developed can be summarised as comprising five elements that would result in at least two lanes of uninterrupted traffic in each direction from the Terrace Tunnel to Kilbirnie:

- North Portal
  - s 9(2)(ba)(ii)
- Terrace Tunnel Duplication
  - s 9(2)(ba)(ii)
  - s 9(2)(ba)(ii)
  - s 9(2)(ba)(ii)
- Northern Interchange
  - s 9(2)(ba)(ii)
  - s 9(2)(ba)(ii)
  - s 9(2)(ba)(ii)
- Long Tunnel
  - 2,900m approximate length
  - Two-lanes in each direction with 750mm shoulders
- Kilbirnie Interchange
  - Kilbirnie Crescent and Evans Bay Parade intersections removed to provide free-flow traffic lanes between Long Tunnel and Cobham Drive
  - Kilbirnie Crecent / Hamilton Road raised on bridge over SH1 with intersections at either end providing ¾ interchange ramps (no eastbound Off-ramp) and connection to Ruahine Street (existing Mt Victoria Tunnel)

More detailed layout drawings are in the Long Tunnel Feasibility Assessment Report in Appendix A. This appendix also includes a Geotechnical Assessment Report and a brief assessment on the likely construction programme.

7 MODELLING

A suite of models are available to assess changing land use patterns and improvements to the multi-modal transport network in Wellington. These include:

- The Wellington Transport Strategy Model (WTSM) - a strategic model of the whole wellington region. This model is able to forecast changing transport demand for all modes in accordance with changing land use and network assumptions. It is typically used to assess long run changes and to provide an assessment of economic benefit; and
- The Ngauranga to Airport Aimsun model (Aimsun) - a traffic simulation model of Wellington City. This tool provides a much more granular representation of network performance than WTSM but has more restricted geographical and temporal coverage.

These tools were used to input into option refinement process as well as to assess the performance of all options. Accordingly, significant modelling has been undertaken during this process. Appendix B provides a detailed description of the modelling undertaken and the output from this process, but the following provides a brief summary of the key findings:

- Overall network delays reduce in all options relative to the do minimum indicating that all options will deliver transport benefits. The delay reduction is most pronounced in the Long Tunnel option, particularly in the AM peak.
- All tests have relatively similar network flows (a representation of total demand processed during the model period). The Long Tunnel option has slightly higher network flows than the other options. This is partially a reflection of the ability of the network to cater for higher demands but also demonstrates that the Long Tunnel is likely to induce additional traffic by improving connectivity between the eastern suburbs and wider region.
- The Long Tunnel option results in slightly higher network speeds than the other options and the Do-minimum. This partly indicates reduced congestion, but also reflects the fact that the Long Tunnel has a higher speed limit than other roads in the CBD.
- Most corridors are forecast to experience similar or improved travel times relative to the Do-minimum for all options and all time periods, but the extent of the improvement changes by option.
- The Long Tunnel delivers improved performance relative to the other options for the longer distance routes (Ngauranga to Airport, Ngauranga to Hospital). It also delivers some reduced travel times for shorter routes within the city due to the removal of traffic from some city streets (note – this also requires reallocation of roadspace and wider network changes not delivered by the tunnel in isolation),
- s 9(2)(ba)(ii) [redacted]
- The Long Tunnel has the greatest overall impact on traffic volumes around the CBD. The net effect is an overall increase in traffic volumes on the network, however there are significant decreases on key city streets (such as the waterfront, Vivian Street and the existing Mt Victoria Tunnel).
- s 9(2)(ba)(ii) [redacted]
- A range of sensitivity tests have also been undertaken to understand the performance under congestion charging or tolling operations. These generally indicate an improvement in performance, however they also highlight the need to undertake additional work to confirm the exact nature of the charging mechanism adopted.

8 OPTION ASSESSMENT

8.1 Option Assessment Framework

The Option Assessment Framework developed for this stage (see **Appendix C: Option Assessment Framework**) enables a robust and transparent comparison of the options.

The framework has been developed to be consistent with previous option assessment frameworks used in previous investigation phases of the Second Mt Victoria Tunnel and Basin Reserve Upgrade albeit significantly simplified. It is a tool that can help decision making, but it does not make the decision.

The framework enables consideration of a range of criteria which are both qualitative and quantitative. These criteria reflect social, economic, cultural and environmental outcomes of the options.

8.2 Assessment Criteria

The criteria each option was assessed against are presented in Table 6. More detail regarding the criteria is outlined in the Option Assessment Framework (Appendix C).

These criteria were chosen as they each represent factors relevant to decision making. They have been taken from previous processes, current draft policy direction and elements which the team know will be differentiators.

It is acknowledged that there may be some overlap between criteria, but double counting has been minimised and was further reduced through ongoing discussions with specialists.

Table 5: Assessment Criteria

Category	Criterion	Specialist
Project objective	Efficient and reliable journeys	s 9(2)(a)
Other transport, economic and urban outcomes	Safety	
	Resilience	
	Travel choice	
	Urban development	
	Urban amenity (reduction in traffic on city streets)	
	Economic growth	
Impacts	Effects on mana whenua values	
	Environmental, social and economic effects	
	Consenting mitigation requirements	
	Carbon	
	Construction disruption	
Deliverability	Property	
	Cost and affordability	
	BCR	
	Commercial	
	Timing	
Other	Pricing	
	Need for future investment	
	Risk	

[5] s 9(2)(ba)(ii)

8.3 Assessment Process

Each criterion (see Section 3.2) was 'owned' and scored by a technical specialist with knowledge and experience in the associated field.

Specialists were briefed through an initial briefing session (See Initial Briefing in Appendix C) after which they provided a draft assessment. The design team used this assessment to update and refine the design. The specialists were then briefed again on the updated design (See Final Briefing in Appendix C) and undertook their final assessment.

Each technical specialist provided an assessment of each option using a methodology agreed between the specialist and the NZTA.

The options were scored on the scale in Table 5 below.

Scores were developed for each option for a future year (assumed to be around 2045, noting that modelling is based on the year 2033) and, as per the table below, represented the change that the option facilitates when compared to the existing situation.

Table 6: Scoring Range

Score	Scoring Description
✓✓	Substantially positive, factoring in the scale of benefits, the degree of confidence of benefits being realised, and how permanent or long-term the benefits are likely to be.
✓	Positive, factoring in the scale of benefits, the degree of confidence of benefits being realised, and how permanent or long-term the benefits are likely to be.
-	No change in benefits, impacts or difficulties from current situation
✗	Negative, factoring in implementation difficulties, costs, impacts on resources / values, and disbenefits.
✗✗	Substantially negative, factoring in implementation difficulties, costs, and impacts on resources / values, and disbenefits

To ensure consistency in the scoring of options, the following key assumptions were determined:

- Options will be assessed against the existing situation.
- No toll or congestion charge is in place.
- No other local or regional projects in place.
- Low-cost mitigation is included. Specialists were asked to note any mitigation that they believed would be required for their criterion.
- No changes to the existing PT network, other than those outlined in the options.

8.4 Assessment Outcomes

Technical Specialists summarised their methodology, scoring and reasoning behind the scoring in a powerpoint presentation (**see Appendix D**).

Additional background for the scoring for Environmental and Social, and Urban Development is also included in that Appendix, along with an assessment of the potential programme implications of the draft Fast Track Consenting approach.

A summary of the outcomes is presented below in tabular format. This is part of the information pertaining to the performance of each option to assist decision makers.

Table 7: Wellington SH1 Option Scores – Core Options

Core Option	Efficient and reliable journeys	Safety	Resilience	Travel choice	Urban development	Urban amenity	Economic growth	Effects on mana whenua values	Enviro., social and economic effects	Consenting mitigation requirements	Carbon	Construction disruption	Property	Operations and Maintenance	Cost and affordability	BCR	Commercial	Timing	Pricing	Need for future investment	Risk	Maintenance and Operations
Basin + Parallel Tunnel	s 9(2)(ba)(ii)																					
Basin + Diagonal Tunnel																						
Long Tunnel	✓	✓	-	✗	✗	✗	✓	?	✗ ½	✗ ½	✗✗	✗✗	✗✗	✗	✗✗	-	✗	✗✗	✓	✗✗	✗✗	✗✗

s 9(2)(ba)(ii)

Table 8: Wellington SH1 Option Scores – Core + Essential Options

Core Option + Essential Elements	Efficient and reliable journeys	Safety	Resilience	Travel choice	Urban development	Urban amenity	Economic growth	Effects on mana whenua values	Enviro., social and economic effects	Consenting mitigation requirements	Carbon	Construction disruption	Property	Operations and Maintenance	Cost and affordability	BCR	Commercial	Timing	Pricing	Need for future investment	Risk	Maintenance and Operations
Basin + Parallel Tunnel	s 9(2)(ba)(ii) redacted																					
Basin + Diagonal Tunnel																						
Long Tunnel + downstream improvements	✓✓	✓	-	-	✓	✗	✓	?	✗½	✗½	✗✗	✗✗	✗✗	✗	✗✗	-	✗	✗✗	✓	✗	✗✗	✗✗
Long Tunnel + + SB off-ramp to Adelaide Road	✓✓	✓	✓	-	✓	✗	✓	?	✗½	✗½	✗✗	✗✗	✗✗	✗	✗✗	-	✗✗	✗✗	✓	✗	✗✗	✗✗

s 9(2)(ba)(ii) redacted

Table 9: Wellington SH1 Option Scores – Core + Essential + Wider Programme Options

Core Option + Essential Elements + Wider Programme	Efficient and reliable journeys	Safety	Resilience	Travel choice	Urban development	Urban amenity	Economic growth	Effects on mana whenua values	Enviro., social and economic effects	Consenting mitigation requirements	Carbon	Construction disruption	Property	Operations and Maintenance	Cost and affordability	BCR	Commercial	Timing	Pricing	Need for future investment	Risk	Maintenance and Operations
Basin + Parallel Tunnel	s 9(2)(ba)(ii)																					
Basin + Diagonal Tunnel																						
Long Tunnel	✓✓	✓	✓	✓✓	✓✓	✓✓	✓✓	?	X ½	X ½	-	XX	XX	X	XX	-	XX	XX	✓	✓✓	XX	XX

s 9(2)(ba)(ii)

9 COST AND BCR

9.1 Options

Because the Core options did not deliver the necessary benefits, and the wider programme options include elements which are outside the scope of NZ Transport Agency to deliver, the cost and BCRs were only calculated for the Core + Essential options.

9.2 Cost estimates

Table 8 provides the indicative cost estimates for each of the Core +Essential options. The cost estimate report, and the subsequent cost estimate summary table, are provided as Appendix E.

Table 10: Indicative cost estimates

Option		Likely Outturn Estimate	Upper Outturn Estimate
Parallel tunnel + Basin improvements		s 9(2)(i)	
Diagonal tunnel + Basin improvements			
Long tunnel	Excluding Adelaide Road Interchange	$4.87bn	$7.10bn
	Including Adelaide Road Interchange	$5.24bn	$7.65bn

9.3 Economics

9.3.1 Approach to economics

The high level economic analysis has been carried out in accordance with the full procedures of the Monetised Benefits and Costs Manual (**MBCM**). The benefit streams captured were travel time (car, heavy vehicles and bus), travel time reliability, vehicle operating costs (inc. VKT), safety and walking (health).

The WTSM was the model used to derive the travel time, reliability and VOC benefits. It also provided inputs into the safety benefit calculations and walking health benefits. Travel time benefits were adjusted based on a comparison of the calculated "daily hours saved" between the WTSM and AIMSUN micro-simulation models, as AIMSUN better reflects congestion effects in across the network.

Potential Wider Economic Benefits (WEBs), such as urban agglomeration, have not been assessed at this stage. However, estimated ranges for WEBs have been identified by applying percentages (identified from research reports and international benchmarks) to the total "conventional" benefits that have been calculated through the MBCM processes. s 9(2)(ba)(ii)

The BCR is only "partial" in respect to that fact that some potential benefits have not been calculated – including detailed safety benefits, urban amenity, active modes and resilience. These are likely to be moderate in scale and can be captured in the next project phase. They are not expected to influence the relative BCRs of the options, or the decision around a preferred pathway forward.

9.3.2 BCR

The BCR ranges are presented in Table 9 and a summary spreadsheet of the BCR assumptions and outcomes is contained in Appendix F). The ranges have been based on the application of "upper outturn estimate" and "likely outturn estimate" cost ranges[6], and with/without the inclusion of estimated WEBs. s 9(2)(ba) s 9(2)(ba)(ii)

[6] The BCRs were calculated on a draft cost estimate, but the change was not enough to alter the BCR figures.

The key benefit streams for all options relate to travel time and travel time reliability savings, with other calculated benefits being relatively minor.

Table 11: BCR Ranges (P50 – P95)

Option		BCR Excluding Est. WEBs	BCR Including Est. WEBS	Overall Range
Parallel tunnel + Basin improvements		s 9(2)(ba)(ii)		
Diagonal tunnel + Basin improvements				
Long tunnel	Excluding Adelaide Road Interchange	0.2 – 0.3	0.4 – 0.6	0.2 – 0.6
	Including Adelaide Road Interchange	0.3 – 0.4	0.5 – 0.7	0.3 – 0.7

9.3.3 Incremental BCRs

For options which are mutually exclusive, an incremental BCR can be used to identify the optimal economic option. Incremental analysis is carried out by comparing options, starting with the lowest-cost option, to determine if the incremental benefit of further investment is justified. The incremental BCR is calculated using the following formula:

$$Incremental\ BCR = \frac{comparator\ option\ benefit - base\ option\ benefit}{comparator\ option\ cost - base\ option\ cost}$$

Table 12: Incremental BCR Ranges (P50, range with and without WEBs)

Base Option	Comparator Option	Incremental BCR Range (P50, with and without WEBs)
Parallel tunnel	s 9(2)(ba)(ii)	
Diagonal Tunnel		
Long Tunnel (ex. Adelaide)	Vs Long Tunnel (inc. Adelaide)	0.7 - 1.3

The table shows that:

- s 9(2)(ba)(ii)
- If the Long Tunnel were preferred based on wider considerations (inc. strength of outcomes), the Adelaide interchange would be worth investigating further from an economic perspective.

9.3.4 Summary

s 9(2)(ba)(ii)

10 RISKS

s 9(2)(ba)(ii)

11 SUMMARY

The NZ Transport Agency is undertaking investigations into improvements to the State Highway 1 (SH1) corridor through/around the Wellington central city to develop a transport network that enables people and freight to move around efficiently, quickly, and safely.

The current options around the Basin Reserve and Mt Victoria Tunnel have been reviewed and updated and compared to a previously considered Long Tunnel option.

This report summarises the work undertaken by a targeted cross-disciplinary team of suppliers to consider the feasibility of the Long Tunnel option, further refinement of all options, and investigation and comparison of the options in relation to their performance, effects and deliverability.

This information is being presented to decision makers to enable a decision to be made as to the next steps.