



Wellington Northern Corridor

Transportation Improvements Around the Basin Reserve

Feasible Options Report

January 2011



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NZ Transport Agency

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1 Introduction

1.1 The Project

The New Zealand Transport Agency (NZTA), in partnership with Wellington City Council (WCC), Greater Wellington Regional Council (GWRC) and the Ministry of Culture and Heritage (MCH) is undertaking an investigation into improving the transportation efficiency of the roading network around the Basin Reserve. The Basin Reserve falls within one of the Government's seven Roads of National Significance (RoNS), which are key Government initiatives to unlock economic growth in New Zealand.

This report is one of several leading to a Scheme Assessment Report for Improvements in and around the Basin Reserve. It provides an overview of the options developed at the time of writing this report.

The Basin Reserve is located to the southeast of Wellington CBD. The eastbound and westbound traffic flows of State Highway One (SH1) follow separate street systems between the Terrace Tunnel and the Mount Victoria Tunnel. This one-way pair is referred to as the Wellington Inner City Bypass. Eastbound traffic exits the Terrace Tunnel and follows Vivian Street and Kent Terrace, approaching the Basin Reserve from the south. Westbound traffic exits Mount Victoria Tunnel and approaches the Basin Reserve from the east, before travelling along Buckle Street to the Terrace Tunnel.

The Basin Reserve is not only required to accommodate these east-west and west-east traffic flows, but also accommodates significant north-south and south-north traffic flows between the Wellington CBD and Wellington's southern suburbs, and the interaction between local and SH1 movements.

The area around the Basin Reserve comprises a mix of land uses, including commercial, residential and institutional, with some regionally significant community facilities. The Basin Reserve, which is used for national and international cricket fixtures and recreational events such as Carols by Candlelight, can at times create a significant number of pedestrian movements in and around the Basin. In addition, approximately 3000 students attend the three schools within close proximity of the Basin Reserve. Even though students tend to use public transport and private cars instead of walking to school, they do nevertheless generate a large number of pedestrian movements in and around the Basin. The Basin area is also home to several churches and Massey University's Wellington Campus. Features of national significance include Government House to the south east and the National War Memorial on Buckle Street. Overseas dignitaries visiting New Zealand use the Basin Reserve to access Government House, and travel around the Basin Reserve during formal processions between Government House and Parliament.

The Ministry for Culture and Heritage and Wellington City Council have been planning the development of a New Zealand Memorial Park along Buckle Street in front of the War Memorial.

Wellington City plans to create a growth spine between Johnsonville, Newtown and Kilbirnie. This will result in more intensified urban redevelopment along Adelaide Road (a key road to the south of the Basin). In conjunction with this intensification, Wellington City Council and Greater Wellington Regional Council plan to develop a high quality passenger transport corridor between the Hospital at Newtown and the Railway Station. In the short term, the level of service of buses will be improved through the provision of dedicated bus lanes. In the longer term, light rail or high quality buses using the latest electronically guided technology may be considered. This passenger transport corridor also passes through the Basin Reserve.

1.2 Objectives

NZTA is undertaking transport improvements around the Basin Reserve as part of the RoNS (Roads of National Significance). It aims to:

- Increase the efficiency of through-traffic between the Mount Victoria Tunnel and the Inner City Bypass and SH1 motorway.
- Improve the efficiency, reliability and level of service of passenger transport services between Kent and Cambridge Terraces and Adelaide Road.
- Improve safety for those who use the streets around the Basin Reserve.
- Maintain or enhance the present level of service for local traffic between Kent and Cambridge Terraces and Adelaide Road and their connections to SH1.
- Improve pedestrian and cycling access to and around the Basin Reserve, particularly addressing the need for pedestrians to cross significant traffic flows.

Factors that the project team must have due regard to:

- Creating options that are economically efficient.
- Ensuring the improvements around the Basin Reserve are consistent with the previously agreed Ngauranga to Wellington Airport Corridor Plan.

- Ensuring the improvements around the Basin Reserve achieve a good strategic fit with the Government's RoNS.
- Considering the Basin Reserve and the surrounding area which contain defining features such as the Basin Reserve itself, Government House, the planned NZ Memorial Park and the National War Memorial, education facilities and churches, buildings and spaces of high heritage character and value that create a unique sense of place.
- Retaining the multi-functional nature of the area, including its social and community focus, and its role as a centre for recreational use, as well as the immediate roading network.
- Recognising that the streets around the Basin Reserve hold a pivotal position in the state highway network (both within and beyond Wellington City), Wellington's urban growth and Wellington's arterial transport network.
- Maintaining the urban design quality of the area.
- Recognising the relationship to other projects including the Mount Victoria Tunnel refurbishment, the development of Adelaide Road and Buckle Street.

1.3 Key considerations

We expect there to be very soft and liquefiable soils around the Basin Reserve. This is likely to lead to problems with settlement of high embankments. Deep piles will be required for any elevated structures. Any tunnels passing around the Basin Reserve are likely to be below ground water level, making construction difficult and expensive.

Ecology is not considered to be a significant issue. A tunnel option may interfere with fish passage along drainage systems. Because the area around the Basin Reserve was developed early in Wellington's history, improvement options are likely to impact on the archaeological resources in the area, although this could also create the opportunity to record and recover archaeological information in this area.

Although the Basin Reserve area generates traffic noise, the terrain, buildings, and other land uses within the area result in a varied noise environment ranging from quiet areas to noisy areas. The option to shift traffic flows from circulating the Basin Reserve to a more direct route to the north, is likely to increase noise in the north-eastern corner of the project area; however these are likely to be readily mitigated. There is also likely to be a reduction in traffic on the southeast, southern, and western sides of the Basin Reserve, reducing noise in these areas.

Existing air quality data shows that the air quality presently meets the guidelines. Improvements around the Basin Reserve are not expected to have any significant effect on air quality outside the study area. Within the study area, there are expected to be some localised changes in air quality immediately adjacent to the road that correspond to changes in traffic flows. Nevertheless, sensitive receptors and residences along the route are not expected to experience any significantly worse air quality.

The following ideas should be considered when developing options for the Basin Reserve:

- Improve travel times for buses using the high quality passenger transport corridor. Ensure that options do not constrain future light rail options or similar systems.
- Improve the connections between open spaces, particularly between the proposed NZ Memorial Park, the Basin Reserve and Government House.
- Ensure the scale of the proposed options fits with the scale of the surrounding environment.
- Enhance the experience for people entering Wellington through the Mount Victoria Tunnel.
- Improve the activity, vitality and amenity of the area through enhancements to edges to the Basin Reserve.
- Careful consideration and design for the undercrofts of any structures.
- Celebrate that the Basin Reserve is located in a natural basin.
- Repetition of elements - such as pohutukawa trees around Basin.
- Minimise the impact of improvements on views down Kent Terrace and Cambridge Terrace.
- Minimise the impact that any elevated structure will have on the Basin Reserve.
- Build elements that align with the natural landscape.
- Highlight any elements within view shafts.
- Avoid the demolition or relocation of heritage buildings, particularly the Former Home of Compassion Crèche located in Buckle Street.

The project is located between Tory Street and Mount Victoria Tunnel, shown in *Figure 1.1*.

As part of the project, we have developed six feasible options for the Basin Reserve. This report documents the option development process and describes the five options, including an indication of their estimated cost and economic benefits.

01 Meritec, Interim Scheme Assessment Report, For Transit NZ, Dec 2000.

02 Meritec, SH1 Basin Reserve Long Term Transport Solutions, Scheme Assessment report, for Transit NZ, March 2001.

03 Opus International Consultants, Ngauranga to Airport Strategy Study, Technical Report I, for Transit NZ, April 2007

04 Opus International Consultants, Ngauranga to Airport Strategy Study, Technical Report III, for Transit NZ, May 2008

05 <http://www.gw.govt.nz/Regional-Land-Transport-Programme/>



Figure 1.1: The Study Area

1.4 Project History

Over the years a number of previous studies have been undertaken within the study area.

In 2000, Meritec (now AECOM)^{1,2} completed a Scheme Assessment Report for the Basin Reserve. They investigated a number of options before recommending Option H as a preferred option. Option H provided for a two-lane flyover from Paterson Street to Buckle Street, an underpass for vehicles using Sussex Street to reach Cambridge Terrace, and an underpass for vehicles using Kent Terrace to reach Adelaide Road. The arrangement provided a direct link for westbound traffic from Mount Victoria Tunnel to Buckle Street and for eastbound traffic from Kent Terrace to Mount Victoria Tunnel.

The Ngauranga to Airport Strategy Study³ investigated a range of options for improving the transportation network within Wellington City. In terms of the Basin Reserve the study⁴ recommended:

- A high quality passenger transport corridor be developed between the Railway Station and the Hospital at Newtown, which would pass through the Basin Reserve; and
- Improvements to SH1 which also passes through the Basin Reserve, particularly for westbound movements from Mount Victoria Tunnel to the Wellington Inner City Bypass.

It is envisaged that the high quality passenger transport corridor would include bus lanes and be used by conventional buses in the short term. However, in the longer term the Council will investigate a more dedicated busway using high-quality high-capacity buses or light rail transit along this corridor.

The report recommended a single flyover (Option B3) to progress to Scheme Assessment. This option was similar to that recommended by Meritec in their 2001 Scheme Assessment report.

Based on the technical work completed as part of the strategy study, the Ngauranga to Wellington Airport Corridor Plan was developed. The Corridor Plan has been adopted by the Regional Land Transport Committee and has become part of the Regional Land Transport Programme⁵. As a priority action, the Corridor Plan seeks to implement the Basin Reserve transport initiative within 10 years.

The project history is discussed in more detail within the Scoping Report (March 2010).

1.5 Existing Situation

The street system around the Basin Reserve functions as a large square gyratory - like a large roundabout with signals. Traffic circulates clockwise, with major entry and exit points distributed around the periphery. Motorists using state highway south-east bound between the CBD and the eastern suburbs and the airport must complete four-90° turns between the end of the by-pass on Vivian Street and Mount Victoria Tunnel, as shown in Figure 1.1. Traffic has to pass through a number of intersections, the majority of which are signal controlled. The speed limit is 50km / hr between the Terrace Tunnel and Mount Victoria Tunnel (including along the Inner City Bypass).

On a daily basis about 26,000 vehicles enter this gyratory from Kent Terrace, with 18,000 vehicles exiting towards the Mount Victoria tunnel, heading east. These flows are replenished by another 18,000 vehicles heading west, which join the gyratory from the Mount Victoria tunnel. Therefore an undiminished flow of 26,000 vehicles moves around the southeast and south of the system. Of these, 8,000 vehicles exit via the southern exit into Adelaide Road; 14,000 join the flow from that same road. This leads to the gyratory having the largest flow of 32,000 vehicles around the southwest and western sides of the Basin Reserve (Sussex Street). Of these, 22,000 exit into Buckle Street on the northwest corner, and only 10,000 travel to the northern exit at Cambridge Terrace.

The Basin Reserve is located between the southern suburb of Newtown and the Wellington CBD. Like other inner city suburbs, up 25% of Newtown residents walk or cycle to work, many passing through the Basin Reserve. It appears that crashes involving pedestrians and cyclists are not significant.

The majority of crashes around the Basin are related to the operation of the signalised intersections situated around the Basin Reserve. The Basin Reserve improvement options that reduce traffic volumes at intersections with a history of accidents, or that reduce the number of intersections, will maximise the economic benefits associated with safety.

With increasing traffic volumes predicted in future years, congestion and journey times around the Basin are predicted to increase by up to 60% by 2026. This will not only impact on the level of service for general vehicles, but will also have a significant impact on bus journey times, in turn affecting the viability of Wellington City to develop a high quality passenger transport corridor through the Basin Reserve area. Increased traffic volumes are also expected to adversely impact on the large number of pedestrian movements, and access to Government House and the Basin Reserve itself.

Further discussion on the existing environment and Basin Reserve context is included in the Scoping Report (March 2010).



Figure 1.2: The Existing Situation



Figure 1.3: The Existing Situation

2 Introduction to the Options

2.1 Option Development Process

In 2008 NZTA organised a three day Inquiry-by-Design Workshop. The workshop was held to develop scenarios that could be taken into the next phase of the project. Six scenarios were developed. These and seven other alternatives were debated and critiqued by the workshop attendees. By the conclusion of the workshop the group agreed on five scenarios as most appropriate for further evaluation.

In August 2009, Opus International Consultants together with Athfields, Wraight & Associates, Ian Bowman and Brewer Davison¹ were commissioned to develop a scheme assessment report for the Basin Reserve Improvement Project. NZTA have asked us to assess these five options in detail and develop them further as appropriate.

This team prepared a Scoping Report² and Transportation Technical Note³ in December 2009. Since then, the team has reviewed the five options developed as part of the Inquiry-by-Design workshop. The option development process has resulted in six options which are the subject of this report.

This option development has happened through the following three stages. A diagrammatic representation of this option development is included in *Figure 2.1*.

Issues, Opportunities and Constraints Assessment

All specialists were asked to undertake an assessment of the existing situation, to set a project baseline, and then assess the five Inquiry-By-Design scenarios as to whether they were fatally flawed or should be considered further. The results of the existing situation assessments are summarised in the Scoping Report.

The assessment of the Inquiry-By-Design options resulted in the following concerns being identified:

- Option 1C required the former Home of Compassion Crèche to be relocated a distance of 20-30m. The architectural heritage assessment identified that the former Crèche has considerable known heritage values and its demolition or relocation would be fatal to the project. This assessment was considered by the project teams in a Design Surgery Workshop (see later) and it was agreed that this option should be retained on the basis that adjustments to the alignment may make it possible for the Crèche to be retained in present locations or the dis-benefits of relocating the Crèche may outweigh the benefits of Option A.
- Option 9A was assessed as not meeting the transportation objectives of the project. Initial modelling showed that Option 9A resulted in negative benefits, meaning transportation operation was worse as a result of the project than doing nothing. It was then modified and developed to provide overall positive transportation benefits to enable it to be taken further.
- Option 9B was assessed as not meeting the transportation objectives of the project. As further modification of this option was not possible to achieve positive transportation benefits, the option was not considered further.

Following this assessment, options 1C, 2A, 8 and 9A were identified as appropriate to progress to the next stage.

Option Development / Design Surgery Workshops

The design team then considered the options against their site assessments and looked for opportunities to improve, mitigate and enhance the proposals. This process included generating two new options which expanded the total number of options out to six and the number of variants out to twenty. These options are presented in more detail in the following pages.

Design Surgery Workshops were used by the project team to challenge the options and narrow down those that would be developed further. These workshops included specialists from the design team and representatives from the project partners: NZTA, WCC, GWRC, and MCH.

Through specialist assessments and workshops these options were then narrowed down to six feasible options, A-F.

Cost and Benefit Assessment

The cost of six project options were then estimated and the potential transportation benefits assessed. This enabled a preliminary Benefit Cost Ratio (BCR) to be calculated to indicate whether the options were likely to provide sufficient benefits to make the project viable.

The estimated cost includes all items required to build each Option⁴. The estimated cost includes net land costs required to build the project (including land already owned by NZTA). The project cost estimates exclude escalation and GST. The estimates have a base date of November 2009. Estimated costs are provided as a range to reflect the level of uncertainty associated with a project at this stage. More details on the cost estimate are included in *Appendix B*.

The indicative economic benefits are based on travel time savings and vehicle operation costs obtained from outputs from the Wellington City SATURN model. They do not include benefits from a faster and more reliable passenger transport service or reduced delays for pedestrians, which are considered to be sufficiently small, when converted to monetary values, to be neglected at this stage of the project. Further assessment of these benefits will be undertaken as the project progresses. More details on the cost-benefit assessment are included in *Appendix C*.

A BCR greater than 1 indicates that the project is likely to have sufficient benefits to provide a return on the construction investment. As this assessment is at a fairly preliminary stage it is likely that these BCR figures underestimate the BCR values that would be achieved when more details are known (at the scheme assessment phase).

Option F was the only option that did not provide a BCR greater than 1. This was due to the significant costs associated with constructing a tunnel through poor ground conditions and the fact that it does not offer any additional transportation benefits when compared to other grade separated options, such as Option A and B.

Figure 2.1 illustrates the evolutionary process as to how the team developed the six feasible options presented in this report from the five options published in the inquiry by design workshop report⁵. Further details about the design development process is summarised in *Appendix A*.

Before going on to describe each of the six options and summarise their key features, we will discuss characteristics that are common to all six options.

⁰¹ With assistance from Arups, Fulton Hogan, Urban Perspectives, David Langdon, Endpoint Ltd, Tim Kelly Transport Planning.

⁰² Opus International Consultants, Basin Reserve Transportation Improvements Scoping Report, for NZ Transport Agency, March 2010.

⁰³ Opus International Consultants, Basin Reserve Transportation Improvements Transportation Technical Note, for NZ Transport Agency, December 2009.

⁰⁴ In accordance with NZTA SM014.

⁰⁵ Urbanisplus, Inquiry by Design Workshop, prepared for NZTA, November 2008.

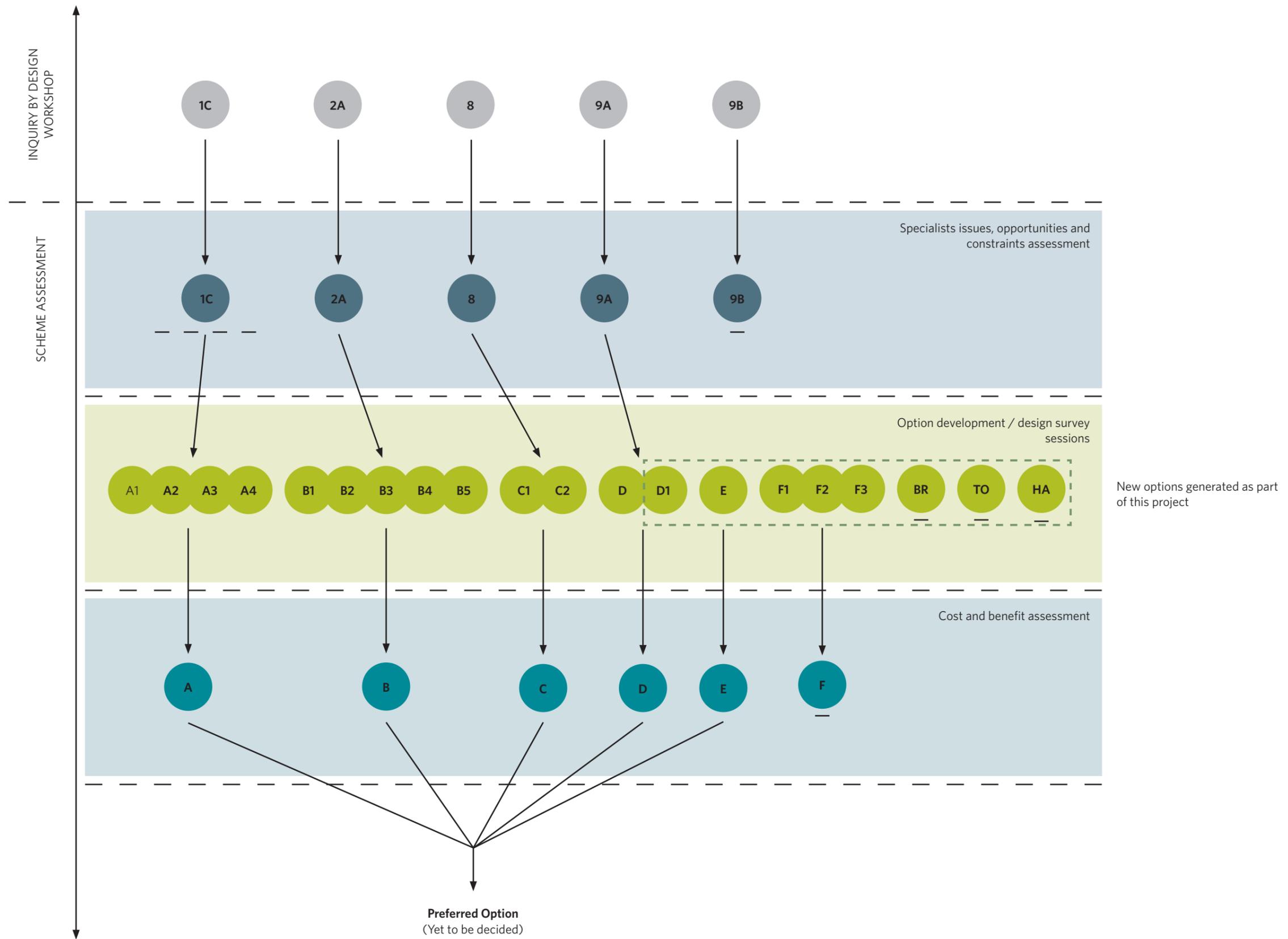


Figure 2.1: Option Development Process

2.2 Possible connection to tunnel in front of the War Memorial

The Ministry for Culture and Heritage is considering the idea of locating the westbound lanes of SH1 in a tunnel in front of the War Memorial, as shown in *Figure 2.2* and *Figure 2.3*. We have been asked by the Agency to determine the feasibility of each option to connect with this tunnel, should a decision be made to locate SH1 in a tunnel rather than along the existing route along Buckle Street. It is feasible to connect all five options to a tunnel in front of the War Memorial. The sixth (tunnel) option is only feasible if it also passes within a tunnel in front of the War Memorial.



Figure 2.2: Possible location of tunnel in front of the War Memorial



Figure 2.3: A SH1 westbound variant within a tunnel in front of the War Memorial

2.3 Land between Cambridge Terrace and Tory Street

The existing vacant lot / car yard on Buckle Street, between Tory and Cambridge Terrace is a site that has potential for development to add to rich quality of the city (refer *Figure 2.4*). It could be used as a building site, thus strengthening the Kent / Cambridge Terrace corridor and its role as a grand urban avenue in Wellington. If this was the case buildings would adapt and incorporate the Former Home of compassion building that currently stands on the site.

Alternatively it could be incorporated as part of Memorial Park. This proposal would link the green spaces of the Carillon with the proposed park opposite, and the Basin. It would present a greener termination to Kent / Cambridge Terrace. All the options presented in this report have been developed with a view to incorporate either of these ideas.



Figure 2.4: Vacant land between Cambridge Terrace and Tory Street

2.4 Walking and Cycling

Six typical journeys around the Basin Reserve have been identified as listed below and shown in *Figure 2.5*.

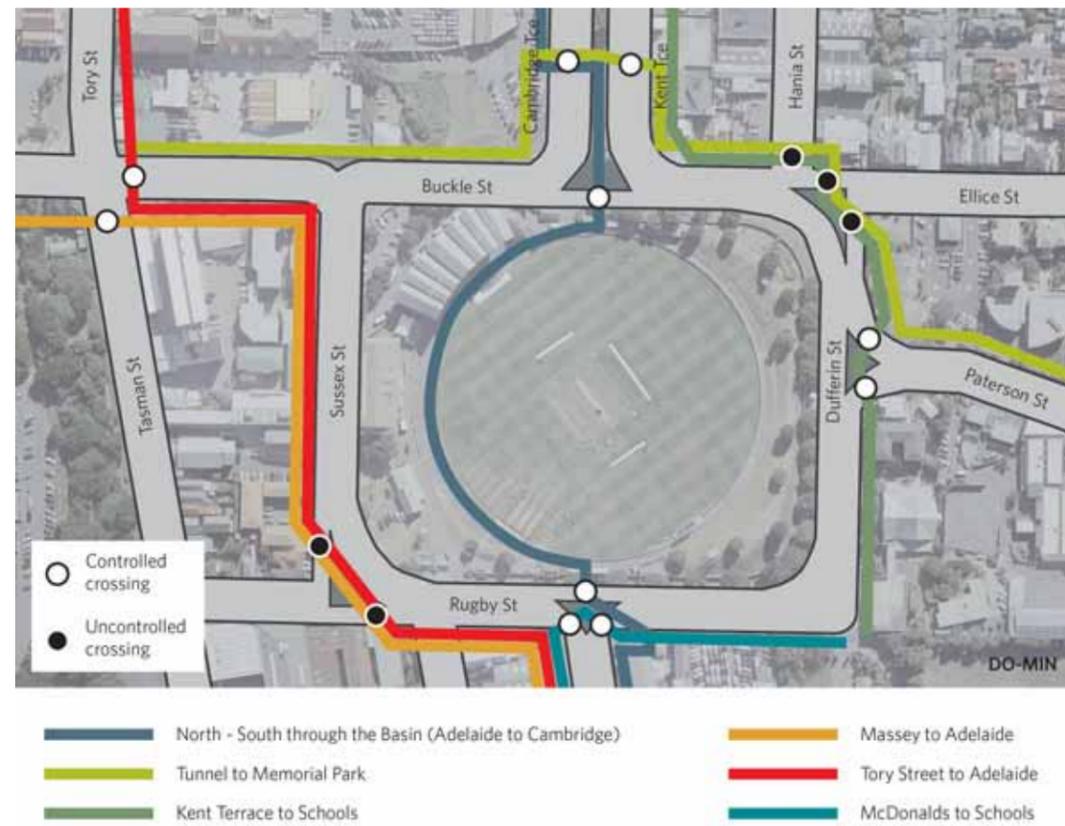


Figure 2.5: Six typical walking and cycling routes around the Basin Reserve in the existing situation

These typical routes have been assessed for the existing situation, refer *Table 2.1*, and each of the options has been compared against the existing situation in the following sections.

Table 2.1: Assessment of existing situation walking and cycling routes

	Crossing type	Controlled crossings	Uncontrolled crossings	Traffic lanes to cross
1	North - South through the Basin	4	0	8
2	Tunnel to Memorial Park	2	3	10
3	Kent Terrace to Schools	2	3	9
4	Massey to Adelaide	1	2	4
5	Tory Street to Adelaide	1	2	4
6	McDonalds to Schools	2	0	4
	Total	12	10	39

2.5 Shared Characteristics for All Options

Alignment

The key feature of all five options is to provide a more direct route for westbound SH1 traffic from the Mount Victoria Tunnel to the Wellington Inner City Bypass. In most other respects, the Basin Reserve Gyratory remains unchanged and will be used for local traffic. This results in a reduction in traffic flows on the western, eastern and southern sides of the Basin Reserve - improving amenity, pedestrian movement and safety within these areas.

Connections

All key existing connections are retained, such as:

- Vehicles from Kent Terrace will still be able to travel around the eastern side of the Basin Reserve to Adelaide Road;
- Vehicles from Adelaide Road will still be able to travel around the western side of the Basin Reserve to Cambridge Terrace;
- Vehicles from the Mount Victoria Tunnel will still be able to use the Basin Reserve to reach Adelaide Road, Rugby Street, Sussex Street and Buckle Street;
- Vehicles from Adelaide Road will still be able to use the Basin Reserve to reach Buckle Street and the Inner City Bypass; and
- Some - but not all existing - vehicle connections will remain between the eastbound lanes of SH1 and Ellice Street and Hania Street. All options prevent vehicles from Ellice Street and Hania Street connecting with Adelaide Road and Rugby Street.

Design Speed

All Options have been designed for a speed limit of 50km / h for both State Highway and local road traffic.

Lanes

The following provision of lanes is common to all five options:

- Two lanes in each direction retained for SH1;
- Two lanes for general traffic and one bus lane on southern and western sides of Basin Reserve; and
- One lane for general traffic on Rugby Street where it passes Adelaide Road

Signals

- Signalised pedestrian crossings across Kent Terrace and Cambridge Terrace are retained.
- Signalised pedestrian crossing across Rugby Street and Adelaide Road is retained. This intersection is made significantly more efficient due to the reduction in circulating traffic around the Basin Reserve. This provides an opportunity to reduce the wait for pedestrians to cross.
- Bus priority signal from Adelaide Road onto Rugby Street is proposed.
- Signalised intersection at Paterson Street and Dufferin Street retained for local traffic.

Active Modes

- Less traffic along Dufferin and Rugby Streets will create a more pleasant and safe pedestrian environment.
- North-south cyclists encouraged to cycle through, rather than around, the Basin Reserve.

Passenger Transport

- Dedicated bus lane in both directions around the Basin Reserve.
- A new 'super' bus stop on the southern side of Basin Reserve for school pupils and general public.
- A new school drop-off area for parents to drop off children, reducing the need for parents and their children to cross SH1.

Reconfiguration of Parking

- All parallel parking removed on the eastern side of Kent Terrace (between the Basin Reserve and Vivian Street).
- Parking on Rugby Street (east of Adelaide Road) will be removed and parking on Dufferin Street (south of Patterson Street) will be reconfigured as part of the new 'super' bus stop on the southern side of Basin Reserve for school pupils and general public.
- Some parallel parking will be reconfigured or removed on the western side of Kent Terrace (between the Basin Reserve and Vivian Street) depending on the location of bus stops.

Vivian Street Intersection

Investigations have found that significant benefits can be added to the project by improving the intersection between Vivian Street (SH1) and Kent / Cambridge Terrace and Pirie Street.

An option for improving the intersection is shown in *Figure 2.7*.



Figure 2.6: Shared Characteristics of each Option (Option A used as an example)



Figure 2.7: Option for Improving Vivian Street Intersection

Vivian Street Intersection Key Features

- Ban right turns into and out of Pirie Street.
- Three right turns from Vivian Street (SH1) into Kent Terrace.
- Parking removed in various locations.
- Bus lanes in both directions on Kent and Cambridge Terrace.

In this option the bus stop has been moved from the Kent Terrace left hand kerbside to an island in the centre of the carriageway. Passengers will access the bus platform via the pedestrian crossing.

An alternative to this is keeping the bus lane in the left hand lane and using a bus pre-signal to get the buses into the third lane. This is likely to provide greater delays for buses.

Traffic that currently makes a right turn to or from Pirie Street would have to use Elizabeth Street or Majoribanks Street. The additional travel time for these motorists is offset by the increase efficiency of the Vivian Street intersection for all motorists.

3 Option A

3.1 Key Drivers

- Grade separate northbound arterial traffic from the passenger transport corridor by providing a finely expressed elevated roadway spanning Kent and Cambridge Terrace.
- Maintain Te Aro grid aligning the roadway parallel to the Street network and aligning clearly with Buckle Street.
- Respect the form of the Basin within the City aligning the road with existing buildings and reinforcing the edges of the square boundary around the Basin Reserve.

3.2 Description

Alignment

- Eastbound SH1 traffic turns left from Kent Terrace onto Ellice Street. Traffic travels along a new alignment east of Dufferin Street and onto Paterson Street and the Mount Victoria Tunnel. These movements are all at-grade.
- Westbound SH1 traffic travels on a grade-separated structure along the northern side of Ellice Street. Once exiting the Mount Victoria Tunnel traffic travels above Paterson Street, over Dufferin Street and Ellice Street to meet Buckle Street at its present alignment.

Signals for vehicles

- Retain signalised intersection at corner of Paterson Street and Dufferin Street.

Structures

- Elevated structure built from Buckle Street, across Ellice, Dufferin Street and Paterson Street along northern side of Basin Reserve. Bridge structure is approximately 400m long and 15m wide and 8m high.

Property

- Two properties may need to be acquired.
- Buildings on corner of Ellice Street and Kent Terrace need to be removed (presently owned by NZTA). This site will be re-developed creating an 'active' road edge under the bridge structure.
- Former Home of Compassion Crèche on Buckle Street needs to be relocated slightly to the north.

Active Modes

- New signalised pedestrian crossing installed across slip lane in front of main entrance to Basin Reserve.
- New signalised pedestrian crossing near corner of Paterson and Dufferin Streets is proposed.
- East and westbound cyclists using Mount Victoria Tunnel would use the proposed pedestrian crossings near Dufferin Street to access the local roads around the Basin Reserve.
- There is an opportunity to provide a path for pedestrians and cyclists on the elevated structure used by SH1 traffic.

3.3 Cost Estimate and BCR

- Option A is estimated to cost between \$75 million and \$100 million and has an indicative benefit cost ratio of between 1.1 to 1.2.



Figure 3.1: Aerial view of Option A

3.4 Option A Artist Sketches



Figure 3.2: Perspective view of Option A from the north west



Figure 3.3: Perspective view of Option A from the north east

3.5 Option A Urban Design Features

- Buckle Street can be located to minimise impact on width of proposed Memorial Park.
- Requires relocation of Former Home of Compassion Crèche building (registered Category II with Historic Places Trust).
- Potential for improved connection between proposed Memorial Park and Basin Reserve - under bridge.
- Allows proposed Memorial Park to extend to Cambridge Terrace.
- Option maintains and reinforces outer edge of the Basin area.
- Proximity of option to Basin Reserve may have an impact on the amenity of the Basin Reserve.
- Elevated structure has an impact on Kent Terrace view shaft.
- Clear alignment to Te Aro grid street pattern.
- Potential for sheltered route to schools below elevated structure on Dufferin Street.
- There is an opportunity to provide a path for pedestrians and cyclists on the elevated structure used by SH1 traffic.

The locations of the street views on the right side of the page are shown on *Figure 3.1*.



Figure 3.4: View from Kent Terrace (Existing Situation on the left, Option A on the right)



Figure 3.5: View from Buckle Street (Existing Situation on the left, Option A on the right)



Figure 3.6: View from the Basin Reserve (Existing Situation on the left, Option A on the right)



Figure 3.7: View from Dufferin Street (Existing Situation on the left, Option A on the right)



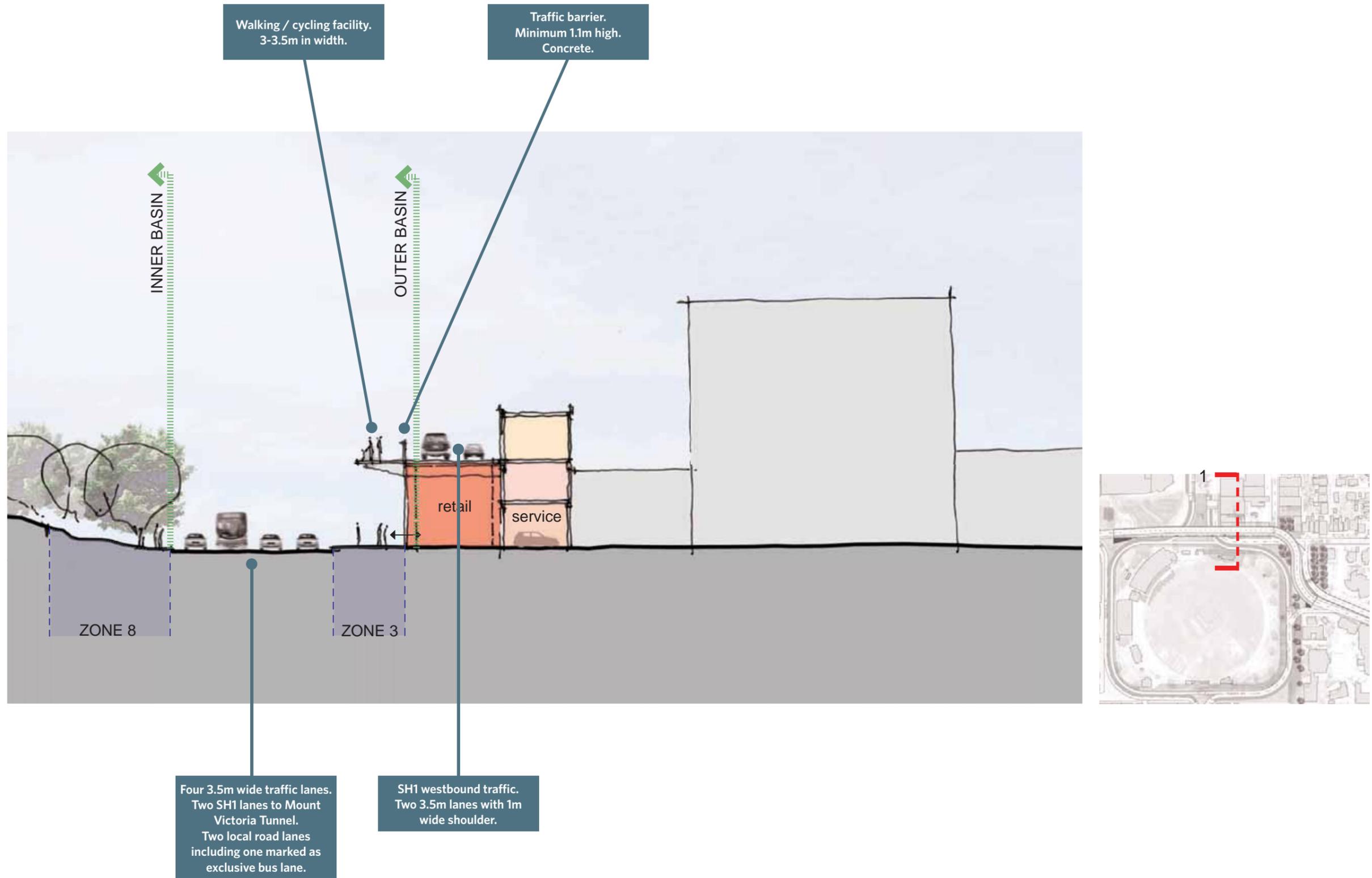


Figure 3.8: Option A Cross Section (Note: the sketches are preliminary concepts only and subject to change)

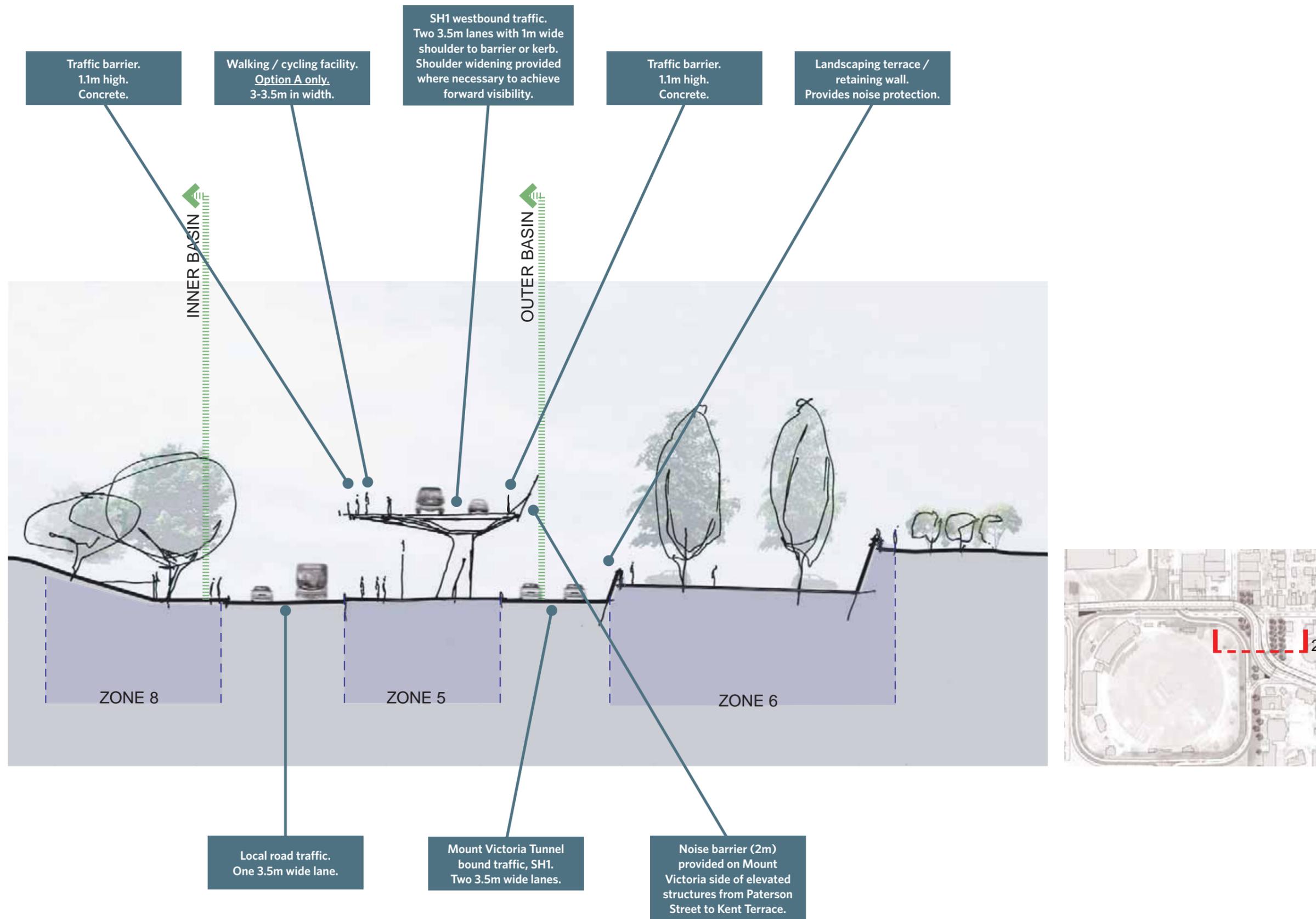


Figure 3.9: Option A Cross Section (Note: the sketches are preliminary concepts only and subject to change)

3.6 Built Form Integrated With Road Structure

At the corner of Ellice Street and Kent Terrace, one option is to construct a building under the elevated bridge structure (for Option A and Option B). This building either forming part of the structure or separate to it would offer several important benefits:

- Retain existing active edge on Susses Street replacing the existing building which would need to be demolished with the Option A Alignment.
- Allows space under the flyover to have active use rather than being left derelict as an unusable unattractive space.



Figure 3.10: Examples of built form integrated with road structures

3.7 Walking and Cycling Routes

Figure 3.11 shows the typical routes for six different journeys around the Basin Reserve. For a description of the six journeys and the routes for the do minimum scenario refer Section 2.4.

Table 3.1 below provides a quantitative record of the differences between Option A and the Do Minimum scenario.

Table 3.1: Walking and Cycling Crossing Comparison (Between the existing and Option A)

Crossing type	Controlled crossings		Uncontrolled crossings		Lanes to cross	
	Existing	Option A	Existing	Option A	Existing	Option A
1 North - South through the Basin	4	4	0	0	8	6
2 Tunnel to Memorial Park	2	1	3	0	10	2
3 Kent Terrace to Schools	2	2	3	3	9	8
4 Massey to Adelaide	1	1	2	2	4	4
5 Tory Street to Adelaide	1	1	2	2	4	3
6 McDonalds to Schools	2	2	0	0	4	4
Total	12	11	10	7	39	27

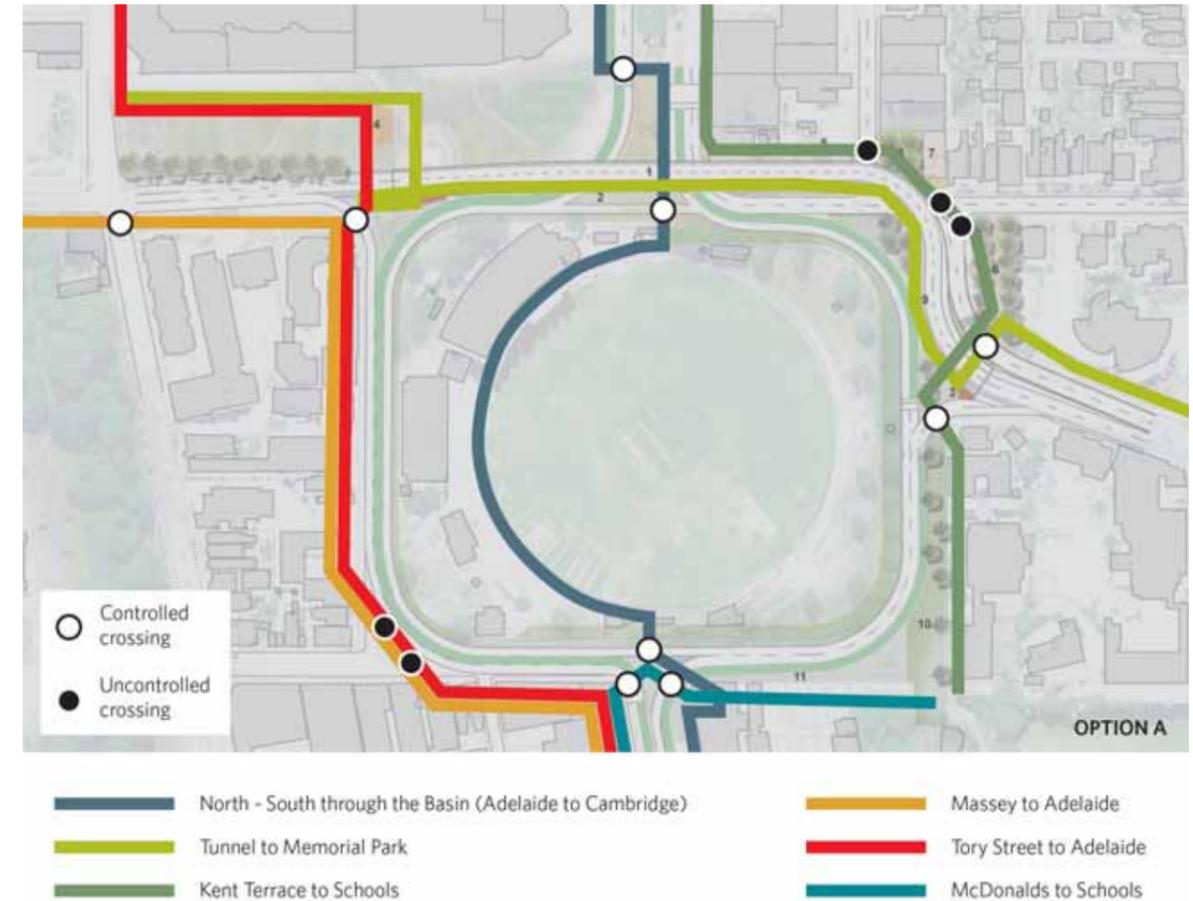


Figure 3.11: Walking and Cycling Routes for Option A

3.8 Transportation Benefits

Objectives

SH1 travel time reductions (westbound) (all peaks)	✓
SH1 travel time reductions (eastbound) (all peaks)	✗
Bus travel time reductions (both directions) (all peaks)	✓
Local road travel time reductions (both directions) (all peaks)	✓
All traffic and PT objectives achieved	✗

Travel Times

- Reduction in overall travel time for westbound SH1 traffic between Evans Bay and Willis Street of up to 35%.
- Little change in travel time for eastbound SH1 traffic between Kent Terrace and Mount Victoria Tunnel.
- Increased efficiency at Adelaide Road and Rugby Street intersection.
- Reduction in journey time between Adelaide Road and Kent Terrace and Cambridge Terrace for buses and general traffic.
- Access to the main entrance to the Basin Reserve is retained with pedestrians sharing the road space with the few vehicles using the slip lane.

Traffic Volumes

Figure 3.12 below shows the change in forecast traffic volumes around the Basin Reserve for Option A in 2016 (from the 2016 Wellington Saturn model).

The black text indicates the forecast traffic flow for the do-minimum scenario in 2016. The green text indicates the forecast traffic flows under the option scenario in 2016.

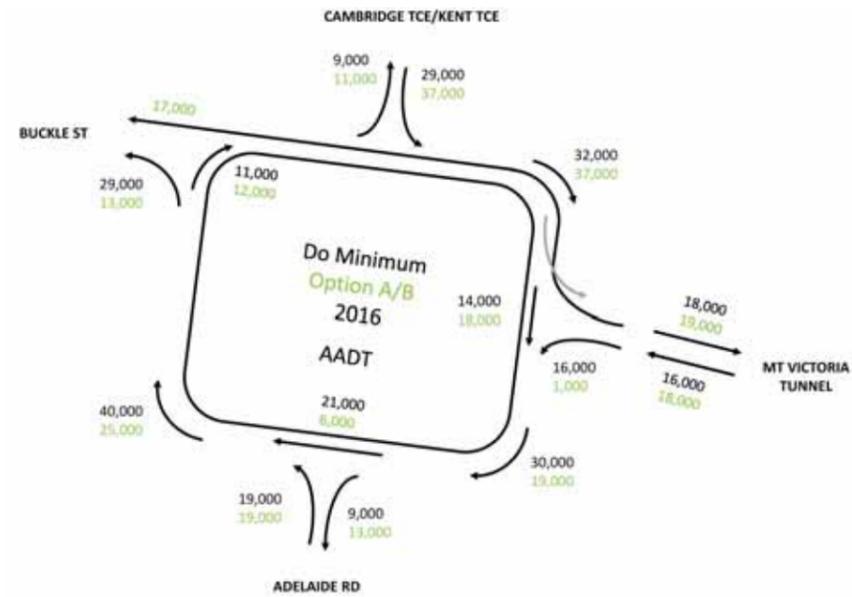


Figure 3.12: Traffic Volumes around the Basin Reserve in Option A

Figure 3.12 above shows the following:

- Significant reduction in traffic volumes around the southern side of the Basin Reserve in the option.
- Increased traffic on Adelaide Road in the option.
- Increased traffic through Mount Victoria tunnel in the option
- Significant volumes on new link westbound north of the Basin in the option.

4 Option B

4.1 Key Drivers

- Grade separate northbound arterial traffic from the passenger transport corridor by providing a finely expressed elevated roadway spanning Kent and Cambridge Terrace.
- Respect the form of the Basin within the City by pulling the bridging element away from its edge.
- Reduce the impact of the elevated structure by embedding it within the block and crossing perpendicular to adjacent streets.

4.2 Description

Alignment

- Eastbound SH1 traffic turns left from Kent Terrace onto Ellice Street. Traffic travels along new alignment east of Dufferin Street and onto Paterson Street and the Mount Victoria Tunnel. Movements are all at-grade.
- Westbound SH1 traffic travels on grade-separated structure approximately 65m north of Ellice Street, immediately north of the Grandstand Apartments. Once exiting the Mount Victoria Tunnel, traffic travels over Dufferin Street and Ellice Street, then turns left and travels across Kent Terrace and Cambridge Terrace before veering left to meet up with Buckle Street at its present alignment.

Signals for vehicles

- Retain signalised intersection at corner of Dufferin Street and Paterson Street.

Structures

- Elevated structure built from Buckle Street, across Kent Terrace and Cambridge Terrace, Ellice Street, Dufferin Street and Paterson Street. Bridge is approximately 440m long, 12m wide, and 8m high.

Property

- Up to five properties may need to be acquired.

Active Modes

- New zebra crossing installed across slip lane in front of main entrance to Basin Reserve.
- East and westbound cyclists and pedestrians using Mount Victoria Tunnel would use the new signalised pedestrian crossing near corner of Ellice Street and Dufferin Street to access the local roads around the Basin Reserve.

4.3 Cost Estimate and BCR

- Option B is estimated to cost between \$90 million to \$120 million and has an indicative benefit cost ratio of between 0.9 and 1.0. Refer to *Appendix B and C* for the basis for these numbers.

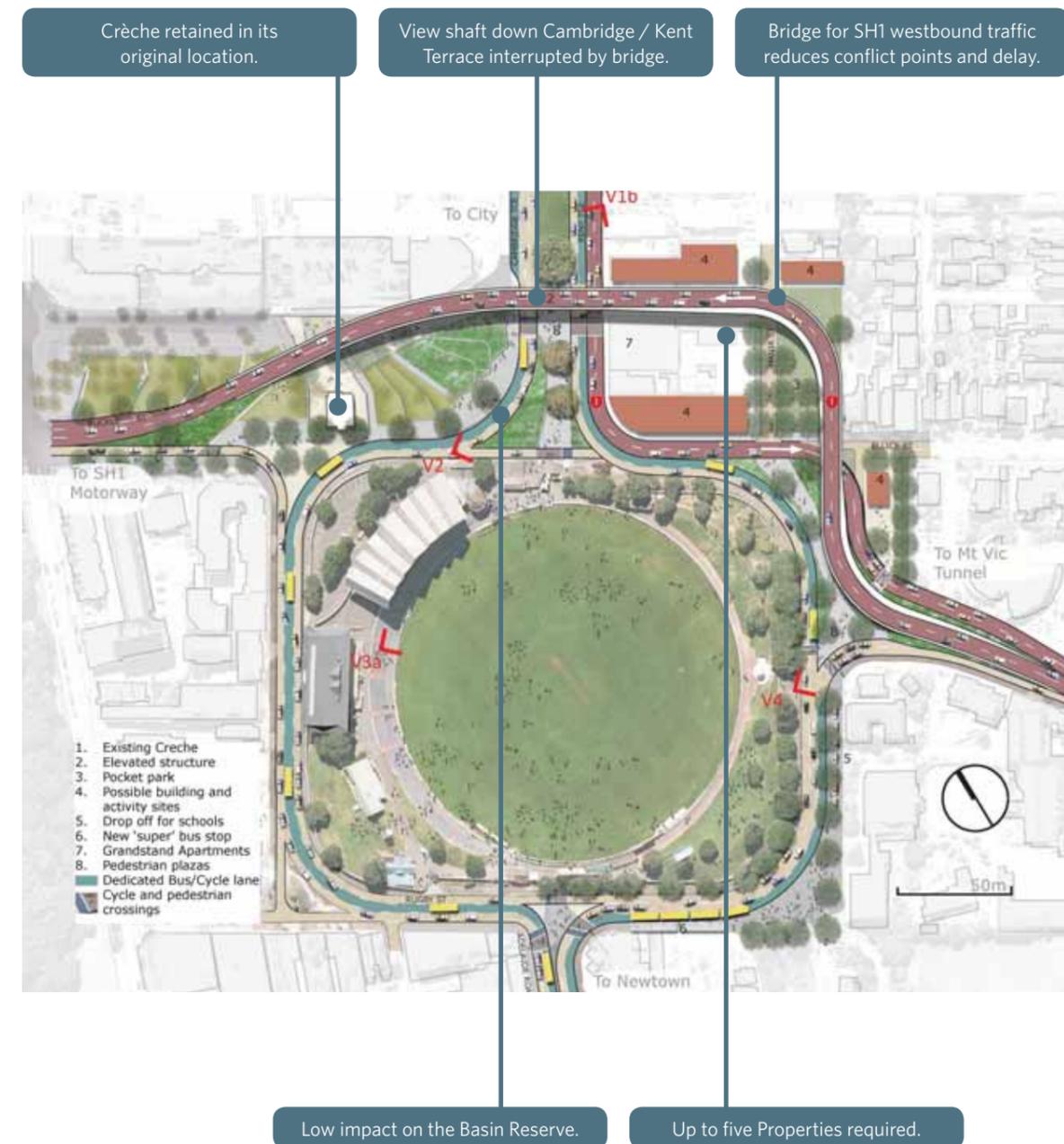


Figure 4.1: Aerial View of Option B

4.4 Option B Artist Sketches



Figure 4.2: Perspective view of Option B from the north west



Figure 4.3: Perspective view of Option B from the north east

4.5 Option B Urban Design Features

- Potential to provide some connection between the proposed Memorial Park and Basin Reserve under bridge.
- Proposed Memorial Park split by road alignment.
- Option pulls away from Basin Reserve to minimise impact on the amenity of the Basin Reserve.
- Elevated structure impacts on Kent Terrace view shaft. Effect may be mitigated by distance from Basin Reserve and by integrating the bridge into with new built edges on Kent Terrace and Cambridge Terrace.
- Retains existing buildings, and active edge, on the corner of Kent Terrace and Ellice Street.
- Impact properties on, and adjacent, to Hania Street.
- Option deviates from Te Aro grid pattern.
- Potential for sheltered route to schools under elevated structure on Dufferin Street.
- Access to the main entrance to the Basin Reserve is retained with pedestrians sharing the road space with the few vehicles using the slip lane.

The locations of the street views on the right side of the page are shown on *Figure 4.1*.



Figure 4.4: View from Kent Terrace (Existing Situation on the left, Option B on the right)



Figure 4.5: View from Buckle Street (Existing Situation on the left, Option B on the right)



Figure 4.6: View from the Basin Reserve (Existing Situation on the left, Option B on the right)



Figure 4.7: View from Dufferin Street (Existing Situation on the left, Option B on the right)



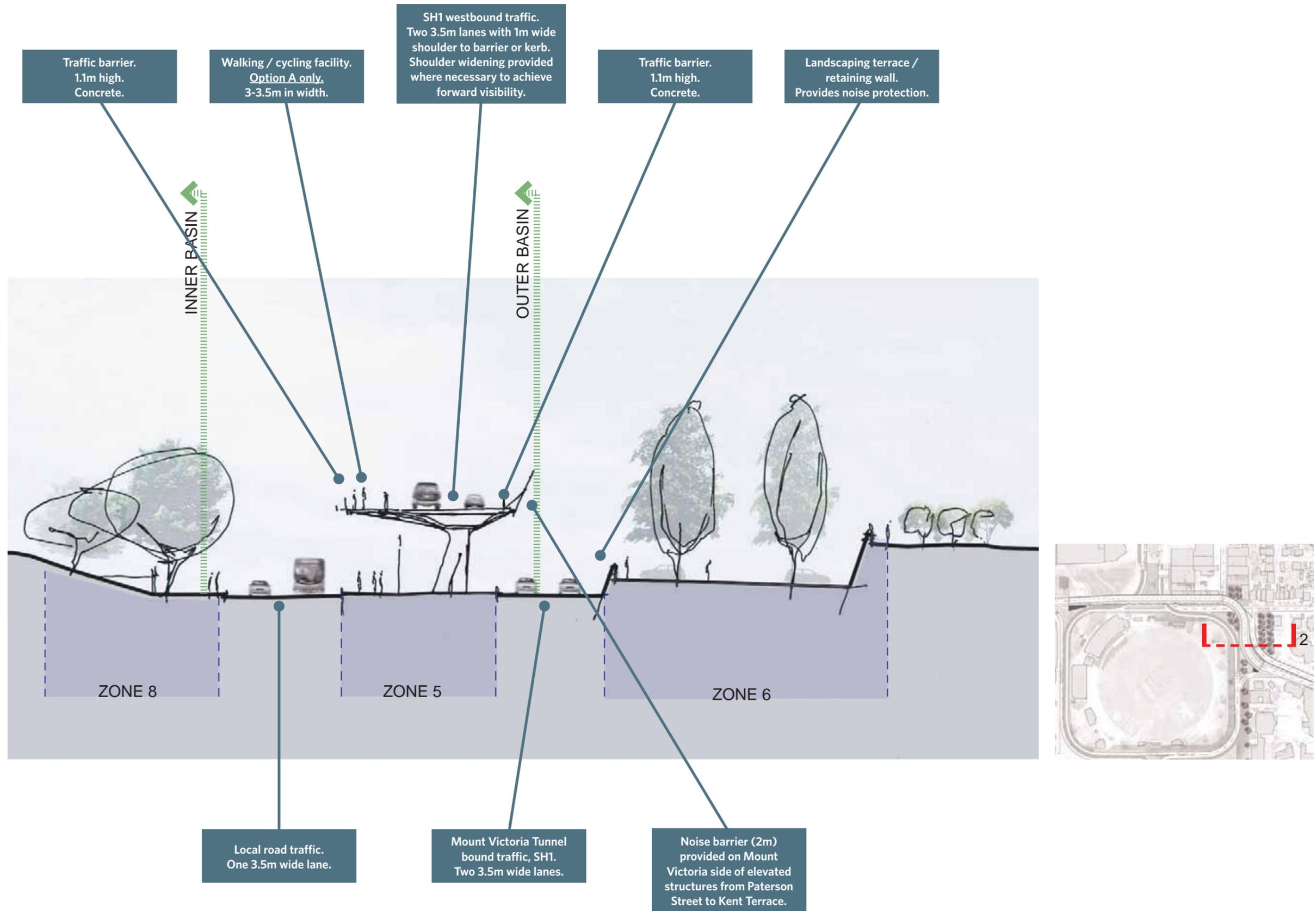


Figure 4.8: Option B Cross Section (Note: the sketches are preliminary concepts only and subject to change)

4.6 Walking and Cycling Routes

Figure 4.9 below shows the typical routes for six different journeys around the Basin Reserve. For a description of the six journeys and the routes for the do minimum scenario refer Section 2.4.

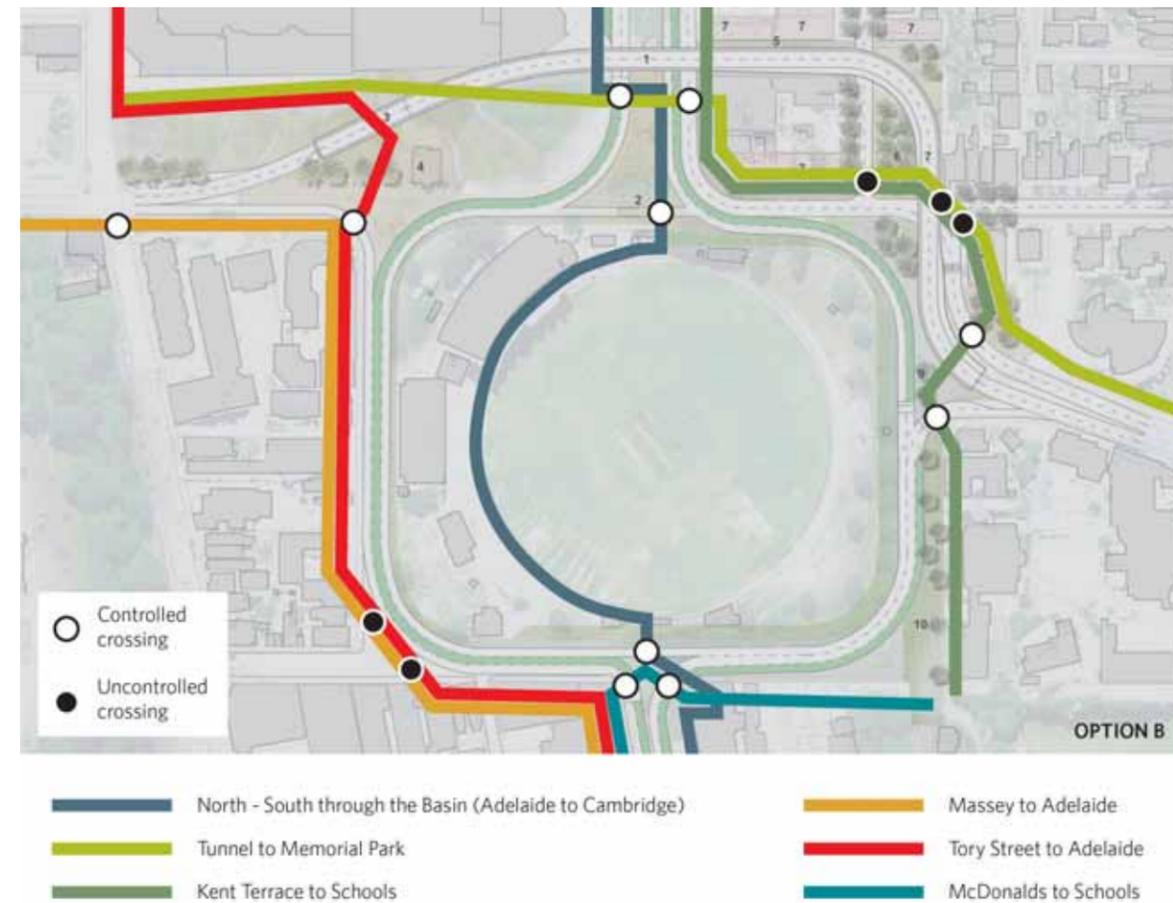


Figure 4.9: Walking and Cycling Routes for Option B

Table 4.1 below provides a quantitative record of the differences between Option B and the Do Minimum scenario.

Table 4.1: Walking and Cycling Crossing Comparison (Between the existing and Option B)

Comparison	Crossing type	Controlled crossings		Uncontrolled crossings		Lanes to cross	
		Existing	Option B	Existing	Option B	Existing	Option B
1	North - South through the Basin	4	4	0	0	8	6
2	Tunnel to Memorial Park	2	2	3	3	10	10
3	Kent Terrace to Schools	2	2	3	3	9	8
4	Massey to Adelaide	1	1	2	2	4	4
5	Tory Street to Adelaide	1	1	2	2	4	3
6	McDonalds to Schools	2	2	0	0	4	4
Total		12	12	10	10	39	35

4.7 Transportation Benefits

Objectives

SH1 travel time reductions (westbound) (all peaks)	✓
SH1 travel time reductions (eastbound) (all peaks)	✗
Bus travel time reductions (both directions) (all peaks)	✓
Local road travel time reductions (both directions) (all peaks)	✓
All traffic and PT objectives achieved	✗

Travel Times

- Reduction in overall travel time for westbound SH1 traffic from Evans Bay and Willis Street of up to 35% - similar to Option A.
- Little change in travel time for eastbound SH1 traffic between Kent Terrace and Mount Victoria Tunnel.
- Increased efficiency at Adelaide Road and Rugby Street intersection.
- Reduction in journey time between Adelaide Road and Kent Terrace and Cambridge Terrace for buses and general traffic.

Traffic Volumes

Figure 4.10 below shows the change in forecast traffic volumes around the Basin Reserve for Option B in 2016 (from the 2016 Wellington Saturn model).

The black text indicates the forecast traffic flow for the do-minimum scenario in 2016. The green text indicates the forecast traffic flows under the option scenario in 2016.

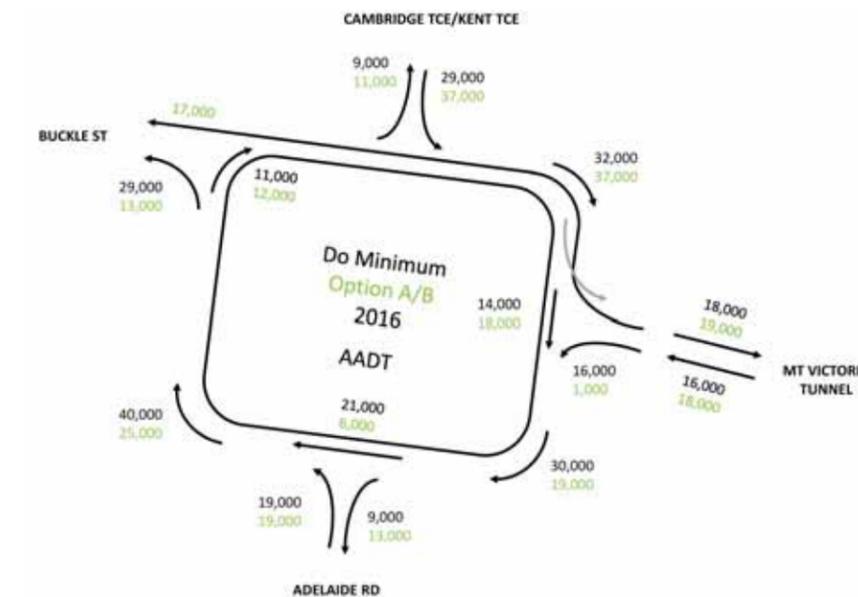


Figure 4.10: Traffic Volumes around the Basin Reserve in Option B

Figure 4.10 above shows the following:

- Significant reduction in traffic volumes around the southern side of the Basin Reserve in the option.
- Increased traffic on Adelaide Road in the option.
- Increased traffic through Mount Victoria tunnel in the option
- Significant volumes on new link westbound north of the Basin in the option.

5 Option C

5.1 Key Drivers

- Maintain all routes at-grade to remove impact of elevated structures.
- Push arterial north to reduce impact of additional lanes on the Basin Reserve.

5.2 Description

Alignment

- Eastbound SH1 traffic turns left from Kent Terrace approximately 50m north of Ellice Street, immediately north of the Grandstand Apartments. Traffic then turns right east of Hania Street and travels along the western edge of Dufferin Street and then onto Paterson Street towards the Mount Victoria Tunnel. Eastbound traffic for Option C is all at-grade.
- Westbound SH1 traffic exits the tunnel on Paterson Street and veers right to run alongside Dufferin Street, crosses Ellice Street then turns left across Hania Street, near the Grandstand Apartments. Westbound traffic for Option C is all at-grade.
- A new signalised at-grade intersection is formed with SH1 and Kent Terrace and Cambridge Terrace, 50m north of Ellice Street. No turning movements are allowed at this intersection. Vehicles wishing to make turning movements use the Basin Reserve Gyratory, as they do at present.

Signals for vehicles

- New signalised intersection created where SH1 intersects Kent and Cambridge Terrace.

Structures

- There are no elevated road structures in Option C. There may be the potential to provide a grade separated pedestrian connection under SH1 in Memorial Park.

Property

- Up to five properties may need to be acquired.

Active Modes

- Signalised pedestrian crossings at the new intersection of SH1 and Kent Terrace and Cambridge Terrace.
- New signalised pedestrian crossing across SH1 just to the north of Ellice Street.
- East and westbound cyclists using Mount Victoria Tunnel would use the proposed Ellice Street pedestrian crossings to access the local roads around the Basin Reserve.

5.3 Cost Estimate and BCR

- Option C is estimated to cost between \$50 million to \$70 million and has an indicative benefit cost ratio of between 1.2 and 1.4. Refer to *Appendix B and C* for the basis for these numbers.

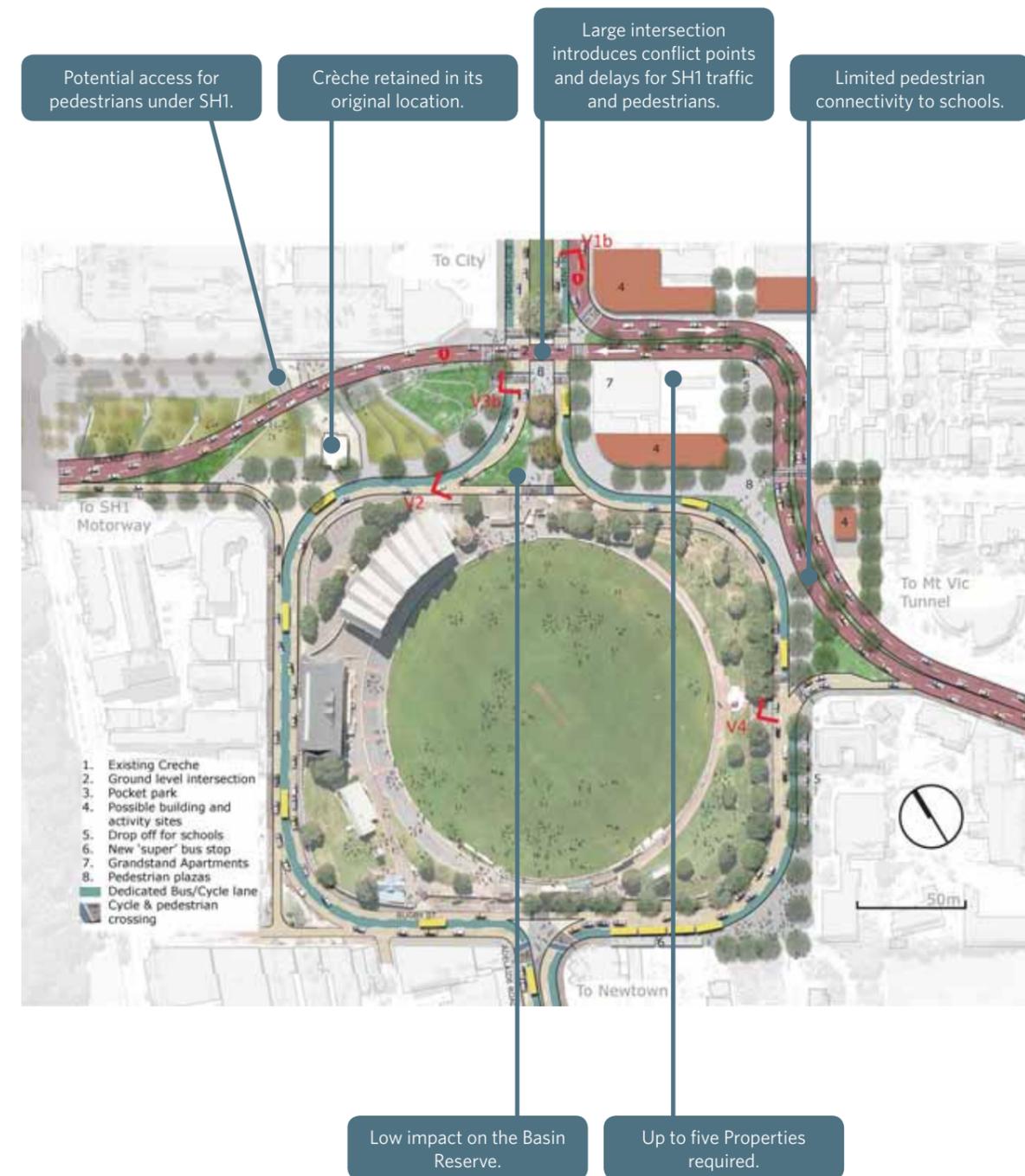


Figure 5.1: Aerial view of Option C

5.4 Option C Artist Sketches



Figure 5.2: Perspective view of Option C from the north west



Figure 5.3: Perspective view of Option C from the north east

5.5 Option C Urban Design Features

- Limited connection between proposed Memorial Park to Basin Reserve.
- Proposed Memorial Park split by road alignment.
- Option pulls away from Basin Reserve to minimise impact on the amenity of the Basin Reserve.
- At-grade connection maintains Kent Terrace and Cambridge Terrace view shaft of the Basin Reserve.
- Retains existing buildings and active edge on the corner of Kent Terrace and Ellice Street.
- Impact properties on, and adjacent to, Hania Street.
- Option deviates from Te Aro grid street pattern.
- Pedestrians travelling south on Dufferin Street do not need to cross SH1.
- Access to the main entrance to the Basin Reserve is retained with pedestrians sharing the road space with the few vehicles using the slip lane.

The locations of the street views on the right side of the page are shown on *Figure 5.1*.



Figure 5.4: View from Kent Terrace (Existing Situation on the left, Option C on the right)



Figure 5.5: View from Buckle Street (Existing Situation on the left, Option C on the right)



Figure 5.6: View along Cambridge Terrace (Existing Situation on the left, Option C on the right)



Figure 5.7: View from Dufferin Street (Existing Situation on the left, Option C on the right)

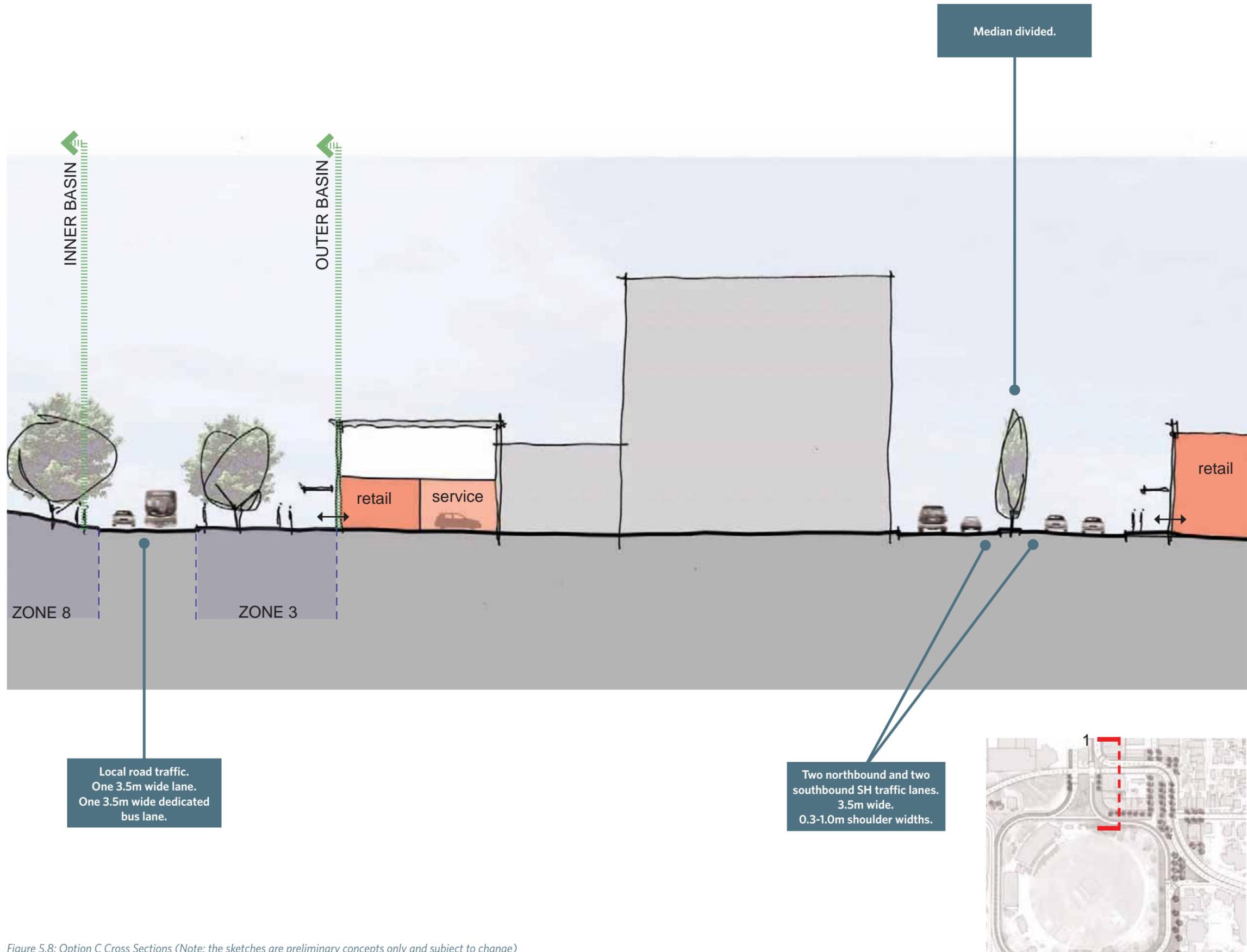


Figure 5.8: Option C Cross Sections (Note: the sketches are preliminary concepts only and subject to change)

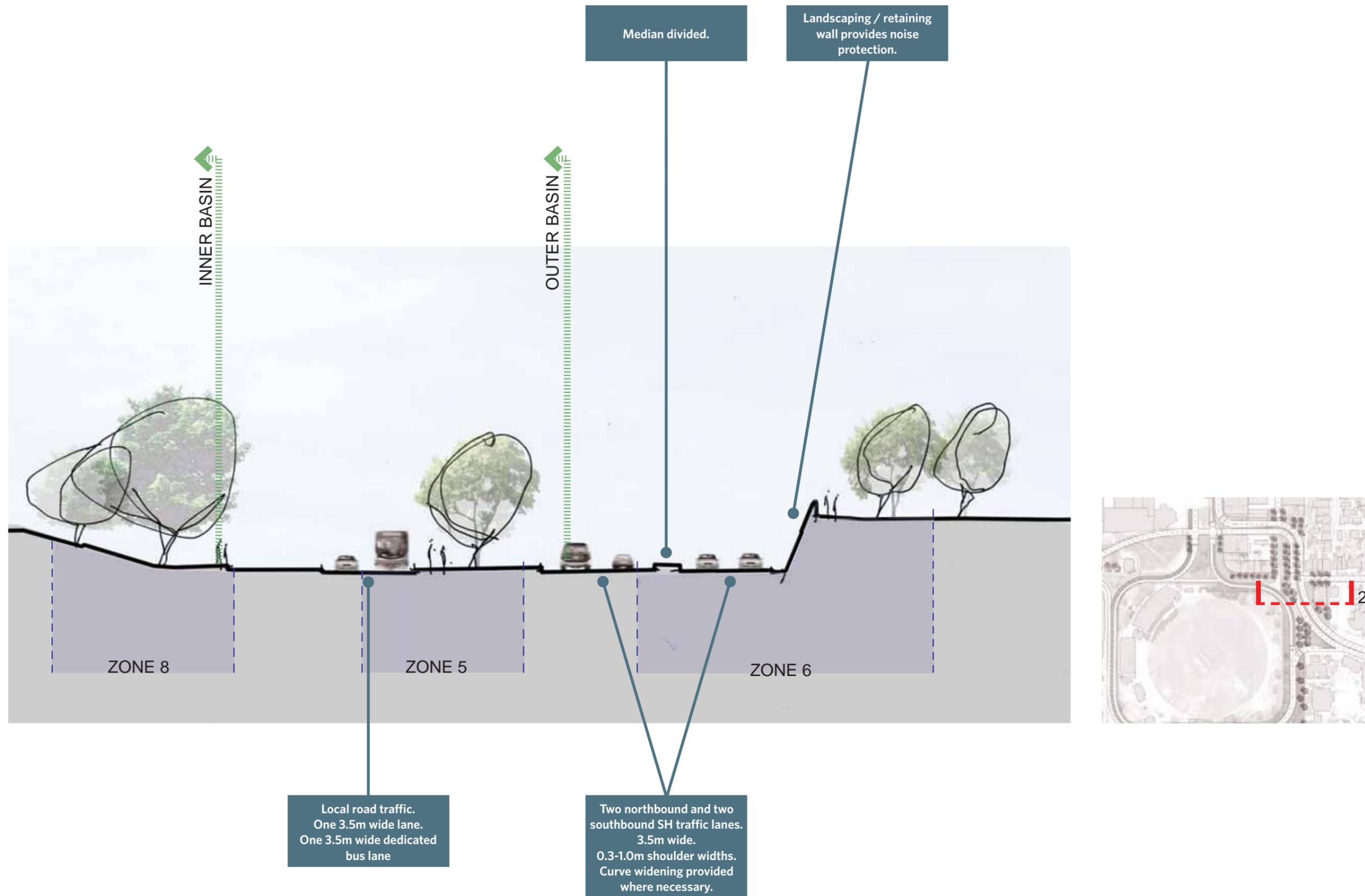


Figure 5.9: Option C Cross Sections (Note: the sketches are preliminary concepts only and subject to change)

5.6 Walking and Cycling Routes

Figure 5.10 below shows the typical routes for six different journeys around the Basin Reserve. For a description of the six journeys and the routes for the do minimum scenario refer Section 2.4.

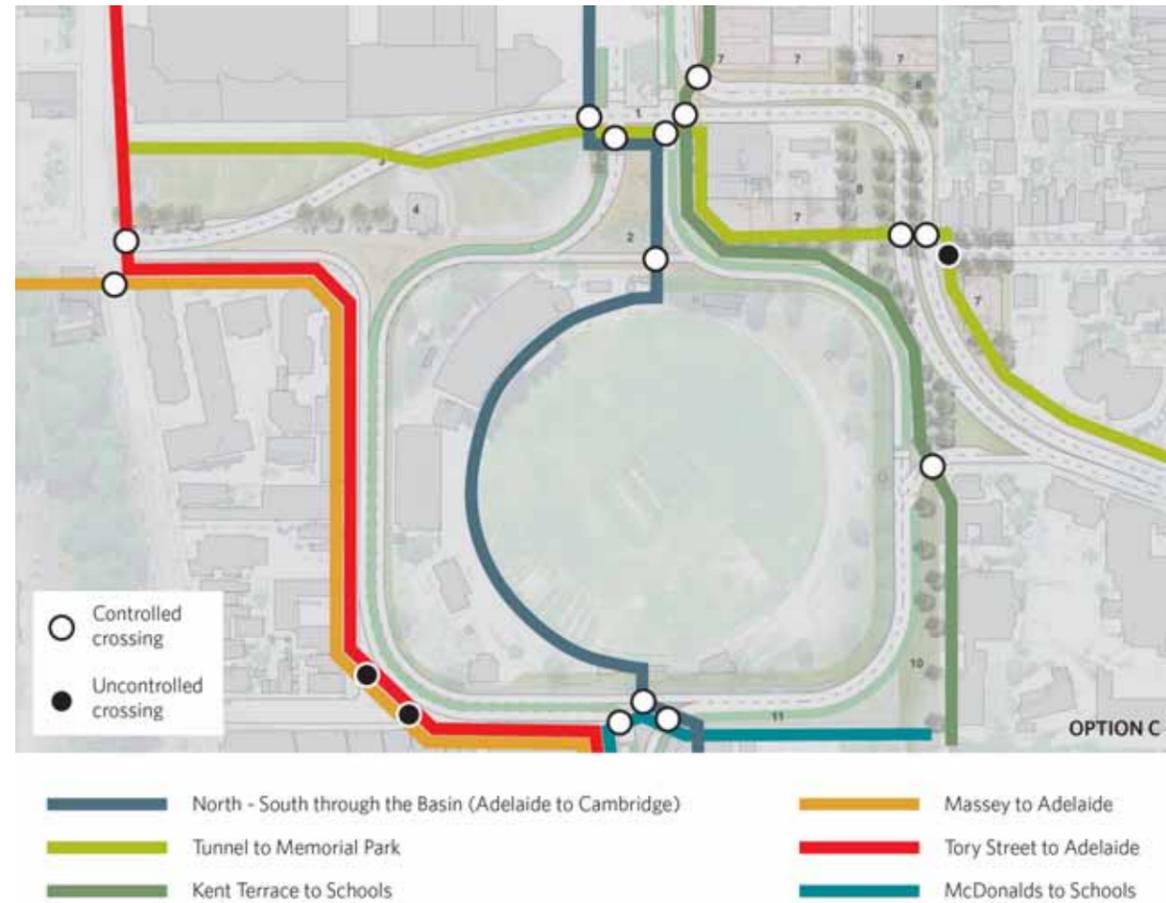


Figure 5.10: Walking and Cycling Routes for Option C

Table 5.1 below provides a quantitative record of the differences between Option C and the Do Minimum scenario.

Table 5.1: Walking and Cycling Crossing Comparison (Between the existing and Option C)

Crossing type	Controlled crossings		Uncontrolled crossings		Lanes to cross	
	Existing	Option C	Existing	Option C	Existing	Option C
1 North - South through the Basin	4	5	0	0	8	9
2 Tunnel to Memorial Park	2	4	3	1	10	11
3 Kent Terrace to Schools	2	3	3	0	9	6
4 Massey to Adelaide	1	1	2	2	4	4
5 Tory Street to Adelaide	1	1	2	2	4	6
6 McDonalds to Schools	2	2	0	0	4	4
Total	12	16	10	5	39	40

5.7 Transportation Benefits

Objectives

SH1 travel time reductions (westbound) (all peaks)	✓
SH1 travel time reductions (eastbound) (all peaks)	✗
Bus travel time reductions (both directions) (all peaks)	✓
Local road travel time reductions (both directions) (all peaks)	✓
All traffic and PT objectives achieved	✗

Travel Times

- Reduction in overall travel time westbound SH1 between Evans Bay and Willis Street of up to 30%, slightly less than Option A and B.
- Little change in travel time for eastbound SH1 traffic between Kent Terrace and the Mount Victoria Tunnel.
- Some reduction in journey time between Adelaide Road and Kent Terrace and Cambridge Terrace for both general traffic and buses, although the improvements are not as good as Options A and B.

Traffic Volumes

Figure 5.11 below shows the change in forecast traffic volumes around the Basin Reserve for Option C in 2016 (from the 2016 Wellington Saturn model).

The black text indicates the forecast traffic flow for the do-minimum scenario in 2016. The green text indicates the forecast traffic flows under the option scenario in 2016.

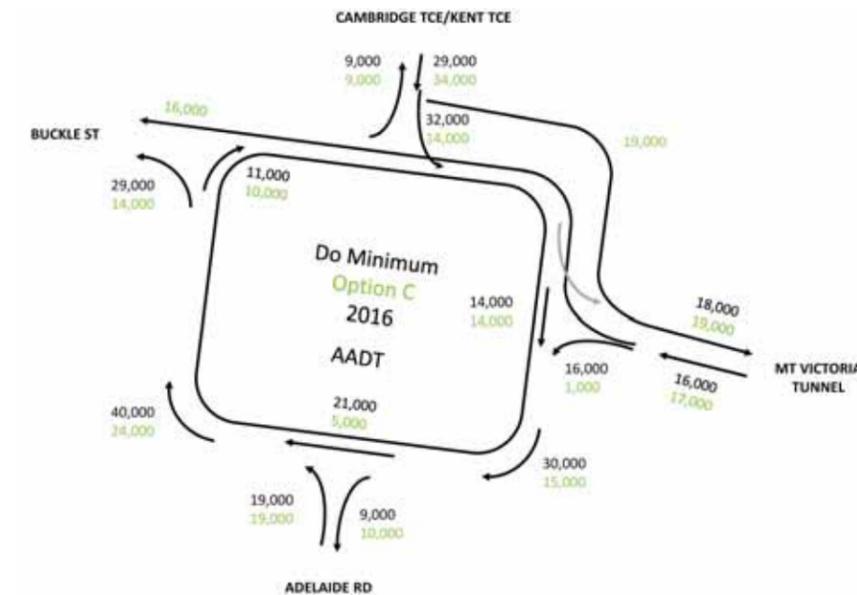


Figure 5.11: Traffic Volumes around the Basin Reserve in Option C

Figure 5.11 above shows the following:

- Significant reduction in traffic volumes around the southern side of the Basin Reserve in the option.
- Increased traffic on Adelaide Road in the option.
- Increased traffic through Mount Victoria tunnel in the option
- Significant volumes on new link westbound north of the Basin in the option.

6 Option D

6.1 Key Drivers

- Maintain all routes at-grade to remove impact of elevated structures.
- Keep east-west arterial close to the Basin to avoid impact on surrounding urban fabric.

6.2 Description

Alignment

- Eastbound SH1 traffic from Kent Terrace turns right onto Ellice Street and left onto Dufferin Street before entering Paterson Street and Mount Victoria Tunnel. Eastbound traffic for Option D is all at-grade.
- Westbound SH1 traffic exits the Mount Victoria Tunnel onto Paterson Street and then turns right onto Dufferin Street and left onto Buckle (immediate north of the Basin Reserve). Traffic can turn right onto Cambridge Terrace via a slip lane. Westbound traffic for Option D is all at-grade.
- Local traffic travelling south from Kent Terrace to Newtown would turn left at Kent Terrace onto Ellice Street (similar to SH1 traffic). A new intersection at the corner of Dufferin Street and Paterson Street will allow local southbound traffic to cross over SH1 to reach Adelaide Road.
- Northbound local traffic would use Sussex Street, to either turn left onto Buckle Street or join Cambridge Terrace. Traffic joining Cambridge Terrace would proceed through a new intersection between Sussex Street and Buckle Street. No turning movements would be allowed at this intersection. They would then travel 50m north of Buckle Street before veering right to join Cambridge Terrace.
- Traffic wanting to access Ellice Street or the Mount Victoria Tunnel from Adelaide Road would need to travel down Cambridge Terrace and perform a u-turn onto Kent Terrace.

Lanes

- Four lanes of traffic turn from Kent Terrace into Ellice Street - two lanes for SH1 eastbound, one lane of local traffic and one bus lane. On Dufferin Street this increases to five lanes with the addition of an extra local traffic lane.

Signals for vehicles

- A new signalised intersection is proposed at the intersection between Dufferin Street and Paterson Street for local traffic travelling from Kent Terrace to Adelaide Road to cross over westbound SH1 traffic.
- New signalised intersection at intersection of Sussex Street and Buckle Street.

Structures

- No elevated structures.

Property

- Two properties may need to be acquired.
- Buildings on corner of Ellice Street and Kent Terrace need to be removed (presently owned by NZTA).

Active Modes

- Crossings provided as part of new signalised intersections at Paterson Street and Dufferin Street. East and westbound cyclists using Mount Victoria Tunnel would use this pedestrian crossing to access the local roads around the Basin Reserve.
- Crossings provided as part of new signalised intersections at Sussex Street and Buckle Street.
- New signalised pedestrian crossing immediately north of Basin Reserve across Buckle Street.

6.3 Cost Estimate and BCR

- Option D is estimated to cost between \$40 million to \$50 million and has an indicative benefit cost ratio of between 1.4 and 1.6. Refer to *Appendix B and C* for the basis for these numbers.

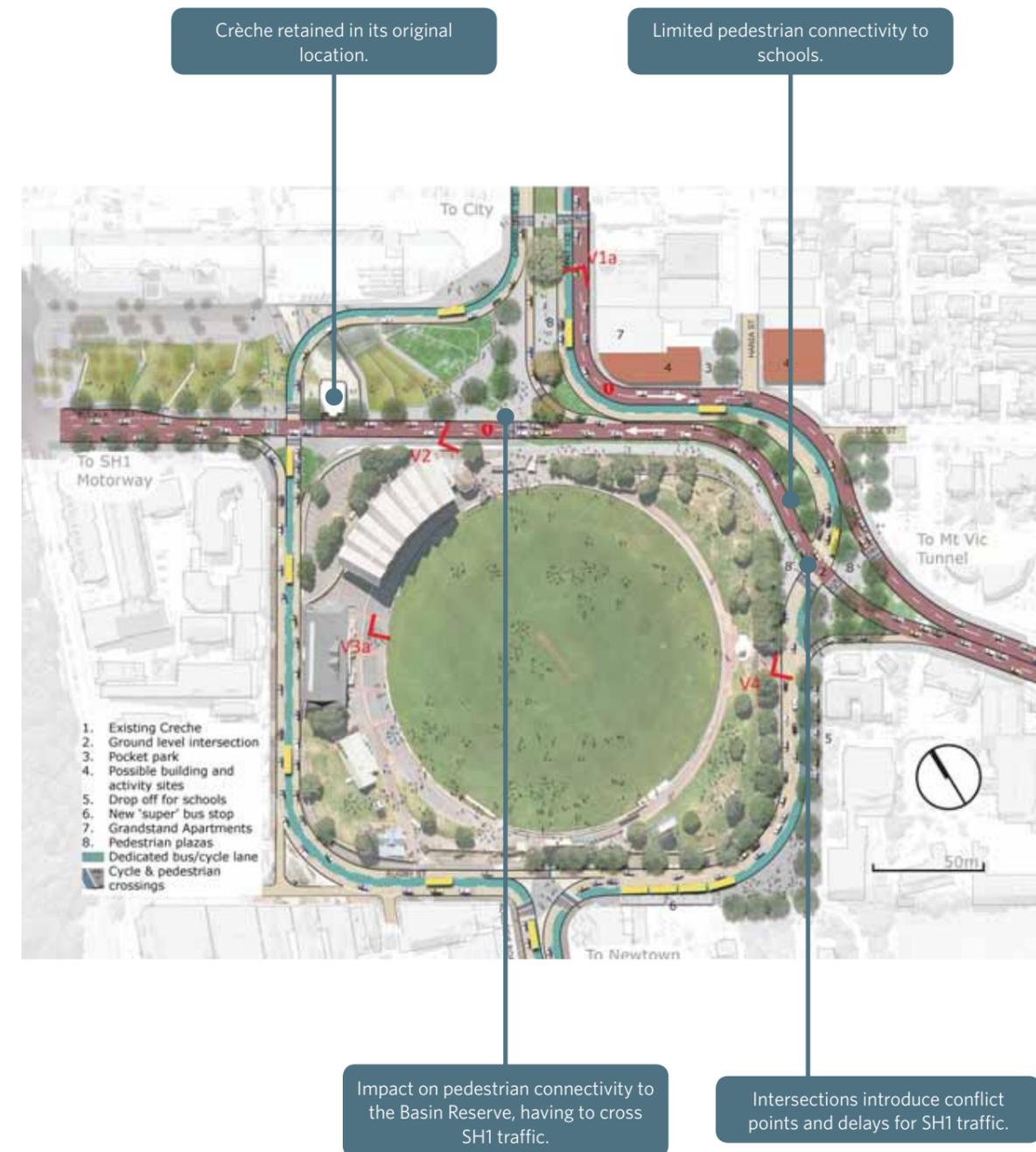


Figure 6.1: Aerial view of Option D

6.4 Option D Artist Sketches



Figure 6.2: Perspective view of Option D from the north west



Figure 6.3: Perspective view of Option D from the north east

6.5 Option D Urban Design Features

- Limits connection of proposed Memorial Park to Basin Reserve.
- Proposed Memorial Park split by road alignment.
- Option is at-grade which minimises impact on the amenity of the Basin Reserve.
- Requires the removal of existing buildings on the corner of Ellis Street and Kent Terrace. However there is the opportunity to re-create an active edge on the new corner of Kent Terrace and Ellice Street.
- Need to cross busy SH1 westbound lanes to gain access to Basin Reserve using the main entrance.
- At-grade connection maintains Kent Terrace and Cambridge Terrace view shaft of Basin Reserve.
- Multiple lanes of traffic limits the potential for high quality active frontage along Ellice Street.
- Pedestrians must cross six traffic lanes at controlled intersection on Dufferin Street.

The locations of the street views on the right side of the page are shown on *Figure 6.1*.



Figure 6.4: View from Kent Terrace (Existing Situation on the left, Option D on the right)



Figure 6.5: View from Buckle Street (Existing Situation on the left, Option D on the right)



Figure 6.6: View from Dufferin Street (Existing Situation on the left, Option D on the right)



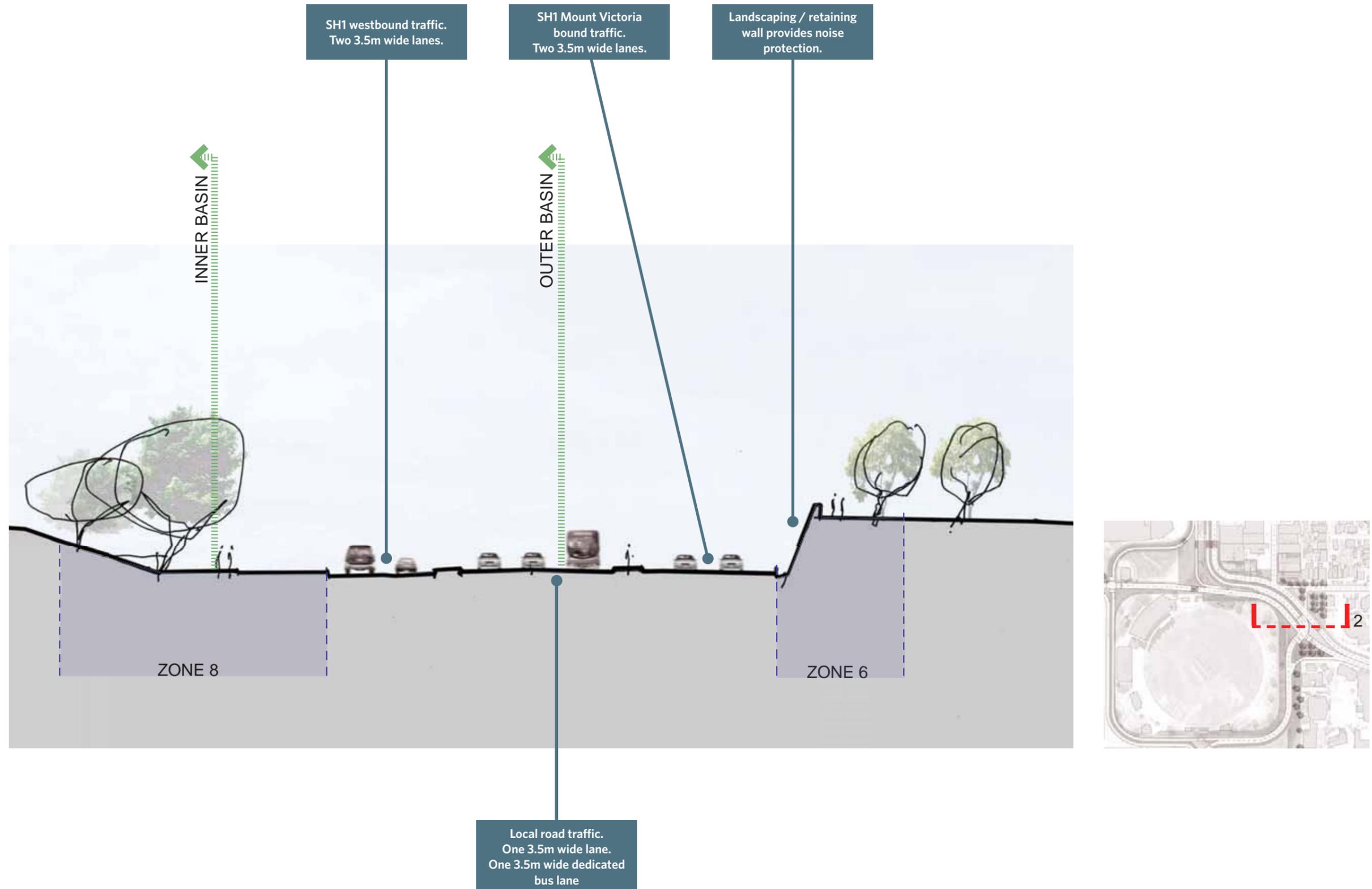


Figure 6.7: Option D Cross Sections (Note: the sketches are preliminary concepts only and subject to change)

6.6 Walking and Cycling Routes

Figure 6.8 below shows the typical routes for six different journeys around the Basin Reserve. For a description of the six journeys and the routes for the do minimum scenario refer Section 2.4.

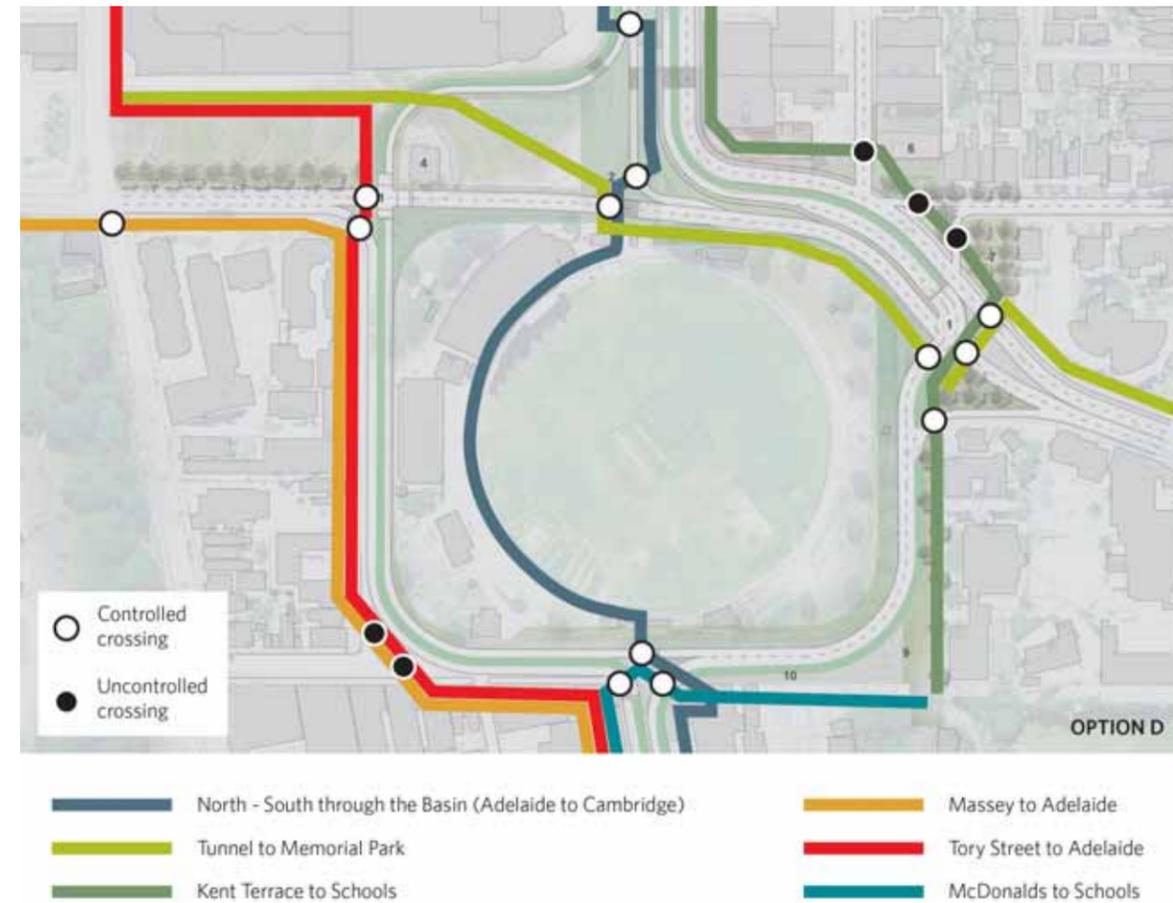


Figure 6.8: Walking and Cycling Routes for Option D

Table 6.1 below provides a quantitative record of the differences between Option D and the Do Minimum scenario.

Table 6.1: Walking and Cycling Crossing Comparison (Between the existing and Option D)

Comparison	Crossing type	Controlled crossings		Uncontrolled crossings		Lanes to cross	
		Existing	Option D	Existing	Option D	Existing	Option D
1	North - South through the Basin	4	5	0	0	8	9
2	Tunnel to Memorial Park	2	4	3	0	10	9
3	Kent Terrace to Schools	2	3	3	3	9	9
4	Massey to Adelaide	1	1	2	2	4	4
5	Tory Street to Adelaide	1	2	2	2	4	5
6	McDonalds to Schools	2	2	0	0	4	4
Total		12	17	10	7	39	40

6.7 Transportation Benefits

Objectives

SH1 travel time reductions (westbound) (all peaks)	✓
SH1 travel time reductions (eastbound) (all peaks)	✗
Bus travel time reductions (both directions) (all peaks)	✗
Local road travel time reductions (both directions) (all peaks)	✗
All traffic and PT objectives achieved	✗

Travel Times

- Reduction in overall travel time westbound SH1 between Evans Bay and Willis Street of about 25%.
- Travel time for eastbound SH1 traffic between Kent Terrace and the Mount Victoria Tunnel increases slightly in the PM peak.
- Travel time northbound between Adelaide Road and Cambridge Terrace is increased for both buses and general traffic due to the installation of signals on Sussex Street.
- Southbound travel time between Kent Terrace and Adelaide Road for general traffic increases. Travel time decreases for buses due to dedicated bus lanes.

Traffic Volumes

Figure 6.9 below shows the change in forecast traffic volumes around the Basin Reserve for Option D in 2016 (from the 2016 Wellington Saturn model).

The black text indicates the forecast traffic flow for the do-minimum scenario in 2016. The green text indicates the forecast traffic flows under the option scenario in 2016.

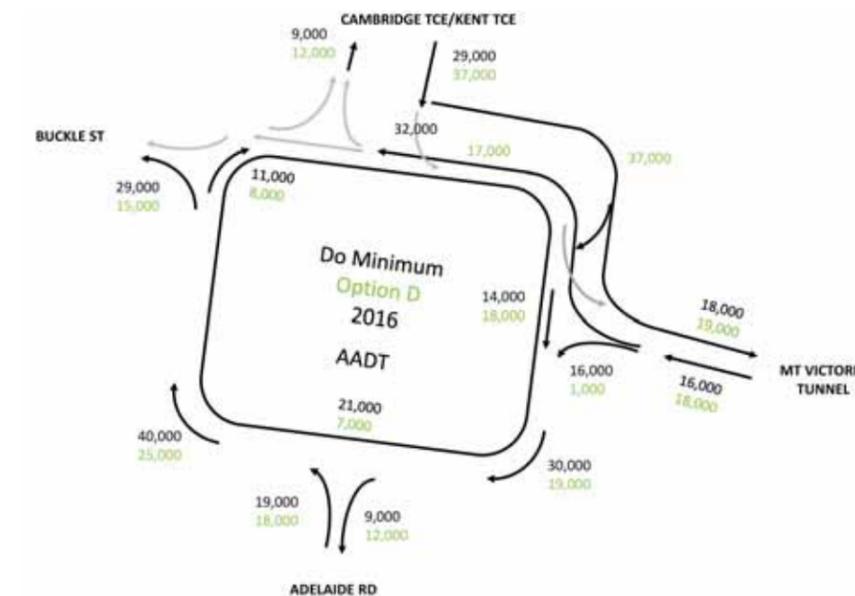


Figure 6.9: Traffic Volumes around the Basin Reserve in Option D

Figure 6.9 above shows the following:

- Significant reduction in traffic volumes around the southern side of the Basin Reserve in the option.
- Increased traffic on Adelaide Road in the option.
- Increased traffic through Mount Victoria tunnel in the option
- Significant volumes on new link westbound north of the Basin in the option.

7 Option E

7.1 Key Drivers

- Grade separate by lowering northbound arterial slightly and elevating the local route for north-south traffic and passenger transport.
- Lower Sussex Street to grade separate south-north local route from east-west arterial.
- Push ramp for local north-south traffic and passenger transport to reduce impact of additional lanes on the Basin Reserve.
- No elevated structures impede view shaft along Kent Terrace towards Basin Reserve.

7.2 Description

Alignment

- Eastbound SH1 traffic from Kent Terrace turns left onto Ellice Street and right onto Dufferin Street before veering left across Paterson Street into Mount Victoria Tunnel. A 120m portion of this road between Ellice Street and Paterson Street is located in a 2m deep trench to allow clearance below an elevated structure above carrying local traffic.
- Westbound SH1 traffic exits the Mount Victoria Tunnel onto Paterson Street and then turns right onto Dufferin Street and left onto Buckle Street passing north of the Basin Reserve. Traffic can turn right onto Cambridge Terrace via a slip lane. A 120m portion of the road between Ellice Street and Paterson Street is in a 2m deep trench to allow clearance below an elevated structure above carrying local traffic.
- Local traffic travelling south from Kent Terrace to Newtown would turn left at Kent Terrace north of Grandstand Apartments (50m north of Ellice Street). A new elevated structure rises up over Hania Street and turns south above Dufferin Street to rejoin street level prior to Street Mark's School on Dufferin Street.
- Northbound local traffic from Adelaide Road would proceed on Sussex Street, with the option to turn left onto Buckle Street or to join Cambridge Terrace. Vehicles travelling to Cambridge Terrace would go through a tunnel under Buckle Street (SH1) and travel 50m north under the proposed Memorial Park before veering right to join Cambridge Terrace.
- Traffic from Adelaide Road wanting to access Ellice Street or the Mount Victoria Tunnel needs to travel down Cambridge Terrace and do u-turn onto Kent Terrace.

Lanes

- Four lanes of SH1 traffic are provided within a trench from Ellice Street to Paterson Street, two in each direction.
- Two local southbound traffic lanes are provided on a bridge structure: one general traffic lane and one bus lane. This same configuration is used on Sussex Street and the northbound tunnel connection to Cambridge Terrace.

Structures

- A 230m long elevated structure constructed for local traffic and buses on eastern side of the Basin Reserve.
- A 60m long tunnel for local traffic on western side of Basin Reserve with an additional 190m of trenched sections.

Property

- Up to five properties may need to be acquired.

Active Modes

- New signalised crossing installed on the Paterson Street approach to the Mount Victoria Tunnel across SH1. This would allow east and westbound cyclists using Mount Victoria Tunnel to access the Basin Reserve.
- Signalised crossing on westbound lanes on SH1 in front of northern entrance to Basin Reserve.
- Pedestrian and cycling facilities provided on Dufferin Street bridge structure.
- Pedestrian facilities not provided in Sussex Street tunnel under Buckle Street and proposed Memorial Park.

7.3 Cost Estimate and BCR

- Option E is estimated to cost between \$100 million to \$130 million and has an indicative benefit cost ratio of between 0.8 and 0.9. Refer to *Appendix B and C* for the basis for these numbers.

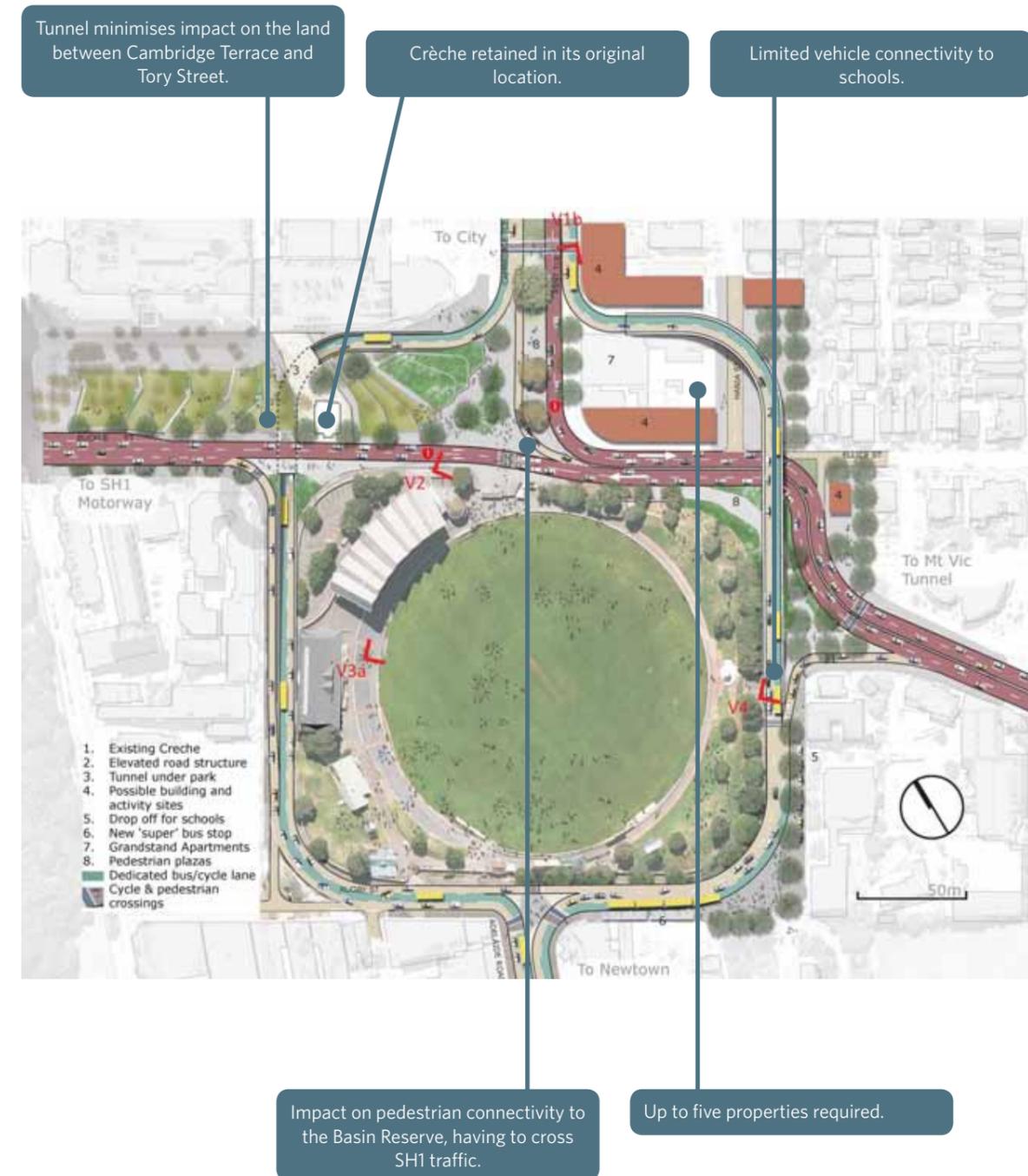


Figure 7.1: Aerial View of Option E

7.4 Option E Artist Sketches



Figure 7.2: Perspective view of Option E from the north west



Figure 7.3: Perspective view of Option E from the north east

7.5 Option E Urban Design Features

- Buckle Street can be located to minimise impact on width of proposed Memorial Park.
- Sussex realignment allows proposed Memorial Park to be extended uninterrupted to Cambridge Terrace.
- Option E places SH1 traffic at ground level to minimise impact on amenity of the Basin Reserve.
- Trenching of SH1 at north-east corner of Basin Reserve results in pedestrian obstacle between the Basin Reserve and Ellis Street and Dufferin Street.
- Locating westbound lanes of SH1 at-grade just north of the Basin Reserve limits connection between Basin Reserve and the proposed Memorial Park and to the main entrance to the Basin Reserve.
- Elevating Dufferin Street is not ideal for buses which are best retained at ground level.
- Impacts properties on, and adjacent to, Hania Street.
- Elevating Dufferin Street limits ability of local vehicles to access drop-off area in front of Street Mark's School.

The locations of the street views on the right side of the page are shown on [Figure 7.1](#).



Figure 7.4: View from Kent Terrace (Existing Situation on the left, Option E on the right)



Figure 7.5: View from Buckle Street (Existing Situation on the left, Option E on the right)

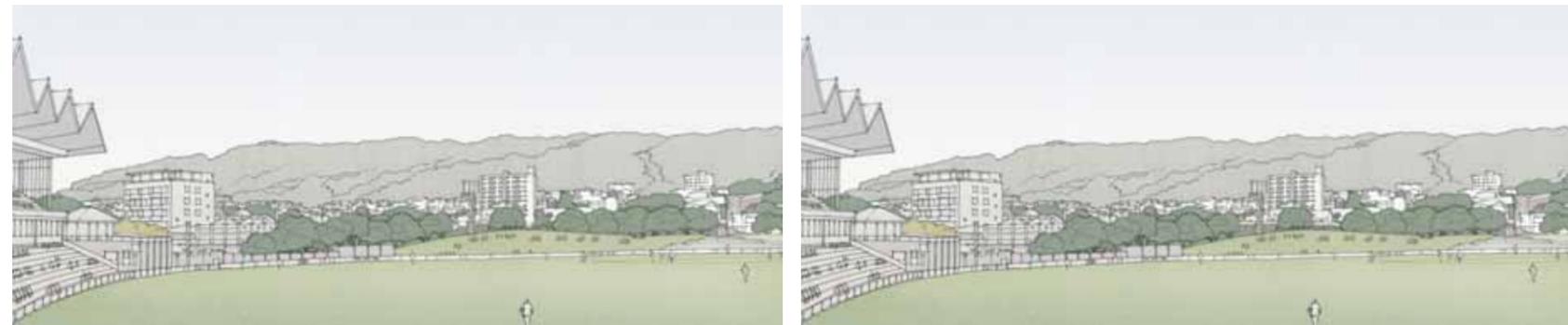


Figure 7.6: View from the Basin Reserve (Existing Situation on the left, Option E on the right)



Figure 7.7: View from Dufferin Street (Existing Situation on the left, Option E on the right)

7.6 Walking and Cycling Routes

Figure 7.8 below shows the typical routes for six different journeys around the Basin Reserve. For a description of the six journeys and the routes for the existing situation refer Section 2.4.

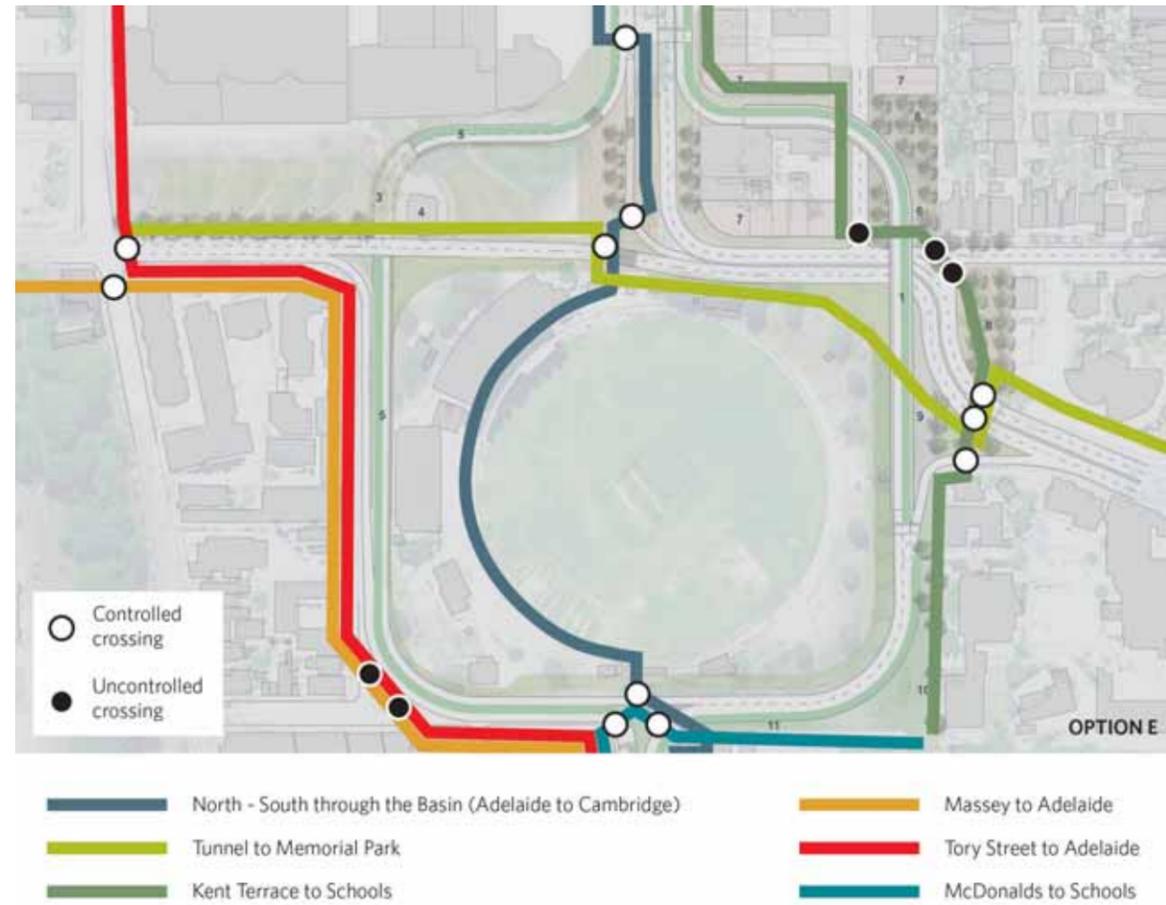


Figure 7.8: Walking and Cycling Routes for Option E

Table 7.1 below provides a quantitative record of the differences between Option E and the Do Minimum scenario.

Table 7.1: Walking and Cycling Crossing Comparison (Between the existing and Option E)

Comparison	Crossing type		Controlled crossings		Uncontrolled crossings		Lanes to cross	
	Existing	Option E	Existing	Option E	Existing	Option E	Existing	Option E
1 North - South through the Basin	4	5	0	0	8	9		
2 Tunnel to Memorial Park	2	3	3	0	10	6		
3 Kent Terrace to Schools	2	3	3	3	9	9		
4 Massey to Adelaide	1	1	2	2	4	4		
5 Tory Street to Adelaide	1	1	2	2	4	6		
6 McDonalds to Schools	2	2	0	0	4	4		
Total	12	15	10	7	39	38		

7.7 Transportation Benefits

Objectives

SH1 travel time reductions (westbound) (all peaks)	✓
SH1 travel time reductions (eastbound) (all peaks)	✓
Bus travel time reductions (both directions) (all peaks)	✓
Local road travel time reductions (both directions) (all peaks)	✓
All traffic and PT objectives achieved	✓

Travel Times

- Reduction in overall travel time for westbound SH1 traffic from Evans Bay and Willis Street of up to 35% - similar to Option A and B. Link to Cambridge Terrace from SH1 westbound provides greater time savings than Options A and B (avoids the need to use the Gyratory).
- Small reduction in travel time for eastbound SH1 traffic between Kent Terrace and Mount Victoria Tunnel.
- Increased efficiency at Adelaide Road and Rugby Street intersection.
- Reduction in journey time between Adelaide Road and Kent Terrace and Cambridge Terrace for buses and general traffic.

Traffic Volumes

Figure 7.9 below shows the change in forecast traffic volumes around the Basin Reserve for Option E in 2016 (from the 2016 Wellington Saturn model).

The black text indicates the forecast traffic flow for the do-minimum scenario in 2016. The green text indicates the forecast traffic flows under the option scenario in 2016.

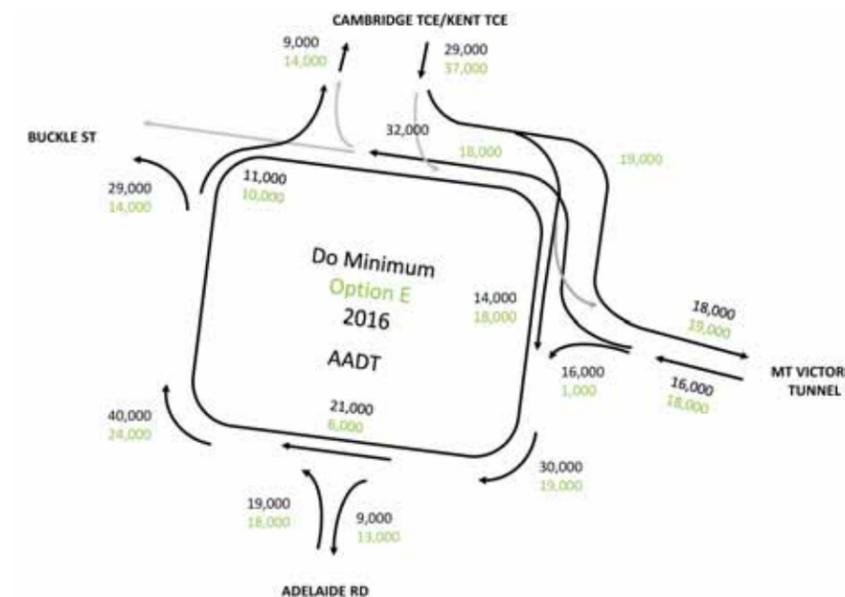


Figure 7.9: Traffic Volumes around the Basin Reserve in Option E

Figure 7.9 above shows the following:

- Significant reduction in traffic volumes around the southern side of the Basin Reserve in the option.
- Increased traffic on Adelaide Road in the option.
- Increased traffic through Mount Victoria tunnel in the option
- Significant volumes on new link westbound north of the Basin in the option.

8 Option F

8.1 Key Drivers

- Grade separate northbound arterial traffic by providing a tunnel linking Patterson Street to Buckle Street intersection with Taranaki Street.
- No elevated structures that impede view shaft along Kent Terrace towards the Basin Reserve or that impact on the amenity of the Basin Reserve.
- Removes traffic from around the Basin Reserve.

8.2 Description

Alignment

- Eastbound SH1 traffic from Kent Terrace turns left onto Ellice Street and then veers across the corner of Dufferin Street to Paterson Street, all at-grade.
- Westbound SH1 traffic exits the Mount Victoria Tunnel onto Paterson Street and then turns right onto Dufferin Street and enters a 100m long trenced section. Near the corner of Ellice Street and Hania Street, SH1 enters a 400m long tunnel. This tunnel travels north of the Basin Reserve and under the proposed Memorial Park. It emerges back at ground level between Tory Street and Taranaki Street via a 100m trenced section within the proposed Memorial Park.
- Local traffic travelling between Adelaide Road and Kent Terrace and Cambridge Terrace would use the present road alignment.
- The slip road from Sussex Street to Ellice Street, immediately north of the Basin Reserve, is retained.

Lanes

- Two lanes of SH1 westbound traffic travel through the tunnel and trenced sections.
- At the north-east and north-west corners of the Basin Reserve there are two lanes for local traffic: one bus lane and one general traffic lane.

Structures

- A 400m long tunnel with 100m long trenced section on either end of the tunnel.

Property

- Two properties may need to be acquired.
- Buildings on corner of Ellice Street and Kent Terrace need to be removed (presently owned by NZTA).

Active Modes

- New signalised crossings installed across SH1 (Paterson Street) on the approach to the Mount Victoria Tunnel.

8.3 Cost Estimate and BCR

- Option F is estimated to cost between \$160 million to \$220 million and has an indicative benefit cost ratio of between 0.7 and 0.8¹. Refer to *Appendix B and C* for the basis for these numbers.



⁰¹ Option F BCR is based on an expected cost of \$115M (Sept 2009 index). This cost excludes the cost of the Memorial Park Tunnel (estimated to cost \$43M at Sept 2009 index).

Figure 8.1: Aerial view of Option F

8.4 Option F Artist Sketches



Figure 8.2: Perspective view of Option F from the north west



Figure 8.3: Perspective view of Option F from the north east

8.5 Option F Urban Design Features

- Buckle Street traffic numbers significantly reduced by removal of SH traffic.
- SH traffic no longer able to 'experience' Memorial Park.
- Potential for improved pedestrian connection between proposed Memorial Park and Basin Reserve.
- Proposed Memorial Park to extend to Cambridge Terrace.
- A tunnel under the valley of Kent and Cambridge Terraces is counter-intuitive.
- Requires removal of existing buildings on corner of Kent Terrace and Ellice Street.
- Access to the main entrance to the Basin Reserve is pedestrianised - no traffic lanes across the entrance.
- Below ground State Highway removes traffic from Kent Terrace and Cambridge Terrace view shaft of the Basin Reserve.
- Trenching of SH1 at north-east corner of Basin Reserve results in pedestrian obstacle between the Basin Reserve and Ellis Street and Dufferin Street.

The locations of the street views on the right side of the page are shown on *Figure 8.1*.



Figure 8.4: View from Kent Terrace (Existing Situation on the left, Option F on the right)



Figure 8.5: View from Buckle Street (Existing Situation on the left, Option F on the right)



Figure 8.6: View from Dufferin Street (Existing Situation on the left, Option F on the right)

8.6 Walking and Cycling Routes

Figure 8.7 below shows the typical routes for six different journeys around the Basin Reserve. For a description of the six journeys and the routes for the existing situation refer Section 2.4.

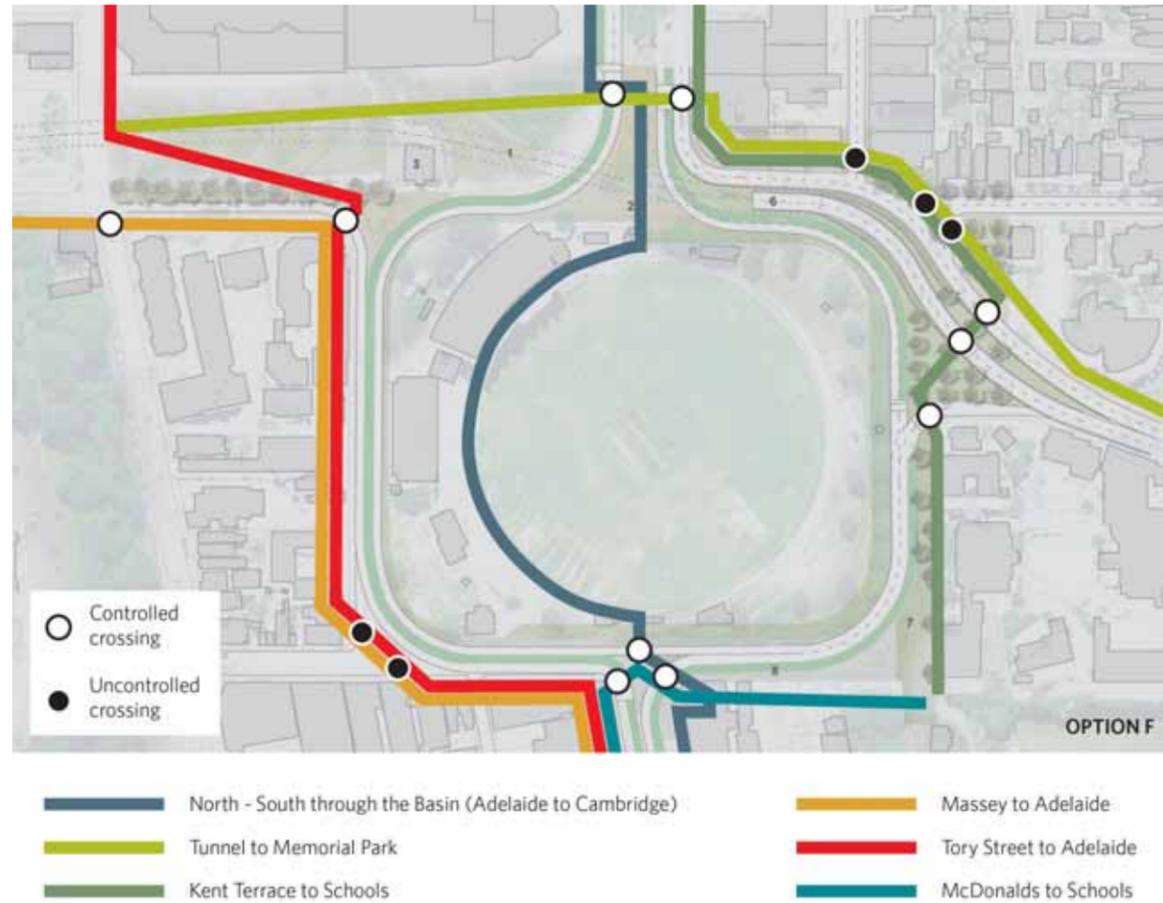


Figure 8.7: Walking and Cycling Routes for Option F

Table 8.1 below provides a quantitative record of the differences between Option F and the Do Minimum scenario.

Table 8.1: Walking and Cycling Crossing Comparison (Between the existing and Option F)

Crossing type	Controlled crossings		Uncontrolled crossings		Lanes to cross	
	Existing	Option F	Existing	Option F	Existing	Option F
1 North - South through the Basin	4	3	0	0	8	5
2 Tunnel to Memorial Park	2	2	3	3	10	10
3 Kent Terrace to Schools	2	3	3	3	9	10
4 Massey to Adelaide	1	1	2	2	4	4
5 Tory Street to Adelaide	1	1	2	2	4	3
6 McDonalds to Schools	2	2	0	0	4	4
Total	12	12	10	10	39	36

8.7 Transportation Benefits

The modelling has not yet been completed for Option F.

Traffic Volumes

Figure 8.8 below shows the change in forecast traffic volumes around the Basin Reserve for Option F in 2016 (from the 2016 Wellington Saturn model).

The black text indicates the forecast traffic flow for the do-minimum scenario in 2016. The green text indicates the forecast traffic flows under the option scenario in 2016.

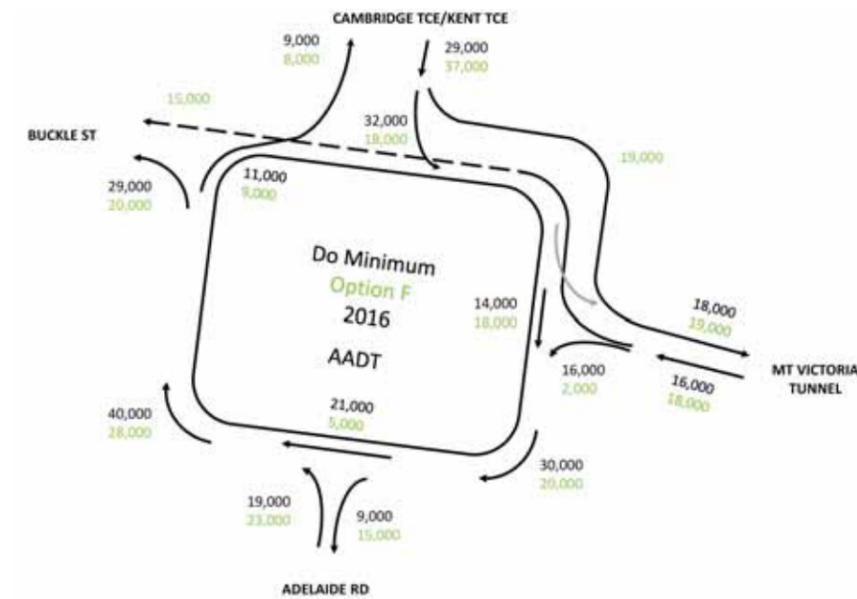


Figure 8.8: Traffic Volumes around the Basin Reserve in Option F

Traffic Volumes

Figure 8.8 above shows the following:

- Significant reduction in traffic volumes around the southern side of the Basin Reserve in the option.
- Increased traffic on Adelaide Road in the option.
- Increased traffic through Mount Victoria tunnel in the option
- Significant volumes on new link westbound north of the Basin in the option.

9 Option Evaluation

9.1 Introduction

This section outlines the process by which the project options will be evaluated, and the preliminary outcomes of this evaluation to arrive at a preferred option for the Basin Reserve Improvements project.

Appendix D includes two attachments listing matters that could be considered in option evaluation and an evaluation criteria checklist.

9.2 Evaluation Process Framework

Overview

The key focus of the evaluation process is to assist the project team to come to a view of what is the preferred (or better) option. The preferred option can be considered as that option which best meets the project objectives with the least overall social, community and environmental impacts.

The project team was guided by the project objectives during the development of the options. The team has also been mindful of the potential for adverse social, community and environmental impacts and has tried to minimise these during option development. Determining the preferred option is complicated by the numerous, and often competing, demands on achieving the project objectives while minimising environmental, social and community impacts.

Where impacts of the Basin Reserve project can be quantified and given monetary value, they can be included in a benefit cost analysis. The benefit cost analysis is the most robust method of comparing alternatives.

Where impacts are intangible and based on qualitative assessments by specialists, a multi-scaling evaluation method is required as there are no mathematical methods that can be used to compare alternatives explicitly when qualitative assessments are undertaken using two or more criteria.

A feature of a good option evaluation method is that it can help collate and summarise all the information about each option in a meaningful way that enable comparisons to be made¹. Such a method should be seen as a tool that helps decision makers provide insight into the alternatives being considered and encourage clarity into which is the preferred option.

Key to the evaluation process is deciding on the evaluation criteria which will enable options to be compared. It is easy to become overwhelmed when listing all the matters that need to be included in an evaluation process. These might include the Project Objectives, Government Policy Statements, NZ Transport Strategy, the Resource Management Act, regional strategies, and other documents. Attachment One in Appendix D lists some of these matters that could be adopted from these documents. There are several problems including all of the matters listed as evaluation criteria in Attachment One in Appendix D. Firstly because a number of matters are repeated several times, we are likely to double count some criteria - double counting leads the evaluation team to give unintended weight to these criteria. Secondly, it turns out that we make the best decisions when we limit the number of evaluation criteria being used². The decision making process becomes significantly more complex and difficult to undertake with more evaluation criteria. A good evaluation process will attempt to limit the number of evaluation criteria being used.

For this reason, we have decided to limit the evaluation criteria to reflect the number of specialist areas being assessed in the project (summarised below). Attachment Two in Appendix D shows how these evaluation criteria align with the project objectives, LTMA, NZTS objectives, RMA and other key matters that should be considered.

EVALUATION CRITERIA

- Social impacts
- Ecology
- Archaeology
- Air Quality
- Transportation
- Noise
- Built Heritage
- Urban Design
- Benefit Cost Ratio
- Strategic fit with RoNS³

The option evaluation process is summarised in Figure 9.1. Each step is discussed in more detail below.

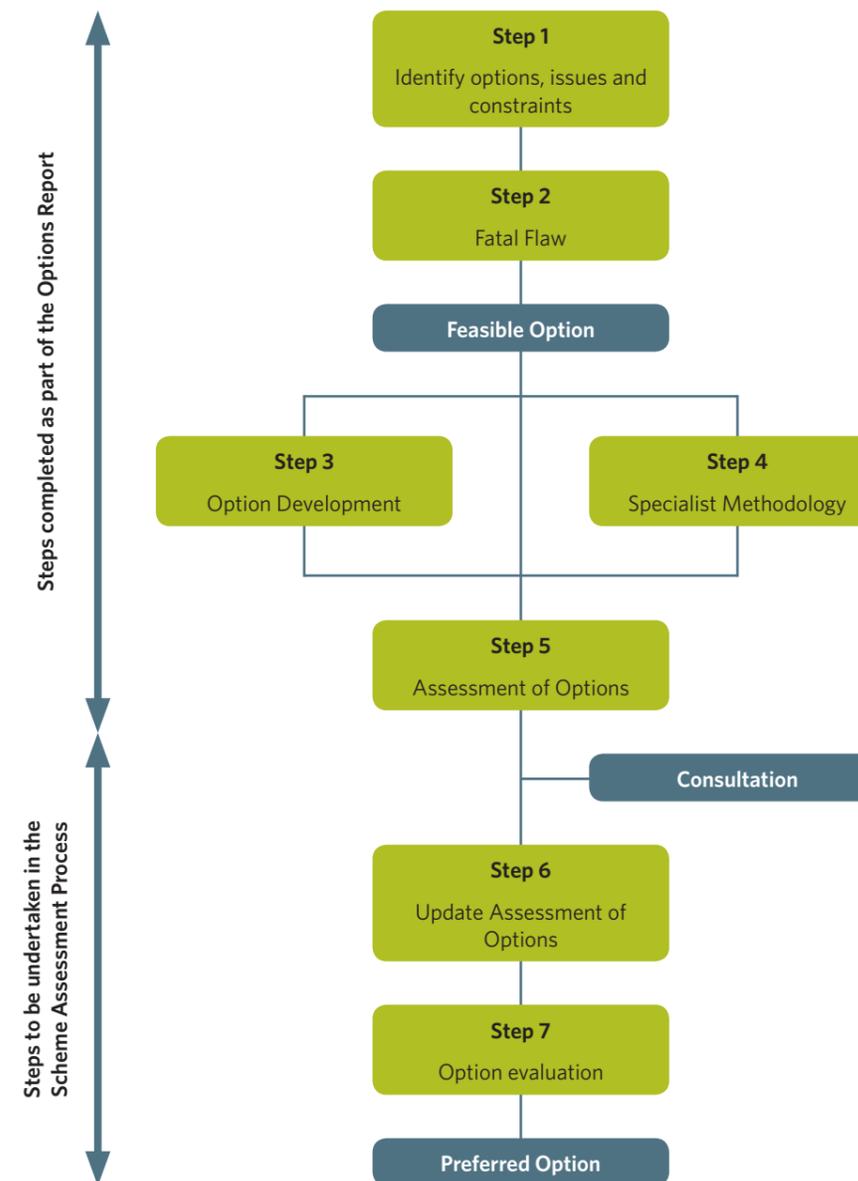


Figure 9.1: Process Chart for Option Evaluation

Step 1: Issues, Opportunities and Constraints

In addition to the scope of work shown in Figure 9.1, specialists were aware of the five options that were developed during the Inquiry-by-Design process to guide their thinking when developing the issues opportunities and constraints for the project area.

⁰¹ W.G Stewart and et al, Comparing Alternatives, published in Assessment of Environmental Effects: Information, evaluation and outcomes, John Lumsden, editor - Centre for Advanced Engineering, 2001.

⁰² John Lehrer, How We Decide, Houghton Mifflin Harcourt, 2009

⁰³ Required only if the Government decides to place Buckle Street within a tunnel in front of Memorial Park

04 While operational costs of maintaining the built infrastructure are important, they are not considered to vary significantly on this project to affect the option evaluation and selection process. Therefore, operational costs will only be included in the economic assessment of the preferred option.

Step 2: Fatal Flaw Analysis

An initial assessment to confirm that each option meets the project objectives, is feasible to construct, meets the objectives of relevant strategic documents and does not have fatal or serious Part II RMA or Historic Places Act flaws.

This assessment highlighted the following fatal flaws:

1. Option 9A that came out of the inquiry-by-design process resulted in longer overall network journey times than the existing situation giving negative economic benefits. This option failed to meet the first two project objectives.
2. Option 9B, also a result of the inquiry-by-design process, was also found to be fatal, but was subsequently shown to provide positive economic benefits with significant modification from the original concept. Therefore, Option 9B has been retained and renamed Option D.
3. The heritage building assessment has confirmed that any option that requires the removal or relocation of the Crèche building would be a serious Part II RMA or Historic Places Act flaw. This means Option A (was Option 1A), is therefore potentially seriously flawed, however modifications to minimise the impact on the Crèche are being considered. After some discussion, it has been agreed that it is premature to discount options which require moving the Crèche, and that Option A will continue to be developed as a feasible option. Nevertheless, the team is aware of the importance of the Crèche and will consider variants for Options A that minimise impacts on it.

Step 3: Option Development

From the five options that were developed as part of the inquiry-by design workshop, four have remained (now renamed as Option A, B, C and D). These four options have been further refined and developed from the original concepts. Furthermore, a fifth option (Option E) has been developed and the client has asked us to consider a tunnel option (which is referred to as Option F).

Step 4: Specialist Definition of Methodology

Specialists have been asked to define the methodology that they will then use to assess the various options.

Attachment One in *Appendix D* will also act as a check list to ensure that they are focusing their assessments on the project objectives, the NZTS and RMA.

Step 5: Specialist Assessment of all Feasible Options

Following development of the options the specialists received a data-pack containing a description of Options A to E together with sufficient information to enable them to undertake their assessment. It is important to note that the specialists are only comparing the options which permit SH1 to be at-grade in front of the War Memorial: Options A to E. Once the Government makes a decision on whether to fund the War Memorial Tunnel, Option F will be assessed with other options which permit SH1 to be located in a tunnel in front of the War Memorial.

The specialists' assessments will address a number of criteria as follows:

TANGIBLE CRITERIA (THE BENEFIT COST RATIO)

Costs:

- Capital cost of option, including client costs, professional fees and cost of mitigation of social, community and environmental impacts⁴.

Benefits:

- Reduced road vehicle operating costs, and time savings (including \$ value of reduced congestion)
- Reduced CO² emissions.

INTANGIBLE CRITERIA

Social and community impacts:

- Effects on schools, community areas and facilities.
- Effects on housing and residential dwellings.
- Community cohesion - severance, access and connectivity.
- Promotion of public health through active modes.

Ecology:

- Impacts on vegetation.
- Impacts on surface streams or waterbodies.
- Impacts on terrestrial ecology.
- Impacts on subsurface drainage and fish passage.

Archaeology:

- Contextual value.
- Condition.
- Rarity.
- Information potential (scientific value).
- Amenity value.
- Cultural association.

Air Quality:

- Health effects.
- Air quality standards.
- Projected traffic volumes.
- Dispersion of vehicle contaminants.

Transportation:

- SH1 traffic.
- Local roads.
- Passenger transport.
- Waling and cycling.
- Safety.
- Strategic fit.

Noise:

- Extent.
- Residential impact.

Built Heritage:

- Impact on former GHQ.
- Impact on HMNZS Olphert.
- Impact on National War Memorial and Carillon.
- Impact on former National Museum.
- Impact on former Mount Cook Police Station.
- Impact on former Home of Compassion Crèche.
- Impact on Basin Reserve Pavilion.
- Impact on William Wakefield Memorial.
- Impact on Basin Reserve.
- Impact on Government House.
- Impact on Mount Victoria buildings north of Paterson and a line east of Dufferin.
- Impact on Mount Victoria residential area.
- Impact on Kent / Cambridge Terrace

Urban Design:

- Environment and ecology.
- Culture and heritage.
- Urban structure.
- Quality of space.
- Connectivity.
- Activity.
- Visual quality.
- Quality of experience.

Urban Design (Review):

- Effects on urban structure of Kent / Cambridge / Basin Reserve / Memorial Park.
- Amenity effects on Mount Victoria neighbourhood.
- Amenity effects on the Home of Compassion Crèche.

The following specialists were responsible for making assessment for the intangible criteria:

- Social impacts Justine Bray (Opus)
- Urban Design Wraight Associates and Athfields (WALA)
- Urban Design (Review) Kevin Brewer
- Ecology John Turner (Opus)
- Noise Vince Dravitzki (Opus)
- Air quality Vince Dravitzki (Opus)
- Archaeology Cathryn Barr (Opus)
- Built Heritage Ian Bowman
- Transportation David Dunlop (Opus)

The effects rating to be used by specialists to estimate the overall intangible effects that each option has in terms of the above evaluation criteria is given below. The assessments are to be made in terms of impact that each option has against the do minimum. Assessments can be either positive or negative depending on whether the option improved outcomes or makes outcomes worse.

EFFECT RATINGS

- Severe Negative.
- Significant Negative.
- Moderate Negative.
- Minor Negative.
- Insignificant.
- Minor Positive.
- Moderate Positive.
- Significant Positive.
- Substantial Positive.

RATINGS FOR EVALUATION CRITERIA

When determining the degree of the impact (minor, moderate etc), specialists make an absolute assessments of the impacts. By making an absolute assessment, the specialist compares the impact in this situation against any other project that might occur in NZ or the world. In this way, if an assessment is determined as being 'severe' negative, then the specialist is saying that the option is nearly 'fatal', where fatal is the situation where the Environment Court would reject the consent or designation application based on the severity of this criterion alone. So when an assessment is rated as being severe, we are saying that the effects are severe but not quite sufficient to be fatal.

In determining the overall impact value for an option, the specialists considered, amongst other things:

- The importance of the feature (landscape, ecology) in terms of local, regional, national or international significance.
- The severity of the effect that the proposed option has on that feature.
- How the effects vary with time including whether the impacts are temporary or permanent.
- How the effect varies spatially.
- Any cumulative effects.

In assessing the importance of any feature, the specialists must be mindful of the matters in Part II of the RMA.

Specialists provide an overall rating for their area of expertise, together with a short summary paragraph of the key issues. In arriving at this overall rating, specialists devise their own set of sub-evaluation criteria and methods for combining the results of the assessments to provide an overall assessment for their area of responsibility.

REFINEMENT PROCESS

In working with the team the specialists will identify any measures that might mitigate any adverse impacts or further enhance positive impacts. If it is decided by the team to incorporate any proposals for mitigation into an option, the cost of this mitigation will be added to the costs and the option will need to be re-assessed by all specialists, as shown in Figure 9.2.

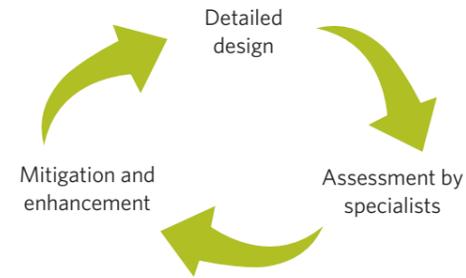


Figure 9.2: The Refinement Process

Where specialists identify more than one mitigation option, it will be necessary to agree on the option to be adopted as a trade off between likely cost to the project and the benefit in terms of overall rating, as shown in Figure 9.3. A key feature of this process will be to ensure that improvements in one area, by way of mitigation, do not create more adverse impacts in another area.

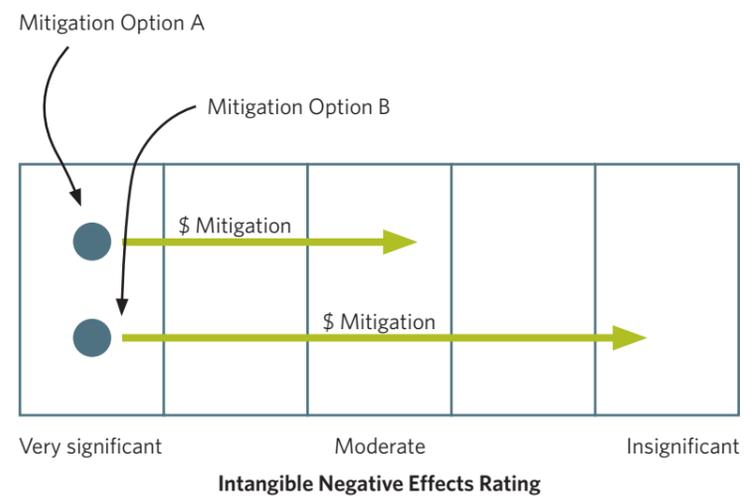


Figure 9.3: Considering a range of mitigation options

As part of the option assessment a workshop was held with all specialists on 18 August 2010. The aim of this workshop was to provide an opportunity to challenge and discuss the specialists' ideas in a group forum. The outcome of this workshop was that a number of the specialists made alterations to their working papers to reflect a better understanding of the options or new opinions brought about through the discussion.

THE COMPARISON PROCESS

Any two or more options that provide an alternative can be compared with each other to determine the better option.

Key to good decision making is to limit the number of options or evaluation criteria being used. The decision making process therefore falls into three distinct problems.

- **Eliminate options:** A pairwise analysis can be used to directly compare any two options. A pairwise analysis can be used where one option is consistently better or equal in all evaluation criteria to another option. Such a method is repeatable, is not subjective and does not require any emphasis on one criterion over another.
- **Eliminate evaluation criteria:** Where the remaining options have similar ratings for a particular criterion it is helpful to eliminate this criterion from further analysis. This simplifies the problem you are trying to solve. For example, if ratings for environmental is much the same for all options, it can be eliminated.
- **The options matrix:** The most challenging problem in decision making is where one option is better than another in some criteria but worse in another. In this case, the better option can often only be determined by giving emphasis to one set of criteria over another. An options matrix can be used to provide insight into the issues and help the team agree on the better option. An example of an options matrix is shown in Table 9.1.

Table 9.1: Example Options Matrix

Type	Description of effect	Option A	Option B
Noise	Impact of changes in traffic generated noise on properties adjacent to the highway.	Fencing and use of quiet road surfacing mitigates the majority of adverse effects along the route, while there are positive noise impacts on adjacent streets.	Fencing and use of quiet road surfacing mitigates the majority of adverse effects along the route, while there are positive noise impacts on adjacent streets.
		Minor positive effects.	Minor positive effects.
Visual	Ability of the landscape to absorb and embrace the proposed project.	The industrial area adjacent to Ascots Park already compromises the existing visual quality of the area. Many of the landscape effects can be mitigated through plantings.	The visual effect of an elevated section of the proposed motorway will have some affect on Victoria Park.
		Insignificant effects	Minor adverse effects.
Ecology	Assessment of direct, indirect and cumulative ecological impacts.	There will be significant improvement of the riparian margin vegetation along Little River. Significant improvement of nationally important wetlands will be achieved through improved drainage system and storm water treatment facilities. No other notable ecological features will be affected by the proposed project.	About one hectare of regenerating indigenous and exotic scrub and trees in the vicinity of Victoria Park will be destroyed. Several remnant Tawa and associated hardwood shrubs will be removed along the terrace cliffs above Little Toot River.
		Significant positive effects	Significant adverse effects.
Overall Summary of Impacts		Moderate positive effects	Minor adverse effects

Step 6: Specialist Update Assessment of all Feasible Options (not yet undertaken)

Following public consultation, specialists will review and update their working papers taking into account any issues or views expressed during Consultation that may affect their assessment. Where appropriate, specialists may need to make reference to the consultation within their assessments.

Step 7: Option Evaluation Workshop (not yet undertaken)

The short list of options will then be compared based on their updated specialist assessments together with the results of Iwi consultation, stakeholder consultation and other consultation.

If necessary, an option evaluation workshop involving all the specialists will be held. The feedback from the consultation will guide the team in terms of giving weight to the various evaluation criteria and specific impacts leading to positive and negative ratings. Where particular emphasis is needed to be given to one evaluation criteria over another in order to arrive at a better option, the views expressed during the consultation can be used in conjunction with the specialist's professional assessment to help determine the appropriate emphasis to be applied.

9.3 Specialist Option Assessment

This section summarises the results of Step 5, specialist assessment of all feasible option, of the evaluation process. The assessments and ratings provided by each specialist are reflective of the discussions at the option evaluation workshop. It is important to remember that this is a preliminary assessment consistent with a scoping study stage. These assessments and ratings may change following further design work and / or mitigation. While some mitigation measures have already been incorporated into the options, possible mitigation measures will receive further consideration in future phases of this project.

Social Impact Assessment

The criteria used for the social impact assessment were derived from Part II considerations under the RMA, the New Zealand Transport Agency's (the NZTA) Z / 19 Social and Environmental Management (SEM) requirements for Scheme Assessment Reports (SAR), and key community factors.

The Part II RMA considerations are:

- Promotion of sustainable management - section 5(1) and 5(2);
- Matters of national importance - section 6(d); and
- Other matters - section 7(f).

The NZTA SEM requirements and key community factors are:

- Effects on schools, community areas and facilities;
- Effects on housing and residential dwellings;
- Community cohesion - severance, access, and connectivity; and
- Promotion of public health through active transport modes.

These criteria were used to assess each of the options based on a range of information sources including reports, local information, and relevant legislation / plans.

The assessment of options from a social impact perspective is in outlined in [Table 9.2](#) with an overall assessment in [Table 9.3](#).

Table 9.2: Social Impact Assessment

Criteria	Option A	Option B	Option C	Option D	Option E
Part II RMA	Consistent with Part II RMA.				
Effects on schools	Most schools in the study area draw students from a wide catchment which results in a significant proportion needing to commute. Positive benefit from reduced traffic flows. Reduced traffic will also result in significant improvements to amenity, pedestrian movements, and safety for the school communities. This will mean positive benefits in terms of health and school accessibility and operation (e.g. Less noise impacts). Benefit from new school drop-off zone and "super stop" in terms of accessibility. The dedicated bus lanes will facilitate movement of students to local schools. No direct effect in terms of land requirements will mean that schools will not be impacted physically during the process and effects will be more limited.				
	The pedestrian / cyclist bridge will provide an alternative and safer route to schools.				Elevated structure directly adjacent to Street Marks School entrance could impact on school amenity. Pedestrian crossing directly outside the school will provide for improved student access.
Effects on community areas	Benefits to the community from improved connectivity throughout the Basin Reserve area and improved access to the Basin Reserve. Has the potential to increase use of community areas.				
		Some landscaped and additional open space areas are provided on the NE corner. May provide for community use. Partial severance of park.	Some landscaped and additional open space areas are provided on the NE corner (NB. Unclear on what level of community use due to location adjacent to carriageway). Complete severance of park.	Some landscaped strips around eastern edge but it is not envisaged that these would be wisely used due to location adjacent to carriageway. Complete severance of park.	Landscaped strips are provided at strategic locations. Minimised impact on park.
Effects on housing and residential dwellings	Improvement in living environment through reduction in traffic flows. Improved safety through reducing potential for traffic related accidents.				
	Structure will be viewed from residential units. May impact on residential amenity.				
		No elevated structure.			
	Elevated structure directly adjacent to residential dwellings at northern point. May impact on residential amenity.				Elevated structure directly adjacent to residential dwellings at northern point. May impact on residential amenity.
Community cohesion - severance, access, and connectivity	Improved connectivity and community cohesion through the wider project area due to increased accessibility. Could increase accessibility for mobility impaired.				
	Will provide partially sheltered route to school and other interest points.				
	Potential for improved connection between Memorial Park and the Basin Reserve.				
	Improved direct access to Basin Reserve Entrance.				Access to main Basin Reserve entrance will be across SH1 westbound lanes.

Criteria	Option A	Option B	Option C	Option D	Option E
Promotion of public health through active transport modes	Improved pedestrian and cycle environment. Could encourage use of active transport modes. Positive benefits for commuters through potential for health improvements through enhanced safety and reduced congestion.				
	Pedestrian bridge grade separation will have the potential to increase and promote active transport modes.				
	Increased width of intersections and crossing points may create challenges, particularly for mobility impaired.				Pedestrian and cycling facilities via Dufferin Street bridge structure may have the potential to increase and promote active transport.

Table 9.3: Social Impact Assessment Overall Assessment

Type of Assessment	Description of Effects	Option A	Option B	Option C	Option D	Option E
Social Impact Assessment	Effects on schools, community areas and facilities, housing and residential dwellings, community cohesion / severance, access and connectivity, promotion of public health through active transport modes.	Minor positive.	Minor positive.	Insignificant.	Insignificant.	Minor negative.

Table 9.4: Ecology Assessment

Criteria	Option A	Option B	Option C	Option D	Option E
Impacts on vegetation	There are no substantial areas of vegetation likely to be affected. Potentially affected vegetation is limited to mature trees and amenity grassland around the edge of the Basin Reserve and along a central median.				
Impacts on surface streams or waterbodies	There are no open streams or waterbodies in the vicinity of the Basin Reserve.				
Impacts on terrestrial ecology	There are no sites in the project area or immediate vicinity recognised as being of ecological significance in with the Wellington District Plan or Wellington Regional Plan. There are no sites in the project area that meet the criteria in Environment Waikato and Wildland Consultants Ltd. (November 2002) for the determination of significant indigenous vegetation or signification habitat of indigenous fauna.				
Impacts on subsurface drainage and fish passage	There are a number of subsurface drainage structures which pass beneath the project area. At best these structures are highly modified watercourses where a great deal of functional value has been lost. Likely that even if temporary disturbance occurs then re-instatement permitting continued fish passage should be possible.				Greater potential for impact on fish passage due to the permanent cuts required as part of this option. May require permanent diversion of subsurface drains. Likely that cuts would avoid drains linking to Prince of Wales Park.

Ecology Assessment

The criteria used for the ecological assessment were derived from the requirements under section 6(c) of the RMA. A number of specialist papers were used to assist in determining ecological values and sites that would be covered by section 6(c) of the RMA:

- For sites excluding lakes and rivers - Environment Waikato and Wildland Consultants Ltd. (November 2002): Areas of Significant Indigenous Vegetation and Habitats of Significant Fauna in the Waikato Region: Guidelines to applying Regional Criteria and Determine Level of Significant. Environment Waikato Technical Report TR 2002 / 15.
- For rivers and lakes - Warr, S., Perrie, A. And McLea, M. (2009). *Selection of rivers and lakes with significant indigenous ecosystems*. Greater Wellington Regional Council.
- For species - Hitchmough, R.; Bull, L.; Cromarty, P. (comps) 2007: *New Zealand Threat Classification System lists - 2005*. Department of Conservation, Wellington 194p.

The criteria developed from these sources were used to assess each of the options based on a range of information sources including aerial photographs, street level photographs, topographic maps, consultation with the Councils, and relevant legislation / plans.

The assessment of options from an ecology perspective is outlined in Table 9.4. An overall ecology summary is in Table 9.5.

Table 9.5: Ecology Assessment Overall Summary

Type of Assessment	Description of Effects	Option A	Option B	Option C	Option D	Option E
Ecology Assessment	Impacts on vegetation, surface streams or waterbodies, terrestrial ecology, and subsurface drainage and fish passage.	Minor negative.				

Archaeology Assessment

The criteria used to assess the potential impacts on archaeology are based on criteria identified and used by the Historic Places Trust (HPT) which are outlined in their *Guidelines for Archaeological Assessments*. These criteria include:

- Condition;
- Rarity;
- Contextual value;
- Information potential (scientific value);
- Amenity value; and
- Cultural associations.

These criteria were used to assess specific sites within the project area as well as the overall archaeological resource in relation to similar areas within the Wellington region and nationally. A wide range of sources were consulted as part of the assessment including:

- New Zealand Archaeological association database;
- Thomas Ward Survey - Wellington City 1891 and 1900;
- Wellington City Council Survey of Buildings 1937;
- Historic survey places of the Basin Reserve;
- Published works on the history of the Basin Reserve, Mount Cook, and Wellington City; and
- Unpublished archaeological assessment and excavation reports for Wellington City.

The assessment of options from an archaeology perspective is outlined in Table 9.6, with an overall summary in Table 9.7.

Table 9.6: Archaeology Assessment

Criteria	Option A	Option B	Option C	Option D	Option E
Condition, rarity, contextual value, Information potential (scientific value), amenity value, cultural associations.	Along Dufferin Street there are several pre-1900 houses that have been removed. However there is the potential for sub-surface archaeological material. Earthworks may disturb archaeological material.				
	Shops along Kent Terrace would have to be demolished or removed. The original 1800s buildings remain at the rear of some of these properties. Earthworks may disturb archaeological material.				Shops along Kent Terrace would have to be demolished or removed. The original 1800s buildings remain at the rear of some of these properties. Earthworks may disturb archaeological material.
	The new alignment of Buckle Street will pass through the site of the Former Home of Compassion Crèche and empty sections to either side. These sites were occupied by pre-1900 housing. Earthworks may disturb archaeological material.				
		The new alignment of Buckle Street will pass through the site of the Catholic Church marked on the 1900 plan. Earthworks may disturb archaeological material.			
		There are buildings shown on the historic plan where the proposed elevated structure will pass over Cambridge and Kent Terraces. Earthworks may disturb archaeological material.			
				Land to the north and east of Kent Terrace will be affected. There are historic buildings in this area. Earthworks may disturb archaeological material.	
					The new alignment will cross Buckle Street to the immediate west of the former Crèche building. Earthworks may disturb archaeological material.

Table 9.7: Archaeology Assessment Overall Summary

Type of Assessment	Description of Effects	Option A	Option B	Option C	Option D	Option E
Archaeology Assessment	Condition, rarity, contextual value, Information potential (scientific value), amenity value, cultural associations.	Significant negative (minor negative with mitigation).				

MITIGATION

The potential for positive opportunities as part of this project is considered to be high. These opportunities include, but are not confined to:

- The recovery and recording of archaeological evidence within Mount Cook and the Basin Reserve;
- The potential to provide interpretation and greater appreciation for the history and development of settlement in Mount Cook;
- Potential to enhance heritage features within the area that will remain, linked with interpretation;
- The potential to obtain and compare archaeological information with other sites in Wellington - particularly the Inner City Bypass, adding to our overall understanding of the settlement and development of Wellington City.

These or other mitigation measures have the potential to reduce the negative impacts on archaeology in the project area.

Table 9.8: Air Quality Assessment

Criteria	Option A	Option B	Option C	Option D	Option E	
Air quality standards, health effects, projected traffic volumes, dispersion of vehicle contaminants.	Traffic values are not great and in general will not result in air quality constraints. The schools and church may experience slightly elevated air quality values - but insignificant in terms of standards.					
	Elevation of traffic provides better dispersion of vehicle emissions.				Elevation of traffic provides better dispersion of vehicle emissions.	
		The affected area will be closer to the Mount Victoria residential area and may result in more localities being affected - will not result in any exceedances of standards.				
				At ground is the worst option in terms of air quality and dispersion of vehicle emissions.		
				Unlikely to be any air quality exceedances except perhaps on the very edge of the eastern properties if they are within 10m of the roadway.		
					Separation of lanes results in slightly better dispersion of vehicle emissions.	
					Traffic is further removed from the sensitive areas of Mount Victoria.	

Table 9.9: Air Quality Assessment Overall Summary

Type of Assessment	Description of Effects	Option A	Option B	Option C	Option D	Option E
Air Quality Assessment	Air quality standards, health effects, projected traffic volumes, dispersion of vehicle contaminants.	Minor negative to insignificant.	Minor negative to insignificant.	Minor negative.	Insignificant.	Insignificant.

Air Quality Assessment

The criteria used for the air assessment were based on air quality and health considerations. The specific factors that were considered included:

- Air quality standards;
- Health effects;
- Projected traffic volumes; and
- Dispersion of vehicle contaminants.

These factors were used to assess each of the five options.

The assessment of options from an air quality perspective is outlined in *Table 9.8*. *Table 9.9* provides an overall summary of the air quality assessment.

Transportation Assessment

The criteria used for evaluation from a transport perspective were comprehensive and covered a wide range of transport related considerations. The criteria and sub-criteria included:

1. SH1 traffic benefits⁵;
2. Local road benefits;
3. Passenger transport benefits;
4. Provision for walking / cycling (Travel Demand Management (TDM));
5. Safety;
 - Network wide
 - Study area
6. Strategic fit;
 - Roads of National Significance (RoNS) strategy - considers how well each option at the Basin Reserve would operate for SH1 traffic if a RoNS strategy (duplicating both the Mount Victoria and Terrace Tunnels) was implemented on the network)⁶.
 - Wellington City / local roads strategy - considers how well each option can handle potential increases in demand between Adelaide Road and the city centre. Also considers how well the option safeguards for the provision of a strengthened north / south passenger transport link (either bus or tram) in the future.
 - Future proofing - considers how well a grade-separated then an at-grade option at the Basin Reserve would function if a fully grade separated westbound link was constructed between the Mount Victoria and Terrace Tunnels.
7. Economic efficiency (BCR).

Each of the five options were assessed against these criteria and sub-criteria.

The sub-assessment criteria 1-5 above are all included in the economic efficiency calculation of sub-assessment criteria 7. The only sub-assessment criteria not included in the BCR calculation is sub-criteria 6 - strategic fit.

The assessment of options from transport perspective is outlined in [Table 9.10](#).

Table 9.10: Transportation Assessment

Criteria	Option A	Option B	Option C	Option D	Option E	
SH1 traffic benefits	Westbound travel time reduced by up to 35%.		Westbound travel time reduced by up to 30%.	Westbound travel time reduced by up to 25%.	Westbound travel time reduced by up to 35%.	
	Eastbound little change.			Eastbound slight increase in travel time.	Eastbound small reduction in travel time.	
Local road benefits	Reduction in local road travel time (all peaks, both directions).		Reduction in local road travel time (all peaks, both directions). NB. Not as good as Options A and B.	Increase in local road travel time (northbound and southbound).	Reduction in local road travel time (all peaks, both directions).	
Passenger transport benefits	Reduction in bus travel time (all peaks, both directions).		Reduction in bus travel time (all peaks, both directions). NB. Not as good as Options A and B.	Northbound bus travel time increases. Southbound travel time decreases due to bus lane.	Reduction in bus travel time (all peaks, both directions).	
Provision for walking and cycling (potential for TDM)	1 less controlled crossing. 3 less uncontrolled crossings. 12 less lanes to cross.	No change in controlled crossings. No change in uncontrolled crossings. 4 less lanes to cross.	4 more controlled crossings. 5 less uncontrolled crossings. 1 more lane to cross.	3 less uncontrolled crossings. 5 more controlled crossings. 1 more lane to cross.	3 more controlled crossings. 3 less uncontrolled crossings. 1 more lane to cross.	
Safety	Network wide	\$650,000 reduction in 2026 crash costs relative to do minimum / nothing. Discounted crash benefits (NPV) \$7.8M.	\$843,000 reduction in 2026 crash costs relative to do minimum / nothing. Discounted crash benefits (NPV) \$8.9M.	\$844,000 reduction in 2026 crash costs relative to do minimum / nothing. Discounted crash benefits (NPV) \$9.6M.	\$650,00 reduction in 2026 crash costs relative to do minimum / nothing. Discounted crash benefits (NPV) \$7.8M.	
	Study area	Grade separation eliminates conflict points at intersections.		New intersections and pedestrian crossings introduce conflict points.	Grade separation eliminates conflict points at intersections.	
RoNS strategy	Westbound travel time reduced by up to 54%.		Westbound travel times reduced by up to 26%.	Westbound travel time reduced by up to 30%.	Westbound travel time reduced by up to 54%.	
	Network wide travel time benefits \$7.1 million (2026).		Network wide travel benefits \$6.4 million (2026).	Network wide travel time benefits \$4.2 million (2026).	Network wide travel time benefits \$7.4 million (2026).	
Strategic fit	Wellington City / local roads strategy			Provides good north / south connection between Adelaide Road and the City.	Increased travel time between Adelaide Road and the City.	Provides good north / south connection between Adelaide Road and the City.
	Future proofing			Enhanced public transport / trams could be provided in the future.	Grade separated north / south ramps are less preferable for trams.	
Economic efficiency	2026 travel time costs are \$458M (\$2.3M greater than Option C).	Not specifically analysed, but should be comparable to Option A since both are grade separated.	2026 travel time costs are \$460M (\$2.3M less than Option A).	Not specifically analysed, but should be comparable to Option C since both are at grade.	Not specifically analysed, but should be comparable to Option A since both are grade separated.	
	Discounted cost \$59M. NPV benefits \$65-74M. BCR 1.1 to 1.2.	Discounted cost \$71M. NPV benefits \$64-74M. BCR 0.9 to 1.0.	Discounted cost \$44M. NPV benefits \$54-61M. BCR 1.2 to 1.4.	Discounted cost \$30M. NPV benefits \$44-50M. BCR 1.4 to 1.6.	Discounted Cost \$79M. NPV benefits \$65-73M. BCR 0.8 to 0.9.	

⁰⁵ SH1 traffic benefits are based on SATURN modelling using RLTS matrices and no RoNS projects.

⁰⁶ RoNS Strategy traffic benefits are based on SATURN modelling using RoNS trip matrices and include RoNS projects (Mount Victoria and Terrace Tunnel duplication, and Ngauranga to Aotea Quay improvements).

Noise Assessment

The criteria used for the noise assessment are the NZTA noise guidelines which have been in use since 1994.

In addition, the New Zealand Standard for Road Traffic Noise (NZS 6806) came into effect on 30 April 2010. This set new criteria for new and altered roads.

A combination of these two have been used when assessing potential noise impacts at the Basin Reserve. The criteria developed from these sources were used to assess each of the options based on a range of information sources including aerial photographs, street level photographs, topographic maps, consultation with the Councils, and relevant legislation / plans.

The assessment of options from a noise perspective is outlined in *Table 9.11*, with an overall noise summary in *Table 9.12*.

Table 9.11: Noise Assessment

Criteria	Option A	Option B	Option C	Option D	Option E
Extent of noise impact	At ground level location the noise from the elevated section is usually less than for the other roads sections that are at ground level.		Closest to current road configuration.		
Residential impact	Cluster of houses at Ellice Street will receive significant increase in noise.				Cluster of houses at Ellice Street will receive significant increase in noise.
	Change in traffic flows will result in noise levels in the south and west decreasing by 1.5dBA (still likely to exceed 64dBA).		Change in traffic flows will result in noise levels in the south and west decreasing by 1.5dBA (still likely to exceed 64dBA).		
				Noise at Ellice Street and Moir Street expected to meet criteria.	
				Increase in noise at the northern end of the Basin.	
			Breach of 64dBA around southern side of Paterson Street, SW sides of Basin Reserve, and Buckle Street.		
Potential mitigation	Low solid walls. Low noise OGPA road surfacing.	Acoustic insulation for taller buildings.	Acoustic insulation for taller buildings. Higher noise barriers.		Acoustic insulation for taller buildings.

Table 9.12: Noise Assessment Overall Summary

Type of Assessment	Description of Effects	Option A	Option B	Option C	Option D	Option E
Noise Assessment	Extent of impact, residential impact, potential mitigation.	Minor negative (including mitigation).				

Built Heritage Assessment

The criteria used for the built heritage assessment are based on those that would be used to assess a resource consent. These include:

- Wellington City Council District Plans;
- The Historic Places Trust Sustainable Management of Historic Heritage Guidance Information Sheets;
- International criteria: ICOMOS Washington Charter; and Xi'an Declaration.

These criteria were used to assess the potential impacts on the recognised heritage structures in the Basin Reserve area. These structures are:

- Former GHQ;
- HMNZS Olphert;
- National War Memorial and Carillon;
- Former National Museum;
- Former Mount Cook Police Station;
- Former Home of Compassion Crèche;
- Basin Reserve Pavilion;
- William Wakefield Memorial;
- Basin Reserve;
- Government House;
- Mount Victoria buildings north of Paterson and a line east of Dufferin; and
- Other non listed buildings on the corner of Kent Terrace and Ellice Street.

The assessment of options from a built heritage perspective is outlined in *Table 9.13*. An overall built heritage summary is in *Table 9.14*.

Table 9.13: Built Heritage Assessment

Criteria	Option A	Option B	Option C	Option D	Option E
Former GHQ	No impact.				
HMNZS Olphert	No Impact.				
National War Memorial and Carillon	Visual - elevated roadway is visible.		No impact		
Former National Museum	Visual - elevated roadway is visible.		No impact		
Former Mount Cook Police Station	Visual - elevated roadway is visible.		No impact		
Former Home of Compassion Crèche	Physical - building relocated, roadway high than existing, more difficult access for pedestrians and vehicles.	Physical - building retained, elevated roadway behind Crèche, no road frontage to Crèche.	Physical - building retained, isolation in traffic island with road to the north, difficult vehicle access.	Physical - building is retained, isolation in traffic island.	Physical - building retained, rear of site a tunnel with portal and trench close, in partial traffic island.
	Visual - elevated roadway is highly visible, partly obscures Basin Reserve and pavilion, obscures buildings to SE and S.				
Basin Reserve Pavilion	Visual - elevated roadway is visible, partly or fully obscures buildings to NE and S.	Visual - elevated roadway is visible, partly or fully obscures buildings to E and N.	Effects are less than minor.	Visual - moderate impact.	Visual - overbridge at east of site, trench to west.
William Wakefield Memorial	Effects are less than minor.				
Basin Reserve	Visual - elevated roadway is visible, partly or fully obscures buildings to NE and N.		Effects are less than minor.		
Government House	No impact.				
Mount Victoria buildings north of Paterson and a line east of Dufferin	Visual - elevated roadway is visible, partly or fully obscures buildings to NE and N.	Visual - elevated roadway is visible, partly or fully obscures buildings to E and S.	Effects are less than minor.		Visual - overbridge over Hania Street.
Other non listed buildings on the corner of Kent Terrace and Ellice Street	Physical - demolition of buildings.	Buildings retained.	Effects are less than minor.	Physical - demolition of buildings.	Visual - overbridge over Hania Street.
Mount Victoria residential area	Visual - elevated roadway is visible.		Effects are less than minor.		Visual - overbridge visible from SW corner of area.
Kent / Cambridge Terraces	Visual - elevated roadway is visible, presents a physical barrier at the south end of the Terraces.	Visual - elevated roadway is visible although further away than Option A, presents a physical barrier at the mid south end of the Terraces.	Physical - the Terraces will have an additional intersection going across both with a large traffic volume, a road is added to the SE of Kent Terrace.	Physical - additional road is added to the SE of Kent Terrace.	Physical - road is added to the SE of Kent Terrace which turns at right angles to the Terrace before the corner.

Table 9.14: Built Heritage Assessment Overall Summary

Type of Assessment	Description of Effects	Option A	Option B	Option C	Option D	Option E
Built Heritage Assessment	12 heritage sites in the area and surrounding residential and Kent Terrace area.	Severe negative.	Significant negative.	Moderate negative.	Moderate negative.	Significant negative.

Urban Design Assessment

The criteria used for the urban design assessment were developed through consultation and synthesis of the following documents:

- Urban Design Professional Services Guide, NZTA;
- New Zealand Urban Design Protocol, Ministry for the Environment; and
- Urban Design Implementation Principles, NZTA.

The criteria that were developed from these documents set out the key factors that were considered in the urban design assessment:

- Environment and ecology;
- Culture and heritage;
- Urban structure;
- Quality of space;
- Connectivity;
- Activity;
- Visual quality; and
- Quality of experience.

The assessment of options from an urban design perspective is outlined in *Table 9.15*. An overall summary of the urban design assessment is in *Table 9.16*.

Table 9.15: Urban Design Assessment

Criteria	Option A	Option B	Option C	Option D	Option E
Environment and ecology	Removes protected tree on NZTA land and other trees adjacent to Street Joseph's but retains and extends Basin fringe vegetation.				
	Potential catalyst for East Memorial Park to treat stormwater.		Potential catalyst for East Memorial Park to treat stormwater.		
	Potential for shelter close to Basin entry.				Potential for sheltered pedestrian space along Dufferin Street.
	Some overshadowing occurs on road and open space.				Minimal overshadowing of important public spaces but some overshadowing along Hania / Dufferin Streets.
	Accentuates landform and the crossing of the valley.				Cut and fill will impact on existing topography.
	Minimal increase in impermeable surface.			Significant increase in impermeable surface.	Moderate increase in impermeable surface.
	Includes minor new tree planting.			Includes moderate new tree planting and will protect most existing vegetation.	Includes moderate new tree planting.
				Cut and fill will have minor impact on existing topography.	Nature of grade separation is counter intuitive to topography.
Cultural and heritage	Retains close reference to historical street alignments for both surface and elevated routes.		Retains heritage fabric and improves setting on Ellice Street / Kent Terrace corner.	Removes heritage fabric Ellice Street corner and significantly modifies corner condition.	Significant impact on historical setting to schools precinct and Government House entry, and historic Basin Reserve stand building.
	Significant impact on the heritage elements of Crèche and Ellice / Kent corner buildings.	Retention of the heritage elements of Crèche and Ellice / Kent corner buildings.			
	Former Crèche building relocated with potential for improved setting, adaptation and interpretation.		Retains the former Crèche building with potential to improve setting adaptation and interpretation.		
	Minor impact on the fabric and setting of historical Mount Victoria precinct.		No effect on form, urban and setting of the Basin and maintains access.	Moderate impact on urban setting of Basin Reserve.	Significant effects on urban form of the Basin due to trenches and surface road impeding visual and physical access.
	Accentuates the form of the Basin and improves access.				
			Minor impact on fabric of historic Kent / Cambridge median.	Significant impact on historic fabric / setting of corner Kent / Ellice and minor impact on setting of Mount Victoria precinct.	
	Minor impact on setting of Kent / Cambridge median.		Functionality and access to Kent / Ellice corner buildings are reduced by new intersection on Kent / Cambridge.		Functionality and access to Kent Ellice corner buildings is reduced due to trench.
					Relatively high impact on Mount Victoria precinct buildings

Criteria	Option A	Option B	Option C	Option D	Option E
Urban Structure	Retains alignments to the Ellice / Buckle Street axis for both local and SH1 routes.	Retains alignment to the Ellice / Buckle Street axis for local route but significant deviation for SH1 route.	Minor effects on alignment to Ellice / Buckle Street axis for local route and significant deviation for SH1 route.	Minor effects on alignment to the Ellice / Buckle Street axis for both local and minor deviation to SH1 routes.	Moderate effect alignment to Ellice / Buckle Street axis for SH1 and significant effect on alignment for local road.
	Retains close alignment to grid with both local and SH1 routes.	Significant deviation to grid for both SH1 routes.		Moderate deviation to grid with both local and SH1 routes.	
	Moderate risk of scale misalignment between elevated structure and Basin / Ellice Street buildings.	Significant effect on character of Ellice and Hania Street.		Moderate effect on streetscape and spatial structure of Hania / Ellice precinct.	Significant effect on street character Sussex, Ellice, Hania, Dufferin. Significant effect on spatial structure of Hania / Ellice precinct.
	Significant effect on street character to Kent / Cambridge Terraces.		Moderate effects on perceived continuity of Kent / Cambridge Boulevard. Moderate effect on potential for consistent grain and density of built form and streetscape along Kent / Cambridge Terrace.	Minor effect to perceived continuity of Kent / Cambridge Boulevard. Maintain the potential for consistent grain and density of built form and streetscape along Kent / Cambridge Terrace.	Moderate effect on potential for consistent grain and density of built form and streetscape along Kent / Cambridge. Moderate effects on perceived continuity of Kent / Cambridge Boulevard.
	Maintains the potential for a consistent grain and density of built form along Kent / Cambridge.	Moderate effect on potential for consistent grain and density of built form and streetscape along Kent / Cambridge. Moderate risk of scale misalignment of new structure to Mount Victoria buildings.			
	Moderate effect on streetscape, spatial structure of Hania / Ellice precinct.	Retains spatial structure of Kent / Ellice corner. Significant effect on streetscape at Hania / Ellice precinct. Hania Street character changed.	Scale and character of built environment significantly eroded at Hania St. Significant effect on streetscape of Ellice and Hania Streets and spatial structure.		
	Strengthens definition of the Basin 'Square'				Moderate effect on the definition of the Basin 'Square'.
	Minor improvement to open space network surface connections.				
Quality of Space	Retains potential for better integrated surface level open space between Memorial Park, Kent / Cambridge and the Basin.			Diminished quality / integration of open space Ellice / Dufferin due to breadth and form of road structure.	Potential for diminished quality / integration open space Kent / Cambridge, Basin perimeter, Dufferin, Hania, Sussex.
	Minor resultant poor quality residual open space. Potential for reduced quality of open space under elevated structure.	Moderate resultant poor quality residual open spaces. Potential for reduced quality of open space under elevated structure.	Significant resultant levels of poor quality residual space.	Resultant poor quality residual space.	Moderate resultant poor quality residual space. Potential for reduced quality open space under elevated structure.
	Potential for moderate negative effects to Basin from presence of elevated structure.			Diminished quantity / quality of open space at Basin North gateway due to SH1 proximity at grade.	Potential for moderate negative effects to Basin / Dufferin from presence of elevated structure.
	Potential for high quality open space on new pedestrian link attached to elevated structure.				
		Difficult residual space at Hania Street / Dufferin St. Potential for moderate negative effects to open space of future park, Kent / Cambridge from presence of elevated structure.	Potential for improvement in area / quality open space corner Kent / Ellice but compromised by reduced accessibility from Kent Terrace.	Significant impact on Kent / Ellice corner from 6 lanes of traffic, but potential for increased pedestrian on Basin edge.	Potential for reduced activation of Kent / Ellice and Dufferin street public space due to diminished accessibility due to trench. Potential for significant negative effects to public open space of Ellice, Sussex and future park from trench. Diminished quantity / quality open space at Basin North gateway due to SH1 proximity at grade.

Criteria	Option A	Option B	Option C	Option D	Option E	
Connectivity	Grade separation improves multimodal surface connections north / south.		Large intersection Kent / Cambridge and SH1 will cause disruption to multimodal traffic movement north-south.	Convoluted multimodal connectivity, particularly north-south.		
	Very direct and legible connections for both SH1 and surface traffic.	Deviation away from the grid is counter intuitive for SH1.		Direct and intuitive routes and connection for SH1 but minor for local traffic.	Direct and intuitive rout for SH1 but significant deviation in plan and elevations for local traffic.	
	Mount Victoria street connections to SH1 but limited local.		Mount Victoria local connections removed, no access to SH1, Hania and limited to Ellice.		Mount Victoria Street connections to SH1 but limited local.	
	Moderate effects on visual connection Kent / Cambridge to Basin subject to bridge design.		Minor effects on visual connection Kent / Cambridge to Basin due to greater surface traffic crossing.			
	Minor improvement to open space network surface connection due to grade separation.					
	Improves drop-off and transit zones to schools.					Compromises functionality and safety of drop-off zone to schools.
	Potential to improve legible accessible processional route between Memorial Park / Kent and Cambridge / Basin and Government House	Retains potential processional Kent / Cambridge to Basin to Government House, but disrupts processional from Memorial Park to Kent / Cambridge	Potential procession not possible through Memorial Park unless traffic control added, and disrupts Kent / Cambridge to Basin	Potential procession limited through Memorial Park and Kent / Cambridge to Basin by surface traffic	Potential procession retained Kent / Cambridge to Memorial Park, but disrupted to Basin due to surface traffic. Possibility for intermittent ceremony / procession subject to traffic control.	
		SH1 diagonally dissects Memorial Park limiting East / West surface connection to under SH1	SH1 diagonally dissects Memorial Park excluding surface connection East / West			
	Minor improvement to open space network surface connection due to grade separation		Moderate negative effects to open space network surface connections due to increase in surface roads	Moderate negative effects to open space network surface connections due to trenches		
Activity	Potential for moderate increase in area and range of ground based activity zones due to elevation of significant area of arterial vehicular traffic.		Moderate reduction in area and potential range of ground based activity due to enlarged / additional surface based arterial vehicle road area.			
	Retains vehicle circulation in similar corridor to existing, thus restricting potential effects on activity largely to existing road corridors.	Distributes vehicle circulation beyond existing road corridors, thus spreading potential effects more broadly to adjacent activity zones (ie Kent Terrace apartments, Mount Victoria / Hania street precinct).		Retains vehicle circulation in similar corridor to existing, thus restricting potential effects on activity largely to existing road corridors.	Distributes vehicle circulation beyond existing road corridors, thus spreading potential effects more broadly to adjacent activity zones (ie Mount Victoria / Hania Street precinct).	
	Enhances potential to improve ground based activity and safety through enhanced pedestrian accessibility, local traffic and PT drop- off and pick- up amenity to Schools / Government house precinct, Dufferin corner.					Diminishes potential to improve ground based activity and safety through enhanced pedestrian accessibility, local traffic and PT drop- off and pick- up amenity to Schools / Government house precinct, Dufferin corner.
	Retains potential to improve ground based activity and safety through enhanced pedestrian accessibility and shelter at Basin North gateway and Kent / Ellice corner- although this very dependant on quality of building and undercroft.		Retains potential to improve ground based activity and safety through enhanced pedestrian accessibility at Basin North gateway and Kent / Ellice corner, although diminished pedestrian accessibility (From Kent) likely to limit this.	Moderate negative effects on ground based activity and safety through diminished pedestrian accessibility / width at Basin North gateway and Kent / Ellice corner.	Significant negative effects on potential activity at Kent / Ellice corner with trench adjacent. Moderate negative effects on ground based activity and safety through diminished pedestrian accessibility at Basin North gateway.	
	Retains potential to enhance activity associated with former Crèche building in new location by improved accessibility and potential association with future Museums precinct.	Retains potential to enhance activity associated with former Crèche building in existing location by improved accessibility and quality of local frontage to building.	Retains potential to enhance activity associated with former Crèche building in existing location by improved accessibility and quality of local frontage to building- but diminished accessibility in 'traffic island' situation likely to limit positive effects.	Moderate negative effects on potential to enhance activity in relation to Crèche building due to proximity / traffic volume in arterial east west route.	Minor negative effects on potential to enhance activity in relation to Crèche building due to proximity / traffic volume in arterial east west route.	

Criteria	Option A	Option B	Option C	Option D	Option E
Activity	Introduces new opportunity for elevated zone of activity as pedestrian / cycle 'clip-on' to side of elevated structure.				
Visual quality	Moderate effect on views from the Basin looking toward Kent / Cambridge due to aerial structure. Potential for mitigation of negative effects and contribution of positive effects due to quality design, positive relationship to existing Basin fringe trees and visible elevated pedestrian / cycle activity on bridge.	Minor effect on view from Basin looking toward Kent / Cambridge due to aerial structure. Potential for mitigation of negative effects and contribution of positive effects due to quality design and integration with Kent Cambridge buildings.	Insignificant effects on views from Basin.		
	Significant effect on views from Kent / Cambridge looking toward the Basin. Potential for mitigation of negative effects and contribute positive effects due to quality design, potential to frame view of Basin entry, positive relationship with Kent / Cambridge and Basin fringe trees.	Moderate effect on views from Kent / Cambridge looking toward the Basin. Potential for mitigation of negative effects and contribution of positive effects due to quality design, potential to frame view of Basin entry, positive relationship with Kent / Cambridge trees, and integration of bridge structure with Kent / Cambridge buildings.	Minor effects on ground level views from Kent / Cambridge looking toward the Basin due to increased volume of ground based cross traffic and road infrastructure in Basin foreground.		
	Minor effects on local ground level views toward Basin / City from Mount Victoria. Potential to mitigate effects by quality of design, integration with existing topography and trees.	Moderate effects on local ground level views toward Basin / City from Mount Victoria. Potential to mitigate effects by quality of design, integration with existing topography and vegetation.			Moderate effects on local ground level views toward Basin / City from Mount Victoria. Potential to mitigate effects by quality of design, integration with existing topography and vegetation.
	Minor effects on ground level views to Carrilion / Memorial park precinct from Kent / Cambridge. Significant new improved elevated views of this precinct.	Moderate effects on ground level views to Carrilion / Memorial park precinct from South Kent / Cambridge. Significant new improved elevated views of this precinct.	Moderate effects on views toward the Carrilion with west bound arterial crossing park in foreground.	Insignificant effects on views toward the Carrilion.	Minor effects on views toward the Carrilion with trench in foreground.
	Minor effects on views from surrounding east, south and west precincts. Potential to mitigate negative effects and contribute positive effects by quality of design, positive integration and, integration with existing topography.		Minor effects on local ground level views from Hania / Mount Victoria precinct due to new road infrastructure through Hania corner. Potential to mitigate effects by quality of design and associated local streetscape / landscape works.	Minor effects on views from Mount Victoria precinct.	Minor effects on views from surrounding east, south and west precincts. Significant effect on streetscape visual quality from trench.
Quality of experience	Local ground level vehicle / cycle and pedestrian experience of the Basin is maintained by continued / enhanced proximity of local routes through and around the Basin.		Moderate effects to Local vehicle / cycle and pedestrian experience in relation to the Kent Terrace approach to the Basin by the new intersection crossing in Basin foreground. Other ground level experience generally retained by continued / enhanced proximity of local routes through and around the Basin.	Moderate effects to local vehicle, cycle and pedestrian experience in relation to the Kent / Ellice corner by the new configuration of arterial route effecting local relationship to existing street scape. Other ground level experience generally retained by continued / enhanced proximity of local routes through and around the Basin.	Significant effects to local vehicle / cycle and pedestrian experience of the Basin and surroundings in configuration of new local movements with overpass and trench combination.
	More direct intuitive and legible experience of local Basin and Memorial precinct and a city approach offered to vehicle / cycle and pedestrian based arterial west bound users.	A less direct, less intuitive and less legible experience of local Basin and Memorial precinct and city approach offered to vehicle based west bound arterial road users.		Intuitive and legible experience of Basin and Memorial precinct / city approach offered to vehicle based arterial west bound users. Convoluted route for south bound local traffic.	Less intuitive or legible experience of local Basin and memorial precinct / city approach offered to vehicle based arterial west bound users due to trench.
	Quality of ground level experience dependant on quality of undercroft design aspects of elevated structures. If well designed, potential for enhancement of ground level experiences from 'gateway' or sheltering or positive visual amenity from overhead structure.	Quality of ground level experience dependant on quality of particularly undercroft design aspects of elevated structures. If well designed, potential for enhancement of ground level experiences with structure as 'gateway'.			Quality of ground level experience dependant on quality of undercroft design aspects of elevated structures. Quality of ground level experience and vehicle based experience dependant on quality of trenches.

Criteria	Option A	Option B	Option C	Option D	Option E
Quality of experience	New elevated route offers potential for significant enhancement of vehicle / cyclist / pedestrian experience in terms of appreciation of: the topography; axial reading and approach to Memorial park and distant Cuba precinct; reading of Kent / Cambridge corridor; reading of Basin and Basin fringe tree canopy.	New elevated route offers potential for significant enhancement of vehicle based experience in terms of appreciation of: the topography; 'swooping' approach to Memorial park / Carrilion; reading of Kent / Cambridge corridor.			

Table 9.16: Urban Design Assessment Overall Summary

Type of Assessment	Description of Effects	Option A	Option B	Option C	Option D	Option E
Urban Design Assessment	Environment and ecology, culture and heritage, urban structure, quality of space, connectivity, activity, visual quality, quality of experience.	Minor negative.	Moderate negative.	Moderate negative.	Moderate negative.	Significant negative.

Urban Design (Review) Assessment

The criteria used for the urban design (review) assessment were developed in part based on the New Zealand Urban Design Protocol.

The significant features that were identified as potentially being impacted included:

- Effects on urban structure of Kent / Cambridge / Basin / Memorial Park;
- Amenity effects on Mount Victoria neighbourhood; and
- Amenity effects on Home of Compassion Crèche.

The assessment of options from an urban design (review) perspective is outlined in *Table 9.17*. *Table 9.18* summarises the urban design (review) assessment.

Table 9.17: Urban Design (Review) Assessment

Criteria	Option A	Option B	Option C	Option D	Option E
Effects on urban structure of Kent / Cambridge / Basin / Memorial Park	Greater Basin Reserve entry effects are offset by less effects on Park. Least effects on pedestrian connectivity through Park to Basin.	Flyover setback from Basin so less visual effects on entry but this is outweighed by Park severance. Effect on Kent / Ellice / Hania block moderate.	At grade solution has less visual effects on urban structure but is offset by Park severance. Severe effects on development potential of Kent / Ellice / Hania block will impact on Basin entry in long term.	At grade solution has less visual effects on Kent / Cambridge and Basin entry but SH1 westbound severs Basin entry. Wider road at grade has physical rather than visual effects.	Flyover on Dufferin and at grade SH1 westbound severing Basin entry. Access to Kent/Ellice / Hania block better but effects extend around block.
Amenity effects on Mount Victoria neighbourhood	Minimal effect with separation and proposed building screening viaduct. Flyover visible down Ellice Street.	Flyover visible from neighbourhood. Noise walls likely to increase height of flyover. Ellice Street access maintained.	Ellice Street access severed.	Ellice Street access maintained.	Flyover visible down Ellice Street. Flyover visible from neighbourhood. Noise walls likely to increase height of flyover. Ellice Street access severed.
Amenity effects on Home of Compassion Crèche	The Crèche will be severely compromised by the flyover's height. Loss of street context.	Severs Park and the setting for the Crèche is compromised with a rear flyover as well as Buckle Street in the front.	At-grade solution reduces visual effects in Park but the open space is still severed so the setting for the Crèche is compromised.	At-grade solution reduces visual effects but proximity will still have noise and pollution effects. Insignificant effects with at grade solution.	Trenching the Sussex Street connection reduces the visual impact for the Crèche setting in Park.

Table 9.18: Urban Design (Review) Assessment Overall Summary

Type of Assessment	Description of Effects	Option A	Option B	Option C	Option D	Option E
Urban Design Assessment	Effects on urban structure of Kent / Cambridge / Basin / Memorial Park, Amenity effects on Mount Victoria neighbourhood, amenity effects on Home of Compassion Crèche.	Moderate negative.	Significant negative.	Significant / moderate negative.	Significant negative.	Significant / moderate negative.

9.4 Outcomes of Option Evaluation

Table 9.19 provides an overall summary of the ratings that each specialist gave to each option. This summary shows that no one option performs consistently better than other options for all evaluation criteria.

Table 9.19: Overall Summary

Criteria	Criteria	Option A	Option B	Option C	Option D	Option E
Social Impact	Effects on schools, community areas and facilities, housing and residential dwellings, community cohesion / severance, access and connectivity, promotion of public health through active transport modes.	Minor positive.	Minor positive.	Insignificant.	Insignificant.	Minor negative.
Ecology	Impacts on vegetation, surface streams or waterbodies, terrestrial ecology, and subsurface drainage and fish passage.	Minor negative.	Minor negative.	Minor negative.	Minor negative.	Minor negative.
Archaeology	Condition, rarity, contextual value, Information potential (scientific value), amenity value, cultural associations.	Significant negative (minor negative with mitigation).	Significant negative (minor negative with mitigation).	Significant negative (minor negative with mitigation).	Significant negative (minor negative with mitigation).	Significant negative (minor negative with mitigation).
Air Quality	Air quality standards, health effects, projected traffic volumes, dispersion of vehicle contaminants.	Minor negative to insignificant.	Minor negative to insignificant.	Minor negative.	Insignificant.	Insignificant.
Noise	Extent of impact, residential impact, potential mitigation.	Minor negative.	Minor negative.	Minor negative.	Minor negative.	Minor negative.
Built Heritage	12 heritage sites in the area and surrounding residential and Kent Terrace area.	Severe negative.	Significant negative.	Moderate negative.	Moderate negative.	Significant negative.
Urban Design	Environment and ecology, culture and heritage, urban structure, quality of space, connectivity, activity, visual quality, quality of experience.	Minor negative.	Moderate negative.	Moderate negative.	Moderate negative.	Significant negative.
Urban Design (Review)	Effects on urban structure of Kent / Cambridge / Basin / Memorial Park, Amenity effects on Mount Victoria neighbourhood, amenity effects on Home of Compassion Crèche.	Moderate negative.	Significant negative.	Significant / moderate negative.	Significant negative.	Significant / moderate negative.
Transport	BCR Strategic fit	BCR 1.1 to 1.2. Westbound travel time reduced by up to 54%. Network wide travel time benefits \$7.1 million (2026).	BCR 0.9 to 1.0. Westbound travel time reduced by up to 54%. Network wide travel time benefits \$7.1 million (2026).	BCR 1.2 to 1.4. Westbound travel times reduced by up to 26%. Network wide travel benefits \$6.4 million (2026).	BCR 1.4 to 1.6. Westbound travel time reduced by up to 30%. Network wide travel time benefits \$4.2 million (2026).	BCR 0.8 to 0.9. Westbound travel time reduced by up to 54%. Network wide travel time benefits \$7.4 million (2026).

It is easier to compare options by reducing either the number of options or the number of evaluation criteria. While it is not possible to combine ratings together without introducing some unknown scaling and weight to the various criteria, it is possible to use pair-wise comparison to reduce the size of the problem.

Pair-wise comparison is a simple technique which compares two options at a time. If one of the two options being compared is either similar or better than the other option in all evaluation criteria, then we can conclude that this option is better than the other option, without the uncertainty of solving the problem of scaling or weight. The problems of scaling and weight are inherent in all multi-criteria analysis problems where values cannot be converted to a single currency like money.

In our case, no option is consistently better than other options. Option D is better than Option C in all criteria except transportation - strategic fit. So in this case we cannot eliminate options.

We can, however, reduce the problem by eliminating evaluation criteria. We can see in Table 9.19 that the ratings given for ecology, archaeology, and noise are identical. Furthermore, if we assume that the differences between the options for air quality are sufficiently small to be neglected, then the problem can be reduced in size significantly.

The criteria reduces to social, built heritage, urban design, strategic fit, and BCR. If we give more weight to strategic fit, this being the fit to the RoNS and enhancements to the Wellington Inner-City Bypass in the future, then the grade separated options, A, B, and E, are preferred to options C and D. However, close examination of Table 9.20 reveals that the differences

between the at-grade and grade-separated options in terms of economic benefits over 30 years is relatively small for an urban project of this nature: approximately a difference of only \$30 million over 30 years. Furthermore, the differences in BCR of between 1.0 and 1.5 are also small for an urban project of this nature, especially considering the impacts of urban form, social impacts, and built heritage.

If we decided to assume that all options performed equally in terms of BCR and strategic fit, then the problem can be further simplified, see Table 9.20.

Table 9.20: Summary of Key Differences

Criteria	Option A	Option B	Option C	Option D	Option E
Social Impact	Minor positive.	Minor positive.	Insignificant.	Insignificant.	Minor negative.
Built Heritage	Severe negative.	Significant negative.	Moderate negative.	Moderate negative.	Significant negative.
Urban Design	Minor negative.	Moderate negative.	Moderate negative.	Moderate negative.	Significant negative.

Table 9.20 shows the key differences between all five options, assuming that the difference between BCR and strategic fit are sufficiently small to be neglected. Analysis of *Table 9.20* enables us to conclude:

1. If we undertake a pair-wise comparison between option C and D, we find that they are the same.
2. If we undertake a pair-wise comparison between options C and E we find that C is consistently better than E. Given our findings in 1 above, we can also conclude that D is better than E. This means we can eliminate E from further analysis.
3. If we give more weight to the built heritage then we should select options C, D or B but not A.
4. If we give more weight to social impacts and urban design then we should select options A or B and not C or D.

10 Conclusions and Recommendations

Our team recommended options A and B as preferred options if more weight is given to urban design, social impacts, and long term strategic fit. Of these two options, option A is the better of the two when giving more weight to these criteria. Option A requires the relocation of the Crèche. We acknowledge that while relocating heritage buildings is not favoured, this may be mitigated to some extent by being able to relocate the Crèche building to provide improved connections to Buckle Street or to relocated the Crèche to a larger historic precinct closer to the War Memorial.

