

Auckland needs good transport networks, rail, road and public transport to continue developing as a world-class city and to continue economic growth.

WHAT IF I LIVE ABOVE THE TUNNEL?

If you live above or next to the proposed tunnel you will be contacted directly by Transit to explain in detail how you might be affected and answer any questions you may have.

Transit is committed to making sure you are fully informed and is keen to work with all householders. Please refer to page six for contact details. We want to hear from you.

The tunnel will be 20 to 40 metres below the surface (about seven to 13 storeys). Transit will negotiate to buy the rights to the ground beneath peoples' properties.

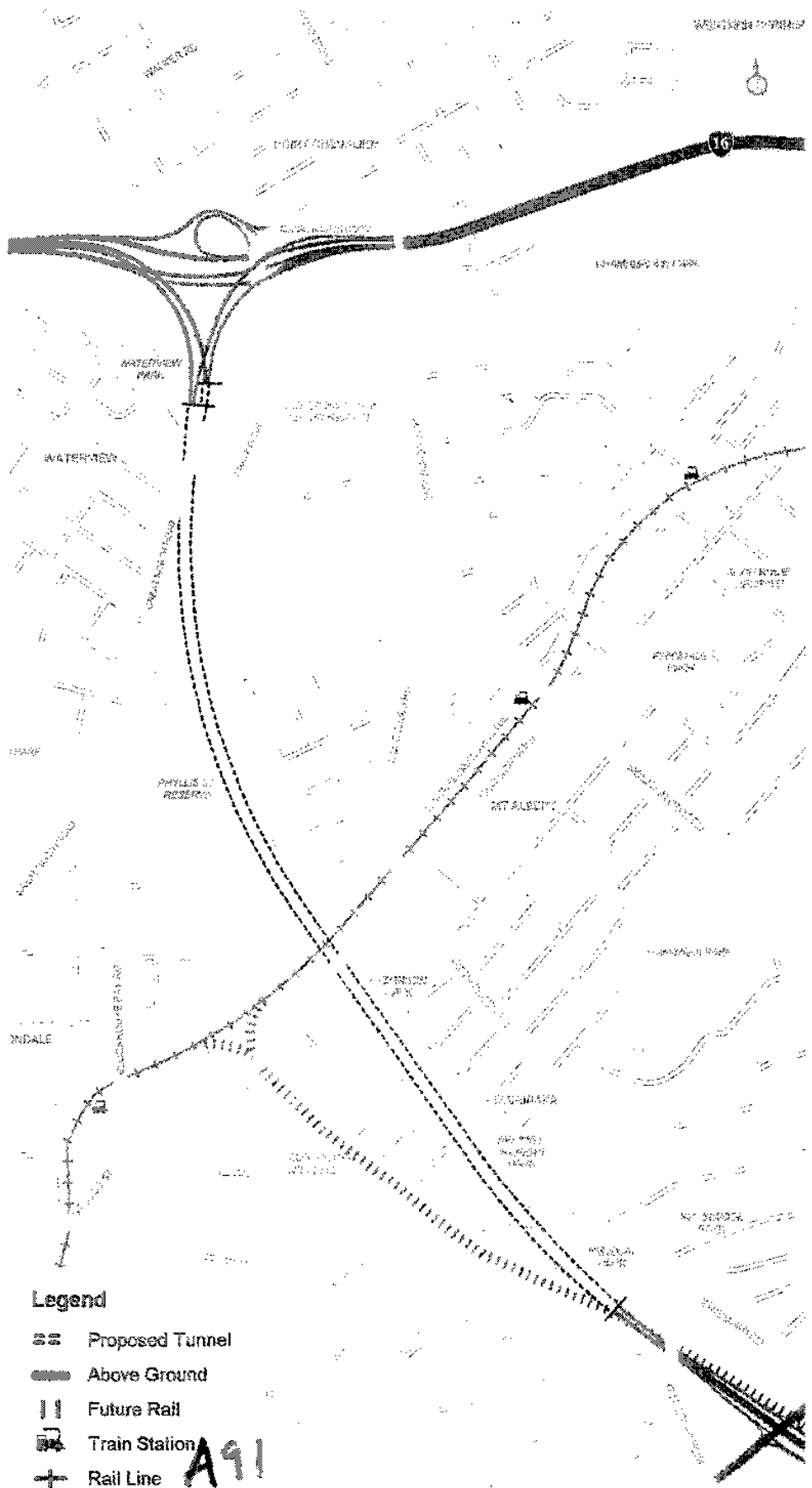
There are lots of road tunnels around the world built beneath urban areas, Sydney, Brisbane, Paris, Dublin to name a few, and Transit would use this international experience for the Waterview Connection project.

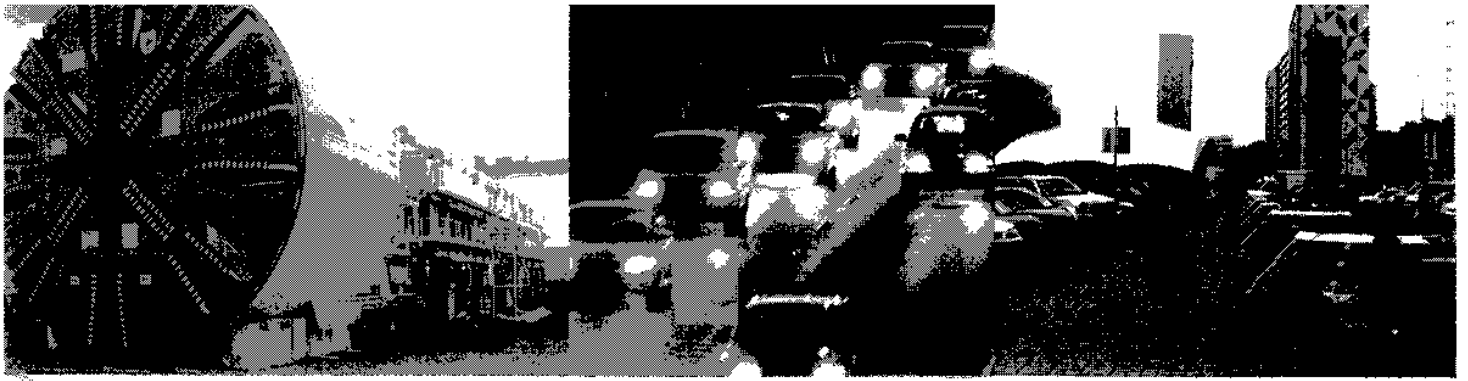
If the tunnel is confirmed as the best option for the Waterview Connection project, you will not be able to feel or hear anything above the tunnel once it is completed.

WHAT IF I LIVE ELSEWHERE IN THE AREA?

Transit wants to ensure that everyone interested in the Waterview Connection project is fully informed about the proposal. If you want to know more, refer to page six.

We have listened to the community's views and believe the tunnel responds positively to calls for much less disruption to families and homes.





A tunnelling machine similar to the one pictured above (in Germany) would be used on the project (left). Auckland's peak hour traffic.

Vertical air vents (black and gray) at Auckland central business district

WATERVIEW CONNECTION

The 4.5km project has three main parts.

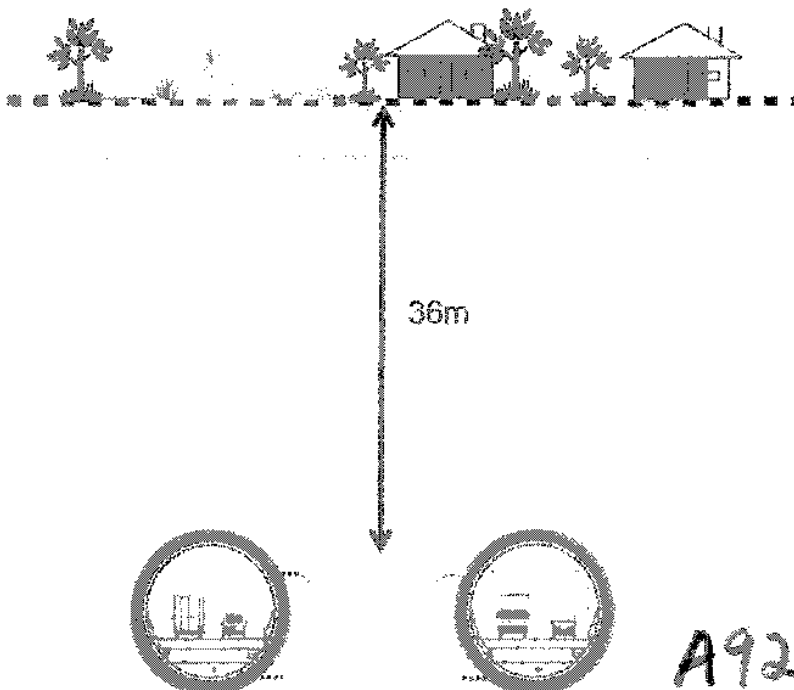
1. Tunnels
2. Portals
3. Interchanges

TUNNELS

There are twin two-lane tunnels, one for each direction of traffic, constructed side by side under the ground using a tunnel-boring machine. The tunnels will not have walking or cycling access. They will be designed to a high standard for lighting, ventilation and fire safety. Features of the tunnel construction are:

- The tunnelling machine travels about 10–15m a day depending on ground conditions, so it will be working under each property for about three days.
- It will cause vibration on the surface, like the rattle of an old fridge, but this will vary according to how deep it is and what the ground conditions are like above it.
- The machine first bores through the soil and rock and then puts up a pre-cast concrete tunnel lining as it passes so the ground is not left unsupported.
- There will be some surface settlement, preliminary estimates suggest an average of 6cm.
- We will meet and discuss any concerns about vibration or settlement with the people who live above or near the tunnel.

Drawing showing tunnel below property. Tunnel depth would vary between 20–40 metres.



PORTALS

A portal is where the road in a tunnel comes to the surface and where most of the construction work will be visible.

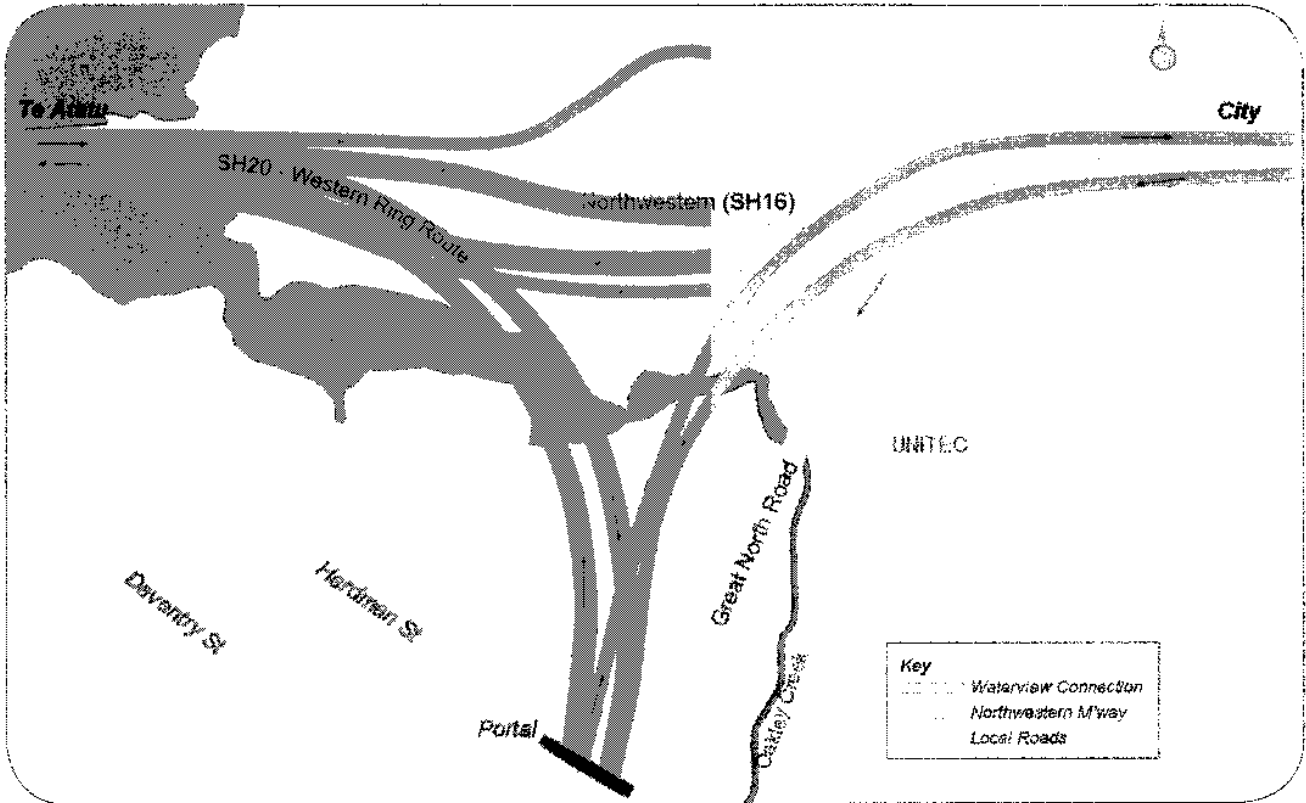
- During construction, a large area will be needed to:
 - build a ramp to get the tunnel-boring machine underground
 - provide room for other construction equipment
 - store and truck away the soil and rock coming from the tunnel.
- After construction the areas no longer required will be made available for other uses such as parks or housing.
- The southern portal at Majorca Street will allow for the proposed Avondale rail line.
- The portals will include an operations centre to manage the tunnel and traffic
- There will be two vents, one at the Mt Roskill portal and one at the Waterview portal to take the air from the tunnel.
- The vents will be about 15–20 metres tall and will push the air from the tunnel into the atmosphere.
- The vented air will meet national air quality standards and will be better than a surface option.

Aerial impression of the southern portal entrance of the North South Bypass tunnel in Brisbane Australia



You will not be able to feel or hear anything above the tunnel once it's built.

Waterview Interchange

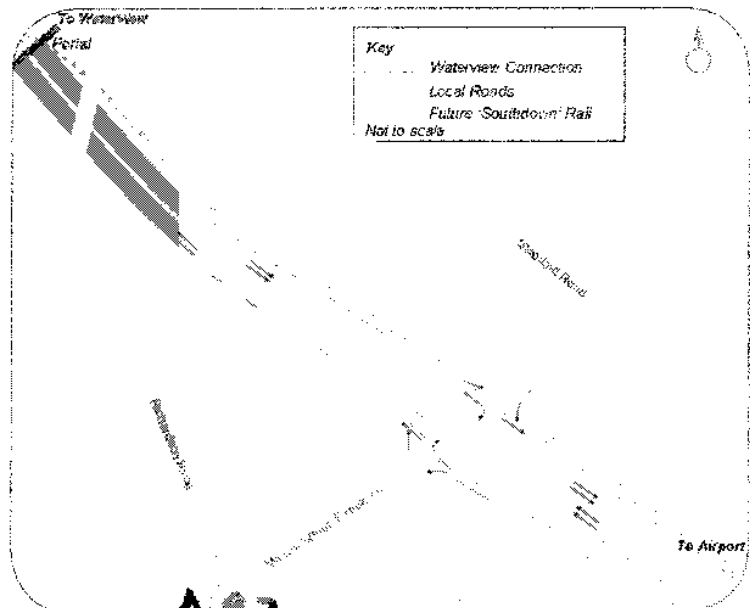


INTERCHANGES

There will be two interchanges, one at the southern end at Maioro Street between Stoddard and Richardson Roads and one at Waterview by Great North Road and the northwestern motorway.

- There is no other planned connection to SH20 between these interchanges.
- At Maioro Street Extension, traffic can enter and exit SH20 to travel either south toward the airport or Manukau City or north to SH16.
- At Waterview, traffic will be able to move on motorway-to-motorway connections between SH20 (the tunnel) and SH16 (the northwestern motorway) in both directions.
- All the current Great North Road connections with SH16 are proposed to remain.

Maioro Street Interchange



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WANT TO KNOW MORE?

Online: www.transit.govt.nz

Email: waterview.connection@transit.govt.nz

Phone: 09 368 2000 or 368 2160

Fax: 09 368 2059

Mail: Waterview Connection Team, PO Box 6345, Wellesley St, Auckland 1141.

In person: We will visit you if you live above or next to the proposed tunnel. Everyone is welcome at an open or information day (details below).

WHAT INFORMATION IS AVAILABLE?

Written Material

- This booklet
- Fact sheets on specific issues
- Technical summary reports

Online

This information is available online as well as answers to some frequently asked questions, further information and maps and images.

TALK TO TRANSIT AT OPEN AND INFORMATION DAYS

Open Days are an opportunity to view plans and talk with engineers and other experts.

Information Days are an opportunity to get general project information and meet project team members.

Event	Venue	Date/Time
Open Day	Owairaka Primary School, Richardson Rd	March 4, 3.30pm–8.30pm
Open Day	Waterview Methodist Church, Fir St	March 5, 3.30pm–8.30pm
Information Day	Owairaka Primary School, Richardson Rd	March 15, 10am–3pm
Information Day	Waterview Methodist Church, Fir St	March 29, 10am–3pm

WHAT WILL TRANSIT DO WITH YOUR COMMENTS?

All comments received will be recorded. You can comment by returning the form at the back of this booklet or attend one of the open or information days. You can write to us, email or phone us with your comments. The information will be collated and reported back to the Transit Board to aid its final decision.

Please take the time to return the comment form by April 11. Posters will be.

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COMMENT FORM

Waterview Connection Project Tunnel Proposal



Transit wants to know what you think about its preferred option of under grounding the Waterview Connection project using a bored tunnel. Before completing this form, read this brochure, or refer to the website www.transit.govt.nz or call us on 09 368 2000 if you need more information. You may attach other pages if you need more space to write.

- Support
- Oppose
- Don't Mind

the proposed tunnel option for the Waterview Connection. My comments are: _____

Tick any boxes that apply to you

- I believe my house is above the proposed tunnel
- I believe my house is next to the tunnel
- I live in the project area
- I represent an organisation that has an interest in the project. Please specify what organisation _____
- I do not live in the project area but am interested in the project because _____

Please return your completed form by April 11, 2008

You can also fax it to 09 368 2059

Or fill it out online at www.transit.govt.nz

Or email it to waterview.connection@transit.govt.nz

if you want to be included on the project mailing list please provide your name and address or email

Name _____

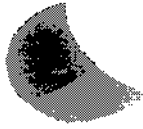
Address _____

Email _____



Thanks for taking the time to let us know what you think.

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Western Ring Route

Waterview Connection

Briefing Paper for Public Sector Transport Authorities and Agencies

Overview of the Waterview Connection Project

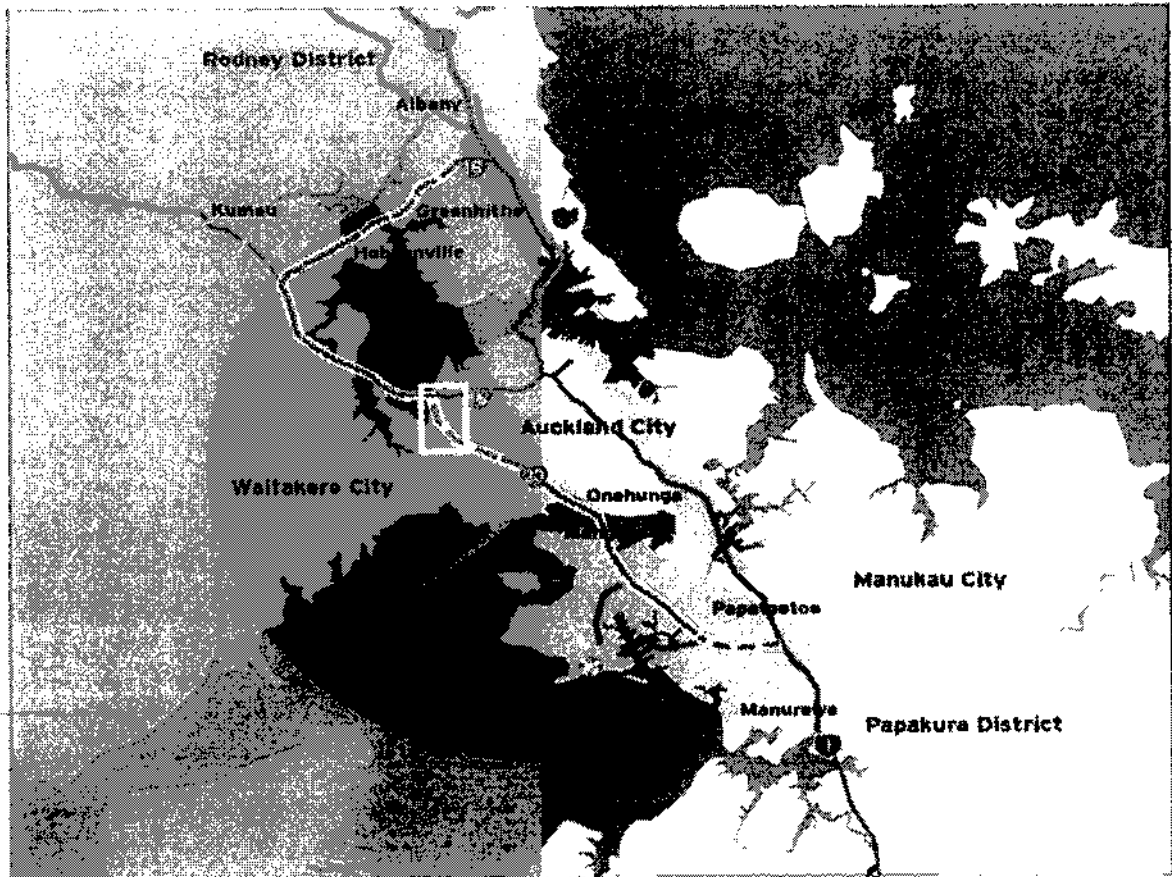


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ATTACHMENTS

Attachment 1: Ascari Partners 'Assessing the Wider Economic Impacts from the Waterview Connection'

Attachment 2: Overview of Traffic Modelling

Attachment 3: Option Evaluation Summary

1 PURPOSE

The purpose of this briefing paper is to provide the public sector transport authorities and agencies with an introduction and overview of the Waterview Connection Project from its strategic context through to the scope of the preferred project option and the issues associated with its delivery.

2 EXECUTIVE SUMMARY

The need to complete a state highway connection through the south of the Auckland isthmus to link with SH16 and the west of Auckland was first mooted in 1963 as part of the De Leuw Cather Comprehensive Transport Strategy.

Most recently the need for this route was endorsed through the South Western Transport Corridor study (2005), and the Auckland Growth Strategy. The completion of the Western Ring Route (WRR) has been a key strategic driver in Transit NZ's state highway planning and development in Auckland. The completion of the Waterview Connection has significant economic benefits for the region, by improving connectivity between existing and developing employment and residential areas and by improving the ability to transport goods and services.

Whilst the project has been discussed for many years, no designation is in place to protect a route alignment. As a consequence, the focus of Transit's work over the past 8 years has been to identify the most appropriate route to connect SH20 to SH16 and thereby give effect to the Western Ring Route and the associated investment that has already taken place.

Commencing in 2000, the process to identify a preferred alignment generated numerous options for the route. By 2003 the alignment options had been narrowed to two: a route from Avondale to Rosebank (AR1) and a route from Avondale to Waterview (AW1). By 2006 Transit had identified AW1 as its preferred option. Auckland City and Waitakere supported this in principal subject to mitigation measures. However, the ARC preferred the AR1 alignment.

Both the community and ACC requested Transit to explore further undergrounding of the route. This led to Transit focussing its investigations on three options:

1. Surface Option: Partial Cover (AW1)
2. Surface Option: Extended Cover
3. Tunnel Option

These three options were further investigated through 2007, particularly to establish reliable cost estimates. The Transit Board has considered an option evaluation report and concluded that the tunnel option is its preferred option for delivering the project. The lesser community and social disruption of the tunnel option and its lower relative cost compared with the extended cover option were significant in the option selection decision.

In making the decision to engage with the community on the tunnel as the preferred construction option, Transit has also carefully considered the functional scope of the tunnel option. Transit believes that 2x two lane tunnels keeps the network in balance. However, it is considered essential that some form of travel demand management measures are put in place to both manage congestion, particularly around the link to SH16, as well as to avoid queuing in the tunnels.

Transit announced the preferred option on 7 February 2008 and is now embarking on a communications process (from 18 February 2008) with the community and stakeholders that will conclude in April 2008. Transit hopes to confirm the selected option following this community and stakeholder feedback.

To facilitate delivering the project, the Government has established a PPP Steering Group to investigate delivery of the project by a public private partnership (PPP). This will include consideration of the preferred option for public sector delivery for comparison with any PPP approach.

3 TRANSPORT NETWORK

Regional State Highway Network

The Auckland state highway network is primarily served by SH1 through the centre of the region connecting Northland to the rest of the North Island. Regionally SH1 connects Rodney District and North Shore City with Auckland, Manukau and Franklin. Historically the linear nature of SH1 has led to development and dependence on a single corridor. The development of the ladder concept is designed to provide a more resilient network capable of providing for diversions in the event of major incidents closing links. The 'ladder' concept is effectively two parallel highways primarily SH1 and SH20 (Western Ring Route) running north and south with connections (rungs) running between them.

State Highway 1 forms the eastern side and the Western Ring Route makes up the western side of the ladder and a northern rung. The four rungs are represented by SH1 to SH20 Manukau extension to the south; a proposed east-west connection north or south of the Manukau Harbour forms the central rung; the SH16 Northwestern Motorway to the port, and the SH18 Upper Harbour Corridor connection to SH1 create the final rungs. The most northerly extension of this concept is SH16 connecting SH1 at Wellsford.

There are a number of projects required to complete the ladder diagram concept that are not provided for in the current 10-year forecast. These include:

- Waterview Connection connecting SH20 Mt Roskill Extension to the SH6 Northwestern Motorway;
- Changes to SH16 to improve freight access to the port and Mechanics Bay (Grafton Gully Stage 3);
- Upgrading SH18 Upper Harbour Highway between Albany Highway and SH1 to motorway standards;

- A new state highway connecting the SH1 Southern Motorway to SH20 South Western Motorway; and
- The additional Waitemata Harbour Crossing

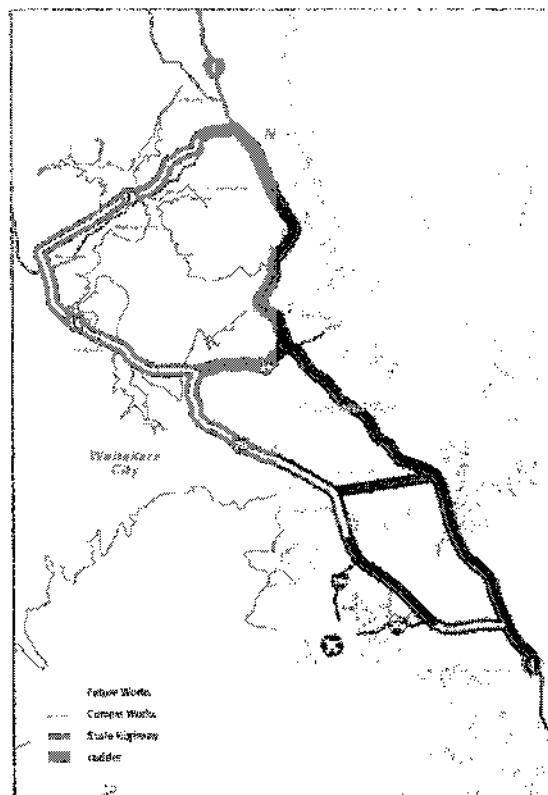


Figure 1: Western Ring Route

Away from the urban areas Transit aims to protect the connections to the rest of the country by upgrading SH1 and SH16 up to the northern boundary of the region. SH22 needs to be carefully managed in terms of supporting regional growth and providing an alternative to SH1 through the Waikato near the Bombay Hills.

When the ladder is completed, Auckland will have a state highway network that serves all of the major growth nodes and is able to meet the needs of Auckland growing economy and population.

The Western Ring Route, as a part of a wider transport network strategy, will meet the needs of commercial and industrial traffic that depends on an efficient road transport network even where air, sea and rail modes also play a part. Commuters will continue to use the network, but the new developing transport policy environment seeks such journeys to be accommodated by enhanced passenger transport and by reduction in single occupancy vehicles.

The Western Ring Route

The Western Ring Route (WRR) concept has been part of Auckland's motorway network since it was first proposed some 40 years ago in the De Leuw Cather Comprehensive Transportation Plan (1963). The initial concept was to link dormitory suburbs in the south to economically active areas in the north. This plan was

completed in 1965 and introduced the idea of a ring route around the central Auckland Isthmus and a programme of continuing motorway construction together with upgrading of important arterial routes.

Features of the WRR are:

1. The Western Ring Route connects three existing State Highways: SH20 from Manukau; the Northwestern motorway, and the Upper Harbour highway to provide an alternative link between SH1 south and north.
2. The Western Ring Route is a 48km route running through Manukau City, the central west of Auckland City to Waitakere City and North Shore City.
3. New sections are being built at Manukau and Mt Roskill and a new Manukau Harbour crossing is underway. To the north, the Greenhithe section is now open and work will start on the Hobsonville section this year.
4. Once the Western Ring Route is completed it will provide a reduced dependence on SH1 and Auckland Harbour Bridge improved connection from west and north to the airport, reduced through traffic on local roads in Mt Albert/Avondale and region-wide improvement to average traffic speeds.
5. The improved connectivity and reduced travel times will bring important economic benefits to Auckland.
6. Waterview Connection completes the Western Ring Route.

The Auckland region's population continues to grow and this has significant implications for the movement of people, goods and freight. The Auckland Regional Growth Strategy (ARGS) suggests population increases of about 850,000 over the next 50 years. A proportion of this growth will be accommodated by intensification of existing urban areas focused at key nodes, growth areas and along major road and rapid transit corridors, of which Avondale and New Lynn form a significant part.

Between 2003 and 2005 the manner in which Transit develops state highways changed in response to the introduction of the Land Transport Management Act (2003). This legislation fundamentally changed the context of land transport provision in New Zealand. In particular the Act set a new objective for Transit 'to operate the state highway system in a way that contributes to an integrated, safe, responsive and sustainable land transport system' (section 77 (1)).

In light of this Transit carried out a project review to ensure consistency with the Act and as a region. The South Western Transport Corridor Study (2005) was undertaken to review the complimentary projects required to complete the wider transport network including PT, Walking and Cycling projects. In light of the LTMA review, Transit's objectives for the Waterview Connection project were revised as follows:

- *To assist in meeting the objectives of the SW Corridor Study*
- *The Provision of an integrated, safe, responsive and sustainable land transport facility that will:*

- *Act as an alternative to the existing SH1 corridor through the greater Auckland area, linking Waitakere, Auckland and Manukau cities;*
- *Improve access from the western part of Auckland Isthmus and Waitakere City to the rest of the Auckland region;*
- *Separate through traffic (including commercial and freight) from local traffic and residential areas in the corridor (Avondale and Waterview areas); and*
- *To plan and protect opportunities to integrate the land transport facility with the proposed Additional Waitemata Harbour Crossing identified in Transit's Auckland State Highway Strategy.*

The South Western Transport Corridor Study (2005) concluded that the SH20 Waterview Connection should be completed through to the Northwestern motorway to provide additional transport capacity in the region and improve safety and assist economic development. It also identified the need for sustainable transport improvements such as greater bus priorities in the area, and the need for emphasis to be placed on pedestrian and cycle activity in the Avondale and New Lynn growth centres.

The Western Ring Route (WRR), has consistently received a high priority reflecting the strategic merit of the WRR in supporting the transportation network of Auckland, enabling a state highway network to be established thus supporting the economic development of Auckland by increasing connectivity and reducing everyday congestion across the network.

The Allen report (2004) commissioned by the AA estimated the economic benefits arising from the completion of the whole WRR at some \$800m per annum. More recently, Transit commissioned Auckland based consultants (Ascari) to undertake a detailed analysis of the economic benefits of the addition of the Waterview Connection to the WRR and overall network. Based on UK methodology the consultants estimated some \$800m to \$1.7bn of total benefits (NPV). They also estimated that up to 18,000 jobs (mainly relocated) may be generated in the areas with improved accessibility brought about by the completion of the Waterview Connection. These results are consistent with the Allen report and are in line with the existing economic growth and development frameworks in Auckland. Auckland City is looking to attract 10,000 more jobs to the Rosebank area and 70,000 more jobs to the city as a whole. The Waterview Connection provides a catalyst and is complementary to these aims.

The Ascari Partners report is provided as **Attachment 1**.

Sub Regional and Local Network

The transport network in Auckland needs to be robust and efficient in providing an appropriate and balanced level of functionality. As part of the WRR, it is intended that the new motorway will meet the needs of current future traffic demands and improve access to the airport, western suburbs and Waitakere City. As an alternative strategic route to the Central Motorway Junction (CMJ), the southern motorway and Auckland Harbour Bridge, the WRR will provide significant relief to city arterials.

This allows the opportunity to reprioritise or reallocate road space and provide greater bus priority.

The WRR has primarily been designed as a four-lane facility, which can be future-proofed to six lanes in parts depending on traffic demand and future policy decisions. The Waterview Connection, as proposed, has been designed as a four-lane highway with two interchanges (Waterview and Maioro Street) at either end. The traffic demand on Waterview is sensitive to a number of variables including the capacity on SH16 at Waterview.

As part of a wider state highway network, the Waterview Connection provides a strategically important connection to the Northwestern Motorway. From a regional perspective it facilitates the WRR movement relieving SH1, CMJ and a number of local arterials. It provides an important connection from SH20 and its catchment to the Auckland CBD and the Auckland Harbour Bridge.

One of the objectives of the Western Ring Route is to relieve congestion that currently occurs on State Highway 1 and provide an alternative route north across the Auckland isthmus. The Waterview Connection is expected to result in traffic diverting from SH1 through the Central Motorway Junction (CMJ) to the Western Ring Route. Modelling suggests that there is a net reduction in daily flow in CMJ in the year 2026 of 13,000 vehicles per day (6%).

This net reduction is a result of 32,000 vehicles per day trips diverting out of CMJ, but these being replaced by 19,000 vpd of new trips who take advantage of the reduced congestion.

The Northwestern motorway (SH16) currently experiences congestion in the morning and evening peaks. It carries in the region of 170,000 vehicles per day, which is a similar volume to the Auckland Harbour Bridge traffic volume. In the same way as SH1 is constrained by the Auckland Harbour Bridge/St Mary's Bay (VPT) capacity, traffic flow to and from Waterview Connection (SH20) will be constrained at times by the traffic volumes on SH16 between Patiki Road and St Lukes.

This is particularly true in the morning peak where traffic on SH16 queues, on a typical day, from CMJ through to Waterview Interchange and beyond. Traffic entering SH16 from the Waterview Connection is effectively joining a queue.

Preliminary traffic modelling undertaken in early 2007 indicated that there would be approximately 90,000 vehicles per day in a forecast year of 2026 using the Waterview Connection.

27,400 vpd of the 90,000 travel from the south from the SH20 Mt Roskill extension onto the Northwestern motorway heading west along the WRR. 18,900 vpd travel from the south from the Mt Roskill extension onto the Northwestern Motorway to the east citybound at the Waterview Interchange.

In the southerly direction 17,700 come off the Northwestern at Waterview Interchange from the east (city) to travel to the south and 24,900 travel from the west through Waterview Interchange to go south.

Transit is currently progressing investigations to determine the most appropriate and effective strategy to deal with these issues from a network wide perspective.

Congestion in a tunnel environment is undesirable from both a health and safety perspective. Traffic flows into and out of the tunnels will require some form of management regime that includes escalating levels of intervention and control either through Travel Demand Management (including tolling) or other fiscal measures to manage and control the level of traffic using the network. Further work needs to be undertaken to establish the management regime. This should be developed in liaison with the affected transport agencies.

Overall there are a number of complex interrelationships between SH16, SH20, CMJ and SH1. These need to be addressed at a policy level as well as at a detailed operational management level. The final form and management regime for Waterview Connection will be influenced by these considerations.

At the district level the Waterview Connection takes through traffic off local roads. The Mt Roskill section, which is almost complete, will end in a roundabout configuration at Maioro Street. Without the Waterview Connection, traffic wishing to route to the Northwestern Motorway will wind its way through local streets to access the motorway. In 2026 with Waterview Connection and other improvements in place, significant reductions in traffic demand are predicted on radial routes including:

- Manukau Road
- Gillies Avenue
- Mt Eden Road
- Dominion Road and
- Sandringham Road

The roads within the study area also experience a reduction in traffic including:

- Tiverton/Wolverton corridor
- Mt Albert Road
- Carrington Road
- Great North Road (west of New Lynn),
- Great North Road (north of Blockhouse Bay Road
- Hillsborough Road
- Richardson Road and Blockhouse Bay Road

4 OPTION SELECTION PROCESS

Since 2000, Transit has been actively investigating and planning the extension of SH20 from the Mt Roskill extension to the North-western Motorway (SH16). It is intended that the investigations will conclude by seeking a designation and application for resource consents for the preferred route option. Many alignment options have been considered and consulted upon. Technical, environmental and

economic assessments were undertaken to determine the most effective way of connecting the Mt Roskill extension to the Northwestern Motorway.

Between 2000 and 2003, a long list of some 800 routes were summarised into some 20 general route options. These were screened to identify a revised list of 12 routes. The 12 routes were subject to a more detailed assessment, which resulted in a recommendation of 4 shortlisted options (AR1, AR3, AW1 and AW4) to be carried through to the next phase of investigation. The revised shortlist was subject to further investigation and subsequently in 2003 the options were narrowed down to two alignments Avondale to Rosebank (AR1) and Avondale to Waterview (AW1). The two options were evaluated in detail. Auckland City Council and Waitakere City Council supported the AW1 alignment in principle. The Auckland Regional Council supported the AR1 alignment.

The Land Transport Management Act 2003 prescribed a new approach to the manner in which Transit develops state highway schemes. With regard to the project, Transit identified that the LTMA objectives required consideration at both a strategic level and a detailed (project) level. In order to meet with these objectives the South Western Transport Corridor Study (2003 – 2005) commenced to determine a preferred strategy for project packages for the overall corridor.

In 2006 following a full LTNZ review of the project, Transit confirmed its preferred route as AW1 for the construction of a cut and cover scheme and started consultation on this option. This consultation in 2006 gave Transit feedback from both the community and stakeholder to explore further undergrounding of the scheme, particularly to reduce social and environmental impacts. This led directly to Transit investigating both a cut and cover option with extended sections of cover and a tunnel option.

The 'extended cover' option (AW1-EC) has essentially the same alignment and construction method as AW1 (partial cover option) but with further cut and cover sections along the northern end of the project between Oakley Creek and Great North Road (known as the Waterview Straight).

The investigation of a bored tunnel option connecting Avondale to Waterview was also undertaken. This tunnel option is a more direct route generally to the north of the AW1 alignment. This option has far less construction effects on the surface with the main impacts limited to the tunnel portals and interchanges at either end of the Project.

In 2007 Investigations continued on three options based on the AW1 route option:

- Surface Option: Partial Cover (PC)
 - Surface Option: Extended Cover (EC)
 - Tunnel Option (T)
- **Partial Cover Option** – The original 2006 AW1 option consisted of 4 lanes with shoulders with the capacity to widen to six lanes within the cut and cover structure. It also had a full central interchange. This option developed for

evaluation is based on this original AW1 alignment but amended following further Transit consideration to provide a central interchange with only south-facing ramps and 4-lane capacity from the interchange to SH16. The detail of this is covered in 'Overview of Traffic modelling' in **Attachment 2**. The covered section of the route is mainly south of New North Road.

- **Extended Cover Option** – This is an amended version of Option 1 with extended section of cover north of New North Road, particularly parallel to Great North Road.
- **Tunnel Option** – This is four-lane highway formed by two tunnels each containing two lanes. The main difference to the surface options is that it follows a more direct alignment between Maioro Street and Waterview Interchange and is constructed as a bored tunnel (tunnelling without disruption to the surface). The key functional differences are that a central interchange is not included and two-lane tunnels cannot be upgraded later to three lanes.

All three options have varying degrees of functionality, social and environmental effects and costs. Each is a balance between these often-competing variables and a number of iterations have been tested as a basis of comparison.

After extensive evaluation studies on the three options, Transit selected the tunnel option as preferred for consultation. The summary of the evaluation framework is attached for your consideration in **Attachment 3**.

Some of the conclusions that this study revealed included:

- The tunnel option has less physical environment impact as it avoids surface disruption. The surface options have more extensive property acquisitions and adverse impacts on public open space, geology and landscapes.
- The social environmental impact is significantly less for the tunnel option. The surface cut and cover options are intrusive during construction and disrupt community life.
- There is a strong likelihood that the tunnel option will have greatest community support.

5 COST PROFILE OF OPTIONS

As part of the recent option investigation work Transit commissioned detailed cost estimates of all three options. These options were developed based on an assumed construction methodology that assessed resource requirements. This work informed cost, cash flow and programme assumptions. The estimating team included experienced tunnel contractors.

While estimates were prepared in 2007 costs, these costs have been escalated to 2015 to provide a risk weighted outturn cost. Project costs are presented as escalated 'expected' outturn costs. This is a change from normal practice of quoting estimates

in dollars of the day. This change has been requested by the Ministry of Transport and Treasury to provide a consistent reference point.

The benefit cost ratios for the options range from 0.9 to 1.1. The tunnel option has a traditional b/c of 1.0. This can increase with the addition of 'agglomeration' benefits that attempt to calculate the increase to productivity in the economy not captured in the traditional benefit/cost formula.

The 2015 expected out-turn costs for the options are shown in Table 1 below. These include all project costs including investigations, design, consenting, property acquisition and construction.

Table 1: Summary of Escalated Total Costs By Option

Option	2015 Expected Cost ⁽¹⁾
Option 1 Partial Cover	\$1.705B
Option 2 Extended Cover	\$1.995B
Option 3 Tunnel 2x 2 lanes	\$1.89B

(1): Assumes escalation at 3% per annum

For comparison these detailed estimates were adjusted to give cost indications of other related options of interest to the Board.

Table 2: Summary of Costs for Other Options

Tunnel 2x3 lanes	\$2.135B
AR1	\$2.700B

6 TUNNEL OPTION

The tunnel option emerged as Transit's response to the lengthy consultation with key stakeholders and the community. Our investigations have confirmed that the tunnel

option suited the expected geology of the area and would provide significant benefits including:

- Reduced environmental disturbance through the construction phase in an area with marine and land reserves and several archaeological sites
- Reduced community disruption in an area with 16% of Auckland City's population
- Reduced consent approval times
- Improved road safety

The tunnel option alignment passes through the east coast bays formation (ECBF) a generally weak rock consisting of layers of sandstone and siltstone. Other than at portals the tunnel is underneath the overlying thick basalt layer.

The length of the total scheme from Maioro Street to Waterview Interchange is 5km, with approx 3.8 km in two parallel tunnels with cross- passages for emergency egress at 120m spacing along the tunnel. Given the length of the tunnel, longitudinal ventilation systems are required in the form of ventilation jet fans in the tunnels with ventilation buildings and elevated discharge points (stacks) at the portals of between 15m – 25m in height. There would be one ventilation point for each tunnel. Ongoing air dispersion modelling will confirm the most appropriate heights of the discharge points to safely disperse the vitiated air.

Each tunnel will have an external bore diameter of 12.4m to accommodate two lanes of traffic both travelling in one direction.

The current scheme design work and cost estimation work is consistent with Transit's State Highway Geometric Design Manual (SHDGM) and follows Australasian guidelines for road tunnels of this nature.

The tunnel portals will be constructed from the surface using 'cut and cover' methodology. The total length of these is 450m each. Other than at portals the tunnel construction does not have any surface disruption to communities or the environment.

The Waterview Interchange has been designed to give priority to the WRR movements. At the Waterview Interchange there are two lanes from the tunnel that flow onto lanes 3 and 4 of SH16 travelling west. The reverse occurs in the opposite direction travelling south. The city bound (east) facing connection has been designed as a single lane feeding traffic onto the Northwestern (SH16) as a lane merge. The merit of this being formed as a 'lane gain' is still to be investigated.

At Waterview, the westbound ramps from SH20 cross the Coastal Management Area and Coastal Protection 1 Area of Oakley Creek with its proximity to the nearby Coastal Marine Area of Pollen Island.

There are a number of archaeologically important areas around Waterview Interchange. Specialist's reports have indicated that the Mill and Tannery site is the most important and should be avoided. Most of the remaining sites are middens and the likelihood of disturbance is subject to more investigation and assessment.

Construction impact at the northern portal, particularly around Cowley Street and Waterview Primary and Kindergarten will need to be carefully managed. There are growing concerns around air quality around schools and Transit has been preparing to address the community and health related concerns that will arise.

By the southern portal a designation is in place for the future 'Avondale – Southdown' rail line. Provision has been made in the tunnel portal design for this railway link to be accommodated at the southern portal. The rail line will connect from the Mt Roskill section of SH20 across the Waterview Connection at the tunnel portal. From here it will run in its own designation connecting to the North Auckland line. Discussions are ongoing with ONTRACK to ensure Transit plans do not preclude future rail investment.

Other impacts include:

- Full acquisition of 150 properties at the portal areas and strata acquisition from a further 160 properties that are over the tunnel
- Construction impacts, particularly noise, vibration and settlement

The tunnel option brings an associated set of operational issues that are relatively new to New Zealand. Establishment of a set of operational standards is required; these are being to be based on established overseas practise, particularly in Australia.

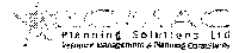
Key areas of focus for operational management are likely to be:

- Fire protection and evacuation within the tunnel
- Incident management
- Tunnel ventilation and its relationship to traffic congestion and fire/life safety
- Traffic management particularly outside the tunnel to avoid congestion inside
- Storm water and flood protection
- Power supply and energy consumption
- Emergency communications
- CCTV and incident detection
- Lighting
- 24/7 operational management from a dedicated control centre

Whole of life costs are important to consider given the essential nature of system reliability and the constraints on maintenance access. The NPV of the tunnel operating costs has been estimated at \$98m (NPV over 25 years at 10%).



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Waitemata Harbour Crossing Study

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