WHERE IS AUCKLAND'S TUNNEL VISION?

Address to

UNDERGROUND AUCKLAND SYMPOSIUM:
Urban Geoscience and Engineering for the 21st Century

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Unveiling Transit NZ's updated 10-year Auckland State Highway construction programme last August, the Prime Minister Helen Clark endorsed a tunnel for the Avondale section of the SH20 Western Ring Route as a "modern city" solution to minimise adverse impacts on the local environment and community.

She was responding to a question suggesting that a tunnel was unnecessary and would be too expensive for the benefits offered compared to a traditional surface motorway. There is no tunnel on other sections, why should the Avondale Extension be treated differently?

The question-answer was a timely prompt to ask whether Auckland should make more use of tunnels, and how their advantages might be better evaluated in the policy development and decision-making process to determine the Auckland region's transport strategy.
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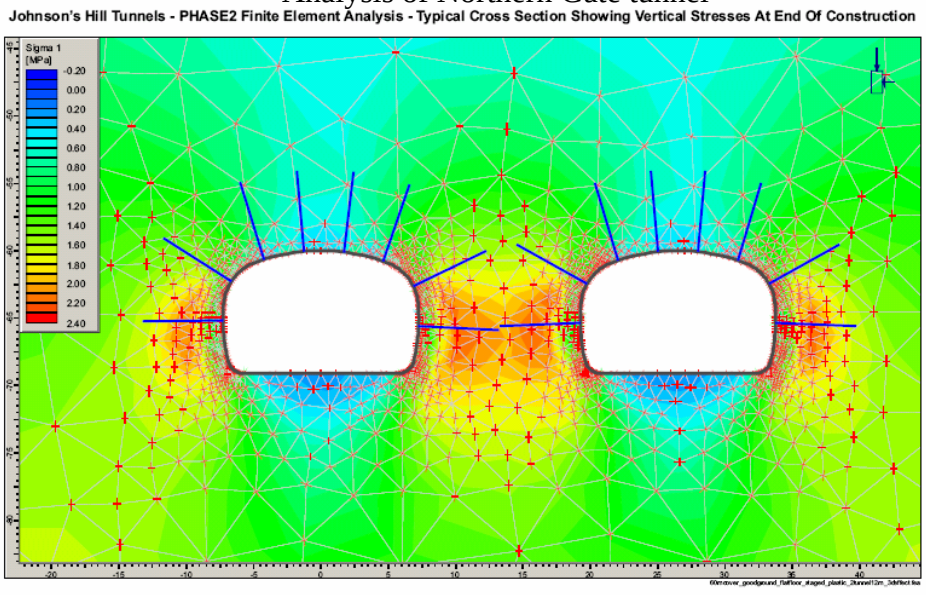
A hundred years ago, New Zealand's infrastructure pioneers didn't give a second thought to building tunnels as part of establishing the country's transport and energy infrastructure networks.

The first major tunnel in NZ was the Moorhouse tunnel excavated in 1859-67 to link Christchurch and Lyttleton. There are 26 tunnels spanning about 15 kilometres on the main trunk railway between Auckland and Wellington most of which were built between 1893 and 1908. In the South Island, the Otira rail tunnel punched through the Southern Alps early last century has had possibly a greater influence than any other single factor on the development of the West Coast.

The road header ready to start the Northern Gateway Tunnel

Analysis of Northern Gate tunnel



Wellington's urban rail and road networks are peppered with tunnels, without which moving people and goods around the suburbs would be far more costly and challenging.

Many of the major hydro projects have included long diversion tunnels. In the Tongariro Scheme there is 56 kilometres of tunnels while the recent duplication of the Manapouri tunnel involved excavation through some of the hardest rock in the world. There are many other tunnels that form part of hydro power projects throughout New Zealand.

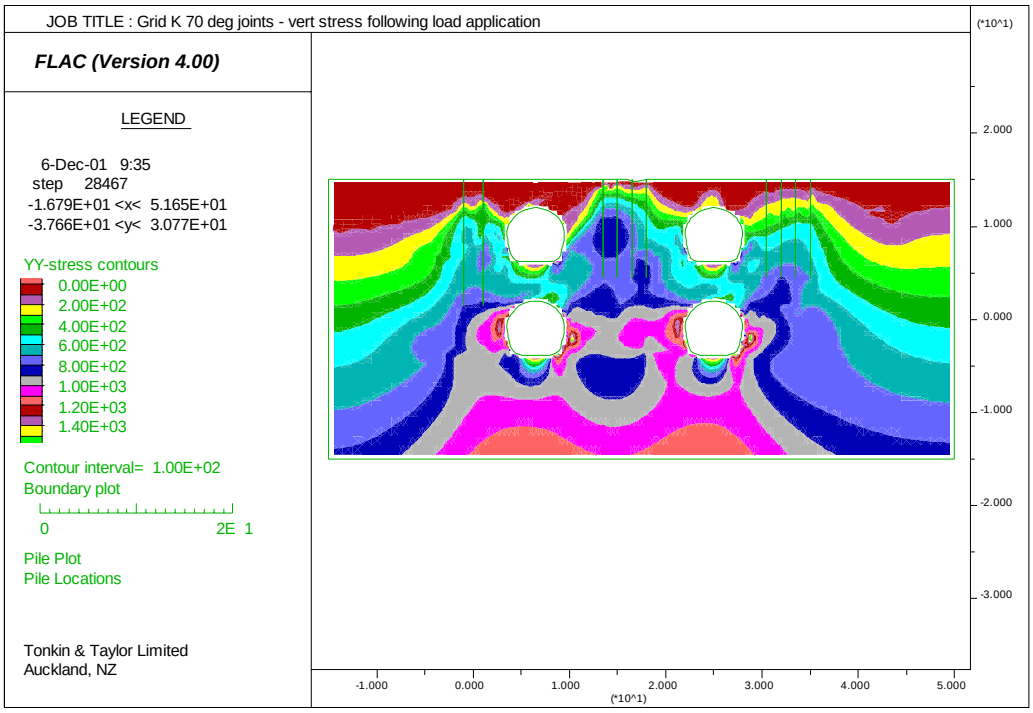
But despite significant engineering advances in tunnelling technology in recent years and a growing list of world cities making major investments in urban road and rail tunnels, Auckland has given the option scant attention until the recently approved Northern Gateway tunnels.

In many cities – Amsterdam, Boston, Melbourne, Oslo, Stockholm and Sydney to name a few – tunnels are regarded as a good answer to complex urban questions. It is now policy in a number of cities that new roads in the urban area be constructed underground. And some cities are replacing road viaducts and city waterfront routes with tunnels.

Boston recently replaced a 50-year old viaduct with an underground road system, revitalising the neighbourhood and adding around $1 billion to nearby property values. Seattle is using a tunnel alternative to revitalise its waterfront, burying a road along the waterfront (similar to Auckland's Quay Street) to open up public access to the waterfront and improve amenity values.

Sydney has recently built three underground motorway tunnels totalling 7 kilometres through its suburbs and central business district. And around the world there are literally hundreds of cities with underground transport tunnels – rail, road, trams and pedestrians.

New Zealand Consultancies have had major inputs into recently completed underground rail projects in London and Hong Kong.



It is therefore surprising that Auckland has not given more serious consideration to using tunnels to connect the missing links in the region's half-built urban motorway network, or to extend the rail and/or bus networks to serve the whole region and provide a comprehensive public transport infrastructure able to meet Auckland's growth into an impressive world city.

It is surprising because, firstly, Auckland already has an extensive tunnel network for water, sewerage and electric cables as well as three rail tunnels that have been excavated through a basic geology of basalt and sandstone with relative ease and which have proven to be largely self-supporting and long-lasting. Two rail tunnels – at Parnell and St Johns – were all built early last century and are still capable of giving useful service.

Other tunnels include Vector's 9.5 km long Penrose to Hobson Street, built following the 1998 electricity blackout, and which has a mini rail service track. The region's many kilometres of sewerage and storm water systems include large service and overflow tunnels.

In Auckland as in other cities, tunnels last a long time. Based on United States data, tunnels have an average lifespan of 100 years or more, whereas viaducts last about 50 years on average.

Secondly, and most obviously, road and rail tunnels offer Auckland potential to reclaim unused space, permit better use of scarce surface land and adjacent amenities, and, arguably, add value to the economy.

Auckland's population of 1.3 million generates about a third of New Zealand's GDP, has a third of its jobs and businesses and is growing by about 25,000 people and 18,000 motor vehicles every year. All this activity is taking place in an area that comprises just 2% of New Zealand's land area.

As more and more people and businesses crowd into Auckland, tunnels are an obvious option for ensuring people and goods can move swiftly and conveniently around the region. They suppress noise and other pollution, and are a good answer for Auckland's desire to improve the quality of life and add amenity value to the city and region.

Transport benefits include reduced disruption and ability to avoid environmentally sensitive landscapes – typified in Auckland by the time and cost it is taking to design and build the 4.5 km section of the SH20 motorway at Mt Roskill to avoid damaging a volcanic cone and realign numerous local road intersections. Total cost of the Mt Roskill project is $240 million of which the construction cost is just $170 million. In addition to the original designation land, Transit also brought about 400 properties.

In contrast, a tunnel could arguably have left the volcanic landscape untouched, reduced local disruption, reduced the need to buy considerable property, reduced noise and vibration and allowed the local community to 'reclaim the streets' in the suburbs in a way that won't be possible with a motorway running through the community.

Similarly, the CMJ motorway could have been re-configured with a dedicated tunnel to transfer traffic from the Auckland Harbour Bridge to south of Newmarket, avoiding the numerous exits and entries that cause traffic congestion for over 35% of bridge traffic that travel south of Newmarket and greatly improving grades for heavy commercial vehicles.


Strategic Road Transport Network
By 2010
Northgate
Albany
SH18 Corridor Improvements
• Northwestern to Northern Link
• North to Port Link
• Spaghetti Junction Improvements
• Grafton Gully Upgrade
Glenfield
Takapuna
Cross Harbour
Birkenhead
WAITEMATA HARBOUR
Westgate
Immersed Travelator
Eastern Corridor
HBTC
Herne Bay
Te Atatu
Eastern Corridor
Newmarket
St Johns
Ponsonby to Newmarket
Albert
Alpers Tunnel
Eastern Corridor Extension
SH20 Extension
Mt Wellington
Hillsborough
Western Corridor
Mangere
MANUKAU HARBOUR
Botany Downs
Manukau
Airport
SH1 to SH20 Link
AUCKLAND BUSINESS FORUM

A potential option of short tunnel sections for traffic on the Eastern Arterial would have provided a route from Stanley Street through to Purewa Creek, thereby removing the need to drape the motorway along the foreshore and across Hobson Bay, possibly removing many of the objections to this vital link for the Auckland Ring Road.

With the need to add ventilation, systems to detect and control fire, allow for people to escape from the tunnel and emergency services to access, the direct cost of road tunnelling is calculated to be about two to three times as expensive as a surface road construction. However, when the social, environmental benefits and lower property and consent process costs are put into the evaluation a tunnel may in fact have turned out to be more competitive and socially acceptable, than persisting with defacto eastern corridor on existing surface roads.

A tunnel may certainly have reduced the time taken to obtain consents. The Vector power tunnel and the Hobson Sewer tunnel both took less than 12 months to proceed through all phases of Consents, which is possibly the fastest ever for a major inner city project.

In the absence of a regional tunnel vision and transport strategy that gives serious consideration to the option, Auckland is also missing out on the opportunity to offset and share costs with other services.

When the Vector tunnel was built, the chance was lost for a services super-tunnel to include sewer, water supply, stormwater, communication cables as well as a possible cross-Auckland rapid transit route linking central Auckland City with Manukau City.

Auckland's many tunnel options

Over the years there has been lots of talk about Auckland's potential for road and rail tunnels but little action. Following the pattern occurring in other world cities, however, Auckland is starting to turn talk and interest in underground transport tunnels into specific proposals and projects. They include:

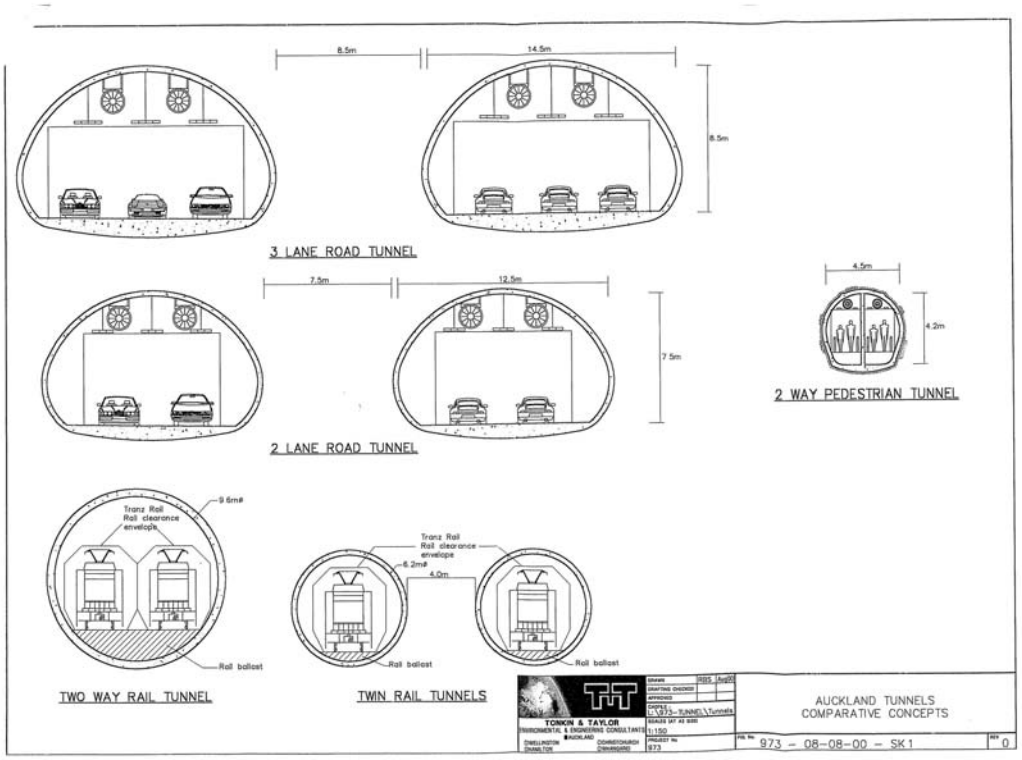
- The twin two lane Northern Gate Tunnels currently about to commence construction through Johnsons Hill north of Waiwera as part of the extension of the SH1 Northern Motorway beyond Orewa. This will be open to traffic in early 2009.

- Up to $350 million for a 3-lane tunnel project for northbound traffic to the west of Victoria Park Viaduct, due for completion about 2010.

- Tunnels of between $700 million and $1.1 billion – depending on the route yet to be selected - along the SH20 Avondale Extension of the Western Ring Route, due for completion by 2015-16.

- New Lynn Station - $140 M – provides opportunity to reconnect the community that is dislocated by the rail through the Town Centre.

- A $3 billion-plus 6-lane tunnel under Waitemata Harbour. The current proposal envisages an immersed-tube tunnel running under the harbour from the SH1 Northern Motorway to Wynyard Wharf. This would link with cut-and-cover tunnels southbound to Halsey Street and northbound to Beaumont Street.



The harbour tunnel investigation option includes a format of twin 3-lane tunnel cells, but doesn't rule out three 2-lane cells, with at least 2 lanes dedicated for buses. However, the project is not included in Transit's current 10-year programme, and there has been no transport demand assessment done on where the crossing should be located, or whether it should be a bridge or tunnel; all this despite current projects underway on SH20 (e.g. the Avondale Extension) and SH1 (e.g. Harbour bridge to City) being interdependent with 3rd harbour crossing options.

Nonetheless, as Auckland gets more adventurous, farsighted and strategic in exploring tunnel options for the region, the Waitemata Harbour project holds out the possibility for some innovative and potentially exciting tunnel possibilities that deserve serious consideration in its next study phase.

For example, regardless of what developments take place in enhancing the region's public transport services, Aucklanders car ownership is expected to double in the next 20 years and trucks and vans will continue to be the region's predominant freight mode. An option for inclusion in a harbour tunnel is therefore a tolled 2-lane cell dedicated for commercial traffic – this is a tunnel option currently being developed for under the Hudson River in New York in an area where there is no rail freight network.

Yet another obvious possibility for the harbour tunnel is to include a rail option (commuter & freight) as part of an extended public transport network plan for the whole region, and which could be built in stages over the balance of the century.

Another option is to include a pedestrian travelator in the project; an innovation which would enable commuters to 'walk' (and/or cycle) across the harbour in 10 minutes. Travelators are in common use for getting quickly between terminals in large airports, and in cities with sub-zero winters for long periods where large underground shopping complexes are linked together by travelators extending kilometres over several city blocks.

Other tunnel options for building a more modern Auckland include:

- Extending the Britomart underground railway station line into a tunnel running under Albert Street and eventually linking back to the western line at Mt Eden, and creating a modern commuter loop rail system for central Auckland.

- Using modern tunnel bore technology to put Auckland's rail network underground (and extend its reach to urban areas not currently served, such as the populous suburbs of North Shore and the eastern suburbs) and offsetting the cost with other infrastructure likely to be expanded over the next 50 years – Vector electricity and other utility cables and pipes.

- Undergrounding the rail line to Waitakere to create a modern urban rail system and free-up the surface alignment for the rapidly expanding freight and commercial traffic servicing west Auckland's expanding business community. This could include under-grounding the rail through New Lynn to enable reconnection of the centre with new development to the south.

- An underground rail system to Waitakere might also be linked to a power cable tunnel under consideration for a possible substation in Henderson, partly to meet demand in west and north Auckland and partly to provide a strategic alternative to just relying on the Harbour Bridge cable for carrying power to the North Shore and Northland.

- A sewer tunnel outfall on the North Shore as part of the upgrade for the sewage treatment plant.

- A sewer storage tunnel beneath Auckland to reduce potential for overflows to harbour.

- Putting Quay Street along Auckland's waterfront into a tunnel which also includes space for cables and other additional utility services required for the waterfront development project currently getting underway.

In a number of cities in the United States where waterfront roads have been put into tunnels – San Francisco, Boston and Seattle – significant social and economic benefits have resulted: reduced congestion, reduced noise, higher downtown property values and increased waterfront visitor spending. In some cases, the higher property values have been used as a source of funding for the tunnel.

Development of tunnel cost-benefit analysis techniques

The main reason that tunnels have not been given serious consideration in Auckland over the past 30 years or more, despite clear evidence of environmental, social and economic benefits, is because the traditional cost-benefit appraisal used in assessing motorway schemes has not taken these factors into particular account.

Tunnels are disadvantaged in a cost-benefit appraisal because construction is inevitably more expensive than surface options, and increasing the 'cost' is likely to include having to spend money up front (e.g. on a tunnel boring machine).

Because road building decisions have traditionally been made on a 'least-cost to build' scenario, the greater engineering uncertainties in predicting the cost of tunnels compared to a surface route means that even though there may be environmental and social benefits, tunnels have not been able to hold their own against the so-called 'hard' figures of surface road construction engineering costs. In short, environmental, social, traffic disruption and even economic factors have not been part of the cost-benefit appraisal process.

However, the transport reforms introduced in 2003 offer new hope for tunnel proposals and a way out of the dilemma posed by the limitations of the cost-benefit approach.

The new LTMA criteria will help Auckland's tunnel vision

At the heart of the Land Transport Management Act 2003 is a new system for appraising transport infrastructure projects based on cost-effectiveness (instead of cost-benefit) criteria, where decisions are based on schemes achieving a set of pre-defined objectives (assisting economic development, safety and personal security, access and mobility, public health and environmental sustainability).

Under this approach it becomes a matter of public policy that in decisions about transport infrastructure certain assets are worth protecting in their own right, and the solution that can best meet the pre-defined objectives for the least cost is then deemed to be the preferred option.

For example, a tunnel may achieve a set of pre-defined objectives that a surface road cannot – e.g. to improve regional access and mobility, assist Auckland's long-term economic development, and also to assist safety and personal security in the local community, preserve a treasured volcanic cone, and reduce air pollution and noise for nearby residents. The protection of sensitive flora and fauna were major factors in the decision to tunnel a section of the Northern Gate project.

While the Prime Minister and other individuals have signalled support for greater consideration to be given to tunnels, the recently updated regional transport strategy has missed an opportunity to define clear policies on when road and rail tunnels could or should be used to protect a wider range of social and environmental assets, and also when a tunnel (as opposed to a surface route) might enhance the region's economic development.

The evolving road tunnel networks in cities such as Oslo and Sydney are based on a holistic policy and decision-making process aimed at balancing many different aspects – cost, safety, technical feasibility, environmental impact, economic benefit and social acceptability.

The key question in such projects is whether the benefits of reducing environmental and social impacts outweigh the additional costs in building and operating the tunnel. Such decisions are often characterised by weighing the 'hard' monetary figures of construction against the 'softer' qualitative values embracing sub-objectives such as:

- **Economic:** Improving cross city travel times and reliability for commercial traffic, including bus and taxi services;

- **Social:** Making local streets more pleasant for local traffic and residents – i.e. avoid disruption, noise, vibration and improve access, amenity and safety;

- **Environmental:** Protecting physical and cultural assets – i.e. urban forms, volcanic cones, pa sites, flora and fauna, communities of interest.

Weighted against these benefits of a wider role for tunnels and an Auckland tunnel policy and strategy, is the issue of not just how costs should be assessed but also who pays.

Since the extra costs of a tunnel option will have to be justified not only by the specific benefits involved, but also take into account what other roading or rail schemes might have to be deferred or cancelled to provide the extra funds, it is logical to look to other sources of funding.

For example, if the objective were to protect a volcanic cone should there be a claim against the budget of the Ministry of Conservation? If the quality of life of a local community is at risk from a surface route (disruption, noise etc), could or should a local authority allocate rate money? Or should all users be required to pay when they use the tunnel?

Sources of alternative funding other than the roading account for covering the social and environmental benefits of a tunnel over a surface road include using tolls and private funds, and also the proceeds from commercial developments above the tunnel.

In conclusion – it's time to plug a gap in the region's transport plan

In the efforts underway by many world cities to modernise themselves in a way that allows sustained economic and social growth while protecting and enhancing quality of life, greater consideration is being given to tunnel alternatives. Auckland has been slow to grasp this opportunity even though the ground conditions are generally highly favourable to tunnel excavation.

If Auckland is to lift its sights and seek to become a truly world city then, as has been said many times, it needs to build modern, state-of-the-art infrastructure and services that provide an environment of certainty and high quality for businesses and other residents – and making that effort should include strategic consideration to making more use of tunnels.

However, tunnel proposals have to overcome a number of hurdles to be accepted, including a reliance - at the moment - more on subjective public and political pressure than the "objective" but largely untested cost-effectiveness appraisal system of the LTMA (as opposed to the benefit-cost appraisal system previously used by Transit NZ, and which clearly disadvantaged tunnels).

As Auckland comes to terms with its aspirations to be a top world city while at the same time retaining a physical and social environment of high quality, a useful policy option for the region (and central government) could be to promote a consensus (and get some serious policy work done) on what aspects of the environment and quality of life should be protected from the adverse effects of new infrastructure, and from that assessment, identify cost-effective tunnel solutions.

Auckland's regional councillors are clearly involved in setting such priorities, so it is hoped that this discussion paper will help encourage them to lead a debate and seek to create a constructive tunnel vision that adds value to the region's efforts to elevate Auckland's status as a top world city to live and locate innovative and growing businesses.

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