F3 TO SYDNEY ORBITAL LINK STUDY

summary report

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RTA

DOTARS

DEPARTMENT OF TRANSPORT AND REGIONAL SERVICES

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SKM

Part A
Summary

Foreword

This is the summary report on a study to identify a preferred option for a new National Highway link through northern Sydney between the F3 Sydney to Newcastle Freeway and the Sydney Orbital.

The new link is intended to replace the existing interim National Highway, which runs along Pennant Hills Road. Pennant Hills Road suffers from traffic congestion and high crash rates as well as causing severe amenity impacts for adjacent residents. The new link is intended to be constructed after the Westlink M7 opens.

Consultants Sinclair Knight Merz were commissioned in early 2002 to carry out the study for the Australian Government. The NSW Roads and Traffic Authority (RTA) managed the study. The study team reported to a Steering Committee of the Department of Transport and Regional Services (DOTARS), the RTA and the NSW Department of Transport, now Department of Infrastructure, Planning and Natural Resources (DIPNR).

The study includes a range of assumptions about the development of the transport system of Sydney. While most of these assumptions were drawn from public documents at the time of analysis they are not necessarily current proposals or policy views of the NSW or Australian Governments.

The study was strategic in nature and examined broad corridors and options for a new link. These were assessed for their feasibility in terms of:

- Traffic and Transport – safety and network capacity, focusing on freight, commercial and inter-regional travel;
- Social effects – amenity, severance and property ;
- Economic effects – project and community costs and benefits, including the effects of tolls; and
- Environmental impacts – air quality, flora and fauna, noise and heritage.

A comprehensive community and stakeholder involvement program was an integral part of the study. The views of the community have played an important part in formulating the study's recommendations.

The study has found that rail is unlikely to meet the future inter-regional transport task even if major rail infrastructure upgrades occur. The study also found that the Type A Purple option linking the F3 with the M2 Motorway best meets National Highway objectives and is justified on social, economic and inter-regional transport grounds. The study recommends that the Purple option be the preferred option for the new National Highway link.

The next step should be the development of a concept proposal based on the Purple option. This should be the subject of further consultation with the community and an Environmental Impact Statement (EIS).

Contents

Introduction....2
The Current Situation....3
Key Issues of Growth and Sustainability....5
Rail Freight and Public Transport....7
Need for a New Link and Its Objectives....8
Options Development and the Corridor Types....10
Transport Assessment of Corridor Types A, B and C....12
Social Effects Assessment of Corridor Types A, B and C....14
Environmental Assessment of Corridor Types A, B and C....15
Economic Assessment of Corridor Types A, B and C....17
The Type A Options....18
Transport Assessment of Type A Options....20
Social and Environmental Assessment of Type A Options....21
Capital Cost Estimates and Economic Assessment of Type A Options....22
Community Consultation....23
The Recommended Purple Option....25
Recommendations and Way Forward....27

Introduction

This study builds on the work and findings of previous studies which have investigated improvements to the main northern transport corridor.

Background and Purpose of the Study

This feasibility study was funded by the Federal Department of Transport and Regional Services (DOTARS) and managed by the New South Wales Roads and Traffic Authority (RTA). Sinclair Knight Merz was commissioned to undertake the study. The study area is shown in Figure 1.

The purpose of the study was to identify a new high standard transport link between the F3 and the Sydney Orbital and replace Pennant Hills Road as the interim National Highway. The study timeframe is 20 years.

Prior to 1994 there was no designated National Highway route through Sydney. The National Highway terminated at Hornsby in the north and at Crossroads (near Liverpool) in the south. In 1994, the Cumberland Highway was declared part of the National Highway system. Since then the Australian Government has provided funding for significant upgrading of this link, and has been exploring opportunities to develop an alternative National Highway through Sydney which is of motorway standard.

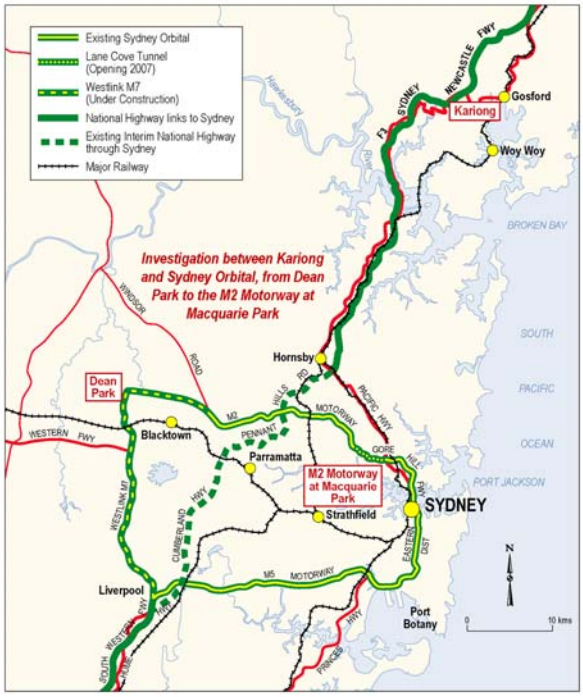


Figure 1: The Study Area

One of those opportunities is the Westlink M7 (previously known as the Western Sydney Orbital). Construction of Westlink M7 has commenced and is anticipated to be completed in 2006. The Westlink M7 and part of the M2 Motorway will collectively form part of the Sydney Orbital and replace the Cumberland Highway, as the National Highway through Sydney.

The completion of the Westlink M7 will leave the remaining section of Pennant Hills Road between the Sydney Orbital and the F3 as the only section of the National Highway through Sydney that is not motorway standard.

Approach to the Study

The stages and the key steps in undertaking the study are shown in Figure 2.

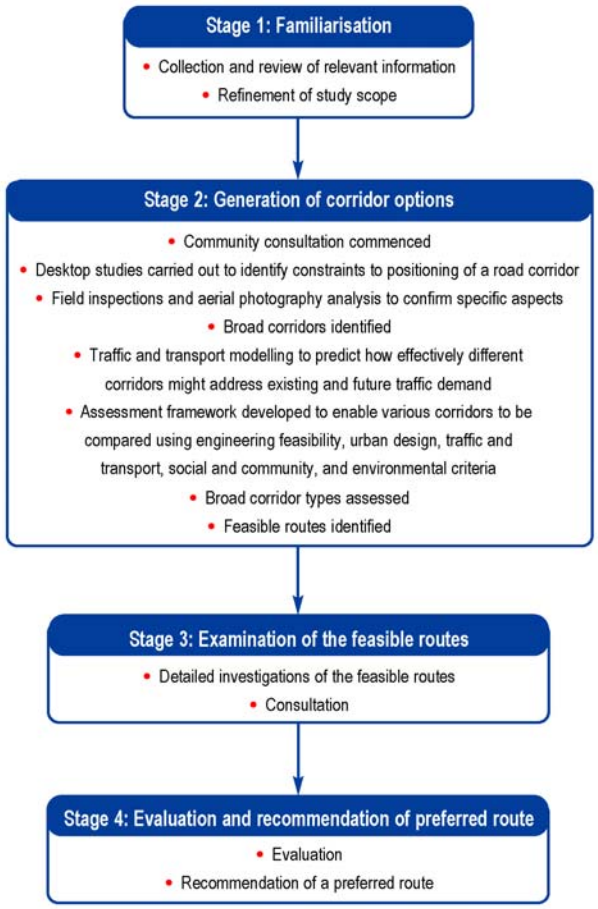


Figure 2: The Study Process

The Current Situation

The large and increasing volumes of traffic including heavy trucks travelling day and night along the interim National Highway have caused a significant loss of urban amenity along Pennant Hills Road. Of the 8,800 trucks using Pennant Hills Road each week-day, about half are six, eight or nine axle articulated trucks carrying 40 gross tonnes or more.

Travelling Conditions

Pennant Hills Road

The existing interim National Highway route through Sydney runs partly along Pennant Hills Road. North of the M2 Motorway, Pennant Hills Road operates as a major arterial road in Sydney's transport network carrying up to 75,600 vehicles per day (see Figure 3). Inter-regional and long-distance through-traffic volumes make up about 23% of total daily traffic. Pennant Hills Road is generally six traffic lanes wide. There are 22 sets of traffic signals over the 9 kilometre section from the M2 Motorway to the F3 interchange at Wahroonga.

Average peak travel speeds on Pennant Hills Road are often below 25 km/h at Pennant Hills and can be as low as 14 km/h. The road is congested during commuter peak periods and business hours which results in unreliable travel times and can lead to major disruptions to inter-regional traffic movements.

Pennant Hills Road and the Pacific Highway are expected to experience continuing traffic growth. Since movements are at capacity during most peak periods, traffic volumes will grow outside the current peak periods and into business hours.

F3 Freeway

Pennant Hills Road joins the F3 Freeway at Wahroonga. F3 is the National Highway route linking the Hunter region and the Central Coast to Sydney. Traffic to/from the Central Coast makes up about 60% of the total daily traffic on the F3. Long distance traffic including heavy vehicle traffic with origins and destinations north of the Central Coast make up about 40% of the daily traffic volumes.

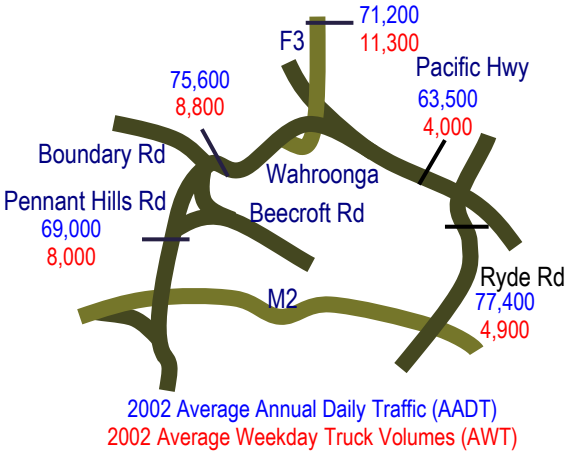


Figure 3: Existing Traffic Volumes on Major Arterials on the Northern Sydney Road Network

Traffic along the F3 corridor has been increasing at an average rate of about 3% per year over the last ten years. Average annual daily traffic (AADT) at the Hawkesbury River Bridge was 71,200 vehicles per day in 2002. During some holiday periods traffic flows are much higher than the average daily flows and severe congestion can occur.

Freight and Public Transport

Rail Freight

The current rail share of the contestable freight market on the Main North Line is 5 million net tonnes per year or about 14% of total freight moved (by net tonnes) in the corridor.

About 50% of rail freight traffic on the Main North line can be classified as through Sydney traffic, that is traffic on trains without an origin or destination in Sydney.

Rail's traffic growth is restricted by the curfew on rail freight movements on the Sydney network during commuter peak periods and other capacity and service reliability limitations on the Main North and North Coast lines.

Rail services are constrained on the Main North Rail Line

Road Transport

Supporting freight and commerce is a key objective of the National Highway network. The F3 carries an average of 11,300 trucks each weekday at the Hawkesbury River bridge, including more than 5,500 articulated trucks, many of them undertaking long-distance trips during night time hours.

Pennant Hills Road carries about 8,800 heavy vehicles each weekday, including 4,400 articulated trucks. About 20% of these heavy vehicles are servicing local shops, commercial and industrial centres in Hornsby and the Hills Districts. The Pacific Highway south of Wahroonga carries up to 4,000 heavy vehicles per day, including about 1,200 articulated trucks.

Pennant Hills Road carries at least twice the total number of heavy vehicles as the Pacific Highway.

About 25% of trucks using Pennant Hills Road have origins or destinations north of Newcastle, in northern New South Wales and in Queensland.

Public Transport

Rail is the principal public transport service in the corridor.

Overall, rail currently has a 43% share of all peak period trips between the Central Coast and Sydney.

Limitations to increasing rail's mode share include:

- capacity limitations, particularly on the rail network between the Central Coast and the Sydney CBD (these limitations also handicap rail freight movements); and
- dispersed origins/destinations on the Central Coast and in Sydney, and especially in western Sydney, making it difficult to provide high levels of service through good interchange facilities.

Bus

Most of the bus services along the corridor are provided by private bus operators. Most train stations are fed by bus services.

The local bus services experience delays caused by the volume of traffic on the road network. Access to rail stations by bus, car, bicycle or on foot is affected by traffic congestion in the corridor.

There are a number of private long distance bus and coach services linking Sydney with the Central Coast and more northern destinations, including a service to Sydney Airport. Very few buses use Pennant Hills Road.

Pedestrians and Cyclists

The road and public transport infrastructure system must cater for the requirements of cyclists and pedestrians. They are small groups compared with the majority of travellers, however, they represent important groups contributing to the sustainability of the Sydney urban system.

Pedestrians and cyclists often face long delays waiting to cross the Pacific Highway or Pennant Hills Road at signal-controlled crossings. This reduces the attractiveness and efficiency of sustainable modes of transport in the area.

Loss of Urban Amenity from External Effects

Road congestion and high traffic volumes on the interim National Highway have substantial negative economic effects on road users and industry and impose high external costs on the community. Road congestion is also detrimental for the environment, as it encourages traffic to use unsuitable local roads, damages the quality of life of people who live nearby, wastes fuel and increases vehicle exhaust emissions and greenhouse gases. It also leads to "peak spreading" even when this involves unwanted adjustments of travel, work and production schedules and practices.

The social and environmental external effects of the high traffic volumes on Pennant Hills Road are described by some people as intolerable. Road users are subject to serious congestion-induced travel delays, and residents living along Pennant Hills Road suffer noise and exhaust fumes, community severance and a high risk of road crashes.

Crash rates on Pennant Hills Road and Pacific Highway were significantly higher than the average across the Sydney Road Network between 1999 and 2001. The recorded three-year average crash rate in the National Highway corridor is nearly double the Sydney arterial road network average. The number of serious and fatal road crashes along Pennant Hills Road north of the M2 was 114 in 2001.

Key Issues of Growth and Sustainability

The population of the Sydney / Central Coast region is predicted to increase by about 20% over the next 20 years. There will be continued pressure for increased provision of transport infrastructure.

Population and Employment Growth Assumptions

The population of the Sydney Region is forecast to grow from 4.3 million in 2002 to just over 5 million by around 2021 and 6 million by around 2042.

The growth in the outer areas is likely to be focussed on the north-west, the south-west and the Central Coast. These areas are directly served by the F3 and the Sydney Orbital. A large proportion of growth (up to 50%), would take place as infill in the already developed suburbs.

By 2021, with a forecast total Sydney Region population of 5 million people, the distribution would have shifted from today, with 2.25 million people east of Parramatta (45%), 2.35 million west of Parramatta (47%) and up to 400,000 on the Central Coast (8%).

It will be important for each region to have a balance of jobs and workforce. To achieve this, it will be important for jobs to be created in the outer areas. This is particularly important on the Central Coast to limit the need for commuter movements on the F3 corridor.

The land use assumptions used in this study are based on the NSW Department of Infrastructure, Planning and Natural Resources' (DIPNR) population and employment forecasts associated with the Urban Development Program (UDP) Scenario A. Scenario A is the medium growth forecast.

Future Transport Demand

Increasing transport demand is mainly determined by growth in population and economic activity. Future estimates of population and employment are only able to be made reliably for up to 20 years in the future. Hence DIPNR's 2021 forecasts of population and employment are the basis for the analysis of future transport demand in this study.

Over the next 20 years, road travel demand in the corridor is likely to grow by at least 30%, even if integrated land use – transport planning, significant investments in rail, and travel demand management policies are implemented. Growth on the Central Coast would put increasing pressure on the F3. Growth in the north-west sector would increase pressure on the arterial roads in northern Sydney that feed the F3.

Total road traffic demand along the F3 corridor is projected to increase at an average rate of around 1.5% per year over the next 20 years. This is about half of the rate experienced over the last ten years, mainly as a result of the expected slowdown in the rate of growth of the Central Coast.

An average traffic growth rate of 1.5% per year would result in average daily traffic flows on the F3 reaching 94,000 vehicles (AADT) at the Hawkesbury River bridge by 2021, compared with 71,200 vehicles today (2002). Without a new link, traffic on Pennant Hills Road would increase from 75,600 vehicles per day (AADT) at present to 96,400 vehicles per day by 2021.

By 2021, the volume of freight vehicles on the F3 is calculated to reach 21,600 trucks per average weekday compared with 11,300 trucks per day now and about half of these trucks would be articulated vehicles.

By 2021, the volume of average weekday freight vehicles on Pennant Hills Road is expected to reach 16,700 trucks compared with 8,800 trucks today. About half of these trucks would be articulated vehicles. This increase would mainly occur outside the morning and evening peaks, at weekends and during the night-time.

The total freight moved in the corridor is expected to grow at 3.25% per year up to 2021.

By 2021, freight moved by articulated vehicles on the F3 is forecast to have increased from 32 million tonnes today to 60 million tonnes. That would represent an average of over 160,000 tonnes each day by road, assuming rail freight maintains its current 14% mode share in 2021 (Base Case).

By 2021 rail would be expected to move about 10.5 million tonnes in the corridor compared with the 5 million tonnes moved today, assuming a 3.25% per year growth to maintain its market share. However, if rail continues its long term trend of 2% volume growth per year, rail's market share would fall to about 11% in 2021. This would result in an additional 600 heavy vehicles using the F3 each day in 2021 compared with the Base Case.

Demand Management

Government places importance on demand management policies to reduce Sydney's dependence on cars and car use.

This study investigated some key aspects of demand management in the context of achieving sustainable infrastructure development within the National Highway corridor over the study's 20 year time frame. Although it is difficult to reduce the overall amount of travel which will occur in a given region, demand management measures can be effective in reducing the amount of travel made in cars, particularly during the peak period.

The main policy levers government has to influence behaviour and achieve sustainability are:

- land use planning (population and employment distribution and density)

- pricing (eg. road pricing, tolls and parking fees)
- type of infrastructure provision (eg. better use of existing infrastructure, public transport priority, more public transport services)

Land Use Planning

Land use planning can make significant contributions to reducing car dependency:

- ensuring population and employment density along the main transport corridors is high enough to support early provision of public transport services, especially rail;
- population and employment distributions may be used to reduce the average trip length on the network, which has been increasing over recent years with urban sprawl.
- matching residential and employment generating land uses within each region, to reduce the amount of external trips;

Land use development on the Central Coast and in western Sydney are important inputs to this study. The population and employment growth assumptions used are based on DIPNR's medium forecasts for a metropolitan population of 5 million people by 2021.

With the projected population and employment growth in the corridor, it is likely that road transport will maintain or even increase its high modal share over the next 20 years.

Road Pricing

Road pricing is a policy option which can have significant and efficient outcomes depending on objectives. Road tolls are one possible form of road pricing.

The application of a toll to a new National Highway link would reduce the economic efficiency of the investment but improve the affordability of the project. It could be argued that a toll on the National Highway is counter productive to the Highway's economic objectives. This may be mitigated by adopting a toll regime that encourages heavy vehicles to use the tollway. Without a toll however, the new link may not be affordable.

Broader road pricing schemes may need to be applied over a wide area of Sydney to be effective. Such schemes may emerge and be more acceptable in Sydney with the development of the tollway network.

Use of Existing Infrastructure

Management measures which may be considered for congested corridors such as the interim National Highway include priority to buses and heavy vehicles via Freight or High Occupancy Vehicle (HOV) lanes and signal priority.

The RTA regularly reviews the use of these measures as part of its ongoing traffic management strategy. They do not appear to be a suitable solution for the interim National Highway, due to land use development and intersection constraints along Pennant Hills Road.

Providing Rail and Bus Infrastructure

There is little doubt that providing new road infrastructure would attract traffic to the new investment, mostly redistributed traffic from the rest of the network. The study assumed major investments in rail capacity would take place in the corridor in line with Action for Transport 2010. This Base Case was tested without this high investment in rail to measure the traffic effects on the National Highway.

The study went further, by analysing a future where the Action for Transport 2010 rail investments targeted for completion beyond 2010, were brought forward to 2010, without any investment in a new National Highway link.

This would result in increased rail usage, but not sufficient to address the overall need for travel demand expected in the corridor. The overall mode share in the corridor would remain much the same. The analysis indicates that it would not be possible to achieve the project objectives by upgrading public transport alone.

Transport Network Improvement Assumptions

Almost 90% of the total city-wide passenger kilometre travel is undertaken by car. This study has assumed that travel behaviours are unlikely to change significantly over the study's 20 year horizon. Furthermore the study has assumed that there would be no significant change in transport pricing and continued supply of fossil fuel for transport.

The study has also assumed major road and rail network improvements would take place over the next 20 years, including:

- F3 widening to 6 lanes by 2011 (Wahroonga to Kariong)
- Westlink M7 and Lane Cove Tunnel operating by 2011
- M2 widening to 6 lanes, east of Windsor Road by 2021
- Main North Rail Line upgrade, Hornsby–Hawkesbury by 2011;
- Main North Rail Line upgrade, Hawkesbury–Wyong by 2021; and
- Parramatta–Chatswood line by 2011.

The study found that these improvements would result in:

- No significant change to rail freight modal share in the corridor (ie rail freight growth would keep pace with road freight growth estimated at an average of 3.25% pa over the period);
- Rail passenger mode share in peak periods would increase slightly from 2011.

Rail Freight and Public Transport

Rail and Public Transport improvements are important in the corridor but they would not remove the need for a new National Highway link.

Rail Freight's Targets in the Corridor

The rail infrastructure improvements assumed in the Base Case for this study are consistent with rail maintaining its current market share.

Provided substantial investment in rail infrastructure improvements are implemented in a timely way, beyond that required to hold market share, forecasts prepared for NSW RailCorp (previously Rail Infrastructure Corporation) suggest rail freight volumes could increase at a rate of 6% per year from 2011, taking rail's freight market share from 14% today to 23% in 2021.

To achieve these higher growth targets significant investment would be required above that assumed for the Base Case, including a new freight line through Sydney to Port Botany to allow freight trains a 22 hour a day service in the corridor.

Effect of Meeting Rail Freight Targets on the Future National Highway Truck Volumes

Achieving a 23% mode share by 2021 would have the effect of shifting 20,000 tonnes of general freight from the National Highway each day. This would be equivalent to reducing the number of articulated trucks using the F3 from an estimated 10,800 per weekday to about 9,800 per weekday in 2021. (This can be compared with about 5,600 articulated vehicles using the F3 each weekday today.) This would represent about 9% of the total number of articulated trucks per weekday projected to be using the F3 in 2021.

The effect on Pennant Hills Road would be similar. Today, Pennant Hills Road carries about 4,400 articulated vehicles each weekday. In 2021, this would increase to about 8,300 per weekday. The higher rail share would reduce this daily number by about 700 articulated vehicles, that is by about 8% in 2021.

This estimated shift to rail would be equivalent to about 4 years truck growth in the corridor.

Public Transport Only Scenario

A "Public Transport Only" option was considered as an alternative to the investment in a new road link between the F3 and Sydney Orbital. The effects of this option on changes in road travel demand and modal shares in the corridor were assessed and compared against the new link's objectives.

The 'Public Transport Only' option is based on the implementation of all planned rail infrastructure improvements plus additional expenditure in lieu of expenditure on the road link. The long term rail proposals for the Sydney area were advanced to be implemented by 2010. These proposals improve public transport access to western and north western Sydney and include:

- North West Rail Link (Epping to Rouse Hill)
- Full Chatswood to Parramatta rail link
- Main North Line upgrade Hornsby to Wyong
- Quadruplication of Strathfield-Hornsby line.

It also included completion of the bus Transitways listed in Action for Transport 2010.

In addition, two completely new train services linking the Central Coast with Parramatta and Western Sydney were included in the 2021 network. The proposed new train services would require up to 12 new 4 car trains (Central Coast – Parramatta service) and up to 10 new 4 car trains (Epping – Emu Plains service).

Although the rail developments overall would lead to a major increase in rail travel on the rail network – passenger numbers would be 21% higher in 2011 and 28% higher in 2021 – there would be no significant difference on modal shares for trips with an origin or destination in the corridor.

While investment in rail to the level assumed in the study's Base Case and for the Public Transport Only scenario, would significantly add value and benefit for rail users across the rail network, such investment would not service the expected growth of passenger transport demand in the corridor nor relieve traffic impacts to residents along Pennant Hills Road. Overall, rail would not meet the future transport task even if these infrastructure upgrades occur.

Passenger rail services between the Central Coast and Sydney are constrained by the Main North line's capacity limitations and its steep, circuitous alignment, especially on the climb from the Hawkesbury River to Cowan.

Need for a New Link and Its Objectives

The Study found that a new National Highway link is needed on social, amenity, economic and long-distance transport grounds.

National and State Development

The Sydney region is economically the most valuable region in Australia. It has a higher proportion of international business than other State capitals. It also generates the largest number and the highest value of employment positions. This employment growth leads to a growth in population and consequently Sydney is growing more quickly than the rest of the country. Efficient transport systems are an essential requirement to service this economy and its development.

The majority of commercial transport demand in NSW and south-eastern Australia is served by road freight, mostly with origins or destinations in Sydney. Without a National Highway system that is up to the task of linking together the coastal areas from the Hunter to the ACT, the economy of Sydney, its surrounding region, and the State as a whole could be compromised.

Regional and Local Needs

The existing volumes of trucks (8,800 per weekday) on Pennant Hills Road, of which about half are 40 gross tonne or larger articulated vehicles are vital to our daily life and the economy. However, they impact significantly on the urban fabric and the people who live and work along Pennant Hills Road.

Pennant Hills Road has one of the highest concentrations of trucks on the National Highway network. The road functions as an urban arterial road, but it is not designed for continued use as a National Highway. The conflicts between traffic and local amenity are significant.

There is an existing social and amenity improvement need for a new link. Once Westlink M7 is completed in 2006 there will be an even greater need.

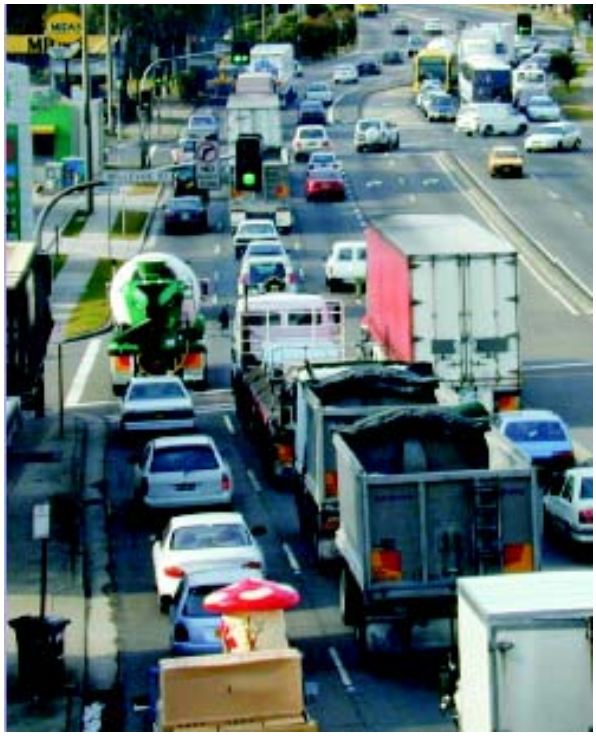
The interim National Highway would be unable to effectively service future growth in long distance travel as congestion and traffic delays increase out of commuter peak periods and into business hours of the day. Increasing congestion on Pennant Hills Road will constrain the interim National Highway's function as a reliable route for inter-regional traffic.

A new F3 to Sydney Orbital link would provide a continuous motorway standard for commercial vehicles travelling between Sydney and the north.

Public Transport's Role

Rail and bus public transport play an important part in the corridor. However, general road traffic volumes are expected to increase significantly (by 30%) by 2021 compared with today, and truck traffic volumes are likely to nearly double on the National Highway over this period.

Even with significant investment to allow an increase in rail's share of freight traffic and to maintain its passenger mode share, rail and public transport would not be able to meet the expected increase in long distance transport demand in the corridor.



Traffic on Pennant Hills Road

By 2011, without a new F3–Sydney Orbital link, traffic volumes on Pennant Hills Road would reach the capacity of the interim National Highway over most periods of the business day, resulting in greater levels of traffic congestion and worsening social, environmental, economic and urban amenity impacts than today.

National Highway Objectives

The National Highway system, including the interim National Highway on Pennant Hills Road, is funded by the Australian Government to promote national and regional economic development. The objectives of the system are to:

- **Facilitate overseas and interstate trade** and commerce;
- **Allow safe and reliable access** by a significant proportion of Australians to major population centres;

- **Minimise the cost** of the National Highway to the Australian community;
- **Support regional development**; and
- Contribute to **ecologically sustainable development**.

Planning and Project Objectives

The NSW Government sets guidelines on the acceptability and assessment of major transport projects in NSW. The need for the project and how well the project compares against its planning and project objectives are major considerations in the assessment process.

Planning Objectives

The following planning objectives which a new National Highway link would need to satisfy were developed for the purpose of this study:

- **Alleviate existing poor travelling conditions** (traffic congestion and high number of road crashes) on the interim National Highway and the surrounding network.
- **Improve local amenity** (reduce traffic, air and noise emissions; reduce severance) for people living and working along Pennant Hills Road.
- **Improve travel reliability** and reduce operating costs of long-distance commercial and freight transport on the National Highway.
- **Serve the future growth needs** of long-distance transport.

Project Objectives

From an assessment of the current conditions and issues in the corridor, project objectives were developed:

- **Provide a high standard link** that integrates with the regional transport network.
- **Minimise social and environmental impacts** during construction and operation.
- Provide opportunities for **improved public transport**.
- **Be economically justified** and affordable to government.

AusLink Initiative

Following the commencement of this study, the Australian Government announced AusLink, its new framework for planning and funding transport infrastructure in Australia. A Green Paper was released for comment in November 2002. The AusLink funding process has not yet been finalised, however it is likely that any F3 to Sydney Orbital link resulting from this study would be subject to this new process.

Options Development and the Corridor Types

Three broad corridor types were investigated for a new link – Type A, B and C.

Development Process

The processes used in developing options for potential new National Highway corridors between the F3 and the Sydney Orbital are summarised in Figure 4:

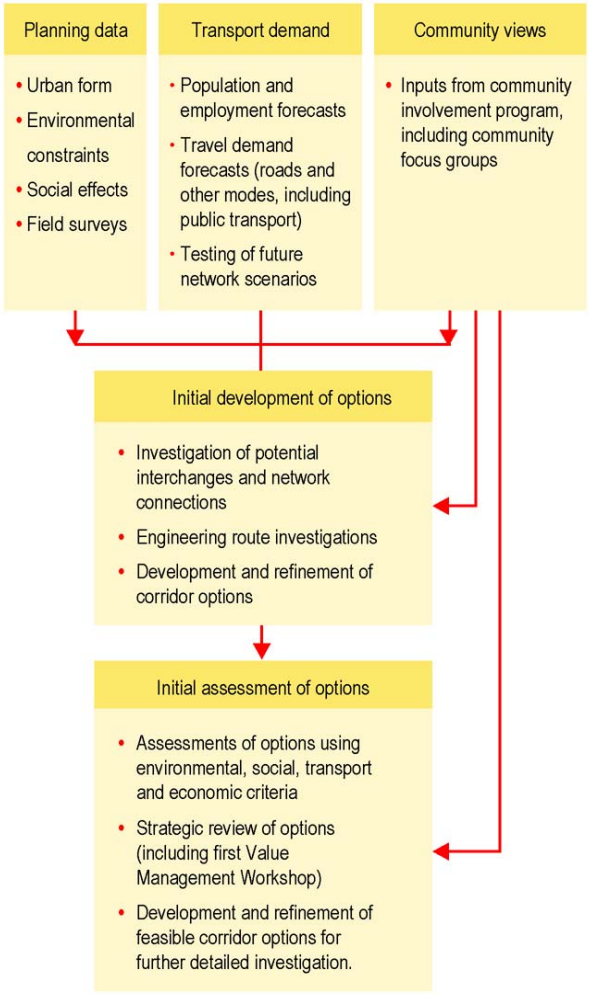


Figure 4: Process to Develop Corridor Options

The land-use opportunities and constraints that primarily influenced the identification of corridor options included:

- the directness of accessibility to growing or existing industrial and employment zones;
- the potential to integrate with the planning of new urban release areas and;
- the avoidance of impacts on existing urban areas or areas in advanced stages of planning, particularly residential areas, and
- the avoidance of impacts on national parks, nature reserves, regional reserves and land zoned for environmental protection purposes.

Broad Corridor Types

Potential options were classified into three groups, or types, of corridors, referred to in this report as Types A, B and C and shown in Figure 5, to understand their relative advantages and disadvantages with respect to the objectives of a new National Highway Link.

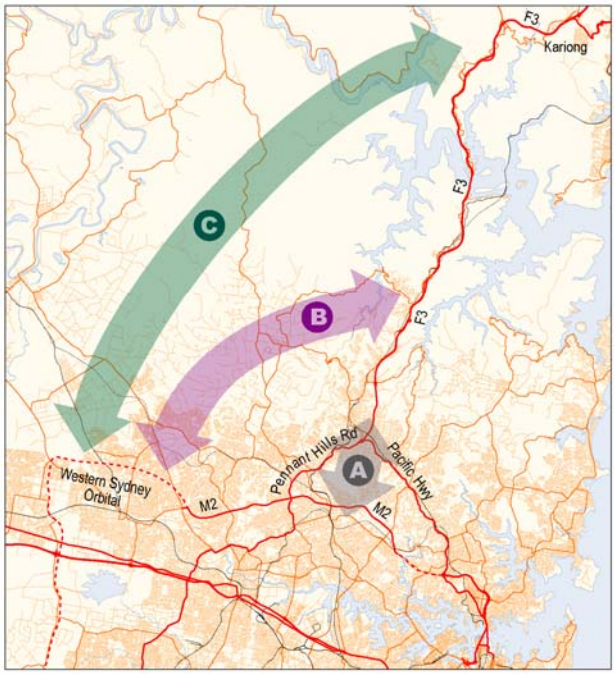


Figure 5: The Broad Corridor Types Investigated

Type A Corridors

Type A corridors include the more easterly options, which generally form a southern extension of the F3 corridor to connect with the M2 Motorway.

All the Type A options would be mostly in tunnel under existing roads and/or residential areas. Some Type A options would involve a tunnel under the Lane Cove River and Lane Cove National Park.

Type A corridor options range from an easterly alignment connecting with the M2 Motorway at Macquarie Park, to a westerly alignment, generally following Pennant Hills Road and connecting with the M2 Motorway at the existing M2/Pennant Hills Road Interchange.

Type A corridor options would continue to use the F3 as the major road transport link between Sydney and the north.

Type B Corridors

Type B corridors include options within the central study area that would connect the Sydney Orbital between Pennant Hills Road and Dean Park to the F3 between Wahroonga and the Hawkesbury River. The options would bypass the developed areas of Hornsby.

Type B corridor options would generally consist of above ground sections and tunnels under existing residential areas. Most options would cross the Berowra Creek Valley with major bridge structures. Some options would include tunnels under the Mt Colah area and Castle Hill, Cherrybrook and West Pennant Hills residential areas.

Type B corridor options would continue to use the F3 corridor, north of Mt Colah/Berowra as the major road transport link between Sydney and the north.

Type C Corridor

Type C corridors include the more westerly options which would connect the Sydney Orbital between Windsor Road and Dean Park with the F3 north of the Hawkesbury River.

All Type C options would consist of above ground and tunnelled sections, and a major new crossing of the Hawkesbury River. It is also assumed that some tunnel sections would be required under Marramarra National Park. Most options would involve above ground sections through the Schofields/Kellyfield/Annangrove area and run along parts of the existing Old Northern Road alignment in the Glenorie area. Some options would also include tunnels under existing residential areas at Baulkham Hills and Castle Hill.

Type C options would form a second major road corridor between Western Sydney and the north. Traffic would continue to use the F3 corridor north of Mt White as the major transport link between Sydney and the north.

Strategic Assessment of Corridors

The Type A, B and C corridors were assessed at a strategic level against the project and National Highway objectives using the following assessment framework:

Transport – how well would each corridor satisfy the transport objectives of a new National Highway, including consideration of freight demand, capacity, safety and effects on public transport?

Social – what would be the likely social effects of each corridor, including effects such as severance, properties required, local impacts on communities and consequent changes to land use?

Environmental – how would the environmental impacts of each corridor compare, and would there be any unacceptable impacts?

Economic – would the corridors represent a sound investment of the community's resources, taking into account the benefits to travellers and associated costs, and how easy would they be to fund?

The key findings of the assessment are described on the following pages.

Transport Assessment of Corridor Types A, B and C

Type A options would perform better than Types B and C in relation to the link's transport objectives. Type A options would remove more traffic from Pennant Hills Road and best satisfy the National Highway objectives. All options would provide a safer and more reliable route than the present interim National Highway.

Transport Performance of Corridors

The great majority of traffic on the interim National Highway and approaching Sydney on the National Highway (F3) from the north is headed for destinations within urban Sydney, rather than seeking to pass through or around it.

In considering the transport performance of the various options, the following effects are apparent:

- the further west the new link, the less traffic will use it;
- the closer the new link is aligned to Pennant Hills Road, the more traffic relief to Pennant Hills Road;
- the closer the new link is aligned to Pennant Hills Road, the more truck traffic will use it.

Project Transport Objectives

Relieve congestion on the interim National Highway

Pennant Hills Road is currently congested with a traffic volume of about 75,000 vehicles per day. The Type A corridor would provide the most traffic relief to Pennant Hills Road and would achieve a reduction in traffic volume of the order of 20% to 40% in 2021.

The Type B and C corridor provides less relief. For both Type B and C corridors, the options which connect to the Westlink M7 furthest to the west, perform the poorest. For all Type A, B and C corridors, the traffic relief would be less if the new link was tolled.

About 20% of trucks currently travelling on Pennant Hills Road have local origins/destinations. The remaining 80% of these trucks would potentially use a Type A tunnel link. The Type A corridor would reduce truck traffic on Pennant Hills Road by about 65%. Type B and C corridors would remove less than half as many trucks as Type A. This is because the majority of trucks on Pennant Hills Road and the F3 have destinations in the east, centre and in the south of Sydney, which are not as well served by Type B and C corridors.

Improve travel reliability on the new National Highway

With all of the new corridors proposed to be built to freeway standards, there would be no noticeable difference between them. All of the corridor types over the next 20 years, would operate at acceptable levels of service within their capacity over the timeframe of this study.

Serve future growth needs of long-distance traffic

Long distance freight traffic is forecast to double during the next 20 years. Most long distance traffic on the F3 has an origin or destination within Sydney. The proportion of long distance traffic that would use each option over the next 20 years, depends on how conveniently they serve major commercial and industrial areas of Sydney. Type A corridors would be used by the highest percentage of long-distance traffic and Type C by the least.

Provide opportunities for improved public transport

All three corridor types would make car travel more attractive and result in some reduction in public transport usage. Type A corridors provide sufficient spare capacity in Pennant Hills Road to add bus or High Occupancy Vehicles (HOV) lanes should they be appropriate. Type B and C corridors do not provide such an opportunity.

National Highway Transport Objectives

Facilitate overseas and interstate trade and commerce

Type A corridors would provide more direct access to Sydney's commercial and industrial areas, interchange facilities, and ports and airport than Types B and C .

Safe and reliable access to major population centres

Safety and reliability of travel on the National Highway would be improved by reducing both the amount of congestion and the volume of traffic on Pennant Hills Road. Type A corridors would have the greatest benefit.

Table 1: Transport Performance of Types A, B and C Corridors

	Corridor Type		
Transport Criteria	**A**	**B**	**C**
Daily Traffic Relief to interim National Highway (1)	20,000 to 40,000	2,000 to 12,000	4,000 to 10,000
Daily Truck Relief to interim National Highway (1)	4,000 to 11,000	Up to 3,000	Up to 2,000
Potential for HOV and bus lanes on Pennant Hills Road	Yes	No	No
Crash reduction on Pennant Hills Rd(2)	10-15/ year	5-10/ year	0-5/ year
Improved Access to Sydney Ports and Airport	More direct	Circuit-ous	Circuit-ous

(1) AADT in 2021, untolled link.

(2) Crashes refers to those involving fatalities or serious injuries.

Social Effects Assessment of Corridor Types A, B and C

Type A options would best improve local amenity along Pennant Hills Road. Overall, Type A options would also have the lowest adverse social impact in the study area.

Impact on Communities

Corridor Types A, B and C all have the potential to impact negatively on the social structure of those communities they pass through.

Type A options are mostly in tunnel. Direct impacts on nearby properties and severance effects would be small. Most impacts would be limited to access points, tunnel portals, interchanges, and tunnel ventilation stacks which would be generally located in already heavily trafficked areas.

Recent experience in Sydney has demonstrated the willingness of the community and government to place higher monetary values on the avoidance of social and environmental impacts from new surface roads in built-up areas, compared with the significantly higher costs of tunnel construction.

Types B and C are longer and would include above ground sections traversing both rural and residential built environments. They would be new routes in relatively lightly trafficked areas and have the potential to adversely impact a large number of people. New severance issues may be introduced to communities, particularly by the longer Type C corridor options. The presence of an above ground freeway standard road, and associated ramps, interchanges and infrastructure, would be likely to have a significant impact on the community character and amenity of these areas.

Type A, B and C corridors would all involve long tunnelled sections and would require the use of ventilation stacks. The locations of stacks would need to be carefully considered during any EIS in order to minimise impacts on the surrounding environment and residential areas.

Property Effects

The likely numbers of properties affected along each corridor are shown in Table 2. Type A would effect the least and Type B the highest number of properties.

Urban Design Effects

The Type A corridor would result in the lowest impacts in relation to urban design criteria, including maintaining existing townscape qualities and impacts on existing and future town land uses. The Type C corridor would have the least acceptability with the most changes to existing land use patterns.

Local Amenity Along Pennant Hills Road

The greater the reduction of truck and vehicle volumes along Pennant Hills Road, the better the local amenity would be for people living and working along Pennant Hills Road. The benefits would include reduced noise levels, improved air quality and a lower level of community severance.

Type A options would offer the greatest improvements in amenity. They would provide the largest level of relief to Pennant Hills Road by removing 20-40,000 vehicles per day, including up to 11,000 trucks in 2021 if untolled. In comparison, Type B and C options would remove less than 12,000 vehicles per day, including up to 3,000 trucks if untolled.

Reduced levels of traffic along Pennant Hills Road would also allow for urban design and landscaping initiatives to be carried out, further enhancing amenity.

A reduction in severance would mean improved accessibility for local residents, including pedestrians and cyclists. Currently pedestrians face long delays waiting to cross Pennant Hills Road, which serves to discourage pedestrian access to shops, railway stations and bus stops.

Table 2: Summary of Social Effects of Corridor Types

	Corridor Type		
Social Criteria	**A**	**B**	**C**
Potential adverse changes to the character of communities	Low	Medium-high	Medium-high
Change in severance, traffic emissions including noise impact along Pennant Hills Road	Significant improve-ment	Some improve-ment	No noticeable change
Number of properties affected:-			
• Directly on the surface(1)	20-130	80-450	300-600
• Indirectly(2)	350-600	10-1400	10-700
Acceptability of urban design character changes(3)	High	Medium	Low

(1) Full or strip acquisition.
(2) The number of properties located over tunnel whose title would be effected.
(3) In terms of maintaining existing townscape quality and minimising adverse change to existing and future land use patterns.

Environmental Assessment of Corridor Types A, B and C

Type B and C corridors are longer than Type A, and would affect more, bushland, waterways and areas of National Parks. Overall, Type A options would have less environmental impact than Types B and C.

Land Use

Type A options would be mostly in tunnel under existing roads and residential areas, with surface works only at connecting points and possibly some mid-route points.

Type B options would involve above-ground and tunnel sections, passing through rugged creek valleys, bushland, semi-residential/rural areas and tunnels under developed residential areas.

Type C options would traverse similar land types as Type B, and also involve a connection to the F3 in rugged terrain near Mt White, a new crossing of the Hawkesbury River and a tunnel under Marramarra National Park.

Impact on Threatened Fauna Species

The preliminary assessment based on National Parks database indicates a low to medium probability of significant impacts to threatened fauna species. The Type A corridor would have the lowest impact. The B and C corridors are judged to have higher probable effects, given their longer surface lengths.

Impact on Bushland and National Parks

In terms of land area affected Types B and C corridors could have a significant impact on bushland and National Parks.

Some of the Type A options could have some impact on Lane Cove National Park. Type C corridor would have a significant impact on Marramarra National Park. The biggest impact would result from Type B through Berowra Valley. The community has expressed a strong view against any option that adversely impacts on Berowra Valley and its bushland.

Water Quality

All three corridors would traverse waterways, with varying impacts. Some easterly Type A options would traverse the Lane Cove River Valley, where a tunnel would be required to pass under the river. The use of a tunnel would result in minimal direct impact on water quality and ecology.

The Type B corridor would traverse the Berowra Creek Valley, where a bridge would carry the new link. This would have the potential to impact on existing water quality and ecology. Other small creeks and waterways exist along the corridor, where similar issues could be encountered.

The Type C corridor would involve a major new crossing of the Hawkesbury River and the impact on water quality and ecology would need to be well managed. The Type C corridor would pass over many other small creeks and waterways with the attendant risk of impact on the many small creeks and tributaries running along its length.

Air Quality

By providing a free-flowing route, compared to the existing congested stop-start conditions experienced along Pennant Hills Road, reductions in vehicle emissions would be achieved with all options.

Air quality along Pennant Hills Road would be improved most with the Type A corridor, due to the greatest level of traffic congestion relief it would provide. In terms of overall emissions, Type A would have the lowest number of vehicle kilometres travelled and therefore lower vehicle exhaust emissions, with Type C the highest.

Landscape and Visual Impacts

The Type B corridor would have the higher visual impact on the Berowra Creek Valley and Berowra Valley Regional Park. The impacts of a high level bridge and approaches across the valley would result in a high and unacceptable level of visual disturbance. Similarly, the Type C corridor would have high impact on the Hawkesbury River and Marramarra National Park.

Heritage

There would be a higher risk of impact on indigenous heritage locations from the construction of the Type C route compared with Type B and A. Furthermore, the Type C corridor would traverse areas that are subject to Native Title claims.

Table 3: Summary of Environmental Impacts of Corridor Types

	Corridor Type		
Environmental Criteria	**A**	**B**	**C**
Impact on Bushland/National Parks	Low	High[1]	High
Potential Impact on threatened fauna species	Low	Medium	Medium
Effect on Water Quality [2]	Low	Medium	Medium
Effect on Air Quality [3]	Improve most	Improve slightly	Improve slightly
Impacts on character landscape [4]	Low	Medium	High
Heritage effects – probable impact on known sites	Low	Medium-high	High

(1) In the opinion of most community respondents, the impacts on Berowra Valley Regional Park were considered unacceptable.
(2) In terms of major waterways crossed.
(3) Based on congestion relief.
(4) Adverse landform modifications and reduced landscape character.

Economic Assessment of Corridor Types A, B and C

Overall Type A corridor options would have the best economic performance, against both project and National Highway economic objectives. Type A options would be easier for government to fund than Types B and C.

Economic performance of Corridors

Economic benefits of transport corridors are measured by determining the total change in motorists' travel time and distance travelled. This is measured across the whole road network, because some impacts from redistributed traffic may occur on other parallel routes. The benefits are compared with the whole-of-life costs of the corridors to assess their overall value.

Type A, B and C corridors would all result in a slight increase in the number of trips compared to the situation without the project. However, economic benefits accrue to the additional trips, as well as to existing trips on the network. This has resulted in benefit-cost ratios (BCRs) in the range of 1.2 to 1.4 for four lane Type A corridors, assuming the link is untolled.

Type B and C corridors would have relatively less economic benefits than Type A corridors because they attract less traffic away from the congested Pennant Hills Road and hence there will be less travel time saved. In addition, Type B and C corridors would have substantially higher construction costs than Type A.

A cost-benefit analysis of Type B and C corridors compared to Type A corridors (all four lane projects) indicates that they would have much lower economic performance than Type A corridors. In other words, in all cases the benefits associated with Type B and C corridors would be less and would be outweighed by the construction costs of Type B and C corridors. This is summarised in Table 4.

Combining these results, Type A corridors would be the only ones with a BCR likely to be above 1. Types B and C corridors would have much lower BCRs, in the range of 0.1 to 0.4.

All of the corridor Types A, B and C would have other less tangible benefits such as encouraging regional development, improving the safety and reliability of travel on the National Highway, and improving access to major ports and airports. Type A corridor options would have the greatest benefit in improving access to ports and airports due to their central location in Sydney.

Financial performance of Corridors

The financial performance of the corridor types relates to their construction and operating cost, ability to stage delivery, and the ability of government to recover any revenue from them. Generally, the lower cost options, are more financially attractive. All three Types A, B and C corridor options would cost in excess of $1.5 billion (2003 dollars) to deliver, making funding the project a significant issue. Type A options would have lower construction costs, and hence would be easiest to fund.

Due to the inclusion of several kilometres of tunnels in all corridor options, operating and maintenance costs for the project would be significant, estimated at up to $15 million per annum.

For all Type A, B and C corridors it would be possible to place a toll on traffic using the corridor. Type A corridors are likely to generate the highest revenue, due to their higher traffic volumes.

Table 4: Economic Performance of Types A, B and C Corridors

	Corridor Type[1]		
Economic Criteria	**A**	**B**	**C**
Strategic Capital Cost Estimate ($million 2003)	1,500 to 2,200	1,600 to 3,400	2,700 to 3,600
Operational Cost Estimate ($million 2003)	7 to 10 per year	6 to 15 per year	12 to 16 per year
Benefit Cost ratio	1.2 to 1.4	0.1 to 0.4	0.1 to 0.3
Support regional development	Yes	Yes	Yes

(1) These results are as determined for the strategic comparison of the alternative corridors. Later investigations of the specific Type A options resulted in changes to those costs (see Table 7). It would be expected that a more detailed investigation of the Type B and C corridor options would result in similar changes to the cost and economic performance of those corridors.

The Type A Options

The assessment of corridor types led to the selection of corridor Type A options for further investigation. Four feasible route options were identified within the corridor Type A category: Purple, Blue, Yellow and Red

Preference for Type A Corridor

The Type A corridor is preferred on transport, social, environmental and economic grounds. It would also best serve the National Highway objectives.

Development of Type A Options

After the selection of Type A as the preferred corridor type, a more detailed investigation was carried out of the corridor, feasible options within it, and their impacts. Type A route options from the strategic corridor assessment were further refined into Purple, Red, Yellow and Blue options shown in Figure 6.

Most of the length of these options would be in tunnel. There would be a need for surface works associated with new interchanges and on/off ramps connecting the new link with the existing road network.

The Purple Option

The Purple option assumed for analysis would have a northern connection with the F3 at Wahroonga and a southern connection to the M2 at the existing Pennant Hills Road/M2 interchange. Its alignment would generally follow Pennant Hills Road.

The Purple option would comprise dual 2km tunnels from the F3, a short (500 metres) section where it would daylight in an open cut adjacent to the railway corridor and in the vicinity of Brickyard Park at Thornleigh, and dual 5.5km long tunnels to the M2.

The interchange at the northern end, at Wahroonga, would directly connect the new link with both the F3 and Pacific Highway/Pennant Hills Road. It would cater for all existing traffic movements between the F3 and Pennant Hills Road.

A new link/M2 interchange would allow for all traffic movements.

The Blue Option

The Blue option would have a northern connection with the F3 at Wahroonga, and a southern connection to the M2 at the existing Pennant Hills Road/M2 interchange. It would generally follow a route to the east of Pennant Hills Road.

The main dual tunnels would be approximately 8km in length.

The Blue northern interchange would allow for all existing traffic movements between the F3 and Pennant Hills Road. The southern interchange would be similar to that for the Purple option.

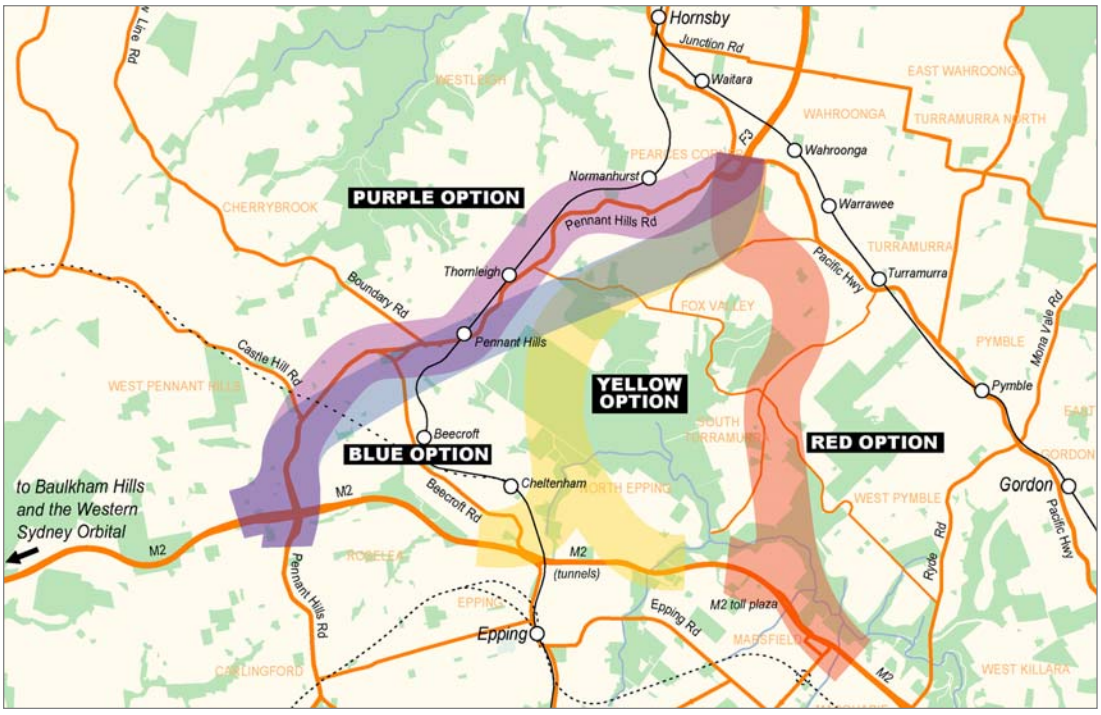


Figure 6: The Type A Options

The Yellow Option

The Yellow option would have a northern connection to the F3 at Wahroonga, and a dual southern connection to the M2, either side of the existing M2 tunnels in North Epping. At the M2, the eastern connection would join the M2 Motorway at Terrys Creek with the western connection west of Beecroft Road.

This option would involve dual main tunnels of about 6.5km in length.

The Yellow northern interchange would be similar to the Blue option northern interchange.

The southern interchange (with the M2) would directly connect the new link with the M2 to and from both the east and west. Connections with roads to and from the south, such as Lane Cove Road and Pennant Hills Road, would be via the M2 Motorway.

The Red Option

The Red option would have a northern connection to the F3 at Wahroonga, and a dual southern connection to the M2 at Macquarie Park, either side of the existing toll plazas. It would involve dual main tunnels of approximately 6.5km in length.

The Red northern interchange would be similar to the Blue option northern interchange.

The southern interchange would directly connect to the M2 to and from both the east and west. Connections with roads to and from the south, such as Lane Cove Road, would be via the M2. The M2 would need to be widened between Herring Road and Lane Cove Road.

Assessment of Type A Options

An assessment of the Purple, Blue, Yellow and Red options was undertaken using transport, social, environmental and economic criteria.

The assessment is based on indicative alignments and associated engineering assumptions regarding interchanges and ventilation layouts. The preferred option would be further developed, including the consideration of sub-options, before being the subject of an Environmental Impact Statement.

The key findings of the assessment of Type A options are described in the following pages.

Transport Assessment of Type A Options

Of the Type A options, the Purple Option, running underneath Pennant Hills Road, best satisfies the National Highway objectives.

Main Traffic Effects

Table 5 shows the amount of traffic relief to the interim National Highway (Pennant Hills Road) as a result of the four Type A options. As may be seen, Purple and Blue options exhibit similar traffic relief characteristics. Yellow and Red options have a significant travel cost penalty of the existing M2 toll for journeys with origins/destinations south of the M2. This is a major reason for the large difference in traffic relief effects between Purple/Blue and Red/Yellow. The Red and Yellow options, while relieving Pennant Hills Road less than Purple/Blue, would reduce traffic on the Pacific Highway and Ryde Road as well, whereas Purple/Blue would provide little relief to the Pacific Highway.

All four Type A options would provide similar road user benefits (vehicle operating costs and travel time savings) as an untolled link, compared to the Base Case. From an overall Sydney-wide network assessment, Purple/Blue options provide slightly higher user benefit when redistributed traffic is taken into account.

Truck Routing

Over the next 20 years, the majority of trucks on the National Highway will continue to have their origins/ destinations south of the M2 and continue to use Cumberland Highway as a major route. Yellow and Red Options would require more trucks to use the M2 Motorway and increase their route length compared to Blue and Purple. The Purple and Blue Options provide the preferred route for trucks now and in the foreseeable future. Purple is preferred for truck traffic given its lower tunnel gradients and consequent truck operating cost savings compared to Blue.

Public Transport, Pedestrians and Cyclists

The Purple and Blue options would provide sufficient relief to Pennant Hills Road to allow the reallocation of road space for other users where appropriate and improved amenity along Pennant Hills Road. The Red and Yellow options would not provide traffic relief to the same extent.

Effect of Tolls on the New Link

Purple would best satisfy the National Highway traffic objectives with or without a toll on the new link. However, a toll reduces traffic relief to Pennant Hills Road and the user benefits of the scheme for all options. The Red and Yellow options would have the least benefit in traffic reduction with a toll in place.

Table 5: Summary of Transport Effects of Untolled Type A Options

		Option			
Interest Groups	**Measure**	**Purple**	**Blue**	**Yellow**	**Red**
Travellers • Users of Light Vehicles • Long Distance Travellers • Users of Heavy Vehicles • Pedestrians and Cyclists	• Network Travel and Accident cost savings	Significant	Significant(1)	Significant(1)	Significant(1)
	• Improvement in amenity(2) for other users in the corridor	Significant	Significant	Some	Some
Government - Transport Develop-ment and Economic Policies • Transport Development • Economic Development • Improve urban amenity	• Reduced congestion and traffic relief on interim National Highway, AADT in 2021(3) - All Traffic - Trucks	35-40,000 about 11,000	35-40,000 about 11,000	20-25,000 about 8,000	20-25,000 about 8,000
	• Reduced congestion and traffic relief on other major arterials, AADT in 2021(3) Pacific Highway - All Traffic - Trucks Ryde/Lane Cove Road - All Traffic - Trucks	 < 5,000 < 500 5 – 10,000 < 1,000	 < 5,000 < 500 5 – 10,000 < 1,000	 5 - 10,000 < 1,000 5 – 10,000 < 1,000	 10 - 15,000 1 – 2,000 5 – 10,000 < 1,000
	• Improved Access to Sydney Ports	Less Direct	Less Direct	Direct	Most Direct
	• Improved Access to Western Sydney	Most Direct	Most Direct	Less Direct	Least Direct
	• Opportunities to encourage more use of Public Transport(4)	Moderate	Moderate	Few	Few

(1) Steep north-bound tunnel grades increase truck operating costs over Purple. Overall network-wide benefits would be similar for all four options.

(2) Based on traffic relief along interim National Highway and potential to reallocate road space on Pennant Hills Road.

(3) Truck traffic relief would be similar with a toll.

(4) As a result of traffic relief and reallocation of Pennant Hills Road road space.

Social and Environmental Assessment of Type A Options

On Social and Environmental grounds, the Blue and Purple Options are preferred. They would yield significant social benefits to people living and working along Pennant Hills Road, as a result of the large traffic relief to Pennant Hills Road.

Improved Local Urban/Residential Amenity

All four options (Purple, Blue, Yellow and Red) would improve the local amenity (reduced severance, noise, crashes, etc) along Pennant Hills Road as a result of removing through-traffic from surface roads in the corridor. Purple and Blue options would provide the greatest local amenity benefits as a result of traffic relief along Pennant Hills Road.

Air Quality and Tunnel Ventilation Stacks

There would be air quality benefits in the vicinity of Pennant Hills Road from all four options as traffic (including large volumes of trucks) would avoid 22 sets of traffic signals, reduce vehicle emissions (CO and greenhouse gases) associated with stop/start and acceleration/deceleration conditions, compared to the Base Case. The effects of tunnel ventilation stacks have not been investigated in detail in this study. For the purpose of assessment, it was estimated that between 2 and 4 stacks would be required for each option given the length of the tunnels. Details of these would be included as part of an Environmental Impact Statement (EIS).

Property Effects

The property effects vary according to option and type of interchange for each option. Overall direct effects are shown in Table 6.

Impact on Bushland, National Parks and Threatened Species

All four options would avoid surface impacts to Lane Cove National Park and other bushland habitats.

Overall Assessment

All four options would have significant social and environmental benefits as a result of the construction of a tunnel link compared to the Base Case. The Blue and Purple options would have greater environmental benefits, compared with the other options as a result of their alignment located away from bushland, National Park and waterways. Table 6 summarises the main social and environmental effects of the four options. Overall Blue and Purple are preferred.

Table 6: Summary of Social/Environmental Effects of Type A Options

		Option			
Interest Groups	**Measure**	**Purple**	**Blue**	**Yellow**	**Red**
Occupiers • Residential • Commercial/Shops • Schools	• No of properties directly affected	20-80	50-130	20-100	20-100
	• Improvement in amenity[1] (noise, exhaust emissions, severance etc.)	Significant[2]	Significant	Some	Some
Users of Facilities • Community/Sports Centres • Parks • Churches	• Improvement in amenity (as above)	Significant[2]	Significant	Some	Some
Those concerned with conserving and enhancing the area • Air Quality • Water Quality • Landscape • Urban Design	• Air quality along Pennant Hills Rd	Significant	Significant	Some	Some
	• Impact on water quality	Low	Low	Medium	Medium
	• Visual impacts[3]	Moderate	Moderate	Moderate	Low

Notes

(1) Based on traffic relief along interim National Highway and potential to reallocate road space on Pennant Hills Road.

(2) Increased noise impacts at Brickyard Park on surrounding occupiers and users of facilities. Some impact on Hornsby Council Sports Complex at Brickyard Park.

(3) Makes allowance for impact of tunnel portals.

Capital Cost Estimates and Economic Assessment of Type A Options

The Type A options are mostly in tunnel and their capital cost estimates are high, ranging from $1.6 billion to $2.15 billion (in 2003 dollars). The economic assessment shows that the Purple option performs best.

Capital Costs

The estimated strategic capital costs shown in Table 7 for dual 3 lane and 2 lane options, are based on construction using a Build, Own, Operate and Transfer (BOOT) method of delivery and include an allowance for associated BOOT costs. The cost estimates are expressed in 2003 dollars.

The capital cost estimates are based on strategic investigations, indicative route alignments and scope of work consistent with current RTA practice for each option. Cost estimates are therefore likely to change during concept design development and environmental assessment stage as a result of further investigations, refinement to the accepted option, changes to Government policy and community and other stakeholder input. The final construction cost will also change with inflation between now and the project's completion date.

Economic Assessment

Table 7 presents the summary results of an economic analysis of the Type A options. It provides information of the estimated benefit cost ratios (BCR) of each option for a non-tolled and tolled scenario and for a dual two lane and dual three lane tunnel project.

The economic analysis is based on cost and benefit estimates prepared for the scope of works as far as it can be foreseen at this time. Economic analysis would again be undertaken during the EIS process, based on the adopted concept proposal and the corresponding revised costs and benefits.

The results suggest that the Purple option is preferred on economic grounds, yielding higher BCR's than Blue, Yellow and Red.

Effect of a Toll

The BCR results suggest that the project with a car and truck toll of $3.50 is marginal in economic terms and that the Purple dual 2 lane project would be the only tolled scheme of those assessed which would be close to passing Treasury's economic efficiency test with a BCR in excess of 1.0.

Effect of Not Upgrading Main North Rail Line

The analysis indicates that the economic results for the link would be more attractive under the scenario where the proposed capacity improvements to the Main North Rail Line assumed in the Base Case are not implemented.

	Purple	Blue	Yellow	Red
Strategic Capital Costs Estimates (in 2003 dollars)(1)				
Dual 3 lane ($million)	1,960	2,150	1,990	2,000
Dual 2 lane ($million)	1,670	1,820	1,650	1,600
Benefit Cost Ratio (BCR)(2) – No Toll(3)				
Dual 3 lane	1.1	1.0	1.0	1.0
Dual 2 lane	1.2	1.1	1.1	1.2
Benefit Cost Ratio (BCR)(4) – $3.50 Toll				
Dual 3 lane	0.8	0.8	0.7	0.5
Dual 2 lane	1.0	0.9	0.8	0.7

(1) Costs are based on the BOOT model of project delivery and are rounded to nearest $10 million.

(2) For the Base Case - based on Urban Development Program Scenario A, implementation of major rail upgrades on Main North Rail Line and calculated at 7% real discount rate.

(3) BCRs are calculated using D&C capital cost estimates.

(4) Note that the BCRs for tolled options are based on certain assumptions about the tolling regime that would apply on the M2 for travel east & west of the interchange with the new link and that results could vary if toll assumptions were altered.

Table 7: Summary Results of Economic Analysis of Type A Options

Finance

The project would cost between $1.6 billion and $2.15 billion (in 2003 dollars) to construct, plus ongoing operating costs.

The project may either be funded by the Government from consolidated revenue or in partnership with the private sector. A number of ways for private sector participation were investigated.

Community Consultation

Community consultation has been on-going throughout the study period and there has been discussion with Councils, organisations and individuals in the study area.

General Findings

The most intense period of consultation occurred at the route options display stage. During that time about 1,000 submissions were received. The majority of submissions received were from the areas potentially affected by the Type A options, with submissions from Wahroonga/Turramurra and Thornleigh/Normanhurst comprising around 52% of the total submissions received.

Given the dominance of submissions from these areas there needs to be some caution with interpretation of views and weight of community opinion. Nevertheless this is a good indication of the depth of feeling about the options and the issues that arise.

The summary of issues takes into consideration the content of the submissions as well as discussions with members of the community, industry and business groups, issues raised at Community Focus Group meetings and discussions with other stakeholders such as Councils.

Options Preferences

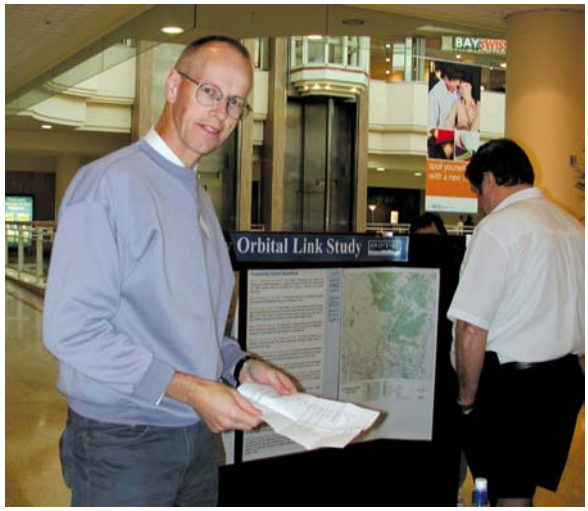
Figure 7 illustrates the number of submissions which commented on a particular option.

There was strong preference for the Type A Purple option, predominantly on the basis that it best meets the project objectives, is an existing transport route and will provide relief to Pennant Hills Road with least adverse environmental and social impact.

There was least support for (and some very strong opposition to) the Type A Red option, predominantly on the basis that it is in the vicinity of the abandoned B2-B3 corridor and because of the potential adverse impacts on the Lane Cove Valley and the Lane Cove River. Some submissions wrongly anticipated the necessity for a bridge over the Lane Cove River and opposed this.

Many of the comments that were made in relation to the Purple option were common to the Blue option except in relation to the 500m of open trench on the Purple option.

The majority of comments made in relation to Yellow were similar to those from Red, with most differences related to the interchange arrangements with the M2 and potential impacts on Terrys Creek.



Public Information days were held at five locations in May 2002 and Route Option Displays were held at four locations in August 2003 over a 6 week period.

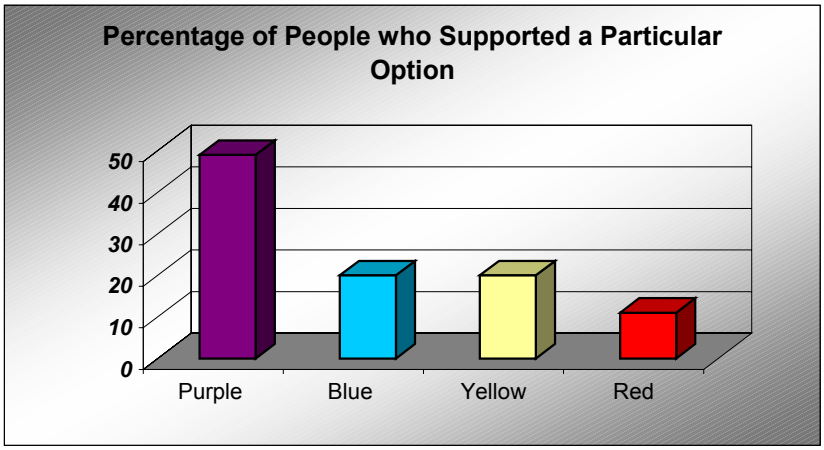


Figure 7: Option Preferences from Community Consultation.

Major Issues Raised

The community raised a number of issues of substantive concern. The top ten issues are shown in Figure 8. By far the biggest concern was the effect of tunnel ventilation stacks (nearly 50% of respondents raised this as an issue).

Ventilation stacks and air quality

The number and location of ventilation stacks and whether tunnel emissions would be filtered were the issues of greatest concern for all Type A options. Significant concern was expressed in relation to the potential health impacts, and amenity and environmental impacts of emissions.

Impacts of Purple Option through Brickyard Park

Although not one of the top ten issues, Hornsby Council and Normanhurst/Thornleigh residents oppose a surface section of the indicative Purple option through Brickyard Park. The Park is being developed with sporting and community facilities and the community values these highly. There was also concern that construction in this vicinity would expose toxic waste, with health and other impacts for the local community and environment. The impact on schools, hospitals, aged care facilities and residential areas was of significant concern.

Impacts on Individual Properties

Many submissions and comments received were from residents, concerned about the likely effects on their property and uncertainty of outcome.

Public Transport and Sustainability

Many groups and individuals sought to point out the need for increased investment in rail for freight and public transport. It was argued strongly that integrated transport approaches are needed to achieve sustainability.

Longer term transport needs for Sydney

While most people recognised that Type A options are the best solution for this project, most Councils in the study area, the majority of concerned groups and many individuals expressed a strong opinion that there should be further investigation of a longer-term strategy such as a Type C corridor. It was argued this will be needed to provide efficient connections between western Sydney, the Central Coast and the Hunter region in the future. At the same time, some respondents also expressed concerns about the negative environmental impacts of the Type C corridor especially through National Park.

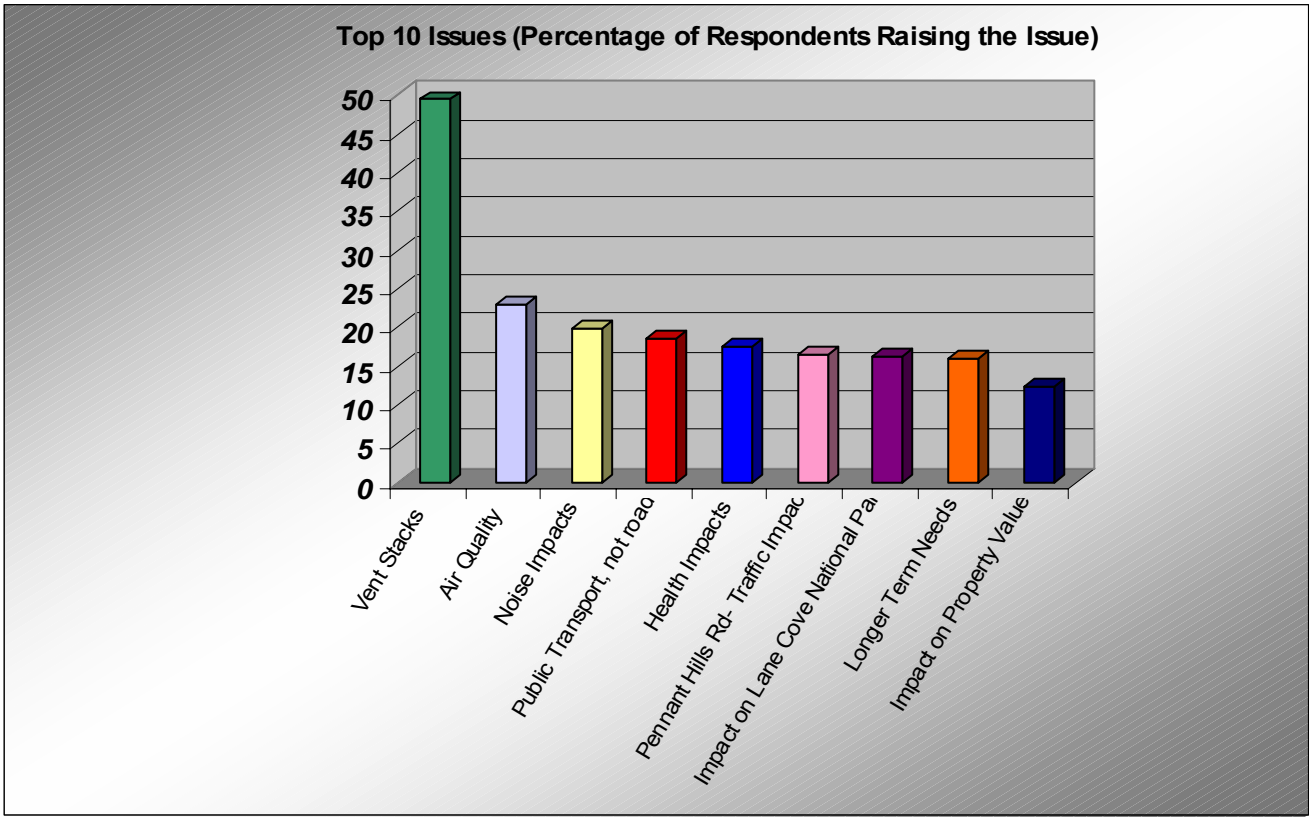


Figure 8: Major Issues from Community Consultation.

The Recommended Purple Option

The preferred Purple Option is mostly in tunnel running 30 to 40 metres underneath Pennant Hills Road

Tunnels

The current tunnel concept can be described as twin tubes with northbound traffic in one tube and southbound traffic in the other.

Emergency pedestrian cross passages would be provided to connect the two parallel tunnels. As with other tunnels in Sydney, for example the Sydney Harbour and M5 East Freeway tunnels, these cross-passages allow for emergency escape from one tunnel to the other.

Other safety measures that would be installed in the tunnel include lighting, ventilation and fire protection, communication, surveillance and control systems consistent with RTA practice.

Tunnel Ventilation

Ventilation stacks would be required at various points along the length of any tunnel. They would be required to provide for the exhaust of air from the tunnel in both normal operation and during emergency conditions.

In terms of potential air quality impacts overall, there would be beneficial effects for residents along Pennant Hills Road, and other roads where traffic volumes would be reduced, through a reduction in exposure to vehicle emissions. EPA requirements for air quality would be achieved in all locations.

Construction

Construction would take 3-4 years. The majority of construction would be underground and therefore most construction impacts would be relatively minor in comparison with the scale of the project.

Property Effects

Only after further concept development is undertaken and an EIS design is completed would it be possible to say with any certainty which properties would be affected and to what extent.

The Purple option would be mostly in tunnel to reduce direct surface property impacts on areas of environmental value, and on other land uses.

Surface property impacts would be limited to those properties located within the potential interchange areas and other areas that may be required for associated roadworks, such as during construction, for landscaping, for emergency access and for ventilation stacks.

The tunnel would generally be located deep (30-40 metres) below most properties and would have no discernible effect on them during construction or operation.

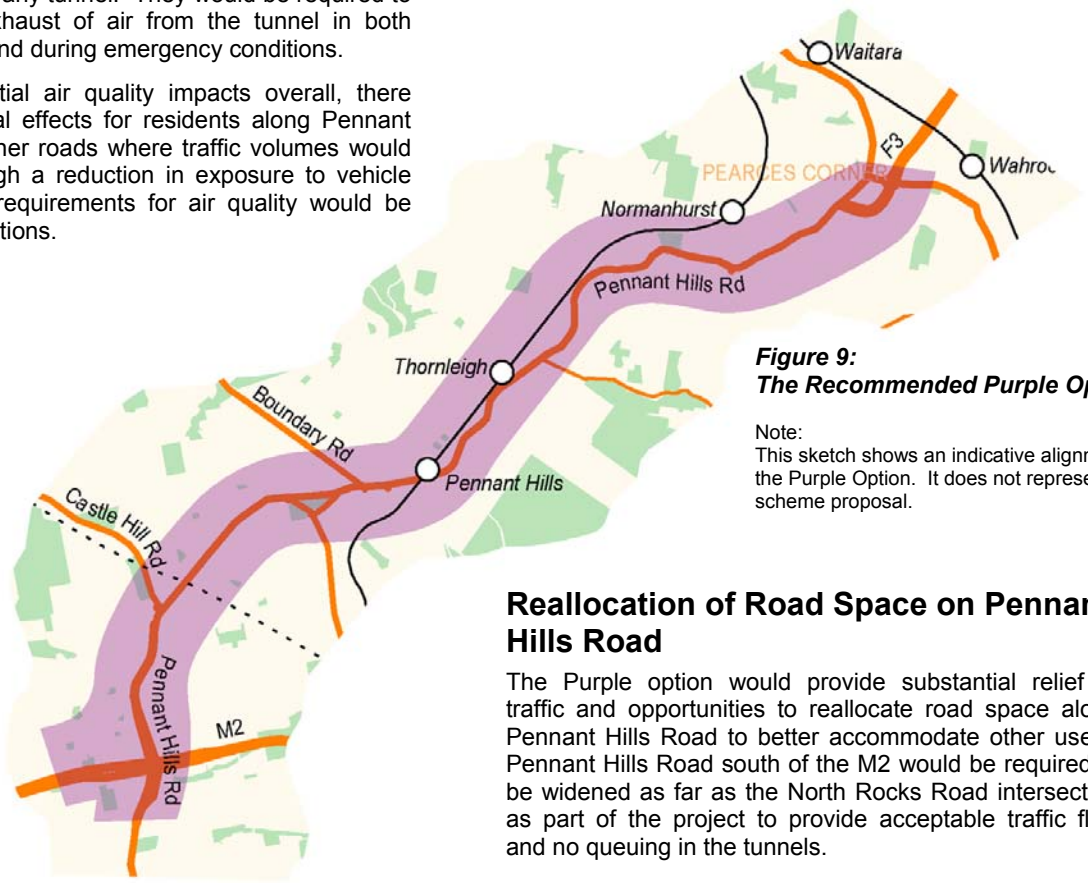


Figure 9:
The Recommended Purple Option

Note:
This sketch shows an indicative alignment of the Purple Option. It does not represent a scheme proposal.

Reallocation of Road Space on Pennant Hills Road

The Purple option would provide substantial relief of traffic and opportunities to reallocate road space along Pennant Hills Road to better accommodate other users. Pennant Hills Road south of the M2 would be required to be widened as far as the North Rocks Road intersection as part of the project to provide acceptable traffic flow and no queuing in the tunnels.

Travel Time Savings

The existing peak period travel time on Pennant Hills Road (between the M2 and the F3) averages about 19 minutes. The Purple Option (untolled), would save travellers about 10 minutes journey time on average in 2011 compared to travel times on Pennant Hills Road.

This would increase to about 15 minutes if the link is tolled.

Purple Option refinement

The Base Purple option is one alignment within the broad band of the Purple route option developed from strategic study. It does not represent the preferred Purple alignment. A concept proposal would need to be developed before undertaking an EIS. The concept proposal would need to be refined prior to completion of an EIS taking full account of community issues.

Many alternative alignments are possible within the broad band of the Purple Option and should be investigated. Further consultation with the community would be required before a preferred alignment within the Purple Option is selected.

Possible Purple Option alternative alignments and sub-options to explore include:

- Varying tunnel length – the tunnel could be built as a single long tunnel 8km long, without openings or could be broken into two or more sections of shorter length;
- Intermediate openings – these may be either in open space, such as Brickyard Park, or combined with intermediate access points;
- Intermediate access points – it may be possible to provide local access to the tunnel via intermediate connection ramps to service major roads such as Beecroft Road and Boundary Road;
- Sharing with other transport corridors – it may be possible for a new link to share the existing Main North rail line corridor north of Pennant Hills station. Technical feasibility would need to be investigated with the RailCorp. This would reduce ventilation requirements for the road tunnel and could provide opportunities to redevelop Pennant Hills and Thornleigh Railway Stations.
- More closely following Pennant Hills Road or the railway alignment – this would limit opportunities for travel time improvements, but may keep ventilation stacks and impacts closer to the existing transport corridor.

Recommendations and Way Forward

Recommendations

The main findings and recommendations of the study are presented below:

A: The Preferred Option

A1: The Purple Option be adopted as the preferred corridor for a new link, which best satisfies National Highway objectives between the F3 Freeway at Wahroonga and the M2 Motorway.

A2: Planning and design of the link should be based on constructing the tunnels as two lanes in each direction if tolled or three lanes in each direction if untolled.

A3: The new link be designed with appropriate recognition of the high proportion of heavy vehicles (up to 18%) that would use the link.

A4: The link be designed for motorway to motorway design standards at its interchanges with the F3 Freeway and M2 Motorway west. Furthermore, interchange ramps should be constructed within existing road reserves as far as practicable.

A5: The desirability of an intermediate connection with Pennant Hills Road should be considered in the development of the link.

A6: Opportunities to reallocate road space on Pennant Hills Road should be considered, to realise benefits for other users, improve the general amenity of the area and access to Pennant Hills and Thornleigh railway stations.

A7: Improvements needed on Pennant Hills Road south of the M2 motorway up to and including the North Rocks Road intersection be implemented to ensure acceptable traffic flow and no queuing in the Purple link tunnels.

A8: Improvements needed on the F3 Freeway at Wahroonga, including widening within the road reserve up to approximately Edgeworth David Avenue, be implemented so as to ensure acceptable traffic flow and no queuing in the Purple link tunnels.

B: Way Forward

B1: Governments consider the affordability of the Purple Option.

B2: Investigate alternative alignments and sub-options within the Purple corridor, and develop a concept proposal.

B3: Consult with the community on the concept proposal.

B4: Prepare an Environmental Impact Statement (EIS) on the preferred concept proposal.

C: F3 Capacity Issues

C1: The proposed link would greatly improve connectivity between the Sydney Orbital and the F3 Freeway. The capacity of the F3 Freeway would also influence operations of the new link. There will be a need to increase the capacity of the F3 over some sections south of the Hawkesbury River crossing by 2011. Further capacity enhancements and/or traffic demand management measures impacting on the F3 Freeway are likely to be required beyond the timeframe of this study (2021).

C2: An investigation into the planning need for a new northern transport corridor could be considered as part of the current review of the Sydney Metropolitan Strategy by the NSW Department of Infrastructure, Planning and Natural Resources. Such an investigation is outside the scope of this study, or National Highway planning.