PROPOSED CROSS CITY TUNNEL

Kings Cross to Darling Harbour

VOLUME 1

Director-General's Report
Section 115C of the
Environmental Planning and
Assessment Act 1979

September 2001

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FOREWORD

The RTA's proposed Cross City Tunnel is an important road infrastructure project of significance to the environment, the economy and to the planning of Sydney and New South Wales.

The proposal is being determined under the provisions of the *Environmental Planning and Assessment Act 1979*, which requires an independent assessment by my Department prior to the Minister for Urban Affairs and Planning making a decision on the project - hence the purpose of this Report.

This Report reviews the environmental impact statement, issues raised in submissions and in representations made in response to its exhibition and other relevant matters. The report concludes that the potential environmental and amenity impacts associated with the project can be mitigated and managed by adopting the comprehensive measures and safeguards specified in the Recommended Conditions of Approval.

In particular, the Department recognises the potential benefits of the Cross City Tunnel to the traffic, amenity and environment of the CBD and surrounds. However, the assessment indicates that for such benefits to be sustainable and long-lasting, a number of co-ordinated public transport and related initiatives should be implemented as an integral part of the project.

The Department's assessment recommends in that regard the early establishment of a Cross City Tunnel Public Transport Committee, chaired by the Department of Transport, to oversee the implementation of the public transport initiatives recommended in the conditions of approval as well as other associated measures.

Sue Holliday
Director-General

EXECUTIVE SUMMARY

The Proposal

The RTA's proposed Cross City Tunnel (CCT) is a major $400M road infrastructure project recognised in *Action for Transport 2010* to be of significance to the economy, environment and planning of Sydney and New South Wales. Key features of the proposal include a 2-kilometre tunnel generally running east-west below William/Park and Druitt Streets, connecting the Kings Cross Tunnel with the Western Distributor. New connections are also proposed at the Eastern Distributor and at Sir John Young Crescent. A new, 39-metre high tunnel emissions ventilation stack is proposed in Darling Harbour located near to the IMAX theatre. Traffic would be tolled electronically in each direction - $2.50 for the main tunnel and $1.10 for traffic exiting to Sir John Young Crescent.

Assessment and Approval Process

State Environmental Planning Policy No. 63 – Major Transport Projects was gazetted on 2 February 2001 to provide a consistent assessment and decision making framework for the CCT under the provisions of Division 4, Part 5 of the Environmental Planning and Assessment Act (EP&A Act). The decision making process requires the preparation of an independent assessment report by the Director-General of the Department of Urban Affairs and Planning, hence the purpose of this report. The Minister for Urban Affairs and Planning must also grant his approval before the project can proceed. In determining the project, the RTA's determination must be consistent and in accordance with the approval of the Minister for Urban Affairs and Planning.

An environmental impact statement (EIS) for the proposed development was publicly exhibited from 2 August to 6 October 2000. The RTA received 196 representations to the exhibited EIS. The Minister and Director-General also received numerous representations indicating the wide public interest in the proposal. Key issues raised in representations included: need and justification including public transport alternatives, air quality (particularly issues relating to the ventilation stack), traffic implications both regional and local and noise and vibration. Section 3 of this Report provides a detailed analysis of all representations received.

Project Objectives

The key primary objectives of the proposed Cross City Tunnel are:

- to improve the environmental quality of public space within Central Sydney;
- to improve ease of access and reliability of travel within Central Sydney; and
- to improve the reliability and efficiency of travel between areas east and west of Central Sydney.

The proposal has been justified in the EIS on the basis that it best meets these objectives, which in turn are related to overcoming many of the current issues facing Sydney CBD, particularly the undesirable competition between public transport, pedestrians and motorists for road space.

Proposed Modifications

Based on the representations to the EIS exhibition and from other additional information, the RTA propose a number of modifications to the original proposal as described in the EIS. The key ones include:

- modifications to CBD intersections;
- consideration of portal emissions;
- construction of a tunnel control centre on Palmer Street;
- additional construction compound on Palmer Street between William and Cathedral Street;
- combining the bicycle lanes with the T2 transit lanes in William Street and bus lanes in Park Street; and,
- amendments to construction management.

Since the preparation of the Representations Report, three other key modifications have been made. These are:

- reverting the cycle lanes in William Street and Park Street back to the EIS scheme;
- re-arrangement of pedestrian access to Darling Harbour; and,
- a minor relocation of the ventilation stack about 50 metres to the west with a five metre increase in height.

The Department has also made a number of recommendations to improve the project's ability to meet the stated objectives. The key recommendations are a number of public transport related projects and improvements to the cycleway network.

The modified proposal was described (together with the rationale for such changes) in a Preferred Activity Report which was made publicly available. Overall, the Department is satisfied that the modifications reduce the detrimental effect of the activity on the environment and broadly supports these modifications on this basis.

Key Issues

Need and Justification

The proposal has been justified on the basis of:

- removal of traffic from Central Sydney;
- making the environment of Central Sydney streets and adjoining public spaces more pleasant for pedestrians, residents and business; and,
- improving travel times and reliability of bus services and other road users within Central Sydney.

However when the detailed outcomes of the project are evaluated, the Department considers that the benefits of the project in isolation would appear to be incremental rather than substantive. The benefits that would be substantive would be primarily concentrated on the Park Street/William Street corridor. In particular, should the project be constructed in isolation of other measures, the overall CBD benefits to bus journey times and reliability and pedestrian walk times beyond the William/Park Street corridor would appear marginal, as would the net improvements to regional air quality levels.

The Department considers that for the CCT to achieve substantial and noticeable improvements for traffic, public transport, pedestrians and cyclists, it cannot rely on the road infrastructure alone nor in isolation. A highly cohesive and pro-active co-ordination of all key transport decision makers in the CBD including STA, DoT and the RTA and in consultation with Sydney City and South Sydney City Councils is required for this project to obtain its stated benefits in a sustainable and long-lasting way.

To ensure that this occurs, the Department recommends the establishment of a publicly accountable Public Transport Committee, chaired by the DoT, to formally carry the investigation and coordination of transport initiatives through the construction phase and at least the early operation phase. This would ensure that the opportunities to capture potential benefits of the project during construction and operation are maximised, primarily by absorbing any spare surface road capacity through additional public transport and pedestrian/cyclists offset measures. Together with a recommended comprehensive package of around 30 specific public transport and cyclist/pedestrian improvement offsets including potentially some 20 kilometres of new bus or transit lanes, bus performance indicators, investigation of electronic based passenger information systems, co-ordination of buses with the RTA's traffic systems (SCATS), real time congestion monitoring and further improvements to cycle connection, the Department is confident that the project could achieve its specified objectives in a more substantive way. The justification for the project can be accepted on that basis.

Public Transport and Cyclists

The ability of this project to improve public transport outcomes in the CBD as implied in the EIS in isolation of any other measure, appears at best incremental rather than demonstrating substantive improvements that are likely to be widely perceptible to bus users. For example improvements to key bus intersections along George and Elizabeth Streets would be confined largely to one or two intersections, bus travel time improvements are predicted to be in the order of seconds and on a number of routes would worsen.

In addition to the Public Transport Committee, the Department has identified a comprehensive package of over 30 accompanying public transport offset initiatives. These include:

- some 5 kms of additional bus lanes, on the Western Distributor between the Druitt Street Ramp and Anzac Bridge, on sections of Chalmers and Elizabeth Streets, Bridge Street and Liverpool Street and potentially a further 15 kms of new bus or transit lanes including sections on Pitt Street, Park Street, Ocean Street, New South Head Road, Anzac Bridge and Victoria Road between Anzac Bridge and Gladesville;
- construction stage public transport management plans;
- development of specific bus performance indicators;
- investigation of electronic based passenger information systems;
- improved co-ordination of buses with the RTA's traffic systems (SCATS);
- real time congestion monitoring, further improvements to cycle connection;
- improvements to digital cameras for policing of bus lanes; and,
- a contingency fund of $5 million for additional works required following additional investigations.

In addition, further improvements to the CBD cycle network have been identified, including an improved connection between the William Street cycleway and Pyrmont Bridge and further investigations into a new connection between Oxford Street and Darling Harbour.

Harbour Street Exit

The proposal includes an exit at Harbour Street on the western edge of the CBD, expected to be used by some 30% of west bound traffic in the tunnel. However, the provision of the exit at Harbour Street could potentially compromise the ability of the project to meet its strategic objective of reducing traffic in the CBD. This is because there is the potential, over the long term, for increasing traffic infiltration into the city from this exit as the CBD western fringe car parks become increasingly full. However, at this stage, the extent of potential infiltration is difficult to determine given the nature of external factors that are outside the control of the RTA, in particular the potential for relaxation of parking restrictions. At this stage, a strict monitoring regime is recommended. Should infiltration become problematic for city congestion, further traffic management measures are recommended, including the option of invoking a congestion toll. Public reporting of monitoring outcomes is recommended.

Alternatives

A number of representations to the EIS suggested that there needs to be more serious consideration of public transport alternatives. It must be recognised however that this assessment of the CCT must relate to the project as submitted and in the context of other strategic studies such as DUAP's "*Shaping Our Cities"* and the Government's "*Action for Transport 2010".*

Notwithstanding and as indicated above, the Department considers that the proposal could potentially meet its objectives and would complement the overall public transport system provided that important improvements to bus services and other measures are implemented as an integral part of the proposal. It is also important to note that, as the option could be constructed at no cost to the Government, the benefits would have a greater potential to be realised within the short to medium term. Whether a comparable public transport option could achieve similar outcomes is outside the scope of this assessment. The Department is satisfied that should its recommended measures be implemented, public transport benefits will result as a component of the project implementation.

Air Quality

Goals

The Department considers that the RTA's commitments to a net improvement to air quality (or at least no worsening) as a result of the construction of the proposal is fundamental and integral to the strategic justification of the project. On this basis, the Department recommends meeting National Environment Protection Measure (NEPM) ambient goals as a way of ensuring accountability to such commitments. Used in conjunction with proposed stack limits, this would prevent the ability to "pollute-up" to maximum levels. The Department's recommended strategy of requiring compliance with both in-stack limits as well as regional ambient air quality standards would ensure net improvement in city air quality.

Air Quality Impacts

At the local level and based on advice from the EPA, the Department of Health and an independent evaluation by the Department, emissions of pollutants from the ventilation stack are not expected to be an issue for existing residents at ground level. The contributions from the ventilation stack would be extremely small and undetectable, even if the predictions were underestimated by a factor of 2 or 3. Notwithstanding, continued monitoring of ambient conditions in the area should be undertaken to confirm this predicted outcome.

The impacts on residents living in nearby high-rise apartments are predicted to be an order of magnitude higher (ie factor of 10), and are more likely to be of potential concern. A comprehensive localised monitoring and mitigation response program is recommended, including monitoring at the air conditioning intake of the IMAX theatre and at the balcony level of nearby high-rise apartments.

Ventilation Stack Location

The Department appreciates that any location for a ventilation stack in a city environment with a high density commercial and residential population is highly unlikely to be tolerated by any community. The Department considers however, that the proposed site would, when compared to other locations, potentially provide the greatest margin for compliance with the goals. Notwithstanding, there is a strong case for a minor relocation of the stack about 50 metres to the west including an increase in height of 5 metres (relative to the height of the top of the EIS ventilation stack). The revised location and height would have significant benefits to nearby high-rise apartments in terms of air toxics and nitrogen dioxide without any greater impacts for other receivers (ground level or elevated). There would also be urban design advantages in terms of better integration with the existing infrastructure. The Department must therefore support such a relocation which is recommended accordingly.

At this stage, filtration of particulate matter for this project is not cost effective nor necessary, as the level of particulate matter removal would be extremely small compared to the total particulate matter exposure. For this project a more sensitive pollutant would be NO_2. Electrostatic precipitators (ESPs) do not remove nor treat gaseous components. NO_2 treatment systems are still very much in pilot stage and there are no known large-scale systems operating in the world.

Notwithstanding it is recommended that provisions be made for the retrofitting of pollution control systems should the need arise and in the case of treatment of gases, if technological developments make such systems available, necessary and cost effective. Extensive monitoring and community involvement would be an essential element in that decision-making.

Portal Emissions

The Department would support portal emissions in principle. Portal emissions have the potential to lead to significant long term cost savings, reduced energy demands and associated reduction in greenhouse gases.

However at this stage, a much more detailed and comprehensive technical assessment would be required before the Department could recommend portal emissions. Subject to this technical analysis, a detailed management Procedure for portal emissions would also need to be prepared. This Procedure would clearly detail the management regime for portal emissions and include: duration, emission limits, timing of emissions, ambient air quality circumstances, justification with respect to energy savings, predicted impacts, monitoring, public notification, responding to residents concerns etc.

The Procedure would require approval by the Director-General and be made public prior to allowing any portal emissions.

Regional Traffic

There is a potential for the project to redistribute regional traffic particularly to the major feeder roads to the tunnel entrances and exits. The potential adverse regional impacts, including impacts on local area precincts need to be balanced against the overall regional network benefits. Whilst this balance may have a general level of acceptance given the overall net improvements, this would entirely depend upon whether the forecast reductions on regional and local streets can be maintained in the long term. Again, this would be highly dependent on the achievement of accompanying public transport, pedestrian and cyclist initiatives as well as comprehensive Local Area Traffic Management (LATM) measures. Appropriate recommendations have been made in this regard.

Local Traffic

The Department acknowledges the views of the local councils and community groups that there are potential impacts in the local residential areas adjacent to the CBD as a result of traffic redistribution caused by the proposal. As was experienced after the Eastern Distributor opened, some areas in particular could potentially experience the burden of additional traffic. At this stage of the assessment, such impacts are highly complex and difficult to accurately predict. In recognition, it would be essential that traffic-planning decisions be made in a consultative and integrated manner.

The area most potentially affected would be Paddington. Early implementation of LATM measures would improve the amenity and safety of local roads and public spaces by restricting through traffic and ensuring that alternative routes for traffic wishing to avoid the toll is relatively unattractive. Monitoring of other precincts including Glebe, East Sydney, the Eastern Precinct, Darlinghurst/Woolloomooloo and Ultimo-Pyrmont areas, in recognition of the potential, though less likely level of intrusion, is also considered appropriate at this stage.

Noise

Noise during construction may exceed EPA criteria during both the day and night time. A noise management strategy that would limit construction time is to be implemented. In particular, the use of rock hammers during night time hours, raised by the community as the biggest concern with the Eastern Distributor, should not be allowed.

In addition, a construction noise goal of no more than 5 db(A) above background would apply which can only be exceeded if a Construction Noise Method Statement considering all reasonable and feasible noise mitigation methods is prepared. The Director-General would also approve the appointment of an Independent Community Liaison Representative who would consult with the Environmental Management Representative for the project in the event of unacceptable noise impacts who would, if required, stop work until noise can be appropriately mitigated. The EPA has indicated that, subject to these and other measures, it expects to be able to grant pollution control approvals and licences.

Existing traffic noise levels along the proposal's corridor in places already exceed EPA criteria. The assessment indicates that there would be an overall reduction in operational noise levels from the modifications relative to those indicated in the EIS. Where small increases are anticipated, additional mitigation measures including the erection of noise barriers would be considered.

Other Issues

Other issues of relevance to the proposal are assessed in Section 6, the key ones include local area traffic; property impacts; settlement; groundwater; spoil removal and urban design. The assessment concludes that all such impacts can be managed and would not, subject to conditions, result in long term adverse or irreversible effects.

Conclusions

The need and justification of the Cross City Tunnel has been based on concerns about current traffic congestion levels in the CBD and the associated adverse impacts on public transport services, pedestrian amenity, and delivery of goods and services. It is acknowledged that these impacts all significantly detract from a working and living city environment.

The construction of the Cross City Tunnel would have the potential to alleviate part of this problem by removing a proportion of through traffic from City streets, possibly in the order of some 80 000 vehicles per day. However its construction would technically create a net increase in road capacity as well as freeing up road space across a number of regional roads. The consequence of this is difficult to accurately predict through traditional techniques such as traffic modelling, particularly given the highly complex nature of the inner CBD road network and the travel behaviour response in a major city such as Sydney. However, if the freed space does backfill with induced or redirected traffic, any net benefit of the project for surface streets could be significantly eroded over time.

For a sustainable outcome to be achieved, a precautionary approach is required. It is therefore imperative that if the long-term benefits of the project are to be anything more than beyond the William/Park/Druitt Street corridor, a comprehensive package of accompanying support measures and offsets is essential.

In conjunction with the establishment of a specific Public Transport Committee (PTC), the Department has identified a comprehensive package of accompanying public transport, pedestrian and cyclist improvement works. However, these works will require commitments beyond that of the RTA who is the Proponent of the project. In this regard, the PTC would have a key function in co-ordinating the investigation and ensuring the implementation of feasible public transport and other initiatives necessary to achieve the objectives of the project.

The other primary justification for the project is that it is expected to result in a net improvement to air quality, a key and significant factor for the Sydney CBD. The RTA's public statements and commitments to this are considered fundamental and integral to the strategic justification of the project. Continued monitoring and compliance with ambient goals at least in the short-term would ensure public accountability to this broader strategic air quality commitment.

The Department's assessment has concluded that the project if supplemented by the recommended public transport and associated conditions would be of benefit to the community and that all residual impacts could be appropriately managed.

Recommendations

It is recommended that should the proposal proceed, it would be essential for extensive and comprehensive conditions to be imposed so as to ensure, to the greatest extent practicable, its long-

term benefits. Section 8 of this Report lists all the recommended conditions of any approval, the key ones include:

- the establishment of a Public Transport Committee to carry the project through the construction and at least early operation stages to ensure that there is a strong and pro-active approach in integrating public transport provisions as part of the project;
- creation of around 5 kms of bus lanes with the potential for a further 15 kms of additional bus or transit lanes;
- a contingency fund of $5 million for the purposes of implementing additional mitigation measures not explicitly identified in the Conditions, relating to public transport, cyclist provisions, local area traffic management, air quality and other environmental improvements;
- a comprehensive package of over 30 public transport enhancement measures including: improved co-ordination with existing CBD traffic controls (SCATS), performance indicators, investigation of electronic based passenger information systems, digital cameras for bus lanes, intersection improvements, bus facilities such as bus shelters and street furniture and protection of bus routes during construction;
- minor relocation of the stack approximately 50 metres to the west, with a small increase in height of 5 metres;
- compliance with stack limits to ensure no "polluting-up" and compliance with ambient air quality goals to ensure no net worsening of air quality. Real-time public access to monitoring results via the Internet is also recommended;
- deferral of any portal emissions until a comprehensive assessment has been undertaken including the development of a Protocol which would include extensive community consultation;
- requirement for a Community Based Air Quality Monitoring Station operated independently from the RTA;
- provision for retro-fitting of pollution control systems subject to air quality impacts and technological improvements for treatment of gases;
- preparation and implementation of comprehensive environmental management plans for both the construction and operation stages;
- preparation of a Community Involvement Plan and an independent Community Liaison Representative with the ability to address community concerns regarding construction impacts within no greater than 2 hours from a complaint;
- the establishment of community liaison groups and a 24 hour complaint phone system during construction;
- extensive monitoring and auditing requirements during construction by independent persons, including making results publicly available;
- comprehensive Local Area Traffic Management Measures for Paddington. Also monitoring of other areas including Glebe, Ultimo/Pyrmont, Darlinghurst, East Sydney and Woolloomooloo for potential LATM Measures;
- enhancements to the cycle network including improved connections to Pyrmont Bridge and King Street Cycleway and an investigation into a new link from Oxford Street to Darling Drive (Darling Harbour);
- extensive building surveys and settlement monitoring to overcome the types of major concerns raised during the construction of the Eastern Distributor;
- establishment of an Independent Property Impact Assessment Panel to resolve disputes arising from potential and/or actual property impacts;
- improved access provisions to Darling Harbour including new grade separated pedestrian links from Harris Street and from Bathurst Street; and,

- various conditions that are aimed at heritage conservation; water and waste management; minimising impacts on business and maximising benefits to pedestrian and cyclists.

TABLE OF CONTENTS

LIST OF APPENDICES (VOLUME 2)

LIST OF FIGURES

GLOSSARY AND ABBREVIATIONS

AEP	Annual Exceedance Probability
dB(A)	decibel (A-weighted scale)
CBD	Central Business District
CCS	Council of the City of Sydney
CCT	Cross City Tunnel
CO	Carbon Monoxide
Department, The	Department of Urban Affairs and Planning
Director-General	Director-General of the Department of Urban Affairs and Planning
DLWC	Department of Land and Water Conservation
DoT	Department of Transport
DoH	Department of Health
EIS	Environmental Impact Statement
EMP	Environmental Management Plan
EMR	Environmental Management Representative
ENCM	EPA's Environmental Noise Control Manual
EPA	Environment Protection Authority
EP&A Act	Environmental Planning and Assessment Act 1979
ESPs	electro-static precipitators
FAC	Federal Airport Corporation
LATM	Local Area Traffic Management
km	kilometre
km/h	kilometre per hour
m	metre
Minister, The	Minister for Urban Affairs and Planning
NPWS	National Parks and Wildlife Service
NEPM	National Environment Protection Measure
NO_2	nitrous oxides
PAR	Preferred Activity Report
PCA	Pollution Control Approval
PM10	particulate matter with equivalent aerodynamic diameter less than 10μm
PTC	Public Transport Committee
RAC	Rail Access Corporation
Regulation, The	Environmental Planning and Assessment Regulation 2000
RTA	Roads and Traffic Authority
SHFA	Sydney Harbour Foreshore Authority
SSCC	South Sydney City Council
STA	State Transit Authority
SRA	State Rail Authority
SWC	Sydney Water Corporation
TAG	Transport Action Group
WHO	World Health Organisation

1. INTRODUCTION

1.1 Nature of the Proposal

The Cross City Tunnel (CCT) would comprise twin two-lane road tunnels for traffic traveling east–west across Central Sydney between Darling Harbour and Kings Cross. The resulting reduction of traffic from surface streets would allow some road space within Central Sydney to be reallocated from general traffic to public transport, pedestrians and cyclists. Consequently, a range of surface works that would improve facilities for these road users, and the amenity of a number of public spaces within Central Sydney are also proposed.

A toll would be collected electronically. The emissions from the tunnels would be released through a proposed 39-metre high single ventilation stack located near Harbour Street in Darling Harbour. Traffic would be tolled electronically in each direction - $2.50 for the main tunnel and $1.10 for traffic exiting to Sir John Young Crescent.

In response to the representations received during the exhibition, the RTA is now proposing a number of modifications to the proposal. The key modifications are detailed in Section 4 of this Report.

1.2 Background and History

The Central Business District (CBD) is the primary centre of the Sydney Metropolitan Region and is the predominant influence on the form and function of the urban environment of Central Sydney. The 1996 workforce of the CBD was approximately 217,000, and is expected to grow to approximately 233,000 by 2016. The residential population of the CBD is relatively small, but is expected to increase by over 100 percent to 28,000 by 2016. Shopping, tourism and other attractions and facilities in and around Central Sydney also contribute to the daily mix of activities.

The public domain of the CBD is characterised by an undesirable competition between public transport, pedestrians and motorists for road space. High volumes of traffic contribute to poor air quality and a noisy environment. To the east of the CBD, William Street lacks visual coherence and fails to meet its potential as a major structuring element in Central Sydney. On the western edge of the CBD, Harbour Street has been developed without an overall design concept, and lacks strong definition.

Central Sydney is the focus of the regional road network. The Eastern and Western Distributors provide effective bypass routes for north-south through traffic. No comparable arterial routes exist for east–west through traffic. Direct travel between the east and west of Central Sydney currently takes place on a number of Central Sydney streets that also perform local access and circulation functions. These streets are, principally, William, Park and Druitt Streets (westbound) and Bathurst, Elizabeth Park/William or Liverpool/Oxford Streets (eastbound).

The conflict between east–west through traffic and traffic with an origin or destination within Central Sydney contributes to delays and congestion. Buses predominantly use north–south streets and are affected by traffic signal priority favouring east–west traffic. Bus journey times and reliability in Central Sydney are poor due to congestion and delays. These problems lead to inefficiencies in the operation of the bus fleet, affecting reliability, timetabling and fleet utilisation rates.

The amount of traffic traveling through Central Sydney in an east–west direction has contributed to poor accessibility within Central Sydney for all modes of road transport including buses, taxis, commercial vehicles, private vehicles, pedestrians and cyclists. The east–west through traffic causes major routes such as William, Park, Oxford, Liverpool and Bathurst Streets to operate at or close to capacity in peak periods, resulting in poor levels of service at key intersections. Travel speeds on these routes are low and highly variable, which results in unreliable travel times for all road users, with associated adverse economic, social and environmental consequences.

1.3 Statutory Provisions and Assessment Process

State Environmental Planning Policy No. 63 was gazetted on 2 February 2001. This enables the project to be assessed entirely under Part 5 of the *Environmental Planning and Assessment (EP&A) Act 1979*. The RTA determined that the project is likely to significantly affect the environment and required the preparation of an Environmental Impact Statement (EIS) in accordance with Section 112 of the EP&A Act.

As the RTA is both the Proponent and determining authority for the proposal, and an EIS was prepared, Division 4 of Part 5 of the EP&A Act applies. As such, the approval of the Minister for Urban Affairs and Planning is required for the proposal. An independent assessment report is to be prepared by the Director-General as part of the decision making process.

The RTA sought the requirements of the Director-General of the Department of Urban Affairs and Planning for the EIS on 2 June 1999. The Director-General's requirements were issued to the RTA in a letter dated 22 July 1999. An EIS for the proposal was subsequently prepared by PPK Environment and Infrastructure on behalf of the RTA and exhibited by the RTA from 2 August 2000 to 6 October 2000. One hundred and ninety-six (196) representations were received by the RTA in response to the EIS exhibition and forwarded to the Department as required by the EP&A Act.

1.4 Request for the Approval of the Minister for Urban Affairs and Planning

In accordance with Section 115B of the EP&A Act, the RTA sought the approval of the Minister for Urban Affairs and Planning by way of a letter received on 14 May 2001. The request for approval was accompanied by the Representations Report which presented the RTA's response to the issues raised in response to the public exhibition and proposed modifications to the proposal in order to reduce or eliminate some environmental impacts identified in the EIS.

A subsequent addendum to the Representations Report was received on 16 August 2001. This addendum addressed issues relating to cycle lanes on William Street and pedestrian access to Darling Harbour.

1.5 Release of Preferred Activity Report

Under State Environmental Planning Policy No. 63, the RTA was required to release a Preferred Activity Report (PAR) detailing the modifications made to the EIS proposal. The RTA placed the PAR on exhibition from 19 May 2001 to 18 June 2001. A brochure summarising modifications to the proposal and detailing locations where the PAR could be viewed was sent to all whom made representations to the EIS exhibition. Details were advertised in newspapers.

1.6 Purpose of the Report

The purpose of this Report is to review the EIS for the proposal, the issues raised in representations to the public exhibition, the RTA's Representations Report and other matters pertinent to the potential environmental impact of the proposal.

This Report has been prepared in accordance with Section 115C of the EP&A Act, which requires the Director-General to report to the Minister on the proposal. This Report documents the outcome of an independent environmental impact assessment by the Department accounting for all issues raised in representations to the EIS.

2. THE PROPOSAL AS DESCRIBED IN THE EIS

This section of the Report provides a description of the project as described in the EIS. The purpose is to provide an overview of the information presented in the EIS and does not necessarily represent the views of the Department. Section 4 provides a discussion of the proposed modifications to the proposal following exhibition of the EIS. The Department's consideration of the modified proposal is provided in Sections 5 and 6.

2.1 Project Description

2.1.1 Introduction

The project involves the construction and operation of two road tunnels for traffic traveling east–west through Central Sydney between Darling Harbour and Kings Cross, and all necessary ancillary works including access points and improvements to roads in the vicinity of the Cross City Tunnel. The proposal also includes a number of surface improvements primarily relating to the reduction of traffic capacity along William, Park and Druitt Streets.

2.1.2 Proposed Alignment

The location and horizontal and vertical alignment of the tunnel has been determined by a number of significant underground constraints. The proposed alignment of the Cross City Tunnel is shown in Figure 2.1.

2.1.3 Key Features

Key features of the proposal include:

- separate two-lane eastbound and westbound tunnels between William Street, at the western end of the existing Kings Cross Tunnel, and the Western Distributor at Darling Harbour;
- connections to the Eastern Distributor;
- a single-lane tunnel under Riley Street to an exit in Sir John Young Crescent;
- a single 39 metre high tunnel emission ventilation stack located in Darling Harbour;
- an overall design speed of 70 kilometres per hour. Design speeds would range from 40 to 60 kilometres per hour at the entry and exit ramps;
- a width of 7 metres between barriers for the two lane tunnels and 5.5 metres between barriers for single lane tunnels; and
- tunnel traffic would be tolled in each direction by using electronic facilities.

2.1.4 Surface Works

In addition to the construction and operation of the tunnel, a number of surface works would be undertaken to either take advantage of opportunities created by the proposal or to address access issues arising from its development. The major works include:

- widening and upgrading of footpaths in William and Park Streets;
- provision of bus lanes in Park and Druitt Streets. Eastbound and westbound bus lanes would also be provided on the Druitt Street viaduct. The southbound bus lane on Elizabeth Street would be extended for the full distance between Park Street and Liverpool Street;

- changing the peak hour T2 transit lanes on William Street to daytime T2 transit lanes between Forbes and College Streets westbound and College and Palmer Streets eastbound;
- re-allocation of traffic signal priority in favour of north–south traffic and a reduction in traffic signal cycle lengths to reduce delays for pedestrians and buses; and
- provision of bicycle lanes.

2.1.5 Other Design Features

Other design features of the proposal include:

- a central supervisory control and monitoring system;
- a traffic management and control system;
- various systems to allow communication within the tunnel;
- an electrical supply system to provide power;
- a lighting system in compliance with the guidelines for road tunnels;
- directional signposting, variable message signs, lane usage signs, intersection direction signs and regulatory signposting; and
- speed cameras in the eastbound, westbound and northbound tunnels.

2.1.6 Property Acquisition

It is not anticipated that there would be a need for any total property acquisition but there may be some partial property acquisition. This would probably be in the form of either a sub-surface easement for rock anchors or a sub-surface stratum land acquisition. All property acquisitions identified at the final design stage would be undertaken in accordance with the provisions of the *Land Acquisition (Just Terms Compensation) Act 1991*.

2.1.7 Tunnel Construction

Tunneling works would include the construction of the main tunnels, caverns at tunnel divergence and merging areas, fan niches, cross-over ventilation tunnels, ventilation shaft, underground substations and emergency egress cross-passages. Two construction methods for the tunnel would be employed, being cut-and-cover and driven tunnels.

Construction of the proposal is expected to take approximately 3 years. General work hours are proposed between 7:00 am and 6:00 pm weekdays and 7:00 am to 1:00 pm Saturdays. Tunnelling is likely to be undertaken 24 hours a day.

2.1.8 Construction Issues

The construction of the proposal would involve three key phases, pre-construction, construction and commissioning. Establishment of four major work compounds would be required. It is estimated that each work compound would generate an average of 100 vehicle movements per day up to a peak of 120. These traffic movements would occur throughout the construction period. It is estimated that a further 111 laden trucks per day (222 total truck movements) would operate between the hours of 7.00 am and 6.00 pm on weekdays and 7.00am and 1.00 pm on Saturdays, over a period of approximately 13 months to transport spoil from the site.

2.2 Need, Benefit, Project Justification and Consequences of Not Proceeding

The need, benefit and justification of the proposed Cross City Tunnel is to improve the environmental quality of public space within Central Sydney, to improve ease of access and reliability of travel within Central Sydney, and to improve the reliability and efficiency of travel between areas east and west of Central Sydney.

According to the RTA, the consequences of not proceeding would be increased traffic volumes on east–west surface routes through Central Sydney; increased congestion at intersections in Central Sydney and a related decline in travel speeds and travel times; increased travel times for buses within Central Sydney; increased vehicle and pedestrian accidents in Central Sydney; and more emissions of air pollutants from vehicles within Central Sydney.

2.3 Alternatives Considered

A number of strategic options were identified to broadly achieve the objectives of the proposal. The strategic options were minimal intervention, management of travel demand, public transport and road-based infrastructure. The preferred option is to provide additional road-based infrastructure, which would be supplemented by improving provision of public transport, implementing demand management measures and implementing local area traffic management. The Cross City Tunnel was selected as the preferred option for satisfying the identified primary and secondary objectives. Substantial environmental and travel efficiency benefits would result from the implementation of the option and because the option could be constructed at no cost to the Government, the benefits would be realised within the medium term.

Various design and operational options were considered for each element of the Cross City Tunnel. Assessment of these options took into consideration relationship to environmental quality, accessibility, engineering and capital costs. The EIS option was the preferred option as it provided the best balance between costs and impacts.

2.4 Major Benefits and Adverse Impacts Identified in the EIS

<u>Major Benefits</u>

The major benefits of the proposal would be:

- improvement in air quality in a number of streets in Central Sydney;
- redistribution of pollutant emissions so that overall dispersion is improved;
- significant noise level reductions;
- improvement in pedestrian safety;
- provision of bicycle lanes on William and Park Streets;
- improved amenity of public spaces within and adjacent to Central Sydney streets;
- improved visual quality of public spaces;
- increase in the size of public space available in Central Sydney; and
- creation of a new area of open space over the Kings Cross Tunnel.

<u>Major Adverse Impacts</u>

The adverse effects of the Cross City Tunnel proposal have been described on an area by area basis and not as individual impacts over the entire study area. Local impacts associated with the construction and operation of the proposal are described below in relation to Darling Harbour, Central, Hyde Park and Eastern Precincts.

Darling Harbour Precinct

The eastern area of the Darling Harbour Precinct would experience a range of adverse impacts for the estimated 20-month period of construction activities. These include:

- disruption to traffic flows;
- reduced capacity of the road system around the construction works;
- noise levels exceeding the EPAs construction noise goals at the nearest, most sensitive locations;
- potential risk of structural damage to buildings, including heritage buildings;
- potential disturbance to residents due to regenerated noise;
- potential dust impacts; and
- visual impacts.

Impacts during the operation of the Cross City Tunnel include:

- altered traffic volumes on a number of streets in the Darling Harbour Precinct. Harbour Street would experience a significant increase in traffic volumes. Druitt Street and Bathurst Street would experience significant reductions in traffic volumes; and
- continued high noise levels surrounding the western portals of the Cross City Tunnel. Increases would be experienced mainly on Harbour Street.

Central Precinct

The construction of the Cross City Tunnel would result in increases in traffic volumes on King Street, Market Street and westbound on Goulburn Street, potential vibration of buildings, potential noise, and potential impacts on buildings caused by surface settlement.

Changes to the environment resulting from the operation of the proposal include reductions in daily traffic volumes on some east–west streets with a mix of changes on north–south streets.

Hyde Park Precinct

Adverse impacts resulting from the construction of the proposal include movement of construction vehicles along Park Street, footpath widening, road re-linemarking, signal rephasing, signposting and kerbside landscaping to be carried out after the Cross City Tunnel opens. These impacts would result in minor disruption and some nuisance to park users in the short term during construction.

Changes to the environment resulting from the operation of the proposal include increased traffic volumes on north–south streets.

Eastern Precinct

Adverse impacts resulting from the construction of the proposal include:

- disruption to traffic flows as a result of the temporary closure of some existing roads, additional traffic generated from the construction areas or site compounds, temporary diversion of existing traffic to enable construction works to be carried out, and preparation for these temporary measures;
- noise levels would exceed the EPA's construction noise goals at the nearest sensitive receivers;
- potential risks of structural damage to buildings, due to vibration;
- potential disturbance to residents due to regenerated noise;
- potential dust impacts; and
- visual impacts.

Changes to the environment resulting from the operation of the proposal include increases in traffic volumes, and noise levels in areas surrounding the eastern portal, the exit to Sir John Young Crescent and the connections to the Eastern Distributor would experience either a minor decrease or an increase of less than two decibels. Nevertheless, daytime and night-time noise levels would continue to exceed EPA's goals. The most significant decreases in noise levels would be experienced on William Street, with moderate increases being experienced on McLachlan Avenue and Craigend Street.

3. SUMMARY OF REPRESENTATIONS

3.1 Representations made in relation to the EIS

The EIS was exhibited from 2 August 2000 to 6 October 2000. A total of 196 representations were received, of which 113 were individual representations.

The category types of the representations are summarised below:

Commonwealth Government	2
State Government	11
Members of Parliament	2
Local Government	7
Utilities and Infrastructure	6
Businesses / Institutions	24
Interest / Political Groups	31
Private Individuals	113
Total	**196**

Of the representations received, 24 stated clear support for the proposal, and 28 objected to the proposal. A petition with 1835 signatures protesting against the unfiltered exhaust emission stack proposed for Darling Harbour was also received.

3.2 Identification of Key Issues from Representations to the EIS

In its Representations Report, the RTA included a summary of key issues raised which categorised issues into 42 issue categories. The Department has examined the specific concerns raised in each of these categories and cannot find discernible differences between the issues listed in the RTA's 'Consultation' 'Process' and 'Exhibition Period,' 'Economic Impact and Costs' and Socio-economic Impacts' and 'Air Quality' and 'Health Concerns' categories. Accordingly, the Department has undertaken a supplementary assessment of representations to better understand the nature of concerns raised.

This assessment indicated that operational air quality impacts, particularly in relation to emissions from the proposed ventilation stack, were of the most significant concern. Strategic transport planning and impacts on public transport were also a frequently raised concern. The Department's summary of issues raised in representations is given at Appendix A.

A summary of key issues raised in representations to the EIS is given in Figure 3.1. A summary of the representations from Commonwealth, State and Local Government agencies is given in Table 3.1. The following points provide an overview of the main issues raised using where appropriate the actual wording found in representations.

<u>Object to ventilation shaft</u>

- Impact of ventilation shaft on landscape;
- Objection of single unfiltered stack in Darling Harbour;

Table 3.1 A summary of the representations from Commonwealth, State and Local Government agencies

Issues/Agencies	EPA	NSW DoT	State Rail Authority	State Transit	NSW Crime Comission	DHA & SHFA	NSW Health Dept.	NSW DPWS	Department of Housing	NSW Heritage Office	City of Sydney	South Sydney Council	Leichhardt Council	North Sydney Council	Woollahra Council	Eastern Suburbs	Clover Moore Bligh MP	Total
Public Transport Alternatives		✓	✓	✓			✓		✓		✓		✓	✓		✓		9
William Street Upgrade Issues		✓		✓					✓		✓	✓		✓			✓	7
Noise & Vibration Impacts	✓						✓		✓	✓			✓			✓		6
Pedestrian Access Issues		✓		✓		✓			✓		✓			✓		✓		7
Impacts on Cycle Links		✓	✓			✓			✓		✓			✓				6
Air Quality Impacts						✓	✓		✓				✓			✓		5
Congestion at Local Intersections						✓					✓		✓		✓	✓		5
Ongoing Consultation Needed			✓	✓							✓						✓	4
Regional Implications						✓	✓						✓		✓			4
Relocation of Congestion							✓						✓		✓	✓		4
Local Amenity Impacts						✓							✓	✓	✓	✓		5
Further Traffic Modelling Needed											✓	✓	✓		✓			4
Principles of Urban Design						✓				✓	✓							3
Health Impact of Vehicle Emissions							✓		✓								✓	3
Heritage Impacts										✓			✓					2
Property Access					✓				✓									2
Encourages Private Car Dependency							✓					✓						2
Further Air Quality Monitoring Needed							✓				✓							2
Induced Traffic	✓										✓							2
Reservation of Metro West Rail Corridors			✓															1
EIS Objectives Too Restrictive													✓					1
Exact Location of Exhaust Stack						✓												1
Consideration of Community Suggestions																	✓	1
Visual Impact of Stack																	✓	1
Toll Avoidance																	✓	1
Community Liaison Officer Needed																	✓	1
Impact on New South Head Road															✓			1
Doubtful Economic Benefit												✓						1
Delays From Construction Road Closure											✓							1

- Incorrect location of stack in low area would not provide adequate dispersal of emissions;
- Option for two emission stacks should be considered to better disperse emissions; and,
- Concern that ventilation stack located near Sydney Family Day Care.

Air quality

- Inadequate air quality monitoring of Pyrmont and Darling Harbour areas;
- Question accuracy of monitoring data and air quality goals;
- Increase in air pollution in Darling Harbour;
- Concern that pollution would be trapped in Darling Harbour;
- Concern that latest filtering technology not included in stack;
- Need for further air quality monitoring/modelling;
- Concern about the effect unfiltered air would have on air conditioners in high-rise buildings;
- Request for independent air quality monitoring of the stack during operation; and,
- CCT fails to meet the NSW government's *Action for Air* objectives.

Health impacts of air pollution

- The ventilation stack would add more carcinogens to the air;
- Concern that children would be allowed to develop cancer from unfiltered emissions;
- Concern that rock drilling would produce dust-containing silica. Exposure to such dust over even a short time can result in lung damage. Concern that predicted dust levels and a monitoring regime not included in EMP;
- Concern that increased dust levels are associated with enhanced conditions for Legionella proliferation in air-conditioning cooling towers;
- Concern that the health of residents can be affected by long term exposure to excessive levels of exhaust contaminants; and,
- Concern that exhaust contaminants from motor vehicles are potential carcinogens.

Public transport options

- Concern that CCT does not address NSW Government's *Action for Transport 2010*;
- Concern that bus services may be affected during construction;
- Concern that the EIS did not adequately address public transport options;
- Concern that the CCT does not address long term public transport problems for east-west transit of the city;
- Concern that the CCT undermines sustainable transport planning for Sydney; and,
- Concern that the CCT would impact the economic viability of future public transport infrastructure.

Operational traffic congestion

- Increased congestion corner Harbour and Bathurst Streets;
- Increased traffic levels would have a significant impact on air quality; and,
- Concern about the impact of operating noise from the CCT.

Construction

- Concern about increased noise and vibration during construction;
- Obstruction to businesses including access during building;
- Concern that the private amenity of residents in the vicinity of the CCT would be affected during construction;
- Concern has been raised as to the impact of out of hours construction on the community;
- Concern that construction works would cause major traffic flow disruptions;
- Concern that construction of the CCT would result in reduced traffic on the Eastern Distributor;
- Concern about the impacts of dust and air quality during construction;
- Concern about the impact on the ED ventilation system from construction of the CCT;
- Request for dust monitoring to be carried out at street level during construction to ensure compliance of health based goals;
- Request for dust suppression to be undertaken to effectively control dust from construction activities;
- Concern about the impact that construction activities would have on the structural integrity of properties in the vicinity of the CCT works;
- Concern that the disruption caused by the construction works would a have a negative impact on the visitation levels to Darling Harbour;
- There is concern about increased noise levels impacting on school classes; and,
- Request that approval should include requirements to ensure that vibration and subsidence impacts related to the construction of the tunnel and it's ongoing use do not have a detrimental impact on items or areas of heritage significance.

Increase in private car use

- The proposal would induce private vehicle use;
- CCT would facilitate access to under-utilised parking spaces on the western fringe of the city making car travel more attractive; and,
- Additional traffic induced by the CCT could reverse the predicted benefits of reduced air pollution
- Increased traffic congestion beyond the CBD.

Community impacts

- Concern about potential displacement of prostitution in William street;
- Concern that the CCT would further reduce the quality of living in the inner- city;
- Concern has been raised about the potential displacement of low income people and increase isolation and stigmatisation of those that remain;
- There is concern that the CCT principally benefits private vehicle drivers at the disproportionate expense of local residents adversely affected during construction;
- Concern that pedestrian access would be impacted in certain areas during construction;
- Concern that the EIS process and community consultation process is flawed as the outcome is predetermined;
- Request for appointment of community consultative committee and or an independent arbitrator to facilitate the consultation process during construction;
- Concern about lack of consultation within the communities of non English speaking backgrounds;
- Concern that the CCT would negatively impact on property prices of properties in the vicinity of the CCT; and,

- Concern that EIS does not address environmental issues of surrounding areas.

3.3 Request for Commission of Inquiry

The Royal Australian Planning Institute NSW requested that a Commission of Inquiry be held given the level of public interest in the proposal. The Department considers that a Commission of Inquiry is not warranted, given the independent assessment process utilised and the lack of significant technical concerned raised by government agencies.

3.4 Community Meetings

The Department was invited to attend two community meetings held to discuss issues in relation to the proposal. At the first meeting, held on 30 May 2001 at the Ultimo Community Centre, Harris Street, Ultimo, key issues of concern were air quality impacts, the location of the ventilation stack, traffic impacts on local streets and dissatisfaction with local public transport services. At the second meeting, held on Tuesday 10 July 2001 at St Johns Church Hall, Victoria Street, Darlinghurst, key issues of concern were portal emissions, noise impacts surrounding portals and impacts on cyclists. Summaries of the issues raised at these meetings are given in Appendix B.

3.5 Representations Made in Relation to the Preferred Activity Report

The RTA modified the proposal following consideration of the representations received in relation to the EIS. A summary of these modifications is given in Section 4 of this Report. The RTA prepared a Preferred Activity Report (PAR) which detailed these modifications to the proposal. The PAR was put on public exhibition from 19 May 2001 to 18 June 2001.

The Department received six representations in relation to the PAR. Key concerns include:

- lack of traffic management proposed;
- concern over level of traffic assessment undertaken;
- concern over impacts of increased traffic resulting from the proposal, particularly in the afternoon peak;
- need for 24 hour independent community liaison officer;
- potential structural damage due to ground vibration;
- impacts of the additional site compounds on surrounding residences
- concern over portal emissions;
- loss of pedestrian crossings;
- loss of parking;
- urban design;
- need to reduce growth in vehicle kilometres travelled;
- need for separation of bus and cycle lanes;
- need for wide area view bicycle planning;
- need for link with Eastern Distributor cycling facilities; and,
- need for cyclist facilities from Darling Harbour to the city.

4. Modifications to the Proposal Following Exhibition of the EIS

This Section describes the current proposal for which the RTA has sought approval from the Minister of Urban Affairs and Planning as described in the Representations Report and Addendum. The modifications to the proposal described in this Section have been made by the RTA following exhibition of the Environmental Impact Statement in response to the issues raised in Representations.

4.1 Overall Project

The modified proposal is illustrated in Figures 4.1 (a) – (i). Modification to the overall project are detailed in the Representations and the Preferred Activity Report (PAR) and include:

- modifications to tunnel emission management system including:
  - segmentation of the ventilation stack. This is proposed to increase air velocity and dispersion of pollutants at times when ventilation is not operating at full capacity;
  - provision for partial portal emissions during operation of the Tunnel; and
  - provision for potential future installation of electrostatic precipitators;
- combined bicycle lanes with bus or T2 transit lanes;
- advertising ban within land leased by the Contractor;
- variable message signs at ten locations external to the tunnel;
- installation of boom gates on all entry portals to prevent access during incidents;
- signposting the speed limit in the tunnel;
- modifications to breakdown bays within the tunnel to allow for B-doubles; and,
- revised property acquisition requirements.

4.2 Eastern Precinct

The Tunnel Control Centre would be relocated to Palmer Street (see Figure 4.2). It would be a purpose-built building solely serving the Tunnel and would be constructed on land previously used for the cut and cover section of the Eastern Distributor.

Modifications would be made to intersections and lane arrangements on Sir John Young Crescent including:

- northbound access from Riley Street to Sir John Young Crescent would be banned. This design allows local access without providing direct access through Woolloomooloo;
- provision of opposing right turns from Sir John Young Crescent into Domain Carpark and Crown Street with two through lanes in all legs. This allows local access without compromising traffic movements; and
- provision of two lanes on Sir John Young Crescent northbound through the Palmer Street intersection while restricting southbound traffic to one lane between Cowper Wharf Roadway and Palmer Street. This modification allows better local access to Cowper Wharf Roadway without compromising southbound traffic movements.

A number of changes to the Domain Carpark are also proposed:

- replacement of the egress ramp from the Domain Carpark. This would be relocated to allow access for service and emergency vehicles to the Domain Carpark; and
- changed access to the RIC rail maintenance yard. This would be modified to fit in with the Domain Carpark ramp and to provide for over-sized railway maintenance vehicles.

A new electrical substation site would be provided near William Street. Two potential sites have been identified and the location would be confirmed during detailed design.

Other modifications to the Eastern Precinct include:

- elimination of access to Moore Park Road and Anzac Parade from the Cross City Tunnel;
- increasing the height of the wall at the Bourke Street ramp to the Eastern Distributor by 6 metres;
- inclusion of traffic calming measures in the Paddington Local Area on Brown Street/Nield Ave and Glenmore Road;
- refurbishment of the Kings Cross Tunnel to match the Cross City Tunnel; and
- construction of a retaining wall on the east side of the Eastern Distributor off load ramp to William Street.

4.3 Central and Hyde Park Precincts

Modifications in the Central and Hyde Park precincts include intersection modifications to cater for changed traffic arrangements at:

- York and Druitt Streets;
- George and Druitt Streets;
- Elizabeth and Park Streets; and
- College and William Streets.

4.4 Darling Harbour Precinct

There has been a revised layout (see Figure 4.3) of Harbour Street and Bathurst Street to:

- include an additional left-turn lane from Harbour Street southbound to Bathurst Street eastbound;
- allow right turns from the Bathurst Street viaduct eastbound into Harbour Street southbound, including provision of a short right-turn storage bay;
- delete the proposed right turn bay from Bathurst Street eastbound into Day Street southbound;
- provide twin left turn lanes from the Bathurst Street viaduct eastbound into Harbour Street northbound, signal controlled at Harbour Street;
- provide two dedicated right turn lanes for westbound traffic exiting the Cross City Tunnel to turn right into Harbour Street northbound;
- provide three lanes southbound in Harbour Street from Bathurst Street to Liverpool Street;
- provide three lanes eastbound on Bathurst Street between Harbour Street and Sussex Street; and
- reduce to a single proposed westbound lane in Bathurst Street between Sussex and Day Streets.

A number of changes to the intersection of Sussex and Druitt Streets are also proposed involving:

- relocation of the westbound exit portal in Day Street three metres to the south;
- revised access arrangements to Darling Park towers;

- relocation of the Park Royal Hotel electrical substation in Day Street;
- reduced length of exit lane from the westbound tunnel to Harbour Street; and
- amended pedestrian crossings at the Sussex Street intersection.

Modifications to the intersection of Clarence and Market Streets are proposed to provide for two westbound left turn lanes from Clarence Street to Market Street.

It is also proposed to change the pedestrian access arrangements, with the provision of a new bridge from Bathurst Street connecting to the Darling Harbour Information Centre.

4.5 Modifications to Construction Arrangements

Modifications to constructions arrangements include amendments to construction staging to allow the retention of Sewage Pumping Station 12 (SPS12) on Harbour Street. SPS12 is listed on the State Heritage Register and in response, the design has been revised to allow SPS12 to be retained. This modification would mean that during construction southbound traffic on Harbour Street would be split to the east and west of SPS12.

Changes to the Druitt Street viaduct work area are also proposed. Site Compound No. 1 would now be located on the northern side of the Druitt Street viaduct rather than the southern side.

An additional site compound on Palmer Street between William Street and Cathedral Street would now be required. The RTA concludes that this additional compound would be required to ensure that there is adequate space for the storage of equipment and materials and for facilities for the workforce during construction.

Other modifications include amended requirements for management of the Central Sydney road network during construction, restrictions on sheet piling works and the use of smart reversing alarms.

5. ASSESSMENT OF KEY ISSUES RELATING TO THE MODIFIED PROPOSAL

This Section of the Report provides an assessment of the key environmental impacts of the modified proposal based on an examination of the EIS, issues raised in representations during the exhibition period and the RTA's response to these issues in its Representations Report and during further consultation with the Department.

The RTA has also provided the Department with an assessment of all issues raised in representations in Appendix 2 of its Representations Report. This assessment has been reviewed by the Department and where required further assessment has been undertaken and discussed. It is therefore important that this Section be read in conjunction with the RTA's Representations Report to understand how all issues raised in representations were addressed.

5.1 Need and Justification

5.1.1 Project Justification as Described in the EIS

The primary objectives of the proposed Cross City Tunnel as stated in the EIS are:

- to improve the environmental quality of public space within Central Sydney;
- to improve ease of access and reliability of travel within Central Sydney; and
- to improve the reliability and efficiency of travel between areas east and west of Central Sydney.

The proposal has been justified in the EIS on the basis that it best meets these objectives, which in turn are related to overcoming current impacts on the Sydney CBD. These include:

- undesirable competition between public transport, pedestrians and motorists for road space;
- high volumes of traffic that contribute to poor air quality and a noisy environment. Poor visual quality and legibility of Central Sydney, including pedestrian links between the CBD and Darling Harbour and the CBD and the east, particularly William Street;
- direct travel between the east and west of Central Sydney currently takes place on a number of Central Sydney streets that also perform local access and circulation functions;
- conflict between east–west through traffic and traffic with an origin or destination within Central Sydney contributes to delays and congestion;
- buses predominantly use north–south streets and are affected by traffic signal priority favouring east–west traffic, therefore, bus journey times and reliability in Central Sydney are poor due to congestion and delays;
- east–west through traffic causes major routes to operate at or close to capacity in peak periods, resulting in poor levels of service at key intersections; and,
- travel speeds on these routes are low and highly variable, which results in unreliable travel times for all road users, with associated adverse economic, social and environmental consequences.

Having established the current problems and primary objectives, the RTA considered a number of alternative approaches including minimal intervention, demand management, public transport and road infrastructure construction. A short-list of options under each of these broad categories was subsequently developed and assessed.

The minimal intervention and demand management options were not considered acceptable by the Department as neither would provide improvements to the environmental quality of public space and only minor improvements to existing travel efficiency would be achieved. The public transport option had difficulties meeting the objectives given the dispersed nature of the origins and destinations for trips east/west across the CBD. Notwithstanding, the Department considers that this option is still worthy of consideration as a companion longer-term solution as it could potentially more comprehensively address longer-term broader regional transportation issues. Further discussion on this issue is provided in Section 5.2 of this Report.

Overall, the Cross-City Tunnel is considered by the RTA to provide the most cost effective and the approach best able to address the issues. In addition, the RTA states that the Cross City Tunnel offers a major financial advantage in that it would be constructed with no cost to government.

The consequences of not proceeding with the proposal as stated in the EIS are:

- increased traffic volumes on east–west surface routes through Central Sydney;
- increased congestion at intersections in Central Sydney and a related decline in travel speeds and travel times;
- increased travel times for buses within Central Sydney;
- increased vehicle and pedestrian accidents in Central Sydney; and
- more emissions of air pollutants from vehicles within Central Sydney.

5.1.2 Key Issues Raised

The need and justification of the proposed development was raised by a number of government agencies, local councils, community groups and private individuals. The key concerns raised included:

- failure to meet the NSW Government's *Action for Air* objectives;
- the strategic context of the proposal within integrated transport planning initiatives, particularly the encouragement of private vehicle use rather than improving the public transport system, not addressing long term public transport issues and not addressing the NSW Government's *Action for Transport 2010*;
- the ability to quantify and ensure that the benefits identified in the EIS, particularly improvements to the environmental quality of public space and improvements to ease of access and reliability of travel within the CBD, can be achieved in a way that can be identified by those that live in and use the City; and,
- concerns that the short term impacts of the construction and the long term impacts of pollution from the stack would not be offset by the overall benefits.

Specifically, the Nature Conservation Council raised concerns that the proposal would undermine sustainable transport planning for the rest of Sydney and that the options of public transport and demand management were not fully assessed.

South Sydney City Council indicated opposition to the project on the grounds of a doubtful economic benefit to the community, especially given perceived errors in traffic modelling, failure to reduce dependency on private cars and that expenditure on inner-city road based infrastructure of the scale of the CCT would be better diverted to public transport systems and improvements in the inner suburbs.

Leichhardt Council, Light Rail Association, Sydney Light Rail Company, the NSW Chapter of the Royal Australian Planning Institute (RAPI), Eco Transit, Australian Institute of Architects, Greenways, Action for Public Transport, Improve Sydney Public Transport (ISPUT), Sydney City Residents Against Polluting Stacks, Eastern Suburbs Greens and the Member for Bligh, all raised fundamental objections to the proposal indicating that improvements to public transport would potentially provide a better long term outcome.

5.1.3 Consideration of Key Issues

Strategic Policy Objectives

NSW's *Action for Transport 2010* and *Action for Air* policies outline a number of objectives with regard to integrated transport planning and infrastructure initiatives, including the need:

- to achieve more effective use of existing and proposed transport infrastructure;
- to improve air quality;
- to reduce car dependency;
- to meet the needs of future urban development;
- to improve public transport services and usage;
- to ensure new urban developments are provided with equitable access to economic and social opportunities;
- to improve facilities for cyclists and pedestrians;
- to reduce road accidents;
- to make movement of freight more efficient; and,
- to provide value for money.

Overall it must be appreciated that the strategic transport objectives, would by necessity, apply to a program of projects rather than to an individual project such as the Cross-City Tunnel. In this regard it is not expected that each project on its own would necessarily address all the objectives but rather cumulatively all (or the majority) of projects should address or support a majority of the objectives. Notwithstanding, there would be an expectation that no individual project should result in a significant detrimental impact on any of the strategic objectives.

The ability of the proposed CCT to meet these broader strategic policy objectives is considered in the context of the specific project objectives below.

Strategic Project Objectives

- *Improve the Environmental Quality of Public Space within Central Sydney*

The EIS, as modified by the Representations Report, states the proposal would reduce the number of intersections with poor operation and increase the number with good operation. As quantified in detail in Section 5.6 of this Report, the Department's key findings indicate that the extent of substantial and noticeable improvements to the CBD intersections would be more limited. Overall, Section 5.6 indicates there is expected to be a net major improvement to possibly only five (5) intersections throughout the Sydney CBD, of which three (3) would be along the Park/ William/ Druitt Street corridor.

When the specific objective of improving bus operation is further assessed, the benefits also do not appear to be highly substantial when the project is considered in isolation. For example, the EIS

argues that the improvements to east – west intersections would result in improved bus services. Analysis of the EIS shows that the operation of the proposal would result in an increase in traffic volumes along both George and Elizabeth Streets, with only a slight reduction in Oxford Street. Indeed, negative impacts would be experienced for buses on Elizabeth Street at Market Street. Further quantified detail can be found in Section 5.3 of this Report.

Overall, only incremental benefits would appear to apply to the travel time savings of buses unless further measures are implemented. The EIS analysis shows that the majority of savings would be less than 10% with the key north – south route along George Street achieving a saving of less than 10 seconds over the entire journey. Such small improvement increments are not likely to be perceived to the traveller considering the normal daily variations in travel time.

Similarly with pedestrians (refer to Section 6.9 of this Report), a more focussed CBD pedestrian analysis identifies relatively minor changes to the prime pedestrian environment in the CBD. For the twelve (12) prime pedestrian CBD intersections examined, only the intersection of Park and George shows a major improvement (based on the removal of the "scramble") and the intersection of George and Market Streets shows a medium improvement. Balanced against these improvements is a predicted worsening of pedestrian conditions at the intersections of Market and Elizabeth Streets and at Park/Castlereagh Streets. All other intersections show effectively no perceptible changes. Again most of the benefits to pedestrians are focussed on the William/Park/Druitt Street corridor.

In terms of improvements to the environmental quality of the CBD, the extent of "transformation" would appear to be essentially limited to the William/Park/Druitt Street corridor. Impact on congestion levels beyond this corridor would appear to be marginal and unlikely to be "perceptible" to the driver, public transport passenger or pedestrian unless essential complementary measures are implemented.

Improve Ease of Access and Reliability of Travel within Central Sydney

The construction of the tunnel would have significant implications for general accessibility to the CBD, particularly for east west travel. The Harbour Street exit raises a more specific strategic traffic issue, which also has implications for long term reliability of travel in the CBD. Both these key issues are addressed below.

- *General Accessibility*

Table 7.2 of the Traffic Working Paper indicates that the project would result in an overall net increase of traffic in the CBD of around 15400 vehicles per day. Although the CCT would accommodate more than 15000 vehicles, routes leading to the CBD and the CCT are likely to become more congested. The issue of potential induced traffic would further exacerbate this situation.

The argument then follows that some 80 000 vehicles would be in the tunnel and thus there is a potential net reduction of cars in the CBD - ie some 65 000 (ie 80000 minus the 15000 drawn in) cars per day. However, the construction of the CCT would also create the potential for additional capacity in the order of 25 000 to 50 000 vehicles per day. This is because the creation of capacity by building the CCT is not completely offset by the proposed reduction of capacity in William Street. Assuming this additional net capacity is absorbed, the potential for the CCT to reduce traffic from city streets could be reduced to about 15 000 to 30 000 per day.

The Department accepts that induced traffic is not readily modelled, as induced travel occurs due to behavioural changes, which is problematic for a computer traffic model to accurately predict. However, the Department recognises that in the case of the CBD there are limiting factors on the extent of the induced effect, as the feeder roads to the city also have a strong control on the ability for induced traffic, as would the imposition of a toll. Notwithstanding, as the traffic modelling indicates that the CCT would actually draw traffic away from many of these existing controls, the freed space once again allows the potential for the inducement of traffic. Similarly, whilst it is recognised that there is a toll, electronic tolling has the ability to be less of a disincentive to travel than traditional tollbooth collection as there are no delays and there is no obvious point of expenditure.

Overall the travel behavioural changes due to the construction of the Cross City Tunnel are highly complex. Whilst the traffic modelling is a reasonable indicator it has limitations with complex travel behaviour in a major city centre and in particular dealing with induced traffic. The ability to reliably predict that the project would provide a positive contribution to meeting the objective of improving ease of access and reliability of travel within Central Sydney should therefore be viewed with potential limitations in isolation of any offset measures.

- *Harbour Street Access*

The tunnel exit at Harbour Street raises more problematic strategic traffic issues, which have less potential for amelioration. The Journey to Work (JTW) data indicates that some 80% of the origins and destinations from the eastern suburb LGAs are to the city or north of the Harbour. This is reflected strongly in the traffic model, which indicates that during peak periods, up to 30% of west bound traffic using the CCT would exit the tunnel at Harbour Street. Thus, a strong outcome of building the CCT is that a significant amount of traffic is predicted to be relocated to other parts of the city rather than removed entirely from the city. That is, of the 80 000 removed, a potential 30 000 are relocated to other parts of the CBD rather than removed altogether. The issue then becomes what happens to this traffic once in the CBD.

The traffic model implies that this traffic would be relatively contained to the main car parks along Sussex, Kent and Clarence Street, and that the level of infiltration to the rest of the CBD would be relatively small. This is generally a positive outcome for the project, as it would take traffic out of the key pedestrian precinct. However there are some potential key limitations in the modelling as follows:

- there is a strong likelihood (particularly given the already high (65%) mode split of journey to work trips to the CBD from the eastern suburbs) that a major reduction in private vehicle (as opposed to public transport) travel time would potentially encourage greater than modelled traffic levels to the CBD (ie induced traffic);
- a new link to the south-west of the CBD has a significant potential to attract traffic from other parts of the Sydney area and in particular from the Eastern Distributor; and,
- with a much greater reduced travel time to the CBD, the attractiveness of the car parks in this part of the city could significantly increase. Whilst the limited availability of parking spaces could potentially control this attractiveness, it has a high potential to result in greater traffic infiltration to other parts of the CBD searching for other car parks.

It is acknowledged that to some extent, the ultimate control on the extent of traffic over and above that predicted by the traffic modelling (ie induced traffic) would primarily relate to parking provisions in the CBD. However there is a real and strong potential for the CBD parking supply to readjust upward with a corresponding level of traffic congestion equal to that before the CCT.

It is therefore evident from a strategic traffic perspective, that whilst the east-west through movement in the CCT has the potential to remove traffic from the CBD (ie subject to the public transport offsets and capacity reductions discussed in Section 5.3 of this Report), the Harbour Street exit does not have similar mitigation strategies and could ultimately erode the benefits of the CCT in the long term.

The Department requested the RTA to undertake additional traffic modelling to assess the broader traffic implications of deleting the Harbour Street exit. The response indicated that the aggregated road network performance would not change if the exit was deleted nor would there be a marked decline in overall economic benefits. However the forecast traffic using the tunnel is predicted to fall by about 23 percent. The RTA has indicated that this would have serious impact on toll revenue and hence financial attractiveness. The RTA also indicates that traffic redistribution would refocus access into the CBD from the eastern suburbs to Macquarie Street, William Street and Liverpool and Goulburn Streets with accompanying poor levels of CBD intersection performances.

The Department concludes that the strategic outcome of the Harbour Street exit has the potential to conflict with the benefits of a "Cross-City" tunnel. At best, the Harbour Street exit would relocate traffic to a different part of the CBD, but at worst, could lead to significant infiltration of traffic back into the CBD as well as potential pressure for more parking in the CBD. However, as indicated above, the RTA has expressed concerns that its removal would have serious implications for the financial viability of the project given its significant use, particularly if the principle of "no cost to government" is to be preserved.

The Department notes that its concerns in relation to the Harbour Street Exit are somewhat subjective, iterative, and difficult to substantiate due to the timing and consequences of external events (essentially outside the realms of traffic modelling) that would need to arise for them to be confirmed. In this regard the Department recommends that at this stage of the project assessment, the Harbour Street exit be closely monitored for infiltration of traffic beyond the nearby car parks and into the CBD (ie east of George Street). Should infiltration become a critical issue, it is recommended that further traffic management measures be imposed including the option of a congestion toll on the exit.

Improvements in Efficiency of Travel East to West Suburban Trips

There is an expectation that the Cross City Tunnel would achieve demonstratable improvements to travel times for travel between areas either side of the city and certainly to provide for a more efficient means of travel across the City than currently exists.

Sydney City Council has estimated that 51% of traffic in Central Sydney is through traffic. The EIS refers to this claim but does not substantiate it. On review of the information provided in the EIS, particularly that summarised in Figures 2.16 to 2.20, traffic movements (calculated by trips generated) east – west and west – east appear to be around 10 % of the total trips generated.

To further emphasise the comparatively smaller number of cross city trips, an examination of Figures 2.18 onwards shows that east – west trips per number of jobs would be lower in the overall hierarchy of suburb to suburb trips. In particular, the EIS does show that the CCT will pick up trips from suburban areas other than the inner east and inner west (refer EIS, Figures 5.1 and 5.2). Overall, it is estimated that the reduction in flow on east – west surface streets within Central Sydney would range between 19 % and 38% (page 5-5). It is recognised that there will also be reductions in the north – south traffic flows. The reduction in traffic flows will have varying effects on different roads.

The savings made, in terms of time saved in "Suburb to Suburb" movement is summarised in Tables 5.6 and 5.7 of the EIS. On various east – west trips, travel time improvements calculated for both 2006 and 2016, vary from 2 to 7 minutes on existing trips varying in time from 21 to 38 minutes. The greater savings of 7 minutes are usually gained on the shorter trips, with the smaller savings gained on longer trips.

Overall the improvements to true "cross-city" trips resulting from the proposal appear incremental rather than substantive. Furthermore they would be dependent on maintaining congestion reductions on regional streets in the long term and assume limited induced or re-directed traffic.

5.1.4 Conclusion

The EIS establishes the need for the project based on various observations such as "the public domain of Central Sydney is characterised by an undesirable competition between pedestrians and motorists"…"traffic is a major contributor to noise levels, air pollution and pedestrian safety problems" and "bus journey times and reliability in Central Sydney are poor due to congestion and delays". The proposal is then justified on the basis of the following key benefits:

- removal of traffic from Central Sydney;
- making the environment of Central Sydney streets and adjoining public spaces more pleasant for pedestrians, residents and business; and,
- improving travel times and reliability of bus services and other road users within Central Sydney.

However when the detailed outcomes of the project are evaluated, the Department considers that the benefits of the project if undertaken in isolation would appear to be incremental rather than substantive. The benefits that would be substantive would be primarily concentrated on the Park Street/William Street corridor. In particular, unless complementary measures are undertaken the overall CBD benefits to bus journey times and reliability and pedestrian walk times beyond the William/Park Street corridor would appear marginal, as would the net improvements to regional air quality levels. The exit at Harbour Street in particular, has a potential to more directly erode the potential benefits of the project, particularly if parking controls are relaxed to the extent that current congestion levels return.

The Department considers that for the CCT to achieve significant and noticeable long-term improvements for traffic, public transport, pedestrians and cyclists, it cannot rely on the infrastructure alone nor in isolation. A highly cohesive and pro-active co-ordination of all key transport decision makers in the CBD including the Sydney and South Sydney Councils, STA, Sydney Buses, DoT and the RTA is required for this project to obtain its stated benefits. That is, for this project to substantially (rather than incrementally) meet its objectives, and that of State Government strategic policy, there must be a strong commitment to the achievement of substantial accompanying public transport, pedestrian and cyclist initiatives and for these to be implemented as an integrated part of the project.

To ensure that this occurs, the Department recommends the establishment of a publicly accountable Public Transport Committee (PTC) to formally carry the investigation and co-ordination of transport initiatives through the construction phase and at least the early operation phase. This recommendation is reflected in Recommended Condition of Approval No. 27. This would ensure that the opportunities to capture potential benefits of the project during construction and operation are optimised, primarily by absorbing any spare surface road capacity through additional public transport and pedestrian/cyclists offset measures. Together with a comprehensive package of around 30 specific public transport and cyclist/pedestrian improvement offsets including some 5 kms of additional bus lanes and potentially a

further 15 kms of new bus or transit lanes, bus performance indicators, investigation of electronic based passenger information systems, co-ordination of buses with the RTA's traffic systems (SCATS), real time congestion monitoring, further improvements to cycle connection, (discussed in detail in Sections 5.3 and 6.10 of this Report) the Department is confident that the project could achieve its specified objectives in a more substantive way and therefore could be justified.

5.2 Alternative Route Options

5.2.1 Background

The EIS identified a number of strategic options as well as specific project variations. These are described below.

Strategic Options

The EIS identifies a number of strategic options to broadly achieve the objectives of the proposal including:

- minimal intervention (the 'do nothing' option);
- management of travel demand;
- public transport; and
- road-based infrastructure (including other road-based options as well as the Cross City Tunnel proposal).

Five strategic options were ultimately examined in detail to assess whether or not they would satisfy the needs and objectives of the project being:

1. a minimal intervention option, including various localised changes to intersections to favour the east–west movement of traffic through Central Sydney;
2. priority public transport corridors extending from West Ryde in the west to Edgecliff in the east and Maroubra and Randwick in the south-east;
3. an integrated transport package, including the public transport option mentioned above, and a range of demand management measures in Central Sydney related to parking pricing, cordon pricing of surface east–west through traffic and management of commercial vehicles;
4. road tunnels crossing Central Sydney between the Western Distributor and Paddington and Darlinghurst under Druitt, Bathurst and Oxford Streets and Hyde Park; and
5. the Cross City Tunnel proposal incorporating road tunnels between Darling Harbour and Kings Cross under Druitt, Bathurst, Park and William Streets and Hyde Park.

The EIS preferred option is to provide additional road-based infrastructure, which would be supplemented by improving the provision of public transport, implementing traffic demand management measures and implementing local area traffic management. The EIS indicated that this option is preferred because:

- the minimal intervention option would provide no improvements to the environmental quality of public space within Central Sydney and only minor improvements in travel efficiency would be realised; and,
- the public transport, Oxford Street Tunnel and Cross City Tunnel proposals would result in a range of reductions in traffic flows on Central Sydney streets. These reductions would create the potential

to re-allocate road space for pedestrian, public transport and bicycle use. Significant urban design improvements would be possible. The Oxford Street Tunnel and Cross City Tunnel would, however, provide a greater overall level of traffic flow reduction in the CBD and therefore, the EIS concludes, would provide a greater level of improvement to traffic efficiency within Central Sydney.

Project Variations

The EIS identified a number of project sub-options to the proposed CCT alignment. These related to the western connection to the Western Distributor, location of the tunnel portal in Rushcutters Bay, connection to Sir John Young Crescent and the Eastern Distributor connection. It also assessed alternative tunnel configurations and treatment of William Street and Park Street.

5.2.2 Key Issues Raised

Strategic concerns were raised by Leichhardt Council, Light Rail Association, Sydney Light Rail Company, the Royal Australian Planning Institute (RAPI), Eco Transit, Australian Institute of Architects, Greenways, Action for Public Transport, Improve Sydney Public Transport (ISPUT), Sydney City Residents Against Polluting Stacks, Eastern Suburbs Greens and the Member for Bligh. All raised concerns that a more appropriate alternative would be to improve public transport rather than constructing a new road.

The Council of the City of Sydney raised issues about relocating the tunnel to the north to accommodate a future bus interchange and also the provision of stub tunnels at the western end to allow a future link to the Anzac Bridge. South Sydney Council raised issues about the Kings Cross lid options and the surplus land between Bourke and Palmer Street.

The Australian Museum raised a number of opportunities that would benefit the Museum including a new underground storage space for archival material, an underground pedestrian tunnel link connecting the Museum to Cook Park and additional overpasses/walkways. The mobilisation of large construction equipment and the proximity of the tunnel was seen as a major opportunity to do the works in a highly cost effective and low impact way.

5.2.3 Consideration of Key Issues Raised

Strategic Options

A number of representations to the EIS suggest that there needs to be more serious consideration of public transport alternatives. However as indicated in the Department's EIS *Guideline for the Preparation of an EIS for Roads and Related Facilities*, it is not the role of a project EIS to undertake a strategic environmental assessment of transport plans or policies. The assessment must therefore focus on the merits of the proposal as submitted for approval by the RTA.

Nonetheless, it is expected that relevant strategic studies should be considered in formulating and justifying the proposal. In this regard, the EIS relies on strategic documents such as DUAP's "*Shaping Our Cities",* and the government's "*Action for Transport 2010".* The RTA's analysis of a public transport alternative highlights the difficulty in identifying a conventional public transport proposal that would satisfy a diverse range of project objectives. Notwithstanding, as identified in Section 5.3 of this Report, a public transport option could be considered as a long-term solution to resolving the environmental and transport related issues identified within Central Sydney. Broader regional environmental and transport related benefits would be likely to result from pursuing a long-term public transport solution within the constraints of a major city environment.

As previously indicated, the Department accepts that the proposal could meet its objectives and could complement the overall public transport system provided that important ancillary improvements to bus services are implemented as an integral part of the proposal. It is also important to note that, as the option could be constructed at no cost to the Government, the benefits would have a greater potential to be realised within the short to medium term. Whether a comparable public transport option could be achieved within the same timeframe is not within the scope of the Department's assessment, but rather a matter for the government transport agencies to determine.

Project Modifications/Additions

The City of Sydney Council preferred that the tunnel reserve be aligned as far as possible to the north in order to maximise the space for a proposed bus-interchange. At this stage it is problematic for the Department to alter the project on the basis of another project, which has not yet been assessed or approved. Nonetheless, the construction of the tunnel should not preclude the construction of an underground bus interchange in the future.

The City of Sydney also indicated that there was no provision for the construction of tunnel stubs to allow for future tunnel extensions. As with the relocation of the tunnel to the north, it is inappropriate and certainly statutorarily questionable for the Department to require the RTA to construct additions to the project which are not directly related to the project and for which no impact assessment or public consultation has been conducted. However it is unlikely that the construction of the tunnel would preclude the construction of stub-tunnels.

The site located between Palmer and Bourke Streets could create an open space consistent with the William Street Revitalisation Strategy. However more detailed information is required on the design and finishes proposed for the open space. Further consultation with SSC is also considered necessary. Appropriate conditions of approval have been specified.

The additions identified by the Museum are acknowledged, but in general are not within the project scope as they are not directly related to the construction and/or operation of the Cross City Tunnel.

From a preliminary inspection there would appear to be significant cost savings gained as well as minimising environmental impacts by doing the work in conjunction with the construction of the tunnel. However the justification of these works, appropriate planning approval including public consultation and government endorsement would be required.

5.3 Public Transport Issues

5.3.1 Background

The Sydney CBD is the most accessible point in the metropolitan area by public transport, with all major modes of public transport converging on the CBD. The EIS identified that approximately 60 per cent of passenger journeys to Sydney CBD are made by public transport (including taxis). This includes some 75,000 bus and rail trips made to Sydney CBD during the morning peak hour.

There are more than 160 bus routes that run to, from, or within the Sydney CBD region. The principal bus termini in Sydney CBD are:

- Central Railway Station – Eddy Avenue and Railway Square;
- York Street – Queen Victoria Building;
- York Street/Carrington Street – Wynyard Station;
- Alfred Street – Circular Quay;
- George Street – The Rocks; and,
- Harrington Street – Circular Quay express services.

These termini enable good penetration of services into the CBD allowing passenger drop-offs and pick-ups close to their destinations, but do not necessarily allow passengers to conveniently transfer between services. Congestion and geometric constraints at intersections further impinge upon the movement of buses in the CBD, including limiting the ability for buses to turn around within the CBD.

There is a reliance on the principal north-south roads by buses for servicing the CBD. However the heavy north-south bus movements are disadvantaged by the heavy east-west through traffic movement across the CBD and the phasing of traffic lights to favor east-west movements. This has particular implications for bus operations in that delays and poor reliability for bus services mean that passengers are disadvantaged, services are made less attractive and bus operators are required to operate larger fleets to overcome travel inefficiencies on the road system.

The EIS identified a further significant point in that regard, in that there are no east-west cross regional services that pass through the Sydney CBD. Passengers wishing to travel east-west across the CBD are obliged to interchange within the CBD. Specific to the Cross City Tunnel proposal, there are no bus services running between the Western Distributor and either William Street or Oxford Street.

The EIS nominates a number of public transport related components of the proposed Cross City Tunnel including:

- provision of eastbound and westbound 24-hour bus lanes in Park Street between College and Elizabeth Streets, in Druitt Street between Sussex and George Streets and on the Druitt Street viaduct from Harris Street to Sussex Street;
- conversion of the peak hour T2 Transit Lanes on William Street to 6am – 7pm T2 lanes between Forbes and College Streets westbound and between College and Palmer Streets eastbound;

- extension of the southbound bus lane on Elizabeth Street from Park Street to Liverpool Street by removing one right turn lane from Elizabeth Street northbound into Park Street eastbound; and,
- provision of bus priority signals at the Park Street mid-block signals in Hyde Park for westbound buses.

In addition to these physical measures, the EIS states that the removal of a large number of east-west traffic from the CBD would facilitate smoother traffic flow and thus assist buses travelling along CBD streets. In this regard there would be a greater capacity to manage George Street in a way that is expected to better suit bus services. There would also be an opportunity for buses to use the Cross City Tunnel. Tourist and other unscheduled buses would use it as a matter of course when a journey across the CBD did not necessitate a stop within it. However, there is the potential for express eastern suburbs buses to use the CCT for fast access to Bathurst Street from New South Head Road.

As a result of the proposal, the EIS indicates that improvements identified to traffic would enable surface road based public transport to operate more efficiently within the CBD. This would include improved travel speeds on streets and less congestion at major intersections. Additionally, bus travel time savings would be accompanied by better reliability.

Despite the expected improvements to bus services, the EIS states that the Cross City Tunnel is likely to cause only small mode shifts from buses to private vehicles as:

- private vehicle travel to/from the CBD is most heavily influenced by parking costs and availability and this is not likely to change;
- the toll would offset some of the travel time savings; and,
- dispersed origins and destinations of trips across the CBD mean that these are hard to serve by public transport, public transport services between most of them are accordingly not highly convenient and thus the number of public transport trips that might be affected is relatively low in the first place.

During the construction period, the EIS anticipates that the road network would operate satisfactorily, therefore concludes that the bus operations would not be significantly impacted by the general traffic arrangements. Special treatment is proposed in the construction plan to maintain bus priority in both Druitt Street and Bathurst Street. The construction plan otherwise maintains all bus lanes, including those through the Druitt Street and Bathurst Street cut and cover operations.

5.3.2 Key Issues Raised

As previously indicated, impacts on public transport was raised as a very significant issue particularly in representations by Leichhardt Council, Light Rail Association, Sydney Light Rail Company, the Royal Australian Planning Institute (RAPI), Eco Transit, Australian Institute of Architects, Greenways, Action for Public Transport, Improve Sydney Public Transport (ISPUT), Sydney City Residents Against Polluting Stacks, Eastern Suburbs Greens and the Member for Bligh. The principle concern was that the construction of more road infrastructure would not address the current public transport deficiencies and further entrench car dependency. Typical specific concerns included:

- the aims of the NSW Government's *Action for Transport 2010* are not achieved through the proposal, particularly given that the EIS states that there would be a slight shift to car dependency on east – west trips although the EIS states that the overall shift would be neutral;
- impact on bus services during construction;

- lack of solutions identified for long term public transport problems for east-west transit of the city;
- concern that the proposal undermines sustainable transport options; and
- redirection of public finds from public transport solutions (Councils).

In addition to the issues outlined above, a number of key agencies raised specific issues including:

- lack of identified improvements to the Town Hall precinct in terms of bus and pedestrian interfaces and need to ensure unimpeded future expansion of rail network (RAC);
- need to identify opportunities for light rail (Woollahra Council, DoT);
- time savings gained for buses are not directly attributable to the proposal (State Transit);
- need to determine the sometimes conflicting benefits to buses and pedestrians with proposed signal phase changes (State Transit);
- need to enforce bus lanes and other measures that enable prioritisation of road users, such as T2 lanes and the bus only section of Druitt Street (DoT);
- importance of integrated public transport facilities, including improvements to bus stops, interchanges and terminals (DoT, CCS); and,
- greater exploration of demand management initiatives is required (North Sydney City Council).

5.3.3 Consideration of Key Issues

General Public Transport Policy Applying in the Sydney CBD

From a strategic public transport assessment, the operation of the Cross City Tunnel needs to be considered in the light of the broader public transport policies and improvements currently being undertaken throughout the CBD. For example, since 1997 the Roads and Traffic Authority (RTA), in partnership with the City of Sydney, State Transit Authority (STA), NSW Police Service and the Department of Transport, has introduced a strategic Sydney CBD Bus Priority Scheme. To date this scheme has involved the introduction of 10 km of dedicated bus lanes in the CBD and approach routes covering major bus corridors as well as the development of the Lee Street bus layover facility. The primary objective in introducing the scheme was to improve the efficiency of bus movements and reliability of bus travel times by providing buses with a competitive advantage over private vehicles.

Bus travel time surveys undertaken by the City of Sydney have indicated improvements in bus travel times as a result of this scheme. For example on George Street, peak period travel times have improved by between 22% and 27% as a direct result of the competitive advantage provided by the dedicated bus lanes. Since the introduction of the Sydney CBD Bus Priority Scheme, the transport agencies have also assisted in a number of initiatives to improve the effectiveness of the bus priority network. These initiatives have included:

- the introduction of amendments to NSW road transport legislation in 1998 to allow the RTA to tow away vehicles illegally parked in Bus Lanes and Transit Lanes. This brought Bus Lanes and Transit Lanes into line with the tow away provision that already existed for Clearways;
- the implementation of "*Don't Get Busted in a Bus Lane*" public education campaigns in 1998 and early 2001 to explain the role of Bus Lanes and the rules relating to their use;
- the progressive introduction of red surface colouring to all Bus Lanes to make them more easily identifiable to motorists which is particularly important in a high density and constrained traffic environment such as Sydney CBD; and,
- the development of a trial Bus Lane Monitoring System (BLMS) utilising digital camera imaging and optical character recognition technologies to automatically detect and record illegal Bus Lane users.

Subject to positive outcomes from the trial, it is understood that consideration would be given to seeking amendments to the NSW road transport legislation that would allow an image recorded by the system to be used for enforcement purposes.

The Department is highly supportive of these strategies and considers that these could be further enhanced with additional strategies more specific to the issues raised by the proposal. This would include:

- support the STA in the development of revised service strategies that focus on the Central City precinct including adaptive response to future developments in road transport in the CBD;
- no toll for STA buses through the Cross City Tunnel;
- progress the planning of uniform bus lanes operating throughout the CBD in a more consistent manner;
- develop a real-time congestion monitoring system and associated protocols to facilitate the pre-emptive diversion of buses from key corridors prior to buses becoming trapped on congested CBD roads;
- investigation of enhancement to the current electronic based passenger information system to provide arrival information for passengers at key City bus stops impacted by the proposal including George, Elizabeth, William, Park and Oxford Streets and New South Head Road;
- implement real-time dynamic bus priority on key CBD approach corridors utilising the capabilities of "next-generation" of SCATS; and
- implement digital camera and optical character recognition based bus lane monitoring systems on all bus lanes through the CBD and key approach roads, where illegal use is evident and impacting on bus efficiency.

These requirements are specified in Recommended Conditions of Approval Nos. 25 through 44.

Local Operational Analysis

Intersection Capacity

Figures 6A and 6B of the EIS clearly indicate the significance of George Street as the primary bus route through the CBD. Of second priority would be Elizabeth Street and then Oxford Street. The EIS indicates that the operation of the CCT would result in an increase in traffic volumes along both George Street and Elizabeth Street and a slight reduction on Oxford Street.

Overall the EIS argues that the improvements to east-west intersections would result in improved services. However, Table 7.16 of the EIS shows relatively minor travel time improvements.

The impacts of the proposal on major bus corridors through the CBD (ie George Street and Elizabeth Street) as assessed in the EIS is given in Table 5.1.

Table 5.1 – Impact of the CCT on Bus Corridors

Intersection	Impact of CCT on bus corridors
George/Hunter	No substantive changes
George/King	No substantive changes
George/Market	Medium Improvement
George/Park	**Major** Improvement

George/Liverpool	No substantive changes
George/Goulburn	No substantive changes
George/Bathurst	No substantive changes
Elizabeth/Hunter	No substantive changes
Elizabeth/King	No substantive changes
Elizabeth/Market	**Major** worsening
Elizabeth/Park	**Major** improvement
Elizabeth/Goulburn	**Major** improvement
Elizabeth/Liverpool	No substantive changes

This analysis shows that any major improvements to intersections with major bus routes would be essentially limited to the Park Street area. The major negative impacts would be on Elizabeth Street at Market Street.

Overall, taking into account the increase in traffic on George and Elizabeth Street, the Department considers that the project on its own and when considered in isolation would not appear to result in substantive improvements on the operating performance of major bus routes on its own accord and certainly not to a degree that is likely to be noticeable by public transport users or with significant positive impact on existing time-tabling. Supplementary measures would be essential, as an integral part of the project implementation to achieve more substantive improvements.

Bus Travel Times

The EIS assessed bus travel time savings along 4 key routes. The analysis showed that the travel time savings would be between 1 and 10%. For the key George Street north-south route, the saving would be less than 10 seconds. The overall benefits of the CCT to public transport appear to be limited and essentially confined to the improved crossing of the William/Park Street corridor.

The RTA provided additional information on the changes to travel times for east-west bus services based on the revised traffic model as shown in Table 5.2.

Table 5.2 Forecast General Traffic Travel Times For Key Bus Routes

Route	Travel Times in Minutes					
	No CCT		With CCT		Change	
	2016 AM	2016 PM	2016 AM	2016 AM	2016 PM	2016 PM
Oxford Street to New South Head Road	3.6	4.3	4.1	4.2	0.6	-0.1
Ocean Street to Kings Cross Tunnel	3.7	4.2	5.5	6.0	1.8	1.8
Kings Cross Tunnel (in)	1.9	1.3	1.2	1.1	-0.7	-0.2
Kings Cross Tunnel to Elizabeth Street	10.0	9.5	5.8	4.3	-4.4	-5.2
Elizabeth Street to Kings Cross Tunnel	8.0	6.4	5.0	4.9	-3.0	-1.8
Kings Cross Tunnel (out)	0.7	0.7	0.7	0.7	0.0	0.0
Kings Cross Tunnel to Ocean Street	4.3	6.4	7.3	10.3	3.0	3.9
New South Head Road to Oxford Street	4.5	4.5	4.5	4.5	0.0	0.0
Ocean Street to Taylor Square	9.1	8.5	8.5	8.6	-0.6	.1

Taylor Square to Whitlam Square	3.4	3.1	3.1	3.1	-0.4	0.0
William Street to Elizabeth Street	3.0	3.4	1.8	1.7	-1.2	-1.7
Elizabeth Street to William Street	3.2	3.2	3.2	3.2	0.0	0.0
Whitlam Square to Taylor Square	2.0	2.0	1.0	1.8	0.0	-0.2
Taylor Square to Ocean Street	10.7	10.5	10.4	10.4	-0.3	-0.2

The Table indicates that apart from William Street, bus travel time improvements would not be substantive. However it is of particular concern that the bus times along Ocean Street would be worsened by almost 50% by 2016. Further investigations to protect this route are required, possibly through the implementation of T3 or bus lanes. However, this would need to be carefully balanced against the role of Ocean Street as an identified regional road. This requirement for further investigation for bus travel time improvements is specificed in Recommended Condition of Approval No. 38.

Other Operational Issues

Representations from City of Sydney Council, State Transit Authority and the Department of Transport raised a number of specific and detailed issues about impacts on particular bus routes, bus priority, stop locations, interchanges and feeder routes.

On the basis of these detailed concerns, a Cross City Tunnel Public Transport Working Group was established including representatives of the above-mentioned groups and the RTA and chaired by the Department of Transport.

Based on discussions with this Group and from the Department's investigation of opportunities, a number of additional bus priority measures have been identified and included in the recommended conditions of approval. These measures include:

- managed routing of buses during construction stage;
- creation of over 5 kilometres of additional bus lanes including the Western Distributor, Chalmers Street, Elizabeth Street, Bridge Street and Liverpool Street;
- subject to further investigation, the possibility of an additional 15 kilometres of bus or transit lanes including Pitt Street, Park Street, Ocean Street, New South Head Road, Anzac Bridge and Victoria Road (outbound);
- rearrangement of bus stands; and,
- footpath and street furniture improvements.

A detailed suite of operation stage requirements is identified in Recommended Conditions of Approval Nos. 34 through 44.

In addition to these measures, the Department also recommends that bus performance measures be identified prior to construction and then followed up through the operation stage, including a "before and after" assessment of timetable performance. This requirement is identified in Recommended Condition of Approval Nos. 28 and 36.

Construction Issues

The Department recognises that construction of a major project in the Central Sydney area would impact on the current bus routes. The broader issues regarding construction and access are discussed in Section 5.6 of this Report. Of high priority is the need to, as a minimum, maintain existing levels of public transport usage. To ensure that impacts on public transport are managed appropriately, it is recommended that a condition be placed on the Proponent to endeavour wherever possible that buses and high occupancy vehicles are able to operate at least at pre construction levels.

To assist in encouraging the community to utilise public transport during the construction period, a key role of the PTC would also be to identify incentives for existing and potential users, particularly during the peak construction period. The Department also recognises the potential of light rail solutions and future rail infrastructure plans and recommends consultation with light rail operators and SRA and the RIC with regards to plans for future development. Requirements relating to construction stage impacts on public transport are specified in Recommended Conditions of Approval Nos. 31 through 33.

5.3.4 Conclusions

The Department acknowledges the general improvements to the public transport system through the broader government policy measures as outlined above. However, the ability of this specific project to improve public transport outcomes in the CBD as implied in the EIS and when implemented in isolation, appears at best incremental rather than demonstrating substantive improvements that are likely to be widely perceptible to bus users. In this regard the Department considers that comprehensive accompanying public transport initiatives would be fundamental and critical to the overall acceptance and subsequent approval of the project should more substantive benefits be required. The creation of the PTC (referred to in Section 5.1) with representation from the major transport agencies would enable initiatives to be explored and discussed in an integrated manner. This should also ensure that potential benefits of reduced private vehicles in the CBD and adjacent areas are translated to positive outcomes for public transport, pedestrians and cyclists.

5.4 Emission Management Alternatives

This section focuses on the assessment of emission management alternatives. Accordingly, a greater emphasis is placed on a qualitative relative analysis. A more quantitative analysis regarding the air quality impacts of the proposed option is discussed in Section 5.5.

5.4.1 Background

The RTA's preferred option for control of tunnel emissions is longitudinal ventilation with a single discharge stack in Darling Harbour. The proposed stack height is 39 metres above adjacent ground level (approx 5m AHD). The proposal does not include an emission treatment plant, however the design includes an area of 300 square metres for possible future installation of an air treatment plant, if necessary.

Air quality, and in particular, the health impacts associated with emissions was the most significant issue raised in representations to the EIS. Of the 196 representations received, some 61 objected outright to the stack, 41 demanded filtration, 17 objected to the location and a further 17 requested a two-stack option.

The Sydney Harbour Foreshore Authority (SHFA) and the Darling Harbour Business Association raised concerns about the impact of the stack on businesses in the Darling Harbour area. Representations from the Council of the City of Sydney and Sydneysiders Against Polluting Stacks (SAPS) (a local community group representing the interests of the Pyrmont/Ultimo/Darling Harbour community) expressed strong support for a two-stack system. South Sydney Council and the Local Member for Bligh (Ms Clover Moore MP) have indicated that locating a stack in close proximity to the existing Eastern Distributor Stacks would not be acceptable to the community.

5.4.2 Stack Locations

Stack Location Options Considered in the EIS

The RTA has stated that the length of the proposed tunnels is such that it requires ventilation control other than that resulting from the simple expulsion of air from the portals. The RTA maintains that such ventilation is required to achieve air quality goals set by the NSW Environment Protection Authority.

One stack location was considered at the western end and three stack locations at the eastern end.

- Western end

1. Near IMAX (the proposed location in the EIS)

- Eastern End

1. William Street between Palmer and Bourke Streets (across Palmer Street from the Westfield building);

2. 60 William Street; and

3. 54 Riley Street (corner of Yurong Lane).

Assessments of the alternative stack locations were based on environmental performance, technical feasibility, and visual impacts. The assessment (refer Appendix G of Technical Paper 16) indicated that all of the eastern stack locations would result in a significant exceedance of the NO_2 goal due to the contribution of the stack alone (ie excluding the background levels). For example the air conditioning intake at Westfield (Location 1) would be exposed to NO2 levels of up to 350ug/m^3 (the National Environment Protection Measure (NEPM) goal for NO2 is 245ug/m^3). This compares to the NO_2 exposure at IMAX of 80ug/m^3.

The EIS assessment concluded that one stack close to IMAX was the best location of all alternatives.

Stack Locations Considered Post EIS

The ventilation and location options for the CCT were presented in the EIS in terms of stack locations and emission treatment alternatives. In general terms, the methodology adopted for the site selection process for the ventilation stack was unclear in the EIS and was not included in the technical papers.

The Department subsequently raised a number of concerns about the robustness of the option investigation. The RTA has since provided more details on all options considered and this is presented in the Representations Report.

The RTA indicates that the stack location options were primarily focused on locations along the alignment of the tunnel. The main difficulty was finding a stack location in the CBD which was not adjacent to a residential tall building. Apart from the options discussed in the EIS, the RTA has indicated that three other options were considered:

1. 465 Kent Street, corner of Druitt Street;
2. 66-68 Druitt Street; and,
3. 70 Druitt Street

These locations were also all eliminated because of the proximity of high-rise apartments and the inability to meet critical NO_2 goals.

Taller stack options were considered, but would have to be in excess of 60 metres to be above existing buildings. A series of short (8 metre) stacks were also considered in the location of a possible pedestrian overpass in the centre of Hyde Park. However these would not meet the air quality goals for nearby residents living in high-rise apartments. Off-line options were also considered but had the same difficulty of separation from high-rise building as the on-line stack option.

The Department considers that finding any location to accommodate a stack, which would be entirely tolerated by the community, to be difficult, if at all possible in a city surrounded with high-density residential and high-rise buildings. Overall it would be preferable in-principle if any new stack site was located outside the potential cumulative impact of the two existing Eastern Distributor stacks. To achieve this, a stack (even off-line) would have to be located in a far more densely populated residential area or alternatively in the heart of the CBD. Notwithstanding, if there was to be a second stack in the eastern end, then it is expected that this would probably only have community acceptance if it provided an overall net improvement to this locality. This would have to consider the existing impacts of the two eastern distributor stacks. Any worsening of impacts is unlikely to have any level of community acceptance. At this stage no such options appear evident.

The difficulty in finding a stack location is also reflected in the Council of the City of Sydney submission. The submission, prepared in April 2001, indicated that individual site options were being reviewed by Council and its consultants Arup and Child Associates. To date, the CCS has not yet been forthcoming with any alternative site locations for further consideration.

Stack Locations Within Darling Harbour

The air quality assessment undertaken for the Darling Harbour location indicates that impacts from ventilation emissions would be negligible at the ground level including residents at Ultimo/Pyrmont and Darling Harbour. Further discussion on air quality impacts is provided in Section 5.5. However, for nearby high-rise apartments including the Millennium Towers, the impact would not be negligible, particularly with respect to NO_2.

On this basis, the Department sought additional information on refinements to the stack location within Darling Harbour. This refinement included three key elements:

1. moving the stack further away from the high-rise apartments, keeping in mind that there should be no net worsening to ground level receivers;
2. increasing the height of the stack; and,
3. increased exit velocities.

Analysis of the air quality impact of these combinations is presented in Appendix C.

Moving the Stack

In general, moving the stack within Darling Harbour is constrained by a number of important factors, particularly; air quality; land availability; ability to connect the vent stack to the main tunnel and urban design issues. Overall this would restrict any relocation principally to the west of the EIS location. Any location further east would generally have greater impact on the nearby high-rise apartments unless the stack was significantly higher.

A location about 50 metres to the west, in a small wedged shaped area between major road viaducts (refer Figure 5.1) was subsequently identified. The revised location (hereafter referred to as Location B), with an increase in height of 5 metres (relative to the height of the top of the EIS stack location[1]) would have the following advantages relative to the EIS location:

- around a 50% reduction in benzene concentrations, 20% reduction in NO_2 and more than a 50% reduction in PM_{10} levels for nearby high-rise apartments;
- a reduction of NO_2 and PM_{10} for IMAX at the 30 metre air conditioning intake level;
- a very slight increase in benzene concentrations and PM_{10} levels for IMAX at the 15 metre air conditioning intake level (the benzene levels would be well within the EPA risk factor of 1×10^{-6} and the PM_{10} levels would be still well below the goals);
- better urban design outcome with potential better screening of the stack and a more discrete location in Darling Harbour; and,
- negligible changes for all pollutants at ground level locations

Further details with respect to air quality impacts for Location B are discussed in Section 5.5.

Increasing the height of the Stack

The analysis indicated that heightening the stack would not limit air quality benefits to the high-rise apartments (the most sensitive receptor). For any highly significant benefits to be achieved, the height of the stack would need to be increased to around 60 to 70 metres. On balance with urban design and visual dominance considerations such a significant increase is not considered acceptable. Notwithstanding, a small increase of 5 metres (relative to the height of the EIS stack) would ensure that air quality impacts resulting from the relocation would be no greater than the EIS stack location.

Stack Exit Velocities

With respect to stack exit velocities, the analysis indicates no relative improvement to air quality resulting from the EIS stack location when compared to the revised stack location.

Conclusion

There appears to be a strong case for relocating the stack to Location B (refer to Figure 5.1) with a 5 metre increase in height. The relocation is also supported in the submission by the EPA (refer

[1] Whilst the top of the stack has increased in height by 5 metres, the base of the stack is now at a lower point than the EIS option (i.e 2.6 metres AHD compared to 5 metres AHD). Thus the physical height of the stack would be 46.4 metres from the ground.

Appendix D). A significant increase to the stack height or increasing the exhaust velocity alone do not appear to have any major benefits relative to the EIS location. The requirement for the relocation of the stack is specified in Recommended Condition of Approval No. 80.

Post Approval/Tender Process

The Department recognises that there may be further opportunities through the post-approval tender process to refine the location of the stack so as to reduce the impacts on the elevated receptors and also address urban design issues. For example, the Sydney Harbour Foreshore Authority has indicated that there may be development and redevelopment sites that could potentially provide an opportunity to integrate the stack into a building. Provided that the air quality modelling and wind tunnel testing indicated an overall improvement in air quality impacts, this could potentially provide an overall benefit from an urban design perspective.

Similarly, other innovative responses through the tender process could also result in a stack location with significant air quality benefits over and above the current option. It is therefore important that such options are not precluded.

At this stage it is not possible for the Department to identify the likelihood of these opportunities. In this regard the Department recommends that the Proponent explore in detail opportunities to integrate the stack in either an existing building or proposed redevelopment site. Subject to there being opportunities, the RTA would be required to undertake further modelling and wind tunnel testing to assess the relative impacts with the original stack site. The Department recognises that any request for approval to relocate the stack or change the design and/or operation of the tunnel ventilation system must demonstrate that the predicted air quality impacts for all pollutants are no greater than those predicted for Location B.

Recommended Condition of Approval No. 81 therefore allows a degree of flexibility in the stack location in recognition of the potential for alternative solutions. Any change however would require the separate approval of the Director-General following consultation with the EPA and the Department of Health. This requirement is specified in Recommended Condition of Approval No. 82.

5.4.3 Emission Treatments

Options Considered

Six emission treatment options were considered in the EIS process:

Alternative 1 – No stack with particulates treated and emissions exhausted through the portals;
Alternative 2 – No stacks with particulates and nitrogen dioxide treatment and exhausted through portals;
Alternative 3 – A single stack at the western end with particulate treatment;
Alternative 4 – A single stack at the western end with treatment of particulates and nitrogen dioxide;
Alternative 5 – A stack at each end with treatment of particulates and nitrogen dioxide; and
Alternative 6 – A single stack at the western end with no treatment of tunnel emissions (the EIS Option).

The no-stack options (Alternatives 1 and 2) would not be able to meet CO goals at all times at the portals and were subsequently eliminated.

The two-stack option with full treatment (Alternative 5) would not be able to meet NO_2 goals at all times at the eastern end. Assuming an 80 to 90 percent removal of particulate matter, Alternative 3 (EIS proposal with filtration) would reduce the maximum ground level contribution of particulate matter from the stack from 0.4 ug/m^3 to 0.08ug/m^3. For residents living in high-rise apartments the maximum contribution would be reduced from 4 ug/m^3 to 0.8ug/m^3. However, such reductions must be considered in relation to the costs, originally estimated in the EIS at $10 million and since substantially revised upwards in the Representations Report to around $25 Million.

The EIS cost estimates are based on a 1998 supplier quotation. When this quotation is adjusted for the size of the installation, exchange rate differences and items to be supplied by others, it would be within 3% of the Representations Report estimate. In addition, the estimate is sensitive to the design decisions such as stand by units of air treated and the success of the ventilation design. Overall, the revised estimates are considered appropriate.

A single stack at Darling Harbour, with full treatment (Alternative 4) would have similar limited improvements to particulate matter emissions but would potentially address what would arguably appear to be the more critical issue of NO_2 exposure. However, the Department is not aware of any tunnel with large-scale NO_2 treatment systems operating anywhere in the world. At a cost of around $45 million, an unproven treatment system is not considered to be strongly justified, particularly when the health goals would be met without it.

Effectiveness of Emission Treatment

Effectiveness

The Department acknowledges that there is continued debate about the effectiveness of electro-static precipitators (ESPs) and in particular whether they can remove ultra-fine particles (ie $PM_{<1}$ micron). These particles are considered, at least in a number of community representations to be the most potentially harmful.

A recent (May 2001) NEPC issues paper "*The Need for a $PM_{2.5}$ Standard in Australia*" (refer to Appendix F) indicates that very few epidemiological studies have been conducted to look at the effects of ultra-fine particles and that the results of studies to date show conflicting results and provide no clear evidence as to the role of ultra-fine particles on health. The Issues Paper also indicates that PM_{10} are still important in terms of health impact and should not be ignored.

The Department considers that the effectiveness of ESPs removing particles at least to the $PM_{2.5}$ remains inconclusive, particularly in the context of road tunnel emission treatment. In addition there are concerns about maintenance requirements, energy consumption, and handling and disposal of by-products. Regardless, ESPs would not remove nitrogen dioxide nor other gases, which is considered to be potentially a more substantive issue for this project compared to PM_{10} levels.

Justification

The Council of the City of Sydney raised serious doubts whether filtration of fine particles would be effective, indicating that such technology has not to date been proven effective. The report also raises the issue that the background air pollution levels are far more problematic than the additional levels contributed by the stack. The Department agrees with this view.

Filtration of particulate matter for this project could potentially reduce maximum 24-hour ground level contributions of PM_{10} from 0.4ug/m^3 to 0.08 ug/m^3. When compared to existing average background levels of around 27ug/m^3, this reduction would be negligible and practically impossible to measure. The cost to install such treatment systems would be in the order of $20 to $40 million. On the basis of such a small and insignificant improvement, this would not appear to be cost effective.

Filtration could potentially have more substantial improvements for residents living in high-rise apartments, with maximum stack contribution levels of PM_{10} reducing from 4ug/m^3 to 0.8 ug/m^3. However, it should be recognised that these levels are maximums. Average PM_{10} exposure levels directly from the stack would be an order of magnitude lower (ie reduced from 0.4 ug/m^3 to 0.08 ug/m^3). Compared with the average background levels of around 20 ug/m^3 the reduction of 0.4 would also be insignificant. As indicated in Section 5.5, levels of NO_2 exposure are considered to be a relatively more sensitive issue for residents in nearby high-rise apartments. However, at this stage there are no proven full-scale NO_2 treatment systems.

On the basis that emissions from the stack are not expected to exceed the goals at nearby high rise apartments (refer Section 5.5), there does not at this stage appear to be a strong nor immediate justification for filtration or other treatment systems. Furthermore, for a more limited number of affected residents, there may be more cost-effective mitigation strategies than installing treatment systems.

Nevertheless, it is considered appropriate that provisions be made in the design and construction of the tunnel for the retrofitting of pollution control systems should the need arise. This requirement is specified in Recommended Condition of Approval 83. Extensive monitoring and community involvement would be an essential element in that decision-making.

Two Stack System (With or Without Treatment)

A number of representations including the Council of the City of Sydney (CCS) and SAPS have expressed strong support for the option of two stacks, on the basis of the principle of "sharing the load".

The CCS argues that this issue needs to be revisited as background data for the eastern end was not available and that background data at the Darling Harbour end has now been shown to be as, if not more, sensitive.

The revised background data would not change the outcomes of the EIS assessment, as the contributions from the stack alone (ie excluding the background data) are higher than the goals. Thus the pollution impacts at the eastern end would still be unacceptable, regardless of the relative background levels. This situation would apply whether or not the NO_2 had treatment.

The other major concern with a stack at the eastern end is that there is a potential for cumulative impacts with the two existing stacks associated with the Eastern Distributor. For example, for a radius greater than approximately 500 metres around each stack, there would be an overlap of potential cumulative impact from all three stacks. This overlap would primarily include the Darlinghurst area around Taylor Square.

Overall, there would be a fundamental difficultly in recommending that the East Sydney/Darlinghurst/ Surry Hills community accept potential cumulative impacts from three stacks, particularly when there is an argument that a single stack in a new area could potentially meet the air quality goals and certainly with far greater certainty than an eastern stack.

Similarly, the option of incorporating emission ventilation from the Cross City Tunnel into one of the Eastern Distributor stacks, whilst reducing the number of stacks in the Darlinghurst/Surry Hills area to two, would still have cumulative air quality impacts as if there were three. Managing ventilation and auditing compliance with air quality goals would also expected to be problematic with the combining of tunnel emissions from two separate private operators. For example if the goals were exceeded, it would be almost impossible to determine which tunnel/operator was at fault.

5.4.4 Treatment of Emissions - International Best Practice - Current Status

As part of the approval for the M5 East project, the RTA submitted a report to DUAP in March 2001 providing an update on international best practice for road tunnel emission treatment. It primarily draws on a report prepared by Bernard Bongiorno QC, commissioned by the Victorian Environment Protection Authority. The report indicates that there are no full-scale tunnel emission treatment systems for particulate matter installed anywhere in the world apart from Norway, Korea and Japan. This includes investigation of some 150 tunnels in the USA, and over 1000 tunnels in Europe.

In the case of Norway, of its 700 tunnels, electro-static precipitators (ESPs) are installed in five. Of these, ESPs in 4 tunnels including the recently opened Laerdal Tunnel are not currently operating, as in-tunnel conditions have been acceptable. The only one that appears to be operating is the ESP in the Ekeberg Tunnel. This operates only in peak periods and is reported to clean only one third of the tunnel air. Again it's purpose has been for in-tunnel conditions. Notwithstanding, it is understood that Norway is planning two more tunnels in Drammen with ESPs to be installed, one with a stack. Whether these ESPs would operate or not, and under what conditions, is still under investigation. A recent report[2] from Norwegian road authorities also indicates, "*from a practical, environmental and economical point of view, our investigations and measurements indicate that use of electro-static filters in road tunnels with heavy two way traffic (f.i. Hell Tunnel) or short one-way traffic tunnel (f.i. Granfos, Ekeberg and Nygard Tunnel) should not be recommended*". A copy of this report is provided in Appendix G.

In Korea, the Chinbu Tunnel also has an ESP. It has never operated apart for 4 hours following a false reading. Again, in-tunnel conditions are the dominant factor in determining whether or not the ESP operates.

In Japan, the report indicates that there are at least three tunnels with ESPs installed for environmental reasons. The report provides little detail on the performance and impact of these ESPs nor on the external environmental conditions. However it is noted that the vehicle composition of traffic using the tunnel is dominated by diesel engine trucks (order of 25 to 40%).

In conclusion, it does not appear that at this stage emission treatment systems are international best practice for control of tunnel emissions to the external environment. However it could be argued that installation of treatment systems for in-tunnel conditions could be considered as appropriate where relevant to the local conditions, albeit that most are not currently operating. Sydney's vehicle fleet composition and weather conditions do not appear to be of the same nature to warrant treatment systems due to in-tunnel conditions.

Notwithstanding it is understood that treatment systems are being considered in many countries, particularly in view of community concern and opposition. For example the recent Legislative Council General Purpose Standing Committee No.5 Inquiry into the M5 East ventilation stack (2001) also

[2] Myran T and Buvik H. Particle Cleaning in Norwegian Urban Road Tunnels.

identified that there were many more tunnels than had been identified in the Bongiorno Report that were currently considering the installation of treatment systems.

The current debate also centres on the cost effectiveness of various control strategies. That is the (capital and operating) costs of treatment systems at the exhaust stacks vs the costs of other pollution reduction on other sources and on vehicle emissions in achieving air quality improvements.

As indicated above, the level of particulate matter removal from the ventilation stack would be extremely small compared to the total particulate matter exposure. Furthermore, there is expected to be an overall improvement to background levels of PM_{10} with improved fuel and engine technology. This should result in no net reduction in air quality even with a ventilation stack, at least for all people at ground level.

With respect to NO_2, electrostatic precipitators do not remove nor treat gaseous components. Whilst the Department is aware that pilot plant testing technologies for NO_2 treatment are underway in several countries notably Japan, Norway, Austria and Germany, no full-scale treatment system for gaseous pollutants has been installed in any tunnel. Furthermore, the pilot plants indicated that a large proportion of the treated NO_2 (ie into NO and O_2) is rapidly converted back to NO_2 when it reacts with ozone, which is abundant in the lower atmosphere and particularly so in Sydney.

The Department recommends that the RTA continues to examine international developments in tunnel emission treatment systems for a further five years from the date of the approval of this project or from the expiration of the M5 East condition, whichever occurs first. This requirement is specified in Recommended Condition of Approval No. 104.

5.4.5 Conclusions and Recommendations

The Department considers that a single stack location in Darling Harbour with no treatment would, at this stage, provide the most appropriate balance with respect to air quality impacts and cost effectiveness.

It is unlikely that any location for a stack will be entirely acceptable to the community. The proposed site would, nevertheless, potentially provide the greatest margin for compliance when compared to other locations. Notwithstanding there appears to be a strong case for a minor relocation of the stack about 50 metres to the west together with a small 5 metre increase in height. The revised location and height would have significant benefits to nearby high-rise apartments in terms of air toxics and nitrogen dioxide. There would also be potential urban design advantages in terms of better integration with the surrounding structures.

A stack at the eastern end (with or without NO_2 treatment) would be problematic in terms of meeting NO_2 goals for residents in high-rise apartments, even if combined with portal emissions, as there are likely to be circumstances where emission from portals may not be possible at all due to CO problems. The potential cumulative impacts with the two existing Eastern Distributor stacks also need to be considered.

Filtration of particulate matter for this project is not considered to be cost effective nor necessary in the circumstance, as the level of particulate matter removal would be extremely small compared to the total particulate matter exposure. With respect to NO_2, electrostatic precipitators do not remove nor treat gaseous components. NO_2 treatment systems are still very much in development stage and there are no known large-scale systems operating in the world.

Issues to further mitigate the impacts of the stack, particularly in regard to residents living in high-rise apartments near to the stack and impacts of portal emissions are discussed in further detail in Section 5.5.

5.5 Operational Air Quality

5.5.1 EIS Statements

The EIS indicates that overall the proposal is expected to achieve a small net improvement to air quality across the Sydney area. This overall net improvement is expected as a result of the reduction of annual motor vehicle emissions due to a reduction in overall traffic congestion across the central Sydney road network. Reductions of over 16% to CO_2 and around 5% to other pollutants (ie CO, NOx, PM_{10}) are anticipated.

The key conclusions of the EIS were as follows:

- the ventilation stack would result in very low ground level concentrations of all pollutants;
- the changes to air quality at ground level from the stack alone would be neither measurable, nor have an adverse impact on the health of people living or working in the area;
- the most likely areas affected would be the nearby high-rise buildings however pollutant levels would be within the EPA health goals and would not measurably affect the health of people;
- there are options available for treatment of some of the emissions, primarily particles of size less than 10 microns (PM_{10}), however the benefits of reducing emissions would be small; and,
- there would be air quality benefits to many of the roadways, however, there would be increases in traffic and air pollution on others.

5.5.2 Studies Subsequent to EIS

RTA's Representations Report

Assessment of Air Quality Impacts

The RTA's Representations Report includes a detailed peer review by Katestone Scientific, which is included in Appendix H.

The key conclusions of this review are:

- confirmation that short-term plume strikes on nearby ground level and residents living in high-rise apartments would be the most significant impact requiring a health risk assessment;
- the methodology undertaken is recognised as being approximate (and probably very conservative) in evaluating worst case conditions for exposed locations on elevated balconies or at the air conditioning inlets for the nearby buildings;
- for people living in nearby apartments the potential additional health risks are estimated to be in the range of 0.01 - 0.37 per hundred thousand, typically 30 -70 times lower than the background daily event;
- the degree of detail in the past and ongoing studies is commendable and air quality monitoring at two near surface sites in Darling Harbour over the winter period goes some way in clarifying the uncertainties in evaluating existing worst case local air quality; and,
- the range of methodologies employed is relevant and generally appropriate to most of the key areas, although the chosen dispersion modelling is not designed to properly treat the influences of buildings on plume dispersion. There is no accepted or recommended approach for evaluating worst case air-quality in such a complex urban environment.

Proposed Modifications Identified in the Representations Report

The major proposed changes to the project since exhibition of the EIS, which would have an implication for air quality, are discussed below.

- *Increased Traffic Volumes*

The revised traffic assessment forecasts a potential 16% daily increase to CCT volumes including a 6% increase in the AM peak and a 24% increase in the PM peak. The RTA indicates that the emissions from the stack assumed in the EIS would still be higher than those calculated from the revised traffic forecasts and thus the conclusions with respect to air quality impacts described in the EIS remain valid.

- *Segmentation of the Stack*

This would involve physically dividing the cross-sectional area of the stack into 3 or 4 sections to enable individual sections to be opened or closed as required. This is proposed by the RTA to achieve higher exit velocities (ie higher effective stack height) without the need to heighten the stack or increase fan speeds (and hence use more power).

- *Partial Portal Emissions*

The EIS scheme proposes that there be no portal emissions. However the natural piston effect of cars passing through a tunnel means that to achieve no portal emissions significant energy is required to drive the fans that push the air against the flow of traffic. Permitting portal emissions in circumstances of low background levels would lower energy demands in the order of 170MWhr per year (15%) which in itself causes air pollution albeit in a remote source (i.e. burning of coal). It would also potentially provide a sharing of the air quality impacts.

Proposed emission points would be Sir John Young Crescent, Bourke Street off load ramp and the main east and west bound portals at King Cross and Darling Harbour respectively.

<u>EPA's Review and Comments on the Representations Report</u>

The EPA prepared a detailed submission on the Representations Report. A copy of the EPA's responses is provided at Appendix D. Issues raised by the EPA, which are relevant to the current proposal, include:

- stack location and height;
- emission limits and monitoring requirements;
- use of ambient standards;
- stack emission limits and stack emission-monitoring requirements; and,
- in-tunnel air quality goals and monitoring requirements.

These issues are integrated in the discussion that follows.

<u>Submission by the Council of the City of Sydney</u>

In response to the Preferred Activity Report, the Council of the City of Sydney has submitted a detailed report on the air quality implications of the proposal. The key conclusions are summarised as follows:

- the proposal would deliver very significant traffic and air quality benefits;
- the contribution of pollution from the tunnel is considered to be marginal, however measures to mitigate the already high and unacceptable levels of pollution in Pyrmont and Ultimo need to be implemented;
- that an electro-static precipitator is unlikely in its current form to provide any effective safeguard against the levels of very fine particles present in either the tunnel emissions or Sydney's air generally. However supports that provision should be made in the tunnel and ventilation system design for retro-fitting should proven technology emerge in the future;
- the additional tunnel ventilation and air quality control measures (i.e. portal emissions combined with a dispersion strategy) are supported;
- further investigation required of using a second stack at the eastern side of the CCT to disperse emissions from the tunnel; and
- further measures be implemented with the provision of the tunnel including:
    - an ongoing air quality monitoring program;
    - a program to reduce background air pollution in Pyrmont and Ultimo including increased regulatory control of diesel vehicles, targeted programs and incentives to convert trucks to cleaner fuels, traffic management measures to reduce truck numbers in City precincts with high pollution levels and appropriate public transport measures;
    - an incremental charge be added to CCT tolls (10 cents) to provide funds for ensuring delivery of these strategy objectives; and,
    - establishing a City convened multi-agency taskforce to implement the proposed air quality management strategy.

Public Meetings

The Department attended public meetings held by communities representing both ends of the tunnel project. This included a meeting organised by Sydney City Council and SAPS on the 30 May 2001 and by Clover Moore on 10 July 2001.

The issues raised at these meetings primarily reflected the same issues raised during the exhibition of the EIS. For details see Section 3.4 and Appendix B of this Report.

With respect to air quality the key issues included:

- major concerns about release of emissions from portals and the need for more extensive community involvement and understanding of impacts before it was allowed. The need to understand what would be considered "favourable conditions" for portal emissions;
- no level of pollution is acceptable;
- strong demand for filtration of the stack;
- strong demand for filtration of all stacks including the existing Eastern Distributor stacks;
- concerns about cumulative impacts of Eastern Distributor and the Cross City Tunnel stacks;
- need for maximum achievable air quality mitigation measures;
- concerns about PM_{10} not being an appropriate measure of health impact which should be focussed on the ultra-fines (i.e. PM less than 1 micron);
- concerns about the appropriateness of background meteorological data and relevance to Darling Harbour conditions;
- need for a toll to pay for ventilation;

- a strong desire from the Ultimo/Pyrmont community for a second stack at the eastern end; and,
- strong opposition from the Darlinghurst community for another stack in their area.

5.5.3 Department's Consideration of Key Issues

Overview

As indicated in Section 3, the potential impacts of the ventilation stack was the most significant issue raised in representations and at public meetings. These issues have been essentially the same as those raised with the M5 East and in particular appear to be centred on the issue of fine particle impact on health. Other key issues include: the desire for a filter; portal emissions; stack location alternatives; $PM_{2.5}$ as a better indicator; validity of the meteorological data; multiple emission release points (ie sharing the load) and greenhouse impacts.

Strategic Air Quality

One of the major strategic concerns raised about the project is that it would lead to an increase in vehicle km travelled (vkt) due to the attraction to travel further on a less congested network. This would appear to be in direct conflict with the *Action for Air* policy of zero growth in road vkt by 2021.

Whilst there would be an increase in vkt, the efficiency improvements could potentially reduce vehicle hours travelled (vhr). These efficiency improvements would potentially more than offset the reductions to air quality due to vkt increases. This outcome is further supported in the regional air quality impact assessment, which indicates that there would potentially be an overall improvement in regional air quality.

Overall the Department considers that improvements to regional air quality and thus compliance with at least the principles in *Action For Air*, is possible, but is totally dependent on there being no induced traffic occurring, and that the predicted traffic efficiency improvements are maintained over the long term. Further discussion is provided in Section 5.1 of this Report.

Air Quality Goals

Current NEPM goals

The approach for the regulation of the Eastern Distributor and the M5 East ventilation stack has been to set goals established by the National Environment Protection Council (NEPC) referred to as National Environment Protection Measures (NEPM). The NEPM goals relate to regional air quality.

For the Cross City Tunnel, the EIS provided specific background air quality monitoring data from 3 ground level locations (SCEGGS, Australian Museum and EPA's site on the corner of George/Market Streets) and two elevated locations (6th floor of IMAX and 16th floor of Millennium Towers). The results generally indicate that existing air quality would exceed the NEPM goals for particulate matter. However, none of these sites would actually meet the criteria for a NEPM monitoring station (a regional based goal) as they do are not representative of general air quality and population exposure that is required by the NEPM standard.

Following exhibition of the EIS and due to community concerns, additional monitoring stations were established at the Art Gallery and at the Sydney Police Station. Results again indicated regular

exceedances of the PM_{10} goal and some exceedances of the CO goal. Again these sites were located on heavily trafficked streets and similarly do not represent general air quality and population exposure (which is the NEPM monitoring requirement).

The NEPM is a regional ambient goal that addresses all sources of pollution. Monitoring results in the City environment indicate this goal is currently exceeded on occasion. It is therefore difficult to assess the adequacy/acceptability or otherwise of cumulative stack emissions relative to a NEPM goal.

In their submission to the Representations Report (refer Appendix D), the EPA has expressed significant concerns about using ambient air quality standards for compliance purposes. The EPA indicate that the NEPM is a regional assessment and reporting tool which is not intended to be used for regulating air quality from individual premises. The EPA's preferred approach is to develop site-specific emission limits using the air quality assessment conducted for the EIS and taking into account ambient standards and existing background conditions. The EPA has indicated that the reason for adopting this approach is that a pollutant present in ambient air would be emitted from a variety of sources and making one premise alone responsible for meeting an ambient air quality standard is unreasonable. It is also extremely difficult to determine compliance.

In this regard the EPA's preferred approach is to set stack limits for all key pollutants. This would provide a more stringent and accountable control of emissions from the stack than applying ambient standards alone as it would incorporate the worst-case background levels of pollutants. This would also prevent the Proponent from 'polluting up' often cited as a significant community concern. This approach has also been adopted by the Victorian EPA for the operation of the Burnley and Domain tunnels as part of the City Link tunnel in Melbourne. Accordingly stack limits have been recommended by the EPA for NO_2, PM_{10}, CO and VOCs. Further technical analysis on how these stack limits were developed is provided in Appendix E. The requirement to meet in-stack limits is specified in Recommended Condition of Approval No. 93. Further, the Department considers that it is essential that these limits do not result in polluting up to the goals. Accordingly, the Department has recommended that the in-stack limits be independently verified.

However the Department considers that whilst the establishment of stack limits places a more direct control it may not ensure that the RTA is accountable to its broader public commitments to improving the regional air shed through predicted improvements to travel efficiency resulting from the project. For example, the EIS clearly indicates that the construction of the tunnel would reduce the total vehicle emissions from the Central Sydney and Sydney Metropolitan road network due to the reduction in overall traffic congestion. If this is the case then this should be reflected in ambient air quality improvements. Similarly, the Department of Health raised concerns about air pollution levels in the Ultimo Pyrmont area and also recommended that the RTA continue monitoring air quality in this area.

More specifically, the RTA has committed to meeting ambient air quality goals in various project related EIA documentation as summarised in Table 5.3.

Table 5.3 - RTA Stated Commitments to Meeting Ambient Air Quality Goals for the CCT

	Meets NEPM Goals		
Location	PM_{10}	NO_2	CO
IMAX	Yes[1]	Yes [3]	Yes [1,3]
High-rise	Yes [2]	Yes [1,3]	Yes [1,3]
Ground Level	Yes[5], Yes [4]	Yes[5],Yes [4]	Yes[5], Yes [1,3]

Portals	Yes [4]	Yes [4]	Yes [4]

Notes:

1. EIS – Page 9-41
2. EIS – Page 10-27
3. Technical Working Paper 16, Page 32
4. Representations Report, Page 366
5. EIS – Page 9-41. States no additional exceedances of the air quality goals

It should also be noted that recent data from monitoring of the Eastern Distributor project at Woolloomooloo (ED1) and Darlinghurst (ED2) from June 2000 (August 2000 for ED2) indicates that to date, there have been no exceedances of the NEPM goals apart from ED1 that had one exceedance in October 2000. However this exceedance was due to bushfires in the area. These sites would qualify as "upper-bound" NEPM monitoring sites.

The Department considers that the RTA's public statements and commitments to a net improvement to air quality (or at least no worsening) as a result of the construction of the CCT is fundamental and integral to the strategic justification of the project. On this basis, the Department recommends that the NEPM goals should be retained for this project as a way of ensuring accountability to such commitments. Used in conjunction with the stack limits, this would address the ability to pollute up but also given the community an assurance that net improvements to the regional air shed will be achieved.

As part of strategic air quality management in the CBD, the Department considers it appropriate for the RTA to install an ambient air quality monitoring network and for monitoring results to be made publicly available. Should results indicate exceedance of the regional NEPM goals, then an independent review would be required. Where such a review establishes that stack emissions are the major contributors resulting in exceedance of these goals then traffic management and/or point emission controls would be installed. This recommendation is specified in the Department's Recommended Condition of Approval No. 95.

In implementing the above, the Department accepts that the likely worst case for air quality would be within the first 3 to 5 years of opening, and by that time there would be clear indications of any improvement trends. In this regard, the need to continue monitoring of ambient air quality could be reviewed in consultation with the community. Should the trends be ambiguous or show worsening, then the RTA would be required to continue monitoring ambient air. The requirement to meet NEPM ambient air quality goals is specified in Recommended Condition of Approval No. 92.

With respect to air toxics, the EPA has advised that the goals specified in the Director-General's Requirements for the EIS were for the purposes of guiding modelling undertaken as part of the development of the proposal. The EPA advises that these goals are not appropriate for ongoing monitoring, rather recommends stack limits for volatile organic compounds (VOCs), as VOCs can be continuously monitored and can be readily correlated with specific air toxic compounds through speciation of VOC emissions from the stack. Based on this advice, ambient goals for air toxics have not been established for this project. Notwithstanding, monitoring of VOCs and compliance with in-stack VOC limits have been specified in Recommended Conditions of Approval 0 and 93 respectively.

Air Quality Impacts

The EIS assessment included two forms of modelling, computer dispersion modelling and wind tunnel testing. The former is often cited as a more conservative approach, however advice from the CSIRO to the Department on the M5 East project, expressed concerns about the level of conservatism with wind

tunnel testing due to the limitations of modelling at very low wind speeds. Thus for the purposes of this assessment the Department has taken a conservative approach in reviewing principally the computer dispersion modelling as a potential worst case.

Regional Level Changes (Total Airshed Emissions)

The key objective of the Cross City Tunnel is to reduce traffic congestion on city streets and improve traffic flow efficiency. The EIS predicts that on this basis total predicted annual emissions in Central Sydney would reduce. Table 5.4 provides an extract from the EIS.

Table 5.4 - Total Predicted Annual Motor Vehicle Emissions from Central Sydney with and without the Cross City Tunnel (2016)

Emissions (tonnes)	Without CCT	With CCT	Reduction (%)	Reduction (tonnes)
CO_2	438 290	364110	16.9	74180
CO	9600	9150	4.6	450
NOx	1915	1840	4.0	75
Hydro Carbons (HC)	810	770	5.0	40
PM10	100	93	6.0	7

As indicated in the table, total pollutant mass reductions of around 5% are predicted. These overall reductions are expected to result in a net improvement to air quality throughout the CBD.

Notwithstanding, the "net improvement" to residents is highly dependent on achieving the forecast road volume reductions and network efficiencies. These forecasts are entirely dependent upon the traffic model and more specifically the modelled changes to total annual vehicle kilometres travelled and total annual vehicle hours. As indicated in Section 5.1, reliance on the traffic model outputs is highly dependent upon maintaining the traffic reductions on city streets. It is understood that the community would be naturally anxious about this issue and therefore there is a requirement to ensure that the RTA is accountable to such commitments. The requirement to monitor ambient goals (refer above) would address this issue.

Residents Living in High-Rise Apartments (Elevated Receptors)

Air quality impact predictions were undertaken for residents living in nearby high-rise apartments including Park Royal, Millennium Towers, Darling Park 2 and 3 as well as nearby taller commercial buildings including IMAX and Sega World.

Table 5.5 identifies the maximum predicted contributions from the stack for the EIS location and Location B. In all cases the worst case is predicted in 2006 with improvements in the order of magnitude of around 50% by 2016. It is noted that the predictions for the EIS location are slightly different to those presented in the EIS, as the air quality model used for comparison with Location B was updated to include improved algorithms for building wakes and for the revised traffic data.

Table 5.5 - Maximum Predicted Concentrations due to Stack Emissions Alone – Location B (Adjacent High Rise Apartments and IMAX)

Location	NO_2 (ug/m^3) I hour max	PM10 (ug/m^3) Maximum 24 hour max	Benzene – Annual Average (ug/m^3)	Aggregated Risk[3]
Millennium Towers (60 m)	71 (130)	1.2 (5.3)	0.197 (0.5050)	$4.44x10^{-6}$ ($1.17x10^{-5}$)
IMAX (30m)	13 (31)	0.09 (0.46)	0.013 (0.0361)	N/A
Darling Park 2 (145 m)	45 (76)	0.38 (0.70)	0.024 (0.0413)	N/A
Air Quality Goal	245	50	No Goal	See Note 2

Notes:
1. Figures for EIS stack location (in brackets) are different to EIS (Table 7.2) as the air quality model was updated to include improved algorithms for building wakes and revised traffic data.
2. EPA policy requires further studies to justify aggregated risk above $1x10^{-6}$
3. $1x10^{-5}$ is a higher risk than $1x10^{-6}$

The Table indicates that the revised location with an increase in the height of the stack would provide substantial benefit to all locations and for all pollutants compared to the EIS location. In particular the relatively high levels of exposure at Millennium Towers would be substantially reduced for all key pollutants. However, the extent of the impact on residents in high-rise apartments would still be high with respect to NO_2. With maximum-recorded background levels of 160 ug/m^3, it would be theoretically possible that the longer-term NO_2 goals (i.e. 200ug/m^3) could still be exceeded even at the revised location.

Whilst it would be unrealistic to add the absolute maximum stack contribution to the maximum-recorded background level (the probability of such would be extremely small), it does highlight the reduced margin to achieve the NO_2 goals for residents living in high-rise apartments compared to any other receptors. It also indicates that it would take an event that is somewhat less than a maximum background with a maximum contribution for the long-term goal to be exceeded.

The EIS provides a health risk assessment of this change. For example, a person over 65 years old located on the top floor of the Millennium Towers, would have an increased risk of admission to hospital with chronic pulmonary disease from 9.9/100 000 person to 10.27/100 000 persons (or 3.7%) on days when the maximum increase in NO_2 occurred. Similarly a person living on the top floor of the unit would have an increasef risk for admission with chronic obstructive pulmonary disease from 9.9 persons per 100 000 to 10.22 persons per 100 000 (2.3%) on days when the maximal increase in PM_{10} occurred.

The EPA has raised a concern that the aggregated risk for the development of cancer from exposure to the range of air toxics from CCT stack emission would be in the order of 2.86×10^{-6} at ground level to 1.46×10^{-6} at 60 metres above ground level in the vicinity of the Millennium Towers apartment block. The EPA normally requires, as best practice, a risk level below $1x\ 10^{-6}$.

The RTA has indicated that the health risk assessment is conservative for the following reasons:

- it is assumed that the most affected individuals would be exposed to the predicted levels for 70 years. This is extremely unlikely given the nature of the residential site (apartment blocks), and the fact that emissions from the stack would decrease over time; and,
- the risks due to the carcinogens are assumed to be additive and the toxicity for each carcinogen is assumed to follow a linear relationship.

The relocation of the stack would more than halve the aggregate risk assessed for the EIS location although the results would still be marginally above the EPA criterion of 1×10^{-6} (refer Appendix C).

The RTA has indicated that the mix of air toxics in emissions from the CCT stack would be similar to the mix in emissions from typical city roads and average arterial roads/highways through Sydney, therefore benzene levels from the stack would be proportionally similar to background levels as measured by the EPA. It follows that the additional risk to the residents at the top of the Millennium Tower due to the CCT stack would be about 10% of the average risk that most of Sydney is exposed to from air toxics.

The Department considers that whilst these increase in risks are extremely small, the statistics may present only part of the picture in terms of change in health amenity. For example, the risks of other health changes not resulting in hospital admission (ie increased coughing, wheezing, general feeling of discomfort) are likely to be higher.

As was stated above, the community is required to put a high degree of faith in modelling and on predictions for an issue which is extremely complex, variable and sometimes uncertain. In the situation of the residents living in high-rise apartments, there is certainly a greater potential for impact given the reduced buffer between the predictions and the specified goals.

Uncertainty about actual air quality impacts and health risks could be further compounded with factors specific to Darling Harbour area including:

- there is expected to be a significant increase in traffic following the opening of the CCT, localised around the Darling Harbour area particularly Harbour Street, the Western Distributor and the Druitt Street exit;
- there is the added potential for congestion on routes leading in and out of the CCT, particularly the elevated Western Distributor viaduct; and,
- the use of 20% for NOx conversion to NO_2 may not be overly conservative on high ozone days.

However in balance, the modelling has a high level of conservatism as the traffic volume assumption assumes that the tunnel is at full capacity for 7 hours per day for 7 days per week for 365 days per year.

Overall, the Department recognises that the changes in pollution exposure levels for residents living in high-rise apartments is important. However as the goals would be met, the health risks are expected to be acceptable. Furthermore the relocation of the stack would provide substantial potential reductions to exposure to NO_2 and air toxics (ie benzene).

Notwithstanding these improved outcomes, the Department recommends that the RTA undertake a comprehensive monitoring program for residents living in high-rise apartments in close proximity to the stack. Should monitoring of pollutants indicate localised exceedance of the goals, the RTA would be required to immediately undertake such measures to meet the goals or mitigate the concerns. In particular, the RTA should be particularly mindful of the more sensitive persons in the exposed

community. In this regard additional protection is recommended for residents in high-rise apartments should the monitored levels exceed the predicted levels but are still within the goals. This would require further risk assessment for the more vulnerable members of the community including the elderly, children and other people with health issues associated with air quality. These requirements are specified in Recommended Condition of Approval No. 98.

It is also recommended that monitoring be undertaken for pollutants near to the air conditioning intake at the IMAX building to confirm the predictions made in the EIS and as a way of addressing the concerns relating to uncertainty about near field conditions. Should monitoring of pollutants indicate localised exceedance of the predictions, the RTA would be required to immediately undertake such measures to meet the predictions or mitigate the concerns.

With the potential for future development around the stack to further confine dispersion, the Department also recommends that the RTA assist Council in preparing a buffer volume analysis management tool including dispersion modelling and wind tunnel testing. This would enable an iterative assessment of air quality impacts from the stack resulting from increased building height and density around the stack. This requirement is specified in Recommended Condition of Approval No. 103.

Local Ground Level Changes

The results from the EIS (refer Table 7-1 of Technical Paper 16), show that the maximum ground level concentrations from the stack alone would be extremely small. For $PM_{10,}$ the maximum contribution at any ground level location by the stack would be less than 0.4 ug/m^3 (goal is 50ug/m^3). Similarly, the maximum NO_2 contribution from the stack alone at any ground level location would be around 11 ug/m^3 (goal is 245ug/m^3). The EIS argues that the stack emissions would generally be in the order of a few percent of the EPA health goals.

In general the Department does not consider that the percentage of the EPA health goal is a particularly useful indicator of impact particularly for threshold pollutants such as NO_2. For example if background levels of NO_2 were 241ug/m^3, and the stack contributed only 2% (ie 5ug/m^3) then the goal would be exceeded. On the other hand if background levels were 20 ug/m^3 and the contribution was 200ug/m^3 (ie 1000%) then the goal would not be exceeded.

Notwithstanding, the Department accepts that the contribution of pollutants from the ventilation stack to residents living at ground levels would be negligible and would be almost impossible to discern from the normal variation in background levels. Predicted worst-case impacts from the stack at residents living at ground levels for the EIS stack location and the revised location and height (Location B) are provided in Table 5.6 below. It is noted that the predictions for the EIS location are slightly different to those presented in the EIS as the air quality model was updated to include algorithms for building wakes and for revised traffic data.

Table 5.6 - Predicted Ground Level Concentrations From the Ventilation Stack (Location B) in 2006 (Worst Case).

Location	NO_2 (ug/m^3) I hour max	NO_2 (ug/m^3) annual average	PM10 (ug/m^3) Maximum 24 hour max	PM10 (ug/m^3) Annual Average
Harbourside - Darling Harbour	5 (7)	0.36 (0.35)	0.22 (0.16)	0.02 (0.02)
Pyrmont/Ultimo	10 (5)	0.44 (0.75)	0.23 (0.24)	0.02 (0.03)
Glebe	2 (2)	0.37 (0.37)	0.10 (0.10)	0.02 (0.02)
Air Quality Goal	245	60	50	30

Notes
1. Figures for EIS stack location (in brackets) are different to EIS (Table 7.3) as the air quality model was updated to include algorithms for building wakes and revised traffic data.

Neither the peer review by Katestone (refer to Appendix H) nor the EPA review of the EIS or Representation Report raised any particular significant concerns about ground level concentrations. Similarly, the report prepared for Council of the City of Sydney by Child Associates concludes that the proposed stack would increase only in a relatively minor way the levels of PM_{10} and NO_2 pollution in the Ultimo-Pyrmont area.

Notwithstanding, the Department acknowledges the significant and extensive community concerns that a lot of the predicted impacts are based on modelling and assumptions and therefore a high degree of assurance is required that the predictions turn into reality. This assurance, particular in terms of air quality impact, monitoring and general air shed improvements, is strongly encapsulated in the recommended conditions of approval. Continued monitoring of ambient conditions in this local area would confirm the predictions.

Portal Emissions

The EIS indicates that the project has been designed assuming no emission of tunnel air from the portals. For a single stack design, this requires that air must be drawn against the flow of traffic at:

- the exit ramp from the eastbound tunnel to the Eastern Distributor;
- the eastbound tunnel east of the ventilation cross over;
- the westbound exit ramp to Sir John Young Crescent; and,
- the end of the westbound chamber.

The RTA has estimated that the annual power consumption to draw all of the air against normal traffic flow would be in the order of 170MWhr or about 15% of the total flow. Achieving any reductions in power consumption would therefore provide substantial cost savings. Taking into account life-cycle impacts, it would also reduce pollution albeit remote from the CBD (ie at source of power generation such as the Hunter Valley). Consequently the RTA is proposing to modify the EIS proposal and allow emissions from the entry and exit points of the tunnel (ie the portals) as is presently the case for the Eastern Distributor.

The Council of the City of Sydney has generally indicated in its submission support for portal emissions. However, South Sydney City Council and Clover Moore, the local Member for Bligh, have rejected portal emissions expressing concern about impacts on local residents near the portals.

Portal emissions would mean reducing or in some cases switching off the fans. Apart from the energy savings, the other significant advantage of managed portal emissions is that there would be the potential opportunity to reduce the concentrations from the single ventilation stack. However it is imperative that the issue of "sharing the load" consider existing background conditions, including variations to such conditions. A comprehensive and accurate monitoring regime would also need to be established.

In principle, the Department would support portal emissions provided that it would have a minimal impact on air quality. Portal emissions have the potential to lead to significant long term cost savings, reduced energy demands and associated reduction in greenhouse gases. However at this stage, a much more detailed and comprehensive technical assessment would be required before the Department could recommend portal emissions. In this regard it is recommended that at this stage, and until more information is available to the community, the tunnel be designed so as prevent portal emissions. This requirement is specified in Recommended Condition of Approval No. 86.

Notwithstanding, should portal emission be proposed, the Department recommends that a Procedure for portal emissions be prepared. This Procedure would need to be developed with the community, and include emission limits, compliance requirements, timing, frequency and duration and ambient air quality conditions, justification with respect to energy savings, predicted impacts, monitoring, public notification, responding to residents concerns etc. The Procedure would be approved by the Director-General and made public prior to allowing any portal emissions. This requirement is specified in Recommended Condition of Approval No. 87.

Validity of the Meteorological Data

The background meteorology was determined from Goat Island and Observatory Hill. A number of residents have expressed major concerns that these monitoring location would not best represent the specific meteorological conditions experienced in the Darling Harbour area and therefore the assessment of stack impacts would be questionable.

The Goat Island data is considered to be an extremely robust and high quality data set, having been collected over many years and providing a long term historical record of prevailing winds. This base meteorological data set was then incorporated into the wind tunnel modelling which takes into account topography and the details of nearby building size and configurations. In this regard the peculiarities of the Darling Harbour conditions would be accounted for in the modelling as best as practicably achievable and thus in the impact assessment.

However to improve the understanding of local conditions, to assist in the verification of the modelling results, and as support for the monitoring network, it is recommended that a meteorological monitoring station be established as part of the air quality monitoring in the Darling Harbour area and is incorporated in the monitoring requirements.

Toll Surcharge

The report by Council of the City of Sydney recommends that a toll surcharge of 10 cents per vehicle in the tunnel be collected and directed towards an air quality management trust. Based on an average annual daily traffic volume of around 80 000, this would equate to about $3 million per annum. Over a 30 to 40 year life, this would equate to around $100 million.

The Department accepts the intent of this condition, that is, that control and management of the sub-regional air-shed is more value adding with respect to local air quality issues than controls within the Cross City Tunnel and its ventilation stack. However, it is not clear how it was decided that a pollution tax would address this issue.

From a "polluter pays" perspective, it could be argued that because constructing the Cross City Tunnel is expected to reduce regional pollution levels, there could be an argument that the CCT users be given pollution credits not debited. It would also seem inequitable that a motorist using the Cross City Tunnel is charged a 10 cent or so pollution levy, but a motorist not using the Cross City Tunnel (theoretically a less efficient and therefore more polluting option) is not charged a pollution levy. Increasing the toll may also deter some motorist from using the CCT, preferring to use less efficient surface routes. This would only reduce the potential regional air quality improvements.

With respect to pollution in the CBD, a more equitable position may be to charge an air quality levy on car parking (whether it be on-street or undercover) or a CBD access levy. This would address the cause for the trip rather than the effect. However such a levy would be outside the scope of the project assessment and would need to be considered by the relevant authorities such as Councils.

Notwithstanding, the Department supports the CCS's overall objective of this recommendation which is to address sub-regional air pollution. A contingency fund of $5 million dollars has been recommended for potential additional mitigation measures that may arise as a result of the operation of the project that at this stage have not been specifically identified or are subject to further investigations. This would include consideration of further public transport, pedestrian, cyclist and air quality improvement measures. This requirement is specified in Recommended Condition of Approval No. 25.

Greenhouse Gas Issues

The EIS states that there would be significant fuel savings resulting from the proposal due to reduced traffic congestion and improved efficiencies to the road network. This is estimated to be around 17 million litres per year on opening to around 26.6 million litres by 2016. This would more than offset the energy expended during construction.

These savings would need to be offset against the operation energy requirements of the project. The regional air quality assessment indicates that with the Cross City Tunnel the traffic efficiencies would equate to a reduction of CO_2 of 50 000 tonnes per annum on opening increasing to over 74 000 tonnes per annum by 2016. This would represent a significant net improvement to greenhouse emissions.

Again, like the air quality impact assessment, this is entirely dependent on the traffic modelling, which is inherently dependent on assumptions about traffic reductions. As indicated in Sections 5.3 and 5.6 these traffic reductions and hence greenhouse benefits are highly reliant on the traffic and public transport recommendations that are detailed in this Report.

5.5.4 Conclusions

At a broad regional air shed and greenhouse perspective, the proposal has the potential to bring about net improvements to air quality due to predicted improvements to traffic efficiency across the regional road network. However these traffic improvements cannot be relied upon in isolation, as the construction of the Cross City Tunnel has the potential to induce and/or re-direct traffic, a problematic issue for traditional traffic models to accurately quantify. The recommendations regarding public

transport improvements referred to above are therefore imperative and integral to the justification of the project particularly in terms of the potential to bring about net improvements to regional air quality.

At the more local level, based on advice from the EPA, Department of Health and an independent evaluation by the Department, emissions of pollutants from the ventilation stack are not expected to exceed acceptable cumulative levels with respect to residents at ground level. The contributions from the ventilation stack are expected to be extremely small, even if the calculations were underestimated by a factor of 2 or 3. Continued monitoring of ambient conditions in the area would confirm this outcome.

The impacts on residents living in nearby high-rise apartments are predicted to be an order of magnitude higher (ie factor of 10). This would not be negligible, particular in terms of the increment of change, regardless of the fact that the impacts are still expected to be within goals. Accordingly, a comprehensive localised monitoring and mitigation response program is recommended, including at the IMAX theatre and the balcony of nearby high-rise apartments.

5.6 Regional Traffic Issues

5.6.1 Background

The existing regional road network enables traffic travelling north-south to bypass Central Sydney using the limited access arterial corridors formed by the Eastern and Western Distributors. However traffic travelling between areas to the west of Central Sydney and areas to the east is forced to use roads that also serve a local access function, as well a supporting adjoining business activities and accommodating pedestrians and cyclists. The dual role of catering for both local access and regional travel patterns creates conflicts in the function and operation of the road network.

Traffic moving between areas located to the east and west of Central Sydney predominantly uses the following routes:

- William/Park/Druitt/Bathurst Streets;
- Oxford/Liverpool/Bathurst/Elizabeth Streets;
- Goulburn Street/Campbell Street/Wentworth Avenue/Oxford Street; and
- Cleveland Street.

The only continuous east-west route is Cleveland Street, located immediately south of Central Sydney. Due to its more southerly location, Cleveland Street does not provide a direct connection between the suburbs of Waverley and Woollahra and Parramatta Road/Anzac Bridge. Thus the absence of a major east-west arterial route compromises and compounds existing traffic congestion in the CBD.

The EIS indicates that the operation of the Cross City Tunnel is forecast to attract approximately 4,500 vehicles in the 2016 morning peak hour from east-west streets in Central Sydney. Consequent changes in traffic routing patterns would impact to varying degrees on other parts of the road system within the Sydney region, on the approach road network to the tunnel, and within Central Sydney.

The EIS states that traffic across the Harbour would be slightly reduced due to the operation of the Cross City Tunnel, providing an easier alternative to cross the city by encouraging a Harbour crossing to be made further west. The main residential areas expected to experience redistribution in traffic

flows are Paddington, Wolloomooloo, Ultimo-Pyrmont and Glebe. These areas are discussed in greater detail in Section 5.7.

5.6.2 Key Issues Raised

There were a number of specific representations made regarding strategic regional traffic and transport issues. The issues were:

- CCT does not address NSW Government's *Action for Transport 200";*
- the proposal would induce private vehicle use;
- creation of more capacity in the road network would encourage induced traffic;
- additional traffic induced by the CCT could reverse the predicted benefits of reduced air pollution;
- increased traffic congestion beyond the CBD particularly at major feeder routes to the tunnel entrances and exits;
- concern that the CCT undermines sustainable transport planning for Sydney;
- EIS does not fully address the impacts of CCT that go beyond Central Sydney;
- need for traffic management processes for regional areas;
- lack of information available regarding the statement that the Eastern Distributor reduced traffic on local streets; and,
- Harbour Street exit would encourage utilisation of the western fringe carparks.

5.6.3 Consideration of Key Issues

Route Purpose

In strategic terms, the CCT offers an enhanced east-west route through the CBD. Of interest is that the EIS indicates (refer Page 10 of the traffic working paper) that the mode share to public transport for this transport axis is low. Essentially this is because of the multitude of destinations and the current poor public transport connectivity. Whilst this means that a CCT can potentially capture the greatest amount of car traffic, its development could be viewed as potentially compromising a primary transport objective of encouraging public transport usage as it could further entrench private vehicle use.

Induced Traffic and Potential For Capacity Reductions

The economic and traffic analysis included in the EIS appears to discount the phenomenon of induced traffic, citing European and Melbourne research papers that suggest difficulties with estimating increases in traffic due to the presence of a new and efficient road. Recent studies, by Hensher and Abelson (Sydney and Macquarie Universities respectively - *Induced Travel and User Benefits: Clarifying Definitions and Measurement for Urban Road Infrastructure),* suggest that new road developments can induce up to 20% more traffic. A presentation, in January, to the US Transportation Research Board entitled *Induced Travel: Recent Research Findings and Policy Implications* (presented by Lewison Lee Lem of the US EPA) offers additional insights into induced travel demand measurement.

The sensitivity analysis performed on induced traffic effects is based on elasticities of traffic demand in response to expected changes in transport costs (a simpler and more relevant method may be to simply assume different growth rates for induced traffic). The EIS, while not indicating the level of induced traffic applied, suggests that an elasticity of – 0.3 would reduce net benefits by around $200 million.

The EIS modelled a traditional tollgate system to forecast the traffic deterrence effect of the proposed toll. However, the EPA is aware that at least one report (Rosella Picado, *ITS Decision Report: Electronic Toll Collection,* 1998) points to a considerable efficiency improvement of electronic toll collection over traditional tollgates. The EPA also questions the level of traffic deterrence attributed by the EIS to the proposed electronic toll when compared to that of the traditional tollgate system used in the model.

As indicated in Section 5.1, one of the Department's key concerns for this project would be the reliance on the project alone to achieve and maintain the predicted traffic reductions. This is because the project would create the potential for capacity as well as draw additional traffic into the CBD. The Department considers that it is difficult for traffic modelling of a CBD environment to take into account induced demand and thus there is a real potential for erosion of traffic benefits over time. Whilst recognising the complexity of stakeholder interests, the Department considers that the RTA needs to undertake a more pro-active approach on this issue if the benefits of the proposal are to be maintained over the long term.

Roads with forecast major traffic reductions, which would have potential for capacity reductions are listed in Table 5.7 together with potential strategies.

Table 5.7 - Roads with Potential For Capacity Reductions

Road	Forecast Traffic Reductions (% 2016)	Actions
Albion Street	31	Review lane allocation from Mary Street to Flinders Street
Bathurst Street	50	Review lane allocation, including loading zones and bus lanes
Castlereagh Street	23	Investigate need for protection for possible future light rail use
Foveaux Street	20	Review lane allocation
Liverpool Street	27	Review lane allocation and the potential for providing cycle lanes
Palmer Street	39	Review lane allocation and off-peak parking/blisters
Pitt Street	51	Review lane allocation including loading zones in PM peak

Achieving capacity reductions of traffic on these streets would address to some extent the Department's concerns about the net capacity created and the potential for induced traffic to erode the traffic benefits of the project in the long term. The requirement for potential actions to ensure capacity reduction is protected is specified in Recommended Condition of Approval No. 58.

Net Intersection Performance Improvements

Intersection performance across the CBD is considered by the EIS to be one of the best analytical indicators of the overall benefits of the project to the CBD traffic environment. Even without considering the potential for induced traffic, the traffic modelling undertaken for the EIS shows a more limited benefit to the CBD traffic environment as a result of the CCT. It is the Department's view that this limited benefit raises potential concerns regarding the project's ability to meet its objective of improvement to "ease of access and reliability of travel within Central Sydney" and to a lesser extent "to improve the environmental quality of public space within Central Sydney."

Table 7.3 of the Traffic Working Paper provides a summary of the intersection performance and then proceeds to argue that the CCT would increase the number of intersections with Level of Service (LOS) A or B and reduce the number of intersections with LOS E or F. However, on further analysis this includes minor category switching (particularly between LOS B and C, and between LOS D and E). Such a change is unlikely to be perceptible, particularly for delay changes of +/- 10 secs. For example, the average delay for the intersection of St James Road/Elizabeth Street with the CCT, would improve from 28 seconds to 27 seconds, but is attributed with a LOS improvement from C to B. A 1 second change would hardly be perceptible yet it shows up as a LOS change. In this regard, it is considered that this analysis may not represent significant improvements.

The Department subsequently undertook a fresh analysis of the 77 intersection performances with and without CCT with an emphasis on where delays would be either improved or worsened by more than 1 LOS change. This is considered to give a more realistic indication about where there would be perceptible changes to congestion levels. The results of this analysis are present in Table 5.8.

Table 5.8 – Cumulative Intersection Performance

	Total Intersections where LOS with CCT would improve by more than 1 LOS criteria	Total Intersections where LOS with CCT would reduce by more than 1 LOS criteria	Net "perceptible" Improvements
2006 AM	5	2	3
2006 Bus	3	2	1
2006 PM	6	1	5
2016 AM*	9	1	8
2016 Bus*	5	2	3
2016 PM*	9	4	5

* Revised CBD Intersection Performance Data

This analysis indicates that the extent of noticeable improvements to the CBD intersections is likely to be more limited. Overall, out of 77 CBD intersections, the CCT would seem to provide a net major improvement of between 1 and 8 intersections throughout the Sydney CBD (depending on the period and year), most of which would be along the Park, William and Druitt Street corridor.

To ensure that any adverse impacts to the regional traffic network is appropriately managed, it is also recommended that as part of traffic management planning processes, the Proponent would be required to work with the relevant local councils to ensure that traffic impacts within the regional areas adjacent to the proposal are monitored and appropriately managed. This requirement is specified in Recommended Conditions of Approval Nos. 56 and 57.

5.6.4 Conclusions and Recommendations

There is a potential for the project to redistribute regional traffic particularly to the major feeder roads to the tunnel entrances and exits. Potential roads affected include New South Head Road, Ocean Street, Edgecliff Road and South Dowling Street. Whilst these roads have a regional function, they nonetheless fulfil important local functions. The extent of "transformation of the CBD" with respect to congestion levels would appear to be essentially limited to the William/Park/Druitt Street corridor. Impact on congestion levels beyond this corridor would appear to be marginal and unlikely to be noticeable to the driver or pedestrian.

The adverse impacts on the regional network need to be traded against the regional network benefits. The benefits would appear to occur primarily to the William/Park Street corridor and to a lesser extent Liverpool Street, Albion Street, Palmer Street, Pitt Street, Riley Street, Cleveland Street, Cowper Wharf Road, Bathurst Street and Oxford Street. Whilst these improvements may be important, this would entirely depend upon whether the reductions on these streets and protection of impacted local streets could be maintained in the long term. As indicated above, this would principally rely on the achievement of accompanying initiatives, particularly public transport, pedestrian and cyclist initiatives as well as comprehensive LATM measures. Achieving capacity reductions on these and other streets with the potential for significant reduced traffic, would address to a large extent concerns about the net capacity created and the potential for induced traffic to erode the traffic benefits of the project in the long term.

5.7 Local Traffic and Access Issues

5.7.1 Background

The extent to which the proposal relates to local traffic and access is defined in the EIS through four precincts Darling Harbour, Central, Eastern and Hyde Park.

Darling Harbour Precinct

The EIS identifies a range of changes in daily traffic volumes in the Darling Harbour Precinct as a result of the Cross City Tunnel. The major change is to Harbour Street which would experience a substantial increase in traffic (17 percent to 60 percent) due to some traffic from the north-west of the CBD switching from surface streets to the Cross City Tunnel and Harbour Street, and some traffic using the Cross City Tunnel and Western Distributor route to cross the Harbour rather than the Cahill Expressway.

Whilst, the performance of intersections in the Darling Harbour Precinct are forecast to improve once the tunnel is in operation(particularly in the morning peak hour along Bathurst Street), the EIS forecasts lesser improvements for the evening peak. Two key intersections Market Street/Kent Street and Bathurst Street/Harbour Street are forecast to have poorer performance in the evening peak.

The EIS also identifies several changes to facilities for pedestrians, particularly those providing a link between Darling Harbour and the CBD. These changes are discussed in Sections 6.2 and 6.9 of this Report.

Central Precinct

This precinct contains part of the grid of roads that serves the CBD, including George, Elizabeth, Park, Bathurst, Clarence and York Streets. Kent Street also operates one-way in conjunction with Sussex Street.

Traffic distribution in the Central Precinct following the opening of the Cross City Tunnel would include three distinct changes:

- removal from surface streets of a significant proportion of through traffic traveling east-west;
- physical changes to a number of surface streets to consolidate the gains achieved by the removal of a substantial proportion of through traffic; and
- some redistribution of traffic within the precinct due to the reduction in east-west movements on the surface.

The EIS states that in relation to the Central Precinct, reductions in surface traffic along the corridor of the Cross City Tunnel and the consequent improvement in flow conditions and intersection performance would result in improvements for pedestrians.

Hyde Park Precinct

The Hyde Park Precinct is bounded by Elizabeth Street, St James Road, College Street and Liverpool Street. Park Street has an east-west alignment, passing through the middle of Hyde Park and linking Park and Druitt Streets to the west with William Street to the east. Consistent with Hyde Park's major role within Central Sydney of providing a passive recreation space, pedestrian use is dominated by the lunch time movement between work places and the Park and other adjoining parks.

Changes in traffic distribution in the Hyde Park Precinct following the opening of the Cross City Tunnel would include:

- removal of a significant proportion of through trips from surface roads along the immediate corridor;
- changes to Park Street to consolidate the gains achieved by the removal of a substantial proportion of through traffic; and,
- Park Street, between College and Elizabeth Streets, would undergo significant physical changes as part of the Cross City Tunnel proposal. These would include:
    - widening of the footpath;
    - provision of a 1.5 metre wide kerb-side bicycle lane in each direction;
    - eastbound and westbound 24-hour bus lanes;
    - the existing six general traffic lanes (two of which are used for parking) would be reduced to two lanes, one in each direction. No provision for parking would be made in this section of Park Street; and
    - eastbound and westbound traffic would be separated by a landscaped median of varying width.

These changes are likely to improve pedestrian access in this precinct, particularly across Park Street, east of Elizabeth Street.

Eastern Precinct

The principal streets passing through the precinct in the east-west direction are Cowper Wharf Road, William Street, Liverpool Street, Burton Street and Oxford Street.

Traffic distribution in the Eastern Precinct following the opening of the Cross City Tunnel would reflect three distinct changes:

- removal of a significant proportion of traffic from surface roads along the immediate corridor;
- changes to a number of affected surface streets to consolidate the gains achieved by the removal of a substantial proportion of through traffic; and
- some redistribution of traffic within the precinct benefiting from the reduction in east–west movement on the surface and movements to the north.

The EIS predicts that most streets would experience a reduction in daily traffic flows following completion of the CCT, however there would be some streets to the east of the Kings Cross Tunnel which would experience increases in flows as traffic diverts to gain access to the Cross City Tunnel.

5.7.2 Key Issues Raised

The majority of individual representations to the EIS raised concerns about the impact of the proposal on local streets. Similar concerns were raised in representations from South Sydney City Council, Council of the City of Sydney, Leichhardt Council, Woollahra Council and a number of local community groups including East Sydney Neighbourhood Association and the Ultimo Precinct Committee.

The issues raised included:

- concerns that the key benefits were directed towards the commuter and commercial areas, rather than residential streets;
- increased levels of traffic, often in an attempt to avoid the toll, in local areas including Paddington, East Sydney, Glebe, Wolloomooloo and Pyrmont – Ultimo;
- need for traffic management works in local precincts to be identified and in place prior to the opening of the project; and,
- increase in traffic on some CBD routes, including:
    - Market and Kent Streets;
    - the Western Distributor as a result of the reduced lanes on the Market Street Viaduct; and,
    - the southbound lanes on the Viaduct.

The Department also received a detailed submission to the Preferred Activity Report (PAR) from the local member for Bligh, Ms Clover Moore. Key issues raised included:

- continued concerns about infiltration of traffic onto local streets and lack of commitment to LAIP measures;
- little benefits to already impacted local streets;
- lack of detailed traffic information;
- concerns about the speed and volume of traffic emerging at the Rushcutters Bay portal and consequent rat running into adjacent suburbs; and,
- difficulties of merging from Roslyn Street.

Specific concerns were also raised in a joint submission for the Darling Harbour Business Association and the Sydney Harbour Foreshore Authority with respect to changes to access to Darling Harbour, including:

- changes in the vicinity of Harbour and Bathurst Streets; and,
- the impact of access to Cockle Bay.

Other key issues raised in regard to local traffic centred around the impact of construction on local traffic which are discussed in Section 6.1 - Construction Stage Traffic Impacts.

5.7.3 Consideration of Key Issues

As a general comment, it is recognised that the existing road system surrounding the CBD already has a number of major issues with respect to traffic congestion and infiltration into local streets. This situation is inevitable to some extent in an active city environment where there are trade-offs between proximity and accessibility. Many of the submissions received raised issues, which, whilst recognised as being real problems, may not necessarily directly relate to the construction and operation of the Cross City Tunnel. For example there were a large number of submissions from residents on streets where the Cross City Tunnel would have nil or even a highly positive impact, but that contained strong requests that the RTA must, as part of building the proposal, address existing problems.

The issue of impact on local streets is further complicated because traffic modelling is only a predictive tool, and it is difficult to predict complex human behaviour which is often a major issue for 'rat-running' and local street intrusion. In addition, the traffic model does not contain each and every local street and lane and thus represents only a skeleton of the actual road network. In this regard, modelling can give results, that may be potentially counter intuitive to local residents.

In principle, there needs to be a nexus between the construction of the project and impacts on local streets for there to be strong justification for intervention by the RTA as part of this project development. At this stage of the assessment, the Department considers that the traffic model is the best technical tool to predict such impacts, and has been principally relied upon for assessment purposes. Nonetheless in recognition of local issues the Department strongly supports impact monitoring and verification to ensure that any local street not identified in the model has having potential problems can be considered if and when required.

Paddington/Edgecliff

The Cross City Tunnel would cause a redistribution of traffic within Paddington, with locally generated traffic making greater use of New South Head Road rather than Oxford Street or Liverpool and Burton Streets for longer trips. There is also some potential for external traffic to this area to be drawn across from Oxford Street to New South Head Road. Increases in traffic are predicted to occur on Gurner Street, Glenmore Road, Nield Avenue, Brown Street and McLachlan Avenue. In particular there is the potential for a significant "rat-run" between Ocean Street in the east and Macdonald Street/McLachlan Avenue/Nield Avenue in the west consisting of the route Moncur Street - Hargrave Street - Gurner Street - Glenmore Road. A second "rat-run" is possible between New South Head Road and Oxford Street using Boundary Street, McLachlan Avenue, Nield Avenue, Brown Street and Glenmore Road.

It is therefore recommended that LATM measures be included for the following streets:

- Brown Street/ Neild Avenue between Macdonald and Lawson Streets; and
- Glenmore Rd, between New South Head Rd and Cascade Street.

The revised traffic modelling also predicts increases on Ocean Street of about 10 to 15% by 2016. This is a notable increase however the absolute figures would not be inconsistent with its current designation as an RTA regional road. The increase would match the reductions obtained with the opening of the Eastern Distributor and thus the cumulative impacts of both projects should at least result in no net worsening. Notwithstanding and given the importance of this route for public transport there is justification for further investigation for the provision of a bus lane or at least a T3 lane along Ocean Street. This is recommended for further investigation by the PTC and is included in Recommended Condition of Approval No. 38.

The Department understands the community concern that local traffic issues should be ideally resolved as part of the development of the project and mitigation measures such as Local Area Traffic Management measures implemented prior to construction. However, the Department does not consider this timing to be realistic given the complex circumstances of a CBD environment, the level of highly local detailed analysis required and the need for extensive community consultation. For example, some of the LATM measures for the Eastern Distributor are still in the design and consultation phase albeit that the project was approved almost 4 years ago. Notwithstanding the Department recommends that LATM measures be developed and in place for this area at least prior to the collection of the toll. These recommendations are reflected in Recommended Conditions of Approval Nos. 59 and 60.

Glebe

There would be flow-on effects of the increased attractiveness of Pyrmont Bridge Road and Western Distributor for the Glebe area. Bridge Road is forecast to have an increase in traffic in the order of 1,800 vehicles per day in 2016 because of the Cross City Tunnel. This is largely a shift from Parramatta Road/Broadway accompanied by decreases on St Johns Road, Mitchell Street and Wentworth Park Road.

Significant reductions of traffic on Pier Street across Darling Harbour (as a result of the reduction in use of the Allen Street exit ramp from the Western Distributor discussed above) would result in some increases in traffic volumes through the Glebe/Broadway area to the William Henry Street/Pier Street route. Such traffic is either destined for Ultimo-Pyrmont, the CBD or the eastbound entry portal of the Cross City Tunnel on Harbour Street.

The traffic model indicates the following increases in daily traffic volumes in 2016:

- Cowper Street, between Glebe Point Road and William Henry Street + 2,000;
- William Henry Street, between Cowper and Wattle Streets + 1,300; and
- William Henry Street, between Wattle and Harris Street + 750.

It is estimated that the operation of the Cross City Tunnel would result in an overall increase in through traffic in the Glebe area of approximately 8 %. However these increases are predicted to be confined to Bridge Road and Bay Street. In this regard limited LATM measures do not appear to be justified at this stage. Notwithstanding, the Department recommends that these streets be monitored during construction and after the tunnel is opened and if problems do arise, LATM be installed. This requirement is specified in Recommended Conditions of Approval Nos. 47 and 61.

Ultimo-Pyrmont

The traffic model, in Technical Paper 8 of the EIS, indicates that the Western Distributor interchange at Pyrmont Bridge Road would draw traffic to and from the local area onto the Western Distributor. This traffic appears to have origins or destinations to the east of Central Sydney. The Western Distributor would become a more attractive route after the opening of the Cross City Tunnel. As a consequence, traffic on Pyrmont Bridge Road would increase in volume (1,800 vehicles per day in 2016), however, the net effect of this increased attractiveness would be more or less neutral for the rest of the road system as the changes relate more to a redistribution of traffic.

There would be significant reductions in traffic on Allen Street and Harris Street as eastbound traffic from Anzac Bridge would stay on the Western Distributor to access the Cross City Tunnel instead of off-loading to Harris Street via Allen Street. On Harris Street, between Allen Street and William Henry Street, volumes are expected to decrease by about 30% to 8,000 vehicles per day in 2016. There would be an increase in traffic on Harris Street between Allen Street and Pyrmont Bridge Road (about 70 percent and 25 percent in the afternoon peak periods in 2006 and 2016 respectively) due to increased usage of the interchange with the Western Distributor on Pyrmont Bridge Road. Other streets in the Pyrmont area, such as William Henry, Miller and Pyrmont Street would benefit with minor traffic reductions.

The revised traffic forecasts generally indicate that greater benefits would accrue to this area and therefore at this stage it would not appear that LATM measures would be justified. Notwithstanding, the Department acknowledges the concerns of the community that there is already significant traffic

intrusion into some of the local area precincts and even if the CCT does not necessarily exacerbate the situation, the cumulative impacts of the project could create potential problems in the long term.

It is recommended that this area be closely monitored during the construction and for at least 12 months after operation and the need for LATM measures be assessed in conjunction with the local councils and community groups. These requirements are specified in Recommended Conditions of Approval Nos. 47 and 61.

Eastern Precinct (Woolloomooloo/East Sydney/Darlinghurst/Rushcutters Bay)

In this area the proposal would affect local traffic conditions through:

- reduced traffic flows along Cowper Wharf Roadway;
- reduced traffic on the existing Kings Cross "rat-run" of Macleay Street and Cowper Wharf Road;
- significant traffic reductions on William, Palmer and Bourke Streets;
- increased traffic on Craigend, Liverpool and Victoria Streets; and,
- the narrowing of Sir John Young Crescent to accommodate the Cross City Tunnel exit for northbound traffic. The residual capacity of Sir John Young Crescent following the construction of the Cross City Tunnel exit for northbound traffic would be more than sufficient to accommodate expected surface traffic flows.

As with the Ultimo/Pyrmont area, the revised traffic forecasts generally indicates that greater benefits would accrue to this area and thus at this stage it would not appear that LAIP measures would be justified. Traffic forecasting indicates that the potential for traffic intrusion on the north side of the tunnel (ie Kings Cross, Potts Point, Elizabeth Bay, Rushcutters Bay, Darling Point) would be negligible.

However, the Department again acknowledges the concerns of the community that there is already significant traffic intrusion into some of the local area precincts and even if the CCT does not necessarily exacerbate the situation, the cumulative impacts of all the Eastern Distributor Local Area Improvement Programs combined with the LATM measures recommended for the Cross City Tunnel could potentially create problems in the long term.

It is recommended that this area be closely monitored during the construction and for at least 12 months after operation and assessed for an LAIP program in conjunction with the local councils and community groups. This requirement is specified in Recommended Conditions of Approval Nos. 47 and 61.

Another key issue raised by the local community for this area was concerns about the speed and volume of traffic emerging from the Kings Cross Tunnel and the potential for subsequent delays and rat running through the nearby suburbs. The issue of 'rat-running' has been addressed with LATM measures for Paddington discussed above. In response to speeding in this area the RTA have fitted speed cameras east of the Kings Cross Tunnel.

5.7.4 Conclusion

The Department acknowledges the views of the local councils and community groups that there are potential impacts in the local areas adjacent to the CBD. As was experienced after the Eastern Distributor opened, some particular areas and local streets are expected to bear the burden of this additional traffic, which at this stage of the assessment, is too complex to accurately predict.

Notwithstanding, in recognition of these potential impacts it is important that traffic-planning decisions are made in a consultative and integrated manner. At this stage the Department must necessarily rely on the best technical advice from traffic modelling that is acknowledged to have limitations at the level of detail required to assess impacts on local streets. It is therefore not appropriate to impose on the project LATM measures throughout all adjacent suburbs, when the best information to date suggests that the problems are likely to be limited to only certain streets rather than a blanket deterioration of entire suburbs.

Early implementation of recognised LATM measures for Paddington would improve the amenity and safety of local roads and public spaces by restricting through traffic and ensuring that alternative routes for traffic wishing to avoid toll is relatively unattractive. Early monitoring of other precincts including the Eastern Precinct, Darlinghurst/Wolloomooloo, Glebe and Ultimo/Pyrmont areas, in recognition of the potential, though less likely level of intrusion, is considered appropriate at this stage.

The importance of funding and completion of local traffic measures was emphasised in a number of submissions from local councils. To ensure that funding measures are in place, the Department recommends that traffic measures are in place prior to collection of the toll.

5.8 Noise and Vibration

5.8.1 Background

Construction

Construction is predicted to take approximately three years. Surface works at connection points, portals, the relocated control centre, at construction compounds, along cut and cover sections and the road haulage of spoil all have the potential to generate adverse noise impacts.

The EIS proposes standard construction hours of 7:00 am to 6:00 pm, Monday to Friday and 7:00 am to 1:00 pm on Saturdays, with no work on Sundays or public holidays.

The EIS proposes the use of a large number of standard mitigation measures including:

- restricting rock-breaking works to within standard construction hours;
- erection of temporary and/or permanent noise barriers in the vicinity of the western and eastern portals, and at the connection to the Eastern Distributor;
- fitting efficient silencers or more efficient exhaust systems to mobile plant;
- regular maintenance of all plant and machinery;
- use of dampened rock hammers; and
- active community consultation.

Noise predictions indicate that the EPA's construction noise goals would be exceeded by up to 29 dBA. The EIS notes that this assessment is based on the most likely construction plant and equipment to be used at each of the major work sites and anticipated durations and states that the selected contractor would determine the actual construction procedures.

The EIS notes that vibration from construction activities, particularly rock-breaking and tunnelling would be transient in nature as periods of work would be interrupted by quiet periods. The EIS indicates that buildings located above tunnelling works and adjacent to cut and cover and tunnel portals would

potentially be susceptible to vibration impacts. The assessment indicates that the risk of structural damage should be minimal for residential structures located over ten metres from the vibration source and heritage structures located at least 15 metres from the vibration source.

Regenerated noise (noise generated from within a space of a building that originates as vibration propagates between the source and receiver through the ground and structural building elements) associated with the project would generally be attributable to rock breaking and, to a lesser extent, road heading activities. The EIS states that compliance with AS 2107 night time criteria should be achieved for residential buildings offset 45 metres or more from road-header works, subject to the actual road header used and 70 metres or more from rock-breaking works.

The EPA noted concern in its representation over the lack of detailed noise assessment of impacts from construction work sites associated with the proposal. In its Representations Report, the RTA relocated the tunnel control centre from the Sir John Young Crescent Compound to Palmer Street and included another construction compound adjoining Site 4. The Representations Report included a supplementary assessment of noise and vibration impacts focusing on portal work sites and the additional Palmer Street construction compound. This assessment indicated that the EPA's construction noise goals could be met for the new Palmer Street compound provided site establishment was completed within four weeks. The Representations Report recommended that a noise wall be erected on the southern boundary of the Palmer Street construction compound to mitigate operational noise and detailed a number of specific management restrictions to limit noise from the use of the site. The supplementary assessments of works within the portal work sites indicate that noise at these sites would comply with or exceed EPA noise goals by up to 11 dB(A). The Representations Report recommends a number of site specific management measures to be applied in addition to measures detailed in the EIS in instances where exceedances are predicted.

Operation

The EIS contains an assessment of the likely traffic noise impacts of the proposal on opening, and ten years after operation. As the CCT would influence existing traffic patterns on the surrounding road network in and around the city, traffic changes resulting from the proposal have also been factored into the operational noise assessment included in the EIS. Monitoring undertaken at seventeen locations (prior to the opening of the Eastern Distributor) as part of the EIS indicates that the EPA's criteria is currently exceeded at all locations.

The EIS indicates that road noise at the western portal would remain unchanged ten years after operation. The EIS notes that receptors along William Street between Rosebank/Brougham Streets and Darlinghurst Road and at the Sir John Young Crescent portal would experience small 'break-outs' of noise and proposes that CCT lanes with an exposure to William Street south of Darlinghurst Road and CCT lanes emerging from the Sir John Young Crescent portal be provided with absorptive noise walls. The EIS indicates that road traffic volumes in Bourke, Palmer and William Streets in the vicinity of the Eastern Distributor connection would generally decrease and, in keeping with noise treatments at the other portals, proposes CCT lanes emerging from the portal be provided with absorptive noise walls.

The EIS assessed three different scenarios for road noise impacts on surrounding streets that indicated the likely noise levels associated with the Eastern Distributor and CCT. The EIS indicates that some noise increases would result from the proposal and details the following possible mitigation measures for surrounding roads:

- low noise road surfaces such as open graded asphalt concrete;
- regular road maintenance;
- traffic management such as limiting vehicle speed, speed humps, signage etc.;
- traffic re-routing;
- installation of noise barriers; and
- building insulation.

The EIS proposes that all available noise mitigation measures be examined in cases where noise increases greater than 2 dBA are predicted on surrounding streets and concludes that site specific mitigation measures would be finalised during detailed design.

Likely noise from the proposed tunnel ventilation system is assessed in the EIS using the EPA's *Industrial Noise Policy.* Predicted noise levels assessed at the nearest critical receiver (the Park Royal Hotel) exceed the applicable criteria by 11 dBA. The EIS notes that noise control measures such as silencers in fan intakes and discharges and building treatments for associated plant rooms would reduce emissions to acceptable levels.

5.8.2 Key Issues Raised

Key issues raised in representations include:

- cumulative impact of Eastern Distributor both in terms of overall noise increases and loss of road noise decreases resulting from changed traffic patterns;
- night time works;
- need for consultation with affected residences/workplaces;
- impacts on New South Head Road;
- mitigation/compensation;
- need for reduced day time hours;
- notification;
- high construction noise predictions;
- noise impacts of the tunnel ventilation system;
- need for additional background monitoring; and,
- specific restrictions on spoil excavation.

5.8.3 Consideration of Key Issues

Background Noise

In its representation to the EIS the EPA raised concerns over the base noise monitoring data used to assess noise impacts in the eastern and central precincts as this data was collected prior to the opening of the Eastern Distributor. In the Representations Report the RTA has undertaken to complete further ambient noise monitoring within these precincts prior to the commencement of construction.

Daytime Construction Noise

The EIS predicts that a large number of residences and businesses would experience exceedances of up to 29 dBA over the EPA's construction noise goals for construction periods of less than four weeks duration. The EPA has indicated that use of construction durations of less than four weeks is inappropriate as construction noise goals are based on the entire duration of the construction of the project. As construction is expected to take three years, the appropriate construction noise goal is background plus 5 dB(A), for the entire duration. This requirement is reflected in Recommended Condition of Approval No. 123.

The EPA also indicated in its representation that the construction noise assessment included in the EIS is conceptual and would need to be finalised during detailed design. The Department notes that the assessment within the EIS does not take the length of exposure or less noisy construction activities into consideration in assessing impacts. The Department therefore considers that a precautionary approach to construction noise management is appropriate, given the conceptual nature of these assessments and the fact that many of the residences and businesses to be affected by CCT construction noise have already had to come to terms with the construction noise impacts associated with the construction of the Eastern Distributor. The Department therefore recommends that a detailed Construction Noise and Vibration Management Sub Plan and Construction Noise Impact Statements be prepared to specifically address noise impacts at each of the major construction sites. These Statements would be prepared in accordance with the Construction Noise and Vibration Management Plan which would detail cohesive management techniques and processes for all construction noise and vibration impacts. These Statements, required by the Department's Recommended Condition of Approval No. 124 would detail proposed construction activities and processes including noise impacts from road haulage and traffic diversions, assess the associated noise impacts and detail and commit to specific noise mitigation measures, respite periods and notification and consultation protocols.

To ensure that construction noise impacts are effectively managed, the Department's Recommended Condition of Approval No. 127 would require the Proponent to monitor construction noise impacts and, where exceedances are noted, implement best available mitigation measures to the satisfaction of the EPA. In order to further minimise noise impacts during construction, the Department also recommends that where practicable, and in consultation with relevant Council(s), the Proponent erect operational noise mitigation measures prior to the commencement of construction. This requirement is reflected in recommended Condition of Approval No. 132.

SCEGGS raised concern over the impacts of increased noise levels during construction having an impact on classes, boarding rooms and especially examinations and requested that they be advised of construction timetabling in the vicinity of the school. The RTA, in its Representations Report, undertook to avoid wherever possible timetabling noisy activities during examination periods. The Department considers that given the duration of construction it is possible for the Proponent to ensure that noise-generating activities are not undertaken in the vicinity of SCEGGS or other school buildings during

exam periods. This requirement is reflected in the Department's Recommended Condition of Approval No. 129. The Department considers that the recommended consultation, assessment and management and monitoring conditions discussed above would ensure that noise impacts outside examination periods are effectively managed.

Road Haulage

The EIS notes that the haulage of spoil from construction sites would take place only during standard daytime construction hours, however indicates that surface stockpiling operations may occur outside these hours. The Department considers that it is possible to manage tunnelling operations so that spoil is stockpiled in the tunnel outside standard construction hours and only transported to the surface for dispatch during standard hours. This requirement is reflected in the Department's Recommended Condition of Approval No. 122.

Night Time Construction Noise

A number of representations noted concern over the noise impacts associated with night time construction works. The Department notes that the RTA has undertaken to transport spoil from the site and undertake rock breaking works only during standard daytime construction hours. These commitments are reflected in the Department's Recommended Conditions of Approval Nos. 122 and 128. Notwithstanding, the RTA propose to tunnel 24 hours a day, and have indicated in the EIS that a number of activities including preparation of traffic diversions and concrete cutting would need to be completed during night time hours.

The Department is concerned that concrete cutting, which is a particularly noisy activity, is listed as a night-time activity in its own right. The Department considers that only those works that would cause significant adverse impacts if constructed during standard hours should be carried out at night. To this end, the Proponent would be required to include justification as to why activities are required to be carried out at night and assess alternative, less noisy construction activities in the Construction Noise Impact Statements required under the Department's Recommended Condition of Approval No. 124. The Department also recommends that scheduling of noisy activities after midnight and over consecutive nights in the same locality be avoided where possible. The EPA have indicated that night time noise should be limited to no more than 5 dB(A) over background levels. This requirement is reflected in the Department's Recommended Condition of Approval No. 123.

Notwithstanding, the Department notes that noise disturbances could still result at night time given the nature of some proposal night time activities. The Department therefore concludes that reactive actions may be required to ensure that noise levels are effectively managed at all times. The Department's Recommended Condition of Approval No. 13 therefore enables an Independent Community Liaison Representative appointed by the Director-General to consult with the Environmental Management Representative (EMR) who can place a hold on noise generating construction works resulting in complaints from affected residents which in the opinion of the EMR do not comply with the Recommended Conditions of Approval.

Palmer Street Construction Compounds

A number of representations raised major concerns over construction noise impacts from the Palmer Street site compounds. Given the concerns raised, the introduction of three additional site compounds in Palmer Street (detailed in the Representations Report), the significant noise levels experienced in this locality during construction of the Eastern Distributor and the proposed 24 hour operation of these

sites, the Department considers that noise impacts from these site require careful and effective management. The RTA have undertaken to erect a permanent masonry wall along the southern boundary of the additional compound prior to construction and implement noise reducing management measures. This requirement is reflected in Recommended Condition of Approval No. 133. However, the Department notes that barriers do not effectively mitigate noise impacts on residents living in medium and high-rise buildings. The Department considers that the additional site compounds should therefore only be used for light activities including administration/office purposes. This requirement is reflected in Recommended Condition of Approval No. 134. Given this restriction, the Department concludes that the recommended consultation, assessment, management and monitoring conditions discussed in the above paragraphs would ensure that the impacts on residents within this locality are effectively managed.

Construction Vibration

Proposed construction activities including use of rock breakers, road headers, and vibratory compacters may result in vibration impacts. The EIS included an assessment of construction vibration, which concluded that the risk of structural damage would be minimal for residential buildings located more than 10 metres from the vibration source and 15 metres form the vibration source for heritage and other sensitive structures. The Department's Recommended Condition No. 146 sets limits for construction vibration to ensure that the potential for structural damage and unacceptable human exposure is minimised. To ensure that sensitive structures such as heritage items are not adversely affected by vibration, the Department's Recommended Condition of Approval No. 147 limits vibration at the foundations of such structures to no more than 3 mm/s. The Department has also recommended that vibratory compacters and rock breakers are not used closer than 70 metres from residences outside standard construction hours and that bored piles are used in place of other more noisy and vibratory piling methods.

Blasting

While the EIS indicates that blasting is not expected to be used during construction, the Department notes that blasting may be necessary to complete some tunnelling operations through hard rock. Since the impacts of blasting have not been assessed in the EIS, the Department considers that a precautionary approach in relation to blast management is appropriate. The Department's Recommended Condition of Approval No. 140 requires that the Proponent prepare a Blast Management Strategy as part of Construction Noise and Vibration Management Sub Plan, should blasting be required. This Strategy would include details of blasting activities, a justification of the need to blast, identify any potential impacts, detail storage and handling arrangements for explosives, determine the risks associated with blasting and detail community consultation procedures. The Department's Recommended Condition of Approval No. 144 requires that the Proponent conduct trial blasts at reduced scales to determine site specific blast characteristics and define the maximum allowable charge size to meet EPA criteria.

To ensure that the potential impacts of blasting operations are effectively minimised and managed, the Department recommends that blasting be undertaken only between 10:00 am and 3:00 pm, Monday to Friday, and 10:00 am and 1:00 pm on Saturdays and at no time on Sundays or public holidays. It is also recommended that blasts be limited to one single detonation per day and that air blast control doors be erected at tunnel portals to reduce impacts until construction has advanced to a stage where emission levels comply with the relevant criteria.

Regenerated Noise from Construction Activities

The EPA expressed concern over disturbance resulting from regenerated noise. The EPA noted that the EIS does not quantify the number of residences likely to be affected by regenerated noise and stated that, based on experience from the construction of the Eastern Distributor, levels of 35 dB LA *eq 1 minute* or less have the potential to cause concerns for residents at night. However, based on further discussions with the EPA it became evident that the primary concern of residents was particularly related to rock-breaking activities at night. On this basis the Department recommends that the 35dB criterion be retained (refer Recommended Condition of Approval No. 125) but that there is no excavation using rock hammers at night (refer Recommended Condition of Approval No. 136). The provision of an immediate (i.e. within 2 hours) response to any complaints should also deliver a more responsive outcome than that achieved with the Eastern Distributor.

Operational Traffic Noise

The EIS indicates that traffic noise increases resulting from the CCT are likely in sections of Clarence Street, Harris Street, Market Street, Crown Street, Palmer Street, McLachlan Avenue and Nield Avenue. The EIS notes that some of these increases would occur after comparable decreases resulting from the operation of the Eastern Distributor and concludes that noise ten years after opening would be almost identical to the levels currently being experienced. The Department considers that using noise reductions resulting from the Eastern Distributor as a justification for not mitigating the noise impacts of the CCT is difficult to accept. The Department concludes that consideration of whether noise mitigation is required should be completed in accordance with the procedures set out in the EPA's *Environmental Criteria for Road Traffic Noise*. In cases where current background noise levels exceed the relevant criteria and where strategic and project specific mitigation measures have been shown not to be feasible and reasonable, then a 2 dB increase in existing noise levels would be acceptable. The Department's Recommended Condition of Approval No 150 requires the Proponent to prepare a detailed Operational Noise Management Sub Plan. As part of this Sub Plan the Proponent would be required to identify appropriate mitigation measures for all potentially affected residences.

To ensure that noise affected residences are effectively ameliorated against road noise impacts the Department's Recommended Condition of Approval No. 152 requires the Proponent to undertake operational noise monitoring one year after commissioning. Should this monitoring indicate a clear trend in traffic noise levels which are higher than the predictions made and exceed EPA noise criteria, the Proponent would be required to implement further mitigation measures including but not limited to consideration of inclusion of noise barriers, insulation of buildings and other measures following consultation with landowners/occupiers.

Operational Ventilation Noise

The EIS indicates that noise from the proposed ventilation stack could be mitigated to achieve the relevant criteria as specified in the NSW Government's *Industrial Noise Policy* using techniques such as fitting silencers to fans and enclosing engines. The Department's Recommended Condition of Approval No. 151 requires that the operational ventilation system is designed and maintained to meet the relevant criteria.

6. ASSESSMENT OF OTHER ISSUES RELATING TO THE MODIFIED PROPOSAL

This Section of the Report provides an assessment of the other environmental impacts of the modified proposal based on an examination of the EIS, issues raised in representations during the exhibition period and the RTA's response to these issues in its Representations Report and during further consultation with the Department.

The RTA has also provided the Department with an assessment of all issues raised in representations in Appendix 2 of its Representations Report. This assessment has been reviewed by the Department and where required further assessment has been undertaken and discussed. It is therefore important that this Section be read in conjunction with the RTA's Representations Report to understand how all issues raised in representations were addressed.

6.1 Construction Stage Traffic Impacts

6.1.1 Background

The EIS indicates that a number of changes to the existing road system would be required during the three year construction period. The EIS details five main areas where traffic would be disrupted:

- streets surrounding the western portal works including Druitt, Day, Bathurst, and Harbour Streets;
- at the connection to the Eastern Distributor including Palmer and Bourke Streets;
- at the exist onto Sir John Young Crescent, including works along Riley Street and Sir John Young Crescent;
- William Street between Dowling and Bourke Street; and
- streets surrounding the eastern portal works including William Street and Darlinghurst Road.

The EIS indicates that the impacts of the proposal on traffic flows would be managed by maintaining limited traffic assess and, in situations where full road closure or only one traffic lane would be available completing work outside of peak traffic periods. Notwithstanding, the EIS concludes that some roads would need to be closed and in these cases proposes diversion of traffic to surrounding streets. The EIS includes an assessment of the likely traffic impacts resulting from these changed arrangements and concludes that a number of specific measures would be required to ensure that disruption to traffic is minimised. These include:

- decommissioning the Bourke/William Street traffic signals and limiting turns at this intersection to 'left in and left out';
- minimum of four lanes on William Street to remain open to traffic;
- provision of two left turn lanes from Kent Street to Market Street to accommodate traffic diverted from Druitt Street;
- access from construction sites to be limited to "left in and left out" or signalised where possible; and,
- close monitoring of bus operations to ensure disruptions are minimised.

The EIS also includes an assessment of the impacts of traffic generated as a result of construction. This assessment assumed traffic generation of 100 to 120 per construction site spread throughout the day, with a maximum of 20 trucks per hour. Haulage routes for spoil removal were also factored into this model. The EIS concludes that the likely construction traffic would have minimal impact on traffic flows, provided that the specific management measures outlined above are implemented.

6.1.2 Key Issues Raised

Key Issues raised in representations include:

- impact on bus operations
- need for advance notification of changed access arrangements;
- signage;
- pedestrian access during construction;
- impact of road closures on bus services;
- property access by owners/tenants and customers;
- loss of parking; and
- traffic delays during construction.

The impacts of the construction proposal on pubic transport are discussed in Section 5.3 of this Report. Construction stage impacts on pedestrians and cyclists are covered in Sections 6.9 and 6.10 of this Report respectively.

6.1.3 Consideration of Key Issues

General

As can be appreciated, construction of a major new arterial road tunnel through the heart of the CBD of a major city such as Sydney raises extremely complex traffic issues. Even minor road closures and detours can have a significant flow on effect across the broad traffic network with potentially significant traffic congestion consequences.

This issue has been acknowledged by the RTA as a considerable construction management challenge and has subsequently identified a schedule of minimum traffic conditions required during construction. This schedule, which is provided in Appendix I details a number of minimum performance outcomes and additional requirements.

Notwithstanding, it is inevitable that the construction program would be a dynamic one and that the tender process could also lead to the potential for innovation that would reduce construction impacts. In this regard the Department has not been unnecessarily prescriptive by way of conditioning about what roads should or should not be affected.

Therefore, in addition to the scheduled list of works, the Department recommends the preparation of a Framework Traffic Management Plan. This recommendation in reflected in Recommended Condition of Approval No. 45. The objective of the Plan would be to minimise impacts of construction through: addressing the overall traffic management strategy and cumulative impact issues, and developing an appropriate communication process. The Plan would also include: details of the cumulative impacts of construction sites; general measures to manage traffic flows including direction signposting and line marking; optimisation of traffic flow efficiency particularly for public transport during peak periods and identify any regulatory measures to improve the efficiency of transport conditions. As part of this Plan, the RTA would be required to prepare individual detailed Traffic Management Plans. These Plans would address each specific work site and at each stage of the construction process including impacts on existing traffic arrangements, construction staging, access to construction compounds and haulage routes and modifications to existing road capacities.

To ensure that these plans are effectively implemented, the Department's Recommended Condition of Approval No. 46 requires that the TMPs be certified by an experienced transport planner, who would also be engaged throughout the construction period to advise on implementation issues and amendments and liaise with relevant local Councils.

The Framework Plan and the Traffic Management Plan would be prepared in close consultation with relevant Council(s) and government agenceis. This would allow a more flexible approach to traffic management in an environment where each and every activity can have highly complex traffic interactions.

The Department considers that traffic management measures need to be responsive to unanticipated impacts. To this end, the Department's Recommended Conditions of Approval Nos. 47 through 49 require the Proponent to monitor the performance of all project traffic arrangements for the duration of construction and report on a monthly basis to the Public Transport Committee. The Proponent would be required to review Traffic Control Plans on request of the Public Transport Committee and implement any additional mitigation measures required.

Notification

A number of representations noted concern over notification of changed traffic arrangements. The Department considers that the effectiveness of many traffic mitigation measures such as traffic diversions is dependent on diligent notification of changes, both in the form of advertisements and letter drops and clear signposting.

The Proponent would be required to install direction signposting and variable message signs by the Department's Recommended Condition of Approval No. 45. The Department's Recommended Conditions of Approval Nos. 9 to 12 require the Proponent to prepare and implement an extensive community consultation program including advertising construction timetabling in papers and via letter drops. The Department concludes that these requirements would ensure that the community is kept informed about changes to traffic arrangements.

Construction Traffic

Despite assertions in the EIS that construction traffic would have a low impact, the Department considers that traffic generated during construction requires careful management. The Department notes that the Proponent has not yet finalised the exact nature of construction activities to be undertaken at each proposed site and therefore construction traffic management requirements. As part of the Traffic Management Plans discussed above, the Proponent would be required to specify maximum and average truck volumes, entry and exit locations, the nature of loads and haulage routes. The Department's Recommended Conditions of Approval No. 51 require the Proponent to take all reasonable steps to ensure that truck drivers adhere to designated haulage routes. The Department considers that these requirements should ensure the impacts of construction traffic on traffic flows and surrounding residents is minimised.

6.2 Darling Harbour Access

6.2.1 Background

The EIS indicates that Darling Harbour would be one of the major areas impacted by the proposal during the construction and operation stages.

Key potential impacts would include:

- overall changes to the existing pedestrian connections;
- the existing footbridge over Harbour Street at Blackwattle Place from the Darling Park development would be reconstructed, but with a connection to the Western Distributor footway;
- the footpath of the western side of the realigned Harbour Street between Day Street and Wheat Road would be rehabilitated;
- the existing footway along the Market Street viaduct would be reinstated with a new footway following conversion of the existing footway to an additional traffic lane;
- the existing footbridge over Harbour Street from Bathurst Street would be replaced by a new bridge providing similar access;
- reduction in pedestrian safety due to potential conflicts with access point for construction traffic; and,
- loss of legibility of the pedestrian network.

Proposed mitigation measures for access to Darling Harbour during construction include:

- maintaining access to Darling Harbour from Druitt Street via the Darling Park Stage 2 walkway and footbridge over Harbour Street for the duration of construction;
- providing a temporary footbridge connecting Bathurst Street to the western side of Harbour Street and Darling Harbour prior to the demolition of the existing footbridge over Bathurst and Harbour Streets;
- providing temporary access to the walkway connecting the CBD to Darling Walk and Ultimo/Pyrmont running along the Western Distributor Market Street viaduct from Bathurst Street; and,
- maintaining footpaths along both sides of Sussex, Druitt and Bathurst Streets east of Sussex Street.

6.2.2 Key Issues Raised

A submission from the Sydney Harbour Foreshore Authority (SHFA) identified a number of critical issues for both the construction and operation of the project:

- pedestrian access between Darling Harbour and CBD is critical to ongoing commercial function of Darling Harbour. Access must be maintained during construction and enhanced after the tunnel completion. An at grade pedestrian link between the CBD and Darling Harbour should be provided;
- concerns about construction effects on owners, tenants and public of the Darling Park complex:
- disruption of pedestrian and vehicle arrangements;
- restricted access and egress to Darling Park Carpark and Tower 2 loading dock; and,
- cycle movements and links.

The SHFA requested that the opportunity be taken to enhance linkages between the CBD and Darling Harbour.

The Council of the City of Sydney and the Central Sydney Planning Committee also raised concerns about the operation of the Harbour Street/Bathurst Street intersection with respect to increased traffic congestion and pedestrian delays.

6.2.3 Consideration of Key Issues

Access to Darling Harbour

Given the extent of concerns raised, the Department commissioned the Urban Design Advisory Service (UDAS) to investigate impacts of the proposal on pedestrian and cyclist access between the CBD and Darling Harbour. The full report is contained in Appendix K.

The report confirmed the concerns from SHFA about the current difficulties with access to Darling Harbour and indicated that the construction of the proposal could exacerbate this further. A major concern, also shared by the Council of the City of Sydney, is the proposed location of the Harbour Street exit and the resultant significant additional traffic on Harbour Street. The exit was considered to create significant additional problems for existing at-grade pedestrian crossings on Harbour Street which are already under utilised.

The justification of the Harbour Street exit has been discussed in Section 5.1, and at this stage the Department supports its retention subject to monitoring of traffic intrusion into the central CBD area. Notwithstanding, the Department considers that to balance the impacts, further improvements would be required in addition to those identified in the EIS.

Based on early comments from the Council of the City of Sydney and the Sydney Harbour Foreshore Authority, further options were developed by the RTA. A report into supplementary options investigated is provided in Appendix K. From this investigation it is proposed to modify to the proposed access arrangements identified in the EIS. The preferred option, known as Option 5, is shown on Figure 5.2.

Where as the EIS provides a means for pedestrians to make a direct connection between Harris Street and Bathurst Street via an elevated footway, the modified proposal requires pedestrians to make the connection via a new elevated footway (lower level) to and from Harris Street, at grade through Darling Harbour and then via a new elevated footway connecting to Bathurst Street between the Western Distributor viaducts and the Darling Walk building.

The principle advantages of this option are:

- an additional east-west grade separated crossing of Harbour Street (via Bathurst Street);
- dropping/picking up pedestrians adjacent to the Darling Harbour information centre;
- less length of overhead pedestrian connections through Darling Harbour;
- a new pedestrian connection from Ultimo/Pyrmont into Darling Harbour; and,
- investigation of a new pedestrian connection from Darling Drive to Oxford Street.

The main environmental impacts of Option 5 have been assessed and are detailed in Appendix K. On balance, the Department considers that the modification would result in a better outcome for pedestrians compared with the EIS, without any significant impacts over and above that required under the EIS option. Accordingly, this option is recommended for approval as specified in

Recommended Condition of Approval No. 72. Any new pedestrian bridges would need to be of a high architectural quality in terms of form, finishes and materials.

SHFA has indicated strong support for this option although has reiterated significant concerns about impacts during the construction stage. To address these concerns the Department considers that it would be appropriate for the pedestrian bridges to be constructed concurrently with the Harbour Street Pedestrian Bridge. This requirement is reflected in Recommended Condition of Approval No. 75.

Given the changes to this area it is also recommended that access to Darling Harbour at ground level in the area of the Bathurst/Harbour Street intersection be improved by providing:

- a new continuous 3.6m wide at-grade pedestrian footpath from Druitt Street to Bathurst Street including the western frontage of the Park Royal Hotel. The footpath should be of a standard and finish to the satisfaction of Sydney City Council; and,
- RTA to provide a new signalised pedestrian crossing at the intersection of Liverpool Street and Harbour Street connecting footpaths along the eastern side of Harbour Street.

In addition, a number of environmental management measures for construction areas in Darling Harbour have been identified. These requirements are identified in Section 7 of Appendix K have been incorporated into Recommended Condition of Approval No. 72.

Harbour Street/Bathurst Street Intersection

At present, the main access between Darling Harbour and the CBD is across Harbour Street. With the Harbour Street exit, daily traffic volumes on Harbour Street are predicted to almost double from 14 000 per day to over 27 000. This would further entrench Harbour Street as a major arterial route. Many of these vehicles would turn right into Bathurst Street to access the western and eastern sections of the City Centre. The EIS proposes changes that improve the Level of Service from category F to B.

Following the Department's concerns regarding the need for good at grade pedestrian access across Harbour Street at the Bathurst Street intersection, the re-phasing of the intersection results in a LoS of C for both the AM and PM peaks. To achieve category C, changes to pedestrian arrangements would be required. These changes, including the increase of the number of lanes to be crossed and for some crossing to occur during a filtered traffic light phase, would affect the level of pedestrian amenity and safety at this major entry point to Darling Harbour.

As this is a primary pedestrian access route to Darling Harbour, and the proposed overhead walkway needs to be complemented with at grade signalised intersection, it is recommended that the Proponent re-examine the operation of this intersection to ensure that an appropriate balance between pedestrian safety and amenity and a satisfactory level of intersection performance is achieved. This requirement is specified in Recommended Condition of Approval No. 74.

6.3 Settlement Issues (Non-Groundwater Related)

6.3.1 Background

The EIS indicates that settlements is likely to be greatest in the following general locations:

- near the portal areas where cover is less;
- where the east and westbound tunnels 'piggy-back' beneath William Street between College and Yurong Street;
- where the east and westbound tunnels run parallel to each other beneath William Street between Bourke and Yurong Streets; and,
- beneath the paleovalley between Riley Street and Yurong Street, as a result of limited rock cover and thick overburden.

The EIS indicates that further assessment of these areas would be required during the detailed design stage of the project to predict settlements with some certainty.

The EIS determines that the majority of the structures along the route corridor are expected to be classified as high sensitivity including old style 3-4 storey masonry structures, high-rise buildings with deep basements, heritage buildings and conservation areas. Buildings that are in a poor condition, or heritage buildings that are extremely sensitive to small movement may also be affected by ground settlement from the tunnel construction.

Key areas were identified from the EIS which require further investigations. These include:

- field in situ stress measurements and characterisation of the mechanical properties of the rock mass to assist in prediction of ground movements; and
- interaction with existing structures and tunnel support design.

6.3.2 Key Issues Raised

Key issues raised in representations include:

- the need for continuous monitoring of settlement;
- pro-active building protection measures;
- the likely impacts on other tunnels in the vicinity of proposed works;
- the likely impacts on buildings and underground garages/basements;
- compensation for building damage, including structural damage; and
- impacts on heritage items including structural integrity.

6.3.3 Consideration of Key Issues

General

A number of components of the project have the potential to cause ground settlement as a result of construction and associated activities. Ground movement may occur as a result of the process of tunnel excavation. Whilst movements are small and highly unlikely to cause major distress to existing nearby surface and underground structures along the route, appropriate design requirements and safeguards, to avoid impacting on structures along the route, would still be required.

Pells Sullivan Meynink Pty Ltd were engaged by the Department of Urban Affairs and Planning (DUAP) to provide the Department with an independent assessment of the geotechnical issues for the Cross City Tunnel. A copy of this assessment in included in Appendix L. The report raised the following key issues:

- the need for a comprehensive condition survey of buildings, particularly basements (refer to section 6.4 of this Report);
- need for a detailed geotechnical model;
- need to monitor the ground vibrations at those structures assessed to be most at risk of damage due to construction activities; and
- establishment and monitoring of inclinometers and settlement monuments along the tunnel route.

Impact on Basements

Basements that extend to a level in the proximity of or below, the crown level of the proposed tunnel would require specific assessment in terms of tunnelling impacts. Ground movement during construction could significantly impact on building foundations and other structural elements in the basements. Detailed predictions would need to be made of the likely ground movements so that potential problem areas can be identified. To prevent potential impacts on basements, Recommended Condition of Approval No. 153 requires that a survey be conducted to locate structures likely to be potentially impacted.

Geotechnical Model

A geotechnical model would need to be developed for the route and its environs. This would identify and include significant geological structures. It would include full details of existing and currently proposed excavations near the western portal. It would also identify basements and other sub-surface structures that may be impacted by the project. The model would be used to:

- assess the predicted settlement and horizontal strain profiles caused by tunnelling; and
- assess the impact of these predicted settlements and strains on buildings and basements.

This requirement is specified in Recommended Condition of Approval No. 153.

Impacts on Adjacent Tunnels and Utility Infrastructure

Ground movement due to tunneling activities may also impact on existing tunnels close to the alignment. As part of detailed design, movement prediction studies must be carried out for underground tunnel structures to identify potential problem sites. The Department's Recommended

Condition of Approval No. 155 requires that settlement criteria for identified utilities be determined by the relevant authorities. The Proponent would be required to carry out dilapidation surveys and movement prediction studies on rail infrastructure, adjacent tunnels and utilities within the vicinity of construction areas and carry out any necessary rectification work to the satisfaction of, and at no expense to the owners. This recommendation is reflected in Recommended Condition of Approval No. 218.

Other Measures

Other mitigation measures for settlement would include:

- identification of those sections of the work with the potential for significant impact on nearby infrastructure or properties;
- a detailed inspection of the structures potentially affected by the works including tunnels, utilities, and buildings;
- a pre-construction dilapidation survey to identify the current condition of all buildings considered at risk;
- design appropriate support measures and/or rock mass reinforcement within the cut or tunnel to restrict ground movements near sensitive structures;
- a range of stabilisation and/or reinforcing measures for those structures that are likely to be critically affected by the works;
- monitor for displacements within the tunnel, surrounding rock mass and at the surface; and
- monitor critical structures for movement during construction and for periods of 3-6 months following completion of the works.

It is recommended that inclinometers and settlement monuments are established and monitored along the tunnel route as specified in Recommended Condition of Approval No. 156. Settlement would be monitored for at least 12 months after construction as reflected in Recommended Condition of Approval No. 157.

It is also recommended that appropriate ground settlement criteria be specified and that failure to meet specified settlement criteria would require the RTA to provide either structural support or modify the construction techniques. This is specified in Recommended Condition of Approval No. 154.

6.4 Property Impacts

6.4.1 Background

As the proposal would be almost entirely underground, property impacts would be minimal. The EIS states that it is not anticipated that there would be a need for any total property acquisition but there may be some partial property acquisition. This would include land from Energy Australia, Sydney Harbour Foreshore Authority, CCS (Bathurst Street), RIC land (Metro-West), Airport Motorway lease (connection to the Eastern Distributor), Crown Land (Hyde Park), SSC (various streets) and several sub-surface stratum land acquisition and sub-surface easements for temporary and/or permanent rock anchors. Details of the property acquisition process are addressed in EIS Technical Working Paper No 13.

The EIS considers that the Cross City Tunnel proposal is not expected to result in any land use changes or pressures for change at a regional level. In terms of regional planning and land use, the

Cross City Tunnel proposal would be generally consistent with broad transport, environmental equity policies and strategies identified for Central Sydney by State and Local Government.

6.4.2 Key Issues Raised

Overall direct impact on property was not a major issue raised in representations. However there were concerns about indirect impacts on property value from air quality and settlement. There were also concerns in regards to assets being affected. Indirect issues with respect to air quality are addressed in Sections 5.5 and 6.13 of this Report.

6.4.3 Consideration of Key Issues

General

As a result of the modifications to the proposal detailed in Section 4of the Report, the area of direct property affectation has also changed. Private properties no longer affected include:

- 453 - 463 Kent Street;
- 436 - 450 Kent Street;
- 465 - 467 Kent Street;
- 287 - 289 Clarence Street;
- 66 - 70 William Street;
- 72 - 86a William Street;
- 88 - 108 William Street;
- 113 William Street; and
- 51 Druitt Street.

However a number of new properties, 55 to 97 William Street, would require stratum declared over the whole property. In addition partial acquisition for rock anchors are required from Park Royal Hotel, 55 Druitt Street and 281 to 287 Sussex Street.

The current schedule of property impacts is shown in Figures 5.3 (a) – (d) however it is likely that further amendments may be required during the detailed design stage.

Tunnel Protection

The recognition and provision for protection of the tunnel is addressed in State Environmental Planning Policy 63 - Major Transport Projects. This requires a notification process for all proposed future buildings located within the zone of influence of the tunnel. This would ensure that the structural integrity of the tunnel is maintained over its design life.

In practice this would potentially result in restrictions on future buildings and sub-surface developments in the zone of influence of the tunnel such that future development in the vicinity of the tunnel would need to include provisions to ensure that:

- tunnel infrastructure and associated support, such as rock bolts are not affected or removed as part of any new development;
- imposed building loads resulting from any new development do not add significantly to the load on the tunnel structure;

- new developments do not change the in-situ stress regime of the area of the tunnel to the extent that there would be a significant reduction in the ability of the rock mass surrounding the tunnel to perform in accordance with the design requirements; and
- any new developments particularly those involving basement excavations are constructed in a way which controls ground movements to acceptable levels, avoiding any significant impacts on the tunnel structure.

Notwithstanding it would be important to recognise that existing landowners with development rights occurring prior to this project approval which would be affected by the proposal, could be considered for compensation in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991*. Appropriate criteria would include lodgement of a development application, preparation of development plans or other evidence of development plans which were evident prior to this approval. This requirement is specified in Recommended Condition of Approval No. 120.

The Council of the City of Sydney and South Sydney City Council would be consulted regarding amendments to statutory planning controls to ensure restrictions are placed on future building in the zone of influence of the tunnel. The zone of influence would be identified by the RTA.

Condition Survey of Buildings

A number of representations raised concerns about protection of buildings during construction and to ensure appropriate compensation. This issue has been particularly elevated in recent times with regard to the construction of the Eastern Distributor. The Department recommends that condition surveys of buildings, including basements, be undertaken within the zone of influence and would include:

- all buildings/structures within a plan distance equal to twice the invert depth from the edge of the tunnel and/or excavation works;
- all heritage buildings as identified in the Heritage and Archaeology Management Sub Plan required by Recommended Condition of Approval No. 175 and other sensitive structures within 100 metres from the edge of the tunnel and/or excavation works;
- buildings/structures on shallow or unknown footings to 150 metres from the edge of tunnelling works near the Sir John Young Crescent exit or the western portals; and
- consideration of other specific buildings.

Unless a qualified geotechnical engineer certifies an inspection in not required.

Notification of the building surveys and copies of the results would be given to all affected owners.

This requirement together with other measures to protect landowners is specified in the Recommended Conditions of Approval Nos. 107 through 119.

In addition to the above traditional methods for control of property damage, and in recognition of the issues relating to the construction of the Eastern Distributor, the Department also recommends the establishment of an Independent Property Impact Assessment Panel to resolve disputes arising from potential and/or actual property impacts. This requirement is specified in Recommended Condition of Approval No. 112.

6.5 Cost Benefit (Economic) Analysis

6.5.1 Background

A cost-benefit analysis was undertaken in the EIS to provide a detailed account of the economic costs and benefits that would arise from the proposal. The costs used were land costs, capital costs, operating costs and maintenance costs. The benefits used were time savings (road user, public transport user and pedestrian), operating cost savings, externalities, accident risk, noise effects, air pollution and greenhouse gas effects, local or ambient air pollution, greenhouse gas emissions, pedestrian and other amenity effects, parking, property and development impacts.

The benefits of the tunnel would mainly relate to trips made in Central Sydney. It would include savings in vehicle operating costs and road user travel time, reductions in pedestrian delays, reduction in likelihood and severity of accidents and improvements in air quality across the Sydney Metropolitan Area. The tunnel would also lead to a small increase in overall time and operating costs for journeys outside Central Sydney and the surrounding area. Other adverse impacts include a marginal increase in the risk of accidents in other areas and noise impacts. Overall, the project would generate a benefit to cost ratio in excess of 3:1 (7% discount rate).

The secondary objective of the tunnel proposal was to achieve acceptable economic and financial outcomes. An analysis of the financial viability of the proposal has indicated that the Cross City Tunnel could be developed at no financial cost to government. Significant positive economic outcomes would also be achieved for both the present generation and succeeding generations.

6.5.2 Key Issues and Consideration

The Director-General's requirements explicitly sought sensitivity analysis of excluding travel times savings of less than 5 minutes. This is because there are arguments that such small savings are not actually realised and in economic terms would be considered 'infra-marginal' and thus should be excluded from the assessment. Despite the EIS Technical Paper No. 22 acknowledging the sensitivity of the issue, it only makes statements about savings of less than 4 minutes. With these travel time savings taken out, it was noted that the Cost Benefit Ratio (CBR) decreased from 3.4 to 1.7 (about 50%).

The Department subsequently sought CBR calculations that did not include 'infra-marginal' travel time savings (savings of less than 5 minutes) as requested in the Director-General's requirements for the EIS. The RTA responded in part by providing BCRs for single years 2006 and 2016. In 2006, the BCR decreased by 70% to 1.1 and for 2016 to 2.3. The Department notes that this single year approach was not consistent with a normal analysis, which extrapolates the costs and benefits over a period of 30 years. The RTA indicated that, in compliance with NSW Treasury and its guidelines, it is not appropriate to conduct a full economic assessment with small travel time savings removed and that the values of times specified by the RTA for use in the economic assessment are based on averages over all values of time savings.

The EPA notes that the value of travel time savings is also predicted to rise each year in line with the general level of proposed traffic demand. However, as an allowance for the impact of induced traffic has not been made, it is incorrect to predict a continuing linear increase in travel-time savings. As the tunnel reaches capacity or there are occasions where the tunnel may be grid-locked, the travel time and vehicle operating cost benefits would diminish or disappear altogether. This leads to further questions regarding the project's ability to meet its objectives without the additional public transport, pedestrian and cyclist initiatives.

6.5.3 Conclusions

The Department did not undertake a fresh economic analysis for the project as it did not have access to the relevant information. Nonetheless, based on the fixed year BCRs available (ie 2006/2016) and taking into account impacts of induced traffic demands, the project BCR is likely to above 1.0. This indicates that the project would return benefits at least equal to the costs.

6.6 Social Impacts

6.6.1 Background

Working Paper No. 20 of the EIS included an assessment of social and community impacts of the Cross City Tunnel. The impacts were divided into those that would occur during the construction stage (mainly adverse) and those during operation (mainly positive). Social impacts include air quality changes, noise impacts, impacts on travel opportunities, impacts on social character, safety and security, views, pedestrian amenity, local open space and access.

Construction

The EIS recognises that the proposal would result in adverse impacts upon individuals and the community through changes to access, noise, vibration, dust and traffic. These impacts would be most severe close to the main construction work sites such as tunnel portals and surface works.

Consultations undertaken with the community in the Eastern Precinct (Woolloomooloo, Kings Cross and Darlinghurst) indicated heightened concerns over potential impacts based on the negative experience of some during the construction of the Eastern Distributor. The communities of these areas suggested that more effective measures were required for the Cross City Tunnel to ensure that the impacts of the Eastern Distributor, such as frequent night time works, lack of consultation etc. be avoided.

Operation

The EIS predicts that by improving the environment and amenity of the area surrounding the Cross City Tunnel, through reduced surface traffic, less noise and air pollution, improved Public Transport access and improved pedestrian accessibility, the operations of the proposal would result in a net social benefit. These benefits would be largest along William Street and the surrounding areas in the Eastern Precinct.

The EIS also identified that potentially negative impacts may result from the operations of the Cross City Tunnel, namely:

- the proposal would be a factor influencing an accelerated gentrification of the Eastern Precinct potentially displacing lower income residents affected by higher rents; and,
- the changes to William Street including reduced traffic flows and improved pedestrian access would encourage street sex-workers to move to surrounding streets.

6.6.2 Key Issues Raised

Representations received during the EIS exhibition reflect the concerns expressed in the social impact assessment in the EIS. A number of individuals expressed concern over the anticipated impacts of the construction of the Cross City Tunnel predominantly based on the recent experience of some members of the community of the activities that took place during the construction of the Eastern Distributor.

The Department of Housing expressed concerns that their tenants in the Eastern Precinct would be severely affected during construction works and that close liaison and consultation would be required to reduce impacts. The Department of Housing also expressed concerns that the Cross City Tunnel, through improvements to the local environment, had the potential to displace low-income residents as well as lead to a reduction in the facilities and community services that they require.

Several representations including South Sydney City Council, the Sydney Church of England Girls Grammar School, individuals and community groups raised concern over the potential displacement of prostitution and drug related activities from William Street into the surrounding area particularly in the vicinity of schools.

6.6.3 Consideration of Key Issues

Construction

The Department is cognisant of the sensitivities of construction of a large-scale infrastructure project in a highly urbanised environment. The Department also appreciates the concerns of the community recently impacted upon by the construction of the Eastern Distributor. In general most of the issues raised related to specific construction issues such as noise, dust, access, impacts on businesses etc and the issues have been dealt with in the appropriate chapters in this assessment report.

However a particular area of concern is the construction site at the eastern end at the corner of Palmer and William Street. This site is discussed in Section 5.8 of this Report. Other key issues have been raised with the Darling Harbour site. These issues are addressed in Section 6.2 of this Report.

The Department has also identified a number of more broadly applicable recommendations reduce construction impacts including:

- that the majority of construction work is undertaken during normal construction hours and that work outside of these hours meets strict noise criteria;
- construction noise and vibration and air quality monitoring throughout construction works;
- the implementation of an extensive communication strategy including notifications, briefings, community liaison groups and a 24-hour complaints telephone number;
- the appointment of Independent Community Liaison Representatives to liaise with the community and with the EMR when unacceptable impacts are noted.

The above construction related conditions are some of a number of recommended mitigation measures discussed in detail in Section 5 of this Report.

Operation

The Department recognises that the Cross City Tunnel would lead to improvements to the environment and amenity of the surface area, particularly in the vicinity of William Street and surrounding areas in the Eastern Precinct. It is recognised that whilst these improvements would generally benefit the

existing community, it would be a factor in the changing social mix and accelerated gentrification of the area. This trend could result in the displacement of lower-income tenants, but public housing tenants in the area would have some greater protection from this trend due to security of tenure.

Whilst noting the potential adverse impacts of displacement, the Department recognises that the Cross City Tunnel is only one factor in the changing social mix of the Eastern Precinct. The significant beneficial impacts are considered to outweigh the potential adverse impacts. The Department notes that government departments, community service providers and South Sydney Council are addressing housing affordability and changing land uses in the Eastern Precinct.

The Department acknowledges that improvements to William Street have the potential to displace street prostitution from William Street to nearby local streets, including those around the Sydney Church of England Girls Grammar School. The Department recommends the inclusion of Recommended Condition of Approval No. 238 requiring that the Proponent to co-operate with the local Steering Group on Street Prostitution and other relevant groups to develop measures to address this issue.

6.7 Business Impacts

6.7.1 Background

The EIS provides very limited specific information on business impacts dealing with the issues more generally under specific impact areas (ie. noise, air access, traffic etc). In response to concerns raised, the RTA in the Representations Report indicated that impacts on businesses would be minimised by maintaining vehicular and pedestrian access during construction.

6.7.2 Key Issues Raised

A number of concerns were raised in the representations by businesses located along the route of the proposal, particularly those in close proximity to the main construction sites such as cut and cover tunnels. Concerns raised included potential loss of trade due to affected access arrangements, concerns about noise, dust, signage and general amenity impacts during construction.

6.7.3 Consideration of Key Issues

In order to further minimise the impacts of construction on businesses the Department has recommended a number of conditions requiring that the RTA consult with those affected prior to undertaking works.

A business representative is to be included in the Community Liaison Group required under Condition of Approval No. 11. Recommended Condition of Approval No. 53 requires that the Proponent consult with potentially affected businesses at least 10 days prior to any altered traffic arrangements and endeavour to maintain business access at all times.

Additionally the Department's Recommended Condition of Approval No. 70 requires the Proponent prepare a detailed Business Management Strategy in consultation with businesses prior to construction works to minimise impacts through provision of appropriate signage, maintaining vehicular and pedestrian access during business hours and minimising noise and dust impacts.

The Department considers that during operation the proposed Cross City Tunnel would generally result in improvements for existing businesses.

6.8 Urban Design and Landscaping

6.8.1 Background

Urban Design Context

The topography of the area is dominated by the Kings Cross/Darlinghurst ridge and the lower ridge upon which the CBD has grown. Parklands are located on the eastern side of the CBD. At present there are effectively only three routes between the CBD and areas to the east, Oxford Street, William Street and Cowper Wharf Roadway. All pass through intensively developed and historic parts of Sydney.

William Street crosses areas where there is a great diversity of activity, but they still retain much of their 19th and early 20th century character. The area is predominantly residential. Large-scale route development on the northern side of William Street has impacted significantly on its character.

Between Yurong and Elizabeth Streets, the William and Park Streets corridor is in a parkland setting and crosses two important visual axis, St Marys Cathedral to the Australian Museum and the Archibald Fountain to the War Museum in Hyde Park. On the western side of Elizabeth Street high-rise buildings dominate. At George Street, the Town Hall, Queen Victoria Building and other significant Victorian buildings constitute what is often regarded as the centre of Sydney.

Darling Harbour is dominated by the overhead structures of the Western Distributor and the distinctive architecture of new retail, tourist and commercial buildings on the eastern side.

Landscaping and Visual Amenity

The EIS states that there are three landscaped areas at the western end of the proposed Cross City Tunnel, south of the Druitt Street viaduct, that would be directly affected by construction works. These areas are located within the spaces created between the Western Distributor and Day, Bathurst and Harbour Streets, and the wide median within Harbour Street. Plantings within these areas are between two and 10 years old.

In Druitt Street, between Kent Street and the Market Street viaduct of the Western Distributor, are a variety of street trees that would also be directly affected by construction works. The area bounded by the Druitt Street viaduct, the Market Street viaduct, the Darling Park development and Sussex Street, consists of small fragmented areas of landscaped open space.

Landscaped areas at the eastern end of the proposed Cross City Tunnel are limited to several small pockets of plantings, including the northern side of William Street, immediately to the west of Darlinghurst Road, and an area on the southern side of William Street known as Peace Park.

Street tree plantings have been undertaken along the footpaths of both Riley Street and Sir John Young Crescent which would be impacted by the construction of the project. While there are other trees planted in the vicinity, for instance on the southern side of Sir John Young Crescent, construction of the proposal would not require direct disturbance or removal of these trees.

6.8.2 Key Issues Raised

Key issues raised include:

- the design of the ventilation stack;
- need for refurbishment of the Kings Cross Tunnel;
- need for more aesthetic and urban design consideration;
- need for appropriate signage;
- need for design that integrates CCT with the city;
- lost trees need to be replaced with mature specimens;
- visual impact on Domain;
- need for landscaping to mitigate visual impacts during construction;
- concern over use of spotted gum in William Street planting;
- need for consistency with William Street Revitalisation Strategy; and,
- need for consideratrion heritage significance in conservation areas.

The Urban Design Advisory Service (UDAS) was engaged by the Department of Urban Affairs and Planning (DUAP) to provide the Department with an independent assessment of the urban design component of the Cross City Tunnel EIS. This assessment is given in Appendix J.

The following are key issues raised from UDAS:

- suitability of the proposed streetscape character and planting through Hyde Park;
- suitability of the proposed William Street streetscape improvements including planting;
- appropriateness of the proposed open space at Kings Cross and exploration of options;
- location of the stack;
- loss of trees on Riley Street;
- design of the Kings Cross Lid; and,
- toll building relocation and design.

Urban design issues relating to Darling Harbour are covered in Section 6.2 of this Report.

6.8.3 Consideration of Key Issues

General

Overall, the assessment completed by UDAS found that the level of detail presented in the EIS is generally adequate in terms of urban design. Given that the route is mostly in tunnel, the main areas of concern in terms of urban design are at the tunnel entry and exit portals and surrounds and at the vent stack location. The report also found that the tunnel offers major benefits to the CBD such as the public domain improvements along William Street and Park Street as part of the tunnel construction.

However, given the conceptual nature of the proposal, it is not possible for the detailed design of the built elements to be finalised at this stage. To this end, the Department's Recommended Condition of Approval No. 166 requires the Proponent to prepare a detailed Urban Design and Landscape Plan to detail an integrated approach to design of the proposal including plans for each precinct. This Plan would include:

- built elements including tunnel portals, bridges and other structures, retaining walls, noise walls, toll infrastructure, control buildings, substations;
- motorway and road furniture including safety barriers, kerbs, paving, signage, lighting, medians, emergency phones and breakdown facilities;
- pedestrian and cycle elements including footpaths and paving, pedestrian crossings, street furniture and fixtures;
- landscape elements including proposed treatments, finishes and materials of exposed surfaces;
- proposals for community art to be integrated into the project;
- timing and staging of works, methodology, monitoring and maintenance;
- identify the species and location of trees to be planted; and,
- consideration of potential relocation of the Museum entrance to William Street and maximising benefits from possible road narrowing.

This Plan would be prepared by a suitably qualified urban designer and in consultation with relevant local Councils, Sydney Buses, the Sydney Harbour Foreshore Authority, the Australian Museum, Royal Botanic Gardens NSW Heritage Office and the Domain Trust.

Design and Location of Ventilation Stack

The EIS proposes 39 metre ventilation stack to be located to the south-east of the IMAX Theatre. The EIS proposes that the stack have a form and finish complementary to the IMAX Theatre. A number of representations raised urban design issues in relation to the stack. UDAS identified three main issues:

1. the EIS has not addressed the broader urban context in which the stack is located. The stack would be a significant urban element and should be designed and located as such;
2. the EIS proposes an architectural relationship between the IMAX building and the stack, by using the same form and materials as the IMAX building. However, the IMAX Theatre is an architecturally discrete object that bears no relationship functionally or otherwise to the proposed exhaust stack; and,
3. the EIS shows the stack located in a park setting with no substation.

Whilst the final location of the ventilation stack needs to be assessed primarily on air quality, the urban design of the ventilation stack requires careful consideration and needs to be sensitive to the Darling Harbour context.

The Department concludes that it may be preferable in the circumstances of extreme public sensitivity that the stack is integrated with the viaducts and structures found in this locality or within an existing building rather than make a major statement in Darling Harbour. At this stage it is therefore considered that further opportunity be made available to modify the final design of the stack subject to innovation and opportunities that may arise during the construction tender process.

The Department's Recommended Condition of Approval No. 167 requires that the Director-General approve the final stack design including materials and finishes.

William and Park Streets

The EIS indicates that footpaths would be widened in William Street between Darlinghurst Road and College Street and in Park Street between College and Elizabeth Streets, allowing for extensive tree

planting. South Sydney City Council in their representation to the EIS noted that the urban design and landscaping of the CCT should be consistent with the William Street Revitalisation Strategy (WSRS).

The WSRS undertaken by UDAS on behalf ofSouth Sydney City Council recommends the upgrading of William Street as a pedestrian boulevard, including landscaping and on-street parking. The Representations Report indicates that the provision of on-street parking in William Street is not possible as it conflicts with the cycle and transit lanes. The Department's Recommended Condition of Approval No. 168 requires the Proponent to ensure that the outcomes of the WSRS are given consideration in preparing the plans for William Street.

Tree Protection and Landscaping

The EIS identified existing vegetation, significant tree and flora and fauna habitats and species that may be impacted by the proposal. No threatened species are known to exist in the CBD. The EIS identifies a number of trees, including four Plane Tress on the northern side of William Street and six juvenile cabbage palms which would need to be removed under the proposal. It is also likely that some trees along Riley Street and the northern side of Sir John Young Crescent would need to be removed. The Department's Recommended Condition of Approval No. 172 requires that the Plane Trees along William Street be conserved where possible and, in the event of removal, be replaced with specimens of equal height. To ensure that the impacts of construction on existing trees are managed, the Department's Recommended Conditions of Approval Nos. 233 and 234 require the Proponent to prepare a Tree Protection Plan and employ a suitably qualified tree surgeon during construction to undertake any root pruning required. The Proponent would be required to replace any trees lost during construction with specimens of a similar maturity. If during the course of construction any threatened species are encountered, the Department's Recommended Condition of Approval No. 237 would ensure that the NPWS are consulted and any recommendations of the NPWS are complied with.

A number of representations also noted concern over the selection of the Spotted Gum (*Eucalyptus maculata*). The Department considered that this tree is not appropriate as:

- the tree is not suited to the shaded conditions on the northern side of William Street;
- the tree is not compatible in character with the existing Plane trees on William Street; and
- the tree is not suitable for a major urban boulevard.

The Department's Recommended Condition of Approval No. 166 requires the identification and location of species to be utilised in William Street to be finalised in consultation with relevant Councils and the Royal Botanic Gardens and states a specific preference for native species.

Kings Cross "Lid"

South Sydney Council raised issues in relation to the Kings Cross "lid" and the site located between Palmer and Bourke Street. The creation of a major open space in this part of Kings Cross is supported and the "lid" is seen as a major opportunity for new public domain. However further consultation with SSC is recommended to develop acceptable design criteria for the construction of the "lid" over Kings Cross, and is specified in Recommended Condition of Approval No. 168.

6.9 Pedestrians

6.9.1 Background

The EIS states that safe pedestrian access would be provided throughout the duration of construction. However, it is indicated that existing pedestrian routes may be closed and in these situations the EIS states that alternative access arrangements would be provided. The EIS also details a number of pedestrian facilities which would be included in the proposal, including:

- a footpath on the western side of the realigned Harbour Street between Day Street and Wheat Road;
- a new footway along the Market Street viaduct to replace the existing footway which would be converted to an additional traffic lane;
- a new footbridge to Darling Walk over Harbour Street adjacent to Bathurst Street to replace the existing bridge which would be demolished;
- widened footpaths in Park Street between College and Elizabeth Streets;
- widened footpaths in William Street; and,
- the connection of Blackwattle Place pedestrian bridge to the northern Western Distributor footway to compensate for the proposed removal of the existing footbridge over Harbour Street at Bathurst Street and the footway under the Market Street viaduct.

6.9.2 Key Issues Raised

Key issues raised in representations to the EIS include:

- pedestrian access during construction; and
- need for an integrated approach to ensure optimum benefits for all transport modes.

Operational access to Darling Harbour is discussed in Section 6.2 of this Report.

6.9.3 Consideration of Key Issues

Construction Stage Pedestrian Access

A number of representations noted concern over loss of pedestrian access during construction. The Representations Report indicates that the Proponent would ensure that safe pedestrian access is provided throughout construction. This commitment is reflected in the Department's Recommended Condition of Approval No. 64. The Department concludes that this commitment, together with the recommended notification and community consultation requirements should ensure that pedestrian access is satisfactorily maintained for the duration of construction.

Operational Pedestrian Impacts

Strategic Issues

The EIS indicates that the area bounded by George Street, King Street, Castlereagh Street and Liverpool Street is the primary pedestrian area. A review of impacts on these intersections with the CCT is given in Table 5.9.

Table 5.9. - Intersection Performance in Relation to Pedestrian Accessibility

Intersection	Impact of CCT on Pedestrian Access
George/King Street	No substantive changes
George/Market	Medium improvement
Pitt/Park	No substantive changes
Pitt/King	No substantive changes
Pitt/Market	No substantive changes
Market/Castlereagh	No substantive changes
Park/Castlereagh	Medium worsening
King/Castlereagh	No substantive changes
George/Bathurst	No substantive changes
Market/Elizabeth	**Major** worsening
George/Bathurst	No substantive changes
Park/George	**Major** improvement

This pedestrian analysis indicates that the CCT would result in relatively minor change to the prime pedestrian environment in the CBD. The major benefits of the CCT to pedestrians would apply to the Park/George Street intersection, however this is relatively low in terms of pedestrian use. While the EIS recommends removing the 'scramble' on this intersection, the Department concurs with the view of DoT and CCS that this may not be the most appropriate solution. Therefore Recommended Condition of Approval No. 38 requires a review of this particular intersection by the Proponent.

The major negative impact is at Market/Elizabeth but again the priority of this intersection for pedestrians is also relatively low. In summary the CCT would appear to produce an overall minor benefit to intersections where pedestrian use is highest.

To ensure that operational pedestrian impacts are minimised, the Department also recommends that performance indicators for pedestrian walk times are developed and reviewed 1 and 2 years after opening of the tunnel and that the Proponent implement any reasonable measures to ensure that these indicators are met to the greatest extent practicable. This recommendation is specified in Recommended Condition of Approval No. 65.

6.10 Cyclists

6.10.1 Background

Construction

Technical Paper No. 9 of the EIS details provisions to be made for cyclists during construction and states that consideration would be given to the provision of alternative routes if adequate road width could not be provided on existing routes. The EIS further indicates that provision would also be made for cyclists in the areas of tunnel portal construction in the form of a detour route to direct cyclists around the area.

Operation

The RTA policy is to provide for cyclists in all new major road projects. During operation, the EIS states a number of changes that would occur to the existing cycle network as part of the proposal:

- cyclists would be prohibited from using the Cross City Tunnel;

- existing access to and from the City via the Kings Cross Tunnel would be prohibited and replaced with access over the top of the tunnel through Craigend Sreet and Kings Cross Road;
- other cycle lanes to be provided include:
  - both directions along Kings Cross Road between Barcom and Roslyn Streets;
  - westbound along Craigend across Victoria Street and Darlinghurst Road; and
  - both directions along William and Park Streets, between Darlinghurst Road and George Street; and
- west of George Street, cyclists would be required to share bus lanes or road space.

6.10.2 Key Issues Raised

Key issues raised in representations to the EIS include:

- impacts on increased traffic volumes on cyclist amenity;
- cyclist safety in Kings Cross Tunnel;
- need to provide continuous cyclist facilities as part of the proposal; and
- conflict between cyclists and other traffic.

Subsequent to the EIS, Bicycle NSW raised a number of issues regarding modifications including:

- the proposal does not meet *Action for Bikes*, *Action for Transport* or *RTA Strategic Plan 2000 – 2005* objectives in relation to bicycle initiatives;
- lack of time to consider options, lack of consultation with users and lack of coordination of input from stakeholders including user groups, local councils and government agencies;
- specific route issues including:
  - removal of access to Kings Cross Tunnel remains an issue in terms of removing the most direct route to and from the CBD and steeper gradients that apply to the alternative route; and,
  - lack of planned routes westbound from the end of William/Park Street cycle lanes; and,
- safety issues with combining bus and bicycle lanes.

6.10.3 Consideration of Key Issues

<u>Construction Stage Impacts</u>

The Department supports the view that provision must be made for cyclists during the construction of the CCT. The east-west alternative routes to the north and south of William Street would be the most suitable alternative to develop for this purpose. Provision would also need to be made for cyclists in the direct vicinity of the tunnel portal construction areas. This would most likely be in the form of a detour route directing cyclists around the area.

The tunnel would produce a major re-configuration of the Kings Cross Tunnel entry and exits and it is proposed that the eastern portion of the proposed route between Rushcutters Bay Park/Neild Ave and Victoria Street via Kings Cross Road and Criagend Street be developed early so as to provide a detour access for cyclists around the eastern tunnel portal area.

Around the western portals near Darling Harbour, detour marking would direct cyclists around the construction site and to the Pyrmont Bridge or Pier Street bridge that are the only access points through the western side of the Sydney CBD in the portal area. North-south movements would also be directed

away from Harbour Street onto Sussex or Kent Streets. This would be managed by the provision of alternate routes around areas impacted by tunnel construction.

Operation Stage

General

As indicated in Section 5.1, the justification of the proposal also relies on a number of accompanying initiatives relating to improvements to public transport, cyclists and pedestrians. This would ensure that any freed road space resulting from the construction of the CCT is not absorbed by induced or re-directed private vehicle traffic in the long term, and to encourage a behavioural switch towards alternative means of transport. Overall the Department strongly supports the view of bike user groups that this project provides potential further opportunities to develop the City cycle network in the spirit of the stated objectives.

The CCT would remove a significant proportion of traffic from the surface street corridor along William/Park/Druitt Streets and hence the RTA propose a new cycleway given the opportunity with reduced traffic and available road space. However this proposed connection is somewhat limited and incomplete due to the following three key factors:

- the major east-west axis should connect with the Ultimo/Pyrmont Cycleway paralleling the function of the CCT. A connection with the Pyrmont Bridge rather than Day Street in Darling Harbour would better accommodate this desire path;
- the western section of Druitt Street is very steep and generally not an ideal connection for cyclists; and,
- no connection to the King Street Cycleway.

As the CCT would also bring significant reductions to traffic to the area bounded by Druitt, Pitt, King, Market, York and Clarence Street, there would appear to be strong grounds and certainly a nexus with the project, to extend the cycleway to the Pyrmont Bridge and the King Street Cycleway. This requirement is specified in Recommended Condition of Approval No. 67.

The Representations Report also predicts a 34% traffic reduction in Liverpool Street. The Department considers that, as this traffic reduction would create a more cyclist-orientated environment, there would appear to be opportunities for the provision of a cycleway connecting with Oxford Street. However at this early stage there are a number of potential issues that require more detailed local resolution, including concerns about contra-flow bike lanes on Liverpool Street. It is therefore recommended that the RTA investigate options in further detail in consultation with CCS and bike user groups prior to implementation. This requirement is also specified in Recommended Condition of Approval No. 68.

Cycle Lane Design in William Street

The EIS proposal included 1.5 metre on-road bicycle lanes in each direction between Town Hall and Rushcutters Bay. These lanes were proposed on Park, William and Craigend Streets and Kings Cross Road. The adjacent bus or T2 transit lanes would be 2.9 metres wide. The Representations Report combines the bicycle lanes with the bus lanes and T2 transit lanes along William and Park Streets.

The Department does not agree with the proposed changes to the bicycle lanes due to safety considerations. Accordingly, the Department recommends that the design for the bicycle lanes be in

accordance with the original EIS proposal. This requirement is reflected in Recommended Condition of Approval No. 69.

6.11 Indigenous and Non-indigenous Heritage

6.11.1 Background

Indigenous Heritage

The EIS assessment, which included a search of National Parks and Wildlife registers found no known sites and concluded that the potential for impacts on indigenous heritage items was low to negligible, given the highly disturbed nature of the area.

Non-indigenous Heritage

The EIS included an assessment of sub-surface archaeological potential along the proposal alignment and a search of heritage registers to identify heritage items. No listed archaeological items would be affected by the proposal. The EIS indicates that there are some sites of potential archaeological significance located adjacent to the proposed tunnel alignment and concludes that all roadways in the city are areas of archaeological potential due to the relative lack of impact on them from recent construction activities.

The EIS indicates that the majority of the tunnel work consists of a tunnel driven through sandstone bedrock and concludes that these works would have no impact upon non-indigenous archaeological resources. Notwithstanding, the EIS concludes that the western and eastern ends of the tunnel that would be connected to the existing road network through portals and cut and cover sections of tunnel would have the potential to disturb or remove some archaeological resources. The EIS proposes further research and monitoring of excavation in these areas.

The Representations Report included a list of all registered heritage items in close proximity to the proposal and modified the proposal so that Sewerage Pumping Station Number 12, which is listed as state significant would be retained. The Representations Report concluded that no items of heritage significance would be demolished or altered under the proposal.

6.11.2 Key Issues Raised

Key issues raised include:

- settlement and vibration impacts on heritage items and the need for dilapidation surveys;
- need for archaeological investigations during construction;
- visual impacts on heritage items;
- retention of the heritage stairway and gate piers;
- need to identify all heritage items; and,
- demolition of Sewerage Pumping Station Number 12.

The likely vibration and settlement impacts of the proposed works on heritage items is discussed in Section 5.8 and 6.3 of this Report respectively.

6.11.3 Consideration of Key Issues

General

The Department notes that there is a large number of listed heritage structures in close proximity to the proposal. In particular, the Department notes that the southern side of William Street, between Yurong and Forbes Streets, is part of a Conservation Area identified in the South Sydney Local Environmental Plan 1998. In addition, the Department considers that there is potential for items of archaeological resources to be disturbed during the construction of the proposal. To this end, the Department's Recommended Condition of Approval No. 175 requires the Proponent to prepare and implement a Heritage and Archaeology Management Sub Plan in consultation with the NSW Heritage Office and relevant Councils. This Sub Plan would identify all heritage items in the area of impact of the proposal, assess the significance of effects on heritage and archaeological items, incorporate a Research Design Strategy which would set out the methodology to be used in archaeological excavation, an Excavation Protocol to be implemented where detailed archaeological investigations are warranted, a Conservation Management Strategy for all identified heritage items and a Contingency Protocol to be implemented in the event of discovery of relics.

Retention of Sewerage Pumping Station 12

The NSW Heritage Office raised concern over the destruction of Sewerage Pumping Station No. 12, which is on the State Heritage Register. In response, the Representations Report modified the proposal in the vicinity of Harbour Street to reduce the work area required and amend the staging proposed so that Sewerage Pumping Station No. 12 would be retained. The Department commends this amendment and concludes that the Heritage and Archaeology Management Sub Plan discussed above would ensure that the impacts of the proposal on this heritage item are effectively managed.

Visual Impacts

A number of representations noted concern over the visual impacts of the proposal in Heritage Conservation Areas. To ensure that the heritage significance of these precincts is taken into consideration in the urban design of the proposal, the Department's Recommended Condition of Approval No. 166 requires the Urban Design and Landscape Plan to be prepared in consultation with the NSW Heritage Office and relevant Councils. The Department considers that this requirement would ensure that heritage significance is taken into consideration in finalising the design of the proposal.

Heritage Stairway and Gate Piers

The Royal Botanic Gardens raised concern over the impacts of the proposal on a heritage stairway and gate piers in the Domain. The Representations Report indicated that the stairway and gate piers would be retained under the proposal. This commitment is reflected in the Department's Recommended Conditions of Approval No. 178. The Department notes that the significance of these items is complemented by the sandstone wall along Sir John Young Crescent. To this end, the Department's Recommended Condition of Approval No. 177 requires this wall to be retained.

6.12 Spoil Disposal and Waste Management

6.12.1 Background

The EIS states that the construction of the proposal is expected to generate waste in the form of building wastes, spoil and general waste. The EIS indicates that building wastes would be recycled and re-used where possible and waste which can not be re-used or recycled would be removed to a licensed waste disposal site. Contaminated material would be excavated and transported to an approved disposal site. Site sewage and effluent would be discharged into existing sewerage systems (where possible) or holding tanks for removal by sewage disposal contractors.

The EIS indicates that the total quantity of excavated material from the tunnel is expected to be around 250,000 m^3, generating approximately 350,000 m^3 of bulk material. The excavated material would be predominantly sandstone and would need to be re-used or disposed of at an approved site. Given the relatively small quantity of spoil generated by the project, it is expected that the excavated material would be readily consumed as general fill by the demand from on-going and proposed projects around Sydney.

The EIS details a number of spoil transport options including barging, rail and road haulage using dump trucks. The EIS indicates that regardless of transportation methods utilised, spoil would need to be removed from work sites via road haulage. The precise route for transportation of the excess material for re-use or disposal depends on the location of the disposal/reuse sites to be identified during detailed design. The EIS concludes that road haulage is expected to be the means of transportation, given the small estimated volume of spoil, limited stockpiling areas and double handling associated with barging and rail options.

6.12.2 Key Issues

Key issued raised include:

- disposal of wastewater;
- the lack of detail in the EIS in relation to waste management;
- the potential road congestion and air pollution resulting from trucking of tunnel spoil; and,
- the opportunity for re-use of excavated material.

Wastewater disposal is discussed in Section 6.14 of this Report

6.12.3 Consideration of Key Issues

General Waste Management and Recycling

The Department notes that waste generation is an unavoidable consequence of the proposal. However, if waste is effectively managed, opportunities for reduction, re-use and recycling can be maximised. To this end, the Department's Recommended Condition of Approval No. 206 requires the Proponent to prepare and implement a Waste Management and Reuse Sub Plan. This Sub Plan would identify how spoil and waste would be handled and disposed based on the waste management hierarchy of reduce, re-use and recycle, and would provide specific requirements for waste minimisation and management.

Spoil Transportation and Reuse

Given the limited stockpiling areas available and the time limits on spoil transportation, the Department notes that transportation, disposal and reuse of spoil from the proposal presents a significant

management issue. To ensure that spoil and waste is appropriately managed, the Department's Recommended Condition of Approval No. 196 requires the Proponent to prepare a Spoil Management Sub Plan in consultation with the EPA, SHFA and relevant Council(s). This Sub Plan would be prepared prior to excavation and address dust mitigation, drainage, disturbance, noise and local amenity.

The Department accepts that the location(s) for reuse and disposal of spoil cannot be finalised at this stage. It is acknowledged that the road haulage of spoil would be required to transport spoil from the extraction sites. However, given the predicted construction stage traffic impacts discussed in Section 6.1 of this Report, the Department considers viable transportation options that reduce the traffic generated during construction would be highly desirable and warrant further investigation. To this end, the Spoil Management Sub Plan discussed above would include investigation of options for the barging of spoil in consultation with relevant industry and waterway authorities.

The EPA and Inner Sydney Waste Board noted that clean spoil should be reused rather than disposed of to landfill. The Department considers that the potential reuse of spoil requires more detailed consideration and that the reuse and recycling of spoil should be maximised in preference to disposal. These requirements are reflected in Recommended Conditions of Approval No. 197 and 199.

Contaminated Spoil

The EIS included a preliminary assessment of the likelihood of encountering contaminated soil during construction. The Department requested further information in relation to the extent of likely contamination and the remediation required. The RTA provided an additional contamination study that identified general potential point and wider impact contamination sources which could exist within the area of impact. This study concluded that further contamination studies would be necessary during detailed design. To this end, the Department's Recommended Condition of Approval No. 200 requires the Proponent to prepare a Contamination Investigation Report as part of the Spoil Management Sub Plan. This Report would detail the results of site investigations, assess the potential risks associated with any contaminants present and indicate where remediation would be required. Should this Report indicate that remediation is necessary, the Department's Recommended Condition of Approval No. 201 requires the Proponent to prepare a Remedial Action Plan to the satisfaction of the EPA. In the event of discovery of previously unidentified contaminants. Recommended Condition of Approval No. 202 requires that the Proponent cease work in the vicinity of discovery and prepare a Remedial Action Plan. The Department considers that these recommendations would ensure that any contaminated spoil is effectively managed.

6.13 Air Quality – Construction Stage

6.13.1 Background

The EIS notes that the only significant construction stage air quality impact of the proposal is the potential for short term dust impacts. Dust would be generated by earthworks, the transportation and stockpiling of spoil and materials and demolition works. The EIS outlines a number of mitigation measures including spraying exposed surfaces with water, sealing construction compound areas if possible, stabilisation of stockpiles, use of wheel wash facilities, maintenance of machinery and the preparation of an Air Quality Management Plan.

6.13.2 Key Issues Raised

Key issues raised include:

- impact of dust emissions;
- need for air quality monitoring;
- need for dust mitigation; and,
- silica dust generation.

6.13.3 Consideration of Key Issues

Dust Management

The Department notes that the effectiveness of the dust mitigation measures outlined in the EIS is dependent on diligent monitoring and maintenance. To this end, the Department's Recommended Condition of Approval No. 226 would require the preparation of a detailed Dust Management Sub Plan. This Sub Plan would detail the implementation and management of measures and procedures to prevent or minimise dust exposure. The Department also recommends that:

- the Proponent undertake a regular dust monitoring program;
- trucks carrying dust generating loads are covered;
- wheel wash facilities are used so dirt in not tracked onto public roads; and
- no open incineration be permitted.

These requirements are specified in Recommended Conditions of Approval Nos. 227 through 232. The Department also recommends that when conditions are excessively dusty and dust emissions cannot be maintained within the specified goal, all dust generating activities cease until dust suppression can be adequately carried out. This recommendation is reflected in Recommended Condition of Approval No. 231.

Silica Dust Potential

The Department of Health raised concern over the potential for silica dust emissions from the excavation of sandstone material. The Department notes that silica dust is generated when rock containing quartz is crushed. The EIS indicates that the sandstone to be excavated is predominately quartz, occurring as medium to very coarse sand and small pebbles. The Department notes that the excavation techniques to be utilised would break up rather than crush the sandstone and concludes that generation of significant quantities of silica dust is unlikely.

6.14 Groundwater

6.14.1 Background

Based on the groundwater assessment undertaken by Woodward-Clyde (May 2000), small overall tunnel inflows are expected along the route. These inflows are expected to occur during tunneling for most of the route. The resulting draw-down is not likely to extend more than a few hundred metres on either side of the tunnels. The draw-down is not likely to impact on the groundwater as a resource in the area.

Limited information is available on groundwater conditions with respect to contamination. The EIS concluded that the potential for contamination sources for soil may also represent potential

contamination issues for groundwater. This is because the water infiltrating through the soil profile would leach contaminants into the groundwater. Soil contamination issues are covered in Section 6.12 of this Report. The affected groundwater may affect nearby surface water bodies, such as Woolloomooloo Bay or Cockle Bay. The EIS states that a groundwater sampling plan would be undertaken in accordance with NSW EPA *Contaminated Sites; Sampling Design Guidelines 1995* and that wastewater would be disposed of via the sewerage system.

6.14.2 Key Issues Raised

Key issues raised in representations include ground settlement as a result of dewatering of aquifers during construction, disposal of wastewater and the need for pre-construction groundwater quality monitoring. Other key issues include:

- the management of groundwater seepage;
- parameters on water table movements and review and approve construction methods to maintain the water table;
- consideration of the stream running under William Street for potential historic interpretation;
- the need for comprehensive groundwater monitoring to establish groundwater quality; and
- identification of high risk areas.

6.14.3 Consideration of Key Issues

General

The Department engaged Pells Sullivan Meynink (PSM) to undertake a peer review of the adequacy of the assessment and in particular sought advice on the predictability of settlement in saturated alluviums and on construction methods. The report by PSM is provided in Appendix L. This Report indicates that the post construction depressurisation of aquifers, particularly in the paleovalley area near Riley Street could potentially result in property damage and recommends a suite of conditions in order to manage these impacts.

Quality of Groundwater

Existing data, particularly from the Eastern Distributor, was used for the preliminary assessment. The Department considers that there is a need for pre-construction monitoring in order to establish base line data. This would be followed up by a need for intensive monitoring during construction. These requirements are specified in Recommended Conditions of Approval Nos. 159, 160 and 161.

Dewatering of Aquifers

The EIS predicts generally low permeability, with potential for higher flow in fault areas and within rock mass below paleovalleys. An assessment of likely drawdown settlement is provided in Table 6 of Technical Paper No. 10.

High risk areas would appear, given the limited information, to include Riley Street area and works in the vicinity of Woolloomooloo Fault Zone. The EIS estimates that draw-down would gradually reduce away from the tunnel and open cut works, and would not extend beyond 100 metres from the alignment. The technical paper recommends further geotechnical investigations in many areas

including high risk areas as part of the detailed design and this is supported in Recommended Condition of Approval No. 158.

Groundwater Induced Settlement

The technical paper recommends re-injection and foundation grouting of sandstone bedrock but does not provide details. Re-injection would be the only possible mitigation measure to reduce settlement in high risk soft soils, however its effects are limited by problems arising from particulate clogging and precipitation of iron oxhydroxides. Potential problems can be minimised by using mains water instead of reinjecting groundwater. Accordingly, if the settlement study discussed above indicates that settlement is likely and protection is required, the Department's Recommended Condition of Approval No. 159 requires the Proponent to prepare and implement appropriate management procedures during construction.

Contaminated Water

As it was recommended that mains water would be used to increase the effectiveness of re-injection, the problem of wastewater disposal would be increased. Technical paper No. 11 from the EIS proposes to pump out all run-off to surface stormwater drainage systems and concludes that the current surplus capacity is adequate. Given that the likely levels of pollutants in this water are unknown (baseline groundwater data has not been collected and contamination has not been adequately assessed), at this stage it is recommended that only water within pollution goals would be released into the stormwater system if the capacity is available. Given this requirement, further details on disposal of wastewater are required. Disposal of wastewater is addressed under Recommended Condition of Approval No. 190.

6.15 Hydrology and Flooding

6.15.1 Background

The EIS states that the proposal would be designed for a 1 in 100 Annual Recurrence Interval. The EIS indicates that the proposed tunnel does not cross any permanent water course, creek or stream, and there are no natural water courses within the study area. An hydrologic analysis was undertaken as part of the EIS to assess the capacity of the existing system. This study found that the existing drainage system surrounding the portals, especially at the western end would need to be reconstructed to provide adequate drainage capacity.

6.15.2 Key Issues Raised

The key issues raised from representations include:

- lack of detailed assessment;
- adequacy of the proposed stormwater system design;
- maintenance of drainage systems;
- the possibility of reusing stormwater; and,
- induced flooding impacts.

The disposal of waste/contaminated water from the tunnel is discussed in Section 6.14 of this Report.

6.15.3 Consideration of Key Issues

Construction Stage Impacts

South Sydney City Council noted concern over potential flooding impacts during construction. The Department's Recommended Condition of Approval No. 181 requires the Proponent to prepare a Construction Water Management Sub Plan. This Sub Plan would be prepared in accordance with the Department of Housing's *Managing Urban Stormwater – Soils and Construction* (1998) and would manage the cumulative impacts of the proposal. In addition the Department recommends that all surfacewater flows from construction sites are detained through appropriate measures to ensure that existing flooding characteristics are not exacerbated. This recommendation is reflected in Recommended Condition of Approval No. 188.

Operational Impacts

The Department notes that Technical Paper No. 11 of the EIS concludes that further hydrological studies would be required and recommends that these studies consider the Probable Maximum Flood Event and incorporate any necessary changes into the detailed design to ensure evacuation is possible. This recommendation in reflected in Recommended Condition of Approval No. 184.

South Sydney City Council and Sydney Water noted concern over the potential flooding impacts associated with the construction and operation of the proposal. The Department's Recommended Condition of Approval No. 194 requires that the operational stormwater and wastewater systems of the proposal are designed, constructed, operated and maintained to meet the requirements of the relevant authorities. To ensure the operational stormwater from the proposal is effectively managed, the Department's Recommended Condition of Approval No. 193 requires the Proponent to prepare and implement an Operational Stormwater Management Sub Plan. This Sub Plan would include details on catchment analysis including localised flooding impacts, the existing drainage system, required changes to this system and the implications of these changes.

Modifications to Drainage Arrangements

The Representations Report detailed a number of changes to the proposal including modified construction staging arrangements on Harbour Street and additional site compounds on Palmer Street. The Department notes that the drainage impacts of these modifications have not been assessed. Accordingly, the Department's Recommended Condition of Approval No. 186 requires the Proponent to prepare site specific drainage and water quality management plans for these areas.

6.16 Water Quality Erosion and Sediment Control

6.16.1 Background

The construction and operation of the proposal would have the potential to affect water quality in parts of the Sydney Harbour catchment. The EIS states that the water quality of this catchment is affected by sewerage overflows and urban stormwater, however no regular monitoring data of inorganic pollutants currently exists. The EIS indicates that pre-construction, construction and operational water quality monitoring would be undertaken.

The EIS concludes that the exposure of surfaces, exposure of Acid Sulfate Soils (ASS), oil and grease from machinery and wastewater from the tunnel during construction all have the potential to impact on the water quality of the Sydney Harbour Catchment if not effectively managed. The EIS proposes a number of standard mitigation measures including, sedimentation fences and basins, sealing/planting of areas to be exposed for extended periods of time and the separation of clean and 'dirty' water using diversion banks. The EIS indicates that wastewater would be collected in detention tanks, treated and released into the stormwater or sewerage system depending on the level of contaminants present.

The EIS indicates that the potential operational water quality impact associated with the proposal include runoff from the road surface and groundwater inflow into the tunnel. The EIS concludes that these impacts would be managed by limiting surfacewater from flowing into the tunnel and the inclusion of detention tanks and pump out facilities fitted with sediment traps and oil separators to collect and assist in the disposal of wastewater from the tunnel.

The EIS concludes that preparation and implementation of a soil and water quality management plan prepared in accordance with the Department of Housing's *Managing Urban Stormwater: Soils and Construction*, 1998 to manage mitigation measures would ensure that the impacts of the proposal are effectively managed.

6.16.2 Key Issues Raised

The key issues raised include:

- sedimentation impacts;
- treatment of water prior to discharge to Sydney Harbour;
- exposure of ASS; and
- need to develop contingency plans for water management.

The treatment of wastewater is discussed in Section 6.14 of this Report.

6.16.3 Consideration of Key Issues

Erosion and Sediment Control

The EPA noted concern over the potential erosion and sedimentation impacts of the proposal. The Department's Recommended Condition of Approval No. 182 would ensure that detailed erosion and sedimentation controls are prepared in consultation with the EPA and incorporated into the Construction Water Management Sub Plan. The Department considers that the effectiveness of these controls is dependent on careful implementation, monitoring and maintenance. To this end, the Department's Recommended Condition of Approval No. 187 would require the Proponent to ensure that all erosion and sediment controls are in place prior to the commencement of works which have the potential to generate sediment, including stockpiling.

Acid Sulfate Soils

The EPA noted that the proposal has the potential to expose ASS and recommended that the Proponent conduct further investigations in areas where potential ASS are likely and prepare an Acid Sulfate Soil Management Sub Plan. These recommendations are reflected in Recommended

Conditions of Approval Nos. 191 and 192. Disposal of contaminated soil is discussed in Section 6.12 of this Report.

6.17 Hazards and Risk

6.17.1 Background

Construction

During construction of the CCT, the Proponent has indicated that there would be a need to establish lay-down areas at which construction materials and equipment may be stored. At these lay-down areas, hazardous materials may be stored, including diesel fuel (a combustible liquid). The Proponent has indicated that hazardous materials other than diesel (for example, paints) would not be stored in sufficient quantities to cause a significant risk concern (although the environmental impacts of a leak or spill may contribute to significant environmental impacts). Too little information has been provided by the Applicant to establish exactly how much diesel would be stored, where it would be stored and the handling and management practices for the fuel. The Proponent has argued that this cannot be established until further design work has been undertaken and a construction program has been refined to a greater level of detail. As such, it is not possible to determine potential incidents that, by their location (for example a car accident adjacent to the lay-down area, causing a fire fuelled by the diesel) may cause significant risk impacts. This is an important issue that must be addressed in any approval issued for the CCT.

The proponent has indicated that there may be a requirement to blast certain parts of the tunnel during construction. The exact requirements for blasting are not able to be determined until detailed design has been completed, and even then subterranean stability may require unexpected blasting. The Proponent did not include details of blasting in the EIS and Representations Report. Of particular note is the absence of details related to where explosives may be stored, how explosives would be transported to the construction site and how they would be handled up until the time of blasting. This is a significant hazards and risk issue that must be covered in any approval issued for the CCT.

Operation

During operation of the CCT, the primary hazards issue is the potential for an incident to occur within the tunnel, resulting in a significant off-site risk impact. The Proponent indicates in the EIS and Representations Report that the movement of dangerous goods through the CCT would be prohibited. This measure is aimed at preventing an explosion, fire or release of toxic material that may affect the integrity of the tunnel or may be large enough to significantly impact land uses outside the tunnel. Despite restricting the potential for incidents involving dangerous goods, the Proponent recognises that other vehicles, including standard sized cars and over-sized trucks pose a potential hazard. Collisions within the tunnel may result in structural damage to the CCT or a fire (through combustion of petrol and diesel) that may affect the CCT structure and release smoke that would impact surrounding land-uses in the vicinity of venting points. The Proponent has undertaken to design the CCT (lane widths, signage, sight distances etc) to minimise the potential for such incidents and intends to develop an Emergency Response Plan to address impacts in the event of an accident within the tunnel.

6.17.2 Key Issues Raised

Key issues raised in representations include:

- impacts of possible blasting activities, in particular the transport, storage and handling of explosive materials;
- quantities of diesel stored at construction sites and the potential for this diesel to contribute, as an additional fuel source, to externally-initiated fires;
- potential for storage of dangerous goods at construction sites and the storage and handling requirements of these materials;
- emergency response planning to adequately address incidents in the CCT such as vehicle collisions and fires;
- potential for the CCT to be used by vehicles carrying dangerous goods; and,
- hazards associated with crime, should the CCT be designed in such a manner as to provide areas that would encourage the incidence of such crime.

6.17.3 Consideration of Key Issues

Construction

The Department recognises that diesel fuel is not considered a dangerous good, as defined under the *Dangerous Goods Act 1975*. Diesel is in fact a combustible liquid which, under normal conditions, does not pose a significant risk of fire (due to its relatively low volatility and ignition energy). However, diesel can act as a fuel for an existing fire, should one occur in the vicinity of stored diesel or in the event that another ignition source with sufficiently high energy contacts the diesel. The Proponent indicated in the EIS that diesel may be stored at construction lay-down areas. This by itself does not constitute a significant concern in relation to risk impacts. It is possible, however, that an incident may occur at the construction site, or a traffic incident may occur on a road adjacent to a construction lay-down area, that initiates a fire, for which stored diesel acts as an additional fuel source. The Proponent has not completed sufficient detailed design and construction planning to determine the exact locations and volumes of any diesel storage, thereby preventing detailed consideration of possible diesel incidents. The Department's Recommended Condition of Approval No. 210 requires details of all diesel storage and management measures to be submitted for the approval of the Director-General, prior to the commencement of construction. This mechanism provides a means to identify potential hazards that may impact on diesel storage and ensure that appropriate mitigation measures are put in place to address those hazards. Further, it provides information that may trigger additional measures to mitigate other environmental impacts associated with diesel, such as its effect on the biophysical environment in the event of a leak.

The Proponent has indicated a possible need to undertake subsurface blasting during construction. As with the issue of diesel fuel storage, the Proponent is not able to establish whether blasting would be required, and subsequently methods for explosives location, storage and handling, until more detailed design work has been completed. The Department accepts this position but notes that should blasting be required, further consideration of explosives risk impacts would be essential. To this end, the Department's Recommended Condition of Approval No. 140 requires the preparation of a Blast Management Strategy to detail risk management measures for the use of explosives should blasting be required.

The Department has not identified any need for hazardous materials or dangerous goods, other than explosives, to be stored or handled during the construction of the CCT. The Department's Recommended Condition of Approval No 208 therefore specifically prohibits the storage or handling of such goods at any location associated with the CCT.

General hazards management during construction of the CCT would be considered in a Construction Safety Study, required to be approved by the Director-General. An approved Study, prepared in accordance with the Department's guidelines, is considered to be an appropriate risk identification and management measure for construction hazards and risk issues. The Department considers that this Study, together with an Emergency Response Plan detailing how possible incidents would be managed would ensure that potential risks are adequately managed. These recommendations are reflected in Recommended Conditions of Approval Nos. 209 and 211.

Operation

The EIS for the CCT identified that a significant hazards issue associated with the proposal is the potential for vehicle accidents within the tunnel. A fire resulting from an accident has the potential to impose significant risk on motorists within the tunnel, the structural integrity of the tunnel itself and surrounding land uses through the emission of combustion gases and the radiation of heat. To address the potential for accidents within the tunnel, the Proponent has undertaken to design carriageways within the tunnel and in proximity to entrance and exit points in accordance with relevant standards. Further, the Proponent has made a commitment to install physical devices to limit the types of incidents that may occur (for example, to prevent the ingress of over-dimensional vehicles). This commitment has been strengthened through Recommended Condition of Approval No. 214 that not only requires physical devices to minimise accident probability, but also measures to address accident consequences, such as the requirement to use fire-retarding construction materials. Fire suppression systems would need to meet the requirements of the NSW Fire Brigades.

A number of representations raised the issue of the possible transport of dangerous goods through the CCT. The presence of dangerous goods in the CCT could lead to hazardous situations including explosions, large fires, corrosion and toxic releases that have the potential to significantly impact on the CCT structure (and subsequently overlying structures) and the safety of population densities within the city. The Proponent has indicated that this issue can be addressed through the *Road Transport (Safety and Traffic Management) (Road Rules) Regulation 1999*. For similar routes, such as the Harbour Tunnel, the transport of dangerous goods through that structure is completely prohibited. The Department recognises this legislative restriction, but has drafted Recommended Condition of Approval No. 212 that requires demonstration of how the restriction would be monitored and enforced. Measures such as signage and monitoring via closed-circuit television may be appropriate for this demonstration.

In the event that an incident does occur within the tunnel or associated infrastructure, Recommended Condition of Approval No. 213 requires the development and implementation of an Emergency Response Plan. The Plan is to outline procedures for the management of the impact of an incident, including the direct impacts of the incident (eg fire), as well as indirect impacts (fire-fighting water and combustion gases). The Plan would be coordinated with relevant emergency response services, including the NSW Fire Brigades, Police and Emergency Services. A mock test of the Plan must be completed before operation of the CCT.

To ensure that the safety of the CCT is maintained during its operation, a Hazard Review is to be undertaken every twelve months. This measure ensures that changing conditions associated with the CCT (traffic conditions, staff and maintenance changes occurring over time) are examined to maintain, and where appropriate, improve safety levels over the life of the CCT. This recommendation is reflected in Recommended Condition of Approval No. 215.

6.18 Utilities

6.18.1 Background

The EIS indicates that the proposal would impact on existing stormwater drainage lines, sewers, power cables and ductlines, gas mains, water mains and communication cables, particularly in the cut and cover sections. The EIS notes that some of the conflicts with utilities may be temporary only and states that in these cases infrastructure would be supported and protected to ensure there is no disruption to services. Notwithstanding, the EIS states that utility conflicts with permanent tunnel infrastructure

would require permanent relocation or modification of infrastructure. The EIS concludes that utility conflicts would be identified and resolved during detailed design at no cost to the service providers.

6.18.2 Key Issues Raised

Key issues raised in representations include:

- impacts on proposed Metro West and MetroPitt rail corridors;
- RTA to bear costs and risks associated with relocation works;
- feasibility of locating infrastructure in the tunnels;
- impacts on existing subsurface infrastructure; and,
- need for ongoing consultation/negotiation.

The likely settlement and vibration impacts of the proposed works on utilities are discussed in Sections 6.3 and 5.8 of this Report respectively.

6.18.3 Consideration of Key Issues

General

The Department notes that the relocation and protection of utilities would need to be completed in consultation with relevant service providers and require careful management to ensure that service disruptions are minimised. The Department's Recommended Condition of Approval No. 217 requires the Proponent to identify all affected utilities and determine requirements for diversion, protection and/or support in consultation with service providers and prior to the commencement of construction. The Department recommends that any works required are carried out to the satisfaction of, and at no expense to the relevant service providers. This recommendation is reflected in Recommended Condition of Approval No. 220. To ensure that service disruption impacts on surrounding residences and businesses are minimised, the Department's Recommended Condition of Approval No. 221 requires the Proponent to advise residents and business owners of any service disruptions during construction.

Proposed MetroWest and MetroPitt Rail Corridors

Rail Infrastructure Corporation and State Rail Authority raised concern over the impacts of the proposal on the MetroWest and MetroPitt rail corridors. The Department's Recommended Condition of Approval No. 219 requires the Proponent to consult with these agencies during detailed design to ensure that sufficient provision is made for these rail proposals, including necessary station concourses.

6.19 Cumulative Impacts

Cumulative impacts may arise from the interaction of the construction and operation of the Cross City Tunnel with other significant proposals and activities planned for the CBD and the Sydney Metropolitan Region. In particular, the Department notes that residences in the eastern precinct have been impacted by the construction and operation of the Eastern Distributor, particularly in and around Palmer Street. While the EIS concludes that the proposal would result in improvement to the amenity of Central Sydney through the removal of through traffic on major streets and a reduction in traffic volumes on surrounding streets the Department considers that construction stage noise and vibration, traffic and

access and dust impacts would require careful management in order to minimise impacts. Specific management measures are detailed in Sections 5.8, 6.1 and 6.13 of this Report.

The Department considers that it would be essential for data obtained from monitoring of impacts during construction and operation which have the potential to result in cumulative effects to be identified. To this end, the Department's Recommended Condition of Approval No. 239 requires the Proponent to collect monitoring data with a view to utilising this data in the assessment of future projects in the surrounding area.

During construction of the Eastern Distributor Connection, the Department notes that traffic flows on the Eastern Distributor may need to be limited and this motorway may be impacted by vibration and settlement. To ensure that the impacts of construction, operation and maintenance of the proposal on the Eastern Distributor are effectively managed, the Department's Recommended Condition of Approval No. 240 requires the Proponent to negotiate an agreement with the Airport Motorway Limited to ensure that potential impacts are appropriately mitigated.

7. CONCLUSIONS AND RECOMMENDATIONS

Conclusions

The need and justification of the Cross City Tunnel has been based on concerns about current traffic congestion levels in the CBD and the associated adverse impacts on public transport services, pedestrian amenity, and delivery of goods and services. It is acknowledged that these impacts all significantly detract from a working and living city environment.

The construction of the Cross City Tunnel would have the potential to address part of this problem by removing some through traffic from City streets, possibly in the order of some 80 000 vehicles per day. However its construction would potentially create a net increase in road capacity as well as freeing up road space across a number of regional roads. The consequence of this is difficult to accurately predict for the CBD through traditional assessment techniques such as traffic modelling, particularly given the highly complex nature of the inner CBD road network and the travel behaviour response in a major city such as Sydney. However, if the freed space does backfill with induced or redirected traffic, any net benefit of the project for surface streets could be significantly eroded over time.

For a sustainable outcome to be achieved, a precautionary approach is required. It is therefore imperative that if the long-term benefits of the project are to be sustained beyond the William/Park/Druitt Street corridor, a comprehensive package of accompanying support measures and offsets is essential.

In conjunction with the establishment of a specific Public Transport Committee (PTC), the Department has identified a comprehensive package of accompanying public transport, pedestrian and cyclist improvement works. However, these works will require commitments beyond that of the RTA who is the Proponent of the project. In this regard, the success of the project would also rely to a large extent on a pro-active and complimentary involvement of other key transport agencies, particularly the Department of Transport and Sydney Buses.

The other primary justification for the project is that it is expected to result in a net improvement to air quality, a key and significant factor for the Sydney CBD. The RTA's public statements and commitments to this are considered fundamental and integral to the strategic justification of the project. Continued monitoring and compliance with ambient goals would ensure public accountability to this broader strategic air quality commitment.

Recommendations

It is recommended that should the proposal proceed, it would be essential for extensive and comprehensive conditions to be imposed so as to ensure, to the greatest extent practicable, its long-term benefits. Section 8 of this Report lists all the recommended conditions of any approval, the key ones include:

- the establishment of a Public Transport Committee to carry the investigation and coordination of the transport initiatives through the construction and at least early operation stages to ensure that there is a strong and pro-active approach in integrating public transport provisions as part of the project;
- creation of around 5 kms of bus lanes with the potential for a further 15 kms of additional bus or transit lanes;

- a contingency fund of $5 million for the purposes of implementing additional mitigation measures not explicitly identified in the Conditions, relating to public transport, cyclist provisions, local area traffic management, air quality and other environmental improvements;
- a comprehensive package of over 30 public transport enhancement measures including: improved co-ordination with existing CBD traffic controls (SCATS), performance indicators, investigation of electronic based passenger information systems, digital cameras for bus lanes, intersection improvements, bus facilities such as bus shelters and street furniture and protection of bus routes during construction;
- minor relocation of the stack approximately 50 metres to the west, with a small increase in height of 5 metres;
- compliance with stack limits to ensure no "polluting-up" and compliance with ambient air quality goals to ensure no net worsening of air quality. Real-time public access to monitoring results via the Internet is also recommended;
- deferral of any portal emissions until a comprehensive assessment has been undertaken including the development of a Protocol which would include extensive community consultation;
- requirement for a Community Based Air Quality Monitoring Station operated independently from the RTA;
- provision for retro-fitting of pollution control systems subject to air quality impacts and technological improvements for treatment of gases;
- preparation and implementation of comprehensive environmental management plans for both the construction and operation stages;
- preparation of a Community Involvement Plan and an independent Community Liaison Representative with the ability to address community concerns regarding construction impacts within no greater than 2 hours from a complaint;
- the establishment of community liaison groups and a 24 hour complaint phone system;
- extensive monitoring and auditing requirements during construction by independent persons, including making results publicly available;
- comprehensive Local Area Traffic Management Measures for Paddington. Also monitoring of other areas including Glebe, Ultimo/Pyrmont, Darlinghurst, East Sydney and Woolloomooloo for potential LATM Measures;
- enhancements to the cycle network including improved connections to Pyrmont Bridge and King Street Cycleway and an investigation into a new link from Oxford Street to Darling Drive (Darling Harbour);
- extensive building surveys and settlement monitoring to overcome the types of major concerns raised during the construction of the Eastern Distributor;
- establishment of an Independent Property Impact Assessment Panel to resolve disputes arising from potential and/or actual property impacts;
- improved access provisions to Darling Harbour including new grade separated pedestrian links from Harris Street and from Bathurst Street; and,
- various conditions that are aimed at heritage conservation; water and waste management; minimising impacts on business and maximising benefits to pedestrian and cyclists.

8. RECOMMENDED CONDITIONS OF APPROVAL

This Section provides the Department's recommended conditions of approval for the project under Section 115B(2) of the EP&A Act. The recommended conditions have been based on the Department's assessment of the EIS, the representations made to the EIS and further supplementary investigations, studies and advice.

It is noted that the EIS and Representations Report contain extensive information on Sub Plans and mitigation strategies to be implemented as part of the proposal to ameliorate the impacts. The recommended conditions of approval should therefore be implemented in conjunction with those Sub Plans and mitigation measures specified in the EIS and the Representations Report as amended by the Addendum. The precedence of documentation is: these Conditions of Approval, the Representations Report (incorporating the Addendum), the EIS.

The following acronyms and abbreviations are used in this section:

Addendum	The Addendum to the Cross-City Tunnel Representations Report dated August 2001
AQCCC	Air Quality Community Consultative Committee
ASS	Acid Sulfate Soils
CBMS	Community Based Monitoring Station
CCS	Council of the City of Sydney
CCT	Cross City Tunnel
CMS	Construction Method Statements
CLG	Community Liaison Group
Department, the	Department of Urban Affairs and Planning
Director-General, the	Director-General of the Department of Urban Affairs and Planning or delegate
Director-General's Report	the report of the Director-General of the Department of Urban Affairs and Planning dated September 2001
DLWC	Department of Land and Water Conservation, NSW
DoH	Department of Health, NSW
DoT	Department of Transport, NSW
DUAP	Department of Urban Affairs and Planning, NSW
EIS	*The Cross City Tunnel Environmental Impact Statement* prepared for the RTA by PPK Environment and Infrastructure Pty Ltd, dated July 2000.
EMP	Environmental Management Plan
EMR	Environmental Management Representative
EP& A Act	Environmental Planning and Assessment Act 1979
EPA	NSW Environment Protection Authority
ESD	Ecologically Sustainable Development
ICLR	Independent Community Liaison Representative
LATM	Local Area Traffic Management
LALC	Local Aboriginal Land Council
L_{Aeq} 9hour	Equivalent continuous (constant) sound level over 9 hour period from 10pm to 7am
L_{Aeq} 15 hour	Equivalent continuous (constant) sound level over 15 hour period from 7am to 10pm

Minister, the	Minister for Urban Affairs and Planning
NATA	National Association of Testing Authorities
NEPC	National Environment Protection Council
NEPM	National Environment Protection Measure
NPWS	National Parks and Wildlife Service, NSW
PM10	Particulate matter with an aerodynamic diameter of less than or equal to 10 microns
PM 2.5	Particulate matter with an aerodynamic diameter of less than or equal to 2.5 microns
Proponent	Roads and Traffic Authority
PTC	Cross City Tunnel Public Transport Committee
Relevant Councils	Any one or more of the following Councils as applicable: Woollahra, South Sydney City Council, Council of the City of Sydney.
Representations Report	*The Cross City Tunnel Representation Report'* prepared by RTA Operations for the RTA and dated 23 April 2001
RIC	Rail Infrastructure Corporation
SCEGGS	Sydney Church of England Girls Grammar School
SHFA	Sydney Harbour Foreshore Authority
SRA	State Rail Authority
SSCC	South Sydney City Council
STA	State Transit Authority
SWC	Sydney Water Corporation
UDAS	Department of Urban Affairs and Planning's Urban Design Advisory Service
VOCs	Volatile Organic Compounds

General

1. The proposal shall be carried out in accordance with:

   (a) the proposal contained in the Environmental Impact Statement (EIS), and as modified by the Representations Report as amended by the Addendum.
   (b) all identified Sub Plans, safeguards and mitigation measures identified in the EIS and Representations Report as amended by the Addendum;
   (c) the Director-General's Report.
   (d) the conditions of approval granted by the Minister.

   Despite the above, in the event of any inconsistency with the proposal as described in the EIS and/or Representations Report as amended by the Addendum, the conditions of approval granted by the Minister shall prevail.

   These conditions do not relieve the Proponent of the obligation to obtain all other approvals and licences from all relevant authorities required under any other Act. Without affecting the generality of the foregoing, the Proponent shall comply with the terms and conditions of such approvals and licences.

   It shall be the ultimate responsibility of the Proponent to ensure compliance with all conditions of approval granted by the Minister.

Compliance

General

2. The Proponent shall comply with, or ensure compliance with, all requirements of the Director-General in respect of the implementation of any measures arising from the conditions of this approval. The Proponent shall bring to the attention of the Director-General any matter that may require further investigation and the issuing of instructions from the Director-General. The Proponent shall ensure that these instructions are implemented to the satisfaction of the Director-General within such time that the Director-General may specify.

Pre-Construction Compliance Report

3. At least one month prior to commencement substantial construction (or within such period as otherwise agreed by the Director-General), the Proponent shall submit to the Director-General a compliance report detailing compliance with all relevant conditions that apply prior to commencement of substantial construction and shall address:

   (a) the dates of submissions of the various studies and/or requirements of various relevant conditions, and their approval and terms of approval; and
   (b) action taken and/or proposed to implement the recommendations made in terms of approvals and/or studies.

Pre-Operation Compliance Report

4. At least one month prior to commencement of operation of the tunnel (or discrete sections of the proposal as agreed by the Director-General), the Proponent shall submit to the Director-General a compliance report detailing compliance with all relevant conditions that apply prior to commencement of operation and shall include:

   (a) results of environmental monitoring required under this Approval including interpretation and discussion by a suitably qualified person;
   (b) a record of all complaints and the action taken to mitigate all such complaints;
   (c) recommendations in regard to compliance issues; and
   (d) action taken and/or proposed to implement the recommendations made in terms of approvals and/or studies.

   The period of one month referred to in this condition above may be altered as agreed by the Director-General.

> *Note:*
> *The Director-General shall provide a response to Conditions 3 and 4 within 1 month of receipt of all relevant information from the Proponent assuming receipt of adequate and sufficient information. If a request is made by the Director-General for additional information, the period of time that elapses between the date on which the Proponent receives the request and the date on which the additional information is provided to the Director-General shall not be taken into account in the 1 month period referred to. Any requests for additional information shall be made by the Director-General within 2 weeks of receipt of all relevant information from the Proponent*.

Project Commencement

5. The Proponent shall notify the Director-General and all relevant authorities in writing of the project commencement both in terms of construction and tunnel operation at least 2 weeks prior to the relevant commencement date.

Dispute Resolution

6. The Proponent shall endeavour, as far as possible, to resolve any dispute between relevant public authorities arising out of the implementation of the conditions of this approval. Should this not be possible, the matter shall be referred firstly to the chief executives and directors of the agencies involved. If the matter cannot be resolved then it shall be referred to the Minister for resolution. The Minister's determination of the disagreement shall be final and binding on all parties.

Contact Telephone Number

7. Prior to the commencement of construction, the Proponent shall institute, publicise and list with a telephone company a 24 hour toll-free complaints contact telephone number, which would enable any member of the general public to reach a person who can arrange appropriate response action to the complaint within two hours.

Complaints Register

8. The Proponent shall record details of all complaints received during construction and ensure that at least a verbal response on what action is to be undertaken is provided to the complainant within 2 hours (unless the complainant agrees otherwise) and a detailed written response within seven (7) calendar days. Information on all complaints received and response times shall be made available to the EMR at the end of day and to the Director-General every three months or any other time specified during construction. This information shall be made available to all relevant government agencies on request. The Proponent shall nominate an appropriate person(s) to receive, log, track and respond to complaints within the specified timeframe. The name and contact details of this person(s) shall be provided to the relevant Council(s) and the Director-General upon appointment or upon any changes to that appointment, but at least one week prior to the commencement of substantial construction.

Advertisement of Activities

9. Prior to the commencement of construction, and then at three-monthly intervals, the Proponent shall advertise in relevant local newspapers, the nature of the works proposed for the forthcoming three months, the areas in which these works are proposed to occur, the hours of operation and a contact telephone number.

   The Proponent shall ensure that the local community and businesses are kept informed (by appropriate means such as: local newsletters, leaflets, newspaper advertisements, and community noticeboards, etc.) of the progress of the project, including any traffic disruptions and controls, construction of temporary detours and work required outside the nominated working hours, including noisy works, prior to such works being undertaken.

10. The Proponent shall establish a project internet site prior to the commencement of construction and maintain the internet site until 12 months after commencement of operation of the project.

This internet site shall contain monthly updates of work progress and consultation activities, including but not limited to:

(a) a description of relevant approval authorities and their areas of responsibility;
(b) a list of environmental management reports that are publicly available and the executive summaries of those reports;
(c) minutes of community liaison group meetings;
(d) bi-monthly newsletters;
(e) contact names and phone numbers of the project communications staff; and
(f) 24 hour toll-free complaints contact telephone number.

Updates of work progress and construction activities shall be provided more frequently where significant changes in the noise impacts are expected.

Community Consultation

Community Liaison Groups

11. The Proponent shall:

(a) establish appropriate representative Community Liaison Groups, having considered the *Guidelines for the Establishment of the Community Liaison Groups* (see Attachment 1);
(b) ensure that the first meeting is held prior to submission of the Construction Environmental Management Plan required under Condition 17;
(c) nominate a chair to be approved by the Director – General;
(d) allow the Groups to make comments and recommendations about the implementation of the development and environmental management plans, monitor compliance with conditions of this approval and other matters relevant to the operation of the development during the term of the consent;
(e) ensure that the Groups have access to the necessary plans and information for such purposes;
(f) consider the recommendations and comments of the Groups and provide a response to the Groups and Director-General;
(g) ensure that the Community Liaison Groups and the Air Quality Community Consultative Committee required by the Conditions of Approval shall be appropriately co-ordinated in terms of nominees, issues covered by each committee and updates from the Air Quality Community Consultative Committee to the Community Liaison Groups;

The Proponent shall bear all costs associated with the establishment and ongoing function of the Groups.

Community Involvement Plan

12. The Proponent shall prepare a Community Involvement Plan for the construction period, which would be in place prior to commencement of construction. The Community Involvement Plan shall set out the community consultation procedures for the project, which shall comply with the obligations under the approval from the Minister, other approvals, licences and permits. The Community Involvement Plan shall also include:

(a) identification of the local community likely to be affected by the project, including identification of residences, businesses and other sensitive land uses;
(b) procedures for the establishment and functioning of the Community Liaison Groups in accordance with Condition 11;
(c) procedures for informing users of the affected road network of planned traffic arrangements including temporary traffic switches;
(d) procedures for informing the local community of planned investigation and construction operations;
(e) provisions for dealing with complaints (particularly night time) and response requirements as specified in Condition 8.
(f) provision for the Proponent's attendance and participation in all groups and public meetings forming part of the Community Involvement Plan; and
(g) the provision of training for all employees and sub-contractors on the requirements of the Community Involvement Plan.

Independent Community Liaison Representative

13. The Director- General shall approve the appointment of the person nominated to serve as the Independent Community Liaison Representative (ICLR), for the duration of the construction period, to:

(a) attend local community liaison group meetings;
(b) oversee the community consultation obligations;
(c) be available for direct contact from the community within reasonable hours; and,
(d) to the greatest extent practicable resolve all community complaints.

The ICLR shall:

(e) be experienced in mediating planning disputes; and
(f) contact the EMR immediately if, in the opinion of the ICLR, an unacceptable noise or other impact is being generated.

The Proponent shall bear the cost of employment of the ICLR.

Display Centres

14. At least two (2) display centres shall be established, staffed and maintained at or near the William Street and the Harbour Street construction sites, at least up until commencement of operation of the project. The ICLR shall be based at one of the display centres. The display centres shall be open between 10:00 am and 6:00 pm on business days. Up-to-date photographs, diagrams, samples and other suitable material shall be provided at each display centre, covering at least:

(a) noise and retaining wall locations, details and finishes;
(b) landscape concept, cross section treatments, perspective views and details;
(c) buildings;
(d) bridges;
(e) tunnels;
(f) overall architectural and landscape design theme;
(g) ventilation technology and ventilation stack design; and
(h) temporary works affecting businesses, residences, pedestrians and public transport users.

A dedicated PC internet access point to the internet site shall be provided in each display centre. A dedicated phone line shall be provided from one display centre to the centre where the ICLR is based.

Environmental Management

Environmental Management Representative

15. Prior to the commencement of construction, the Director- General shall approve the appointment of the person nominated to serve as the Environmental Management Representative (EMR). In considering the appointment, the Director- General shall take into account:

    (a) the qualifications and experience of the EMR including demonstration of general compliance with the principles of AS/NZS ISO 14012:1996 *Guidelines for Environmental Auditing : Qualification criteria for environmental auditors*;
    (b) the role and responsibility of the EMR; and,
    (c) the authority and independence of the EMR including details of the Proponent's internal reporting structure. This shall include the authority to stop work immediately if, in the view of the EMR, an unacceptable impact is likely to occur or to require other reasonable steps to be taken to avoid or minimise any adverse impacts.

    The EMR shall have responsibility for:

    (d) Consideration and advice on matters specified in the conditions of approval;
    (e) Compliance with these conditions; and
    (f) Facilitation of an induction and training program for all persons involved with the construction works.

    The EMR shall immediately advise the Proponent and the Director-General of any major issues resulting from the construction of the project that have not been dealt with expediently or adequately by the Proponent.

    The EMR shall be available during construction activities at the site and be present on-site during any critical construction activities as defined in the relevant Environmental Management Plan (EMP) or Construction Method Statements (CMSs).

Environmental Management System

16. The Proponent shall ensure the appointment of construction and/or operation head contractors that have an Environmental Management System prepared in accordance with the AS/NZS ISO 14000 series or BS7750-1994 certified by an accredited certifier and/or have a proven environmental management performance record.

Construction Framework Environmental Management Plan

17. Prior to the commencement of construction, a Construction Framework Environmental Management Plan (EMP) shall be prepared, following consultation with the EPA, DoH, DLWC, SHFA, SSCC, CCS and all relevant utility/service providers. The Construction Framework EMP shall be prepared in accordance with the conditions of this approval, all relevant Acts and

Regulations and accepted best practice management Sub Plans.

The Construction Framework EMP shall require approval by the Director-General prior to the commencement of substantial construction or within such time as otherwise agreed to by the Director-General. The Construction Framework EMP shall be certified by the EMR as being in accordance with the Conditions of Approval and all undertakings made in the EIS and Representations Report as amended by the Addendum, prior to seeking approval of the Director-General.

> *Note:*
> *The Director-General shall provide a response to the Construction Framework EMP within 1 month of receipt of all relevant information from the Proponent assuming receipt of adequate and sufficient information. If a request is made by the Director-General for additional information, the period of time that elapses between the date on which the Proponent receives the request and the date on which the additional information is provided to the Director-General shall not be taken into account in the 1 month period referred to.*

The Construction Framework EMP shall include:

(a) reference and proposed timeframes for all the Sub Plans required under this Approval;
(b) the role of the EMR;
(c) details of the community consultation process and identification of the role of the ICLR;
(d) definition of the role, responsibility, authority, accountability and reporting of personnel relevant to compliance with the Construction Framework EMP;
(e) a matrix of Construction Method Statements (CMS) required to construct the project, including an assessment of the predicted level of risk and potential level of public interest posed by each CMS and indicative timeframes for completion; and,
(f) propose a response time-frame for all CMS to be approved by the Director-General.

The Construction Framework EMP shall be made publicly available.

Construction Method Statements

18. The Proponent shall prepare in consultation with the relevant government agencies and the CLGs, Construction Method Statements (CMS) for all construction methods and/or major construction work sites to be utilised during construction in accordance with the Framework Construction EMP required by Condition 17. The Director-General shall nominate the CMSs that will require approval by the Director-General. Those CMSs not requiring the approval of the Director-General shall require the certification of the EMR as being in accordance with the Conditions of Approval and all undertakings made in the EIS and Representations Report as amended by the Addendum.. Any CMS to be approved by the Director-General shall be submitted to the Department following certification by the EMR no less than one (1) month prior to the proposed commencement of the relevant construction activities.

Each CMS shall include, but not be limited to:

(a) construction activities and processes associated with the relevant construction site(s), including staging and timing of the proposed works;
(b) specific hours of operation for all key elements including off-site movements;
(c) cover specific environmental management objectives and strategies for the main environmental system elements and include, but not be limited to: noise and vibration; air

quality; water quality; erosion and sedimentation; access and traffic; property acquisition and/or adjustments; heritage and archaeology; groundwater; acid sulfate soils, spoil stockpiling and disposal; waste/resource management; weed management; flooding and stormwater control; geotechnical issues; visual screening, landscaping and rehabilitation; hazards and risks; energy use, resource use and recycling; and utilities; and

(d) address, but not be limited to:

(i) identification of the statutory and other obligations which the Proponent is required to fulfil during project construction, including all approvals and consultations/agreements required from other authorities and stakeholders, and key legislation and policies which control the Proponent's construction of the project;

(ii) measures to avoid and/or control the occurrence of environmental impacts;

(iii) changes to loss of on-street parking;

(iv) measures (where practicable and cost effective) to provide positive environmental offsets to unavoidable environmental impacts;

(v) definition of the role, responsibility, authority, accountability and reporting of personnel relevant to compliance with the CMS;

(vi) site specific environmental management techniques and processes for all construction processes which are important for the quality of the environment in respect of permanent and/or temporary works;

(vii) site specific monitoring, inspection and test plans for all activities and environmental qualities which are important to the environmental management of the project, including performance criteria, tests, and protocols (eg. frequency and location);

(viii) locational details of important elements such as temporary noise barriers; portable offices and amenities; truck, plant and materials storage; access locations; provision of site hoardings etc;

(ix) environmental management instructions for all complex environmental control processes which do not follow common practice or where the absence of such instructions could be potentially detrimental to the environment;

(x) steps the Proponent intends to take to ensure that all Plans and Sub Plans are being complied with;

(xi) consultation requirements with relevant government agencies; and

(xii) community consultation and notification strategy (including local community, businesses, relevant government agencies, and all relevant Councils), and complaint handling procedures.

Specific requirements of the main environmental system elements referred to in (c) shall be as required under the conditions of this approval and/or as required under any licence or approval. All CMS shall be made publicly available.

Environmental Monitoring – Construction

19. The Proponent shall submit to the Director-General a report(s) in respect of the environmental performance of the construction works and compliance with the Construction Framework EMP, all relevant CMS and any other relevant conditions of this approval. The reports shall be prepared six months after the start of substantial construction and thereafter at six monthly intervals or at other such periods as requested by the Director-General to ensure adequate environmental performance over the duration of the construction works. The report(s) shall include, but not be limited to, information on:

a) applications for consents, licences and approvals, and responses from relevant authorities;
b) implementation and effectiveness of environmental controls and conditions relating to the work

undertaken;

c) identification of construction impact predictions made in the EIS and any supplementary studies and details of the extent to which actual impacts reflected the predictions;
d) details and analysis of results of environmental monitoring;
e) number and details of any complaints, including summary of main areas of complaint, action taken, response given and intended strategies to reduce complaints of a similar nature; and
f) any other matter relating to the compliance by the Proponent with the conditions of this approval or as requested by the Director-General.

The report(s) shall be provided to the EPA, DLWC relevant Councils and any other relevant government agency nominated by the Director-General. The report(s) shall also be made publicly available.

20. The Proponent shall ensure that it has an internal audit system and that internal audits are undertaken and certified by the EMR every three (3) months to ensure compliance with the EMP, the conditions of approval and all other relevant licences and approvals. Each audit must be completed within 6 weeks of the end of the 3 month period and be made available to the Director-General upon request.

Operational Environmental Management Plan

21. An Operational Environmental Management Plan (OEMP) shall be prepared prior to the commencement of operation. The Plan shall be prepared in consultation with the EPA, DLWC, DoH, SHFA, SSCC, CCS and any other relevant government agency nominated by the Director-General. The Plan shall be prepared in accordance with the conditions of this approval, all relevant Acts and Regulations and accepted best practice management Sub Plans.

The OEMP shall require approval by the Director-General prior to commissioning or within such time as otherwise agreed to by the Director-General. The EMP shall be certified as being in accordance with the conditions of approval by the EMR prior to seeking approval of the Director-General.

Note:
The Director-General shall provide a response to the Operational EMP within 1 month of receipt of all relevant information from the Proponent, assuming receipt of adequate and sufficient information. If a request is made by the Director-General for additional information the period of time that elapses between the date on which the Proponent receives the request and the date on which the additional information is provided to the Director-General shall not be taken into account in the 1 month period referred to.

a) identification of the statutory and other obligations which the Proponent is required to fulfil, including all licences/approvals and consultations/agreements required from authorities and other stakeholders, and key legislation and policies which control the Proponent's operation of the project;
b) sampling strategies and protocols to ensure the quality of the monitoring program, including the specific requirements of DLWC and EPA;
c) monitoring, inspection and test plans for all activities and environmental qualities which are important to the environmental performance of the project during its operation, including a description of potential site impacts, performance criteria, specific tests and monitoring requirements, protocols (eg. frequency and location) and procedures to follow;
d) steps the Proponent intends to take to ensure compliance with all plans and procedures;

e) consultation requirements, including relevant government agencies, the local community and Council, and complaints handling procedures; and
f) strategies for the main environmental system elements including, but not limited to: noise; water quality; erosion and sedimentation; access and traffic; groundwater; settlement; waste/resource management/removal/disposal; hydrology and flooding; visual screening, landscaping and rehabilitation; hazards and risks; and energy use, resource use and recycling.

Specific requirements for some of the main environmental system elements referred to in (f) shall be as detailed under the conditions of this approval and/or as required under any licence or approval.

The OEMP shall be made publicly available.

All sampling strategies and protocols undertaken as part of the Operational EMP shall include a quality assurance/quality control plan and shall be approved by the relevant regulatory agencies to ensure the effectiveness and quality of the monitoring program. Only accredited laboratories can be used for laboratory analysis.

Environmental Impact Audit Report

22. An Environmental Impact Audit Report shall be submitted to the Director-General, 2 and 7 years from the start of operations or at any time as requested by the Director-General within the first 10 years of operation. The environmental impact audit report shall be undertaken by an independent person(s) or organisation approved by the Director-General and paid for by the Proponent. The Report shall assess the key impact predictions made in the EIS and any supplementary studies and detail the extent to which actual impacts reflect the predictions during the first 12 months of operation and any other periods as required. The Report shall provide details on actual versus predicted impacts for all key issues identified in the EIS. The suitability of implemented mitigation measures and safeguards shall also be assessed. The Report shall also assess compliance with the Operational EMP.

The Report shall discuss results of consultation with the local community in terms of feedback/complaints on the construction and operation phases of the project and any issues of concern raised. The Proponent shall comply with all reasonable requirements of the Director-General, EPA and other relevant authorities with respect to any reasonable measure arising from, or recommendations in, the report.

The Report shall be made publicly available.

Harbour Street Exit

23. The Proponent shall make provision for the installation of electronic toll facilities that will enable charges of higher tolls for vehicles exiting to Harbour Street.

24. The Proponent shall provide a report to the Director-General on traffic using the Harbour Street exit, including a specific assessment of the proportion of traffic with destinations to the east of and including George Street. The traffic assessment shall be undertaken after 12 months of operation, and thereafter, 3 years then 10 years after opening, and shall be provided to the Director-General within 3 months of the end of the required periods. Should the assessment indicate a significant infiltration of traffic from the Harbour Street exit, east of George Street, the Proponent shall prepare

a report in consultation with PTC on potential mitigation measures including further traffic management measures and/or a congestion toll. No toll shall be charged to buses providing public transport services (not including those used for commercial hire or ventures) at any time. Any bonus revenue generated by the Harbour Street exit shall be put towards public transport, pedestrian, cyclist, air quality and other amenity improvements as agreed by the PTC. For the purposes of this Condition, if the PTC has ceased, any reference to the PTC shall mean the Director-General.

Public Transport Enhancement Measures

Contingency Funds

25. The Proponent shall set aside the sum of $5 million to be used for implementing any additional operation stage measures resulting from investigations required as part of these conditions of approval and/or further offset measures including air quality improvement measures (i.e. commercial cooking emission controls, assisting Sydney Buses in converting to less pollution emitting fuel sources), public transport improvement, pedestrian and cyclist improvements and/or for any other measure as required by the Director-General.

Pre-construction Stage

26. The Proponent shall ensure that any construction and/or operation contract arrangement shall not preclude any future public transport developments outside the Tunnel.

27. Prior to commencement of any substantial construction works the Proponent shall establish a Cross-City Tunnel Public Transport Committee (PTC) to be chaired by the DoT. The key role of the PTC shall be to:

    (a) co-ordinate the concerns and interests of relevant local and state transport agencies relating to the proposal;
    (b) ensure adverse impacts of the construction and operation of the CCT on public transport are minimised;
    (c) identify opportunities and develop plans and strategies for maximising short and long term public transport opportunities during construction, including but not limited to: education programs for the public and affected businesses; public transport improvements beyond those already identified as part of these conditions of approval including but not limited to: bus only routes, bus signals, bus priority lanes, enhanced bus and rail services; public transport incentives such as free bus and train travel days particularly during peak disturbance periods; giving due consideration to pedestrians and cyclists and other users of the city; and,
    (d) ensure that any plans and strategies are implemented to ensure that potential benefits to public transport are captured and maintained throughout the construction and operational life of the project.

    The Proponent shall following consultation with the DoT, submit a detailed set of requirements for constituting and funding the operations of the PTC for approval by the Director-General, within 6 months of this approval.

    The PTC shall invite representatives from at least the RTA, NSW Police Service, STA and DoT. The PTC shall also consult with the relevant Council(s) on a regular basis and shall consider any issues, advice and submissions from the relevant Council(s). The PTC shall provide the relevant

Council(s) with written advice within a reasonable time-frame on how any issues raised have been addressed.

The Proponent shall provide appropriate funding assistance to ensure appropriate facilities for and resourcing of the PTC.

The PTC shall continue for at least 3 years after opening of the tunnel unless otherwise agreed by the Director-General.

The Proponent shall prepare a bi-annual report to the Director-General on the progress and outcomes of the PTC process, including results of communications with relevant local Council(s) and the application of these conditions of approval (where relevant) and shall make the report publicly available. The PTC shall take into account any comments/requirements raised by the Director-General.

28. The Proponent shall, in consultation with the PTC, develop measurable performance indicators for bus efficiencies (including consideration of bus timetables), occurring as a result of the project taking into account the existing performance and predictions made in the EIS and Representations Report.

29. The Proponent shall consult all affected schools in relation to all practicable measures to be taken to avoid undue disruption from altered school bus services during construction.

30. The Proponent shall consult with CCS with regard to the final design of kerb realignments for Park Street, between College and Elizabeth Streets.

Construction Stage

31. Prior to the commencement of substantial construction, a Construction Stage Public Transport Management Plan(s) shall be prepared as part of the Framework Traffic Management Plan in consultation with the SRA, RIC, CCS, SSCC, STA, Bus and Coach Association, Sydney Light Rail, NSW Taxi Council and monorail operator and to the satisfaction of the PTC. The Plan shall address the potential impact of construction activities on public transport. The objective of the Plan shall be to achieve, to the greatest degree practicable, at least pre-construction level use of buses and high occupancy vehicles.

> *Note:*
> *The PTC shall be requested to provide a response to this Condition within 1 month of receipt of all relevant information from the Proponent assuming receipt of adequate and sufficient information. If a request is made by the PTC for additional information, the period of time that elapses between the date on which the Proponent receives the request and the date on which the additional information is provided to the PTC shall not be taken into account in the 1 month period referred to.*

32. The Proponent shall, to the satisfaction of the PTC, resolve the need to re-route any bus services and in particular the 311 bus service to Cathedral and Crown Streets for the duration of the closure of Bourke Street.

33. Prior to substantial construction commencement, the Proponent shall develop a Rail Safety Plan to

the satisfaction of RIC and SRA. The plan shall address maintenance of safe train operations during construction of the CCT including:

(a) the safety and well being of passengers, staff, tenants and others in stations including a specific noise and vibration impact statement for Town Hall Station;
(b) methods and means of monitoring construction impacts on rail infrastructure facilities and stations and their operations including the electrical systems for the city underground rail system, including demonstration of how the power supply to the city underground rail lines would not be adversely affected, and,
(c) emergency responses including the immediate cessation of construction to address incidents that could affect train operational safety, and passenger and staff safety.

Operation Stage

34. The Proponent shall ensure to the satisfaction of the PTC that the proposal does not prevent or impose significantly greater cost implications for future provision of a light rail system within Sydney CBD.

35. All STA buses and any other buses providing scheduled public transport services shall be exempt from all CCT tolls.

36. The Proponent shall in consultation with the PTC review the bus performance indicators developed in Condition 28 (including bus timetables) at 6 months after opening, then after 1 and 3 years of operation. The Proponent shall initiate, at its own expense and where practicable, any actions as reasonably required by the PTC to achieve the bus performance indicators to the greatest extent practicable.

37. The Proponent shall manage the Sydney Co-ordinated Adaptive Traffic System (SCATS) to optimise public transport traffic flow efficiency through the CBD at all times, including implementation of real-time dynamic bus priority on key CBD approach corridors including William Street, Oxford Street, Parramatta Road and City Road and consideration of any other roads nominated by the PTC. In managing SCATS, the Proponent shall take into account any reasonable issue raised by the PTC and report back to the PTC on such issues.

38. The following bus priority measures, or as otherwise agreed with PTC, shall be developed in consultation with the relevant community groups nominated by the PTC. The bus priority measures are:

(a) Creation of new bus lanes on:

(i) Western Distributor (westbound) between the Druitt Street ramp and the Anzac Bridge (where feasible);
(ii) Chalmers Street and Elizabeth Street between Redfern and Foveaux Streets;
(iii) Bridge Street (eastbound), between George and Loftus Streets; and,
(iv) Liverpool Street (eastbound) between Elizabeth and College Streets.

(b) Investigate potential for new bus lanes or transit lanes on:

(i) Pitt Street between Alfred and Hunter Streets;
(ii) Park Street, between Elizabeth and George Streets.

(iii) Ocean Street;
(iv) New South Head Road between Kings Cross Tunnel and Ocean Street;
(v) Victoria Road (outbound) to match inbound transit lane (from Cressy Road Gladesville); and,
(vi) Anzac Bridge (outbound).

(c) Marking of the Castlereagh Street bus lane in red;

(d) examine the feasibility of making Druitt Street eastbound a bus only lane between Kent Street and George Street or between Clarence Street and George Street;

(e) Progress the planning, consultation and implementation of measures to prohibit general traffic from using the section of York Street between Market Street and Druitt Street which would continue to operate as a key bus interchange facility;

(f) If appropriate, identify improvements to the transfer capability of Park Street, including footpath improvements with bus stops and increased capacity for "through" buses to negotiate the traffic;

(g) Develop a real time congestion monitoring system and associated protocol to facilitate the pre-emptive diversion of buses off key corridors prior to being trapped on congested CBD corridors;

(h) If agreed by the PTC, include a bus only right hand turn traffic signal at the corner of George and Druitt Streets;

(i) Develop and fund measures (such as relocation of street furniture, etc) to improve the interface between pedestrians and bus commuters in the zones adjacent to bus stops in William Street, in consultation with the PTC;

(j) Ensure that changes to existing pedestrian access will be undertaken in consultation with and to the satisfaction of CCS. In particular, the Proponent shall consult with CCS in regard to changes in Druitt Street, Market Street and Sussex Street; and,

(k) Consult with CCS and DoT with regards to any changes to the signalised scramble crossing at George, Park and Druitt Streets.

39. Subject to outcome of current trials and legislative amendments, the Proponent shall implement digital cameras or such other measures as appropriate, to assist in enforcing appropriate use of bus lanes throughout the CBD and key approach roads.

40. Prior to the operator collecting any toll, the Proponent shall have in place, and to the greatest extent practicable (including agreement on all funding requirements and an implementation program), all the necessary bus priority measures referred to in Condition 38 formulated to the satisfaction of the PTC. The implementation of such measures including any associated construction works shall be completed within 3 months of commencement of toll collection. Any extension of time beyond the 3 month period shall be specifically approved by the Director-General following consultation with the PTC.

41. The Proponent shall, in consultation with the PTC, investigate the feasibility of an electronic based passenger information system to provide arrival information for passengers at key City feeder bus

stops impacted by the proposal, including major stops along William Street, Oxford Street and New South Head Road or other streets as agreed by the PTC.

42. The Proponent shall consult with the PTC regarding the dual left turn from Clarence Street to Market Street and the proposed southbound right hand turn bay for buses at George and Druitt Streets with respect to potential impacts on parking, traffic lanes, bus lanes and bus zones and intersection arrangements and shall comply with any reasonable requirement of the PTC.

43. Prior to commencing operation of the CCT, the Proponent shall prepare an Operations Rail Safety Plan to the satisfaction of RIC and SRA. The plan shall address:

    (a) matters resulting from the operation of the project and incidents in the Tunnel that could affect safe train operations and the safety and well being of passengers and staff in stations and their environs;
    (b) matters resulting from the operation of rail infrastructure facilities and stations and incidents that could affect safe Tunnel operations;
    (c) procedures for the notification of incidents and emergencies; and
    (d) responses to emergencies identified in a risk analysis.

44. The Proponent shall, In consultation with RIC and SRA, conduct regular (at least 6 monthly) testing and review of the Operation Rail Safety Plan's effectiveness, including co-ordination with emergency services, RIC, SRA and the operator of the project. The Proponent shall provide and maintain a communications link between the CCT Control Centre and a train control centre nominated by the SRA.

Construction Stage Traffic Impacts

Pre construction Stage

45. The Proponent shall prepare a Framework Traffic Management Plan for overall traffic arrangements during the full construction period. The Plan shall include, with respect to the project as a whole:

    (a) cumulative impacts of multiple construction sites;
    (b) measures to manage traffic flows through and surrounding the project, including regulatory and direction signposting, line marking and variable message signs;
    (c) management of the Sydney Co-ordinated Adaptive Traffic System (SCATS) to optimise traffic flow efficiency particularly for public transport at all times, particularly during peak periods; and
    (d) identify any regulatory measures to improve the efficiency of traffic conditions.

    The Plan shall take into account both local and regional traffic impacts and shall at all stages give priority to public transport and pedestrian movements. The Plan shall be approved by the PTC prior to substantial construction commencement.

> *Note:*
> *The PTC shall be requested to provide a response to this Condition within 1 month of receipt of all relevant information from the Proponent assuming receipt of adequate and sufficient information. If a request is made by the PTC for additional information, the period of time that elapses between the date on which the Proponent receives the request and the date on which the additional information is provided to the PTC shall not be taken into account in the 1 month period referred to.*

46. The Proponent shall prepare individual Traffic Management Plans (TMPs) for each construction site in accordance with the Framework Construction Traffic Management Plan required by Condition 45, and in consultation with relevant local councils and other agencies, prior to commencement of substantial construction affecting that area. The individual TMPs shall be incorporated into the relevant Construction Method Statements required under Condition 18. The individual TMPs shall include, but not be limited to:

    (a) impacts on all existing traffic (including pedestrians, vehicles, cyclists and disabled persons), including the staging of construction works to minimise road closures and delay or detours to traffic;
    (b) access to construction sites and site compounds, including minimising the disruption from construction vehicles entering and leaving construction sites and site compounds;
    (c) any changes to existing number and width of traffic lanes;
    (d) maximum and average truck volumes and expected hourly distribution;
    (e) truck ingress and egress routes;
    (f) entry/exit locations;
    (g) nature of loads and materials;
    (h) temporary traffic arrangements, including the identification and promotion of alternative routes;
    (i) no heavy vehicle queuing on public roads unless otherwise agreed by the relevant Council(s);
    (j) provision of barriers between working and trafficked areas;
    (k) the impact on pedestrian and bicycle facilities, including measures to ensure safe pedestrian and cycle routes and access at all times, and the provision of alternative facilities and locations for pedestrians and cyclists;
    (l) the provision of safe and convenient access to all bus stops;
    (m) signposting;
    (n) stormwater drainage;
    (o) methods for implementing the TMP;
    (p) access to side streets;
    (q) access to adjoining properties, which would be maintained at all times wherever practicable;
    (r) road or lane closures;
    (s) the use of cranes on public roads;
    (t) deliveries to construction sites and site compounds;
    (u) a response plan which sets out the proposed response to any traffic, construction or other incident; and,
    (v) appropriate review and amendment mechanisms.

    The TMP shall be certified by an experienced traffic/transport planner who shall be engaged throughout the construction stage to advise on implementation issues and amendments and as a key liaison contact for the relevant local Councils.

47. The Proponent shall as part of its construction stage monitoring required under Condition 19, monitor traffic changes during construction on regional and local streets in Paddington, Ultimo, Pyrmont, Glebe, Darlinghurst, East Sydney and Woolloomooloo. Should monitoring indicate traffic intrusion above predicted levels on these streets as a result of the construction of the proposal the Proponent shall also prepare and implement LATM for these areas following consultation with the relevant Council(s).

Construction Management

48. The Proponent shall monitor the performance of all project traffic arrangements during construction, including any impact of bus operations and prepare quarterly reports to the PTC. The report shall be made available to the Director-General upon request.

49. The Proponent shall review the TMPs as required by, and in consultation with, the PTC. The Proponent shall implement any additional public transport management measures as reasonably required by the PTC.

50. The Proponent shall ensure that the proposed traffic arrangements during construction are in accordance with Table 8.1 Section 12.1.5 of the Representations Report unless otherwise agreed by the PTC. Where any measure listed in this table is inconsistent with any other condition of this approval, the conditions of approval shall prevail.

51. The Proponent shall take all reasonable steps to ensure that all heavy vehicles travel to and from all construction sites via State roads and/or the routes specified in the EIS Technical Paper No. 18. In the event of any inconsistency, more recent documentation or the Conditions of Approval shall prevail.

52. The Proponent shall ensure that access and egress to the additional site compound on Palmer Street is left in/left out or signal controlled unless otherwise agreed by the SSCC Traffic Committee.

53. The Proponent shall ensure that all businesses affected by altered traffic arrangements are consulted at least 10 days prior to any affectation and shall endeavour where reasonable and feasible to maintain critical access at all times.

54. For the duration of the project construction, parking shall only be provided for senior site personnel, visitors and delivery vehicles. No construction personnel shall be allowed to park at any construction sites.

55. For the duration of the project, the construction sites, site compounds and surrounding areas shall be maintained in a generally clean and tidy condition.

Regional Traffic

56. The Proponent shall ensure adequate monitoring of the local and regional road network is conducted prior to the opening of the tunnel to provide an appropriate base line for measuring any future impacts resulting from the construction and/or operation of the tunnel. Key impact prediction shall include traffic volumes on approach and departure routes, key central Sydney streets and local streets. The Proponent shall consult with and take into account comments from the PTC and relevant Council(s) regarding the methodology and timing of the study.

57. As part of the TMP identified in Condition 46, the Proponent shall work with the relevant local councils to ensure that traffic impacts within the regional road network affected by the proposal are consistent with the predictions made in the EIS and managed in consultation with the relevant local council(s).

58. The Proponent shall undertake a comprehensive assessment of all roads identified in Table 5.7 of the Director-General's Report, and shall, in consultation with the PTC, develop measures to reduce roadway capacity where practicable.

Local Traffic

Local Area Traffic Management

59. Within 6 months of this approval the Proponent shall in consultation with the PTC, NSW Police, Emergency Services, relevant local Council(s) and community representatives, commence the preparation of the Local Area Traffic Management (LATM) measures for Paddington as defined in Appendix 7 of the Representations Report and shall include as a minimum unless otherwise agreed by the relevant local Council(s) the following:

    (a) traffic calming on Brown Street/Nield Avenue between Macdonald and Lawson Streets; and,
    (b) traffic calming on Glenmore Road between New South Head Road and Cascade Street.

    The preparation of the LATM shall include a comprehensive consultation process, including the relevant government agencies as well as affected community, business and bicycle groups. The key objective of the LATM shall be to restrict through traffic and ensure that alternative routes for traffic wishing to avoid the toll are relatively unattractive.

    The measures listed above shall be installed at full cost to the Proponent as soon as practicable after finalising the LATM consultation process.

60. Prior to the operator collecting any toll, the Proponent shall have in place to the greatest extent practicable and have agreed on all funding requirements and an implementation program for the necessary LATM measures referred to in Condition 59. Despite the above, the implementation of such measures including any associated construction works shall be fully completed within 6 months of commencement of toll collection. Any extension of time for the full implementation of the LATM measures shall be specifically approved by the Director-General following consultation with the relevant local councils.

61. The Proponent shall, as part of its impact verification required under Condition 22, monitor traffic changes on regional and local roads/streets in Paddington, Ultimo, Pyrmont, Glebe (particularly Cowper Street and Bay Street), Darlinghurst, East Sydney and Wolloomooloo. Monitoring shall be undertaken for a period of no less than 12 months after opening. Should monitoring indicate traffic intrusion on these roads/streets reasonably beyond that predicted in the Representations Report as a result of the operation of the proposal, the Proponent shall also prepare and implement traffic management measures to mitigate the impacts of intrusive traffic in the affected areas following consultation and agreement with the relevant Council(s) and consultation with the local communities.

62. The Proponent shall review the design and signal phasing of the Harbour Street and Bathurst Street intersection in consultation with the SHFA, CCS and to the satisfaction of the Director-General to ensure that pedestrian green times and intersection performance are appropriately balanced.

63. The Proponent shall ensure that the access/egress between the Domain car park and Sir John Young Crescent is maintained at all times.

Pedestrian and Cyclist Access

64. The Proponent shall maintain safe pedestrian access to the fullest extent possible during construction. In circumstances where pedestrian access is not possible due to construction activities, the Proponent shall ensure that a satisfactory alternate route is provided and sign posted.

65. The Proponent shall in consultation with the PTC develop measurable performance indicators for pedestrian walk times occurring as a result of the proposal. The performance indicators shall be reviewed 1 and 2 years after opening the tunnel. The Proponent shall, at its own expense, implement any measures as reasonably required by the PTC to achieve the indicators to the greatest extent practicable.

66. The Proponent shall ensure that all cycle lanes are 1.5 m wide and marked in accordance with Austroads *Guide to Traffic Engineering Practice*, Part 14 - Bicycles, 1999 including where appropriate, advanced stop lines.

67. Subject to the ongoing development of the CCS Bike Plan for the CBD, the Proponent shall, in consultation with Bicycle NSW, CCS and SSCC and to the satisfaction of the Director-General, develop and provide funding for the construction of a connection from the William/Park/Druitt Street cycle route to the Pyrmont Bridge and King Street Cycleway.

68. Subject to the ongoing development of the CCS Bike Plan for the CBD, the Proponent shall, in consultation with Bicycle NSW, SSCC and CCS, investigate a cyclist connection between Oxford Street and Darling Drive. In designing this connection, the Proponent shall investigate the provision of a two way cycle route in Liverpool Street between Harbour and Elizabeth Streets; a pedestrian and cyclist crossing at the intersection with Harbour Street; and investigate the establishment of a cycle route along the western footpath of Harbour Street or at the southern side of Pier Street. The Proponent shall submit a Report, prepared by a qualified bicycle planner, on the feasibility of this connection and shall comply with all reasonable requirements of the Director-General.

69. The Proponent shall, in consultation with Bicycle NSW, CCS and SSCC and to the satisfaction of the Director-General, develop a Plan and implement the construction of cycle lanes in William, Park and Druitt Streets (but excluding the section of Druitt Street west of Clarence Street). The plan and construction shall be in accordance with the Addendum. Appropriate line marking shall be provided at bus stops, bus bays and intersections.

Business Impacts

70. Prior to construction commencement with the potential to impact on businesses, the Proponent shall prepare a Business Management Strategy in consultation with all businesses affected during the construction stage. The objective of the Strategy shall be to minimise impacts on local businesses through appropriate signage, maintaining vehicular and pedestrian access during business hours, minimising noise and dust impacts and retaining visibility of the business appropriate to its reliance on such. A draft Strategy shall be made available to all businesses, and to the relevant local Council(s) for comment for a period of no less than 21 days. The final

Strategy shall indicate how any issues raised on the draft have been considered in the final Strategy. The Strategy shall be made publicly available.

Road Safety Audit

71. The Proponent shall undertake a Road Safety Audit during detailed design of the project and prior to commencement of construction, including but not limited to:

    (a) reassessment of the length of the slip lane at the Bourke Street entry to the Eastern Distributor, in relation to the design speed of the entry to ensure acceleration/deceleration distances comply with the Austroads *Guide to Traffic Engineering Practice* – Part 5, 1998 and the *RTA Road Design Guide* (1993);
    (b) review of the design of bicycle facilities for compliance with the Austroads design criteria; and,
    (c) review of the safety implications of the horizontal curves on western approach to the tunnel, and the provision of appropriate sign posting.

Darling Harbour Access

72. The Proponent shall provide access to Darling Harbour in accordance with the Addendum.

73. The final design details of the Darling Harbour access identified in the Addendum shall be developed in consultation with the SHFA and shall require approval by the Director-General within 18 months of this approval. All pedestrian bridges shall be of high quality in terms of form, finish and materials and shall be designed by an architect with appropriate experience in urban pedestrian bridge design.

74. The Proponent shall ensure that the grade separated pedestrian access between Bathurst Street and the Darling Walk building (Harbour Street crossing), as shown on Figure 5.2 of the Director-General's Report is completed in either a temporary or permanent form and opened to pedestrians prior to construction works affecting this area.

75. Subject to resolution of the lessee arrangements for the Darling Walk building, the Proponent shall ensure that the permanent grade separated access between the Darling Walk building and the Kiosk, as shown on Figure 5.2 of the Director-General's Report is completed and opened to pedestrians concurrently with the temporary or permanent (as applicable), Harbour Street pedestrian bridge.

76. The Proponent shall also consult with the SHFA in relation to minimising disruption to:

    (a) traffic, pedestrian and cycle access to Darling Harbour during the construction period;
    (b) the operations of the SHFA and its tenants; and,
    (c) comply with the mitigation measures and strategies identified in Section 2.3 of the Addendum unless inconsistent with the other conditions of this approval.

77. The Proponent shall in consultation with CCS and SHFA provide a new footpath from Druitt Street to Bathurst Street including the western frontage of the Park Royal Hotel. The footpath shall be 3.6 metres wide wherever possible.

78. The Proponent shall also ensure the following specific measures are undertaken unless otherwise agreed by the SHFA:

(a) provide safe pedestrian access along Druitt Street to the Darling Park footbridge to Darling Harbour for the duration of construction;
(b) provide safe pedestrian access along Bathurst Street to the footbridge to Darling Walk for the duration of construction; and,
(c) provide clear signposting of affected pedestrian access between the CBD and Darling Harbour for the duration of construction.

Tolling

79. A tolling system shall be implemented which:

(a) is compatible with the existing standard for electronic tolling adopted throughout Sydney and Australia; and,
(b) makes adequate provision for casual users.

Air Quality - Operation Stage

Physical Requirements

80. Unless otherwise approved under Condition 82, the ventilation stack shall be constructed at Location B, as shown on Figure 5.1 in the Director-General's Report (and appended at Attachment 2), with the top of the ventilation stack at a minimum height of 49m AHD.

81. Prior to finalising the ventilation stack design, the Proponent shall in consultation with SHFA and CCS, demonstrate to the satisfaction of the Director-General, that potential opportunities that arise to incorporate the ventilation shaft within an existing, proposed or newly constructed building have been appropriately considered through the selected tendering and final design process. The allowable degree of relocation shall be no greater than 100 metres from the EIS location and the provision of Condition 82 shall apply.

82. Any change to the location and/or height of the ventilation stack as a result of Condition 81 shall be approved by the Director-General following consultation with the EPA and DoH and shall require the Proponent to undertake a comprehensive air quality assessment as agreed by the EPA, to demonstrate that the predicted air quality impacts are no greater at sensitive receptors than those predicted for Location B. The assessment must be independently verified to the satisfaction of the Director-General following consultation with the EPA.

83. The tunnel shall be designed and constructed so as to make provisions for any possible future installation of an appropriate pollution control system to treat air emissions from the tunnel as required by the Director-General. The Proponent shall provide evidence to this effect during the design and construction phases to the satisfaction of the Director-General.

84. All plant and equipment associated with the ventilation stack including possible pollution control systems shall be located below the existing surface level unless otherwise agreed by the Director-General following consultation with CCS and SHFA.

Air Quality Community Consultative Committee

85. An Air Quality Community Consultative Committee (AQCCC) shall be established by the Proponent. Representatives from CCS, SSCC, SHFA, DoH, and local community representatives

with interests in the ventilation stack and proposed portal emissions shall be invited to participate on the Committee. The AQCCC must be established prior to the commencement of substantial construction. The Committee's role includes: input into air quality monitoring; accessing and disseminating monitoring results and other information on air quality issues; and associated potential impacts. The Proponent shall submit a detailed terms of reference and set of requirements for constituting the AQCCC for approval by the Director-General within 3 months of this approval or within any other time as agreed by the Director-General. The functions and conduct of the AQCCC shall be in accordance with the terms of reference approved by the Director-General.

Portal Emissions

86. Unless otherwise approved under Condition 87, the tunnel ventilation system shall be designed to avoid to the greatest extent practicable, emissions of tunnel air from the portals.

87. If portal emissions are proposed, the Proponent shall in consultation with the EPA, CCS, SSCC, SHFA, DoH and representative community groups develop a Procedure for portal emissions. The Procedure shall clearly detail the management regime for portal emissions and shall address but not be limited to: duration, timing, ambient air quality circumstances, existing development and landuse zonings near the portals, portal emission limits, compliance requirements, justification with respect to energy savings, predicted impacts, in-tunnel and ambient monitoring, public notification, responding to residents concerns and any other matters considered relevant by the EPA. The Procedure shall be approved by the Director-General following consultation with the EPA and AQCCC prior to any portal emissions.

Monitoring of Ambient Air Quality

88. The Proponent shall monitor (by sampling and obtaining results by analysis) the pollutants and parameters specified in Column 1 of Table 1 at a minimum of one (1) ground level location, one (1) elevated receptor, all proposed portal emission locations and at the air conditioning intake nearest to the top of the IMAX Theatre (subject to owners agreement). The Proponent must use the sampling method, units of measure, and sample at the frequency, specified in the other columns. The Proponent shall commence this monitoring within at least 18 months of this approval and shall monitor for at least 12 continuous months prior to opening of the tunnel. For any proposed portal emissions, at least 12 months continuous monitoring prior to portal emissions. Each monitoring station established under this condition is to be independently audited prior to its commencement of monitoring for compliance with the requirements set out in Table 1. Independent auditing is to be undertaken by an independent person(s) or organisation(s) to be approved/appointed by the Director-General and paid for by the Proponent.

Table 1

Pollutant	Units of measure	Averaging Period	Frequency	Method[1]
NO	pphm	1-hour	Continuous	AM-12
NO_2	pphm	1-hour	Continuous	AM-12
NO_x	pphm	1-hour	Continuous	AM-12
PM_{10}	µg/m[3]	24-hour	Continuous	AM-18[1] or AS3580.9.8-2001[2]
$PM_{2.5}$ Note 4	ug/m3	24-hour	Continuous	AM-18[1] or AS3580.9.8-2001[2]
CO	ppm	15-minutes, 1-hour, 8-hour	Continuous	AM-6
Parameter[3, 5]	**Units of measure**	**Averaging Period**	**Frequency**	**Method**[1]
Wind Speed @ 10 m	m/s	1-hour	Continuous	AM-2 & AM-4
Wind Direction @ 10 m	°	1-hour	Continuous	AM-2 & AM-4
Sigma Theta @ 10 m	°	1-hour	Continuous	AM-2 & AM-4
Temperature @ 2 m	K	1-hour	Continuous	AM-4
Temperature @ 10 m	K	1-hour	Continuous	AM-4
Total Solar Radiation @ 10 m	W/m[2]	1-hour	Continuous	AM-4
Other	**Units of measure**	**Averaging Period**	**Frequency**	**Method**[1]
Siting	NA	NA	NA	AM-1 & AM-4

Note: [1]NSW EPA, 2001, Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales
[2] Standards Australia, 2001, AS3580.9.8-2001, Methods for the Sampling and Analysis of Ambient Air – Determination of Suspended Particulate Matter – PM_{10} Continuous Direct Mass Method using Tapered Element Oscillating Microbalance Analyser.
3 Location for IMAX at the top of the building.
4 Not required for IMAX.
5 Not required for elevated receptor as measured at IMAX.

Air Quality - In-Tunnel Limits

89. The concentration of carbon-monoxide (CO) inside the Cross City Tunnel must not exceed the concentration limits specified for that pollutant in Table 2 at any location in the tunnel.

Table 2

Pollutant	Units of measure	Averaging period	100% Limit
CO	ppm	Rolling 15-minute	87

Monitoring of In-Tunnel Air Quality

90. Within the tunnel, the Proponent must monitor (by sampling and obtaining results by analysis) the pollutants, specified in Column 1 in Table 3. The Proponent must use the sampling method, units of measure, and sample at the frequency, specified opposite in the other columns. The siting of the sampling points must be independently verified to the satisfaction of the Director-General following consultation with the EPA. Each monitoring station established under this condition shall be independently audited prior to its commencement of monitoring for compliance with the requirements set out in Table 3. Independent verification and compliance auditing is to be undertaken by an independent person(s) or organisation(s) approved/appointed by the Director-General and paid for by the Proponent.

Table 3

Pollutant	Units of measure	Frequency	Method[1]
CO	Ppm	Continuous	AM-6

Note: [1]NSW EPA, 2001, Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales

Verification of Air Quality Assessment

91. Following 12 months of operation of the project, the Proponent shall, in consultation with the EPA and to the satisfaction of the Director-General, validate the air quality assessment undertaken for the proposal utilising actual monitoring data recorded by the Proponent.

Air Quality Goals – Ambient Air

92. Should ambient monitoring of air pollutants exceed the following goals, the provisions of Condition 95 shall apply:

    (a) CO - 8 hour average of 9.0 ppm (NEPM);
    (b) NO_2 - One hour average of 0.12 ppm (245 $\mu g/m^3$)(NEPM);
    (c) PM_{10} - 24 hour average of 50 $\mu g/m^3$ (NEPM); and,
    (d) $PM_{2.5}$ - (if approved following current NEPC review).

    Only monitoring station(s) that meet the requirements for a background ambient monitoring station in Australian Standard AS2922 – 1987, shall be used for the purposes of assessing compliance with the ambient goals specified in this condition.

Air quality – Ventilation Stack Limits

93. The concentration and mass of pollutants discharged from the Cross City Tunnel ventilation stack referred to in Table 4, must not exceed the respective limits specified for that pollutant in Table 4.

Table 4

	Units of measure	Averaging period	Total CO	Total NO_x	Total PM_{10}	Total VOC
Concentration limit	mg/m^3	one hour	109	19	1	11
Annual load limit	tonne/ annum	annual	588	117	4	59

The stack limits detailed in Table 4 shall be independently verified by an independent person/organization, approved/appointed by the Director-General, to confirm that compliance with the stack limits will not result in air quality impacts greater than predicted in Appendix C of the Director-General's Report.

Compliance with the stack limits specified in Table 4 shall be independently validated and certified as required by the Director-General by an independent person(s) organisation(s) to be approved/appointed by the Director-General and paid for by the Proponent.

The ventilation stack limits detailed in Table 4 shall be reviewed on a 5 yearly basis and, subject to improvements in vehicle fleet emissions, may be lowered (i.e. made more stringent) if the Proponent is directed to do so by the Director-General following consultation with the EPA.

Exceedance of Limits and/or Goals

94. Should the results of monitoring required under Condition 96 show that any of the limits specified in Condition 93 have been exceeded, the Proponent shall submit a report prepared by an independent person/organisation to the Director-General on the cause and major contributor of the exceedance and the options available to ensure the prevention of a recurrence. This report must include consideration of additional traffic management measures to address ambient air and also the option of installing pollution control systems. If the Report does not propose the installation of pollution control systems then this recommendation must be justified. The Proponent shall comply with any requirements of the Director-General's review of the Report. Independent verification shall be undertaken by independent person(s) or organisation(s) approved/appointed by the Director-General.

95. Should the results of monitoring required under Condition 100 show that any of the goals specified in Condition 92 have been exceeded, the Proponent shall submit a report prepared by an independent person/organisation to the Director-General on the cause and major contributor of the exceedance and the options available to ensure the prevention of a recurrence. The Director-General shall approve/appoint the independent person/organisation. This report must include consideration of additional traffic management measures to address ambient air and/or the option of installing pollution control systems. If the Report does not propose the installation of pollution control systems then this recommendation must be justified. The Proponent shall comply with any requirements of the Director-General's review of the Report.

Air Quality Monitoring Requirements – Ventilation Stack Emissions

96. The Proponent must monitor pollutants inside the ventilation stack (by sampling and obtaining results by analysis) for the pollutants and parameters specified in Column 1 of Table 5. The Proponent must use the sampling method, units of measure, and sample at the frequency, specified opposite in the other columns. Monitoring equipment installed under this condition is to be independently audited prior to its commencement of monitoring for compliance with the requirements set out in Table 5. Independent auditing is to be undertaken by an independent person(s) or organisation(s) approved/appointed by the Director-General and paid for by the Proponent.

Table 5

Pollutant	Units of measure	Frequency	Method[1]
NO	mg/m^3	Continuous	CEM-2
NO_2	mg/m^3	Continuous	CEM-2
NO_x (as NO_2)	mg/m^3	Continuous	CEM-2
PM_{10}	mg/m^3	Continuous	AS3580.9.8-2001[2]
$PM_{2.5}$	mg/m^3	Continuous	AS3580.9.8-2001[2]
CO	mg/m^3	Continuous	CEM-4
VOC	mg/m^3	Continuous	CEM-8
Speciated VOC[3]	mg/m^3	Annual	OM-2
PAH[4]	$\mu g/m^3$	Annual	OM-6
Parameter	Units of measure	Frequency	Method[1]
Flowrate	m^3/s	Continuous	CEM-6
Moisture	%	Continuous	TM-22
Temperature	K	Continuous	TM-2
Other	Units of measure	Frequency	Method[1]
Sampling locations	NA	NA	TM-1

Note: [1]NSW EPA, 2001, Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales
[2]Standards Australia, 2001, AS3580.9.8-2001, Methods for the Sampling and Analysis of Ambient Air – Determination of Suspended Particulate Matter – PM_{10} Continuous Direct Mass Method using Tapered Element Oscillating Microbalance Analyser
[3]Must include, but not limited to; Benzene, Toluene, Xylenes, 1,3-Butadiene, Formaldehyde and Acetaldehyde
[4]Must include, but not limited to; 16 USEPA priority PAHs, namely; Napthalene, Phenanthrene, Benz(a)anthracene, Benzo(a)pyrene, Acenapthylene, Anthracene, Chrysene, Indeno(1,2,3-cd)pyrene, Acenaphthene, Fluoranthene, Benzo(b)fluoranthene, Dibenz(a,h)anthracene, Fluorene, Pyrene, Benzo(k)fluoranhtene, Benzo(g,h,i)perylene

Operation Stage Monitoring Stations - Community Based Monitoring Station

97. Subject to the agreement of the AQCCC, the Proponent shall establish, at least two years prior to the opening of the tunnel, a community based monitoring station (CBMS) to monitor ambient air quality consistent with the requirements in Table 1. The Proponent shall meet all operating costs associated with the station. The CBMS is to operate independently from the Proponent and all other authorities and its establishment and operation shall be overseen by the AQCCC on behalf of the community. The establishment and operation of the station is to be undertaken in accordance with recognised Australian standards and undertaken by a consultant accredited by NATA. The results of the monitoring shall be quality assured through a NATA accredited process prior to the data being considered as a basis for compliance/auditing purposes. The monitoring results shall be made publicly available. The monitoring results shall be subject to audit by an independent auditor agreed by the AQCCC, whose report shall be directly provided to the AQCCC. The Proponent, following consultation with the EPA and AQCCC, shall review the need for the continuation of the CBMS after a period of 3 years after the tunnel is opened to traffic. Any recommendation to close the CBMS shall require the approval of the Director-General. The Director-General shall approve/appoint the independent operator.

Operation Stage Monitoring Stations - Residents in High Rise Apartments (Elevated Receptors)

98. Subject to the agreement of the body corporate, the Proponent shall undertake a monitoring program for the nearest residential high rise apartments to the ventilation stack and, unless otherwise agreed by the Director-General following consultation with the EPA, include flag pole receptor monitoring at representative balcony levels at the same or equivalent site as the elevated receptor referred to in Condition 88. Monitoring shall be undertaken over a period of at least 12 months to correlate and verify impacts with the air quality modelling predictions. The details of the monitoring program shall be made available to the Body Corporate and the owners of the apartments as applicable.

    Should monitoring of pollutants indicate localised exceedances of the goals, the Proponent shall prepare a Report to the Director-General, meeting the requirements of a Report required under Condition 95. Should the monitored increment, on an annual average basis, exceed the predictions made as described in Appendix C of the Director-General's Report (even if still within the goals), the Proponent shall in consultation with the DoH and EPA prepare a further risk assessment to address health risks to apartment owner-occupiers. As part of this assessment, the Proponent must address mitigation measures to reduce the air quality impacts to within the predicted levels. The Proponent shall comply with any requirement of the Director-General following consultation with the DoH and EPA.

Operation Stage Monitoring Stations - IMAX Building

99. Subject to the agreement of the owner, the Proponent shall undertake monitoring at the air conditioning intake closest to the top of the IMAX for the pollutants identified in Table 1. Monitoring shall be undertaken over a period of at least 12 months to correlate and verify impacts with the air quality modelling predictions. The results of the monitoring program shall be made available to IMAX.

    Should monitoring of pollutants indicate localised exceedance of the predictions made as described in Appendix C of the Director-General's Report, the Proponent shall immediately undertake such measures to meet the predictions or mitigate the impacts.

Operation Stage Monitoring Stations - Residents Living at Ground Level (Ground Level Receptors)

100. The Proponent shall install at least two monitoring stations (including the CBMS) to assess ambient ground level impacts. The location of the stations and pollutants to be monitored must be developed in consultation with the EPA and the AQCCC and be approved/appointed by the Director-General and shall include the pollutants specified in Table 1 unless otherwise agreed by the Director-General following consultation with the EPA. The location of ground level monitoring stations shall meet the requirements for a background ambient monitoring station in Australian Standard AS2922 - 1987. Monitoring must be carried out by an independent organisation, to be approved by the Director-General, and reports must be made available at 6 monthly intervals from the date the CCT commences operation. The reports must be made available to the Director-General, the EPA, relevant Council(s) and the AQCCC, and must be made publicly available. The total duration of the monitoring shall be for at least 3 years unless otherwise requested by the Director-General. Any closure of the monitoring station shall be approved by the Director-General following consultation with the EPA at least 3 months prior to closure.

Installation of Pollution Control Systems

101. Conditions 89, 92, 93 and 87 (if approved) do not apply for discharge of emissions which occur in an emergency to prevent damage to life or limb other than an emergency arising from a negligent act or omission from the Proponent. The Proponent shall as soon as reasonably practicable, notify the Director-General and the EPA of any such emission.

Public Access to Monitoring Results

102. Results of hourly updated real-time monitoring of PM_{10}, $PM_{2.5}$, NO_2, and CO at the approved ground level and portal (if approved) monitoring locations shall be provided on the Internet and made publicly available in hard form (including to at least the relevant local Council(s), AQCCC and the EPA) These data shall be preliminary until the data has been quality assured by a NATA accredited consultant. The means and availability of this information shall be conveyed to the local community by way of newsletter and newspaper advertisement at least one month prior to the opening of the tunnel to traffic.

Local and Sub-Regional Air Quality Improvements

103. The Proponent shall assist CCS and the SHFA in developing an air quality assessment process for inclusion in a Development Control Plan or other appropriate planning control instrument, in considering planning and building approvals for new development in the area which would be within a potential three dimensional zone of affectation (buffer volume). This process shall include procedures for identifying the width and height of buildings that are likely to be either affected by the plume from the ventilation stack or affect the dispersion of the plume from the ventilation stack through building wake effects. The Proponent shall meet all costs for the development of the planning control instrument.

104. The Proponent shall examine international developments in tunnel emission treatment systems, in consultation with the EPA, DoH and the Director-General. The Proponent must report on the outcome of these examinations (including the cost effectiveness of the systems) for five years from the date of construction commencement or for five years from the expiration of the M5 East Condition 79 (whichever comes first). The results must be made available to the Director-General, EPA, relevant Councils and the AQCCC and must be made publicly available upon request of the Director-General.

Air Quality Auditing and Quality Assurance

105. The Proponent shall appoint an external auditor to conduct an air quality audit every six months or at any longer interval if approved by the Director-General. The auditor shall ensure that the operating procedures and equipment to acquire air monitoring, meteorological data and emission monitoring data comply with NATA (or equivalent) requirements and sound laboratory practice. The Proponent must document the results of the audit and make available all audit data for inspection by the Director-General upon request.

106. The Proponent shall undertake appropriate quality assurance (QA) and quality control (QC) measures for air quality and ventilation stack emission monitoring data. This shall include, but not limited to: accreditation/quality systems, staff qualifications and training, auditing, monitoring procedures, service and maintenance, equipment or system malfunction and records/reporting.

The QA/QC measures shall be approved by an independent expert approved by the Director-General prior to monitoring of air quality and ventilation stack emissions as appropriate.

Property Matters

Pre-construction

107. Prior to the commencement of construction, the Proponent shall consult all affected landowners regarding any practicable and cost-effective measures to minimise impacts which may be beneficially implemented prior to the commencement of construction or within such time as agreed with the relevant landowner.

108. Building condition surveys shall be completed on the following buildings/structures at least 1 month prior to commencement of excavation construction works and major vibration inducing construction activities in the vicinity of such buildings/structures (including basements):

(a) all buildings/ structures within a plan distance equal to twice the invert depth from the edge of the tunnel and/or excavation works unless otherwise determined following geotechnical and vibration analysis as certified by a qualified geotechnical engineer as not likely to be adversely affected;
(b) all heritage buildings as identified in the Heritage and Archaeology Management Sub Plan required by Condition 175 and other sensitive structures within 100 metres from the edge of the tunnel and/or excavation works unless otherwise determined following geotechnical and vibration analysis as certified by a qualified geotechnical engineer as not likely to be adversely affected;
(c) buildings/structures on shallow or unknown footings to 150 metres from the edge of tunnelling works near the Sir John Young Crescent exit or the western portals unless otherwise determined following geotechnical and vibration analysis as certified by a qualified geotechnical engineer as not likely to be adversely affected; and,
(d) the sandstone walls around the perimeter of Hyde Park and along Sir John Young Crescent.

109. Geotechnical and vibration analysis shall be undertaken to assess where there is a potential for damage to each of the following buildings:

Town Hall Station, Town Hall House, York Street car park, Genting Centre, Australian Museum, The Citibank Tower/Park Plaza, Eastern Distributor tollway, Terrace Towers (80 William Street), Westfield Towers (100 William Street), Olivetti (140 William Street), Columbus Line (150 -162 William Street), Crown Garden Apartments (Riley Street), Darling Harbour Park Royal Hotel, Darling Park/Nestle Building, Oakford Development, Millennium Towers, and St Andrews Development (51 Druitt Street).

Where the analysis indicates impacts may occur, building surveys shall be undertaken.

110. The Proponent shall advise all property owners of buildings to be surveyed, as defined in Condition 108, what the survey will entail and of the process for making a claim regarding property damage prior the commencement of building condition surveys. A copy of the survey shall be given to each affected owner. A register of all properties surveyed shall be maintained by the Proponent and provided to the Director-General upon request.

111. The Proponent shall ensure that the acquisition of any land shall be in a responsive and sensitive

manner and in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991*. The Proponent shall consult affected landowners prior to and during the property acquisition process. Where compensation is payable the Proponent shall pay for independent valuation and legal advice if so requested.

Construction

112. Prior to substantial construction commencement, the Proponent shall establish an Independent Property Impact Assessment Panel to be approved by the Director-General. Either the affected property owner or the Proponent may refer any unresolved disputes arising from potential and/or actual property impacts to the Panel for resolution. All costs incurred in establishing and implementing the Panel shall be borne by the Proponent.

113. Prior to the placement of appropriate permanent rock anchors, the Proponent shall notify the owners of all affected properties outside the existing boundary identified in relevant LEPs requiring developments to be referred to the RTA (as of the date of the EIS exhibition), of the need for placement of permanent rock anchors. The Proponent shall provide sufficient detail to each owner to enable the precise location of such anchors relative to existing buildings to be determined. The Proponent shall ensure if necessary, adjustments to construction methods, at no cost to the property owner, to ensure that the placement of any rock anchors or other such construction stage measure does not impose any restrictions on potential development of the affected property unless otherwise agreed by the landowner or where acquisition of easement(s) is undertaken in accordance with the *Land Acquisition (Just Terms) Compensation Act 1991*.

114. Prior to the placement of appropriate temporary soil anchors the Proponent shall notify all affected property owners of the need for placement of temporary soil anchors and shall provide sufficient detail to determine the precise location of such anchors relative to existing buildings. The Proponent shall instigate, if necessary, adjustments to construction methods at no cost to the property owner, to ensure that the placement of any temporary soil anchors or other such construction stage measure does not impose any restrictions on development (existing or proposed) unless otherwise agreed to by the landowner.

115. Once tunnel construction is complete all temporary soil anchors shall be disconnected and made obsolete and no restrictions shall be placed on the use of the land.

116. The Proponent shall notify the owner of any property that is to be adjusted, acquired or from which an easement is to be obtained. This notice shall contain sufficient details to identify the land of interest being adjusted/acquired and is to include dimensions, location with respect to boundaries and any other information necessary to enable the identification of the land in relation to the development. This notification shall be given in adequate advanced time prior to access for construction purposes.

117. Any temporary access road(s) shall be removed and any affected areas reinstated to the reasonable satisfaction of the relevant council and/or landowner when no longer required.

118. Any damage to buildings, structures, lawns, trees, sheds, gardens etc.) shall be fully rectified by the Proponent at no cost to the owner(s). Construction activities undertaken within private property shall be sympathetic to the specific needs of individual property owners particularly in terms of requirements for temporary facilities such as fencing, access to footpaths/ driveways/garages etc.

119. The Proponent shall ensure that the demolition of any structures is carried out only by specialist employees and/or contractors who hold any necessary licences to carry out such works.

Operation

120. The Proponent shall consult with the CCS and SSCC regarding amendments to statutory planning controls to ensure an appropriate notification process is placed on future buildings and development modifications (as defined under Section 96(2) of the EP&A Act) in the zone of influence of the tunnel consistent with the provisions of State Environmental Planning Policy (SEPP) No 63 - Major Transport Projects. The Proponent and the relevant Councils shall agree on criteria for establishing those properties that have a claim for a development right prior to the gazettal of SEPP 63. These criteria may include: lodgement or approval of a development application, preparation of development plans or prospectus' or other evidence of development plans which were evident prior to the gazettal of SEPP 63. Those properties that meet this criteria shall be considered for acquisition of easements in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991*.

Noise and Vibration

Construction Noise and Vibration Management Sub Plan

121. A detailed Construction Noise and Vibration Management Sub Plan shall be prepared as part of the Construction Framework EMP in consultation with the relevant government agencies, Council(s) and the CLGs. The Sub Plan shall provide details of noise and vibration control measures to be undertaken during the construction and operation stages, sufficient to address the technical requirements for any EPA approvals/licences. The Sub Plan shall include, but not be limited to:

(a) tests for ascertaining acoustic parameters;
(b) identification of sensitive receivers particularly residents and sensitive equipment.
(c) identification of all noise and vibration generating tasks, duration and predicted airborne noise and vibration levels;
(d) Impacts from site compounds/construction depots;
(e) location, type and timing of erection of temporary and permanent noise barriers and/or other noise and vibration mitigation measures;
(f) specific physical and managerial measures for controlling noise and vibration demonstrating how activities would be managed so that relevant EPA guidelines and the conditions of approval are complied with;
(g) a pro-active and reactive strategy for dealing with complaints including compliance with Condition 8, particularly with regard to verbal and written responses;
(h) the need for respite periods;
(i) noise and vibration monitoring, reporting and response procedures;
(j) internal audits of compliance of all plant and equipment
(k) construction timetabling, in particular works outside standard hours, to minimise noise impacts;
(l) procedures for notifying residents of construction activities likely to affect their noise and vibration amenity;
(m) contingency plans to be implemented in the event of non-compliances and/or noise complaints; and,
(n) the urban design issues relating to noise and vibration control measures.

With respect to d) above, the Proponent shall consider the use of a range of structural and non-structural measures during construction including barriers, acoustic treatment of residences, scheduling of construction activities to minimise impacts and temporary relocation of affected residents.

Construction Hours

122. All construction activities, including transportation of spoil, shall be restricted to the hours of 7:00 am to 6:00 pm (Monday to Friday); 8:00 am to 1:00 pm (Saturday) and at no time on Sundays and public holidays.

Works outside these hours that may be permitted include:

(a) any works which do not cause noise emissions to be audible at any nearby residential property;
(b) the delivery of materials which is required outside these hours as requested by Police or other authorities for safety reasons;
(c) emergency work to avoid the loss of lives, property and/or to prevent environmental harm;
(d) tunnel excavation and other sub-surface activities providing the criteria in Conditions 123 and 125 can be met; and
(e) any other work as agreed by the EPA through the Construction Noise and Vibration Management Sub Plan Process provided local residents are informed of the timing and duration at least 48 hours prior to commencement of the work .

Construction Noise Criteria

123. The Proponent shall ensure that noise from construction activities is limited to the L_{10} level measured over a period of not less than 15 minutes not exceeding the background level by more than 5dB(A) at any residence or other sensitive receiver unless specified in the Construction Noise Impact Statement prepared in accordance with Condition 124.

For the purposes of the noise criteria for this condition, 5dB(A) must be added to the measured level if the noise from the activity is substantially tonal or impulsive in nature in accordance with Chapter 4 of the *NSW Industrial Noise Policy*.

Construction Noise Impact Statements

124. Specific Construction Noise Impact Statements shall be prepared in consultation with relevant government agencies, relevant Councils, CLGs for specific stages of construction consistent with the Construction Noise and Vibration Management Sub Plan and the relevant CMS and shall specifically address each of the major construction sites. The statements shall include:

(a) a description of the proposed processes and activities;
(b) assessment of potential noise from the proposed construction methods including noise from construction vehicles and noise impacts from required traffic diversions;
(c) examination of alternative methods that would potentially reduce noise if the potential noise exceeds the relevant criteria;
(d) description and commitment to work practices which limit noise;
(e) description of specific noise mitigation treatments and time restrictions including respite periods, duration, and frequency (where possible programming of night works over consecutive nights in the same locality shall be avoided);

(f) justification for any activities outside the normal hours specified in Condition 122;
(g) extent of noise monitoring;
(h) internal noise audit systems including recording of daily hours of construction, progressive impact assessments as the work proceeds, conducting informal checks by the EMR, providing active and continuous communication links to relevant Councils, residents etc; ,
(i) community consultation and notification;
(j) all reasonable and feasible measures including adopting the least noisy available construction methods, systems and equipment;
(k) assessment and examination of potential reasonable and feasible offsite mitigation measures for traffic noise; and,
(l) additional noise mitigation measures as successfully negotiated with affected residents and other sensitive receptors.

Regenerated Noise Criteria

125. Regenerated noise from construction works shall not exceed the following criteria as measured at the nearest sensitive receptor:

(a) 40 dBA between the hours of 6:00 pm and 10:00 pm; and
(b) 35 dBA between the hours of 10:00 pm and 7:00 am.

Construction Noise Management

126. The Proponent shall where reasonable and feasible apply best practice innovative noise mitigation measures including:

(a) maximising the offset distance between noisy plant items and nearby noise sensitive receivers;
(b) avoiding the co-incidence of noisy plant working simultaneously close together and adjacent to sensitive receivers;
(c) minimising consecutive night time works in the same locality;
(d) orienting equipment away from sensitive areas;
(e) carrying out loading and unloading away from noise sensitive areas; and,
(f) selecting site access points and roads as far as possible away from sensitive receivers.

127. Construction noise levels shall be monitored to verify compliance with the Construction Noise and Vibration Management Sub Plan. Should monitoring indicate exceedances of the Construction Noise and Vibration Management Sub Plan, the Proponent shall consult with the EPA and implement best available additional mitigation measures to the satisfaction of the EPA.

128. The Proponent shall ensure that rock breaking, rock hammering, sheet piling and any other activities at or near ground level which result in impulsive or tonal noise generation are only scheduled between the following hours unless otherwise permitted under the EPA environment protection licence:

(a) 8 am to 12 pm, Monday to Saturday; and
(b) 2 pm to 5 pm Monday to Friday.

Where these activities are undertaken for a continuous three hour periods and are audible to noise sensitive receptors, a minimum respite period of at least one hour shall be scheduled before

activities re-commence.

129. The Proponent shall consult with SCEGGS and other affected schools and ensure that noise generating construction works in the vicinity of affected school buildings are not time tabled during examination periods, unless other arrangements acceptable to the affected schools are made at no cost to the affected schools.

130. The Proponent shall consult with the Australian Museum and develop appropriate noise and vibration criteria in consultation with the EPA and to the satisfaction of the Director-General, to ensure that noise, vibration and regenerated noise works in the vicinity of the Australian Museum do not result in any adverse impacts on its collection or sensitive scientific equipment.

131. The Proponent shall ensure that no public address systems are used at any construction sites outside the standard working hours detailed in Condition 122. Any public address system shall be designed and installed with their pointing axis directed away from residential buildings and sensitive receptors unless otherwise specified in the Construction Noise Impact Statement referred to in Condition 124.

132. In order to minimise noise impacts during construction, the Proponent shall consult with relevant Council(s) and where reasonable and feasible, erect operational noise mitigation measures prior to the commencement of construction.

133. Prior to the commencement of use of the southern Palmer Street Site compound (site 4 as identified in Figure 7.3.23 in the Representations Report) for construction, the Proponent shall in consultation with the Department of Housing and South Sydney City Council erect a permanent masonry wall for noise mitigation on the southern boundary of 169 Bourke Street, at least up to the height of the gutter line of the terrace housing unless otherwise agreed by the Department of Housing.

134. The additional Palmer Street site compounds (sites 2, 3A and 3B as identified in Figure 7.3.23 in the Representations Report) shall only be used for light activities (including administration/office purposes etc) with minimal night time activities.

135. The Proponent shall use only dampened rock hammers and/or "city" rock hammers to minimise the impacts associated with rock-breaking works.

136. The Proponent shall not undertake any excavation using rock hammers below ground during the night time (10pm to 7am).

137. The Proponent shall investigate and apply all reasonable and feasible noise source controls to reduce noise from all plant and equipment including bulldozers, cranes, graders, excavators and trucks. Examples of appropriate noise source controls could include efficient silencers, low noise mufflers and alternatives to reversing alarms.

138. The Proponent shall ensure that all entry and departure of heavy vehicles to and from the site are restricted to the standard daytime construction limitations as specified in Condition 122.

139. The Proponent shall ensure that the noisiest activities associated with night time works are scheduled wherever possible to be completed before midnight.

Blasting

140. Should blasting be required, the Proponent shall prepare a Blast Management Strategy in consultation with the EPA and incorporate this Strategy into the Construction Noise and Vibration Management Sub Plan. The Strategy shall be prepared with an aim to demonstrate that all blasting and associated activities will be undertaken in a manner that will not generate unacceptable noise and vibration impacts or pose a significant risk impact to residences and sensitive receptors. The Strategy shall also address the principles outlined in the Department's publications *Hazardous Industry Planning Advisory Paper No.6 - Guidelines for Hazard Analysis* and *Multi-Level Risk Assessment* for the handling and storage of hazardous materials. Issues to be considered in the Strategy shall include, but not necessarily be limited to:

    (a) details of blasting to be performed, including location, method and justification of the need to blast;
    (b) identification of any potentially affected noise and vibration sensitive sites including heritage buildings and utilities;
    (c) establishment of appropriate criteria for blast overpressure and ground vibration levels at each category of noise sensitive site;
    (d) details of the storage and handling arrangements for explosive materials and the proposed transport of those materials to the construction site;
    (e) identification of hazardous situations that may arise from the storage and handling of explosives, the blasting process and recovery of the blast site after detonation of the explosives;
    (f) determination of potential noise and vibration and risk impacts from blasting and appropriate best management practices;
    (g) community consultation procedure including consultation with the Australian Museum, Rail Infrastructure Corporation

141. The vibration level due to blasting activities, including both above ground and underground work, shall meet the requirements of the EPA as specified in its Licence.

    The guideline entitled "*Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration*" prepared by the Australian and New Zealand Environment and Conservation Council (ANZECC) shall be applicable.

142. Blasting shall only be undertaken between the hours of 10:00 am and 3:00 pm (Monday to Friday) and 10:00 am to 1:00 pm on Saturdays and at no time on Sundays or Public Holidays, unless otherwise agreed by the EPA through the Construction Noise and Vibration Management Sub Plan Process.

143. Blasts shall be limited to one single detonation in any one day, unless otherwise agreed by the EPA through the Construction Noise and Vibration Management Sub Plan Process.

144. For any section of the tunnel construction where blasting is proposed, a series of initial trials at reduced scale must be conducted prior to production blasting to determine site-specific blast response characteristics and to define allowable blast sizes to meet ANZECC guidelines.

145. Air blast control doors shall be erected at tunnel portals to reduce air blast emissions from blasting in the tunnels, until tunnel construction has advanced to a stage where emission levels without the doors comply with ANZECC limits.

Vibration Criteria

146. The Proponent shall ensure that vibration resulting from construction of the project is limited to:

(a) German Standard DIN 4150 and BS 7385: Part 2 – 1993 for structural damage vibration; and,
(b) British Standard BS 6472 and AS2670 for human exposure to vibration.

Where there is an inconsistency between these standards, the more stringent criteria shall apply.

147. Unless otherwise agreed by the Director-General, following consultation with the EPA, vibration levels shall not exceed 3 mm/s at the building foundation of heritage buildings and sensitive structures.

148. Prior to commencement of construction activities likely to result in high vibration levels, the Proponent shall identify potential highly sensitive facilities, including scientific equipment, measuring equipment, printing press and the like where the criteria in Condition 147 may not be adequate. Should such cases arise the Proponent shall consult with the potentially affected owners and develop appropriate mitigation measures to ensure impacts are acceptable.

Vibration Management

149. The Proponent shall ensure that wherever practical, piling activities are completed using bored piles. If driven piles are required they shall only be installed as agreed through the environment protection licensing process with the EPA.

Operational Noise Management Sub Plan

150. A detailed Operational Noise Management Sub Plan shall be prepared as part of the Operational EMP, to the satisfaction of the Director-General. The Sub Plan shall provide details of noise and vibration control measures to be undertaken during the operation stages, sufficient to address the technical requirements of the EPA, and generally in accordance with the NSW's *Environmental Criteria for Road Traffic Noise* and the NSW *Industrial Noise Policy*. The Sub Plan shall include, but not be limited to:

(a) tests for ascertaining acoustic parameters;
(b) predicted noise levels;
(c) location, type and timing of erection of permanent noise barriers and/or other noise mitigation measures demonstrating best practice including silencers and building treatments for associated plant rooms and enclosures for exposed plant;
(d) specific physical and managerial measures for controlling noise;
(e) noise monitoring, reporting and response procedures including the monitoring on surrounding roads which experience significantly increased traffic volumes as a result of the CCT; and
(f) the urban design issues relating to noise control measures.

Operational Noise Management

151. The Proponent shall ensure that noise emanating from the tunnel ventilation system does not exceed the noise limits specified in Table 6 below.

Table 6

Location	Period	Intrusive Noise Criteria $L_{Aeq\ (15\ minute)}$ (dB(A))	Amenity Noise Criteria $L_{Aeq\ (Period)}$ (dB(A))
Millennium Tower (façade of most affected sensitive receiver)	Day Evening Night	62 59 54	59 57 53
Park Royal Hotel (façade of most sensitive affected receiver)	Day Evening Night	62 59 54	61 61 59

Daytime shall be defined as the period from 7am to 6pm Monday to Saturday and 8am to 6pm Sundays and Public Holidays. Evening is defined as the period from 6pm to 10 pm. Nighttime is defined as the period 10pm to 7am Monday to Saturday and 10pm to 8 am Sundays and Public Holidays.

152. Monitoring of operational noise shall be undertaken in accordance with the Operational Noise Management Sub Plan. The Proponent shall, in consultation with the EPA, assess the adequacy of the traffic noise and ventilation noise mitigation measures after one year of opening the tunnel with regard to the criteria specified in the Operational Noise Management Sub Plan. Should assessment indicate a clear trend in traffic noise levels on surrounding roads which exceed Operational Noise Management Sub Plan defined noise design goals as approved by the EPA, the Proponent shall implement further reasonable and feasible mitigation measures in consultation with affected landowners and/or occupiers.

Settlement

Settlement Analysis

153. A detailed geotechnical model of representative geological conditions shall be prepared prior to construction commencement to identify and include significant geological structures. This model shall also include full details of existing and currently proposed excavations near the western portal. The model shall also identify basements and other sub-surface structures which may be impacted by the project. The Proponent shall use this model to assess the predicted settlement and horizontal strain profiles caused by tunnelling, with particular regard to be given to the western portal and Sir John Young Crescent.

154. Should the geotechnical model in Condition 153 indicate that exceedances of the criteria in Table 6 are likely, the Proponent shall implement mitigation measures such as appropriate support and stabilisation structures in consultation with the relevant land and/or infrastructure owners prior to the commencement of construction to ensure where possible that underground services, infrastructure and adjacent buildings will not experience settlements exceeding the criteria in Table 7.

Table 7 Settlement Criteria for Specific Structures

Beneath Structure/Facility	Maximum Settlement	Maximum Angular Distortion
Buildings - Low or non sensitive buildings (i.e. ≤ 2 levels and carparks). - High or sensitive buildings (i.e. ≥ 3 levels and heritage buildings).	30 mm 20 mm	1 in 350 1 in 500
Roads and Parking areas	40 mm	1 in 250
Parks	50 mm	1 in 250
Identified Utilities	to be determined by the relevant authorities	to be determined by the relevant authorities

The above criteria shall not remove any responsibility from the Proponent for the protection of existing structures or for rectifying any damages resulting from the project.

155. Settlement criteria for individual sensitive utility structures including SWC services (i.e. brick sewers), gas, electricity and telecommunication services, shall be determined in consultation with the relevant authorities prior to the commencement of construction.

Management

156. The Proponent shall install and monitor inclinometers and settlement monuments along the tunnel route throughout the construction period and for a period of not less than 6 months after settlement has stabilised with particular reference to risk areas identified in the building condition surveys required by Condition 108 and/or the geotechnical analysis required by Condition 153. If monitoring during construction indicates exceedance of the criteria then all work affecting settlement shall cease immediately and shall not resume until fully rectified or a revised method of work has been established that will ensure protection of affected structures.

Operation

157. The Proponent shall monitor settlement for any period as may be specified through the Independent Property Impact Assessment Panel referred to in Condition 112. The results of this monitoring shall be made available to the Director-General upon request.

Groundwater

Dewatering Analysis

158. A detailed settlement study specific to construction stage dewatering within the alluvium and fill areas and all areas detailed for further assessment in Section 6.1.1 of Table 8.1 in the Representations Report shall be conducted to the satisfaction of DLWC to determine the potential extent of settlement and whether structures need to be protected through reinjection, grouting etc.

Groundwater Management Sub Plan

159. A detailed Groundwater Management Sub Plan shall be prepared to meet the requirements of DLWC and the EPA and incorporated into the Construction Framework and Operation EMPs. The

Sub Plan shall cover the complete proposal and shall provide details of groundwater control measures to be undertaken during both the construction and operation stages respectively and include but not be limited to:

(a) impacts on nearby structures from potential settlement;
(b) groundwater inflow control, handling, treatment and disposal of contaminated groundwater;
(c) pre-construction and construction monitoring in accordance with the NSW EPA *Contaminated Sites: Sampling Design Guidelines* (NSW Environment Protection Authority 1995) to identify elevated concentrations of contaminants;
(d) auditing; and,
(e) procedures for mitigation through reinjection, grouting etc identified in the dewatering analysis required by Condition 158, including:

(i) detailed community consultation procedures;
(ii) identification of sensitive structures requiring reinjection;
(iii) identification of borehole spacing, borehole design, injection pipework, monitoring pipework and general system design and redevelopment; and,
(iv) a detailed monitoring plan identifying piezometers locations and standards, construction details, monitoring frequency and analysis requirements; and
(v) maximum allowable groundwater inflow.

Pre-Construction

160. Pre-construction groundwater quality monitoring shall be undertaken from the 50 mm piezometer network referred to in Condition 161.

Construction Stage Dewatering

161. The groundwater monitoring system shall comprise a mix of standpipe piezometers installed by direct push techniques and 50mm piezometers installed by conventional drilling. Slim piezometers shall also be used to monitor groundwater levels at identified vulnerable structures and a selection of the 50mm piezometers shall be fitted with transducers and data loggers for continuous groundwater level monitoring to the satisfaction of DLWC. Fortnightly monitoring shall take place for the duration of construction.

162. Licensable groundwater works shall only be undertaken by drilling contractors who hold a current Drillers Licence issued by DLWC with appropriate endorsement for the nature of the work required.

163. A conventional spear point system shall be used to the satisfaction of DLWC for areas of the excavation where risks to structures are high and where it is desirable to install the system before excavation begins or desirable to locate the system outside the excavation for other reasons.

Operation Stage

164. The Proponent shall take practicable measures to limit operational groundwater inflows to 1 litre/second/kilometre.

165. The Proponent shall ensure that groundwater quality is monitored monthly for a period of at least one year after commissioning of the project or any other such period as required by the Director-General. Seepage, spillages, contaminated water, tunnel washing, fire fighting or other water in the

tunnel which contains pollutant levels above the background concentrations of natural discharge points shall be directed into separate sumps with pump out facilities. This water shall not be discharged to the stormwater system.

Urban Design and Landscaping

Urban Design and Landscape Plans

166. A detailed Urban Design and Landscape Plan for the entire proposal shall be prepared in consultation with relevant Councils, SHFA, Sydney Buses, Australian Museum, NSW Heritage Office, Royal Botanic Gardens, the Domain Trust and other relevant authorities and to the satisfaction of the Director-General prior to construction of project elements subject to urban design considerations. The Plan shall be prepared by a suitably qualified urban designer. The Plan shall present an integrated urban design proposal, applying all design principles established in EIS Technical Paper No. 6.

The Plan shall include plans prepared according to appropriate precincts and addressing the entire surface work component of the project. The precincts shall include:

(a) Kings Cross tunnel precinct, including the Kings Cross "lid";
(b) William Street/East Sydney including the Eastern Distributor/Cross City Tunnel loop;
(c) The Domain;
(d) Park Street/Hyde Park;
(e) Park Street/CBD;
(f) Darling Harbour; and
(g) any other precinct requiring urban design consideration.

The Plan shall include, but not be limited to:

(a) built elements including tunnel portals, bridges and other structures, retaining walls, noise walls, toll infrastructure, control buildings, substations;
(b) motorway and road furniture including safety barriers, kerbs, paving, signage, lighting, medians, emergency phones and breakdown facilities;
(c) pedestrian and cycle elements including footpaths and paving, pedestrian crossings, street furniture and fixtures (i.e. tree guards, seating, lighting, fencing and signage);
(d) landscape elements including proposed treatments, finishes and materials of exposed surfaces (including colour specifications and samples);
(e) proposals for community art to be integrated into the project;
(f) timing and staging of works, methodology, monitoring and maintenance;
(g) impacts on bus stop operations and passenger access;
(h) identification of the species and location of trees to be planted, which would encourage planting of native species that would have existed in the CBD prior to European settlement or matching of existing species;
(i) consideration of potential relocation of the Museum entrance to William Street and maximising benefits from possible road narrowing;
(j) after considering traffic safety implications, include a substantial program of tree planting along the widened footpaths of William Street and landscaping of the following areas:
    (i) adjacent to tunnel portals;
    (ii) Park Street between College and Elizabeth Streets;
    (iii) Harbour Street between the tunnel entry portal and Wheat Road;

(iv) corner of Sussex and Druitt Streets;
(v) area between Harbour, Day and Bathurst Streets;
(vi) Palmer Street between Stanley Street and Robinson Street;
(vii) Sir John Young Crescent near the tunnel exit portal;
(viii) disturbed areas of the Domain; and
(ix) in front of the Park Royal Hotel, following consultation with the Hotel;

The Plan(s) shall consist of a report with accompanying annotated plans, sections and perspective sketches, photo montages and other illustrative material at a scale and level of detail which is adequate to convey the proposal.

167. The final external design, materials and finish of the ventilation stack shall undertaken in consultation with the AQCCC, the CCS and SHFA and approved by the Director-General

168. The urban design and landscaping strategy for William Street required as part of the Urban Design and Landscape Plan shall be specifically prepared in such a manner as to:

(a) if adopted by SSCC, give consideration to incorporating the relevant outcomes of the William Street Revitalisation Strategy ;
(b) undertake further consultation with resident, community and business groups regarding the final design of the Kings Cross "lid".

Specific Urban Design Aspects

169. All construction hoardings, noise walls and fences shall be painted in a consistent colour scheme with bold and informative graphics. The SHFA shall be consulted in relation to the visual impact of hoardings, noise walls and fences on land within and immediately adjacent to the Authority's land.

170. Where practicable, directional signs for the Cross City Tunnel shall be accommodated on existing signage.

171. No advertising shall be permitted within the lease area for the CCT during construction or when in operation.

172. The Proponent shall ensure that all Plane Trees along William Street are retained. Should any be removed they shall be replaced with specimens of equal height where-ever possible or at least 200 litre size or other alternatives as agreed by SSCC.

173. The Proponent shall prepare a report for approval by the Director-General for the installation of electronic tolling facilities within or at least flush with the batter above the portal areas or other means to avoid the erection of gantries separate from the tunnel.

174. Prior to implementation, the Proponent shall consult further with the CCS with respect to urban design and amenity issues relating to variable message signs VMS 8, VMS 9 and VMS 10. In the case of any disputes, the matter shall be referred to the Director-General for resolution, following consultation with the PTC.

Indigenous and Non-Indigenous Heritage

Heritage and Archaeology Management Sub Plan

175. As part of the Construction Framework and Operational EMPs, the Proponent shall prepare and Implement a Heritage and Archaeology Management Sub Plan in consultation with the Royal Botanic Gardens and Domain Trust, NSW Heritage Office and relevant Councils to manage heritage items and archaeological resources located within the impact zone of the project. The Sub Plan shall include:

    (a) identification of all heritage properties including all those listed in Table 8.1 (Section 6.1.1) of the Representations Report plus any additional heritage properties as required by CCS, SSSC and the Heritage Office at the time of construction commencement;
    (b) an assessment of the significance of effects on heritage and archaeological items including demolition, relocation, removal, damage and physical intrusion into conservation areas;
    (c) a Research Design strategy that would evaluate the research potential of archaeological resources and set out in detail the methodology to be used in archaeological excavation;
    (d) Conservation Management Strategies for all heritage items impacted by the proposal;
    (e) an Excavation Protocol including provision for detailed archaeological investigations where initial investigations or research identify items of archaeological significance; and
    (f) a Contingency Protocol to be implemented in the event of discovery of relics including provision for significance assessment, consideration of management options and, where destruction or removal is proposed documentation and recording for archival purposes in accordance with *How to Prepare Archival Records of Heritage Items* and *Guidelines for Photographic Recording of Heritage Sites, Buildings and Structures* (DUAP/NSW Heritage Council).

Management

176. The Proponent shall ensure that the requirements of the Heritage and Archaeology Management Sub Plan are co-ordinated with the CMSs required by Condition 18.

177. The sandstone wall on the boundary of the Domain shall be retained for the full length of Sir John Young Crescent between Crown and Palmer Streets.

178. The gateway and the gate piers in the Domain at the corner of Palmer Street and Sir John Young Crescent shall be retained unless otherwise agreed through the process of preparing the Heritage and Archaeology Management Sub Plan.

179. The Proponent shall ensure that all employees and subcontractors are appropriately trained on the obligations for heritage conservation under the NSW Heritage Act.

Unexpected Items

180. If during the course of construction the Proponent becomes aware of any heritage items or archaeological material, all work likely to affect the site(s) shall cease immediately and the relevant authorities, including NPWS, NSW Heritage Council and/or the relevant Local Aboriginal Land Council(s) shall be consulted to determine an appropriate course of action prior to the re-commencement of work at that site. Appropriate supporting documentation would need to accompany any application for required permit/consent(s).

Water Management

Construction Water Management Sub Plan

181. As part of the Construction Framework EMP, a detailed Construction Water Management Sub Plan shall be prepared in consultation with the EPA, DLWC, and relevant councils. The Sub Plan shall be prepared in accordance with the Department of Housing's guideline *Managing Urban Stormwater - Soils and Construction* to manage the cumulative impacts of the development on the quality and quantity of surface and groundwater, including stormwater in storage, sedimentation dams and flooding impacts. The Sub Plan shall contain, but not be limited to:

    (a) preparation of a catchment analysis in consultation with the relevant Councils and Sydney Water to determine the capacity of existing drainage systems and capacity, changes resulting from the construction of the proposal and implications of pumping load and detention requirements;
    (b) details of short and long term measures to be employed to minimise soil erosion and the discharge of sediment to land and/or waters including the exact locations and capacities of sedimentation basins;
    (c) identification of all potential sources of water pollution and a detailed description of the remedial action to be taken or management systems to be implemented to minimise emissions of these pollutants from all sources within the subject site;
    (d) measures to handle and dispose of stormwater; effluent and contaminated water and soil;
    (e) measures for the use of water reclaimed or recycled on-site;
    (f) detailed description of water quality monitoring to be undertaken including base line monitoring, identification of locations where monitoring would be carried out and procedures for analysing the degree of contamination of potentially contaminated water;
    (g) contingency plans to be implemented in the event of fuel spills or turbid water discharge from the site; and,
    (h) program for reporting on the effectiveness of the sediment and erosion control system against performance goals.

182. The Construction Water Management Sub Plan shall incorporate detailed erosion and sedimentation controls which shall be prepared to the satisfaction of DLWC and in consultation with the EPA and sufficient to address the technical requirements for obtaining the relevant EPA licence.

Pre-Construction

183. The Proponent shall ensure that the construction and operational tunnel water management systems are designed and implemented to include the management measures and meet the performance objectives specified in Section 7.1.1, 7.1.2 and 7.3.1 of Table 8.1 of the Representations Report unless otherwise agreed through the preparation of the Construction Water Management Sub-Plan.

184. Prior to finalisation of detailed drainage design, the Proponent shall undertake the additional hydrological studies recommended in Technical Paper No. 11 and incorporate all required management measures into the final drainage design. As a minimum the tunnel drainage design must provide capacity to deal with at least a 100 year ARI storm for tunnel carriageway and ramp approaches. The Proponent shall also consider in consultation with DLWC the implications of a PMF event in accordance with the *NSW Flood Control Manual*.

185. The Proponent shall undertake pre-construction water quality monitoring included in the

Construction Water Management Sub-Plan for a period of at least three months duration prior to substantial construction commencement.

186. The Proponent shall prepare plans for site specific drainage and water quality management measures for the additional site compound on Palmer Street and design changes to the Western Portal detailed in the Representations Report in consultation with the DLWC and incorporate these plans into the relevant Construction Method Statement required by Condition 18.

Construction

187. The Proponent shall ensure that all appropriate soil and erosion and sediment control works are completed and in place prior to the commencement of any works that may have the potential to generate soil erosion or sediment. Erosion and sediment protection measures shall also be in place before the commencement of any stockpiling activities.

188. All surface water flows from construction sites shall be detained through appropriate measures to ensure that there is no exacerbation of existing flooding to the satisfaction of DLWC. Agreement shall be reached with the relevant Councils on appropriate and specific measures to be implemented at various locations.

189. All water collected during construction, including water drained from tunnel excavations (portal entry, groundwater influx) and from dewatering of major cuts, which is likely to be contaminated shall be tested, treated, handled and disposed of to the satisfaction of the EPA.

190. No disposal of water shall be allowed to the sewer or the storm-water system without prior agreement from Sydney Water and the relevant Council(s) as applicable.

Acid Sulfate Soils

191. The Proponent shall ensure that tests are carried out in advance of excavation to test for the presence of acid sulfate soils in all areas to be disturbed by the proposal. Such tests shall be undertaken in accordance with a strategy prepared to the satisfaction of DLWC and in consultation with the EPA.

192. A detailed Acid Sulfate Soil Management Sub Plan shall be prepared in consultation with EPA and to the satisfaction of the DLWC and incorporated into the Construction Framework EMP. The Sub Plan shall include reference to the water quality monitoring program contained in the Construction Water Management Sub Plan. The ASS Sub Plan shall be prepared in accordance with the Acid Sulfate Soils Manual (ASSMC, 1998). As part of the ASS Sub Plan, a Contingency Plan to deal with the unexpected discovery of actual or potential acid sulfate soils shall be prepared.

Operational Storm Water Management

193. As part of the Operation EMP a detailed Operational Stormwater Management Sub Plan shall be prepared in consultation with EPA, DLWC, SWC, SHFA and the relevant Councils to the satisfaction of the Director-General. The Sub Plan shall provide details on catchment analysis (including localised flooding as recognised by the relevant local Councils), existing drainage systems and capacity, drainage changes resulting from the proposal and implications for the system including total pumping load to drainage systems, detention requirements, possible reuse of wastewater, and the associated environmental impacts.

194. All operational stormwater and wastewater systems of the proposal shall be designed, constructed, operated and maintained to meet the requirements of the relevant authorities including EPA, SWC and relevant Councils.

195. Provision shall be made for retention and treatment of fire water in accordance with the Government's Best Practice Guidelines for Contaminated Water Retention and Treatment Systems.

Spoil and Waste Management

Spoil Disposal

196. As part of the Construction Framework EMP, the Proponent shall prepare a Spoil Management Sub Plan in consultation with the EPA, SHFA and relevant Council(s). This Sub Plan shall identify how spoil would be handled, stockpiled, reused and disposed. The Sub Plan shall be prepared before the commencement of construction at relevant sites and address issues of dust mitigation, drainage, disturbance and contaminated material (including procedures for dealing with the unanticipated discovery of contaminated material during the course of construction), noise and local amenity. The Proponent shall ensure that this Sub Plan is fully integrated with the Transport Management Plans.

    As part of the Sub Plan the Proponent shall investigate options for the barging of spoil in consultation with relevant industry and relevant waterway authorities.

197. Prior to excavation, the Proponent shall undertake a detailed geotechnical/soil analysis assessment to ascertain the potential of excavated material to be used for construction or other such higher value purpose. The Proponent shall encourage and maximise the beneficial use of all excavated material where reasonable and feasible.

198. Prior to commencement of construction at various relevant sites where spoil is to be generated the Proponent shall ensure that the EPA and any other relevant authority is provided with the details of the locations where spoil will be disposed. The Proponent shall also assess the environmental impacts of the disposal in accordance with the EP&A Act and obtain any necessary approvals.

199. The Proponent shall ensure that all clean and/or treated spoil shall be reused or recycled where possible. In particular the EMR shall certify that:

    (a) use of spoil generated from construction activities is maximised in preference to any import of fill; and
    (b) where reasonable and feasible all clean excavated natural material is either reused on the project or otherwise made available for reuse elsewhere in preference to disposal to landfill.

Contamination

200. The Proponent shall prepare a Contamination Investigation Report to the satisfaction of the EPA as part of the Spoil Management Sub Plan to determine the nature, extent and degree of contamination. The Report shall detail the results of site investigations and the assessment of potential risks posed by contaminants to health and the environment and indicate whether remediation is required.

201. Should the Contamination Investigation Report required by Condition 200 indicate that remediation is necessary to reduce or remove risks posed by contaminants in particular locations, then the Proponent shall remediate the land in accordance with a Remedial Action Plan which shall be incorporated into the relevant CMS(s) required by Condition 18. The Plan(s) shall be prepared in consultation with relevant Council(s) and to the satisfaction of the EPA.

202. In the event of discovery of previously unidentified area(s) of potentially contaminated material, the Proponent shall cease work in the vicinity of the discovery and not commence work until the extent of contamination has been assessed and if necessary a Remedial Action Plan has been prepared and implemented in accordance with Condition 201.

203. Disposal of any contaminated material shall only be to a landfill approved by the EPA.

204. Dilution of contaminated spoil with clean spoil shall not be undertaken, unless otherwise approved by an EPA accredited contaminated site auditor.

205. The Proponent shall ensure that the cost of treatment of any contaminated spoil on-site for reuse is investigated, and if cost effective, implemented to the satisfaction of an EPA accredited contaminated site auditor, prior to commencement of spoil disposal.

Waste Management and Recycling

206. As part of the Construction Framework and Operational EMPs and as relevant, a detailed Waste Management and Reuse Sub Plan shall be prepared in consultation with the EPA. The Sub Plan shall address the management of wastes during the construction and operation stages respectively. It shall be prepared prior to construction, and shall identify requirements for:

(a) waste avoidance;
(b) reduction;
(c) reuse; and
(d) recycling,

and provide details of requirements for:

(e) handling;
(f) stockpiling;
(g) disposal of wastes: specifically contaminated soil or water, concrete, demolition material, cleared vegetation, oils, grease, lubricants, sanitary wastes, timber, glass, metal, etc.; and
(h) identifying any site for final disposal of any material and any remedial works required at the disposal site before accepting the material.

This Sub Plan shall include but not be limited to:

(i) methods of management of all waste generated as part of the project;
(ii) an outline of comprehensive plans of action for key waste streams;
(iii) implementation of the waste hierarchy by seeking to avoid waste generation as a priority, the reuse, recycling or reprocessing of waste and, as a last resort, disposal of waste;

(iv) the need for environmental safeguards and the adoption of environmentally sensitive work practices to minimise waste and advance the values of ecologically sustainable development;
(v) arrangements for waste which cannot be re-used, recycled or reprocessed to be disposed of at a licensed waste disposal facility;
(vi) procedures for separating excavation and demolition waste and for identifying destinations for the material;
(vii) procedures for classifying waste in accordance with the EPA's Environmental Guidelines: Assessment, Classification and Management of Liquid and Non-Liquid Wastes;
(viii) installation of segregated bins for recyclable materials and provision for material to be reused or recycled wherever possible;
(ix) except where a sewer is available, the discharge of sewerage from site amenities to holding tanks for removal by tankers;
(x) the provision of rubbish skips at all construction sites and site compounds and their regular removal or emptying;
(xi) ensuring that local roads affected by construction remain intact to reduce the need for new paving materials;
(xii) erecting signs within construction sites and site compounds encouraging employees to reduce, re-use, or recycle wherever possible;
(xiii) the disposal of chemical, fuel and lubricant containers and solid and liquid wastes in accordance with the requirements of the EPA;
(xiv) appropriate induction and training of all employees and sub-contractors in the waste hierarchy and the requirements of this Waste Management and Reuse Sub Plan;
(xv) undertaking regular audits of waste management; and
(xvi) keeping of a waste management register of all significant waste collected from construction sites and site compounds for disposal, including amounts, date and time and details and locations of disposal.

As part of the Sub Plan, an Action Plan shall be prepared to promote the use of recycled materials, including construction and landscape materials. The Plan shall detail how the proposal gives consideration and support to the Government's *Waste Reduction and Purchasing Policy*. The Plan shall also include details on measures to implement energy conservation best practice.

207. The demand for water for construction purposes shall be kept to a minimum. The project shall incorporate water use reduction initiatives including reuse of water and recycling to the maximum extent practicably possible.

Hazards and Risks

Dangerous Goods

208. The Proponent shall not store or handle a quantity of goods defined as dangerous under the Australian Dangerous Goods Code, at any location associated with the CCT, whether during the construction or the operation of the CCT. This Condition does not include explosive materials for blasting and diesel fuel, to which Conditions 140 and 210 apply.

Pre-Construction

209. An Emergency Response Sub Plan shall be prepared as part of the Construction Framework EMP. The Sub Plan shall include, but not be limited to:

(a) the provision of adequate emergency procedures and equipment for the response to and management of any environmental pollution events;
(b) a program for training of all staff;
(c) a protocol for notifying the appropriate authorities in the case of an emergency;
(d) procedures to ensure compliance with all legislative and industry standard requirements for safe handling and storage of hazardous substances; and,
(e) undertaking hazardous activities such as washing out of concrete delivery vehicles, washing down of construction plant etc. only at appropriate locations that have appropriate environmental protection controls.

Construction Hazards

210. The Proponent may seek the approval of the Director-General for the temporary storage of diesel fuel to permit continuous operation of equipment during the construction of the CCT. In seeking the Director-General's approval, the Proponent shall provide:

(a) details of the location(s), stored volume(s) and storage method(s) for the diesel fuel;
(b) the maximum length of time diesel storage will be required;
(c) assessment of the potential environmental and risk impacts associated with the storage of diesel at the locations required; and
(d) details of the mitigation measures proposed to address potential environmental and risk impacts from diesel storage including bunding of storage area(s).

The Proponent shall not locate any quantity of diesel fuel at any location associated with the CCT without the prior written approval of the Director-General. The Proponent shall implement all measures required by the Director-General to mitigate environmental and risk impacts identified through the information listed from (a) to (d) above, within such period as the Director-General may agree.

Note: Diesel fuel is a combustible liquid and not defined as a dangerous good under the Australian Dangerous Goods Code.

211. The Proponent shall prepare and implement a Construction Safety Study for the approval of the Director-General prior to the commencement of construction of the CCT. The Study shall address all safety-related matters relevant to the construction of the CCT and shall be generally in accordance with the principals outlined in the Department's publication *Hazardous Industry Planning Advisory Paper No. 7 - Construction Safety Study Guidelines*.

Operational Hazards

212. The Proponent shall not permit any vehicle carrying a quantity of goods defined as dangerous under the Australian Dangerous Goods Code, to enter the tunnels forming part of the proposal. Prior to the operation of the CCT, the Proponent shall provide, to the Director-General, details of how this condition will be managed and enforced, including measures such as signage and monitoring via closed-circuit television.

213. At least six months prior to the opening of the tunnel, the Proponent shall prepare an Emergency Response Plan for the CCT, in consultation with the NSW Fire Brigades, the Police Service and State Emergency Services. The Plan shall include, but not necessarily be limited to:

    (a) protocols and procedures to be followed during emergency situations associated with the operation of the CCT including vehicle collisions, fires and explosions;
    (b) details of traffic management measures to be implemented during emergencies, where appropriate, to minimise the potential for escalation of the emergency;
    (c) management and infrastructure measures to address the potential environmental impacts of an emergency situation, including measures for containment of contaminated firefighting water, fuel spills and gaseous combustion products; and
    (d) a training and testing program to ensure that all operational staff are familiar with the Plan and coordination with the Fire Brigades, Police and Emergency Services is regularly rehearsed.

    The Emergency Response Plan shall be submitted for the approval of the Director-General prior to the operation of the CCT. A rehearsed emergency response in accordance with the approved Emergency Response Plan, including the Proponent, Fire Brigades and Emergency Services, shall be undertaken on at least one occasion prior to the operation of the CCT.

214. Prior to opening the tunnel, the Proponent shall provide the Director-General with details of design and operational measures to be incorporated into the CCT to minimise the likelihood and impact of vehicular accidents within the CCT. These measures shall include fire resistant materials of construction, fire control centres, emergency access doors and stairways, deluge systems or sprinklers, hydrants and ventilation systems, where applicable. All fire-related devices and designs shall meet the requirements of the NSW Fire Brigades. The Proponent shall provide the Director-General with written certification that all design and operational measures have been implemented prior to the operation of the CCT.

215. For the first five years of operation, the Proponent shall undertake an annual Hazard Review of the CCT and hazardous incidents that have occurred during the preceding twelve-month period, with the first Review to be undertaken no later than twelve months after the commencement of operation of the CCT. A report outlining the results of the Hazard Review, and any proposed additional safety measures to be implemented in response to the findings of the Review, shall be submitted to the Director-General within one month of completion of the Review. The Proponent shall meet the Director-General's requirements in relation to the findings of the Review, within such time as the Director-General may agree. The Proponent shall undertake further Hazard Review if directed by the Director-General following any major incident in the tunnel.

Security and Crime

216. The Proponent shall prepare and implement two Security and Crime Management Strategies, one for each construction and operation. The aim of the Strategies shall be to prevent unauthorised public ingress to the CCT and to minimise the potential for crime in the vicinity of CCT infrastructure (eg vandalism, loitering, illegal dumping etc). The Strategy shall be generally in accordance with the principles outlined in the joint Department and Police Service publication *Crime Prevention and the Assessment of Development Applications*, and be developed in consultation with the NSW Police Service and relevant councils. The Strategy shall include, but not necessarily be limited to:

(a) details of security arrangements to prevent unauthorised access to the CCT, including physical exclusion measures, detection devices and management mechanisms;
(b) policies and procedures for addressing security issues, should they arise;
(c) specific design features of the CCT intended to discourage the incidence of crime at and in the immediate vicinity of CCT access points;
(d) lighting considerations, including light intensity, direction and hours of operation at and in the immediate vicinity of CCT access points, with the aim of minimising areas that may encourage crime;
(e) policies and procedures for the management and removal of graffiti, amelioration of vandalism, should it occur at or on any component of the CCT; and
(f) policies and procedures for the management and removal of illegal or inappropriate bill-posting and illegally dumped materials, should it occur at or on any component of the CCT.

The Security and Crime Management Strategy shall be submitted for the approval of the Director-General no later than one month prior to the commencement of substantial construction or opening of the tunnel as applicable, or within such period as otherwise agreed by the Director-General.

Utilities and Services

Pre-Construction

217. Prior to the commencement of construction the Proponent shall identify the services potentially affected by construction activities to determine requirements for diversion, protection and/or support. This shall be undertaken in consultation with the relevant service provider(s).

218. The Proponent shall prepare dilapidation surveys and reports (including movement prediction studies on the condition of the rail infrastructure facilities, adjacent tunnels and utilities within the vicinity of the construction area) to the satisfaction of the RIC, SRA and all other relevant infrastructure/service providers. The Proponent shall carry out rectification work at the Proponent's expense and to the satisfaction of the owners.

219. The Proponent shall ensure that, in consultation with the RIC and SRA, during the design process, sufficient provision is made for the future construction of the MetroWest and Metropitt rail links, including the necessary station concourses.

Construction

220. Any alterations to utilities and services shall be carried out to the satisfaction of the relevant service provider(s), and unless otherwise agreed to, at no cost to the service/utility provider(s).

221. The Proponent shall ensure that disruption to any utilities are minimised and shall be responsible for advising local residents and businesses affected prior to any disruption of service.

222. The Proponent shall ensure that emergency access from Sir John Young Crescent to the SRA property adjacent to the Eastern Suburbs rail line is maintained at all times.

Greenhouse Gases

Construction Stage

223. The Proponent shall promote the reduction of greenhouse gases by adopting energy efficient work practices including, but not limited to:

    (a) developing and implementing procedures to minimise energy waste in accordance with Conditions 206 to 207;
    (b) conducting awareness programs as part of induction for all site personnel regarding energy conservation methods; and,
    (c) conducting regular energy audits during the project to identify and address energy wastage.

224. No rainforest timbers shall be used in any construction activities.

Sustainable Energy

225. Green power shall be purchased for the supply of at least 6 percent of the energy requirements for the construction and operation of the project.

Air Quality - Construction Stage

Pre-Construction

226. A detailed Dust Management Sub Plan shall be prepared in consultation with the EPA and incorporated into the Construction Framework EMP. This Sub Plan shall detail the implementation and management of measures and procedures to ensure that dust emissions from the project are either prevented or minimised. This Sub Plan shall include, but not be limited to:

    (a) identification of potential sources of dust deposition;
    (b) monitoring (by sampling and obtaining results by analysis) the pollutants specified in Column 1 of Table 8 at nearby sensitive receptors. The Proponent must use the sampling method, units of measure, and sample at the frequency, specified in the other columns.
    (c) details of mitigation measures to be implemented during normal operations and during periods of extreme climatic conditions where high level dust episodes are likely to occur;
    (d) establishment of a protocol for handling dust complaints that includes recording, reporting and acting on complaints; and
    (e) a reactive management program detailing how and when operations are to be modified to minimise the potential for dust emissions, should emission levels exceed the criteria.

Table 8

Pollutant	**Units of measure**	**Averaging Period**	**Frequency**	**Method**[1]
Dust	g/m^2/month	annual	Continuous	AM-19
Other	**Units of measure**	**Averaging Period**	**Frequency**	**Method**[1]
Siting	NA	NA	NA	AM-1 & AM-4

Note: [1]NSW EPA, 2001, Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales.

Construction

227. The Proponent shall undertake a regular dust monitoring program at all locations in close proximity to the public in accordance with the Dust Management Sub Plan.

228. All construction activities shall be carried out in a manner that minimises or prevents the emission of dust.

229. The Proponent shall ensure that trucks entering and leaving all construction sites that are carrying loads of potentially dust generating material are covered.

230. To ensure that any vehicles which leave construction site(s) do not track materials on public roads the Proponent shall construct and maintain wheel wash facilities or equivalent to be utilised by all departing trucks and machinery which have been used in unsealed areas.

231. When conditions are excessively dusty and the dust emissions from operations cannot be maintained within the dust goal specified in Condition 226, then all dust generating activities shall cease until dust suppression can be adequately carried out.

232. In accordance with the *Protection of Environment Operations (Control of Burning) Regulation 2000*, no open burning or incineration shall be permitted at any construction sites.

Flora and Fauna

Pre-Construction

233. The Proponent shall prepare a detailed Tree Protection Plan to manage construction impacts on existing trees. This plan shall identify any significant trees which may be affected during construction and detail appropriate management measures.

Construction

234. A suitably qualified tree surgeon or aborist shall be present for the duration of excavation works within the vicinity of any significant trees as identified I in the Tree Protection Plan required under Condition 233 that are not to be removed or relocated and to undertake any root pruning required. The Proponent shall ensure that the condition of any trees affected are monitored throughout the construction period and for 18 months after opening of the tunnel. Any measures necessary to ensure the survival of the trees (e.g. fencing, watering, fertilising) shall be undertaken by a suitably qualified person to the satisfaction of the Director-General.

235. Maintenance of all landscaping works provided under the Urban Design and Landscape Plan referred to in Condition 166 (including the health of all trees) shall be provided for at least two years from the date of opening of the tunnel unless maintenance responsibility is accepted by Council or other agency.

236. Any trees lost during construction shall be replaced with specimens of a similar maturity unless otherwise agree with the relevant Council(s).

237. If, during the course of construction any threatened flora or fauna species are encountered, the Director-General of the NPWS shall be advised immediately. No activity, which places any of these species at risk, shall be undertaken until advice has been received from the NPWS. All recommendations by the NPWS shall be complied with prior to any works likely to affect any

threatened species.

Social

238. The Proponent shall co-operate with the local Steering Group on Street Prostitution and other relevant groups to develop measures to mitigate the potential displacement of sex-industry workers from William Street to nearby local streets.

Cumulative Impacts

239. As part of the Construction Framework and Operational EMPs the Proponent shall identify parameters to be monitored during construction and operation which have the potential for cumulative effects to occur. The Proponent shall also define the time period for which the identified parameters would be monitored.

240. Prior to the commencement of construction, the Proponent shall negotiate an agreement with the Airport Motorway Limited dealing with mitigation of the impact of the construction, operation and maintenance of the project on the Eastern Distributor

ATTACHMENT 1

Guidelines for the Establishment of the Community Liaison Group

The proponent shall consider the following when establishing a Community Liaison Group:

1. The Group shall comprise at least two (2) representatives of the Proponent (including the Environmental Management Representative), at least one (1) representative of Council, at least two (2) community representatives and one (1) business representative (where relevant).

2. At its first meeting, the Group shall consider its interrelationship with any existing community liaison/ consultative groups of adjoining or interrelated developments.

3. Representatives from relevant government agencies or other individuals may be invited to attend meetings as required by the Chair.

4. Where determined necessary by the Chair, an independent note taker would be provided by the Chair at the expense of the Proponent.

5. The Proponent shall, at its own expense:

- nominate two (2) representatives to attend all meetings of the Committee;
- provide to the Group regular information on the progress of work and monitoring results;
- promptly provide to the Group such other information as the Chair of the Group may reasonably request concerning the environmental performance of the development;
- provide access for site inspections by the Group; and
- provide meeting facilities for the Group, and take minutes of Group meetings. These minutes, once endorsed by the Chair, shall be available for public inspection at Council within 14 days of the meeting.
- The Proponent shall ensure that minutes from Community Liaison Group meetings, annual reports and other public reports required by this approval, and results and interpretation of monitoring required by this Consent are placed on the Internet for public information within 14 days after they are available. The Internet address is to be made publicly available.
- Where reasonably required engage consultants to interpret technical information and tasks of a similar nature.