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# **EASTERN DISTRIBUTOR CITY OF SYDNEY**



## **ENVIRONMENTAL IMPACT STATEMENT**



# **EASTERN DISTRIBUTOR CITY OF SYDNEY**



**L076322**

## **ENVIRONMENTAL IMPACT STATEMENT**



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**SUBJECT: EASTERN DISTRIBUTOR**  
**City of Sydney**  
**Environmental Impact Statement**  
**Certification of Environmental Impact Statement**

In accordance with Clause 59 of the Environmental Planning and Assessment Regulation, 1980, this is to certify that the subject Environmental Impact Statement has been prepared in accordance with Clauses 57 and 58 of that Regulation.

The requirements of the Director notified under Clause 58(2), are included in Appendix 1.



**D. Chesterman**  
**Director**  
**Jackson Teece Chesterman Willis & Partners Pty. Limited**

**August, 1985**



**EASTERN DISTRIBUTOR  
ENVIRONMENTAL IMPACT STATEMENT**

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- Anti-Freeway Action Committee
- Communities for Action on Traffic
- Sydney City Council and their Consultants
- All those who made submissions and participated in public meetings
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## SUMMARY

This report considers the likely environmental impact of the proposed "Eastern Distributor", a twin tunnel arterial road scheme to be built in three stages from the Cahill Expressway in Woolloomooloo to Drivers Triangle at Moore Park (Figure 1.1). The Proposal derives from a longstanding plan for a bypass route on the eastern side of Sydney's Central Business District which would also divert regional traffic from local streets. Previous designs have met with resistance because of their social impact and substantial property loss in one of Sydney's oldest areas.

This proposal involves the provision of two tunnels, one for southbound traffic from the Cahill Expressway to Drivers Triangle and the other for traffic travelling in the opposite direction, towards the Harbour Bridge. In the first instance though, it is proposed that an underpass be constructed at William Street and the present southbound route be geometrically improved at Stanley Street (Figure 2.1) to provide immediate benefits for traffic travelling through the area. This element of the scheme (Stage 1) is also required for the next two stages, which involve the construction of the southbound and northbound tunnels respectively.

The construction of the Eastern Distributor as proposed will allow the lifting of the "County Road reservation" which has affected the area since the early 1950's and been the cause of much building dilapidation and disrepair. An immediate benefit of the Proposal will therefore be the removal of the uncertainty that has affected this area. Together with land remaining from construction, the property in the "corridor" already in public ownership can be rehabilitated or redeveloped. Further, there is the potential for more dwellings to be constructed on these sites than will be demolished for road construction.

The most immediate benefit of the proposal will be to "through traffic". There will be reduced congestion and delay and a greater sense of continuity in the road system leading from major facilities such as the airport to the city and beyond. As the project progresses however, there will be substantial environmental benefits for

residential areas in Surry Hills, Darlinghurst, East Sydney and Woolloomooloo, currently subject to heavy traffic flows. Air and noise pollution levels will decline, local streets will become safer and local services and facilities will be more accessible. Safety at major intersections in the vicinity will also improve.

The character of the area will change as a result of the rezoning of land (from 'County Road' to other uses) and as a result of environmental improvements. This will be of general benefit to the City and the local community. However, without ameliorative measures being taken, the major social costs of the project will be borne by people displaced and by those residents adversely affected by the upgrading of the area and the subsequent loss of low income accommodation.

The costs and benefits of the proposal will be unevenly spread in the Eastern Districts (Figure 1.6). For example, there will be a substantial decrease in traffic in a number of streets but increases in traffic volumes in some streets and some corresponding decline in their environmental quality. This report therefore also examines measures which could be taken to mitigate adverse effects.

The report considers a range of feasible alternatives to the proposal. These are examined in terms of transport, environmental and social objectives established for the project. Where possible, the evaluation has been translated into monetary terms to provide an economic evaluation of the proposed scheme, compared with other possible schemes.

In terms of capital expenditure, the proposal is costly as it involves substantial tunnelling. However, in terms of the social costs avoided and the environmental benefits achieved, it ranks well compared with other options for the area. When the redevelopment opportunities provided by this scheme (including the potential provision of much needed public housing) are also taken into account, the Proposal is considered desirable on transport, social and environmental grounds.



Stage 1:

The first stage of the new scheme will provide an underpass of William Street, at Palmer Street, for southbound traffic.

The bends between Palmer and Bourke Streets will be widened and straightened. There will be easier left hand turns into William Street and Oxford Street.

William Street traffic heading toward the Harbour will only be able to turn right at Riley Street.

Traffic congestion along William Street, Palmer Street and Crown Street will be significantly alleviated.

Stage 1 is scheduled for completion by 1988.

Stage 2:

In the second stage, a Tunnel will be bored from a point just north of William Street near Palmer Street, through to Anzac Parade, with branches coming out directly onto South Dowling Street and Moore Park Road.

This will give southbound traffic heading toward the east, south east and south, including the airport, an uninterrupted flow.

Bourke Street and Palmer Street will then be used exclusively for northbound traffic.

Together with improvements in the phasing of traffic signals, this will significantly improve the flow of northbound traffic.

Existing busy streets, such as Crown Street, will return to the role for which they were designed — quieter, less congested local roads.

Stage 2 is scheduled for completion in 1990.

Stage 3:

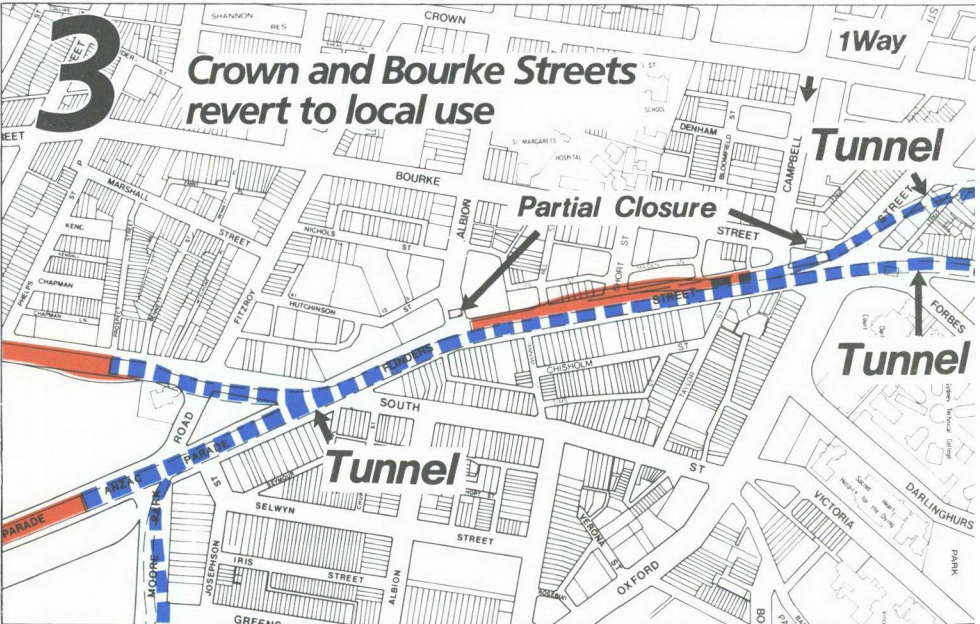
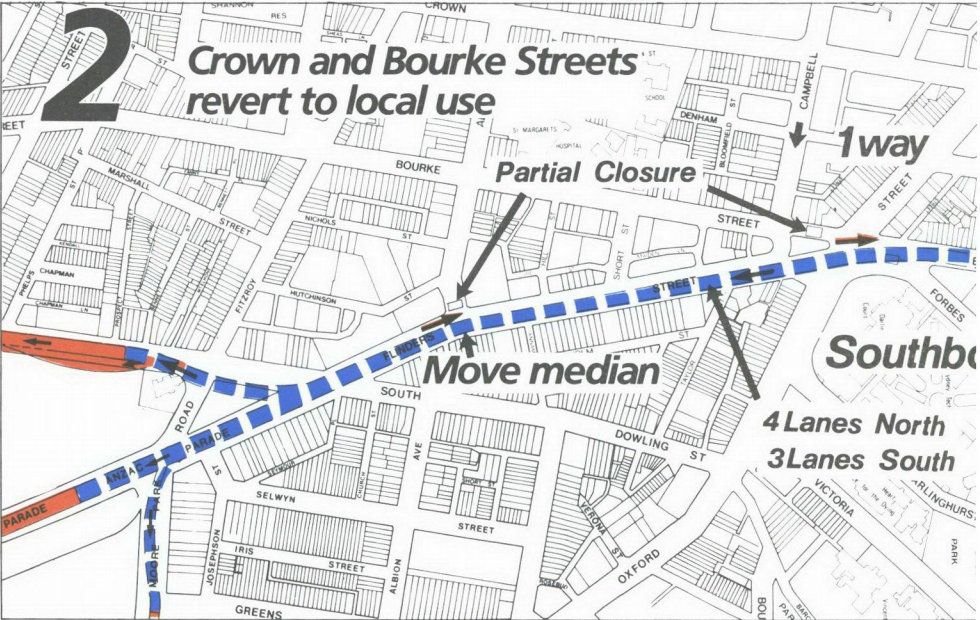
In the third stage of development, a tunnel will be bored from Flinders Street to connect with the underpass of William Street.

This will give northbound traffic an uninterrupted flow.

Surface roads will become quieter and less congested as they are used for local traffic movement.

Stage 3 is scheduled for completion in 1992.

THE PROPOSED EASTERN DISTRIBUTOR



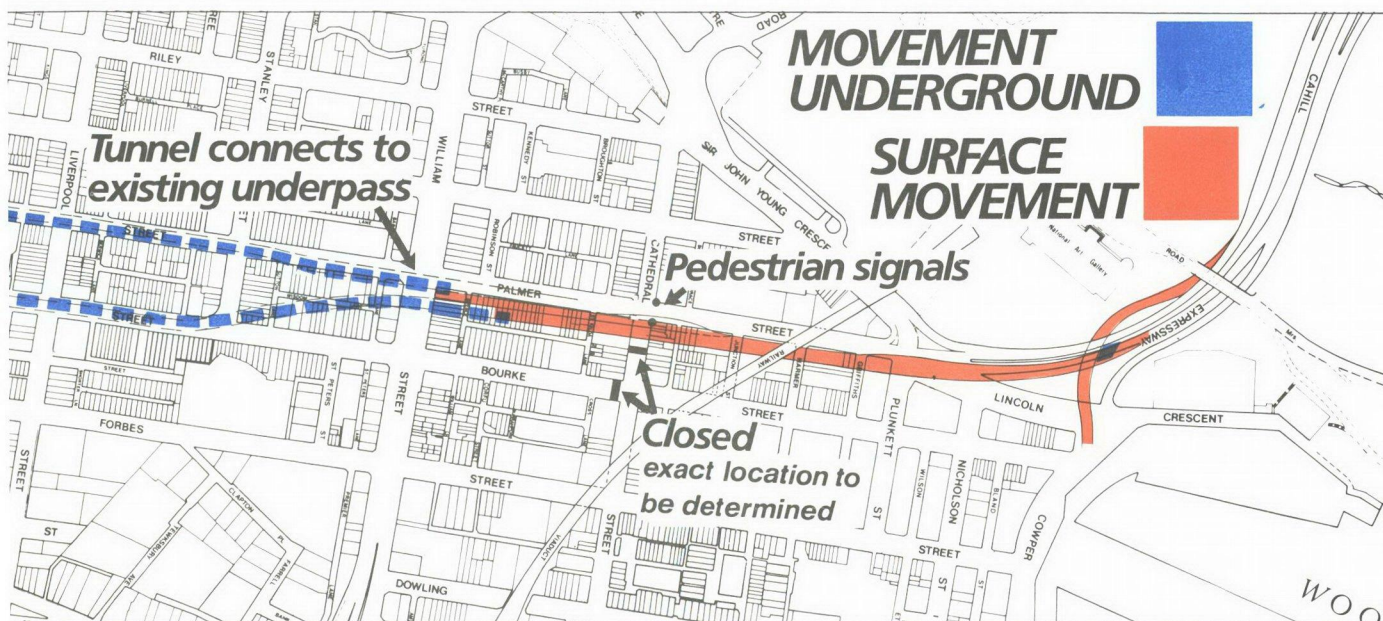
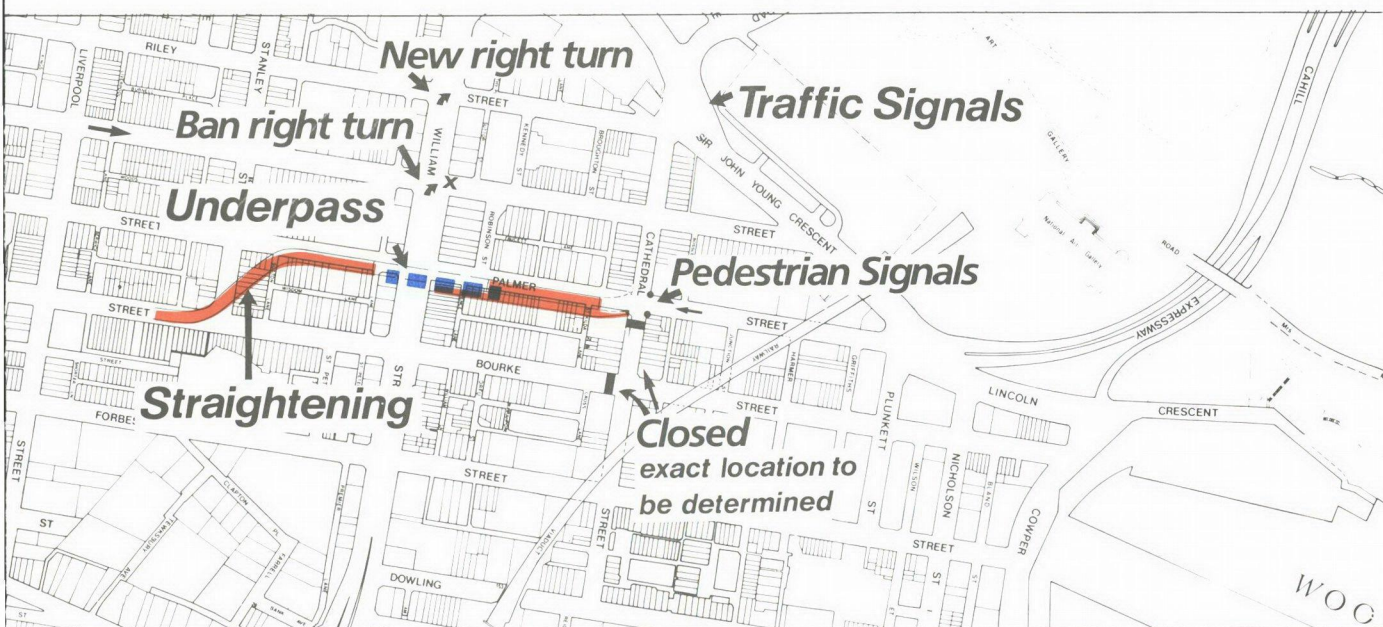
Eastern Distributor - August 1985

1.1

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THE PROPOSAL









Expressway

William Street

Palmer Street

Taylor Square

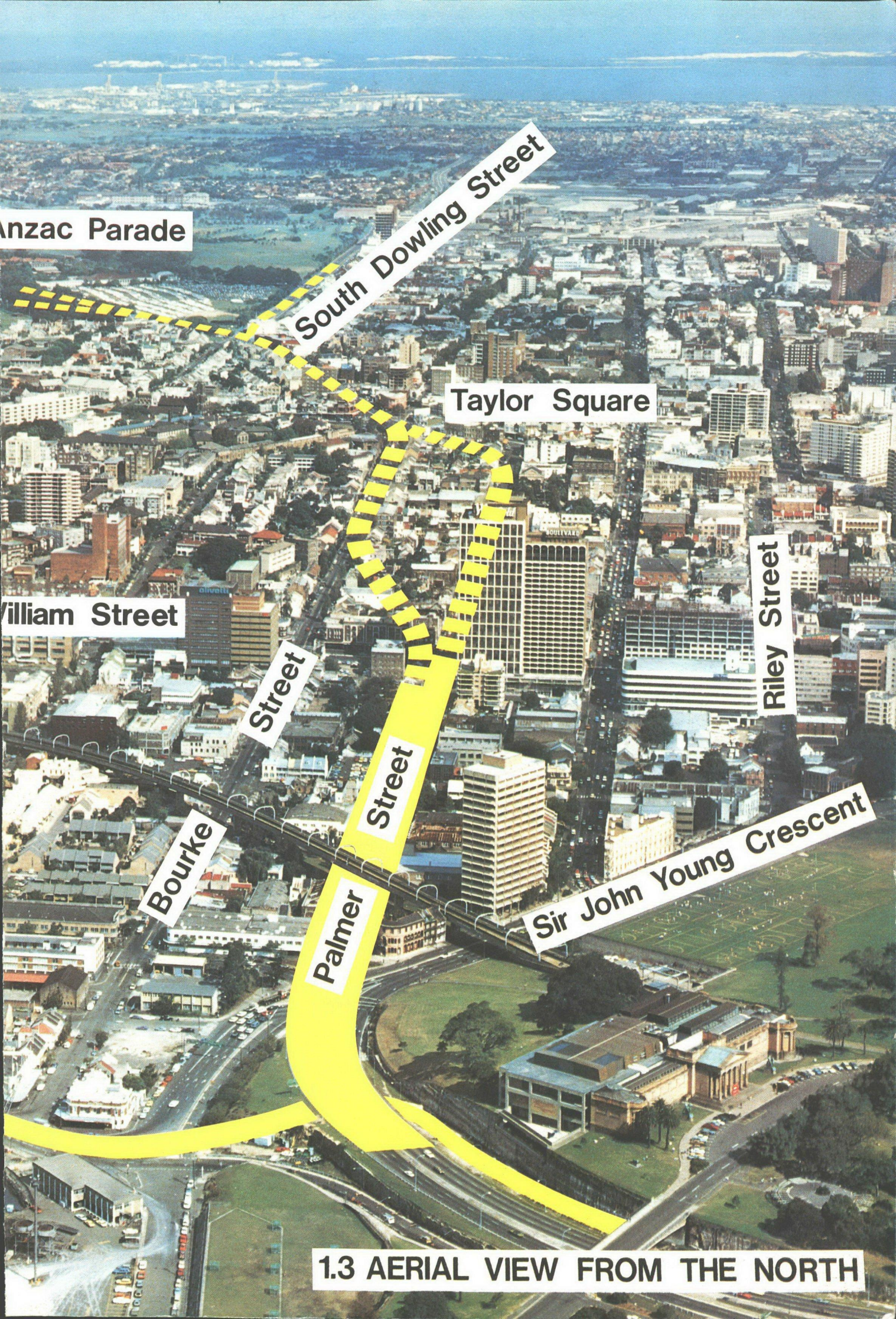
Flinders Street

South Dowling Street

Moore Park Road

1.2 AERIAL VIEW FROM THE SOUTH





Anzac Parade

South Dowling Street

Taylor Square

William Street

Street

Bourke

Street

Palmer

Riley Street

Sir John Young Crescent

1.3 AERIAL VIEW FROM THE NORTH



## 1.0 INTRODUCTION AND BACKGROUND

### 1.1 Introduction

This report examines the likely environmental impact of the proposed "Eastern Distributor" (Figures 1.1 - 1.3). It has been undertaken in terms of Part V of the Environmental Planning and Assessment Act 1979 which sets out the procedure for the preparation of an environmental impact statement by a public authority, in this case the New South Wales Department of Main Roads.

As provided for by the Act, the scope and the contents of the environmental impact statement have been specified by the Director of the Department of Environment and Planning. His requirements are included as Appendix 1.

The environmental impact statement provides an overview of the history and objectives of the Proposal, and an account of the Proposal itself and its likely effect, compared with the likely effects of feasible alternatives.

Various working papers and submissions prepared during the course of the investigation are contained in a collection of Working Papers (Jackson Teece Chesterman Willis & Partners 1985).

### 1.2 History of Proposal

As shown in Table 1.1 the Eastern Distributor has been included in plans for the City of Sydney since 1945. At this time the road structure on the eastern side of the Central Business District was much as it had been in the mid-nineteenth century (see Section 4.3). Incremental improvements had been made, largely by way of widenings, but the arterial system itself was considered incompatible with the population expansion that had occurred and with the growth of private car ownership and traffic volumes (Department of Main Roads 1976: 203-4). The 1945 Main Roads Development Plan and the 1948 County of Cumberland Planning Scheme, which largely incorporated it, sought fundamental changes to the main road structure around the City centre. Their plan was for a system of expressways and regional roads radiating from the core but connected to a series of

circumferential routes surrounding the City itself. One of these was the Eastern Distributor (Figure 1.4).

When the County of Cumberland Scheme was adopted in 1951, County Road reservations, including the Eastern Distributor corridor, were gazetted and subsequently incorporated into local planning schemes. The County of Cumberland Scheme therefore provided the framework for road reservations in the City of Sydney Planning Scheme of 1971 (Figure 1.5).

Parts of the inner urban system (the Warringah and Cahill Expressways and the Kings Cross Tunnel) were constructed in the twenty or so years that followed. By the early 1970's however, as Table 1.1 indicates, there had been a major shift in (the government's and the community's) attitude towards freeways and by the late 1970's a significant proportion of the inner urban freeway reservations had been lifted. The corridor for the Eastern Distributor was retained to provide a bypass route on the eastern side of the City.

### 1.3 Summary Statement of Problems

The upgrading of regional roads feeding into the Eastern Districts in the 1950's and 1960's (specifically the Cahill Expressway and Southern Cross Drive) increased the volume of through traffic carried by local roads in the area, particularly north-south traffic between the Harbour Bridge/Cahill Expressway system and areas south and east of the Eastern Districts (see Figure 1.6 for a definition of the Eastern Districts study area). As a result Crown Street and Bourke Street and Palmer Street north of Stanley Street are especially affected by heavy "through traffic" (Figure 1.7). Other local roads in the Eastern Districts are affected by east-west movement (see Section 3.2).

Through traffic experiences severe congestion and delay. This, in turn, affects local traffic and pedestrian accessibility. The extremely high accident rate in the Eastern Districts is an indication of poor travel conditions and pedestrian/vehicle conflict in the area (see section 3.2.3).



TABLE 1.1 HISTORY OF THE PROPOSED EASTERN DISTRIBUTOR

Date	Plan/Study	Recommendation/Action
1945	Main Roads Development Plan	Land use, population and traffic surveys of Sydney (as well as a traffic origin and destination survey around the Central Business District) undertaken by the Department of Main Roads. Findings and forecasts of likely future trends incorporated into the County of Cumberland Scheme.
1948	County of Cumberland Planning Scheme Report	Distributor road system around the city centre proposed, connecting with radial system of expressways and regional roads. The Eastern Distributor was part of the distributor road system (Figure 1.2).
1951	County of Cumberland Planning Scheme gazetted	Proposed Eastern Distributor route reserved as "County Road".
1968	Sydney Region Outline Plan	No specific reference to Eastern Distributor but Eastern Expressway and Southern Expressway connecting with proposed Eastern Distributor (Figure 1.2) included as "reasonably firm commitments for future regional planning purposes". "New urban highways to overcome traffic congestion will ... call for extensive redevelopment of existing urban areas."
1971	City of Sydney Strategic Plan	Sought faster construction of roads bypassing the city.
1971	City of Sydney Planning Scheme gazetted	County Road reservation included in planning scheme.
1974	Sydney Area Transportation Study (SATS)	Envisaged Eastern Distributor as freeway/expressway with underpasses at William Street and Taylor Square.
1974	City of Sydney Strategic Plan (revised)	Urged faster construction of roads bypassing the city but recommended that alternative routes be investigated for the connection between the Cahill Expressway and South Dowling Street: "Such routes should minimise the impact on the adjacent areas and the amount of property to be acquired".
1976-77	Urban Transport Advisory Committee (URTAC) Report	Following URTAC review of SATS, 23km of inner urban freeway corridors abandoned. Key bypasses of the central business area (including the Eastern Distributor) retained.
1977-78	Eastern Distributor Study for the DMR	Approximately 30 schemes reviewed for north-south traffic on the eastern side of the central business area, ranging from low cost traffic management to major roadworks. Recommended that "if significant improvements are to be made to vehicular movement and to the environment, major roadworks should be constructed".
1980	Sydney Region Outline Plan Review	No specific reference to the Eastern Distributor but noted that "the SATS type of plan is now discredited, and the incremental approach adopted by URTAC is expected to continue".
1980	City of Sydney Strategic Plan (revised)	"Press for early construction of the Eastern Distributor to restrict through traffic in residential areas of East Sydney, and Surry Hills." "On the basis of traffic demand construction of the Eastern Distributor should start immediately".

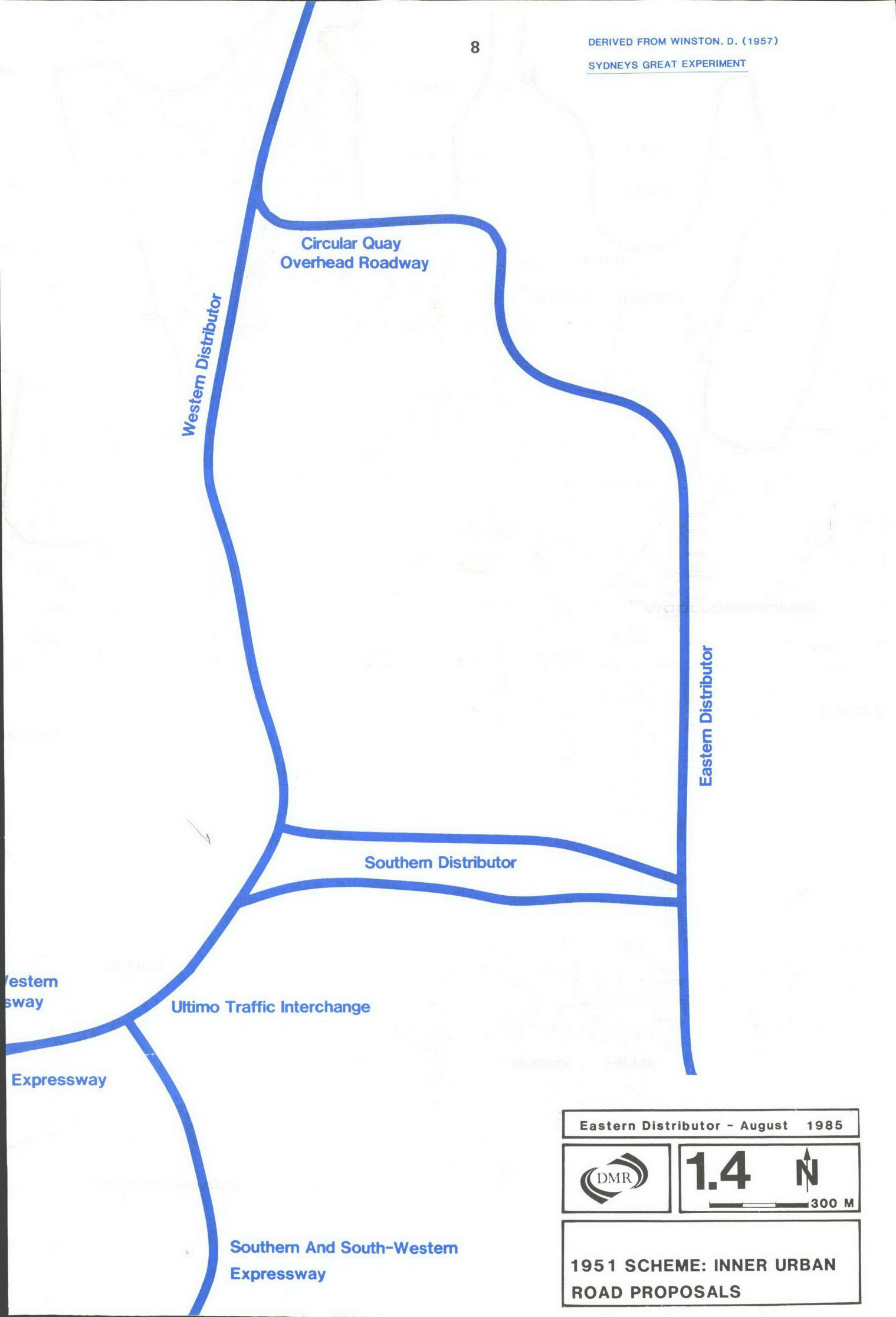
A related problem is the air and noise pollution experienced by residents and other activities on streets in Surry Hills, East Sydney, Darlinghurst and Woolloomooloo.

A problem arising out of planning for the area rather than traffic in the area concerns urban blight in and adjacent to the County Road reservation. Uncertainty about the future of the Eastern Distributor has resulted in indecision by property owners and neglect of the built environment.

#### 1.4 Recent Developments

In August, 1984 the Minister for Roads announced that the Department of Main Roads would proceed with detailed planning for the construction of the Eastern Distributor. Jackson Teece Chesterman Willis & Partners Pty. Limited, Consulting Planners, were appointed to prepare an environmental impact statement on the proposal on behalf of the Department.





Western Distributor

Circular Quay  
Overhead Roadway

Eastern Distributor

Southern Distributor

Ultimo Traffic Interchange

Expressway

Southern And South-Western  
Expressway

Eastern Distributor - August 1985



1.4

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1951 SCHEME: INNER URBAN  
ROAD PROPOSALS

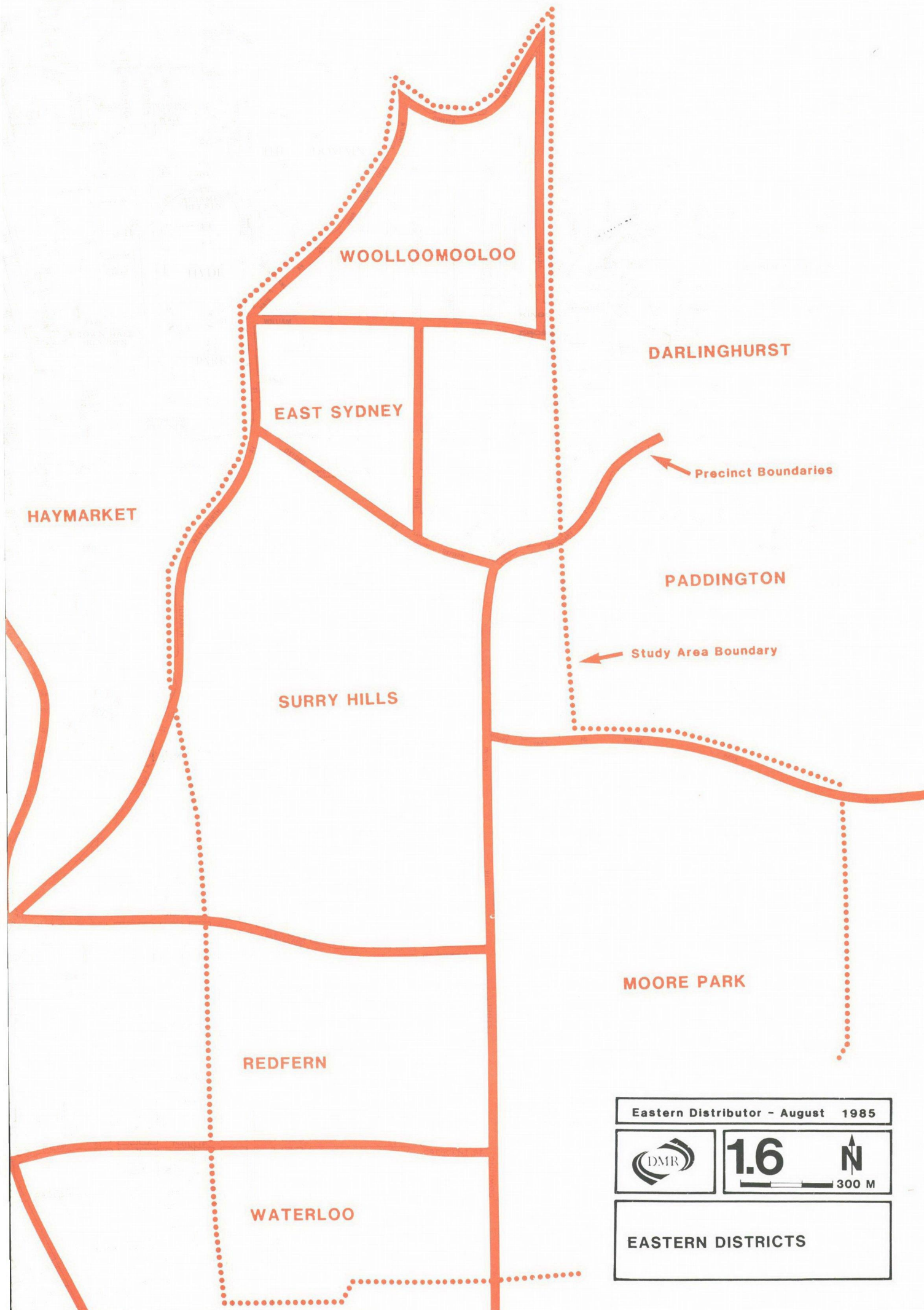
County Road Reservation  
for the Eastern Distributor  
as shown on the City of  
Sydney Planning Scheme  
1971

Areas released from the County  
Road Reservation by I.D.O. 26,  
City of Sydney, August 1975

Areas released from the County  
Road Reservation by I.D.O. 38,  
City of Sydney, January 1977



Eastern Distributor - August 19	
	1.5  300
COUNTY ROAD RESERVATION	











## KEY

-  Arterial Roads as defined by the Traffic Authority, 1984
-  Local or Sub-Arterial Roads as defined by the Traffic Authority, 1984

## No. of Vehicles/Peak Hour


-  less than 2000
-  2-4000
-  4-6000
-  greater than 6000

Calculated as average number of vehicles in either direction per peak hour a.m. and p.m.



Eastern Distributor - August 198



1.7  300

EASTERN DISTRICTS:  
HEAVILY TRAFFICKED ROAD



The first task in the process was to develop a specific scheme for detailed analysis in an environmental impact statement. A public exhibition outlining the broad options was held in November, 1984 as a basis for public consultation and further investigation.

Following this exhibition many written submissions were received from local residents, community groups, local institutions and state wide organisations. The extent of these submissions and their content is noted in Appendix 2.

Two community organisations had a particular interest in the Eastern Distributor proposal: the "Anti-Freeway Action Committee" based in Darlinghurst/East Sydney and Woolloomooloo; and "Communities for Action on Traffic", based in Surry Hills. Regular meetings were held with these groups.

The primary objective of these meetings was to establish a dialogue between the proponents of a scheme and interests that were either inherently opposed to any road construction or which had fundamental criticisms of earlier concepts. The meetings facilitated an exchange of ideas and information. While unanimity was not reached on the most desirable course of action, this exchange proved invaluable for the appreciation of community concerns.

In the development of a preferred scheme for detailed investigation, ten options for improving transport and environmental conditions in the Eastern Districts were examined. They ranged from a scheme involving only minor expenditure to a number of major schemes at or below ground level in the general alignment of the Eastern Distributor corridor. Each scheme was evaluated in terms of its likely impact on regional transport and traffic and local movement, its impact on the local physical environment, its construction impacts, the direct effects on local residents, the longer term effects on local areas and the financial costs to Government. Where possible the costs and benefits of each scheme were translated into monetary terms for inclusion in an economic evaluation.

On the basis of this assessment, in April, 1985 the Minister for Roads announced a three-stage twin tunnel scheme for the Eastern Distributor (Figure 1.1) which became the subject of this environmental impact statement.

In terms of Part V of the Environmental Planning and Assessment Act a final decision on the Proposal cannot be made until this environmental impact statement has been publicly exhibited for a minimum of 30 days and written submissions received within the specified period have been seriously considered.

## 1.5 Objectives

Objectives for the proposal derive from perceived transport, environmental and safety problems in the Eastern Districts as well as from the possible effects of road construction. The objectives themselves, and the relative priority attached to them in the analysis of the proposal and alternatives, were shaped by the process of public consultation. As a result considerable attention has been given to environmental and community concerns associated with the possible impact of an Eastern Distributor.

The objectives are listed in Table 1.2, together with the actions necessary to achieve the objectives and the outcomes sought.

TABLE 1.2 OBJECTIVES

Objectives	Action Necessary to Achieve Objective	Outcomes Sought
1. To improve travel conditions through the Eastern Districts	<ul style="list-style-type: none"> <li>establish an appropriate link in the regional road network</li> </ul>	<ul style="list-style-type: none"> <li>reduction in congestion and delays</li> <li>improved travel times</li> <li>increased travel convenience</li> <li>improved travel reliability</li> <li>opportunities to implement local traffic management schemes</li> </ul>
2. To improve environmental conditions on local streets	<ul style="list-style-type: none"> <li>reduce traffic volumes, especially trucks</li> <li>reduce traffic speeds</li> </ul>	<ul style="list-style-type: none"> <li>reduced air pollution</li> <li>reduced noise pollution</li> <li>increased safety</li> </ul>
3. To reduce the accident rate	<ul style="list-style-type: none"> <li>reduce traffic volumes and speeds in local streets</li> <li>improve travel conditions on arterial routes</li> <li>minimise potential conflict between vehicles and pedestrians</li> </ul>	<ul style="list-style-type: none"> <li>improved safety, especially at locations with poor accident records</li> </ul>
4. To reduce urban blight in and adjacent to the County Road reservation	<ul style="list-style-type: none"> <li>decide on an arterial road plan for this corridor</li> <li>develop compatible traffic management measures</li> </ul>	<ul style="list-style-type: none"> <li>certainty about the future of the County Road reservation</li> </ul>
5. To maintain accessibility to facilities and properties in the Eastern Districts for pedestrians, cyclists and vehicles.	<ul style="list-style-type: none"> <li>provide suitable crossings at points of potential vehicle/pedestrian conflict</li> <li>make provision for cyclists on surface streets</li> <li>make provision for local vehicular access</li> </ul>	<ul style="list-style-type: none"> <li>no reduction in local accessibility for pedestrians, cyclists and vehicles</li> </ul>
6. To retain opportunities for the improvement of existing public transport and the provision of new services	<ul style="list-style-type: none"> <li>ensure that road design enhances opportunities for improvements to existing public transport services and the provision of new services</li> </ul>	<ul style="list-style-type: none"> <li>no reduction in the existing level of public transport service</li> <li>opportunities to improve public transport services</li> </ul>
7. To avoid adverse impacts on the existing townscape and particular buildings and groups of buildings	<ul style="list-style-type: none"> <li>protect buildings and groups of buildings of historic value</li> <li>integrate the design of new works with the terrain and with the existing townscape</li> <li>re-establish streetscapes that are in scale and character with various parts of the area</li> </ul>	<ul style="list-style-type: none"> <li>retention of buildings and groups of buildings of historic value</li> <li>improved coherence in streetscapes and townscape</li> </ul>
8. To minimise adverse community impacts	<ul style="list-style-type: none"> <li>take design measures to minimise the number of dwellings, businesses and other facilities affected by construction</li> <li>liaise with State and local government authorities regarding the provision of local public housing for displaced residents</li> <li>liaise with relevant authorities for re-establishment of community facilities displaced</li> <li>compensate property owners and businesses adversely affected</li> </ul>	<ul style="list-style-type: none"> <li>minimum number of dwellings, businesses and community facilities displaced</li> <li>opportunities to provide public housing for residents displaced</li> <li>opportunities to re-establish community facilities displaced</li> <li>appropriate compensation for property owners and businesses adversely affected</li> </ul>
9. To minimise the impact of construction	<ul style="list-style-type: none"> <li>adopt construction methods which minimise the adverse effects of construction</li> </ul>	<ul style="list-style-type: none"> <li>minimum disruption to residents during construction</li> <li>minimum disruption to traffic during construction</li> </ul>



## 2.0 THE PROPOSAL AND ASSOCIATED DEVELOPMENTS

### 2.1 Introduction

As illustrated in Figures 1.1 and 2.1 - 2.3, the proposal is a three-stage scheme involving the successive construction of the major elements. Staging of the project is proposed because it makes the project more economically attractive, generating benefits from the earlier stages at the earliest possible date. It is also required to facilitate construction, as explained in Section 4.7 below.

Section 2.2. describes the proposed works and the associated traffic management. Section 2.3 describes associated proposals, including additional traffic management measures which could be undertaken by Sydney City Council and possible land use developments.

### 2.2 Description of Proposal

#### 2.2.1 Stage 1

Stage 1 of the scheme (Figure 2.1) involves the construction of an underpass for southbound traffic on Palmer Street beneath William Street, the improvement of the alignment at the Stanley Street crossover to Bourke Street, and the realignment of Bourke Street at Taylor Square to permit three lanes of traffic to flow into Flinders Street. Northbound traffic will benefit from the denial of the right-turn from William Street to Crown Street and the relocation of this movement to Riley Street. This will make the William/Crown Streets intersection a two-phase signal (it is presently three-phase) and more green time available for both Crown Street and William Street eastbound. Crown Street will need to remain one-way during Stage 1.

Traffic signals are proposed for the Riley Street/Sir John Young Crescent intersection. Traffic signals will also be provided on Cathedral Street at Palmer Streets.

Riley Street will change to one-way northbound and Stanley Street will be closed at the realignment between Palmer Street and Bourke Street (Figure 2.16).

Property demolition and road construction will occur on the east side of Palmer Street between Cathedral Street and Stanley Street (including the underpass at William Street) and on the north side of Stanley Street. One property on the south side of Stanley Street will also be affected.

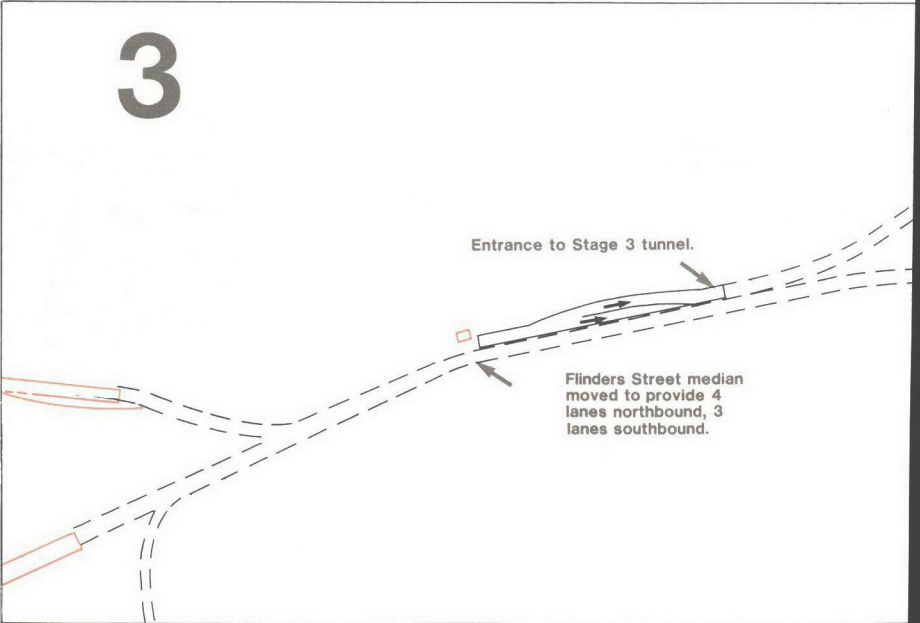
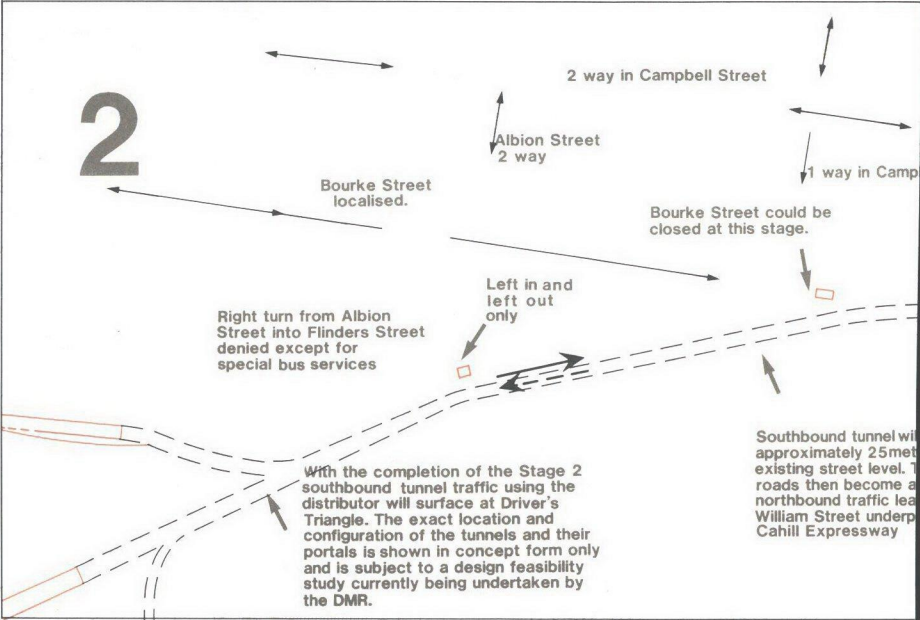
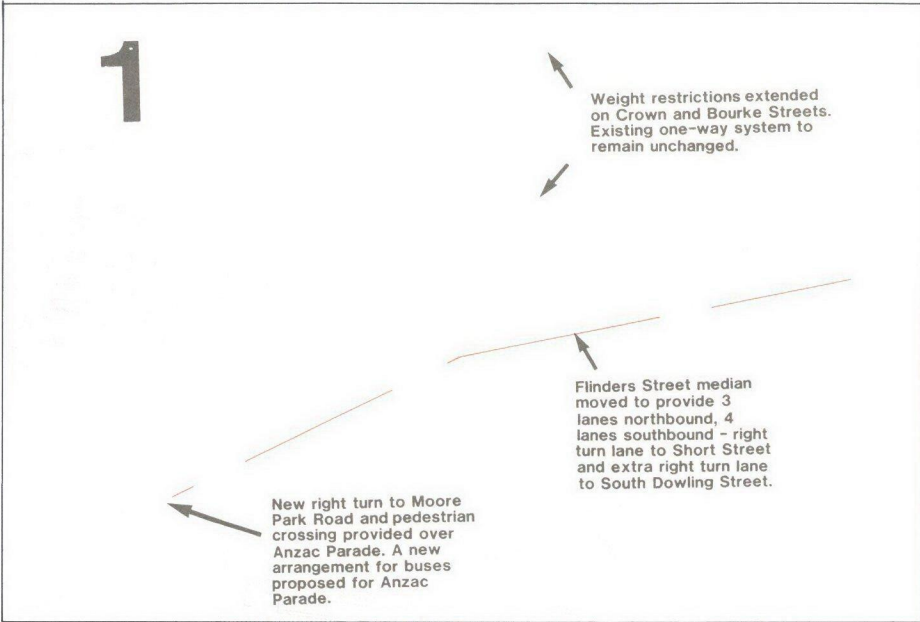
Parking restrictions will be required in sections of Riley, Crown, Palmer and Bourke Streets to obtain the full benefit of the construction works, designed to reduce delays and improve traffic flow. Traffic from the Cahill Expressway wishing to turn into William Street will do so at a turning lane constructed alongside the underpass. This will allow the closure to through traffic of Bourke Street, Woolloomooloo.

Stage 1 construction will create a significant redevelopment site on the eastern side of Palmer Street between William and Stanley Streets as well as a smaller redevelopment site on William Street and two small parcels of land at Stanley Street which could be appropriately landscaped (Figures 2.10 and 2.16). The standard of landscaping would be similar to that around the Western Distributor at Darling Harbour.

The widening and straightening of the bends at Stanley Street is proposed, primarily to achieve a continuous width of three lanes for southbound traffic. The benefits of the underpass could not be fully achieved without this widening and Bourke Street in Woolloomooloo could not be closed (see Section 5.1.4).

Further improvements to traffic flows are proposed for Flinders Street where a seventh lane can be created by kerb and median adjustments and some narrowing of the lanes. Initially this will provide four lanes southbound with a two-lane right turn to South Dowling Street, and should enable a significant reduction in the volume of traffic using Bourke Street, Surry Hills.

Further traffic management proposals are shown in Section 2.2.4.



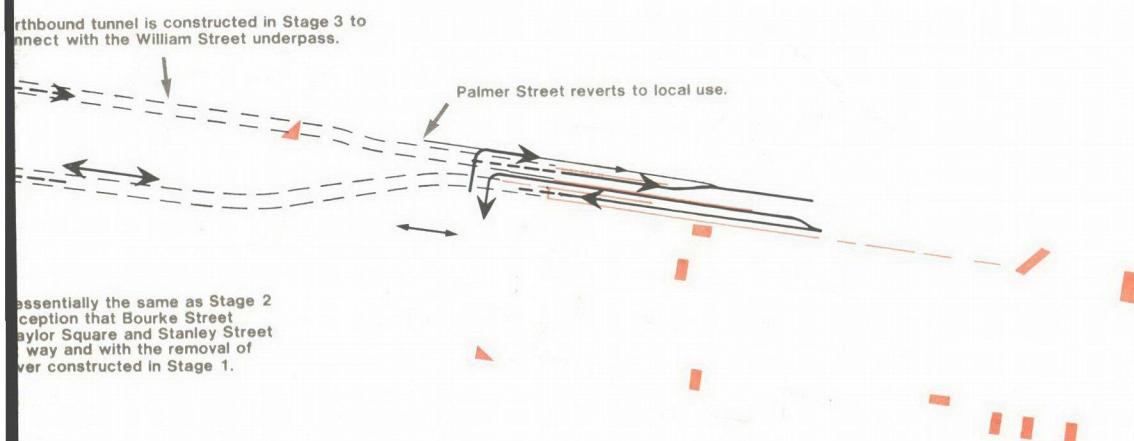
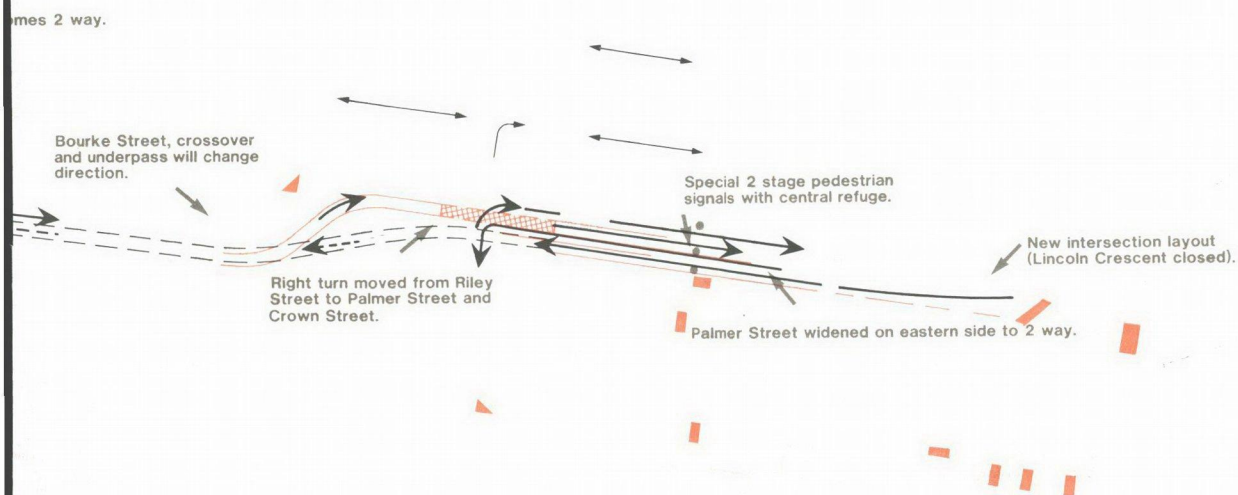
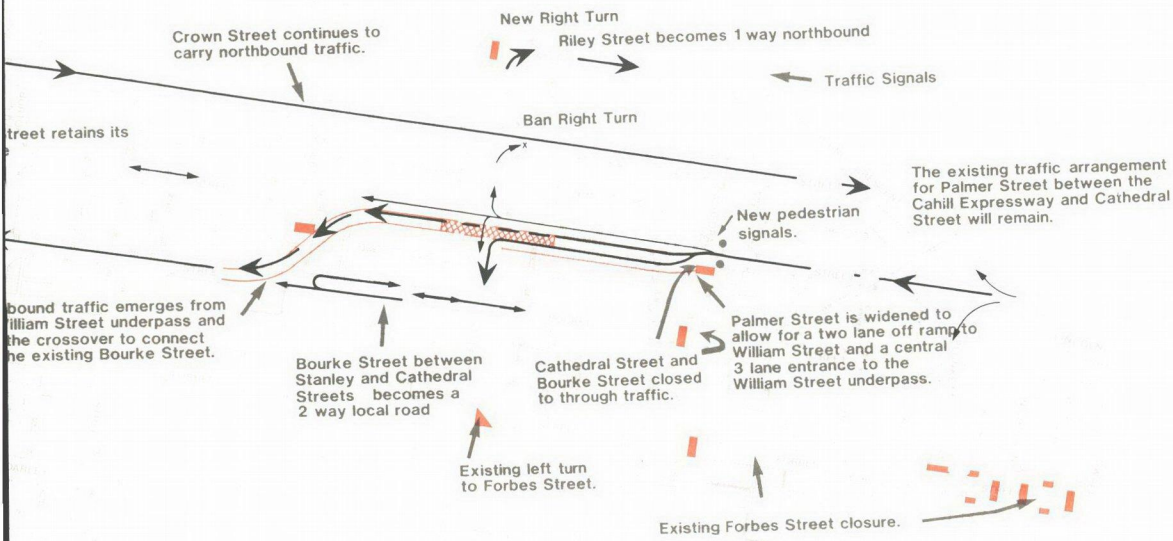
Eastern Distributor - August 1985

2.1

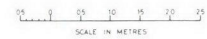
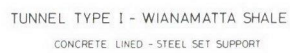
200 M

WORKS AND ASSOCIATED TRAFFIC MEASURES:  
STAGES 1-3





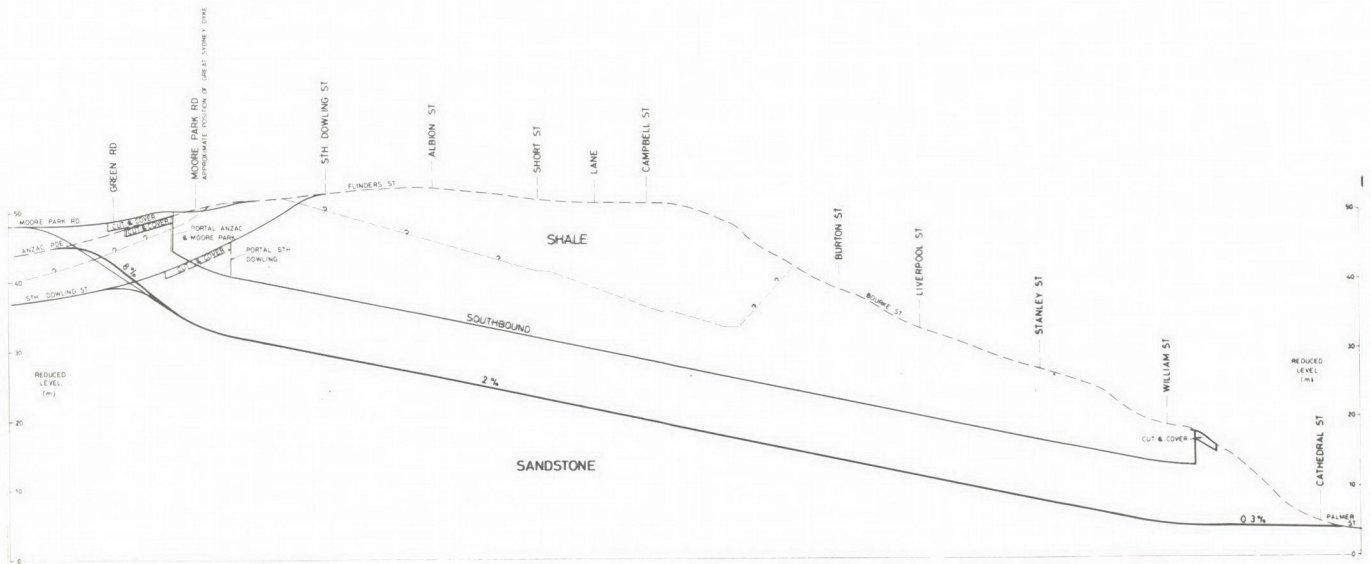




## 2.2

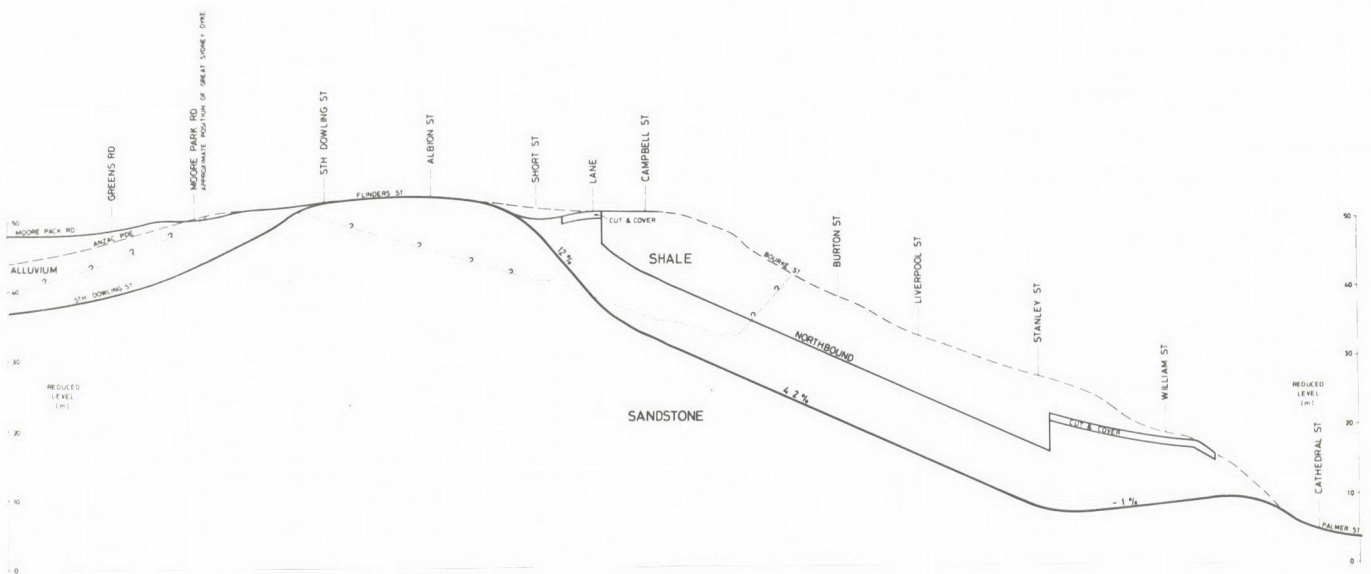
## NOMINAL TUNNEL CROSS SECTIONS





## STAGE 2

SCALE: HOR: 50 0 50 100 150  
 VERT: 5 0 5 10 15  
 (in metres)



## STAGE 3

SCALE: HOR: 50 0 50 100 150  
 VERT: 5 0 5 10 15  
 (in metres)

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# 2.3

NOMINAL TUNNEL LONG  
 SECTIONS



### 2.2.2 Stage 2

This stage of the proposal (Figure 2.1) involves driving a major tunnel from just north of William Street in Woolloomooloo to Drivers Triangle in the north-west corner of Moore Park. Southbound traffic from the Cahill Expressway and Cowper Wharf Roadway will proceed via a widened Palmer Street through the tunnel and emerge onto South Dowling Street, Anzac Parade or Moore Park Road. No other entrance to the tunnel is proposed and traffic in the tunnel will have to choose one of the three exit corridors. It is expected that the tunnel will be an attractive route for most of the traffic presently using Palmer and Bourke Streets. However, it is likely that a significant volume of local traffic or traffic needing to use William Street or Oxford Street will remain on the surface streets.

Following the opening of the tunnel, it is proposed that the northbound traffic presently using Crown Street be diverted to run on Flinders, Bourke and Palmer Streets, reversing the present direction of flow on Bourke and Palmer Streets. This northbound traffic will then use the William Street underpass constructed in Stage 1, but in the reverse direction. This will allow Crown Street to revert to two-way operation. The southbound traffic which could not use the tunnel will then use Crown Street via Sir John Young Crescent.

Palmer Street will be widened on the east side between Sir John Young Crescent and Cathedral Street, leading up to the tunnel, and will become two-way through Woolloomooloo (Figures 2.14 and 2.15). Cathedral Street will be closed at Palmer Street during Stage 2 but pedestrian signals along Cathedral Street at Palmer Street will remain (Figure 2.14). To simplify movements at Plunkett Street a simple square intersection is proposed. This will permit the closure of Lincoln Crescent. Access from Cowper Wharf Roadway to the Cahill Expressway will be provided along a new ramp under the expressway (Figure 2.14). The resulting traffic volumes on Plunkett Street are expected to be lower than at present. Access to Cowper Wharf Roadway will be available on the existing ramp from the Cahill Expressway. For traffic from the Eastern Distributor a right turn bay will be provided at Plunkett Street. (An alternative arrangement at this intersection is described in Section 5.1.4).

In Stage 2 the right turn from William Street north along Riley Street will be shared between Palmer and Crown Streets. Riley Street will revert to local use.

Initially the Proposal involved the use of Riley Street for northbound traffic from William Street in Stages 2 and 3 as well as Stage 1. Subsequent investigations showed that redistributing this traffic between Crown and Palmer Streets in Stages 2 and 3 was likely to improve local accessibility. This is therefore the Proposal. However, because the analysis of likely impacts was initiated prior to this modification, Sections 3, 4.5 and 4.6 (and Appendices 4 and 5) refer to the initial scheme. While they note the likely impact of the modification on Riley, Crown and Palmer Streets, further detailed investigations will be undertaken.

Albion Street will be closed for right turns at Flinders Street in Stage 2 but could be re-opened on particular occasions to allow special buses to operate between Central Station and the Sports Ground (see Figures 2.1 and 2.17). This partial closure of Albion Street will displace some eastbound traffic onto Campbell Street (which will become one-way eastbound east of Crown Street), and to a lesser extent onto Cleveland Street. Existing traffic movements on Fitzroy and Foveaux Streets will remain.

Locations for the portals at the southern end of the tunnel are restricted. To avoid property acquisition and preserve the trees at Drivers Triangle and because constructing an interchange in the park is not considered desirable, the portals have been located clear of these areas to the south. This has significant implications for the cost of the proposal and requires that the tunnel be constructed through difficult geological conditions at Drivers Triangle. A design feasibility study of portal arrangements at Drivers Triangle is currently being undertaken.

At the north portal, and for a short distance along the tunnel, the line of the tunnel passes beneath properties which are to be rezoned and perhaps redeveloped. This redevelopment will need to be sympathetic to the presence of the tunnel and might be restricted to low rise structures to avoid overloading the rock stratum through which the tunnel passes.



### 2.2.3 Stage 3

The final stage (Figure 2.1) involves the construction of a shorter tunnel for northbound traffic from Flinders Street to Palmer Street, connecting with the Stage 1 underpass of William Street. Entry to this tunnel will be available only from the centre lanes of Flinders Street and two lanes of northbound surface traffic will be provided around the portal (Figure 2.17). Construction of the portal will require the demolition of most properties between 11 - 65 Flinders Street (on the western side of the street only). Some of this property will be made available for redevelopment on completion of construction. Access to the redeveloped sites would be available from Bourke Street.

At the north end of the tunnel all traffic will have to proceed down Palmer Street, but access to Woolloomooloo is available at Plunkett Street (Figure 2.14). For a short distance along the tunnel its alignment passes beneath properties which are to be rezoned and perhaps redeveloped. As in Stage 2 the presence of the tunnel may require some consideration of redevelopment heights permitted so as not to overload the tunnel structure or the surrounding rock.

In all three stages lighting consistent with existing street lighting in adjacent streets is likely to be provided on surface roads by Sydney City Council. Inside the tunnel lighting will be adjusted according to the time of day. During daylight hours lighting levels in the tunnel will be higher, to provide consistency with light levels outside the tunnel and compensate for the fact that drivers will not be using headlamps. At night lighting in the tunnels and at the portals will be at a lower intensity, to allow for headlamp usage. The general objective would be to provide the same intensity of lighting inside the tunnel and at its extremities as exists on the surface streets, to minimise necessary visual adjustments on the part of the driver.

The requirements of the Board of Fire Commissioners will be examined during the design process. These will relate mainly to hydrant services and fire protection in the tunnels and procedures in the event of fire or spillage.

### 2.2.4 Traffic Management Proposals

Traffic management proposals associated with the project have been developed in accordance with the objectives of improving travel conditions, improving environmental conditions, reducing accidents, maintaining accessibility, and improving public transport. They are shown on Figure 2.1.

At Sylvia Chase Square (the intersection of Riley Street, Cathedral Street, Haig Avenue and Sir John Young Crescent) a roundabout was seen as a possible solution to the accident potential which additional traffic volumes would bring to this site. However, on further consideration and with particular regard for the needs of pedestrians, it is now proposed that the intersection be controlled with traffic signals and the channelling of traffic.

Additional capacity at Drivers Triangle has been proposed in Stage 1 by means of widening Flinders Street to seven lanes. This can be achieved by narrowing the footpaths and the lanes by a small amount and reconstructing the median off-centre. The main benefit is to southbound traffic turning right onto South Dowling Street. It will be able to do so in a two-lane movement without reducing the capacity for the through movement to Anzac Parade.

The intersection of South Dowling and Cleveland Streets may require some adjustment to accommodate the increased flows on South Dowling Street. However, consideration should be given to this in conjunction with other proposals for the Moore Park area (see Section 5.1.4).

Additional capacity can also be provided at the intersection of Anzac Parade and Moore Park Road by rerouting the citybound bus movement from the bus roadway to Anzac Parade at a point about 50m. south from the intersection. A new set of traffic signals will enable buses to enter Anzac Parade. They will be co-ordinated with the Moore Park Road signals. This will allow the existing three-phase signal site at the intersection of Anzac Parade and Moore Park Road to be rearranged as a two-phase site, thus providing more green time to all traffic. No restriction of movements is required at Drivers Triangle. All movements presently allowed will thus continue to be permissible at each stage of development of the proposed scheme.



Beginning with Stage 1 further weight restrictions may be applied to Bourke and Crown streets in Surry Hills. As it is, truck movements on these streets are prohibited between 11.00 p.m. and 6.30 a.m. With the concurrence of Sydney City Council these restrictions could be extended.

As elsewhere, traffic management measures in the Eastern Districts will continue to be adapted during and after the construction of the Proposal, due to changes in land use and due to drivers reacting differently from the way in which they might have been expected to react.

Traffic management is a dynamic, ongoing process which must adapt continuously to the requirements of traffic in a given corridor. It is therefore inevitable that there will be changes to the traffic management proposals outlined in this report. The details shown are thus illustrative of a possible solution and should not to be regarded as final or permanent.

### 2.2.5 Timing of Stages

The design of Stage 1 may take a year from the time a decision is made to proceed with the project. The latter part of this period will be required by others, including the affected public utility authorities, to design the necessary adjustments to their installations and make arrangements for this work to be carried out before the main construction work commences. It is possible that construction work could begin on Stage 1 in the latter part of 1986. It could be complete by the end of 1987.

Stage 2 requires a comprehensive geological investigation to establish the optimum tunnel cross section and its precise location. This should take at least a year. A further period of six months would then be required to invite and evaluate tenders for the construction of a tunnel. Tunnel and approach construction could start by early 1987. It is expected to take about 3.5 years to complete. The tunnel could thus be open to traffic late in 1990. This timetable represents the most optimistic scenario. It would not be achieved if difficulties were encountered.

For traffic management reasons, Stage 3 cannot be opened to traffic before Stage 2 is complete.

Specifically, the southbound through traffic must be reduced in Flinders Street to allow the number of southbound lanes to be reduced to two and the number of northbound lanes to be increased to four to carry traffic approaching the Stage 3 tunnel.

Construction of the Stage 3 tunnel is expected to take about two years. Since it cannot be opened until after the Stage 2 tunnel, and since there would be significant cost savings achieved by deferring the commencement of construction, it is proposed that Stage 3 be commenced in 1990. Stage 3 would then be open in 1992.

## 2.3 Associated Developments

### 2.3.1 Introduction

This section provides an overview of the road schemes and land use planning proposals that should be considered in conjunction with the proposed Eastern Distributor. The place of the Proposal in the inner metropolitan road hierarchy is described as well as the local environmental and traffic planning measures potentially facilitated by the Proposal. Section 2.3.3 considers the type of developments that could take place on property surplus to the Proposal and residual to construction.

### 2.3.2 Planning Proposals

#### Metropolitan Road Planning

The Eastern Distributor is seen as an important component of the metropolitan arterial road system. It will complete a major portion of the ring road around the City centre and provide a high standard bypass of the City for traffic between the Sydney Harbour Bridge and the Eastern and Southern Suburbs, including Kingsford Smith Airport.

Other schemes are being investigated by the Department of Main Roads to upgrade a bypass route on the western side of the City. This would complement the Eastern Distributor and provide an alternative route for traffic to and from the Central Industrial Area. The components of this arterial route would be:



- introduction of a one-way pair in Harris and Wattle Streets with a connection via Fig Street to the Darling Harbour overpass;
- widening of Cleveland Street at St. Paul's Place and westerly to Abercrombie Street to facilitate the one-way pair;
- introduction of a one-way pair in Wyndham Street and Botany Road.

This scheme is illustrated in Figure 2.4. In addition, there are some related works firmly proposed and included in the Department of Main Roads' current five year construction programme. They are:

- the Glebe Island Arterial across Darling Harbour to Miller Street, Pyrmont (and in subsequent years to Victoria Road);
- upgrading an east-west link from Dacey Avenue to St. Peters via Lachlan Street, McEvoy Street, Euston Road and Mitchell Road.

### Local Planning

**General Planning Issues:** Proposals for an Eastern Distributor have existed for many years. Thus, to a large extent, planning proposals for precincts within Sydney City Council's area of control have reflected this possibility. Implementation of the Proposal would enable Sydney City Council to implement longstanding land use and traffic related policies. Figure 2.5 and Table 4.4 describe the general nature of Sydney Council's planning proposals as expressed in the City of Sydney Strategic Plan (1980) and the City of Sydney Plan (1983). Briefly, Council takes the view that the Eastern Distributor issue has placed a fetter on its forward planning programme and they would welcome its resolution.

Council is concerned that the residential role of the Eastern Districts be safeguarded and strengthened and that cohesive precincts of traditional housing be encouraged to develop.

In addition, they consider that the spread of commercial development should be constrained and that specific areas be designated for diversified mixed use development.

The Proposal will assist Council by improving the amenity and living environment of large sections of the Eastern Districts and resolve much of the uncertainty over traffic management.

**Surry Hills/Redfern:** Traffic management measures to improve the local amenity of Crown, Baptist and Bourke Streets are the responsibility of Sydney City Council. Crown Street north of Oxford Street, however, must become two-way in Stage 2 to permit the southbound surface movement. For environmental and safety reasons, it is considered that all these streets should be made two-way. Other measures designed to reduce traffic speed might be appropriate in some locations and some median closures might also be necessary. These measures would encourage use of the arterial system and reinforce the objectives of the scheme as regards the enhancement of Surry Hills and Redfern.

**Woolloomooloo/Darlinghurst/East Sydney:** A package of traffic management measures and environmental improvements has been adopted by Sydney City Council as part of a district study for this area. The traffic management measures are currently the subject of negotiations between the Council and the Traffic Authority of N.S.W. However, no conflict between these measures and the proposed Eastern Distributor is anticipated.

### 2.3.3 Redevelopment of Residual and Surplus Property

The property required for each stage of the proposal is shown on Figures 2.6 - 2.8. Land residual to construction and surplus property (property owned by the Department of Main Roads but not required for the proposal) is shown on Figures 2.9 - 2.11. This property is potentially available for redevelopment and/or rehabilitation.

The recommended use of this property is shown in general terms on Figures 2.12 and 2.13 and in more detail on Figures 2.14 - 2.17, together with traffic management and landscaping measures that might be taken. At this stage the report is concerned only with the most appropriate land use for residual and surplus property. The question of whether property suitable for residential development, for example, should be used for public or private housing purposes is dealt with later in the report (see Section 4.1 in particular).



## Residential Redevelopment/Rehabilitation

A substantial proportion of the residual and surplus property is recommended for residential purposes (Figure 2.12).

The block between Cathedral Street and Spence Lane (just north of William Street) could be amalgamated to provide a residential redevelopment site of approximately 4,000 sq.m. (Figure 2.15). Houses on Bourke Street that are of historic significance (see Section 4.3) could be incorporated into the redevelopment. A floor space ratio of 2:1 and a maximum building height of 17m. on this site would be consistent with adjacent zonings in the Woolloomooloo Local Environmental Plan (No. 19, gazetted 20 August, 1982). If this site were redeveloped to its maximum density therefore, 8,000 sq.m. of gross building space could be provided. At an average dwelling size of 70 sq.m. and an average household size of 2.2 persons per household, 115 dwelling units could be provided, accommodating 253 people.

Residual property between William Street and Sutton Lane (just north of Stanley Street) is also suitable for amalgamation and residential redevelopment (Figure 2.16). Consistent with the draft Eastern District Local Environmental Plan, this site (approximately 2,000 sq.m.) could be redeveloped at a floor space ratio of 3:1 and up to a height of 18m. With an average dwelling size of 70 sq.m. and 2.2 persons per household, 85 dwelling units accommodating 187 people could be provided. This site would not be available until Stage 3 is complete.

Vacant land suitable for residential use, most of which is currently used for car parking, could be developed for residential purposes. Isolated blocks of surplus land that are already in residential use or clusters of dwellings could continue to be used for housing purposes (Figures 2.12 - 2.17). Two of these dwellings currently used for community purposes (the Kings Cross Youth Refuge and Aquarius Youth Service) could continue to be used as such or converted to (non-crisis) residential use if suitable alternative locations were found for these facilities (see Section 4.2). Some of the dwelling clusters, such as those on Bourke Street north of Stanley Street, are of historic value (see Section 4.3).

The western side of the block between Palmer Street and Bourke Street, immediately to the north of William Street (Figure 2.15) is currently occupied by a block of 28 flats. In Stage 2 of the proposal, the entrance to the tunnel will pass beneath this property. Eventually this may become a suitable site for office development. However, on the basis of the likely value of the property at the time of Stage 2 construction, it is assumed that the flats will remain.

## Commercial/Office Development/Redevelopment

Several existing commercial sites owned by the Department of Main Roads are surplus to the Proposal or will be residual to construction. It is recommended that they continue to be used for commercial purposes or be redeveloped for office/commercial purposes (Figures 2.12 - 2.17).

The eastern side of the block between Palmer Street and Bourke Street (immediately to the north of William Street) is suitable for office development. The laneway to the north and part of the adjacent property may need to be included in the site to provide a parcel of land large enough for office redevelopment (Figure 2.15). The permissible floor space ratio is likely to be 5:1.

The surplus block on the southern side of William Street between Palmer Street and Bourke Street currently contains a mix of commercial and residential uses. Most of its frontage to William Street is of historic value (see Section 4.3). It would be appropriate for the existing buildings to be retained, with a mixed commercial/ residential use.




Isolated parcels of surplus land currently in commercial use could continue to be used as such (Figures 2.12 - 2.17). These are mostly north of Cathedral Street.

On completion of Stage 3 there will be some residual land suitable for commercial development on the western side of Flinders Street, alongside the tunnel portal.



## KEY

INNER METROPOLITAN MAIN AND ARTERIAL ROADS  
UNDER CONSTRUCTION OR INVESTIGATION BY THE  
DMR.

-  GENERALISED EXISTING ARTERIAL ROADS AROUND THE CBD
-  PLANNED ARTERIALS AND UPGRADING
-  THE EASTERN DISTRIBUTOR.

TO VICTORIA ROAD

TO NEW WESTERN ARTERIAL

PROPOSED GLEBE ISLAND ARTERIAL  
ACROSS DARLING HARBOUR TO  
MILLER STREET, PYRMONT THEN  
TO VICTORIA ROAD

POSSIBLE INTRODUCTION OF A ONE-WAY PAIR  
IN HARRIS AND WATTLE STREETS WITH A  
CONNECTION VIA FIG STREET TO THE  
DARLING HARBOUR OVERPASS

CBD

TO EASTERN SUBURBS

GENERALISED ALIGNMENT OF PROPOSED  
EASTERN DISTRIBUTOR

TO EASTERN SUBURBS

TO EASTERN SUBURBS

PARRAMATTA ROAD

INTRODUCTION OF A ONE-WAY PAIR  
IN WYNDHAM STREET AND BOTANY ROAD

UPGRADING OF AN EAST-WEST LINK  
FROM DACEY AVENUE TO ST PETERS

TO RANDWICK

TO KENSINGTON

TO SOUTH AND AIRPORT

TO SOUTH AND  
INDUSTRIAL AREASTO INDUSTRIAL AREAS AND  
AIRPORT

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





2.4



500 M

ASSOCIATED METROPOLITAN  
ROAD PROPOSALS



-  Industrial
-  Open Space
-  Residential
-  Mixed Commercial/Residential
-  Commercial
-  Special Uses
-  Major Arterial Road
-  Minor Arterial Road

SOURCE: 1983 CITY OF SYDNEY PLAN  
1980 CITY OF SYDNEY STRATEGIC  
PLAN

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

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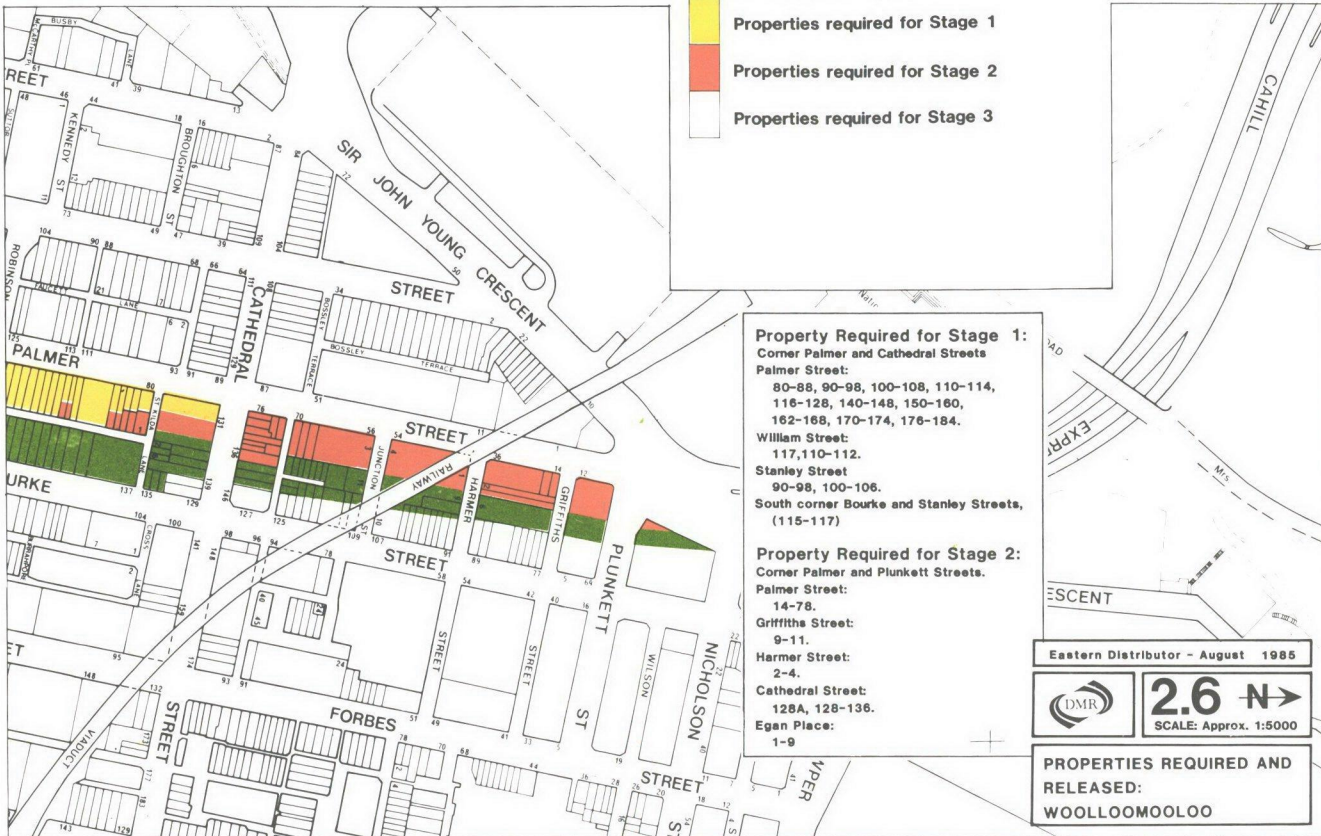
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300 M

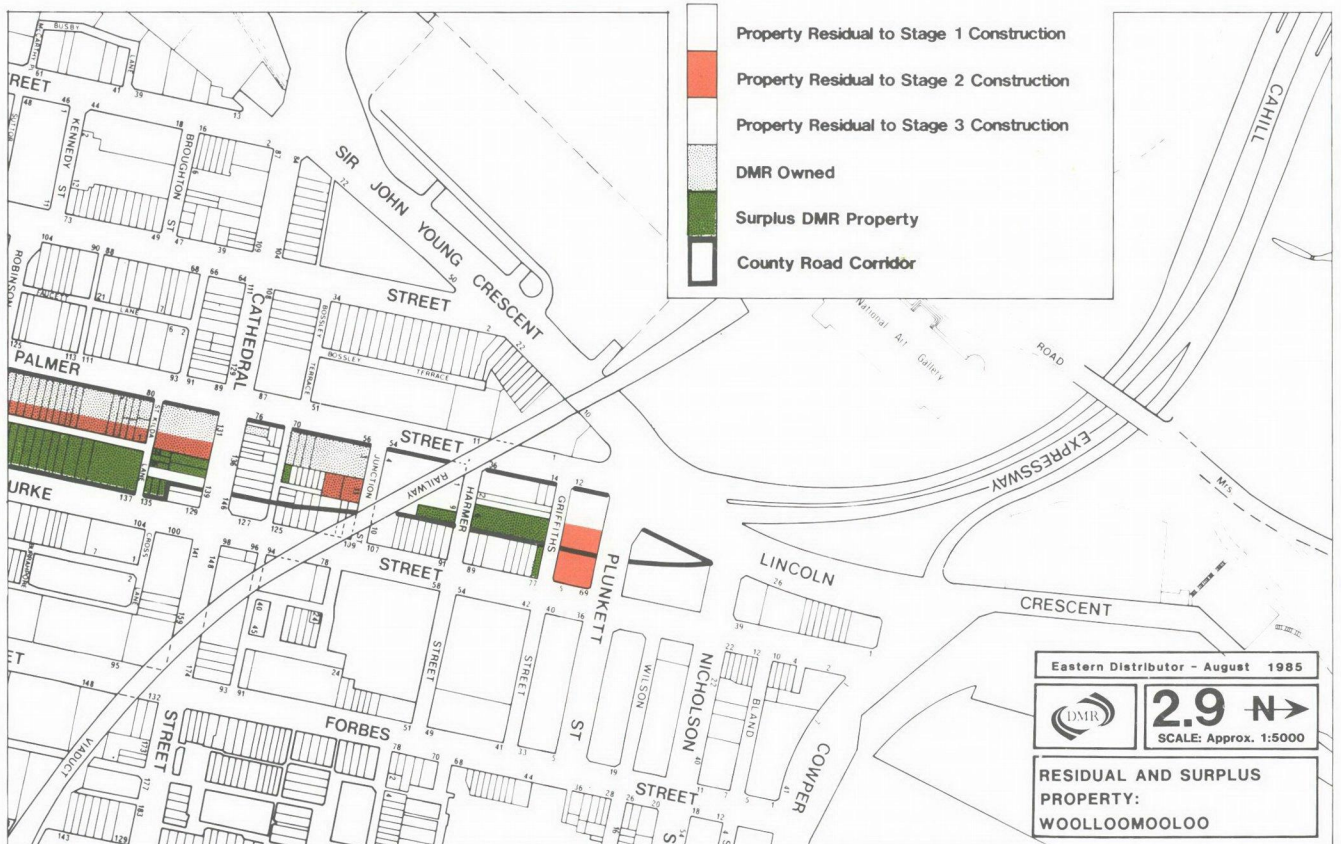
CITY COUNCIL PLANNING  
PROPOSALS



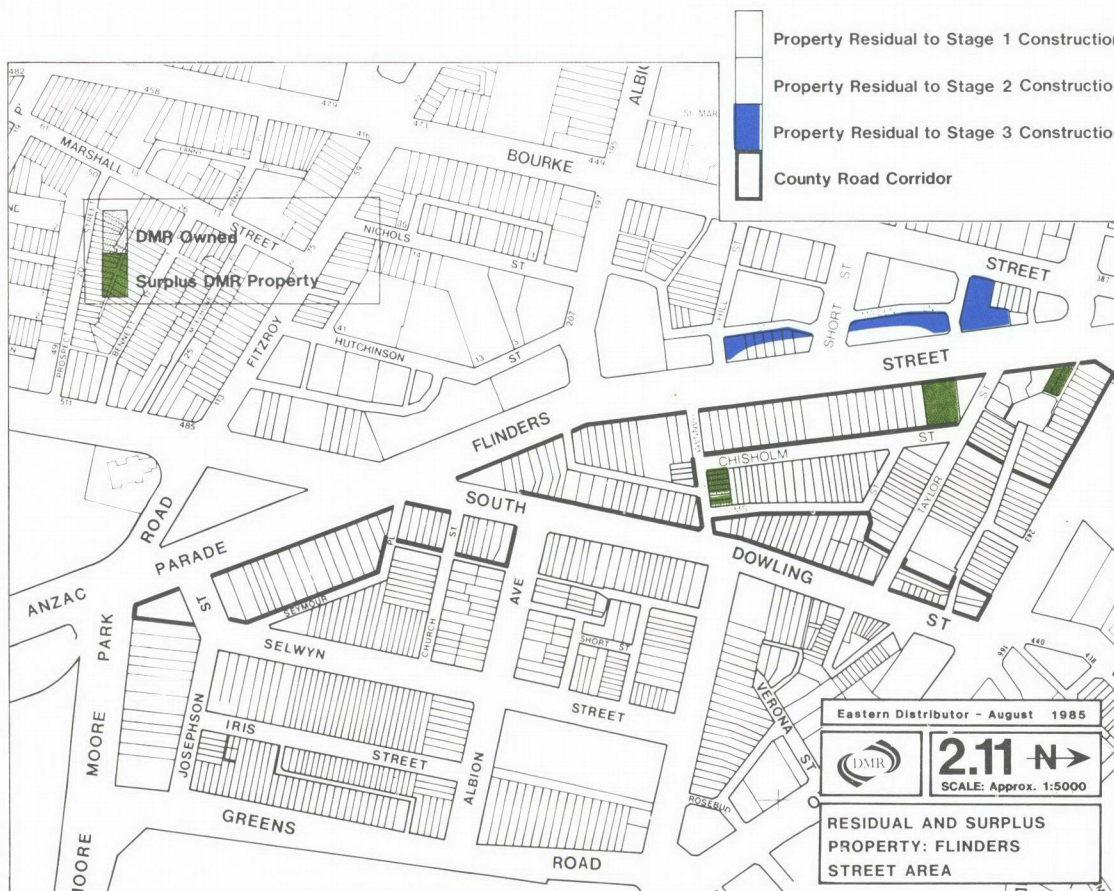
-  Properties released from County Road zoning by the Proposal
-  Properties required for Stage 1
-  Properties required for Stage 2
-  Properties required for Stage 3













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2.12



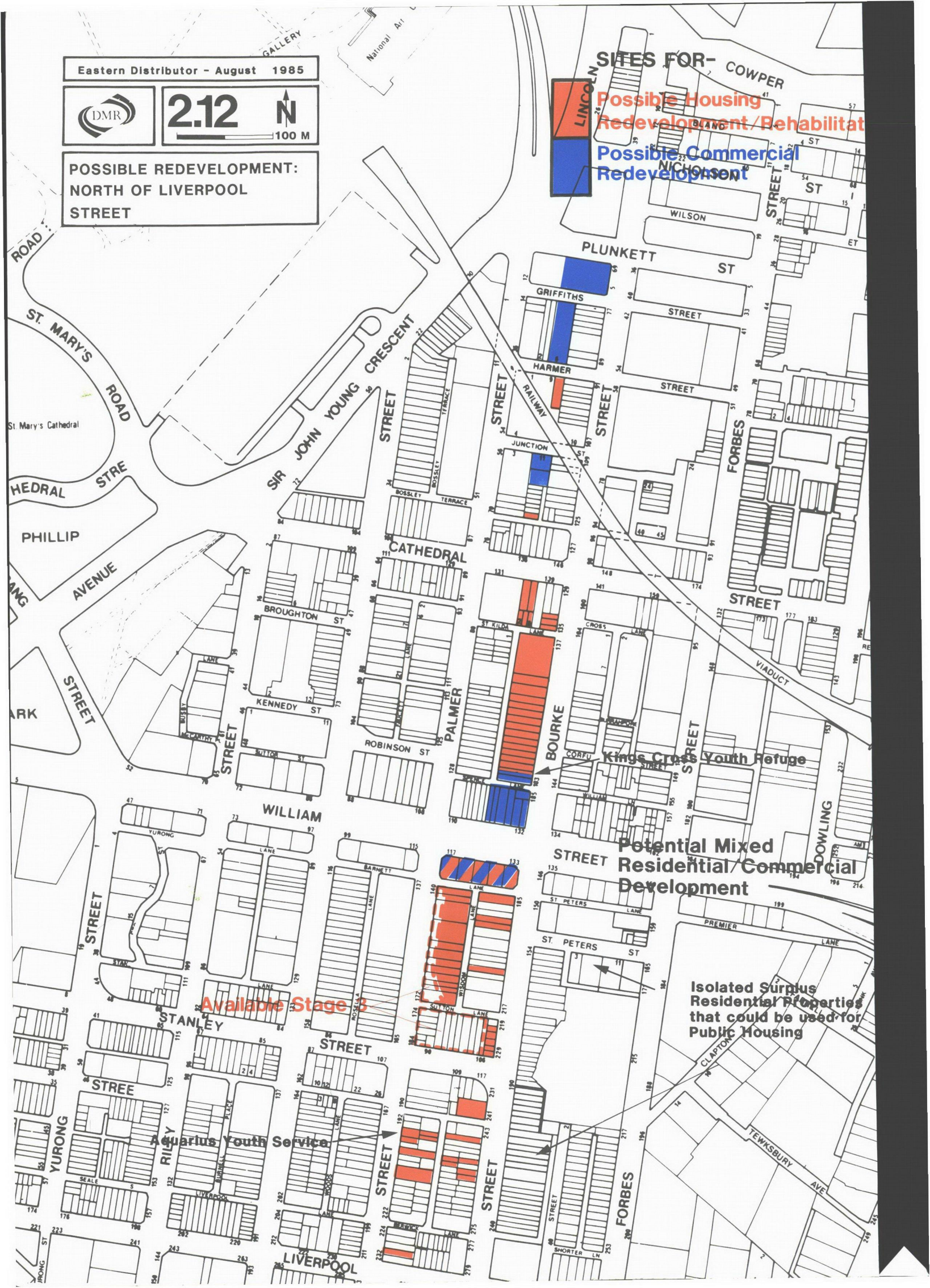
100 M

POSSIBLE REDEVELOPMENT:  
NORTH OF LIVERPOOL  
STREET

SITES FOR-

Possible Housing  
Redevelopment/Rehabilitation

Possible Commercial  
Redevelopment



Kings Cross Youth Refuge

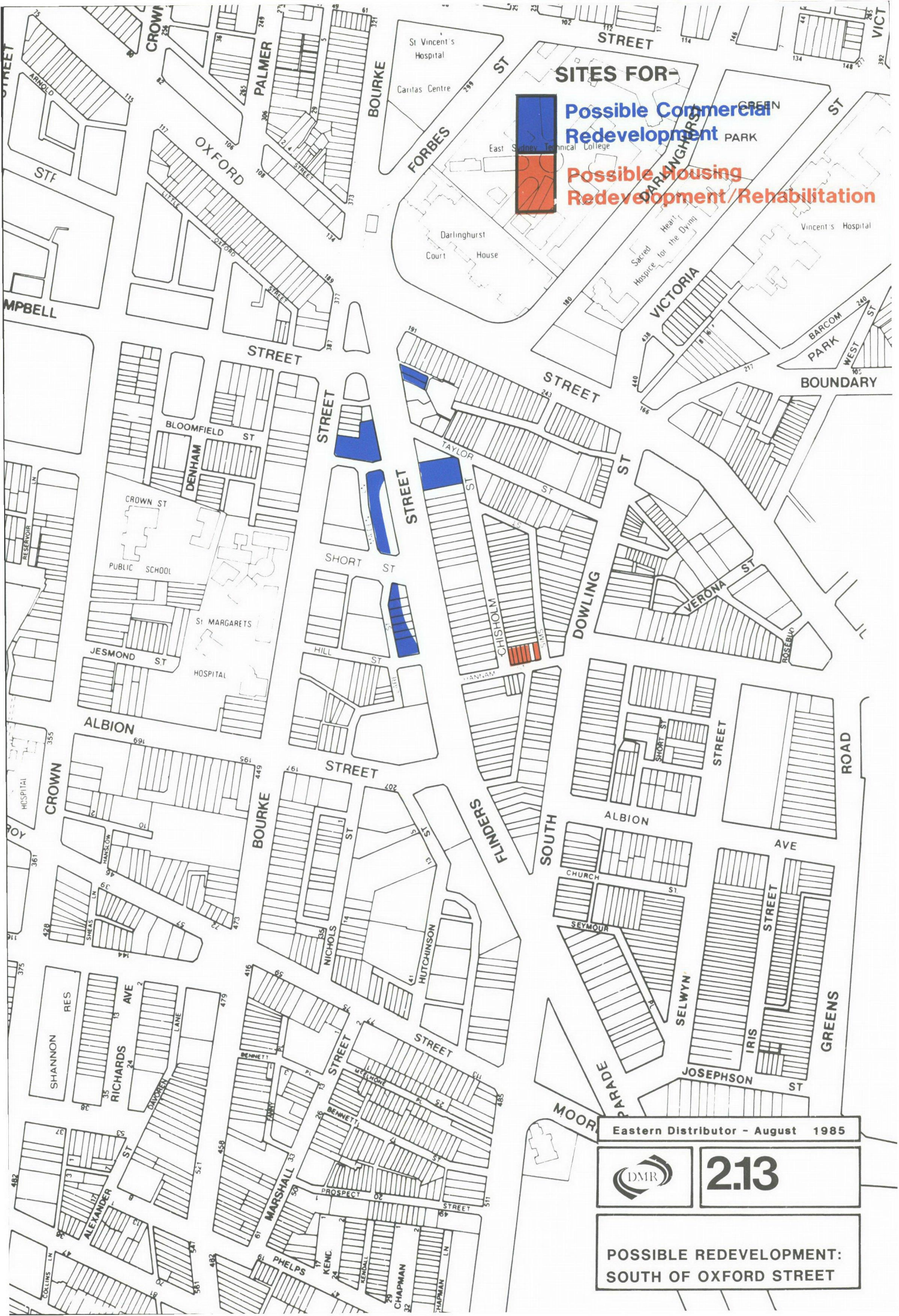
Potential Mixed  
Residential/Commercial  
Development

Isolated Surplus  
Residential Properties  
that could be used for  
Public Housing

Available Stage 3

Aquarius Youth Service





# SITES FOR

Possible Commercial  
Redevelopment

Possible Housing  
Redevelopment/Rehabilitation

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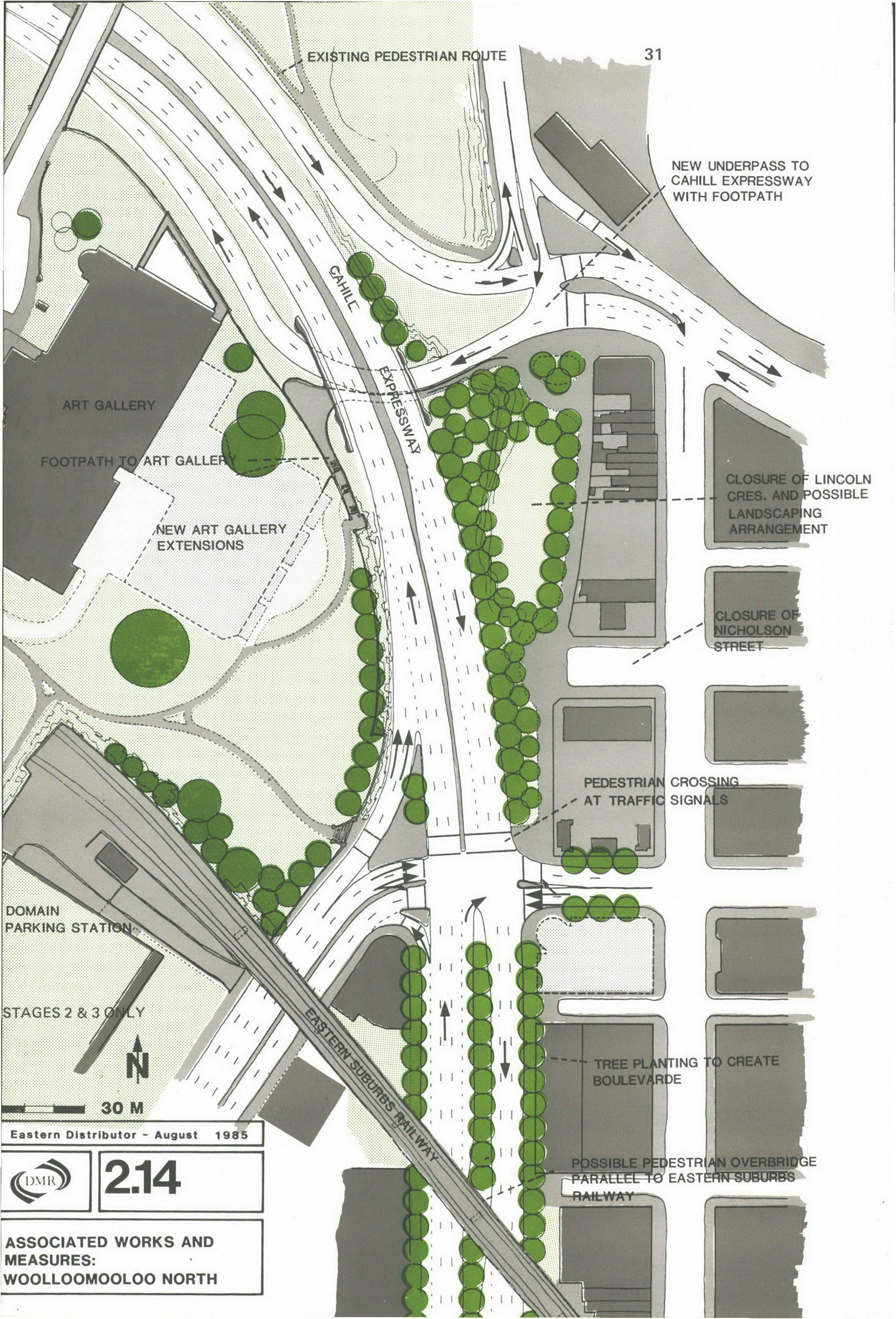
2.13

POSSIBLE REDEVELOPMENT:  
SOUTH OF OXFORD STREET









EXISTING PEDESTRIAN ROUTE

31

NEW UNDERPASS TO  
CAHILL EXPRESSWAY  
WITH FOOTPATH

ART GALLERY

FOOTPATH TO ART GALLERY

NEW ART GALLERY  
EXTENSIONS

CLOSURE OF LINCOLN  
CRES. AND POSSIBLE  
LANDSCAPING  
ARRANGEMENT

CLOSURE OF  
NICHOLSON  
STREET

PEDESTRIAN CROSSING  
AT TRAFFIC SIGNALS

DOMAIN  
PARKING STATION

STAGES 2 & 3 ONLY



30 M

Eastern Distributor - August 1985



2.14

ASSOCIATED WORKS AND  
MEASURES:  
WOOLLOOMOOLOO NORTH

POSSIBLE PEDESTRIAN OVERBRIDGE  
PARALLEL TO EASTERN SUBURBS  
RAILWAY

TREE PLANTING TO CREATE  
BOULEVARDE

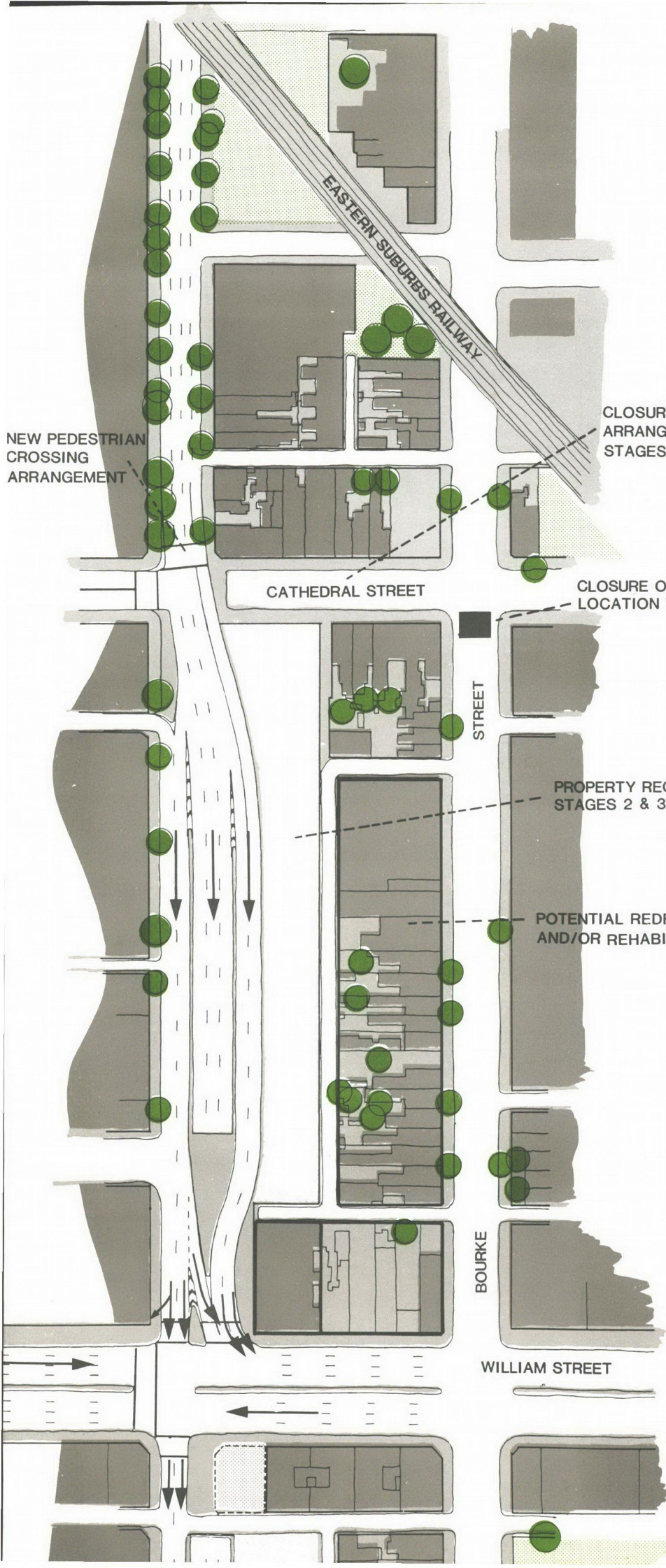
EASTERN SUBURBS RAILWAY

CAHILL  
EXPRESSWAY









CLOSURE OF CATHEDRAL STREET.  
ARRANGEMENT CHANGES FOR  
STAGES 2 & 3

NEW PEDESTRIAN  
CROSSING  
ARRANGEMENT

CLOSURE OF BOURKE STREET. EXACT  
LOCATION TO BE DETERMINED

PROPERTY REQUIRED FOR  
STAGES 2 & 3

POTENTIAL REDEVELOPMENT  
AND/OR REHABILITATION

STAGE 1 ONLY



30 M

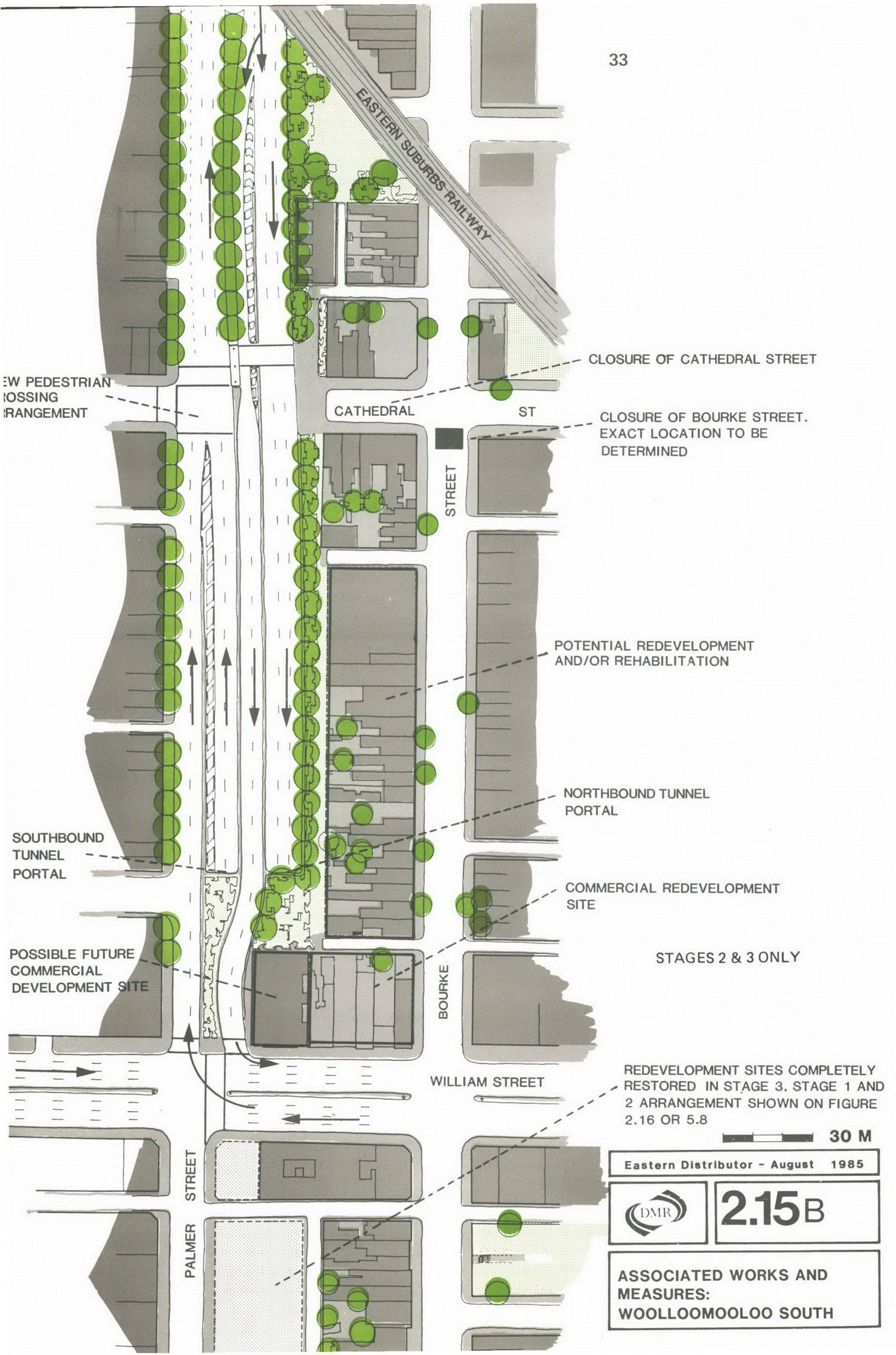
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2.15 A

ASSOCIATED WORKS AND  
MEASURES:  
WOOLLOOMOOLOO SOUTH

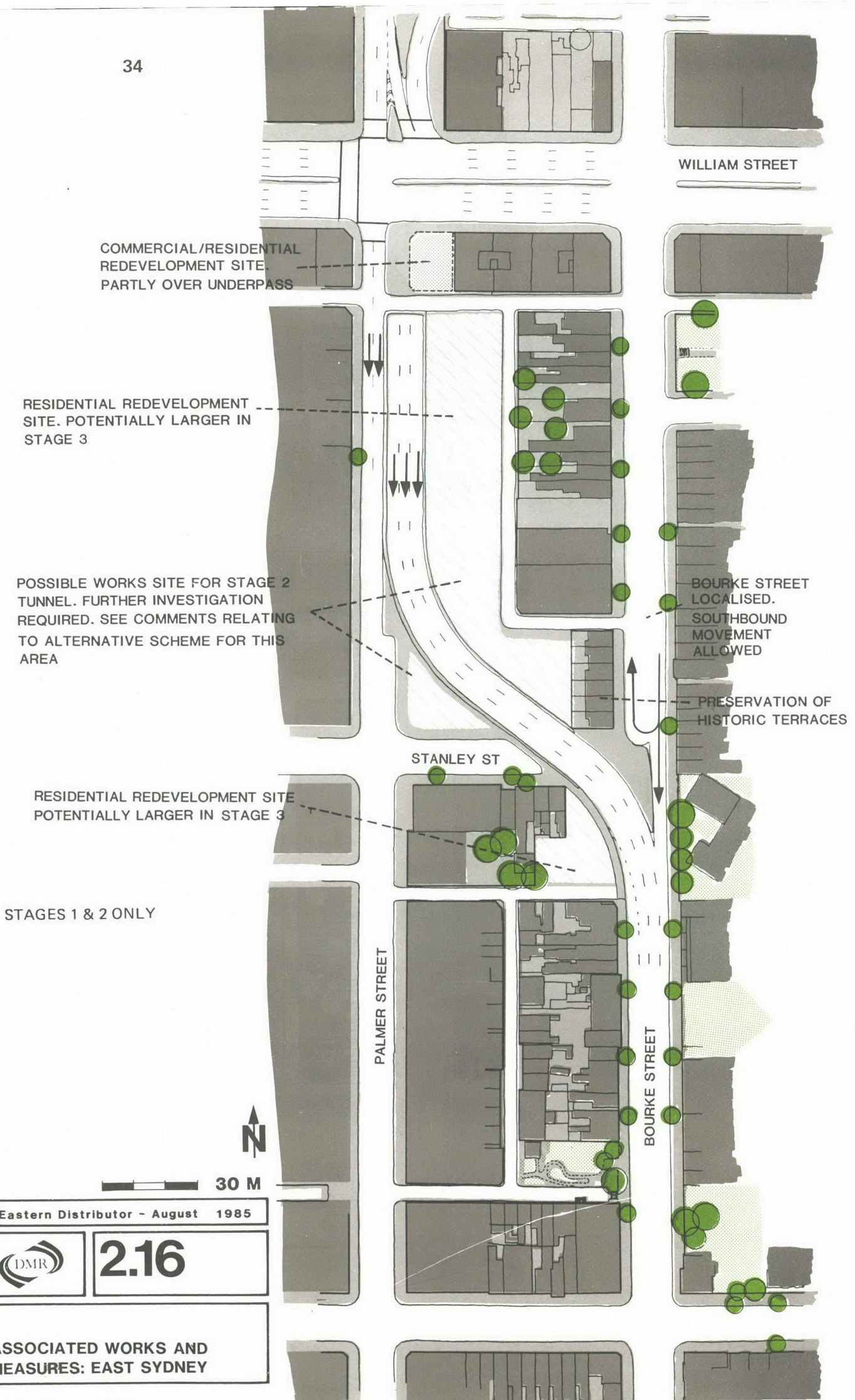








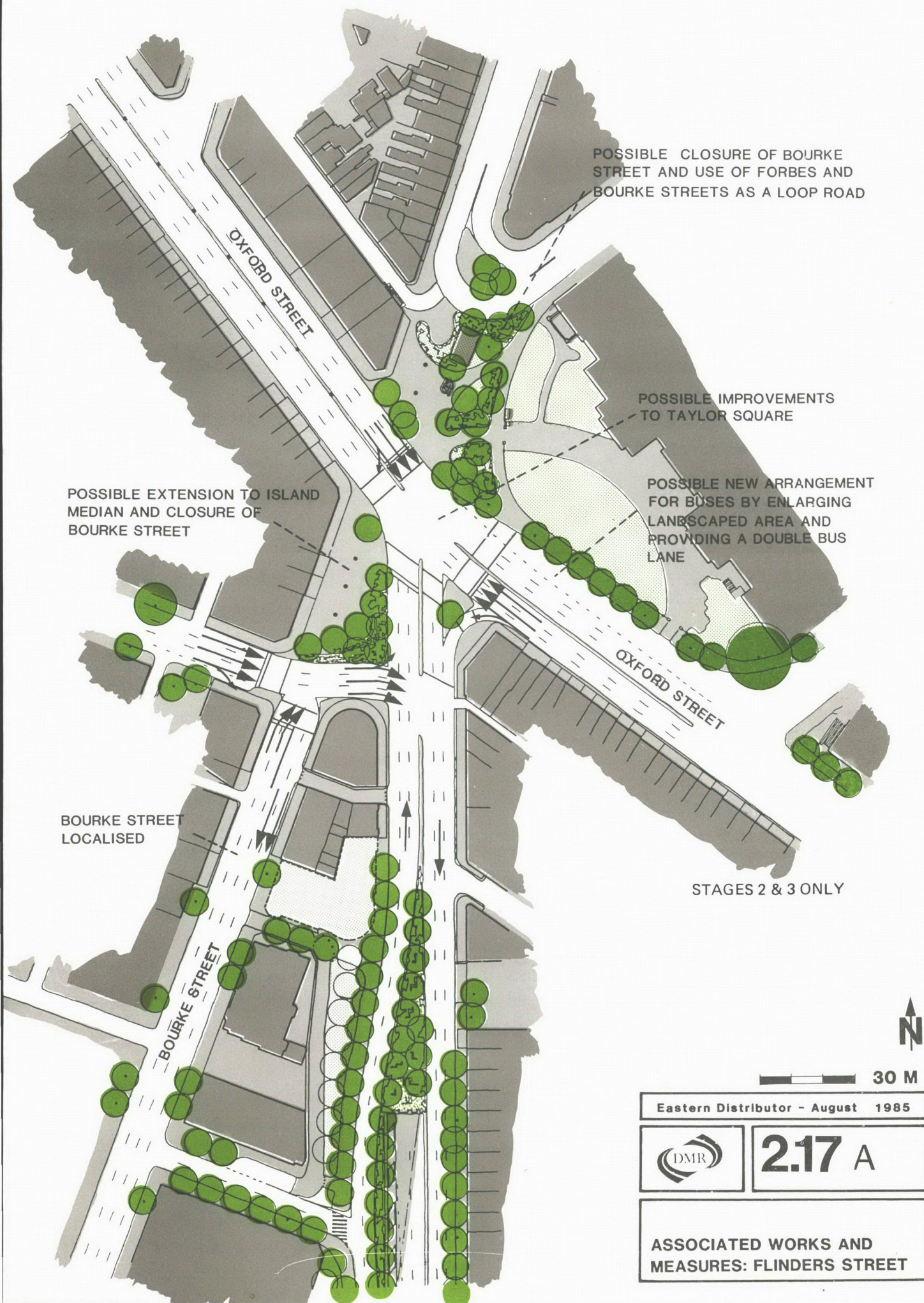




















OXFORD STREET

BOURKE STREET

FLINDERS STREET

NORTHBOUND TUNNEL PORTAL

EXISTING HISTORIC TERRACES TO REMAIN

EXISTING TREES MAINTAINED AND SUPPLEMENTED

LEFT IN TO SHORT STREET

POSSIBLE COMMERCIAL DEVELOPMENT SITES

STAGES 2 & 3 ONLY

ALBION STREET PARTIAL CLOSURE, LEFT TURN OUT ONLY. SPECIAL ARRANGEMENT FOR BUSES TO SHOWGROUND/SCG.

PEDESTRIAN CROSSING UNCHANGED



30 M

Eastern Distributor - August 1985



2.17B

ASSOCIATED WORKS AND MEASURES: FLINDERS STREET







STAGE 1 MEDIAN ARRANGEMENT:  
4 LANES SOUTHBOUND, 3 LANES  
NORTHBOUND

STAGE 1 ONLY

NEW PEDESTRIAN CROSSING  
AT TRAFFIC SIGNALS

MOORE PARK ROAD

NEW ARRANGEMENT FOR BUSES



30 M

Eastern Distributor - August 1985



2.17C

ASSOCIATED WORKS AND  
MEASURES: FLINDERS STREET

MOORE PARK

ANZAC PARADE

SOUTH DOWLING STREET





### 3.0 TRAFFIC AND TRANSPORTATION IMPACTS

#### 3.1 Introduction

Completion of the proposed scheme will create significant opportunities:

- to divert cars and trucks away from existing streets onto roads better suited for high traffic volumes;
- to provide freer flow of north-south traffic bypassing the City centre;
- to reduce conflicts between east-west traffic and north-south traffic;
- to reduce accidents and to improve the efficiency of bus operations.

In this section of the report, existing traffic and public transport systems are reviewed. The effect of the proposed scheme in achieving the objectives listed in Table 1.2 and its influence on the existing system is described. The data developed in this section forms the basis of economic and environmental evaluations later in the report (Sections 4 and 5).

This section does not assess the impact of the Proposal on local traffic movement, pedestrian movement or cyclists. These are addressed in Section 4.4.

The proposed scheme is likely to be attractive to motorists and to be well utilised, without measures having to be adopted to block through traffic from residential streets. Such stringent measures often reduce accessibility for local residents and are undesirable if they can be avoided. Nevertheless it will be necessary in the future for the appropriate authorities to evaluate detailed traffic management alternatives in Surry Hills, East Sydney and Woolloomooloo, to determine how the opportunities created by completion of the proposed scheme can be put to best local area advantage. This has not been attempted in any detail here although Section 2.3.2 refers to City Council proposals in this regard. Nor does this study address the issue of parking. This is not because parking is considered unimportant. Rather, it suggests that the matter is best left to detailed local area evaluation.

A significant issue arising from the Proposal concerns the extent to which east-west traffic could be diverted away from Fitzroy-Foveaux and Albion Streets in the northern sector of Surry Hills. It has been assumed that Albion Street (eastbound) traffic can be partially diverted to Campbell Street (see Figures 2.1 and 2.17). However, this will require further consideration of traffic flows, parking, intersection arrangements, bus movements, local access, linkages across the southern part of the City centre and to Eddy Avenue, the steepness of grades and whether some roadworks may be necessary.

It has been assumed that existing volumes of westbound traffic movement will remain in Fitzroy-Foveaux Streets. This too could be the subject of a detailed evaluation at a later time. However, because it is more difficult to divert this movement to other routes such as Cleveland Street, Albion Street or Oxford Street, it should not be assumed that such a diversion could occur. (An alternative proposal for east-west traffic in Surry Hills is discussed in Section 5.1.4.)

In evaluating the diversion of north-south traffic from Crown and Bourke Streets in Surry Hills to South Dowling Street, it is apparent that consideration will need to be given to upgrading intersections between South Dowling Street and major connecting or crossing streets such as Crescent and Cleveland Streets. The nature of upgrading required, its prospective cost and its primary and secondary traffic benefits have not been evaluated in this report. Alternative arrangements for the design of South Dowling Street will be considered in association with the design of the tunnel portals.

#### 3.2 Existing Traffic

##### 3.2.1 Traffic Movement

Traffic in Surry Hills, East Sydney and Woolloomooloo is made up of regional "through traffic" and locally generated traffic. Through movements are high because these suburbs lie in the direct path between major traffic generators such as the Sydney City centre, the North Sydney commercial centre, the Central Industrial Area, Port Jackson, Port Botany, Kingsford Smith Airport and the University of New South Wales at Kensington. Additional traffic burdens are



imposed through the close proximity between the Eastern Districts and major recreational facilities at the Sports Ground, Sydney Cricket Ground, The Showground, Moore Park, Centennial Park, E. S. Marks Athletic Field and Randwick Race Course.

Surry Hills, East Sydney west of Forbes Street and Woolloomooloo west of Forbes Street are the local areas most likely to be influenced by an Eastern Distributor. Through and around this area, on Elizabeth, Riley, Crown, Bourke and South Dowling Streets and on Anzac Parade, 160,000 - 180,000 vehicles, travelling north-south, pass each day. In an east-west direction, mainly on Cleveland, Fitzroy-Foveaux, Albion, Campbell, Oxford and William Streets and on Cowper Wharf Roadway, 180,000 - 200,000 vehicles pass each day. Of these 340,000 - 380,000 total daily motor vehicle trips, 60,000 - 80,000 trips are on streets which are predominantly residential in character. (Hourly flows on individual streets are shown on Figure 3.4.) Less than half the traffic on these streets (Riley, Crown, Bourke, Palmer, Fitzroy-Foveaux, Albion, Burton and Liverpool) is thought to be associated with traffic generated by land uses in Surry Hills, East Sydney and Woolloomooloo.

### 3.2.2 Traffic Management

The present system of traffic management in the Eastern Districts is efficient in its use of a road system of limited capacity. The principal traffic management features are shown on Figure 3.1. In particular, the one-way traffic systems in Crown, Palmer and Bourke Streets allow significantly greater flow capacity for through traffic than would be the case with two-way streets. This is, however, at the expense of efficiency of local movement because of the additional distance which must be travelled "around the block". In addition to the social and environmental problems caused by traffic, there are major deficiencies to users of the existing road system, including delays and accidents which occur mainly at the following intersections:

- . Crown and William Streets
- . Palmer and William Streets
- . Bourke and Oxford Streets
- . Crown and Oxford Streets
- . The Drivers Triangle area where traffic distribution occurs amongst South Dowling Street, Fitzroy Street, Flinders Street,

Dowling Street, Moore Park Road and Anzac Parade.

To achieve the objectives of the Proposal it is essential that the new road system improves traffic conditions where major north-south movements cross or distribute with major east-west movements. Any such improvement is expected to reduce accident rates, congestion and travel times for motorists, goods movement and buses.

### 3.2.3 Accidents

In the period April, 1982 to March, 1984 the Traffic Accident Research Unit (TARU) recorded 8 fatal, 496 injury and 718 non-injury "tow-away" accidents in Surry Hills, East Sydney west of Forbes Street and Woolloomooloo west of Forbes Street. This data is summarised on Figure 3.2. In a submission to this investigation, the NRMA reported that four of Sydney's worst traffic accident "blackspots" for 1982/83 were recorded by TARU as being in the Eastern Districts, with three such locations likely to be directly influenced by Eastern Distributor construction. The NRMA also reported that the rate of serious crashes for north-south traffic in the Eastern Districts was 2.5 - 6 times the average rate for Sydney.

### 3.2.4 Public Transport

Figure 3.3 shows major bus routes in the Eastern Districts. Buses operated by the Urban Transit Authority provide the main public transport mode and carry an estimated 60,000 passengers per day through the area, on Flinders Street, Oxford Street and William Street. Bus movements on William Street have been reduced since the opening of the Eastern Suburbs Railway but they still carry an estimated 10,000 passengers per day. Oxford Street immediately east of Flinders Street carries an estimated 15,000 and Flinders Street itself an estimated 35,000 bus passengers per day.

Important routes operate on other streets including Crown, Bourke, Campbell, Burton and Stanley Streets and Sir John Young Crescent. Albion Street provides a link between Central Station and the Moore Park area during major sporting and recreational events.

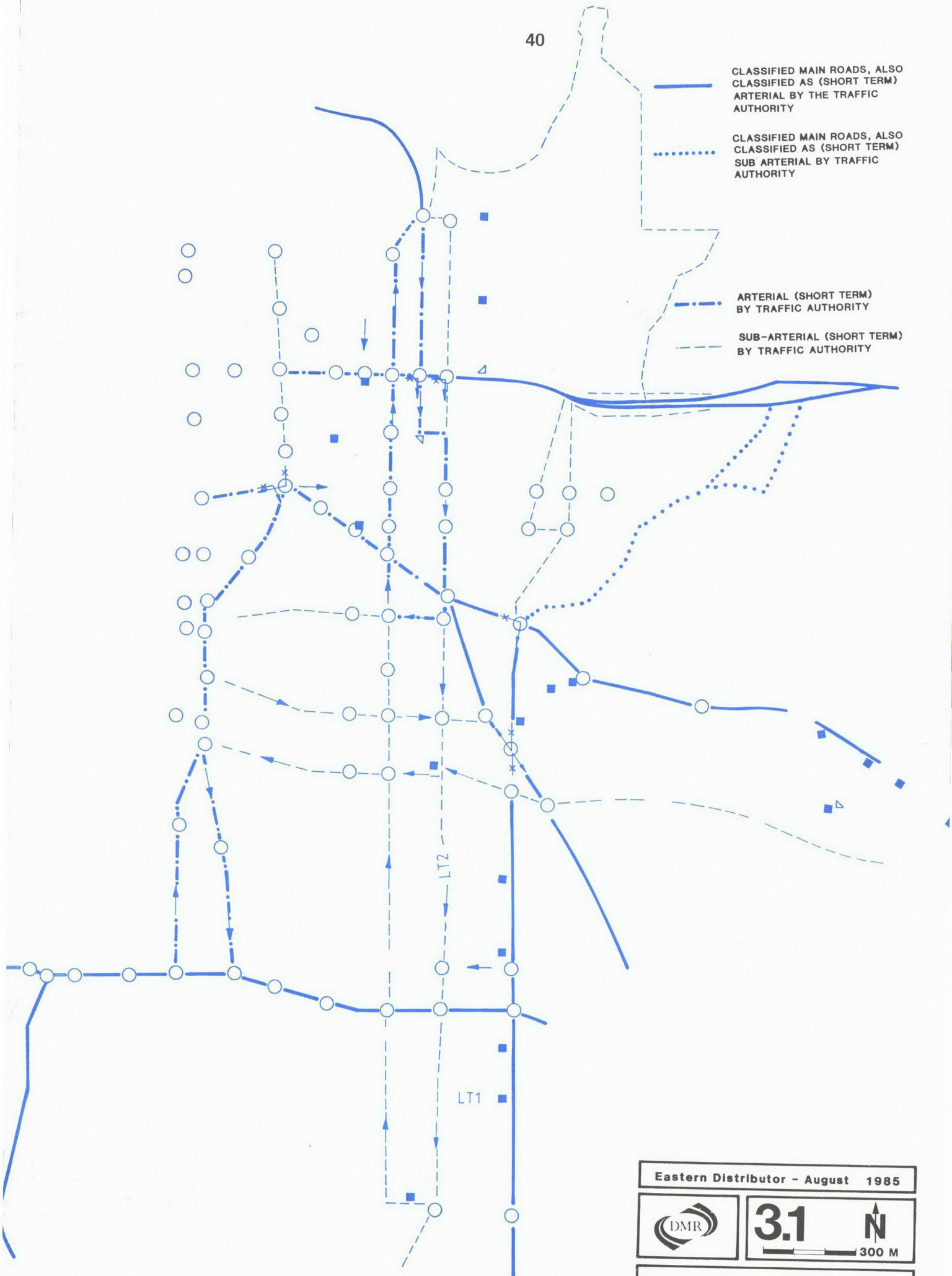


CLASSIFIED MAIN ROADS, ALSO  
CLASSIFIED AS (SHORT TERM)  
ARTERIAL BY THE TRAFFIC  
AUTHORITY

CLASSIFIED MAIN ROADS, ALSO  
CLASSIFIED AS (SHORT TERM)  
SUB ARTERIAL BY TRAFFIC  
AUTHORITY

ARTERIAL (SHORT TERM)  
BY TRAFFIC AUTHORITY

SUB-ARTERIAL (SHORT TERM)  
BY TRAFFIC AUTHORITY



Eastern Distributor - August 1985



3.1 N  
300 M

PRINCIPAL TRAFFIC AND  
TRANSPORT FEATURES



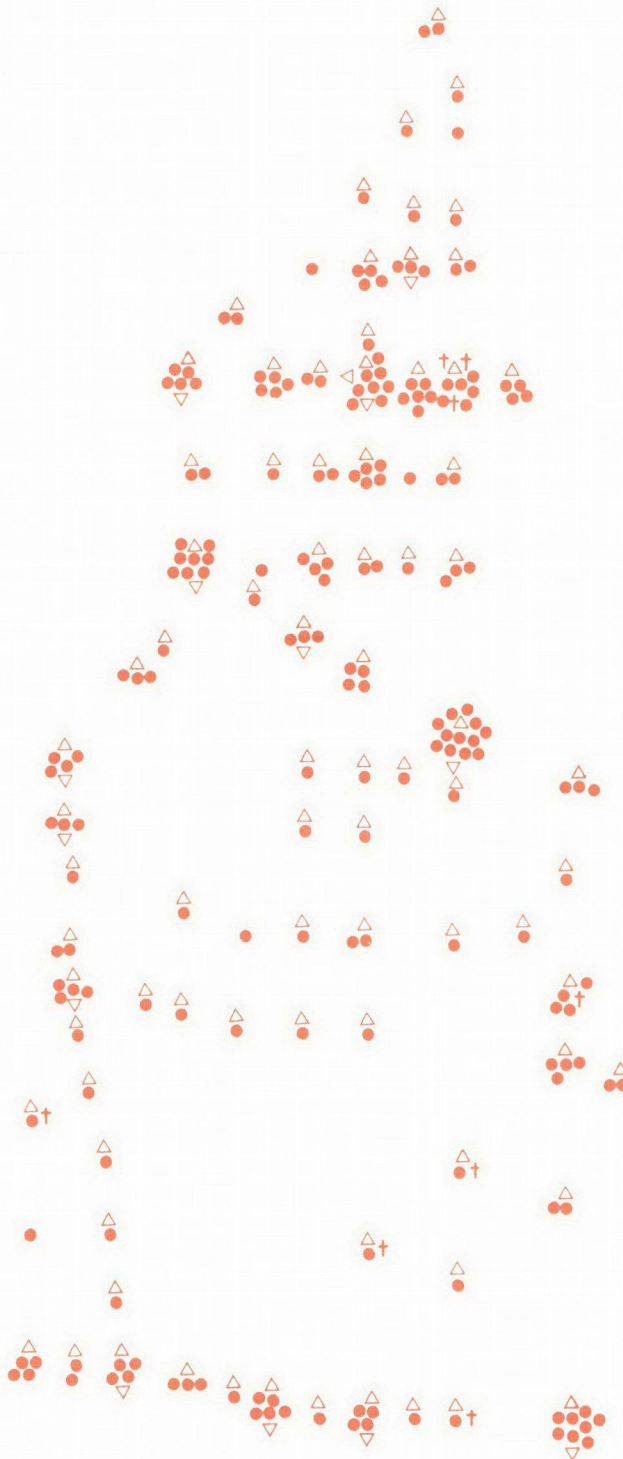
**KEY**

● 5 Accidents

△ 10 Injuries

† 1 Fatality

**T.A.R.U. Reported from  
1/4/82 to 31/3/84**



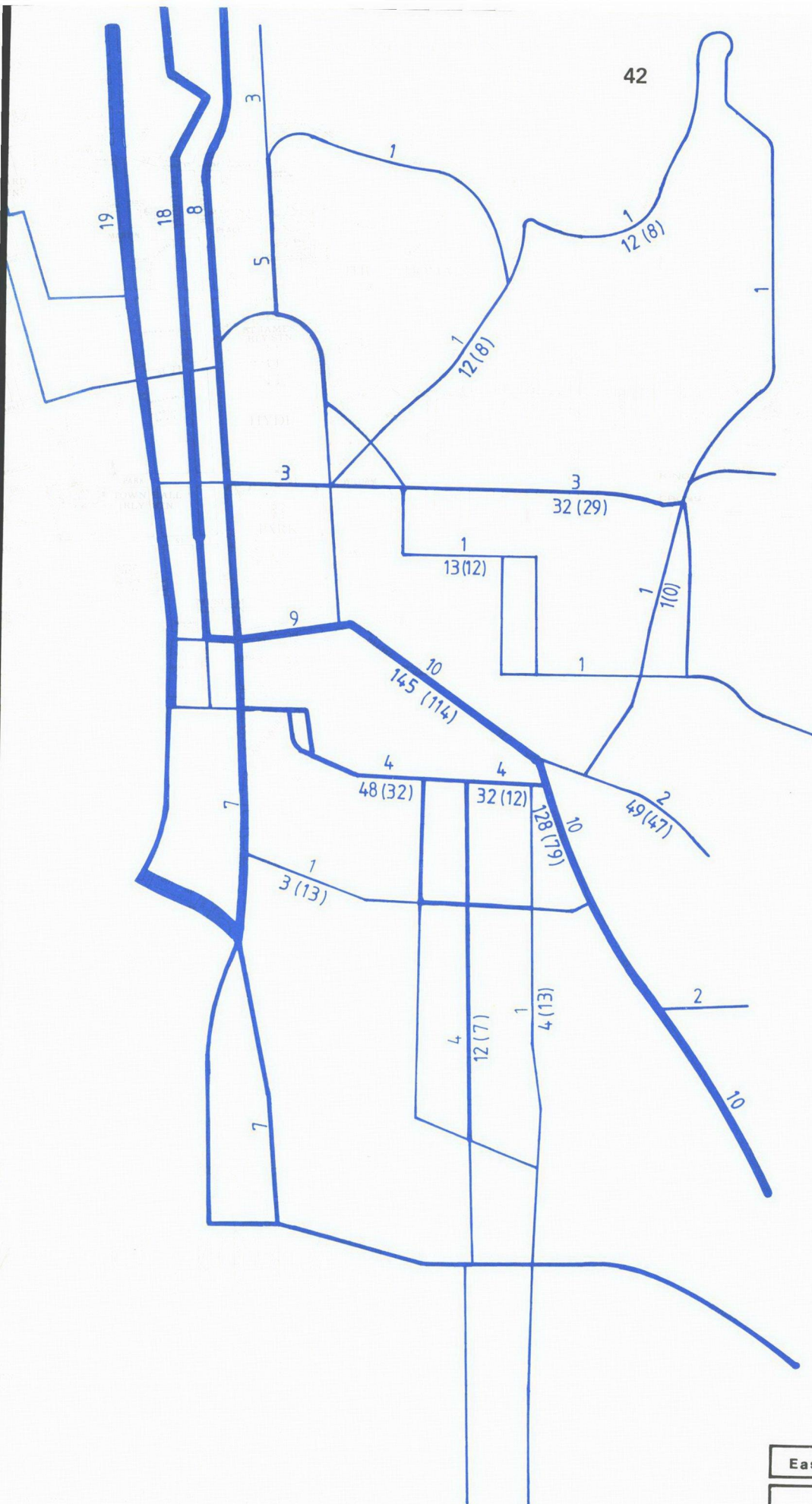
Eastern Distributor - August 1985



**3.2** **N**  
300 M

**ACCIDENTS**





# KEY

7 No. of Routes  
a.m. (p.m.) Peak Hour Trips

Thickness of lines indicates relative volumes.

Eastern Distributor - August 1985



3.3 N  
300 M

MAJOR BUS ROUTES



### 3.2.5 Trucks

Arterial roads through the Eastern Districts carry a large number of trucks providing an essential commercial service, without undue difficulty to other road users. Nevertheless they are very noisy and in this regard are a nuisance to residents, shoppers and others, on Elizabeth Street, Anzac Parade, South Dowling Street, Flinders Street, Oxford Street, William Street and the Woolloomooloo wharf roadways. Truck movements in streets which are predominantly residential in character are considered by residents and motorists to have a nuisance value far in excess of an equal number of lighter and quieter vehicles. Truck movements in Bourke and Crown Streets in Surry Hills have already been restricted between 11.00 p.m. and 6.30 a.m. as a result of resident complaints. Many residents believe that the truck situation in these sub-arterial streets remains unacceptable and that action is required to further reduce or eliminate truck traffic in these and other streets.

Data on existing truck movements is limited but the following summary is provided (from State Transport Study Group computer files) as a guide for such movements in or around the Eastern Districts on a typical weekday over a 24 hour period:

- 600 - 800 trips with both origins and destinations in the Eastern Districts;
- at least 1,200 trips from the southern part of the Central Business District and the Western Suburbs to the Eastern Districts;
- 1,300 or more trips to southern part of the Central Business District and the Western Suburbs from the Eastern Districts;
- 1,800 northbound and southbound trips through the Eastern Districts using the Cahill Expressway and/or Sydney Harbour Bridge;
- 1,200 northbound and southbound trips through the Eastern Districts using the Cahill Expressway for trips to and from the northern part of the Central Business District;
- an unknown number of east-west trips.

This data indicates generally that more than 50 percent of all truck trips in the Eastern Districts are internal trips or have an origin or a destination in the Eastern Districts, i.e. they are directly related to the area and cannot be diverted elsewhere.

The remaining truck traffic, less than 50 percent of the total, has neither an origin nor a destination in the Eastern Districts but is passing through or along the eastern boundary of the area on Anzac Parade or South Dowling Street, then along Oxford Street or through East Sydney and Woolloomooloo.

On individual streets daily truck volumes are thought to be in the order of:

- 800 - 1,000 trips northbound on Baptist Street and Crown Street;
- 800 - 1,000 trips on Bourke Street except in Woolloomooloo and East Sydney where these trips are shared between Palmer Street and Bourke Street;
- 200 trips on South Dowling Street, Surry Hills;
- 500 - 800 trips on Fitzroy-Foveaux Streets;
- 200 - 300 trips on Albion Street.

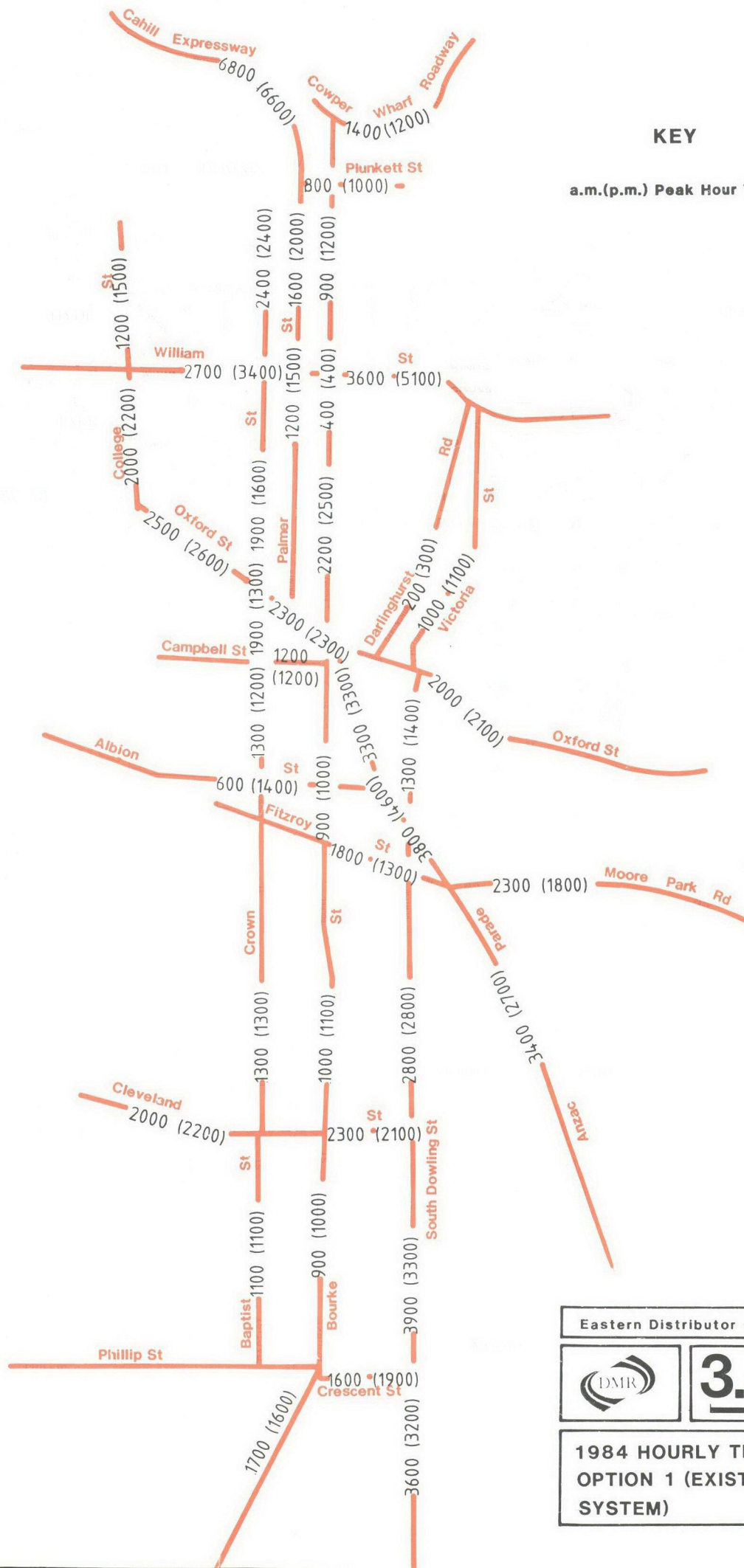
On the Cahill Expressway across Circular Quay trucks represent 2.6 percent of daily trips, 1.2 percent of the a.m. peak period trips, 2.3 percent of p.m. peak trips and 3.7 percent of trips between the a.m. and p.m. peak periods. This pattern of reduced truck movements in the a.m. and p.m. peak periods and maximum percentages of trucks between these periods is common in the Eastern Districts. Daily averages of truck traffic rise to near or above 10 percent in Bourke Street and Burton Street, East Sydney, in Baptist Street, Redfern, and in Foveaux and Bourke Streets, Surry Hills.

## 3.3 Effect of the Proposal on Traffic and Transportation

### 3.3.1 Traffic Redistribution

Figure 3.4 shows 1984 hourly traffic on the existing road system. The existing road system is the "base case" against which the Proposal and other Eastern Distributor alternatives are evaluated (see Section 5).





# KEY

a.m.(p.m.) Peak Hour Total 2 Way Traffic

Eastern Distributor - August 1985



**3.4** **300 M**

**1984 HOURLY TRAFFIC,  
OPTION 1 (EXISTING ROAD  
SYSTEM)**



Data on Figure 3.4 is an extract from a comprehensive series of traffic counts at intersections throughout the Eastern Districts. This data has been studied in conjunction with 1979 City of Sydney Origin Destination Survey Data (Department of Main Roads 1979) and with estimates of vehicle trips generated by the Domain car parking station, Woolloomooloo (including the wharf area) and the Garden Island complex. As a result of these analyses it has been possible to reassign 1984 traffic as depicted in Figure 3.4 to the proposed Eastern Distributor and its alternatives (Section 5).

Figures 3.5, 3.6 and 3.7 show the 1984 hourly traffic reassigned to Stages 1, 2 and 3 of the Proposal respectively. For Stages 2 and 3, where major lengths of tunnel will be constructed, most of the through traffic on the Baptist/Crown Street system and on the Bourke/Palmer Street system in the Eastern Districts, will be diverted to the proposed Eastern Distributor corridor. The diverted traffic will comprise traffic with Cahill Expressway origins or destinations, including the northern part of the City centre, and traffic with origins and destinations in the Domain car parking station, Woolloomooloo and Garden Island.

On completion, the Eastern Distributor is expected to carry about 4,000 vehicles per peak hour in both directions (Figure 3.7).

Ten percent of the traffic with origins and destinations appropriate for diversion to the proposed Eastern Distributor is likely to be retained on routes such as Crown and Bourke Streets because of multi-destination trips, because some motorists may be reluctant to use the long tunnel routes, and because hazardous truck loads will be prohibited from entering the long tunnels.

Most of the Stage 1 traffic diversions will be in the Woolloomooloo area where traffic now turning right from William Street is diverted from Crown to Riley Street, and traffic turning left (eastbound) into William Street is diverted from Bourke into Palmer Street. There is also a nominal reduction expected in Bourke Street traffic in Surry Hills, from the provision of a more attractive southbound route on Flinders Street.

Stage 2 traffic diversions will be much more comprehensive throughout the study area. The

major non-traffic benefits of the Proposal are expected to follow a significant reduction in Baptist, Crown and Bourke Street traffic. Further traffic reductions are expected in these streets upon completion of Stage 3.

Each of the stages is expected to result in time savings to peak period and off-peak traffic and to result in the elimination of energy consuming stops, which also promote driver frustration and accidents. These and other user benefits are discussed further in Section 5.3.

With the completion of the Eastern Distributor, traffic will increase on some streets and decrease on others (Figures 3.6 and 3.7). The most significant increases are expected to be on:

- South Dowling Street (Surry Hills), currently carrying 2,800 vehicles in a peak hour, and expected to carry more than 4,400 in the future;
- Riley Street (Woolloomooloo), with the expected increase averaging 1,200 vehicles per hour in peak periods\*;
- Campbell Street (East Sydney), expected to increase from about 1,100 vehicles per hour west of Crown Street to more than 2,000 in the p.m. peak after the closure of Albion Street;
- Flinders Street (Darlinghurst) where, despite considerable volumes in the tunnel, surface level peak period traffic is expected to increase by 10 to 20 percent.

Decreases in traffic are expected to be more widespread and in some instances to involve streets which are predominantly residential in character. The most significant peak period hourly decreases are expected to be on:

- Bourke Street (Redfern, Surry Hills, East Sydney and Woolloomooloo) where volumes of up to 2,500 vehicles per hour will decrease to 500 or less;
- Crown Street (Surry Hills, East Sydney and Woolloomooloo) where changes similar to Bourke Street are expected;
- Albion Street (Surry Hills) where up to 1,400 vehicles per hour are expected to divert to Campbell Street, leaving only local traffic.

\* With the redirection of northbound traffic from William Street from Riley Street to Crown and Palmer Streets in Stage 2, this effect will occur in Stage 1 only. Crown and Palmer Streets north of William Street will carry relatively more traffic.



Intersections throughout the northern part of Surry Hills and in East Sydney are expected to operate more freely with the diversion of Cahill Expressway and other traffic into tunnels. This applies in particular to east-west streets such as Moore Park Road, Fitzroy/Foveaux, Oxford, Liverpool, Burton and William Streets. Local movements in these areas will be more efficient if one-way streets revert to two-way, providing shorter journeys for local access.

Because of the limited capacity of the Cahill Expressway, it is not expected that there will be much diversion of regional traffic during peak periods, apart from that mentioned above. In off-peak periods the Eastern Distributor is expected to be a very attractive regional route with effects that could spread to the reduction of traffic in Redfern on Botany and Bourke Streets, Baptist Street, and other streets carrying traffic towards the western edge of the Sydney commercial centre and the Harbour Bridge via Wattle and Harris Streets. Some diversion of through traffic travelling to and from the Harbour Bridge through York, Grosvenor, George, Pitt, Castlereagh, Elizabeth and Macquarie Streets is also probable.

Other off-peak benefits are expected in the Paddington and Darlinghurst areas where more Oxford Street traffic is likely to use Moore Park Road. In this same general area, the Eastern Distributor should greatly benefit the distribution of traffic leaving major events in the Moore Park, Sports Ground, Cricket Ground and Showground areas.

In general terms, since the Proposal provides improved traffic conditions between arterial roads at the southern end of the Eastern Districts and the Cahill Expressway to the north, it is consistent with policies which encourage arterial road use by non-local traffic.

Further discussion of the impacts of the proposed Eastern Distributor on traffic movements within the Eastern Districts is provided in Section 4.4.

### 3.3.2 Accident Reductions

To the extent that major cross-traffic movements will be reduced by the diversion of conflicting traffic to the proposed tunnels, the proposed

Eastern Distributor is expected to reduce the rate of accidents. On average at the moment there are 4 fatal, 250 injury and 360 non-injury "tow-away" accidents per annum in the Eastern Districts. In its completed form the Proposal is expected to reduce these numbers by 1 fatality, 90 injuries and 80 to 90 non-injury "tow-away" accidents per annum. It should also reduce non "tow-away" accidents by a number at least equal to the 170 to 180 "tow-away" accidents eliminated.

### 3.3.3 Truck Movements

Truck movements on streets of predominantly residential character in the Eastern Districts should be reduced by an estimated 40 percent, this being the estimated percentage of trucks now using these streets (see Section 3.2.5) and expected to divert to the Eastern Distributor. The remaining truck movements on these streets are thought to be associated mainly with trucks which have an origin or a destination in the Eastern Districts.

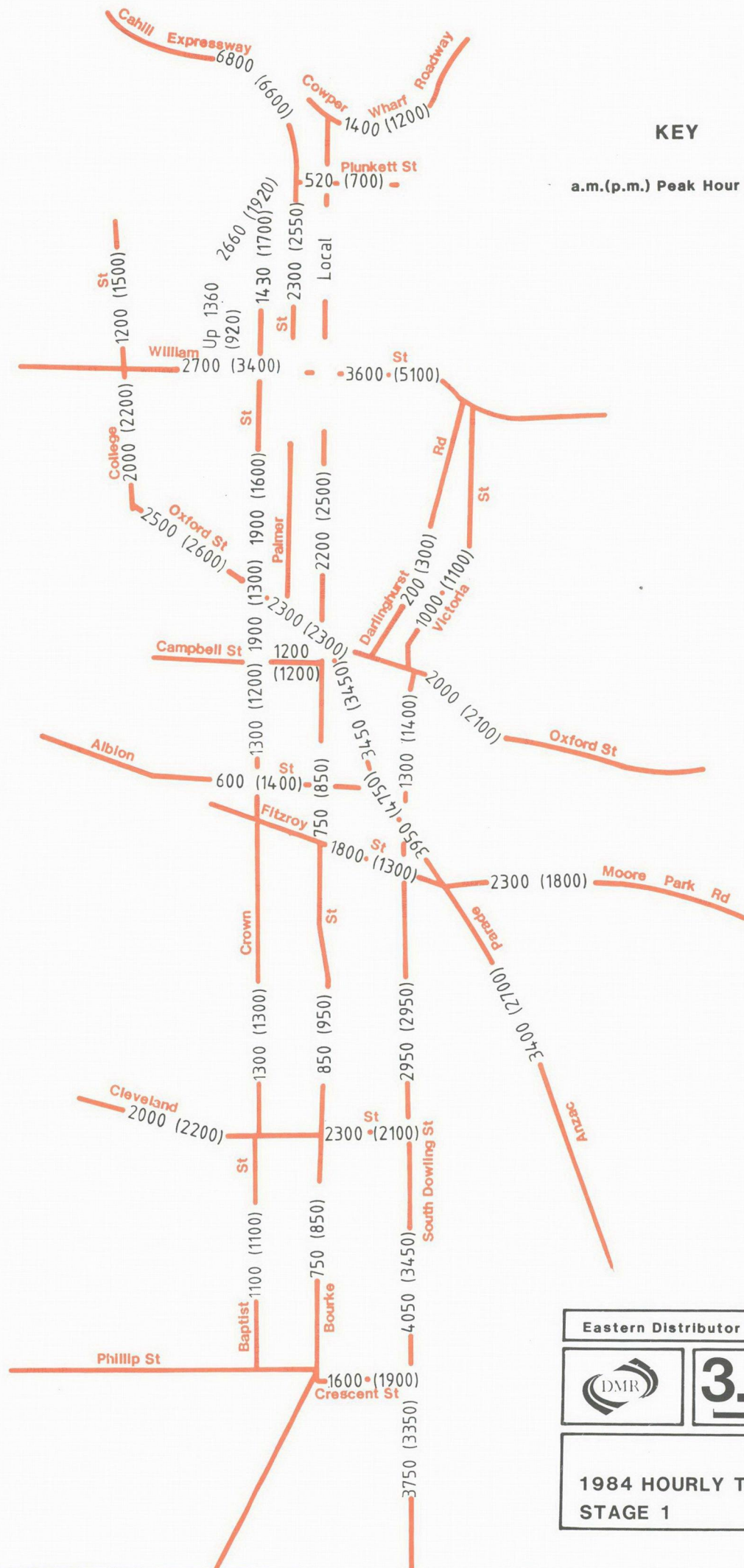
The Eastern Distributor will not have a significant effect on the extent to which freight in the region is moved by road or rail. Decisions on freight movement are more likely to be determined by investment or non investment in rail facilities than by the construction of the Eastern Distributor.

### 3.3.4 Public Transport

Small but nonetheless potentially useful improvements are expected in bus services with the progressive completion of the proposed Eastern Distributor. The improvements are expected to result from reduced traffic on Baptist, Crown and Bourke Streets, from reduced traffic crossing Oxford and William Streets and from freer flow conditions in Flinders Street. More accurate and reliable bus scheduling is possible together with some reduction in travel time. Apart from the need to divert buses from Stanley Street to Liverpool Street between Palmer and Bourke Streets during Stages 1 and 2, no major rerouting of buses is considered necessary.

Special routes to the Showground and Moore Park complex using Albion Street could be accommodated by a limited re-opening of Albion Street and the use of point of duty police to allow





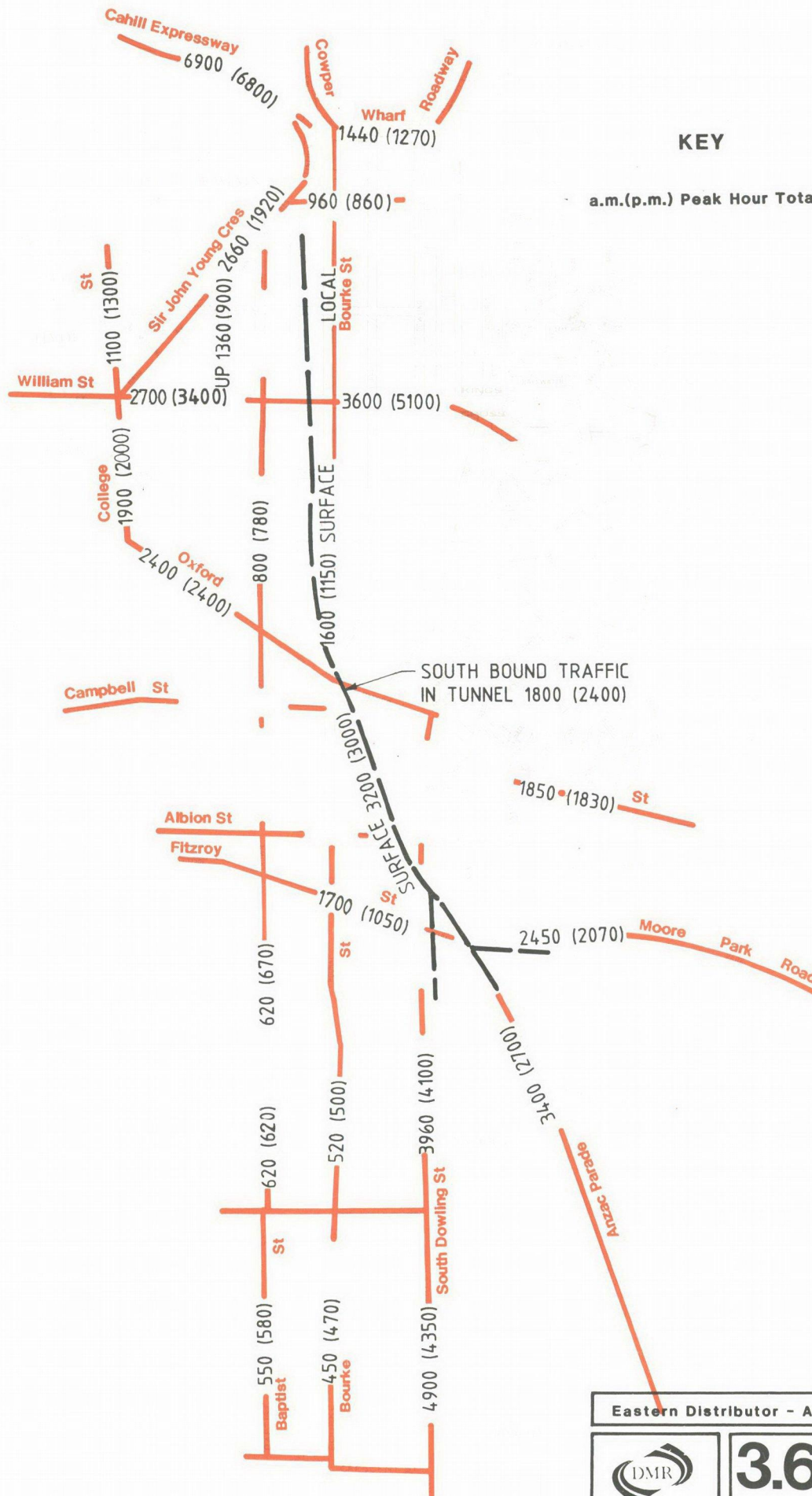
Eastern Distributor - August 1985



**3.5** N  
300 M

**1984 HOURLY TRAFFIC,  
STAGE 1**





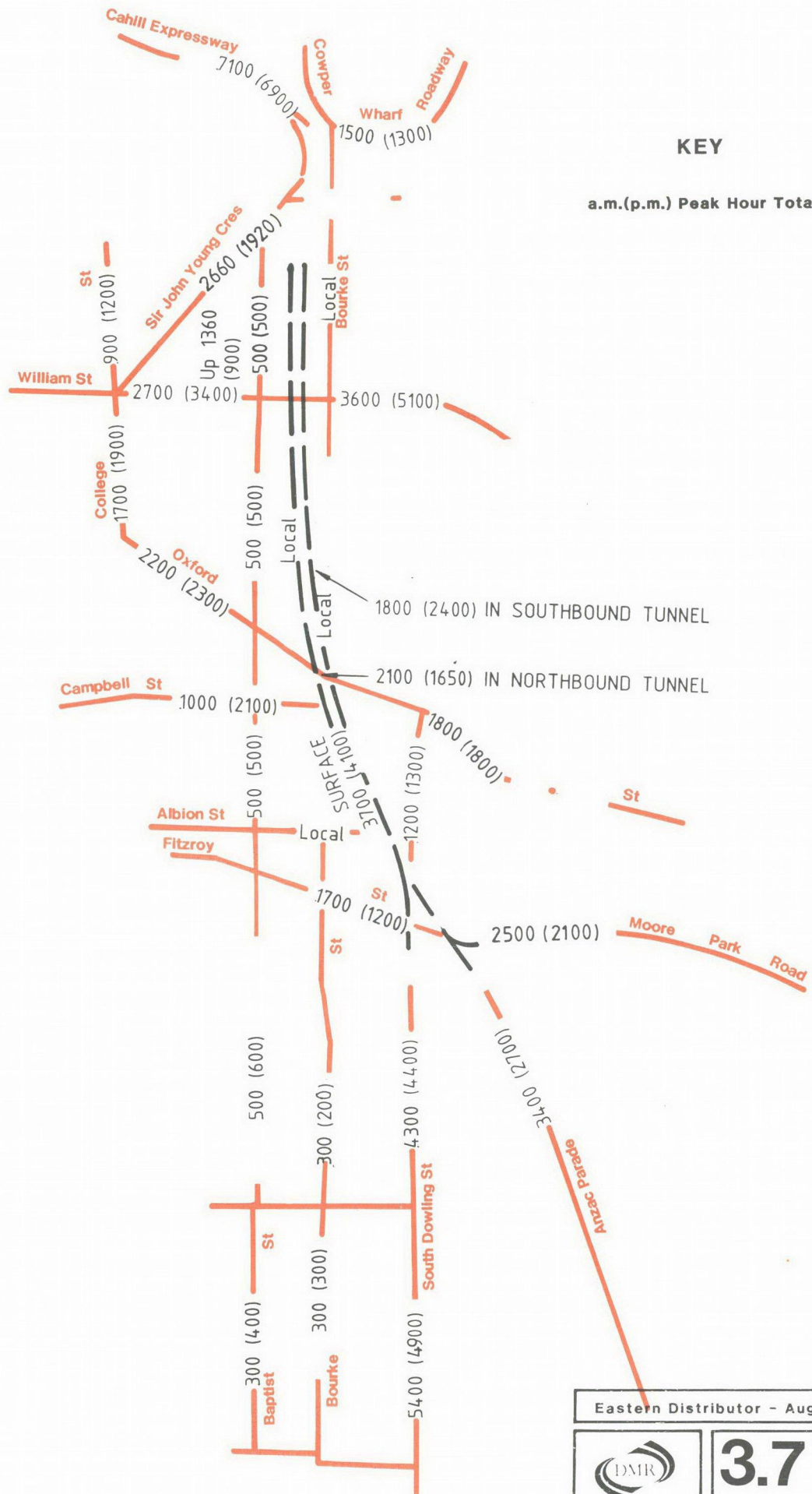
Eastern Distributor - August 1985



**3.6**

**1984 HOURLY TRAFFIC,  
STAGE 2**





Eastern Distributor - August 1985



**3.7**

**1984 HOURLY TRAFFIC,  
STAGE 3**



the bus movement when required. Alternatively, bus-activated signals could operate at the Flinders Street/ Albion Street junction during events at the Showground.

On this basis construction of the Proposal is seen as creating significant opportunities for improvements to road based public transport in and through the Eastern Districts, without disadvantages of any serious magnitude.

Through diversion of traffic onto improved arterial roads, accident reductions and improved accessibility for public transport and local movements, the Proposal fulfils the balanced objectives of better travel conditions overall and improved environmental conditions on local streets.



## 4.0 SOCIAL AND ENVIRONMENTAL IMPACTS

### 4.1 Population and Housing

#### 4.1.1 Introduction

The proposed Eastern Distributor will affect the population in the County Road reservation as well as conditions in a wider area. For the purposes of this analysis the wider area has been defined as the Eastern Districts (Figure 1.6). This is the area in which the effects of an altered road system are likely to be strongest.

This section of the report considers the existing demographic and housing situation in the Eastern Districts and the likely effect of the Proposal in this respect. The analysis is based primarily on 1981 Census data but the equivalent Collector Districts for the 1971 and 1976 Censuses have also been examined to provide an overview of recent trends. Summary population and dwelling profiles have been constructed (Tables 4.1 and 4.2) based on selected variables from the census.

#### 4.1.2 The Existing Situation

##### Summary Social Profile (Table 4.1)

The Eastern Districts accommodate over 25,000 people in what have been defined as 7 precincts (Figure 1.6). Like most other inner areas in the Sydney metropolitan region, they have lost population in recent years. This has been due primarily to declining household size, a result of gentrification (the process whereby higher income households have replaced lower income ones, largely in the inner city) and different patterns of household formation. (The aging of the population as a cause of declining household size is not evident in the Eastern Districts, except in Redfern).

The age structure of the Eastern Districts' population is markedly different from the rest of Sydney. Although the number of people over 65 years of age has dropped significantly in all parts of the Eastern Districts except Redfern in recent years, the proportion of the population over 65 is much higher than in the rest of Sydney. The

proportion under 15 is much lower (except in Waterloo) although the reliability of the census in this respect has been questioned (Bradfield 1984:11). It is likely that the presence of significant numbers of homeless youth in the Darlinghurst area in particular has gone unrecorded. The proportion of youth and children under 15 in the "mainstream" population however has declined dramatically in recent years, except in Woolloomooloo where public housing has provided a stabilising influence.

Public housing in Woolloomooloo has also reversed the trend towards single person families evident elsewhere in the Eastern Districts.

The shift towards single person families (and more generally, gentrification) is reflected in the increasing proportion of the labour force employed in professional and technical occupations.

The employment rates shown in Table 4.1 are not current but they do show that when Sydney had an official unemployment rate of 2.3 percent, the equivalent rate in the Eastern Districts ranged from 2.6 percent to 10.7 percent. Unemployment in this part of Sydney and the proportion of the population receiving welfare payments is still comparatively high.

In 1981 there was a significant difference between the proportion of households with an annual income of less than \$4,000 in the Eastern Districts and the rest of Sydney. ('Households' do not include persons in non-private dwellings.) Similarly the proportion of renting households with a weekly rent of less than \$40 was generally twice as high as in Sydney as a whole.

Except for Paddington, the proportion of individuals with an annual income under \$4,000 was higher in the Eastern Districts (especially in Redfern and Waterloo) than in Sydney as a whole.

Apart from Redfern and Waterloo the Eastern Districts have had a more highly transient population than Sydney as a whole. Between 1976-81 however, there was a higher rate of relocation within the same local government area for the Eastern Districts than for the rest of Sydney.



TABLE 4.1 EASTERN DISTRICTS : SUMMARY POPULATION PROFILE (1981)

Profile Category	Selected Variables	Woolloomooloo	East Sydney	Darlinghurst	Paddington	Surry Hills	Redfern	Waterloo	Sydney
Population Size	Total population	3,103	2,207	2,310	1,449	11,106	6,091	391	3,204,696
	Average annual rate of change (%) 1971 - 81	-1.0	-2.9	-3.1	-2.6	-2.1	-2.2	-5.8	1.8
Age of Population	Population over 65 (%)	11.3	14.0	17.4	10.9	11.6	16.8	14.3	10.1
	Change in population over 65 (%) 1971 - 81	-20.1	-29.7	-33.6	-26.5	-10.8	32.6	-1.8	3.8
	Population under 15 (%)	10.8	7.2	7.0	8.1	11.0	18.5	25.8	23.5
	Change in population under 15 (%) 1971 - 81	-3.4	-39.8	-30.8	-52.0	-46.8	-35.1	-42.0	0.4
Ethnicity	Overseas born (%)	37.2	45.4	41.0	37.4	42.1	40.2	16.9	26.0
	Average annual rate of change (%) 1971 - 81	-1.8	-2.8	-3.4	-4.4	-2.1	-1.9	-12.2	3.6
Family Size	Change in proportion (%) of single person families 1976 - 81	-5.1	2.7	4.8	9.9	5.0	7.7	10.4	3.2
Occupational Structure	Change in proportion (%) of labour force employed in professional, technical occupational group 1971 - 81	7.5	8.1	7.9	11.5	7.6	4.8	0	3.3
Unemployment	Unemployment rate (% of total population)	8.6	10.7	8.8	8.1	6.4	3.2	2.6	2.3
Income	Proportion (%) of households with annual income under \$4,000 <sup>a</sup>	17.4	22.2	25.4	23.0	15.9	21.0	21.2	8.2
	Proportion (%) of individuals with annual income under \$4,000 <sup>b</sup>	37.8	38.0	33.8	31.2	35.8	42.2	47.7	33.7
Rent	Proportion (%) of renting households with weekly rent under \$40 <sup>c</sup>	37.9	45.2	41.6	43.9	38.7	56.4	65.1	21.2
Transiency	Proportion (%) of 1981 usual residents in the same residence in 1976 <sup>d</sup>	21.7	31.9	31.1	40.9	39.0	53.3	63.1	52.2
	Proportion (%) of 1981 usual residents not in the same residence but in same LGA as in 1976 <sup>e</sup>	18.7	13.3	14.5	9.2	9.8	7.5	15.4	10.7
Accessibility	Proportion (%) of labour force walking to work	21.3	27.5	22.9	17.5	21.5	15.5	18.8	4.5
	Mean no. of vehicles per dwelling	0.47	0.33	0.34	0.59	0.56	0.47	0.56	1.2

a. "Households" do not include persons in non-private dwellings

b. This characteristic relates to persons 15 years of age and over

c. This characteristic relates only to rented occupied private dwellings

d. % of population over 5 years of age usually resident in area that was in the same residence in 1976

e. % of population over 5 years of age usually resident in area that was in the same local government area in 1976 but not in the same residence

Sources: Australian Bureau of Statistics, 1981 Census; State Statistical Co-ordination Unit, 1971, 1976 and 1981 Censuses



TABLE 4.2 EASTERN DISTRICTS : SUMMARY DWELLING PROFILE (1981)

Profile Category	Selected variable	Woolloomooloo	East Sydney	Darlinghurst	Paddington	Surry Hills	Redfern	Waterloo
Occupied Private Dwellings	No. of occupied private dwellings	1,047	1,009	1,319	845	4,125	2,594	146
	Average annual rate of change (%) 1971 - 81	-2.3	-2.0	-2.6	2.7	-0.9	-0.7	-3.8
	Occupancy rate (persons per dwelling)	2.05	1.73	1.47	1.69	2.17	2.30	2.68
	Change in occupancy rate 1971 - 81	0.12	-0.18	-0.11	-0.75	-0.31	-0.39	0.51
Unoccupied Private Dwellings	No. of unoccupied private dwellings	370	203	278	123	458	141	72
	Average annual rate of change (%) 1971 - 81	0.1	5.1	0.9	4.4	-1.8	0.7	10.7
Total Private Dwellings	Total no. of dwellings	1,417	1,212	1,597	968	4,583	2,735	218
	Average annual rate of change (%) 1971 - 81	-2.0	-1.3	-2.1	2.6	-1.2	-0.6	-1.2
Dwelling Occupancy	No. of tenant occupied households - Housing Commission	251	0	4	2	506	1,307	66
	No. of other tenant occupied households	483	671	816	448	1,809	473	16
	Total no. of tenant occupied households	734	671	820	450	2,315	1,780	82
	Average annual rate of change (%) 1971 - 81	-2.7	-2.1	-4.1	1.3	-1.6	-1.3	2.8
	Tenant occupied households as proportion (%) of total households	70.1	66.5	62.2	53.3	56.1	68.6	56.2
	Change in proportion (%) of tenant occupied households 1971 - 81	-1.3	-0.8	-11.0	-2.4	-3.7	-4.6	27.5
Non-private Dwellings	No. of non-private dwellings <sup>a</sup> (1971 <sup>b</sup> )	41	31	12	27	93	6	3
	No. of non-private dwellings (1976 <sup>b</sup> )	19	47	26	15	87	4	1
	Persons in non-private dwellings (1981 <sup>b</sup> ):							
	Males	700	283	176	16	1,273	29	0
	Females	258	183	191	2	878	87	0
	Total	958	466	367	18	2,151	116	0
	Proportion (%) of total population in non-private dwellings (1981 <sup>b</sup> )	30.9	21.1	15.9	1.2	19.6	1.9	0.0

a. Non-private dwellings include hotels, hostels, non-private boarding houses, gaols, religious and charitable institutions and other communal dwellings.

b. No. of non-private dwellings not recorded in 1981 Census. No. of persons in non-private dwellings recorded instead.

Sources: Australian Bureau of Statistics, 1981 Census; State Statistical Co-ordination Unit, 1971, 1976 and 1981 Censuses.



Some of the population's transiency is probably not recorded by the census but it has been noted elsewhere for youth and migrants, for example (Bradfield 1984: 12, 20; D4 Darlinghurst 1980: 7, 12).

The accessibility indicators for the Eastern Districts are mixed. The very high proportion of the labour force walking to work indicates good accessibility to jobs and services and facilities in the local area. The relatively low rate of car ownership, apart from being an indication of low incomes, good local accessibility and the lack of parking, probably means lower than average regional accessibility, although regional accessibility by public transport would be relatively high.

#### **Summary Dwelling Profile (Table 4.2)**

There were over 12,000 private dwellings in the Eastern Districts in 1981. Only 87 percent of these were occupied. (In the census 'unoccupied private dwellings' are 'structures built specifically for living purposes and habitable, but unoccupied at the time of the census'. They include 'newly completed dwellings not yet occupied; dwellings which are vacant because they are due for demolition or repair; dwellings to let; and dwellings where all members of the household were absent on census night' - Australian Bureau of Statistics 1983). The high rate of unoccupied private dwellings in the Eastern Districts is likely to relate to population transiency, the high proportion of rental stock and (in 1981) redevelopment activity in Woolloomooloo. In 1981 there were also about 4,000 people in non-private dwellings in the Eastern Districts, a census category which includes hotels, hostels, non-private boarding houses, gaols, religious and charitable institutions and other communal dwellings.

There was a decline in the number of occupied private dwellings in all parts of the Eastern Districts except Paddington between 1971-81, due mostly to the conversion of multiple occupancies to single dwellings but also to the effect of institutional expansion and the intrusion of commercial uses into residential areas. The highest losses were in Darlinghurst, East Sydney and Woolloomooloo. Although the number of non-private dwellings was not recorded in the 1981 Census (the number of persons in non-private

dwellings was recorded instead), the number of non-private dwellings is also likely to have declined due primarily to strata titling. This decline has continued since 1981. The number of unoccupied private dwellings in the Eastern Districts is considered to have increased between 1971-81. This rise may reflect the increasing dilapidation and disrepair of dwelling stock in the County Road reservation but probably does not take into account squatter occupation of these properties. (Similarly, squatters are probably not reflected in the census population figures).

Occupancy rates in private dwellings fell in all parts of the Eastern Districts between 1971-81, except in Woolloomooloo where the rate remained stable. Occupancy rates throughout the Eastern Districts, but particularly in East Sydney, Darlinghurst and Paddington, were lower than the 1981 average of 2.91 persons per household in the Sydney region.

The rate of tenancy in the Eastern Districts is extremely high. Although it fell between 1971-81, in 1981 it was on average more than twice the 1981 rate (26.9 percent) for the Sydney region. In 1981 there were almost 7,000 tenant occupied households in the Eastern Districts, almost 5,000 of which were privately rented. The remainder were Housing Commission dwellings.

The proportion of people in non-private dwellings in the Eastern Districts in 1981 was also extremely high compared with Sydney as a whole. (The proportion for Sydney was 3.3 percent). A large number of these would have been in hotels, hospitals and other institutions (such as the Matthew Talbot Hostel and Edward Eager Lodge) but most would have been residents of boarding or rooming houses. There were many more males than females in non-private dwellings in 1981.

#### **4.1.3 Direct Effects of the Proposal in the County Road Reservation**

Property required for the construction of the Proposal in Stages 1 - 3 is shown on Figures 2.6 - 2.8. In all, 55 dwellings will be demolished, displacing an estimated 210 residents. About 115 of these residents are squatters. The remainder are tenants and owner occupiers (Table 4.3).

Only one residential property not owned by the



TABLE 4.3 EFFECTS OF CONSTRUCTION AND DISPOSAL OF SURPLUS PROPERTY

Action	No. of Dwellings Affected <sup>a</sup>	Estimated No. of Residents Affected <sup>b</sup>				Community Facilities Affected	No. of Businesses Affected <sup>c</sup>
		In Owner Occupied Properties	Tenants	Squatters	Total		
Stage 1 Construction	28	-	45	95	140		3
Stage 2 Construction	19	5	25	20	50	SRA Reserve	6
Stage 3 Construction	8	-	20	-	20		10
<b>Total Construction</b>	<b>55</b>	<b>5</b>	<b>90</b>	<b>115</b>	<b>210</b>	<b>-</b>	<b>19</b>
Disposal of Surplus Property	109	-	140	90	230	Aquarius Youth Services; Kings Cross Youth Refuge	15
<b>TOTAL</b>	<b>164</b>	<b>5</b>	<b>230</b>	<b>205</b>	<b>440</b>	<b>3</b>	<b>34</b>

- a. Dwellings include buildings occupied by tenants or squatters for residential purposes and vacant dwellings. They do not include partially demolished or severely derelict structures. Dwelling stock currently used for non-residential purposes is not included. Dwellings are defined here as units that are fully self-contained. Rooms in hotels, boarding houses, etc., where facilities are shared are therefore included as one dwelling only (or two dwellings where there is a fully self-contained manager's residence). The estimated number of residents affected however include an estimate of all non-private dwelling residents.
- b. Estimated according to likely occupancy rate for various types and sizes of dwellings. Occupancy rates for owner-occupied or tenanted properties estimated at 2, 2.5 and 3 persons per household for small, medium and large dwellings respectively, at 1.5 p.p.h. for flats and 1 person per room in boarding houses, private hotels, etc. Populations of squatter occupied properties estimated at 3, 4.5 and 6 p.p.h. for small, medium and large dwellings respectively.
- c. Does not include storage or car parking ancillary to business located elsewhere.

Department of Main Roads (the Holyrood Private Hotel, 140 Palmer Street) will be required for road construction in Stage 1 (Figure 2.7). In Stage 3 eight dwellings in Flinders Street not owned by the Department of Main Roads will be required (Figure 2.8). (For a definition of 'dwellings' see Table 4.3). Compensation will be paid for the negotiated value of the property and disturbance costs. Where a negotiated agreement is not reached, the dispute will be settled according to the provisions of the Public Works Act and the Environmental Planning and Assessment Act.

The Department of Main Roads will also acquire an interest in a stratum to any land under which the tunnel passes, thus compensating owners for any restriction on foundation loadings.

Stage 1 of the Proposal in particular is likely to cause an increased demand for emergency accommodation in the area.

#### 4.1.4 Indirect Effects of the Proposal in the County Road Reservation

The construction of the Proposal will mean that 418 properties previously affected by the County Road reservation zoning will no longer be required for road purposes (Figures 2.9 - 2.11). Of these properties, 326 are currently used for residential purposes.

Residential properties in the County Road reservation that are surplus to the Proposal but already owned by the Department of Main Roads are shown in Figure 2.9 - 2.11. Some of these dwellings are squatted but the majority are tenanted. The disposal of Department of Main Roads surplus property will affect about 230 residents (Table 4.3).

Surplus residential property will be offered for sale by the Department of Main Roads to the



Housing Commission for rehabilitation or redevelopment as public housing.

Residential property in the County Road reservation not owned by the Department of Main Roads is likely to largely increase in value with the adoption of the Proposal and subsequent rezonings. Specific effects on value will depend on precise locations and, in particular, on the new zonings but changes in traffic volumes past these properties will also affect values. Property owners will benefit but tenants whose rents have been depressed by the effect of the County Road zoning will be disadvantaged.

Residential properties no longer affected by the County Road zoning are likely to be progressively upgraded. Especially where properties have been neglected because of their zoning, tenants will be adversely affected if the upgrading causes rents to rise.

There are a number of boarding/rooming houses in residential property affected by the County Road reservation but not owned by the Department of Main Roads. With the removal of the uncertainty that has affected these properties and possible environmental improvements, these residences are likely to be affected by strata title developments and the conversion of multiple occupancies to single dwellings. Replacement housing for residents displaced will not be easily found as there has been a steady erosion of inner area boarding house accommodation in Sydney in recent years (Department of Environment and Planning 1984). Some regulation of boarding house conversions to strata title is provided for by State Environmental Planning Policy No. 10. This requires that certain local councils (including Sydney City Council) consent to applications for such conversions and in doing so, take into account the likely social impact of their decision. Other mechanisms to protect and improve boarding house stock (Council of Social Service of New South Wales 1985) are also potentially available.

#### **4.1.5 Effects of the Proposal in the Eastern Districts**

The effect of the Proposal on housing in the Eastern Districts will largely depend on changes in environmental conditions. Since most heavily trafficked local residential streets are expected to experience improved environmental conditions (see Sections 4.5 and 4.6 below), property values on

these streets will rise. These increases may radiate outwards, to affect property values in the Eastern Districts in general. As in the County Road reservation itself, property owners will benefit but private renters could be adversely affected by increased rents.

The likely impact of the Proposal on rental levels in the Eastern Districts is complicated by the current rental structure. There has been evidence of high rents (Bradfield 1984 : 160; D4 Darlinghurst 1980 : 13) and large increases in rents for some time (Department of Youth and Community Services, 1979), but "some of the cheapest rental accommodation is (still) to be found in close proximity" (Bradfield 1984 : 10). This is consistent with the finding for the City of Sydney local government area (COS) that "the median income for tenants was substantially below the median income for all residents in COS and in the Metropolitan Area" (Troy 1984 : 14).

The potential for gentrification in the Eastern Districts is therefore likely to be significant still. The most vulnerable group of residents is probably that in non-private dwellings, which includes boarding houses. A Sydney City Council report has suggested that there are almost 1,500 rooming house residents in areas adjacent to the County Road reservation, a large proportion on streets where environmental conditions are likely to improve (MSJ Keys Young 1985).

In the areas adjacent to the County Road reservation where uncertainty about the corridor has had a "spillover" effect, causing dilapidation of the built environment, the lifting of the zoning is likely to promote upgrading. This will have the same social impacts as elsewhere in the Eastern Districts.

#### **4.1.6 Housing Replacement**

Apart from those residents who will be displaced by construction or the disposal of surplus property, the effect on housing conditions of the proposed Eastern Distributor and subsequent rezoning will be to accelerate inner urban renewal. This process is well underway and will proceed in any case, but the environmental improvements brought about by the Eastern Distributor will promote this.

State and local governments have certain limited



means of preventing the erosion of low income housing stock but ultimately the pursuit of better environmental conditions in the inner city is likely to disadvantage lower income rental housing groups. In the light of this and other factors, a recent report on low income housing in the inner city found that "the evidence and argument assembled ... lead to the unassailable conclusion that the most secure way to increase the supply of low rent housing is through a public housing program" (Troy 1984 : 3).

The major advantage of public housing in the inner city is that it provides a permanent supply of low income rental housing. Public housing development in association with the Eastern Distributor proposal may therefore offer a long-term advantage to the area although the adverse impacts on residents described above may still occur.

Land residual to the Eastern Distributor's construction, together with property surplus to the proposal (Figures 2.9 - 2.11), could provide housing for a greater number of people than are potentially affected by construction and the disposal of surplus property. The redevelopment strategy proposed in Section 2.3.3 above suggests that two large parcels of land now in the County Road reservation could be amalgamated for housing redevelopment and rehabilitation. At densities which are consistent with surrounding densities in the City of Sydney Planning Scheme, about 280 dwellings (a mixture of hostel units, small and large flats and townhouses) could be provided on these sites. If this were publicly developed, replacement housing for all residents affected by construction and property disposal could therefore be provided, as well as additional housing stock.

Depending on the Government's decision in this respect, isolated surplus properties suitable for residential purposes could also be used for public housing (Figures 2.12 and 2.13).

## 4.2 Community Structure and Activities

### 4.2.1 The Existing Situation

The Eastern Districts are notable for their

complex urban structure and form, the range and diversity of activities they contain and their heterogeneous population. They comprise a rich mix of land uses (Figure 4.1) and while adjacent uses and structures are not always compatible, there exists a highly compact and functional urban environment.

The area is relatively well served by a network of community facilities and activities, some of which have regional and state wide significance. They include hospitals, educational institutions, emergency accommodation, community resource and information centres, arts and recreation facilities and counselling services.

Specialised facilities in the Eastern Districts and a supportive environment have attracted a number of disadvantaged and/or fringe groups such as the homeless, psychiatric patients and the drug or alcohol addicted. Their presence in the area has reinforced the operation of the services but also promoted the "unorthodox opportunities for irregular income" - prostitution and drug distribution and sale - that have historically existed in the area (Bradfield 1984:10), and the area's image as a "territory of deviance" (Jakubowicz 1975).







The Eastern Districts, especially Oxford Street, are a locale for regional shopping and entertainment and a centre for innovation and experimentation in community life. The ethnic and cultural diversity of the area and the presence of a large artistic community and Australia's largest gay community have been major contributing factors in this respect.

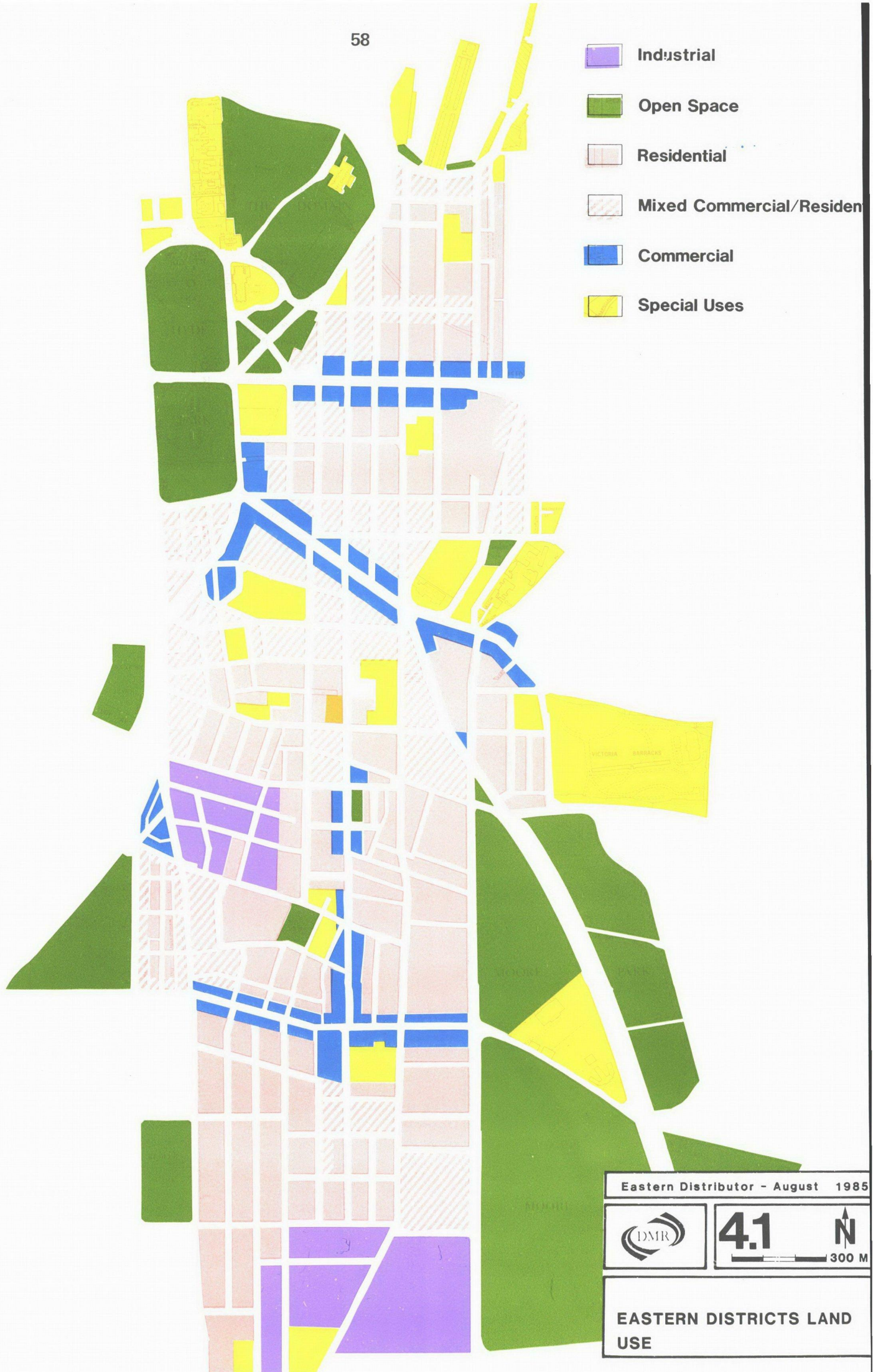
### 4.2.2 Direct Effects of the Proposal

Stage 2 construction will reduce the size of the SRA Reserve on Palmer Street between Junction Street and Harmer Lane. This could be offset by landscaping associated with the Lincoln Street and Nicholson Street closures (Figure 2.14).

The disposal of surplus land will affect the Aquarius Youth Service and the Kings Cross Youth Refuge (Figure 2.9). The properties are not required for construction, so they could remain in their present locations while sale to the



-  Industrial
-  Open Space
-  Residential
-  Mixed Commercial/Residen
-  Commercial
-  Special Uses



Eastern Distributor - August 1985



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appropriate authorities was considered. Depending on the outcome of these negotiations they could stay where they are or alternatively, be re-established in the area, possibly in conjunction with public housing developments.

A number of business properties not owned by the Department of Main Roads will be affected by disposal or construction. Owner operators of business properties will be compensated according to the value of the property, the value of the business and, on occasion, the value of relocating industrial equipment. Business lessees may be compensated too, but the Department of Main Roads normally seeks to purchase affected business properties with vacant possession, allowing property owners to make necessary arrangements with the lessees.

The loss of businesses from the road corridor, while a very significant impact for the owners and/or operators themselves, will not significantly affect the provision of goods and services in the area.

#### **4.2.3 Indirect Effects of the Proposal**

The Eastern Districts contain a rich mix of varying lifestyles, constantly modified by the changing population and changing trends. To some extent though, community life in the Eastern Districts is contingent upon the presence of a large, heterogenous, low income population, housed in rented accommodation of various types and engaged in a wide range of local activities. In recent years this has been affected by the expansion of institutions, the encroachment of commercial activities into residential areas, the loss of low income accommodation and the loss of population itself. At the same time there has been an upgrading of the residential environment and an expansion of the types of activities sought by the new, higher income population and by visitors to the area.

Through the rezoning of land and environmental improvements, the proposed Eastern Distributor is likely to contribute to this trend. Environmental improvements in the Eastern Districts and the subsequent development of a safer environment are likely to be of particular benefit to facilities such as the Frances Newton Pre-School (222 Palmer Street) and S.C.E.G.G.S. As shown in Table 4.4 and explained further in sections 4.5 and

4.6 below, improved residential amenity in and around the Eastern Districts is seen to depend largely on an Eastern Distributor.

### **4.3 Physical Environment**

#### **4.3.1 Heritage Value of the Built Environment : Previous Studies**

The Eastern Districts have been subjected to close scrutiny by all the recognised bodies concerned with the heritage value of the built environment. These include the National Trust of Australia (NSW), the Australian Heritage Commission, the Heritage Council of NSW, the Royal Australian Institute of Architects and the Council of the City of Sydney. Their evaluation of individual items is shown in Figures 4.5 - 4.7. (For detailed schedules of heritage items see Appendix 3.)

It should be noted that most of the properties shown in Figures 4.5 - 4.7 have been identified by the National Trust. Where the Australian Heritage Commission has listed a property, it is because it is of outstanding national or world significance. The properties nominated by the Council of the City of Sydney are generally those that have been excluded from the other lists but which contribute in a significant way to the townscape of the area.

It should also be noted that the full route of the proposed Distributor is within the Classified Urban Conservation Area of the Inner Eastern Suburbs, as defined by the National Trust of Australia (NSW).

#### **4.3.2 Townscape**

The Eastern Districts are characterised by a compact urban form created by a mixture of terrace housing and small industrial and commercial buildings on a grid street network (Figures 4.2 - 4.4). Two to four storey buildings generally occupy a large proportion of their site and are built to both the front and side boundaries. Broad north-south streets are crossed by narrower east-west streets which often terminate in sets of stairs leading up onto the surrounding escarpment. Of the nine cross streets between the harbour and Oxford Street, only three (William, Burton and Liverpool) continue up onto the eastern spur.



TABLE 4.4 REFERENCES TO THE EASTERN DISTRIBUTOR IN SELECTED LOCAL STUDIES AND PLANS

Date	Plan/Study	Recommendation
1976	Action Plan No. 7 Woolloomooloo Precinct	"Within Woolloomooloo, regional traffic spreads through all streets between Forbes and Crown Streets. This traffic ... can be contained to one route, but if so, must be grade-separated under William Street."
1977	Traffic Investigation Crown and Bourke Streets, Surry Hills	"The reduction of through traffic use of Crown and Bourke Streets to a level compatible with the protection and enhancement of the residential character of the Surry Hills Residential Precinct requires ... resolution ... of the problems associated with the further development of the arterial network north of the Precinct."
1979	Eastern District Study (Working paper on the development of a road hierarchy)	"A long-term road hierarchy is proposed for the Eastern District ... The principal features of this hierarchy ... (include) the Eastern Distributor ... assumed to be located on the western side of Bourke Street, passing under William Street and Taylor Square ..."
1980	City of Sydney Strategic Plan : District Plans	<p>"Council will continue to press the State Government for a firm commitment on the route of the Eastern Distributor and redouble efforts to have the Distributor constructed as soon as possible, with the William Street underpass given the highest priority. Through a sensitive combination of innovative engineering, urban planning, and skilful architectural design, the Distributor will be beneficial for motorists and residents alike."</p> <p>"The provision of the William Street underpass as part of the Eastern Distributor will be a crucial factor in the continued implementation of the (modified William Street) Boulevard."</p> <p>"The reduction of through traffic in Crown Street and Bourke Street to a level compatible with the protection and enhancement of the residential character of Surry Hills involves policy consideration by the State road and traffic authorities."</p>
1981	Eastern District Planning Study	"... the successful implementation of the policy of elimination of through traffic from the residential areas of the Eastern District will ultimately depend on the construction of a major north-south arterial, grade separated at the main intersections and capable of accommodating the metropolitan traffic between the Cahill Expressway and the southern road connections."
1982	West Surry Hills Traffic Management and Pedestrian Plan; Moore Park Traffic Management Study	"The longer term road hierarchy shown in the 1980 Strategic Plan incorporates the Eastern Distributor, a limited-access, arterial road connecting the Cahill Expressway with Anzac Parade. With this new road included, the classification of Bourke Street, Crown Street and Campbell Street is reduced from sub-arterial to collector, although Albion Street and Foveaux Street retain their sub-arterial classifications. However the Eastern Distributor is not included in any current roadworks budget and its future is uncertain. This situation places greater emphasis and reliance on those low cost, short term measures and these are likely to be the only improvements capable of implementation in the next 10 years."
1983	1983 City of Sydney Plan	<p>"A package of traffic management measures and environmental improvements has been adopted by Council as part of the (Eastern) District Study. Council is not in a position to implement many of these measures because of the outstanding issue of the Eastern Distributor."</p> <p>"The continuing uncertainty regarding the Eastern Distributor places a fetter on Council's forward planning programme not only in the Eastern District but also in the Surry Hills, Moore Park, and Redfern/Waterloo Districts of the City."</p> <p>"Heavy through-traffic along Bourke and Crown Streets continues to fragment the eastern section of the (Surry Hills) District. The reduction of this traffic to a level compatible with the protection of the residential areas of Surry Hills and Redfern/Waterloo Districts of the City remains a critical issue for consideration by the State road authorities."</p>
1984	Moore Park Local Environmental Study	<p>"... the options for improving traffic flow through the area on the main road system should be developed as part of an overall strategy ..."</p> <p>"The longer term road hierarchy shown in the 1980 Strategic Plan incorporates the Eastern Distributor, a limited-access arterial road connecting the Cahill Expressway with Anzac Parade and South Dowling Street. With this new road included, the classifications of Bourke Street, Crown Street and Campbell Street are reduced from sub-arterial to collector, although Albion Street and Foveaux Street retain their sub-arterial classifications. However ... the Eastern Distributor is only one of a series of major roadwork projects required to provide an adequate level of service on the major road system. In recent years funds have not been available for such projects, a condition which places greater emphasis and reliance on low cost, short-term measures."</p>

Sources: Noted in list of references.



Of the streets which do not carry onto the ridge, Cathedral Street is the most important. It provides a focus for the pedestrian activity of Woolloomooloo and the first convenient pedestrian access to the city from the shores of the harbour. The vista to the west is of significance, as it is terminated by St. Mary's Cathedral.

The introduction of tramways early this century had a significant effect on the townscape of William, Oxford and Flinders Streets. In 1907 the buildings on one side of each of these streets were demolished to make them wide enough for electric trams. The south side of William Street, the west side of Flinders Street and the north side of Oxford Street were rebuilt in the period leading up to the First World War. The consolidation of land holdings associated with the widening is reflected in this redevelopment.

Along William Street the architectural composition of the buildings in each block was given considerable attention. This has resulted in the south side of the street having unique Edwardian architectural character.

Along the north side of Oxford Street redevelopment was less consistent in style, but of the buildings are generally similar in scale. The treatment of the parapet line and the use of awnings to protect the broad footpaths are worthy of particular attention. Recent high rise development at the western end of the street has lessened the architectural unity of the street.

In Flinders Street the buildings on the western side were demolished and replaced with a relatively disparate collection of commercial buildings which lack the architectural integrity and unity of scale of their counterparts in William and Oxford Streets. The eastern side of Flinders Street by contrast retains a streetscape of particular merit.

The surrounding escarpments have experienced considerable redevelopment and are lined with tall buildings, a trend which may continue along the south side of Oxford Street. The views which are naturally obtained from a basin formation such as this are largely thwarted by the high rise development along William Street, but the grid street pattern does allow some glimpses of the harbour and in cross streets good views of prominent local features on the surrounding escarpments can be obtained.

A fuller description of the area is contained in the heritage Working Paper in Jackson Teece Chesterman Willis & Partners (1985).

#### 4.3.3 Townscape and Heritage Significance

In general terms, the townscape and heritage significance of the Eastern Districts lies in the fact that the Woolloomooloo and Darlinghurst basin is a rich and diverse urban landscape illustrating the development of Sydney over a period of 130 years.

It retains numerous institutional, civic and private buildings of major importance (Figures 4.5 - 4.7) including:

- . Darlinghurst Gaol and Court House
- . Darlinghurst Police Station
- . Presbyterian Church and Manse in Stanley Street
- . St. Michael's Church of England in Albion Street
- . Durham Hall
- . Kinsela's Funeral Parlour
- . Bryson Industries Building

Importantly also, it retains a variety of terrace housing and commercial buildings which, although not of great intrinsic architectural merit, contribute to the formation of an increasingly rare nineteenth century urban landscape. Particular streetscapes include:

- . Terrace houses to the east of Flinders Street
- . Buildings surrounding Taylor Square
- . Buildings on both sides of Oxford Street and the south side of William Street. Their relationship to the grid street pattern, their awnings and the treatment of street corners and parapet links are of particular note.
- . Sections of Bourke, Crown and Riley Streets.

The views of St. Mary's Cathedral along Cathedral Street, and the views of the harbour down Bourke, Palmer and Crown Streets are important.

The Moreton Bay fig trees along Anzac Parade (made into a major boulevard and renamed Anzac Parade after the First World War) are historically and environmentally significant.





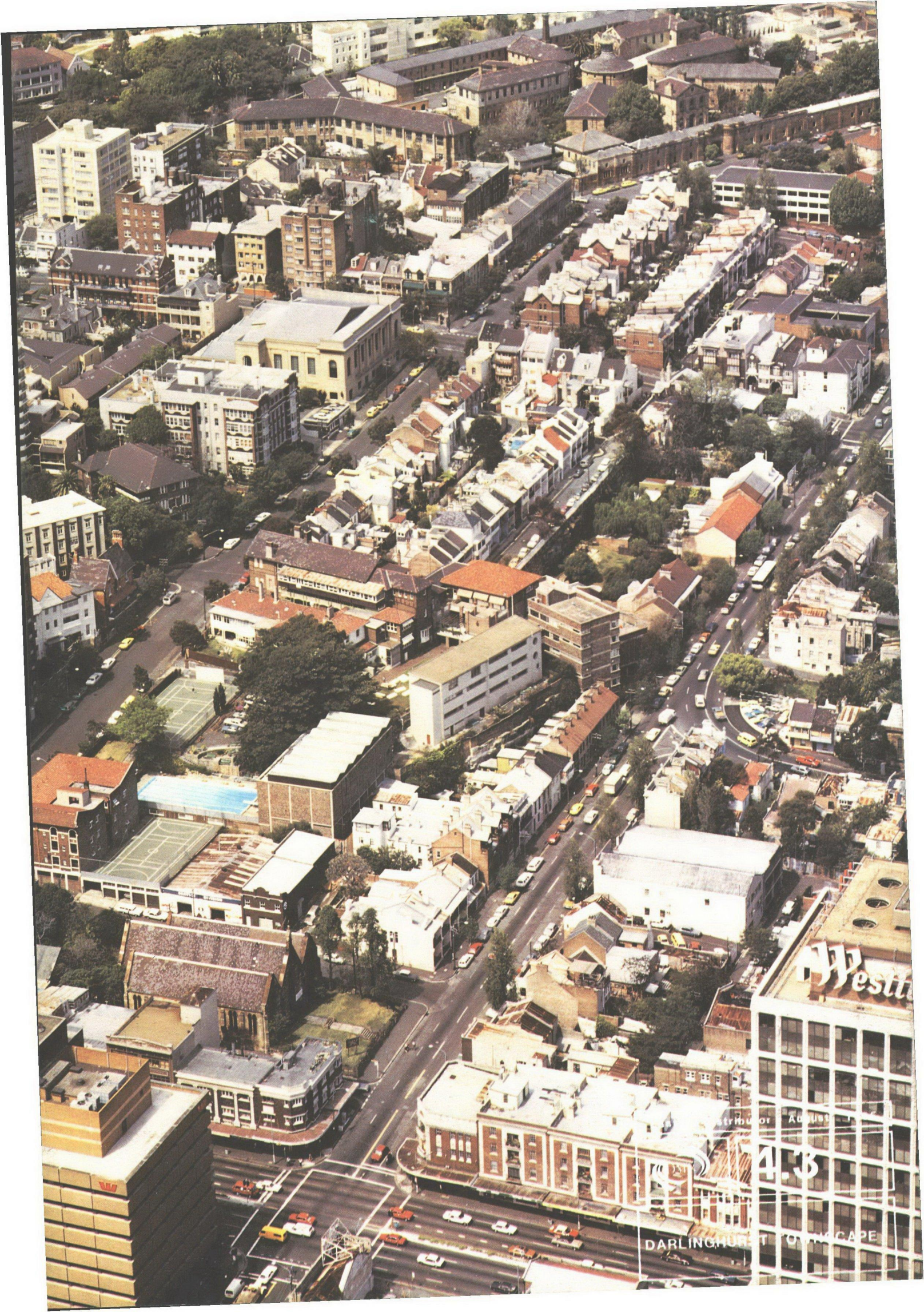
Eastern Distributor - August 1979



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WOOLLOOMOOLOO  
TOWNSCAPE





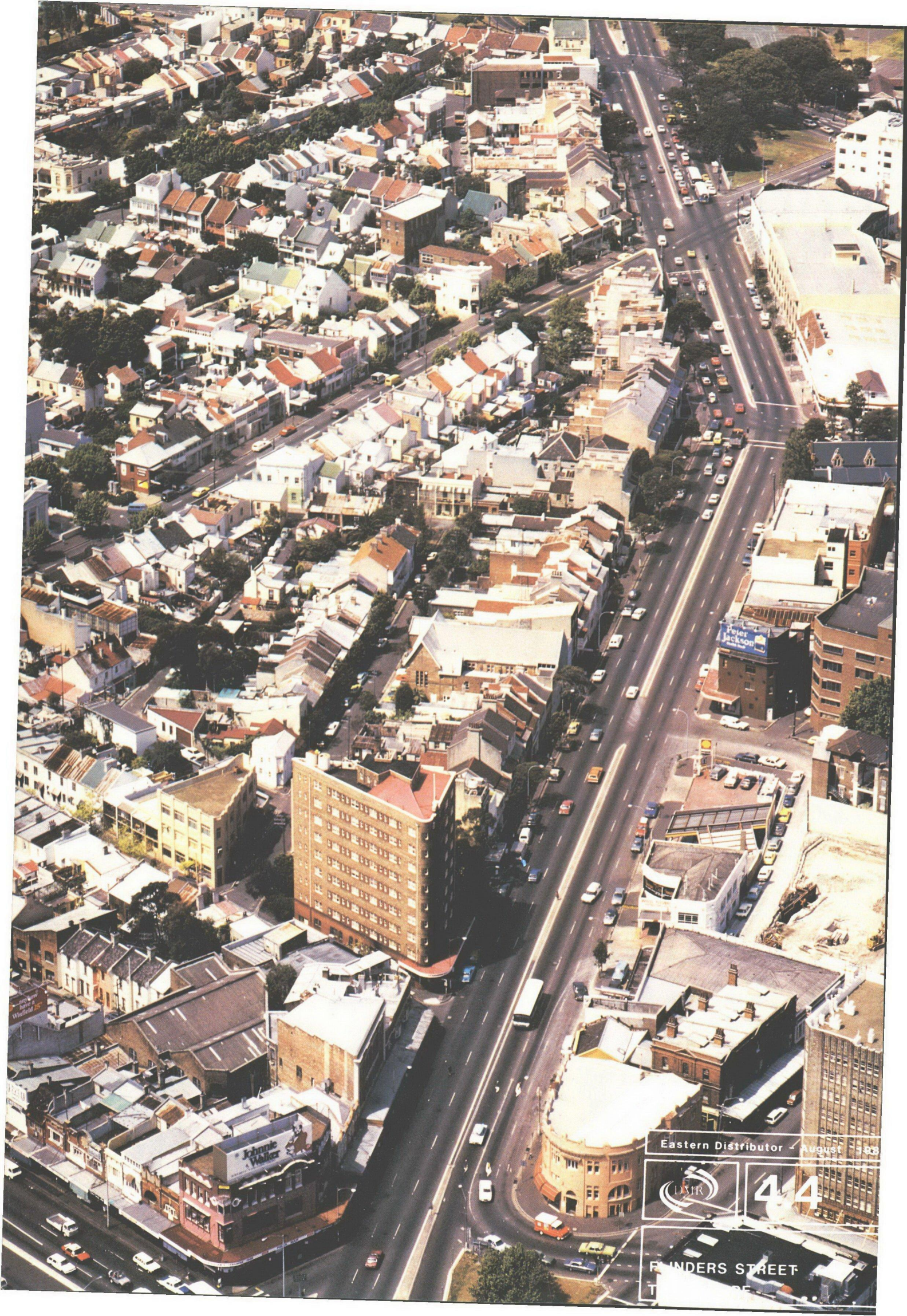
West

STREET OF AUGUST

4.3

DARLINGHURST TOWNSCAPE





Eastern Distributor August 1980



44

FINDERS STREET









Busby's Bore, driven from the Lachlan Swamps (now Centennial Park) to Hyde Park to provide Sydney's first water supply, is a rare and important civil engineering work of significant archaeological potential. It runs under Oxford Street.

#### 4.3.4 Impacts of Proposal : Heritage and Visual

The physical impacts of the proposal occur in four locations:

- Woolloomooloo, along Palmer Street between the harbour and William Street, from road widening, the ramp and tunnel portals;
- Palmer Street between William and Stanley Streets, from road widening in Stage 1;
- Flinders Street, between Taylor Square and St. Michael's Church, from widening and the tunnel portal;
- Moore Park Road, Anzac Parade and South Dowling Street, south of Drivers Triangle, from the tunnel portals and ramps.

In Stage 2 the Proposal requires the demolition (or partial demolition) of the Bryson Industries Building at the corner of Palmer Street and Plunkett Street, currently occupied by Capitol BMW. This building has been noted by the Royal Australian Institute of Architects as being a twentieth century building of significance. The Proposal does not require the demolition of any other buildings of historic significance. It will be important for the streetscape of William Street that the hotel on the corner of William and Palmer Streets, demolished in Stage 1, be replaced by a building of appropriate scale and character (three or four storeys with splayed corner and appropriate facade treatment).

In general, however, the setting of historic buildings will be improved by the reduction of passing traffic and the demolition of derelict buildings. Further, the townscape and the condition of historic buildings are likely to improve following better maintenance of buildings once the County Road reservation is lifted.

The visual impact of the proposal on the locations noted above will be caused by three main atti-



vities: road widening; ramp/portal construction; and the redevelopment of residual and surplus land. It will be greatly affected by the design quality of new engineering and building works and by the quality and scale of tree planting and other landscaping works.

The main visual impact will be in the Woolloomooloo area, east of Palmer Street. Between Plunkett and Cathedral Streets. Provided that a wide median, footpaths and residual land areas are planted with large tree species (such as planes), the visual environment should be improved.

The tunnel portals and associated retaining walls between Cathedral and William Streets will be similar in scale and appearance to the Kings Cross Tunnel. However, as the roadway south of Cathedral Street is below natural ground level, it should be relatively easy to screen them from most pedestrian viewpoints and surrounding buildings. Adequate space exists for buffer planting, roadside trees and parapet walls.

Redevelopment of land on Bourke and William Streets should reflect the character of these streets, as required by the City Council.

The roadworks connecting Bourke and Palmer Streets at Stanley Street, the widening of Palmer Street and redevelopment for housing will significantly alter the appearance of this block. It is, at present, extremely dilapidated.

City Council development controls are likely to require that the housing proposed be constructed in scale and character with the area, probably restricted to five floors in height. On completion of Stage 3 the crossover from Bourke Street to Palmer Street at Stanley Street will no longer be required. That block (opposite the Presbyterian Church) could then be redeveloped or acquired as a park.

Construction of the Flinders Street portal for the Stage 3 northbound tunnel requires the demolition of properties (shops and service station, see Figure 2.8), some of which can be replaced. The ramps and portal within the roadwidth will not enhance the appearance of Flinders Street but redevelopment of the service station site and the

establishment of trees as illustrated (Figure 2.17) have the potential to improve the appearance of this area.

The location of ramps and tunnel portals south and east of Drivers Triangle is still subject to study and design. However, as all major elements will be below ground level, visual impacts will be local.

Detailed design of this area and of vent shafts generally will take account of visual impacts.

#### **4.4 Local Movement**

The following is a description of the major changes to the local road and pedestrian systems that arise from the Proposal.

The Proposal allows the implementation of a number of measures for local traffic management (Figure 4.8). However, since Sydney City Council is responsible for local traffic management the proposed measures should not be taken as final.

##### **4.4.1 Vehicle Movement : Woolloomooloo**

###### **Stage 1**

This stage introduces changes to the local vehicular access and egress pattern in Woolloomooloo. Currently the main means of access are off the Cahill Expressway, via Crown Street and via Cathedral Street. The Stage 1 access off the Cahill Expressway will not change. Access to Crown Street will change to the extent that right turns off William street will be denied and transferred to a new lighted intersection at Riley Street. Cathedral Street will be closed at Palmer Street. The overall effect is that greater reliance will be placed on Plunkett Street as the main entrance to Woolloomooloo. In Stage 1 Bourke Street in Woolloomooloo will be closed. Therefore both Bourke Street and Cathedral Street will be localised.

The diversion of William Street traffic to Riley Street instead of Crown Street will not present access difficulties, as the new Riley Street and Sir John Young Crescent signalised intersections will



provide an efficient movement system to Woolloomooloo.

Movement out of Woolloomooloo will focus on Plunkett Street, Cowper Wharf Roadway, Palmer Street and to a lesser extent Crown and Bourke Streets. Southbound movement will be provided from Plunkett Street along Palmer Street and the Distributor and from areas in south Woolloomooloo along Bourke Street (depending on the location of the proposed closure). The Proposal changes the local access/egress patterns considerably. However, the new arrangement will be workable and overall will not reduce the level of access to Woolloomooloo.

#### Stages 2 and 3

Accessibility to areas east of Palmer Street will remain as in Stage 1. However, for areas west of Palmer Street accessibility to Woolloomooloo in Stages 2 and 3 is improved with the introduction of two-way traffic along Crown Street. Palmer Street itself becomes two-way in Stage 2 which will provide better accessibility.

Overall access to and from Woolloomooloo will be improved as a result of a new crossover lane from Cowper Wharf Roadway to the Cahill Expressway and a new signalised intersection arrangement at Sir John Young Crescent and Plunkett Street. Bourke Street north (via Cowper Wharf Roadway), and Crown and Riley Streets will continue to provide access to the north. William and Plunkett Streets will provide access to the Central Business District and areas west (Figure 2.14).

Residents of Woolloomooloo travelling south will be able to connect with the Distributor at Plunkett Street or the new Palmer Street.

#### 4.4.2 Vehicle Movement : East Sydney

Vehicular access and egress arrangements to and from East Sydney remain largely unchanged as a result of the Proposal. However, the straightening of the Stanley Street crossover between Palmer and Bourke Streets during Stage 1 reduces local vehicle accessibility at this point during Stages 1 and 2.. By Stage 3, Bourke and Palmer Streets revert to local use, thereby improving local accessibility.

Traffic on local streets in East Sydney is not likely to change as a result of Stage 1. However, Stage 2 will bring about an estimated 50 percent reduction in traffic in Crown Street and a 35 percent reduction in Bourke Street. Further, by Stage 3, traffic in both Crown and Bourke Streets will be reduced by approximately 75 percent compared with the present situation.

#### 4.4.3 Surry Hills

The Proposal reduces traffic on north-south local streets in Surry Hills by focussing through traffic along the Distributor tunnels and South Dowling Street. The existing one-way system would remain in Stage 1. However, the potential exists in Stages 2 and 3 to further restrict vehicular movements along at least Crown and Bourke Streets and/or allow these streets to revert to two-way flow. It is envisaged that in Stage 1 Bourke Street flows will be reduced by approximately 15 percent and that Crown Street would maintain its present level. However, Stages 2 and 3 will create 50 percent and 70 percent reductions respectively for Crown and Bourke Streets. The result of these reductions is a clear improvement in local vehicular (and pedestrian) movement along and adjacent to these streets and improved access to local community and commercial facilities located along Crown and Bourke Streets.

East-west traffic through Surry Hills is a complex issue of considerable local concern. The proposed changes to the east-west road arrangements are described in Sections 3.1 and 5.14 and can be summarised as involving Fitzroy, Foveaux and Albion Streets for east to west movement between Flinders Street and the City and Campbell Street and Cleveland Street for west to east traffic. Access to the south along Flinders Street will be denied from Albion Street with the consequence that through traffic is concentrated on Campbell Street. The result will be an estimated traffic increase of approximately 75 percent along Campbell Street.

A more detailed analysis of the local road system may reveal improved local traffic management schemes for this area. However, the Proposal is a workable scheme that will enable Council to implement improvements to the local residential streets on a worthwhile scale.

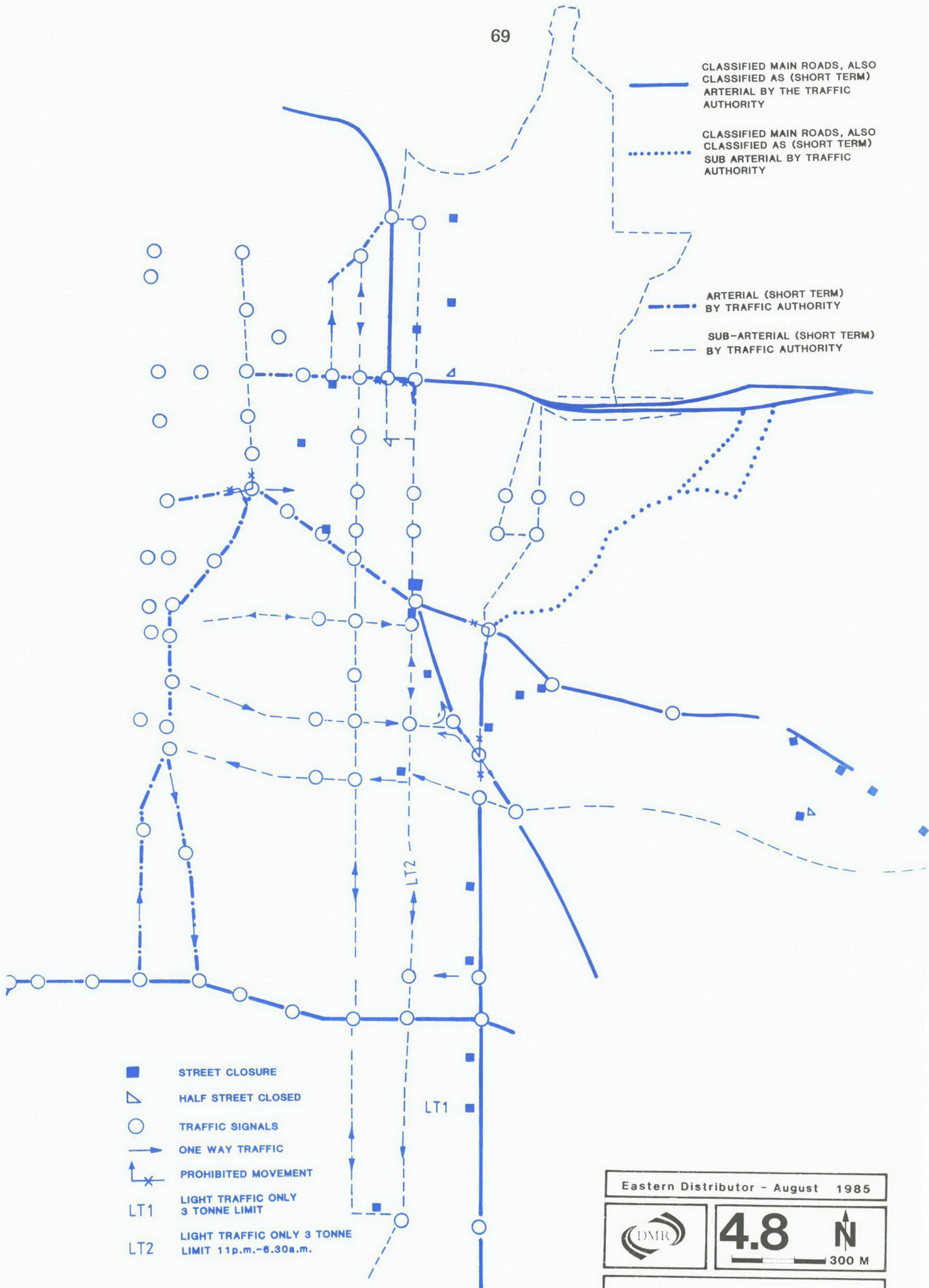


CLASSIFIED MAIN ROADS, ALSO  
CLASSIFIED AS (SHORT TERM)  
ARTERIAL BY THE TRAFFIC  
AUTHORITY

CLASSIFIED MAIN ROADS, ALSO  
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AUTHORITY

ARTERIAL (SHORT TERM)  
BY TRAFFIC AUTHORITY

SUB-ARTERIAL (SHORT TERM)  
BY TRAFFIC AUTHORITY



■ STREET CLOSURE

△ HALF STREET CLOSED

○ TRAFFIC SIGNALS

→ ONE WAY TRAFFIC

⊗ PROHIBITED MOVEMENT

LT1 LIGHT TRAFFIC ONLY 3 TONNE  
LIMIT

LT2 LIGHT TRAFFIC ONLY 3 TONNE  
LIMIT 11p.m.-6.30a.m.

Eastern Distributor - August 1985



4.8

N

300 M

PROPOSED TRAFFIC  
MANAGEMENT FEATURES



#### 4.4.4 Redfern-Waterloo

Under present conditions the area south of Cleveland Street is adversely affected by north-south through traffic which is concentrated on Bourke and Baptist Streets. These arrangements will remain relatively unchanged for Stage 1 of the proposal. However, with the construction of the tunnels and the rerouting of this through traffic onto South Dowling Street in Stages 2 and 3, both Bourke and Baptist Streets will experience traffic reductions of approximately 50 percent by Stage 2 and 70 percent by Stage 3. This would improve local pedestrian movement and provide a good opportunity for re-evaluating current traffic management measures to enhance local vehicular movement as well.

#### 4.4.5 South Dowling Street

South Dowling Street functions as a major arterial road and must absorb nearly 50 percent more traffic if the Proposal is to work.

Access to properties fronting South Dowling Street will be affected by the Proposal and for this reason schemes to improve local access are under investigation. These will be addressed at the detailed design stage and in any subsequent Environmental Impact Statement/s addressing the precise nature of development south of Drivers Triangle (see Section 5.1.4).

#### 4.4.6 Flinders Street

Flinders Street currently functions as a major arterial road, and vehicular access and egress to and from the adjoining precincts of south-west Paddington and north-east Surry Hills is limited. This situation will remain unchanged for Stage 1. In Stages 2 and 3 however, vehicular movement to and from Surry Hills will be further constrained by the partial closure of Albion Street and the location of the northbound tunnel proposal which will prevent access to Short Street from the north.

#### 4.4.7 Bicycle Routes

The Proposal will complement the objectives of Sydney City Council to implement an inner city bicycle plan, principally through the reduction of traffic on local roads and the opportunity to designate roads as bicycle routes.

The routes which now terminate at the northern end of Moore Park and Greens Road (Figure 4.9) could be extended to providing direct links to the northern end of the Central Business District and major open space areas such as Hyde Park, The Domain and the Botanical Gardens.

#### 4.4.8 Pedestrian Movement

Local streets, such as Crown, Bourke and Palmer, are currently heavily trafficked which poses a constraint to local pedestrian movement. However, because the Proposal substantially reduces traffic on Crown and Bourke Streets, local pedestrian movement will be improved. In addition, the Proposal, as illustrated on Figure 4.9, provides for a number of crossing points over the Distributor. No existing main pedestrian crossings have been removed. In fact, a number of improvements are proposed.

In Woolloomooloo (Area 1, Figure 4.9), five (upgraded and new) crossings are proposed:

1. Art Gallery Road overbridge and pedestrian stairs to Cowper Wharf Roadway.
2. A new underpass alongside the Cowper Wharf Roadway crossover to the Cahill Expressway. The new footpath would connect with the pedestrian system associated with the Art Gallery.
3. Improved signalisation and crossing arrangements at the Plunkett Street intersection.
4. Pedestrian access and signalisation across the Distributor and Palmer Street at Cathedral Street.
5. New signalisation at the intersection of Palmer and William Streets.

East Sydney (Area 2, Figure 4.9) pedestrian movement will be largely unchanged. However, by Stage 3 it will be considerably improved, i.e. when Stanley, Palmer, Crown and Bourke Streets revert to local use.

During Stages 1 and 2 the S-bend will inhibit pedestrian accessibility in this vicinity. However, there is not at present a high level of east-west pedestrian movement at this point. Access to



PLUNKETT STREET CROSSING  
TO BE IMPROVED TO COINCIDE  
WITH PATHS THROUGH THE  
DOMAIN

PEDESTRIAN CROSSING AT  
CATHEDRAL STREET  
MAINTAINED

↔ CONTROLLED PEDESTRIAN CROSSING  
[ ] PEDESTRIAN AREAS

ACCESS TO STANLEY STREET FROM THIS AREA  
IS RESTRICTED IN STAGES 1 AND 2. LOCAL  
ACCESS WILL REMAIN OFF WILLIAM, BOURKE  
AND FORBES STREETS

PEDESTRIAN CROSSING HERE WILL  
BE IMPROVED TO EXTEND FROM  
SOUTH DOWLING STREET TO  
MOORE PARK EAST OF ANZAC  
PARADE

EXISTING INNER CITY BIKE ROUTES ALONG  
ANZAC PARADE AND CLEVELAND STREETS  
CAN BE EXTENDED TO INCLUDE BOURKE  
STREET

EXISTING PEDESTRIAN CROSSINGS TO  
MOORE PARK WILL BE MAINTAINED.  
THE POSITION OF ADDITIONAL  
CROSSINGS IS UNDER INVESTIGATION

**1** IN WOOLLOOMOOLOO THE MAIN PEDESTRIAN  
CROSSINGS AT PLUNKETT, CATHEDRAL AND  
WILLIAM STREETS WILL BE IMPROVED

**2** EAST SYDNEY PEDESTRIAN ACCESS WILL BE  
IMPROVED IN STAGE 3. HOWEVER A SMALL  
AREA, OCCUPIED BY SCEGGS SCHOOL,  
WILL LOSE ACCESS TO STANLEY STREET  
IN STAGES 1 AND 2

**3** THE DISTRIBUTOR WILL IMPROVE LOCAL  
PEDESTRIAN MOVEMENTS IN SURRY HILLS  
THROUGH REDUCED TRAFFIC ON LOCAL  
STREETS. ACCESS TO MOORE PARK WILL  
ALSO BE IMPROVED

**4** IMPROVEMENTS AT TAYLOR SQUARE AND  
ALBION STREET WILL CREATE A SAFER  
CROSSING OF FLINDERS STREET FOR  
LOCAL RESIDENTS

Eastern Distributor - August 1985



**4.9** N  
300 M

PEDESTRIAN ACCESS



properties along Bourke and Forbes Streets south of William Street (including SCEGGS) is currently largely from William Street and Oxford Street. This will remain the case in Stages 1 and 2.

Because of large reductions in traffic on local streets, pedestrian movement Surry Hills will be greatly improved (Area 3, Figure 4.9). In addition, a new facility will be provided at Drivers Triangle for pedestrians to cross South Dowling Street and Anzac Parade to Moore Park. Once detailed investigations of South Dowling Street are complete additional crossings to Moore Park could also be provided.

Access across Taylor Square will be improved as a result of the Proposal (Area 4, Figure 4.9). New crossings and landscaping (see Figure 2.17A) are intended to enhance the general level of access both north-south and east-west and to create a pedestrian focus. No change is proposed to the existing crossing points along Flinders Street.

## 4.5 Noise

### 4.5.1. Introduction

A detailed acoustical assessment of the proposed Eastern Distributor is provided in Appendix 3. This section summarises the method and findings of the investigation.

### 4.5.2 Method

Following an assessment of existing noise levels in the Eastern Districts (Jackson Teece Chesterman Willis & Partners 1985), likely future noise levels were predicted for the major roads where traffic flows will change as a result of the Proposal (Section 3.3). More detailed predictions were also made for Palmer Street, north and south of William Street, where the major roadworks will take place.

Existing and likely future noise levels were compared with criteria for traffic noise acceptability currently used by the State Pollution Control Commission and the Department of Main Roads. These criteria relate to both the number of vehicles in a given traffic stream and to subjective perception of annoyance from traffic.

### 4.5.3 Findings

The assessment of existing noise levels in the Eastern Districts (Jackson Teece Chesterman Willis & Partners 1985) confirmed that most areas are subject to high levels of road traffic noise (Figure 4.10). It is only in some of the side streets and small lanes off the main roads that noise drops to the level normally considered acceptable by the State Pollution Control Commission for residential areas.

In general, the proposed Eastern Distributor will provide significant improvements to the noise environment of the Eastern Districts by reducing traffic on a number of residential streets. However, noise levels will increase in some specific locations adjacent to roadworks or where there is an increase in traffic volumes as a result of redirected flows.

The acoustical benefits resulting from reductions in traffic flow are largely obtained in Stages 2 and 3. In Stage 1 (Figure 4.11) the greatest benefit as a result of changes in traffic will be in Bourke Street north of William Street, following the closure of Bourke Street, Woolloomooloo. Noise levels in Riley Street will increase but because there are more dwellings in Bourke Street, and greater potential for residential redevelopment there, the net effect of traffic changes in Stage 1 will be beneficial.

Stage 1 construction will temporarily increase noise levels on the western side of Bourke Street between William Street and Stanley Street as the rear facades of residences are exposed to the roadway through demolition works. However, the residual land along Palmer Street will be suitable for redevelopment which will again screen the rear of Bourke Street buildings. Noise levels in Palmer Street will decrease as the road is built in a cutting at a greater distance from residences than at present.

In Stages 2 and 3 the effects of the Proposal will be felt over a much wider area (Figures 4.12 and 4.13). The major benefits will be in Baptist, Crown and Bourke Streets in Redfern, Surry Hills, Darlinghurst and Woolloomooloo\*. Other streets which will benefit include Albion Street, Surry

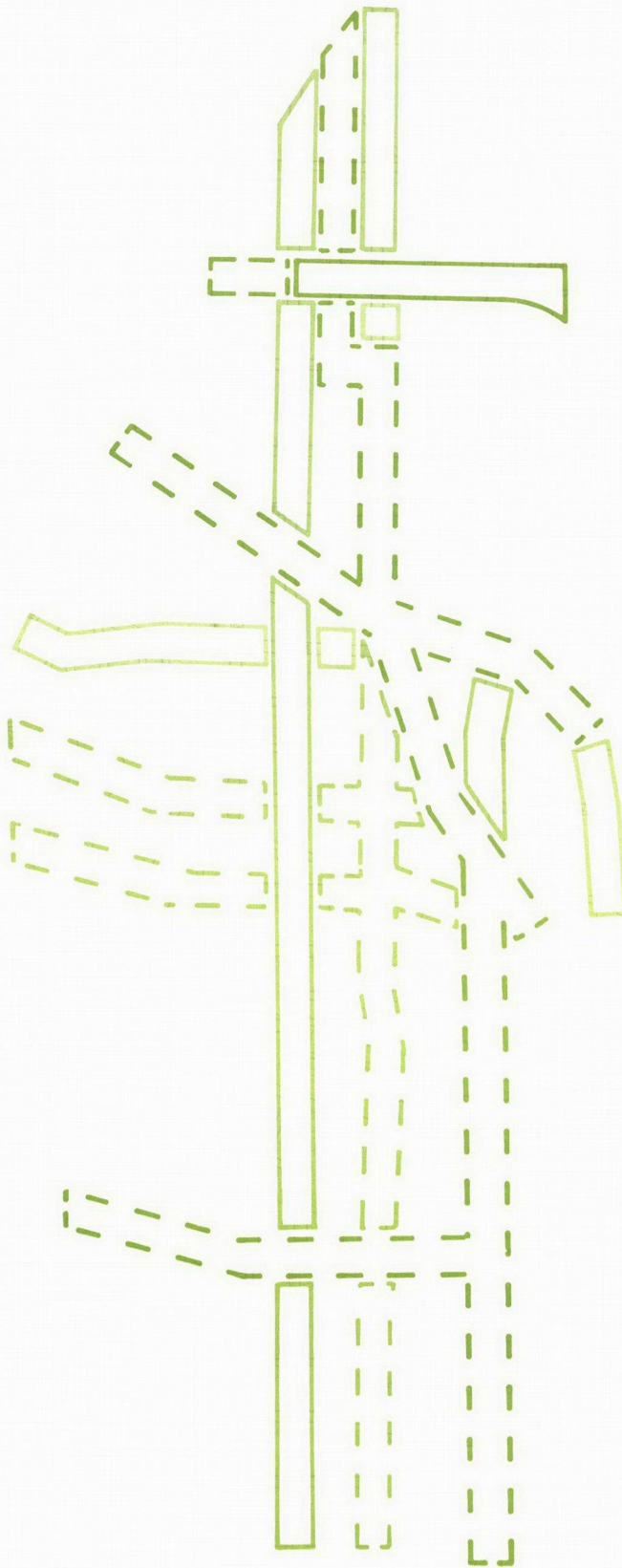
\* The redirection of northbound traffic from William Street from Riley Street to Crown and Palmer Streets in Stage 2 will reduce the beneficial effect on Crown Street north of William Street but improve noise conditions on Riley Street.



## KEY

L10(18Hour) Noise Level dB(A)

78-80	—————
76-77	- - - - -
73-75	—————
71-72	- - - - -
68-70	—————
66-67	- - - - -
63-65	—————
61-62	- - - - -

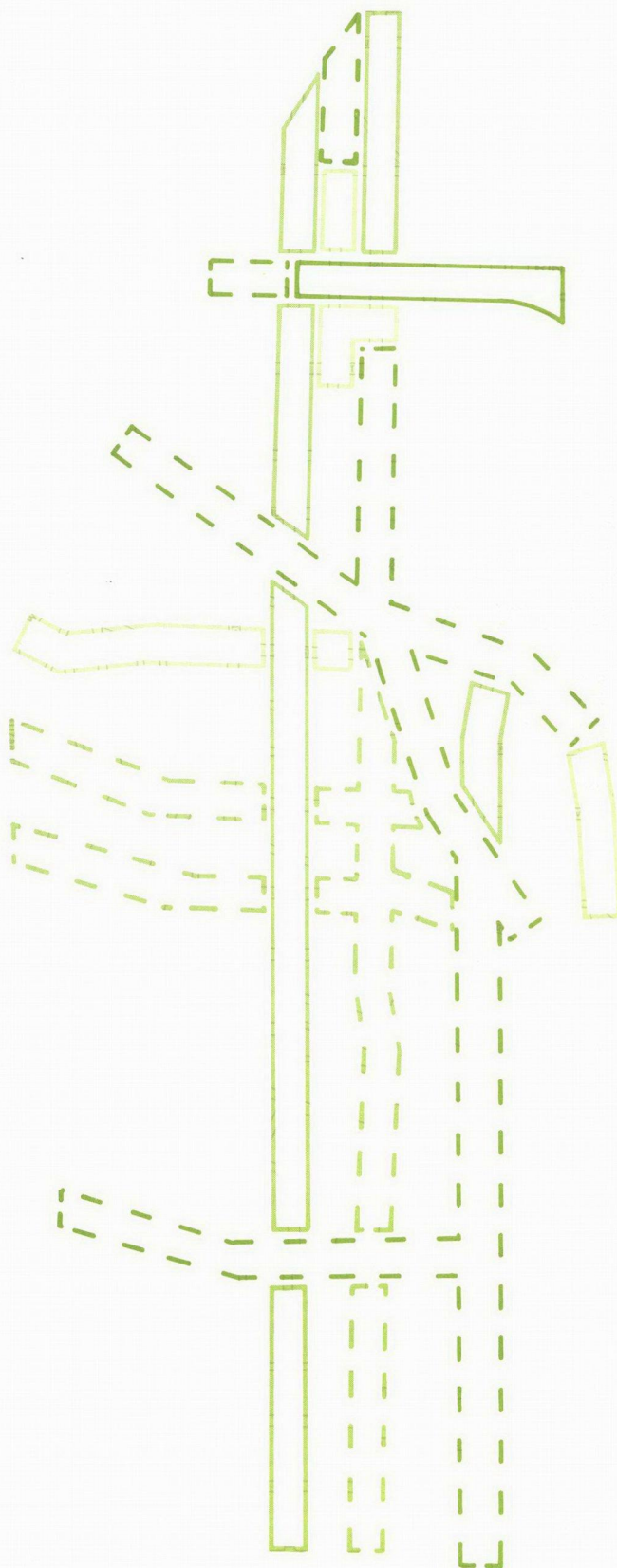


Eastern Distributor - August 1985


**4.10** N  
 300 M

EXISTING NOISE LEVELS





# KEY

L10(18Hour) Noise Level dB

- 78-80 ———
- 76-77 - - -
- 73-75 ———
- 71-72 - - -
- 68-70 ———
- 66-67 - - -
- 63-65 ———
- 61-62 - - -

Eastern Distributor - August 1985



4.11 N  
300 M

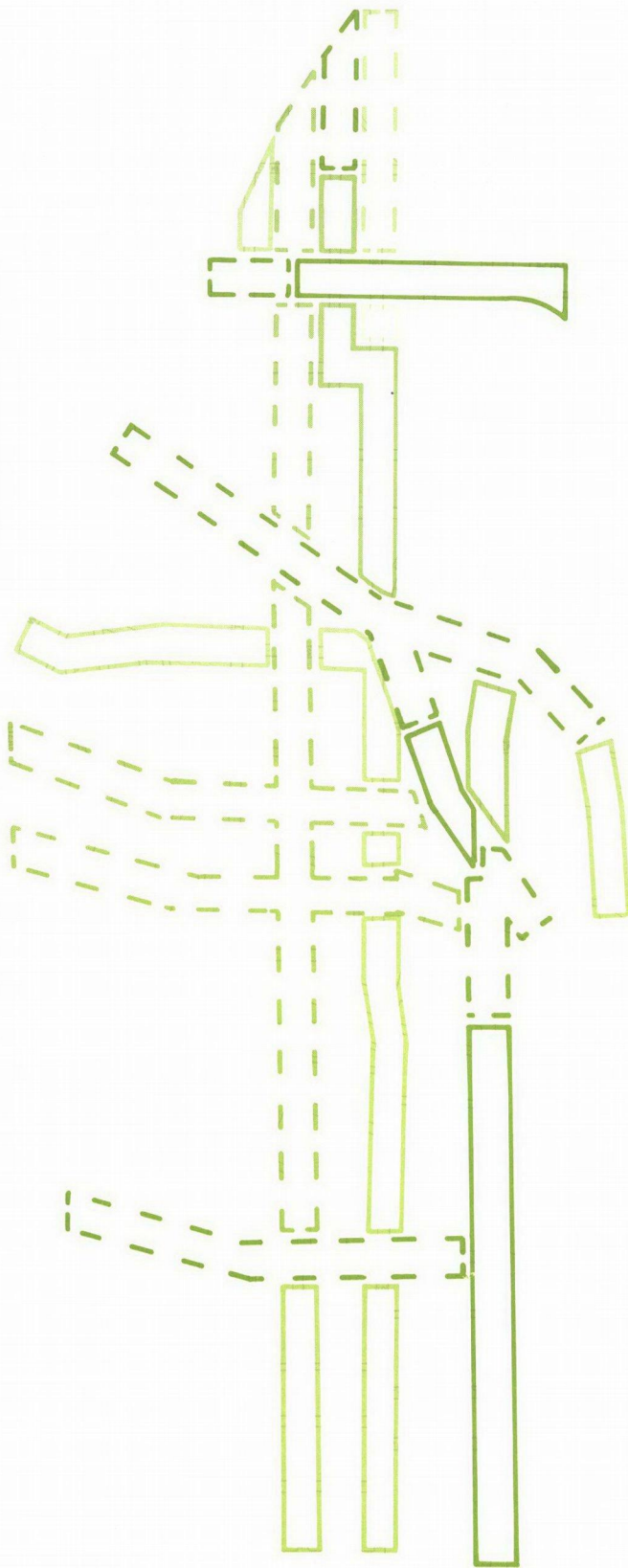
PREDICTED NOISE LEVELS:  
STAGE 1



## KEY

L10(18Hour) Noise Level dB(A)

78-80	—————
76-77	- - - - -
73-75	—————
71-72	- - - - -
68-70	—————
66-67	- - - - -
63-65	—————
61-62	- - - - -



Eastern Distributor - August 1985



**4.12** **N**  
 300 M

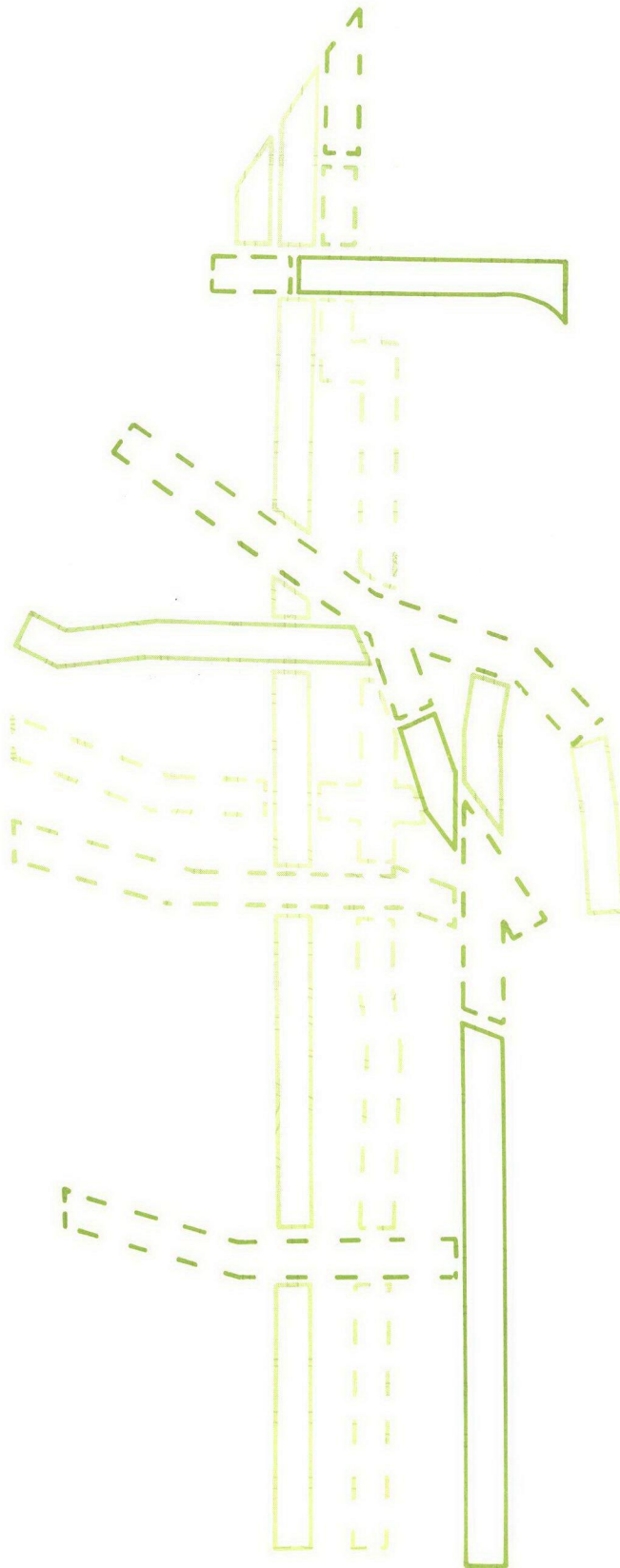
PREDICTED NOISE LEVELS:  
 STAGE 2



## KEY

L10(18Hour) Noise Level dB(A)

78-80	—————
76-77	- - - - -
73-75	—————
71-72	- - - - -
68-70	—————
66-67	- - - - -
63-65	—————
61-62	- - - - -



Eastern Distributor - August 1985


**4.13** N  
 300 M

PREDICTED NOISE LEVELS :  
 STAGE 3



Hills and some of the east-west streets in East Sydney and Woolloomooloo currently used as bypass routes.

The streets on which there will be increases in noise levels as a result of increased traffic flows in Stages 2 and 3 are Flinders Street (south of the tunnel entrance), South Dowling Street (south of the tunnel exit) and Campbell Street.

As a result of roadworks in Stages 1, 2 and 3 the area immediately to the north of William Street will generally be adversely affected in terms of noise levels. "The Diplomat" units in Palmer Street, however, and Nos. 107 - 111 Palmer Street will benefit from the removal of existing Palmer Street traffic into the tunnel entrance and exit.

The rear facade of Kidman's Terrace, between Junction Street and Junction Place, Woolloomooloo, will be exposed to the Eastern Distributor in Stage 2 as a result of demolition works.

Although specific locations will be adversely affected, there will be a general and significant reduction in noise levels in the Eastern Districts as a result of the proposed Eastern Distributor. Further consideration needs to be given to ameliorative measures that might be taken in respect of the small number of areas adversely affected.

## 4.6 Air Quality

### 4.6.1 Introduction

A detailed assessment of the likely air quality effects of the Proposal, and of the method used for the analysis, is contained in Appendix 4. This section summarises the approach employed and the results of the investigation.

### 4.6.2 Method

Initial air quality and climatic monitoring data was collected in two ways during February and March, 1985. Measurements were made on a continuous basis at two sites (Palmer Street, north of William

Street, and Crown Street, south of Oxford Street and north of Campbell Street) and individually, at 15 sites within the Eastern Districts (Figure 4.14).

The two sets of continuous data were compared with State Pollution Control Commission monitoring data, and wind speed and direction data collected from their sampling sites nearest to the Eastern Districts (Figures 4.14).

This data was used to calibrate computer models predicting likely future trends in air quality in the area affected by the Proposal (see Appendix 4 for details).

### 4.6.3 Criteria

In accordance with the procedure adopted by the State Pollution Control Commission standards defined by the National Health and Medical Research Council (NHMRC), the World Health Organisation (WHO) and the U.S. Environmental Protection Agency (USEPA) (see Appendix 4) were used as criteria for the evaluation of air quality in the Eastern Districts.

### 4.6.4 Existing Air Quality

The WHO (one hour) standard was not exceeded at either of the two continuous monitoring sites. However, maximum one hour averages at these sites did reach 86 percent of the upper limit of the standard.

The USEPA (eight hour) average was not exceeded at the Palmer Street site. However, it was exceeded at the Crown Street site on a number of days.

Amongst the individually measured sites, highest concentrations were measured on the Bourke Street hill (a.m. and p.m.) between Liverpool and Burton Streets, and in Flinders Street (east side) during p.m. peak periods. At both of these sites traffic is slow moving. All concentrations, however, were well below (less than 50 percent of) WHO maximum one hour average limits.



14

13

B

1

15

12

11

10

2

9

A

8

5

6

7

3

4

KEY

7

CO Monitoring Sites

A

Anemometer Sites

NOTE: Anemometer site C is located on Goat Island

Eastern Distributor - August 198



4.14 N  
300'

LOCATION OF AIR QUALITY MONITORING SITES



#### 4.6.5 Results

The main effects on air quality of the proposed scheme are summarised in Tables 4.5 (a-c). Each table lists two groups:

- streets in which air quality will improve
- streets where air quality will deteriorate

Streets where air quality will remain unchanged have not been listed.

These tables give predicted carbon monoxide (CO) concentrations based on 1984 traffic data, and the predicted concentrations at each stage of the Proposal, for both a.m. and p.m. peak traffic periods.

##### Stage 1 - Table 4.5(a)

The impact of Stage 1 on air quality in the Eastern Districts will be limited to a few streets only. Concentrations of CO will decrease significantly in Plunkett Street and Bourke Street (north of Stanley Street). Concentrations will also decrease in Crown Street (north of William Street) if right-turn traffic from William Street is diverted into Riley Street. This change in traffic routing will result in a significant increase in CO concentrations in Riley Street since this road currently carries only local traffic. While these predicted values are still low compared with the WHO criteria, they will be higher if good traffic flow in Riley Street is not achieved.

##### Stage 2 - Table 4.5(b)

For Stage 2 it is proposed that southbound traffic will use the tunnel and northbound traffic will flow along Bourke Street (north of Oxford Street) and Palmer Streets (north of Stanley Street) instead of Crown Street. Concentrations in these streets will be similar to the existing situation in Crown Street, north of Oxford Street. Therefore, air quality in Bourke Street north of Taylor Square should improve significantly with the completion of Stage 2.

Crown Street and Bourke Street (south of Taylor Square) are likely to change from a major one-way traffic routes to two-way local traffic. This will result in a significant improvement in air quality.

Air quality will also improve in Albion Street when access to Flinders Street is closed. Concentrations of CO will also be reduced in Flinders Street because most southbound traffic will use the tunnel.

The two streets adversely affected by Stage 2 are Campbell Street and South Dowling Street. Campbell Street is currently one-way, but will change to two-way traffic in Stage 2 when it becomes the access route to Flinders Street after the closure of Albion Street. While concentrations should decrease slightly during the a.m. peak period they will be double the 1984 values in the p.m. peak.

Upon completion of the southbound tunnel, and the (possible) change from one-way to two-way traffic in Bourke and Crown Streets (south of Oxford Street), South Dowling Street will become the major north-south traffic route in the area. As a result CO concentrations will increase and could approach the WHO one hour criteria during the morning peak period.

##### Stage 3 - Table 4.5(c)

The most significant improvement to air quality in the region will occur when Stage 3 of the Proposal is completed. Table 4.5(c) lists the streets that will benefit from major decreases in traffic volumes upon completion of the northbound tunnel. These beneficial effects will be greatest in Crown and Bourke Streets which are likely to become two-way local traffic routes. There should also be some improvement in air quality along Oxford and Flinders Streets as a result of reduced traffic volumes and an increase in traffic speeds.

No predictions have been made for CO concentrations in the vicinity of tunnel portals because data on the preferred method of ventilating the tunnels is not yet available. However, it is likely that the Stage 2 and Stage 3 tunnels will be vented through one or more exhaust towers located along the route. The location and height of these ventilation stations and towers will be determined during the detailed feasibility study, after consideration of likely pollutant levels within the tunnel, prevailing meteorological conditions, local environmental conditions and available sites. These towers will exhaust the polluted air from



TABLE 4.5(a) SUMMARY OF EFFECTS ON AIR QUALITY OF STAGE 1

	a.m. Peak <sup>a</sup> Concentrations (mg/cu.m.)		p.m. Peak <sup>a</sup> Concentrations (mg/cu.m.)	
	1984	Stage 1	1984	Stage 1
<b>(a) Beneficial Effect</b>				
Bourke Street (north of William Street)	10.2	0.4	17.3	0.4
Bourke Street (William to Stanley Street)	4.4	0.4	4.4	0.4
Crown Street (north of William Street)	18.6	6.9	26.0	11.1
Plunkett Street	11.6	2.5	16.5	2.2
<b>(b) Adverse Effect</b>				
Riley Street (north of William Street)	0.9	7.1	0.9	4.8

a. WHO Air Quality Criteria for one hour average: 43mg/cu.m.

## 4.7 Construction Impacts

### 4.7.1 Stage 1

the tunnels to the atmosphere above nearby buildings to facilitate safe pollution levels for the neighbourhood.

In particular, detailed design will take account of the potential for light winds and stable atmosphere to affect the dispersion of CO in Palmer Street where the northern portals of both tunnels emerge.

It is less likely that will be a problem at the southern ends of the tunnels, since north and southbound tunnel entrances are half a kilometre apart and atmospheric dispersion is probably more efficient.

The design of the ventilation system will ensure that the air quality within the tunnels conforms to internationally accepted standards. These permit higher concentrations of CO than currently exist on surface streets because of the short time drivers spend in a tunnel and because tunnel congestion is likely to be infrequent.

The construction of the William Street underpass is possible with very little disruption to traffic. One feasible construction method is to sink a curtain of bored piles along the line of each of the underpass walls for the full width of William Street. This will require the deviation of William Street around a small worksite about 4m. wide which will move across the street as the work progresses. Construction of these underpasses may be possible without seriously inconveniencing traffic on William Street, depending on the equipment employed and the availability of sufficient space on the adjacent properties to permit a satisfactory bypass arrangement. Subsequently a deck may be constructed in strips to span the bored pile walls, and William Street traffic restored over the deck while the excavation of the underpass between the walls proceeds. Excavation of the underpass and its approaches may be undertaken with mechanical equipment and no blasting should be needed. Construction of retaining walls and cover on the underpass approaches may be undertaken using conventional techniques of bridge construction.



TABLE 4.5(b) SUMMARY OF EFFECTS ON AIR QUALITY OF STAGE 2<sup>a</sup>

	a.m. Peak <sup>b</sup> Concentrations (mg/cu.m.) 1984                      Stage 2		p.m. Peak <sup>b</sup> Concentrations (mg/cu.m.) 1984                      Stage 2	
<b>(a) Beneficial Effect</b>				
Crown Street (north of William Street)	18.6	1.9	26.0	1.9
Crown Street (Oxford to William Street)	10.6	2.1	12.4	2.1
Crown and Baptist Street (south of Drivers Triangle)	10.6	2.1	19.6	2.1
Bourke Street (William to Oxford Street)	31.8	10.6	29.3	12.4
Bourke Street (south of Oxford Street)	5.0	1.3	6.0	1.3
Flinders Street (Taylor Square - Drivers Triangle)	27.6	15.7	29.7	15.1
Albion Street	3.9	0.9	12.7	0.9
<b>(b) Adverse Effect</b>				
Campbell Street	10.9	6.7	9.9	21.1
Riley Street <sup>c</sup> (north of William Street)	0.9	16.9	0.9	11.9
South Dowling Street (Drivers Triangle to Cleveland Street)	16.3	25.0	14.1	21.3
South Dowling Street (Cleveland to Crescent Street)	18.1	41.0	15.0	27.1

- a. Where beneficial or adverse impacts from Stage 1 remain the same, the effects are not restated.
- b. WHO Air Quality Criteria for one hour average: 43mg/cu.m.
- c. The redirection of northbound traffic from William Street from Riley Street to Crown and Palmer Streets in Stages 2 and 3 will eliminate this adverse effect. The beneficial effects on Crown Street and Palmer Street north of William Street (see above and Table 4.5(c)) will be proportionately reduced.



TABLE 4.5(c) SUMMARY OF EFFECTS ON AIR QUALITY OF STAGE 3<sup>a</sup>

	a.m. Peak <sup>b</sup> Concentrations (mg/cu.m.) 1984                      Stage 3		p.m. Peak <sup>b</sup> Concentrations (mg/cu.m.) 1984                      Stage 3	
<b>(a) Beneficial Effect<sup>b</sup></b>				
Palmer Street (south of William Street)	10.0	2.1	12.3	2.1
Palmer Street <sup>c</sup> (north of William Street)	24.2	13.6	30.3	10.2
Bourke Street (William to Oxford Street)	31.8	1.3	29.3	1.3
Flinders Street (Albion Street to Taylor Square)	20.9	13.3	19.6	13.4
Oxford Street (Whitlam - Taylor Square)	39.4	22.8	28.7	19.2

a. Where beneficial or adverse impacts from Stages 1 and 2 remain the same, the effects are not restated.

b. WHO Air Quality Criteria for one hour average: 43mg/cu.m.

c. See footnote c. to Table 4.5(b).

Some Palmer Street traffic will have to be routed via Bourke Street during construction as the works will reduce the available width of Palmer Street between Cathedral and Stanley Streets. This construction work is expected to last for about two years and to generate a similar amount of noise and traffic as the construction of a multi-storey building. Some work, particularly in the construction of curtain walls and deck between the kerb lines of William Street, might be undertaken at weekends or out of normal working hours to reduce the effect on traffic. While some inconvenience will probably be unavoidable, it is expected that normal access will be maintained to all properties at all times. No reduction in the normal standards of traffic safety is expected.

A compound would be required to store materials and equipment during construction and this would probably be located between Palmer Street and Wisdom Lane. No significant generation of dust or other atmospheric pollution is expected from the construction works.

The noise of construction activities during Stage 1 would have most affect on the areas in the immediate vicinity of the underpass, on both sides

of William Street. Properties in the vicinity of the Stanley Street realignment would also be affected by construction noise in Stage 1. However, these areas are already subject to high ambient sound levels and to the noise of construction activity along William Street. It is therefore likely that the impacts of construction of the William Street underpass and other elements of Stage 1 could be kept within the limits of existing construction impacts and within the noise limits imposed by the City of Sydney Code (Council of the City of Sydney 1976) where necessary.

#### 4.7.2 Stage 2

Excavation of the driven tunnel will be undertaken so as to minimise noise and vibration at the surface. If it proves practicable, excavation will be done by machines which mill the rock away with a cutting head. Ripping of the rock by dozers and trimming by rock breakers may be required within the driven tunnel and in the "cut and cover" sections. Explosives will only be used if necessary and their use will be restricted so as to comply with accepted practices in urban areas. However, at the tunnel portals construction work on the surface would include excavation and construction



of the approach works, and the disposal of spoil from the tunnel driving operation.

The tunnelling would take about two years if constructed from one end with a single machine, working two shifts per day with maintenance in the third shift. Disposal of the spoil would take 5 - 10 trucks per hour for 10 hours per day through the two year period. While a disposal site cannot be identified at this stage, it is unlikely that it would represent a large addition to existing traffic. Dust generation could be kept to insignificant levels with relatively simple precautions involving the sprinkling of spoil piles. If a spoil site was selected in the Port Botany area, tunnel spoil would be removed through the southern portal directly onto Anzac Parade or South Dowling Street. For a spoil site near the city consideration would be given to construction from the Woolloomooloo end and in this case it is likely that access would be provided along the widened section of Palmer Street or via Crown Street.

Incoming materials would be smaller in volume, perhaps 5 - 10 vehicles per day, and would be expected to continue throughout the construction period, about twelve months beyond the completion of the excavation. The origin of these materials cannot be forecast at this stage as it will depend on competitive tendering at the time, but it is likely that arterial roads only would be used for this purpose.

Temporary arrangements for traffic during construction would be minimal as the works are generally not in conflict with the operation of Stage 1 routes and no reduction in the normal standards of safety or access to property is envisaged. Realignment of the end of the Cahill Expressway should not involve a reduction in capacity and the underpass for traffic from Cowper Wharf Roadway should be able to be constructed using similar techniques to those used for the underpass of William Street in Stage 1.

Location of a site for a construction compound might have to be left to the contractor if the tunnel is to be built from the Moore Park end. A mutually satisfactory arrangement could be expected to be made between the contractor and Council in this regard. If construction is undertaken from the Woolloomooloo end, a compound near the corner of Palmer and

Cathedral Streets on the site of the work would seem most likely.

#### 4.7.3 Stage 3

Construction of this tunnel requires clearing of a strip on the western side of Flinders Street. This will permit the building of a side track around the portal site which is located near the centre of the existing road. The tunnel could be bored from either the Flinders Street end or from near Stanley Street, depending on the results of a design feasibility study.

Tunnel construction would use techniques similar to those described for Stage 2. However, being rather shallower, this tunnel could cause surface movement which might bring about superficial cracking of brickwork in buildings over the tunnel. (The cost of restoration of this has been taken into account.) It is not considered likely that any building would be structurally threatened or that there would be any loss of function or disturbance of existing occupancy.

Disposal of spoil from the excavation could proceed at a similar rate as for the southbound tunnel (5 - 10 trucks per hour) for about 9 months, while the importation of construction materials would continue for another 12 months at about 5 - 10 trucks per day. The comments made about construction traffic routes, spoil sites and materials sources for Stage 2 also apply to Stage 3.

It is expected that the construction of the tunnel and a short length of "cut and cover" structure could be completed to a point about 50m. north of Stanley Street before there is any disturbance to the northbound traffic using the Stage 1 underpass. When the project nears completion, the northbound traffic will be diverted temporarily out of the underpass and along Stanley Street (over the already completed structure) to Crown Street and Sir John Young Crescent. Temporary re-introduction of one-way flows may be necessary. This arrangement should last for no more than six months while the completed tunnel is connected to the William Street underpass.

Again, the location of a suitable construction compound may need to be left to the contractor



but some space will be available in Flinders Street on the residues of properties acquired to construct the side track. If constructed from the northern end, this may not be required.

The levels of ground vibration generated during the tunnelling process will depend on the type of machinery used and whether or not blasting is required. It is expected that no blasting will be necessary. In any case, the recommended limit for maximum particle velocity at buildings of historical significance will be 2mm/sec., according to Australian Standard 2187 Part 2 - 1983 "SAA Explosives Code - Part 2 - Use of Explosives", Table 11.2.

#### 4.8 Energy Statement

It is estimated that completion of the proposed scheme will result in the following use of fuel by construction equipment:

Diesel - 3,000,000 litres  
Petrol - 150,000 litres

When the Eastern Distributor is completed the saving to through traffic has been estimated to be:

Diesel - 150,000 litres per annum  
Petrol - 1,700,000 litres per annum

Annual savings have been calculated on the basis of the number of vehicle stops eliminated, at one-fortieth of a litre of petrol per stop and one-twentieth of a litre of diesel per stop for cars and trucks respectively.

Operating and maintenance costs will reduce the annual savings by a small proportion but overall the fuel used during construction will be saved in little more than two years of operation.

#### 4.9 Summary of Social and Environmental Impacts

The proposed Eastern Distributor will have a significant social and environmental effect on the Eastern Districts. Environmental improvements will be widespread but some areas will be adversely affected by greater traffic volumes. Environmental improvements will result in an upgrading of the housing stock but also in gentrification and the displacement of lower

income groups. A range of mitigating measures therefore needs to be adopted if the transport and environmental benefits of the proposal are not to be achieved at significant social cost.

This section summarises the likely nature, extent and distribution of these beneficial and adverse impacts, noting the measures that would need to be adopted to minimise adverse impacts.

##### Stage 1

Stage 1 of the Proposal will result in some reduction in traffic on local streets including Plunkett, Bourke and Crown Streets in Woolloomooloo. As a result environmental conditions will improve marginally along these streets and in the vicinity. Properties on Riley street north of William street will, however, be affected by higher traffic volumes.

The housing impacts of Stage 1 construction are significant: about 140 residents will be displaced (about 45 tenants and 95 squatters). However, Stage 1 makes available for redevelopment a major site which, if developed at maximum densities, could accommodate about 250 people.

The lifting of the County Road reservation will release 418 properties (326 residential properties) from the County Road zoning. This will have an immediate effect on property values and on the quality of the dwelling stock in the corridor and its environs. Better maintenance and the upgrading of many neglected buildings in the corridor will also result. Gentrification, however, could adversely affect lower income tenants, especially those in the numerous boarding houses. It should be noted that this is likely to result from any decision on the Eastern Distributor, including the "no build" option, since the County Road zoning cannot be relied upon as a permanent protection for low income housing.

Existing environmental planning measures to protect the supply of boarding houses and additional measures may need to be taken to reduce the extent to which these residents were displaced.



The provision of public housing on the redevelopment sites would help retain the social mix of the area and its existing function in the metropolitan area as a whole.

The disposal of Department of Main Roads surplus dwellings could displace about 230 people if sold on the open market. However, surplus residential property will be offered for sale to the Housing Commission for rehabilitation or redevelopment as public housing. Depending on Housing Commission policy, it may be possible for existing occupants to remain.

The impact of Stage 1 construction on the physical environment will be significant along Palmer Street between Cathedral Street and Stanley Street and at the crossover to Bourke Street. Redevelopment that is compatible in scale and character will need to be undertaken to minimise adverse effects. At Stanley Street, where the road configuration will be changed after Stage 3 construction, landscaping can be provided on the land residual to Stage 1 and 2 construction.

Pedestrian signals are proposed along Cathedral Street to ensure continued accessibility between Woolloomooloo and the city and improved safety. Safer conditions for drivers and pedestrians will also result in Stage 1 at the William Street underpass.

The construction of Stage 1 is not expected to cause significant disruption to traffic or to local residents.

## Stage 2

Following Stage 2 the reduction of traffic in local streets will be more substantial. In particular, northbound through traffic will be diverted off Crown Street. As a result, local accessibility will improve and environmental benefits from reduced noise and air pollution will be significant. Safety on local streets could be expected to improve. At the same time conditions at major intersections, where the accident rate is currently high, will become safer.

Although Moore Park Road, Anzac Parade and South Dowling Street will be affected by portal

and ramp construction, the impact on the physical environment of Stage 2 construction will be most evident in Woolloomooloo. Extensive landscaping along the widened length of Palmer Street is proposed, together with pedestrian signals at Cathedral and Plunkett Streets.

Stage 2 construction affects about 50 residents in Woolloomooloo including about 20 squatters. A park in Woolloomooloo is also affected and 6 business properties.

The construction of the Stage 2 tunnel is not expected to cause disturbance at the surface. No reduction in normal standards of safety is expected for traffic rerouted during Stage 2 construction.

## Stage 3

Further decreases in traffic volumes on local streets (particularly in Bourke Street south of William Street) can be expected after Stage 3 construction, with further environmental and accessibility improvements. Campbell Street and South Dowling Street, however, will be subject to increased traffic flows.

The physical impacts of Stage 3 construction will be concentrated along Flinders Street between Taylor Square and St. Michael's Church. Appropriate redevelopment and tree planting would mitigate the adverse visual impacts caused in this location. As shown in Figure 2.13 some of the property required during construction will be available for redevelopment. The character, safety and accessibility of Taylor Square will also be substantially improved (Figure 2.17).

About 20 residents and 10 business properties will be affected by Stage 3 construction.

The construction impacts of Stage 3 are expected to be more significant than Stage 2 as superficial cracking in brickwork over the tunnel could occur. However, no building is structurally threatened and any damage to buildings will be restored.



## 5.0 ANALYSIS OF ALTERNATIVES

### 5.1 Description of Options

#### 5.1.1 Introduction

This section considers a range of feasible alternatives to the proposed Eastern Distributor. The alternatives were distilled from a much wider range of options considered in the first instance. They were regarded as the best examples of certain general types of schemes: relatively low cost schemes involving only minor works; largely at-grade (surface) schemes involving the elimination of major congestion points; and "cut-and-cover" schemes for buried structures constructed from the surface. All alternatives, including the Proposal, are compared with the option of doing nothing (the 'base case').

In selecting these schemes for comparative analysis, the criteria for feasibility included the following:

- whether the option was feasible from a technical point of view without incurring costs that were substantially in excess of the likely cost of the proposal;
- whether the design accommodated traffic flow in such a way as to achieve at least an improvement in travel conditions and local access compared with the existing situation.

For each general type of scheme identified above the options selected for comparative assessment were considered the most feasible according to these criteria.

A new public transport (rail) system was not considered a feasible alternative to the proposal. This is explained in Section 5.1.2 below (and more fully in Jackson Teece Chesterman Willis & Partners 1985). Essentially, however, this view is based on the proposition that the existing and likely future range of travel origins and destinations in the region are too diverse for travel between them to be accommodated by a new public transport system, even a highly idealised one. Consequently, the provision of such a system would not significantly improve traffic conditions in the Eastern Districts or achieve the objectives of the proposed Eastern Distributor.

Similarly, further traffic management in the Eastern Districts, involving no new construction, was not considered a feasible alternative. This view was based on the proposition that to the extent that traffic movement can be redirected to achieve road user benefits, this has already been done. Improvements to the existing system were not considered possible without at least some minor works. A scheme involving minor works and traffic management was therefore included as one of the options.

Options involving alternative tunnel alignments were reviewed in great detail. One proposal to locate the northern portals in Riley Street near Cathedral Street received strong support (Pak Poy and Kneebone 1985; MSJ Keys Young 1985). It was ultimately rejected because of unfavourable shallow cover available on the alignment, which would also escalate costs, and the very steep gradient that would be necessary, which would reduce the operating benefits of the project. The Riley Street/Sir John Young Crescent area is a creek bed and could also be expected to generate significant drainage problems, as would the presence of filled ground in this situation. The Riley Street tunnel option was therefore not included as a feasible alternative in the comparative assessment.

Another proposal, which has been strongly supported, suggests a longer tunnel connecting with the Cahill Expressway near the Art Gallery and passing entirely under Woolloomooloo. This scheme would be significantly less effective than the Proposal in removing existing traffic, as it would be unavailable to the significant volumes of traffic entering or leaving Woolloomooloo, the Domain parking station, the wharves, Garden Island and the extensive local residential and commercial land uses. This traffic is estimated at more than 1,100 vehicles per hour in the a.m. peak or one quarter of all traffic expected to use the tunnels in the Proposal. The scheme would also involve extremely steep gradients at the northern end and construction below sea level in filled ground near the head of Woolloomooloo Bay. Apart from serving significantly fewer traffic movements than the Proposal, this scheme would be much more expensive to build.

In addition to considering major alternatives to the Proposal, this section examines more detailed design alternatives for the Proposal. These design alternatives focus on the northern and southern



extremities of the Proposal but also include the question of the crossover between Palmer and Bourke Streets at Stanley Street and the necessity for Stage 1 construction. A number of these questions have been raised in the report commissioned by the Sydney City Council (MSJ Keys Young 1985) and in consultation with community organisations during the process of preparation of the environmental impact statement. They are discussed in Section 5.1.4 below.

### 5.1.2 Public Transport as an Alternative

If some or all of the Eastern Distributor objectives could be achieved by investing funds in major public transport improvements, such an investment could be considered as an alternative to expenditure on roadworks.

Without consideration of capital or operating costs, an idealised public transport (rail) system has been formulated for comparison with the proposed Eastern Distributor (Figure 5.1). It relies on a conventional rail system extending from Bondi Junction through the Eastern Suburbs to Randwick and from Redfern extending south and south-east through Alexandria, Mascot and Botany to Maroubra Junction. Both of these conventional rail extensions would interconnect with radial light rail systems linking Maroubra past Kensington to the City centre and linking Coogee past Randwick to the City centre.

1979 City of Sydney Origin Destination Survey Data (Department of Main Roads 1979) was used to determine trip distributions (origins and destinations) and trip purposes (work, school, business and shop/social) for drivers travelling southbound on the Cahill Expressway on a weekday between 7.00 a.m. and 6.00 p.m. Drivers were assumed to divert to the idealised public transport system in proportions dependent upon their origins and destinations and trip purposes. Up to 40 percent were diverted from work journeys, up to 50 percent for school journeys, up to 20 percent for business and up to 20 percent for shopping, with lesser percentages where rail systems already existed between origins and destinations.

1981 Travel Survey Data (State Transport Study Group 1982) was also evaluated. It showed that only 3.7 percent of all trips are undertaken on

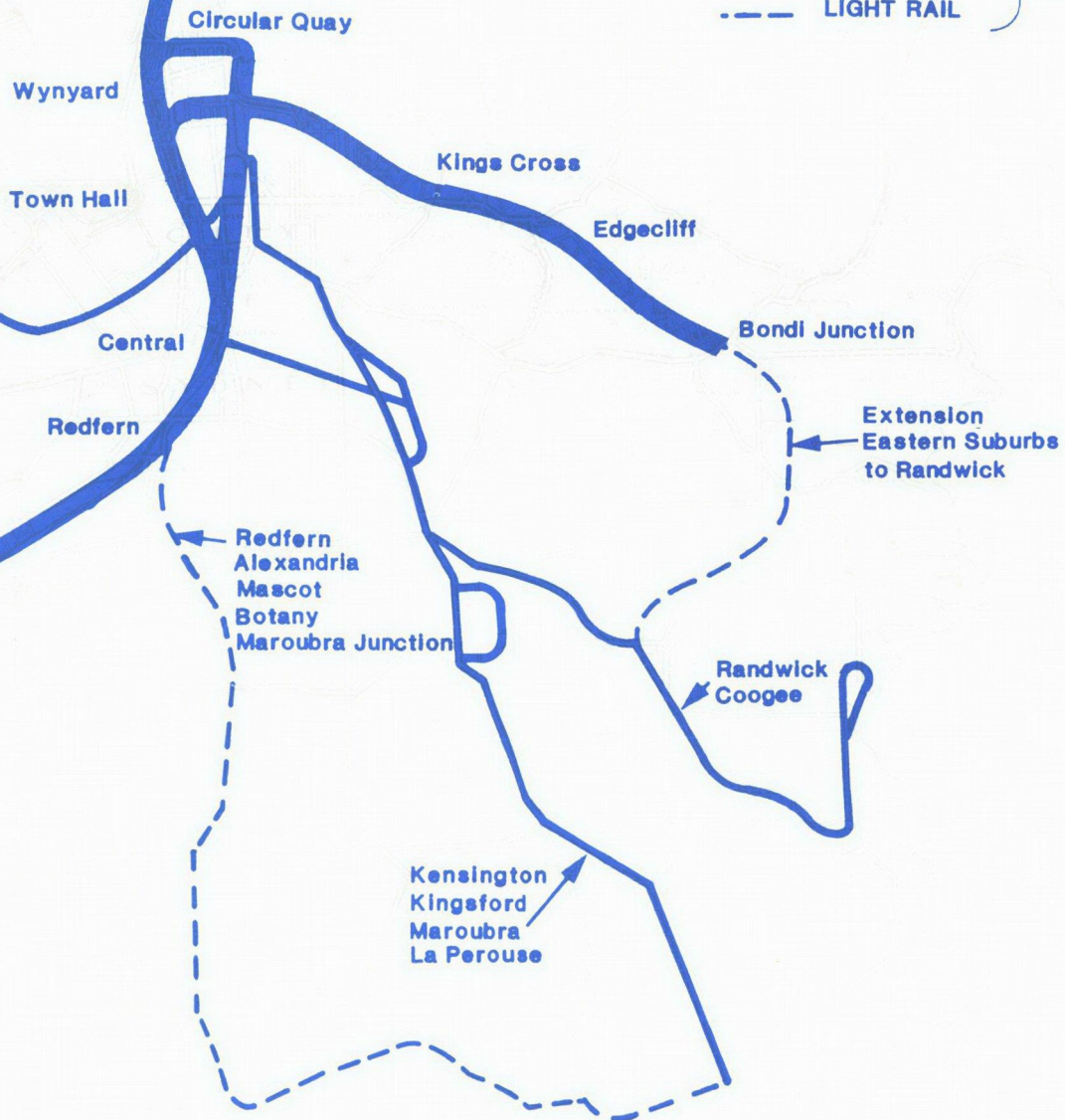
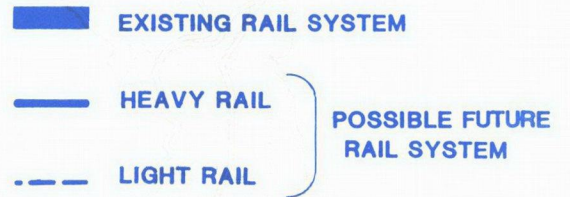
trains or buses during weekends compared with 12.3 percent during the week. This is explained by the dominance of social and recreational journeys during weekends and the fact that only a small proportion of such trips are on bus or rail modes.

Two conclusions are drawn from the above data:

- . Weekend use of an attractive expanded public transport system would be very limited. Given that weekend use of the Cahill Expressway is almost equal to week-day use, public transport enhancement is not seen as an alternative to road improvements in the Eastern Distributor corridor as far as improving weekend traffic conditions is concerned.
- . Week-day afternoon peak period motor vehicle use of the Cahill Expressway would be reduced by 10 percent at most by an attractive expanded public transport system. This is not considered to be a sufficiently high number as to reduce the need for road improvements in the Eastern Distributor corridor (as far as week-day conditions are concerned).

The procedure used is described more fully in Jackson Teece Chesterman Willis & Partners (1985). Irrespective of the extent and efficiency of a public transport system linking major traffic generators in the eastern and southern suburbs, such a system is not expected to cater for the diversity of trip purposes, origins and destinations accommodated on the Cahill Expressway and, by extension, an Eastern Distributor. This conclusion applies equally to a bus public transport system as it does to the idealised rail/light rail system described above. This assumes a continuation of the availability of motor vehicles irrespective of the fuel system used. It is **not** concluded that public transport improvements are not needed or warranted; simply that improvements to public transport are not expected to reduce traffic demands significantly in the Eastern Distributor corridor.





Eastern Distributor - August 1985



5.1



1 KM

IDEALISED FUTURE RAIL  
SYSTEM



### 5.1.3 Major Alternatives

#### Option 1 : Do Nothing

The option of doing nothing in the Eastern Distributor corridor is regarded as the "base case" against which all other feasible alternatives are compared. This option includes the retention of the County Road reservation, which could be lifted with all other options described below.

#### Option 2 : Minor Works (Figure 5.2)

This proposal sought to provide relief to traffic problems in the Woolloomooloo and Darlinghurst areas without substantial land acquisition or construction costs. Improvements could be made to the connection between the Kings Cross Tunnel and the Cahill Expressway by relocating the William Street right turn from Crown Street to Riley Street and by building two left turn lanes in Palmer Street approaching William Street. This would allow the closure of Bourke Street, Woolloomooloo. The alignment in the area of Stanley Street could be improved and the provision of an additional lane for the movement from Bourke to Flinders and Oxford Streets, along with construction of a right turn lane in Flinders Street would help to relieve the existing capacity deficiencies in the area. A right turn was also provided from Anzac Parade into Moore Park Road.

Traffic lights were provided at the intersection of Crown and Cathedral Streets and Palmer and Cathedral Streets, and at Sir John Young Crescent/Riley/Cathedral Street.

Under this scheme the banning of truck movements in Bourke and Crown Street could be sought.

This scheme did not significantly reroute traffic nor relieve the constraints due to major conflicting traffic flows. Also it did not attempt to develop any significant environmental benefits.

#### Option 3 : Underpasses at William Street (Figure 5.3)

This scheme was planned to generate substantial

road user benefits with cost effectiveness as the major design criterion. Most of the road user benefits available in the Woolloomooloo area would be achieved in this scheme by providing underpasses at William Street for both north and southbound through movements. Other features would be broadly the same as for Option 2 (see Figure 5.3).

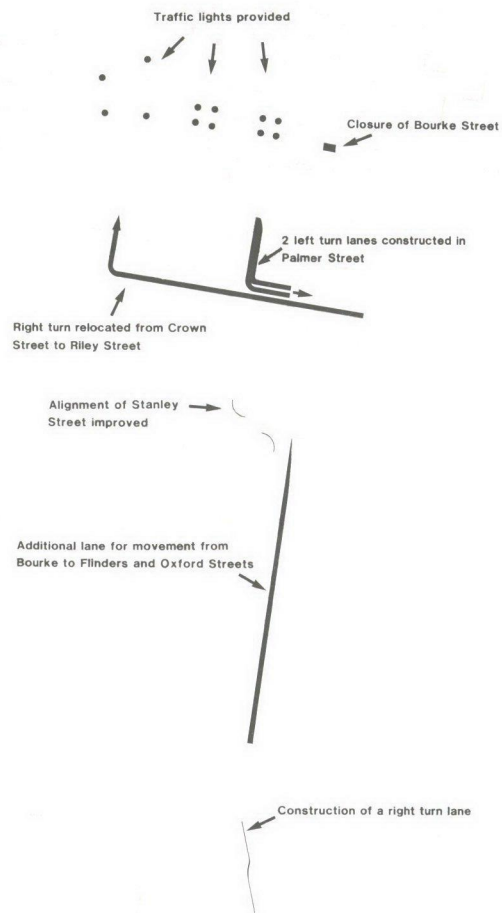
Again no significant attempt was made to reroute traffic or to generate environmental benefits. However, it is expected that relief of the William Street conflicts would substantially ease congestion and delays not only in Woolloomooloo but also, to some extent, in Crown Street, Surry Hills. These benefits represent the bulk of the road user benefits available under any option for the area.


#### Option 4 : Boulevard with Underpasses (Figure 5.4)

This scheme would aim to achieve a maximum of road user benefits and environmental benefits in the Surry Hills area. It would, however, involve large property clearance for construction. It would provide for a simple grade separation of William Street and Oxford Street using minimal underpass structures. Most of the length of the arterial would be built on the surface making maximum use of the existing width of Palmer and Bourke Streets.


Flinders Street would be required to carry almost all of the traffic displaced from Bourke and Crown Streets in Surry Hills. It would require modifications to achieve this. Some restriction of access from the carriageway to properties abutting this length of Flinders Street would be necessary - perhaps the provision of clearway restrictions along both sides. This would include the closure of Albion Street and the rerouting of eastbound traffic via an overbridge at Campbell Street. At Drivers Triangle a grade separation of the right turn for southbound traffic from Flinders Street to South Dowling Street would be necessary to accommodate the additional traffic diverted from Bourke Street. Consequently traffic would be unable to enter South Dowling Street north of Drivers Triangle. Some adjustments might also be required at the intersection of South Dowling and Cleveland Streets to accommodate the increased volumes.



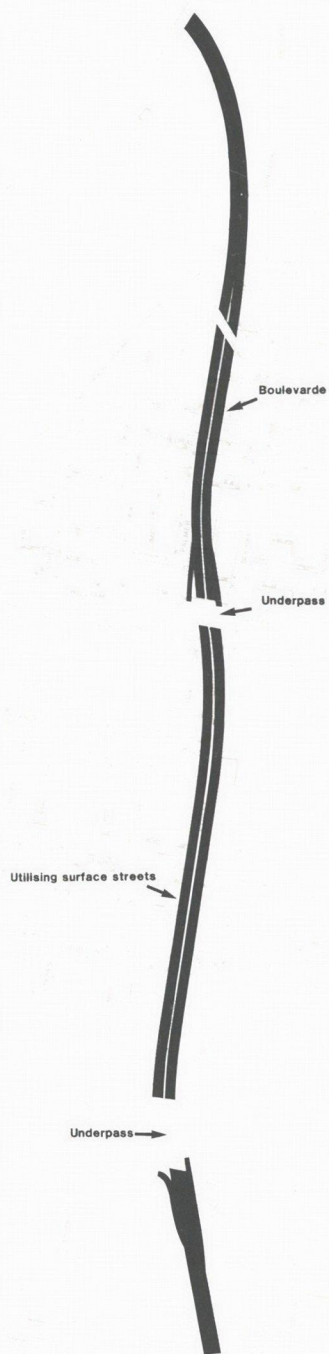


Eastern Distributor - August 1985		
	<b>5.2</b>	<b>N</b>
<b>OPTION 2: MINOR WORKS</b>		



Eastern Distributor - August 1985		
	<b>5.3</b>	<b>N</b>
<b>OPTION 3: UNDERPASSES AT WILLIAM STREET</b>		





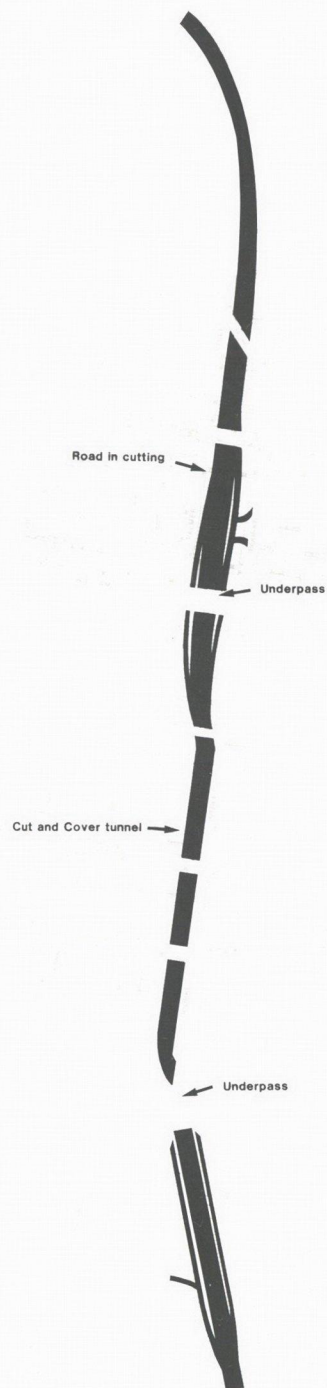
Eastern Distributor - August 1985



5.4



OPTION 4 : BOULEVARDE  
WITH UNDERPASSES



Eastern Distributor - August 1985



5.5



OPTION 5: DISTRIBUTOR IN  
CUTTING



### **Option 5 : Distributor in Cutting (Figure 5.5)**

Under this scheme the arterial would be depressed below ground level for its full length south of Cathedral Street to Flinders Street and provision could be made for placing a cover over much of the structure to permit redevelopment. This cut-and-cover tunnel technique is substantially cheaper to build than a driven tunnel over the same length. However, it incurs costs of property acquisition which may be substantially avoided with a driven tunnel. These considerations and the desire to preserve the existing appearance of Taylor Square suggested that it would be preferable to drive twin tunnels from Burton Street to Flinders Street (one each way) for this option.

In order to avoid disturbing St Michael's church in Flinders Street it would be necessary to locate the portals of these tunnels immediately south of Taylor Square. This would require the removal of the Commonwealth Bank building between Flinders and Bourke Streets. However, the site would be subsequently restored and made available for redevelopment.

In this option Flinders Street would be required to carry almost all of the traffic displaced from the Bourke and Crown Streets in Surry Hills. The comments made for Option 4 regarding Flinders, Albion and South Dowling Streets apply equally to Option 5.

A major objective of the scheme would be to develop most of the available road user and environmental benefits. However, a lower level of service would be provided in this scheme compared to Option 4 because of the difficulty of making the connection between the arterial to the south and William Street to the east. This would cause some rerouting of traffic which presently uses the South Dowling Street-Boundary Street route to Rushcutters Bay.

### **Option 6 : The Proposal**

Option 6 is the proposed Eastern Distributor, as described in Section 2 above.

### **5.1.4 Detailed Design Alternatives to Aspects of the Proposal**

#### **Moore Park Option**

There have been a number of suggestions made regarding the traffic arrangements at Drivers Triangle and on the streets around the north west part of Moore Park (Figure 5.6 illustrates one such suggestion). This raises complex questions about traffic movements throughout the Moore Park area. A detailed investigation is needed of the engineering options and costs. They would all have an impact on the park. An investigation might also be expected to influence the final design of the portal at the south end of the Stage 2 tunnel.

#### **South Dowling Street Option**

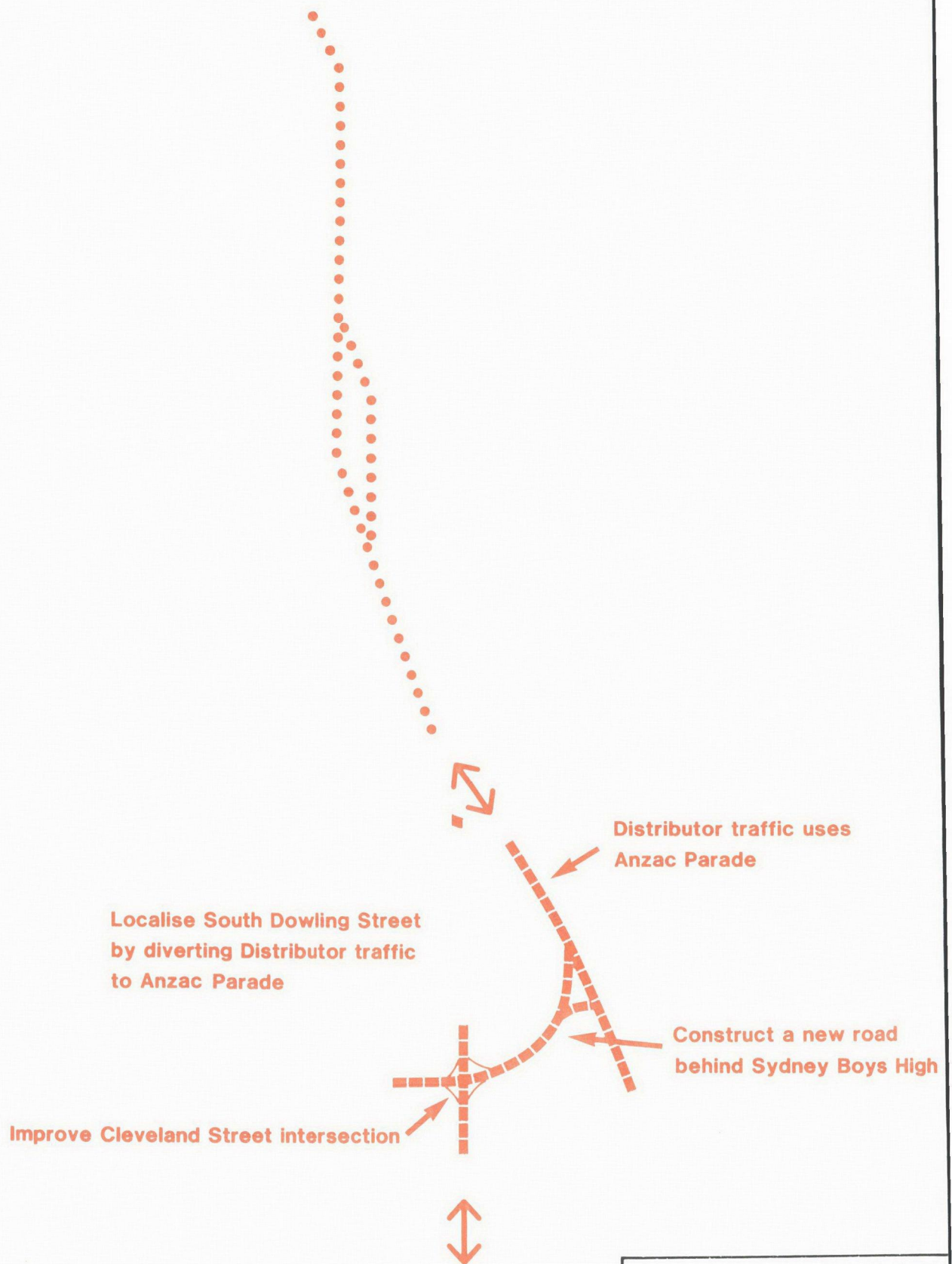
If the Moore Park Option described in Figure 5.6 was to prove unacceptable and it were necessary for the southbound Eastern Distributor tunnel to exit partly onto South Dowling Street, design modifications could be made to lessen the impact of increased traffic on residences in South Dowling Street but at some additional cost. This would involve shifting South Dowling Street 10m. to the east into Moore Park. A 10m. wide strip of Moore Park itself would be required but this would provide a frontage road to residences on South Dowling Street, as well as a line of trees between the frontage road and South Dowling Street. A further line of trees could be provided on the median strip separating north and southbound traffic on South Dowling Street. The feasibility and cost of this option would require further investigation before it could be recommended.

These measures would reduce the adverse effects additional traffic on South Dowling Street would have on air quality and noise levels at the residential frontages.

#### **East-West Traffic in Surry Hills**

The Proposal involves the partial closure of Albion Street in Stage 2 and the use of Cleveland, Campbell and Fitzroy/Foveaux Streets for east-west movement through Surry Hills. Together with Moore Park Road, the Fitzroy/Foveaux Street





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5.6 N  
300 M

POSSIBLE MOORE PARK  
OPTION



route will continue to serve traffic heading west towards Broadway. On completion of the Stage 3 tunnel it is expected that some westbound traffic currently using Fitzroy/Foveaux Streets as far as Crown Street will use the tunnel.

Concern has been expressed by some residents that this does not do enough to relieve the problem of through traffic on Fitzroy/Foveaux Streets. An alternative would be to leave Albion Street open during Stages 2 and 3 and spread westbound traffic through Surry Hills more evenly among Cleveland Street, Albion Street, Fitzroy/Foveaux Streets and Campbell Street. Certain measures could be adopted to encourage relatively greater use of Cleveland and Campbell Streets. However Fitzroy/Foveaux Streets would not be adversely affected, compared with the existing situation.

### **S-Bend at Stanley Street**

Stage 1 of the Proposal involves a realignment of the crossover between Palmer and Bourke Streets at Stanley Street (Figure 2.1).

The block of land affected by the crossover will be available for residential redevelopment on completion of Stage 3, at which time the crossover will be redundant.

It has been argued (MSJ Keys Young 1985) that this realignment is not necessary for Stage 1 to operate effectively as an interim measure until Stage 3 is complete, and that the buildings facing Stanley Street need not be demolished.

If the use of Stanley Street were to be retained it would not save the demolition of buildings facing Palmer Street south of William Street. Demolition will be necessary to construct the underpass of William Street and to bring the traffic up to the level of Palmer Street. The existing S-bend allows two lanes of traffic to turn, at relatively low speed. The underpass will provide three lanes of traffic, only two of which could be used if the existing S-bend were retained.

For these reasons the widening and realignment of the S-bend is proposed. It will also reduce braking, accelerating, noise, air pollution, travel times, vehicle operating costs and accidents.

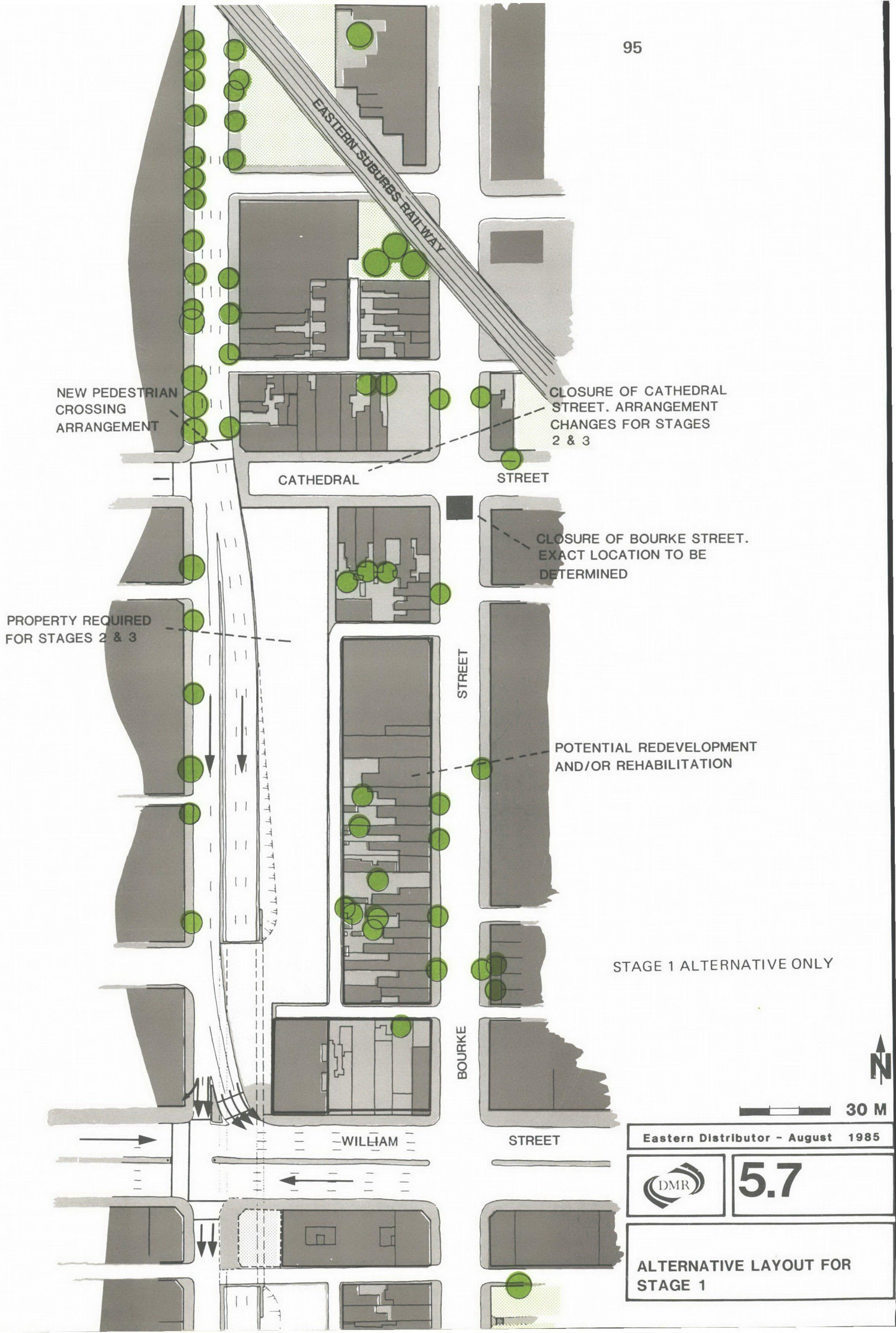
In Stage 2, when the S-bend carries northbound traffic downhill from Bourke Street to Palmer Street, the safety advantages of widening and easing the bends will become even more apparent.

Even with Stage 3 completed four years after the S-bend has been realigned, as proposed, the cost of these temporary roadworks is justified in economic terms. The estimated savings in accidents, travel time and operating costs over a four year period will far exceed the costs of construction and deferred residential development.

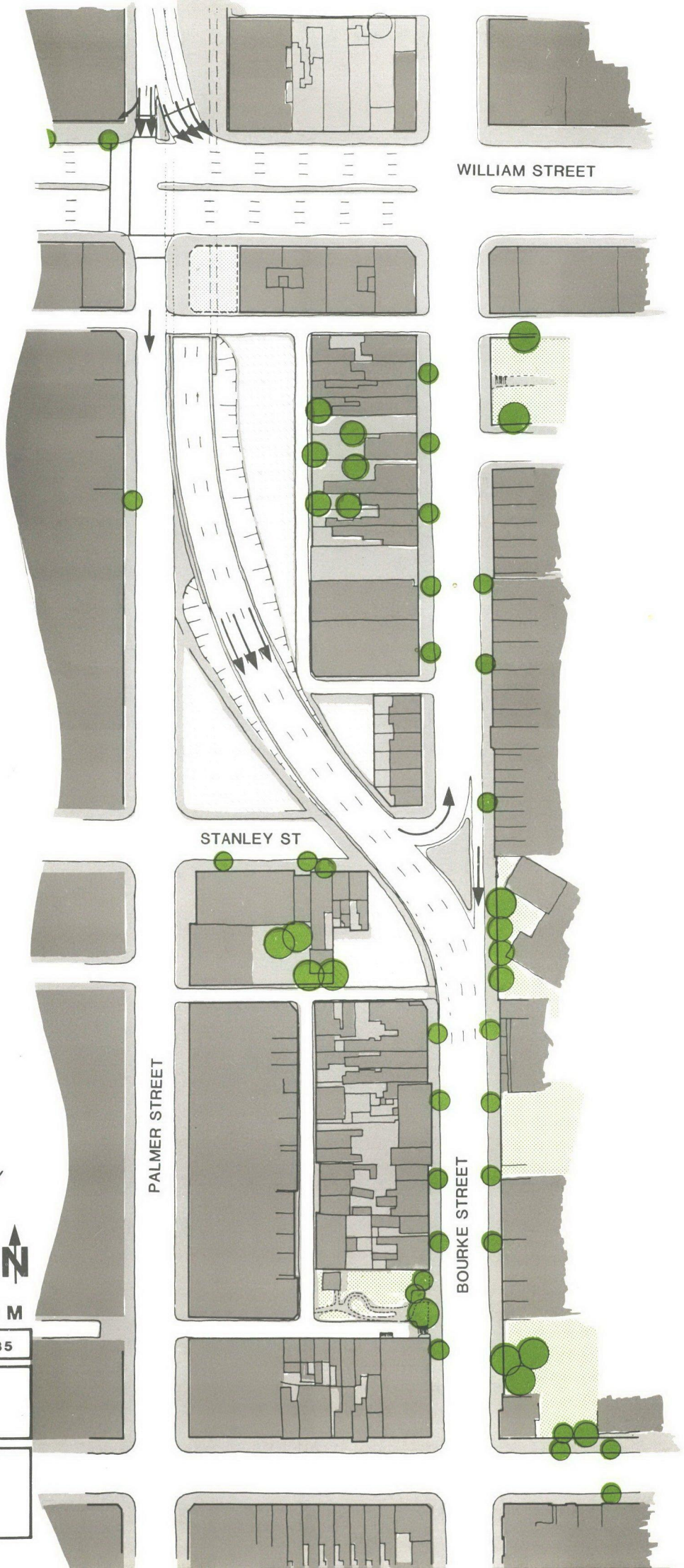
Alternative layouts for the S-bend have been prepared. They all cut through the block facing Stanley Street (avoiding the terraces facing Bourke Street), but vary in the point at which they diverge from Palmer Street. The Proposal is parallel to Palmer Street between William Street and a point just north of Sutton Lane (Figure 2.16). This maximises the area of residual land which could be redeveloped during Stage 1 (north of Sutton Lane and east of Wisdom Lane). However, it constrains the area available to construct the Stage 3 tunnel if it were to be bored from the northern end. Such boring would commence at Stanley Street. The proposed layout is more compatible with boring from the southern end.

An alternative layout would diverge from Palmer Street further north, closer to Barrett Lane (Figure 5.7). This would close the opportunity for residual land to be redeveloped before the completion of Stage 3, but would have two advantages. First, the radius of the bends could be increased, thereby increasing traffic speed to about 60 km/hr and reducing delays. Second, the Stage 3 tunnel could be bored from the vicinity of Stanley Street, using the area of land between Palmer Street and the realigned S-bend for working space.









WILLIAM STREET

STANLEY ST

PALMER STREET

BOURKE STREET

STAGE 1 & 2 ALTERNATIVE ONLY



30 M

Eastern Distributor - August 1985



5.8

ALTERNATIVE LAYOUT FOR  
STANLEY STREET



### Location of Stage 3 Tunnel Portal

It is proposed that the northern portal of the Stage 3 tunnel be located near Stanley Street, with "cut-and-cover" construction used to connect the tunnel to the underpass of William Street completed in Stage 1.

An alternative technique would be to construct a "cut-and-cover" tunnel under Palmer Street as far as about Burton Street. The bored tunnel would then commence near Burton Street. The technique would be similar to that described in Section 4.7 for construction of the underpass at William Street. It would involve the sinking of a curtain of bored piles along the line of each gutter in Palmer Street. The surface would be excavated to a shallow depth and a concrete deck would be placed to span the piled walls.

This work could progress in short lengths along Palmer Street, with the new deck reinstating the street for local access. In effect there would be a mid-block street closure moving progressively along Palmer Street, with a cul-de-sac on both sides. Vehicular access to property frontages would be denied only temporarily. After reinstatement of the road surface, the bulk of excavation would continue underneath.

### Access to William Street from Palmer Street

Stage 1 includes the provision of access to William Street from Palmer Street via a ramp on the eastern side of the William Street underpass (Figure 2.1). This will remove arterial traffic from Bourke Street, Woolloomooloo, and will allow that road to be closed.

It has been argued (MSJ Keys Young 1985) that the necessity to provide access to William Street for traffic from the Cahill Expressway does not warrant the demolition of buildings on the eastern side of Palmer Street and that the use of Bourke Street may be preferable.

However, the buildings on the eastern side of Palmer Street between Cathedral Street and William Street must be demolished to construct the underpass of William Street, not just the ramp. Since the underpass will become part of the

northbound tunnel (Stage 3) it will comprise two traffic lanes plus a breakdown shoulder. Frontage access to the properties on the western side of Palmer Street must be retained, and therefore the underpass and its approach cannot be contained within the existing width of Palmer Street.

A further objection that has been made to the proposed ramp is that at Stage 2 the Proposal will comprise eight lanes of traffic, one parking lane and a breakdown shoulder south of Cathedral Street. If the ramp were deleted the number of lanes would be reduced by two between Cathedral Street and Robinson Street. However, the two tunnels must be at least five metres apart and therefore the total width of the Distributor at Robinson Street could be reduced by only three metres rather than the full width of two traffic lanes.

The proposed ramp will not affect pedestrian access across the Distributor. Pedestrian signals are proposed at Cathedral Street, with four lanes on each side of a central median refuge. The signals will take the pedestrians across four lanes at a time. Pedestrian crossing facilities will also be available at William Street.

An alternative layout for Stage 1 is shown in Figure 5.8. This layout deletes the ramp to William Street and makes use of three lanes of the existing Palmer Street for traffic turning left or right into William Street. The three lanes (two for traffic and one for parking) are needed to carry the large volume of traffic heading towards William Street. Palmer Street would be one lane wider than in the Proposal. Whilst the buildings on the eastern side of Palmer Street will still need to be demolished to accommodate the underpass, this alternative has the advantages of reducing the amount of roadway to be built in Stage 1 and increasing the residual area of land on the eastern side.

The aim with this alternative layout, as with the Proposal, is to accommodate the traffic presently using Bourke Street, Woolloomooloo. The significant environmental benefits in Bourke Street adjacent to the Housing Commission Estate can be achieved without any additional property demolition in Palmer Street.



## Cowper Wharf Roadway Option

If a major redevelopment of Woolloomooloo Bay were to occur so that significant extra traffic to and from Cowper Wharf Roadway was expected, the northbound right turn at Plunkett Street could become a problem. Relief could be provided by opening an additional right turn lane via Lincoln Crescent, thus permitting a two lane movement with capacity for foreseeable development.

The possibility of a full grade separation of this site with an overpass for Eastern Distributor traffic has been ruled out on the basis of its undesirable visual impact, the greater effect of traffic noise on the local environment, and its cost.

## 5.2 Method of Assessment

Each of the major options was assessed in terms of the extent to which it was likely to meet the objectives for the Proposal and provide the outcomes sought (Table 1.2). Where the likely impact of each option was able to be calculated (for example, the estimated number of residents affected by each option), the results were quantified. Where this was not possible, a 7 point assessment scale, comparing the options with one another, was used. This assessment is summarised in Section 5.5 below and in Table 5.12. Section 5.3 provides a more detailed explanation of the likely traffic and transportation impacts of each option.

In addition, each of the options was subject to an economic evaluation. The results of this evaluation are summarised in Tables 5.8 and 5.9. The economic evaluation is explained more fully in Section 5.4 below.

The contents of Tables 5.8 and 5.9 and Table 5.12 are not mutually exclusive. Some factors listed in Table 5.12 are considered from an economic point of view in Table 5.8 and 5.9 which, based on the economic evaluation of the options, describes those costs and benefits deriving from each option that can be expressed in or translated into monetary terms. The methods used for converting certain quantifiable elements into monetary values are explained in Jackson Teece Chesterman Willis & Partners (1985).

The economic evaluation does not provide a comprehensive evaluation of the social and environmental factors. It should therefore be considered in conjunction with the form of assessment employed in Section 5.5 and Table 5.12.

Neither form of assessment refers to the distribution of costs and benefits. Also, in Table 5.12 no reference is made to the weighting that could be given certain factors against others. These issues, which are central to the ultimate comparative assessment of the options, involve choices based on social and political values.

## 5.3 Comparative Traffic and Transportation Impacts

### 5.3.1 Introduction

This section considers the likely effects on traffic and transportation of each of the options described in Section 5.1.3. The "Do Nothing" Option (Option 1) is the "base case" against which all other options are evaluated.

Traffic reassignments have been completed for Options 2, 3, 4 and 5 in the same manner as for Option 6 (see Section 3.3.1) so that the relative merits of each can be evaluated.

The findings of this section provide the basis for the traffic and transportation related costs and benefits included in the economic evaluation (Section 5.4). The findings are also summarised in the assessment of the options in terms of the objectives established for an Eastern Distributor (Section 5.5 and Table 5.12).

### 5.3.2 Traffic Forecasts used in Economic, Noise and Air Quality Evaluations

A series of tables is presented below:

- Table 5.1 shows expected accident reductions in comparison with the "base case", derived from a review of accident history data and reassigned traffic flows.
- Table 5.2 shows Annual Average Daily Traffic (AADT) which is expected to benefit



directly in terms of travel time savings. This is derived from reassigned hourly flows.

- Table 5.3 shows the anticipated savings in minutes for each of the vehicle trips scheduled in Table 5.2. This is assessed from travel time surveys and expected future speeds.
- Table 5.4 is the product of Tables 5.2 and 5.3, and therefore reflects daily vehicle hours saved for each scheme.
- Table 5.5 shows the estimated number of vehicle stop/start manoeuvres saved per day. This is the product of Table 5.2 and the number of stops assumed to be eliminated by each scheme.
- Table 5.6 shows the estimated daily additional vehicle kilometres which have to be travelled under the various schemes as a result of either diversion of right turns from William to Riley Street rather than Crown Street or alternatively, diversions caused by closing Dowling Street to through traffic between Flinders Street and Oxford Street.
- Table 5.7 shows the estimated daily travel time savings for bus passengers on William Street, Oxford Street and Flinders Street.

In addition to the user benefits and disbenefits described in Tables 5.1 - 5.7 above, local traffic will experience improvements with Options 4, 5 and 6. These benefits include:

- less congestion on Bourke and Crown Streets which will result in
  - smoother travel along these streets
  - less delay on leaving a residence
  - less delay for east-west movements crossing these streets;
- shorter travel paths for local traffic as a result of two directional flow in these streets.

These benefits are difficult to quantify, and no such quantification has been attempted.

Options 5 and 6 will accrue similar local traffic benefits, both being greater than those accruing to Option 4.

Option 2 provides only nominal environmental benefits to residents of Woolloomooloo as a result of the closure of Bourke Street, Woolloomooloo. The same can be said of Option 3.

Growth is expected to occur in daily traffic volumes in the Eastern Distributor corridor but not in peak period traffic. Peak period traffic is controlled by the capacity of key intersections and by the Cahill Expressway and Sydney Harbour Bridge. Both the Cahill Expressway and Sydney Harbour Bridge have been shown by records extending back over many years to be operating at capacity during daily peaks.

Daily traffic through the Eastern Districts in the period 1969 to 1983 has increased at rates which, if projected for 10 years to 1993, would see a cumulative growth of 1.1 percent to 2.1 percent per annum. Department of Environment and Planning forecasts indicate that population and work opportunities in the inner city may decrease but in the short term it is expected that traffic will continue to grow because of increasing vehicle ownership. In the longer term declining city centre employment and inner suburb populations may offset vehicle ownership to the extent of levelling out or reversing short term growth.

In this investigation the economic evaluation is for a period of 30 years, considered appropriate for major capital expenditure. At the end of 30 years it is expected that daily traffic will have grown to 15 percent more than 1983 levels. Growth levels of 0 percent (low) and 30 percent (high) have also been considered to test the sensitivity of the economic evaluation (see Section 5.5).

## 5.4 Economic Evaluation

### 5.4.1 Introduction

This section provides an overview of the economic evaluation of the Proposal and its alternatives. A full discussion is given in the paper entitled "Cost Benefit Analysis of the Eastern Distributor" and accompanying Working Papers in Jackson Teece Chesterman Willis & Partners (1985).



### 5.4.2 The Cost Benefit Framework

In the evaluation of transportation projects, the term "economic evaluation" is generally taken to mean "cost benefit analysis" (CBA). This practice has been followed in this environmental impact statement.

The objective of CBA is to bring together the major costs and benefits of a project under a common unit of measure (a dollar or some other monetary unit). As far as possible costs are measured by the amounts individuals require to compensate them for the loss of an asset or resource or for the imposition of some disamenity. Benefits are measured by what individuals are willing to pay for them. These values are derived from studies of individual behaviour and responses to surveys.

There is no hard line between economic costs and benefits and social or environmental costs and benefits. The proper distinction is rather between those costs and benefits which can be measured reasonably accurately in dollars and those which cannot. A CBA includes only the monetarily (\$) quantified elements. In a complete evaluation all effects should be analysed and quantified as far as practicable.

The following is a list of the costs and benefits included in the CBA in this environmental impact statement.

#### Costs:

- . Construction costs, including design and planning;
- . Property costs;
- . Relocation and disturbance costs; and
- . Tunnel maintenance costs.

#### Benefits:

- . Direct and indirect residential benefits from an improved environment;
- . Travel time savings including savings on buses;
- . Vehicle operating cost savings;
- . Savings in accidents; and
- . Residual construction values.

Broadly speaking, these benefits and costs relate to objectives 1, 2, 3, 6 and 8 in Table 1.2. The cost benefit analysis also provides measures of the costs of achieving these objectives.

For each scheme, the proposed Eastern Distributor and the four alternatives described in Section 5.1, the costs and benefits have been estimated relative to a "base case". This is assumed to be the continuation of the existing road system. The adoption of any of the schemes would end the present uncertainty about the County Road reservation (objective 4).

The costs and benefits have been estimated (in December quarter, 1984 dollars) over a 30-year period from 1985/86 to 2024/25. A residual value of 75 percent of the construction costs has been allowed. Alternative real discount rates of 10 and 7 percent per annum have been allowed and all costs and benefits discounted to 1989-90, approximately the mid-point of the proposed construction program for the Proposal.

Two summary measures of the net value of the schemes have been estimated, namely the net present value (NPV) and the benefit cost ratio (BCR). The NPV is the difference between the total discounted benefits and the total discounted costs. The BCR is the ratio of the total discounted benefits to total discounted costs.

### 5.4.3 The Costs and Benefits

Details of the costs and benefits and the basis for valuation of them are given in the economic Working Papers in Jackson Teece Chesterman Willis & Partners (1985). Here only a brief summary is given.

Table 5.8 summarises the estimated major costs. It should be stressed that they are not discounted. Strict comparisons are possible only when costs are discounted to a similar point in time as they are in Table 5.10.

Table 5.9 summarises the estimated benefits. Note that the residential benefits are capital values and the other benefits are annual figures.

The user benefits (travel time savings, vehicle cost savings and accident savings) are assumed to increase broadly with traffic. Alternative assumptions of 0.5 percent and 1.25 percent per annum were made. It is assumed that congestion costs will not rise faster than this because traffic would spread out of peak hours.



TABLE 5.1 PER ANNUM ACCIDENT REDUCTIONS ATTRIBUTED TO EACH OPTION

		2 Minor Works	3 Underpasses at William Street	4 Boulevard with Underpasses	Options 5 Distributor in Cutting	Stage 1	6 The Proposal Stage 2 <sup>a</sup>	Stage 3 <sup>b</sup>
TARU Reported								
Fatality	-	1	1	1	1	1	1	1
Injury	-	10	20	74	75	18	35	89
Property (only)	-	13	23	86	80	11	55	85
Other minor accidents (assumed) <sup>c</sup>		25	45	160	155	30	90	175

- a. Includes Stage 1
- b. Includes Stages 1 and 2
- c. These are accidents in which there were no injuries or vehicles towed away, and which were not reported to TARU

TABLE 5.2 ANNUAL AVERAGE DAILY TRAFFIC EXPECTED TO SAVE TRAVEL TIME, FOR EACH OPTION (1984 VOLUMES ASSIGNED TO OPTIONS)

Traffic Movement	2 Minor Works	3 Underpasses at William Street	4 Boulevard with Underpasses	Options 5 Distributor in Cutting	Stage 1	6 The Proposal Stage 2 <sup>a</sup>	Stage 3 <sup>b</sup>
Northbound	20,000	20,000	23,000	19,000	20,000	20,000	19,000
Southbound	22,000	22,000	25,500	21,000	22,000	21,000	21,000
Change in Riley	13,000	13,000	-	-	13,000	13,000	13,000

- a. Includes Stage 1
- b. Includes Stages 1 and 2



TABLE 5.3 ANTICIPATED SAVINGS IN MINUTES FOR VEHICLE TRIPS SCHEDULED IN TABLE 5.2

+ve : reduction  
-ve : increase

Traffic Movement	2 Minor Works	3 Underpasses at William Street	4 Boulevard with Underpasses	Options 5 Distributor in Cutting	6 The Proposal		
					Stage 1	Stage 2 <sup>a</sup>	Stage 3 <sup>b</sup>
Northbound	-	0.88	3.2	3.7	0.1	2.52	3.8
Southbound	0.2	1.1	2.2	2.68	1.1	2.95	2.95
William	0.25	0.5	0.5	0.5	0.25	0.5	0.5
Oxford	0.17	0.17	0.33	0.33	0.17	0.17	0.33
Riley	- 0.24	- 0.24	-	-	- 0.24	- 0.24	- 0.24
Closure South Dowling	-	-	0.35	0.35	-	-	-

a. Includes Stage 1

b. Includes Stages 1 and 2

TABLE 5.4 TRAVEL TIME CHANGE (VEHICLE HOURS AADT/DAY)  
(The product of Tables 5.3 and 5.4)

Traffic Movement	2 Minor Works	3 Underpasses at William Street	4 Boulevard with Underpasses	Options 5 Distributor in Cutting	6 The Proposal		
					Stage 1	Stage 2 <sup>a</sup>	Stage 3 <sup>b</sup>
Northbound	-	290	1,230 <sup>c</sup>	1,170	35	840	1,200
Southbound	75	400	970 <sup>c</sup>	938	400	1,030	1,032
William	250	500	500	500	250	500	500
Oxford	95	95	180	180	100	100	95
Riley	-50	-50	-	-	-50	-50	-50
Closure South Dowling	-	-	-60	-60	-	-	-

a. Includes Stage 1

b. Includes Stages 1 and 2

c. Local movements contribute to this benefit.



TABLE 5.5 ESTIMATED VEHICLE STOPS ELIMINATED

Traffic Movement	2	3	4	Options	6		
	Minor Works	Underpasses at William Street	Boulevard with Underpasses	Distributor in Cutting	Stage 1	Stage 2 <sup>a</sup>	Stage 3 <sup>b</sup>
Per Vehicle:							
Northbound	-	0.9	4.3	4.7	-	0.9	4.9
Southbound	-	1.5	3.9	4.3	1.2	4.4	4.5
William	0.15	0.3	0.3	0.3	0.15	0.3	0.3
Oxford	0.1	0.1	0.2	0.2	0.1	0.1	0.2
Campbell/Flinders	-	-	0.8	0.8	-	0.3	1.0
Per Day:							
Northbound	-	18,000	98,900	89,300	-	18,000	93,100
Southbound	-	33,000	99,400	90,300	26,400	92,400	94,500
William	9,000	18,000	18,000	18,000	9,000	18,000	18,000
Oxford	3,200	3,200	6,400	6,400	3,200	3,200	6,400
Campbell/Flinders	-	-	11,200	11,200	-	3,000	15,000

a. Includes Stage 1  
b. Includes Stages 1 and 2

TABLE 5.6 VEHICLE KM/DAY DISBENEFIT FROM LONGER TRAVEL PATH

Influence	2	3	4	Options	6		
	Minor Works	Underpasses at William Street	Boulevard with Underpasses	Distributor in Cutting	Stage 1	Stage 2 <sup>a</sup>	Stage 3 <sup>b</sup>
In Riley, (100m) <sup>c</sup>	1,300	1,300	-	-	1,300	1,300	1,300
Closure Sth Dowling Flinders to Oxford <sup>d</sup>	-	-	2,300	2,300	-	-	-

a. Includes Stage 1  
b. Includes Stages 1 and 2  
c. This traffic diverted to Riley. Originally turned right into Crown and Bourke Streets from William Street. This assumption is conservative since it is possible that this traffic will divert back to Palmer Street after Stage 1 and not incur this disbenefit (see Section 5.1.4)  
d. The closure of South Dowling forces traffic to use Flinders-Burton Streets or Moore Park-Greens Road.



TABLE 5.7 PASSENGER HOURS SAVED PER DAY ON UTA BUSES.

Bus Routes	2 Minor Works	3 Underpasses at William Street	4 Boulevard with Underpasses	Options 5 Distributor in Cutting	6 The Proposal		
					Stage 1	Stage 2 <sup>a</sup>	Stage 3 <sup>b</sup>
William	34	69	69	69	34	69	69
Oxford east of Bourke	39	39	78	78	39	39	78
Flinders	77	77	410	410	77	80	450

a. Includes Stage 1

b. Includes Stages 1 and 2

TABLE 5.8 SUMMARY OF COSTS (UNDISCOUNTED)

(\$m. - December Quarter 1984 Prices)

	2 Minor Works	3 Underpasses at William Street	4 Boulevard with Underpasses	Options 5 Distributor in Cutting	6 The Proposal		
					Stage 1	Stage 2 <sup>a</sup>	Stage 3 <sup>b</sup>
Construction <sup>c</sup>	2.3	7.0	24.5	55.0	6.9	67.5	107.9
Property Take <sup>d</sup>	2.6	2.6	28.0	22.4	5.0	10.9	13.3
Relocation and Disturbance <sup>e</sup>	0.4	0.4	3.6	3.4	0.8	1.5	1.8
Tunnel Maintenance (p.a.) <sup>f</sup>	-	-	-	0.3	0.03	0.53	0.76

a. Includes Stage 1.

b. Includes Stages 1 and 2.

c. Includes planning and design.

d. Property required over and above what is needed in "base case".

e. These reflect the estimated social costs of relocation and disturbance, not financial costs.

f. Electricity, cleaning, etc.



TABLE 5.9 SUMMARY OF ESTIMATED MAJOR BENEFITS

(\$m. - December Quarter 1984 Prices)

	2 Minor Works	3 Underpasses at William Street	4 Boulevard with Underpasses	Options 5 Distributor in Cutting	Stage 1	6 The Proposal Stage 2 <sup>a</sup>	Stage 3 <sup>b</sup>
<b>Residential Benefits</b>							
Direct <sup>c</sup>	2.0	2.0	8.0	8.5	2.0	7.1	8.9
Indirect <sup>d</sup>	0.6	0.6	3.5	4.0	0.6	5.6	4.9
<b>Travel Time Savings Per Annum</b>							
High <sup>e</sup>	0.72	2.16	5.03	4.88	1.31	4.15	5.13
Medium <sup>e</sup>	0.55	1.70	3.93	3.81	1.03	3.28	4.00
<b>Vehicle Cost Savings Per Annum</b>							
High <sup>f</sup>	0.05	0.31	0.93	0.89	0.16	0.57	0.96
Medium <sup>f</sup>	0.02	0.21	0.67	0.65	0.10	0.41	0.70
<b>Accident Savings Per Annum<sup>g</sup></b>	0.41	0.56	1.08	1.37	0.50	0.83	1.53

a. Includes Stage 1.

b. Includes Stages 1 and 2.

c. Net increases in residential property values on streets experiencing changes in traffic volumes.

d. Net increases in residential property values in streets adjacent to those experiencing changes in traffic volumes.

e. Including buses. For basis of valuation see Economic Working Paper No. 4 (Jackson Teece Chesterman Willis &amp; Partners 1985).

f. For basis of valuation see Economic Working Paper No. 5 (Jackson Teece Chesterman Willis &amp; Partners 1985).

g. Includes savings associated with fatalities, injuries and property damage.



TABLE 5.10 CENTRAL CASE RESULTS

(\$m. - late 1984 Prices - Discounted to 1989-90)

		2	3	4	Options	6		
		Minor	Underpasses	Boulevard	Distributor	The Proposal		
		Works	at	with	in	Stage 1	Stage 2 <sup>a</sup>	Stage 3 <sup>b</sup>
			William	Underpasses	Cutting			
			Street					
<b>Discounted Costs</b>								
1.	Construction	3.1	9.2	30.1	63.1	8.9	79.8	111.6
2.	Property Take	4.1	4.2	44.6	40.4	8.4	18.5	23.0
3.	Relocation	0.5	0.5	5.3	5.0	1.2	2.3	2.8
4.	Maintenance (Tunnel)	-	-	-	2.6	0.4	5.2	7.2
5.	<b>Total</b>	<b>7.7</b>	<b>13.9</b>	<b>80.0</b>	<b>111.2</b>	<b>18.9</b>	<b>105.8</b>	<b>144.6</b>
<b>Discounted Benefits</b>								
6.	Direct Residential	2.7	2.4	8.7	7.7	2.5	7.5	9.2
7.	Indirect Residential	0.7	0.7	3.8	3.7	0.7	5.6	5.0
8.	Travel Time Savings <sup>c</sup>	8.3	25.0	51.6	40.9	14.9	43.0	49.8
9.	Travel Time Savings <sup>d</sup>	1.4	1.6	4.4	3.6	1.3	2.1	4.3
10.	Vehicle Operating Savings	0.2	2.5	7.5	5.9	1.2	4.3	7.1
11.	Accident Savings	5.5	6.8	12.0	12.5	6.1	9.5	16.0
12.	Residual Value	0.1	0.2	0.6	1.7	0.2	1.7	2.4
13.	<b>Total</b>	<b>18.9</b>	<b>39.2</b>	<b>88.6</b>	<b>76.0</b>	<b>26.8</b>	<b>73.7</b>	<b>93.7</b>
<b>Results</b>								
14.	Benefits-Costs (B-C) <sup>e</sup>	11.2	25.3	8.6	- 35.2	7.9	- 32.1	- 50.9
15.	Benefit Cost Ratio (BCR)	2.46	2.82	1.11	0.68	1.42	0.70	0.65

- a. Includes Stage 1  
b. Includes Stages 1 and 2  
c. Excluding buses  
d. Buses  
e. Equivalent to the net present value (NPV)

TABLE 5.11 ALTERNATIVE SCENARIO RESULTS

(\$M. - late 1984 Prices - Discounted to 1989-90)

		2	3	4	Options	6		
		Minor	Underpasses	Boulevard	Distributor	The Proposal		
		Works	at	with	in	Stage 1	Stage 2 <sup>a</sup>	Stage 3 <sup>b</sup>
			William	Underpasses	Cutting			
			Street					
<b>Discounted Costs</b>								
1.	Construction	2.9	8.5	28.3	60.5	8.3	76.0	107.3
2.	Property Take	3.6	3.6	39.1	34.6	7.3	16.0	19.9
3.	Relocation	0.7	0.7	7.1	6.8	1.6	3.0	3.7
4.	Maintenance (Tunnel)	-	-	-	3.6	0.5	6.9	9.7
5.	<b>Total</b>	<b>7.2</b>	<b>12.8</b>	<b>74.5</b>	<b>105.5</b>	<b>17.6</b>	<b>101.9</b>	<b>140.6</b>
<b>Discounted Benefits</b>								
6.	Direct Residential	3.3	3.1	11.3	10.6	3.1	9.9	12.1
7.	Indirect Residential	0.9	0.9	4.9	5.1	0.8	7.5	6.6
8.	Travel Time Savings <sup>c</sup>	9.1	28.4	59.7	49.5	16.8	50.6	59.0
9.	Travel Time Savings <sup>d</sup>	1.1	1.2	3.5	3.0	1.0	1.6	3.5
10.	Vehicle Operating Savings	0.8	5.4	14.9	12.3	2.8	9.0	14.6
11.	Accident Savings	7.6	9.6	17.3	18.9	8.6	13.6	23.7
12.	Residual Value	0.2	0.4	1.5	4.4	0.5	4.5	6.4
13.	<b>Total</b>	<b>23.1</b>	<b>48.8</b>	<b>113.2</b>	<b>103.7</b>	<b>33.6</b>	<b>96.7</b>	<b>125.9</b>
<b>Results</b>								
14.	Benefits-Costs (B-C) <sup>e</sup>	14.5	35.9	38.7	- 1.8	15.9	- 5.3	- 14.7
15.	Benefit Cost Ratio (BCR)	3.24	3.80	1.52	0.98	1.90	0.95	0.90

- a. Includes Stage 1  
b. Includes Stages 1 and 2  
c. Excluding buses  
d. Buses  
e. Equivalent to the net present value (NPV)



TABLE 5.12 EASTERN DISTRICTS : SUMMARY ASSESSMENT SHEET BASED ON OBJECTIVES

Assessment Category	Assessment Factors	Likely Impact of Major Options							
		1 Do Nothing	2 Minor Works	3 Underpasses at William Street	4 Boulevard with Underpasses	5 Distributor in Cutting	6 The Proposal		
							Stage 1	Stage 2 <sup>a</sup>	Stage 3 <sup>b</sup>
1. Impact on Travel Conditions through the Eastern Districts	. Congestion and delays; travel times; travel convenience and reliability <sup>c</sup>	o	+	++	+++	+++	+	++	+++
	. Opportunities to implement local traffic management schemes	o	+	++	+++	+++	+	++	+++
2. Impact on Environmental Conditions in Local Streets	. Air quality	o	o	+	++	+++	+	++	+++
	. Noise and vibration	o	o	o	+	++	+	++	+++
	. Safety on local streets	o	+	+	++	++	+	++	+++
3. Impact on the Accident Rate	. Safety at locations with poor accident records <sup>d</sup>	o	+	+	+++	+++	+	++	+++
4. Impact on Urban Blight in and Adjacent to the County Road Reservation	. Certainty about the future of the County Road reservation	o	+	++	+++	+++	+++	+++	+++
5. Impact on Accessibility to Facilities and Properties in the Eastern Districts for Pedestrians, Cyclists and Vehicles	. Level of local accessibility	o	+	++	+	++	+	++	+++
6. Impact on Opportunities to Improve Existing Public Transport and the Provision of New Services	. Existing level of public transport service	o	o	+	++	++	+	++	++
	. Opportunities to improve public transport services	o	o	o	+	++	o	+	++
7. Impact on Existing Townscape and Particular Buildings and Groups of Buildings	. Buildings and groups of buildings of historic value	o	-	-	- - -	- -	o	o	o
	. Coherence in streetscapes and townscape	o	+	-	- - -	- -	-	-	-
8. Community Impact	Number of dwellings demolished		17	17	210	167	28	19	8
	. Number of people displaced		60	60	470	415	130	50	20
	. Number of businesses displaced		o	o	40	55	3	6	10
	. Number of community facilities displaced		o	o	2 e.f.	2 e.f.	o	1 e	o
	. Opportunities to provide public housing for residents displaced		+++ <sup>g</sup>	+++	- - -	-	+++	+++	+++
	. Opportunities to re- establish community facilities displaced				-	-		+	
	. Compensation for property owners and businesses adversely affected		+++	+++	+++	+++	+++	+++	+++
9. Impact of Construction	. Disruption to local residents		o	-	- -	- -	-	-	-
	. Disruption to traffic		o	-	- - -	- - -	- -	-	- -

a. Includes Stage 1 except for Assessment Category 8. 'Community Impact'

b. Includes Stages 1 and 2 except for Assessment Category 8. 'Community Impact'

c. See Table 5.4

d. See Table 5.1

e. The SRA Reserve on Palmer Street between Junction Street and Harmer Lane

f. Kings Cross Youth Refuge

g. Assumes County Road reservation lifted

## Key

- - - )  
 - - )  
 - )  
 o )  
 + )  
 ++ )  
 +++ )

Symbols provide a 7 point ranking with "o" representing no change from existing situation.  
 (+++ does not necessarily mean that a scheme is particularly good in terms of the characteristic examined; rather it means that it is the best in this respect.)



Residual values were assumed to be 75 percent of construction costs but discounted over the life of the project. This is not a critical assumption.

#### 5.4.4 Cost Benefit Results

Two sets of results are presented. Table 5.10 gives the results of the "Central Case". This is based on the best estimates of costs and benefits. Table 5.11 gives the results of an alternative set of assumptions which may also be regarded as plausible. The inputs are generally described as above; those that vary are as follows:

	Central Case	Alternative Case
Discount Rate	10 percent p.a.	7 percent p.a.
Relocation and disturbance costs	10 percent of property costs	15 percent of property costs
Residential benefits	As given in Table 5.9	33 percent higher than in the central case
Travel time savings	High values shown in Table 5.9	Medium values shown in Table 5.9
Vehicle cost savings	Medium values shown in Table 5.9	High values shown in Table 5.9
Annual increase in traffic benefits	0.5 percent p.a.	1.25 percent p.a.

### 5.5 Assessment of Options in Terms of Objectives

As described in Section 5.2 above, each of the options was assessed in terms of the objectives established for the proposal and the outcomes sought. Table 5.12 summarises the evaluation, using a 7 point ranking for the comparison of the options with one another. It is important to note with this assessment that the options are being compared with one another, not with an absolute standard for any one variable. It is also important to note that this assessment does not deal with the distribution of costs and benefits, either across the Eastern Districts or amongst social groups. It is concerned only with the overall effect of each option in various respects.

The following is an account of the criteria used in comparing the various options according to the objectives. Table 5.12 presents the results of this analysis.

#### (1) Impact on Travel Conditions through the Eastern Districts

##### **Congestion and delays; travel times; travel convenience and reliability**

The options were ranked according to travel time saved (Section 5.3.2) and related reductions in delays and congestion. Travel convenience and reliability were added factors where the continuity of the regional road network was enhanced.

##### **Opportunities to implement local traffic management schemes**

The ranking here relied on the extent to which the proposal attracted traffic onto the arterial system, allowing Sydney City Council to implement local traffic management measures such as street closures and the conversion of one-way streets to two-way local traffic routes. The extent to which regional traffic was attracted onto the arterial system depended on the time likely to be saved for each option and the associated reduction in delays.

#### (2) Impact on Environmental Conditions in Local Streets

##### **Air Quality**

Options were ranked according to their likely effect on overall local air quality. The effect depended on the extent to which the option was likely to improve traffic flow (and thereby reduce stop-start traffic), and the extent to which the option was placed underground.

##### **Noise and Vibration**

Options were ranked according to their aggregate ability to reduce noise and vibration levels as a result of changes in traffic volumes and conditions of traffic flow.

##### **Safety on local streets**

The ranking for each option of likely safety on local streets was contingent on the extent to which regional traffic was attracted to the arterial system, allowing local traffic management measures to be adopted.



### (3) Impact on the Accident Rate

#### **Safety at locations with poor accident records**

Options were ranked according to the anticipated impact of each option on the accident rate (see Table 5.1).

### (4) Impact on Urban Blight in and Adjacent to the County Road Reservation

#### **Certainty about the future of the County Road reservation**

Under all options except Option 1 (the 'do nothing' option) there would be greater certainty than exists at present about the future of the County Road reservation. Options 4, 5 and 6 would allow the lifting of the entire County Road zoning. Under Options 2 and 3 parts of the County Road reservation might be retained but it could be lifted were Options 2 and 3 seen as long term alternatives to the Proposal.

### (5) Impact on Accessibility to Facilities and Properties in the Eastern Districts for Pedestrians, Cyclists and Vehicles

#### **Level of local accessibility**

The factors taken into account in the ranking of options according to this factor included the extent to which traffic volumes on local streets were reduced, facilitating ease of local movement; the location of existing community services, facilities and activities, especially shopping; and the extent to which access across the Eastern Distributor corridor was diminished or enhanced by the option (see Section 4.4).

### (6) Impact on Opportunities to Improve Existing Public Transport and the Provision of New Services

#### **Existing level of public transport service**

Options were ranked according to whether there was likely to be reduced traffic on Baptist, Crown and Bourke Streets and reduced traffic volumes crossing Oxford and William Streets, and according to flow conditions in Flinders Street. These factors would determine the extent to which more accurate and reliable bus scheduling was possible and the extent to which there could be reductions in bus travel times.

The extent of bus rerouting required for each option was also considered.

#### **Opportunities to improve public transport services**

Opportunities to improve public transport services were also considered in terms of likely reductions in traffic volumes and improved traffic flow at key intersections and on local streets (potentially) used by buses. Opportunities to provide new cross-regional bus routes were most important in this assessment.

The extent to which any of the options might affect the engineering feasibility of an underground rail system in this location was not specifically considered.

### (7) Impact on Existing Townscape and Particular Buildings and Groups of Buildings

#### **Buildings and groups of buildings of historic value**

The factors taken into account in the ranking of the options according to this factor included the extent to which high volumes of traffic would remain adjacent to buildings and precincts of historic interest; and the likely physical impact of the option on specific locations such as Taylor Square, the historic dwellings along Bourke Street and the William Street frontage on the southern side between Palmer and Bourke Streets. In the case of William Street the likely impact of the Proposal in the longer term was assessed. Thus for Stage 2 of the Proposal the restoration of the site required for construction on the southern side of William Street was assumed. Options 4 and 5 rated poorly on this score because of their impacts on Taylor Square and Bourke Street respectively.

#### **Coherence in streetscapes and townscape**

All options which rationalised traffic movement and reduced volumes on local streets had some potential to improve local streetscapes. However, in all options involving more than minor construction, this was seen to be outweighed by the break in the continuity of the urban fabric that would occur as a result of property required for construction, and the visually intrusive effect of specific features. Possible design measures to mitigate these effects (see Section 4.3) were considered but overall all construction options, except that involving minor works, were expected to have an adverse impact. The likely impact was worse for those options with substantial at-grade construction.



**(8) Community Impact****No. of dwellings demolished; no. of people displaced; no. of businesses displaced; no. of community facilities displaced**

The potential impact of each option on dwellings, population, businesses and community facilities was examined. The results are noted in Table 5.12.

**Opportunities to provide public housing for residents displaced**

The opportunity to provide public housing for residents displaced by construction or the sale of surplus property (see Section 2.3.3) was judged in terms of the potential availability for public housing of the property now in public ownership. The ranking therefore depended on the proportion of publicly owned land in the County Road reservation that would be required for road construction purposes. A related consideration was the capacity for residential development of residual and surplus sites that could be amalgamated for this purpose (see Sections 2.3.3 and 4.1).

**Opportunities to re-establish community facilities displaced**

For those options which displaced community facilities the opportunity to re-establish them was considered in terms of surplus and residual property remaining from the option which might be used for redevelopment purposes, including the re-establishment of community facilities.

**Compensation for property owners and businesses adversely affected**

In all cases it was assumed that appropriate compensation would be paid to property and business owners adversely affected. This also applied to the acquisition of an interest in the stratum to any land which would be required for tunnelling purposes.

**Disruption to traffic**

As with the impact of construction on local residents, the impact of construction on traffic would necessarily be adverse if anything more than minor works were undertaken. These effects would be temporary but would be worse where major construction occurred on or from the surface.

**(9) Impact of Construction****Disruption to local residents**

In all cases except where minor works were undertaken construction would have an adverse, if temporary, effect on local residents. This impact would be worse where construction was from the surface and not localised, as it would be with bored tunnels.



## 6.0 JUSTIFICATION FOR THE PROPOSAL

### Staging of the Proposal

The first stage of the Proposal comprises those elements which achieve large benefits for road users as early as possible, and at low cost. These include traffic management measures such as diverting the right turn from William Street into Riley Street, and creating an additional lane in Flinders Street. They also include an underpass of William Street and approaches to the underpass, reducing delays for southbound traffic and east-west traffic on William Street.

It has been argued (MSJ Keys Young 1985) that the underpass should not be built, on the basis that it will unnecessarily demolish housing, and that it will be superseded by Stage 3.

The properties to be demolished during Stage 1 can be considered in two groups. Firstly, those facing Palmer Street, both north and south of William Street, must be demolished if an 11m. wide underpass is to be built under William Street. This is the width needed to subsequently become part of the Stage 3 tunnel. Even if the proposed ramp on the east side of the underpass is not constructed in Stage 1 (see Section 5.1.4), the underpass cannot be constructed in the existing width of Palmer Street because of the need to retain frontage access to properties and the need to accommodate pedestrians and underground utilities during construction.

Construction of the William Street underpass as Stage 1 rather than proceeding immediately with the tunnel proposed in Stage 2, is justified on the following grounds:

- it will be open to traffic about three years before the southbound tunnel could be open, and will provide considerable benefits to road users during those three years, both in the southbound direction and east-west on William Street;
  - also during those three years, environmental benefits will be achieved by the early closure of Bourke Street in Woolloomooloo;
  - it will be used by northbound traffic for about a further two years before the northbound tunnel could be open, and will provide considerable benefits to road users during those two years, both in the northbound direction and east-west on William Street; and
  - these road user benefits will include reductions in accidents and pedestrian injuries at the Palmer Street and Bourke Street intersections with William Street.
- The second group of buildings to be demolished in Stage 1 are those on the north side of Stanley Street east of Palmer Street, required to widen and straighten the S-bend. It has been argued (MSJ Keys Young 1985) that these roadworks are not necessary and that the underpass should re-join Palmer Street, with no widening of the bends. However, the Proposal is justified on the following grounds:
- three continuous lanes and widened curves will reduce delays to traffic and accidents;
  - the benefits of reduced delays alone are estimated at \$80,000 per year, compared with a construction cost of the S-bend of only \$150,000, thereby economically justifying the improvement since it will be used for at least four years;
  - reduced braking and accelerating of vehicles will reduce noise and air pollution; and
  - on the completion of the southbound tunnel it is proposed to direct northbound traffic down Bourke Street, around the improved S-bend and into the underpass; the widening and straightening will reduce the potential for delays and accidents caused by traffic merging and turning the sharp corners.
- Stage 1 as a whole will achieve significant benefits for road users with a relatively low level of investment. The benefit/cost ratio of Stage 1 is calculated as 1.42 (Table 5.10), meaning that the public benefits to be derived from Stage 1 are 1.42 times as large as the public costs. (The benefits to Surry Hills of removing through traffic from local streets two years earlier than would be the case without Stage 1 should also be taken into account.) The public costs include the value of the land required for the underpass and S-bend.



As discussed in Section 2.2.5, the southbound tunnel must be completed before the northbound tunnel and portal in Flinders Street can be constructed. Consequently, the two tunnels are proposed to be constructed as Stages 2 and 3, respectively.

### **The Proposal as a Whole**

The likely environmental effect of the proposed Eastern Distributor has been examined in this report and compared with the likely effects of a number of feasible alternatives. The investigation has confirmed that while the capital costs of the Proposal are high, it achieves maximum environmental and transport benefits for the area, at minimum social cost. In addition, it provides potentially for a net increase in dwelling stock.

The transport benefits achieved by the Proposal are as extensive as for any of the alternatives. A high level of consistency in the regional road system is achieved, with increased travel reliability and convenience. Travel times are improved and congestion and delays reduced.

In environmental terms the benefits of the Proposal are greater than for any of the alternatives. The reduction in air and noise pollution in the Eastern Districts is substantial and the redirection of traffic from local streets to a coherent arterial system creates a safer environment for pedestrians and motorists alike. It also allows the introduction of a range of traffic management measures designed to promote local environmental amenity and accessibility.

Being largely underground, the Proposal avoids the severance effect of schemes of similar capacity which would be on the surface or not entirely covered. Similarly, it avoids the property requirements and associated displacement impacts and associated displacement impacts of some of the less expensive at-grade alternatives. Importantly, it largely maintains the coherence of the urban townscape and protects a large proportion of the built environment which would be demolished by the alternatives with similar transport effects.

The Proposal will bring about a marked improvement in the quality of the built

environment as neglected buildings, affected by 30 years of indecision about an Eastern Distributor, are progressively improved and major improvements are made to Taylor Square. However, as with any scheme which lifts the County Road reservation (or a substantial proportion thereof), the Proposal will cause displacement of lower income residents via its positive effect on the environment and subsequent increases in rent. An alternative, in the circumstances, would be to preserve a degraded environment in order to preserve low income housing stock. The implication of such an outlook - that lower income groups in potentially desirable locations be subject to poor environmental conditions in order to maintain their location - is considered less acceptable than ensuring a permanent supply of low income (public) housing in the vicinity, in substantially improved environmental conditions (and improving the environmental amenity of existing public housing in the area).

The Proposal provides potentially for an overall increase in the local dwelling stock. A substantial proportion of this could be public housing of various types, providing accommodation (on a permanent or temporary basis) for residents adversely affected by the Proposal. None of the alternatives with comparable transport benefits have the capacity to mitigate adverse impacts in this way.

If the Eastern Districts are not to become increasingly degraded, a decision on the Eastern Distributor is required. Any decision which did not ensure that a coherent arterial road network could be established in the area would reinforce for all time the environmental problems experienced in residential localities in the Eastern Districts. On the other hand, the establishment of such a network on the surface or only partly covered would have greater severance and displacement effects and severely affect the townscape of an historic part of the City. Overall, air and noise pollution would also not be reduced as much as under the Proposal. A less costly scheme could achieve the same transport benefits but at a substantially increased social and environmental cost.



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## APPENDIX 1

## N.S.W. DEPARTMENT OF ENVIRONMENT AND PLANNING

SCHEDULE OF THE DIRECTOR'S REQUIREMENTS FOR AN ENVIRONMENTAL IMPACT STATEMENT FOR THE CONSTRUCTION OF THE PROPOSED EASTERN DISTRIBUTOR BY THE DEPARTMENT OF MAIN ROADS BETWEEN SIR JOHN YOUNG CRESCENT, WOOLLOOMOOLOO AND FLINDERS STREET, SURRY HILLS.

A comprehensive environmental impact statement should adequately cover all those matters specified in clauses 34/57 of the Environmental Planning and Assessment Regulation, 1980.

These matters should be clearly and succinctly outlined in the text and, where appropriate, be supported by adequate maps, plans, diagrams or other descriptive details to enable all concerned to gain a clear understanding of the full scope of the project and its likely impact on the environment.

## 1. BACKGROUND INFORMATION

- . Statement of objectives for the Eastern Distributor project.
- . Justification of project in terms of environmental, economic and social considerations.
- . Relationship with regional network of existing and planned arterial roads and road hierarchy.
- . Relationship with pedestrian, cycle and vehicle movements in local precincts.
- . Implications for existing public transport services and likely future public transport undertakings.
- . Relationship with environmental planning instruments, draft local environmental plans and City of Sydney Strategic Plan and action plans prepared by Sydney City Council.
- . Planning constraints and opportunities associated with the project.
- . Reference by suitable appendices to all relevant studies/investigations dealing with

traffic flow patterns, noise, air quality, planning etc.

- . General location of route.
- . Broad nature and extent of works proposed.

## 2. ALTERNATIVES

Alternative schemes for the Eastern Distributor should be discussed and the criteria used for selecting the preferred scheme should be presented.

## 3. DESCRIPTION OF PROPOSAL

A detailed description of the preferred scheme should be provided. The description should include the following aspects of the proposal.

- . Access and interchange arrangements, particularly at the southern terminal.
- . Provision of facilities for local traffic, pedestrian and bicycle movements.
- . Numbers and types of properties affected by preferred scheme.
- . Procedures to be followed in acquisition or any resumption of properties including any compensation arrangements.
- . Alternative roads to be used by local and through traffic during construction period.
- . Staging of construction.
- . Hours of operation of construction machinery.



- . Arrangements for transporting materials to and from construction site (i.e. truck routes and any time restrictions).
- . Location of storage areas, works depots etc.
- . Landscaping.
- . Noise barriers.
- . Any opportunities for redevelopment above Eastern Distributor.
- . Details of lighting levels.

### 3. DESCRIPTION OF EXISTING ENVIRONMENT

This description should provide details on those aspects of the environment in areas adjoining the proposed Eastern Distributor that are likely to be affected by the proposal. In this regard, physical, natural, social, cultural, historic, archaeological, aesthetic and economic aspects of the environment should be described to the extent necessary for assessment of the environmental impacts of the proposal.

### 4. ASSESSMENT OF IMPACT

The assessment of environmental impacts and proposed measures to mitigate those impacts should include the following:

- . Social impacts on residents displaced by demolition of affected housing, particularly low income groups.
- . Loss of any business premises and community facilities.
- . Severance effect on local community.
- . Any loss in amenity in areas adjoining the Eastern Distributor and proposed measures to ameliorate this effect e.g. landscaping, buffers etc.
- . Any obstructions to local public transport, pedestrian, bicycle and vehicle movements during and after construction.
- . Visual impacts of the proposed roadway, both by day and night, taking into account:
  - . scale and obtrusiveness in relation to adjoining land uses,

- . appearance from nearby and afar;
- . shadowing effects in midsummer and midwinter;
- . effects of lighting on adjoining land uses.

- . Effects on items of heritage significance (e.g. historic buildings and urban conservation areas identified by the National Trust) either through demolition, changes in streetscape or visual dominance.

- . Impacts arising from the diversion of traffic onto alternative streets during the construction stage.

- . Impacts of changes in traffic patterns in residential areas following completion of Eastern Distributor with particular regard for heavy vehicles and peak period traffic at the southern end of the freeway.

- . Changes in noise levels resulting from construction activities and from altered patterns after completion of Eastern Distributor.

- . Changes in air pollution levels in vicinity of proposed Eastern Distributor, particularly near ventilation points for tunnels.

- . Effects of dust generated during construction.

- . Effects on safety for pedestrians and vehicles both during and after construction stage, including efficacy of safeguards for emergencies, accidents, fires, spillages etc.

- . Impacts arising from any proposed redevelopment above Eastern Distributor corridor.

- . Any effects on the structural stability of nearby buildings during the construction stage.

- . Any environmental impacts arising from disposal of tunnel spoil or other wastes.

### 5. CONSULTATION

During the preparation of the environmental impact statement, the Traffic Authority, State Pollution Control Commission, Heritage Council and other relevant Government authorities should be consulted. The Sydney City Council and local community groups should also be consulted and their views taken into account in the preparation of the statement.



## A2.1

### APPENDIX 2

#### SUMMARY OF SUBMISSIONS RECEIVED

#### A SUMMARY OF SUBMISSIONS RECEIVED FROM PUBLIC AUTHORITIES, AGENCIES, INSTITUTIONS, ETC.

	Authority/Agency/ Institution, etc.	Major Concerns	Relevant Section in Environmental Impact Statement
Submissions received following Preliminary Information Exhibition* (October/November 1984)	Inner City Community Health Services	Social impacts of Distributor	4.0
	Kindergarten Union of NSW	Loss of Frances Newton Pre- School Playground	(Not affected by the Proposal)
	National Trust of Australia	Impact of Distributor on the classified Urban Conservation Areas (UCA's) of Woolloomooloo, East Sydney/ Darlinghurst, Oxford Street and Surry Hills	4.3
		Adequacy of Exhibition	
		That options are fully evaluated in the E.I.S.	5.0
		That any Cost-Benefit Analysis will include "social costs" borne by those affected by the Proposal.	5.2 and 5.4
		Tunnel options preferred.	
	St. Vincent's Hospital	Accessibility of the Hospital	4.4
		Emergency vehicle access to and from the Distributor	4.4
	Sydney Church of England Girls Grammar School (SCEGGS)	Noise	4.5
		Air Pollution	4.6
		Vehicular Access and Parking	4.4
		Safety of school children	3.3 and 4.2
		Amenity of school generally	4.0
		Tunnel options preferred	
Submissions received following Exhibition of the Proposal (April/May 1985)	The Australian Gas Light Company	Impact on location of gas mains.	4.7
	Board of Fire Commissioners	Fire control facilities in tunnels	2.2
		Procedures in the event of accidents/fires in tunnels	2.2
		Transport of dangerous goods in tunnels	2.2 and 3.3
	Bourke Street Primary School (Surry Hills)	Safe pedestrian passage for children across South Dowling Street (footbridge preferred)	4.4
		Through traffic on local streets	1.3, 1.5, 3.0, 4.4, 5.3 and 5.5
	Council of the City of Sydney	Social and environmental impacts in Woolloomooloo precinct	4.0
		Impact of increased traffic on residences in South Dowling Street	5.3, 4.5, 4.6 and 5.1.4
		Resumption of land presently used for housing	4.1
		Surfacing of tunnels in Woolloomooloo	5.1.4
		East-west through traffic in Surry Hills	1.3, 1.5, 3.0, 4.4, 5.3 and 5.5
		Heavy vehicles/freight transportation through residential communities	3.0
		Displacement of residents by road construction/ gentrification	4.1
		Staging. Stage 2 should be completed before or in conjunction with Stage 1 to ensure benefits of scheme to inner East Sydney are realised immediately	2.2 and 6.0

\* The Preliminary Information Exhibition was included in the first stage of a study undertaken by the DMR and its consultants to investigate alternatives for an Eastern Distributor and to identify the scheme most suitable for detailed analysis in a subsequent Environmental Impact Statement. It involved the exhibition of a range of options for the Distributor, inviting comment from interested persons and organizations.



## A2.2

Authority/Agency/ Institution, etc.	Major Concerns	Relevant Section in Environmental Impact Statement
Electricity Commission of NSW	No major concerns	
Maritime Services Board of NSW	No major concerns	
Metropolitan Water Sewerage and Drainage Board	Impact on sewers, water- mains and stormwater drains	4.7
Department of Mineral Resources	No major concerns but interested in the possibility of extracting the potential "yellow block" sandstone supply between Cathedral Street and Taylor Square in conjunction with tunnel construction	
National Roads and Motorists Association (NRMA)	General support for the Proposal	
	Access from the Distributor to Oxford Street	3.3
	Tunnel access for northbound traffic on the Distributor from Moore Park Road, Anzac Parade and South Dowling Street	2.2
	Staging. Early completion of Stage 3 is essential to gain full benefit from the distributor	2.2
	Congestion on South Dowling Street, particularly at Cleveland Street.	3.3 and 5.1.4
National Trust of Australia	General support for the Proposal	
	Improved public transport and alternative traffic management should be fully evaluated	5.1
	Townscape quality	4.3
	Pedestrian accessibility	4.4
	Location and treatment (visual integration) of tunnel portals	4.3
	Trees and visual quality of Anzac Parade	4.3
	Demolition of buildings associated with construction of northbound tunnel portal in Flinders Street (Stage 3)	4.3 and 4.7
	The redevelopment of land temporarily used (Stages 1, 2) between Bourke and Palmer Streets at Stanley Street	4.3
State Pollution Control Commission	Redevelopment of Gladstone Hotel site	4.3
	No major concerns	
	No major concerns	
	General support for the Proposal	
Sydney Church of England Girls Grammar School (SCEGGS)	Building foundations during tunnel construction	4.7
	Noise	4.5
	Air pollution from dust during construction	4.7
St. Margaret's Hospital	Water pollution from fuel and effluent spillage during construction	4.7
	Hospital access	4.4
	The need for road closures in the vicinity of the hospital to provide needed hospital parking space	Not specifically affected by the Proposal
St. Vincent's Hospital		
Sydney County Council	Modification and relocation of transmission facilities	4.7
Telecom	No major concerns	
Urban Transit Authority of NSW (UTA)	Disruption to UTA bus services	3.0



## A2.3

### B SUMMARY OF SUBMISSIONS RECEIVED FROM COMMUNITY GROUPS AND ORGANISATIONS

	Community Group/ Organisation	Major Concerns	Relevant Section in Environmental Impact Statement
Submissions following the Preliminary Information Exhibition (October/November 1984)	Action for Public Transport	<ul style="list-style-type: none"> <li>Excessive traffic on residential streets</li> <li>Limited capacity of the Harbour Bridge/ Cahill Expressway</li> <li>Distributor will only encourage more traffic</li> <li>Distributor merely shifts the point of traffic congestion</li> <li>Focus of Exhibition too narrow - biased towards a "road" based solution</li> <li>No consideration of long-term transportation needs</li> <li>Inadequate consideration of public transport</li> <li>Improved public transport preferred but if a freeway is built it should be a low-speed design with minimal number of on/off ramps</li> </ul>	1.3, 1.5, 3.0, 4.4, 5.3 and 5.5 3.0 3.0 3.0 5.1 2.3 and 5.1 5.1 5.0
	Anti-Freeway Action Committee (AFAC)	<ul style="list-style-type: none"> <li>Cost</li> <li>Noise</li> <li>Air pollution</li> <li>Visual impact</li> <li>Speed of traffic/ pedestrian safety</li> <li>Construction disturbance</li> <li>Barrier effects:               <ul style="list-style-type: none"> <li>severance of the local community</li> <li>local vehicular and pedestrian movement</li> <li>access to facilities</li> </ul> </li> <li>Displaced/ disrupted businesses and amenities</li> <li>Through traffic on residential streets</li> <li>Vulnerability of pedestrians on overbridges/ underpasses</li> <li>Adequate provision for cyclists</li> <li>Availability of adequate street parking space</li> <li>Urban blight caused by planning uncertainty</li> <li>Stress on residents living close to a freeway</li> <li>Diminished residential amenity generally</li> <li>Social impacts generally</li> <li>Destruction of historically unique buildings and areas</li> <li>Loss of low-cost housing (and land for its potential development) where it is desperately needed</li> <li>Displacement of residents (particularly the poor and aged) through the resumption of property in the short-term and gentrification over the long-term</li> <li>CBD encroachment into East Sydney</li> <li>Destruction of the urban fabric of Woolloomooloo, East Sydney/ Darlinghurst</li> <li>Disruption to public transport services</li> <li>Traffic generating impact of freeways</li> <li>Freeway will cause congestion at termination points</li> <li>Minimal travel benefits</li> <li>Distributor will necessitate further inner-city freeway development</li> <li>Limited capacity of the Harbour Bridge/ Cahill Expressway</li> <li>Disposal of surplus DMR property</li> </ul>	5.4 4.5 4.6 4.3 3.0 and 5.3 4.7 4.4 4.1 1.3, 1.5, 3.0, 4.4, 5.3 and 5.5 No footbridges or pedestrian only underpasses proposed 4.4 4.4 4.1 4.0 4.0 4.0 4.3 4.1 4.1 and 4.2 4.1, 4.2, 4.3 and 4.4 3.0 3.0 3.0 5.3 2.3 3.0 4.1



## A2.4

Community Group Organisation	Major Concerns	Relevant Section in Environmental Impact Statement
Australian Labor Party (East Sydney Branch)	<ul style="list-style-type: none"> <li>Adequacy of Exhibition: <ul style="list-style-type: none"> <li>- biased towards a "road" based solution</li> <li>- inadequate consideration of public transport, alternative routes and improved traffic management measures</li> <li>- no evidence provided to justify the scale of roadworks considered or the need for a Distributor</li> </ul> </li> </ul>	
	Noise	4.5
	Air pollution	4.6
	Visual impact	4.3
	Loss of needed housing	4.1
	Displacement of primarily low-income residents	4.1
	Severance of local communities	4.4
	Destruction of urban fabric	4.1, 4.2, 4.3 and 4.4
	Destruction of historically unique buildings and areas	4.3
	Destruction of Taylor Square	4.3
	Pedestrian movement in Woolloomooloo	4.4
	Encroachment of CBD into East Sydney	4.1 and 4.2
	Heavy vehicles/ freight transportation through residential precincts	1.3, 1.5, 3.0, 4.4, 5.3 and 5.5
	No consideration of long-term transport planning	2.3
	Minimal travel benefits	5.3
	The need to give adequate consideration to: <ul style="list-style-type: none"> <li>- new traffic management measures</li> <li>- improved public transport</li> </ul>	5.0
Centennial Park Residents Association	Unsatisfactory traffic arrangements at Drivers Triangle	5.1.4
Communities for Action on Traffic (CAT)	Noise	4.5
	Air pollution	4.6
	Aesthetic/visual impacts	4.3
	Construction disturbance	4.7
	Traffic accidents	3.0 and 5.3
	Speeding and aggressive driving	3.0
	North-south through traffic on Bourke, Crown and Baptist Streets	1.3, 1.5, 3.0, 4.4, 5.3 and 5.5
	East-west through traffic on Fitzroy/Foveaux and Albion Streets	1.3, 1.5, 3.0, 4.4, 5.3 and 5.5
	Traffic conflict and congestion at Drivers Triangle	1.3, 1.5, 3.0, 4.4, 5.3 and 5.5
	Concentration of traffic onto Flinders and South Dowling Streets	1.3, 1.5, 3.0, 4.4, 5.3 and 5.5
	Traffic bottlenecks where the Distributor terminates	3.0
	Heavy vehicles/ freight transport through residential precincts	
	Access to Moore Park	4.4
	Barrier effects: <ul style="list-style-type: none"> <li>- severance of local communities</li> <li>- access to local facilities</li> <li>- constraints to pedestrian and local vehicular movement</li> </ul>	4.4
	Disruption to public transport services	3.3
	Adequate provision for cyclists	4.4
	Diminished residential amenity generally	4.0
	Compensation for those adversely affected	4.1
	Effects on community composition as a result of gentrification	4.1
	Loss of housing	4.1
	Destruction of Taylor Square (a major social and cultural resource)	4.3
	"Urban blight" caused by planning uncertainty	4.1
	Conservation of historically significant buildings and areas	4.5



## A2.5

Community Group Organisation	Major Concerns	Relevant Section in Environmental Impact Statement
D4 Darlinghurst	The need to extend a Distributor at least as far as Drivers Triangle	2.2
	Adequacy of the Exhibition, particularly the inadequate consideration given to public transport	5.1
	Opposition to a Distributor "in cutting"	5.0
	Tunnel solution with improved public transport and traffic management preferred	5.0
	Noise	4.5
	Construction disturbance	4.7
	Through traffic	
	Barrier effects: <ul style="list-style-type: none"> <li>severance of communities and the isolation of West Darlinghurst</li> <li>constraints on pedestrian movement</li> <li>access to facilities</li> </ul>	4.4
	Threat to historic buildings and areas	4.3
	Loss of small businesses	4.2
	Displacement of residents	4.1
	Disruptive impact on the unique cultural mix/ urban fabric of Darlinghurst	4.1, 4.2, 4.3 and 4.4
	Threat to low income households as a result of gentrification induced by improved environmental amenity	4.1
	Social impacts generally	4.0
	Urban blight caused by planning uncertainty	4.1
	Critical housing shortage in inner city	4.1
	Needs of socially disadvantaged groups (e.g. children, elderly, low-income earners, etc.)	4.1
	Adequacy of the Exhibition	
	Basis of selection of preferred option	5.0
	Inadequate attention to planning for the maintenance and redevelopment of the area	4.0
National Roads and Motorists Association (NRMA)	Noise	4.5
	Air pollution	4.6
	Traffic accidents	3.0 and 5.3
	Conflict between traffic and pedestrian movements	4.4
	High traffic volumes	3.0
	Low travel speeds and delays at intersections	3.0
	Through traffic on residential streets	1.3, 1.5, 3.0, 4.4, 5.3 and 5.5
	East-west traffic flows	3.0, 5.1
	North-south traffic flows	1.3, 1.5, 3.0, 4.4, 5.3 and 5.5
	Present road network inappropriate and inefficient	2.3
	Confusion and congestion at Drivers Triangle	2.2 and 3.0
	Need for a proper structuring of the road system to put arterial traffic in its proper place	2.3
	Misunderstandings about the nature of the Distributor in the current debate	
Paddington Chamber of Commerce	Need to publicise the benefits of the Distributor	
	Volume of traffic on Oxford Street - need to redirect it to Moore Park Road	3.0
St. Michael's Anglican Church	Visual impact	4.3
	Quality of environment in Surry Hills	4.0
	Pedestrian/ vehicle accidents	3.0 and 5.3
	Congestion particularly at Drivers Triangle	3.0
	Disruption to public transport	3.0



## A2.6

Community Group Organisation	Major Concerns	Relevant Section in Environmental Impact Statement
Surry Hills Neighbourhood Centre	• East-west traffic flows	3.0 and 5.1
	• Impacts of increased traffic on Flinders Street	4.5 and 4.6
	• Barrier effects: - social segregation - constraints to pedestrian movement	4.4
	• Maintenance and improvement of the historic St. Michael's precinct	4.3
	• Impact of Distributor on the Classified Urban Conservation areas it will pass through	4.3
	• Great cost	5.4
	• Minimal travel benefits	5.3
	• Noise	4.5
	• Pollution	4.6
	• Traffic accidents	3.0 and 5.3
	• Large volumes of through traffic on residential streets	1.3, 1.5, 3.0, 4.4, 5.3 and 5.5
	• Heavy vehicles/ freight transportation on residential streets	3.0
	• Access to retail and community facilities	4.4
	• Access to Moore Park	4.4
	• Reduction in housing stock	4.1
	• Lack of low-income housing in the inner city	4.1
	• Any change to the composition of the community	4.1 and 4.2
	• Necessity for a major roadwork	1.0 and 2.3
	• Adequacy of the Exhibition - failure to address the concerns of Surry Hills residents - no consideration of continuing the Distributor south of Drivers Triangle - options did not address Exhibition objectives - emphasis biased towards a road based solution - inadequate consideration of public transport - engineering/cost considerations given more priority than local concerns	
	• Process of public participation	1.4
Submissions received following the Exhibition of the Proposal (April/May 1985)	• Anti-Freeway Action Committee (AFAC)	
	• Noise	4.5
	• Air pollution	4.6
	• Visual impact	4.3
	• Construction disturbance	4.7
	• Cost	5.4
	• Disruption to public transport services	3.3
	• Barrier effects: - severance of the local communities - isolation of "west" Woolloomooloo - access to local facilities	4.4
	• Demolition of housing where public housing is desperately needed	4.1
	• Displacement of primarily low-income residents through: - resumption of property (in the short term) - gentrification (over the long term)	4.1
	• Tunnel ventilation	Appendix 5
	• Heavy vehicles/freight transportation	3.0
	• CBD encroachment into West Woolloomooloo	4.1 and 4.2
	• Inadequate consideration of public transport	5.1
	• The necessity of Stage 1 especially: - the widening of Palmer Street north of William Street - the straightening of the Palmer/ Stanley Street section	2.2 and 6.0
	• Sincerity of government's commitment to Stages 2 and 3	



## A2.7

Community Group Organisation	Major Concerns	Relevant Section in Environmental Impact Statement
- Australian Labor Party (King Branch)	- Adequacy of the Exhibition and consultation process	4.1, 4.2, 4.3 and 4.4
	- Disruption to the community fabric of Woolloomooloo	4.4
	- East-west pedestrian and vehicular movement in Woolloomooloo	4.4
	- Access to community facilities in Woolloomooloo	4.1
	- Disposal of surplus DMR property	4.1
	- Need for public housing in the area	5.1
- Australian Labor Party (Maroubra Branch)	- Extension of Eastern Suburbs Railway of greater value than the Distributor	4.5
Body Corporate - 95 Palmer Street, Woolloomooloo	Noise	4.6
	- Air pollution	4.4
	- Availability of street parking in West Woolloomooloo	4.4
	Barrier effects: - severance of the community - access to local facilities	4.4
- Communities for Action on Traffic (CAT)	- Impact of increased traffic on the amenity of residents and businesses fronting South Dowling Street in Redfern and Surry Hills	3.0, 4.5, 4.6 and 5.1
	- Access to Moore Park across South Dowling Street	4.4
	- Prevention of through traffic on Bourke, Crown and Baptist Streets	1.3, 1.5, 3.0, 4.4, 5.3 and 5.5
	- Prevention of heavy vehicles/freight transportation on residential streets	3.0
	- The high volume of east-west through traffic on Fitzroy/Foveaux/Albion Streets and its impact on the amenity of adjoining residents and community facilities; and traffic congestion at Eddy Avenue	3.0 and 5.1
	- Inadequate consideration of public transport	5.1
	- Sincerity of government's commitment to Stages 2 and 3	
- The Co-Op.	- Disposal of surplus DMR property - request for premises	4.1 and 4.2
- Friends of the Earth	- Increased air pollution	4.6
	- Visual impact	4.3
	- Cost	5.4
	- Disruption to the community fabric of Woolloomooloo	4.1, 4.2, 4.3 and 4.4
	- Social impacts (stress, alienation, social dislocation)	4.0
	- Loss of needed low-cost, inner-city housing	4.1
	- "Urban blight" caused by DMR	4.1
	- Disposal of surplus DMR property and associated redevelopment may adversely affect the character of East Sydney/Darlinghurst	4.1 and 4.2
	- No consideration of overall transport needs of Sydney (especially public transport)	2.3 and 5.1
	- Traffic generating impact of freeways	3.0
- Inner City Care	- Disposal of surplus DMR property - request for premises	4.1
- Oxford Street and South Darlinghurst Association	- Impact on Taylor Square (especially the necessity of removing the toilet block at the intersection of Oxford Street)	4.3 (Toilet block not now affected by Proposal)
	- Housing demolition in Woolloomooloo and Palmer/Stanley Streets	4.1
- Royal Australian Planning Institute (RAPÍ)	- General support - no major concerns	
- Residents of South Dowling Street	- Impact of increased traffic on the amenity of residences and businesses fronting South Dowling Street in Redfern and Surry Hills	3.0, 4.5, 4.6 and 5.1.4
Residents of Surry Hills and Redfern	- Impact of increased traffic on the amenity of residences and businesses fronting South Dowling Street in Redfern and Surry Hills	3.0, 4.5, 4.6 and 5.1.4



## A2.8

Community Group Organisation	Major Concerns	Relevant Section in Environmental Impact Statement
Squatters and Renters Public Housing Action Collective	Access to Moore Park across South Dowling Street	4.4
	Heavy vehicles/ freight transportation in residential and commercial precincts	3.0
	Inadequate consideration of public transport	5.1
	Noise	4.5
	Construction disturbance	4.7
	Loss of needed low-cost housing and land for its potential development	4.1
	Displacement of low-income residents	4.1
	Loss of historic buildings	4.3
	Barrier effects:	4.4
	- severance of Woolloomooloo and the isolation of "West" Woolloomooloo	
	- access to local facilities	
	- East-west pedestrian movement in Woolloomooloo	
	Heavy vehicles/freight transportation	3.0
	Tunnel ventilation	Appendix 5
	The straightening of the Palmer/ Stanley street section - a speed hazard	5.1.4
	The necessity of Stage 1	2.2 and 6.0
	The sincerity of the government's commitment to stages 2 and 3	
	Inadequate consideration of public transport	5.1
	Adequacy of the consultation process	
Surry Hills East/West Traffic Action Group	The high volume of traffic on Fitzroy/Foveaux Streets and its impact on the value and amenity of adjoining residences, businesses and community facilities; and traffic congestion at Eddy Avenue	3.0 and 5.1.4
Uniting Church of Australia (Inner City Parish)	Noise	4.5
	Air pollution	4.6
	Construction disturbance	4.7
	Physical undermining of the historically significant Presbyterian Church and adjoining building in Palmer Street (subsidence, etc.)	4.7
	Loss of low-cost housing	4.1
	Barrier effect:	4.4
	- severance of the local community	
	- access to community facilities	
	- local vehicular and pedestrian movement	
	Diminished property values	5.4
Westfield Developments	Adequacy of the consultation process	
	Vehicular access to Robinson and Sutor Streets which serve the major commercial developments on William Street:	4.4
Woolloomooloo Residents Action Group	- Westfield Tower	
	- Boulevard Hotel	
	- 80 William Street office tower (now under construction)	
	- proposed Crown Street Hotel	
	Noise and air pollution at tunnel portals	Appendices 4 and 5
	Increased traffic on Riley Street	3.0
	Demolition of housing where public housing is desperately needed	4.1
	Displacement of primarily low-income residents	4.1
	Barrier effects:	4.4
	- severance of the Woolloomooloo community and the isolation of "West" Woolloomooloo	
	- east-west pedestrian movement in Woolloomooloo	
	Minimal travel benefits	5.3
	The necessity of Stage 1	2.2 and 6.0
	The sincerity of the government's commitment to Stages 2 and 3	



## A2.9

Community Group Organisation	Major Concerns	Relevant Section in Environmental Impact Statement
Woolloomooloo Residents Petition (133 signatures)	<ul style="list-style-type: none"> <li>Inadequate consideration of other options:               <ul style="list-style-type: none"> <li>improved public transport</li> <li>extention of tunnels to Cahill Expressway</li> <li>traffic management resources to redirect through traffic to perimeter roads (e.g. Sir John Young Crescent, Haig Avenue and College Street)</li> </ul> </li> <li>Adequacy of the consultation process</li> </ul>	5.0
	Residential amenity of Woolloomooloo	4.0
	Loss of low-cost housing and land for its potential development	4.1
	Barrier effects: <ul style="list-style-type: none"> <li>access to local facilities</li> <li>east-west pedestrian and vehicular movement in Woolloomooloo</li> </ul>	4.4
	Heavy vehicles/ freight transportation on local streets	3.0
	Constraints on the residential regeneration of "West" Woolloomooloo	4.1
	Inadequate consideration of traffic management schemes to redirect through traffic around the western perimeter of Woolloomooloo	5.0

### C SUMMARY OF SUBMISSIONS RECEIVED FROM PRIVATE PERSONS

	Major Concerns	No. of Submissions	Relevant Section in Environmental Impact Statement
Submissions received following Preliminary Information Exhibition (October/November 1984 - 54 Submissions received)	Air pollution	12	4.6
	Noise	10	4.5
	Destruction of urban fabric of Darlinghurst/ Woolloomooloo	9	4.1, 4.2, 4.3 and 4.4
	Limited capacity of Harbour Bridge/Cahill Expressway	8	3.0
	The need to reduce traffic and increase public transport	7	5.1
	Visual impact	6	4.3
	Displacement of residents	6	4.1
	Loss of needed housing	6	4.1
	Inadequate consideration of public transport in the exhibition	6	5.1
	General anti-freeway comments	6	
	Adequate provision for pedestrians generally	5	4.4
	The need to extend Distributor to Drivers Triangle	5	2.2
	Adequate provision for cyclists	4	4.4
	Adequate provision for local vehicle movement	4	4.4
	Freeway will cause congestion at termination points	4	3.0
	Minimal travel benefits	4	3.3, 5.3 and 5.4
	Cost	4	5.4
	The need to reroute traffic around Woolloomooloo via Sir John Young Crescent	4	5.1,4
	Design alternatives	4	5.1
	Vibration	3	3.2 and 4.5
	Destruction of an historically unique area	3	4.3
	Traffic generating impact of freeways	3	3.0
	Transport problems not considered in their wider metropolitan context	3	2.3



## A2.10

[illegible]



## A2.11

Major Concerns	Number of Submissions	Relevant Section in Environmental Impact Statement
Local vehicular and pedestrian movement in Darlinghurst	3	4.4
The impact of increased traffic on South Dowling Street	3	3.3, 4.5, 4.6 and 5.1.4
Displacement of low-income residents through resumption and gentrification	3	4.1
The need for public housing in the area	3	4.1
Surfacing of tunnels in Woolloomooloo	3	5.1.4
Heavy vehicles on South Dowling Street	2	3.0 and 5.4.1
Through traffic in Surry Hills	2	1.3, 1.5, 3.0, 4.4, 5.3 and 5.5
Street parking on Palmer Street	2	2.2
Inaccessibility of Palmer and Riley Streets and West Woolloomooloo	2	4.4
Decreased value of residences fronting freeways	2	5.4
Disruption to Free City Bus Service (Route 777)	2	3.3
Inadequate consideration of public transport	2	3.0 and 5.1
Lack of consultation with residents	2	1.4
General anti-freeway comments	2	
Reroute traffic via Sir John Young Crescent and Haig Avenue	2	5.1
The need to release DMR affected properties as soon as possible	2	4.1
Increased traffic on Fitzroy Street	1	3.3
Increased traffic on Moore Park Road	1	3.3
Increased traffic on Riley Street	1	3.3
Congestion on William Street	1	3.3
Speed of northbound traffic in Woolloomooloo	1	3.3 and 5.3
Through traffic on Bourke Street	1	1.3, 1.5, 3.0, 4.4, 5.3 and 5.5
Through traffic on local streets generally	1	1.3, 1.5, 3.0, 4.4, 5.3 and 5.5
Width of Palmer Street north of William Street	1	4.3 and 5.1.4
Adequate provision for cyclists	1	4.4
Pedestrian movement at Taylor Square	1	4.4
Pedestrian access to Moore Park	1	4.4
Pedestrian movement across South Dowling Street (footbridges preferred)	1	4.4, 5.1.4
Pedestrian movement generally	1	4.4
Encroachment of roadworks into Moore Park	1	2.2 and 5.1.4
Views of Moore Park	1	5.1.4
Removal of Taylor Square Toilet Block	1	Not now affected by Proposal
Traffic generating impact of freeways	1	3.0
Limited capacity of Harbour Bridge/Cahill Expressway	1	3.0
Adequacy of exhibition	1	
Stages 2 and 3 unlikely to be implemented. Full environmental impact statement on Stage 1 necessary	1	2.2 and 6.0
The need to direct South Dowling Street traffic on to Anzac Parade/Dacey Avenue		5.1.4
No firm proposals for preventing through traffic on Crown/Bourke Streets, Surry Hills	1	1.3, 1.5, 3.0, 4.4, 5.3 and 5.5
Northbound tunnel portal (Flinders Street) too close to Taylor Square	1	2.2 and 4.3
The need to close Junction Lane at Palmer Street	1	Closed in Stages 2 and 3
The need to retain Bourke Street closure in Stages 2 and 3	1	4.4



## APPENDIX 3

## SCHEDULE OF HERITAGE ITEMS : EAST SYDNEY/DARLINGHURST

SCHEDULES OF HERITAGE ITEMS : WOOLLOOMOOLOO; EAST SYDNEY/  
DARLINGHURST; SURRY HILLS

ITEM	AHC	HC	NT	RAIA	PAC	1980 PLAN	DISTRICT/ ACTION PLANS
1 Berwick Lane 21-33, terrace			C/R				2
2 Bourke Street 152, St. Peter's Anglican Church including front fence and Hall						X	1
3 154-162			C		2		X
3 164A-164C			C/R		2		X
4 195-203, terraces and cottages group			C/R		3		
5 219-229, terraces			C/R		1		
6 234-240, terraces			C/R				
7 243-269, terraces			C/R		1		
8 323-367, (excluding 345) terraces			C/R				
9 383-387, former Kinsela Funeral Parlor		5130 22/5/81		X			
10 Burton Street 33-37							2
11 49-61, terraces			C/R				
12 76-88, terraces			C/R		3		X
13 106-112, semi-detached cottage			C/R		3		X
14 Chapel Street 2-4, town house group			C/R				2
15 3-9, town house group			C/R				2
16 18-20, town house group			C/R				2
17 Crown Street 213-225, terraces							2
18 214-218, 220-228, 230-236			C		1		2
19 238-242, terraces							2
20 Darley Place 1, 2, 3, 4, 5 Darley Place, group of cottages and terrace			C				
21 Darley Street, Corner Liverpool Street Darley Street group comprising: 1, Stonleigh now Greencourt	X	S44 11/9/81	C		2		
22 2, former Hughlings Private Hospital	X	S44 21/8/81	C		2	X	X
23 4, Novar	X		C		2		
24 9-15, terraces and cottage group			C/R		2		
25 2A		S 57(2)					
26 Darlinghurst Road 263-75			C/R		2		X
27 Forbes Street East Sydney Technical College including walls and gates, cell blocks and other buildings	X		C		1	X	X
28 Corner Forbes and Liverpool Streets Church of Christ Scientist, (not indicated on Figure 4.6)			C/R		2		X
29 SCEGGS Barham (excluding later additions)	X		C		2	X	X
30 188, St. Peter's Anglican Rectory	X		C		1	X	X
31 217-253, Forbes Street group, terraces and shops			C/R		3		
32 238-252, former Belgrave Terrace	X		C				
33 257-297, Forbes Street group			C/R		2		X
34 299, Caritas Centre including gatehouse, fence and gates			C/R				
35 Darlinghurst Police Station	X		C		1	X	X
36 Langley Street 1-15, town houses (part of Squizzy Taylor Square group)			C/R		1		2
37 Liverpool Lane 6-12, town house group			C/R				2
38 Liverpool Street 204-218, terraces	X		C		2		1
39 248, Claremore Lodge			C/R		2	X	X
40 250-260, Liverpool Street group			C/R		3	X	
41 285, terrace			C/R		1		
42 280, former Marist Brothers' High School	X			X	2		X
43 278, Liverpool Street, Hilton	X		C		2		
44 The Grange (not indicated on Figure 4.6)	X		C		2	X	X
45 337-345, terraces	X		C		2	X	X
46 347, Mount Clair		57 (2)	C		2	X	X
47 349-353, The Patieson		57 (2)					
48 355-357, Lynton		57 (2)					
49 359, Ballina Flats		57 (2)					
50 361-373, terraces			C/R				
51 O'Brien's Lane Stone building			C/R				2
52 Oxford Street 82-106			X				2
53 108-122			X				2
54 117			X				2
55 130-134			X				2
56 137-141			X				2
57 143			X				1
58 151A-157			X				2
59 159			X				1
60 161			X				2
61 163-169			X				1
62 171			X				2
63 173-175			X				2
64 183			X				1
65 185			X				2
66 187			X				1

These schedules are based on Sydney City Council listings of heritage items in the LGA. The Council listings have been compiled from the Australian Heritage Commission's Register of the National Estate, the Register of the Heritage Council of New South Wales, the Register of the National Trust of Australia (NSW), the Royal Australian Institute of Architects (NSW Chapter) list of Twentieth Century Buildings of Significance and City Council's lists included in Action Plan No. 13, the 1980 City of Sydney Plan, as well as District Plans and Action Plans.

This schedule lists ONLY those buildings, sites, relics, works and places already identified by these bodies as at December, 1982.

## LEGEND

AHC = Listed in the Register of the National Estate  
 INT = Interim Register  
 HC = Listed in the Register of the Heritage Council of NSW  
 ICD = Interim Conservation Order  
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## A3.2

## SCHEDULE OF HERITAGE ITEMS : EAST SYDNEY/DARLINGHURST

ITEM	AHC	HC	NT	RAIA	PAC	1980 PLAN	DISTRICT/ ACTION PLANS
<b>Palmer and Stanley Street Group</b>							
67 Presbyterian Church Group including single storey annex in Stanley Street and front fence in Palmer Street	X		C		2	X	1
68 186, Presbyterian Manse	X		C		2	X	1
<b>Palmer Lane</b>							
69 5, town house			C/R				
70 6-18, town house group			C/R				
<b>Palmer Street</b>							
71 155A-165B, terraces			C/R		2		2
72 169-175, terraces			C/R				2
73 188-206 and 212-220 Palmer Street terraces and cottages group			C/R		2		2
74 213-217 Palmer Street, terraces			C/R		1		2
75 Huey's Stairs, between 217-219 Palmer			1				1
76 199-211, McBeath Terrace			C/R		3		2
77 224-228 Palmer Street Terrace			C/R				2
78 249, Baptist Church						X	1
<b>Stanley Street</b>							
79 96-100, terraces			C/R				
80 109-113, terraces			C/R				
<b>Taylor Square Courthouse</b>	X		C		1	X	X
<b>Thomson Street</b>							
82 2-40, Thomson Street group with railings			C/R		2	X	X
83 42-86, terraces			C/R		3		
83 61-73, terraces			C/R		3		
<b>William Street</b>							
84 119-129							1
85 171-175, William Street			C/R				X
86 177-185, Grenville House				X	1	X	X
<b>Woods Lane</b>							
87 9-25, townhouse and cottage groups			C/R				2
88 20, townhouse			C/R				2
<b>Bourke Street</b>							
89 377			C/R				

## SCHEDULE OF HERITAGE ITEMS : SURRY HILLS

ITEM	AHC	HC	NT	RAIA	PAC	1980 PLAN	DISTRICT/ ACTION PLANS
<b>Bourke Street</b>							
1 Campbell corner, Belgenny Flats				X			
<b>Moore Park Road</b>							
2 4-30, terraces and houses	X		C		1	X	
<b>Albion Street</b>							
3 179-93, Carlingford Terrace					1	X	
( St. Michael's Anglican Church	X		C		1	X	X
( St. Michael's Hall	X		C		1	X	X
( St. Michael's Rectory	X		C		1	X	X
5 197-201, terrace	X	S44 3/7/81	C		1	X	
6 203-205, houses	X		C		1	X	
7 207, Durham Hall	INT		C		1	X	
<b>Bourke Street</b>							
8 348A, former Wesleyan Chapel facade	X		C		1	X	
9 348, terrace			C/R		1		
10 350A, house			C/R		1		1
13 350-352, terraces					3		
11 437-445, terraces					3		
14 366-372, terraces					3		
15 464A-496, terraces					1		
16 436-444, terraces					1		
17 450, terraces					1		
<b>Bennett Street</b>							
( 8-46, terraces					1		
( 1-11					1		
( 17-35					1		
<b>Chapman Street</b>							
( 3-29, terraces					1		
( 2-32, terraces					1		
<b>Chisholm Street</b>							
19 14-58, terraces					3		
<b>Church Street</b>							
( 2-28, terraces					3		
( 1-15, terraces					3		
<b>Clare Street</b>							
21 1-3, terraces					3		

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# A3.3

## SCHEDULE OF HERITAGE ITEMS : SURRY HILLS

ITEM	AHC	HC	NT	RAIA	PAC	1980 PLAN	DISTRICT/ ACTION PLANS
22	Flinders Street ( 82-84, terraces ( 86, house ( 88-120, terraces ( 122-124, Palace Hotel	X X X X	C C C C		1 1 1 1	X X X X	
23	( 126-144, houses and terraces ( 146, "Moirs" ( 150-56, houses	X X X	C C C		1 1 1	X X X	
24	368-78, South Dowling Street, house and terraces	X	C				
25	Fitzroy Street 97, shop			IAS	1		
26	( 57A, house ( 65A, house ( 69-75, terraces 46-72A, terraces				1 1 1 1		
28	Greens Road 37-109				3		
29	Hannam Street 2-14, Terraces				3		
30	Iris Street ( 2-20, terraces ( 1-65, terraces				3 3		
31	Josephson Street 11-21, terraces				3		
32	Kendall Street ( 2-22, terraces ( 9-15, terraces				1 1		
33	Little Napier Street 1-17, terraces				3		
34	Marshall Street 13-19, terraces				1		
35	( 12-18, terraces ( 20-24, terraces 58-74, terraces 59-61, terraces 26-30, terraces				1 1 1 1 2		
39	Napier Street ( 1-31, terraces ( 3-44, terraces				3 3		
40	Prospect Street ( 2-42, terraces ( 5-47, terraces				1 1		
41	Hill Street 11, terrace		C/R		1		
42	McElhone Street McElhone/Marshall Streets group comprising: ( 1-23, McElhone Street, terraces ( 2-30, McElhone Street, terraces ( 8-10, Marshall Street, houses		C C C		1 1		
43	Selwyn Street 1-9				3		
44	27-65				3		
45	2-64				3		
46	Seymour Place 2-12, terraces				3		
47	South Dowling Street 339-373				3		
48	379-411				3		
49	264-276				3		
50	292-300				3		
51	306-352				3		
52	354-366				3		
53	302-304, Church				3		
54	Taylor Street 5-39, Taylor Street, terraces		C/R		3		

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SCHEDULE OF HERITAGE ITEMS : WOOLLOOMOOLOO

ITEM		AHC	HC	NT	RAIA	PAC	1980 PLAN	DISTRICT/ ACTION PLANS
<b>Bourke Street</b>								
1	1-7, The Bella Hotel			C/R		3		
2	2, Macquarie Hotel			C/R				
3	4-10, terraces			C/R		2		
4	9-21, terraces			C/R		3		
5	12-22, terraces			C/R		3		
6	89, 89A and 89B, corner terrace			C/R		2		
7	129, Corner Cathedral Street terrace			C/R		2		
<b>Broughton Street</b>								
8	12, house			C/R		3		
<b>Cathedral Street</b>								
9	168, 170, 172, 174, Victorian terraces	X		C		3	X	X
10	176, Cathedral Street, late Victorian building (not indicated on Figure 4.5)	X		C				
11	84-104, commercial buildings	X		C		1	X	X
12	108-118, terrace and shops (excluding modern fences)	X		C		1		X
13	111, East Sydney Hotel			C/R		3		
14	138-142, terraces			C/R		3		
<b>Crown Street</b>								
15	1, Eye Hospital			C		1		
16	2-34, Bossley Terrace	X		C		1	X	X
17	49, 51, 55, 57, 59			C/R		2	X	X
18	75-85, City Ford			C	X	2	X	X
19	96-100, 102-104, Crown Street group, houses			C/R		2		
<b>Forbes Street</b>								
20	13, former electricity substation			C				X
21	28-34, terraces			C/R		2		X
22	52-66, 74, terraces			C/R				
23	59-69, terraces			C/R				
24	84-88, terraces			C/R		2		
25	102-130, Forbes Street group, terraces	X		C		3	X	X
26	132-134, terraces	X		C		3		
27	150-166, former Bryson Building				X	2		X
<b>Judge Street</b>								
28	11, 13, 15, 17, mid Victorian terraces with attics			C				X
29	19, early Victorian cottage			C				
30	23, 25, 27, 29, 31, early Victorian terraces with single storey verandahs							X
<b>Palmer Street</b>								
31	87, corner shop			C/R		3		
32	107-111, terraces			C/R		2		
<b>Riley Street</b>								
33	2-4, former Hotel (excluding later additions to Cathedral Street)			C		1		X
34	6-8, terraces			C		1		
35	55,							X
36	41, former warehouse			C/R		1		
<b>Sir John Young Crescent</b>								
37	2-8, former Merrifield Hotel and terrace	X		C		1	X	X
38	10, Sir John Young Crescent Terrace			C/R				

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## APPENDIX 4

### ACOUSTICAL ASSESSMENT OF THE PROPOSED EASTERN DISTRIBUTOR

#### 1. Introduction

This report presents the results of a detailed acoustical assessment of the proposed Eastern Distributor.

This assessment covers Stages 1, 2 and 3 of the proposed scheme. Predicted noise levels are presented for the major roads whose traffic flows are likely to change as a result of the implementation of the scheme. A series of detailed predictions was carried out for the Palmer Street area north and immediately south of William Street, where the major roadworks will take place. The predicted noise levels were assessed by comparison with the existing noise levels measured along these roads (Jackson Teece Chesterman Willis & Partners 1985). Comparisons were also made with criteria for traffic noise currently being used by the Department of Main Roads and separately by the NSW State Pollution Control Commission (SPCC).

In general, the Eastern Distributor will achieve significant improvements to the noise environment of the Eastern Districts by reducing traffic on many residential roads. However, noise levels will increase at some specific locations.

#### 2. Acoustical Criteria

The  $L_{10}$  (18 hour) noise level descriptor has been used as the basis for this assessment. The  $L_{10}$  sound level is a level exceeded for 10 percent of the specified period. The  $L_{10}$  (18 hour) is defined (U.K. Department of the Environment 1975) as the arithmetic mean of the  $L_{10}$  (1 hour) levels determined in each hour over the period 0600 to 2400 hours on a week day. The  $L_{10}$  (18 hour) level is expressed in decibels A-weighted, or dB(A).

The primary advantages of using the  $L_{10}$  are that this is a single number descriptor which is responsive to both the noise level and numbers of vehicles in a traffic stream, and that it correlates

well with subjective annoyance from road traffic noise. Considerable research (Hede 1984) has been carried out both in Australia and overseas in recent years, and this has in general confirmed the validity of the  $L_{10}$  descriptor for local as well as overseas conditions. Stemming from this research, a number of acoustical criteria have been developed for use by planning and road building authorities.

##### (a) Department of Main Roads Criteria (Department of Main Roads, 1984)

The Department of Main Roads uses the U.K. procedure and is guided by the U.K. criteria. Consideration to noise attenuation is given when the  $L_{10}$  (18 hour) noise level at a point one metre from the facade of adjacent dwellings is estimated to be at least 68dB(A) and to have risen by at least 2dB(A) since before construction. Allowance is made for traffic growth or other road changes planned for the 5 years following. Consideration is also given to noise during the road design process when estimated levels are less than 68dB(A).

##### (b) State Pollution Control Commission Criteria

The SPCC currently promotes a planning criterion of  $L_{10}$  (18 hour) = 60dB(A) for proposed residential developments near major roads. In existing situations where the noise from road traffic is already significant, the SPCC recommends the introduction of ameliorative measures when  $L_{10}$  (18 hour) = 65dB(A) or greater (State Pollution Control Commission 1984b).

Based on the above considerations, and their experience in numerous road traffic studies, the acoustic consultants for this project recommended the following criteria for residential frontages:

- (i) Increases of 5dB(A) or more in the  $L_{10}$  (18 hour) level are regarded as constituting a significant acoustical impact, in cases where the existing  $L_{10}$  (18 hour) level is nominally between 50 and 60dB(A). Whilst this would represent many typical urban situations, there are few locations in the area under investigation in which the existing  $L_{10}$  (18 hour) levels are less than 60dB(A).
- (ii) Increases of greater than 5dB(A) in the  $L_{10}$  (18 hour) level may be acceptable in



situations where the  $L_{10}$  (18 hour) level was less than 50dB(A). This would not apply in the Eastern Districts.

- (iii) Increases of 2dB(A) in the  $L_{10}$  (18 hour) level are regarded as significant where the existing  $L_{10}$  (18 hour) levels are greater than 65dB(A). A sliding scale should be applicable between this criterion and (i) above.

### 3. Prediction of Future Noise Levels

#### Areas Affected by Changes in Traffic Flows

In the case of an area or areas where no major roadworks are proposed, the benefits or impacts of the Eastern Distributor can be assessed in terms of the likely changes in traffic volumes. For this assessment, the traffic predictions provided in Section 3.3 were used as a basis. The future  $L_{10}$  (18 hour) noise levels were predicted from the measured existing levels (on the basis of the method described in U.K. Department of the Environment, 1975) as follows:

$$L_{10} \text{ (18 hour) Predicted} = L_{10} \text{ (18 hour) Existing} + 10 \log (\text{AADT Predicted} / \text{AADT Existing})$$

where AADT represents the Annual Average Daily Traffic flow.

The AADT, a 24 hour figure, taken from 1983 data, was used as a basis for predicting likely future 18 hour traffic flows since the lower traffic volumes over the 18 hour period would be approximately compensated by the likely growth in traffic volumes between 1983 and the opening of the Eastern Distributor.

In a small number of cases where no measurements of existing noise levels were made an indicative existing noise level was estimated from measured data for similar areas.

Predictions were carried out for Stages 1, 2 and 3. In order to provide an indication of the likely level of effect of the existing and future noise levels, in terms of the percent of population likely to be "highly annoyed" by road traffic noise, further predictions were carried out on the basis

of research (Hede 1984) considered to be reasonably applicable to Australian conditions. In that data, a relationship was developed between  $L_{10}$  (18 hour) level and the percent of population "highly annoyed" as follows:-

$$\text{Percent highly annoyed} = 1.19 L_{10} \text{ (18 hour)} - 56.8$$

This has been applied to the measured and predicted  $L_{10}$  (18 hour) levels for each area and for each stage. The results of the predictions are presented in Figure 1.

#### Areas Affected by Roadworks

The areas primarily affected by roadworks will be those adjacent to Palmer Street to the north and immediately south of William Street. The areas adjacent to the southern tunnel portals on Moore Park Road and Anzac Parade will not be affected by the roadworks as such since the tunnel surfaces in areas not considered residential. Those areas adjacent to the tunnel portals in South Dowling Street and Flinders Street were taken into account above by considering overall traffic flows north and south of the portals.

The areas adjacent to Palmer Street, on the other hand contain residences which may be exposed to higher future noise levels as a consequence of the demolition of intervening buildings, which presently provide some degree of acoustical screening. Detailed noise predictions were carried out for Stages 1, and 3 (Stage 2 being considered equivalent to Stage 3 in this area), for 12 receiving positions.

The 12 prediction positions selected were as follows:

(see Figure 2)

- Position 1 - Rear of No. 221 Bourke Street, at first floor level, overlooking Stage 1 underpass.
- Position 2 - Rear of No. 189 Bourke Street, at first floor level, overlooking Stage 1 underpass.
- Position 3 - Front of No. 161A Palmer Street at first floor level, overlooking Stage 1 underpass.



# EASTERN DISTRIBUTOR - AREA PLAN SHOWING EXISTING & PREDICTED TRAFFIC FLOWS, NOISE LEVELS AND POPULATION EFFECTS

FIGURE 1

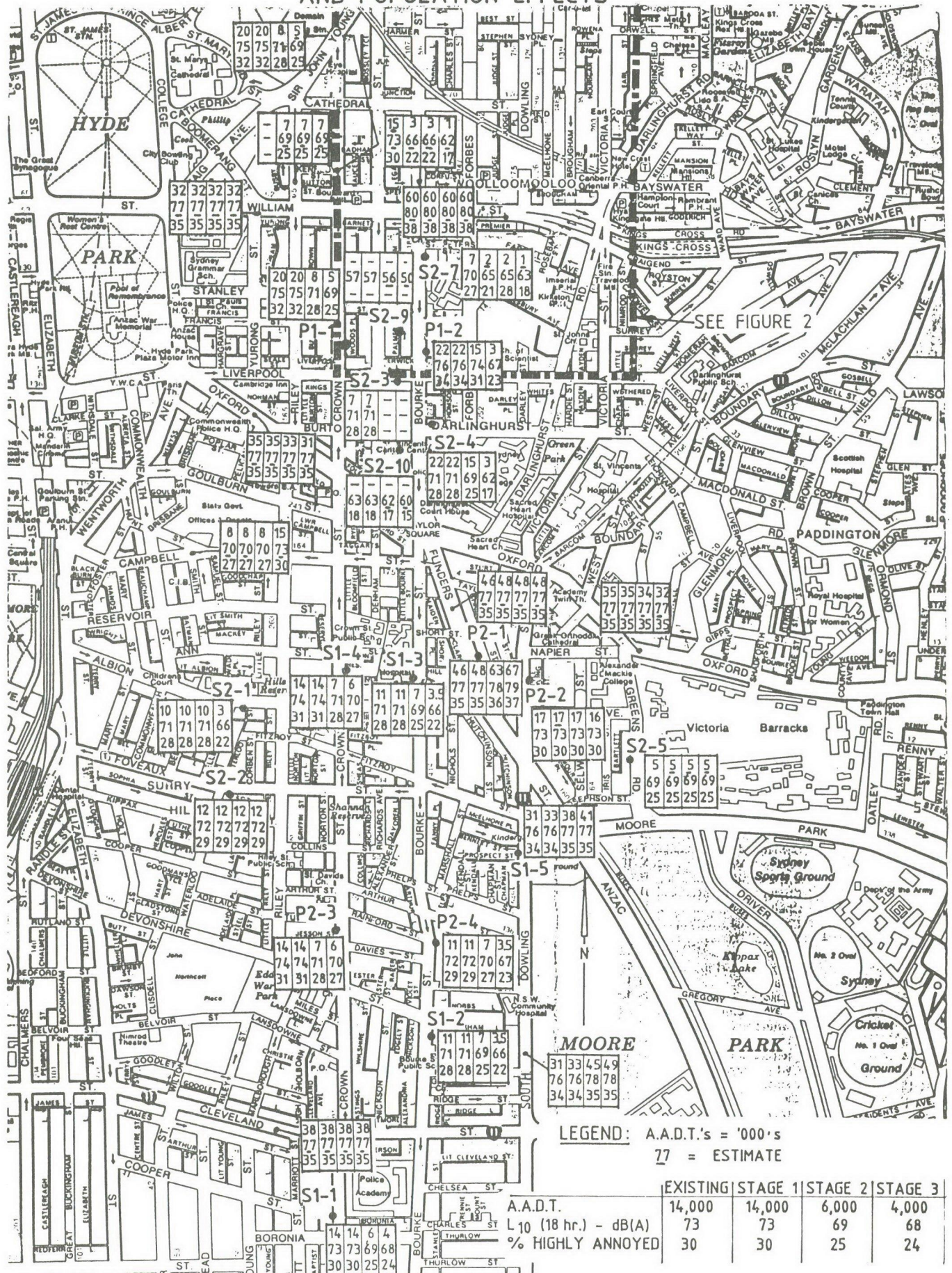
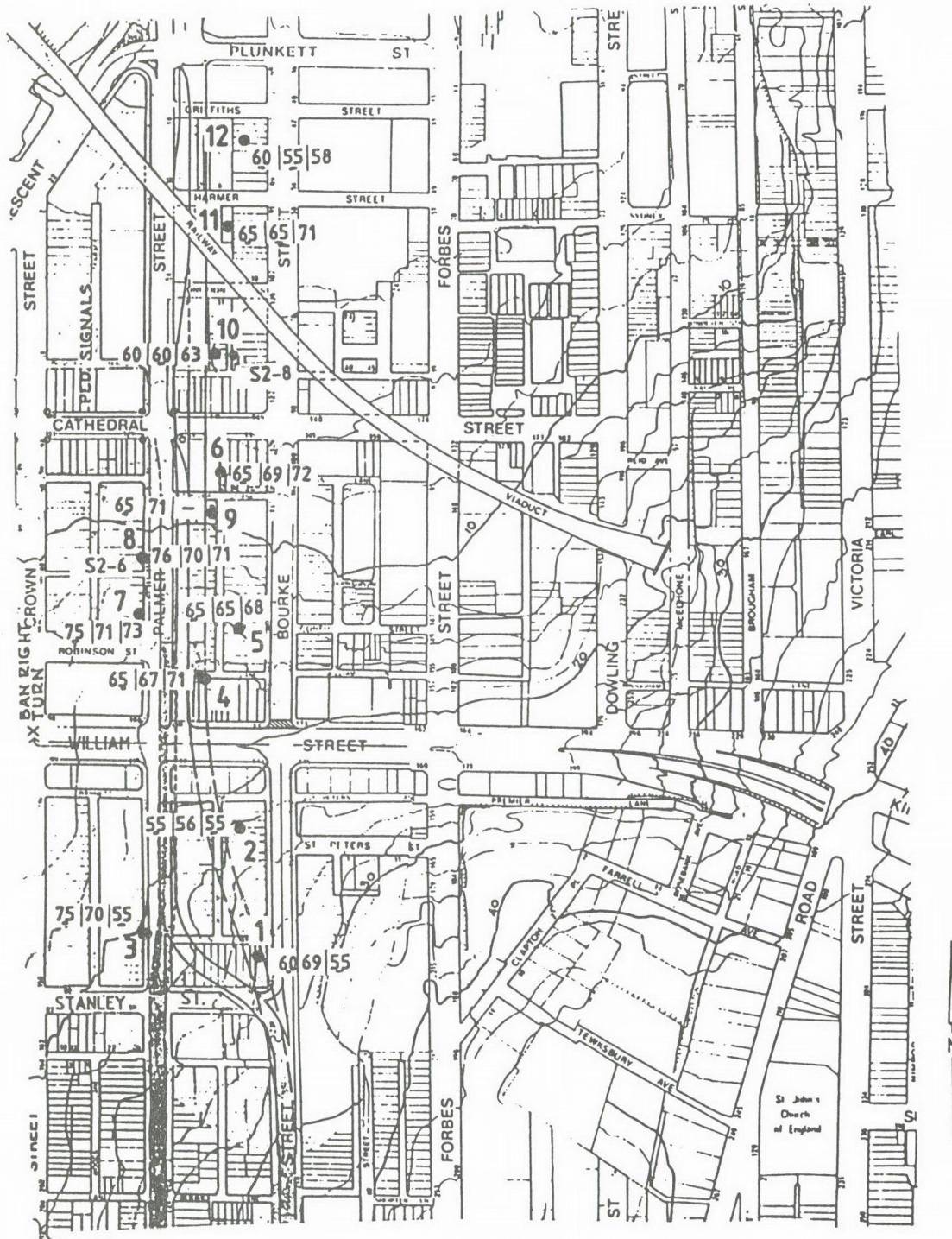




FIGURE 2

EASTERN DISTRIBUTOR - PLAN OF NORTHERN AREA  
SHOWING EXISTING & PREDICTED NOISE LEVELS  
ADJACENT TO ROADWORKS



Existing and Predicted Noise Levels  
Adjacent to Major Roadworks

	EXISTING	STAGE 1	STAGE 3
L <sub>10</sub> (18 hr.) - dB(A)	60	69	55
60 = ESTIMATE			



The main assumptions are detailed in Table 1:

TABLE 1 ASSUMPTIONS IN NOISE PREDICTIONS FOR  
PALMER STREET AREA

		Item	Stage 1	Stage 3	
		Traffic Flow (AADT)			
Position 4	-	Rear of "Delroy Flats", William Street, second floor level, overlooking Stage 1 underpass and Stage 3 tunnel entrances.	- Eastern Distributor tunnel southbound	21,000	21,000
		- Eastern Distributor tunnel northbound	-	19,000	
		- Southbound ramp to William Street	8,000	10,000	
		- Palmer Street south of William Street	1,000	-	
		- Palmer Street north of William Street	1,000	1,000	
Position 5	-	Rear of No. 173 Bourke Street, first floor level, overlooking Stage 1 and Stage 3 tunnel entrances.	Mean Traffic Speed (km/hr)		
		- Eastern Distributor tunnel entrances	50	50	
		- Palmer Street and ramp to William Street	40	40	
Position 6	-	Rear of No. 131 Cathedral Street, at first floor level, overlooking Stage 1 and Stage 3 tunnel entrances.	Heavy Vehicles (%)		
		- Eastern Distributor tunnels and ramp	3	3	
		- Palmer Street (north and south of William Street)	10	10	
Position 7	-	Front of "The Diplomat" units, Palmer Street, fourth floor level, overlooking tunnel entrances.			
Position 8	-	Front of No. 109 Palmer Street, at first floor level, overlooking Stage 1 and Stage 3 tunnel entrances. (Position S2-6 for existing noise measurements (see Jackson Teece Chesterman Willis & Partners 1985))			
Position 9	-	Rear of No. 3 Egan Place, first floor level, overlooking Stage 1 tunnel entrance. This residence would be demolished in Stage 2.	The road surfaces were assumed to be smooth, and the intervening ground surface between the roads and the residences was assumed to be hard. The receiving positions were assumed to be 1 metre from the building facades, and the effects of barriers created by the road configuration or intervening buildings were taken into account. In this regard, a 1.2m. high safety wall was assumed on each side of the cuttings leading into the tunnels. Furthermore, a 4m. high wall was assumed on the boundary between Kidman's Terrace and the roadway, and a 3m. high wall was assumed along the east boundary of the roadway between Griffiths Street and Harmer Street. These assumptions approximate the existing situation.		
Position 10	-	Rear of Kidman's Terrace, at first floor level, overlooking Eastern Distributor in Stage 3.			
Position 11	-	Rear of No. 11 Harmer Street, at first floor level, overlooking Eastern Distributor in Stages 1 and 3.			
Position 12	-	Rear of No. 83 Bourke Street, at first floor level, overlooking Eastern Distributor in Stage 3.			
			The results of these predictions are presented in		

In these cases, a detailed assessment was carried out taking into account the relevant design features for the proposed roadworks as well as the predicted traffic flows.

The road surfaces were assumed to be smooth, and the intervening ground surface between the roads and the residences was assumed to be hard. The receiving positions were assumed to be 1 metre from the building facades, and the effects of barriers created by the road configuration or intervening buildings were taken into account. In this regard, a 1.2m. high safety wall was assumed on each side of the cuttings leading into the tunnels. Furthermore, a 4m. high wall was assumed on the boundary between Kidman's Terrace and the roadway, and a 3m. high wall was assumed along the east boundary of the roadway between Griffiths Street and Harmer Street. These assumptions approximate the existing situation.

The results of these predictions are presented in Figure 2 for Stages 1 and 3 (where relevant). The "percent of population highly annoyed" figures have been omitted as the prediction positions in general refer to one or a small number of residences only.



#### 4. Comments on the Results

The results presented in Figures 1 and 2 show two different aspects of the overall effect of the Eastern Distributor on noise levels. Figure 1 provides a broad picture of the effects (in most cases benefits) of the proposal in terms of overall reductions in noise levels in areas which are presently badly affected by road traffic noise. Figure 2 on the other hand presents a more detailed picture of a localised area adjacent to the major roadworks associated with the project, where the effects are generally likely to be adverse. These two sets of results are discussed in more detail below:

##### Figure 1

Figure 1 shows clearly that the existing situation is one in which many areas are presently being subjected to high levels of road traffic noise. Indeed it is only in some of the side streets and small lanes off the main roads that noise levels drop to the level considered as a normally acceptable limit by the SPCC for existing situations, i.e.  $L_{10}$  (18 hour) = 65dB(A). Furthermore, Figure 1 shows that in very few areas, even where substantial reductions in noise levels are achieved by the Proposal, will this criterion be achieved.

The suggested criterion that sound level increases above 68dB(A) be less than 2dB, will be achieved in all areas on Figure 1 with four exceptions. These are respectively:

1. Flinders Street, south of the tunnel entrance for northbound traffic, where the  $L_{10}$  (18 hour) level would rise from 77-79dB(A), by Stage 3.
2. Campbell Street, where the  $L_{10}$  (18 hour) level would rise from 70-73dB(A), at Stage 3.
3. South Dowling Street, south of the southbound tunnel exit, where the  $L_{10}$  (18 hour) level would rise from 76-78dB(A), in Stages 2 and 3.
4. Riley Street, north of William Street, where the existing  $L_{10}$  (18 hour) level would rise to an estimated level of 69dB(A), in Stage 1\*.

\* The redirection of northbound traffic from William Street from Riley Street to Crown and Palmer Streets in Stage 2 will reduce the beneficial effect on Crown Street north of William Street but improve noise conditions on Riley Street.

\*\* The redirection of northbound traffic from William Street from Riley Street to Crown and Palmer Street in Stage 2 will confine this effect to Stage 1.

The affected areas include a row of residences and St. Michael's Church in Flinders Street; groups of residences in Campbell and Riley Streets; and a row of residences and an (aged persons') activity centre in South Dowling Street.

The benefits of the proposal would be felt most significantly along Baptist, Crown and Bourke Streets through Redfern, Surry Hills, Darlinghurst and Woolloomooloo\*\*. Other streets which would experience benefits would be Albion Street, Surry Hills as well as some of the cross-streets in East Sydney and Woolloomooloo, presently used as bypass routes for the congested main streets.

The "percent of population highly annoyed" figures are particularly useful in assessing the overall balance of benefits and impacts, given the SPCC and Department of Main Roads criteria do not indicate "how beneficial" or "how adverse" the effect is of a given drop or rise in noise levels. The "percent highly annoyed" figures however can relate a given rise or drop in noise levels to a population effect, and could be readily converted to numbers of people, given the actual population numbers along the various roads assessed.

The results indicate that the numbers of people along Crown Street, Bourke Street and Albion Street who would rate themselves as "highly annoyed" would drop by about 20-25 percent. Furthermore, there may be a much larger number of people who would accept the future situation given their level of habituation to the existing noise levels. The perception of heavy vehicles and motor cycles in the traffic stream as representing a greater degree of annoyance than their percentages would suggest is well documented. The existing proportion of heavy vehicles (3 percent - a low proportion but a large number of trucks) on the major roads represents a significant noise component, and presents a case for further consideration of traffic management schemes.

It should also be noted however, that there are very few areas which will receive benefits under the Stage 1 scheme (the construction of an underpass at William Street). The main area to receive such a benefit would be Bourke Street north of Stanley Street. (Bourke Street will be closed to through traffic north of William Street in Stage 1.) However, although there are fewer residences and less residential redevelopment potential in Riley Street, some of this benefit will



be offset by the noise increase likely to occur in Riley Street north of William Street\*. This street will carry traffic turning right from William Street towards the Harbour Bridge. In other respects, the effects of Stage 1 are more apparent from Figure 2 which is discussed below.

## Figure 2

Figure 2 shows the predicted noise levels in areas adjacent to the major roadworks associated with the proposal for Stages 1 and 3. The noise levels for Stage 2 should be assumed to be equivalent to those for Stage 3. The noise levels in the area between William Street and Stanley Street will increase temporarily on the Bourke Street side as the rear facades of residences are exposed to the roadway through demolition works. However, the residual land along Palmer Street will be suitable for redevelopment, which will again screen the rear of the Bourke Street buildings. Noise levels in Palmer Street would decrease as the road is built in a cutting at a greater distance from the houses than at present.

In Stage 3, this area will benefit from substantial noise reductions as the traffic is reduced to local vehicles only.

The area immediately to the north of William Street will generally experience increased noise levels at Stages 1 and 3. Exceptions to this are "The Diplomat" units in Palmer Street and three terrace houses at Nos. 107-111 Palmer Street, which will benefit by the removal of the existing Palmer Street traffic into the tunnel entrances and exits.

The rear facade of Kidman's Terrace, between Junction Street and Junction Place, will be exposed to the Eastern Distributor at Stage 2 as a result of demolition works. This area is currently shielded to a significant extent by existing buildings.

It should be noted that since, in this area, the assessment concerns small numbers of houses, the use of "percent highly annoyed" figures was not deemed necessary.

It should be stressed that any re-development of sites in this area adjacent to the tunnel entrances and exits should take account of the high traffic noise levels, particularly if residential, medical or educational facilities are envisaged. This should be taken into account in the planning and design stages.

The suggested criterion that sound level increases above 68dB(A) be less than 2dB(A) will be achieved in all areas on Figure 2 except the following:

- . Nos. 219-229 Bourke Street (rear of terraces, Stage 1 only)
- . Rear Nos. 1 - 5 Egan Place (property required for Stage 2 roadworks, Stage 1 only).
- . "Delroy" flats in William Street (rear affected in Stages 2 and 3).
- . No. 131 Cathedral Street and Nos. 2-6 St. Kilda Lane (Stages 2 and 3).
- . No. 11 Harmer Street and Nos. 99 - 101 Bourke Street (Stage 2 and 3).
- . Nos. 79 - 83 Bourke Street (Stages 2 and 3).
- . Rear of Kidman's Terrace between Junction Street and Junction Place (Stage 3).

In addition to the above, consideration will also be given to possible ameliorative measures in respect of Nos. 157-183 Bourke Street. The rear of this row of terraces would be marginal in terms of the above criterion in Stages 2 and 3.

## 5. Conclusion

This report has shown that the existing traffic noise levels in many areas adjacent to the proposed Eastern Distributor are presently very high. This situation is unlikely to change significantly under Stage 1 of the Proposal in which local effects only will result.

The primary local effect under Stage 1 will be the removal of traffic from Bourke Street, north of William Street, resulting in a benefit in terms of reduced noise levels, partially offset by a likely increase in noise levels (to a fewer number of dwellings) in Riley Street north of William Street.

\* With the redirection of northbound traffic from William Street from Riley Street to Crown and Palmer Streets in Stage 2, this adverse effect will be reduced.



In Stages 2 and 3 the effects of the Eastern Distributor will be felt over a much wider area. It should be noted that the Proposal is greatly superior from a noise standpoint to alternative schemes which envisage a surface road concept (see Section 5).

The major acoustical benefits of the Proposal would be in the reduced noise levels along Bourke Street and Crown Street throughout Woolloomooloo, East Sydney, Darlinghurst and Redfern and also along Albion Street and possibly other streets presently used as a bypass.

The reduction in noise levels is considered significant and worthwhile in terms of the greatly reduced numbers of people likely to regard the residual traffic noise as "highly annoying". However, it should be recognised that the residual noise levels will not in all instances meet current criteria for acceptable traffic noise levels for urban areas.

There are likely to be adverse impacts in a number of specific locations under Stages 2 and 3. These include a row of houses and a church in Flinders Street; a row of houses and an activity centre in South Dowling Street; and a number of houses in Campbell and Riley Streets. There will also be local adverse effects in the area immediately north of William Street where the major roadworks will take place. Some of these impacts can be ameliorated through careful design of the roadworks combined with possible architectural solutions in a small number of cases.

The Eastern Distributor in Stages 2 and 3 represents a positive move towards reduction of existing high noise levels and a consequent improvement in the level of acoustical amenity in a number of areas. However, consideration will be given to appropriate ameliorative measures in respect of the small number of areas likely to be adversely affected.

## REFERENCES

- Hede A. J. (1984) "Factors Determining Traffic Noise Annoyance", **Bulletin Australian Acoustical Society**, 12, 3:81-87
- State Pollution Control Commission (1984) **Environmental Noise Control Manual** (draft)



## APPENDIX 5

### AIR QUALITY ASSESSMENT OF THE PROPOSED EASTERN DISTRIBUTOR

#### 1. Introduction

This report presents the results of a detailed assessment of air quality in the Eastern Districts adjacent to the route of the proposed Eastern Distributor.

The assessment is concerned with local air quality only and has not considered regional air quality across the Sydney Basin.

It concentrates on Stages 1 and 3 of the proposed scheme and highlights any aspects of Stage 2 not addressed by the survey of Stages 1 and 3.

The pollutant emitted by motor vehicles that has the most direct affect on health is carbon monoxide (CO). For this reason CO was used as the chemical constituent to assess the air quality in the Eastern Districts of Sydney.

Typically, around 70 percent of CO comes from motor vehicle exhausts. Other significant sources are combustion of fuels such as coal and oil, foundries, steel mills and other industrial processes. Natural sources include natural gas, marine organisms and bush fires.

The major sinks of CO include chemical transformations in the stratosphere and uptake by soil micro-organisms and plants.

The major effect of CO is on people and animals. It has no significant effects on vegetation, materials or aesthetics.

CO can be used as the indicator of a variety of pollutants including oxides of nitrogen, hydrocarbons and lead. This approach has been recognised (Hickman and Colwill 1982) as a method of predicting levels of other pollutants emitted from mobile sources. However, concentrations generated should be used only as a

guide to general air quality and not taken as accurate (Hickman and Colwill 1982). A series of correlation curves of other pollutants compared with CO are presented in Jackson Teece Chesterman Willis & Partners (1985).

Initial air quality and climatic monitoring data were collected using two basic approaches. Measurements were made on a continuous basis at two sites, and individually, at 15 sites during a.m. and p.m. peak hours within the Eastern Districts. The latter technique is referred to as spatial distribution data.

Monitoring approaches, measurement test methods and calibration procedures are detailed in Jackson Teece Chesterman Willis & Partners (1985).

The two sets of continuous CO data were compared with State Pollution Control Commission (SPCC) monitoring data, and wind speed and direction data collected from their sampling sites nearest to the Eastern Districts. Figure 1 presents the location of monitoring sites for air quality, wind speed and direction and traffic data.

CO measurements were made continuously in Palmer Street (north of Cathedral Street) and in Crown Street (north of Campbell Street and south of Oxford Street). Data was collected for one month during February and March, 1985.

CO spatial distribution measurements were made over a similar period during a.m. and p.m. peak traffic periods; in essence, between 0630 and 1030 hours and 1530 and 1830 hours respectively. CO measurements were correlated with traffic speed, volume and type, plus windspeed and direction above the urban canopy.

This data was collated and used as the basis to calibrate dispersion models used to predict future trends in air quality in the area affected by the proposed scheme.

Prediction was based on two U.S. Environment Protection Agency (USEPA) mathematical pollutant dispersion models, HIWAY II and the APRAC-1A urban diffusion model which was used to assess effects of the urban street canyon on pollutant dispersal.





## KEY

## 7 CO Monitoring Sites

## A Anemometer Sites

**NOTE:** Anemometer site **C** is located on Goat Island

13

①

**B**

15

12

11

10

2

9

**A**

8

5

⑥

7

③

4

Eastern Distributor - August 1985



1



300 M

## LOCATION OF AIR QUALITY MONITORING SITES



The SPCC emission (hot) equation (Mowle, Pengilley and Stewart 1981) was used to predict the mass emission of CO generated by motor vehicles.

These models were calibrated against ground level measurements and found to consistently under-predict by at least a factor of 2. This was due in part to the presence of "background" concentrations of CO in the areas in which the measurements were made.

## 2. Air Quality Criteria

The following is an extract from the SPCC Quarterly Air Quality Monitoring Report (1984) which describes the current status of air quality criteria in New South Wales:

Air quality criteria for urban air pollutants have not been defined in New South Wales. While many of the effects of air pollution on materials, vegetation and visibility have been documented, the effects on health for some pollutants require further investigation under Australian conditions.

In the absence of specific data the Commission (SPCC) adopts as objectives National Health and Medical Research Council (NHMRC) Guidelines supplemented by World Health Organisation (WHO) Long Term Goals and US Environmental Protection Agency (USEPA) Air Quality Standards. These air quality criteria have been determined in the light of international knowledge on the adverse effects of air pollutants on health. Damage to plants and materials and reduction to visibility have not been considered in establishing these criteria. Selected air quality criteria together with their agency source are listed below.

Pollutant	Standard	Agency
Total Suspended	90 ug/cu.m. (Annual geometric mean)	NHMRC
Particulate	260 ug/cu.m. (24 hour maximum)	USEPA
Lead	1.5 ug/cu.m. (90 day average)	NHMRC/ USEPA
Carbon Monoxide	35ppm (43 mg/cu.m.) (1 hour maximum) 17ppm (1 hour maximum)	WHO/ USEPA
Nitrogen Dioxide	5ppm (Annual arithmetic mean)	NHMRC USEPA

ug/cu.m. - microgram ( $10^{-6}$  gram) per cu.m.  
mg/cu.m. - milligram ( $10^{-3}$  gram) per cu.m.  
ppm - parts per million  
pphm - parts per hundred million

WHO recommends that CO 13ppm (16mg/cu.m.) should not be exceeded for exposure times between one and eight hours and that 35ppm (43mg/cu.m.) should not be exceeded for exposures between a half and one hour (World Health Organisation 1979).

USEPA Federal Air Quality Standard for one hour exposure to CO is that a concentration of 35ppm (43mg/cu.m.) should not be exceeded more than once a year. This standard also specifies that for an eight hour exposure a CO concentration of 9ppm (11mg/cu.m.) should not be exceeded more than once per year.

The Victoria Environment Protection Authority works on an ambient air quality objective for CO of 30ppm (1 hour average) and 10ppm (8 hour average) as an acceptable level and 60ppm (1 hour average) and 20ppm (8 hour average) as a detrimental level. The levels referred to for CO are based on health effects.

## 3. Existing Air Quality

Table 1 presents a summary of SPCC CO monitoring data collected over the past three years at the city site. The SPCC data shows that the WHO one hour Standard was not exceeded during 1984. However, the USEPA eight hour Standard was frequently exceeded at the SPCC city site. This data was the basis for SPCC input



TABLE 1 SPCC AIR QUALITY MEASUREMENTS REPORT (CO)  
CARBON MONOXIDE PARTS PER MILLION 1 HOUR SAMPLE  
SYDNEY MONITORING SITE - GEORGE AND MARKET STREETS

	1984											
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
% Sampling Time	98	99	94	96	51	***	***	***	90	92	97	99
Daily 1 Hour Maxima												
. Monthly Average	14	13	14	13	13	***	***	***	8	9	10	8
. Standard Deviation	-	-	-	6	6	***	***	***	4	3	4	4
. Max. 1 Hour Value	23	20	24	26	21	***	***	***	15	17	22	14
US EPA 8 Hour goal <sup>a</sup>												
. % Time Exceeded	-	-	-	17	23	***	***	***	3	3	2	1
. No. Days Exceeded	13	15	17	14	12	***	***	***	3	4	5	4

\*\*\* Data not available. SPCC CO data for 1982 and 1983 also not available.

a. US EPA 8 Hour goal = 9ppm

Source: State Pollution Control Commission (1984)

TABLE 2 SUMMARY OF CONTINUOUS CO MONITORING

Site	No. of days exceed		
	Maximum 1 Hour Average (mg/cu.m.)	WHO 1 Hour <sup>a</sup> Average (mg/cu.m.)	USEPA <sup>b</sup> 8 Hour Average (mg/cu.m.)
Myers (SPCC)	30.4	NIL	9 <sup>c</sup>
Crown Street (9)	36.1	NIL	10 <sup>c</sup>
Palmer Street (1)	35.8	NIL	NIL

(9) Refers to continuous monitoring site adjacent to spatial distribution site No. 9 in Crown Street (south of Oxford Street and north of Campbell Street)

(1) Refers to continuous monitoring site adjacent to spatial distribution site No. 1 in Palmer Street (north of William street)

a. WHO 1 Hour average for CO is 43mg/cu.m.

b. USEPA 8 Hour average for CO is 11mg/cu.m.

c. Computed from 1 hour average data.



data in Table 2. During 1984 the highest one hour average values, and the greatest number of exceedences of the USEPA eight hours standard occurred during the first half of the year.

The existing air quality was determined by measurement of CO and comparison of monitoring results with SPCC air quality measurements. Road traffic volume, type of vehicle and speed and meteorological measurements, including wind speed and direction, were made simultaneously with CO monitoring at 15 sites throughout the Eastern Districts.

Sites were selected on the basis of streets that would most likely have a change in traffic volume or speed upon the completion of each stage of the proposed scheme. Location of sites is presented in Figure 1.

CO was monitored continuously for a month at one site in Palmer Street (north of William Street) and one in Crown Street (south of Oxford Street and north of Campbell Street). Results of this monitoring have been compared with average data for the SPCC city site (corner of George and Market Streets) and are presented in Jackson Teece Chesterman Willis & Partners (1985), and graphically in Figure 2. All one hour average CO monitoring results are tabulated with respect to time and date for the three sites in Table 1 - 3 (Appendix 1) in the above reference.

This data indicates reasonable correlation of continuous monitoring test data for sites in Palmer and Crown Streets with the only SPCC permanent CO monitoring site in Sydney city. A summary of this data is presented in Table 2 along with maximum and mean one hour average CO concentrations. These are compared with WHO (1 hour) and USEPA (8 hour) Standards.

WHO one hour average for CO was not exceeded at any of the three sites. However, maximum one hour averages did attain approximately 86 percent of the Standard limit.

USEPA eight hour average was not exceeded at the Palmer Street (No. 1) site. However, it was exceeded at the other two sites on a number of days. While this exceedence may seem high, it needs to be placed into the context of the longer

term co-data collected by the SPCC. Table 1 shows percentage exceedences of 38 to 54 percent between January and April, 1984, and similar trends have been observed in unpublished data for the first three months of 1985.

Table 3 presents a summary of mean one hour average CO concentrations during morning and afternoon peak traffic periods measured at 15 discrete sampling sites in the Eastern Districts. Mean, maximum and minimum one hour averages are presented. Also shown are the average CO values from the continuous monitoring sites for the periods that the spatial measurements were conducted. These data show good agreement between the two methods of measuring CO.

Highest concentrations were measured on the Bourke Street hill (a.m. and p.m.) between Liverpool and Burton Streets, and in Flinders Street (east side) during p.m. peak periods. At both of these sites traffic is slow moving. CO concentrations increase as combustion becomes less efficient which occurs in spark ignition vehicles when idling or under load.

All CO concentrations, however, were well below (less than 50 percent of) WHO maximum one hour average limits.

During the monitoring period a range of meteorological conditions were encountered including both high and low wind speeds from a number of directions. This data has all been utilised for modelling purposes.

Wind direction does have an effect on concentration of emissions in the local atmosphere generated by the motor vehicle. Figures 3 and 4 illustrate the effect of cross canopy winds on the dispersion of pollutants within the urban canyon. Concentrations of CO will be highest on the lee side of the canyon and lowest on the windward side. Winds blowing along the canyon produce concentrations between these two extremes.

Wind speed and direction have been correlated with CO concentration in Table 3.2 of the air quality Working Paper (in Jackson Teece Chesterman Willis & Partners 1985) on the three continuous monitoring sites and Flinders (Site Nos. 3 and 8) and Bourke (Site No. 2) Streets spatial



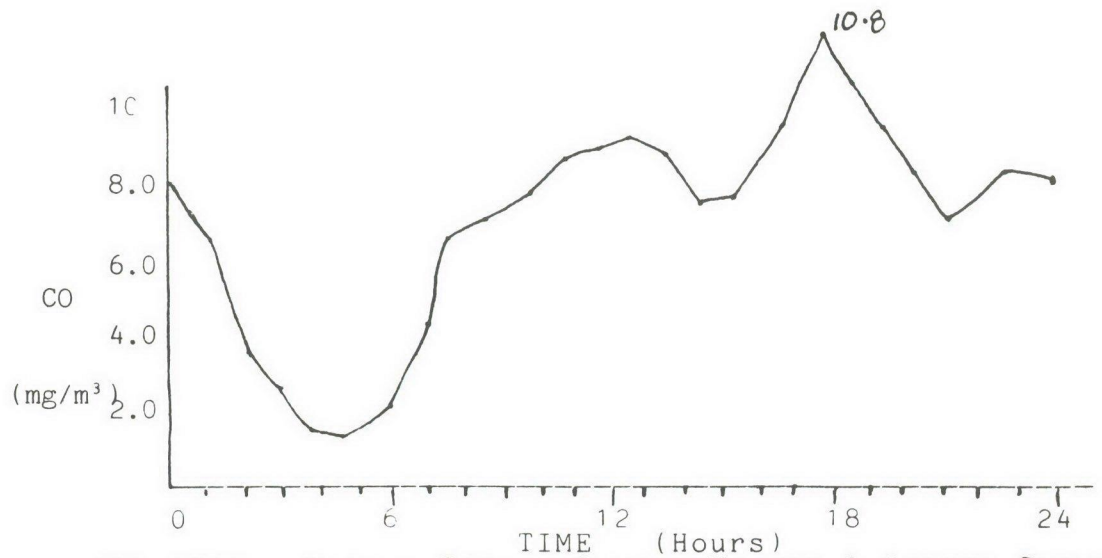
TABLE 3 MEAN SPATIAL CARBON MONOXIDE CONCENTRATION 9A.M. AND P.M.) AND RANGES

AVERAGE 1 HOUR CO CONCENTRATIONS								
SITE			A.M. <sup>a</sup>	No. of			P.M. <sup>b</sup>	No. of
	ppm	mg/cu.m.	Range mg/cu.m.		ppm	mg/cu.m.	Range mg/cu.m.	
1. Palmer Street	7.1	8.52	4.32 - 15.0	14	8.1	9.72	6.40 - 15.6	10
2. Bourke Street (north of Oxford)	13.2	15.8	6.12 - 22.2	13	14.4	17.3	6.29 - 27.5	10
3. Flinders Street (Drivers Triangle)	7.7	9.24	4.2 - 20.0	13	15.3	19.0	6.55 - 28.0	9
4. Moore Park	2.9	3.48	0.12 - 8.04	12	3.0	3.6	0.76 - 8.03	9
5. Crown Street (south of Albion)	5.7	6.84	1.92 - 11.6	12	3.7	4.44	1.93 - 7.44	10
6. Albion Street	4.2	5.04	0.36 - 11.6	13	7.3	8.76	1.93 - 16.8	10
7. Bourke Street (south of Albion)	5.7	6.84	3.0 - 11.3	13	6.5	7.8	4.56 - 12.0	10
8. Flinders Street (Taylor Square)	9.1	10.9	3.72 - 26.8	12	4.0	4.8	2.83 - 5.53	7
9. Crown Street (north of Campbell)	6.5	7.80	2.88 - 14.2	14	8.1	9.72	3.71 - 15.0	10
10. Crown Street (north of Liverpool)	5.2	6.24	2.52 - 9.48	13	4.9	5.88	1.85 - 7.88	9
11. William Street (adjacent to Crown)	6.8	8.16	0.84 - 18.5	12	8.7	10.4	3.23 - 16.0	10
12. Riley Street (south of William)	4.5	5.4	1.44 - 9.0	13	3.2	3.84	1.68 - 7.73	10
13. Crown Street (south of Sir John Young Crescent)	7.5	9.0	2.28 - 16.1	12	3.1	3.72	1.26 - 5.71	10
14. Domain	2.8	3.36	0.48 - 11.2	13	1.9	2.28	0.70 - 3.84	10
15. Bourke Street (north of William)	5.9	7.08	3.24 - 11.3	12	3.6	4.32	2.20 - 6.44	10
CONTINUOUS MONITORING COMPARISON								
SPCC City	6.5	7.8		20	7.5	9.8		21
Crown Street (9)	6.1	7.3		20	7.6	9.1		21
Palmer Street (1)	6.3	7.6		21	8.9	10.7		20

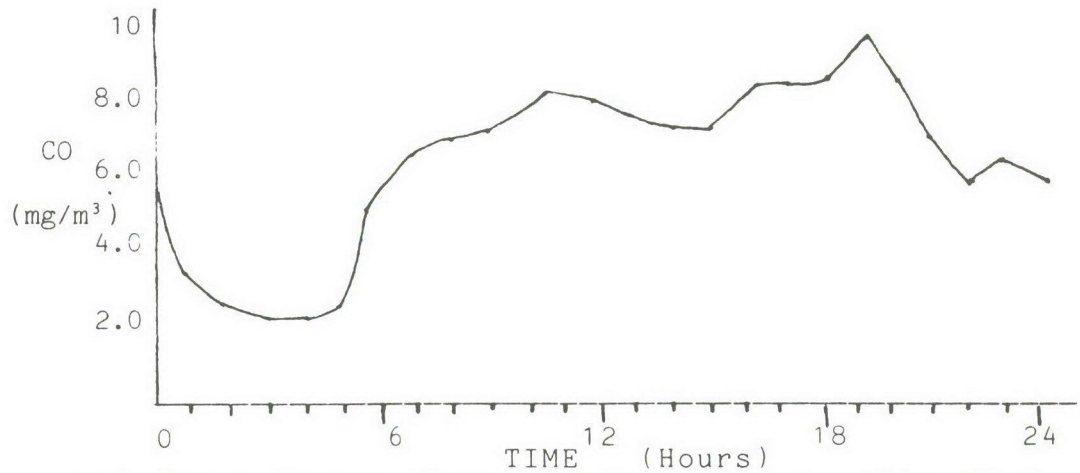
a. WHO Air Quality Criteria for a 1 Hour average for CO is that a concentration of 35ppm (43mg/cu.m.) should not be exceeded.



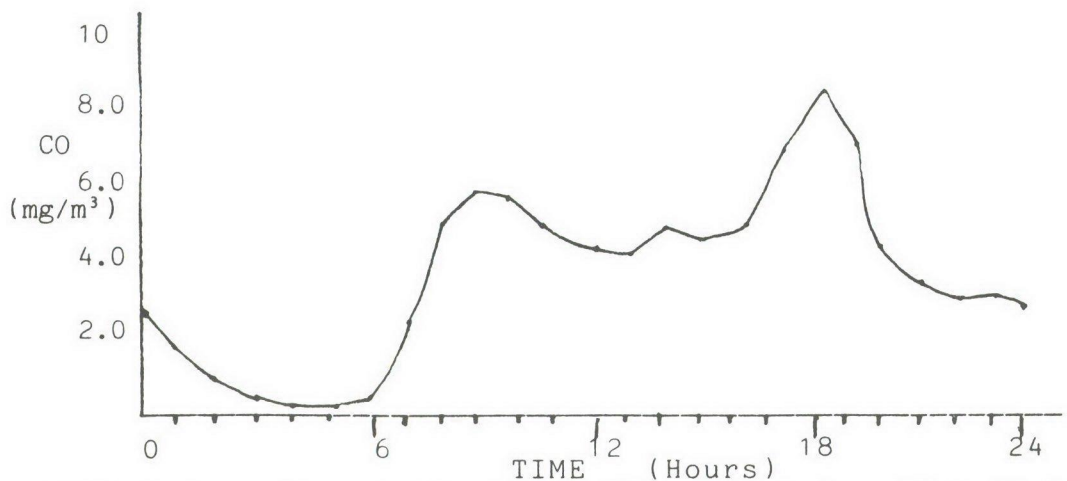
A5.7



(i) SPCC - Sydney City - Corner Market & George Streets



(ii) Crown Street (South of Oxford St.) - Site N° 9



(iii) Palmer Street (North of William St.) - Site N° 1

FIGURE 2 Mean CO One Hour Average Concentration Against Time of Day for 3 Continuous Monitoring Sites.



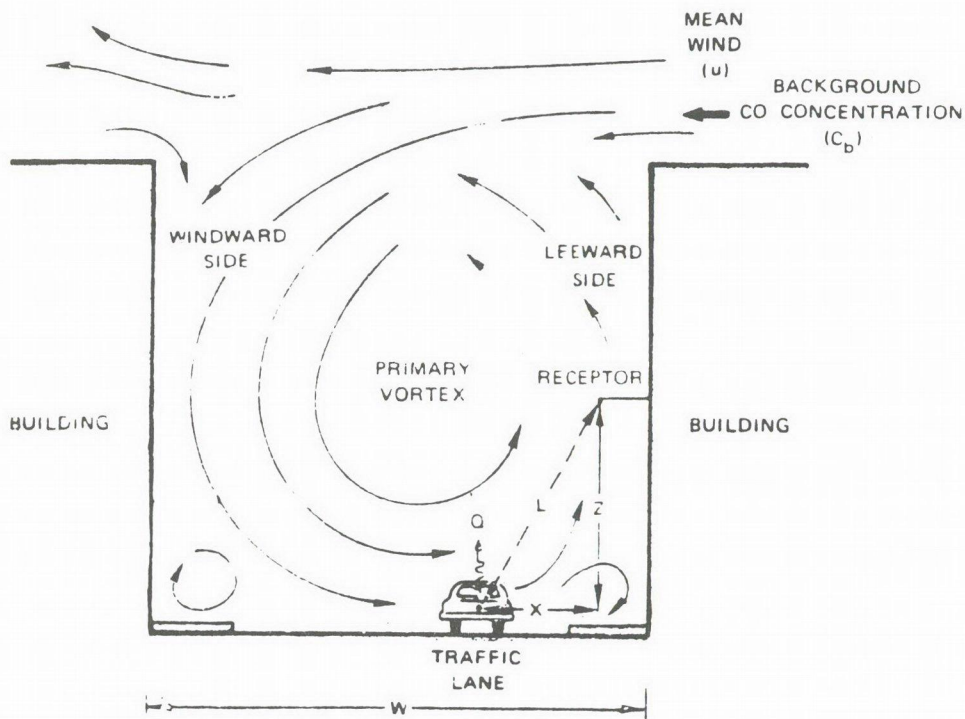


FIGURE 3 SCHEMATIC OF CROSS-STREET CIRCULATION BETWEEN BUILDINGS.

Source: Mancuso and Ludwig 1972

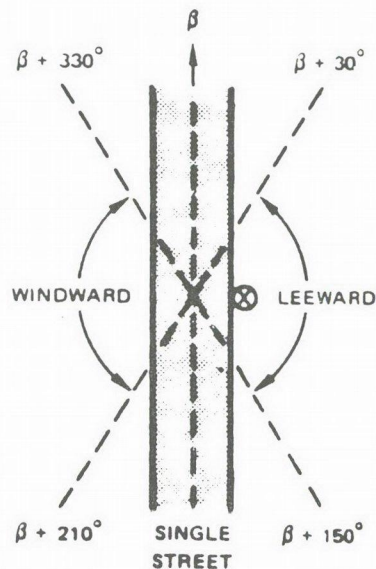


FIGURE 4 SPECIFICATION FOR LEEWARD AND WINDWARD CASES ON THE BASIS OF RECEPTOR LOCATION, STREET ORIENTATION AND WIND DIRECTION.

Source: Mancuso and Ludwig 1972



distribution sites, and produce results consistent with the urban canyon dispersion model.

#### 4. Prediction of Future Air Quality

##### Approach to Predicting Future Air Quality

With the exception of South Dowling Street and Moore Park Road all predictions of future air quality were made using the USEPA APRAC-1A canyon model.

Concentrations were calculated for a height of 2m above the kerbside on the lee side of the street.

An above canopy speed of 0.5 m/s was selected as being representative of light wind conditions that could exist during the a.m. and p.m. peak traffic periods.

Traffic volume inputs for prediction purposes were based on data supplied in Section 3.3 of the environmental impact statement.

Traffic speeds under existing (1984) conditions were derived from a Department of Main Roads floating car survey.

Future traffic speeds were based on the assumption that traffic speeds within the tunnel will be of the order of 50km/hr. It was assumed that this tunnel speed would control the speeds of the traffic in the streets feeding the tunnel.

Tables 1 and 2 of Appendix 4 in the air quality Working Paper (Jackson Teece Chesterman Willis & Partners 1985) present the traffic volumes and speeds used in predicting future air quality (CO) levels.

For South Dowling Street and Moore Park Road the CO concentrations were calculated as the average of the APRAC-1A and HIWAY II models. This was because these streets have buildings on only one side. A wind speed of 0.2m/s and stable conditions were used as inputs to the HIWAY II model.

The Hot Version of the SPCC emission equation was used to predict mass emission of CO generated by future traffic volumes.

#### 5. Results and Discussion

Full details of the predicted changes in air quality are presented in Tables 1 and 2, Appendix 4, of the air quality Working Paper in Jackson Teece Chesterman Willis & Partners (1985).

The main effects on air quality of the proposed scheme are summarised in Tables 4(a-c). Each table lists two groups:

streets in which air quality will improve  
streets where air quality will deteriorate.

Streets where air quality will remain unchanged have not been listed.

These tables give predicted concentrations based on 1984 traffic data, and the predicted concentrations at each stage of the proposed scheme, for both a.m. and p.m. peak traffic periods.

The results from the dispersion model using 1984 data predicted trends in CO concentrations that agreed with measured spatial distribution data collected during the 1985 monitoring programme. However although the overall pattern is good the model is extremely sensitive to traffic speed and wind speeds above the top of the urban street canyon.

##### Stage 1 - Table 4(a)

The impact of Stage 1 on air quality in the region will be limited to a few streets only. Concentrations of CO will decrease significantly in Plunkett Street and Bourke Street (north of Stanley Street). Concentrations will also decrease in Crown Street (north of William street) since it is proposed that right-turn traffic from William Street be diverted into Riley Street. This change in traffic routing will result in a significant increase in CO concentrations in Riley Street since this road currently carries only local traffic. While these predicted values are still low compared with the WHO one hour criteria for CO,



of 43mg(cu.m.), they will be higher if good traffic flow in Riley Street is not achieved. \*

#### Stage 2 - Table 4(b)

For Stage 2 it is proposed that southbound traffic will use the tunnel and northbound traffic will flow along Bourke Street (north of Oxford Street) and Palmer Street (north of Stanley Street) instead of Crown Street. Concentrations in these streets will be similar to the existing situation in Crown Street, north of Oxford Street. Therefore, air quality in Bourke Street north of Taylor Square should improve significantly with the completion of Stage 2.

Crown Street and Bourke Street (south of Taylor Square) are likely to change from a major one-way traffic route to two-way local traffic. This will result in a significant improvement in air quality.

Air quality will also improve in Albion Street when access to Flinders Street is partially closed. Concentrations of CO will also be reduced in Flinders Street because most southbound traffic will use the tunnel.

The two streets adversely affected by Stage 2 are Campbell Street and South Dowling Street. Campbell Street is currently one-way, but will change to two-way traffic in Stage 2 of the scheme when it becomes the access route to Flinders Street after the closure of Albion Street. While concentrations should decrease slightly during the morning peak period they will be double the 1984 values in the afternoon.

Upon completion of the southbound tunnel and the (possible) change from one-way to two-way of Bourke and Crown Streets (south of Oxford Street), South Dowling Street will become the major north-south traffic route in the area. As a result CO concentrations will increase and could approach the WHO one hour criteria during the morning peak period. However, air quality on the western side of South Dowling Street would not be adversely affected if the major traffic bearing lanes were relocated some 10m. east of their current position (see Section 5.1.4 of the environmental impact statement).

#### Stage 3 - Table 4(c)

The most significant improvement to air quality in the region will occur when Stage 3 of the scheme is completed. Table 4(c) lists the streets that will benefit from major decreases in traffic volumes upon completion of the northbound tunnel. These beneficial effects will have the greatest impact in Crown and Bourke Streets which are likely to become two-way local traffic routes. There should also be some improvement in air quality along Oxford and Flinders Streets as a result of reduced traffic volumes and an increase in traffic speeds.

No predictions have been made for CO concentrations in the vicinity of tunnel portals because data on the preferred method of ventilating the tunnels is not yet available. However, it is likely that the Stage 2 and Stage 3 tunnels will be vented through one or more exhaust towers located along the route. The location and height of these ventilation stations and towers will be determined during the detailed feasibility study, after consideration of likely pollutant levels within the tunnel, prevailing meteorological conditions, local environmental conditions and available sites. These towers will exhaust the polluted air from the tunnels to the atmosphere above nearby buildings to facilitate safe pollution levels for the neighbourhood.

In particular, detailed design will take account of the potential for light winds and stable atmosphere to affect the dispersion of CO in Palmer Street where the northern portals of both tunnels emerge. It is less likely to be a problem at the southern ends of the tunnels, since north and southbound tunnel entrances are half a kilometre apart and atmospheric dispersion is probably more efficient.

The design of the ventilation system will ensure that the air quality within the tunnels conforms to internationally accepted standards. These permit higher concentrations of CO than currently exist on surface streets because of the short time drivers spend in the tunnel and because tunnel congestion is likely to be infrequent.

\* The redirection of northbound traffic from William Street from Riley Street to Crown and Palmer Streets in Stage 2 will allow Riley Street to revert to its present condition. The benefits to Crown and Palmer Streets north of William Street will be proportionately reduced.



TABLE 4(a) SUMMARY OF EFFECTS ON AIR QUALITY OF STAGE 1

		a.m. Peak <sup>a</sup> Concentrations (mg/cu.m.) 1984                      Stage 1		p.m. Peak <sup>a</sup> Concentrations (mg/cu.m.) 1984                      Stage 1	
<hr/>					
(a)	<b>Beneficial Effect</b>				
	Bourke Street (north of William Street)	10.2	0.4	17.3	0.4
	Bourke Street (William to Stanley Street)	4.4	0.4	4.4	0.4
	Crown Street (north of William Street)	18.6	6.9	26.0	11.1
	Plunkett Street	11.6	2.5	16.5	2.2
(b)	<b>Adverse Effect</b>				
	Riley Street (north of William Street)	0.9	7.1	0.9	4.8

a. WHO Air Quality Criteria for one hour average: 43mg/cu.m.



TABLE 4(b) SUMMARY OF EFFECTS ON AIR QUALITY OF STAGE 2<sup>a</sup>

		a.m. Peak <sup>b</sup> Concentrations (mg/cu.m.) 1984                      Stage 2		p.m. Peak <sup>b</sup> Concentrations (mg/cu.m.) 1984                      Stage 2	
<hr/>					
(a)	Beneficial Effect				
	Crown Street (north of William Street)	18.6	1.9	26.0	1.9
	Crown Street (Oxford to William Street)	10.6	2.1	12.4	2.1
	Crown and Baptist Street (south of Drivers Triangle)	10.6	2.1	19.6	2.1
	Bourke Street (William to Oxford Street)	31.8	10.6	29.3	12.4
	Bourke Street (south of Oxford Street)	5.0	1.3	6.0	1.3
	Flinders Street (Taylor Square - Drivers Triangle)	27.6	15.7	29.7	15.1
	Albion Street	3.9	0.9	12.7	0.9
(b)	Adverse Effect				
	Campbell Street	10.9	6.7	9.9	21.1
	Riley Street <sup>c</sup> (north of William Street)	0.9	16.9	0.9	11.9
	South Dowling Street (Drivers Triangle to Cleveland Street)	16.3	25.0	14.1	21.3
	South Dowling Street (Cleveland to Crescent Street)	18.1	41.0	15.0	27.1

- a. Where beneficial or adverse impacts from Stage 1 remain the same, the effects are not restated.
- b. WHO Air Quality Criteria for one hour average: 43mg/cu.m.
- c. The reduction of northbound traffic from William Street from Riley Street to Crown and Palmer Streets in Stages 2 and 3 will eliminate this adverse effect. The beneficial effects on Crown Street and Palmer Street north of William Street (see above and Table 4(c)) will be proportionately reduced.



TABLE 4(c) SUMMARY OF EFFECTS ON AIR QUALITY OF STAGE 3<sup>a</sup>

	a.m. Peak <sup>b</sup> Concentrations (mg/cu.m.)		p.m. Peak <sup>b</sup> Concentrations (mg/cu.m.)	
	1984	Stage 3	1984	Stage 3
<b>(a) Beneficial Effect<sup>b</sup></b>				
Palmer Street (south of William Street)	10.0	2.1	12.3	2.1
Palmer Street <sup>c</sup> (north of William Street)	24.2	13.6	30.3	10.2
Bourke Street (William to Oxford Street)	31.8	1.3	29.3	1.3
Flinders Street (Albion Street to Taylor Square)	20.9	13.3	19.6	13.4
Oxford Street (Whitlam - Taylor Square)	39.4	22.8	28.7	19.2

- a. Where beneficial or adverse impacts from Stages 1 and 2 remain the same, the effects are not restated.
- b. WHO Air Quality Criteria for one hour average: 43mg/cu.m.
- c. See footnote c. to Table 4(b).



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