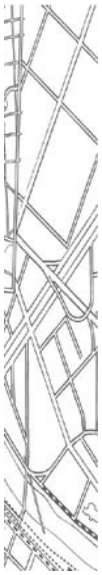
APPENDIX 5.
REVISED TRANSPORT CONCEPT PLAN



Transport Report

Barangaroo - Modified Concept Plan

July 2008

Prepared for

Sydney Harbour Foreshore Authority

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Contents

Executive Summary

The purpose of this report is to support the Sydney Harbour Foreshore Authority's application for a modification of the existing approved Concept Plan for Barangaroo. The existing approval is for a mixed use development of approximately 400,000 square metres of gross floorspace in Sydney's Central Business District. This Modified Concept Plan application would increase the commercial floorspace by 120,000 square metres.

Strategic Context

Government is committed to expanding transit accessibility to Sydney CBD. It is also committed to fostering further growth of the CBD, as the major employment concentration in Sydney, which currently supports many of the global city functions.

Metro rail and heavy rail improvements will boost system capacity and the proportion of Sydney that is readily accessible to the CBD by transit. These initiatives will be supported through improved bus networks, bus priority measures and planning processes.

The Approved Concept Plan responded to elements of the prevailing strategic context at the time it was prepared. Since then, the strategic context has advanced considerably with the announcement of the North West Metro. While still proposing the same overall strategy, the Modified Concept Plan application further supports Government policy through additional commercial employment within the site and ongoing application of a restricted parking policy.

Existing Conditions

Modes of Travel

Currently the Central Business District of Sydney achieves the following approximate mode splits for the journey to work (JTW):

Train	-	48%
Bus	-	22%
Ferry & Light Rail	-	2%
Car (Driver + Passenger)	-	19%
Other (walk/cycle/ferry etc)		9%

Road System

The principle vehicular access roads for the Barangaroo development are Sussex Street/Hickson Road and Kent/York Streets.

Hickson Road currently carries some 700 to 800 vehicles per hour during peak periods of a weekday.

Prior to recent cessation of activity, the port operation on the site generated intermittent peaks of traffic, with a surveyed peak of some 40 truck movements per hour.

Key local intersections are modelled as having reasonable levels of operation, however queuing back from the Harbour Bridge approach constrains traffic operating conditions locally in peak periods.

The overseas passenger terminal currently generates intermittent traffic with a peak surveyed (for a visit by the Pacific Sun) of some 220 vehicle movements per hour.

Parking

A study of parking supply in the area indicates some 500 on-street spaces within some 250 metres and 1160 within 500 metres of Barangaroo. Of these some 270 spaces in Hickson Road are all-day (10p) whilst the remainder are generally short-stay (meter controlled).

There are some 800 off-street public parking spaces within 250 metres and some 1,000 off-street spaces within 500 metres of Barangaroo.

Public Transport

The southern part of the site is approximately 400m from Wynyard Station and Bus Interchange and is located near the ferry wharf at King Street. However, there is a considerable difference in grade between the site and Wynyard. The site is not currently directly served by bus services.

Walking and Cycling

There are low levels of current pedestrian and cycle activity adjacent to the site and the site is currently closed to public access. The site is flat which is conducive for pedestrian and cycle movement within the site but there is a considerable gradient to other parts of the CBD and to Wynyard.

The City of Sydney Council has prepared a cycle plan for the CBD. The further development and testing of a number of measures outlined in that plan is subject to collaborative work between the City of Sydney and State Government agencies.

Concept Plan

Uses

The Approved Concept Plan included a total of some 400,000 square metres, comprising commercial and mixed use space, two hotels, public buildings, some 75,000m² of residential space and extensive foreshore parklands. The current application for modification of the Concept Plan encompasses an increase of 120,000 square metres of commercial floorspace. These indicative development floorspace area figures have been used as the basis for estimating car parking requirements and initial traffic generation estimates.

These uses (when fully developed) under the Modification Application are likely to result in an additional 6,000 workers on the site, over the Approved Concept Plan. Overall, the complete scheme would see a total of some 22,000 workers and up to 1,500 residents.

The majority of workers would be located at the southern end of the site with nearly 90% within 300 metres of the site's southern boundary. This is an improvement in the relative accessibility of workers to existing public transport facilities and services over the Approved Concept Plan.

Road Network

It is proposed that Hickson Road provide a collector level road function and provide for bus (and potentially light rail) access to Barangaroo.

A new north-south local road (Globe Street) is proposed to provide local access and serve cyclists.

A number of east-west roads are proposed to link Hickson Road and Globe Street and would provide service vehicle access to individual development sites.

Traffic Effects

A restrictive parking supply policy is proposed for the commercial components of the development. Including this policy, the total traffic generation of full development of the Approved Concept Plan plus the additional 120,000 sqm of floorspace described in this Modified Concept Plan application is estimated to be some 708 to 750 vehicles/hour (in + out) in peak periods. This is an increase of some 206 to 234 vehicles/hour (in + out) in peak periods from the Approved Concept Plan.

Local traffic modelling indicates that key intersections would not witness significant changes in levels of operation apart from the Hickson Road – Napoleon Street intersection. Traffic modelling indicates that this intersection would need to be signalised to provide a reasonable level of traffic operation.

The wider traffic implications of the Barangaroo development have been tested in the RTA's PARAMICS micro-simulation model of the CBD.

Public Transport Services

The Barangaroo development will facilitate new direct pedestrian connections to rail and bus services at Wynyard.

A Barangaroo Bus Service Strategy has been prepared in consultation with the Ministry of Transport and RTA. This proposes selective amendments to the CBD's existing bus service network, to bring high frequency services into the site.

The proposed Barangaroo development will strengthen the potential demand for tourist and commuter trips along a western corridor. The Barangaroo development will not preclude the provision of a light rail service on Hickson Road.

The existing King Street Wharf is seen as the source of likely ferry commuters to Barangaroo. There is potential that Government might designate a second ferry hub at East Darling Harbour – either as an expanded facility based on King Street Wharf, or locating it at Barangaroo. The Government is yet to formulate a position on this matter pending its response to the Walker Inquiry.

Parking Policy

To minimise site traffic generation in peak periods it is proposed that commercial development on site parking supply be limited to 1 space per 600m² GFA. For residential and other land use it is proposed to adopt Sydney City Council's parking rates prevailing in 2007.

It is also proposed that existing on-street all day parking on Hickson Road be made short-term only.

One public car park (of some 300 spaces) is proposed to the north of the site. Its traffic generation has been included in the local intersection traffic modelling conducted as part of this study.

Pedestrian Linkages

The Barangaroo development provides for a number of new pedestrian connections to other parts of the CBD particularly to create safe and convenient connections to Wynyard Station. The importance of these links cannot be underestimated.

Internally the development provides for a generous foreshore walkway as well as a network of north-south and east-west connections. The foreshore walkway will substantially complete the promenade from ANZAC Bridge through to Woolloomooloo.

Cycle Facilities

Barangaroo's proposed cycle routes are along Napoleon Street – Globe Street – Parkland – Hickson Road as well as shared bike/pedestrian route along the foreshore.

Individual buildings would be required to provide bicycle parking and shower facilities and it is proposed that bike parking will be provided within the public domain.

1. Introduction

The purpose of this report is to support the Sydney Harbour Foreshore Authority's (Foreshore Authority) application for a modification of the existing approved Concept Plan for Barangaroo. It does this by adjusting transport-related parameters to reflect the new scheme and comparing them with the approved scheme.

Masson Wilson Twiney Pty Ltd (MWT) was commissioned by the Foreshore Authority in 2006 to prepare the Transport Concept Plan as part of the Authority's Concept Plan application. Following approval of the Concept Plan in February 2007, the development proposal for Barangaroo has evolved, and the Modified Concept Plan application now proposes an additional 120,000sqm of commercial space.

This report is structured through the following chapters:

- Chapter 2 – provides an overview and a strategic transport context
- Chapter 3 – reviews existing transport conditions and services
- Chapter 4 – describes the transport implications of the Modified Concept Plan application.

Appended are car parking considerations and a study of trip generation.

The work described by this report considers the Modified Concept Plan application against the Approved Concept Plan. It also describes and assesses changes to government policy and plans, where these have changed since preparation of the Concept Plan in 2006.

It is stressed that transport plans given in this report are concepts prepared by MWT for consideration by relevant agencies and do not represent Government policy.

The transport approach to support Barangaroo is to ensure that transit services are provided to the site and that good pedestrian links are provided to nearby heavy rail and bus services at Wynyard and to other activities in the CBD. It is necessary that traffic generated by the site is limited to an amount that could be accommodated by the CBD road network. A necessary complement to this approach is a stringent car

parking policy and high mode splits to public transport, which formed part of the Approved Concept Plan.

2. Strategic Transport Context

2.1 Preamble

This chapter describes Barangaroo's strategic transport context with reference to selected State Government policies and proposals by the City of Sydney. The policies provide a high level description of the way in which transport and land use is anticipated to evolve within Sydney. The discussion then considers individual projects and improvements and their likely direct effects on transport conditions at Barangaroo.

2.2 Metropolitan Strategy

The NSW Government released the Metropolitan Strategy in December 2005. This strategy seeks to guide Sydney's growth in a sustainable manner.

One of main focuses of the Metropolitan Strategy is to encourage employment in centres with good transport access. The Sydney CBD is the prime Global City identified in the strategy and this anchors the "*Global Economic Corridor*" (also known as the *Global Arc*), which is a corridor with a concentration of jobs and activities in centres from North Sydney to Macquarie Park and from the Sydney CBD to Sydney Airport and Port Botany. The Global Economic Corridor currently contains approximately 40% of Sydney's jobs and 75% of Sydney's information technology and telecommunications jobs (refer to Metropolitan Strategy). Approximately 30% of Sydney's new jobs are anticipated to locate to this corridor.

The transport section of the Metropolitan Strategy identifies potential public transport projects to improve the accessibility of the Global Economic Corridor.

Other measures in the Metropolitan Strategy are discussed below.

2.3 Urban Transport Statement

In November 2006, the Premier of NSW released the Government's Urban Transport Statement (UTS) - a $660 million package of new and accelerated initiatives to address Sydney's present and future transport needs.

It outlines the Government's priorities and current and future investment in the key areas of road and rail. Some of the major initiatives include:

- Rail Clearways program (see below)
- Fast tracking of North West Rail Link
- "Pinch point" Road Network Strategy
- Victoria Road upgrade
- CBD bus strategy

The Urban Transport Statement (UTS) raises the possibility of a light rail system serving Barangaroo to Wynyard. The Government position as outlined in the UTS is not to support any light rail proposal along the main CBD corridors including George and Castlereagh Streets.

2.4 Walker Inquiry

The Special Commission of Inquiry into Sydney Ferries by Bret Walker SC was released in October 2007. The Inquiry makes a number of major recommendations to changing ferry operations and servicing for Sydney. These recommendations may impact on options for Barangaroo pending the Government's response.

This Inquiry flagged the possible need for a second CBD ferry hub (in addition to Circular Quay). However, the timeframe for this is not determined. This hub could be located in East Darling Harbour at an expanded King Street Wharf or a new facility at Barangaroo. A second hub would provide capacity relief for Circular Quay.

The Government is yet to formulate a position on the Walker Inquiry recommendations.

2.5 Section117 Direction #3.4: Integration of Land Use and Transport

New Section 117 directions commenced in July 2007, with direction 3.4 *Integrating land use and transport* seeking to ensure that changes in the use of land meet the following objectives:

- Improving access to housing, jobs and services by walking, cycling and public transport
- Increasing the choice of available transport and reducing car dependence
- Reducing travel demand including the number of trips generated by development and the distances travelled, especially by car
- Supporting the efficient and viable operation of public transport services.

The direction applies to all councils and wherever a draft LEP creates, removes or alters a zone or a provision relating to urban land.

A consequence of this S117 direction is that the location of zones should include:

- provisions that give effect to and are consistent with the aims, objectives and principles of the following:
    - *Improving transport choice*

- *The Right Place for Business and Services*[1]

Should a zone or provision not meet these requirements, then further justification is required.

Improving transport choice – guidelines for planning and development

These guidelines provide a rationale for the policy and a number of measures to achieve these objectives.

- Improving transport choice
- Manage travel demand
- Role of land use planning

The guideline sets out 10 accessible development principles:

1. Concentrate development in centres
2. Mixed uses in centres
3. Align centres within corridors
4. Link public transport with land use strategies
5. Connect streets
6. Improve pedestrian access
7. Improve cycle access
8. Manage parking supply
9. Improve road management
10. Implement good urban design

The Right Place for Business and Services – planning policy

The aims of this policy are to encourage a network of vibrant, accessible mixed use centres which are closely aligned with and accessible by public transport, walking and cycling. This to ensure that:

- There are development opportunities in centres for businesses and services
- Community investment in infrastructure is protected
- Investor confidence is maintained

The planning objectives of the policy include:

- Locate trip-generating development which provides important services in places that:
  - Help reduce the reliance on cars and moderate the demand for car travel
  - Encourage multi-purpose trips
  - Encourage people to travel on public transport, walk or cycle
  - Provide people with equitable and efficient access
- Minimise dispersed trip-generating development that can only be accessed by cars

[1] *Improving transport choice, guidelines for planning and development*, DUAP, 2001 and *The right place for business and services – planning policy*, DUAP, 2001

- Ensure a network of viable, mixed use centres closely aligned with the public transport system to accommodate and create opportunities for business growth and service delivery
- Protect and maximise community investment in centres, in transport infrastructure and facilities
- Encourage continuing private and public investment in centres, and ensure that they are well designed, managed and maintained
- Foster growth, competition, innovation and investment confidence in centres, especially in the retail and entertainment sectors, through consistent and responsive decision making

2.6 City of Sydney Vision 2030

In April 2008, the City of Sydney released their "Sustainable Sydney 2030 Vision". Sustainable Sydney 2030 is the City of Sydney's vision for the sustainable development of the City through to 2030 and beyond. The vision covers a number of long term themes, with respect to transport some of its major recommendations include:

- CBD light rail loop serving Barangaroo
- Grounding of Western Distributor
- New pedestrian boulevard linking Central, Town Hall and Circular Quay

It should be noted that the State Government does not endorse all aspects of the 2030 Vision.

2.7 Specific projects and programs

2.7.1 Metro Rail

On 18 March 2008, the Premier of NSW announced a new North West Metro for Sydney linking St James (Sydney CBD) to Rouse Hill. A station location will be within walking distance of Barangaroo, providing interchange with existing rail and bus services at Wynyard rail precinct.

The new link will:

- o be separate from the existing road and rail network;
- o be fast, frequent and efficient carrying large numbers of people reducing commute times on busy corridors by potentially up to 50 per cent;
- o will deliver an independent mode of transport adding significant additional capacity.

This rail link is expected to be completed by 2017.

2.7.2 Heavy Rail

The previously announced Metropolitan Rail Expansion Program, including the CBD Rail Link has two potential alignments through the CBD, a MetroPitt alignment, predominantly under Pitt Street and a second western alignment, MetroWest via

Wynyard and west of Town Hall. These two corridors have been reserved under SEPP (Infrastructure) 2007.

The recent announcement of the North West Metro for Sydney does not preclude the use of these North South alignments for future heavy or metro rail options.

Clearways Project – this is a $1.8bn programme to build a number of incremental works to assist to sectorise the current rail system. This will result in more reliable rail services. It should also permit an increase in train frequency and hence capacity. This program is currently well under way, and is expected to be complete around 2012.

The Epping to Chatswood Rail Link will link the Main North Line at Epping with the North Shore Line at Chatswood when it opens in late 2008. While the link will provide additional train operating flexibility, it will also permit higher service frequencies on the North Shore Line into the CBD and free up some capacity on the Main Western Line. This should boost the train capacity at Wynyard Station, potentially reducing passenger waiting times on the platforms.

Upgrading of Sydney passenger rail car fleet, including introduction of eight-car sets where six-car sets are currently used, will provide marginal capacity relief.

2.7.3 CBD Bus Strategy

As part of the UTS, the Government announced a CBD Bus Strategy. The strategy aims to improve bus travel times in the CBD.

The improvements to be introduced include:

- new CBD bus lanes on Druitt, Liverpool, Park, Elizabeth and Chalmers Streets; and
- operational improvements near Wynyard, saving time for north-east and north-west region bus commuters.

The UTS includes more than $20 million to implement a two stage plan which will extend the number of bus lanes, rationalise bus lane hours, introduce a new Mid-City Interchange Precinct in Park Street and a new bus lay-over in the Domain Car park.

2.7.4 Strategic bus corridors

Forty-three Strategic Bus Corridors are planned for Sydney. The main benefits of these will be:

- Improve bus service reliability
- Improve bus service running times
- Focus for roadside infrastructure (e.g., shelters, information, pedestrian facilities)

Approximately a dozen of these corridors will anchor in the CBD, and should result in improved reliability for services.

Elements of a number of these corridors are already in place, and will be progressively expanded.

2.7.5 *Bus Reforms, Bus Planning Process & Bus System Improvements*

Basis of reform

A major review of the industry, the Unsworth Review[2], was released by the Government in March 2004, along with a commitment to implement many of its recommendations[3].

Unsworth made a number of recommendations for fundamental reform of the way bus services are delivered in NSW. Many of these are enabling measures that will facilitate and enhance the introduction of 'integrated' networks. The enabling measures include:

- Consolidation of 79 metropolitan contract areas into 15 contract regions, falling to 8 contract regions by 2012;
- Harmonisation of fares, so that bus users in Sydney pay the same fare for the same distance, whether they use private or public buses;
- A new bus service contract, with a different funding model for services and removal of territorial set-down and pick-up restrictions;
- Introduction of strategic bus corridors to provide a focus for networks, bus priority and other supporting infrastructure (e.g., shelters at stops).

New service planning – improved services

The objective of this reform is to support a new approach to bus service planning. The Bus Service Planning Guidelines[4] set out a new approach to service planning which has an emphasis on achieving integrated networks and incorporate community consultation mechanisms. It also sets minimum service standards in terms of frequency, span and coverage.

In order to ensure the financial sustainability of bus services, the reforms seek to increase the number of boardings per kilometre of in-service running. This will result in better utilisation of existing resources.

Improved bus vehicle fleet

STA has indicated that the progressive introduction of low floor buses into its fleet is reducing passenger boarding times, in the order of 10%[5]. This is expected to assist to reduce bus dwell times and hence to improve system capacity and to reduce passengers' journey times.

These reforms are designed to provide improved accessibility by bus to major centres, including the CBD and rail nodes that serve the CBD. In conjunction with the UTS's

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[2] *Review of Bus Services in NSW*, Final Report, released 17 March 2004 – known as the Unsworth Review
[3] *NSW Government's response to the Final Report of the Unsworth Review*, 16 March 2004, sourced from www.transport.nsw.gov.au, June 2006
[4] *Service Planning Guidelines Sydney Contract Regions*, Ministry of Transport, 14 July 2004
[5] Pg 25 Submission to the Independent Pricing and Regulatory Tribunal on Bus Fares for 2006, Ministry of Transport

CBD Bus Strategy, discussed above, these reforms will substantially improve the attractiveness of bus as a mode.

2.8 Light rail

As stated in the UTS, the potential use of the western CBD corridor (west of George Street) to serve Barangaroo via Hickson Road remains an option, subject to technical and economic feasibility. The NSW Government does not, however, support a CBD light rail system using the main CBD corridors such as George Street or Castlereagh Street.

2.9 Implications for Barangaroo

2.9.1 Contextual implications

The recognition by the Metropolitan Strategy of Sydney as a Global City, with the CBD as the key foundation of Sydney's Global Economic Corridor results in policies and measures that seek to enhance and support the success of this key function. Barangaroo would provide a boost to employment and residential capacity within this corridor, well served by public transport.

At a more detailed level Barangaroo meets the requirements of the Integrated Land Use and Transport policy, especially with regard to transport access by non car modes, as well as in terms of strengthening the CBD as an activity centre.

The rail projects planned should result in:

- With regard to the CityRail network:
    - Higher frequencies and all eight-car sets reducing platform loadings in the morning and evening peak for a given station entry volume
    - Additional train frequency and capacity through Wynyard
- Additional train frequency and capacity through Wynyard, as well as elsewhere in the CityRail network plus the new Metro line station linked to Barangaroo via an attractive pedestrian walkway
- An expanded range of origins and destinations served by rail, primarily as a result of the North West Metro allowing direct linkages to the North West and Ryde area
- Improved rail reliability and overall frequency, resulting in reduced perceived travel and waiting times for passengers, thereby increasing rail's utility.

The North West Metro would:

- provide a new station at Wynyard, proximate to Barangaroo.
- increase the proportion of Sydney served by rail, with direct access to the CBD and specifically the Barangaroo site

The bus system improvements including the CBD Bus Strategy should:

- Improve service reliability, thereby reducing perceived cost of transit

- Improve bus boarding times and reduce bus dwell times at stops, especially outbound from the CBD in the PM peak
- Facilitate service changes and intermodal interchanges (e.g. bus-rail, ferry-bus, ferry-rail).

In addition, the new bus service contract regime and service planning process has introduced specific capacity requirements for services, to ensure that capacity is better matched to demand.

Public transport planning for Barangaroo should ensure that facilities can broadly support bus servicing under different potential bus network arrangements and be integrated with the CBD Bus Strategy. In the longer term, with the North West Metro, buses from North Western Sydney may be reduced thus alleviating CBD bus congestion, especially at Wynyard. The exact nature of these service changes is yet to be determined.

Allowing for a future light rail line on Hickson Road would assist to link the activity along the western side of the CBD into a unified transit corridor.

The possibility of a new ferry hub or wharf at Barangaroo as discussed within the Walker Inquiry presents a potential opportunity for direct ferry services to the site.

2.9.2 Modified Concept Plan application's response to context

Transport planning for Barangaroo responds to this strategic planning outlook, it also recognises that Sydney CBD is the heart of Sydney's global city functions and that increased activity within the CBD will occur and that transit services will expand to meet associated demands. It follows that the CBD's road space is limited and that new development must take advantage of the CBD's superior transit accessibility and minimise the generation of additional traffic.

To this end, the Concept Plan and Modified Concept Plan application seek to:

- Meet stringent mode split targets and provide access to existing public transport services;
- Provide access to public transport to and from the site whilst improving general conditions for others travelling to and from the CBD by public transport;
- Provide the opportunity for integration with envisaged future rail developments including the North West Metro Rail, future heavy rail or possibly Light Rail;
- Not preclude the opportunity to create a major multimodal transport interchange with ferry, rail and bus services; and
- Provide safe and accessible access to all, including the mobility impaired.

From a transport perspective the following themes emerge:

- The site is located in the CBD in close proximity to a broad range of services and activity opportunities, as part of the core of the Global Economic Corridor

- The CBD is well served by transit and future improvements to Sydney's transit networks and services (both rail and bus) are expected to improve transit conditions in the CBD
- The CBD road network is constrained by congestion during peak periods, and there are limited opportunities to readily expand road capacity
- A substantial set of bus routes depend on the reasonable function of the CBD's road network in order to provide a service
- Additional traffic generation by the site would be comparable with existing parts of the CBD, which is modest by Australian standards. However, this level of traffic generation would not be acceptable in terms of impacts on the road network. A more stringent approach to parking, as included in the Approved Concept Plan, is considered the only practical solution to achieving very high non-car mode shares and ensuring that car traffic generated by the site does not overload the CBD's road network

3. Existing Conditions

3.1 General

This chapter describes existing transport services and land use around Barangaroo. Access conditions to the site are described in general terms and for selected points within each block of development.

3.2 Role of transit in CBD

A feature of Sydney is the relatively high mode share to transit when compared with other Australian Capital Cities. The two charts below indicate that Sydney, as a whole, is an unusual Australian city when it comes to low car use and high transit use for the journey to work (JTW).

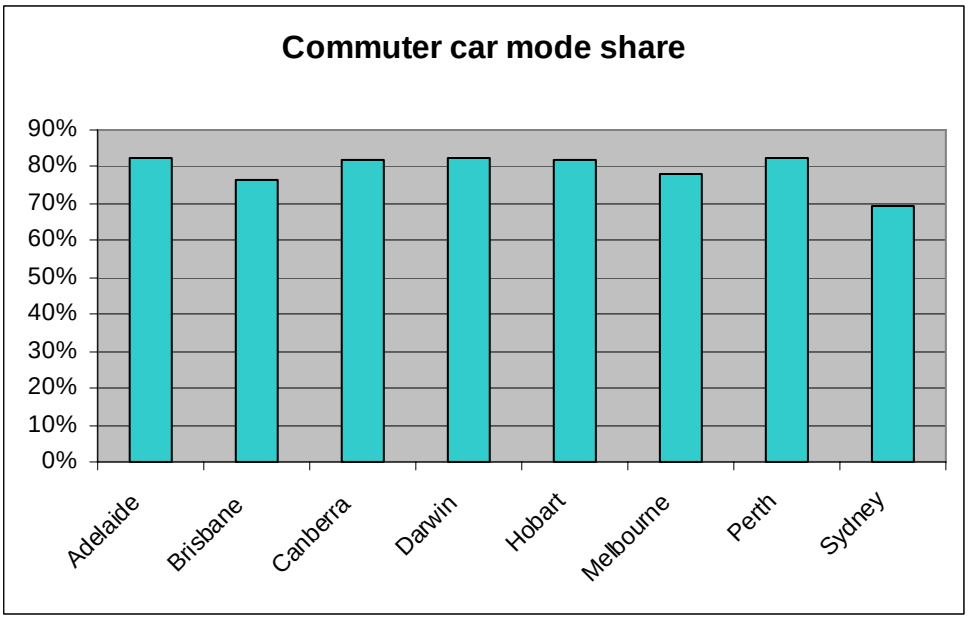

Chart 3.1 – Journey to work car mode share for Australia's Capital Cities (2006)

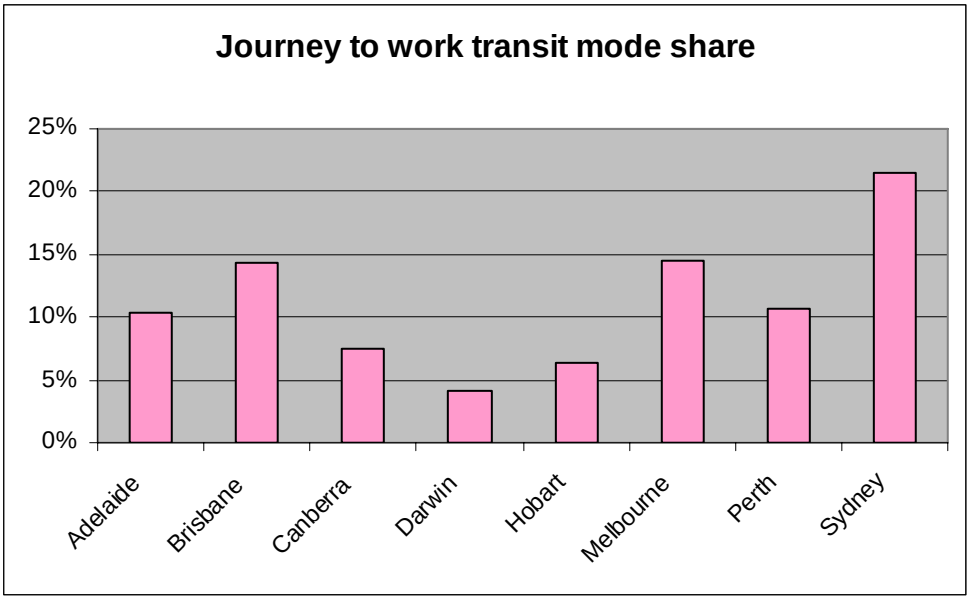

Chart 3.2 – Journey to work transit mode share for Australian Capital Cities (2006)

The Sydney CBD achieves a substantially higher mode share to transit than Sydney as a whole. The following chart compares mode shares for commuter trips with destinations within Sydney statistical division (SD), Inner Sydney statistical sub-division (SSD), and Sydney Inner statistical local area (SLA)[6].

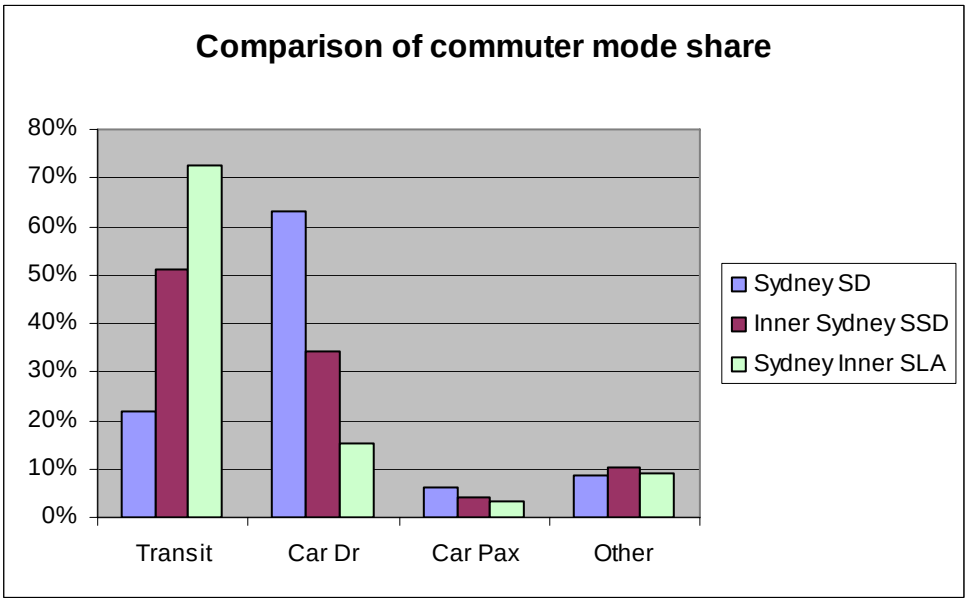

Chart 3.3 –Journey to work mode share for different units of Sydney (2006)

This analysis indicates that non-car modes win an overwhelming proportion of the travel market to the CBD. A prime reason for this is the level of peak transit service to the CBD which, from many origins in Sydney, is faster than car for travel to the CBD.

[6] Sydney statistical division – is Sydney metropolitan area, including Gosford, Wyong and Blue Mountains; Inner Sydney statistical sub-division comprises the local government areas of Sydney, Botany, Leichhardt and Marrickville; Sydney Inner statistical local area (2006 definition) approximates Sydney CBD.

3.3 The road system

The central Sydney road network is characterised by four to six lane two way arterial roads interconnected by sub-arterial roads which are in turn connected to local access roads. Figure 3.1 shows the CBD's road network.

The main internal circulating distributor CBD network consists of:

- Bridge Street;
- Elizabeth Street/College Street/Macquarie Street;
- Eddy Avenue/Rawson Place; and,
- George Street.

Within this network the key links are provided by the following paired one way streets:

- Pitt/Castlereagh Streets in the north-south direction for the CBD
- Market/Clarence/King Streets and Bathurst/Liverpool Streets in the east-west direction; and,
- Kent/York Streets in the north-south direction for circulation in the western sector of central Sydney.

The principal vehicular access roads to the Barangaroo development site from the rest of Sydney are Sussex Street and Kent/York Streets.

Hickson Road forms a northern extension of Sussex Street to the north of Napoleon Street. Hickson Road forms the eastern boundary for the Barangaroo development site and will be the principal road for direct vehicular access into the development. Hickson road continues in the northern direction to provide a perimeter road around Walsh Bay and Dawes Point feeding into George Street at The Rocks.

Sussex Street runs along the western side of the Sydney CBD, eventually terminating to the south at Hay Street in Haymarket. It is two way north of King Street but one way southbound south of King Street.

Local access into the area is provided as follows:

- from the CBD via Napoleon Street which is a moderately sloping, relatively wide road that intersects with Hickson Road at a large unsignalised T-intersection
- from Millers Point via Dalgety Road which connects Kent and Argyle Streets to Towns Place
- via George Street from the north east
- via Sussex Street/Kent Street/Napoleon Street from the southern CBD
- via Harbour Street, Wheat Road (through King Street Wharf) from the south
- via the east-west alignment of Napoleon Street and Margaret Street, which provides access to George Street.

Arterial access to Barangaroo is available as follows:

- from the west

CENTRAL SYDNEY ROAD NETWORK

BARANGAROO MODIFIED TCP

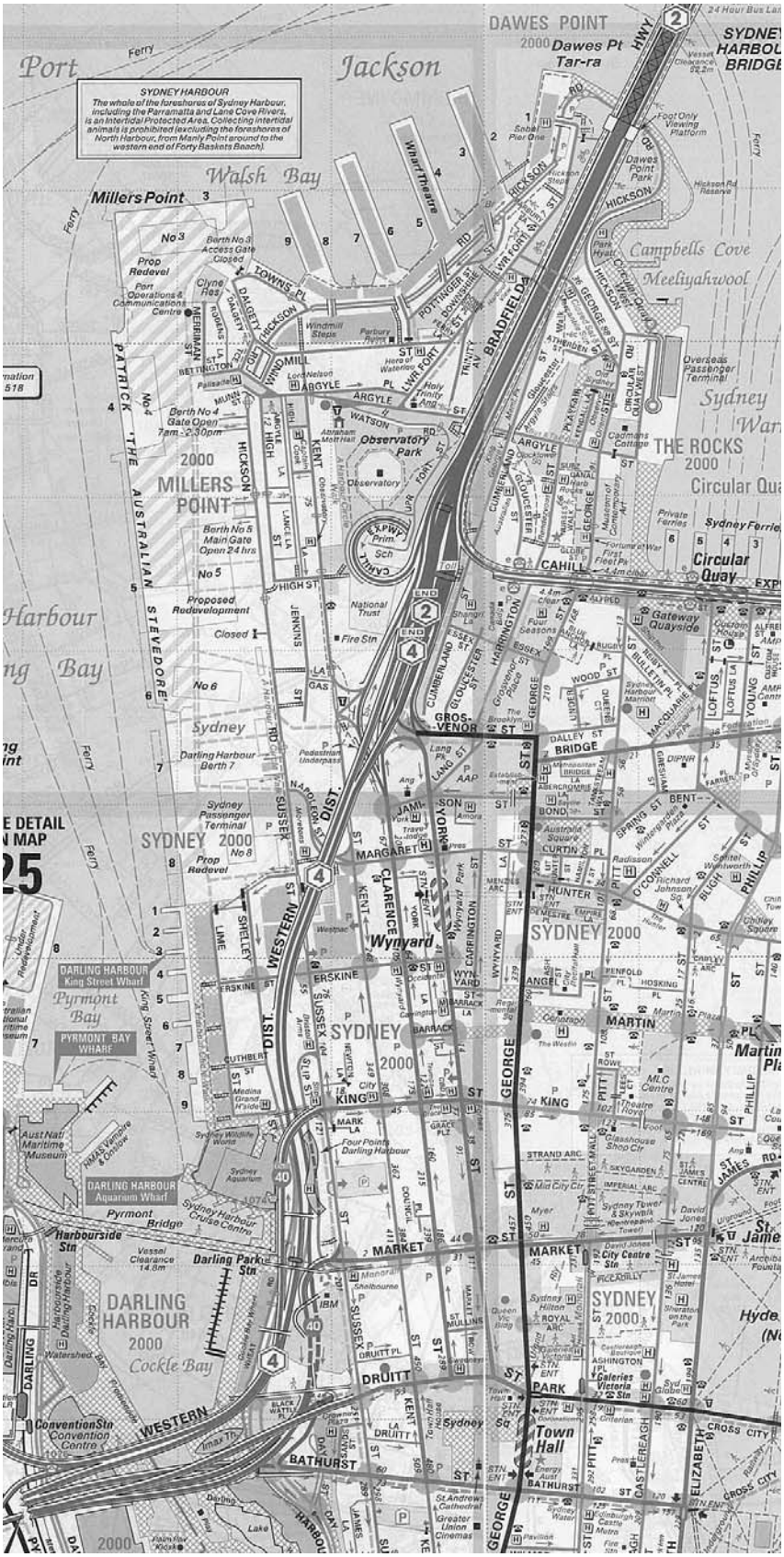

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Figure 3.1

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Date: 21 May 2008

- arrive via Western Distributor, offload via ramp to Sussex Street, northwards on Sussex Street, Hickson Road
- depart via Hickson Road, Sussex Street, Market Street ramp onto Western Distributor

- from the south
  - southern arterial route on Wattle Street/Harris Street then use same routes as for western traffic

- from the east
  - light vehicle traffic crosses the CBD on King, Market, Park and Bathurst Streets then uses Kent/Sussex/Harbour Streets
  - light vehicle traffic uses the Cross City Tunnel and then Sussex Street
  - heavy vehicle traffic uses Cleveland Street then southern arterial and Western Distributor as for western traffic

- from the north
  - Victoria Road traffic as for western traffic
  - Harbour Bridge light traffic uses York/Kent/Clarence Streets and Napoleon Street
  - Darling Harbour trucks are discouraged from using the Harbour Bridge.

3.4 Traffic flows

Hickson Road

To determine the existing volume and composition of traffic on Hickson Road an Automatic Traffic Counter (ATC) was installed to the north of Napoleon Street. The counter recorded vehicle volumes, speeds and classifications during the week commencing Monday 10 July 2006. The results are shown in Table 3-1.

The survey identified that the weekly average peak hour flows along Hickson Road were 710 and 765 two way movements during 8.00am to 9.00am and 5.00pm to 6.00pm respectively. The busiest hour during the week was Thursday 6.00pm to 7.00pm when 846 two way movements were recorded. Traffic flows during this time are likely to be associated with leisure purposes e.g., late night shopping, dining or theatre visits.

Traffic flows on Saturday were slightly lower than the weekday evening peak hour flows with a peak flow of 647 two way movements recorded on Saturday between 4.00pm and 5.00pm.

Vehicle classifications were also obtained from the ATC. This data was used to provide an estimate of the existing level of truck generation associated with wharf activity.

Traffic count classification was in accordance with the Austroads vehicle classification system. Class 6 and above represent the largest vehicle sizes which are articulated and have a minimum of three axles. It is these vehicle types which would be associated with current activity at the wharves. Similarly, classes 3 to 5 are two to four axle rigid vehicles. Some of these vehicle types would be associated with the operation of the wharves.

An analysis of the vehicle classification is presented in Table 3-1.

Table 3-1– Vehicle Classifications on Hickson Road during Peak Hour Periods by Day

Survey Day	Peak Hour Period	Class 1 & 2 (Car & short vehicle towing)	Class 3, 4 & 5 (2, 3 & 4 axle truck)	Class 6 to 12 (articulated vehicles greater than 3 axle)	Total
Monday 10 July '06	AM	681	47	26	754
	PM	716	53	6	775
Tuesday 11 July '06	AM	576	52	27	655
	PM	701	46	1	748
Wednesday 12 July '06	AM	593	41	39	673
	PM	698	55	0	753
Thursday 13 July '06	AM	671	49	31	751
	PM	725	56	1	782
Friday 14 July '06	AM	610	49	26	685
	PM	684	51	1	736
Saturday 15 July '06	AM	149	21	3	173
	PM	425	20	0	445
Sunday 16 July '06	AM	137	11	1	149
	PM	361	24	2	387

Note 1) Average AM peak hour is 8.00am to 9.00am
2) Average PM peak hour is 5.00pm to 6.00pm

All class 6 to 12 vehicles would be trucks associated with wharf activities. A small proportion of classes 3 to 5 would also be associated with wharf activities. For the purposes of this assessment it is assumed that 10% of these vehicles would be associated with the wharf activity.

Therefore it is calculated that the peak level of peak hour truck movements associated with the wharf operation during the survey week in 2006 was as follows:

- AM peak hour: 44 truck movements
- PM peak hour: 12 truck movements

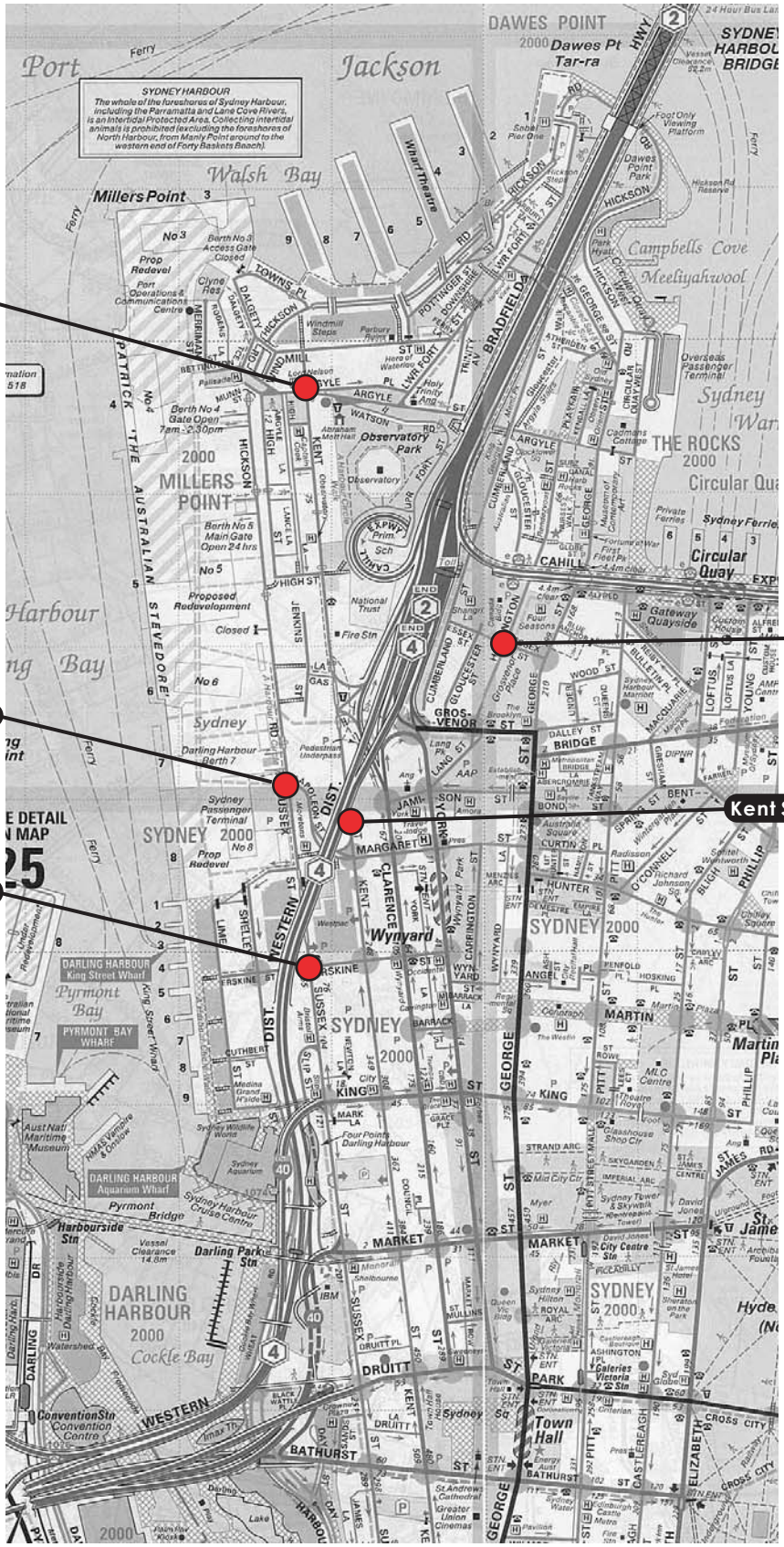
Intersection surveys

Manual classified turning counts were undertaken on Tuesday 18 July 2006 at the intersections shown on Figure 3.2 and listed below:

- Sussex Street / Erskine Street
- Sussex Street / Napoleon Street
- Kent Street / Napoleon Street / Margaret Street
- Kent Street / Argyle Street
- Harrington Street / Essex Street.

LOCATION OF MANUAL INTERSECTION COUNTS

BARANGAROO MODIFIED TCP



MASSON | WILSON | TWINEY

TRAFFIC AND TRANSPORT CONSULTANTS

Figure 3.2

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Date: 21 May 2008

The results identified that the morning peak hour at all intersections occurred between 8.00am and 9.00am whilst the evening peak hour occurred between 5.00pm and 6.00pm. A summary is provided in Table 3-2 .

Table 3-2 - Existing Peak Hour Traffic Volumes (veh/hr)

Road	Section	Existing Two-Way Peak Hour Traffic Flows	
		Weekday AM	Weekday PM
Hickson Road	N of Napoleon Street	662	752
Sussex Street	S of Napoleon Street	1,249	1,035
Napoleon Street	E of Hickson Road	883	685
Sussex Street	N of Erskine Street	1,445	1,150
Sussex Street	S of Erskine Street	1,538	1,534
Erskine Street	E of Sussex Street	878	798
Erskine Street	W of Sussex Street	939	468
Kent Street	N of Margaret Street	1,117	1,181
Kent Street	S of Margaret Street	878	1,048
Margaret Street	E of Kent Street	625	604
Margaret Street	W of Kent Street	606	671
York Street	S of Grosvenor Street	1,042	616
Grosvenor Street	E of York Street	1,317	1,170
Bradfield Highway Off ramp	W of Grosvenor Street	2,255	1,663
Argyle Street	E of Kent Street	437	465
Argyle Street	W of Kent Street	285	162
Kent Street	N of Argyle Street	84	74
Kent Street	S of Argyle Street	452	535

The level of existing intersection performance was modelled using the computer program SIDRA. SIDRA determines the average delay that vehicles encounter and the resultant level of service. SIDRA provides analysis of the operating conditions which can be compared to the performance criteria set out in Table 3-3.

SIDRA determines the average delay that vehicles encounter, the degree of saturation of the intersection, and the level of service. The degree of saturation, known as the x-value, is the ratio of the arrival rate of vehicles to the capacity of the approach. SIDRA provides analysis of the operating conditions which can be compared to the performance criteria set out in Table 3-3.

The existing performance of the intersection provides the baseline against which to compare future intersection operation under increased traffic demands resulting from the development proposal. included within the existing traffic volumes are forecast traffic flows associated with adjacent development (for further details see committed

development sub heading within this chapter) that was not operational at the time of the traffic surveys but which has planning approval and is likely to be constructed and operational in the near future.

Table 3-3 – Level of Service Criteria

Level of Service	Average Delay per Vehicle (secs/veh)	Signals & Roundabouts	Give Way & Stop Signs
A	less than 14	Good operation	Good operation
B	15 to 28	Good with acceptable delays & spare capacity	Acceptable delays & Spare capacity
C	29 to 42	Satisfactory	Satisfactory, but accident study required
D	43 to 56	Operating near capacity	Near capacity & accident study required
E	57 to 70	At capacity; at signals, incidents will cause excessive delays Roundabouts require other control mode	At capacity, requires other control mode
F	> 70	Extra capacity required	Extreme delay, traffic signals or other major treatment required

Adapted from RTA Guide to Traffic Generating Developments, 2002.

The results of the analysis are presented in Table 3-4.

Table 3-4 – Existing Intersection Performance

Intersection	Control	AM Peak		PM Peak	
		Ave. Delay (s/veh)	Level of Service	Ave. Delay (s/veh	Level of Service
Kent Street / Napoleon Street / Margaret Street	Signals	16.5	B	16.4	B
Sussex Street / Erskine Street	Signals	25.1	B	22.6	B
Sussex Street / Napoleon Street	Priority	27.9	B	15.9	B
York Street / Grosvenor Street / Bradfield Highway ramp	Signals	12.6	A	12.8	B

Avg Delay is over all movements at signals, and for the worst movement at priority and roundabouts

Table 3-4 shows that all the CBD intersections modelled in isolation perform at satisfactory levels of service. There is however a major difference between the modelled outputs and observed traffic conditions at the intersections. This is due to the input traffic flows which were those recorded by the traffic surveyors of the vehicles which passed a certain point during the survey period. This does not allow for the fact that demand may be constrained by capacity constraints at upstream or downstream intersections which have the effect of limiting the amount of vehicles that would pass through the intersection if were there no capacity constraints. It is also observed that queuing back from the Harbour Bridge approach constrains operating conditions locally during weekday peak periods.

Existing Wharf Traffic Generation

In January 2002 Masson Wilson Twiney produced the 'Darling Harbour Port Traffic Access Strategy Study' on behalf of Sydney Ports Corporation. The report examined the traffic implications of a masterplan for development of cargo handling and warehouse space and associated marine commercial uses at Wharves 3 to 8 at Darling Harbour.

Traffic surveys were undertaken to determine the existing level of vehicular activity associated with the operation of the wharves.

The results of the surveys identified that the greatest period of traffic generation occurred when a ship was at berth. It was estimated that 200 private vehicle movements per day were associated with this operation. It was further estimated that the combined number of vehicle movements associated with the Maritime control tower, Moores Wharf and the associated depot were 100 vehicles per day. The report did, however, identify that shift change times and berthing activities occur outside of the normal weekday morning and evening peak hour traffic periods and that these 300 daily vehicle movements would have little impact upon local traffic conditions.

The report identified that the number of truck visits associated with the operation of the existing wharf operations was in the region of 2,000 visits per week.

It should be noted that at the time of preparation of the Modified Concept Plan application, April 2008, port operations had ceased.

Wharf 8 Passenger Terminal

A traffic survey was undertaken on Monday 10 July 2006 when the Pacific Sun was berthed at Wharf 8 passenger terminal. The ship had a timetabled arrival at berth of 7.00am and departure time of 10.00am on the same day. The survey recorded the number of cars, trucks and coaches associated with the wharf between the hours of 6.00am to midday.

The busiest hour of vehicular activity was between 9.30am and 10.30am. During this time 384 two way movements were recorded with the following classifications:

Buses / coaches	: 5 inbound	11 outbound	16 two-way
Trucks	: 2 inbound	3 outbound	5 two-way
Cars	: 154 inbound	209 outbound	363 two-way

The vehicular activity recorded during the road network weekday morning peak hour was 220 two way movements with the following classifications:

Buses / coaches	: 5 inbound	4 outbound	9 two-way
Trucks	: 1 inbound	5 outbound	6 two-way
Cars	: 103 inbound	102 outbound	205 two-way

Over the survey (0600 – 1200hrs) period the passenger terminal generated: 72 bus/coaches, 40 truck trips, 1094 car trips – a total of 1206 vehicle trips.

The Modified Concept Plan application has been prepared on the basis that this facility is to be relocated elsewhere in Sydney. An assessment has however been made of the likely traffic impact of a passenger terminal (refer to Section 4.6.7).

Adjoining Developments

The adjacent King Street Wharf development has been largely constructed. However, there are two sites within the development area which have approval but which remain to be developed. The two sites known as sites 1 and 6 in combination will provide a hotel with associated function rooms and retail/commercial uses.

Consultants Transport and Traffic Planning Associates (TTPA) were responsible for the assessing the traffic impacts of the development. TTPA provided information relating to the likely traffic generation of these land uses which remain to be implemented. These additional traffic flows were included within the existing traffic flows.

Slight adjustments were made to the committed development flows used in the Concept Transport Plan for use in these assessments to account for the further occupation of elements of the King Street Wharf development.

3.5 Parking conditions

A study of parking supply indicates some 500 on-street spaces within 250m and some 1160 within 500 metres of the Barangaroo site. (More details on parking are in Appendix A).

Some 270 spaces in Hickson Road are 10p (all day) parking whilst the remainder is generally short stay meter controlled.

There are some 800 off-street public spaces within 250 metres and some 1,000 off-street spaces within 500 metres of Barangaroo.

On-street parking is observed to have high levels of utilisation during the day on weekdays with spare space generally only to be found in the north-west on local roads.

Off-street car parking is concentrated to the south and east of the Barangaroo site and has some spare capacity during weekdays.

3.6 Public transport

This section describes existing public transport services and land use relevant to Barangaroo. Access conditions to the site are described in general terms and for selected points within each block of proposed development.

3.6.1 Access Conditions to Public Transport

Walk distances, based on existing and proposed road network and on-site pedestrian links, between Barangaroo's commercial and residential development blocks and the nearest railway stations are summarised in Table 3-5, whilst Table 3-6 summarises walk times.

Table 3-5 - Access distances by foot from site blocks to public transport facilities (metres)

Block	Wynyard Railway Station	Town Hall Railway Station	Light Rail Pyrmont Bay Stop	Circular Quay Station	Argyle St Bus Terminus	King Street Wharf #3	Proposed On Site Ferry Wharf
1	381	1,339	1,379	1,350	1,163	245	410
2	369	1,369	1,409	1,230	1,053	350	400
3	499	1,494	1,534	1,100	943	460	285
4	604	1,594	1,634	1,150	838	545	120
5	734	1,714	1,754	1,257	713	680	265
6	834	1,844	1,884	1,277	549	780	405
7	954	1,969	2,009	1,284	549	900	500

Table 3-6 Access times by foot from site blocks to public transport facilities (minutes)

Block	Wynyard Railway Station	Town Hall Railway Station	Light Rail Pyrmont Bay Stop	Circular Quay Station	Argyle St Bus Terminus	King Street Wharf #3	Proposed On Site Ferry Wharf
1	4.8	16.7	17.2	16.9	14.5	3.1	5.1
2	4.6	17.1	17.6	15.4	13.2	4.4	5.0
3	6.2	18.7	19.2	13.8	11.8	5.8	3.6
4	7.6	19.9	20.4	14.4	10.5	6.8	1.5
5	9.2	21.4	21.9	15.7	8.9	8.5	3.3
6	10.4	23.1	23.6	16.0	6.9	9.8	5.1
7	11.9	24.6	25.1	16.1	6.9	11.3	6.3

3.6.2 Rail

Rail stations in the northern part of the CBD are:

- Wynyard
- Circular Quay
- Town Hall
- Martin Place

Of these, Wynyard is the closest to Barangaroo and has services on all lines except for the Eastern Suburbs/Illawarra Line, which serves Martin Place and Town Hall stations.

3.6.3 Bus

The CBD is the prime focus of bus services in the eastern third of the Metropolitan area. It is also served by a number of longer distance services from the north and north-west of Sydney.

Bus services in proximity to Barangaroo are listed below.

Services terminating at Millers Point:

- 308 – Marrickville
- 339 – Coogee
- 343 – Rosebery
- 431 – Glebe

- 433 – Balmain

Services terminating at King Street Wharf:

- 412 – Campsie
- 413 – Campsie

In addition to these, Wynyard (York Street, Carrington Street and Clarence Street) is the focus for services from the Northern Beaches, the North Shore and north-west, including private services, which access the CBD via the Harbour Bridge bus lane. A number of these services terminate at Wynyard, whilst a proportion continues to QVB, where some terminate and the balance continue to Railway Square, terminating at Lee Street.

Bus stops in the vicinity of Wynyard on George Street provide access to the CBD's main bus spine.

3.6.4 Ferry

The closest existing ferry wharves to Barangaroo are:

- King Street Wharf #3
- Darling Harbour Aquarium

Ferry services are summarised in Table 3-7.

Table 3-7 - Summary of ferry services

Ferry Service	Direction Of Travel	Total Travel Time (minutes)	Frequency Weekday			Frequency Weekend			Wharf nearest site
			AM 0600-0900	Midday 1100-1300	PM 1700-1900	AM 0600-0900	Midday 1100-1300	PM 1700-1900	
Pyrmont Bay-Circular Quay	Inbound	23-38	2	4	2	1	2	4	Pyrmont Bay/Darling Harbour (Aquarium)
	Outbound	25-27	3	4	3	2	4	4	
Birkenhead to Circular Quay and Woolwich to Circular Quay	Inbound	21-35	5	2	1	2	2	2	Balmain East
	Outbound	23-25	3	2	3	3	2	2	
Parramatta/Rydalmere to Circular Quay	Inbound	60-65	2	2	0	0	2	2	Darling Harbour (King Street wharf)
	Outbound	60-65	0	3	2	1	2	2	
Darling Harbour Express Service (Palm Beach Ferry Service) Bayview Park to King Street Wharf	Inbound	30	2	0	0	0	0	0	Darling Harbour (King Street wharf)
	Outbound	30	0	0	3	0	0	0	

The ferry service network is:

- Balmain East and Birchgrove to Circular Quay operated by Sydney Ferries
- Darling Harbour/Pyrmont to Circular Quay, also operated by Sydney Ferries
- Darling Harbour Express Service from Bayview Park to King Street Wharf number 3, operated by Palm Beach Ferry.

King Street Wharf services are a short walk to the bus stops for routes 412 and 413. They are also a walk of about 500 to 600 metres from Wynyard's train and bus services.

3.6.5 Light Rail

This system currently runs between Central and Lilyfield, via the Pyrmont Peninsula. It has stops along the east side of the Pyrmont Peninsula at:

- Star City (casino)
- Pyrmont Bay – in close proximity to the western end of the Pyrmont Bridge, providing an attractive access into the western edge of the CBD around Market Street and connecting into the major pedestrianised area of Darling Harbour which links through to King Street Wharf
- Exhibition Centre at Darling Harbour
- Convention Centre at Darling Harbour
- Paddys Market (the old Haymarket stop).

3.6.6 Wharf 8 Passenger Terminal

This facility currently serves regular cruise ships. Under the Concept Plan it had been intended that its function would be retained within the Barangaroo scheme, although the facilities would be re-configured. The Modified Concept Plan application has made the assumption that this facility is being relocated away from Barangaroo. However, a final decision has not been made by Government.

3.6.7 Harbour Cruise Boat Terminal

A number of the finger wharves at King Street Wharf serve harbour cruise/charter services and water taxis.

3.7 Surrounding land use

3.7.1 Established residential

The immediate environs include apartment buildings (either conversions or new builds) and older terraces along Kent Street, High Street, Hickson Road and generally around Millers Point.

Child care facilities are within The Bond development, on High Street and on Kent Street.

3.7.2 CBD

As the state's administrative centre and Australia's main financial centre, the CBD provides a range of services which are unique, including:

- Commercial, including Australia's main financial centre, including associated specialised producer services
- Major specialised retail
- Leisure activities such as provided at the Opera House
- Institutional uses such as art galleries, State Parliament and government offices
- A focus for tourism
- Residential

3.7.3 Western Corridor

The western side of the CBD is going through a progressive transformation from predominantly port related uses, as Sydney's maritime activities have responded to changes in technology and patterns of trade. Major elements along the corridor are:

- Darling Harbour was developed in the 1980s to provide a large-scale mixed use precinct for leisure, as well as functions such as the Convention Centre and Exhibition Centre. This precinct connects through to activities in the redeveloped Ultimo-Pyrmont area, and Pyrmont Bridge provides a pedestrian and cycle facility linking the two areas and the CBD.
- Darling Park is a large, predominantly commercial development built during the 1990s on the west side of Sussex Street. It has attracted a number of high profile occupiers, indicating market acceptance of the location.
- King Street Wharf is an emerging mixed use precinct with commercial employment, residential, and leisure facilities. It includes a concentration of bars and restaurants which attract people to the area in the evenings and at weekends. This tends to draw activity through from Darling Harbour, which also has strong weekend activity.
- Walsh Bay Cultural Precinct is located further north along Hickson Road. The Wharf Theatre on one of Walsh Bay's historic finger wharves, has been a focus for cultural activities for many years. In the past ten years this role has been strengthened through development of:
    - Sydney Theatre, plus the retention of the Wharf Theatre
    - Sydney Dance Company
    - Residential development
    - Commercial space
    - Services and retail
    - Open space
    - Marina and ferry wharf

The proposed redevelopment of Barangaroo needs to be viewed in the context of this progressive trend.

3.7.4 Circular Quay and the Rocks

This area is a major tourist and leisure precinct of the city. Features include:

- Major office buildings providing a backdrop to Circular Quay
- Major tourism attractions such as The Rocks, Opera House, Museum of Contemporary Art, Sydney Harbour Bridge, retail, hotels and apartments and cinema
- Transport interchange between ferry, bus and rail at the Quay
- International passenger terminal

3.8 Walking

Pedestrian conditions around the site have been analysed. Current conditions have the following salient features:

- Substantial pedestrian flows between George Street and Sussex Street, through bus and train nodes, characterised by marked peaks, with access to the western precinct of the city a major desire line
- Surveys in November 2007 indicated westbound peaks around 8.30am, 1pm and eastbound around 5.15pm
- Pedestrian conditions are generally acceptable, but operate in peaks below comfortable conditions (below Fruin LOS C)
- There are issues of pedestrian compliance with signal controlled crossings
- Overflow movements at mid-block
- Sections of footpaths with local constraints
- Congestion in the vicinity of bus zones
- Apparent preference by pedestrians to make use of tunnels
- Challenges associated with change of grade

The site does not currently have general public access.

Internally, the site is flat which is conducive for pedestrian and cycle movement.

Surrounding the site the change in grade between Hickson Road and Kent Street as well as the width of Hickson Road constrains access to the east.

A traffic signal controlled pedestrian crossing in Kent Street at the existing walkway leading to the Wynyard Station concourse commenced operation since the transport study for the Barangaroo Concept Plan was completed. This crossing facilitates pedestrian access to the Westpac building (KENS site).

3.9 Bicycle planning

3.9.1 Introduction

The 2006 journey to work data from the Census indicates that bicycles make up some 0.8% of all commuter trips to the CBD. On a typical weekday this represents some 1,600 commuter cycle trips. Commuter cycling to the CBD shows a steady upward trend from 1,200 commuter cycle trips into the city in 2001, and up from 1996 when the journey to work figure was 600 (0.3%) commuter trips into the city.

3.9.2 Existing Situation

There are currently low levels of cycle activity in the area around the site. However the site and Hickson Road are flat, which is conducive for cycling.

The site is within a short distance of existing cycle facilities, including the Sydney Harbour Bridge's cycleway, Pyrmont Bridge, and its westward connection to ANZAC Bridge's shared cycle and footway. Cycleways at the suburban end of these facilities are being progressively extended, and this greater coverage means that cycle facilities are becoming more attractive for cyclists.

Since the preparation of the Concept Plan for Barangaroo, the Sydney City Council has released a revised bike plan, *Cycle Strategy and Action Plan 2007-2017*, in which it outlines a broad range of strategies and specific actions to increase the use of cycle as a mode of transport within the Sydney local government area. It should be noted that the detail of proposals has not been endorsed by the State Government, as it has only been recently released. The assessment and design development of a number of proposals are subject to collaborative work between the City of Sydney and State Government agencies.

4. Description of Modified Concept Plan Proposal

4.1 Land use

The proposed additional floorspace in the Modified Concept Plan application is summarised in along with the total floorspace for the affected development blocks in the Approved Concept Plan Table 4-1.

Table 4-1 – Comarison of proposed changes to floorspace under the Modified Concept Plan application with approved floorspace in affected blocks (sqm of GFA)

Block	Total Approved Floorspace	Modified Concept Plan Additional Commercial Floorspace	Resulting Total Floorspace
5 AGAR-HEALY STEETS	29,200	15,000	44,200
4 HEALY-BULL STREETS	74,500	46,500	121,000
3 BULL-NAPOLEON STREETS	56,000	32,250	88,250
2 NAPOLEON-MARGARET STREETS	180,000	26,250	206,250
Total			

Note – GFA is based on the model LEP provisions

It should be noted that the proposed Modified Concept Plan application is exactly the same as the approved Concept Plan, apart from the additional 120,000 square metres of commercial floorspace, as distributed in the third column of Table 4-1.

For comparative purposes, the following table summarises floorspace from the Approved Concept Plan for the whole development.

Table 4-2 – Approved Concept Plan Proposed development mix of floorspace (sqm of GFA)

Block	Commercial	Hotel/ Tourist	Public	Residential	Retail	Total
8 HEADLAND-PARK-MUNN STREETS		5,800				5,800
7 MUNN - LITTLE CLYDE STREETS	1,500		1,000	25,000	500	28,000
6 LITTLE CLYDE-AGAR STREETS	500		2,500			3,000
5 AGAR-HEALY STEETS	17,700			10,000	1,500	29,200
4 HEALY-BULL STREETS	54,500			15,000	5,000	74,500
3 BULL-NAPOLEON STREETS	35,000			10,000	11,000	56,000
2 NAPOLEON-MARGARET STREETS	125,000	30,000		15,000	10,000	180,000
1 MARGARET-SHELLEY STREETS	10,300				1,500	8,500
Cruise Ship Terminal		8,000			500	
Kiosks and Pavillions in Parkland			1,500		1,500	
Total	***244,500***	***43,800***	***5,000***	***75,000***	***31,500***	***399,800***

It should be noted that the development mix and areas are indicative for the purposes of calculation. Final GFA and parking numbers per block are subject to future development assessment processes.

Other uses on the site include:

- Passive and active open space
- Harbour control tower (retained)

4.2 Distribution of employment and population

The approximate distribution of commercial employment and population along the north-south axis of the site is indicated in Chart 4.1, on a block-by-block basis. This compares the distribution of employment under the Approved Concept Plan and the Modified Concept Plan application. (Note that scheme's residential population is the same in both the Approved Concept Plan and the Modified Concept Plan application.)

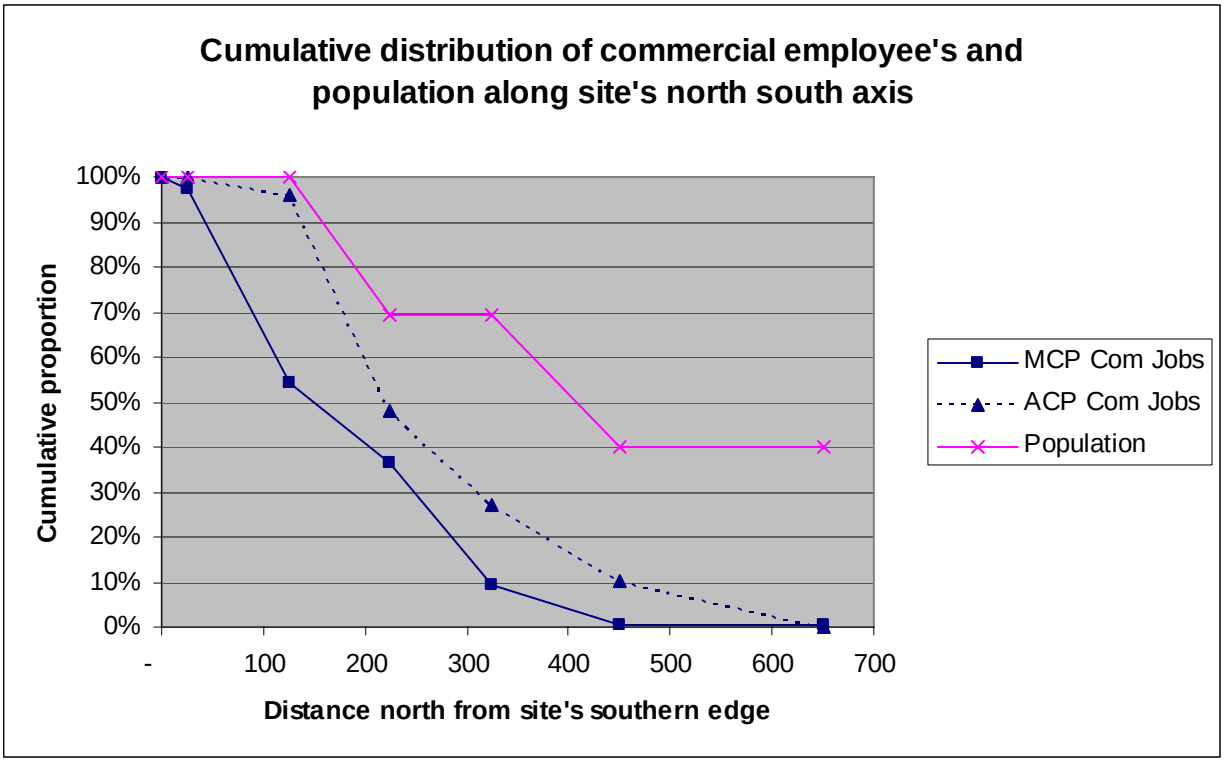


Chart 4.1 – Cumulative distribution of commercial employees and population along site's north-south axis

This indicates that development on the site will be heavily concentrated at the southern end of the site, with nearly 90% of the commercial employment within 300 metres of the southern edge of the site. The importance of the southern end of the site is that it is close to both commercial activities and existing transport nodes. The Modified Concept Plan application's higher concentration of employment toward the southern end of the site is considered to be an improvement, in terms of accessibility, over the Approved Concept Plan, which had approximately three-quarters of site employment within 300 metres of the southern edge of the site.

4.3 Car parking provision

As noted in Chapter 2, the parking provision for the site responds to the strategic context for land use and transport in the CBD. It is proposed to constrain the provision of car parking. Among other things this reflects:

- The site currently has a poor level of public transport accessibility, which reflects its low level of use.
- Traffic access is constrained during peak traffic hours of a weekday and there is limited opportunity for significant traffic capacity increases on key access routes.

Based on the existing City of Sydney Code the commercial component of the Modified Concept Plan application would be allowed some 1,182 on-site spaces – a rate of 1 car space per 340m².

Developments in the core of the CBD (with a higher floorspace ratio of around 12:1) have an effective parking supply rate of around 1 space per 600m² of commercial space.

As approved in the Concept Plan for the site, it is recognised that the parking policy for the development should support public transport and non car borne (walk/cycle) travel. Low car parking provision is considered important because it will also act to limit potential traffic generation by the site's activity to a level which will not unduly compromise the operation of the CBD's existing road network.

Given the site's traffic access difficulties, it is recommended a rate of 1 space per 600m² commercial space be adopted and the existing Sydney City Council Code rates be adopted for other uses (residential and hotel).

This approach to parking is considered an important complement to achieving the mode share targets for the site. Further, this level of restricted parking provision is vital to ensure that the traffic generated by the site, especially during the peaks, does not result in undue congestion which may prejudice the bus strategy and have broader impacts on the CBD's transport network.

The proposed rates of off-street car parking provision for the site are discussed in Appendix A. These equate to:

- Commercial/mixed use – 673 spaces
- Hotel – 146 spaces
- Residential – 771 spaces
- Parkland public car park – 300 spaces

In addition, there would be approximately 400 short stay on-street spaces, depending upon traffic facilities and kerbspace allocation. It is proposed to rationalise parking along Hickson Road, to convert current all day car parking to short stay; convert rear to kerb parking to parallel parking; and remove a proportion of on-street spaces to introduce access points and other traffic facilities (e.g., bus stops, coach parking, taxi ranks, etc). In addition, the ability to re-configure Hickson Road's cross section to support future potential light rail should not be precluded.

4.4 Potential travel market

Trip generation for the site has concentrated on estimating peak movements to the site by mode. In addition, an indication of daily movements by transit has also been prepared.

The process adopted uses a status quo estimate based on access conditions and car parking similar to the current levels of parking and transit service provision at the time of the last census (i.e., no bus service at King Street Wharf). This is described in Appendix B. The process then applies the level of parking restraint proposed for the site to constrain car use to the site.

Based on approximately 22,000 workers, of which about 8.5% would not be on site on any day (implied from 2006 JTW data), then estimated daily inbound commuter trips and mode shares are summarised in the following table, and compared with the Approved Concept Plan estimates.

Table 4-3 – Comparison of estimated Barangaroo commuter markets by mode, Approved Concept Plan and Modified Concept Plan, daily inbound JTW

Mode	Approved Concept Plan	Mode Share	Modified Concept Plan	Mode Share
Train	8,900	62%	12,500	62%
Bus	2,900	20%	4,100	20%
Car	535	4%	750	4%
Other	1,800	12%	2,500	12%
Ferry (King St Wharf)	200	1%	280	1%

Note: market shares may not sum to 100% due to loss of numerical precision in rounding

Approximately 80% of the transit passengers would arrive in the AM peak three hours. From counts at the Wynyard Station underground access from Kent Street, an estimate of the peak hour proportion of the three hour peak would be 61%. This yields peak hour commuter arrivals by train and bus, which are summarised in the following table.

Table 4-4 – Comparison of estimated peak hour commuter market for train and bus, inbound JTW

Mode	Approved Concept Plan	Modified Concept Plan
Train	4,300	6,100
Bus	1,400	2,000

For transit planning purposes, on a daily basis, the following table summarises estimates of employment generated commuter travel.

Table 4-5 – Comparison of approximate daily commuter market for train and bus, (two-way JTW)

Mode	Approved Concept Plan (in and out)	Modified Concept Plan (in and out)
Train	9,000 to 10,500	12,000 to 13,000
Bus	3,000 to 3,500	4,000 to 4,500

4.5 Proposed road network

An on-site traffic layout is proposed which would connect into the existing CBD road network with minimal alterations to the existing network to provide good vehicular accessibility for cars, delivery/service and emergency vehicles to each of the building blocks within the proposed development. This on-site road network proposed by the Modified Concept Plan application is the same as that proposed by the Approved Concept Plan.

The main concept is to allow for Hickson Road to provide collector road functions carrying bus and possible light rail movement in the north-south direction. It would provide limited access options.

A new north-south Globe Street would provide a local access function and would serve cyclists. Access options would be limited. At its northern end Globe Street would connect back into Hickson Road via Towns Place.

East-west side roads would be created to link between Hickson Road and Globe Street and such streets would provide primary vehicular and service vehicle access to developments. A number of side road are proposed which, from north to south, are as follows:

- Munn Street
- Little Clyde Street
- Agar Street
- Healy Street
- Bull Street
- Napoleon Street (westward continuation of existing).

A series of cross section diagrams were prepared to support the Approved Concept Plan; these remain the same in the Modified Concept Plan application. The following paragraphs define the function of the proposed road network.

4.5.1 Hickson Road

Hickson Road is proposed as a collector level road which will accommodate buses and a possible light rail scheme located centrally within the available road corridor. To ensure efficient operation of Hickson Road no direct access to the development sites located within Barangaroo will be permitted from Hickson Road.

It is intended that Hickson Road will provide the following road configuration:

- A 4.0 metre wide pedestrian footpath on either side of the road.
- A kerbside parking lane of 2.5m width in either direction.
- A 3.3m wide trafficable lane in either direction (an STA requirement if a road is to accommodate buses).
- A 3.3m wide light rail lane in either direction[7] for a possible light rail route.
- A central 3.3m wide median to accommodate possible light rail platforms as stations where required.
- Boulevard-style urban design treatment as per the Consolidated Concept Plan.
- Provision of bus layover as per the Barangaroo Bus Strategy.

A traffic signal controlled intersection will need to be provided at the location of the existing Sussex Street/Napoleon Street intersection. Full pedestrian crossing facilities will be required. This is considered in further detail in Section 4.6.

[7] If Light Rail were not to eventuate, the road space nominated here for Light Rail would be available for reallocation to other on-street public transport in a configuration which is yet to be determined.

4.5.2 Globe Street

Globe Street is proposed to provide a landscaped street which will provide a local access function and accommodate cyclist movements. The road will limit access options to Barangaroo.

It is intended that Globe Street will provide the following road configuration at its southern end:

- A 5.0 metre wide pedestrian footpath on either side of the road.
- A kerbside parking/cycle lane of 3.5m width in either direction.
- A 3.3m wide trafficable lane in either direction (an STA requirement if a road is to accommodate buses).
- A central median varying in width between 2.0m and 2.2m wide.

Towards its northern end the road corridor will narrow. It is intended to remove the on carriageway cycle facilities and instead provide off-carriageway cycle facilities through the Headland Park to reconnect to Hickson Road via Towns Place.

The road configuration for Globe Street at its northern end will provide the following road configuration:

- A 2.1m wide kerbside parking lane on its western side
- A 3.5m wide footpath on its eastern side.
- A 3.3m wide trafficable lane in either direction.

4.5.3 Napoleon Street

Napoleon Street is proposed to form the main vehicular entry point to access Globe Street.

The new section of Napoleon Street, west of Sussex Street, will provide the following road configuration:

- A 5.0 metre wide pedestrian footpath on the north side of the road
- A 11.4 metre wide pedestrian footpath on the south side of the road
- A kerbside parking/cycle lane of 3.5m width in either direction
- A 3.3m wide trafficable lane in either direction.

Modifications to the existing section of Napoleon Street east of Sussex Street will be required to connect the proposed on-site cycle lanes into the broader CBD network.

4.5.4 Margaret Street

The alignment of Margaret Street and Napoleon Street will form an important access corridor for the site. A detailed traffic assessment, as required in the Approved Concept Plan's Statement of Commitments, has been undertaken including an assessment of this alignment.

4.5.5 Munn Street

All east-west side streets in the development will provide service vehicle access and access to underground on-site car parking.

Munn Street shows a typical east-west side street and will provide the following configuration:

- A 4.7 metre wide pedestrian footpath on the south side of the road
- A 3.0 metre wide pedestrian footpath on the north side of the road
- A 3.5m wide kerbside coach parking lane on one side
- A 2.2m wide kerbside parking lane on the other side
- A 3.3m wide trafficable lane in either direction.

4.6 Traffic effects

4.6.1 Traffic Generation

The traffic impact of the proposed Barangaroo development will occur when the combination of traffic from the proposed development and traffic already in existence on the road network are at their greatest.

To determine the traffic effects of the proposed development an estimate of the number of vehicle trips associated with particular land uses within the site have been forecast.

The approach taken within this report to determine the traffic generation potential of the proposed development, to ensure on-site parking restraint and good non-car mode accessibility, is to use the results of traffic surveys undertaken for similar land uses with comparable locational and accessibility criteria.

4.6.2 Residential Development

Traffic surveys were undertaken of a number of residential tower blocks within the city. Surveys recorded the number of vehicle movements associated with the driveways of the following buildings:

- Millennium Tower – Sussex Street
- Windsor on Kent – Kent Street

Peak hour trip rates per dwelling were obtained from the survey results by dividing the number of surveyed two way vehicular movements by the number of units which the developments provided.

Rather than use average trip rates, which could be exceeded 50% of the time, it was considered a more conservative approach was to adopt the greatest value from the two survey data sets. The highest values recorded by the survey revealed trip rates of 0.14 and 0.09 trips per dwelling during the AM and PM peak period. It was assumed that these trips would split 80% depart and 20% arrive in the morning peak hour and 20% depart and 80% arrive in the evening peak hour.

The number of residential dwellings which the proposed Barangaroo development will provide was calculated on the basis of 1 dwelling per 100 sqm. For the proposed 75,000 sqm of residential floorspace this would equate to about 750 dwellings.

Table 4-6 provides a summary of the traffic generation of the proposed development.

4.6.3 Commercial/Retail Development

As part of the King Street Wharf development application, consultant TTPA undertook surveys of the usage of car parks at existing CBD commercial developments. The results revealed that the peak hour traffic generation rate of CBD commercial car parks was 0.26 trips per parking space. This value was adopted in the assessments.

The retail development will be largely ancillary to the other land uses proposed within Barangaroo. However, for modelling assessment purposes a traffic generation rate of 0.4 trips per car parking space was considered appropriate to account for the retail floorspace. This higher generation rate makes an allowance for service vehicles and taxi movements. Trips were assumed to split 20% depart and 80% arrive in the morning peak hour and 80% depart and 20% arrive in the evening peak hour.

Table 4-6 provides a summary of the traffic generation of the proposed development.

4.6.4 Hotel

The 'Traffic Assessment Report for the Proposed Redevelopment of Darling Harbour Wharves 9 & 10' produced by TTPA consultants in October 1997 identified the traffic generation characteristics for an adjacent mixed use development which also included hotels.

The report used a traffic generation rate of 1 trip per 10 rooms in a one hour peak period. It was considered appropriate to adopt this rate for consistency.

The total available floorspace for hotel development at Barangaroo is 36,380 sqm. As per the TTPA report it was assumed that one hotel room occupies 50 sqm. Therefore, it was calculated that there would be a total of 728 rooms available in the hotels at the proposed development. As per the commercial/retail it was assumed that these trips would split 20% depart and 80% arrive in the morning peak hour and 80% depart and 20% arrive in the evening peak hour.

The resultant level of traffic generation was consistent with the restrained level of on-site car parking that the hotel uses would provide a total of 61 parking spaces.

Table 4-6 provides a summary of the traffic generation of the proposed development.

4.6.5 Car Parking

The Barangaroo proposal will result in an increase in both on and off street parking within and around the site area.

The Approved Concept Transport Plan identified that there would be around 400 on-street spaces created in total at Barangaroo.

The existing 270 ninety degree long stay parking spaces along Hickson Road are proposed to be converted to parallel spaces. It is estimated that the reconfiguration will provide about 125 on-street spaces.

The resulting reduction in parking numbers along Hickson Road would be off set by higher turnover per space such that there would be no change in on-street traffic generation.

The traffic generation of the remaining 275 spaces was calculated on the basis of 0.4 trips per car parking space per hour during the peak periods. The same traffic generation rate was also applied during the evening peak hour to the proposed 300 space public car park located towards the north of the site.

Table 4-6 provides a summary of the traffic generation of the proposed development.

4.6.6 Public Transport

The Barangaroo Bus Service Strategy describes potential amendments to the CBD's bus service networks to improve bus access to the site.

4.6.7 Wharf 8 Passenger Terminal

As noted in Section 3.6.6, while no final decision has yet been made, a working assumption for this assessment is that the passenger terminal would be relocated elsewhere in Sydney. Consequently, for traffic generation purposes the Approved Concept Plan's floorspace for the terminal has been treated as commercial floorspace in the current investigation.

If the passenger terminal was included in the Barangaroo Scheme, then the change in overall traffic impact would be likely to be:

- For a normal day of operation with no ship berthing at the terminal, there would be no material difference in traffic impact. Based on past shipping schedules, this would be about 85% of the time.
- Analysis of the Cruise Schedule for the twelve months to June 2009[8] indicates that 10 ships are anticipated to arrive on each of Monday, Tuesday and Thursday, with 4 on Wednesdays and 8 on a Friday. Of these expected 42 weekday arrivals in the coming year, 40 would arrive in or just before the morning peak. This is a similar situation to that surveyed and described in Section 3.4, when Pacific Sun was berthed and was estimated to generate 220 vehicles per hour (in + out) during the road system peak. Of the scheduled sailings, almost all would be turned around and sail on the same day, with over

[8] Refer to http://www.sydneyports.com.au/port_operations/cruise_schedule

half sailing prior to the PM peak, 9 sailing after the PM peak and less than 10 sailing during the PM peak. MWT's conclusions from this are:

- Approximately 40 weekday mornings in the next year would have their traffic affected by the arrival of a cruise ship at Darling Harbour
- Traffic generated by these arrivals would be around 220 additional vehicles per hour
- The morning peak is the road network's better performed peak period and is likely to be able to handle this additional demand, albeit with potential for some minor additional localised congestion
- Almost no PM peak period would be affected by cruise ship-generated traffic, with the low frequency (a bit less than 10 over the year) similar in nature to the occasional function or event that might be held from time to time at a premises in the general area

Table 4-6 – Weekday Peak Hour Traffic Generation

Development Block/Element	Max GFA per block	AM Peak Hour						PM Peak Hour					
		In		Out		Two-way		In		Out		Two-way	
		Light vehicles	Heavy vehicles	Light vehicles	Heavy vehicles	Light vehicles	Heavy vehicles	Light vehicles	Heavy vehicles	Light vehicles	Heavy vehicles	Light vehicles	Heavy vehicles
275 short stay on-street spaces		**88**	**0**	**22**	**0**	**110**	**0**	**88**	**0**	**132**	**0**	**220**	**0**
300 public off-street spaces		**10**	**0**	**2**	**0**	**12**	**0**	**24**	**0**	**96**	**0**	**120**	**0**
Block 8 HPM Headland Park – Munn Streets	5,800	**2**	**0**	**9**	**0**	**12**	**0**	**9**	**10**	**2**	**10**	**12**	**20**
Block 7 ML Munn – Little Clyde Streets	28,000	8	2	28	2	36	4	18	0	5	0	23	0
Block 6 LA Little Clyde – Agar Streets	3,000	0	0	0	0	0	0	0	0	0	0	0	0
Block 5 AH Agar – Healy Streets	39,400	13	3	14	3	27	6	10	0	12	0	22	0
Block 4 HB Healy – Bull Streets	100,900	35	6	24	6	59	12	18	0	33	0	52	0
Block 3 BN Bull – Napoleon Streets	75,800	28	5	17	5	45	10	13	0	27	0	40	0
Block 2 NM Napoleon – Margaret Streets	243,600	87	15	82	15	169	30	76	0	85	0	162	0
Block 1 MS Margaret – Shelley Streets	11,800	4	0	1	0	5	0	1	0	4	0	5	0
Cruise Ship Terminal	8500	5	0	1	0	6	0	1	1	5	1	6	2
Total	**516,800**	**280**	**30**	**202**	**30**	**482**	**60**	**260**	**11**	**402**	**11**	**662**	**22**

The following assumptions are used:

1) 1 residential unit provides an average of 100 sqm
2) Commercial & public trips split 80% in / 20% out during AM & 80% out / 20% in during PM
3) Residential & hotel trips split 80% out / 20% in during AM & 80% in / 20% out during PM
4) Public use parking assumed to generate at commercial rate during PM peak hour and at 10% of that level during AM peak hour.

The traffic generation estimated in Table 4-6 above for the Modified Concept Plan application is compared with traffic generation estimated for the Approved Concept Plan in the table below.

Table 4-7 Comparison of traffic generation Approved Concept Plan and Modified Concept Plan application

	Approved Concept Plan				Modified Concept Plan			
	AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour	
	In	Out	In	Out	In	Out	In	Out
Development traffic	192	172	173	272	310	232	271	413
Public Transport	50	50	50	50	39	27	27	39
Total	**242**	**232**	**223**	**321**	**449**	**259**	**298**	**452**

4.6.8 Traffic Distribution & Assignment

To determine the likely trip origins and destinations of traffic associated with the proposed Barangaroo development a traffic distribution was calculated based upon the Journey to Work data from the 2001 Census.

Table 4-8 shows the proposed distribution of traffic.

Table 4-8 – Traffic Distribution

Destination	Route	Distribution	AM Peak Hour			PM Peak Hour		
			Inbound	Outbound	Two way	Inbound	Outbound	Two way
North	Harbour Bridge	40.7%	129	97	226	111	169	280
East	Eastern Distributor	22.9%	64	46	110	60	92	152
East	William Street	1.5%	4	3	7	4	6	10
East	Oxford Street	4.1%	11	8	20	11	17	27
South	Harbour Street	8.6%	24	17	41	22	35	57
West	Western Distributor	21.8%	76	59	135	62	93	155
Sydney Inner	-	0.4%	1	1	2	1	2	3
Total		**100%**	***310***	***232***	***542***	***271***	***413***	***684***

The traffic was assigned to the road network in accordance with the above traffic distribution making allowance for competing routes.

4.6.9 Future Local Intersection Operation

The wider external traffic impacts of the development traffic resulting from the proposed development has been assessed on an area wide basis using a PARAMICS microsimulation traffic model of the Sydney CBD.

The traffic model is owned by the RTA and permission has been granted to test the capability of the modelled network to accommodate the traffic demands which would include the forecast traffic generated by the proposed development.

The prime focus of the traffic analysis in this report is to examine the more localised traffic impacts at key intersections around the site.

Table 4-9 compares the existing and forecast level of intersection performance with the traffic flows from the proposed development included.

Table 4-9 – Results of Intersection Operational Analysis of the Existing Layouts

Intersection	Control	Weekday AM Peak						Weekday PM Peak					
		Existing		Concept Transport Report		Modified Concept Transport Report		Existing		Concept Transport Report		Modified Concept Transport Report	
		Ave. Delay	LoS	Ave. Delay	LoS	Ave. Delay	LoS	Ave. Delay	LoS	Ave. Delay	LoS	Ave. Delay	LoS
Kent St/Napoleon St/ Margaret St	Signals	16.5	B	16.7	B	16.0	B	16.4	B	16.4	B	16.4	B
Sussex St/Erskine St	Signals	25.1	B	28.8	B	27.2	B	22.6	B	25.6	B	28.4	B
Sussex St/Napoleon St	Priority	27.9	B	164.5	F	417.1	F	15.9	B	59.7	E	154.5	**F**
York St /Grosvenor St / Bradfield Highway ramp	Signals	12.6	A	12.7	A	16.9	**B**	12.8	B	12.8	B	12.8	B

Note – where LOS changes between the Approved Concept Plan analysis and the Modified Concept Plan application analysis, the type face is emboldened and coloured red.

Table 4-9 shows that all the key intersections local to the site would provide an acceptable level of operation with the addition of the development traffic. The intersection of Sussex Street and Napoleon Street would not provide sufficient capacity under priority control to accommodate the forecast traffic demands. This is consistent with the findings of the Approved Concept Plan. The reduced level of service in the AM peak at the intersection of York Street, Grosvenor Street and Bradfield Highway Ramp from LOS A to LOS B reflects a minor increase in delays, but is still considered to operate with a LOS that is better-than-acceptable, when compared with standard assessment criteria (refer to Table 3-3 – Level of Service Criteria).

Further assessments were undertaken to determine the resultant performance of an upgrade of the intersection of Sussex Street and Napoleon Street to traffic signal control. Due to the volume of pedestrians that would be generated by the site, a scramble pedestrian crossing phase was tested, as well as more typical pedestrian crossing arrangements. The following table summarises the results of this analysis.

Table 4-10 – Results of Intersection Operational Analysis of the Proposed Layouts

Intersection	Control	At-grade Ped, Crossing Facilities	AM Peak		PM Peak	
			Ave. Delay (s/veh)	Level of Service	Ave. Delay (s/veh	Level of Service
Sussex St/Napoleon St	Signals	Yes	30.1	C	26.8	C
		Scramble phase	57.8	E	42.0	C

Avg Delay is over all movements at signals, and for the worst movement at priority and roundabouts

With traffic signal control the intersection is modelled as having a 'C' level of service in both the morning and evening peak periods with normal pedestrian facilities. The introduction of a pedestrian scramble phase would improve conditions for pedestrians crossing at the intersection. It would, however, reduce the available time for vehicles and it consequently shows poor performance in the morning peak period. This suggests that an alternative, high volume pedestrian facility would be required to ensure that the site access performs efficiently.

The results are based on the survey of vehicles which were recorded crossing the signal stoplines. This does not take account of the actual demand which is constrained by the upstream and downstream intersection. Hence the results may suggest that the intersections operate better than occurs in reality. The PARAMICS model of the Sydney CBD being prepared to assist in the assessment of the traffic effects of Barangaroo will provide a better picture of intersection level of performance with the inclusion of traffic from the proposed development.

The increases in peak hour traffic through the local intersections may have the effect of redistributing some of the existing traffic to other competing routes.

Overview of pedestrian conditions at Hickson Road and Napoleon Street

An overview assessment of conditions for pedestrians waiting to cross at this location in the morning peak hour, indicates high levels of crowding. This assessment used the following assumptions:

- All train users would cross at this location
- At-grade crossing only
- Approximately 60% of bus users would cross at this location (the balance would take direct service to site)
- Ferry, car and cycle proportion of other (assumed to be 2% points – or approximately 400) would not cross here
- Walkers would be split approximately 50% using this crossing with the balance coming from south or from north of this location; about 50% of these would arrive in the peak hour

These assumptions would result in morning peak hour demand of:

- Train – 6,100
- Bus – 1,200
- Walkers – 525

- Peak hour total: 7,825 per hour

With an assumed signal cycle time of 112 seconds (32 cycles per hour) and assuming a flat demand profile through the hour, approximately 245 pedestrians would need to cross per cycle. At Fruin LOS E, this would require between 114 and 227 sqm of pedestrian storage. If demand was balanced across the two Hickson Road approaches to the intersection, this would require 60 to 115 sqm of storage at each location – in broad terms, this would equate to a 10 m wide crossing on each approach and 7 to 10 m of storage depth.

Should grade separated pedestrian facilities be provided (i.e., so pedestrian movement was not interrupted by traffic signal control), a Fruin LOS C would be achieved with a flow rate of between 33 and 49 pedestrians per metre per minute. With a flat demand profile for the above hourly volume of 7,825 pedestrians, this would require an effective width 3 to 4 m, plus an appropriate allowance for edge effects, the modest counter-peak direction pedestrian volumes and some factor for demand surges.

This overview assessment of pedestrian conditions reinforces the need for grade separated pedestrian links into the site.

4.6.10 Bus/Coach/Taxi Parking Facilities

It is proposed to provide a kerbside bus and taxi facility. Provision of bus layover is considered further in the Barangaroo Bus Service Strategy. The location of taxi rank(s) within the site would be a matter for consideration at a later stage of the planning process, as details of design become available.

Also, the proposed hotel within Barangaroo would be likely, as part of its detailed design, to provide coach access and limited layover.

4.7 Public transport strategy

In order to achieve low car use by site users, a high proportion will need to have convenient access to good transit services.

In order for rail (heavy and Metro), to be attractive modes, good pedestrian access is proposed between the site and Wynyard Station. This access will also provide connections to bus networks on York Street and Carrington Street, as well as on George Street.

The need to provide direct bus access to Barangaroo as recognised in the Approved Transport Concept Plan has been addressed through the preparation of the *Barangaroo Bus Service Strategy*.

This strategy recommends direct and frequent services to the site through extension to a number of existing CBD services. This will ensure frequent bus services to the site especially during peak periods, as well as being integrated with the CBD Bus Strategy.

Detailed service and route requirements will be determined by the Ministry of Transport (MoT) at a later stage.

Given the development of King Street Wharf and Barangaroo, and associated additional passenger demand, might result in additional frequency on some current ferry services. If this eventuated, then ferry would become a more attractive mode. The Walker Inquiry indicated the potential for a second ferry hub – if this were located either as part of an expanded King Street Wharf or as an additional facility as part of Barangaroo, it would improve ferry access to the site. This would also contribute to higher ferry mode share for travellers to and from the site. A decision on locating a new ferry terminal at East Darling Harbour will be made at a later stage.

The design of Barangaroo would not preclude the provision of a light rail service on Hickson Road, should such a facility be built. Should a light rail line be developed it would provide linkages along the Western CBD corridor.

4.8 Pedestrian facilities

The proposed Barangaroo development has the potential to create a good level of pedestrian (and cycle) accessibility but is constrained by the topography to the east.

It is anticipated that the Barangaroo Project will provide for a number of new pedestrian connections to the surrounding area. An essential component of the development will be provision of a new high-capacity, accessible and attractive pedestrian link to the existing rail and bus services at Wynyard Station.

The proposed development will provide foreshore walkways as well as a network of north-south and east-west road and footpath connections.

These facilities will support reduced dependency on car travel to the city through new and safe pedestrian links to a range of transport modes.

(source: Barangaroo, EOI Documentation, Stage 1)

4.9 Cycle facilities

Barangaroo occupies a level site, which is conducive to cycling. It is relatively close to existing trunk cycle facilities on the Harbour Bridge, Pyrmont Bridge and ANZAC Bridge. These facilities provide connections into emerging suburban cycle networks. However, due to topography, access to Wynyard and the CBD core by bicycle is difficult. Also this limits the preferred cycling path to Circular Quay, via Hickson Road, to follow favourable gradients.

The Approved Concept Plan and the Modified Concept Plan application proposed to provide a cycle route along Napoleon Street – Globe Street – Parkland – Hickson Road plus a shared bike/pedestrian route along the foreshore.

Since the preparation of the Approved Concept Plan, the City of Sydney Council has released an updated bike plan, the Cycle Strategy and Action Plan (2007 to 2017). The main differences between this new plan and the City of Sydney cycle plan referenced in the Concept Plan Transport report in the immediate environs of Barangaroo are:

- the identification of a recreational route along the foreshore of Barangaroo, which connects with the eastern end of Pyrmont Bridge; and,
- a local route running north-south within the site, which connects with the above recreational route and the proposed local routes along Kent Street via the extension of Napoleon Street.

In some respects, these specific proposals by the City of Sydney in their latest strategy, by way of connecting Barangaroo's proposed facilities, would further their utility for cyclists.

Individual buildings would be required to provide bicycle parking and shower facilities and it is proposed that bicycle parking would be provided within the public domain.

Glossary

ABS – Australian Bureau of Statistics, the official statistician of the Commonwealth

ATC – automatic traffic count, also known as a tube count or tube counter – this is generally conducted using pneumatic tubes affixed to the road at the survey point. A sensor and microprocessor then log vehicle movements across the tube(s), with discrimination possible between direction of travel, type of vehicle (or vehicle classification) and speed. Vehicle classification is generally to Austroads' 12 bin system, where each bin corresponds to a group of similar vehicles (e.g., bin 1 is car).

At-grade – at ground level.

CBD – Central Business District, which in Sydney is broadly accepted as the area north of Eddy Avenue, bounded by Darling Harbour on the west and East Sydney on the east.

Class/classification – this refers to the classification of vehicles into groups on the basis of their physical dimensions, and hence, their impact on traffic capacity.

CoS – City of Sydney – the local government area in which Barangaroo is located.

Fruin – refers to the system of assessing conditions for pedestrians developed by Dr JJ Fruin, which uses the concept of level of service (LOS) to characterise conditions for different types of pedestrian facilities, with LOS A being the highest standard of pedestrian conditions and LOS F being the lowest.

Gross floor area (GFA) – specific term used to describe the scale of development. Gross Floor Area means the sum of the area of each floor of a building where the area of each floor is taken to be the area within the outer face of the external enclosing walls as measured at a height of 1,400 millimetres above each floor level, excluding:
(a) columns, fin walls, shade devices, and any elements, projections or works outside the general lines of the outer face of the external walls, and
(b) lift towers, cooling towers, machinery and associated plant rooms, and ancillary

storage space and vertical air conditioning ducts, and
(c) N/A
(d) space for the loading and unloading of goods (but not in the case of warehouses or distribution centres).

Heavy vehicle traffic – refers to trucks.

JTW – journey to work, which is Census data that describes commuter travel. This provides the most comprehensive information about travel at a fine level of geographic resolution. In this document the most recent JTW data is used: in the case of the charts in Chapter 3 these use 2006 census data; for the relationships between walk distances and mode shares, 2001 data as equivalent 2006 data (i.e., about the home and work end of the trip and the mode used) was not available. Comparison of 2001 and 2006 JTW information on a broadly comparable area basis indicates models changes in mode shares between the two census: car driver mode share to the CBD core in 2001 was approximately 15% and car driver mode share for workers in Sydney inner SLA (broadly the CBD) in 2006 was also about 15%.

Level of service (LOS) – for traffic facilities this scale permits the broad categorisation of their performance, as experienced by users.

Light vehicle traffic – this refers to traffic of mainly cars.

Manual classified turning counts – these entail the use of manual observers to count the volume of traffic undertaking specific movements (i.e., left turn, through and right turn) at intersections. This data is a fundamental input to determining the performance of an intersection.

MoT – NSW Ministry of Transport.

Paramics – is a software application for micro-simulation modelling of traffic streams. The networks used are spatially correct and the model is largely based on the relationship between individual vehicles.

RTA – NSW Roads and Traffic Authority, which is the NSW State Government agency with broad responsibilities for planning, managing and regulating traffic and traffic facilities.

SIDRA – also known as aaSIDRA – is intersection design and analysis software (Signalised Intersection Design and Research Aid) which has developed into a well recognised tool for application to signal controlled, priority (give-way and stop controlled) and roundabouts. The software was developed in Australia and is sold extensively overseas.

Statistical division (SD) – a spatial unit used by Australian Bureau of Statistics (ABS) to describe an area with a relatively large population for example, each of the states' capital cities is a statistical division.

Statistical local area (SLA) – is the next unit down from a statistical sub-division, City of Sydney local government area comprises four SLAs.

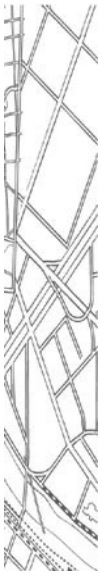
Statistical sub-division (SSD) – is a spatial unit used by ABS which is one level lower down the hierarchy than the statistical division.

Sydney Harbour Foreshore Authority – the Foreshore Authority also known as SHFA is the government agency responsible for the planning of the proposed development of Barangaroo and other foreshore development.

Transit – term meaning non-car mechanised modes of transport (e.g., bus, rail, ferry).

UTS – Urban Transport Statement produced by the NSW Government in November 2006.

Appendix A - Car Parking Considerations



Traffic and Parking Report

Barangaroo - Car Parking Considerations

June 2008

Prepared for

Sydney Harbour Foreshore Authority

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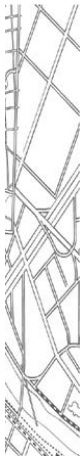

Document:

Title: Barangaroo - Car Parking Considerations

File Name: 052765r09 Barangaroo modified Appendix A Car Parking

Client:

Sydney Harbour Foreshore Authority

Issue Date:

June 2008

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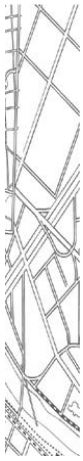

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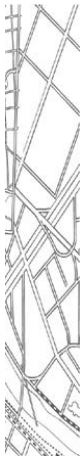
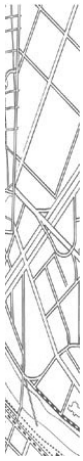


1. Introduction

Masson Wilson Twiney Pty Ltd has been commissioned to study the parking aspects of the proposed redevelopment of Barangaroo for commercial, residential and park uses. This appendix originally formed part of the Approved Concept Plan for Barangaroo and has subsequently been amended to reflect the proposed Modified Concept Plan application.

Our report is structured through the following sections:

- Chapter 2 – describes the existing situation
- Chapter 3 – reviews the proposed development parking implications and recommendations as to parking policy
- Chapter 4 – Summarises the report



2. Existing Situation

2.1 Parking supply

The context for parking supply around Barangaroo has been defined as the area bounded by Pitt Street in the West and Erskine Street, Barrack Place and Martin Place in the South (plus one off-street car park further south). This area has been investigated in regards to on-street and off street public parking as well as sources of parking demand (see Figure A1).

2.1.1 On Street Parking

Total on-street parking, which are generally available on weekdays, numbers some 1880 spaces. The parking is concentrated to the north with approximately 50 percent of the parking located in the Walsh Bay precinct.

Table 2.1 On-Street Parking

On-Street Spaces and Proximity to Barangaroo				
	Less than 250m	250 - 500m	Greater than 500m	Total
Northern End	370 (20%)	1160 (61%)	350 (19%)	1880 (100%)
Middle Portion	501 (27%)	700 (37%)	679 (36%)	1880 (100%)
Southern End	92 (5%)	388 (21%)	1400 (74%)	1880 (100%)

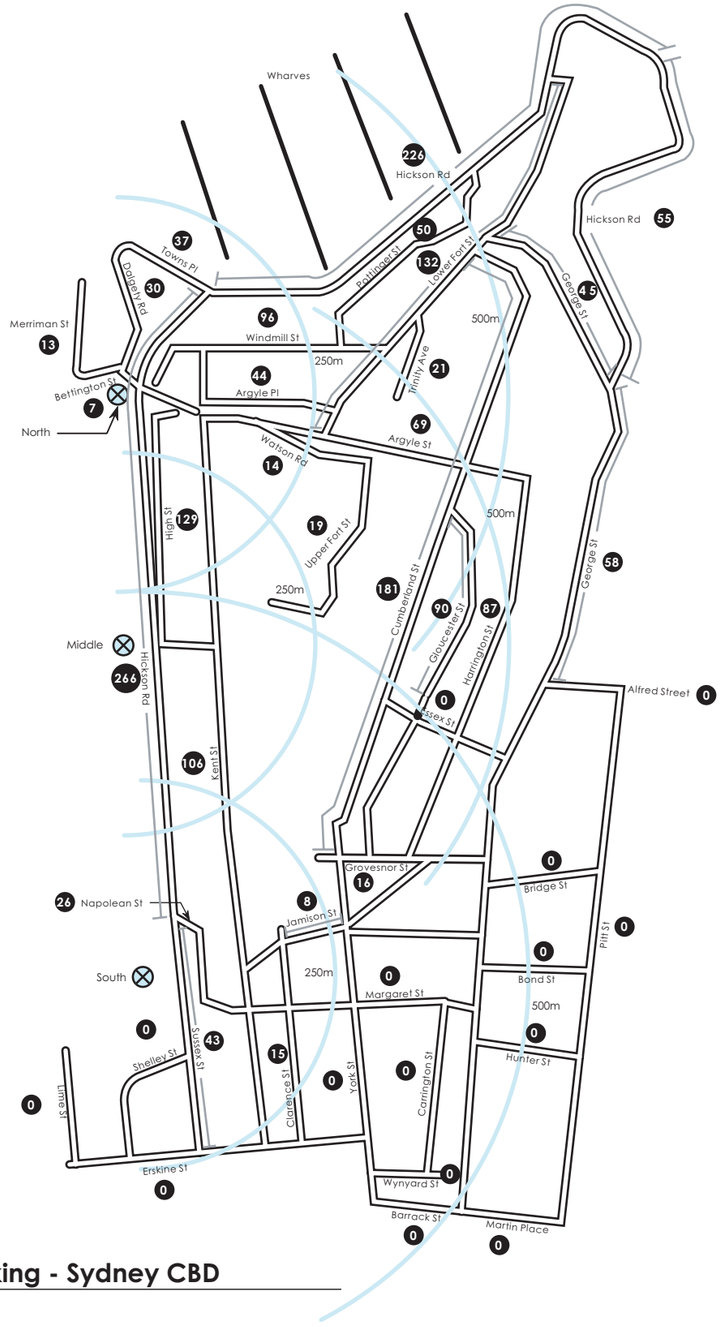
Some 270 on-street spaces in Hickson Road are 10p (all day) parking whilst the remainder in the area is generally short term (meter controlled).

2.1.2 Off-Street Parking

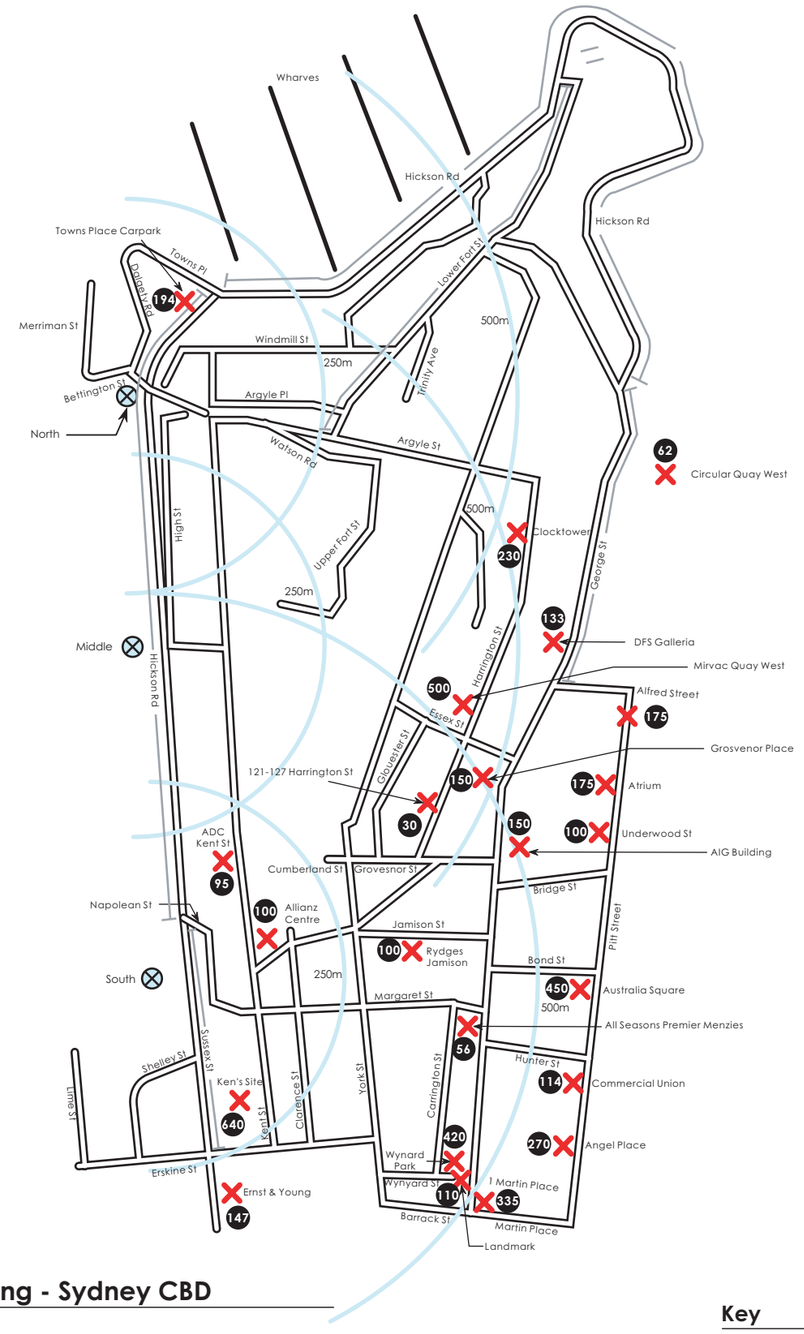
Total public off-street parking for the study area totals approximately 4700 parking spaces as shown in Table 2.2.

PARKING - SYDNEY CBD

BARANGAROO



On Street Parking - Sydney CBD



Off Street Parking - Sydney CBD

250m

Key

13 Total and Daytime Off Street Parking Capacities

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Figure A1

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Date: 10 May 2006

Table 2.2 Public Off-Street Parking

Off-Street Spaces and Proximity to Barangaroo				
	Less than 250m	250 - 500m	Greater than 500m	Total
Northern End	194 (4%)	0(0%)	4506 (96%)	4700 (100%)
Middle Portion	0 (0%)	1069 (23%)	3631(77%)	4700 (100%)
Southern End	835 (18%)	1013 (21%)	2852 (61%)	4700 (100%)

It can be seen that there are comparatively few off street parking spaces near the northern part of the site whilst the middle portion is better served (at some distance) and the southern end better served by available off-street parking.

In addition to the spaces above there are some 2119 spaces within 750 metres of the site, concentrated along Pitt Street and George Street along the eastern border of the analysis region.

2.2 Parking demand

2.2.1 On-Street Parking

In regards to on-street parking the following table is demonstrative of space occupancy in the Rocks area and is considered to corroborate casual observations that on-street parking is generally heavily used.

Table 2.3 On-Street Parking Utilisation in the Rocks

Time	% Occupied
Saturday Midday	93
Saturday Night	98
Tuesday Midday	85
Thursday Midday	76
Thursday Midday (Fashion Week)	95

Source: Transport and Traffic Planning Associates 2004

In the northern residential area (Walsh Bay Cultural Precinct), there is the largest amount of on street parking and lower occupancy rates, however, in general, the combination of parking pressure and the mixed uses in the study area suggest that patterns of weekday parking demand are fairly homogenous across all of the land use zones with high levels of usage of both short and long stay on-street spaces.

2.2.2 Off-Street Public Parking

These facilities are concentrated in the Commercial district to the south and east of the study area, with approximately 60 percent of capacity located there compared to only 22 percent of capacity located within 250 metres of the development site. Off-street public car parking is concentrated at the southern end of the development area.

Off Street car parks in the Rocks area generally have occupancy of some 80-90% of available spaces during the day on weekdays with higher occupancy rates at weekends.

2.3 Public transport

The site is not currently directly served by public transport services (see section 3.6 of main report).

A number of bus routes terminate at Millers Point and link to Glebe Point, Clovelly, Birchgrove, Kingsford and Marrickville via the City.

The Sydney Explorer Service runs along Kent Street past the site.

The 412 and 413 bus services run from King Street Wharf to Campsie via George Street.

Wynyard Railway Station is reasonably accessible from the southern part of the site with a tunnel connection from Kent Street to the Station concourse.

Ferry services to Darling Harbour run past the site with the closest wharf being located at King Street Wharf.

In total, the site does not have a good level of public transport accessibility especially so for the northern portion.

2.4 Traffic operations

Road access to the site is limited to a small number of routes which have limited traffic capacity during weekday peak periods (see section 3.4 of main report).

Routes from the South Sussex Street and Erskine Street are constrained by the Erskine – Sussex Street intersection.

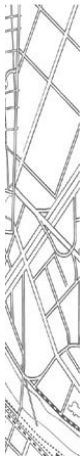
The Napoleon Street route is constrained by queuing back from the Harbour Bridge on ramps from Kent Street.

The route via Hickson Road and the Rocks is constrained by the Grosvenor/George/Bridge Street intersection.

Upper level access via Kent Street is also constrained by the Kent Street ramp to the Harbour Bridge (in peak periods).

The built form around these roads (and key intersections) means that it is extremely difficult to make changes that would add significant new traffic capacity.

In summary, the traffic operations of key site access routes are significantly constrained during weekday peaks of traffic flow.



3. Proposed Development

3.1 Components of proposed development

The main components of the Modified Concept Plan application for Barangaroo are:

- Commercial and mixed use 404,000m² GFA
- Two hotels of 35,800 m² GFA
- Public buildings 5,000m² GFA
- Residential 75,000m² GFA
- Parklands

3.2 Comment by Jury

The Stage 2 competition Jury report included the comment: *"The Jury also noted that a new parking code would need to be developed to respond to the unique nature of the site, and that therefore the parking numbers nominated by this scheme will be greatly reduced"*

3.3 Parking policy objectives

It is considered that the parking policy for the development should support ESD principles by minimising the level of traffic generation (especially in normal weekday peaks of traffic flows) and encouraging use of public transport and non-car borne travel.

3.4 Sydney City Council Parking Code

Applying the Central Sydney Local Environment Plan, 2005, to the proposed concept development the following calculations yield a maximum permitted on site parking of some 1980 spaces.

Table 3.1 Council Code Parking Calculation

Component		Rate	Parking Spaces
Residential(1)			
Studio	82	0.25	21
1 Bedroom	205	0.5	103
2 Bedroom	349	1.2	419
3 Bedroom	72	2	144
3+ Bedroom	42	2	84
Sub total	**750**		**771**
Hotel			
Some	730rms	0.2/rm	146
Commercial/Public			
Block Area 76,110 ÷ 50 = = 1,522 spaces			
404,000m² ÷ 519,800m² = 77.7% of GFA			
77.7% of 1,522 = 1,182 spaces			1,182
Total			2,099

(1) Assumed mix of unit sizes

For the commercial/public components of the concept plan the City of Sydney Council rate would represent one space per 260m² floor area.

3.5 Discussion of parking policy

Site Location

The site is not well located for existing public transport services and has a constrained capacity for additional traffic at key access routes/locations.

The development will eliminate existing port generated traffic but this is comparatively limited in peak periods (of a weekday) with truck activity during the day and limited staff journey to work trips.

The policy should support ESD principles and walking/cycling.

The site location suggests a need for:

- Significant new public transport service provisions
- Very limited on-site supply of commuter parking
- Strict control over any public car parking (and its charge rates)
- Short term only on-street parking

Parking Supply in the CBD

Based on the Council 2001 Floor Space and Employment Survey for the whole of Sydney/Pyrmont/Ultimo area there is a supply of some 34,420 tenant parking spaces servicing an internal area of some 15.1 million square metres of floor space. This is an overall rate of 1 car space per 438m².

In the core of the CBD this ratio reduces to around 1 space per 639m² floor space (this is roughly equivalent to the parking code: 1 space per 50m² site area at 12:1 floor space ratio leading to 1 car space per 600m² floorspace).

Commercial Uses Car Parking

The scheme has a total built form of some 519,800m² on a total block area of 76,110m² or a floor space ratio of around 6.8:1. This suggests that for parking supply to be equivalent to the existing Council Code (based on site area) then a parking supply rate of some 1 space per 340m² would be produced for commercial components of the scheme, with 404,000m² of commercial/public floorspace this would be equivalent to some 1,182 spaces.

However use of a 1:600m² rate (which is what new development in the CBD at 12:1 FSR receives) would reduce parking supply to some 673 spaces.

Given the site's traffic access issues it is recommended that a rate of space per 600m² be adopted for commercial uses.

Residential Car Parking

There is no direct relationship between car parking supply for residential uses and peak period traffic generation. Traffic generation for residential uses in urban areas are more directly related to availability of public transport or the ability to walk/cycle to work.

If convenient/safe walking/cycling routes to the City can be created then there is likely to be a low level of traffic generation for residential development at Barangaroo.

However it would be important that there be appropriate restrictions on sale or rent of parking spaces so as to avoid use of parking space by commuters to the CBD.

It is recommended that the following car parking rates apply to residential development of Barangaroo.

1 bedroom apartments	-	1 space/2 units
2 bedroom apartments	-	1.2 spaces/unit
3+ bedroom apartments	-	2.0 spaces/unit

Public Car Parking

Some public car parking will be needed to:

- Provide for visitors to residences/commercial uses/retailing.
- Provide for visitors to the park areas.
- Activate streets.

The need for public car parking will depend upon the likely levels of general visitation to the area and it is considered that in general:

- Public car parking should preferably be provided on-street (rather than in off-street parking stations)
- Public parking should be time limited and/or paid and commuter use discouraged by appropriate charging rates (prohibitive charges for all day parking)
- Special events may be served by use of special parking such as that provided by the Overseas Passenger Terminal
- Existing 10p (all day) on-street parking should be made short term only.

It is considered that the final parking supply will largely be decided by the final road arrangement and availability of kerb space that results. Based on the concept plan this is likely to be around 400 spaces.

It is considered that there is a case to be made for some additional public off-street car parking to serve the northern parkland part of the site (and associated kiosks/pavilions) which is most distant from Wynyard Station. This location would also enable it to be used by visitors to Walsh Bay.

It is considered that parking would be limited to around 300 spaces and should be subject to appropriate restrictions/charging regimes to keep it for short term users. The financial viability of a 300 space car park will, however, be subject to further investigation.

Other Uses

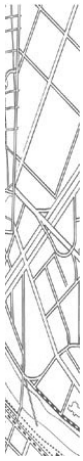
For hotel and other uses it is considered appropriate to adopt the Council of the City of Sydney rates namely:

- Hotels, private hotels and motels
  - 1 space per 5 bedrooms
  - 4 spaces per 100m² of function room area
- Theatres/Recital Halls
  - 1 space/7 seats
- Serviced Apartments
  - 1 space per one bedroom units
  - 1.2 spaces per two or more bedroom units

3.6 Accessible parking

It is recommended that 1-2% of car parking supplied with commercial public/hotel floorspace by fully accessible for the disabled.

For residential uses disabled parking is recommended to be supplied for any adaptable housing.



4. Summary

A study of parking supply in the vicinity of Barangaroo indicates some 800 on-street spaces within 250m and some 2,000 spaces within 500 metres.

Some 270 spaces in Hickson Road are 10p (all day) parking whilst the remainder is generally short stay meter controlled.

There are some 1,000 off-street public spaces within 250 metres and some 2,700 off-street spaces within 500 metres of Barangaroo.

On-street parking concentrated in Walsh Bay and Hickson Road and is observed to have high levels of utilisation during the day of weekdays with spare space generally only to be found in the north-west of local roads.

Off-street car parking is concentrated to the south and east of the Barangaroo site and has some spare capacity during weekdays.

The site currently has a poor level of public transport accessibility.

Traffic access to the site is constrained during peak traffic hours of a weekday and there is limited opportunity for significant traffic capacity increases on key access routes.

The concept plan incorporates approximately 404,000m^2 of commercial floorspace, around 750 residential units, hotels, public use and extensive parklands and circulation space.

Based on the existing Council Code the commercial floorspace, excluding hotels, would be allowed some 1,182 on-site spaces – a rate of 1 car space per 340 m^2.

Developments in the core of the CBD (with a higher FSR of around 12:1) have an effective parking supply rate of around 1 space per 600m^2 of commercial space.

It is considered the parking policy for the development should support public transport and non car borne (walk/cycle) travel.

Given the site's traffic access difficulties, it is recommended a rate of 1 space per 600m^2 commercial space be adopted and the existing Council Code rates adopted for other uses (residential/hotel).

A comparison of the application of different rates is:

Table 4.1 Parking Numbers

	Council Code Based Rate	Proposed Provision
Commercial	1,182	673
Residential	771	771
Hotel	146	146
Public	300	300
On-Street	400	400
Public buildings	n/a	16
Ports Parking (retained)	n/a	140
Total	**2,799**	**2,446**

Appendix B - Trip Generation

B.1.1 Travel markets

Barangaroo will generate demand in a number of travel markets, including:

- Workers – commercial/office and other
- Residents
- Shoppers
- Leisure visitors
- Open space users/public domain visitors
- Tourists

B.1.2 Barangaroo's Workers

From an impact perspective, the peak periods will be critical. The pre-dominance of activity associated with commercial employment, will dominate peak travel.

The following steps were used to estimate likely peak person trips:

- From floorspace, estimate the likely number of workers on site
- Disaggregate into origin markets based on 2001 JTW data for the core CBD[9]:
    - CBD
    - Pyrmont
    - Ferry-served origins
    - Other – non-bus-served, these are zones within Sydney but generally outside the area fed by city bus services
    - Other – East, eastern suburbs
    - Other – North, northern suburbs
    - Other – Southwest and Victoria Road, Marrickville around to Canada Bay and Leichhardt
- Calculate a 'status quo' trip generation and mode share based on JTW relationships and walk distances of the different development blocks on the site

[9] CBD core defined as Sydney Travel Zones 4, 5, 6, 7, 8, 9, 11, 14, 15, 16, 18, 20, 21, 831 and 832

- Re-estimate status quo trip generation and mode share when parking constraint is applied; effectively transferring 'capped' car trips pro-rata to other modes (these are daily estimates of commuter travel by workers on the site)
- Apply a time profile of demand to identify peak demands

For commuter travel by commercial employees, the following relationships between mode choice and access distances were derived from the JTW data set in order to capture the effect of location relative to transit nodes. The structure of the data, among other factors, leads to limitations regarding the strength of a number of correlations.

JTW relationships used are:

- CBD residential market – average mode shares for travel to site
- Pyrmont residential market – average mode shares for travel to site
- Ferry served market and CBD access – ferry mode share based on relationship below Chart B.1; other mode share uses an average
- Other – non-bus-served: train refer to Chart B.2; bus is an average value (0.8%); other mode share uses an average
- Other – East: train refer to Chart B.3; bus uses average bus mode share of 40.5% as intercept and -0.0002 as coefficient of walk distance; other mode share uses an average
- Other – South West and Victoria Road: train refer to Chart B.4 and bus refer to Chart B.5; other mode share uses an average
- Other – North: train refer to Chart B.6 and bus refer to Chart B.7; other mode share uses an average

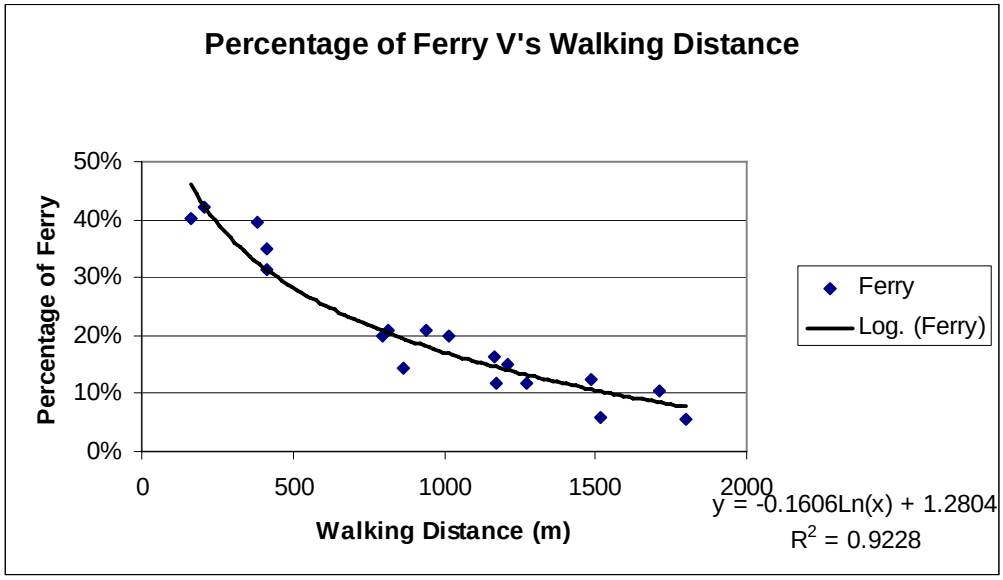


Chart B.1 – Journey - Ferry-served market: ferry mode share versus walk distance

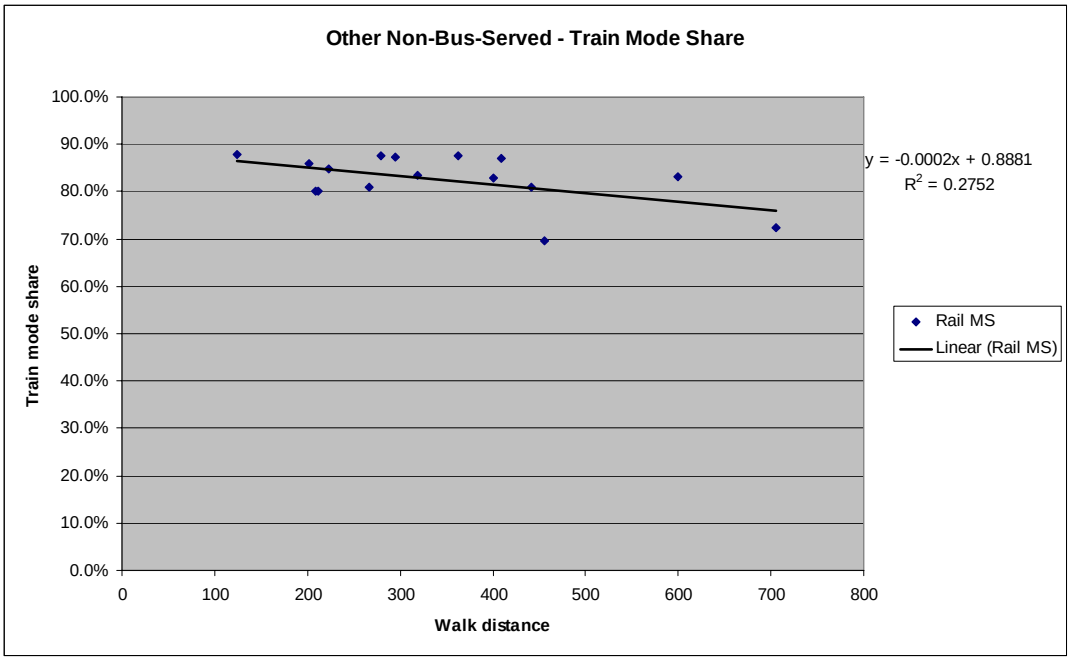


Chart B.2 – Other non-bus-served market: train mode share versus walk distance to station

Chart B.3 – Other East – Train mode share versus walk distance

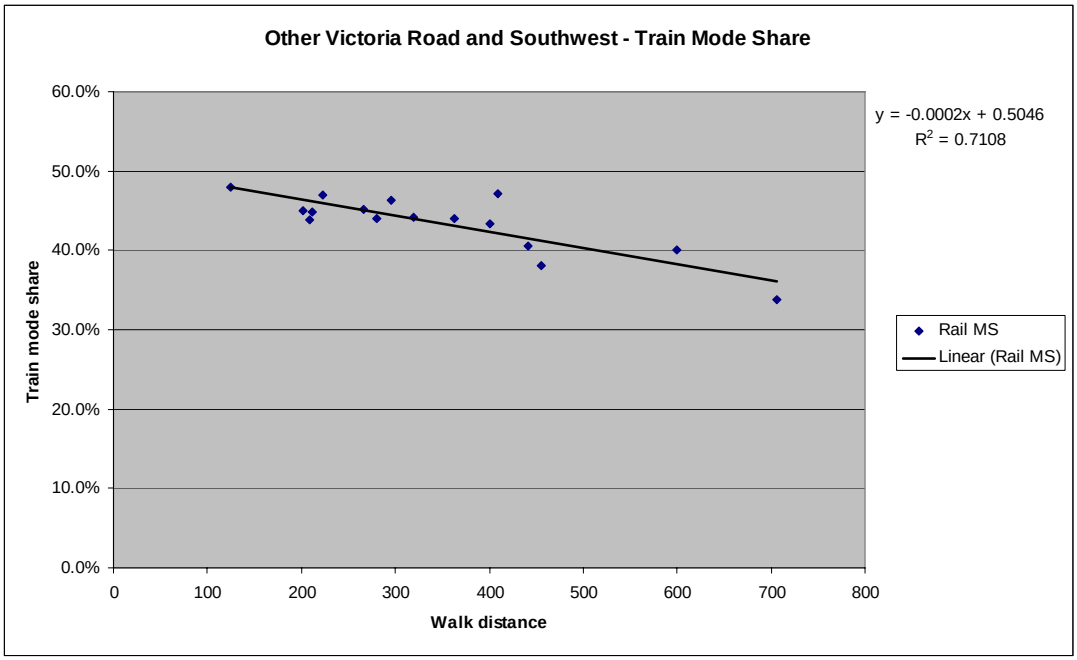


Chart B.4 – Other Victoria Road and South West – Train mode share versus walk distance

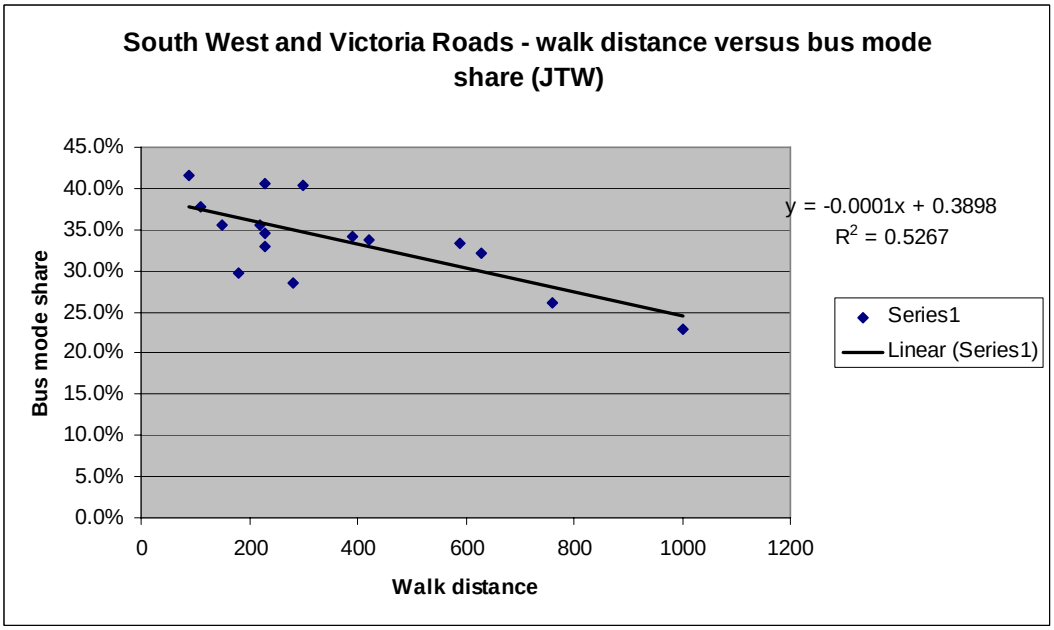


Chart B.5 – Other South West and Victoria Road – bus mode share versus walk distance

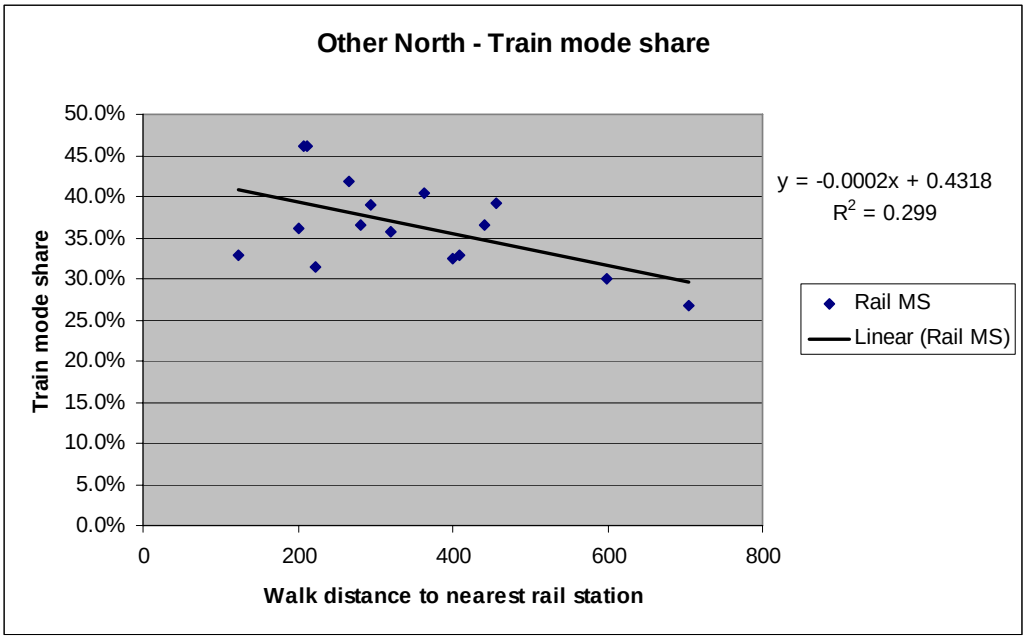


Chart B.6 – Other North – train mode share versus walk distance

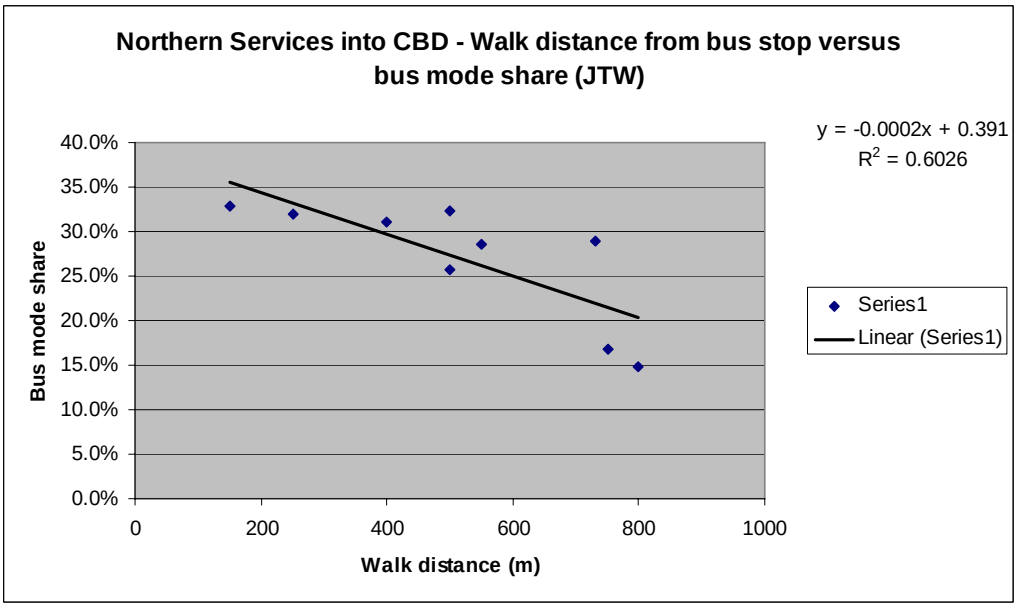


Chart B.7 – Other North – bus mode share and walk distance

B.1.3 Barangaroo's Residents

Site residents' travel during the peak is estimated using:

- Mode share from journey to work constrained by CBD traffic generation rate (from surveys) or 0.14 vehicle trips per unit
- Time profile of demand – peak 1 trip per unit per hour

CBD core mode share for residents travelling to work from journey to work data is:

Mode		Train	Bus	Car Dr	Car Pax	Other	Total
CBD Origin	Core	10.2%	9.2%	19.6%	2.7%	58.4%	100.0%

Constraining peak mode share for surveyed traffic generation, yields the following adjusted estimate of mode share:

Mode		Train	Bus	Car Dr	Car Pax	Other	Total
CBD Origin	Core	11.0%	9.9%	14.0%	1.9%	63.1%	100.0%

At one trip per unit per peak hour results in the following estimates of trip volumes by mode:

Mode		Train	Bus	Car Dr	Car Pax	Other	Total
CBD Origin	Core	83	75	105	14	473	750

'Other' mode is primarily walking.