

# Barangaroo Concept Plan (MP06\_0612 MOD 9)

## Transport Management and Accessibility Plan – MOD 09

Rev G | 30 October 2023



Image credit: Infrastructure NSW June 2021

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Job number 274378-00

Arup  
Arup Pty Ltd ABN 18 000 966 165



**Arup**  
Level 5 151 Clarence Street  
PO Box 76 Millers Point  
Sydney 2000  
Australia  
[www.arup.com](http://www.arup.com)

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		Name	Emma Carlisle	James Turner	James Turner
		Signature			
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		Name	Emma Carlisle	James Turner	James Turner
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		Name	Emma Carlisle	Michael Cavallaro	Michael Cavallaro
		Signature			
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		Name	Emma Carlisle	Michael Cavallaro	Michael Cavallaro
		Signature			

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		Name	Emma Carlisle	Eoin Cunningham	Eoin Cunningham
		Signature			
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		Name	Emma Carlisle	Eoin Cunningham	Eoin Cunningham
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		Name	Lynette Yang/ James Glenn-Craigie	Tony Nichol	Tony Nichol
	Signature				
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		Name	James Glenn-Craigie	Tony Nichol	Tony Nichol	
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## Acknowledgement of Country

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We would like to acknowledge the Gadigal people who are the Traditional Custodians of this land. We would also like to pay respect to the Elders both past and present of the Eora Nation and extend that respect to all Aboriginal people.

## Executive Summary

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Barangaroo reference scheme Modification 9 (MOD 9) provides a flexible approach to the future mix of land uses at Central Barangaroo comprising residential, retail, hotel, community uses and public open space. This Transport Management and Accessibility Plan (TMAP) assesses the transport, traffic, and access implications of the proposed development, which is represented by a mix of uses in Blocks 5, 6 and 7 as part of the reference scheme.

The analysis in this report has been completed based on the flexible approach to the reference scheme. Any changes to the design as part of ongoing consultation with stakeholders, will require the analysis to be revisited and could result in change to the impact of the development as the design develops.

The previous MOD 9 report was submitted in 2021 for comments by the public and local authorities. City of Sydney have submitted comments, these have been addressed in this report. The GFAs and proposed land uses for the development have also been finalised and are reflected in the report.

Both MOD 9 exhibited and RTS do not proposed a final quantum of car parking for Central Barangaroo. The car parking provision is set out in the existing Instrument of Approval under Condition C4 and there is no change to this condition.

Additionally, the report addresses the changes to the future public transport plans announced by the NSW government. The transport recommendations and findings of several key planning documents relevant to Barangaroo, those being:

- Future Transport 2056.
- Barangaroo Integrated Transport Plan.
- Sydney City Centre Access Strategy.

Initial planning approval for Barangaroo was based on the principle of achieving high usage of public transport, walking and cycling as a method of travel to work, with a low target of 4% travel using private car. The overall mode split targets have been retained for the whole of Barangaroo from the TMAP August 2015 (MOD 8), with the exception of train and Metro trips. The TMAP August 2015 did not consider the provision of a new Metro Station at Barangaroo. It is now forecast that the travel demand will be split evenly between heavy rail (primarily using Wynyard Station) and the Metro to Barangaroo.

The precinct maintains a high degree of pedestrian connectivity, with Wulugul Walk providing a continuous link for pedestrians between Barangaroo Reserve and Barangaroo South. The Central Barangaroo reference scheme also includes a new overhead, grade-separated bridge between the development and High Street, through reinstating a historic bridge connection. Interventions would be needed to provide accessible routes along High Street to the bridge. At precinct level, the extension of Scotch Row connecting Nawi Cove and Hickson Park, one-way shared street at Barangaroo Avenue and wide footways on the western side of Hickson Road provide capacity for Barangaroo Metro Station and Central Barangaroo. Permeability of the development will also be provided east-west through connections for pedestrian and cyclists.

Complementing this pedestrian network will be several high-quality bicycle routes, including a bi-directional cycleway on Hickson Road adjacent to the site and connections through the site to connect cycle movements in all directions.

The introduction of the Barangaroo Metro Station will improve public transport access for people travelling to and from the precinct by providing a highly accessible, high-capacity alternative to Wynyard Station. It will provide future workers, residents and visitors direct access to key strategic centres such as Bankstown, Waterloo, North Sydney, Crows Nest and Macquarie Park. One entry point to the Metro Station is planned within the Central Barangaroo Precinct at Nawi Cove.

A comparison has been undertaken of the traffic modelling from MOD 8, and this proposed modification (MOD 9). It was concluded that the total volume of traffic generated by the entire precinct will be approximately the same compared with that previously assessed in MOD 8. Change in the MOD 9 assessment are as follows:

- Adjustment in traffic generation due to the decrease in commercial and increase residential GFAs;
- The introduction of a new Metro Station in Central Barangaroo; and
- The revision in future bus numbers on Hickson Road.

A network traffic model was developed which assessed the future performance of the road network serving the precinct. Changes in vehicle delays are relatively minor for most parts of the network in both the AM and PM commuter peak hours. In the PM peak hour Hickson Road / Napoleon Street intersection is showing that it is operating at capacity with LOS E. Changes to the road network layout and the lane assignment on Hickson Road has resulted in Napoleon Street operating slightly worse than MOD 8. The assessment concluded that the road network operates at capacity.

Car parking is proposed at the same parking ratios as used in the MOD 8 TMAP. The number of off street car parking is proposed to be 483 spaces. A reduction in the number of on-street parking bays on Hickson Road to approximately 20 spaces (down from 125) due to the road upgrade is envisaged compared to that previously considered. Six on-street parking spaces are also being proposed within development.

# 1 Introduction

The Central Barangaroo Developer commissioned Arup to prepare a Transport Management and Accessibility Plan (TMAP) report to accompany a modification (MOD 9) to the currently approved Barangaroo reference scheme (MP06\_0162).

This document was prepared with reference to the amendment to the “Barangaroo Transport Management and Accessibility Plan, Request for Detailed Proposal - Barangaroo South” issued by the NSW Government in 2008 (TMAP September 2008), MOD 8 (TMAP 2015) and the MOD 10 Supplementary TMAP. Since the 2008 TMAP was prepared, there have been some changes which have implications for the precinct, including:

- Modifications to the planned floor space mix;
- Changes to the future public transport network serving the precinct, particularly the introduction of a new Metro Station at Central Barangaroo; and
- Adjustments in the road network layout (both internal and external to the site).

The main transport principles for the updated TMAPs have remained unchanged including journey to work mode share target of 4% trips by car, 19% trips by bus/light rail and 61% by Train and 4% trips by ferry.

MOD 9 provides a flexible approach to the future mix of land uses at Central Barangaroo comprising residential, retail, hotel, community uses and public open space. For the purposes of MOD 9, this TMAP assesses the transport, traffic and access implications of the reference scheme, which is represented by a mix of uses that optimises future potential residential use in Blocks 5, 6 and 7.

An initial application for MOD 9 was submitted in 2021, that submission has generated comments for a number of authorities. This update to the MOD 9 TMAP addresses comments made to the submission as well as changes that have been made to the yields of each land use.

Table 1 Changes to MOD 9 development for re-submission

Land Use	Area in original MOD 9 (GFA)	Area in updated MOD 9 (GFA)
Commercial	46,997 m <sup>2</sup>	736 m <sup>2</sup>
Hotel	0 m <sup>2</sup>	15,898 m <sup>2</sup>
Community	2,350 m <sup>2</sup>	2800 m <sup>2</sup>
Residential	28,000m <sup>2</sup>	69,800 m <sup>2</sup>
Retail/Other uses	36,781 m <sup>2</sup>	14,766 m <sup>2</sup>
<b>Total</b>	<b>114,128 m<sup>2</sup></b>	<b>104,000 m<sup>2</sup></b>

The analysis in this report has been completed based on the flexible approach to the reference scheme. Any changes to the design as part of ongoing consultation with stakeholders, will require the analysis to be revisited and could result in change to the impact of the development as the design develops.

## 1.1 Barangaroo Concept Plan

The transformation of the former East Darling Harbour site into Barangaroo is Sydney’s most important waterfront renewal project in decades, regenerating a once neglected and inaccessible area of the city into a dynamic cultural, residential, business and retail hub.

Barangaroo is located on the north western edge of the Sydney Central Business District. It is bounded by Sydney Harbour to the west and north, the historic precinct of Millers Point (for the northern half), The Rocks and the Sydney Harbour Bridge approach to the east and a range of development dominated by large CBD commercial tenants to the south.

The Barangaroo site has been divided into three distinct redevelopment areas (from north to south) - the Barangaroo Reserve, Central Barangaroo and Barangaroo South as shown in Figure 1. The Approved Barangaroo Concept Plan relates to Central Barangaroo.

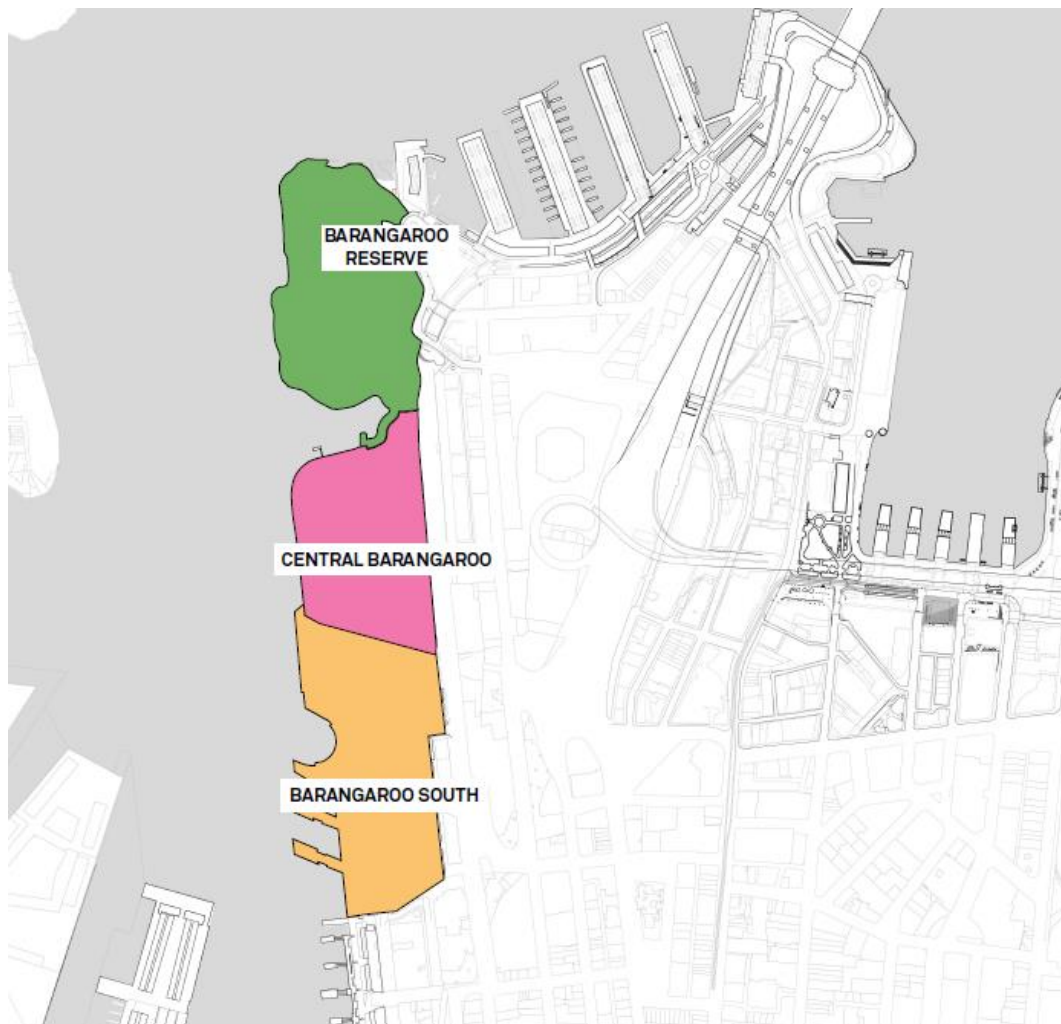


Figure 1 Site location of Barangaroo (source: Urban Design Report)

Barangaroo’s mixed use development framework creates three connected precincts each with their own distinct character:

1. **Barangaroo Reserve.** At the northern end of the precinct, Barangaroo Reserve, has been designed and delivered as a six-hectare foreshore parkland offering spectacular panoramic harbour views, extensive walking and cycling trails, idyllic coves, unique event spaces and peaceful picnic spots.
2. **Barangaroo South.** To the south is Barangaroo’s commercial and residential precinct featuring world class dining, retail, and premium waterfront office space. Barangaroo South includes the three International Towers, International House, Daramu House, five residential buildings, Barangaroo Ferry Wharf, the iconic Barangaroo House, and nearly three hectares of public space. It will also be home to Sydney’s first six-star luxury hotel and resort, Crown Sydney Hotel and Resort, attracting thousands of visitors from overseas and around Australia.
3. **Central Barangaroo** is a mixed-use precinct located between the Barangaroo Reserve in the north, the new financial, retail and residential address of Barangaroo South and the adjacent historic suburbs of Millers Point and Walsh Bay. As Barangaroo’s keystone project, Central Barangaroo will draw together residential, retail and hotel uses with civic spaces and foreshore parklands to create its own distinct identity and become the vibrant civic and community heart of Barangaroo.

The initial environmental assessment requirements for the overall Barangaroo renewal project were issued in June 2006 (Ref MP06\_0162) and the original Barangaroo Concept Plan for the redevelopment of Barangaroo was approved in February 2007, by the then Minister for Planning.

The currently approved Barangaroo reference scheme creates a development framework of streets and development blocks that is delivering a dynamic mix of residential, tourist, retail, community and cultural uses, whilst ensuring over half of the 22-hectare site is dedicated for public open space on or close to the harbour foreshore.

The currently approved Barangaroo reference scheme has been modified a number of times since 2007. Most recently by Modification 10 and Modification 11 and to be concluded with the proposed MOD 9 for Central Barangaroo.

## 1.2 Introduction to Central Barangaroo

Central Barangaroo is proposed as a dynamic mixed-use foreshore precinct that draws together and integrates high quality foreshore public spaces with city living, community and cultural uses, a bustling shopping and dining precinct, all easily connected to Sydney’s new metro network.

Barangaroo Metro Station will significantly improve access for visitors, residents, workers and shoppers alike and transform how people arrive in the Sydney CBD and on the harbour foreshore. Central Barangaroo will connect seamlessly to the new metro station and create the new place to arrive in and experience the city.

Central Barangaroo comprises the remaining development blocks 5, 6 and 7 of the approved Barangaroo reference scheme and Harbour Park connecting to the western harbour foreshore, as displayed in Figure 2. There are three main streets

which provide access to Central Barangaroo, those being Hickson Road, Barangaroo Avenue and Street D.

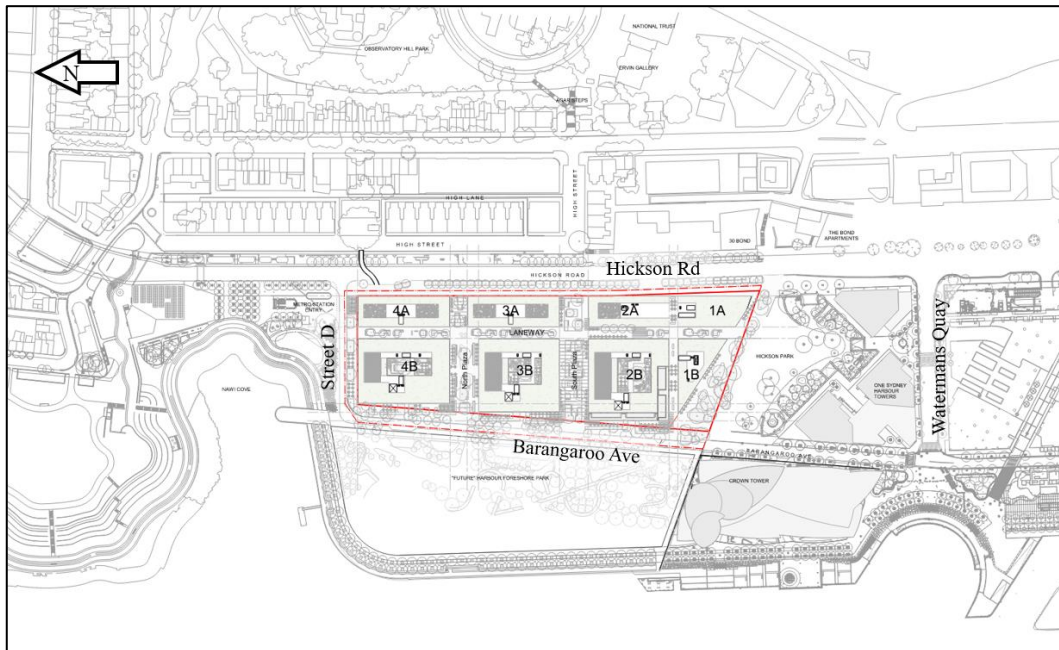


Figure 2 Central Barangaroo proposed blocks and streets (base map source: SJB)

The Central Barangaroo Urban Design Report builds upon the key objectives and core principles of the SOM Master Plan Framework for Central Barangaroo to ensure the proposed built form creates an appropriately scaled visual transition between the natural setting and scale of Barangaroo Reserve and Nawi Cove, to the bustling, high rise central business district scale of Barangaroo South.

The recently completed Wulugul Walk now extends along the entire Barangaroo waterfront as a vital section of the 14km Woolloomooloo to Glebe foreshore walk. Central Barangaroo’s Harbour Park will create a major western harbour public open space that seamlessly integrates with Wulugul Walk, to diversify and enhance the city’s waterfront experience. To the south, Central Barangaroo will shape and activate Hickson Park as a city park and to the north, help create Nawi Cove as the new place to arrive in the city.

### 1.3 Planning Context

Barangaroo is a globally recognised urban renewal project of approximately 22 hectares (ha) located on the western harbour foreshore of Sydney’s CBD. As Australia’s first carbon neutral urban precinct, Barangaroo showcases world-class sustainability, whilst delivering extensive new foreshore public spaces on Sydney Harbour, international design excellence, the implementation of leading technologies and public art and cultural programs.

The Barangaroo Act 2009 (transferred to Infrastructure NSW on 1 July 2019) was established in March 2009 to ensure management and compliance of Barangaroo in achieving the following objectives:

- *To encourage the development of Barangaroo as an active, vibrant and sustainable community and as a location for national and global business;*
- *To create a high-quality commercial and mixed-use precinct connected to, and supporting, the economic development of Sydney;*
- *To facilitate the establishment of Barangaroo Reserve and public domain land;*
- *To promote the orderly and sustainable development of Barangaroo, balancing social, economic and environmental outcomes; and*
- *To create in Barangaroo an opportunity for design excellence outcomes in architecture and public domain design.*

Infrastructure NSW (INSW) was established in July 2011 to assist the NSW Government in identifying and prioritising the delivery of critical public infrastructure for NSW. As of 1 July 2019, INSW is the State Government agency responsible for the development of Barangaroo and management of its public spaces.

The original environmental assessment requirements for the overall Barangaroo renewal project were issued in June 2006 (Ref MP06\_0162) and the original Concept Plan for the redevelopment of Barangaroo was approved in February 2007, by the then Minister for Planning.

The currently approved Barangaroo reference scheme creates a development framework of streets and development blocks that can deliver a future mix of commercial, residential, tourist, retail and community uses, whilst dedicating approximately 50% of the 22 hectare site for new public open space. The approved Barangaroo Concept Plan has since been modified a number of times and the most recent approved modification is Modification 11 (MOD 11) to Barangaroo Concept Plan (MP06\_0162 MOD 11).

The currently approved Barangaroo reference scheme defines three distinct precincts referred to as Barangaroo South, Central Barangaroo and Barangaroo Reserve. These three precincts together form the overall mixed use development framework as approved under MOD 11 comprise the following:

- A mixed-use development involving a maximum of 602,354 sqm gross floor area;
- (GFA), comprised of:
  - a maximum of 191,031 sqm of residential GFA of which a maximum of 162,031 sqm will be in Barangaroo South;
  - a maximum of 76,000 sqm of GFA for tourist uses of which a maximum of 59,000 sqm will be in Barangaroo South;
  - a maximum of 34,000sqm of GFA for retail uses of which a maximum of 30,000 sqm will be in Barangaroo South;
  - a maximum of 5,000 sqm of GFA for active uses in the Public Recreation zone of which 3,500 will be in Barangaroo South; and
  - a minimum of 12,000sqm GFA for community uses.

- Approximately 11 hectares of new public open space/public domain, with a range of formal and informal open spaces serving separate recreational functions and including an approximate 2.2km public foreshore promenade;
- Built form design principles, maximum building heights and GFA for each development block within the mixed use zone;
- Public domain landscape concept, including parks, streets and pedestrian connections;
- Alteration of the existing seawalls and creation of a partial new shoreline to the harbour;
- Construction, operation and maintenance of a concrete batching plant to supply concrete for construction of future development under this approved Concept Plan at Barangaroo South; and
- No approval is granted or implied for the future use of a heliport and/or a helipad.

The GFA and maximum building heights for each development block, as approved under MOD 11 are detailed below:

Table 2 MOD 11 GFA and maximum building heights

Block	GFA (sqm)	Residential GFA (Max) (sqm)	Height (m) (Max AHD)	Height above existing ground level (m)
Block 1	1,927	0	RL 25	23
Block 2	197,280	0	RL 180	178
Block 3	129,934	10,515	RL 209	207
Block 4A	92,629	91,816	RL 250	248
Block 4B	21,508	20,637	RL 107	173
Block X	18,908	16,463	RL 41.5	39.5
Block Y	77,500	22,600	RL 275	273
Block 5	29,688	15,000	RL 34	32
Block 6	3,000	0	RL 29	27
Block 7	15,000	14,000	RL 35	33
<b>Total</b>	<b>587,354</b>	<b>191,031</b>		

In addition to the above, the current Barangaroo Concept Plan as approved in MOD 11 also allows for:

- a maximum of 5,000sqm of GFA for active uses within the Public Recreation zone (RE1), 3,500sqm of which is located within Barangaroo South; and
- a minimum of 12,000sqm GFA for community uses.

The Concept Plan as modified provides for a B4 Mixed Use Zone within Central Barangaroo comprising three development blocks (Blocks 5, 6 and 7) in addition to land identified for new public open space / public domain.



The Section 75W Modification to the currently approved Concept Plan for Barangaroo (MOD 9) was initially commenced in 2014 and has been recommenced in 2023. MOD 9 incorporates significant further master planning work and public consultation to realise the delivery of the final stage of the Barangaroo renewal project.

## 1.4 Proposed Modification to Barangaroo Reference Scheme for Central Barangaroo (MOD 9)

Modification 9 to the Barangaroo reference scheme (MP06\_0162 MOD 9) proposes:

- 1) An increase in total permissible **GFA** from 602,354m<sup>2</sup> to 667,686m<sup>2</sup>, with the following within Central Barangaroo:
  - a. up to 92,908m<sup>2</sup> of above ground GFA within Blocks 5, 6 and 7;
  - b. up to 11,092m<sup>2</sup> of below ground GFA within Blocks 5, 6 and 7;  
and
  - c. up to a total of 104,000m<sup>2</sup> above and below ground within Blocks 5, 6 and 7.
- 2) Modifications to Barangaroo's **movement network** to redirect and reduce the impact of vehicular traffic and significantly improve pedestrian movement, safety, and amenity, including the removal of vehicular traffic from internal road networks between the blocks and the extension of Central Barangaroo's Harbour Park.
- 3) Modifications to the Central Barangaroo **building envelope** that allow for greater variation in building heights across Blocks 5, 6 and 7 to enable building form, massing and modulation that is responsive to context and adjusts the development boundary for Block 5.
- 4) Introduction of **Design Guidelines** for Central Barangaroo.
- 5) Consequential amendments to the **State Significant Precincts SEPP**.
- 6) Revisions to the Barangaroo reference scheme **Statement of Commitments**.

## 1.5 Response to submissions

### 1.5.1 Comments from the City of Sydney

In response to the proposed changes to the Central Barangaroo development outlined in MOD9, the City of Sydney have issued a series of comments to Department of Planning and Environment detailing objections to and advice for aspects of the application. Comments relevant to this TMAP and responses provided in the report are summarised in Table 3 below.

Table 3 Comments from the City of Sydney

CoS Ref	Comments	Response	Further details in
<b>City of Sydney Submission – R/2008/16i – 2022/403674</b>			
6.1.2	The connection with the Metro station may underestimate the peak volume of people that will move through the space, having soft landscape areas and constrained widths of pathways.	An assessment, in-line with the TfNSW's Walking Space Guide (2020), has been undertaken demonstrating the minimum width of the streets and pathways. The configuration of the streets and pathways will be developed as part of detailed applications.	Section 6.6
6.1.3	Pedestrian volumes and service levels need to be assessed to determine whether footpath widths will cope with the volume of pedestrians and commuters generated by Metro and additional commercial/residential GFA. Level of service modelling should be provided to support the proposed footpath widths. This modelling needs to document the cumulative impact of development in addition to modelling for Sydney Metro Barangaroo stop by TfNSW.	An assessment, in-line with the TfNSW's Walking Space Guide (2020), has been undertaken demonstrating the minimum width of the streets and pathways. The configuration of the streets and pathways will be developed as part of detailed applications.	Section 6.6
6.1.6	Hickson Road is being partly delivered by Metro. Hickson Road design needs to be fully coordinated, designed, and resolved in consultation with the City.	The Central Barangaroo masterplan will be developed to co-ordinate with the delivery of Hickson Road.	Section 6.5 and Section 6.6

6.3	<p>The City generally supports a bridge as a way of integrating and connecting Barangaroo Central to the rest of the City (with consideration of the heritage comments provided above).</p> <p>Community concerns around this bridge allowing people to park in Millers Point and walk to the proposed shopping centre need to be adequately addressed.</p> <p>The bridge must provide disability access and be accessible to people cycling. The City should remain involved in the selection of location and the design process</p>	<p>To supplement the provision of a bridge connection Central Barangaroo and Millers Point via High Street, interventions will be needed to provide access for all users, including cycle movements connections along High Street. Engagement will be needed with City of Sydney to determine the design and supplementary measures such as a parking strategy which will also be needed to ensure any impacts on car parking does not adversely affect the local community.</p>	Section 6.6
6.6.2	<p>Barton Street lies across the path of people moving north south and has only one crossing provided. It forms an obstacle to the movement of people particularly on any alignment of the pedestrian avenue and links between parks.</p>	<p>Barton Street is being removed from the masterplan. Therefore, Barton Street does not lie across pedestrian movements in north south direction and there is no obstacle.</p>	Section 1.8
6.6.4	<p>It is recommended that the size of the pedestrian crossing be increased and extended to the corner to facilitate the desire line of pedestrians and park users.</p>	<p>Barton Street is being removed from the masterplan. Therefore, a pedestrian crossing is not needed. There is no street that needs to be crossed.</p>	Section 1.8
6.6.5	<p>Clarification around cyclist connections along Barton Street is also required.</p>	<p>Barton Street is being removed from the masterplan. However, cyclist will still be able to use this as a route to get to the Harbour Park. It will be a shared area between pedestrians and cyclists.</p>	Section 1.8 and Section 6.7
8.1	<p>The application shows very little about cycling provision, in particular how the proposed cycleway down Hickson Road is integrated with the development and links to open space and the harbour.</p>	<p>The masterplan allows for a highly accessible street network that will enable cycle access. Pedestrian and cycling crossing will be provided on Hickson Road. The exact location and design of these will be looked at in greater detail in SSDA stage.</p>	Section 6.7
8.2	<p>The proposal results in an increase in car parking on the site compared to Mod 8, which is generally not supported by the City in this location. In order to address community concerns about demand for car parking with the extent of retail proposed, the proposal should design the retail strategy around a no-drive approach.</p>	<p>Comparing MOD 8 to MOD 9, the difference in the total number of car parking spaces within Central Barangaroo is an increase of 17 spaces. This is due to the reworking of the landed uses and the area of each. Also refer to item 5.2 in this table (below)</p>	Section 6.4

8.5	<p>The walking assessment should use the methodology set out in TfNSW’s Walking Space Guide (2020) rather than Fruin which is only suitable for within constrained interchanges. The assessment should include background walking volumes, not just people exiting the Metro.</p>	<p>An assessment, in-line with the TfNSW’s Walking Space Guide (2020), has been undertaken demonstrating the minimum width of the streets. The configuration of the streets will be developed as part of detailed applications.</p>	Section 6.6
8.6	<p>Cycle parking and end of trip facilities for all land uses, including visitor parking, should meet the Sydney DCP rates. Guidance regarding placement, quality and accessibility should also refer to Sydney DCP. In particular:</p> <ul style="list-style-type: none"> <li>• Where bike parking for tenants is provided in a basement, it is to be located on the uppermost level, close to entry/exit points and subject to security surveillance;</li> <li>• A safe path of travel from bike parking areas to entry/exit points is to be provided;</li> <li>• Bike parking should be accessible via ramp;</li> <li>• End of trip facilities should be located close to the bike parking area.</li> </ul> <p>Visitor bike parking is to be provided in an accessible on-grade location near a major public entrance to the development.</p>	<p>End of trip facilities have been removed from the development due to the removal of office development from Central Barangaroo.</p> <p>Bike parking will be designed in line with Sydney DCP. The final arrangement of bike parking stands will be confirmed at SSDA stage.</p>	Section 6.7
<b>City of Sydney Submission – R/2008/16i – 2022/433502</b>			
5.1	<p>Section 6.7.1 of the Transport Assessment notes a separated on-road cycleway on the eastern side of Hickson Road. The City has previously been involved in the development of the Barangaroo Station Design and Precinct Plan (2020-21) which was prepared by Metro in consultation with INSW and Metro. The design proposed at the end of this process is supported in principle by the City. The design should incorporate the City’s feedback that has been provided. Once people cycling exit the formal cycling network, they still need to feel comfortable for the last several blocks before reaching their destination. To make this possible in mixed traffic, all internal streets should be designed for low speed (30km/h maximum) vehicle movements.</p>	<p>All internal roads will comply with standards for mixed traffic roads and speed will be limited to allow for safe movements of cyclists.</p>	Section 6.7
5.2	<p>Table 14 in the Transport Assessment sets out the proposed increase in parking spaces from 3,602 to 3,768, including 113 spaces associated with retail use.</p>	<p>The number of car parking spaces the proposed as part of MOD 9 for Barangaroo over all</p>	Section 6.4

	<p>... The City remains concerned that the unnecessary provision of car parking will encourage private vehicle use... The City considers that no additional car parking should be provided as part of Modification 9. To address community concerns about demand for car parking with the extent of retail proposed, the proposal should design the retail strategy around a no-drive approach.</p>	<p>is 3,619 spaces instead of 3,768. Central Barangaroo is proposed to have 483 car parking spaces, 94 spaces less than the maximum permissible allocation based on the standards.</p>	
5.3	<p>The City supports the reduction in on-street parking and the use of the remaining spaces for short-stay uses only. It is unclear the exact number of on-street parking spaces to be provided within the precinct. In the Transport Assessment, Table 14 states 25 spaces, while Section 6.4.2 says 6 spaces will be provided. This needs to be clarified. The City supports the lower of the two figures stated (6 spaces).</p>	<p>Hickson road will have 20 on street parking spaces.  Central Barangaroo will have 6 on street parking spaces.</p>	Section 6.4
5.4	<p>Section 6.6 of the Transport Assessment describes a Fruin Level of Service analysis used to determine whether the provided footpaths are adequate. There are two issues the City would like addressed regarding this piece of analysis.</p> <ul style="list-style-type: none"> <li>• Firstly, Fruin is suitable for use within confined stations and interchanges but is not a suitable method for assessing pedestrian flows on streets. TfNSW's Walking Space Guide should be used instead as it accounts for interactions between people walking and vehicles and includes consideration of buffers and active frontages.</li> <li>• Secondly, background pedestrian flows should be included in the assessment. If exact numbers are not known, then an order-of-magnitude sensitivity test would be acceptable. Only looking at people exiting Metro is likely an underestimation of the total footpath use.</li> </ul>	<p>An assessment, in-line with the TfNSW's Walking Space Guide (2020) demonstrates that minimum width of the streets. The configuration of the streets will be developed as part of detailed applications.</p>	Section 6.6

## 1.6 Proposed GFA

The existing and proposed GFA for each Barangaroo development block, comprising Barangaroo South, Central Barangaroo and including Barangaroo public domain (RE1), are tabulated below in Table 4.

Table 4 Proposed GFA

Block	GFA (sqm)	Residential GFA (sqm)
<b>BARANGAROO SOUTH - Existing</b>		
Block 1	1,927	0
Block 2	197,280	0
Block 3	129,934	10,515
Block 4A	92,629	91,816
Block 4B	21,508	20,637
Block X	18,908	16,463
Block Y	77,500	22,600
<b>Barangaroo South subtotals</b>	<b>539,686</b>	<b>162,031</b>
<b>CENTRAL BARANGAROO - Proposed</b>		
Block 5, 6 & 7 above ground	92,908	67,219
Block 5, 6 & 7 below ground	11,092	2,581
<b>Block 5, 6 and 7 subtotals</b>	<b>104,000</b>	<b>69,800</b>
<b>COMMUNITY AND ACTIVE USES (RE1)</b>		
Community uses (in the Cutaway, located below the Barangaroo Reserve RE1 Zone)	18,000	0
Active uses in the RE1 Zone	5,000	0
Community uses in the RE1 Zone (Central Barangaroo and Barangaroo South)	1,000	0
<b>Community and active uses subtotals</b>	<b>24,000</b>	<b>0</b>
<b>BARANGAROO REFERENCE SCHEME TOTAL</b>	<b>667,686</b>	<b>0</b>

NOTE: The approved Barangaroo reference scheme defines *Community uses* and *Active uses* as follows:

- **Community uses** include child care centres, community facilities, educational establishments, entertainment facilities (other than cinemas and amusement centres) information and education facilities, landside ferry facilities, places of public worship, public administration buildings, public halls, recreations areas, recreation facilities (major, outdoor and indoor) and health services facility;
- **Active uses** include café kiosks, retail kiosks, pavilions, ferry ticket office, public convenience (toilet facilities) and small equipment storage spaces and the like.

## 1.7 Place Principles for Central Barangaroo (MOD 9)

In envisioning the last phase of Barangaroo’s renewal, the urban design principles for Central Barangaroo respond to and build upon the planning, design and development guidance provided in SJB Urban Design Report.

The place principles for MOD 9 for Central Barangaroo's propose to:

**1. Distinctly Sydney;**

- Embodying the beauty of the city and its harbour setting, without the need or desire to over-power and dominate.
- Creating a sense of 'the local', that's familiar and comfortable - avoiding a sense of exclusivity and elitism.
- Forming a new neighbourhood that relates to the grain and texture of Millers Point, with the global reach of Barangaroo and the Harbour City.

**2. Connecting communities;**

- Seamlessly integrated streets and spaces that open views and vistas to the harbour.
- Bringing nodes and modes together into cityscape that caters to everyone but frames the experience around the pedestrian.
- Opening-up the western edge of the city from The Rocks and Millers Point to the Harbour and Headland Parks.

**3. Right fit;**

- Spaces and places between the buildings are distinctive and provide relief from the intensity of the city and openness of the foreshore spaces.
- Eroding the monumental scale of the city into a grain and form that feels familiar, comfortable and content.
- Nestled into the sandstone cliff along Hickson Road to create a 'gully'; cool, contained and calm.

**4. Engage with nature;**

- Dynamic spaces and streets catering to the diurnal rhythm of the city, shifting seasons and phases of the harbour life finer grain.
- Deep soil at the edges, providing cool canopies that protect pedestrians and manage privacy.
- Seamless integration to the Harbour Park, drawing nature into the heart of the precinct through intimate landscaping;
- Bringing nature in and up buildings, utilising edges, balconies, and roof planes.
- Sun and air into the open streets, using the proportions of these spaces to manage weather, shade, and comfort levels.

**5. Holding the edges;**

- Provide strong edges to Harbour Park, Hickson Park, Hickson Road and Nawi Cove, which are public, active, and dynamic. These are the 'front door' of the place.
- The interface at ground will determine the relationship with the place. The publicness of this experience will influence its role in the city.

- Consider where people wish to move, dwell, sit and enjoy the spaces in and around the site. Slow and fast spaces, controlled through changes in street and space aperture, placement of seating, landscaping, and wayfinding;
- Provide clear thresholds between the edges and the internal experience - consciously designed by experienced in the subconscious.

#### 6. **Beauty and delight;**

- Beauty is in the ‘eye of the beholder’, and should be sought through individual moments, rather than a monumental gesture.
- Each building can offer unlimited and varied outcomes but should sit comfortably within the fabric of the city - there’s no need to yell or shout from every façade.
- The beauty of the site and its setting provide the ideal backdrop for framed and reflected views of the park, harbour and city setting.
- Honest and tactile materials, embraced and crafted with care into a place that offers variation and texture, but reads in a coherent way for those that visit.
- Being playful is always a good thing, but everyone needs to be in on the game. Be inclusive and engaging throughout.

#### 7. **Future focused**

- The sustainability of the precinct should be the legacy of Barangaroo and surpass the ambitions of the City.
- Targets should be set within the context of global best practice; this is the expectation.
- Locally, the focus will be on liveability, community well-being, health, and amenity - this is the same, whether you’re a resident, tenant or visitor.
- Record, Report and Refine over time - progress requires movement in a positive direction, and not a static response.

## 1.8 **Central Barangaroo – Key Moves and Design Strategy**

To realise these urban design principles, Central Barangaroo’s design strategy proposes three key integrated planning and design moves:

### **A. Improve the movement network and create better places**

MOD 9 for Central Barangaroo proposes to improve Barangaroo’s movement network by redirecting and reducing the impact of vehicular traffic, whilst significantly improving pedestrian movement, amenity, safety and the quality of future public spaces and places. The key movement network and place improvements propose to:



- 1) remove vehicular traffic from Blocks 5, 6 and 7 and enable Central Barangaroo's Harbour Park to extend eastwards between Hickson Park and Street D via unimpeded north south pedestrian link ;
- 2) remove Barton Street from the masterplan as a vehicular connection between Barangaroo Avenue and Hickson Road;
- 3) redesign Barangaroo Avenue (north of the Crown hotel) and Streets D as shared pedestrian street zones that connect Hickson Road with Barangaroo Avenue, Harbour Park and Nawi Cove; and
- 4) create a finer grain and walkable network of activated streets, laneways, public parks and urban places that offer improved movement, pedestrian safety, amenity and quality of place.

#### **B. Increasing public open space and accessible public domain**

MOD 9 for Central Barangaroo proposes to increase the overall provision of public open space to over 11 ha, an area greater than 50% of the Barangaroo precinct.

To complement this harbour foreshore public open space, MOD 9 proposes a connected network of finer grained urban spaces and places designed as part of the Central Barangaroo development blocks, to provide accessible and activated public domain in three new urban spaces:

- 1) Extension of Scotch Row connecting Nawi Cove and Hickson Park;
- 2) A new/reinstalment of historic bridge over Hickson Road, as a linear pedestrian connection, linking Harbour Park with High Street;
- 3) Alignment with High Street to provide east-west connections to High St steps; and
- 4) Opening of the public interface to connect to the Wulugul foreshore walk, Barangaroo Reserve and Central Barangaroo to the south to Darling Harbour via King Street Wharf and Barangaroo South.

#### **C. Integrating and shaping the built form response**

MOD 9 proposes amendments to the shape, form, massing and modulation of the Central Barangaroo building envelope to enable new streets, new pedestrian connections, new urban spaces and new buildings that can better respond to both context and opportunity. The key changes to Central Barangaroo building envelope propose to:

- 1) optimise the benefits of proximity and direct access to the city's evolving metro network, via the adjacent Barangaroo Station;
- 2) increase allowable reference scheme GFA to enable an intensity of retail, residential and community use activity, in a location with optimal access to new metro infrastructure, CBD activities and services and harbour foreshore amenity, with limited overall development impact; and

- 3) Enhanced pedestrian connectivity throughout the precinct to promote walking as a primary mode of choice.

Central Barangaroo’s public domain design is shown below in Figure 3.

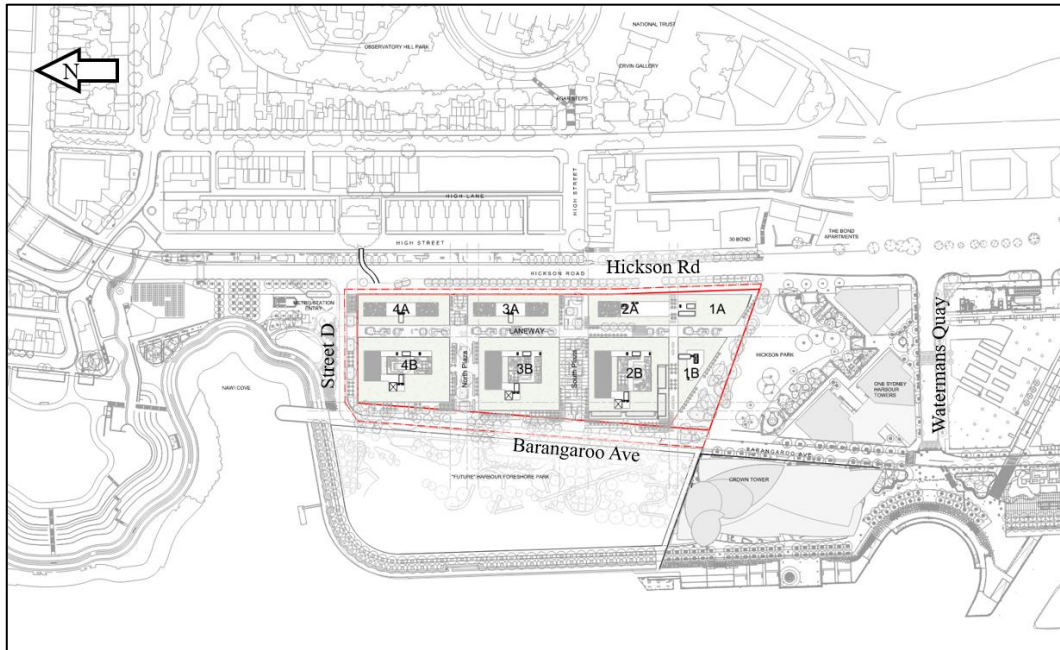


Figure 3 Day-to-Day Public Domain Condition (Source: SJB)

## 2 Director General’s Requirements

The Department of Planning, Industry and Environment issued a list of the Director General’s Requirements (DGRs) which inform the approved reference scheme Modification 9 for Central Barangaroo. Table 5 lists the DGRs that are specific to traffic and transport and accessibility.

Table 5 Transport, traffic and accessibility specific DGRs

Item	Director - Generals Requirements	Sections addressed
8. Transport Management and Accessibility Impacts	Undertake an assessment of future transport needs associated with Barangaroo Central and the Headland Park, including a clear understanding of the travel task for all modes at different times of the day (peak, off-peak and other peak periods relevant to differing uses) and week; and confirmation or modification (with justification) to the AM and PM peak commute mode share targets for Barangaroo as outlined in the Barangaroo integrated Transport Plan 2012.	Sections 4 & 5
	Analyse the operation of existing and future transport networks (all modes) to understand the implications for Barangaroo. The analysis of the future road network operations needs to focus on intersections in the north-west quadrant of the CBD in the vicinity of Barangaroo, In particular, address the road network in the King Street Wharf area to ensure that intersections such as Erskine Street and Lime Street and Lime Street itself are modified to cater for the different traffic demands that Barangaroo Central and the Barangaroo Reserve will bring to the network.	Section 5
	Analyse car parking provision and how traffic generation (number of vehicles and time of access) will be managed in response to capacity limitations on the road network. The car parking breakdown shall identify all approved car parking numbers, and all potential car parking numbers across the whole of the Barangaroo site.	Section 6.4
	Undertake a corridor model analysis of the road network, including an analysis of traffic generation and circulation, and service vehicle arrangements as a consequence of the modification; and demonstrate the potential to accommodate additional vehicular movements (including private vehicles, buses, commercial traffic and cyclists) in the surrounding road network.	Section 5
	Undertake an assessment of the public transport network and associated pedestrian linkages and demonstrate that additional people movements can be accommodated by the surrounding public transport network.	Section 6
	Outline late night transport provision	Section 6.13
	Outline the timing and responsibility for delivering different elements of the transport network to serve	Section 8

Item	Director - Generals Requirements	Sections addressed
	Barangaroo Central and the Barangaroo Reserve and Barangaroo in general.	
	Outline provisions for water-based transport and outline the potential to accommodate charter vessels, water taxis and private boats for short or long stays.	Section 6.8
	<p>Prepare a comprehensive Traffic Management and Accessibility Plan, including an assessment of all of the above matters and:</p> <ul style="list-style-type: none"> <li>• cumulative regional traffic impacts, including but not limited to, local and regional intersections and road improvements, and vehicular access options;</li> <li>• impacts from changes to Barangaroo South (MOD 8);</li> <li>• amendments to accommodate future bus service provision on Hickson Road (in consultation with Transport for NSW);</li> <li>• identify provision for taxi ranks and coach parking on site;</li> <li>• the timing and cost of infrastructure works and identification of funding;</li> <li>• package of travel demand management measures for workers, residents and visitors to the site.</li> <li>• emergency vehicle access arrangements; and</li> <li>• proposed loading dock provisions and access arrangements to loading docks and car parks.</li> </ul>	Sections 5, 6, 7 and 8
9. Pedestrian and Cycle Access	Outline the future cycleway network and demonstrate direct cycle connections between Barangaroo Central and the strategic cycleway network as outlined in the Sydney City Centre Access Strategy.	Section 6.7
	Outline provisions for walking and demonstrate provision for direct walking connections.	Section 6.6

## 3 Transport and Access Planning Framework

### 3.1 Methodology

The TMAP September 2008 was derived from the iterative process that commenced in 2006. This involved refinement of the Barangaroo concept and development details, establishment of the statutory planning and approvals framework, and preparation of the initial Transport concept based on investigation of various transport and access matters. The Statement of Commitments and development of the approved reference scheme Modification facilitated the more detailed assessment of transport and access matters in a series of supporting studies including detailed Paramics modelling. These have provided the basis for the TMAP September 2008. This previous work has informed this TMAP report.

Since the TMAP September 2008 (MOD 2) was released a Transport Report was prepared in August 2015 to support the Modified Concept Plan (MOD 8). The study reiterated the transport principles outlined in the TMAP September 2008 report as a basis for the analysis of the traffic impacts for the modification. The 2015 study also considered an updated road network layout for the precinct and the likely public transport provision, including a potential Metro Station at Barangaroo and a ferry hub at Barangaroo. Mode splits were adjusted to reflect this improved public transport provision, but the 4% car mode share target was not altered at this point in time. A LinSig model was established for the surrounding road network and assessed on this basis.

MOD 8 has since been modified further by the MOD 10 and MOD 11 applications to the currently approved Barangaroo Concept Plan. Two supplementary TMAPs were prepared by JMT Consulting for each MOD.

A MOD 10 TMAP was issued by JMT Consulting on 11 December 2019 which relates specifically to Barangaroo South and was approved on 2 September 2020. This study showed that MOD 10 has an improved level of traffic flows compared to the previously assessed MOD 8 noting: *“despite the small increase in traffic associated with the additional residential GFA, this will be significantly offset by a reduction in overall bus numbers on Hickson Road and traffic generation from residential uses due to the introduction of a metro station at Barangaroo.”* No traffic modelling was undertaken.

On 22 October 2020, MOD 11 of the Barangaroo Concept Plan was approved which further amended MOD 10 for Barangaroo South. MOD 11 is a minor modification and relates specifically to Barton Street and Hickson Park and does not change GFA or building height. A transport assessment for MOD 11 was issued by JMT Consulting on 9 July 2020, which noted minimal changes in future traffic outputs compared to MOD 8. Traffic modelling was focused at the Hickson Road and Watermans Quay intersection in its current condition (i.e. no signals) with and without Barton Street.

MOD 11 is not used as the basis of comparison for the MOD 9 TMAP as it considers the temporary nature of traffic arrangements before the completion of Central Barangaroo only whereas MOD 9 is considering the end state. Therefore,

due to only minor GFA changes and negligible changes in traffic volumes above, this current report compares the comprehensive traffic modelling undertaken for the MOD 8 TMAP as amended for the MOD 10 Supplementary TMAP and GFA.

The traffic modelling methodology for this MOD 9 TMAP used the software SIDRA Network 9.0 as it is the preferred modelling tool advised by TfNSW for assessments such as these. Therefore, a network model was created in SIDRA and calibrated against the LinSig model used previously for MOD 8. The analysis for MOD 9 considers the slightly reduced traffic generation in comparison to the MOD 8 analysis.

The configuration of Hickson Road is dependent on the Hickson Road Design currently being undertaken by INSW and Sydney Metro.

## 3.2 Service Principles

The service principles of Barangaroo with regards to mode split targets, opportunity to create a transport hub and provide good access to public transport remain largely unchanged from that described in the September 2008 TMAP. These principles are outlined below.

- Meet the mode split targets and provide access to existing public transport bus and rail services;
- Provide access to public transport to/from the site without prejudicing the majority of existing passengers to and from the CBD;
- Provide the opportunity for integration with envisaged future public transport projects; and
- Provide safe and convenient access to all, including the mobility impaired.

## 3.3 Scope of Investigations

### 3.3.1 Barangaroo Integrated Transport Plan

The Barangaroo Integrated Transport Plan (BITP) was released in August 2012, which was prepared by a taskforce chaired by Transport for NSW and included City of Sydney, INSW, Lend Lease and other Government agencies. The plan outlines a series of transport strategies and actions to accommodate the significant employment growth in the northern CBD over both the short and long term. A selection of the recommended actions includes:

- Plan for investigation of a future bus corridor along Hickson Road in lieu of light rail;
- For Wynyard Station to accommodate the significant increase passenger throughput over the short and long term (up to 26%), prepare a costed implementation plan to upgrade the station and improve capacity;
- Investigate options to relieve congestion at the Wynyard bus interchange and increase the number of bus stops and layovers;

- Construct Wynyard Walk, City Walk Bridge and other bridges over Hickson Road as per existing planning approvals;
- Improving cycling access to Barangaroo by extending the City of Sydney’s bicycle network, including upgrading existing bicycle shoulder lanes on Hickson Road; and
- Locate sufficient taxi ranks in consultation with City of Sydney, INSW and the Taxi Council.

### 3.3.2 Sydney City Centre Access Strategy

The Sydney City Centre Access Strategy was released by the NSW Government in December 2013 following a period of public review. The document outlines the NSW Government’s key strategies for transport access to, and within, the Sydney CBD. A summary of the key elements of the strategy relevant to Barangaroo include:

- Commitment to the construction of a new ferry hub at Barangaroo South and new ferry routes to provide more opportunities to access Barangaroo via public transport;
- New bus routes to run to Barangaroo and Walsh Bay via the city centre, Napoleon Street and Hickson Road, with the major bus stop serving the precinct in the area surrounding Wynyard Station on York, Clarence and Kent Streets;
- Commitment to the completion of the Wynyard Walk bridge and tunnel which will provide a direct and accessible pedestrian connection between Barangaroo and Wynyard Station;
- Identification of new taxi rank locations within Barangaroo South;
- Commitment to the implementation of light rail along George Street through the CBD;
- Completion of the city cycleway network, including new bi-directional cycle routes on Castlereagh Street and Pitt Street and the identification of new routes into Barangaroo via the Pyrmont Bridge and Sydney Harbour Bridge cycleways;
- Upgrades to Wynyard Station including better interchange facilities for rail, bus and ferry customers at the station and at Barangaroo; and
- Improving visitor information including wayfinding and signage to CBD destinations and transport hubs in major visitor precincts such as Barangaroo.

### 3.3.3 Future Transport 2056

Future Transport 2056 is an update of NSW’s Long Term Transport Master Plan. It is a suite of strategies and plans for transport developed in concert with the Greater Sydney Commission’s Sydney Region Plan, INSW’s State Infrastructure Strategy, and the DPIE’s regional plans, to provide an integrated vision for the state.

A key component of the strategy is to balance the movement and place needs on the transport network. This aligns with the principles of the Barangaroo Integrated

Transport Plan through the idea of keeping pedestrians and cyclists safe by implementing various measures and ensuring speed limits are reduced in areas of high pedestrian activity such as Barangaroo.

Central Barangaroo lies in the Eastern Harbour City, which is focused on achieving improved public transport, congestion management and urban renewal outcomes, supporting renewal and walkability by drawing vehicle traffic away from centres. The mix of uses proposed in Central Barangaroo, particularly housing, jobs, open space and retail, supports this concept as it allows people to work, live and play in the one precinct.

### 3.3.4 Sydney Metro at Barangaroo

Existing rail and ferry access to Barangaroo is achieved via Wynyard Station and Barangaroo Ferry Wharf and is supplemented by the city's bus and light rail services. The Barangaroo precinct, when complete, is projected to provide employment for up to 26,000 office workers, be home for up to 4,000 people and attract up to 33,000 visitors per day (NSW Auditor-General's Report 2011).

In June 2015, as part of the Sydney Metro City & Southwest project, the NSW Government confirmed a strategic alignment option to build a new metro station at Barangaroo, as shown in Figure 4. In November 2015, the location of Barangaroo Station was confirmed as beneath the northern end of Hickson Road in Millers Point, with pedestrian access via Central Barangaroo and Nawi Cove. The station is currently being constructed beneath Hickson Road and is due to be operational in 2024 when the City & Southwest line opens.





Figure 4 City and Southwest Metro line (base map source: Urban Design Report)

The Metro Station is a key part of the city shaping metro network that will transform how people arrive in Sydney CBD. At a city scale, the 400 metre walking catchments from existing CBD rail stations and ferry wharves clearly illustrate that the historic suburbs of Millers Point and Walsh Bay are poorly served by existing rail and ferry services and largely dependent on bus services. The Metro Station will allow for better connections between these historic areas and the Sydney CBD and broader city, as shown in Figure 5.

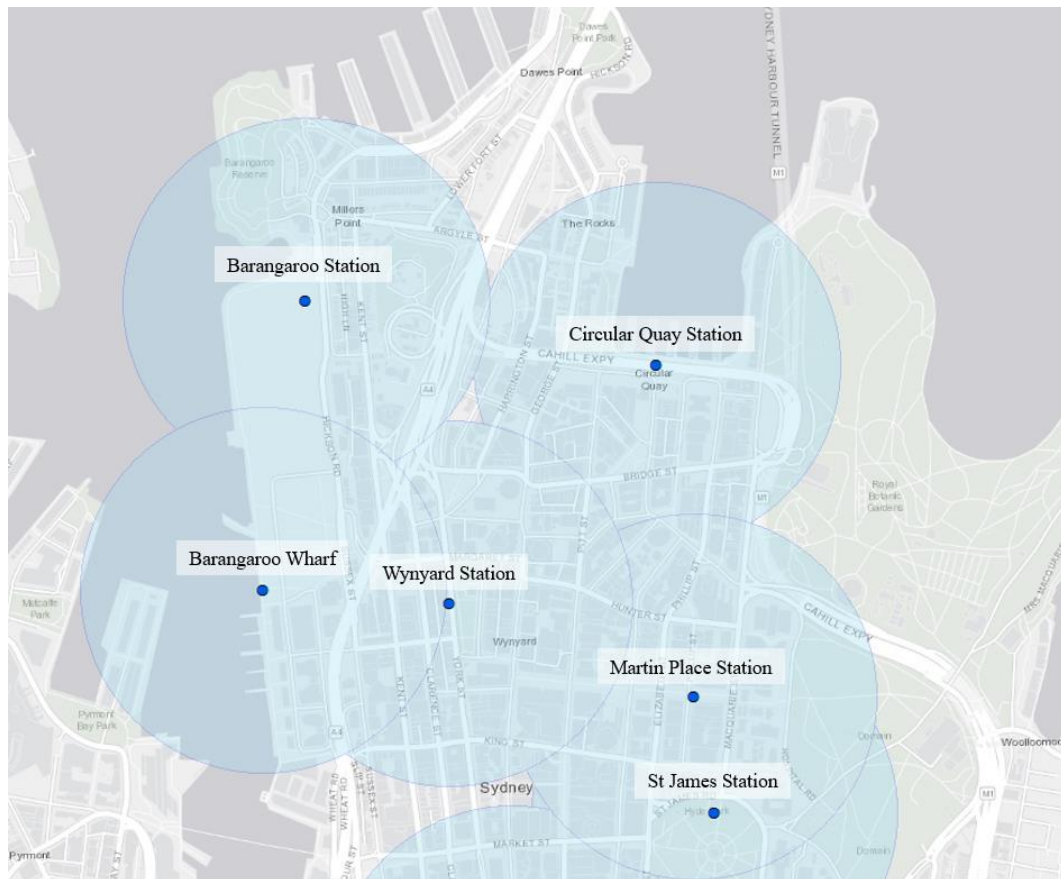


Figure 5 400 metre walking catchments from stations and wharves in Sydney CBD (source: Arup)

The Metro Station is being constructed beneath Hickson Road towards its northern end and is scheduled to open in 2024. By 2036, Sydney Metro estimates that during peak hour, approximately 6,525 customers will exit, and 900 customers enter the Metro network at Barangaroo (Sydney Metro EIS).

The overall mode split targets have been largely retained for the Barangaroo site from the TMAP MOD 8, with the train mode percentage being split evenly between train and metro. The delivery of the Metro Station combined with the mixed-use development of Central Barangaroo is forecast to support public transport mode targets to 31% metro, 30% rail, 4% ferry and 19% bus/light rail. Whilst reflecting predominant commuter use of the Metro Station accessing employment within Barangaroo and Sydney CBD, these patronage forecasts also reflect increased accessibility to and attraction of the historic Walsh Bay Arts and Cultural Precinct and Millers Point, as well as nearby residents.

### 3.4 Movement and place

The Practitioner’s Guide to Movement and Place recognises that a liveable, productive and successful city requires a variety of road and street typologies that serve different roles and functions in different places. This framework is a useful tool for obtaining a greater understanding of the existing and future function of street and road networks.

Movement and place classifications are grouped into road and street typologies that have similar or shared land-use activities and user groups. The typologies provide a quick overview of how movement and place interact. Each street and road typology varies according to a modal hierarchy and provides the basis for discussions on future changes. The movement and place classification graph divides four overarching street and road typologies in a matrix to assist with more detailed classifications (shown in Figure 6). The matrix is a useful tool for comparing the relative significance of movement and place functions particularly when the intensity of movement and place vary.

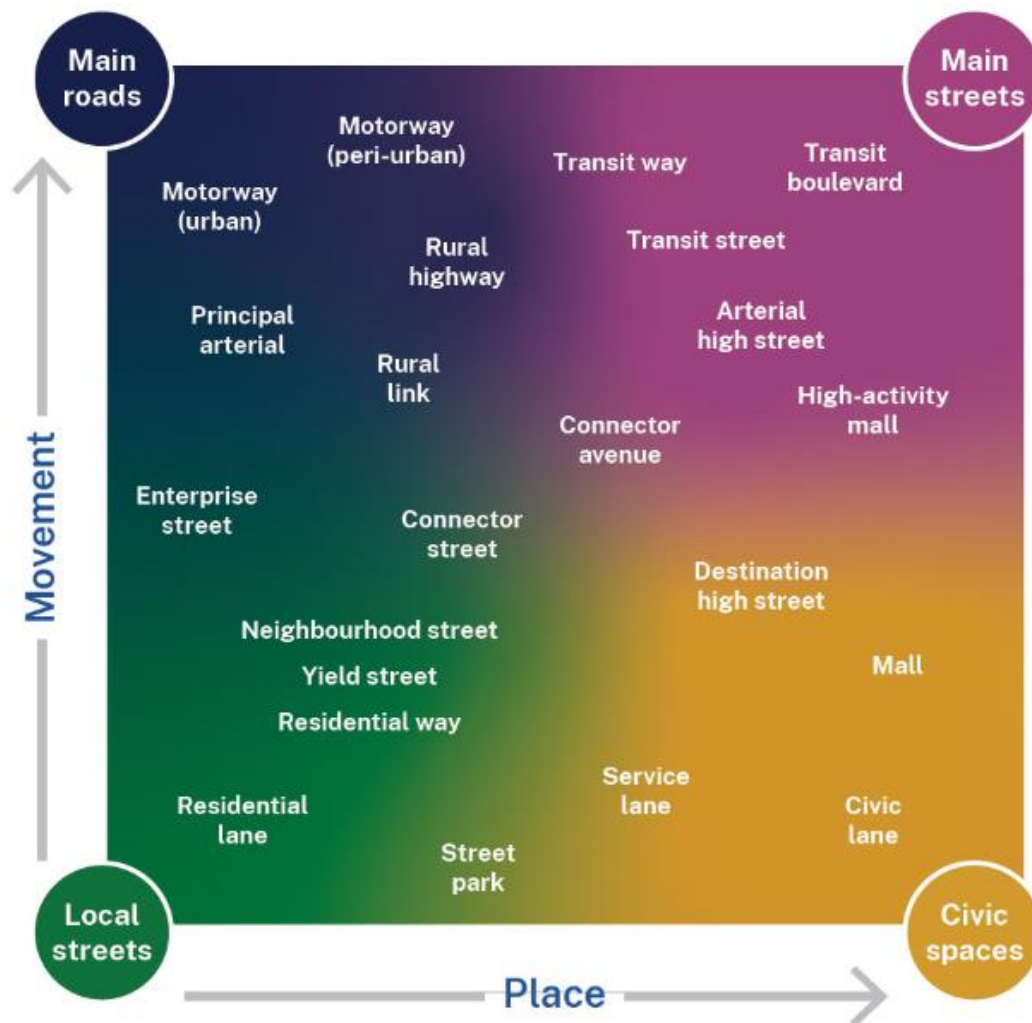


Figure 6 Four street typologies matrix within the Movement and Place Guide

### 3.4.1 Road and Street typologies

Through categorising streets and roads into movement and place typologies, it assists transport planners with balancing competing demands within the transport network. Ideally, major place and streetscape planning schemes succeed when improvements create positive impacts for a range of user groups. The four general road and street typologies are defined below:

Civic Spaces	Civic spaces are places at the heart of our communities. They have significant meaning, activity functions, and built forms. They are often located in major centres, tourist and leisure destinations, or community hubs, and are destinations for large numbers of people.
Local Streets	Local streets are strongly influenced by their edge conditions and adjacent properties. While the street types described in this guide are a helpful concept for structuring design advice, real-life situations are far more diverse, and require you to establish a fine-grain understanding of the specific context you are designing for.
Main Streets	Main streets are some of the most vibrant places in our cities and towns. They have both significant movement functions and place qualities. They are found in centres where people gather to socialise, work, shop or access essential services, or around public transport nodes. Balancing the functions of these streets is a common challenge, often requiring trade-offs and compromises.
Main Roads	Main roads and routes are central to the efficient movement of people and goods. They include motorways, primary freight corridors, major public transport routes, the principal bicycle network and high-intensity routes for people to walk and cycle. Their place activity levels are less intense although these roads and routes can still hold significant meaning for people.

## 4 Barangaroo Development

### 4.1 Total floor space

The GFA allocation per activity used to develop the trip generation for the traffic analysis is shown in Table 6 for the above-mentioned approvals and modifications of the approved reference scheme.

Table 6 Total GFA for the Barangaroo Development

	Commercial GFA (m <sup>2</sup> )	Hotel/tourist GFA (m <sup>2</sup> )	Community GFA (m <sup>2</sup> )	Residential GFA (m <sup>2</sup> )	Retail/Other Uses GFA (m <sup>2</sup> )	Total GFA (m <sup>2</sup> )
<b>MOD 8/10</b>						
Barangaroo South	312,109	48,200	3,598	151,479	24,300	<b>539,686</b>
Central Barangaroo	30,225	0	3,250	24,000	1,750	<b>59,225</b>
Active/Community Uses						<b>14,500</b>
Concept Plan (MOD 8/10)	342,334	48,200	6,848	175,479	26,050	<b>613,411</b>
<b>MOD 9 Proposed</b>						
Barangaroo South	312,109	48,200	3,598	151,479	24,300	<b>539,686</b>
Central Barangaroo	736	15,898	2,800	69,800	14,766	<b>104,000</b>
Active/Community Uses						<b>24,000</b>
Proposed reference scheme (MOD 9)	312,845	64,098	6,398	221,279	39,066	<b>667,686</b>
<b>Difference between MOD 9 and MOD 8/10</b>	<b>-29,489</b>	<b>15,898</b>	<b>-450</b>	<b>45,800</b>	<b>13,016</b>	<b>54,275</b>

### 4.2 Barangaroo site population

The assumptions used for estimating the population numbers are summarised in Table 7 below which combines both Barangaroo South and Central Barangaroo. These population assumptions are kept consistent with those previously utilised in the TMAP September 2008 so that a direct comparison with MOD 8/10 traffic can be made.

Table 7 Barangaroo site population assumptions (Barangaroo South and Central Barangaroo)

Land Use	MOD 8/10 GFA (m <sup>2</sup> )	MOD 9 GFA (m <sup>2</sup> )	Density	MOD 8/10 population	MOD 9 population
Commercial	342,334	312,845	1 employee / 20m <sup>2</sup> GFA	17,117	15,642
Hotel/Tourist	48,200	64,098	1 employee / 20m <sup>2</sup> GFA	2,410	3,205
Public	6,848	6,398	1 employee / 20m <sup>2</sup> GFA	342	320
Retail/ Other Uses	26,050	39,066	1 employee / 20m <sup>2</sup> GFA	1,303	1,953
<b>Total – Population</b>				<b>21,172</b>	<b>21,120</b>
<b>Population On-site per Day*</b>				<b>19,372</b>	<b>19,325</b>
Residential	175,479	221,279	2 residents /100m <sup>2</sup> GFA	3,510	4,426

\*Consistent with previous TMAPs, it has been assumed 8.5% of workers would not be on-site on a typical day

### 4.3 Mode share targets

Initial planning approval for Barangaroo was based on the principle of achieving high usage of public transport, walking and cycling as a method of travel to work. Journey to work mode share by car is targeted at 4% which will be achieved through minimal on-site parking and promotion of travel demand management plans. These mode split targets were adopted in the Barangaroo Integrated Transport Plan. Journey to work mode split data for SA2 (Sydney, Haymarket and The Rocks) from 2016 has also been presented as a comparison. It is worth noting that the light rail was not operational at the time of the census in 2016. 2021 census data was not used for this comparison as it was taken during COVID-19 and would not be representative.

The overall mode split targets have been retained for the Barangaroo site from the MOD 8 TMAP, noting that train and Metro trips were combined overall as train (further described in Section 6.1). From MOD 8, MOD 11 has an increase in residential GFA. A transport assessment for MOD 11 was issued by JMT Consulting on July 2020, which displays minimal changes in future traffic outputs compared to MOD 8 and is therefore expected to have a similar mode share. It is noted that the MOD 10 or 11 TMAPs did not change the mode split assumptions.

It is now forecast that the travel demand will be split evenly between heavy rail (primarily using Wynyard Station) and the Metro to Barangaroo once the Metro opens in 2024, in line with the 2017 Sydney Metro Stage 1 Design Pedestrian Modelling Report prepared by Metron. The adopted journey to work mode share targets for the precinct are noted in Table 8 below. The mode of travel for the AM and PM peaks will be the same as the majority of the trips are return journeys to/from work.

Table 8 Mode Share Targets for Journey to Work

Mode	2016 Census SA2	TMAP MOD 8/10 (AM or PM peak)		TMAP MOD 9 (AM or PM peak)		Difference between MOD 8/10 and MOD 9
	Mode share	Mode share target	Number of trips	Mode share target	Number of trips	
Car (driver / passenger)	14%	4%	775	4%	773	-2
Bus / Light Rail	23%	19%	3,681	19%	3,672	-9
Metro	0%	0%	0	31%	5,991	-28
Train	53%	61%	11,817	30%	5,798	
Ferry	<1%	4%	775	4%	773	-2
Other (pedestrian, cyclists, motorcycles, taxi)	9%	12%	2,325	12%	2,319	-6
<b>Total</b>	<b>100%</b>	<b>100%</b>	<b>19,372</b>	<b>100%</b>	<b>19,325</b>	<b>-47</b>

## 5 Road Network Assessment

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### 5.1 Proposed Scheme

The Central Barangaroo Developer has a proposed schemes to inform the preparation of the TMAP. The area of each land use are as follows:

- Residential GFA of **69,800m<sup>2</sup>**;
- Commercial GFA of **736m<sup>2</sup>**;
- Community GFA of **2,800m<sup>2</sup>**;
- Retail GFA of **14,766m<sup>2</sup>**; and
- Hotel GFA of **15,898m<sup>2</sup>**.

### 5.2 Traffic generation

#### 5.2.1 Traffic generation rates

Assumption used to calculate the traffic generation for MOD 9 are mostly consistent with the ones used in the MOD 8 (please refer to MOD 8 TMAP report). Changes to the traffic generation assumptions are mainly focused on forecast bus numbers and minor parking changes, as well as how residential trip are calculated.

The reference scheme is proposed to have 143 apartment dwellings with either three and four bedrooms equating to 286 car parking spaces being provided (two spaces per dwelling). Trip rates have been applied to the number of spaces to calculate the trips generated during the AM and PM peak hours.

Forecast bus numbers on Hickson Road were previously based on a strategy developed in 2008. There is now more certainty around the number of buses using Hickson Road following the introduction of three bus routes in October 2015. Existing services provide 12 buses in each direction during the peak hour travel along Hickson Road. As a conservative assumption that represents the worst cases scenario, it has been assumed there will be 18 buses an hour in each direction on Hickson Road in future, which is a 50% increase from the current situation. This is however significantly less than the predicted bus numbers assumed in the MOD 8 TMAP as supplemented by MOD 10.

The existing public transport services considered as part of MOD 9 remain unchanged from those used in the assessment of MOD 8. The public transport services will provide future residents of Barangaroo a connection to key employment centres in metropolitan Sydney such as Central Station, North Sydney, Crows Nest and Macquarie Park.

The TMAP 2008 (and subsequent MOD 10/11 TMAPs) adopted traffic generation rates for the residential component of the development of 0.14 and 0.09 in the AM and PM peak hours respectively. This was based on surveys of similar residential developments in the CBD on Sussex Street and Kent Street. An update has since



been made to the TfNSW traffic generation rates guidelines (TDT 13/04a). Since similar locations such as St Leonards and Chatswood display comparable traffic generation rates to TMAP 2008, the rates have been kept consistent.

2016 Census data indicates that only 5% of residents in the northern CBD area use private vehicles as their primary mode of travel to work, which would equate to a rate of approximately 0.04 trips / dwelling. Notwithstanding this, the traffic generation rates for the surveyed site in St Leonards has been adopted in the analysis.

The number of car parking spaces for the development is calculated using GFAs of each land use (number of dwellings for residential). The number of trips generated is then calculated by applying the trip rate to the number of car parking spaces being provided for each land use.

## 5.2.2 Forecast traffic generation (MOD 8/10)

Peak hour traffic generation for the MOD 8 TMAP is shown in Table 9, refer to the MOD 8 report in Appendix B for further details.

Table 9 Forecast traffic generation, MOD 8/10

2015 Concept Plan (MOD 8/10)			AM Peak Hour				PM Peak Hour			
Land Use	Variable	Variable Number	trip rate	No. of trips	In	Out	trip rate	No. of trips	In	Out
<b>Light Vehicles</b>										
Residential	car space	2,018	0.14	283	57	226	0.09	182	145	36
Commercial	car space	571	0.26	148	119	30	0.26	148	30	119
Retail	car space	48	0.4	19	15	4	0.4	19	4	15
On-Street Parking	car space	40	0.4	16	13	3	0.8	32	13	19
Public Off Street Parking	car space	300	0.04	12	10	2	0.4	120	24	96
Hotel*				75	51	24		213	147	66
Cultural / Civic				8	6	2		8	2	6
<b>Sub Total</b>				<b>561</b>	<b>270</b>	<b>291</b>		<b>722</b>	<b>365</b>	<b>357</b>
<b>Heavy Vehicles</b>										
Service vehicles				70	35	35		0	0	0
Coaches				4	2	2		22	11	11

2015 Concept Plan (MOD 8/10)			AM Peak Hour				PM Peak Hour			
Land Use	Variable	Variable Number	trip rate	No. of trips	In	Out	trip rate	No. of trips	In	Out
<b>Sub Total</b>				<b>74</b>	<b>37</b>	<b>37</b>		<b>22</b>	<b>11</b>	<b>11</b>
<b>Total traffic generation</b>				<b>635</b>	<b>307</b>	<b>328</b>		<b>744</b>	<b>376</b>	<b>368</b>
<i>Public Transport (Bus)</i>				66	39	27		66	39	27
<b>Total Additional Traffic</b>				<b>701</b>	<b>346</b>	<b>355</b>		<b>810</b>	<b>415</b>	<b>395</b>

\*The hotel forecast future traffic generation is based on the Crown resort in Melbourne. See TMAP MOD 8 report for further detail, provided in the appendices.

### 5.2.3 Forecast traffic generation (MOD 9)

The forecast trip generation arising from the changes to the Central Barangaroo development are outlined in Table 10.

Table 10 Forecast traffic generation, Central Barangaroo

Approved reference scheme (MOD 9)			AM Peak Hour				PM Peak Hour			
Land Use	Variable	Variable Number	trip rate	No. of trips	In	Out	trip rate	No. of trips	In	Out
<b>Light Vehicles</b>										
Residential	car space	286	0.14	40	8	32	0.09	26	21	5
Commercial	car space	1	0.26	1	1	0	0.26	1	0	1
Retail	car space	10	0.4	4	3	1	0.4	4	3	1
On-Street Parking	car space	15	0.4	2	2	0	0.8	5	2	3
Hotel*				23	15	8		64	44	20
<b>Total</b>				<b>70</b>	<b>29</b>	<b>41</b>		<b>100</b>	<b>70</b>	<b>30</b>

\*The hotel forecast future traffic generation is based on the Crown resort in Melbourne. See TMAP MOD 8 report for further detail, provided in the appendices.

Combining the traffic generation with the rest of the Barangaroo development the forecast traffic generation arising from the proposed amendment to the approved reference scheme (MOD 9) is outlined in Table 11.

Table 11 Forecast traffic generation, MOD 9

Approved reference scheme (MOD 9)			AM Peak Hour				PM Peak Hour			
Land Use	Variable	Variable Number	trip rate	No. of trips	In	Out	trip rate	No. of trips	In	Out
<b>Light Vehicles</b>										
Residential	car space	2041	0.14	286	57	229	0.09	184	147	37
Commercial	car space	521	0.26	136	108	27	0.26	136	27	108
Retail	car space	50	0.4	20	16	4	0.4	20	4	16
On-Street Parking	car space	31	0.4	12	10	2	0.8	25	10	15
Public Off Street Parking	car space	300	0.04	12	10	2	0.4	120	24	96
Hotel*				97	66	31		276	191	85
Cultural / Civic				8	6	2		8	2	6
<b>Sub Total</b>				<b>571</b>	<b>273</b>	<b>298</b>		<b>769</b>	<b>405</b>	<b>364</b>
<b>Heavy Vehicles</b>										
Service vehicles				70	35	35		0	0	0
Coaches				4	2	2		22	11	11
<b>Sub Total</b>				<b>74</b>	<b>37</b>	<b>37</b>		<b>22</b>	<b>11</b>	<b>11</b>
<b>Total traffic generation</b>				<b>645</b>	<b>310</b>	<b>335</b>		<b>791</b>	<b>416</b>	<b>375</b>
<i>Public Transport (Bus)</i>				<i>36</i>	<i>18</i>	<i>18</i>		<i>36</i>	<i>18</i>	<i>18</i>
<b>Total Additional Traffic</b>				<b>681</b>	<b>328</b>	<b>353</b>		<b>827</b>	<b>434</b>	<b>393</b>

\*The hotel forecast future traffic generation is based on the Crown resort in Melbourne. See TMAP MOD 8 report for further detail, provided in the appendices.

## 5.2.4 Traffic generation comparison

A comparison of the traffic generation forecast under the TMAP August 2015 (MOD 8) as amended by MOD 10 Supplementary TMAP and the proposed modification (MOD 9) has been undertaken and is summarised in Table 12.

Table 12 Traffic generation comparison

Time Period	Direction	MOD 8/10	MOD 9	Change
AM Peak Hour	In	346	328	-18
	Out	355	353	-2
	<b>Two-way</b>	<b>701</b>	<b>687</b>	<b>-14</b>
PM Peak Hour	In	415	434	19
	Out	395	393	-2
	<b>Two-way</b>	<b>810</b>	<b>827</b>	<b>17</b>

Under the Barangaroo reference scheme MOD 9, the total volume of traffic generated by the entire precinct will be approximately the same when compared with that previously assessed in the MOD 8 TMAP. This is due to the following reasons:

- Adjustment to traffic generation due to the decrease in commercial and increase residential GFAs;
- The introduction of a new Metro Station in Central Barangaroo; and
- The revision in future bus numbers on Hickson Road. It should be noted that the future bus numbers are less than the predicted bus numbers in MOD 8 TMAP (Appendix B), as per Section 5.2.1 in this report.

It should be noted that the volume of traffic forecast under the proposed modification is commensurate with that forecast under the MOD 2 TMAP. This is important to note as the traffic modelling and road network analysis contained in the MOD 2 TMAP underpinned the development of the 4% car mode share for the site.

### 5.3 Peak and off-peak traffic generation

The mix of land uses proposed within Barangaroo will generate trips during both the traditional commuter peak hours (i.e. 7am-10am and 4pm-7pm) and other times of the day – e.g. lunchtime peak, evening peak and weekend peak.

Figure 7 below provides an illustration of the variation in travel task generated by the entire Barangaroo development (MOD 9) throughout a typical weekday and on the weekend peak hour. This demonstrates that traffic generated during the lunchtime and evening peak hours is expected to be less than that in the commuter peak hours. Evening peak hour traffic is forecast to be less than half of that the PM commuter peak hour.

The Crown Sydney Hotel is anticipated to be the primary generator of vehicular traffic from the entire Barangaroo precinct in the evening peak hour. The occupier of the hotel in Central Barangaroo is not yet known for it has been compared directly with the Crown Hotel. The Central Barangaroo is approximately 30% size of the Crown Hotel. The number trips generated by this hotel is assumed to be proportional to the number of trips generated by the Crown.

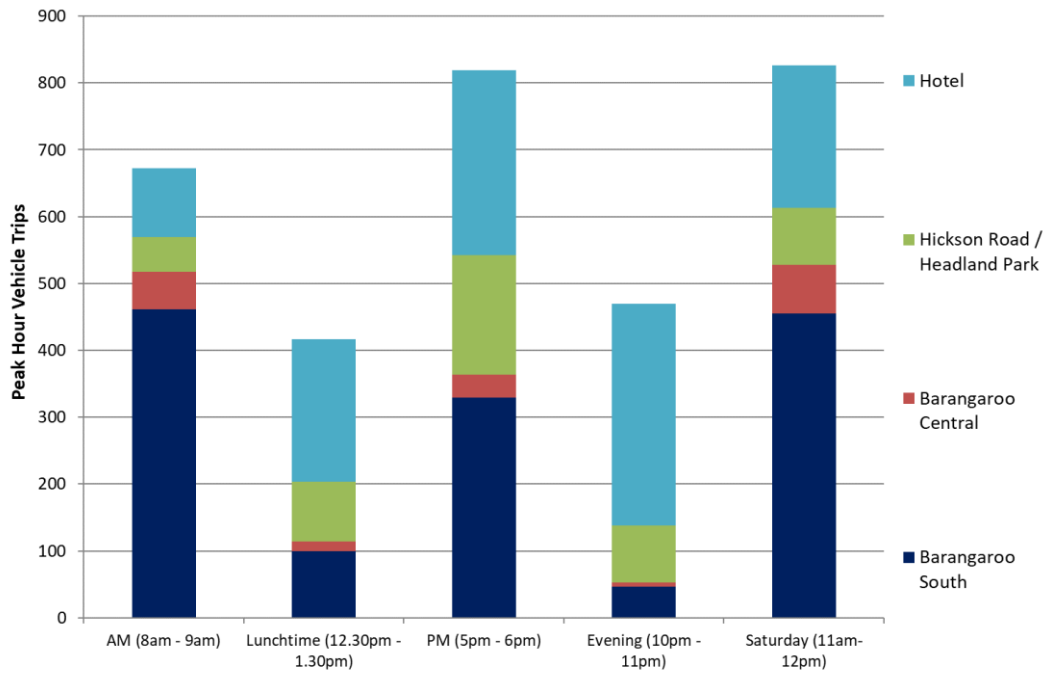


Figure 7 Peak and off-peak traffic generation (source: Arup)

## 5.4 Saturday traffic

As shown in Figure 7 in section 5.3, the level of traffic generated during the Saturday peak hour is comparable to that during the AM and PM weekday periods. While the traffic generated by the commercial uses at Barangaroo is reduced compared to the weekday peaks, the residential and retail uses are expected to generate higher levels of traffic movements on weekends.

The Saturday peak hour from a road network operations perspective in the Sydney CBD is not as critical when considered in the context of the level of background traffic on key roads. The figure below illustrates the volume of traffic during the respective peak hours on Hickson Road (north of Napoleon Street) adjacent to the Barangaroo site. This shows that background traffic on a Saturday is 15% lower compared to the weekday PM peak hour and 20% lower compared to the weekday AM peak hour. This is to be expected as much of the traffic on CBD streets is related to the commercial uses in nearby areas which are not operating on weekends. The difference between weekday and Saturday is smaller at off peak times. As a result, nearby intersections in Barangaroo operate with spare capacity and may accommodate the forecast levels of traffic generated by the precinct.

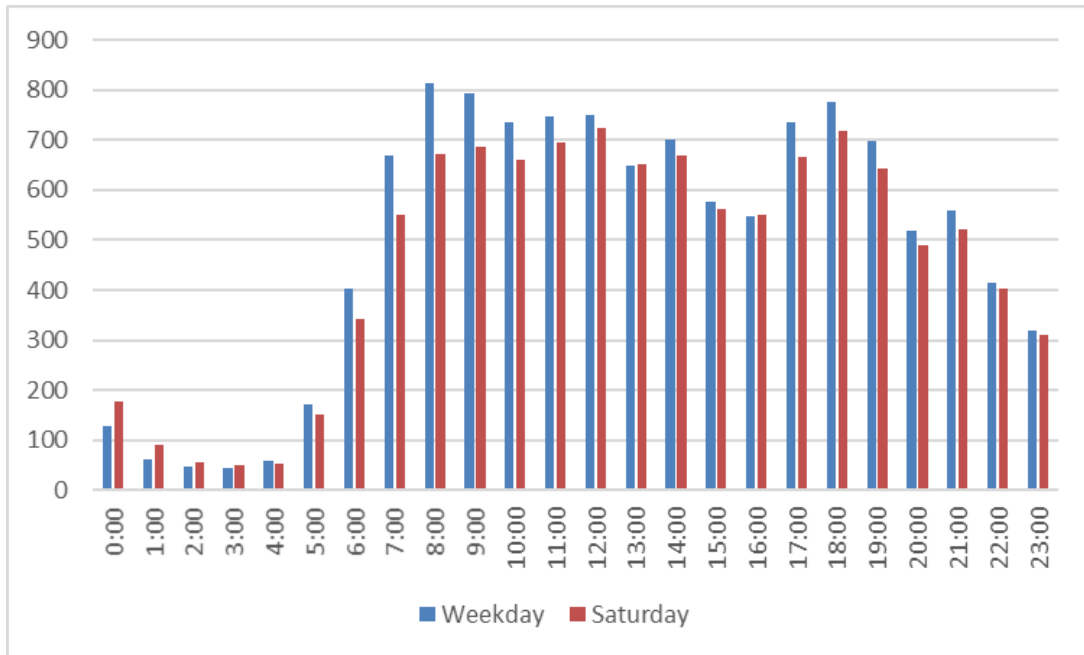


Figure 8 Comparison of weekday and Saturday traffic flows (Hickson Road) (source: Arup)

## 5.5 Road Network Modelling

### 5.5.1 Existing traffic data

Existing traffic data collected on Thursday 10 May 2018 was used as the basis of the traffic modelling. This date is still considered acceptable as the traffic data was taken prior to COVID-19, which would impact the traffic volumes. MOD 8 TMAP used traffic data from July 2013 which were broadly lower than the 2018 counts. It should be acknowledged that the base flows have been increased incrementally based on the forecasts from the Barangaroo South precinct (still progressively opening), but there have been no major development occupations apart from varying construction activity.

The data was collected at the following intersections in Barangaroo:

- Hickson Road / Watermans Quay
- Hickson Road / Napoleon Street / Sussex Street
- Sussex Street / Erskine Street
- Kent Street / Napoleon Street / Margaret Street

This survey date was outside of school holiday periods and is representative of typical weekday traffic conditions in the precinct. The identified peak hours were as follows:

- AM peak hour: 8.15am – 9.15am
- PM peak hour: 5.15pm – 6.15pm

These existing traffic counts are illustrated in Figure 9 (for the AM peak hour) and Figure 10 (for the PM peak hour).

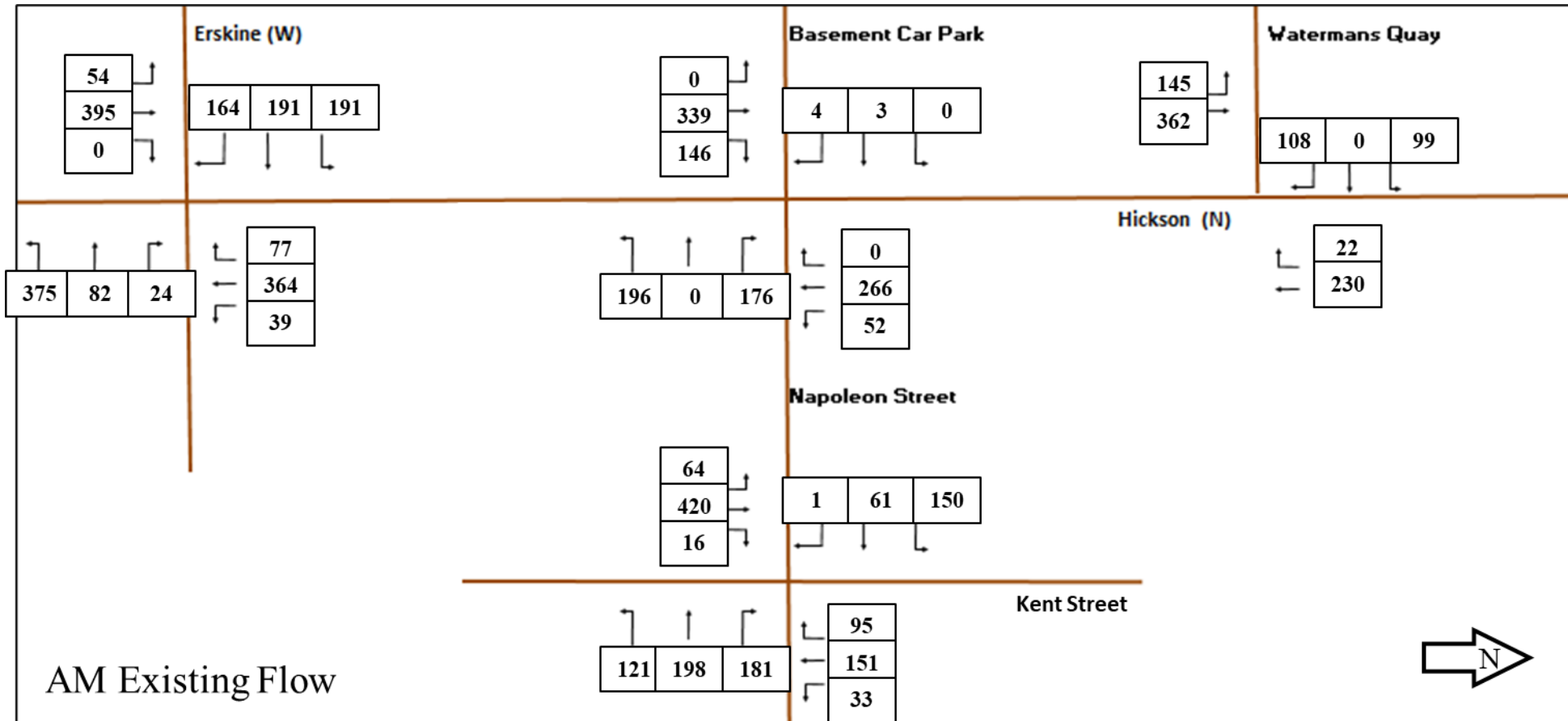


Figure 9 Existing traffic counts – AM peak hour (8.15am – 9.15am) (source: Arup)



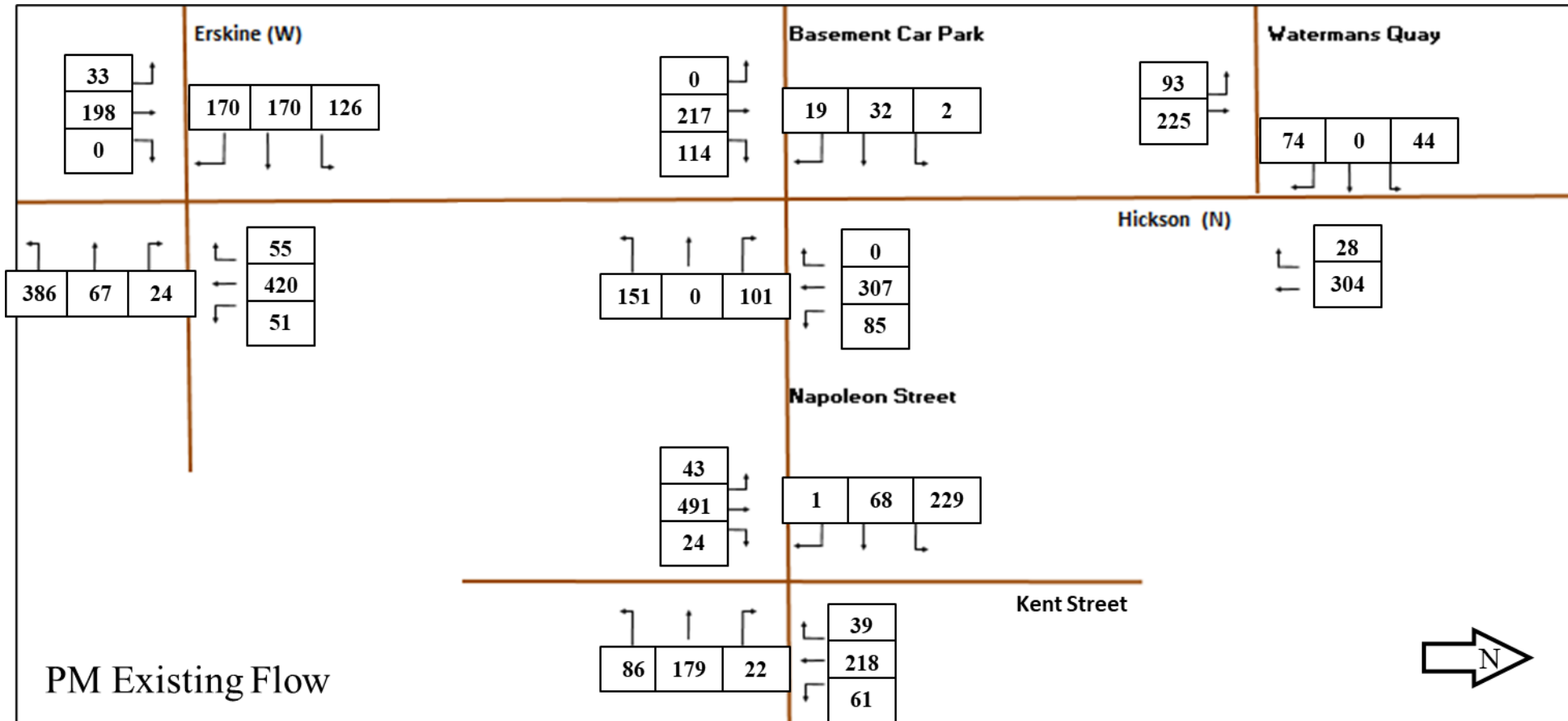


Figure 10 Existing traffic counts – PM peak hour (5.15pm – 6.15pm) (source: Arup)

## 5.5.2 Traffic distribution

Traffic associated with the new development has been distributed across the road network based on Journey to Work Census data as shown in Table 13. This is consistent with the assumptions outlined in the MWT Modified Concept Plan – Transport Report, July 2008.

Table 13 Development traffic distribution

Direction	Route	Distribution
North	Harbour Bridge	40.7%
East	Eastern Distributor	22.9%
	William Street	1.5%
	Oxford Street	4.1%
South	Harbour Street	8.6%
West	Western Distributor	21.8%
Sydney Inner	-	0.4%
<b>Total</b>		<b>100%</b>

These key approach and departure routes are consistent with previous Concept Plan modifications and those illustrated in the in the Barangaroo Integrated Transport Plan.

## 5.6 Future traffic modelling

### 5.6.1 Overview

A corridor traffic model (using the SIDRA 9 software package) was developed to assess the future road network performance arising from the currently approved Barangaroo reference scheme MOD 9. SIDRA 9 software is approved by Transport for New South Wales (TfNSW) for use as a network modelling tool. This software allows intersections to be modelled in a single network and provides the ability to forecast future traffic conditions within Barangaroo. The corridor network modelled is shown in Figure 11.

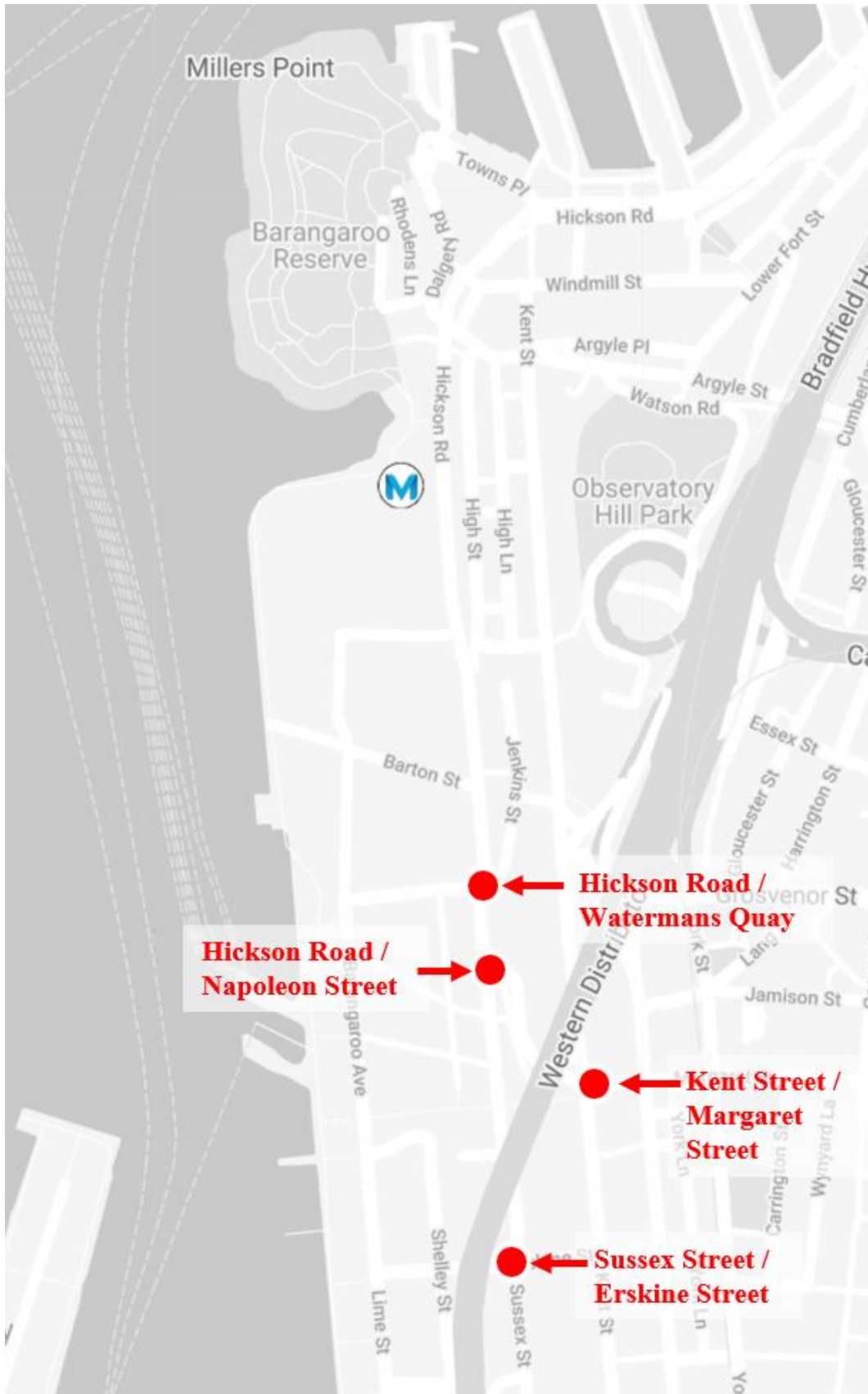


Figure 11 Road network modelled (source: Arup)

To optimise the throughput movements within SIDRA, a southbound route was applied to the networks for both peaks to prioritise the phase times for southbound traffic along Hickson Road. In the previous MOD 8 TMAP, phase times were optimised manually.

Within the SIDRA model, the lane capacity at a number of locations was manually reduced to reflect queue spillback from downstream and upstream intersections that currently occurs during peak hours. These capacity adjustments are consistent with those previously applied in the TMAP August 2015 (MOD 8). The SIDRA flows were calibrated with the previous MOD 8 LinSig outputs by further reducing the saturation flows to emulate consistent traffic conditions.

The following capacity adjustments shown in Table 14 were applied in the model.

Table 14 Capacity adjustments at key intersections

Intersection	Approach	Movement	Capacity Adjustment
Sussex Street / Erskine Street	South	Through and left	20% reduction (AM and PM)
	West	Right	20% reduction (AM only)
		Left	20% reduction (PM only)
	North	Right	20% reduction (AM and PM)
		Through	50% reduction (PM only)
East	Through and right	20% reduction (AM and PM)	
Hickson Road / Napoleon Street / Sussex Street	South	Through	50% reduction (AM only)
	North	Through and left	20% reduction (PM only)
Kent Street / Napoleon Street / Margaret Street	South	Through and right	50% reduction (AM and PM)
	North-west	Left	50% reduction (AM and PM)
		Through	50% reduction (PM only)
	North	Through and left	50% reduction (AM and PM)

It is understood that TfNSW are currently investigating the reinstatement of a second eastbound traffic lane on Margaret Street. This lane was removed following the closure of the Kent Street pedestrian tunnel to provide additional footpath capacity on Margaret Street. This new traffic lane has not been included within the traffic model. Provision of this measure would significantly reduce the extent of queue spillback experienced in the PM peak hour for eastbound vehicles – therefore improving the operation of the Kent Street / Napoleon Street / Margaret Street intersection.

The DGRs have requested that the road network in the King Street Wharf area be addressed to ensure that intersections such as Erskine Street and Lime Street and

Lime Street itself are modified to cater for the different traffic demands that Central Barangaroo and the Barangaroo Reserve will bring to the network. Traffic distribution, as discussed in section 5.5.2, focuses generated traffic mainly onto Hickson Road, Sussex Street and Napoleon Street as the key access road. As Barangaroo Avenue north of the Crown Hotel is proposed as a low speed shared zone environment, high volumes of drivers are not expected to travel to Central Barangaroo via Lime Street and Erskine. On this basis, minimal impacts on the King Street Wharf area are expected from Central Barangaroo.

## 5.6.2 Assessment methodology

The road network performance has been measured against three parameters, those being:

- Level of Service (LOS)
- Degree of Saturation (DOS)
- Average Vehicle Delay (AVD)

The performance of intersections in an urban environment is measured in terms of its Level of Service (LOS). Levels of service ranges from A (very good) to F (over capacity with significant delays). This is described in the RTA Guide to Traffic Generating Developments as summarised in Table 15. Across the Sydney CBD Road network, it is not uncommon for intersections to operate at Level of Service E or F (at capacity) during commuter peak hours.

Table 15 Intersection level of service

Level of Service	Average Vehicle Delay (seconds)	Traffic Signals and Roundabouts	Priority Intersections ('Stop' and 'Give Way')
A	< 14	Good operation	Good operation
B	15 to 28	Good with acceptable delays and spare capacity	Acceptable delays and spare capacity
C	29 to 42	Satisfactory	Satisfactory, but accident study required
D	43 to 56	Operating near capacity	Near capacity and 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	>71	Unsatisfactory with excessive queuing	Unsatisfactory with excessive queuing; requires other control mode

Another common measure of intersection performance is the degree of saturation, which provides an overall measure of the capability of the intersection to accommodate additional traffic. A DOS of 1.0 indicates that an intersection is operating at capacity.

### 5.6.3 Scenarios considered

Two scenarios have been considered in the traffic modelling:

- (i) MOD 8 Base plus development - Operation of the road network using the land use and traffic generation assumptions from the August 2015 TMAP (MOD 8); and
- (ii) MOD 9 Base plus development - Operation of the road network based on the proposed amendment to the approved reference scheme (MOD 9), using the traffic generation assumptions detailed in Section 5.2.1 of this report.

### 5.6.4 Opening year traffic flows

The opening year traffic flows generated by the proposed development have been distributed throughout the network. The development flows at the intersections assessed in this study (based on the MOD 9 scenario) are shown in Figure 12 and Figure 13 for the AM and PM peak hours respectively. These traffic flows reflect full development of Barangaroo traffic under MOD 9. The reduction in the number of trips generated by the reference scheme are detailed in Table 12.

It should be noted that under both scenarios, traffic generated by Barangaroo (as of May 2018) has been discounted from the overall traffic generation forecasts, as this traffic is already included in the existing traffic counts. Reductions have been applied to the volume of traffic generated by the Barangaroo South development (approximately 70% occupied as at May 2018), on-street parking in Barangaroo South and traffic from the Barangaroo Reserve car park.

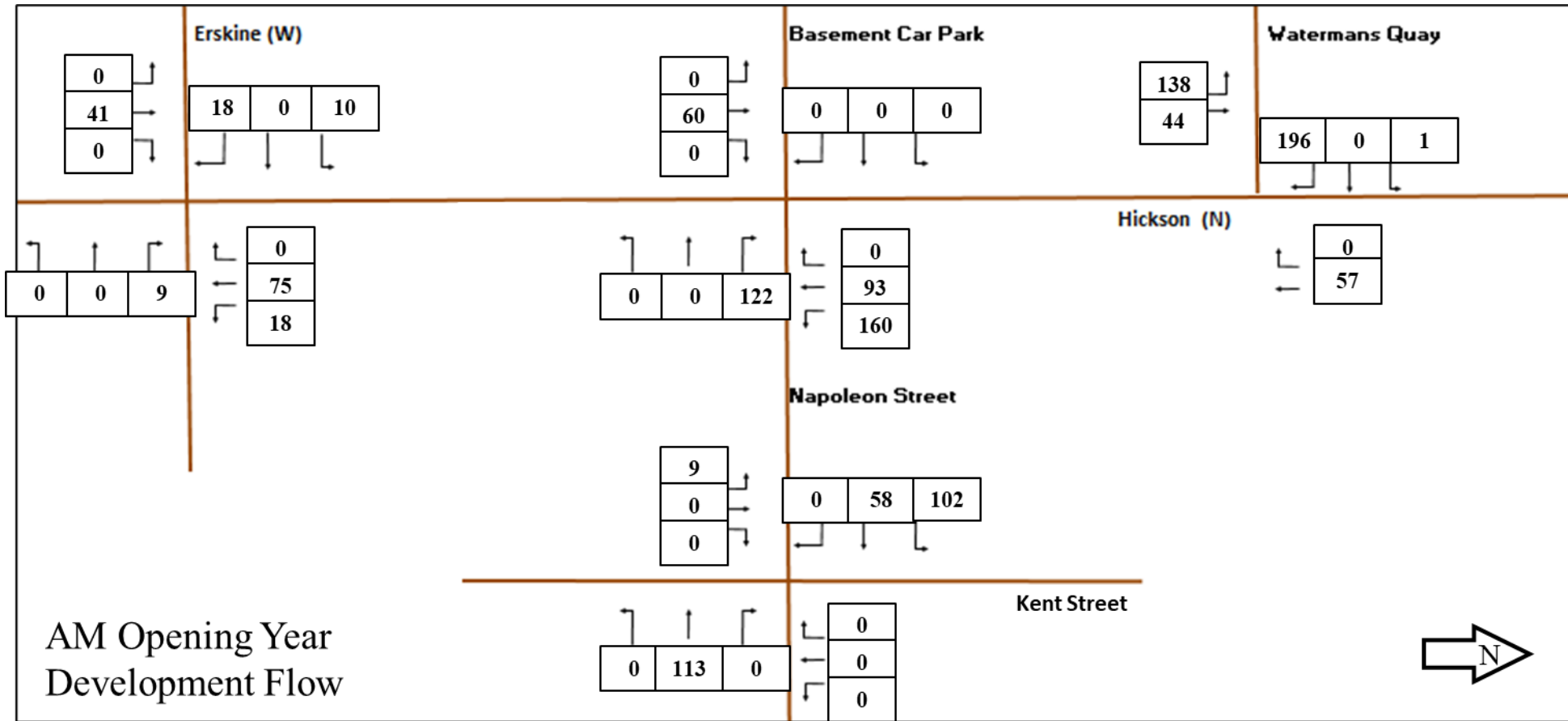


Figure 12 Opening year (additional) development flows – MOD 9 AM peak hour (source: Arup)

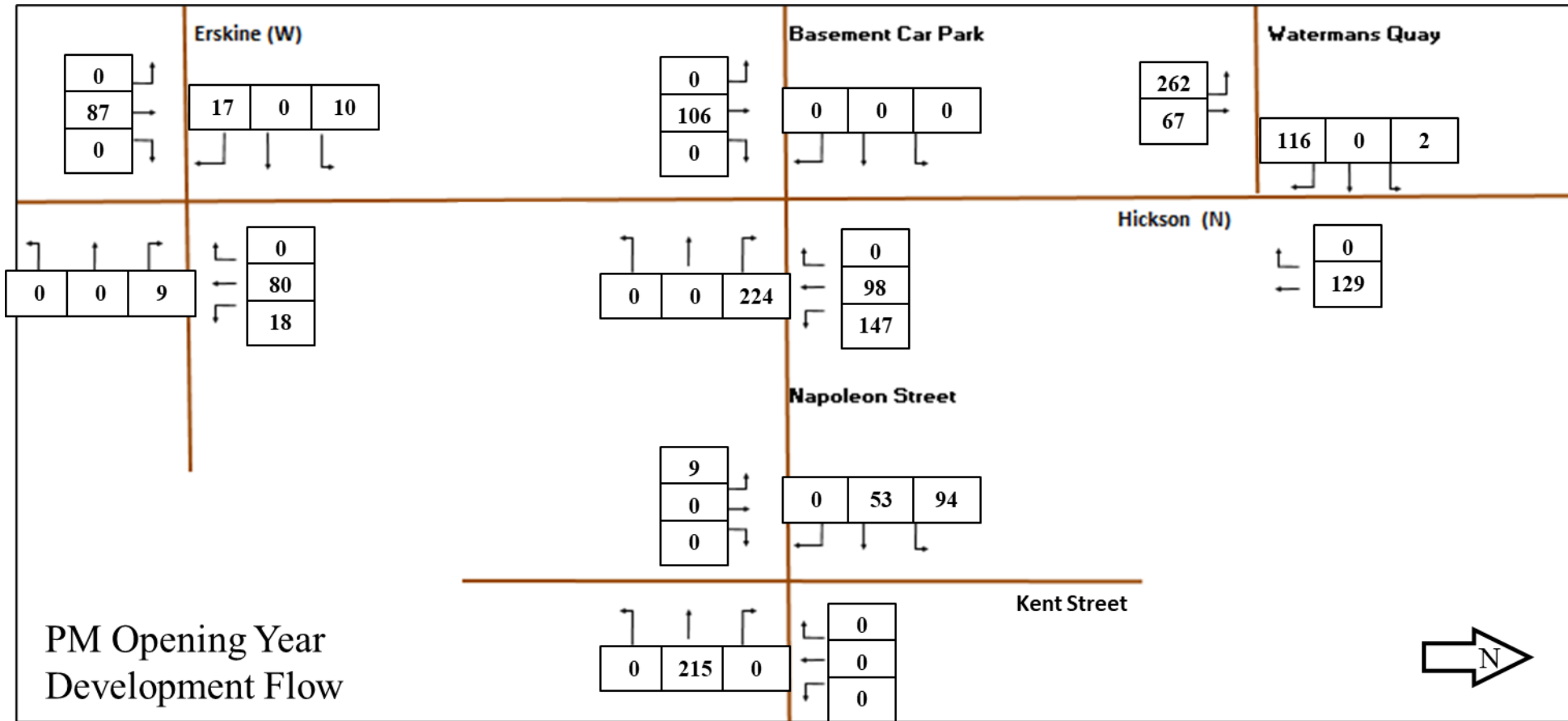


Figure 13 Opening year (additional) development flows – MOD 9 PM peak hour (source: Arup)



## 5.6.5 Intersection modelling results

The results of the traffic modelling comparing MOD 8/10 to MOD 9 are summarised in Table 16 below. The complete traffic results are provided in Appendix B.

Table 16 Traffic Modelling Results

Peak	Intersection	TMAP MOD 8/10			TMAP MOD 9		
		LOS	DOS	AVD (sec)	LOS	DOS	AVD (sec)
AM	Sussex Street / Erskine Street	B	0.60	27	C	0.87	35
	Hickson Road / Napoleon Street	E	1.00	69	E	1.14	58
	Hickson Road / Watermans Quay	B	0.62	16	B	0.5	19
	Kent Street / Margaret Street	B	0.77	26	C	0.88	32
PM	Sussex Street / Erskine Street	D	0.97	55	C	0.98	41
	Hickson Road / Napoleon Street	D	0.92	43	E	1.17	70
	Hickson Road / Watermans Quay	A	0.47	11	B	0.88	21
	Kent Street / Margaret Street	B	0.75	23	C	0.89	33

LOS - Intersection Traffic Level of Service, DOS - Degree of Saturation, AVD - Average Delay per vehicle

The results of the traffic modelling forecast minor changes in the operation of key intersections as a result of the Central Barangaroo reference scheme MOD 9 when compared with performance under MOD 8 (and therefore MOD 10 and 11). Changes in vehicle delays are relatively minor for most parts of the network in both the AM and PM commuter peak hours.

In the PM peak hour Hickson Road / Napoleon Street intersection is showing that it is operating at capacity with LOS E. Changes to the road network layout and the lane assignment on Hickson Road has resulted in Napoleon Street operating slightly worse than MOD 8. At the Hickson Road/Watermans Quay intersection on the northern leg the short lane was the right turn lane. The latest arrangement has the straight thought lane as the short lane. This is causing the Napoleon Street intersection to operate with a worse LOS.

Given that these results are consistent with the previously approved TMAPs, this indicates that the road network can accommodate both development modifications with the intersection operating at capacity. This implies that the trips generated by the increase in residential floor space are offset by the removal of commercial uses and reduction in bus volumes along Hickson Road. The commercial use option is based on car spaces is assumed to be fixed, which therefore will not affect trip generation.

The DGRs require consideration of how vehicular traffic will be managed in response to capacity limitations on the road network. This assessment considered the cumulative regional traffic impacts of the area. The analysis of the local road network has indicated that most of the intersections operate with an acceptable level of performance. However, Napoleon Street intersection operates with a LoS E and is considered to be at capacity which could cause the network to be constrained. The limited amount of car parking provided within Barangaroo, strong accessibility to public transport and constrained road network surrounding the site effectively limits the traffic generation to be within the capacity of the road network.

## 6 Transport and Access Service Strategy

### 6.1 Sydney Metro

Sydney Metro is a major rail project connecting the Sydney CBD, the inner south-western suburbs and the north-western suburbs of Sydney. A map of the project is shown in Figure 14. It is a high-capacity system, with the ability to run trains every four minutes in the peak in each direction of the line. The first stage of Sydney Metro (Sydney Metro Northwest) opened in May 2019.

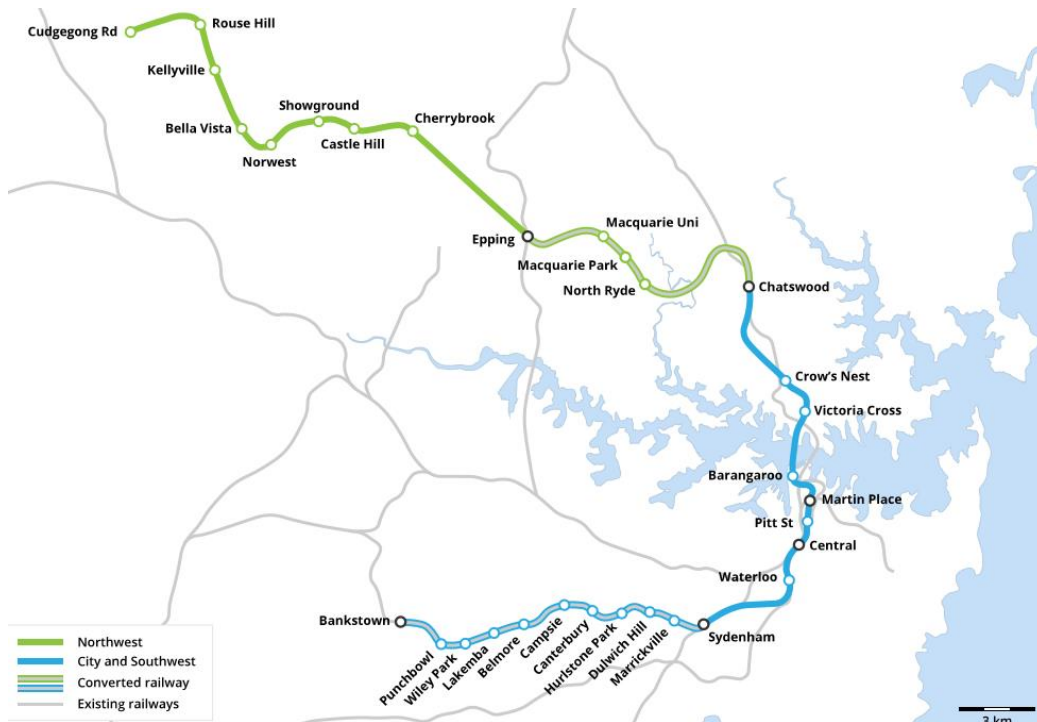


Figure 14 Sydney Metro Project (source: Sydney Metro)

In June 2015, the NSW Government announced a new station would be constructed at Barangaroo as part of the Sydney Metro (City and Southwest) project. Based on patronage modelling undertaken by Sydney Metro, delivering a new station at Barangaroo will, in the morning peak, reduce entries and exits at both Wynyard Station and Martin Place station by approximately 5,000 passengers (NSW Government). This Metro Station will improve public transport access for people travelling to and from Central Barangaroo by providing an accessible, high-capacity alternative to Wynyard Station, which can experience over-crowding during peak periods. It will provide future workers and residents direct access to key strategic centres such as Bankstown, North Sydney, St Leonards and Macquarie Park.

Sydney Metro Stage 2 (which includes the new Metro Station at Barangaroo) is currently under construction and is expected to be opened in 2024. One entry point to the Metro Station is planned within the Central Barangaroo precinct as shown in Figure 15. This will provide convenient access to high capacity, high-frequency public transport services for workers, residents and visitors to the Central Barangaroo precinct.

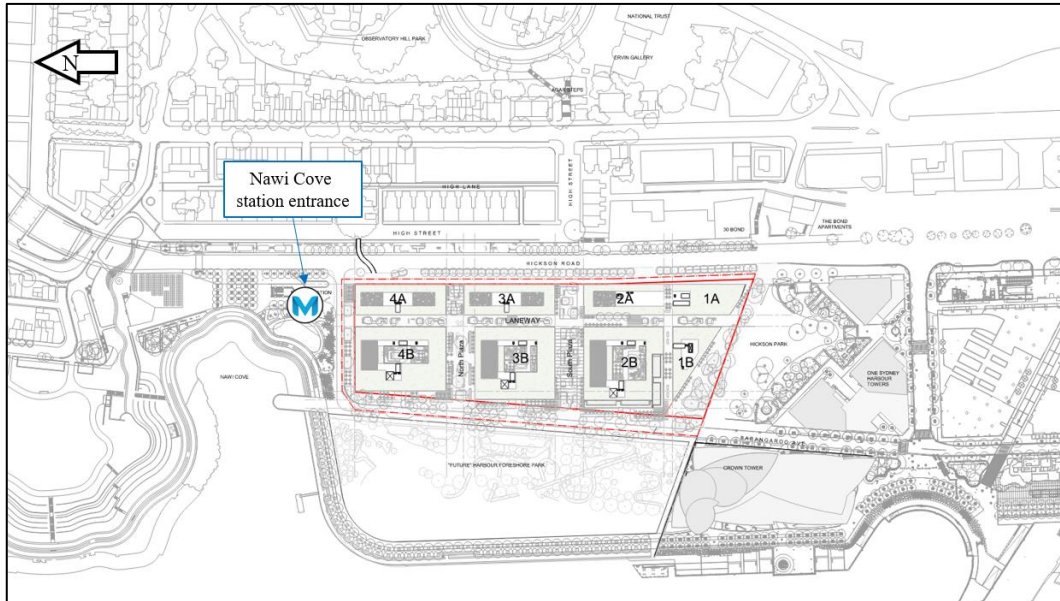


Figure 15 Indicative entry points to the Metro Station (base map source: SJB)

## 6.2 Vehicular site access and circulation

The site access arrangements and circulation arrangements for Central Barangaroo are shown in Figure 16. Key features of the proposed scheme include:

- It is proposed that Barangaroo Avenue (north of the Crown Hotel) and Street D are one way shared zone as shown in orange in Figure 16, where pedestrians are prioritised, as part of the masterplan which makes this loop a Civic Place in the Movement and Place classification;
- Watermans Quay will be established as the main access and two-way connection between Barangaroo Avenue and Hickson Road, serving the function of a Local Street in the Movement and Place classification;
- Barangaroo Avenue outside the Crown will remain two-way and will act as the main access point to the site in addition to the basement car park access; and
- A north-south pedestrian link is proposed to extend Scotch Row and connect Nawi Cove to Hickson Park.

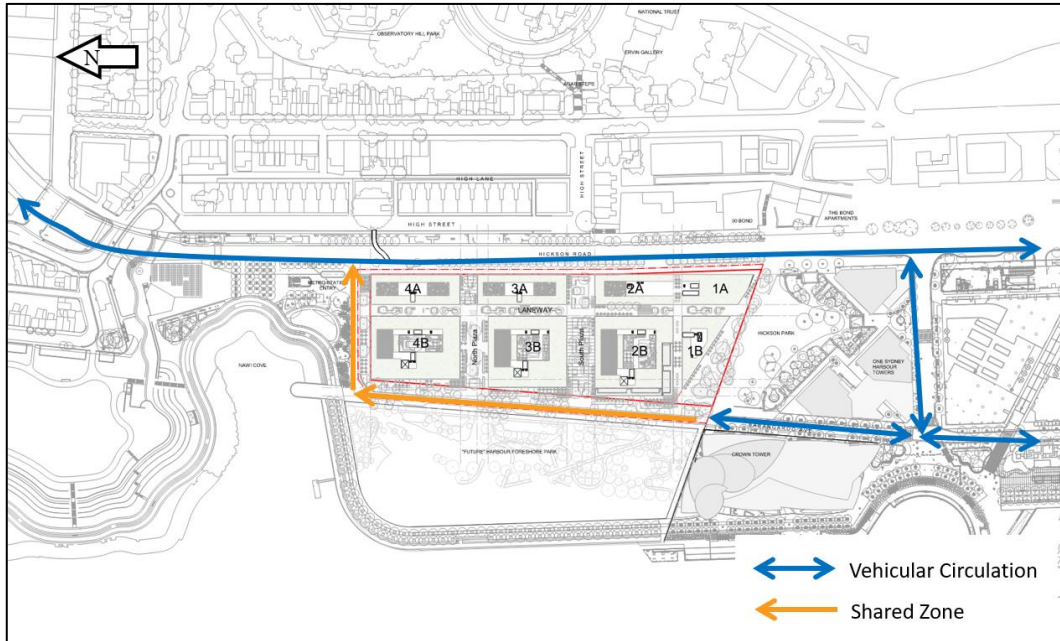


Figure 16 Central Barangaroo circulation strategy for vehicles  
 (base map source: SJB)

Barangaroo Avenue (north of the Crown Hotel) and Street D are proposed as a shared zone. “*NSW TTD Traffic management and road safety practices*” provides a principle for the design and implementation of shared zone. Whilst there is no thresholds from a traffic volume perspective previous versions of this document have indicated threshold for a shared zones should be less than 100 veh/hr and less than 1,000 veh/day.

It is anticipated that the volume of vehicles using this Barangaroo Avenue will be lower than the threshold. This is subject the outcome of the Harbour Park design and traffic generated by activities at the park. The reason are as follows:

- Residential trip to/from Central Barangaroo will all use Hickson Road as this is where the basement car parking accesses are located. i.e. they have no reason to be on Barangaroo Avenue;
- Trips to the Crown Hotel will access via Watermans Quay intersection, only northbound trip from the hotel are likely to use the shared zone, these numbers are expected to be low and will mostly be taxis, ride-share vehicles and vehicle servicing Harbour Park; and
- Deliveries to the retail shops in Central Barangaroo are expected but these trips are expected to occur early in the morning and the volume of vehicle is expected to be low.

A detailed designed will be required to confirm the specific elements and operation of the shared zone. These will include surface treatment, signage and speed restrictions (10km/hr).

## 6.3 Street layouts and building access

Streets within Central Barangaroo comprise of pedestrian only links and a one-way vehicular route along Barangaroo Avenue, operating in a clockwise direction. The driveway access point into the basement car park will be via Hickson Road. The number of driveways will be minimised to limit the interaction between pedestrians and vehicles within the precinct. It is envisaged all turning movements will be permitted at these driveway access points, but this will be confirmed during subsequent design stages of the project (subject to a separate application).

Barangaroo Avenue will be designed to accommodate articulated vehicles up to 19 m in length to facilitate service vehicle requirements, as well as NSW Fire brigade aerial appliances. This will also preserve options to get trucks to/from the central event space within Harbour Park.

## 6.4 Car parking

### 6.4.1 Summary

Car parking analysis has been based on the same parking ratios as used in TMAP 2008 and 2015. The parking numbers are presented for the potential parking needs of development for Central Barangaroo and for the proposed Barangaroo reference scheme MOD 9.

The parking numbers presented in this section are calculated based on the proposed GFAs applying the approved car parking rates specified under the proposed MOD 9. Table 17 present the maximum permissible number of parking spaces the parking rate allow as well as the number of spaces proposed as part of the development.

Table 17 Parking Rates within Central Barangaroo

Land Use and Activity	Parking Rate	GFA/Units	Maximum permissible (parking spaces)	Proposed (parking spaces)
Commercial	1 space / 600m <sup>2</sup> GFA	736m <sup>2</sup>	1	1
Retail	1 space / 600m <sup>2</sup> GFA	14,766m <sup>2</sup>	25	10
Community Theatre	1 space / 30m <sup>2</sup> GFA	2,800m <sup>2</sup>	93	14
Residential	3+ bed: 2.0 spaces / dwelling	143 dwellings	286	286

Visitor Parking	0.2 spaces / dwelling up to 30 dwellings;  0.125 spaces / dwelling more than 30 and up to 70 dwellings, and  0.067 spaces / dwelling more than 70 dwellings.	-	16	16
Car Share Scheme*	1 space / 50 standard residential parking spaces.	286 spaces	6	6
Hotel	Rate used for the Crown	15,898m <sup>2</sup>	150	150
<b>Total</b>			<b>577</b>	<b>483</b>

\*Car share scheme spaces are minimum rates instead of maximum rates.

Table 18 present the number of proposed spaces within Barangaroo combining Central Barangaroo, South Barangaroo and Barangaroo Reserve comparing MOD 8/10, MOD 9 (old scheme) and MOD 9 RtS.

Table 18 Parking Rates within Barangaroo

Land Use and Activity	Source	Parking Rate	Parking spaces with MOD 8/10	Parking spaces with MOD 9 (previous scheme)	Parking spaces with MOD 9 RtS
Commercial	Concept Plan	1 space / 600m <sup>2</sup> GFA	571	599	521
Retail / other uses	Concept Plan	1 space / 600m <sup>2</sup> GFA	48	113	65
Residential	Concept Plan	1 bed: 0.5 spaces / dwelling 2 bed: 1.2 spaces / dwelling 3+ bed: 2.0 spaces / dwelling	2,018	2,202	2,057
Hotel	n/a	n/a	500	500	650
Hickson Road on-street parking*	n/a	n/a	125	20	20
On-Street parking within Barangaroo Central	n/a	n/a	40	25	6
Barangaroo Reserve parking	n/a	n/a	300	300	300
<b>Total</b>			<b>3,602</b>	<b>3,759</b>	<b>3,619</b>

\* Based on draft Hickson Road masterplan (subject to change)

As per the Sydney DCP (2012), car parking areas in developments are to be designed and constructed so that electric vehicle (EV) charging points can be

installed at a later time. The location and quantum of EV charging spaces will be confirmed at detailed design stages.

Sydney DCP (2012), also states that a provision for a car share scheme within the development should be considered. Car share parking spaces should be provided in addition to the maximum number of car parking spaces permitted in the development. The maximum rate at which it should be provided is 1 space per 50 standard parking spaces. Based on 2,057 residential parking spaces that are proposed for MOD 9 approximately 40 car share spaces will be provided (6 of these will be allocated within Central Barangaroo).

## 6.4.2 On-street parking

It is envisaged only a small number of on-street parking bays will be provided within Central Barangaroo, which is in keeping with the overall strategy of reducing car dependency and enhancing the movement of pedestrians and cyclists. Public car parking is available in the 300-space car park under Barangaroo Reserve, as well as a number of other car parking areas in the precinct.

The on-street parking provided within the Central Barangaroo streets will be provided in indented parking bays for drop-off of passengers and disabled parking. The anticipated approximately six car parking spaces are accommodated on-street. All on-street spaces are likely to be for short stay purposes only, aligning with restrictions that have been implemented in the wider precinct.

There is also some on-street parking expected to be provided on Hickson Road. Previous planning for Barangaroo envisaged approximately 100 to 125 parallel parking spaces between Napoleon Street and Towns Place. With the latest Hickson Road upgrade master plan it is expected this number will be reduced to approximately 20 spaces.

## 6.4.3 Loading and servicing

Access to loading docks, temporary tradesman parking and servicing areas will be provided from Hickson Road at basement levels of Block 6 and at specific times along the pedestrian priority zone along Barangaroo Avenue. Internal turning facilities would be provided to enable large refuse vehicles and delivery/removalist vehicles to enter and leave in a forward movement. As per the Statement of Commitments for the approved Concept Plan:

- All building servicing & loading facilities are to accord with City of Sydney Council's rates;
- All service/delivery areas to accord with AS2890. 2:2002 subject to driveways complying with City of Sydney Council's requirements; and
- Loading and servicing will be provided 24 hours a day in the basement for the retail tenants within Central Barangaroo.

Approximately 35 service vehicles will generate 70 trips to the development in the AM peak hour (refer to Table 11).



## 6.5 Hickson Road

Hickson Road will be a two-way street connecting Central Barangaroo with the broader Sydney CBD street network. Pedestrian movement corridors will be predominately located to the west of the street and aligned with the new development blocks of Central Barangaroo. A minimum 2 meters wide footpath has been provided on the eastern side of the road adjacent to a bi-directional cycleway. This allows for pedestrian connectivity between pedestrian interfaces at High St steps. Pedestrian crossings will also be provided to allow for east-west movement. A footpath of 8 meters wide will be provided on the western side adjacent to Blocks 6 and 7.

A 3 meter wide dedicated bi-directional cycle lane will be provided on the eastern side of the road, separated from the southbound traffic lane by a 0.4 metres wide kerb. Intersections and crossing points at Napoleon St and Watermans Quay will allow for cyclists to connect to the west of Hickson Road and into the Central Barangaroo development.

The Central Barangaroo masterplan will be developed to co-ordinate with the delivery of Hickson Road and ensure the provision of the infrastructure is commensurate with the estimated usage.

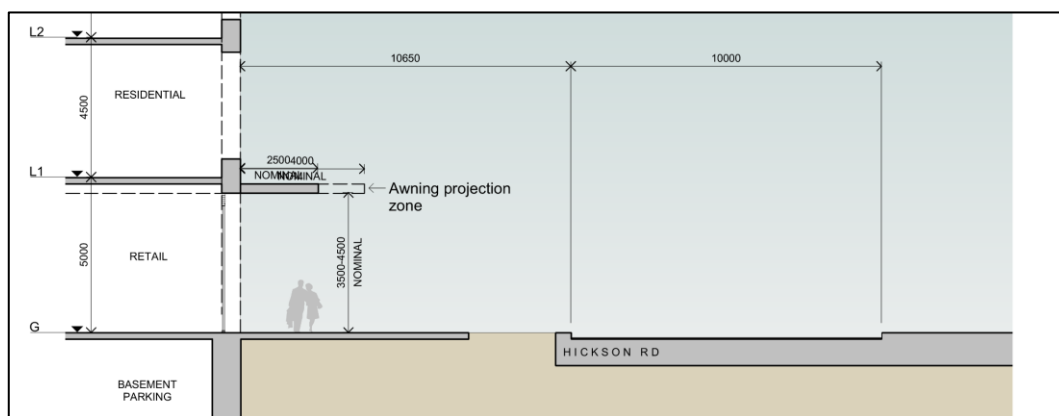


Figure 17 Hickson road cross section (source: SJB)

## 6.6 Pedestrians

### 6.6.1 Pedestrian accessibility

A number of pedestrian connections are proposed to service the Central Barangaroo precinct. This includes a widened pedestrian footpath on the western side of Hickson Road, as well as a permeable internal pedestrian priority network within Central Barangaroo which includes the following:

- Extension of Scotch Row connecting Nawi Cove and Hickson Park; and
- Open public interface to the water connecting the water with Wulugul foreshore walk connecting Barangaroo Reserve and Central Barangaroo to the south to Darling Harbour via King Street Wharf and Barangaroo South.

Formal pedestrian crossings are provided at the Hickson Road / Napoleon Street intersection, as well as the future signalised Hickson Road / Watermans Quay intersection. A direct pedestrian connection to Central Barangaroo will also be provided as part of the Hickson Road upgrade as well as interfaces at Bond Plaza and High St steps. These are consistent with the connections identified in the Barangaroo Integrated Transport Plan as illustrated in Figure 18.

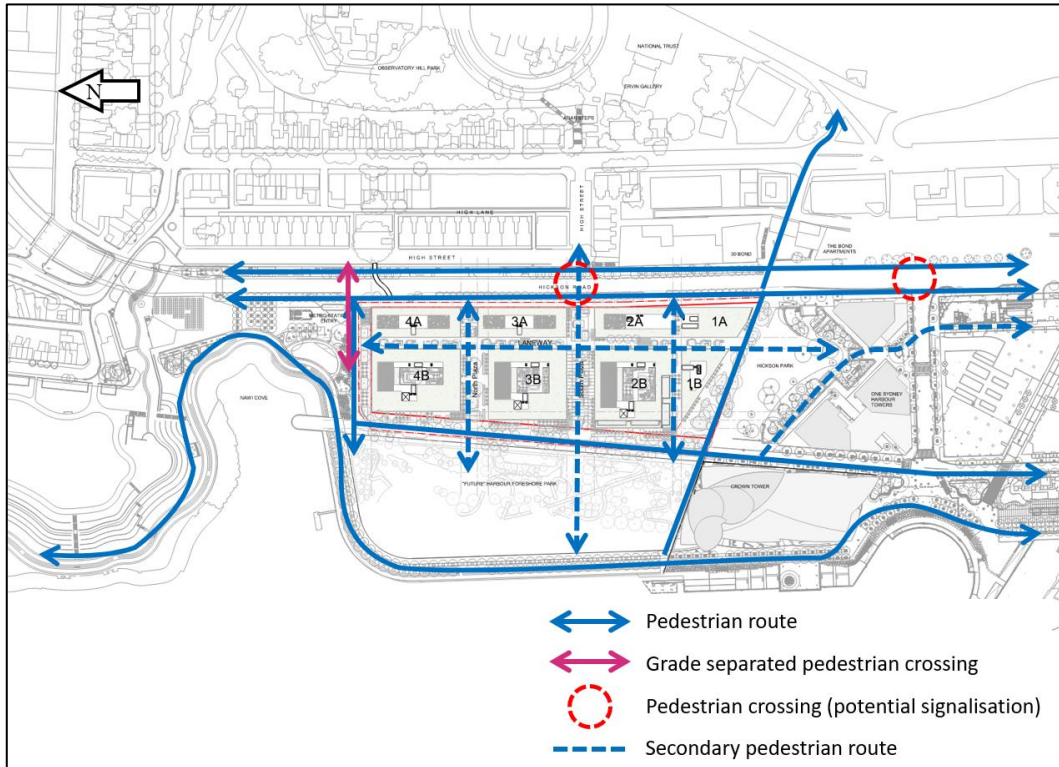


Figure 18 Pedestrian routes serving Central Barangaroo (base map source: SJB)

### 6.6.1.1 High Steps and Bridge Connection

The grade difference between Hickson Road and Kent Street creates a physical barrier for pedestrians. High Street steps are an existing steep and narrow link between Hickson Road and High Street and is the only west-east connection linkage between Central Barangaroo and Millers Point.

As part of the Central Barangaroo MOD 9 reference scheme, a new bridge is proposed to reinstate the connection to Millers Point, landing at the low point of High Street, providing direct access between Millers Point, Central Barangaroo, and the Barangaroo Metro station. The proposed location of the bridge connection is indicated in Figure 19 and will be subject to further refinements following consultation on the MOD 9 and detailed design.

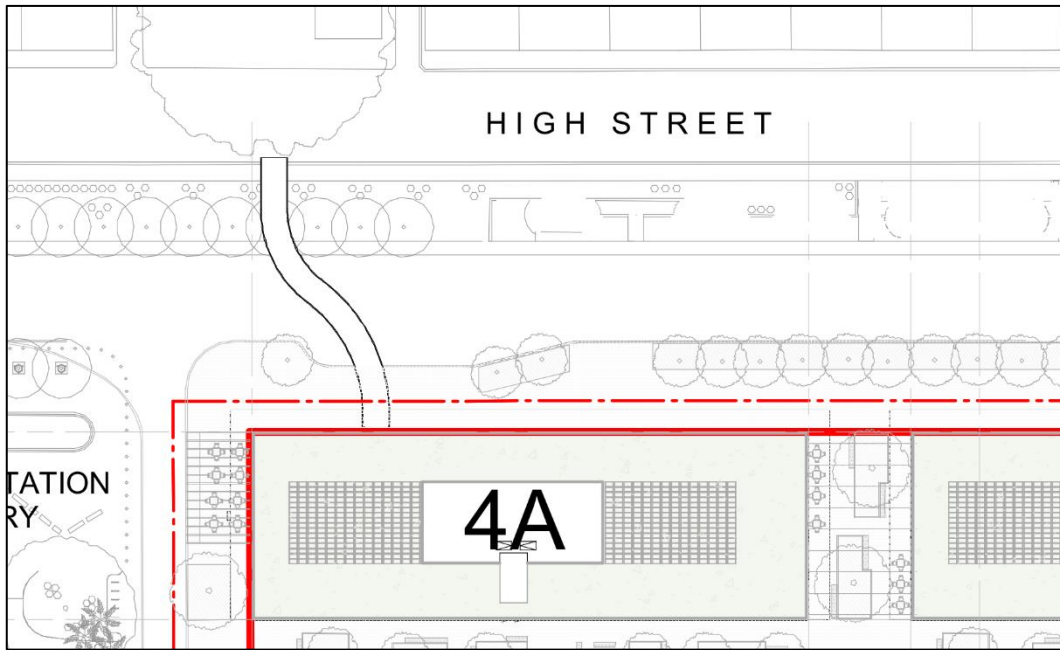


Figure 19 Proposed historic bridge connection (source: SJB)

### 6.6.1.2 Napoleon Bridge

The Napoleon Bridge provides a pedestrian link bridge over Sussex Street located close to the intersection of Hickson Road and Napoleon Street which links into the Wynyard Walk. The facility enhances connectivity between Barangaroo South and the Wynyard Station precinct. Napoleon Bridge will be one of the key pedestrian routes for those travelling between Central Barangaroo and Wynyard transport interchange.

### 6.6.1.3 Wynyard Walk

The Wynyard Walk is a direct pedestrian link connecting the Wynyard Interchange to Barangaroo. The Wynyard Walk helps provide an efficient and fast connection between the site and Wynyard Station, with a typical walking time from the Central Barangaroo to Wynyard Station of approximately ten minutes. Wynyard Walk is shown in Figure 20.



Figure 20 Wynyard Walk

## 6.6.2 Walking Space Guide Approach

A high-level pedestrian assessment, using the NSW Walking Space Guide (WSG), has been undertaken of the following:

- Precinct:
  - main south-north pedestrian corridors at Hickson Road;
  - extended Scotch Row; and
  - Barangaroo Avenue.
- High Street.

The overall aim of the assessment is to allow for sufficient walking space in the street design, and to allow for interactions between people walking and vehicles. This includes consideration of buffers and active frontages. The applied assessment addresses comments made on the MOD 9 application by the City of Sydney as detailed in Table 3.

The WSG is a state-wide guide to be applied in the design of comfortable walking spaces. The document was developed through a collaboration between the City of Sydney and TfNSW to understand the relationship between pedestrian volumes, density, and comfort in the NSW context, and to establish a consistent framework for assessing footpaths within the built environment. The WSG intends to set minimum footpath widths that provide the opportunity for comfortable pedestrian movement across different footpath types and contexts, from high-use central city footpaths to neighbourhood footpaths.

General discussions with the City of Sydney have been held on various projects, about how to deal with the required WSG calculations given the impact of pandemic-influenced low pedestrian activity throughout the City. City of Sydney

has advised that pedestrian counts should be investigated from other sources such as the City of Sydney Walking Data samples and adjacent DAs. Investigations of these, and other open-source data sources, have provided no detailed pedestrian count information to help understand the busyness of the streets in close proximity to the Central Barangaroo precinct. Where data is not available, City of Sydney recommended performing the analysis from a capacity perspective, and this approach has been adopted for the Central Barangaroo Masterplan.

### 6.6.3 Walking Space Guide Assessment – Precinct

The peak pedestrian flows within Barangaroo are expected to occur during the peak passenger demand at Barangaroo Metro. These flows were obtained from the 2017 Sydney Metro Stage 1 Design Pedestrian Modelling Report prepared by Metron. During 2056, the AM peak minute passenger demand is estimated to be ~440 people arriving/departing from the station. PM peak flows were substantially smaller than the AM peak flows and therefore these were not analysed in detail.

Based on the information contained in the report, ~360 people are estimated to be travelling to/from the south of Central Barangaroo. As the northern access point at Nawi Cove represents the access to the station, the demand going to/from that location and travelling through the Central Barangaroo masterplan, has been used as a proxy for the WSG assessment. The WSG has five types of footpath types that form the basis for the assessment. Columns B-D of Table 2A (refer to Figure 21) from the WSG are used to classify footpath types.

**Table 2A – Footpath Type Classification**

	Column A	Column B	Column C	Column D
<b>Footpath Type</b>	<b>Peak Hour number of people on the footpath (People Per Hour – PPHr)</b>	Land use characterisation	Proximity to public transport	Proximity to places of interest  (where a block is measured to a major pedestrian dispersal point like a street intersection)
<b>Type 5</b>	<b>Greater than 2000 PPHr</b>	Very high intensity mixed use, employment, retail, transport or entertainment areas, significant public places or buildings with very large numbers of people, transport interchanges and associated waiting areas, entries and overflow areas	0-50m from a transport interchange including at least 2 modes	Within one block of a metropolitan place of interest  (Table 2B List 3)

Figure 21 NSW WSG, Table 2A Footpath Type 5 Classification

Barangaroo Metro Station is a primary driver for the classification of footpaths in the precinct due to its proximity and the expected volume of passengers. Central Barangaroo will also generate pedestrian trips across the day associated with all uses and yields. On that basis, Type 5 footpaths have been used as the basis for the assessments of the precinct footpaths as the peak hour flows are likely to be greater than 2000 people per hour. Figure 22 provides further detail on the type 5 classification.

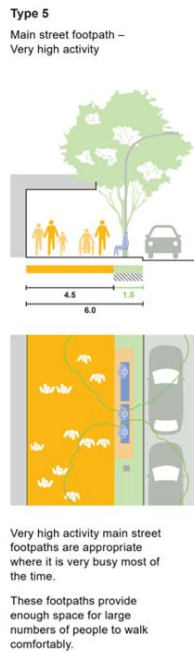


Figure 22 NSW WSG, Type 5 Footpath Classification

As specified in the WSG, a spatial LoS ranging from A (the best) to F (the worst) was used to help provide an indication of comfort percentiles on footpaths. The WSG LoS has been calibrated to Australian urban norms, relatively Australians have a clear preference for more space.

Table 5 of the WSG outlines the correlation of LoS and comfort percentile. For example, a LoS A would indicate 85% of people are expected to be comfortable. The WSG specifies a minimum target criteria of LoS C in which 50% of people would expect to be comfortable. The walking space and LOS guide is outlined in Figure 23.

Table 4A – Walking Space Level of Service

Footpath Type	Adjacent to Active Edge	Walking Space and LOS					
		Types 1-4 Minimum Walking Space in metres (m)					
		Type 5 Minimum Walking Space in metres (m) and Maximum Peak Hour flow rate in PPMM					
		LOS A	LOS B	LOS C	LOS D	LOS E	LOS F
Type 5	Min. width (m)	5.2	4.6	3.9	3.4	2.9	Less than 2.9
	Max. PPMM	4.0	6.0	9.5	13.5	18.0	Greater than 18.0

Figure 23 Walking Space LOS, Table 4a WSG – Type 5 Footpath Type

To inform the assessment of the Central Barangaroo masterplan, a minimum of 3.9m (walking space) is considered to be an appropriate starting point to assess the masterplan against.

The routes through the masterplan comprise of multiple routes such as the pedestrian corridors along Hickson Road, north-south pedestrian link to extend

Scotch Row and connect Nawi Cove to Hickson Park, and the shared zone at Barangaroo Avenue. The routes are illustrated in Figure 24 below.

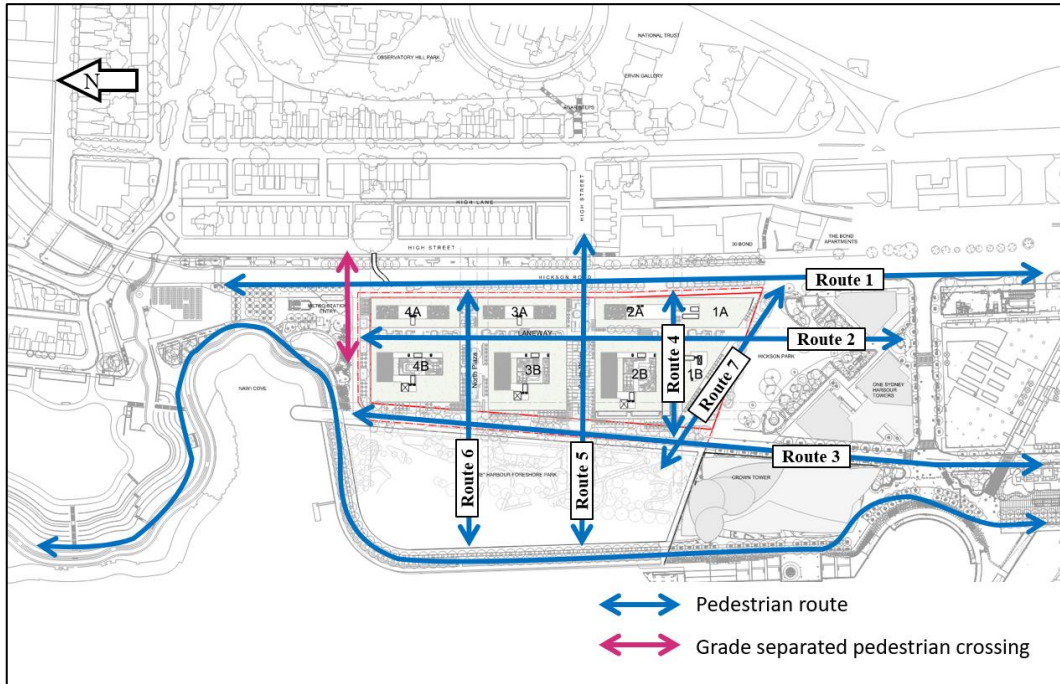


Figure 24 Pedestrian routes – WSG assessment (base map source: SJB)

The reference scheme supporting the MOD 9 application has yet to design each of these routes in detail to include kerbside treatments, width of furniture (i.e. obstructions) and static activity. Architectural concepts for the internal pedestrian network design are provided below in Figure 25.

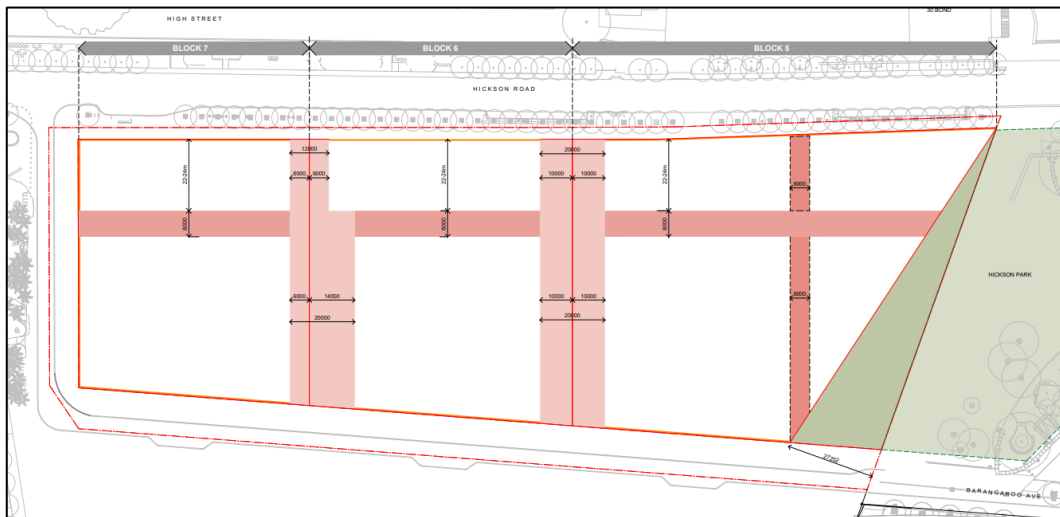


Figure 25 Public Spaces Image (map source: SJB)

The narrowest part of each route has been measured to understand the most constrained sections of walking space and non-walking space (i.e. obstructions). The minimum width of 3.9m of walking space is needed as previously identified. The assessment of the walking space is contained in Table 19.

Table 19 Precinct WSG Walking Space Calculations

Route	Minimum design width required to achieve LOS C (m)	Minimum proposed width (m)	Difference (m)
1 – Hickson Road (West Footpath)*	3.9	8	4.1
2 – Extended Scotch Row	3.9	8	4.1
3 – Barangaroo Avenue	3.9	8.2	4.3
4 – East-West routes (South)	3.9	6	7.9
5 – East-West routes (Central)	3.9	20	16.1
6 – East-West routes (North)	3.9	12	8.1
7 – Hickson Park route	3.9	13	9.1

\*Refer to Section 6.5

The routes have capacity and will be able to accommodate high levels of activity and trips generated by the Metro and Central Barangaroo. The Hickson Road west footpath as detailed in Section 6.5, indicates that an 8 metre footpath will be part of the wider scheme. The Central Barangaroo masterplan will work with INSW to understand the integration of the scheme and provision of footpaths that comply with the minimum requirements.

The extended Scotch Row route is a pedestrian priority route, with no vehicular traffic. The route is expected to be attractive for people traveling north-south and will have a consistent width of 8 metres throughout its length. At Barangaroo Avenue, a shared zone is proposed which will provide a low-speed and traffic volume environment for pedestrians to connect to the wider Barangaroo area. The provision of at least 8 metres width provides significant capacity for high levels of activity.

The east-west routes, opening up the public interface to the water and the Open public interface to the water connecting the water with Wulugul foreshore walk, provide generous width of between 6 metres and 20 metres. These routes provide permeable routes connecting to Central Barangaroo in all directions.

The Hickson Park route provides a high-quality pedestrian east-west route. Like the internal pedestrian street connections, it has been designed to take advantage of connecting to the existing foreshore walk. As the design develops, wayfinding will be an important element to establish the key routes and direct people through the precinct.

## 6.6.4 Walking Space Guide Assessment – Bridge Connection

The reinstatement of the historic bridge connection as described in Section 6.6.1, proposes to connect the Central Barangaroo masterplan to High Street at Millers Point. The bridge will provide direct access for people accessing Millers Point to the west and reduce walking times and distances.



To support the WSG assessment, an appraisal of High Street has been undertaken to demonstrate the supplementary measures that would need to be implemented to provide accessible connections to/from the bridge along High Street.

For the connections to the bridge at High Street, a review of the existing conditions has been undertaken. The images taken along High Street (see Figure 32) demonstrate the following:

- Existing street furniture reduces the usable width of the footway to less than 1 metre. *A minimum of 1.8m is required as outlined in the Sydney Streets Code;*
- Kerbside car parking prevalent along the length High Street; and
- Level change between High Street and Kent Street of approximately 5 metres.



Figure 26 High Street Images

Using Table 2A Columns B-D of the WSG the existing provision has no exact fit. Type 2 has been used as the basis due to the land use characteristics and proximity to public transport to determine the required the level of infrastructure to compare against the minimum requirements as outlined in the Sydney Streets Code.

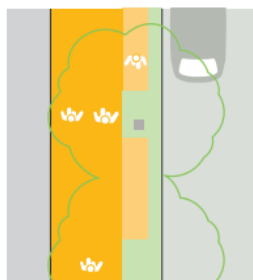
**Table 2A – Footpath Type Classification**

	Column A	Column B	Column C	Column D
<b>Footpath Type</b>	<b>Peak Hour number of people on the footpath</b>	Land use characterisation	Proximity to public transport	Proximity to places of interest
	<b>(People Per Hour – PPHr)</b>			(where a block is measured to a major pedestrian dispersal point like a street intersection)
<b>Type 2</b>	<b>7-69 PPHr</b>	Residential areas that include row or town houses or up to 3 storey residential flat buildings/mixed use residential buildings or medium intensity employment areas (up to 3 storey campus model business parks), hotel/motel, one or two shops	Adjacent to regional cycle lane  0-200m from a bus stop (excluding stops with less than 10 services per day)  0-600m from a LR/Bus Rapid Transit (BRT) stop  400-800m from a train/ metro station	Within two blocks of a local place of interest  (Table 2B List 1)

Figure 27 NSW WSG, Table 2A Footpath Type 2 Classification

**Type 2**

Local footpath –  
 Medium activity



Medium activity local footpaths are appropriate where people walking are more than likely to pass people coming the other way.

These footpaths support 2 people passing abreast or 2 friends walking together passing another person using the Passing Zone.

Figure 28 NSW WSG, Type 2 Footpath Classification

The footpaths in their current form, at less than 1m in width. Using a minimum target criteria of LOS C in which 50% of people would expect to be comfortable, a minimum of 2.9m walking space (refer to Figure 29) would be needed along High Street to connect to the proposed bridge.

**Table 4A – Walking Space Level of Service**

Footpath Type	Adjacent to Active Edge	Walking Space and LOS					
		Types 1-4 Minimum Walking Space in metres (m)				Type 5 Minimum Walking Space in metres (m) and Maximum Peak Hour flow rate in PPMM	
		LOS A	LOS B	LOS C	LOS D	LOS E	LOS F
Type 2	-	3.0 + 0.6 Passing Zone	2.7 + 0.6 Passing Zone	2.3 + 0.6 Passing Zone	1.9 + 0.6 Passing Zone	1.6 + 0.6 Passing Zone	Less than 1.6 + 0.6 Passing Zone

Figure 29 Walking Space LOS, Table 4a WSG – Type 2 Footpath Type

LOS C is the minimum target level and LOS F is the intervention trigger. As already identified, the minimum space to ensure accessible connections to the bridge would be 1.8m. The provision of a 2.9m space would represent a larger intervention trigger and in-line with the minimum requirements as detailed in the WSG.

To supplement the provision of a bridge connection Central Barangaroo and Millers Point via High Street, interventions will be needed to provide access for all users, including cycle movements connections along High Street. Engagement will be needed with City of Sydney to determine the design and supplementary measures such as a parking strategy which will also be needed to ensure any impacts on car parking does not adversely affect the local community.

## 6.7 Cycling

### 6.7.1 Key cycling routes

Central Barangaroo is located close to major cycle routes into the CBD from the north, and close to the City of Sydney cycleway network. The Barangaroo development has the ability to improve the city cycleway network as well as improving its own transport options through the upgrade of Hickson Road and Sussex Street alongside the Central Barangaroo precinct. The proposed bicycle network is shown in Figure 30 and includes:

- A dedicated bi-directional cycle lane will be provided on the eastern side of the road, separated from the southbound traffic lane by a 0.4m wide kerb. this cycle lane will be design to incorporate City of Sydney feedback given to Metro and INSW;
- Hickson Road slow speed traffic environment (between Watermans Quay and Barangaroo Reserve);

- Napoleon Street – on street mixed cycle lane uphill (eastbound) connecting to Kent Street cycleway;
- Foreshore Walk – shared pedestrian and cycle path;
- Kent Street two-way segregated cycleway; and
- Slow speed, pedestrian and cycle friendly environments within Central Barangaroo precinct.

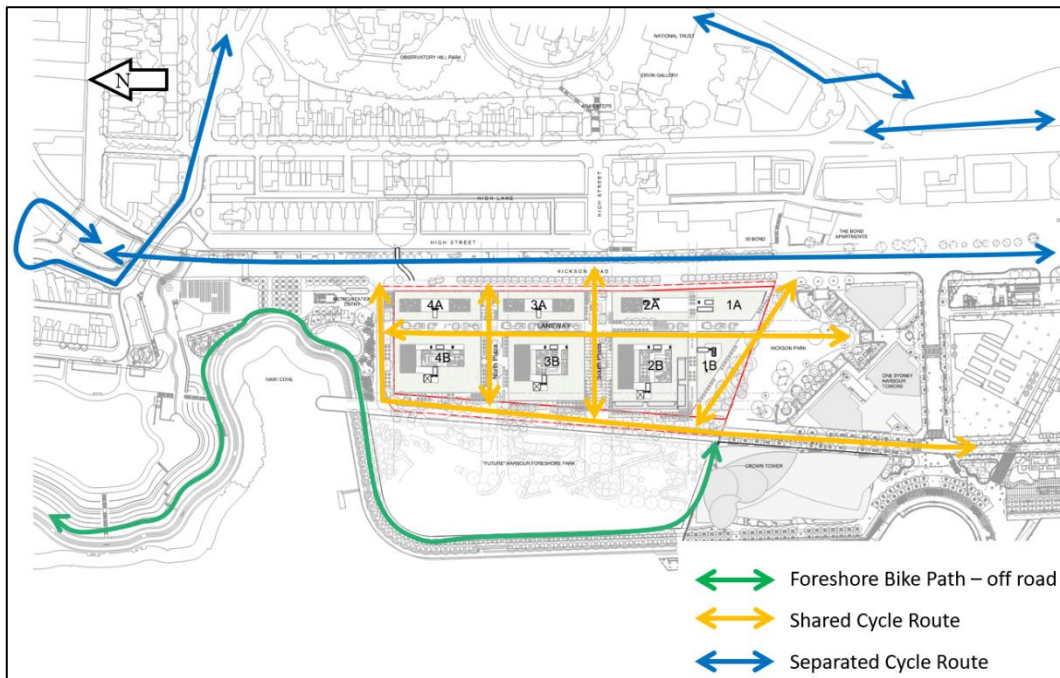


Figure 30 Supporting cycleway network (base map source: SJB)

As part of the Central Barangaroo development, the convenience of using bicycles will be improved by:

- Connections through the precinct to between Barangaroo Avenue and the Foreshore Walk using the route previously occupied by Barton Street;
- Providing bicycle locking facilities within public spaces for visitors, retail customers and tourists; and
- Incorporating generous bicycle parking in residential buildings.
- Reducing the maximum speed of internal roads to 10km/h for all vehicles.

Further details on how the Hickson Road cycleway will be integrated with the Central Barangaroo precinct will be completed in SSDA stage.

## 6.7.2 Bicycle parking

Sydney Metro is providing bicycle racks at the northern entrance to the station and also on the eastern Hickson Road opposite the station.

Off street bicycle parking will be provided within buildings amounting to 550 spaces.

A small quantum of visitor bicycle parking will be considered in the public domain and monitored as required. Bicycle parking will be considered in the public domain and will be increased if demand requires.

Further details on final arrangement of bike parking will be completed at SSDA stage.

## 6.8 Water-based transport

The Barangaroo Ferry Hub opened to the public in June 2017. The new ferry hub connects Central Barangaroo to Circular Quay and other stops along the Paramatta River route. It also reduces capacity constraints on the Circular Quay terminal and brings additional ferry services and routes directly to Barangaroo. It will provide a viable and convenient mode of travel to Central Barangaroo, with pedestrian access to the ferry wharf via the foreshore walk.



Figure 31 Barangaroo ferry wharf

A summary of the current Sydney ferry routes and frequency of these services from Barangaroo Ferry Wharf is listed in Table 20.

Table 20 Ferry routes and frequencies

Ferry Routes	Frequency valid from 2 July 2023
F3 Circular Quay to Parramatta River	Service operates Monday to Friday every 30 minutes in the morning (8am to 9am) and every 10-15 minutes in the evening (5pm to 6pm).  Weekend services operate throughout the day.
F3 Parramatta River to Circular Quay	Service operates 1 service per hour in the morning (8am to 9am) and evening (5pm to 6pm).  Weekend services operate throughout the day in both directions.

<p><b>F4</b> Circular Quay to Pymont Bay</p>	<p>Service operates Monday to Friday every 20 minutes in the morning (8am to 9am) and every 20 minutes in the evening (5pm to 6pm).</p> <p>Weekend services operate throughout the day.</p>
<p><b>F4</b> Pymont Bay to Circular Quay</p>	<p>Service operates Monday to Friday every 20 minutes in the morning (8am to 9am) and every 20 minutes in the evening (5pm to 6pm).</p> <p>Weekend services operate throughout the day.</p>

## 6.9 Bus services

In July 2015 the NSW Government announced a series of bus routes will directly service Barangaroo. These services all run along Hickson Road adjacent to Central Barangaroo, terminating at Walsh Bay, and include:

- Route 311
- Route 324
- Route 325

Figure 32 displays key bus stops in relation to Central Barangaroo. These stops take 4-10 minutes walking time from Central Barangaroo.

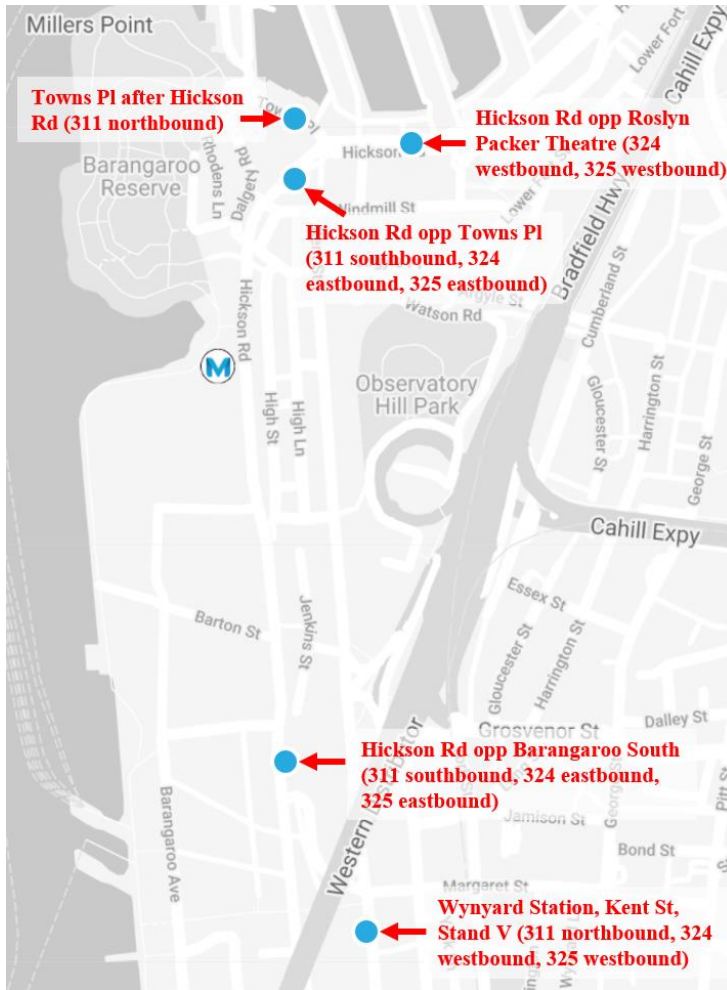


Figure 32 Bus stops servicing Barangaroo

A summary of the bus routes and frequency of these services along Hickson Road is listed in Table 21.

Table 21 Bus routes and frequencies

Bus Routes	Frequency valid from 24 April 2023
<b>Route 311</b> Millers Point to Central Railway Square via Darlinghurst & Potts Point	Service will operate Monday to Friday every 15-20 minutes in the morning (8am to 9am) and every 15-20 minutes in the evening (5pm to 6pm). Weekend services will operate throughout the day in both directions.
<b>Route 324</b> Walsh Bay to Watsons Bay via Old South Head Road	Service will operate Monday to Friday every 8-23 minutes in the morning (8am to 9am) and every 16-21-24 minutes in the evening (5pm to 6pm). Weekend services will operate throughout the day in both directions.
<b>Route 325</b> Walsh Bay to Watsons Bay via Vaucluse Road	Service will operate Monday to Friday every 24-32 minutes in the morning (8am to 9am) and every 18-23 minutes in the evening (5pm to 6pm). Weekend services will operate throughout the day in both directions.

Wynyard Walk will provide the main pedestrian link between Barangaroo and bus and rail services in Wynyard. The focus for bus services to/from Barangaroo will

therefore be on providing a frequent connection to the City Centre, from where connections can be made with bus services to the east, south and west and with rail services at Town Hall Station.

Based on the Barangaroo Integrated Transport Plan and current planning for Hickson Road, two north bound and two south bound bus stops would be provided on Hickson Road to serve Barangaroo South and Central Barangaroo/Barangaroo Reserve.

## 6.10 Sydney Light Rail

The opening of the CBD and South East Light Rail in 2019 has improved public transport accessibility and further increased the attractiveness of public transport as a means of access to Central Barangaroo. Light rail services travel between the Sydney CBD and Moore Park approximately every four minutes, and approximately run every eight minutes between Moore Park and Kingsford.

For Barangaroo, light rail offers the opportunity of a high-frequency service that can provide a quicker journey than walking to some destinations. The Bridge Street stop is the most convenient for passengers from Central Barangaroo taking a walking time of 10 minutes, with access via the new pedestrian bridge over Hickson Road, Kent Street and Grosvenor Street. During inclement weather, the route via Wynyard Walk to the Wynyard stop may be preferable. The light rail route and stops are shown in Figure 33

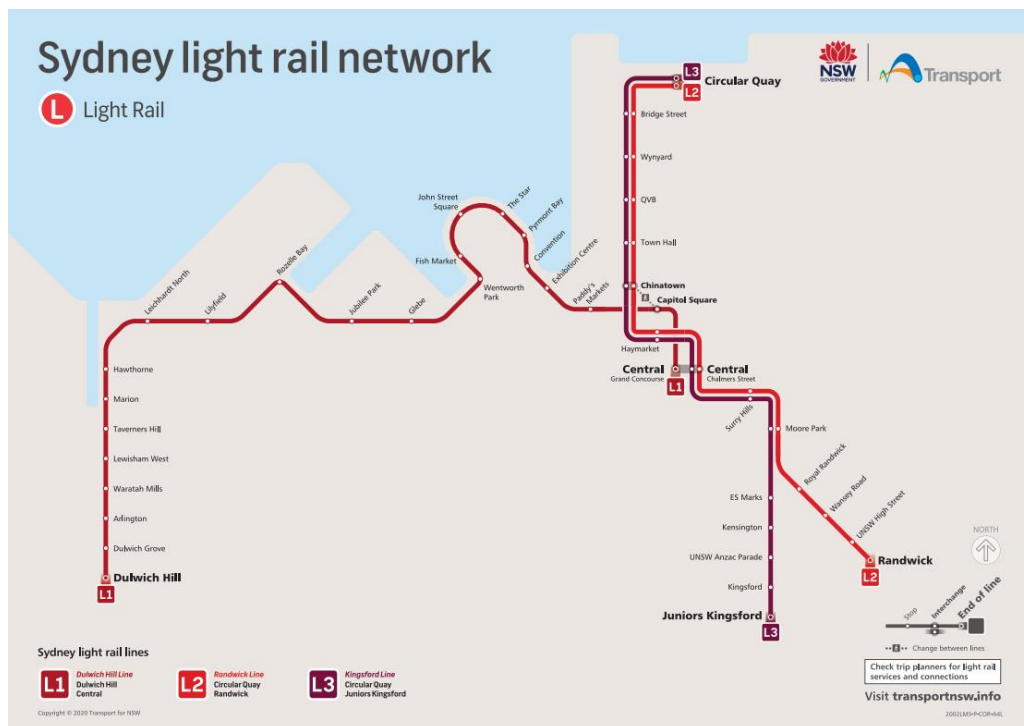


Figure 33 CBD and South East Light Rail route (Source: Transport for NSW)



## 6.11 Taxis and ridesharing

Taxis and ride-sharing services (e.g. Uber) play an important role in assisting Barangaroo to meet its mode share targets. While they make up only 1% of the target mode share, they reduce the need for residents and workers to own/use their cars. The number of taxis generated by the development is captured and accounted for by within the trip rates for each land uses that generate trips.

A number of taxi ranks are proposed throughout Barangaroo to serve the commercial, resident and visitor population. These will be strategically located to serve major buildings including the hotel, residential buildings and commercial towers, in line with the objectives outlined in the Barangaroo Integrated Transport Plan. Taxis will form an important component of the transport network serving Barangaroo, particularly for tourists and those departing the precinct late at night.

On street valet drop off and pick up will be provided within Central Barangaroo. Taxi ranks will be provided on Hickson Road adjacent to the precinct and/or on internal streets. The size and location of these ranks will be detailed further at SSDA stage.

## 6.12 Coach

The types of events held at Central Barangaroo Waterfront Park, Nawi Cove and Barangaroo Reserve could attract tourist coaches. Allocation of kerbside space in the vicinity of the Central Barangaroo, on Hickson Road, for coach set down / pick up is planned within the currently approved Barangaroo reference scheme MOD 9. This will service tour groups travelling to and from the precinct to other areas of Sydney. The number of coaches generated by the development in the AM peak is expected to be approximately 2 and in the PM peak approximately 11, as detailed in Table 11.

The size, location and number of bus parking will be detailed further at SSDA stage.

## 6.13 Late night transport network

Barangaroo is a mixed-use precinct which will generate activity at all hours of the day, including in the evening and late at night. A number of transport alternatives will be available at these times, currently including:

- Train services from Wynyard which run until 1am on weeknights on several routes, resuming again at 4.30am. On weekends the last train service departs Wynyard at 1.41am.
- Ferry services at the Barangaroo Ferry Hub run until midnight seven days a week.
- Services on the future Sydney Metro line are expected to run into the early hours of the morning seven days a week.
- Taxi services and rideshare operators provide an important form of late-night transport for users, as they currently do at King Street Wharf. Taxis will be available at all hours of the night at the strategic taxi ranks identified in

Section 6.11. These ranks will likely be managed during busy periods to accommodate the increased demands expected in the evening.

The majority of the late-night traffic is expected to be generated by the hotel in Barangaroo South. Access to the hotel for taxis and private vehicles will be available via Watermans Quay. The late-night traffic is expected to have a minimal effect on Central Barangaroo.

## 6.14 Emergency vehicles

The internal roads within Central Barangaroo will be designed to accommodate the turning requirements of a NSW Fire Brigade aerial appliance. Emergency Vehicles will be able to enter the site via Watermans Quay from Hickson Road and travel one-way along Barangaroo Avenue and Street D. Emergency vehicle routes into the public open space and along the foreshore walk will be planned to ensure the site has adequate access. Any bollards that are used to define the laneway area will include removable bollards to enable access for emergency vehicles. These paths through the public open space will be coordinated with the event transport plans to provide the necessary access for ambulances and Police vehicles.

## 7 Travel Planning

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One of the TMAP objectives is to reduce the level of private car usage in favour of more sustainable modes of travel such as walking, cycling and public transport. A method of achieving this is personalised marketing strategies to assist in modifying travel behaviour through the development of Travel Demand Management Plans (TDMPs).

The main objectives of the Travel Demand Management Plan are to reduce the need for unnecessary travel and promotion of sustainable means of transport. The more specific objectives include:

- To reduce the number of car journeys associated with the site;
- High modal share for sustainable transport modes including public transport, cycling and walking journeys;
- To ensure adequate facilities are provided at the site to enable staff and patrons to visit the site by sustainable transport modes, and
- To raise awareness of sustainable transport options, particularly amongst the patrons of the site who may be tourists or visitors to Sydney and thus not familiar with the Sydney public transport network.

A number of travel demand travel plans have already been prepared by occupants of buildings in Barangaroo South. These plans outline measures that will be encouraged by future tenants to support sustainable modes of travel to Barangaroo and reduce car dependency. It is expected that commercial and residential buildings within the Central Barangaroo development would prepare similar plans as part of their respective development applications. A summary of the measures already in place in Barangaroo South is as follows:

### 7.1 General Promotion and Marketing

The objectives of the Travel Demand Management Plan will only be achieved with the support of tenants within the precinct. Marketing the benefits and promoting the sustainable alternatives available are therefore crucial in encouraging the adoption of the Travel Demand Management Plan measures. Currently, ‘Getting Here’ information is provided by both the Barangaroo South and Streets of Barangaroo websites. This is shown in Figure 34 and Figure 35.

Other promotional material will take a variety of forms and are issued either to individual employees or displayed in prominent locations.

Barangaroo South
lendlease

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Live   Eat Drink Shop   Work

## GETTING HERE

With significant investment into transport and infrastructure including buses, ferries, trains, cycle paths and pedestrian routes including the Sussex Street and Napoleon Street pedestrian bridges, Barangaroo is seamlessly connected with every part of wider Sydney.

**Train**

Wynyard Station is only a short walk away. The Wynyard Walk tunnel provides a fully accessible, covered pedestrian link between Wynyard Station and Barangaroo south, and avoids steep inclines and road crossings.

**Bus**

Bus services will now take you directly to Barangaroo. Routes 311, 324 and 325 travel to Hickson Road from Town Hall, and a number of off peak services are now arriving at neighbouring King Street Wharf.

**Car**

There is limited parking available at Barangaroo South. If you are visiting by car, public carparks are available nearby at Barangaroo Reserve and Shelley Street.

**Taxi**

There are multiple taxi ranks located within Barangaroo South, such as on Hickson Road, Watermans Quay and Barangaroo Avenue. There are also additional taxi ranks nearby on Shelley Street and Lime Street.

**Bike**

As the number of designated bike lanes within the CBD continue to grow, access to the streets of Barangaroo for bicycle riders is set to become even easier as time goes by. Bike access within the neighbourhood is through Watermans Quay and Barangaroo Avenue, with short term bicycle parking available at a number of convenient locations, the largest of these located along Barangaroo Avenue, in front of The Canteen, and residential buildings Alexander and Anadara.

**Ferry**

There are two ferry wharves at Barangaroo South, accessible from Wulugul Walk adjacent to the foreshore.

**Metro**

For more information about Barangaroo's Metro station, please click here

Figure 34 Travel information – Barangaroo South website

**Barangaroo South**

Barangaroo Ave, Barangaroo, NSW, Sydney, 2000

[Get Directions](#)

- 📍 Daramu House 44m
- 📍 One Sydney Harbour 97m
- 📍 International Towers Sydney - Tower One 109m
- 📍 International Towers Sydney - Tower Two 109m
- 📍 International House Sydney 139m

Figure 35 Travel information – Streets of Barangaroo website

## 7.2 Staff Induction

To ensure new members of staff are aware of the Travel Demand Management Plan, all new staff members should be made aware of the Plan as part of their induction process. The Travel Demand Management Plan section of the induction should provide new starters with the following:

- A brief introduction to the Travel Demand Management Plan and its purpose; and
- Provision of a Travel Demand Management Plan information package which would include information on incentives to use sustainable means of transport e.g. public transport, NightRide buses, cycling and walking information.

## 7.3 Cycling

The precinct already has good access to the well-developed local cycling network, as outlined in Section 6.7. To further encourage the usage of cycling as a means for staff and patrons to access the site, the following measures should be considered:

- Consider the provision of a bicycle pump adjacent to the bicycle storage racks;
- Provide a Sydney cycle map to the staff and patrons accessing the site;
- Consider having a wayfinding sign board at the front of the site to also show detailed cyclist information such as nearby cycleways and information on how to access and use local bikesharing applications;
- The tenant websites could provide information detailing how to access the site by cycling, including details of bike storage areas and links to bikesharing service providers; and
- Make staff and patrons aware of public transport cycling carriage policies and cycle storage facilities at rail stations.

## 7.4 Public Transport

The precinct enjoys good accessibility to public transport including trains, ferries and buses. The usage of public transport by the staff and patrons of the site can be encouraged through the following measures:

- Provide a public transport website containing useful links to journey planning websites in Sydney;
- Provide useful public transport information and maps to patrons and staff;
- Provide live public transport information to patrons near the exit to the building, including information such as upcoming train, bus and ferry services;
- Consider having a public wayfinding sign board at the front of the site to also show detailed information about nearby NightRide Buses information in order to encourage this as a key late-night mode of transport instead of private vehicles and taxis;

- The tenant websites could have information detailing how to access the site by public transport, including the nearest railway station at Wynyard, the Barangaroo Ferry Wharf, the Metro Station at Barangaroo, nearby bus services and NightRide buses. This would help patrons of the site unfamiliar with the Sydney Public Transport network to access the site easily, reducing the need for less sustainable means of travel such as taxi or private vehicle; and
- Ensure that customer service staff members are able to give accurate information about accessing public transport, especially late-night transport options such as NightRide buses, to the customers and patrons of the site, many of whom may be tourists or visitors to Sydney and unfamiliar with the public transport network.

## 7.5 Walking

Staff and Patrons can be encouraged to walk to Central Barangaroo through the following measures:

- Providing wayfinding signage and maps on pedestrian links to public transport and nearby attractions such as Barangaroo Reserve, Walsh Bay, The Rocks, Darling Harbour, Wynyard Station and the City Centre;
- The tenant websites could have information detailing how to access the site easily by walking; and
- Ensure that customer service staff members are able to give accurate walking directions to the customers and patrons of the site, such as tourists or visitors.

## 7.6 Monitoring

The Travel Demand Management Plan is a strategy that will evolve over time. Although the objectives of the Plan to inform staff and patrons to facilitate travel by sustainable modes will not change, it may be possible over time to refine this. Target setting should reflect an ambition for continued progress year on year and there should be a mechanism to review targets. The monitoring measures could include collecting data on travel patterns from patrons and staff accessing the building. The recorded data would inform modes of transport and distance travelled by each mode, from which energy consumption and emissions could be estimated. The recorded data could be published online and be available on the website homepage. This will allow external review and provide public evidence that the Travel Demand Management Plan is being implemented over the life of the development.

Following the implementation of the Travel Demand Management Plan, it is recommended that a travel survey is conducted at least 12 months post-occupation and periodically thereafter to assess the effectiveness of the travel plan against the mode share targets. Based on the results of this survey, the Travel Demand Management Plan team should adjust the strategy to promote non-car related travel.

## 7.7 Targeted users

Table 22 displays an overview of the travel demand measures and their associated users in which they are targeted towards.

Table 22 Application overview of travel demand measures

Measure	Description	Targeted users
General promotion and marketing	<ul style="list-style-type: none"> <li>• ‘Getting Here’ information</li> <li>• Other promotional material</li> </ul>	Visitors
Staff induction	<ul style="list-style-type: none"> <li>• Introduction to Travel Demand Management Plan</li> <li>• Travel Demand Management Plan information package</li> </ul>	Workers
Cycling	<ul style="list-style-type: none"> <li>• Provision of a bicycle pump</li> <li>• Provision of Sydney cycle map</li> <li>• Wayfinding sign board to show detailed cyclist information</li> <li>• Information on tenant websites detailing how to access the site by cycling</li> <li>• Awareness of public transport cycling carriage policies and cycle storage facilities at rail stations</li> </ul>	Workers, residents and visitors
Public transport	<ul style="list-style-type: none"> <li>• Public transport website containing useful links to journey planning websites in Sydney</li> <li>• Useful public transport information and maps</li> <li>• Live public transport information</li> <li>• Public wayfinding sign board to show detailed public transport information</li> <li>• Information on tenant websites detailing how to access the site by public transport</li> <li>• Accurate information about accessing public transport</li> </ul>	Workers, residents and visitors
Walking	<ul style="list-style-type: none"> <li>• Wayfinding signage and maps on pedestrian links to public transport and nearby attractions</li> <li>• Information on tenant websites detailing how to access the site easily by walking</li> <li>• Accurate walking directions to the customers and patrons of the site, such as tourists or visitors</li> </ul>	Workers, residents and visitors
Monitoring	<ul style="list-style-type: none"> <li>• Data collection on travel patterns from patrons and staff accessing the building</li> </ul>	Workers and residents

## 8 Delivery and Timing

The transport management measures proposed to support Central Barangaroo, the Headland Park and Barangaroo in general, including the agency responsible for the delivery of the measure and estimated timing, are summarised in Table 23 below.

Table 23 Delivery and Timing of Transport Measures

Measure	Description	Responsibility for Delivery	Estimated Timing
Road network modifications	Hickson Road upgrade	INSW	Prior to completion of Central Barangaroo
	Signalisation of Hickson Road / Watermans Quay	Barangaroo South developer and INSW	Prior to the opening of Stage 1B development
	Creation of intersections on Hickson Road to access Central Barangaroo	Central Barangaroo developer	Prior to opening of each block within Central Barangaroo
	Creation of the following streets within Central Barangaroo: <ul style="list-style-type: none"> <li>• Barangaroo Avenue</li> <li>• Street D</li> </ul>	Central Barangaroo developer	Opening of Block 5 Opening of Block 6 Opening of Block 7 Staged with the opening of each block
Pedestrian connections	Wynyard Walk	TfNSW	Completed
	Napoleon Bridge	Barangaroo South developer	Completed
	Reinstate historic bridge connection to High Street	Central Barangaroo developer	At completion of Central Barangaroo
	At grade walking routes within Central Barangaroo	Central Barangaroo developer	Concurrently with the opening of each block
	Wulugul / Foreshore Walk	INSW	Completed
Cycling	Visitor bicycle parking in Central Barangaroo public domain	Central Barangaroo developer	Staged following the opening of the precinct
	Hickson Road Cycleway	INSW	In conjunction with Hickson Road upgrade
Bus and coach services	Allocation of space on Hickson Road to accommodate future bus stops	TfNSW, City of Sydney and INSW	In conjunction with Hickson Road upgrade
	Allocation of kerbside space in vicinity of the Central Barangaroo	City of Sydney and INSW	Prior to initial opening of Central Barangaroo
Metro	Sydney Metro Station at Barangaroo	TfNSW	2024



<b>Measure</b>	<b>Description</b>	<b>Responsibility for Delivery</b>	<b>Estimated Timing</b>
Taxi services	Provision of taxi ranks serving Central Barangaroo	Central Barangaroo developer	Staged following the opening of the precinct
Water based transport	Barangaroo Ferry Hub	TfNSW	Completed

## 9 Summary

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The comparison of the traffic generation forecast under the MOD 8/10 transport assessment and the proposed modification (MOD 9) indicates that the total volume of traffic generated by the entire precinct will be approximately the same when compared with that previously assessed.

The TMAP August 2015 (MOD 8) was used as the comparator given that way the latest change to GFA and traffic volumes. A corridor traffic model was developed which assessed the future performance of the road network serving the precinct. The modelling indicated that the road network operates slightly worse when compared to MOD 8, this is due to the minor changes in design of the road network and the lane assignment. The assessment concluded that the road network operates at capacity under MOD 9.

Off-street car parking will be provided at the same parking ratios as used in previous MODs, consistent with the currently approved Barangaroo reference scheme. A reduction in the number of on-street parking bays on Hickson Road of approximately 20 spaces (down from 125) is envisaged compared to that previously considered. Six on-street parking spaces will be provided within Central Barangaroo masterplan.

The precinct maintains a high degree of pedestrian connectivity, with the Foreshore Walk providing a continuous link for pedestrians between Barangaroo Reserve and Barangaroo South. The Central Barangaroo masterplan also includes a new overhead, grade-separated bridge between the Central Barangaroo and High Street, through reinstating a historic bridge connection. Interventions would be needed to provide accessible routes along High Street to/from the bridge. At precinct level, the extension of Scotch Row connecting Nawi Cove and Hickson Park, one-way shared street at Barangaroo Avenue and wide footways on the western side of Hickson Road provide capacity for Barangaroo Metro Station and Central Barangaroo. Permeability of the masterplan will also be provided east-west through pedestrian connections.

The introduction of the Metro Station at Barangaroo will improve public transport access for people travelling to and from the precinct by providing an accessible, high-capacity alternative to Wynyard Station. It will provide future workers and residents direct access to key strategic centres such as Bankstown, Waterloo, North Sydney, St Leonards and Macquarie Park.

The analysis in this report has been completed based on the flexible approach to the reference scheme. Any changes to the design as part of ongoing consultation with stakeholders, will require the analysis to be revisited and could result in change to the impact of the development as the design develops.

## Appendix A

### Traffic modelling outputs

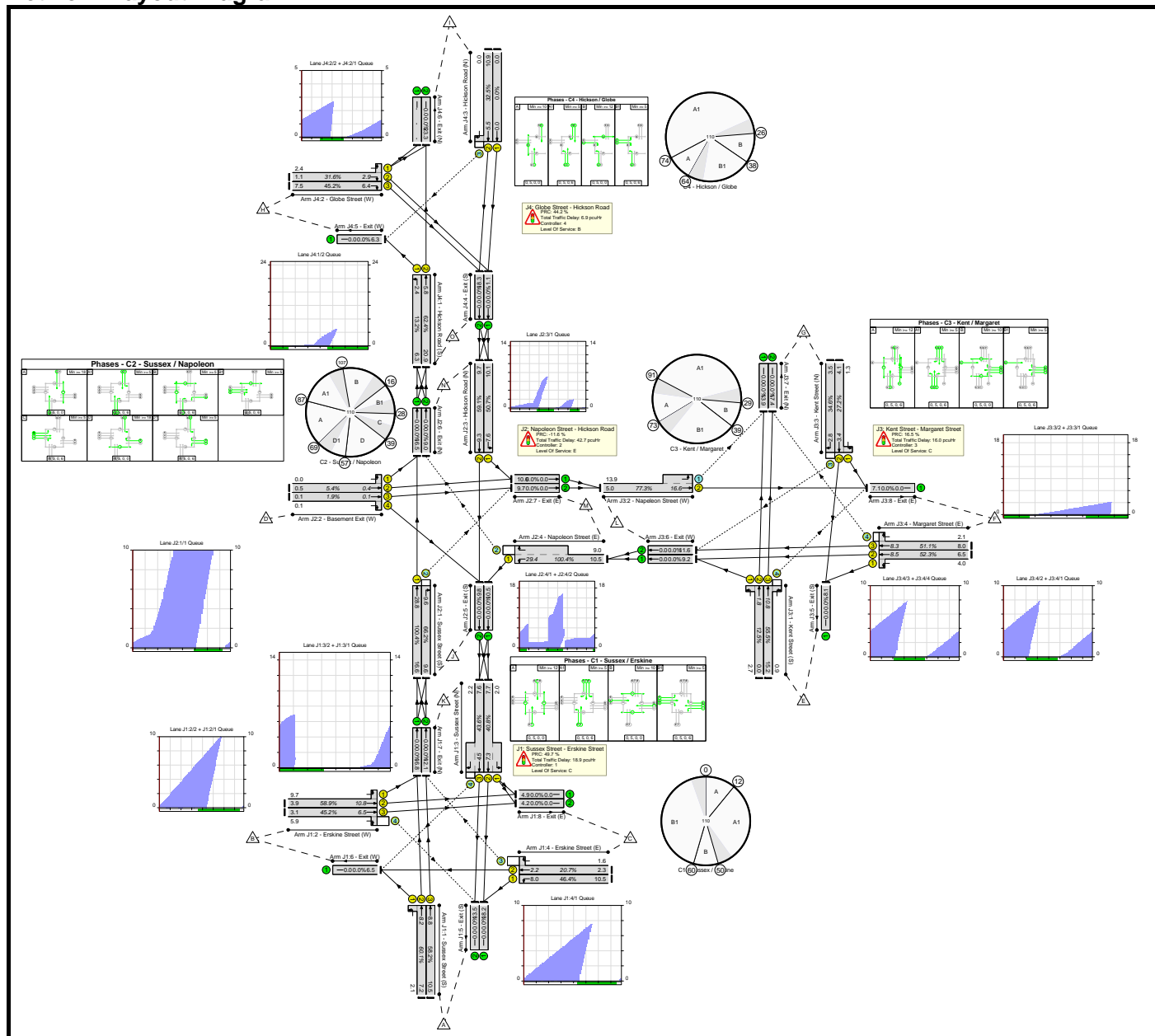
# A1 LinSig modelling outputs: MOD 8

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# Basic Results Summary

## Scenario 3: 'AM Mod8' (FG5: 'AM Future MOD8 Traffic', Plan 1: 'Future (with Basement)')

### Network Layout Diagram



Basic Results Summary

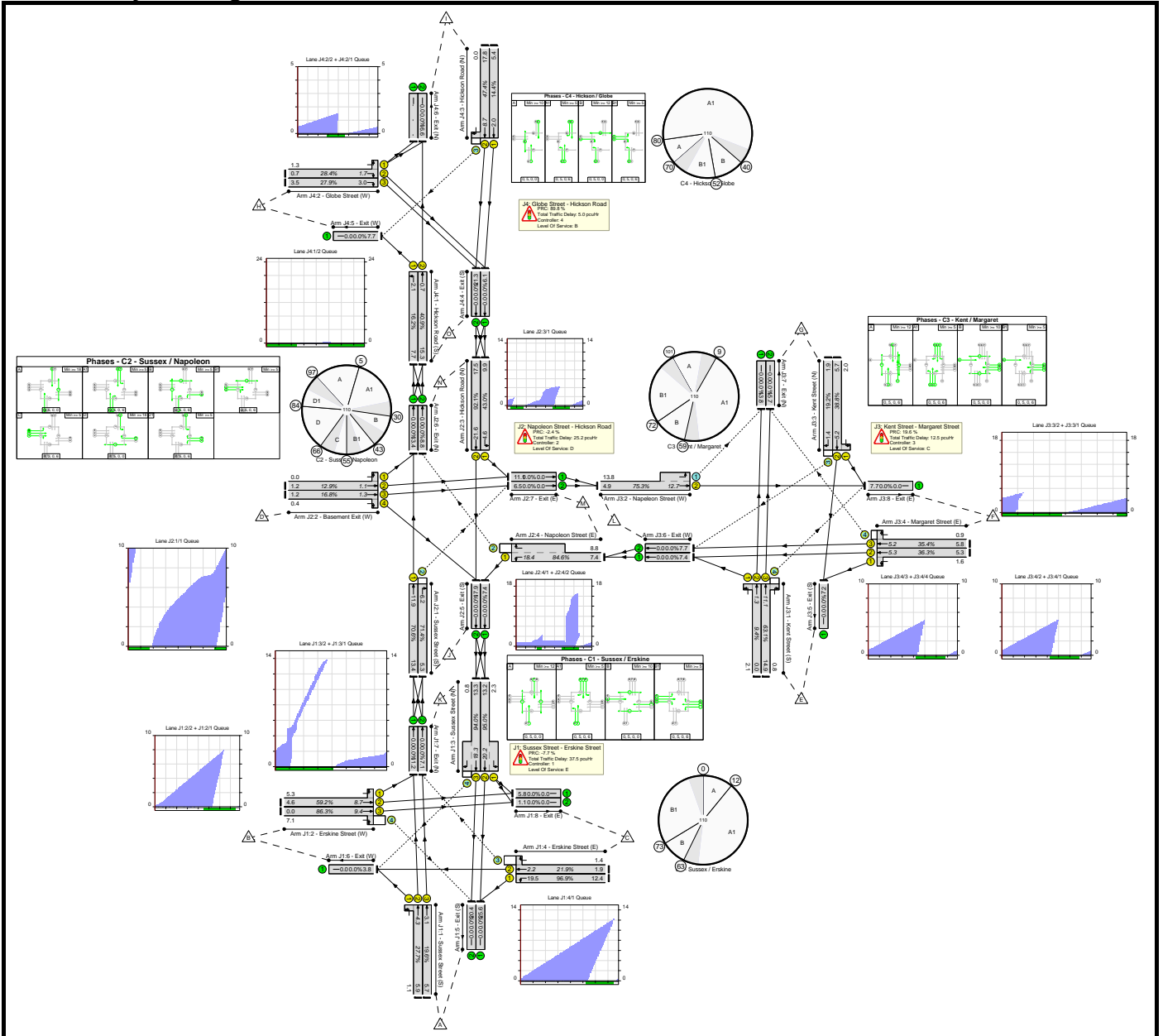
**Network Results**

Item	Lane Description	Lane Type	Deg Sat (%)	Av. Delay Per PCU (s/pcu)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Max. Back of Uniform Queue (pcu)	Mean Max Queue (pcu)
<b>Network: Linsig Modelling</b>	-	-	<b>100.4%</b>	-	-	-	-	-
<b>J1: Sussex Street - Erskine Street</b>	-	-	<b>60.1%</b>	-	-	-	-	-
1/2+1/1	Sussex Street (S) Left Ahead	U	60.1%	37.3	302	1440:1440	7.4	8.2
1/3	Sussex Street (S) Ahead	U	58.2%	32.5	343	1440	8.1	8.8
2/2+2/1	Erskine Street (W) Left Ahead	U	58.9%	30.4	443	1800:1800	10.1	10.8
2/3+2/4	Erskine Street (W) Right Ahead	U+O	45.2%	28.1	295	1800:1440	6.1	6.5
3/2+3/1	Sussex Street (N) Ahead Left	U	40.8%	18.3	318	1800:1800	6.9	7.3
3/3+3/4	Sussex Street (N) Ahead Right	U+O	43.6%	17.2	320	1800:1440	4.1	4.5
4/1	Erskine Street (E) Left	U	46.4%	28.3	342	1800	7.6	8.0
4/2+4/3	Erskine Street (E) Ahead Right	U+O	20.7%	23.0	129	1440:1440	2.1	2.2
<b>J2: Napoleon Street - Hickson Road</b>	-	-	<b>100.4%</b>	-	-	-	-	-
1/1	Sussex Street (S) Ahead	U	100.4%	120.7	542	1800	16.6	28.8
1/2	Sussex Street (S) Right	O	66.2%	35.0	315	1800	8.7	9.6
2/2+2/1	Basement Exit (W) Left Ahead	U	5.4%	45.4	16	1800:1800	0.4	0.4
2/3+2/4	Basement Exit (W) Right Ahead	U	1.9%	44.6	6	1800:1800	0.1	0.1
3/1	Hickson Road (N) Left	U	50.7%	15.4	332	1800	7.1	7.6
3/2	Hickson Road (N) Ahead	U	59.1%	33.0	319	1800	8.6	9.3
4/1+4/2	Napoleon Street (E) Left Right	U+O	100.4%	95.1	639	1800:1800	16.2	29.4
<b>J3: Kent Street - Margaret Street</b>	-	-	<b>77.3%</b>	-	-	-	-	-
1/2+1/1	Kent Street (S) Left Ahead	U	12.5%	24.4	88	1800:1800	1.7	1.8
1/3+1/4	Kent Street (S) Ahead Right	U+O	55.5%	20.1	526	1800:920	10.2	10.8

Basic Results Summary

2/2+2/1	Napeleon Street (W) Left Ahead	U+O	77.3%	24.1	619	920:1800	14.9	16.6
3/2+3/1	Kent Street (N) Ahead Left	U	27.2%	19.9	174	1800:920	3.2	3.4
3/3	Kent Street (N) Right	O	34.6%	35.2	116	1800	2.5	2.8
4/2+4/1	Margaret Street (E) Left Ahead	U	52.3%	33.1	344	1800:1800	7.9	8.5
4/3+4/4	Margaret Street (E) Ahead Right	U+O	51.1%	33.3	333	1800:1800	7.8	8.3
<b>J4: Globe Street - Hickson Road</b>	-	-	<b>62.4%</b>	-	-	-	-	-
1/1	Hickson Road (S) Left	U	13.2%	5.3	206	1800	2.4	2.4
1/2	Hickson Road (S) Ahead	U	62.4%	7.5	686	1800	4.9	5.8
2/2+2/1	Globe Street (W) Right Left	U	31.6%	44.2	114	1800:1800	2.7	2.9
2/3	Globe Street (W) Right	U	45.2%	37.2	244	1800	6.0	6.4
3/1	Hickson Road (N) Ahead	U	0.0%	0.0	0	1800	0.0	0.0
3/2+3/3	Hickson Road (N) Ahead Right	U+O	32.5%	12.9	356	1800:1800	5.2	5.5
C1 - Sussex / Erskine		PRC for Signalled Lanes (%):	49.7	Total Delay for Signalled Lanes (pcuHr):		18.91	Cycle Time (s): 110	
C2 - Sussex / Napoleon		PRC for Signalled Lanes (%):	-11.6	Total Delay for Signalled Lanes (pcuHr):		42.75	Cycle Time (s): 110	
C3 - Kent / Margaret		PRC for Signalled Lanes (%):	16.5	Total Delay for Signalled Lanes (pcuHr):		16.02	Cycle Time (s): 110	
C4 - Hickson / Globe		PRC for Signalled Lanes (%):	44.2	Total Delay for Signalled Lanes (pcuHr):		6.92	Cycle Time (s): 110	
			PRC Over All Lanes (%):	-11.6	Total Delay Over All Lanes(pcuHr):		84.60	

Basic Results Summary  
**Scenario 6: 'PM Mod8'** (FG6: 'PM Future MOD8 Traffic', Plan 1: 'Future (with Basement)')  
**Network Layout Diagram**





Basic Results Summary

**Network Results**

Item	Lane Description	Lane Type	Deg Sat (%)	Av. Delay Per PCU (s/pcu)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Max. Back of Uniform Queue (pcu)	Mean Max Queue (pcu)
<b>Network: Linsig Modelling</b>	-	-	<b>96.9%</b>	-	-	-	-	-
<b>J1: Sussex Street - Erskine Street</b>	-	-	<b>96.9%</b>	-	-	-	-	-
1/2+1/1	Sussex Street (S) Left Ahead	U	27.7%	18.4	229	1800:1440	4.1	4.3
1/3	Sussex Street (S) Ahead	U	19.6%	16.1	186	1800	2.9	3.1
2/2+2/1	Erskine Street (W) Left Ahead	U	59.2%	40.1	325	1800:1800	8.0	8.7
2/3+2/4	Erskine Street (W) Right Ahead	U+O	86.3%	79.8	231	1800:920	6.7	9.4
3/2+3/1	Sussex Street (N) Ahead Left	U	95.0%	53.1	507	920:1800	13.8	20.2
3/3+3/4	Sussex Street (N) Ahead Right	U+O	94.0%	52.0	461	900:1440	12.7	18.3
4/1	Erskine Street (E) Left	U	96.9%	103.7	406	1440	12.2	19.5
4/2+4/3	Erskine Street (E) Ahead Right	U+O	21.9%	31.8	108	1440:1800	2.1	2.2
<b>J2: Napoleon Street - Hickson Road</b>	-	-	<b>92.1%</b>	-	-	-	-	-
1/1	Sussex Street (S) Ahead	U	70.6%	43.7	439	1800	10.7	11.9
1/2	Sussex Street (S) Right	O	71.4%	60.2	174	1800	5.0	6.2
2/2+2/1	Basement Exit (W) Left Ahead	U	12.9%	46.3	38	1800:1800	1.0	1.1
2/3+2/4	Basement Exit (W) Right Ahead	U	16.8%	46.3	52	1800:1800	1.2	1.3
3/1	Hickson Road (N) Left	U	43.0%	15.9	324	1800	4.2	4.6
3/2	Hickson Road (N) Ahead	U	92.1%	59.3	573	1800	16.8	21.6
4/1+4/2	Napoleon Street (E) Left Right	U+O	84.6%	33.2	531	1800:1800	15.8	18.4
<b>J3: Kent Street - Margaret Street</b>	-	-	<b>75.3%</b>	-	-	-	-	-
1/2+1/1	Kent Street (S) Left Ahead	U	9.4%	22.7	69	1440:1800	1.3	1.3
1/3+1/4	Kent Street (S) Ahead Right	U+O	63.1%	21.8	512	1440:920	10.2	11.1

Basic Results Summary

2/2+2/1	Napeleon Street (W) Left Ahead	U+O	75.3%	17.4	613	920:1440	11.2	12.7
3/2+3/1	Kent Street (N) Ahead Left	U	38.8%	22.3	251	1800:920	4.9	5.2
3/3	Kent Street (N) Right	O	19.2%	33.4	62	1800	1.3	1.4
4/2+4/1	Margaret Street (E) Left Ahead	U	36.3%	31.7	225	1800:1800	5.0	5.3
4/3+4/4	Margaret Street (E) Ahead Right	U+O	35.4%	31.7	218	1800:1800	4.9	5.2
<b>J4: Globe Street - Hickson Road</b>	-	-	<b>47.4%</b>	-	-	-	-	-
1/1	Hickson Road (S) Left	U	16.2%	2.2	252	1800	2.0	2.1
1/2	Hickson Road (S) Ahead	U	40.9%	2.9	502	1800	0.3	0.7
2/2+2/1	Globe Street (W) Right Left	U	28.4%	52.9	66	1800:1800	1.5	1.7
2/3	Globe Street (W) Right	U	27.9%	41.2	114	1800	2.9	3.0
3/1	Hickson Road (N) Ahead	U	14.4%	7.9	177	1800	1.9	2.0
3/2+3/3	Hickson Road (N) Ahead Right	U+O	47.4%	11.0	582	1800:1800	8.2	8.7
C1 - Sussex / Erskine		PRC for Signalled Lanes (%):	-7.7	Total Delay for Signalled Lanes (pcuHr):		37.52	Cycle Time (s): 110	
C2 - Sussex / Napoleon		PRC for Signalled Lanes (%):	-2.4	Total Delay for Signalled Lanes (pcuHr):		25.16	Cycle Time (s): 110	
C3 - Kent / Margaret		PRC for Signalled Lanes (%):	19.6	Total Delay for Signalled Lanes (pcuHr):		12.53	Cycle Time (s): 110	
C4 - Hickson / Globe		PRC for Signalled Lanes (%):	89.8	Total Delay for Signalled Lanes (pcuHr):		5.00	Cycle Time (s): 110	
			PRC Over All Lanes (%):	-7.7	Total Delay Over All Lanes(pcuHr):		80.21	

## A2 SIDRA modelling outputs: MOD 9

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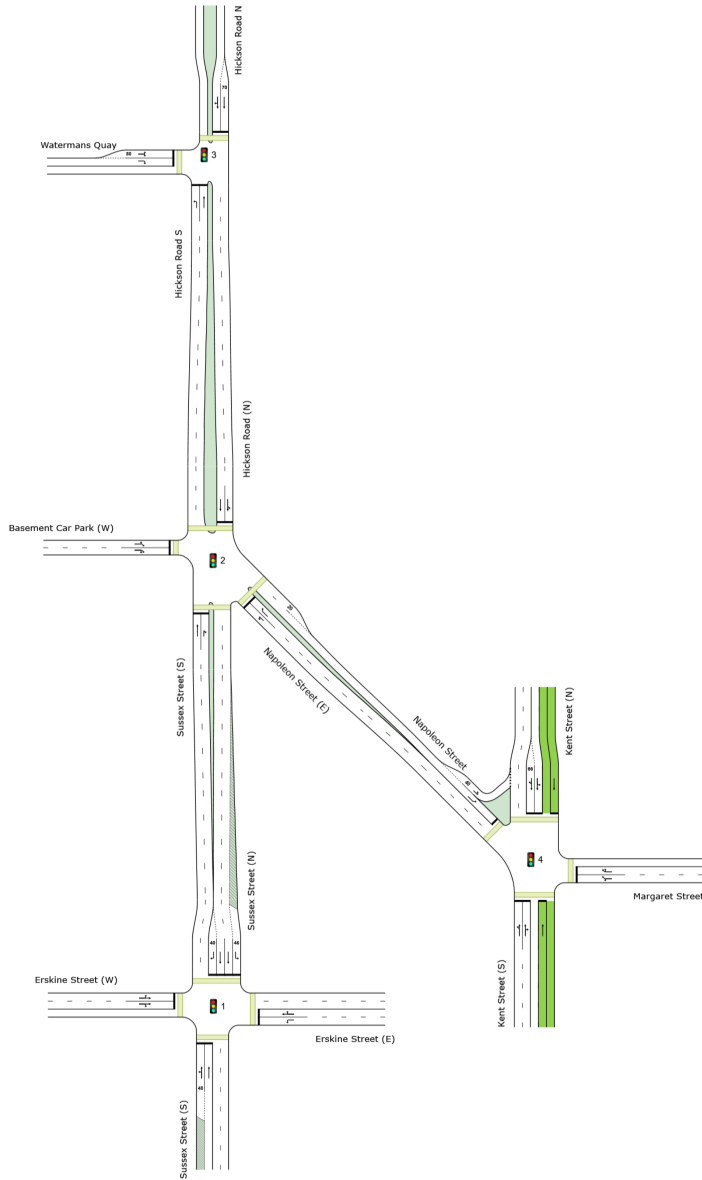
# NETWORK LAYOUT

Network: N101 [AM Future (Network Folder: General)]

New Network

Network Category: (None)

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



SITES IN NETWORK		
Site ID	CCG ID	Site Name
1	NA	1_Erskine Street /Sussex Street _ Future_AM
2	NA	2_Hickson_Sussex_Napoleon_Future_AM
3	NA	3_Watermans Quay_Hickson Road_Future_AM
4	NA	4_Napoleon_Kent_Margaret_Future_AM

# LANE SUMMARY

Site: 1 [1\_Erskine Street /Sussex Street \_ Future\_AM (Site Folder: General)]

Network: N101 [AM Future (Network Folder: General)]

Erskin Street /Sussex Street

Site Category: (None)

Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 82 seconds (Network Optimum Cycle Time - Minimum Delay)

Lane Use and Performance															
	DEMAND FLOWS		ARRIVAL FLOWS		Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE		Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
	[ Total veh/h	HV %	[ Total veh/h	HV %						[ Veh	Dist ] m				
South: Sussex Street (S)															
Lane 1	197	3.0	197	3.0	243	0.810	100	43.0	LOS D	8.8	63.1	Short (P)	48	0.0	NA
Lane 2	293	3.0	293	3.0	362	0.810	100	37.6	LOS C	12.7	91.1	Full	50	0.0	60.4
Approach	490	3.0	490	3.0		0.810		39.8	LOS C	12.7	91.1				
East: Erskine Street (E)															
Lane 1	375	3.0	375	3.0	450	0.833	100	41.1	LOS C	16.3	117.4	Full	77	0.0	43.6
Lane 2	115	3.0	115	3.0	281	0.409	100	32.6	LOS C	4.2	29.9	Full	77	0.0	0.0
Approach	490	3.0	490	3.0		0.833		39.1	LOS C	16.3	117.4				
North: Sussex Street (N)															
Lane 1	57	3.0	57	3.0	368	0.155	100	31.8	LOS C	1.9	13.3	Short (P)	45	0.0	NA
Lane 2	220	3.0	220	3.0	883	0.249	100	15.9	LOS B	6.5	46.4	Full	280	0.0	0.0
Lane 3	220	3.0	220	3.0	883	0.249	100	6.1	LOS A	2.6	18.9	Full	280	0.0	0.0
Lane 4	77	3.0	77	3.0	328	0.235	100	23.7	LOS B	2.0	14.6	Short	40	0.0	NA
Approach	573	3.0	573	3.0		0.249		14.8	LOS B	6.5	46.4				
West: Erskine Street (W)															
Lane 1	386	3.0	386	3.0	444	0.869	100	43.2	LOS D	17.8	128.1	Full	64	0.0	69.4
Lane 2	188	3.0	188	3.0	217	0.869	100	51.4	LOS D	9.0	64.6	Full	64	0.0	5.8
Approach	574	3.0	574	3.0		0.869		45.9	LOS D	17.8	128.1				
Intersection	2127	3.0	2127	3.0		0.869		34.5	LOS C	17.8	128.1				

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).

Lane LOS values are based on average delay per lane.

Intersection and Approach LOS values are based on average delay for all lanes.

Delay Model: SIDRA Standard (Geometric Delay is included).

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Approach Lane Flows (veh/h)										
South: Sussex Street (S)										
Mov. From S To Exit:	L2	T1	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL %	Ov. Ov. %	Ov. Lane No.
	W	N								
Lane 1	54	143	197	3.0	243	0.810	100	29.9	2	
Lane 2	-	293	293	3.0	362	0.810	100	NA	NA	
Approach	54	436	490	3.0		0.810				
East: Erskine Street (E)										
Mov. From E To Exit:	L2	T1	R2	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL %	Ov. Lane No.
	S	W	N							

Lane 1	375	-	-	375	3.0	450	0.833	100	NA	NA
Lane 2	-	82	33	115	3.0	281	0.409	100	NA	NA
Approach	375	82	33	490	3.0		0.833			
North: Sussex Street (N)										
Mov. From N To Exit:	L2	T1	R2	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
	E	S	W							
Lane 1	57	-	-	57	3.0	368	0.155	100	0.0	2
Lane 2	-	220	-	220	3.0	883	0.249	100	NA	NA
Lane 3	-	220	-	220	3.0	883	0.249	100	NA	NA
Lane 4	-	-	77	77	3.0	328	0.235	100	0.0	3
Approach	57	439	77	573	3.0		0.249			
West: Erskine Street (W)										
Mov. From W To Exit:	L2	T1	R2	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
	N	E	S							
Lane 1	201	185	-	386	3.0	444	0.869	100	NA	NA
Lane 2	-	6	182	188	3.0	217	0.869	100	NA	NA
Approach	201	191	182	574	3.0		0.869			
Total %HV Deg. Satn (v/c)										
Intersection	2127	3.0		0.869						

Lane flow rates given in this report are based on the arrival flow rates subject to upstream capacity constraint where applicable.

Merge Analysis												
	Exit Lane Number	Short Lane Length m	Percent Opng in Lane %	Opposing Flow Rate % veh/h	Critical Gap sec	Follow-up Headway sec	Lane Flow Rate veh/h	Capacity veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec	
South Exit: Sussex Street (S) Merge Type: <b>Not Applied</b>												
Full Length Lane	1											
Full Length Lane	2											
East Exit: Erskine Street (E) Merge Type: <b>Not Applied</b>												
Full Length Lane	1											
Full Length Lane	2											
North Exit: Sussex Street (N) Merge Type: <b>Not Applied</b>												
Full Length Lane	1											
Full Length Lane	2											
West Exit: Erskine Street (W) Merge Type: <b>Not Applied</b>												
Full Length Lane	1											

# LANE SUMMARY

Site: 2 [2\_Hickson\_Sussex\_Napoleon\_Future\_AM (Site Folder: General)] Network: N101 [AM Future (Network Folder: General)]

Hickson Road / Sussex Street / Napoleon Street

Site Category: (None)

Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 82 seconds (Network Optimum Cycle Time - Minimum Delay)

Lane Use and Performance															
	DEMAND FLOWS		ARRIVAL FLOWS		Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE		Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
	[ Total veh/h ]	[ HV % ]	[ Total veh/h ]	[ HV % ]						[ Veh ]	[ Dist m ]				
South: Sussex Street (S)															
Lane 1	399	3.0	399	3.0	450	0.887	100	41.9	LOS C	20.4	146.3	Full	280	0.0	0.0
Lane 2	146	3.0	146	3.0	313	0.467	100	37.6	LOS C	5.7	41.2	Full	280	0.0	0.0
Approach	545	3.0	545	3.0		0.887		40.8	LOS C	20.4	146.3				
SouthEast: Napoleon Street (E)															
Lane 1	196	3.0	196	3.0	646	0.303	100	26.9	LOS B	6.7	48.0	Full	130	0.0	0.0
Lane 2	298	3.0	298	3.0	261	1.141	100	181.8	LOS F	29.5 <sup>N4</sup>	212.2 <sup>N4</sup>	Full	130	-43.7 <sup>N3</sup>	50.0
Approach	494	3.0	494	3.0		1.141		120.4	LOS F	29.5	212.2				
North: Hickson Road (N)															
Lane 1	310	3.0	310	3.0	561	0.552	100	15.8	LOS B	6.3	45.0	Full	60	0.0	0.0
Lane 2	261	3.0	261	3.0	474	0.552	100	28.4	LOS B	9.5	68.3	Full	60	0.0	16.8
Approach	571	3.0	571	3.0		0.552		21.6	LOS B	9.5	68.3				
West: Basement Car Park (W)															
Lane 1	2	3.0	2	3.0	120	0.013	24 <sup>6</sup>	42.4	LOS C	0.1	0.4	Full	500	0.0	0.0
Lane 2	6	3.0	6	3.0	120	0.054	100	43.1	LOS D	0.3	1.8	Full	500	0.0	0.0
Approach	8	3.0	8	3.0		0.054		42.9	LOS D	0.3	1.8				
Intersection	1618	3.0	1618	3.0		1.141		58.3	LOS E	29.5	212.2				

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).

Lane LOS values are based on average delay per lane.

Intersection and Approach LOS values are based on average delay for all lanes.

Delay Model: SIDRA Standard (Geometric Delay is included).

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

<sup>6</sup> Lane under-utilisation due to downstream effects

<sup>N3</sup> Capacity Adjustment due to downstream lane blockage determined by the program.

<sup>N4</sup> Average back of queue has been restricted to the available queue storage space.

Approach Lane Flows (veh/h)										
South: Sussex Street (S)										
Mov. From S To Exit:	T1	R3	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL %	Ov. Ov. %	Ov. Lane No.
Lane 1	399	-	399	3.0	450	0.887	100	NA	NA	NA
Lane 2	-	146	146	3.0	313	0.467	100	NA	NA	NA
Approach	399	146	545	3.0		0.887				
SouthEast: Napoleon Street (E)										
Mov. From SE To Exit:	L3	R1	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL %	Ov. Ov. %	Ov. Lane No.
Lane 1	196	-	196	3.0	646	0.303	100	NA	NA	NA

Lane 2	-	298	298	3.0		261	1.141	100	NA	NA	
Approach	196	298	494	3.0			1.141				
North: Hickson Road (N)											
Mov. From N To Exit:	L1	T1	Total	%HV		Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.	
	SE	S									
Lane 1	212	98	310	3.0		561	0.552	100	NA	NA	
Lane 2	-	261	261	3.0		474	0.552	100	NA	NA	
Approach	212	359	571	3.0			0.552				
West: Basement Car Park (W)											
Mov. From W To Exit:	L2	R1	R2	Total	%HV		Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
	N	SE	S								
Lane 1	1	1	-	2	3.0	120	0.013	24 <sup>6</sup>	NA	NA	
Lane 2	-	2	4	6	3.0	120	0.054	100	NA	NA	
Approach	1	3	4	8	3.0		0.054				
Total %HV Deg.Satn (v/c)											
Intersection	1618	3.0		1.141							

Lane flow rates given in this report are based on the arrival flow rates subject to upstream capacity constraint where applicable.

6 Lane under-utilisation due to downstream effects

Merge Analysis												
	Exit Lane Number	Short Lane Length m	Percent Opng in Lane %	Opposing Flow Rate veh/h	pcu/h	Critical Gap sec	Follow-up Headway sec	Lane Flow Rate veh/h	Capacity veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec
South Exit: Sussex Street (S) Merge Type: <b>Not Applied</b>												
Full Length Lane	1											
Full Length Lane	2											
SouthEast Exit: Napoleon Street (E) Merge Type: <b>Priority</b>												
Exit Short Lane	1	20	0.0	148	151	3.00	2.00	213	1648	0.129	0.2	0.3
Merge Lane	2	-	100.0	Merge Lane is not Opposed				148	1800	0.082	0.0	0.0
North Exit: Hickson Road (N) Merge Type: <b>Not Applied</b>												
Full Length Lane	1											
Full Length Lane	2											

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Project: \\global.arup.com\australasia\SYD\Projects\274000\274378-00 CENTRAL BARANGAROO TRAFFIC\Work\Internal\Traffic Analysis

\SIDRA\230731 Barangaroo Sidra Model MOD09 - updated layout - Base plus development.sip9



## LANE SUMMARY

Site: 3 [3\_Watermans Quay\_Hickson Road\_Future\_AM (Site Folder: General)]

Network: N101 [AM Future (Network Folder: General)]

2\_ Watermans Quay\_Hickson Road

Site Category: (None)

Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 82 seconds (Network Optimum Cycle Time - Minimum Delay)

Lane Use and Performance															
	DEMAND FLOWS		ARRIVAL FLOWS		Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE		Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
	[ Total veh/h ]	[ HV % ]	[ Total veh/h ]	[ HV % ]						[ Veh ]	[ Dist ] m				
South: Hickson Road S															
Lane 1	283	3.0	268	3.0	737	0.364	100	6.3	LOS A	1.5	11.1	Full	60	0.0	0.0
Lane 2	406	3.0	385	3.0	775	0.496	100	20.8	LOS B	12.7	91.5	Full	60	0.0	43.7
Approach	689	3.0	653 <sup>N1</sup>	3.0		0.496		14.8	LOS B	12.7	91.5				
North: Hickson Road N															
Lane 1	192	3.0	192	3.0	1055	0.182	100	7.9	LOS A	3.4	24.7	Short	70	0.0	NA
Lane 2	117	3.0	117	3.0	641	0.182	100	12.5	LOS A	2.6	18.4	Full	500	-14.1 <sup>N3</sup>	0.0
Approach	309	3.0	309	3.0		0.182		9.7	LOS A	3.4	24.7				
West: Watermans Quay															
Lane 1	228	3.0	228	3.0	464	0.492	100	30.6	LOS C	7.8	55.9	Short	80	0.0	NA
Lane 2	176	3.0	176	3.0	358	0.492	100	32.4	LOS C	6.2	44.5	Full	118	-16.8 <sup>N3</sup>	0.0
Approach	404	3.0	404	3.0		0.492		31.4	LOS C	7.8	55.9				
Intersection	1402	3.0	1366 <sup>N1</sup>	3.1		0.496		18.5	LOS B	12.7	91.5				

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).

Lane LOS values are based on average delay per lane.

Intersection and Approach LOS values are based on average delay for all lanes.

Delay Model: SIDRA Standard (Geometric Delay is included).

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

<sup>N1</sup> Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

<sup>N3</sup> Capacity Adjustment due to downstream lane blockage determined by the program.

Approach Lane Flows (veh/h)										
South: Hickson Road S										
Mov. From S To Exit:	L2	T1	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL %	Ov. Lane No.	
Lane 1	268	-	268	3.0	737	0.364	100	NA	NA	
Lane 2	-	385	385	3.0	775	0.496	100	NA	NA	
Approach	268	385	653	3.0		0.496				
North: Hickson Road N										
Mov. From N To Exit:	T1	R2	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL %	Ov. Lane No.	
Lane 1	192	-	192	3.0	1055	0.182	100	0.0	2	
Lane 2	95	22	117	3.0	641	0.182	100	NA	NA	
Approach	287	22	309	3.0		0.182				
West: Watermans Quay										
Mov. From W	L2	R2	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL %	Ov. Lane No.	

To Exit:	N	S			veh/h	v/c	%	%	No.
Lane 1	100	128	228	3.0	464	0.492	100	0.0	2
Lane 2	-	176	176	3.0	358	0.492	100	NA	NA
Approach	100	304	404	3.0		0.492			
Total %HV Deg.Satn (v/c)									
Intersection	1366	3.1		0.496					

Lane flow rates given in this report are based on the arrival flow rates subject to upstream capacity constraint where applicable.

Merge Analysis												
	Exit Lane Number	Short Lane Length m	Percent Opng in Lane %	Opposing Flow Rate % veh/h	Critical Gap pcu/h	Follow-up Headway sec	Lane Capacity Flow Rate veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec		
South Exit: Hickson Road S												
Merge Type: <b>Not Applied</b>												
Full Length Lane	1										Merge Analysis not applied.	
Full Length Lane	2										Merge Analysis not applied.	
North Exit: Hickson Road N												
Merge Type: <b>Not Applied</b>												
Full Length Lane	1										Merge Analysis not applied.	
West Exit: Watermans Quay												
Merge Type: <b>Not Applied</b>												
Full Length Lane	1										Merge Analysis not applied.	

# LANE SUMMARY

Site: 4 [4\_Napoleon\_Kent\_Margaret\_Future\_AM (Site Folder: General)]

Network: N101 [AM Future (Network Folder: General)]

New Site

Site Category: Napoleon\_Kent\_Margaret\_Future\_AM

Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 82 seconds (Network Optimum Cycle Time - Minimum Delay)

Lane Use and Performance															
	DEMAND FLOWS		ARRIVAL FLOWS		Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE		Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
	[ Total veh/h	HV %	[ Total veh/h	HV %						[ Veh	Dist ] m				
South: Kent Street (S)															
Lane 1	408	3.0	408	3.0	846	0.482	100	15.6	LOS B	10.9	78.6	Full	150	0.0	0.0
Lane 2	97	3.0	97	3.0	202	0.482	100	32.7	LOS C	3.6	26.0	Full	150	0.0	0.0
Lane 3	4	0.0	4	0.0	476	0.009	100	37.3	LOS C	0.2	0.4	Full	150	0.0	0.0
Approach	509	3.0	509	3.0		0.482		19.1	LOS B	10.9	78.6				
East: Margaret Street															
Lane 1	293	3.0	293	3.0	330	0.887	100	48.9	LOS D	14.0	100.6	Full	42	0.0	87.0
Lane 2	320	3.0	320	3.0	361	0.887	100	48.1	LOS D	16.0	115.1	Full	42	-30.3 <sup>N7</sup>	100.0
Approach	613	3.0	613	3.0		0.887		48.5	LOS D	16.0	115.1				
North: Kent Street (N)															
Lane 1	2	0.0	2	0.0	476	0.003	0 <sup>5</sup>	37.1	LOS C	0.1	0.2	Full	500	0.0	0.0
Lane 2	184	2.5	184	2.5	230	0.802	100	40.4	LOS C	8.3	59.1	Full	500	0.0	0.0
Lane 3	95	3.0	95	3.0	122	0.779	100	47.8	LOS D	4.5	32.1	Short	66	-50.0 <sup>N7</sup>	NA
Approach	281	2.6	281	2.6		0.802		42.9	LOS D	8.3	59.1				
NorthWest: Napoleon Street															
Lane 1	252	3.0	252	3.0	479	0.527	100	6.5	LOS A	1.6	11.7	Short	40	0.0	NA
Lane 2	119	3.0	119	3.0	509	0.234	100	31.7	LOS C	4.4	31.6	Full	130	0.0	0.0
Approach	371	3.0	371	3.0		0.527		14.6	LOS B	4.4	31.6				
Intersection	1774	2.9	1774	2.9		0.887		32.1	LOS C	16.0	115.1				

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).

Lane LOS values are based on average delay per lane.

Intersection and Approach LOS values are based on average delay for all lanes.

Delay Model: SIDRA Standard (Geometric Delay is included).

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

<sup>5</sup> Lane under-utilisation found by the program

<sup>N7</sup> The capacity reduction has been determined from the queue blockage probability of a Site further downstream due to intermediate continuous lanes.

Approach Lane Flows (veh/h)											
South: Kent Street (S)											
Mov. From S To Exit:	L1	T1	R2	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL %	Ov. Lane No.	
Lane 1	73	335	-	408	3.0	846	0.482	100	NA	NA	
Lane 2	-	81	16	97	3.0	202	0.482	100	NA	NA	
Lane 3	-	4	-	4	0.0	476	0.009	100	NA	NA	
Approach	73	420	16	509	3.0		0.482				
East: Margaret Street											
Mov.	L2	R1	R2	Total	%HV	Deg.	Lane	Prob.	Ov.		

From E To Exit:	S	NW	N			Cap. veh/h	Satn v/c	Util. %	SL %	Ov. %	Lane No.
Lane 1	121	172	-	293	3.0	330	0.887	100	NA	NA	
Lane 2	-	139	181	320	3.0	361	0.887	100	NA	NA	
Approach	121	311	181	613	3.0		0.887				
North: Kent Street (N)											
Mov. From N To Exit:	L2	T1	R3	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL %	Ov. %	Ov. Lane No.
Lane 1	-	2	-	2	0.0	476	0.003	0 <sup>5</sup>	NA	NA	
Lane 2	35	149	-	184	2.5	230	0.802	100	NA	NA	
Lane 3	-	-	95	95	3.0	122	0.779	100	0.0	2	
Approach	35	151	95	281	2.6		0.802				
NorthWest: Napoleon Street											
Mov. From NW To Exit:	L3	L1	Total	%HV		Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL %	Ov. %	Ov. Lane No.
Lane 1	252	-	252	3.0		479	0.527	100	0.0	2	
Lane 2	-	119	119	3.0		509	0.234	100	NA	NA	
Approach	252	119	371	3.0			0.527				
Total %HV Deg. Satn (v/c)											
Intersection	1774	2.9		0.887							

Lane flow rates given in this report are based on the arrival flow rates subject to upstream capacity constraint where applicable.

5 Lane under-utilisation found by the program

Merge Analysis											
	Exit Lane Number	Short Lane Length m	Percent Opng in Lane % veh/h	Opposing Flow Rate pcu/h	Critical Gap sec	Follow-up Headway sec	Lane Capacity Flow Rate veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec	
South Exit: Kent Street (S) Merge Type: <b>Not Applied</b>											
Full Length Lane	1										Merge Analysis not applied.
Full Length Lane	2										Merge Analysis not applied.
East Exit: Margaret Street Merge Type: <b>Not Applied</b>											
Full Length Lane	1										Merge Analysis not applied.
North Exit: Kent Street (N) Merge Type: <b>Not Applied</b>											
Full Length Lane	1										Merge Analysis not applied.
Full Length Lane	2										Merge Analysis not applied.
Full Length Lane	3										Merge Analysis not applied.
NorthWest Exit: Napoleon Street Merge Type: <b>Not Applied</b>											
Full Length Lane	1										Merge Analysis not applied.
Full Length Lane	2										Merge Analysis not applied.

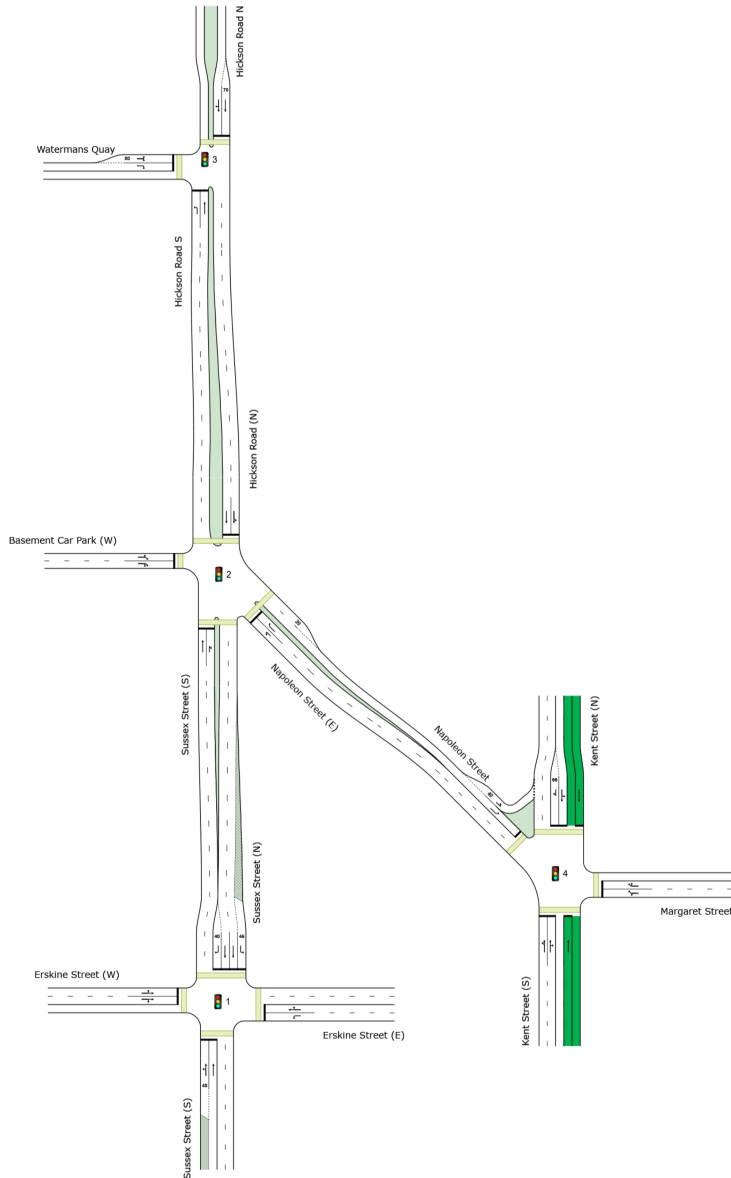
# NETWORK LAYOUT

Network: N101 [PM Future (Network Folder: General)]

New Network

Network Category: (None)

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



SITES IN NETWORK		
Site ID	CCG ID	Site Name
1	NA	1_Erskine Street /Sussex Street _ Future_PM
2	NA	2_Hickson_Sussex_Napoleon_Future_PM
3	NA	3_Watermans Quay_Hickson Road_Future_PM
4	NA	4_Napoleon_Kent_Margaret_Future_PM



# LANE SUMMARY

Site: 1 [1\_Erskine Street /Sussex Street \_ Future\_PM (Site Folder: General)]

Network: N101 [PM Future (Network Folder: General)]

Erskin Street /Sussex Street

Site Category: (None)

Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 89 seconds (Network Optimum Cycle Time - Minimum Delay)

Lane Use and Performance															
	DEMAND FLOWS		ARRIVAL FLOWS		Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE		Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
	[ Total veh/h	HV %	[ Total veh/h	HV %						[ Veh	Dist ] m				
South: Sussex Street (S)															
Lane 1	58	3.0	58	3.0	92	0.625	100	50.9	LOS D	2.7	19.6	Short (P)	48	0.0	NA
Lane 2	260	3.0	260	3.0	417	0.625	100	33.6	LOS C	10.4	74.5	Full	50	0.0	41.5
Approach	318	3.0	318	3.0		0.625		36.7	LOS C	10.4	74.5				
East: Erskine Street (E)															
Lane 1	386	3.0	386	3.0	407	0.948	100	66.2	LOS E	23.8	170.9	Full	77	0.0	79.4
Lane 2	100	3.0	100	3.0	470	0.213	100	23.3	LOS B	3.1	22.2	Full	77	0.0	0.0
Approach	486	3.0	486	3.0		0.948		57.4	LOS E	23.8	170.9				
North: Sussex Street (N)															
Lane 1	69	3.0	69	3.0	75	0.915	100	61.2	LOS E	3.6	25.9	Short (P)	45	0.0	NA
Lane 2	253	3.0	253	3.0	335	0.755	100	41.1	LOS C	11.7	84.3	Full	280	0.0	0.0
Lane 3	247	3.0	247	3.0	327	0.755	100	31.1	LOS C	10.2	73.2	Full	280	0.0	0.0
Lane 4	55	3.0	55	3.0	170	0.324	100	29.3	LOS C	1.7	12.0	Short	40	0.0	NA
Approach	624	3.0	624	3.0		0.915		38.3	LOS C	11.7	84.3				
West: Erskine Street (W)															
Lane 1	297	3.0	297	3.0	457	0.650	100	26.5	LOS B	10.9	78.1	Full	64	0.0	23.1
Lane 2	195	3.0	195	3.0	300	0.650	100	41.8	LOS C	8.3	59.3	Full	64	0.0	0.0
Approach	492	3.0	492	3.0		0.650		32.6	LOS C	10.9	78.1				
Intersection	1920	3.0	1920	3.0		0.948		41.4	LOS C	23.8	170.9				

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).

Lane LOS values are based on average delay per lane.

Intersection and Approach LOS values are based on average delay for all lanes.

Delay Model: SIDRA Standard (Geometric Delay is included).

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Approach Lane Flows (veh/h)										
South: Sussex Street (S)										
Mov. From S To Exit:	L2	T1	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL %	Ov. Lane No.	
Lane 1	33	25	58	3.0	92	0.625	100	0.0	2	
Lane 2	-	260	260	3.0	417	0.625	100	NA	NA	
Approach	33	285	318	3.0		0.625				
East: Erskine Street (E)										
Mov. From E To Exit:	L2	T1	R2	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL %	Ov. Lane No.
Lane 1	S	W	N							

Lane 1	386	-	-	386	3.0	407	0.948	100	NA	NA
Lane 2	-	67	33	100	3.0	470	0.213	100	NA	NA
Approach	386	67	33	486	3.0		0.948			
North: Sussex Street (N)										
Mov.	L2	T1	R2	Total	%HV	Cap.	Deg.	Lane	Prob.	Ov.
From N										
To Exit:	E	S	W			veh/h	v/c	Util. %	SL %	Lane No.
Lane 1	69	-	-	69	3.0	75	0.915	100	0.0	2
Lane 2	-	253	-	253	3.0	335	0.755	100	NA	NA
Lane 3	-	247	-	247	3.0	327	0.755	100	NA	NA
Lane 4	-	-	55	55	3.0	170	0.324	100	0.0	3
Approach	69	500	55	624	3.0		0.915			
West: Erskine Street (W)										
Mov.	L2	T1	R2	Total	%HV	Cap.	Deg.	Lane	Prob.	Ov.
From W										
To Exit:	N	E	S			veh/h	v/c	Util. %	SL %	Lane No.
Lane 1	136	161	-	297	3.0	457	0.650	100	NA	NA
Lane 2	-	9	186	195	3.0	300	0.650	100	NA	NA
Approach	136	170	186	492	3.0		0.650			
Total %HV Deg. Satn (v/c)										
Intersection	1920	3.0		0.948						

Lane flow rates given in this report are based on the arrival flow rates subject to upstream capacity constraint where applicable.

Merge Analysis												
	Exit Lane Number	Short Lane Length m	Percent Opng in Lane %	Opposing Flow Rate % veh/h	Critical Gap sec	Follow-up Headway sec	Lane Flow Rate veh/h	Capacity veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec	
South Exit: Sussex Street (S)												
Merge Type: <b>Not Applied</b>												
Full Length Lane	1											
Full Length Lane	2											
East Exit: Erskine Street (E)												
Merge Type: <b>Not Applied</b>												
Full Length Lane	1											
Full Length Lane	2											
North Exit: Sussex Street (N)												
Merge Type: <b>Not Applied</b>												
Full Length Lane	1											
Full Length Lane	2											
West Exit: Erskine Street (W)												
Merge Type: <b>Not Applied</b>												
Full Length Lane	1											



# LANE SUMMARY

Site: 2 [2\_Hickson\_Sussex\_Napoleon\_Future\_PM (Site Folder: **Network: N101 [PM Future (Network Folder: General)]**)]

Hickson Road / Sussex Street / Napoleon Street

Site Category: (None)

Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 89 seconds (Network Optimum Cycle Time - Minimum Delay)

Lane Use and Performance															
	DEMAND FLOWS		ARRIVAL FLOWS		Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE		Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
	[ Total veh/h ]	[ HV % ]	[ Total veh/h ]	[ HV % ]						[ Veh ]	[ Dist m ]				
South: Sussex Street (S)															
Lane 1	323	3.0	323	3.0	632	0.511	100	26.9	LOS B	12.3	88.2	Full	280	0.0	0.0
Lane 2	114	3.0	114	3.0	97	1.171	100	207.2	LOS F	12.5	89.9	Full	280	0.0	0.0
Approach	437	3.0	437	3.0		1.171		73.9	LOS F	12.5	89.9				
SouthEast: Napoleon Street (E)															
Lane 1	151	3.0	151	3.0	397	0.381	100	32.8	LOS C	5.4	38.8	Full	130	0.0	0.0
Lane 2	325	3.0	325	3.0	291	1.115	100	170.4	LOS F	29.5 <sup>N4</sup>	212.2 <sup>N4</sup>	Full	130	-37.5 <sup>N3</sup>	50.0
Approach	476	3.0	476	3.0		1.115		126.7	LOS F	29.5	212.2				
North: Hickson Road (N)															
Lane 1	301	3.0	301	3.0	454	0.662	100	29.5	LOS C	11.4	81.6	Full	60	0.0	33.0
Lane 2	336	3.0	336	3.0	508	0.662	100	26.3	LOS B	12.3	88.6	Full	60	0.0	40.7
Approach	637	3.0	637	3.0		0.662		27.8	LOS B	12.3	88.6				
West: Basement Car Park (W)															
Lane 1	4	3.0	4	3.0	94	0.041	24 <sup>6</sup>	48.8	LOS D	0.2	1.2	Full	500	0.0	0.0
Lane 2	49	3.0	49	3.0	279	0.176	100	37.5	LOS C	1.9	13.5	Full	500	0.0	0.0
Approach	53	3.0	53	3.0		0.176		38.3	LOS C	1.9	13.5				
Intersection	1603	3.0	1603	3.0		1.171		70.1	LOS E	29.5	212.2				

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).

Lane LOS values are based on average delay per lane.

Intersection and Approach LOS values are based on average delay for all lanes.

Delay Model: SIDRA Standard (Geometric Delay is included).

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

<sup>6</sup> Lane under-utilisation due to downstream effects

<sup>N3</sup> Capacity Adjustment due to downstream lane blockage determined by the program.

<sup>N4</sup> Average back of queue has been restricted to the available queue storage space.

Approach Lane Flows (veh/h)										
South: Sussex Street (S)										
Mov. From S To Exit:	T1	R3	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL %	Ov. Ov. %	Ov. Lane No.
Lane 1	323	-	323	3.0	632	0.511	100	NA	NA	
Lane 2	-	114	114	3.0	97	1.171	100	NA	NA	
Approach	323	114	437	3.0		1.171				
SouthEast: Napoleon Street (E)										
Mov. From SE To Exit:	L3	R1	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL %	Ov. Ov. %	Ov. Lane No.
Lane 1	151	-	151	3.0	397	0.381	100	NA	NA	

Lane 2	-	325	325	3.0		291	1.115	100	NA	NA	
Approach	151	325	476	3.0			1.115				
North: Hickson Road (N)											
Mov. From N To Exit:	L1	T1	Total	%HV		Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.	
	SE	S									
Lane 1	232	69	301	3.0		454	0.662	100	NA	NA	
Lane 2	-	336	336	3.0		508	0.662	100	NA	NA	
Approach	232	405	637	3.0			0.662				
West: Basement Car Park (W)											
Mov. From W To Exit:	L2	R1	R2	Total	%HV		Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
	N	SE	S								
Lane 1	2	2	-	4	3.0	94	0.041	24 <sup>6</sup>	NA	NA	
Lane 2	-	30	19	49	3.0	279	0.176	100	NA	NA	
Approach	2	32	19	53	3.0		0.176				
Total %HV Deg.Satn (v/c)											
Intersection	1603	3.0		1.171							

Lane flow rates given in this report are based on the arrival flow rates subject to upstream capacity constraint where applicable.

6 Lane under-utilisation due to downstream effects

Merge Analysis												
	Exit Lane Number	Short Lane Length m	Percent Opng in Lane %	Opposing Flow Rate veh/h	Critical Gap sec	Follow-up Headway sec	Lane Flow Rate veh/h	Capacity veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec	
South Exit: Sussex Street (S) Merge Type: <b>Not Applied</b>												
Full Length Lane	1											
Full Length Lane	2											
SouthEast Exit: Napoleon Street (E) Merge Type: <b>Priority</b>												
Exit Short Lane	1	20	0.0	127	129	3.00	2.00	234	1670	0.140	0.2	0.2
Merge Lane	2	-	100.0	Merge Lane is not Opposed			127	1800	0.071	0.0	0.0	
North Exit: Hickson Road (N) Merge Type: <b>Not Applied</b>												
Full Length Lane	1											
Full Length Lane	2											

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Project: \\global.arup.com\australasia\SYD\Projects\274000\274378-00 CENTRAL BARANGAROO TRAFFIC\Work\Internal\Traffic Analysis

\SIDRA\230731 Barangaroo Sidra Model MOD09 - updated layout - Base plus development.sip9

# LANE SUMMARY

Site: 3 [3\_ Watermans Quay\_Hickson Road\_Future\_PM (Site Folder: General)]

Network: N101 [PM Future (Network Folder: General)]

2\_ Watermans Quay\_Hickson Road

Site Category: (None)

Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 89 seconds (Network Optimum Cycle Time - Minimum Delay)

Lane Use and Performance															
	DEMAND FLOWS		ARRIVAL FLOWS		Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE		Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
	[ Total veh/h	HV %	[ Total veh/h	HV %						[ Veh	Dist ] m				
South: Hickson Road S															
Lane 1	355	3.0	337	3.0	641	0.525	100	5.1	LOS A	1.3	9.6	Full	60	0.0	0.0
Lane 2	292	3.0	277	3.0	674	0.411	100	34.6	LOS C	11.9	85.7	Full	60	0.0	37.6
Approach	647	3.0	614 <sup>N1</sup>	3.0		0.525		18.4	LOS B	11.9	85.7				
North: Hickson Road N															
Lane 1	258	3.0	258	3.0	890	0.290	100	3.7	LOS A	3.5	25.3	Short	70	-33.0 <sup>N3</sup>	NA
Lane 2	203	3.0	203	3.0	702	0.290	100	6.3	LOS A	3.5	25.3	Full	500	-37.2 <sup>N3</sup>	0.0
Approach	461	3.0	461	3.0		0.290		4.9	LOS A	3.5	25.3				
West: Watermans Quay															
Lane 1	138	3.0	138	3.0	157	0.877	100	58.2	LOS E	7.3	52.3	Short	80	-24.7 <sup>N3</sup>	NA
Lane 2	98	3.0	98	3.0	112	0.877	100	60.6	LOS E	5.3	37.8	Full	118	-40.7 <sup>N3</sup>	0.0
Approach	236	3.0	236	3.0		0.877		59.2	LOS E	7.3	52.3				
Intersection	1344	3.0	1311 <sup>N1</sup>	3.1		0.877		21.0	LOS B	11.9	85.7				

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).

Lane LOS values are based on average delay per lane.

Intersection and Approach LOS values are based on average delay for all lanes.

Delay Model: SIDRA Standard (Geometric Delay is included).

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

<sup>N1</sup> Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

<sup>N3</sup> Capacity Adjustment due to downstream lane blockage determined by the program.

Approach Lane Flows (veh/h)										
South: Hickson Road S										
Mov. From S To Exit:	L2	T1	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL %	Ov. Lane No.	
Lane 1	337	-	337	3.0	641	0.525	100	NA	NA	
Lane 2	-	277	277	3.0	674	0.411	100	NA	NA	
Approach	337	277	614	3.0		0.525				
North: Hickson Road N										
Mov. From N To Exit:	T1	R2	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL %	Ov. Lane No.	
Lane 1	258	-	258	3.0	890	0.290	100	0.0	2	
Lane 2	175	28	203	3.0	702	0.290	100	NA	NA	
Approach	433	28	461	3.0		0.290				
West: Watermans Quay										
Mov. From W	L2	R2	Total	%HV	Cap.	Deg. Satn	Lane Util.	Prob. SL	Ov. Lane	

To Exit:	N	S			veh/h	v/c	%	%	No.
Lane 1	46	92	138	3.0	157	0.877	100	0.0	2
Lane 2	-	98	98	3.0	112	0.877	100	NA	NA
Approach	46	190	236	3.0		0.877			
Total %HV Deg.Satn (v/c)									
Intersection	1311	3.1		0.877					

Lane flow rates given in this report are based on the arrival flow rates subject to upstream capacity constraint where applicable.

Merge Analysis												
	Exit Lane Number	Short Lane Length m	Percent Opng in Lane %	Opposing Flow Rate % veh/h	pcu/h	Critical Gap sec	Follow-up Headway sec	Lane Flow Rate veh/h	Capacity veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec
South Exit: Hickson Road S												
Merge Type: <b>Not Applied</b>												
Full Length Lane	1											Merge Analysis not applied.
Full Length Lane	2											Merge Analysis not applied.
North Exit: Hickson Road N												
Merge Type: <b>Not Applied</b>												
Full Length Lane	1											Merge Analysis not applied.
West Exit: Watermans Quay												
Merge Type: <b>Not Applied</b>												
Full Length Lane	1											Merge Analysis not applied.

# LANE SUMMARY

Site: 4 [4\_Napoleon\_Kent\_Margaret\_Future\_PM (Site Folder: General)]

Network: N101 [PM Future (Network Folder: General)]

New Site

Site Category: Napoleon\_Kent\_Margaret\_Future\_AM

Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 89 seconds (Network Optimum Cycle Time - Minimum Delay)

Lane Use and Performance															
	DEMAND FLOWS		ARRIVAL FLOWS		Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE		Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
	[ Total veh/h ]	[ HV % ]	[ Total veh/h ]	[ HV % ]						[ Veh ]	[ Dist m ]				
South: Kent Street (S)															
Lane 1	414	3.0	414	3.0	760	0.545	100	14.8	LOS B	11.8	84.6	Full	150	0.0	0.0
Lane 2	151	3.0	151	3.0	277	0.545	100	29.0	LOS C	5.7	40.7	Full	150	0.0	0.0
Lane 3	2	0.0	2	0.0	270	0.009	100	41.6	LOS C	0.1	0.3	Full	150	0.0	0.0
Approach	567	3.0	567	3.0		0.545		18.7	LOS B	11.8	84.6				
East: Margaret Street															
Lane 1	257	3.0	257	3.0	308	0.833	100	47.2	LOS D	12.3	88.4	Full	42	0.0	74.3
Lane 2	245	3.0	245	3.0	294	0.833	100	43.6	LOS D	12.2	87.9	Full	42	-47.6 <sup>N3</sup>	73.7
Approach	502	3.0	502	3.0		0.833		45.4	LOS D	12.3	88.4				
North: Kent Street (N)															
Lane 1	1	0.0	1	0.0	438	0.002	100	40.7	LOS C	0.0	0.1	Full	500	0.0	0.0
Lane 2	278	2.4	278	2.4	311	0.892	100	52.0	LOS D	15.7	112.0	Full	500	0.0	0.0
Lane 3	39	3.0	39	3.0	134	0.292	100	34.3	LOS C	1.5	10.5	Short	66	-50.0 <sup>N3</sup>	NA
Approach	318	2.4	318	2.4		0.892		49.8	LOS D	15.7	112.0				
NorthWest: Napoleon Street															
Lane 1	323	3.0	311	3.0	813	0.383	100	19.1	LOS B	10.1	72.6	Short	40	0.0	NA
Lane 2	121	3.0	116	3.0	278	0.419	100	35.6	LOS C	4.8	34.7	Full	130	0.0	0.0
Approach	444	3.0	427 <sup>N1</sup>	3.0		0.419		23.6	LOS B	10.1	72.6				
Intersection	1831	2.9	1814 <sup>N1</sup>	2.9		0.892		32.7	LOS C	15.7	112.0				

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).

Lane LOS values are based on average delay per lane.

Intersection and Approach LOS values are based on average delay for all lanes.

Delay Model: SIDRA Standard (Geometric Delay is included).

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

<sup>N1</sup> Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

<sup>N3</sup> Capacity Adjustment due to downstream lane blockage determined by the program.

Approach Lane Flows (veh/h)											
South: Kent Street (S)											
Mov. From S To Exit:	L1	T1	R2	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.	
Lane 1	52	362	-	414	3.0	760	0.545	100	NA	NA	
Lane 2	-	127	24	151	3.0	277	0.545	100	NA	NA	
Lane 3	-	2	-	2	0.0	270	0.009	100	NA	NA	
Approach	52	491	24	567	3.0		0.545				
East: Margaret Street											
Mov. From E	L2	R1	R2	Total	%HV	Cap.	Deg. Satn	Lane Util.	Prob. SL Ov.	Ov. Lane	

To Exit:	S	NW	N			veh/h	v/c	%	%	No.
Lane 1	86	171	-	257	3.0	308	0.833	100	NA	NA
Lane 2	-	223	22	245	3.0	294	0.833	100	NA	NA
Approach	86	394	22	502	3.0		0.833			
North: Kent Street (N)										
Mov.	L2	T1	R3	Total	%HV					
From N						Cap.	Deg.	Lane	Prob.	Ov.
To Exit:	E	S	NW			veh/h	v/c	Util.	SL	Lane
								%	%	No.
Lane 1	-	1	-	1	0.0	438	0.002	100	NA	NA
Lane 2	61	217	-	278	2.4	311	0.892	100	NA	NA
Lane 3	-	-	39	39	3.0	134	0.292	100	0.0	2
Approach	61	218	39	318	2.4		0.892			
NorthWest: Napoleon Street										
Mov.	L3	L1	Total	%HV						
From NW						Cap.	Deg.	Lane	Prob.	Ov.
To Exit:	N	E				veh/h	v/c	Util.	SL	Lane
								%	%	No.
Lane 1	311	-	311	3.0		813	0.383	100	60.1	2
Lane 2	-	116	116	3.0		278	0.419	100	NA	NA
Approach	311	116	427	3.0			0.419			
Total %HV Deg.Satn (v/c)										
Intersection	1814	2.9		0.892						

Lane flow rates given in this report are based on the arrival flow rates subject to upstream capacity constraint where applicable.

Merge Analysis											
	Exit Lane Number	Short Lane Length m	Percent Opng in Lane %	Opposing Flow Rate % veh/h	pcu/h	Critical Gap sec	Follow-up Headway sec	Lane Capacity Flow Rate veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec
South Exit: Kent Street (S) Merge Type: <b>Not Applied</b>											
	Full Length Lane	1	Merge Analysis not applied.								
	Full Length Lane	2	Merge Analysis not applied.								
East Exit: Margaret Street Merge Type: <b>Not Applied</b>											
	Full Length Lane	1	Merge Analysis not applied.								
North Exit: Kent Street (N) Merge Type: <b>Not Applied</b>											
	Full Length Lane	1	Merge Analysis not applied.								
	Full Length Lane	2	Merge Analysis not applied.								
	Full Length Lane	3	Merge Analysis not applied.								
NorthWest Exit: Napoleon Street Merge Type: <b>Not Applied</b>											
	Full Length Lane	1	Merge Analysis not applied.								
	Full Length Lane	2	Merge Analysis not applied.								

## Appendix B

### MOD 8 Report and Appendices

Lend Lease Pty Ltd

**Barangaroo South Concept Plan  
(MP06\_0612 MOD8)**

**Transport Management and  
Accessibility Plan**

Issue

This report takes into account the particular instructions and requirements of our client.

It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Job number 222061-15

Arup  
Arup Pty Ltd ABN 18 000 966 165



**Arup**  
Level 10 201 Kent Street  
PO Box 76 Millers Point  
Sydney 2000  
Australia  
[www.arup.com](http://www.arup.com)

**ARUP**



## Executive Summary

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This report supports a modification to Concept Plan (MP06\_0162) submitted to the Minister for Planning and Infrastructure pursuant to Section 75W of Part 3A of the Environmental Planning and Assessment Act 1979 (EP&A Act), addressing the relevant Director General Requirements (DGRs)

This Transport Management and Accessibility Plan (TMAP) report addresses the changes that have come about as a result of the proposed floor space modifications as well as any changes to the future public transport plans announced by the NSW Government. Although there have been changes in the Gross Floor Area (GFA) and site layout, the transport principles and assumptions for the analysis has remained consistent with the original TMAP for the Barangaroo South site prepared by the NSW Government in September 2008 - including the rates for calculating population, parking and trip generation, as well as the journey to work mode share target of only 4% trips by car.

The Barangaroo site has been divided into three distinct redevelopment areas (from north to south) – the Headland Park, Barangaroo Central and Barangaroo South (also known as Barangaroo Stage 1). Although the Concept Plan Amendment only relates to Barangaroo South, this report considers the whole precinct to maintain consistency of the analysis when compared to previous traffic studies for the overall Barangaroo site.

Planning for Barangaroo included a process of developing a Concept Plan that provided for a public recreation area and a mixed use area. The proposed modification to the Concept Plan seeks to:

- Relocate the landmark building (Block Y) from the harbour onto the land in the Barangaroo South site in front of the existing Blocks 4A, B and C;
- Revise the layout of Blocks 4A-C;
- Amend the size and location of the Southern Cove and public domain;
- Redistribute the GFA, public domain and land uses across development blocks 1-3, 4A-C, X and Y;
- Increase the maximum GFA on the site to provide for additional GFA within the hotel building and redistribution of land uses;
- Increase the height of the buildings within modified 'Block 4' and the relocated Block Y; and
- Amend the conditions of the Concept Approval to reflect the modifications to development.

The latest modification of the Concept Plan (Mod 8) seeks approval for total floor area for the whole site of 605,911m<sup>2</sup> GFA across Barangaroo, comprised of:

- (a) a maximum of 183,028m<sup>2</sup> and a minimum of 84,595m<sup>2</sup> residential GFA;
- (b) a maximum of 76,000m<sup>2</sup> GFA for tourist uses (of which a maximum of 59,000m<sup>2</sup> may be located in Barangaroo South);
- (c) a maximum of 34,000m<sup>2</sup> GFA for retail uses (of which a maximum of 30,000m<sup>2</sup> may be located in Barangaroo South);

(d) a maximum of 5,000m<sup>2</sup> GFA for active in the Public Recreation zone (3,500m<sup>2</sup> of which will be in Barangaroo South); and

(e) a minimum of 12,000m<sup>2</sup> GFA for community uses that may be located within the Public Recreation or Mixed Use zones.

For the purposes of this assessment, particularly with respect to the traffic generation and traffic modelling undertaken, a mix land use types has been assumed for Barangaroo based the per land use category GFA limits nominated above, as proposed to be modified. These are as follows:

- 342,334m<sup>2</sup> commercial;
- 48,200m<sup>2</sup> hotel/tourist;
- 6,848m<sup>2</sup> public;
- 167,479m<sup>2</sup> residential;
- 26,500m<sup>2</sup> retail/other uses; and
- 14,500 m<sup>2</sup> active/community uses.

The TMAP report has considered the transport recommendations and findings of a number of key planning documents relevant to the Barangaroo Precinct, those being:

- Barangaroo Integrated Transport Plan;
- NSW Long Term Transport Masterplan;
- Sydney City Centre Access Strategy

Initial planning approval for Barangaroo South was based on the principle of achieving high usage of public transport, walking and cycling as a method of travel to work, with a target of 4% by car. The mode split targets have been largely retained in this TMAP report, with the exception of ferry trips. With the provision of a new ferry hub at Barangaroo South it is expected that a minimum of 4% of all journey to work trips to Barangaroo will be undertaken via ferry.

Traffic analysis has been undertaken using the same transport principles and assumptions that were used for TMAP September 2008 including the rates for calculating population, parking and trip generation. The analysis has considered the cumulative traffic impacts arising from the changes in GFA relating to both Barangaroo South (i.e. the proposed modification) and the Barangaroo Central precinct. A comparison of the traffic generation forecast under the Modified Concept Plan (Mod 2) and the proposed modification (Mod 8 + 9) is listed in Table 1 below.

Table 1 Traffic generation comparison

Time Period	Direction	TMAP 2008 (Mod 2 GFA)	TMAP Mod 4	TMAP Mod 8	TMAP Mod 8 + Mod 9
AM Peak Hour	In	348	347	336	349
	Out	260	268	317	369
	<b>Two-way</b>	<b>608</b>	<b>614</b>	<b>653</b>	<b>718</b>
PM Peak Hour	In	299	290	390	424
	Out	452	447	389	398
	<b>Two-way</b>	<b>751</b>	<b>736</b>	<b>779</b>	<b>821</b>

A corridor traffic model (using the LinSig 3.2 software package) was developed to assess the future road network performance arising from the Concept Plan modification. The modelling has considered the cumulative traffic impacts of the Barangaroo development, including traffic generated by Barangaroo Central and Headland Park. The modelling indicates little difference in the road network performance due to the minor traffic increase arising from the Concept Plan modification. Changes in vehicle delays are relatively minor in both the AM and PM commuter peak hours.

Car parking will be provided at the same parking ratios as used in TMAP September 2008, excluding for the hotel. Approximately 2,100 car parking bays are envisaged for the residential component of the development - based on an indicative dwelling mix. The quantum of traffic generated by the residential uses is based on the total number of dwellings provided and independent of the number of resident parking bays. The number of on-street parking spaces within Barangaroo has reduced from 275 envisaged in the TMAP September 2008 to 40.

The Barangaroo precinct will be served by a number of pedestrian and public transport enhancements planned to be delivered in the coming years, including:

- Wynyard Walk pedestrian bridge and tunnel;
- City Walk pedestrian bridge;
- Expansion of the Sydney CBD cycleway network;
- Upgrades to Wynyard Station;
- Introduction of new bus routes to Barangaroo and Walsh Bay via the city centre;
- Provision of new taxi ranks within the Barangaroo precinct;
- Construction of a new ferry hub at Barangaroo; and
- Construction of the CBD and South East Light Rail link;

These improvements will accommodate the future population of the Barangaroo precinct by providing a number of viable (non private vehicle) transport options – meeting the mode split target for journey to work trips by private vehicle of 4%. The works will be delivered primarily from government agencies with the exception of the commitments made by Lend Lease under their Project Development Agreement with the Barangaroo Delivery Authority.

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Hotel Traffic and Parking Generation Methodology

### Appendix B

LinSig Traffic Modelling Outputs

# 1 Introduction

---

## 1.1 Background

This report supports a modification to Concept Plan (MP06\_0162) submitted to the Minister for Planning pursuant to Section 75W of Part 3A of the Environmental Planning and Assessment Act 1979 (EP&A Act).

The proposed application is the outcome of negotiations between Lend Lease and the NSW Government, including the Barangaroo Delivery Authority, to relocate the approved landmark hotel building site from a pier over Sydney Harbour to a location on land elsewhere on the Barangaroo South site. It also incorporates a number of related changes to the urban design guidelines to maintain an appropriate built form and public domain outcome for the Barangaroo South site.

## 1.2 Overview of the Proposed Modification

The proposed modification to the Concept Plan seeks to:

- Relocate the landmark building (Block Y) from the harbour onto the land in the Barangaroo South site in front of the existing Blocks 4A, B and C;
- Revise the layout of Blocks 4A-C;
- Amend the size and location of the Southern Cove and public domain;
- Redistribute the GFA, public domain and land uses across development blocks 1-3, 4A-C, X and Y;
- Increase the maximum GFA on the site to provide for additional GFA within the hotel building and redistribution of land uses;
- Increase the height of the buildings within modified 'Block 4' and the relocated Block Y; and
- Amend the conditions of the Concept Approval to reflect the modifications to development.

It is also proposed to amend Part 12 of Schedule 3 of the Major Development SEPP to reconcile the SEPP with the modifications to the Concept Plan, including amending the location of the RE1 and B4 Mixed Use zone boundaries.

## 1.3 Site Location

Barangaroo is located on the north western edge of the Sydney Central Business District. It is bounded by Sydney Harbour to the west and north, the historic precinct of Millers Point (for the northern half), The Rocks and the Sydney Harbour Bridge approach to the east and a range of development dominated by large CBD commercial tenants to the south.

The Barangaroo site has been divided into three distinct redevelopment areas (from north to south) - the Headland Park, Barangaroo Central and Barangaroo South. Concept Plan (Mod 8) relates to Barangaroo South only as shown in Figure 1.



Figure 1 Indicative Site Boundary for Barangaroo South



## 1.4 Planning History

On 9 February 2007 the Minister approved a Concept Plan for the site and on 12 October 2007 the land was rezoned to facilitate its redevelopment. The Approved Concept Plan allowed for a mixed use development involving a maximum of 388,300m<sup>2</sup> of gross floor area (GFA) contained within 8 blocks on a total site area of 22 hectares.

A condition of consent also required two enlarged water intrusions into the Barangaroo site, one at the northern end and one at the southern end and the creation of a natural northern headland.

Modification No. 1 was approved in September 2007 which corrected a number of minor typographical errors.

On 25 February 2009 the Minister approved Modification No. 2 to the Concept Plan. The Approved Concept Plan as modified allowed for a mixed use development involving a maximum of 508,300m<sup>2</sup> of GFA contained within 8 blocks on a total site area of 22 hectares.

On 11 November 2009 the Minister approved Modification No. 3 to the Concept Plan to allow for a modified design for the Headland Park and Northern Cove. The Approved Concept Plan as modified allowed for a mixed use development involving a maximum of 489,500m<sup>2</sup> of GFA contained within 7 blocks on a total site area of 22 hectares.

On 16 December 2010 the Minister approved Modification No. 4 to the Concept Plan. The Approved Concept Plan as modified allowed for a mixed use development involving a maximum of 563,965m<sup>2</sup> of GFA contained within 7 blocks on a total site area of 22 hectares, an increase in height of a number of the proposed towers within Barangaroo South, the establishment of the new pier and landmark building extending into the Harbour; and reconfiguration and activation of the public waterfront area through the introduction of uses including retail and residential to the west of Globe Street.

Modification No. 5 was withdrawn.

Modification No.6 was approved in March 2015 to re-align a number of the block boundaries without changing the overall GFA.

Modification No.7 was approved in April 2015 which permitted the use of the concrete batching plant over the entire site, without changing the overall GFA.

## 1.5 Purpose of Report

This report has been prepared in support of the Concept Plan Amendment (MP06\_0162 MOD 8), addressing the relevant Director General Requirements. This document was prepared with reference to the amendment to the “Barangaroo Transport Management and Accessibility Plan, Request for Detailed Proposal - Barangaroo South” issued by the NSW Government in 2008 (TMAP September 2008) and the “Transport Management and Accessibility Plan Supplementary Report” prepared by Arup in 2010 (Supplementary TMAP 2010). Since the 2008 TMAP was prepared, there have been some changes which have implications for the precinct, including:

- Modifications to the planned floor space mix;
- Changes to the future public transport network serving the precinct; and
- Adjustments in the road network layout (both internal and external to the site)

The main transport principles have remained unchanged including journey to work mode share target of only 4% trips by car.

## 1.6 Responses to Director Generals Requirements

Table 2 below summarises the responses to the transport related issues addressed in the DGR MP06\_0162 MOD 8 – key issues 8 (transport management, traffic and car parking and vehicular access) and 9 (pedestrian and cycle access).

Table 2: DGR Summary

<b>DGR No.</b>	<b>Issue</b>	<b>Report Reference</b>
<b>8 - Transport Management, Traffic &amp; Car Parking and Vehicular Access</b>		
8.1	Undertake an assessment of future transport needs associated with Barangaroo Central and the Headland Park, including a clear understanding of the travel task for all modes at different times of the day (peak, off-peak and other peak periods relevant to differing uses) and week; and confirmation or modification (with justification) to the AM and PM peak commute mode share targets for Barangaroo as outlined in the Barangaroo Integrated Transport Plan 2012.	Section 3.2 & 3.3
8.2	Analyse the operation of existing and future transport networks (all modes) to understand the implications for Barangaroo, The analysis of the future road network operations needs to focus on intersections in the north-west quadrant of the CBD in the vicinity of Barangaroo, in particular, address the road network in the King Street Wharf area to ensure that intersections such as Erskine Street and Lime Street and Lime Street itself are modified to cater for the different traffic demands that Barangaroo South will bring to the network.	Section 4.3 & 4.4
8.3	Analyse car parking provision and how traffic generation (number of vehicles and time of access) will be managed in response to capacity limitations on the road network, The car parking breakdown shall identify all approved car parking numbers, and all potential car parking numbers across the whole of the Barangaroo site.	Section 4.5

<b>DGR No.</b>	<b>Issue</b>	<b>Report Reference</b>
8.4	Undertake a corridor model analysis of the road network, including an analysis of traffic generation and circulation, and service vehicle arrangements as a consequence of the modification; and demonstrate the potential to accommodate additional vehicular movements (including private vehicles, buses, commercial traffic and cyclists) in the surrounding road network.	Section 4.4
8.5	Undertake an assessment of the public transport network and associated pedestrian linkages and demonstrate that additional people movements can be accommodated by the surrounding public transport network.	Section 4.6 through to Section 4.13.
8.6	Outline late night transport provision to support the hotel and casino.	Section 4.14
8.7	Outline the timing and responsibility for delivering the transport network to serve Barangaroo,	Section 5.4
8.8	Prepare a comprehensive Traffic Management and Accessibility Plan, including an assessment of all of the above matters and: <ul style="list-style-type: none"> <li>- cumulative regional traffic impacts, including but not limited to, local and regional intersections and road improvements, and vehicular access options;</li> <li>- impacts from changes to Barangaroo South (MOD 9);</li> <li>- amendments to accommodate future bus service provision on Hickson Road (in consultation with Transport for NSW);</li> <li>- identify provision for taxi ranks and coach parking on site;</li> <li>- the timing and cost of infrastructure works and identification of funding;</li> <li>- package of travel demand management measures for workers, residents and visitors to the site.</li> <li>- emergency vehicle access arrangements; and</li> <li>- proposed loading dock provisions and access arrangements to loading docks and car parks.</li> </ul>	This document
<b>9 - Pedestrian &amp; Cycle Access</b>		
9.1	Outline the future cycleway network and demonstrate direct cycle connections between Barangaroo South and the strategic cycleway network as outlined in the Sydney City Centre Access Strategy.	Section 4.7
9.2	Outline provisions for walking and demonstrate provision for direct walking connections	Section 4.6

In addition to addressing the above DGRs, the traffic modelling contained within this TMAP report addresses Condition C3A of the approved Concept Plan in relation to the proposed Modification 8.

## 2 **Transport and Access Planning Framework**

### 2.1 **Methodology**

The TMAP September 2008 was derived from the iterative process that commenced in 2006. This involved refinement of the Barangaroo concept and development details, establishment of the statutory planning and approvals framework, and preparation of the initial Transport concept based on investigation of various transport and access matters. The Statement of Commitments and development of the Concept Plan Modification facilitated the more detailed assessment of transport and access matters in a series of supporting studies including detailed Paramics modelling. These have provided the basis for the TMAP September 2008. This previous work informed this TMAP report.

Since the TMAP September 2008 (Mod 2) was released a Transport Report was carried out to support the Modified Concept Plan (Mod 4). The study used reiterated the transport principles outlined in the TMAP September 2008 report as a basis for the analysis of the traffic impacts for the modification. Although the Mod 4 study is considered, this current TMAP report uses the TMAP September 2008 and associated reports as the basis for comparison, given the transport modelling and road network analysis underpinning the 4% car mode share was undertaken at this point in time.

### 2.2 **Service Principles**

The service principles of Barangaroo with regards to mode split targets, opportunity to create a transport hub and provide good access to public transport remain largely unchanged from that described in the September 2008 TMAP. These principles are outlined below.

- meet the mode split targets and provide access to existing public transport bus and rail services;
- provide access to public transport to/from the site without prejudicing the majority of existing passengers to and from the CBD;
- provide the opportunity for integration with envisaged future public transport projects;
- not preclude the opportunity to create a major multimodal transport interchange with ferry, rail and bus services; and
- provide safe and convenient access to all, including the mobility impaired.

## 2.3 Scope of Investigations

### 2.3.1 Barangaroo Integrated Transport Plan

The Barangaroo Integrated Transport Plan (BITP) was released in August 2012, which was prepared by a taskforce chaired by Transport for NSW and included City of Sydney, BDA, Lend Lease and other Government agencies. The plan outlines a series of transport strategies and actions to accommodate the significant employment growth in the northern CBD over both the short and long term. A selection of the recommended actions includes:

- Plan for investigation of a future bus corridor along Hickson Road in lieu of light rail;
- To accommodate the significant increase passenger throughput over the short and long term (up to 26%), prepare a costed implementation plan to upgrade the station and improve capacity;
- Investigate options to relieve congestion at the Wynyard bus interchange and increase the number of bus stops and layovers;
- Construct Wynyard Walk, City Walk Bridge and other bridges over Hickson Road as per existing planning approvals;
- Improving cycling access to Barangaroo by extending the City of Sydney's bicycle network, including upgrading existing bicycle shoulder lanes on Hickson Road; and
- Locate sufficient taxi ranks in consultation with City of Sydney, BDA and the Taxi Council.

### 2.3.2 NSW Long Term Transport Masterplan

The NSW Long Term Transport Master Plan was released in December 2012 and outlines a 20 year plan for the direction of transport services across NSW. The plan presents an integrated approach to transport planning and identifies the roles different modes of transport play in meeting the future needs of the State population.

The Master Plan aims to integrate public transport services to maximise future use as well as improve the overall customer experience. The master plan discusses the implementation of the 'Opal' card – the future integrated public transport ticketing system for NSW.

### 2.3.3 Sydney City Centre Access Strategy

The Sydney City Centre Access Strategy was released by the NSW Government in December 2013 following a period of public review. The document outlines the NSW Government's key strategies for transport access to, and within, the Sydney CBD. A summary of the key elements of the strategy relevant to Barangaroo include:

- Commitment to the construction of a new ferry hub at Barangaroo South and new ferry routes to provide more opportunities to access Barangaroo via public transport ;
- New bus routes to run to Barangaroo and Walsh Bay via the city centre, Napoleon Street and Hickson Road, with the major bus stop serving the precinct to in the area surrounding Wynyard Station on York, Clarence and Kent Streets;
- Commitment to the completion of the Wynyard Walk bridge and tunnel which will provide a direct and accessible pedestrian connection between Barangaroo and Wynyard Station;
- Identification of new taxi rank locations within Barangaroo South;
- Commitment to the implementation of light rail along George Street through the CBD;
- Completion of the city cycleway network, including new bi-directional cycle routes on Castlereagh Street and Pitt Street and the identification of new routes into Barangaroo via the Pyrmont Bridge and Sydney Harbour Bridge cycleways;
- Upgrades to Wynyard Station including better interchange facilities for rail, bus and ferry customers at the station and at Barangaroo; and
- Improving visitor information including wayfinding and signage to CBD destinations and transport hubs in major visitor precincts such as Barangaroo.

## 3 Barangaroo Development

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### 3.1 Proposed Maximum GFAs

The latest modification of the Concept Plan (Mod 8) seeks approval for total floor area for the whole site of 605,911m<sup>2</sup> GFA across Barangaroo, comprised of:

- (a) a maximum of 183,000m<sup>2</sup> of residential GFA;
- (b) a maximum of 76,000m<sup>2</sup> GFA for tourist uses (of which a maximum of 59,000m<sup>2</sup> may be located in Barangaroo South);
- (c) a maximum of 34,000m<sup>2</sup> GFA for retail uses (of which a maximum of 30,000m<sup>2</sup> may be located in Barangaroo South);
- (d) a maximum of 5,000m<sup>2</sup> GFA for active in the Public Recreation zone (3,500m<sup>2</sup> of which will be in Barangaroo South); and
- (e) a minimum of 12,000m<sup>2</sup> GFA for community uses that may be located within the Public Recreation or Mixed Use zones.

For the purposes of this assessment, particularly with respect to the traffic generation and traffic modelling undertaken, a mix land use types has been assumed for Barangaroo based the per land use category GFA limits nominated above, as proposed to be modified. These are as follows:

- 342,334m<sup>2</sup> commercial;
- 48,200m<sup>2</sup> hotel/tourist;
- 6,848m<sup>2</sup> public;
- 167,479m<sup>2</sup> residential;
- 26,500m<sup>2</sup> retail/other uses; and
- 14,500 m<sup>2</sup> active/community uses.

#### 3.1.1 Barangaroo South

The latest modification of the Concept Plan seeks approval for total floor area for the Barangaroo South site of 535,186m<sup>2</sup> GFA. This comprises of:

- (a) a maximum of 154,000m<sup>2</sup> of residential GFA;
- (b) a maximum of 59,000m<sup>2</sup> GFA for tourist uses;
- (c) a maximum of 30,000m<sup>2</sup> GFA for retail uses;
- (d) a maximum of 3,500m<sup>2</sup> GFA for active uses in the Public Recreation zone, which may include Community Uses.

For the purposes of this assessment, a mix land use types has been assumed for the Barangaroo South Site based the per land use category GFA limits nominated above, as proposed to be modified. These are as follows:

- 312,109m<sup>2</sup> commercial;
- 48,200m<sup>2</sup> hotel/tourist;
- 3,598m<sup>2</sup> public;
- 143,479m<sup>2</sup> residential; and
- 24,300m<sup>2</sup> retail/other uses.

In addition, up to 3,500m<sup>2</sup> of active uses are planned for Barangaroo South

### 3.1.2 Barangaroo Central (Mod 9)

Concurrent with this Concept Plan modification, a separate planning application is to be lodged to increase the maximum allowable floor space to be developed within Stage 2 of the Barangaroo site (Barangaroo Central). The changes to the permissible floor space relate to the commercial, residential and retail components of the development.

Based on current advice provided by the Barangaroo Delivery Authority, the assumed floor space mix for Barangaroo Central is as follows:

- 25,000m<sup>2</sup> commercial;
- 20,000m<sup>2</sup> public;
- 75,000m<sup>2</sup> residential; and
- 5,000m<sup>2</sup> retail/other uses.



### 3.1.3 Total Floor Space

The GFA allocation per activity is shown in Table 3 for the above mentioned approvals and modifications of the Concept Plan.

Table 3 Total GFA's for the Barangaroo Development

	Commercial	Hotel/Tourist	Public	Residential	Retail/ Other Uses	Total
<b>Consolidated Concept Plan from 2007</b>						
Consolidated Concept Plan	253,000	35,800	5,000	75,000	31,000	<b>399,800</b>
<b>TMAP September 2008 – Concept Plan Modification for additional commercial (Mod 2)</b>						
Concept Plan	373,000	35,800	5,000	75,000	31,000	<b>519,800</b>
<b>Modified Concept Plan for Headland Park (Mod 3)</b>						
Concept Plan (Mod 3)	371,500	30,000	4,750	64,000	30,750	<b>501,000</b>
<b>Mod 4</b>						
Barangaroo South	323,700	33,000	13,000	99,763	33,777	<b>503,240</b>
Barangaroo Central	30,225	0	3,250	24,000	1,750	<b>59,225</b>
Concept Plan (Mod 4)	353,925	33,000	16,250	123,763	35,527	<b>562,465</b>
<b>Mod 8 (Modification to Barangaroo South Only)</b>						
Barangaroo South	312,109	48,200	3,598	143,479	24,300	<b>531,686</b>
Barangaroo Central	30,225	0	3,250	24,000	1,750	<b>59,225</b>
Active/Community Uses						<b>14,500</b>
Concept Plan (Mod 8)	342,334	48,200	6,848	167,479	26,500	<b>605,911</b>
<b>Mod 8 + Mod 9 (Modification to Barangaroo South &amp; Barangaroo Central)</b>						
Barangaroo South	312,109	48,200	3,598	143,479	24,300	<b>531,686</b>
Barangaroo Central	25,000	0	20,000	75,000	5,000	<b>125,000*</b>
Active Uses						<b>4,500</b>
<b>Concept Plan (Mod 8 + Mod 9)</b>	<b>337,109</b>	<b>48,200</b>	<b>23,598</b>	<b>218,479</b>	<b>29,300</b>	<b>661,186</b>

\* based on current advice provided by the Barangaroo Delivery Authority

## 3.2 Site Population

The assumptions used for estimating the population numbers are summarised in Table 4 below. These population assumptions are consistent with those previously utilised in the TMAP September 2008.

Table 4 Site Population Assumptions

Land Use	Floor Space	Density	Site Population
Commercial	337,109m <sup>2</sup>	1 employee / 20m <sup>2</sup> GFA	16,855
Hotel/Tourist	48,200m <sup>2</sup>	1 employee / 20m <sup>2</sup> GFA	2,410
Public	23,598m <sup>2</sup>	1 employee / 20m <sup>2</sup> GFA	1,180
Retail/Other Uses	32,580m <sup>2</sup>	1 employee / 20m <sup>2</sup> GFA	1,629
<b>Sub-Total: Workers</b>			<b>22,074</b>
<b>Workers On-site per Day<sup>1</sup></b>			<b>20,198</b>
Residential	218,479m <sup>2</sup>	2 residents / 100m <sup>2</sup> GFA	4,370

## 3.3 Mode Share Targets

Initial planning approval for Barangaroo South was based on the principle of achieving high usage of public transport, walking and cycling as a method of travel to work. Journey to work mode share by car is targeted at 4% which will be achieved through minimal on-site parking and promotion of travel demand management plans. These mode split targets were adopted in the Barangaroo Integrated Transport Plan.

The overall mode split targets have been largely retained for the Barangaroo site from the TMAP September 2008, with the exception of ferry trips. The current TMAP assigns only a 1% mode to ferry for journey to work. With the provision of a new ferry hub at Barangaroo South (further described in section 4.10), it is expected that a minimum of 4% of all journey to work trips to Barangaroo will be undertaken via ferry. This is at the lower end of the target ferry mode share outlined in the Barangaroo Integrated Transport Plan – similar to the rest of the northern CBD. The BITP notes that potentially up to 8% of works trips via ferry is achievable should existing travel patterns for workers near Circular Quay be replicated at Barangaroo. Large tenants in this area already record ferry mode share as high as 7% indicating that there is good potential for an increased ferry mode share with increased services and improved frequencies.

The increase in ferry mode share will likely result in a reduction of other public transport modes. A reduction of 2% by train and 1% by bus has been assumed in this study.

<sup>1</sup> Consistent with previous TMAPs, it has been assumed 8.5% of workers would not be on-site on a typical day

Table 5 Mode Share Targets

Mode	TMAP Mod2	TMAP Mod8	Number
Car (driver / passenger)	4.0%	4.0%	808
Bus / Light Rail	20.0%	19.0%	3,636
Train	63.0%	61.0%	12,321
Ferry	1.0%	4.0%	808
Other (pedestrian, cyclists, motorcycles, taxi)	12.0%	12.0%	2,424
<b>Total</b>	<b>100%</b>	<b>100%</b>	20,198

A detailed summary of the number of workers commuting to Barangaroo during the AM commuter peak hour is summarised in Table 6.

Table 6 Number of People Arriving at Barangaroo – Peak Hours

Mode	Number of People Travelling to Work			
	%	Daily	AM peak period (3 hour peak)	AM peak hour
Car (driver / passenger)	4.0%	808	646	394
Bus / Light Rail	19.0%	4,040	3,232	1,971
Train	61.0%	12,725	10,180	6,210
Ferry	4.0%	202	162	99
Other (pedestrian, cyclists, motorcycles, taxi)	12.0%	2,424	1,939	1,183
<b>Total</b>	<b>100%</b>	<b>20,198</b>	<b>16,158</b>	<b>9,857</b>

## 4 Transport and Access Service Strategy

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### 4.1 Site Access

The site access arrangements for Barangaroo South are shown in Figure 2 for:

- Pedestrians
- Cyclists
- Service vehicles
- Cars to basement and hotel

The key pedestrian routes are focused on Wynyard Walk which provides connection to Wynyard Station for train and bus passengers. This new pedestrian infrastructure, as provided for in the Sydney City Centre Access Strategy, will provide a direct and accessible pedestrian connection between Barangaroo and Wynyard Station.

Cyclists will access the basement bicycle parking facility via a dedicated bicycle entry on Hickson Road. Cyclists will use Hickson Road, Sussex Street and Napoleon Street bicycle routes for access.

Service vehicles access the basement loading area from Globe Street and arrive and depart from Hickson Road.

Emergency vehicles gain access within the precinct along Globe Street and Lime Street where they can stop to gain foot access to City Walk, Union Walk and Transport Place. Emergency vehicles may also traverse Shelley Street and Sussex Street/Hickson Road.

Cars access the Stage 1A basement parking areas via vehicle ramps onto Globe Street and Lime Street with a basement egress available onto Hickson Road opposite Napoleon Street. Two vehicular entry and exit points are currently envisaged for cars utilising the Stage 1B basement, with access provided from the northern end of Globe Street.

The primary vehicle access route into the hotel will be via Hickson Road and Globe Street. Key aspects of the access strategy for the hotel include:

- A new porte-cochere to be located within the site boundary;
- Entry and exit for vehicles utilising valet parking to be located at the northern end of Lime Street within the porte-cochere; and
- A consolidated basement entry/exit for service vehicles, as well as self-park patrons and residents further south on Lime Street

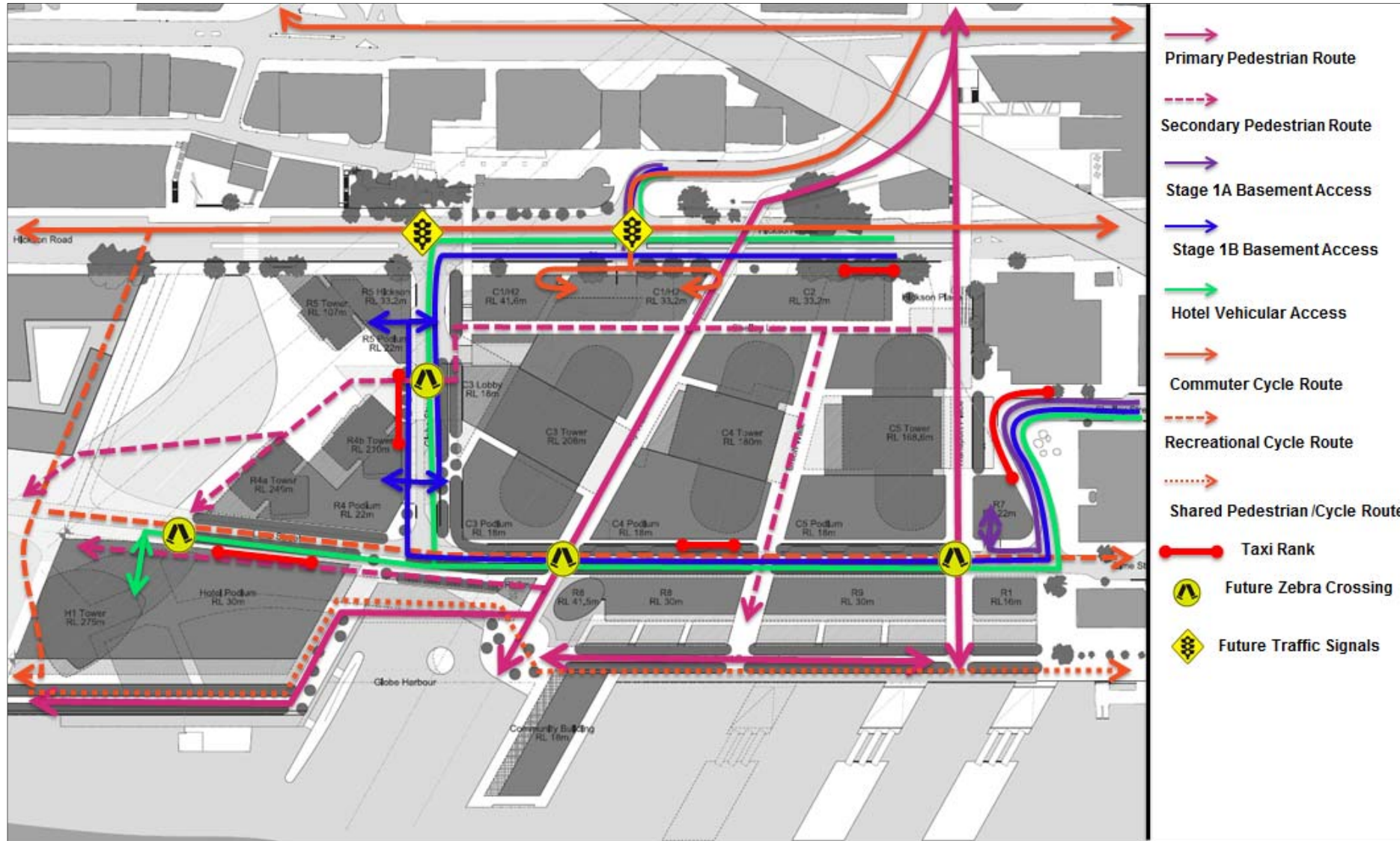


Figure 2 Barangaroo Site Access

## 4.2 Road Network Layout

There have been a number of amendments to the road network layout assumed in the TMAP September 2008. Some roads in Barangaroo South and the surrounding precinct will now be pedestrian ways rather than vehicular access routes. Modifications to the road network serving Barangaroo since the TMAP September 2008 are as follows:

- Following the completion of the Wynyard Walk development and approval from the RMS, the northern section of Shelley Street (previously known as Margaret Street West) will be closed to vehicular traffic. The existing traffic signals at the Shelley Street / Sussex Street intersection will be removed.
- Napoleon Street West will no longer serve as a vehicular access route through the precinct. The western approach of the Hickson Road / Napoleon Street intersection will instead function as an exit from the Stage 1A basement car park via a new signalised intersection.
- The northern entry to the commercial car park and loading dock is via Globe Street, north of Napoleon Street. This serves as an entry only for commercial vehicles, and both an entry and exit for service vehicles. This intersection will be upgraded to traffic signals in the ultimate configuration.
- An entry to the commercial and residential car park levels is provided via an access adjoining Lime Street in the south-west corner of the basement. This serves as an entry and exit.

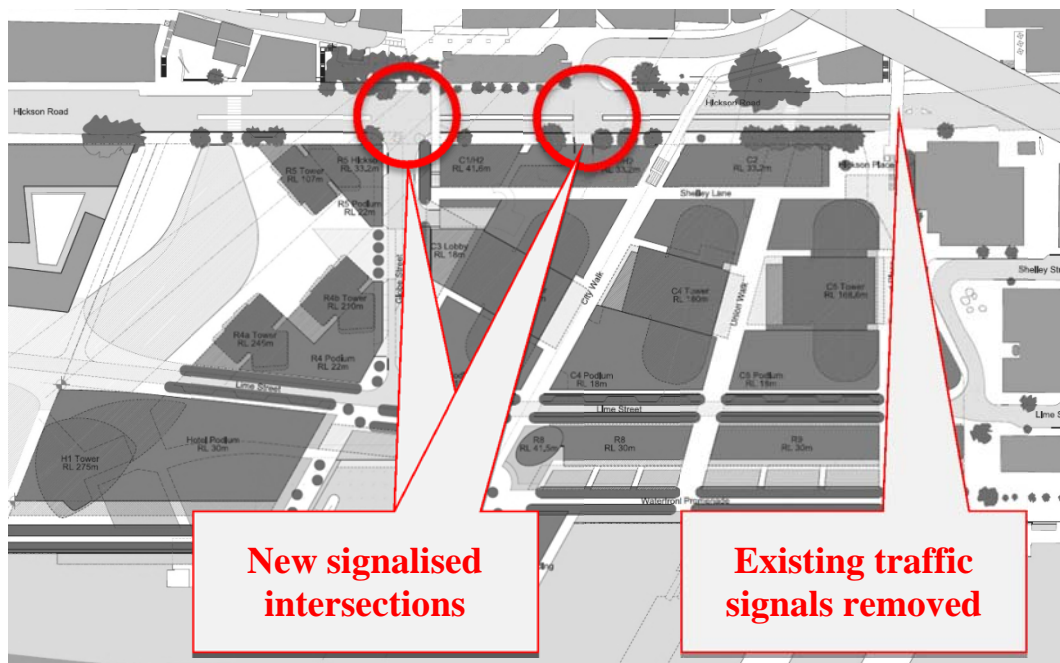


Figure 3 Road Network Layout

## 4.3 Road Network Operations

### 4.3.1 TMAP September 2008

Paramics modelling of Sydney CBD was utilised to test traffic options with different traffic generations and traffic management measures and is outlined in the MWT Modified Concept Plan – Transport Report, July 2008. The modelling concluded the road network would operate satisfactorily based on the modified concept plan development, with a 4% journey to work car mode share.

Peak hour traffic generation based on the proposed land use mix outlined in the September 2008 TMAP is summarised in Table 7.

Table 7 Traffic Generation TMAP September 2008 Modified Concept Plan Mod 2

Traffic generation as per Barangaroo TMAP September 2008			AM Peak Hour 8am – 9am				PM Peak Hour 5pm – 6pm				
Land Use	Variable	Variable number	trip rate <sup>2</sup>	no of trips	In	Out	trip rate	no of trips	In	Out	
<b>Light Vehicles</b>											
Residential	dwelling	750	0.14	105	21	84	0.09	68	54	14	
Commercial	car space	622	0.26	162	129	32	0.26	162	32	129	
Retail	car space	52	0.4	21	17	4	0.4	21	4	17	
On street parking	car space	275	0.4	110	88	22	0.8	220	88	132	
Public off street parking	car space	300	0.04	12	10	2	0.4	120	24	96	
Hotel	rooms	730	0.1	73	15	58	0.1	73	58	15	
<b>Sub total</b>				<b>482</b>	<b>279</b>	<b>203</b>		<b>663</b>	<b>261</b>	<b>402</b>	
<b>Heavy vehicles</b>											
Service vehicles				60	30	30		0	0	0	
Coaches				0	0	0		22	11	11	
<b>Sub total</b>				<b>60</b>	<b>30</b>	<b>30</b>		<b>22</b>	<b>11</b>	<b>11</b>	
<b>Total traffic generation</b>					<b>542</b>	<b>309</b>	<b>233</b>		<b>685</b>	<b>272</b>	<b>413</b>
<i>Public Transport (Bus)</i>					66	39	27		66	27	39
<b>Total additional traffic</b>					<b>608</b>	<b>348</b>	<b>260</b>		<b>751</b>	<b>299</b>	<b>452</b>

<sup>2</sup> Refer Masson Wilson Twiney Modified Concept Plan Report, July 2008 (Section 4.6)

### 4.3.2 Concept Plan Modification Mod 4

In December 2010 Modification No. 4 to the Concept Plan was approved, allowing for a mixed use development involving a maximum of 563,965m<sup>2</sup> of GFA. The implications for traffic generation resulting from the approved scheme are summarised in Table 8 below.

Table 8 Traffic Generation TMAP September 2010 Modified Concept Plan Mod 4

Traffic generation as per Barangaroo TMAP September 2008			AM Peak Hour 8am – 9am				PM Peak Hour 5pm – 6pm			
Land Use	Variable	Variable number	trip rate <sup>3</sup>	no of trips	In	Out	trip rate	no of trips	In	Out
<b>Light Vehicles</b>										
Residential	dwelling	1166	0.14	163	33	131	0.09	105	84	21
Commercial	car space	590	0.26	153	123	31	0.26	153	31	123
Retail	car space	62	0.4	25	20	5	0.4	25	5	20
On street parking	car space	275	0.4	110	88	22	0.8	220	88	132
Public off street parking	car space	300	0.04	12	10	2	0.4	120	24	96
Hotel	rooms	249	0.1	25	5	20	0.1	25	20	5
<b>Sub total</b>				<b>488</b>	<b>278</b>	<b>211</b>		<b>648</b>	<b>252</b>	<b>397</b>
<b>Heavy vehicles</b>										
Service vehicles				60	30	30		0	0	0
Coaches				0	0	0		22	11	11
<b>Sub total</b>				<b>60</b>	<b>30</b>	<b>30</b>		<b>22</b>	<b>11</b>	<b>11</b>
<b>Total traffic generation</b>				<b>548</b>	<b>308</b>	<b>241</b>		<b>670</b>	<b>263</b>	<b>408</b>
<i>Public Transport (Bus)</i>				66	39	27		66	27	39
<b>Total additional traffic</b>				<b>614</b>	<b>347</b>	<b>268</b>		<b>736</b>	<b>290</b>	<b>447</b>

<sup>3</sup> Refer Masson Wilson Twiney Modified Concept Plan Report, July 2008 (Section 4.6)



### 4.3.3 Concept Plan Modification Mod 8 (Barangaroo South)

Peak hour traffic generation has been analysed to reflect the revised GFAs (as proposed in Table 3) for this Concept Plan modification. All assumptions from TMAP September 2008 and MWT Modified Concept Plan – Transport Report, July 2008 including traffic generation rates and parking ratios have remained the same for this analysis, excluding the proposed hotel.

Given the unique nature of the future hotel, the most appropriate method to forecast traffic generation is to refer to an existing development with comparable characteristics. The Crown resort in Melbourne was selected as a suitable site which will provide similar uses to that of the proposed hotel at Barangaroo.

To facilitate this study, Arup was provided with parking and traffic data by Crown for a number of their properties in Melbourne. This included both video surveillance footage and entry/exit data from Crown's car parking areas. This is described in detail in Appendix A of this report.

Table 9 Traffic Generation TMAP, Mod 8 (Barangaroo South)

2015 Concept Plan (MOD 8)			AM Peak Hour				PM Peak Hour			
Land Use	Variable	Variable Number	trip rate	no of trips	In	Out	trip rate	no of trips	In	Out
<b>Light Vehicles</b>										
Residential	Dwelling	1675	0.14	234	47	188	0.09	151	121	30
Commercial	car space	568	0.26	148	118	30	0.26	148	30	118
Retail	car space	50	0.4	20	16	4	0.4	20	4	16
On-Street Parking	car space	40	0.4	16	13	3	0.8	32	13	19
Public Off Street Parking	car space	300	0.04	12	10	2	0.4	120	24	96
Hotel*				75	51	24		213	147	66
Cultural / Civic				8	6	2		8	2	6
<b>Sub Total</b>				<b>513</b>	<b>260</b>	<b>253</b>		<b>691</b>	<b>340</b>	<b>351</b>
<b>Heavy Vehicles</b>										
Service vehicles				70	35	35		0	0	0
Coaches				4	2	2		22	11	11
<b>Sub Total</b>				<b>74</b>	<b>37</b>	<b>37</b>		<b>22</b>	<b>11</b>	<b>11</b>
<b>Total traffic generation</b>				<b>587</b>	<b>297</b>	<b>290</b>		<b>713</b>	<b>351</b>	<b>362</b>
<i>Public Transport (Bus)</i>				<i>66</i>	<i>39</i>	<i>27</i>		<i>66</i>	<i>39</i>	<i>27</i>
<b>Total Additional Traffic</b>				<b>653</b>	<b>336</b>	<b>317</b>		<b>779</b>	<b>390</b>	<b>389</b>

\* See Appendix A for further detail

The following common assumptions have been used, consistent with those utilised in the TMAP September 2008:

- 1 residential unit provides an average of 100m<sup>2</sup>
- Commercial and public trips split 80% in / 20% out during AM and 80% out / 20% in during PM
- Residential trips split 80% out / 20% in during AM and 80% in / 20% out during PM
- Public use parking at Headland Park assumed to generate at retail rate during PM peak hour and at 10% of that level during AM peak hour
- No net change in traffic generation during peak hours will occur as a result of the conversion of the existing 270 ninety degree parallel spaces to 125 short term on-street car parking spaces on Hickson Road
- Bus numbers were based on the Barangaroo Bus Service Strategy, Transport and Traffic Planning Associates April 2008

A key change since the TMAP September 2008 concerns the number of on-street parking spaces within the precinct. Current planning for Barangaroo South and Central allows for approximately 40 parking spaces on the local streets - a significant reduction from the 275 assumed in the TMAP September 2008. This is a result of both the pedestrianisation of some streets in the precinct and the design progression of Globe Street and Lime Street, which will accommodate only a small number of on-street parking spaces.

It should be noted that the traffic generation rate for the residential component of the site is based on the number of dwellings provided, and is independent of the number of parking bays provided.

### 4.3.4 Concept Plan Modification Mod 8+Mod9

This TMAP report has modelled the cumulative traffic impacts on the local road network arising from the revised GFAs of the southern and central Barangaroo precincts (i.e. Mod 8 + Mod 9). This is summarised in Table 10.

Table 10 Traffic Generation TMAP, Mod 8 + 9

2015 Concept Plan (MOD 8 + MOD 9)			AM Peak Hour				PM Peak Hour			
Land Use	Variable	Variable Number	trip rate	no of trips	In	Out	trip rate	no of trips	In	Out
<b>Light Vehicles</b>										
Residential	Dwelling	2185	0.14	306	62	244	0.09	197	157	40
Commercial	car space	558	0.26	145	116	29	0.26	145	29	116
Retail	car space	55	0.4	22	18	4	0.4	22	4	18
On-Street Parking	car space	40	0.4	16	13	3	0.8	32	13	19
Public Off Street Parking	car space	300	0.04	12	10	2	0.4	120	24	96
Hotel*				75	51	24		213	147	66
Cultural / Civic				8	6	2		8	2	6
<b>Sub Total</b>				<b>584</b>	<b>275</b>	<b>309</b>		<b>733</b>	<b>377</b>	<b>361</b>
<b>Heavy Vehicles</b>										
Service vehicles				70	35	35		0	0	0
Coaches				4	2	2		22	11	11
<b>Sub Total</b>				<b>74</b>	<b>37</b>	<b>37</b>		<b>22</b>	<b>11</b>	<b>11</b>
<b>Total traffic generation</b>				<b>658</b>	<b>312</b>	<b>346</b>		<b>759</b>	<b>388</b>	<b>372</b>
<i>Public Transport (Bus)</i>				<i>66</i>	<i>39</i>	<i>27</i>		<i>66</i>	<i>39</i>	<i>27</i>
<b>Total Additional Traffic</b>				<b>724</b>	<b>351</b>	<b>373</b>		<b>825</b>	<b>427</b>	<b>399</b>

\* See Appendix A for further detail

### 4.3.5 Traffic Generation Comparison

A comparison of the traffic generation forecast under the Modified Concept Plan (Mod 2) and the proposed modification (Mod 8 + 9) has been undertaken and is listed in Table 11 and illustrated in Figure 4.

Comparison has been made with the traffic forecast in the TMAP September 2008 (Mod 2) given the transport modelling and road network analysis underpinning the 4% car mode share was undertaken at this point in time. The previous 2010 TMAP (Mod 4) reiterated the transport principles outlined in the TMAP September 2008. The traffic generation forecasts outlined in the Mod 4 TMAP have been included as reference material.

Table 11 Traffic generation comparison

Time Period	Direction	TMAP 2008 (Mod 2 GFA)	TMAP Mod 4	TMAP Mod 8	TMAP Mod 8 + Mod 9
AM Peak Hour	In	348	347	336	351
	Out	260	268	317	373
	<b>Two-way</b>	<b>608</b>	<b>614</b>	<b>653</b>	<b>724</b>
PM Peak Hour	In	299	290	390	427
	Out	452	447	389	399
	<b>Two-way</b>	<b>751</b>	<b>736</b>	<b>779</b>	<b>825</b>

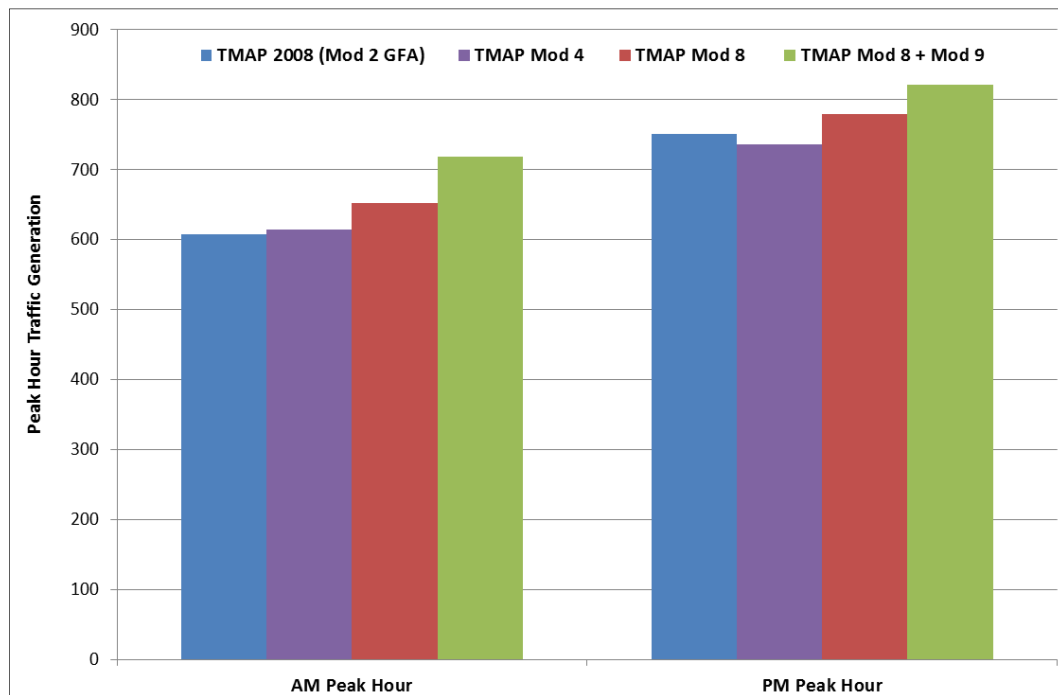


Figure 4 Traffic Generation Comparison

### 4.3.6 Peak and Off Peak Traffic Generation

The mix of land uses proposed within the Barangaroo precinct will generate trips during both the traditional commuter peak hours (i.e. 7am-10am and 4pm-7pm) and other times of the day – e.g. lunchtime peak and evening peak. Traffic generation for the hotel is expected to be highest in the evening after 7pm and on weekends – therefore not coinciding with the road network peak hours.

Figure 5 below provides an illustration of the variation in traffic generated by the entire Barangaroo development (Mod 8 + 9) throughout a typical weekday. This demonstrates that traffic generated during the lunchtime and evening peak hours is expected to be less than that in the commuter peak hours. Evening peak hour traffic is forecast to be less than half of that the PM commuter peak hour. The hotel is anticipated to be the primary generator of vehicular traffic from the entire Barangaroo site in the evening peak hour.

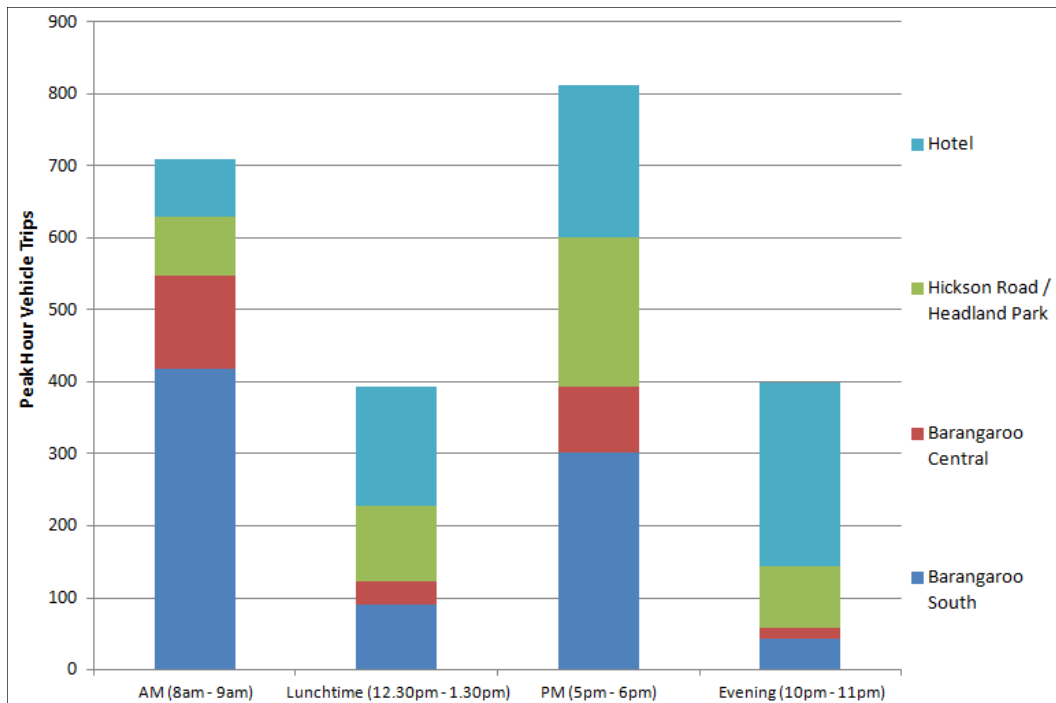


Figure 5 Off Peak Traffic Generation (Mod 8+9)

## 4.4 Road Network Modelling

### 4.4.1 Description

The operation of the road network following the full development of Barangaroo has been modelled using the LinSig analysis software. The LinSig model has considered the revised road network layout as described in Section 4.1 of this study, including the future closure of Shelley Street to vehicle movements following the completion of the Wynyard Walk development.

The modelling does not consider the redistribution of traffic arising from the changes in transport conditions in the CBD following the introduction of the light rail on George Street. It is understood that Transport for NSW is currently preparing a mesoscopic traffic model which considers the traffic impacts of this proposal. The results of this analysis were not available at the time of writing.

### 4.4.2 Traffic Volumes

Traffic counts were undertaken for this study in the Barangaroo precinct in July 2013 and are presented in Figure 6 and Figure 7.

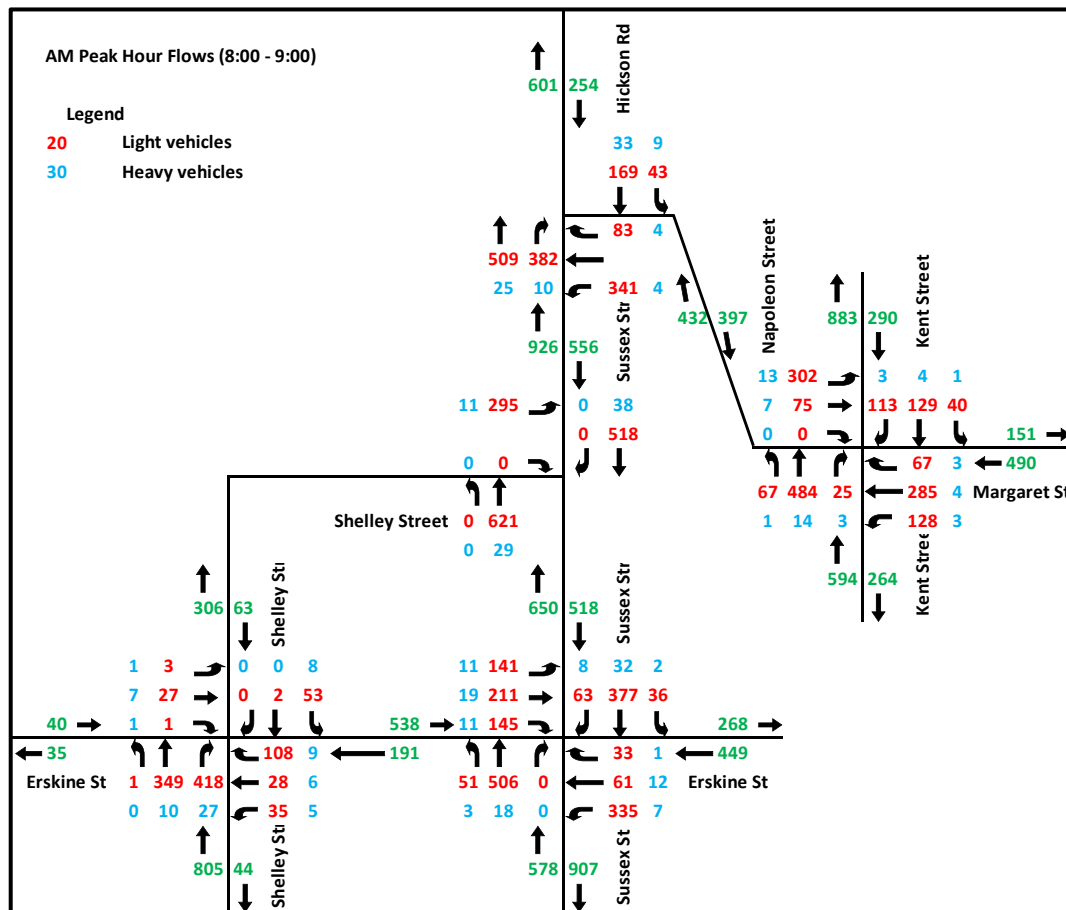


Figure 6 AM Peak Hour Traffic Flows, July 2013

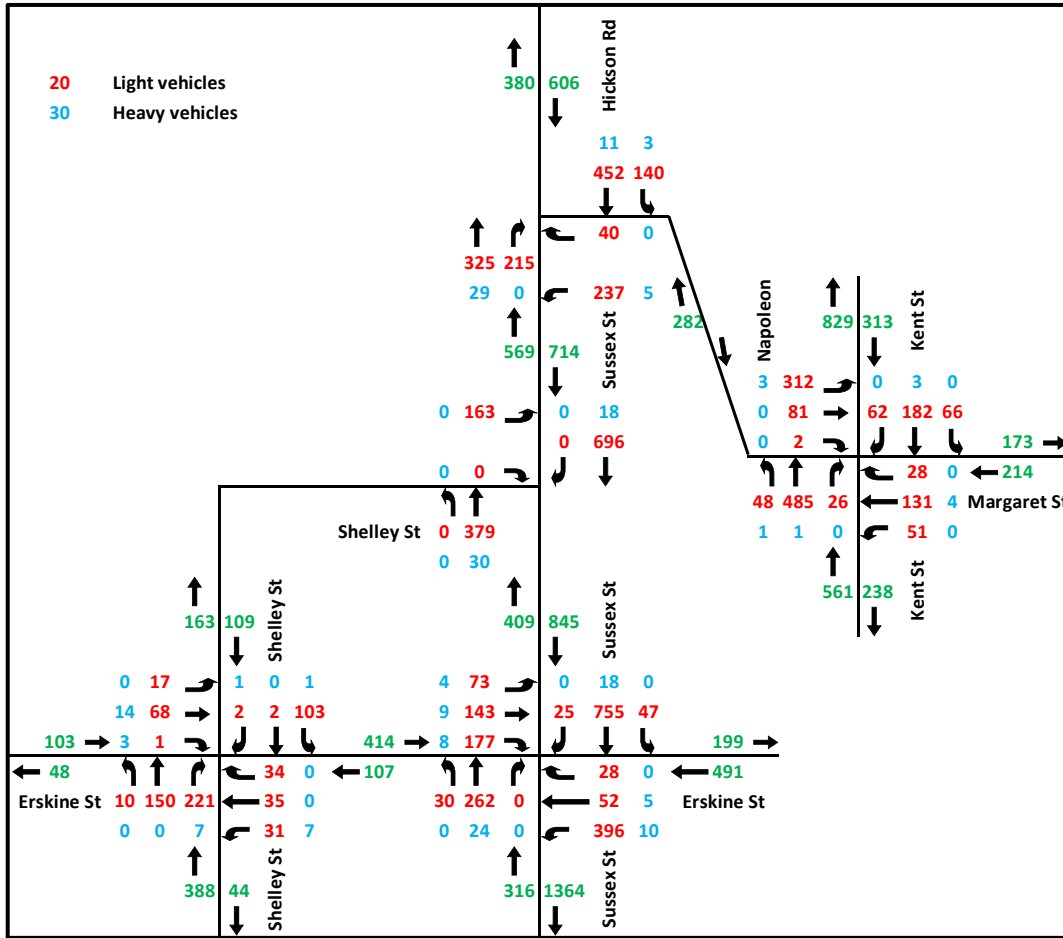


Figure 7 PM Peak Hour Traffic Flows, July 2013

### 4.4.3 Traffic Distribution

#### Existing Traffic

The closure of the northern section of Shelley Street following the completion of the Wynyard Walk development will necessitate a redistribution of traffic currently turning left from Shelley Street into Sussex Street. These traffic movements have been redistributed as follows:

- 50% will travel via Lime Street and Globe Street North; and
- 50% will turn right from Shelley Street into Erskine Street and then left into Sussex Street

This redistribution is based on current traffic patterns which indicate that of the vehicles previously turning left from Shelley Street into Sussex Street, approximately half would turn right onto Napoleon Street and the remaining half would continue north along Hickson Road.

#### Development Traffic

Traffic associated with the new development has been distributed across the road network based on Journey to Work Census data, consistent with the assumptions outlined in the MWT Modified Concept Plan – Transport Report, July 2008.

Table 12 Development Traffic Distribution

Direction	Route	Distribution
North	Harbour Bridge	40.7%
East	Eastern Distributor	22.9%
	William Street	1.5%
	Oxford Street	4.1%
South	Harbour Street	8.6%
West	Western Distributor	21.8%
Sydney Inner	-	0.4%
<b>Total</b>		<b>100%</b>

These key approach and departure routes are consistent with previous Concept Plan modifications, as well as those illustrated in the BITP (Figure 8).





Figure 8 Arrival and Departure Traffic Routes  
 Source: Barangaroo Integrated Transport Plan, Figure 7

#### 4.4.4 Intersection Operation

A corridor traffic model (using the LinSig 3.2 software package) was developed to assess the future road network performance arising from the Concept Plan modification. This modelling software allows intersections to be modelled in a single network and provides signal optimisation to reflect future traffic conditions within the Barangaroo precinct.

Within the LinSig model, the lane capacity at a number of locations was manually reduced to reflect queue spillback from downstream and upstream intersections that currently occurs during peak hours. The following capacity adjustments were applied in the model.

Table 13 Capacity adjustments at key intersections

Intersection	Approach	Movement	Capacity Adjustment
Kent Street / Napoleon Street / Margaret Street	South	Through	20% reduction (PM only)
	West	Through	50% reduction (PM only)
Sussex Street / Erskine Street	South	Through	20% reduction (AM only)
	North	Through	50% reduction (PM only)

It is understood that the RMS and Transport for NSW are currently investigating the reinstatement of a second eastbound traffic lane on Margaret Street. This lane was removed following the closure of the Kent Street pedestrian tunnel to provide additional footpath capacity on Margaret Street. This new traffic lane has not been included within the LinSig traffic model. Provision of this measure would significantly reduce the extent of queue spillback experienced in the PM peak hour for eastbound vehicles – therefore improving the operation of the Kent Street / Napoleon Street / Margaret Street intersection.

The road network performance has been measured against three parameters, those being:

- Level of Service (LOS)
- Degree of Saturation (DOS)
- Average Vehicle Delay (AVD)

The performance of intersections in an urban environment is measured in terms of its Level of Service (LoS). Levels of service ranges from A (very good) to F (over capacity with significant delays). This is described in the RTA Guide to Traffic Generating Developments as summarised in Table 14. Across the Sydney CBD road network, it is not uncommon for intersections to operate at Level of Service E or F (at capacity) during commuter peak hours.

Table 14 Intersection level of service

Level of Service	Average Vehicle Delay (seconds)	Traffic Signals and Roundabouts	Priority Intersections ('Stop' and 'Give Way')
A	< 14	Good operation	Good operation
B	15 to 28	Good with acceptable delays and spare capacity	Acceptable delays and spare capacity
C	29 to 42	Satisfactory	Satisfactory, but accident study required
D	43 to 56	Operating near capacity	Near capacity and 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	>71	Unsatisfactory with excessive queuing	Unsatisfactory with excessive queuing; requires other control mode

Another common measure of intersection performance is the degree of saturation, which provides an overall measure of the capability of the intersection to accommodate additional traffic. A DOS of 1.0 indicates that an intersection is operating at capacity.

The results of the traffic modelling are summarised in Table 15 below. Full analysis is provided as an Appendix B.

Table 15 Traffic Modelling Results

Peak	Intersection	TMAP 2008 (Mod 2 GFA)			TMAP Mod 8+9		
		LOS	DOS	AVD (sec)	LOS	DOS	AVD (sec)
AM	Sussex Street / Erskine Street	B	0.60	27	B	0.60	27
	Hickson Road / Napoleon Street	E	1.00	68	E	1.00	69
	Kent Street / Margaret Street	B	0.69	25	B	0.77	26
	Hickson Road / Globe Street	B	0.65	15	B	0.62	16
PM	Sussex Street / Erskine Street	E	0.97	59	D	0.97	55
	Hickson Road / Napoleon Street	D	0.94	48	D	0.92	43
	Kent Street / Margaret Street	B	0.81	24	B	0.75	23
	Hickson Road / Globe Street	A	0.48	11	A	0.47	11

The cumulative traffic analysis indicates little difference in the road network performance due to the minor traffic increase arising from the Concept Plan modification. Changes in vehicle delays are relatively minor in both the AM and PM commuter peak hours.

In both scenarios analysed, the forecast queue length at the northern approach of the Hickson Road / Sussex Street intersection is forecast to spill back to the Hickson Road / Globe Street intersection. It is recognised however that significant vehicle queuing currently occurs in the southbound direction on Sussex Street in the PM Peak hour as a result of more congested traffic operating conditions in the vicinity of the cross traffic movements at the King Street and Market Street intersections.

The operation of the future signalised intersections on Hickson Road will be dependent on the operating conditions of intersections further downstream on Sussex Street. Essentially they will act as 'slave' in the Sussex Street road network, with intersections at King Street and Market Street acting as the 'masters'.

In this context, the road network impacts of the proposed modification are considered modest.

## 4.5 Car Parking

This car parking analysis has been based at the same parking ratios as used in TMAP September 2008, excluding for the hotel. These rates are summarised below.

Table 16 Parking Rates

Land Use and Activity	Parking Rate
Commercial	1 space / 600m <sup>2</sup> GFA
Retail	Based on the City of Sydney LEP2005 rates for 'other' uses.
Residential	Bedsitter: 0.5 spaces / dwelling 1 bed: 0.5 spaces / dwelling 2 bed: 1.2 spaces / dwelling 3 bed: 2.0 spaces / dwelling 3+ bed: 2.0 spaces / dwelling
Hotel	n/a
Hickson Road on-street parking	n/a
On-Street parking within Barangaroo	n/a
Headland Park Off-Street car park	n/a

The parking numbers presented in this section are nominal numbers extrapolated from:

- The assumed GFA mix described in Section 3 and an indicative dwelling mix for residential uses (which may be subject to change), applying the approved car parking rates specified under the Concept Plan; and
- An assessment of parking demand and management in relation to hotel uses.

The parking numbers are presented below for the purposes of presenting the potential parking needs of development under the Concept Plan, as proposed to be modified. Actual parking numbers may vary from those presented in this report and will be confirmed in the relevant applications to carry out development contemplated by the Concept Plan.

While the proposed GFA may potentially provide for more car parking on the site, this has not resulted in a significant increase in traffic generation in the vicinity of the site as demonstrated in Section 4.4.

Table 17 Comparison of Potential Parking Supply Spaces

Land Use	TMAP Mod 2	TMAP Mod 4	TMAP Mod 8
Commercial / Mix Use	673	652	647
Hotel	146	156	500*
Residential	771	1,166	2,205^
Parkland public car park	300	300	300
<b>Total on site</b>	<b>1,187</b>	<b>2,274</b>	<b>3,652</b>
Hickson Road on-street parking	125	125	125
On-Street parking within Barangaroo	275	275	25 (Barangaroo South) 15 (Barangaroo Central)
Public buildings	16	16	16
Ports Parking	140	0	0
<b>Grand Total</b>	<b>2,446</b>	<b>2,690</b>	<b>3,833</b>

^ Based on indicative dwelling mix for residential uses. Final residential car parking provision to be determined at a later stage of the planning process

\* Includes parking related to the serviced apartments, retail and gaming component, and based on expected demand based on surveys of comparable facility. Excludes residential component. See Appendix A for further information

Since the September 2008 TMAP there has been further development with respect to planning for on-street parking within the Barangaroo precinct. A number of internal roads previously envisaged are now dedicated pedestrian routes. Further, the design development of both Lime Street and Globe Street has progressed to a stage where it is now known that space available for on-street parking is limited. The number of on-street parking spaces within Barangaroo has reduced from 275 to 40 (25 in Barangaroo South, 15 in Barangaroo Central).

The profile of car parking demand for the hotel (excluding residential uses) across a typical weekend demonstrates demand is likely to peak at approximately 800 spaces on a Friday and Saturday evening. 500 spaces may potentially be allocated for the non-residential uses within the hotel building. At all other times however, the on-site parking provision will accommodate the expected car parking demand for the hotel (excluding residential uses).

During periods when car parking demand may exceed visitors and staff of the hotel will be required to either use alternate transport or find parking in the surrounding road network and off-street publicly accessible commercial car parks. As demonstrated in Figure 9, there are numerous existing off-street publicly accessible commercial car parks located in proximity to the proposed hotel site which are expected to have sufficient capacity to accommodate any additional demand for car parking for the hotel (excluding residential uses) during the evenings.

Shared parking arrangements could also be established with nearby commercial buildings as an appropriate and efficient means of managing parking requirements. For example The Star has a similar arrangement with the Harbourside Car Park.

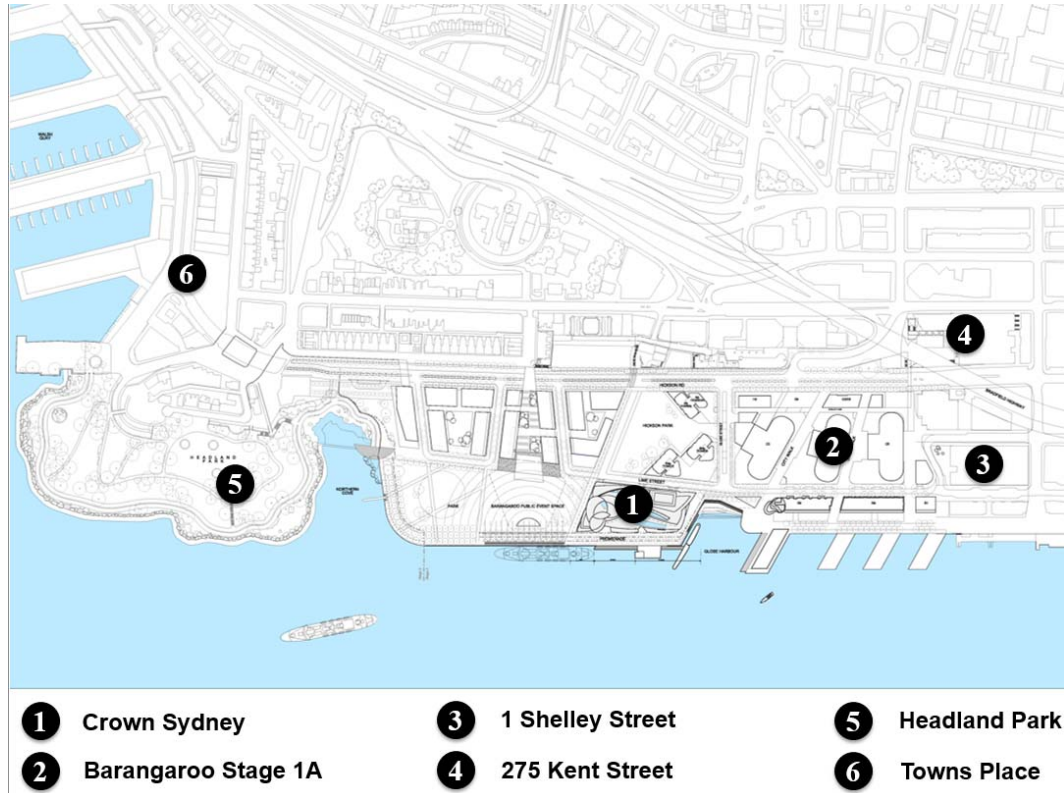


Figure 9 Public Off-Street Car Parks

#### 4.5.1 Car Park Management

The provision of car parking will be staged depending on the timing of the various components of the development. It is likely that various elements of car parking areas are managed in differing forms. The residential cars are likely to be managed through the owners corporation and transferred with individual apartments. The residential car parks will have controlled access. The commercial and retail car parking is likely to be managed as a common pool by a single operator.

## 4.6 Pedestrian Linkages

### 4.6.1 Pedestrian Context and Needs

High levels of pedestrian access are essential to achieving the low car mode share target that is critical to making the Barangaroo development successful. The committed mode share target for “Other” (which includes pedestrians and cyclists) is 12% for the journey to work to Barangaroo.

The Barangaroo Pedestrian Precinct Demand strategy, developed by Arup for Lend Lease (in conjunction with the Barangaroo Delivery Authority) in 2013, provides a summary of expected weekday, weekend, and event populations across the Barangaroo development site. This gives an estimation of the anticipated foot traffic along major pedestrian routes over different time periods.

The strategy identified high pedestrian activity at all times of the day travelling along two major corridors, those being:

- From Wynyard Station, across the Wynyard Walk bridge and through to the Barangaroo Ferry Hub and waterfront promenade; and
- From Wynyard Station, across City Walk bridge and through to Lime Street and the waterfront promenade.

A summary of the maximum expected pedestrian flows along key walkways is presented in Table 18.

Table 18: Maximum Hourly Pedestrian Movements

Link	Weekday AM	Weekday Midday	Weekday PM	Weekday Evening	Weekend
City Walk Bridge	3,827	2,366	3,180	2,557	1,829
Wynyard Walk Bridge	6,846	2,336	4,341	2,721	1,551
City Walk	4,637	4,926	4,196	2,759	1,880
Union Walk	3,463	3,105	2,744	1,087	583
Transport Place	5,342	2,144	3,426	2,457	1,436
Foreshore Promenade	748	2,091	1,448	793	2,294

It should be noted that the pedestrian volumes presented above represent a conservative scenario where the population densities and occupancy rates assumed for the various land uses within Barangaroo are higher than those in this TMAP report. This served the purpose of providing an estimate of the maximum number of pedestrian movements along various routes to inform the design of pedestrian walkways within Barangaroo South and ensure the peak pedestrian access demands may be accommodated. This is the case as described in the ensuing sections.



### 4.6.2 Pedestrian Routes and Facilities

For AM and PM peak period trips by workers at Barangaroo, the main pedestrian desire lines will be between the commercial development in the southern end of the site and Wynyard public transport hub. The main desire lines will change in the midday peak more towards mid-city areas. Outside peak periods, pedestrians will focus more strongly on access to Walsh Bay and King Street wharf areas along the waterfront promenade, as well as Wynyard and mid-city.

Appropriate at-grade pedestrian crossing facilities (either pedestrian signals or zebra crossings) are planned throughout the precinct to ensure pedestrians are provided with safe and efficient road crossing opportunities along key desire lines.

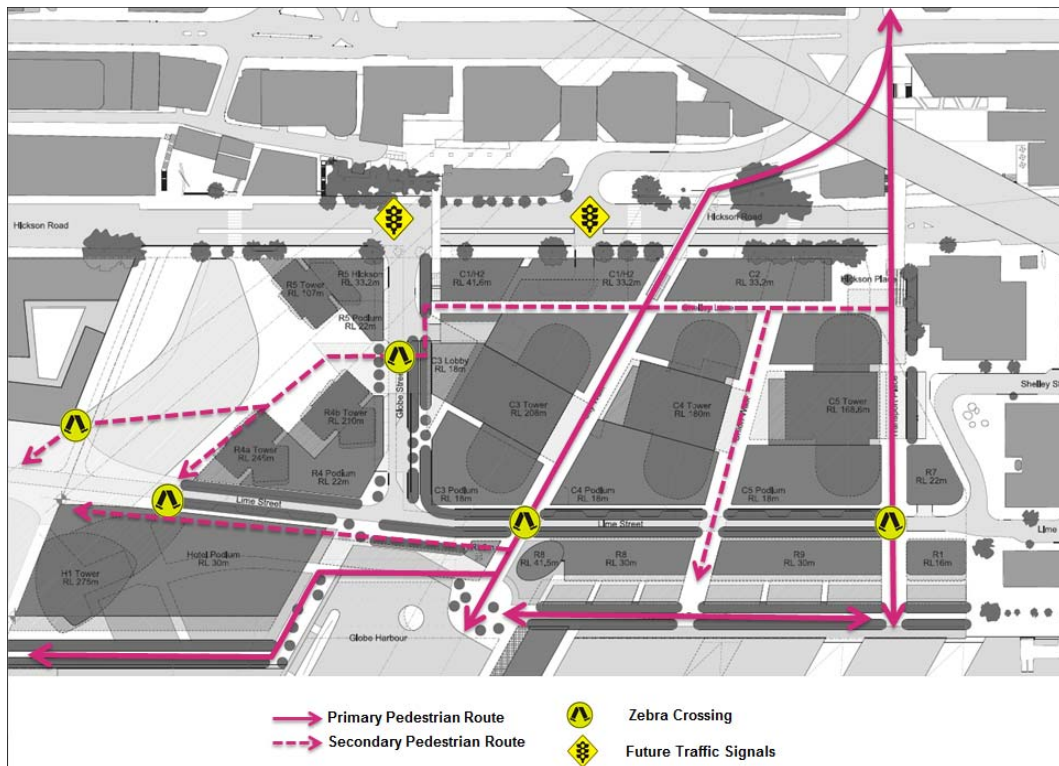


Figure 10 Major Pedestrian Routes

### 4.6.3 Pedestrian Linkages

For the ultimate Barangaroo development the following pedestrian linkages are proposed:

**Wynyard Walk:** The NSW Government has commenced work on Wynyard Walk (previously Barangaroo Pedestrian Link), a direct pedestrian link between the new Barangaroo development and Wynyard Station and transport interchange. The Wynyard Walk will provide a high level of access to public transport for the growing western corridor of the CBD, including Barangaroo and the King Street Wharf. Wynyard Walk will allow people to access Barangaroo from Wynyard Station in approximately six minutes. The Wynyard Walk bridge (over Sussex Street) will open in 2015, with the new tunnel connection to open in 2016. The proposed route for Wynyard Walk is shown in Figure 11.



Figure 11 Wynyard Walk (Source: REF April 2012, Transport for NSW)

**City Walk Bridge:** A new pedestrian link bridge over Sussex Street/Hickson Road located close to the intersection of Hickson Road and Napoleon Street which links into the Wynyard Walk. The facility will enhance connectivity between Barangaroo South and the Wynyard Station precinct. The bridge is forecast to be operational by 2015. An overview of the City Walk Bridge alignment is presented in Figure 12.

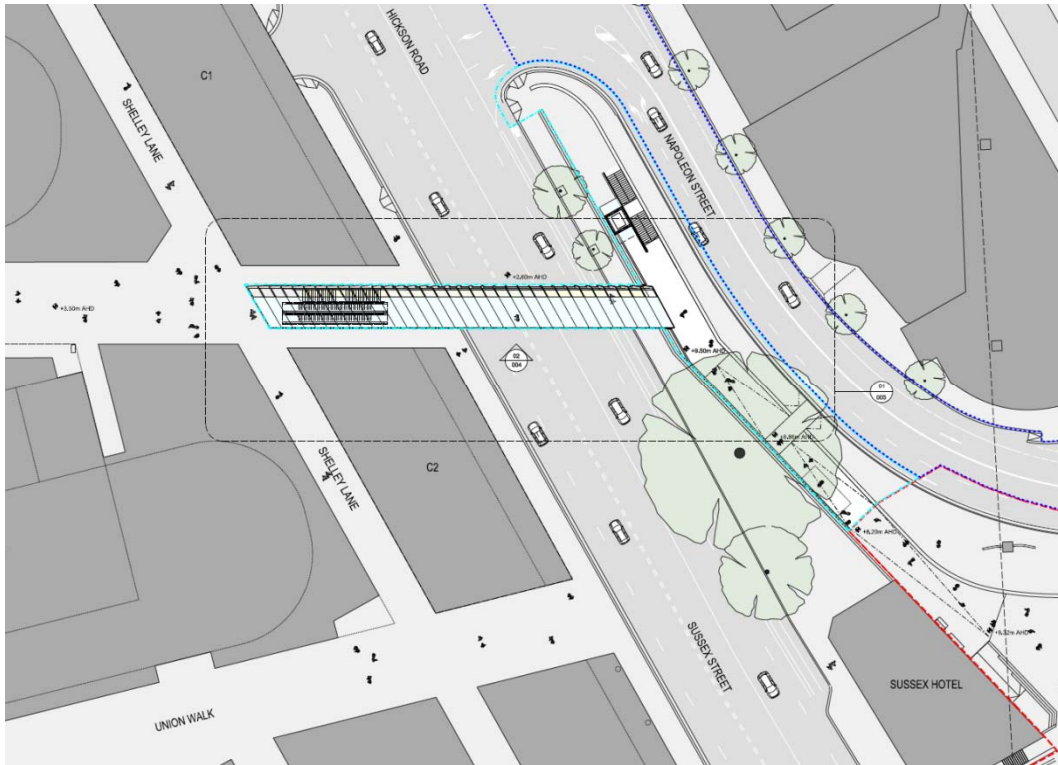


Figure 12 City Walk Bridge

A number of additional pedestrian connections are proposed to service the Barangaroo Central and Headland Park precincts. This includes new pedestrian bridges over Hickson Road at High Street and Jenkins Street, as well as a permeable internal pedestrian network which provides connections to Barangaroo South. These are consistent with the connections identified in the Barangaroo Integrated Transport Plan as illustrated in Figure 13.

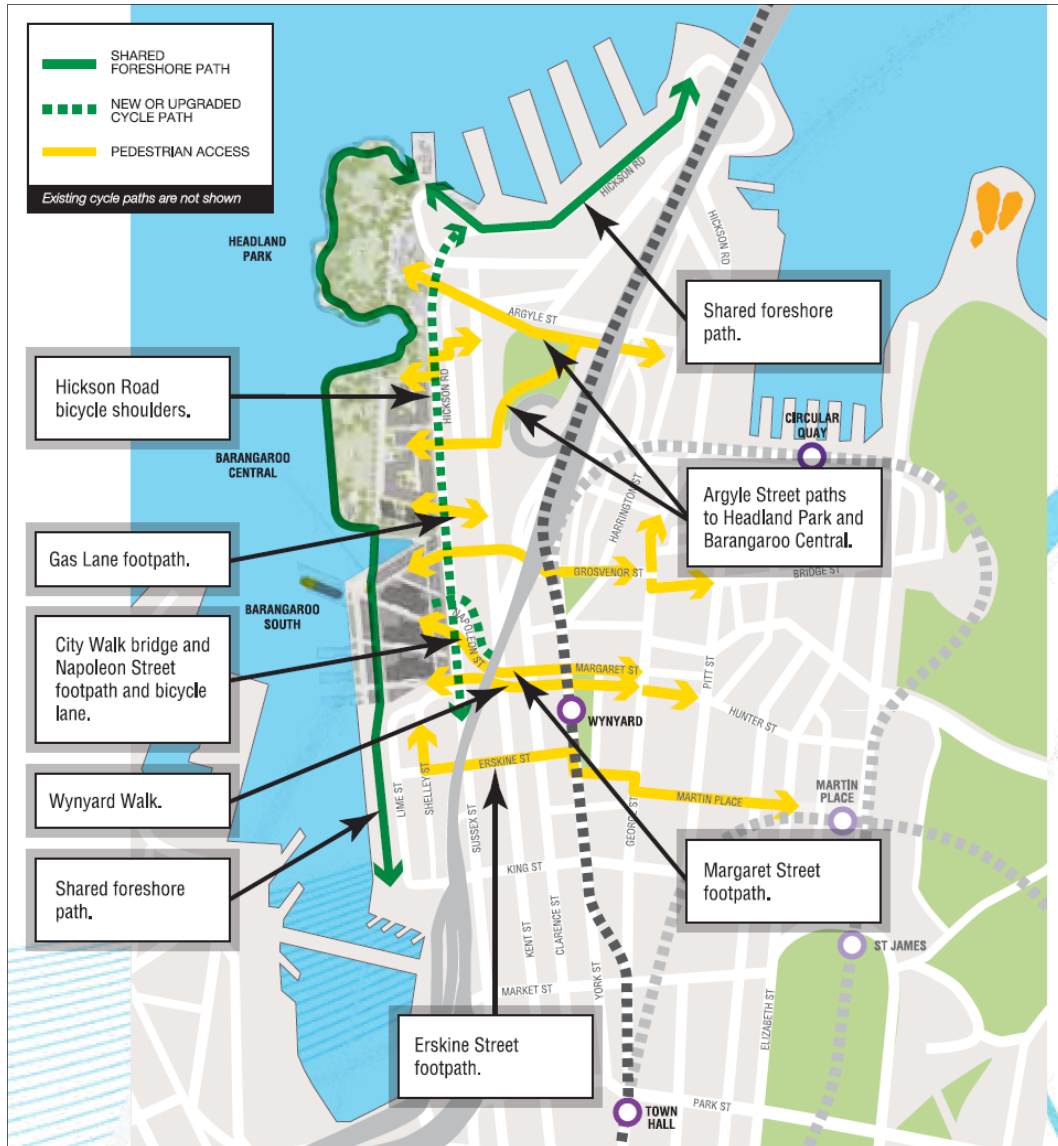


Figure 13 Pedestrian Routes

Source: Barangaroo Integrated Transport Plan, Figure 5

## 4.7 Cycling

### 4.7.1 External Bicycle Network

The Sydney City Centre Access Strategy outlines the future city centre cycleway network to encourage growth in cycling and reduce pressure on the public transport system. Measures proposed include:

- Extending the Kent Street cycleway south to Liverpool Street
- Construction of a bi-directional cycleway on Liverpool Street
- Construction of a bi-directional cycleway on Castlereagh Street and Pitt Street, providing a new north-south connection through the CBD
- Extending the existing King Street cycleway to Castlereagh Street
- Extending the east- west cycleway along Park Street to Castlereagh Street

The Strategy's strategic cycleway network map (see Figure 14) indicates future cycleway connections into Barangaroo to be via the Pyrmont Bridge cycleway and the Harbour Bridge cycleway. These new links are yet to be determined.



Figure 14 Strategic Cycleway Network Map

Source: Sydney City Centre Access Strategy (NSW Government, 2013)

The primary route for riders travelling to Barangaroo South from the north (via the Sydney Harbour Bridge cycleway) will be via the new cycleway along Napoleon Street. This is consistent with the City of Sydney cycling strategy. An alternative route exists via Argyle Street, Dalgety Road and Hickson Road. Many cyclists will find this route attractive given the low traffic volumes and the available road space.

Napoleon Street will form a key link for cyclists travelling between the Barangaroo South development and the existing separated cycleway on Kent Street. Discussions are currently ongoing with the road authority regarding the most appropriate facility to be provided at this location, however it is currently envisaged a bicycle lane will be provided for eastbound riders (uphill), with a mixed traffic environment in the westbound direction. This is consistent with that identified in the Barangaroo Integrated Transport Plan.

A bi-directional separated cycleway is envisaged on the eastern side of Hickson Road, up to the intersection with Towns Place. This is currently under investigation by Lend Lease in conjunction with the road authority and other stakeholders. Beyond this point, the existing single direction on-road cycle lane will facilitate the movement of cyclists onwards towards The Rocks and Circular Quay. It is assumed the cycleway will commence at Shelley Street, which will provide a link to the new Transport Place.

The future external bicycle network serving Barangaroo is outlined in Figure 15 on the following page.

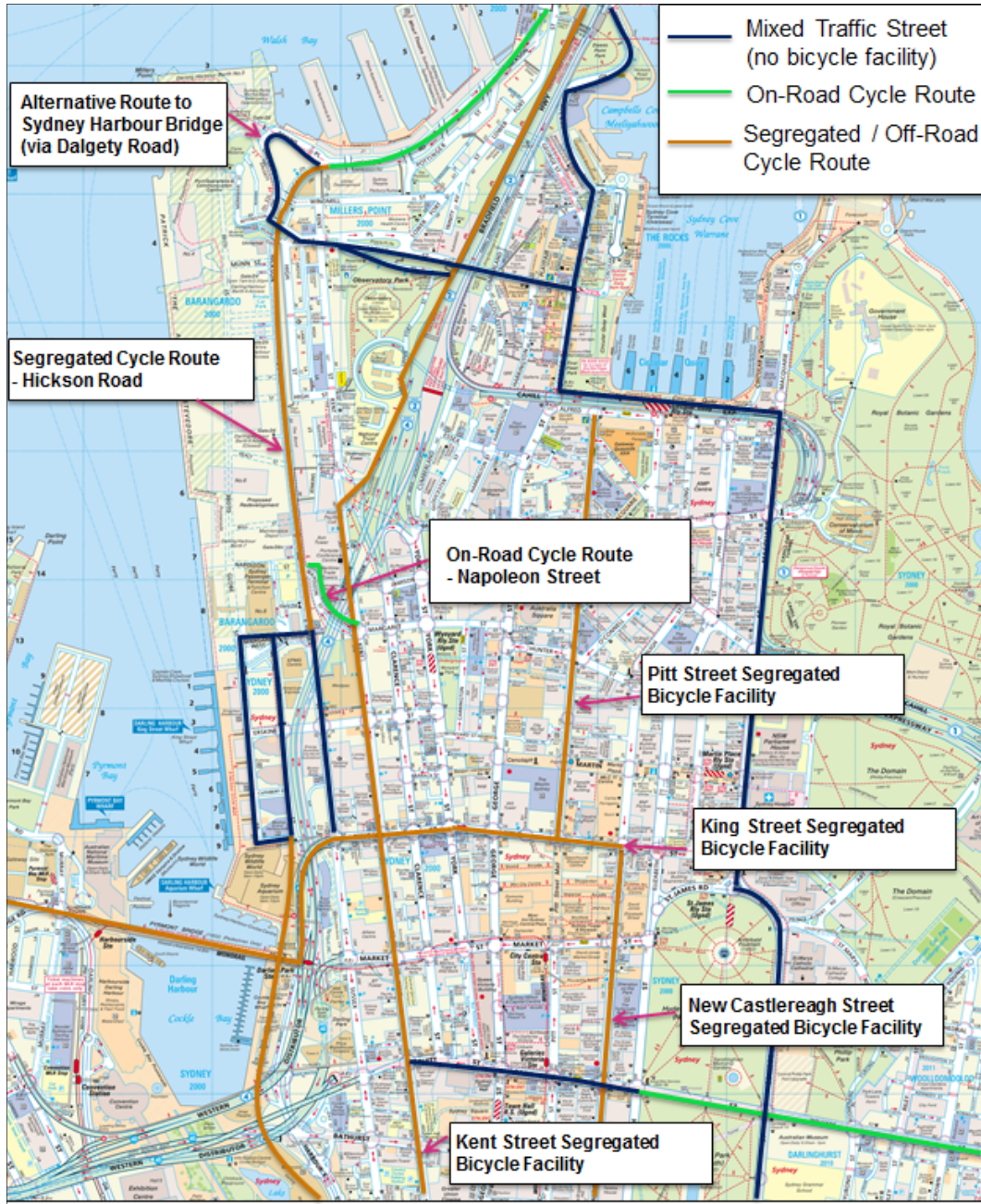


Figure 15 Future Cycleway Network

### 4.7.2 Internal Bicycle Network

Cycling within Barangaroo will be confined to the internal road network, i.e. along Globe Street and Lime Street. These will function as mixed traffic streets given the relatively low levels of vehicular traffic and anticipated 40km/hr speed limit. On-road bicycle symbols can be provided at minimum 200m intervals towards the centre of the travel lane to signify to drivers the presence of cyclists along these routes. The route along Lime Street will connect with a recreational cycle route which continues through Barangaroo Central and into Headland Park.

Given the high level of pedestrian movement, street furniture and retail/café activity on public pedestrian routes through Barangaroo (e.g. Union Walk, City Walk, foreshore promenade), these paths will not be signposted to permit cycling activity. The potential for pedestrian/cycle conflicts is considered too high in these areas to permit cycling movements. To travel through the Barangaroo precinct, cyclists will utilise the public roadways (Globe Street and Lime Street) or dismount from their bikes and walk along the pedestrian routes. These pedestrian routes will be treated like any other footpath in the CBD, for example in Martin Place where cycling is not permitted.

The recommended internal cycle network is outlined in Figure 16.

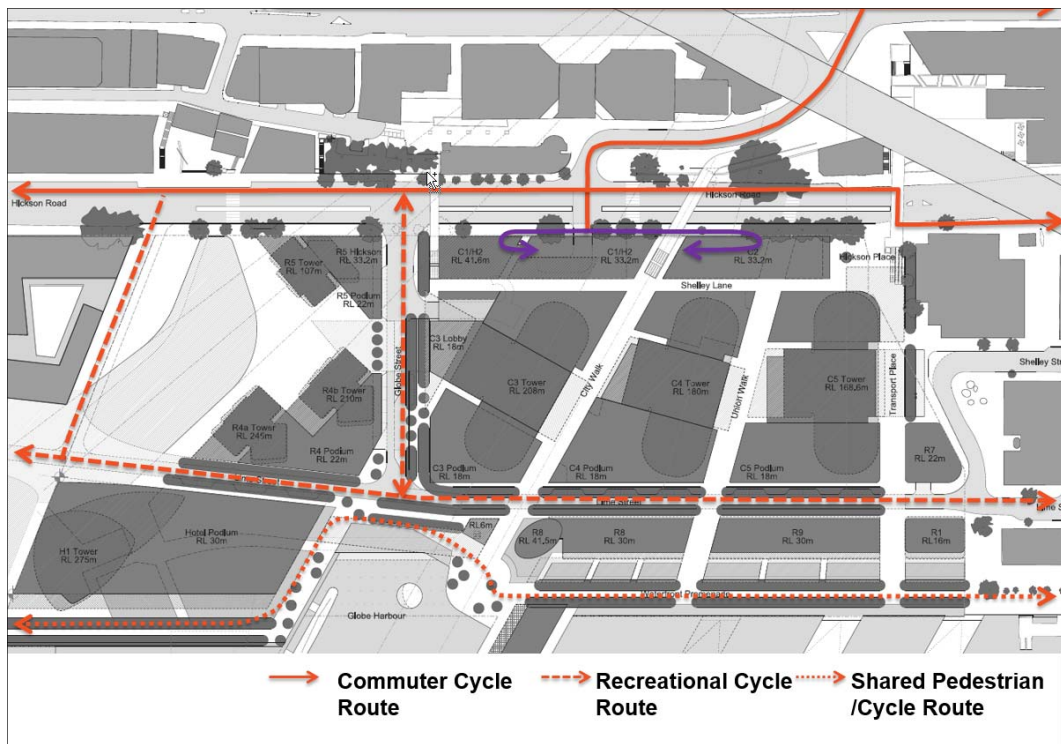


Figure 16 Barangaroo Internal Bicycle Network



### 4.7.3 Bicycle Parking and End of Trip Facilities

A minimum target of 5% of the commercial building occupants provided with a bicycle parking space has been adopted which aligns with the mode share target of 4% of journey to work by bicycle. Complementary end of trip facilities (e.g. lockers, showers and change rooms) will be provided for staff throughout the development.

Short term visitor bike parking will be available in the permanent public domain adjacent to major buildings. Bicycle parking spaces will be provided in the basement to meet the needs of the buildings tenants.

## 4.8 Heavy Rail and Metro Rail

The NSW Long Term Transport Masterplan released in December 2012 outlines a 20 year plan and includes the following rail projects for Sydney:

- North West and South West Rail Lines
- Second Harbour Crossing including new city rail line
- Wynyard Station improvement works

### 4.8.1 North West Metro

Although the Metro scheme has been cancelled by the NSW Government, the metro corridor under Barangaroo South is being maintained.

### 4.8.2 Wynyard Station

A significant number of work trips into Barangaroo are anticipated to occur by rail, with Wynyard Station to act as the major transport hub. Actions relating to Wynyard Station in the Sydney City Centre Access Strategy include:

- Better interchange facilities for rail and bus passengers at the station and at Barangaroo.
- Station refurbishment.
- Station upgrade in the longer term.

In May 2015 the NSW Government announced a \$100 million upgrade of Wynyard Station. The works include an upgrade to the CBD station's concourse and platforms, new lighting, tiling and signage to improve wayfinding.

Transport for NSW has engaged the Novo Rail Alliance to design and deliver \$10 million worth of early works for the station. Subject to planning approvals, major construction for the Wynyard Station upgrade will start in 2015 and is expected to finish in 2016. Key features of the works include:

- New, premium fixtures and finishes, such as lighting, tiling and painting;
- Widened paid concourse and ticket gates;
- Reduced clutter on the concourse and platforms;
- Upgraded existing and new platform stairs to improve pedestrian circulation and reduce queuing;
- New wayfinding and signage to make it easier for customers to move in and around the Station;
- Improving operational reliability through upgraded services and removal of redundant services; and
- Renovated back of house areas, including new and relocated Station Manager's office.

### 4.8.3 North West/South West Rail Link

The NSW Government is committed to building the North West Rail Link and South West Rail Link. Work continues on the projects including:

- Planning for the Rapid Transit System which will connect the 23km distance between Epping and Rouse Hill.
- Construction of the South West Rail Link, which includes 10.5km of twin track between Glenfield and Leppington, two new stations at Edmondson Park and Leppington, car parking and a train stabling facility at Rossmore. The project will be finalised in 2016

These two links are being integrated into the rail system as shown in the plan for operating trains in three tiers as shown in Figure 17



Figure 17 Future Sydney Rail Network

(Source: Sydney's Rail Future, TfNSW June 2012)

The North West Rail Link is planned by the NSW Government to run as a shuttle service between Chatswood and Cudgong Road in the North West growth sector. The proposed alignment is presented in Figure 18.



Figure 18 North West Rail Link Proposed Alignment

### 4.8.4 Sydney Rapid Transit

In June 2015 the NSW Government detailed plans to construct a new rapid transit network to deliver more train services across Sydney. The \$20 billion dollar investment plan extends the north west rail link (currently under construction) to Chatswood, under Sydney Harbour, through the CBD and on to Bankstown using new trains and fully automated rail system. Train frequencies will increase to every two minutes through CBD stations once completed.

Provision of a rapid transit line through the CBD would relieve pressure at Wynyard Station and provide an alternative public transport option for access to Barangaroo.

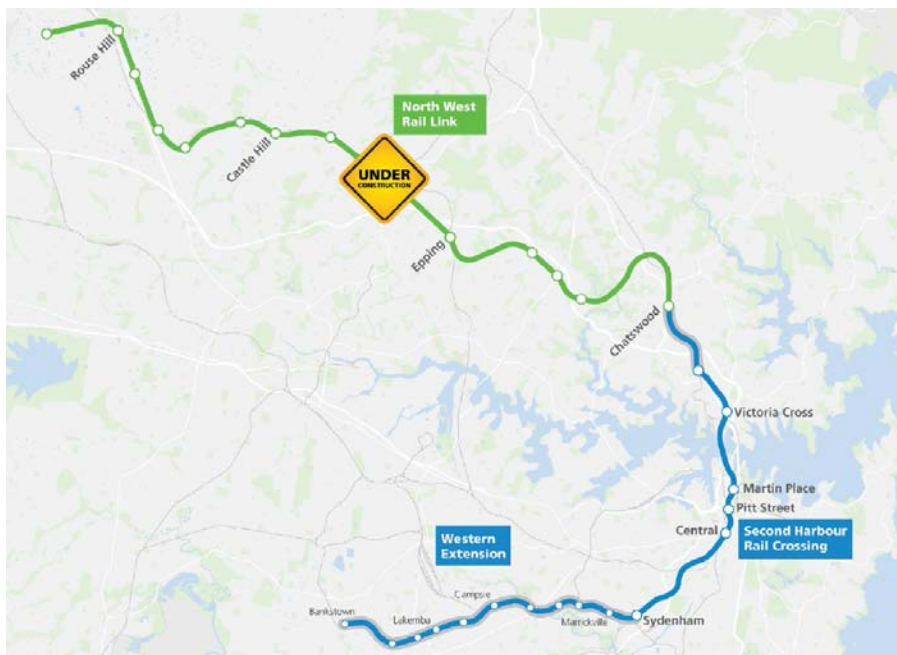


Figure 19 Sydney Rapid Transit Network

## 4.9 Bus Services

The Sydney City Centre Access Strategy outlines a redesigned bus network which improves bus reliability and address congestion and capacity constraints. Some of the key proposals relevant to the Barangaroo development include:

- New bus routes will run to Barangaroo and Walsh Bay via the city centre, Napoleon Street and Hickson Road
- Erskine Street to act as a key east-west bus corridor in the northern CBD
- The major bus stop precinct serving Barangaroo will be in the area surrounding Wynyard Station on York, Clarence and Kent Streets.
- Approximately every second bus service on key Inner West bus routes entering the city centre via Broadway will only operate to Central. This will reduce the number of buses unnecessarily entering the city centre. The remaining services will continue to the northern end of the city centre via Elizabeth Street northbound and Castlereagh Street southbound.
- Bus routes servicing the Eastern Suburbs will utilise Elizabeth Street. Passengers travelling to Barangaroo will alight at Martin Place and walk through the city and across Wynyard Walk

The future city centre bus network is summarised in Figure 20.

Locations for new bus stops to serve the future routes along Hickson Road and Sussex Street are currently being investigated by Transport for NSW. These stops would be in close proximity to Barangaroo South and provide good accessibility for commuters and visitors travelling to the precinct. The Barangaroo Integrated Transport Plan envisages two pairs of bus stops would be provided on Hickson Road to serve Barangaroo South and Central Barangaroo/Headland Park.

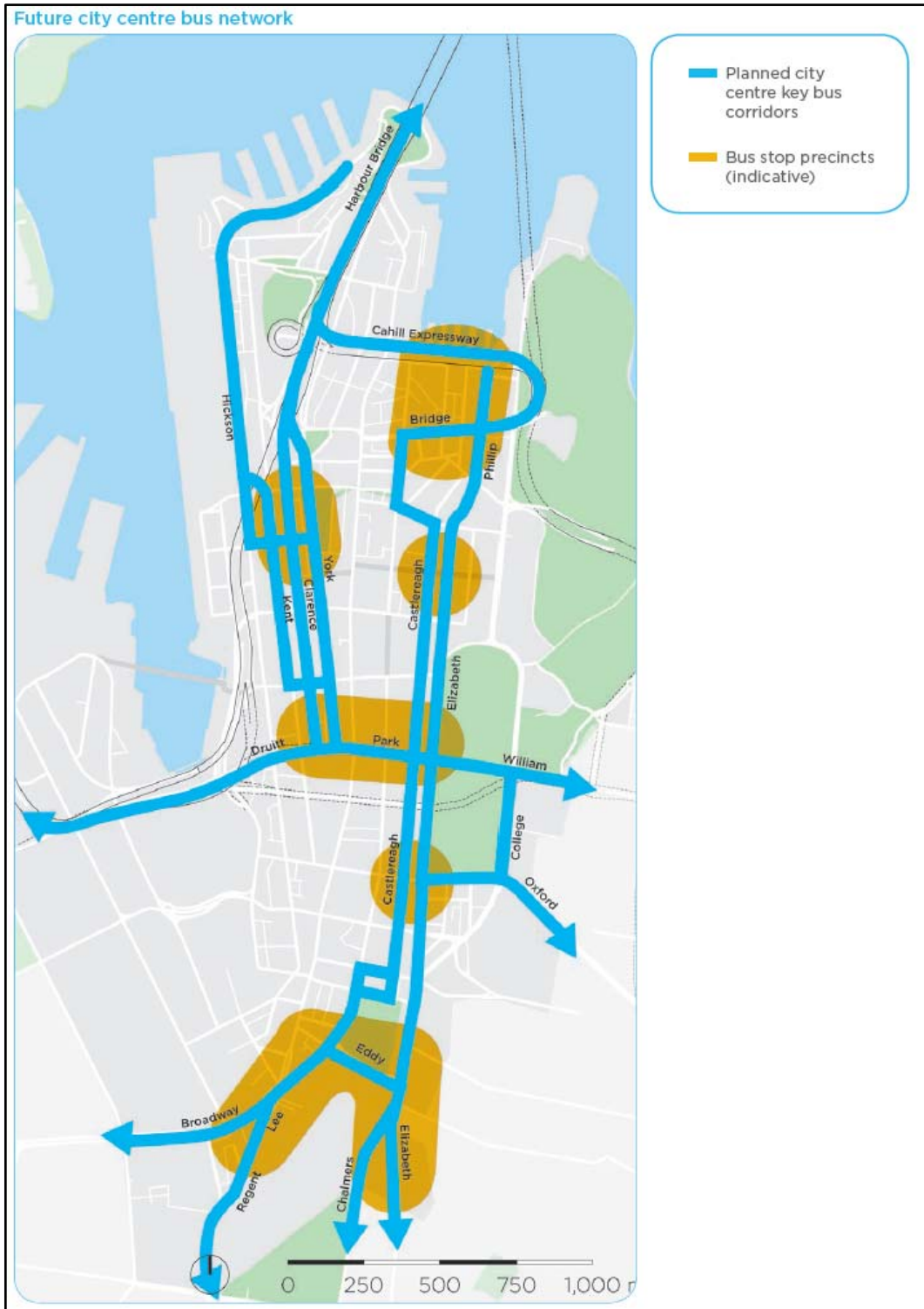


Figure 20 Future City Centre Bus Network

Source: Sydney City Centre Access Strategy (NSW Government, 2013)

The Barangaroo Integrated Transport Plan identifies bus service planning work to accommodate bus patronage access.

*Based on existing bus routes, Barangaroo workers and visitors travelling by Bus would mostly walk from Wynyard Bus Interchange, Town Hall, George Street or Elizabeth Street, depending on the origin of their trip. A few existing services terminate closer to Barangaroo, at Millers Point and at King Street Wharf.*

*There are opportunities to extend some bus services to terminate at Barangaroo, and the potential to introduce a bus service along Hickson Road to link the three parts of Barangaroo with the other foreshore attractions between Darling Harbour and Circular Quay, and to Haymarket to the South.*

*One aim of such services would be to provide opportunities for those commuters and visitors who are unable to walk from Wynyard or from other bus routes but are able to transfer between buses (for example, about 2,300 Barangaroo workers are forecast to commute by bus by 2024, and a proportion of those will want to transfer to a bus that terminates close to Barangaroo).*

## 4.10 Water Based Transport

Existing commuter ferry services providing access to Barangaroo and the CBD arrive and depart from King Street Wharf (number 3) and Circular Quay.

The Sydney City Centre Access Strategy commits to constructing a new ferry hub at Barangaroo, delivered in time for major tenants moving in to the development. This new wharf will support the commercial development of the precinct, with new ferry services anticipated from the east and north, as well as the existing western ferry catchments.

The new ferry hub will service the new development and connect ferry users to the western and midtown parts of the city centre via the Wynyard Walk link. It will reduce capacity constraints on the Circular Quay terminal and will bring additional ferry services and routes directly to Barangaroo.

The development of the new Barangaroo ferry wharf will not preclude provision for water taxis within Barangaroo. Planning for this mode of transport is ongoing, however it is envisaged a facility for these vessels would be provided in the vicinity of the southern cove.

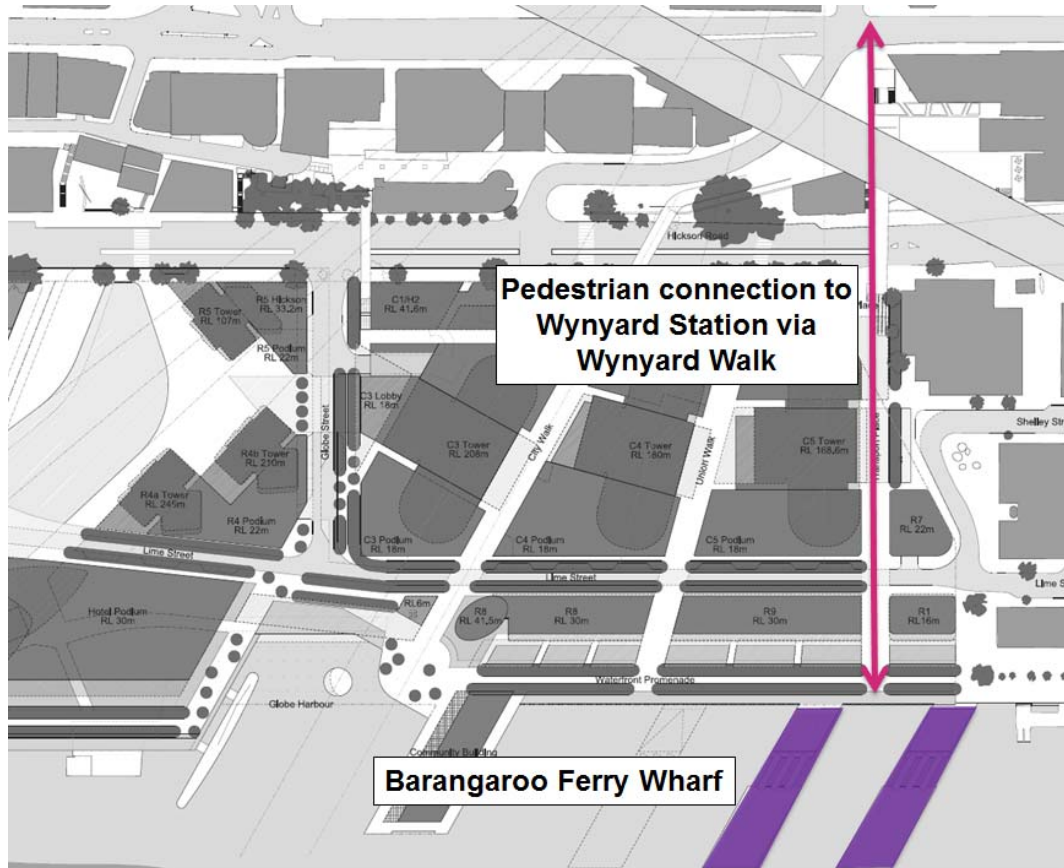


Figure 21 Barangaroo Ferry Wharf

## 4.11 Coaches

Allocation of kerbside space in vicinity of the hotel for coach set down / pick up is planned within the Concept Plan. This will service tour groups travelling to and from the hotel to other areas of Sydney. Additional on-street set-down and pick up space is understood to be provided within the Barangaroo Central precinct.

## 4.12 Light Rail

In December 2012, the NSW Government released 'Sydney's Light Rail Future'. This document details plans for expanding the existing light rail network to the Sydney CBD and South Eastern Sydney as well as the completion of the Inner West Light Rail extension. It could be expected that public transport patronage to Barangaroo from the inner west would shift mode from bus and rail as a result of these extensions.

### 4.12.1 Inner West Light Rail Extension

The first stage of the inner-west light rail extension is a 5.6km extension running between Lilyfield and Dulwich Hill as shown in Figure 22. It will run from the current light rail terminus at Lilyfield, along the disused freight rail corridor, to Dulwich Hill. The extension opened in March 2015.



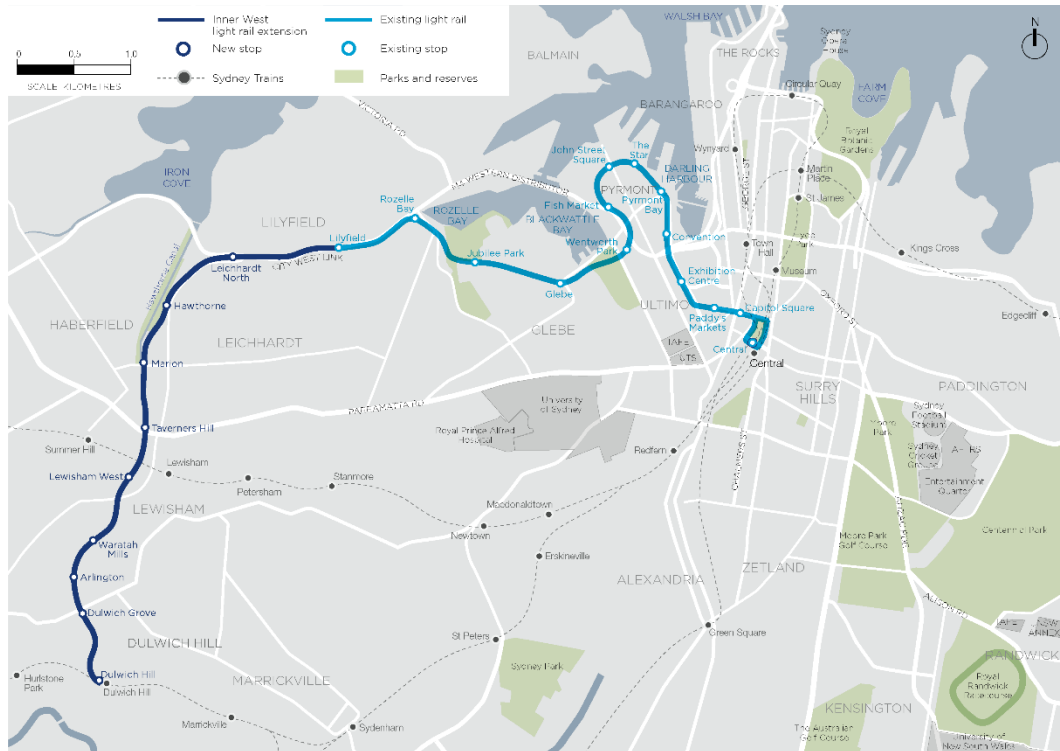


Figure 22 Inner-West Light rail extensions

#### 4.12.2 CBD and South East Light Rail

The CBD and South East Light Rail link will connect Circular Quay to the University of New South Wales via Anzac Parade and Alison Road. The integration of existing and planned light rail networks would further enhance patronage by this mode to Barangaroo. This link will include the pedestrianisation of a 1 kilometre section of George Street, between Bathurst and Hunter Streets. Construction is scheduled to commence in 2015 and will take five to six years to complete.



Figure 23 CBD and South East Light Rail Route Map

## 4.13 Taxis

A number of taxi ranks are proposed throughout the Barangaroo South precinct to serve the commercial, resident and visitor population. These will be strategically located to serve major buildings including the hotel, residential buildings and commercial towers, in line with the objectives outlined in the Barangaroo Integrated Transport Plan. Taxis will form an important component of the transport network serving Barangaroo, particularly for tourists and those departing the precinct late at night.

Current planning also allows for taxi ranks at the following locations:

- Western side of Sussex Street, opposite the Sussex Hotel;
- Northern side of Globe Street adjacent to Stage 1B development;
- Northern side of Shelley Street adjacent to Transport Place;
- Eastern side of Lime Street opposite the T2 building; and
- Western side of Lime Street near the hotel.

A summary of the taxi ranks currently planned for Barangaroo South is shown in Figure 24.

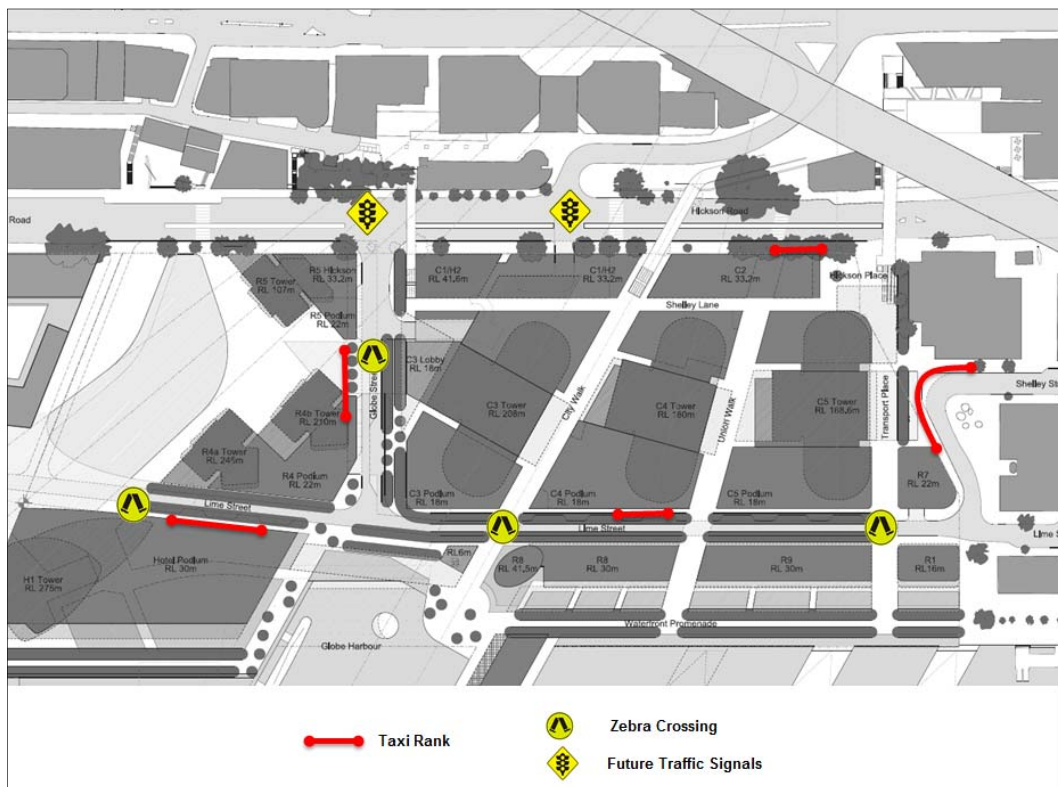


Figure 24 Proposed Taxi Ranks

Note: Indicative only, not to scale

Planning for taxi ranks in the Barangaroo precinct is currently ongoing, in consultation with key stakeholders including City of Sydney, Transport for NSW, the Barangaroo Delivery Authority and the RMS.

## 4.14 Late Night Transport Network

Barangaroo is a mixed use precinct which will generate activity at all hours of the day, including in the evening and late at night. A number of transport alternatives will be available at these times, including:

- Train services from Wynyard which run until 1am on weeknights on several routes, resuming again at 4.30am. On weekends the last train service departs Wynyard at 1.41am.
- Ferry services at the future Barangaroo Ferry Hub are expected to run until midnight seven days a week;
- Taxi services will provide an important form of late night transport for users, as they currently do at King Street Wharf. Taxis will be available at all hours of the night at the strategic taxi ranks identified in Section 4.13. These ranks will likely be managed during busy periods to accommodate the increased demands expected in the evening.

As bus planning for the precinct is currently still in progress, the availability of buses as a late night transport option is still to be confirmed.

## 5 Summary of Requirements

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### 5.1 Transport and Accessibility Framework

The transport and accessibility framework includes: overarching requirements, detailed requirements and timing and funding of relevant infrastructure.

### 5.2 Overarching Requirements

The main requirement for delivering a good quality transport network at Barangaroo is meeting the mode split target for journey to work trips with a very low private vehicle use of 4% and high use of public transport. The largest challenge will be meeting the 61% base mode share for rail which will require the provision of a safe and efficient pedestrian connection between the site and Wynyard station. This is being delivered through:

- The construction of the Wynyard Walk bridge and tunnel;
- The construction of the City Walk bridge; and
- \$100 million upgrade of Wynyard Station to provide additional capacity including upgraded existing and new platform stairs to improve pedestrian circulation and reduce queuing.

### 5.3 Detailed Requirements

#### 5.3.1 Road Network

- The journey to work mode share targets including the low share for car travel must be implemented;
- The proposed network must provide cohesive connections from Barangaroo to CBD streets and regional roads;
- Signalisation of intersections along Hickson Road at Napoleon Street and Glove Street will provide the primary vehicular access and egress points from Barangaroo South;
- Timely delivery and funding of the required road and intersection upgrades is essential; and
- All proposed road network changes and improvements are subject to approval by the road authority.

#### 5.3.2 Car Parking

- The parking rates adopted in this TMAP based on an assumed land use mix are to be applied;
- On-street parking supply must be short stay only and limited in number; and
- Limited parking is to be provided at Headland Park to cater for leisure and tourist requirements.

### 5.3.3 Pedestrian Connections

- The main route between Barangaroo and Wynyard Station will be facilitated via the Wynyard Walk – a high quality pedestrian connection which provides direct access to Barangaroo;
- Design and delivery of the Wynyard Walk is to be undertaken by the NSW Government; and
- Other grade separated connections between existing streets and Barangaroo will be implemented, including the City Walk pedestrian bridge.

### 5.3.4 Rail Services

- Improvements to Wynyard Station are proposed to be undertaken by the NSW Government to accommodate the significant increase in passenger throughput over the short and long term; and
- The construction of the North West Rail Link and South West Rail Link will improve rail access for those travelling to Barangaroo

### 5.3.5 Bus Services

- The Sydney City Centre Access Strategy outlines a redesigned bus network which improves bus reliability and addresses congestion and capacity constraints;
- New bus routes will run to Barangaroo and Walsh Bay via the city centre, Napoleon Street and Hickson Road; and
- Bus stops must be provided on Hickson Road to service new bus routes into Barangaroo

### 5.3.6 Ferry

- The introduction of a new ferry wharf at Barangaroo will improve accessibility via this mode of transport

### 5.3.7 Cycling

- The delivery of an enhanced cycleway network as outlined in the Sydney City Centre Access Strategy will provide improved connectivity to local and regional bicycle routes; and
- The inclusion of facilities for cyclists (e.g. bicycle parking) within the development in Barangaroo will promote travel via this mode.

### 5.3.8 Light Rail

- Design and delivery of light rail through the CBD and inner west by the NSW Government has the potential to shift mode from bus and rail as a result of these extensions.

### 5.3.9 Travel Planning

A series of Travel Demand Management Plans for the commercial and residential buildings in Barangaroo South has already been prepared in previous project applications. These plans outline measures that will be encouraged of future tenants to support sustainable modes of travel to Barangaroo and reduce car dependency. A summary of these measures are outlined below.

#### General Marketing and Promotion

The objectives of the TDMP will only be achieved with the support of building employees. Marketing the benefits and promoting the sustainable alternatives available are therefore crucial in encouraging staff to adopt the TDMP measures. It is important that at an early stage, staff are made aware of the need for the TDMP, and that it is emphasised that the measures are being introduced to support and encourage people to use cars more wisely. In addition to raising general awareness, any successes achieved will be fully publicised to staff in order to motivate them to use sustainable modes of transport.

- A dedicated webpage for employees commercial buildings will be created to include travel information section containing information on cycle parking and useful links to public transport websites specific to the office location.;
- Support and promote events such as National Bike Week, Bike2Work Days, walk to work day to staff through, broadcast messages and intranet.

#### Reducing The Need To Travel

To ensure that sustainable transport options are promoted to staff when making journeys for work purposes, and to reduce the need to travel, the following measures should be implemented. These measures require implementation by staff members across the building.

- Active promotion of the office teleconferencing facilities as an alternative to face to face meetings. This can be achieved by placing 'reducing the need to travel' as an item on internal group meeting agendas;
- Include teleconference meetings as a standard option in client proposals in preference to face to face meetings where practical; and
- Consider a more formal approach to working from home and actively encourage staff to consider this option. Include working from home as an item on the agenda for internal group meetings.

#### Spreading Travel Demand

Currently the highest travel demand occurs in the peak periods between 7am and 9am and 4pm to 6pm. Public Transport services are in lower demand and road congestion is lower during the inter peak and off peak. Tenants could be encouraged to implement flexible working hours allowing the employees to arrive at work and leave work during the shoulders of the peak e.g. start work at 10am and finish at 6.30 pm or start at 7am and finish at 3.30pm.

## Travel During the Working Day

To provide staff with a choice of convenient sustainable transport option for work – related travel during the working day the following initiatives should be promoted:

- Use of the Sydney Trains network to travel to places that are on or near a train line;
- Walk to places that are close by rather than taking the taxi;
- Promotion of the taxi pooling system which would cross check for common destinations and inform the passenger of possible taxi pooling options.

## Cycling

In order to activate and promote cycling the following measures should be taken:

- Provide Sydney cycle maps to staff;
- Participate in annual events such as 'Ride to Work Day';
- Provide secure bicycle parking and end of trip facilities for building staff
- Broadcasts in staff areas should have news of events / generic posters promoting cycling;
- Staff who cycle to work should be encouraged to form a Bicycle User Group in order to provide a body of regular cyclists who can discuss issues relating to the provision of on-site cycling facilities and the maintenance of off-site cycle routes; and
- Set up 'Bike Buddies' scheme for less confident staff interested in cycling.

## Public Transport

To promote the use of public transport work related trips and journeys to/from Barangaroo.

- Create and maintain an intranet 'Public Transport links page' containing useful links to journey planning websites in Sydney;
- Consider reimbursing or partially reimbursing staff for journey to work trips made by public transport;
- Consider providing interest-free loans for staff to buy an annual ticket for public transport;
- Provide useful public transport maps and promotional items to potential and current public transport users; and
- Investigate the possibility of purchasing an Opal Card for general use of building staff for business journeys, in lieu of cars and taxis

## Walking

Specific Travel Plan measures designed to encourage more walking trips to and from work by those employees living within a reasonable distance.

- Produce walking related articles for inclusion in the office newsletter focussing on 'walking champions' to highlight best practise in walking to business meetings;



- Create and maintain an intranet ‘useful walking routes’ containing useful routes to key parts of the Sydney CBD, including public transport terminals at Wynyard, Circular Quay, Martin Place and Town Hall rail stations;
- Participate in Walk to Work day.

### **Staff Induction**

To ensure new members of staff are aware of the Travel Demand Management Plan, all new staff members should be made aware of the Plan as part of their induction process. The TDMP section of the induction should provide new starters with the following:

- A brief introduction to the TDMP and its purpose;
- Tour of the office to include a visit to cycle parking areas and shower and changing facilities; and
- Provision of TDMP information which would include information on incentives to use sustainable means of transport e.g. /taxi share system.

### **Visitor Travel / Site Access Information**

For internal site access information, consider developing an interactive map to show useful walking routes, nearby public transport terminals and popular cycling routes to work, expanded to include additional local information useful to staff such as nearby shops and services or locations for recreational activities

## 5.4 Delivery and Timing

The various transport initiatives outlined in this strategy will be delivered primarily from government agencies with the exception of the commitments made by Lend Lease under their Project Development Agreement with the Barangaroo Delivery Authority. This is summarised in Table 19 below.

Table 19 Delivery and Timing of Transport Measures

Measure	Description	Responsibility for Delivery	Estimated Timing
Road network modifications	Signalisation of Hickson Road / Napoleon Street	Lend Lease, City of Sydney and BDA	2015
	Signalisation of Hickson Road / Globe Street	Lend Lease, City of Sydney and BDA	Prior to the opening of Stage 1B
Pedestrian connections	Wynyard Walk	TfNSW	2016
	City Walk Bridge	Lend Lease	2015
	Union Walk and City Walk (at-grade routes)	Lend Lease	2015
	Foreshore Walk	BDA	From 2015
Bicycle connections	Hickson Road bi-directional cycleway	BDA and City of Sydney	To be confirmed
	Napoleon Street eastbound cycle lane	BDA and City of Sydney	2015
Bus and coach services	Allocation of space on Hickson Road to accommodate future bus stops	TfNSW, City of Sydney and BDA	2015
	Allocation of kerbside space in vicinity of the hotel for coach set down / pick up	Lend Lease and BDA	To be confirmed
Taxi services	Provision of taxi ranks serving Barangaroo South	Lend Lease and City of Sydney	From 2015
Water based transport	Barangaroo Ferry Hub	TfNSW	2016

## 6 Conclusions

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This Transport Management and Accessibility Plan (TMAP) report supports a modification to Concept Plan (MP06\_0162) submitted to the Minister for Planning pursuant to Section 75W of Part 3A of the Environmental Planning and Assessment Act 1979 (EP&A Act). This report addresses the changes that have come about as a result of the proposed floor space modifications as well as any changes to the future public transport plans announced by the NSW Government. The report has considered the transport recommendations and findings of a number of key planning documents relevant to the Barangaroo Precinct, those being:

- Barangaroo Integrated Transport Plan;
- NSW Long Term Transport Masterplan;
- Sydney City Centre Access Strategy

Initial planning approval for Barangaroo South was based on the principle of achieving high usage of public transport, walking and cycling as a method of travel to work, with a target of 4% by car. The mode split targets have been largely retained in this TMAP report, with the exception of ferry trips which has increased to a minimum of 4% of all journey to work trips.

A cumulative traffic analysis has been undertaken which considers the development of the entire Barangaroo precinct - using the same transport principles and assumptions that were used for TMAP September 2008. A corridor traffic model was developed which assessed the future performance of the road network serving the precinct. The modelling indicated little difference in the road network performance due to the minor traffic increase arising from the Concept Plan modification. Changes in vehicle delays were found to be relatively minor in both the AM and PM commuter peak hours.

Car parking will be provided at the same parking ratios as used in TMAP September 2008, excluding for the hotel. Approximately 2,100 car parking bays are envisaged for the residential component of the development - based on an indicative dwelling mix. The quantum of traffic generated by the residential uses is based on the total number of dwellings provided and independent of the number of resident parking bays. The number of on-street parking spaces within Barangaroo has reduced from the 275 envisaged in the TMAP September 2008 to 40 – consistent with the transport planning principles for the precinct.

The Barangaroo precinct will be served by a number of pedestrian and public transport enhancement planned to be delivered in the coming years, including:

- Wynyard Walk pedestrian bridge and tunnel;
- City Walk pedestrian bridge;
- Expansion of the Sydney CBD cycleway network;
- Upgrades to Wynyard Station;
- Introduction of new bus routes to Barangaroo and Walsh Bay via the city centre;
- Provision of new taxi ranks within the Barangaroo precinct;
- Construction of a new ferry hub at Barangaroo; and
- Construction of the CBD and South East Light Rail link;

These improvements will accommodate the future population of the Barangaroo precinct by providing a number of viable (non private vehicle) transport options – meeting the mode split target for journey to work trips by private vehicle of 4%. The works will be delivered primarily from government agencies with the exception of the commitments made by Lend Lease under their Project Development Agreement with the Barangaroo Delivery Authority.

## **Appendix A**

### **Hotel Traffic and Parking Generation Methodology**

# A1 Hotel Forecast Traffic Generation

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## A1.1 Methodology

The primary document relating to traffic impact assessments in NSW is the RMS's *Guide to Traffic Generating Developments*. Traffic generation forecasts are typically based on rates per m<sup>2</sup> of GFA development for each type of land use, or other factors including parking provision or dwelling numbers. Rates are usually derived from one of the following two sources:

- Standard rates contained in the RMS's Guide to Traffic Generating Developments; or
- Rates estimated on the basis of surveys of existing developments similar to the proposed development.

Traffic generation rates are heavily influenced by factors such as public transport availability, availability and cost of parking, mixed use and complementary nature of various land use components and peak traffic generation hours. The RMS guide notes that:

*Surveys of existing developments similar to the proposal, can also be undertaken and comparisons may be drawn. By simplifying generation rates, site-by-site variations from the average are not taken into account.....Departures from the average generation rates for individual development proposals may be adopted, in which case such a departure should be justified with relevant supporting facts.*

Given the unique nature of the proposed hotel at Barangaroo South, the most appropriate method to forecast future traffic generation is to refer to development with similar characteristics (e.g. with components of retail, tourist and gaming facilities). The Crown resort in Melbourne was identified as a suitable site.

To facilitate this study, Arup was provided with parking and traffic data by Crown. This included both video surveillance footage and entry/exit data from Crown's car parking areas. This is further described in the sections below.

## A1.2 Self-Park Traffic Movements

The methodology undertaken for forecasting the number of self-park traffic movements for the proposed hotel was as follows:

- The number of black, platinum and gold members entering and exiting the Crown Melbourne basement car park over the course of an entire year (broken down each hour for every day of the week) was recorded.
- Major event days (e.g. AFL grand final, Melbourne Cup) were excluded from the analysis to provide a typical representation.
- The data was then moderated based on the number of members anticipated for The proposed hotel relative to the total number in Crown Melbourne
- A profile of activity was then generated for the proposed hotel which considered all anticipated self-park arrivals and departures. It should be noted that the data was not moderated to match the anticipated capacity of the hotel basement – which is likely to be lower than that at Crown Melbourne.

Screenshots of the porte-cocheres taken from the surveillance footage are shown in Figure 25 and Figure 26.



Figure 25 Crown Melbourne VIP Gaming Porte-Cochere



Figure 26 Crown Melbourne Hotel Porte-Cochere

The forecast number of self-park arrivals and departures for a typical Friday and Saturday (the busiest days of the week) is shown in Figure 27 and Figure 28. The number of vehicles generated Monday to Thursday are generally significantly lower than those experienced on Fridays or Saturdays.

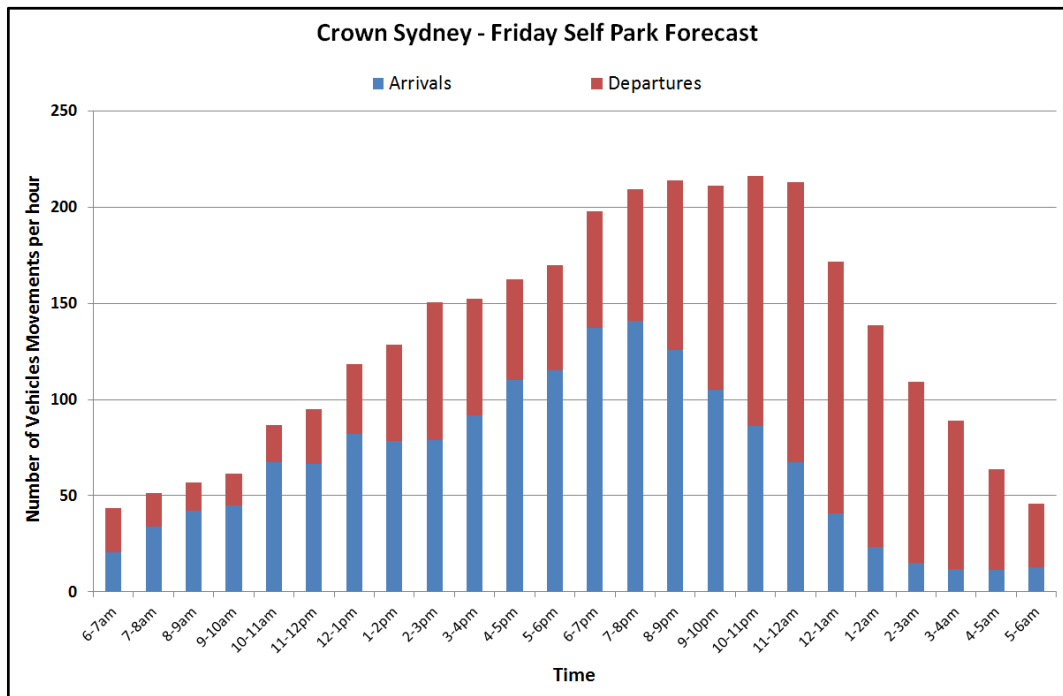


Figure 27 Friday Self-Park Traffic Movements



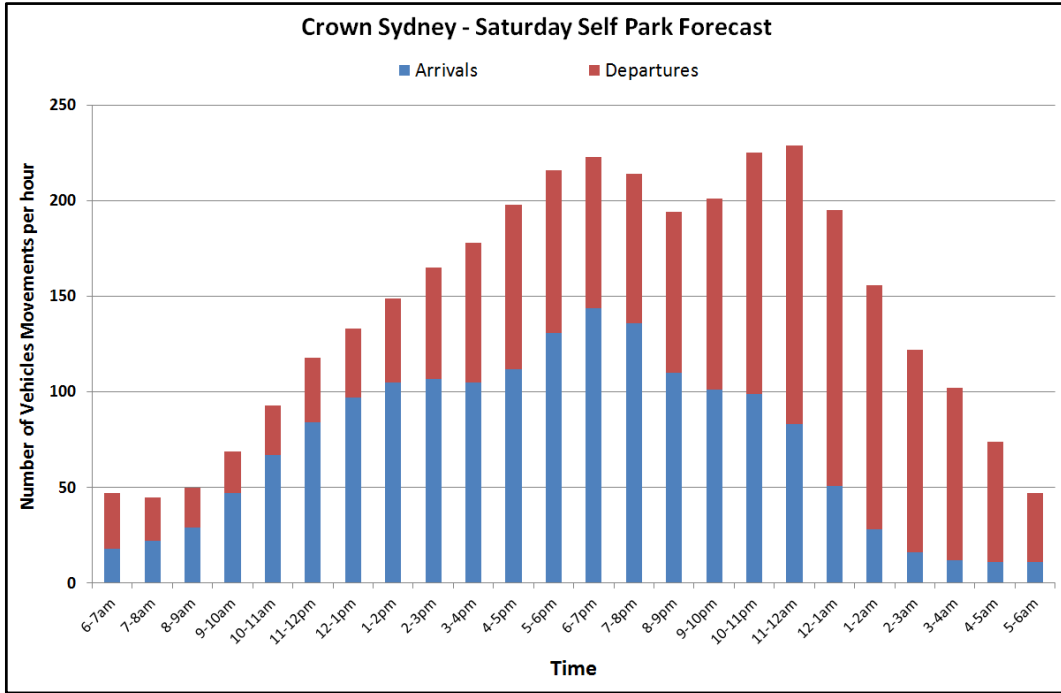


Figure 28 Saturday Self-Park Traffic Movements

### A1.3 Valet Movements

Arup studied surveillance footage of the Crown Melbourne southern and eastern porte-cochere to determine potential valet use over a typical Friday and Saturday. Traffic counts of chauffeured cars and valet vehicles were conducted between 7am and midnight to determine the likely level of traffic generated by the proposed hotel. These counts included traffic movements related to the hotel, VIP gaming, restaurant and function room uses.

The forecast number of valet arrivals and departures at the hotel porte-cochere for a typical Friday and Saturday are shown in Figure 29 & Figure 30.

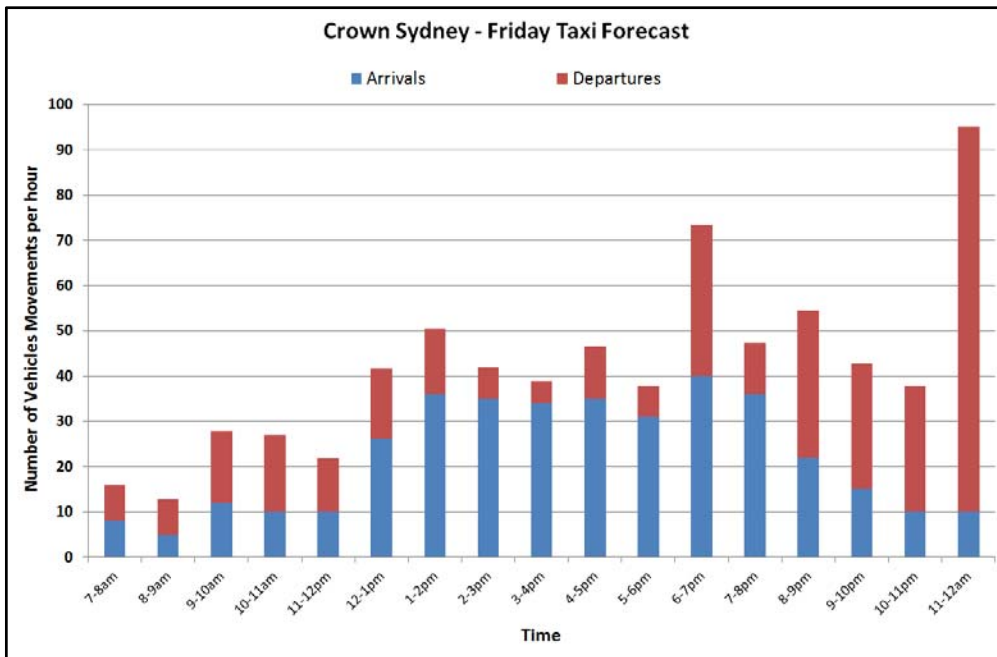


Figure 29 Friday Valet Traffic Movements

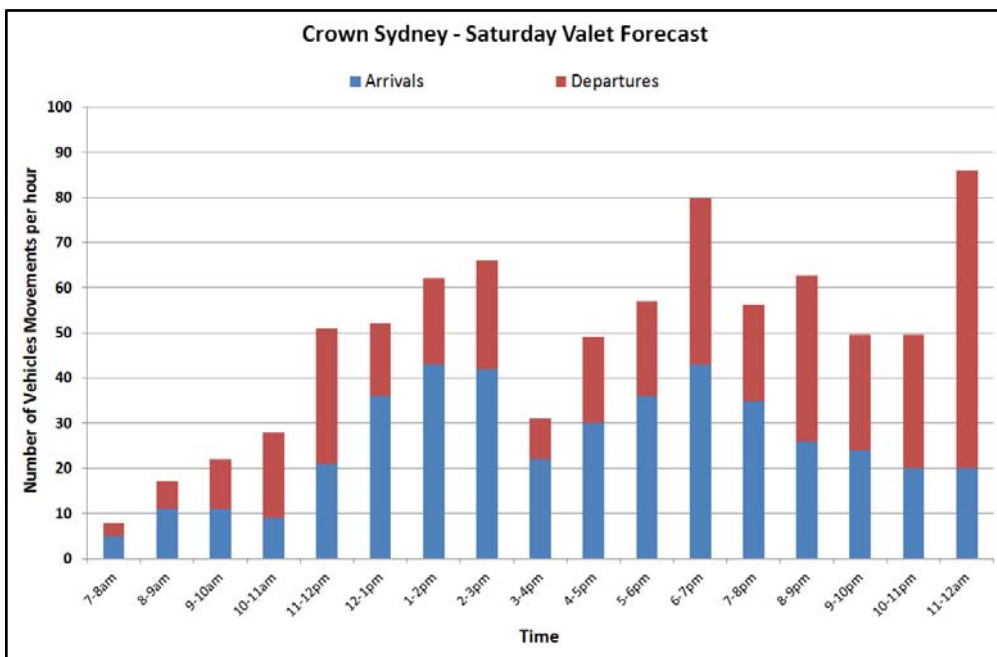


Figure 30 Saturday Valet Traffic Movements

## A1.4 Service Vehicle Movements

To estimate the likely level of service vehicles generated by The proposed hotel, Arup studied video footage of similar loading dock facilities in two Crown properties in Melbourne. Surveillance footage was studied between 5am and 5pm for Friday 30 August which is typically the busiest day of the week in terms of loading activity. The properties studied were:

- Crown Metropol (658 rooms plus restaurant, bar & retail)
- Crown Promenade (465 rooms plus restaurant, bar & conferencing)

Screenshots of the two loading docks taken from the surveillance footage are shown in Figure 31 and Figure 32. Key findings are as follows:

- During the AM peak period (7am – 10am), where pedestrian and vehicle volumes are generally highest, there were no more than 10 service vehicle movements generated by either Crown Metropol or Crown Promenade. This indicates that the majority of vehicle movements are more likely to occur during the middle of the day
- The majority of service vehicle movements were observed to be smaller delivery vans, with the remainder consisting of waste pick-ups, food deliveries and small to medium trucks (medium rigid vehicles)

The detailed survey results are provided in Table 20 and Table 21.



Figure 31 Crown Metropol Loading Dock



Figure 32 Crown Promenade Loading Dock

Table 20 Crown Promenade Loading Dock Counts

Vehicle Type	Total Service Vehicle Movements per Hour (In + Out)												Total In	Total Out	Total Movements	% of Total
	5-6AM	6-7AM	7-8AM	8-9AM	9-10AM	10-11AM	11-12PM	12-1PM	1-2PM	2-3PM	3-4PM	4-5PM				
Van	0	3	2	3	2	0	3	0	6	5	3	2	15	14	29	57%
Truck	0	1	1	0	2	2	2	3	4	3	1	1	10	10	20	39%
Garbage Vehicle	0	0	0	0	0	2	0	0	0	0	0	0	1	1	2	4%
<i>Total</i>	<i>0</i>	<i>4</i>	<i>3</i>	<i>3</i>	<i>4</i>	<i>4</i>	<i>5</i>	<i>3</i>	<i>10</i>	<i>8</i>	<i>4</i>	<i>3</i>	<b>26</b>	<b>25</b>	<b>51</b>	<b>100%</b>

Table 21 Crown Metropool Loading Dock Counts

Vehicle Type	Total Service Vehicle Movements (In + Out)												Total In	Total Out	Total Movements	% of Total
	5-6AM	6-7AM	7-8AM	8-9AM	9-10AM	10-11AM	11-12PM	12-1PM	1-2PM	2-3PM	3-4PM	4-5PM				
Van	0	0	0	0	5	6	1	2	3	4	1	2	12	12	24	62%
Truck	0	0	0	0	0	0	0	2	0	2	2	1	4	3	7	18%
Garbage Vehicle	0	0	1	3	0	0	2	0	1	1	0	0	4	4	8	20%
<i>Total</i>	<i>0</i>	<i>0</i>	<i>1</i>	<i>3</i>	<i>5</i>	<i>6</i>	<i>3</i>	<i>4</i>	<i>4</i>	<i>7</i>	<i>3</i>	<i>3</i>	<b>20</b>	<b>19</b>	<b>39</b>	<b>100%</b>

Based on these surveys, a revised profile of service vehicle movements for a busy Friday at the proposed hotel has been developed. This has assumed a total of 51 service vehicle movements, in line with that recorded at Crown Promenade. The breakdown of these movements is shown in Table 22 below

Table 22 Hotel Forecast Service Vehicle Movements

Time Period			Hotel Forecast Service Vehicle Movements			
			Vans	Trucks	Garbage Vehicles	Total
5:00	to	6:00	0	0	0	0
6:00	to	7:00	3	1	0	4
7:00	to	8:00	2	1	0	3
8:00	to	9:00	3	0	0	3
9:00	to	10:00	2	2	0	4
10:00	to	11:00	0	2	2	4
11:00	to	12:00	3	2	0	5
12:00	to	13:00	0	3	0	3
13:00	to	14:00	6	4	0	10
14:00	to	15:00	5	3	0	8
15:00	to	16:00	3	1	0	4
16:00	to	17:00	2	1	0	3
<b>Total Service Vehicle Movements</b>			<b>29</b>	<b>20</b>	<b>2</b>	<b>51</b>
<b>% of Total Movements</b>			<b>57%</b>	<b>39%</b>	<b>4%</b>	<b>100%</b>

## A1.5 Parking Provision

### A1.5.1 Parking for Non-Residential Uses

Based on the anticipated number of arrival and departures into the hotel basement (refer sections A1.2 and A1.3), the total parking demand for the proposed hotel can be estimated. This forecast demand, shown over a peak weekend period, is shown in Figure 33.

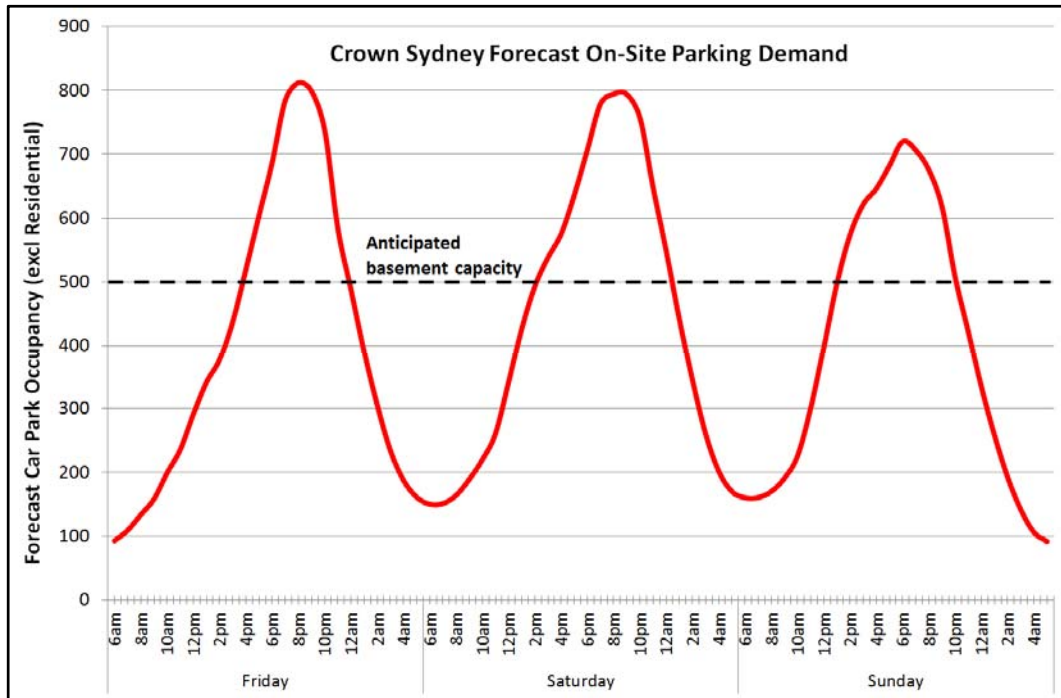


Figure 33 Hotel Forecast Car Parking Demand

This profile demonstrates car parking demand (excluding residential uses) will peak at approximately 800 spaces – above the anticipated 500 spaces to be allocated for non-residential uses. Other off-street car parks in the precinct, such as in the Barangaroo South 1A basement, may be utilised to accommodate the shortfall of approximately 300 spaces during peak periods.

### A1.5.2 Parking for Residential Uses

The level of parking for residential uses will be dependent on the final dwelling mix, however will be based on the following maximum car parking rates (consistent with those in Section 4.5 of the main report)

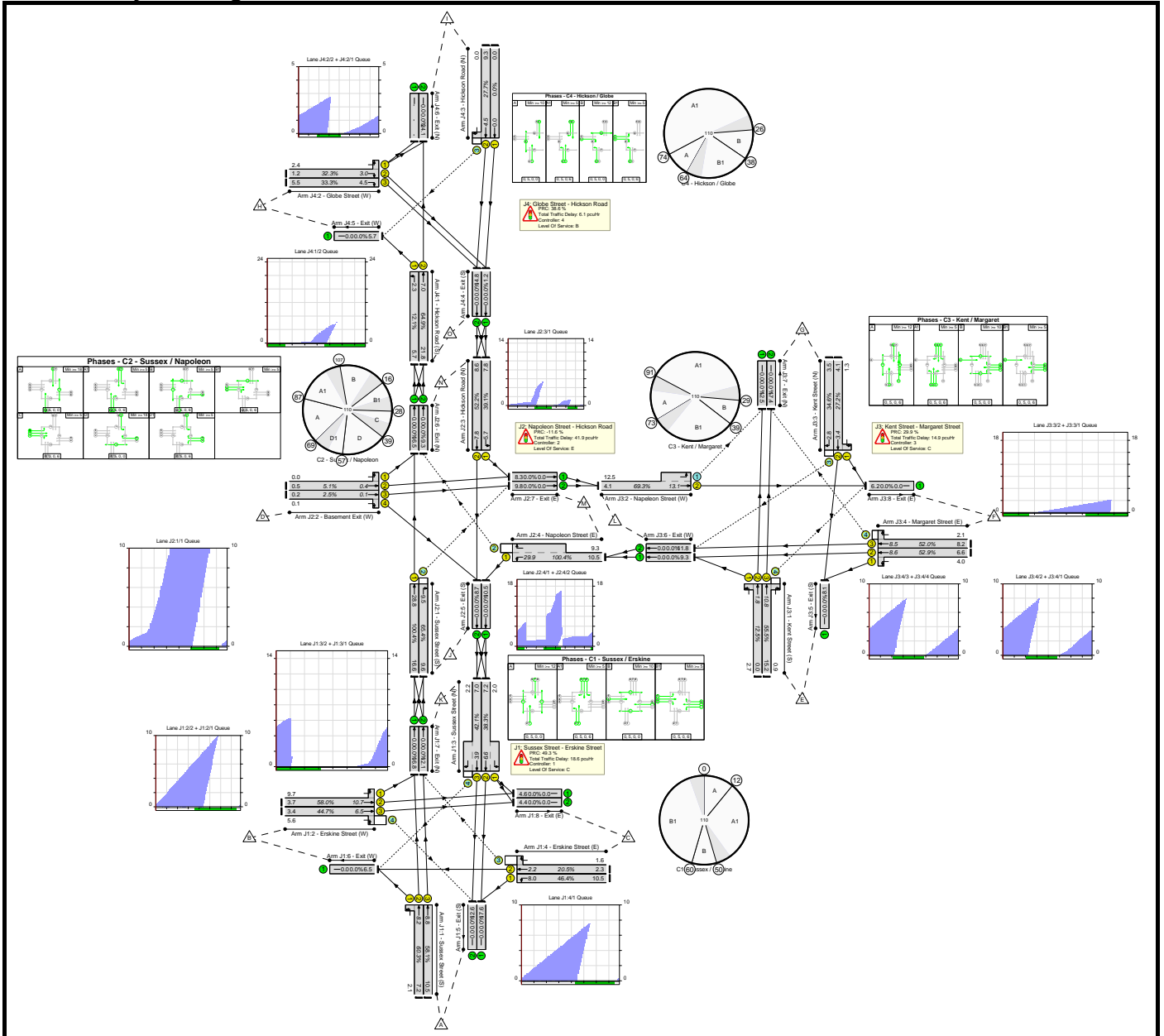
- Studio apartment: 0.25 spaces / unit
- 1 bed apartment: 0.50 spaces / unit
- 2 bed apartment: 1.2 spaces / unit
- 3 bed apartment: 2 spaces / unit

## **Appendix B**

### **LinSig Traffic Modelling Outputs**



Basic Results Summary  
**Scenario 2: 'AM Mod2'** (FG9: 'AM Future MOD2 Traffic', Plan 1: 'Future (with Basement)')  
**Network Layout Diagram**



Basic Results Summary

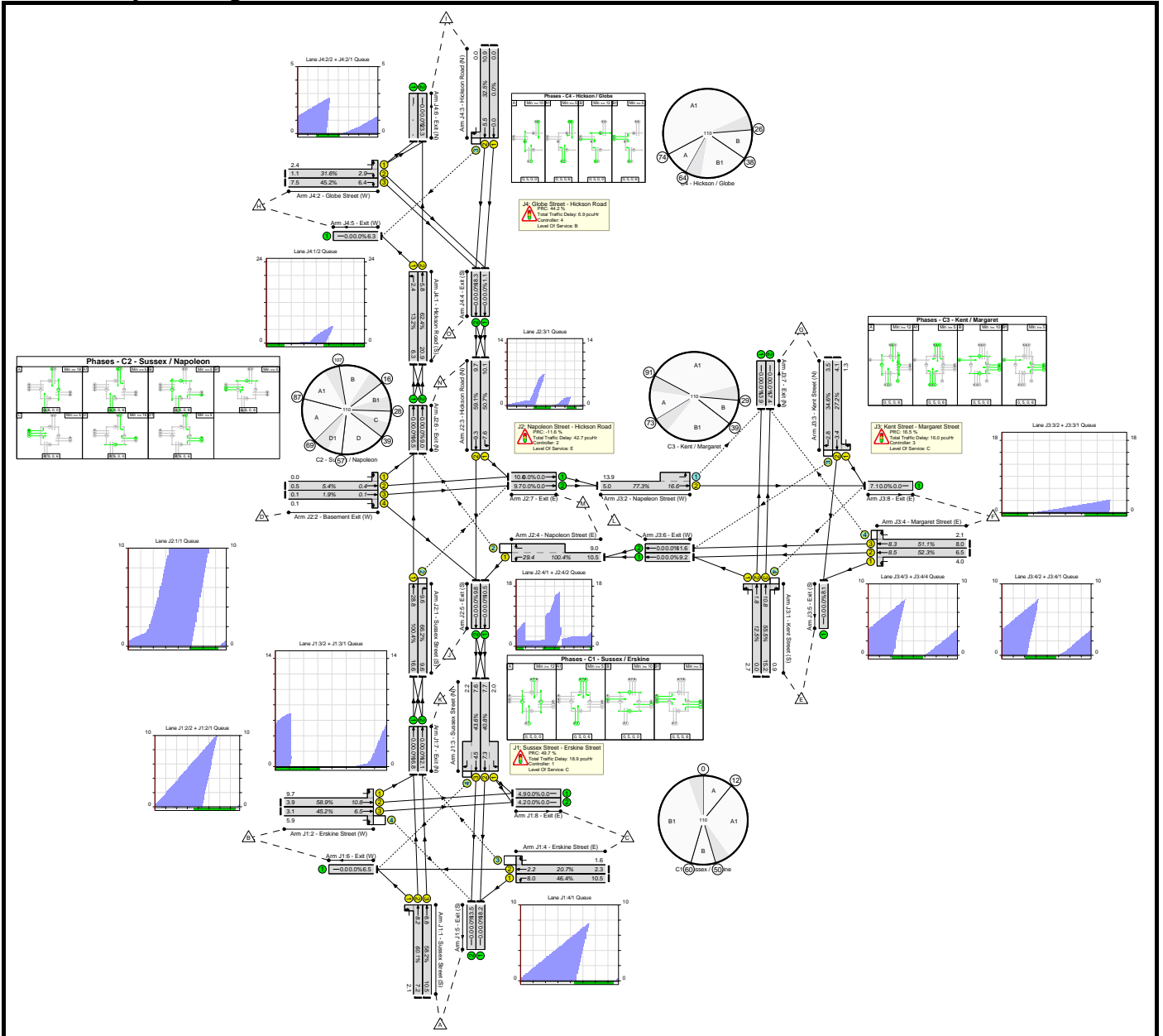
**Network Results**

Item	Lane Description	Lane Type	Deg Sat (%)	Av. Delay Per PCU (s/pcu)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Max. Back of Uniform Queue (pcu)	Mean Max Queue (pcu)
<b>Network: Linsig Modelling</b>	-	-	<b>100.4%</b>	-	-	-	-	-
<b>J1: Sussex Street - Erskine Street</b>	-	-	<b>60.3%</b>	-	-	-	-	-
1/2+1/1	Sussex Street (S) Left Ahead	U	60.3%	37.4	303	1440:1440	7.4	8.2
1/3	Sussex Street (S) Ahead	U	58.1%	32.4	342	1440	8.1	8.8
2/2+2/1	Erskine Street (W) Left Ahead	U	58.0%	30.2	436	1800:1800	10.0	10.7
2/3+2/4	Erskine Street (W) Right Ahead	U+O	44.7%	27.8	294	1800:1440	6.1	6.5
3/2+3/1	Sussex Street (N) Ahead Left	U	38.3%	18.4	300	1800:1800	6.3	6.6
3/3+3/4	Sussex Street (N) Ahead Right	U+O	42.1%	17.3	301	1800:1440	3.5	3.9
4/1	Erskine Street (E) Left	U	46.4%	28.3	342	1800	7.6	8.0
4/2+4/3	Erskine Street (E) Ahead Right	U+O	20.5%	23.1	128	1440:1440	2.1	2.2
<b>J2: Napoleon Street - Hickson Road</b>	-	-	<b>100.4%</b>	-	-	-	-	-
1/1	Sussex Street (S) Ahead	U	100.4%	120.7	542	1800	16.6	28.8
1/2	Sussex Street (S) Right	O	65.4%	34.4	315	1800	8.6	9.5
2/2+2/1	Basement Exit (W) Left Ahead	U	5.1%	45.3	15	1800:1800	0.4	0.4
2/3+2/4	Basement Exit (W) Right Ahead	U	2.5%	44.8	8	1800:1800	0.1	0.1
3/1	Hickson Road (N) Left	U	39.1%	13.4	256	1800	5.4	5.7
3/2	Hickson Road (N) Ahead	U	52.2%	30.8	282	1800	7.3	7.8
4/1+4/2	Napoleon Street (E) Left Right	U+O	100.4%	94.5	649	1800:1800	16.5	29.9
<b>J3: Kent Street - Margaret Street</b>	-	-	<b>69.3%</b>	-	-	-	-	-
1/2+1/1	Kent Street (S) Left Ahead	U	12.5%	24.4	88	1800:1800	1.7	1.8
1/3+1/4	Kent Street (S) Ahead Right	U+O	55.5%	20.1	526	1800:920	10.2	10.8

Basic Results Summary

2/2+2/1	Napeleon Street (W) Left Ahead	U+O	69.3%	19.5	544	920:1800	12.0	13.1
3/2+3/1	Kent Street (N) Ahead Left	U	27.2%	19.9	174	1800:920	3.2	3.4
3/3	Kent Street (N) Right	O	34.6%	35.2	116	1800	2.5	2.8
4/2+4/1	Margaret Street (E) Left Ahead	U	52.9%	33.3	348	1800:1800	8.0	8.6
4/3+4/4	Margaret Street (E) Ahead Right	U+O	52.0%	33.5	339	1800:1800	8.0	8.5
<b>J4: Globe Street - Hickson Road</b>	-	-	<b>64.9%</b>	-	-	-	-	-
1/1	Hickson Road (S) Left	U	12.1%	5.3	188	1800	2.2	2.3
1/2	Hickson Road (S) Ahead	U	64.9%	8.1	714	1800	6.1	7.0
2/2+2/1	Globe Street (W) Right Left	U	32.3%	44.2	117	1800:1800	2.8	3.0
2/3	Globe Street (W) Right	U	33.3%	34.9	180	1800	4.3	4.5
3/1	Hickson Road (N) Ahead	U	0.0%	0.0	0	1800	0.0	0.0
3/2+3/3	Hickson Road (N) Ahead Right	U+O	27.7%	12.4	304	1800:1800	4.3	4.5
C1 - Sussex / Erskine		PRC for Signalled Lanes (%):	49.3	Total Delay for Signalled Lanes (pcuHr):		18.63	Cycle Time (s): 110	
C2 - Sussex / Napoleon		PRC for Signalled Lanes (%):	-11.6	Total Delay for Signalled Lanes (pcuHr):		41.88	Cycle Time (s): 110	
C3 - Kent / Margaret		PRC for Signalled Lanes (%):	29.9	Total Delay for Signalled Lanes (pcuHr):		14.95	Cycle Time (s): 110	
C4 - Hickson / Globe		PRC for Signalled Lanes (%):	38.6	Total Delay for Signalled Lanes (pcuHr):		6.10	Cycle Time (s): 110	
			PRC Over All Lanes (%):	-11.6	Total Delay Over All Lanes(pcuHr):		81.56	

Basic Results Summary  
**Scenario 3: 'AM Mod8'** (FG5: 'AM Future MOD8 Traffic', Plan 1: 'Future (with Basement)')  
**Network Layout Diagram**



Basic Results Summary

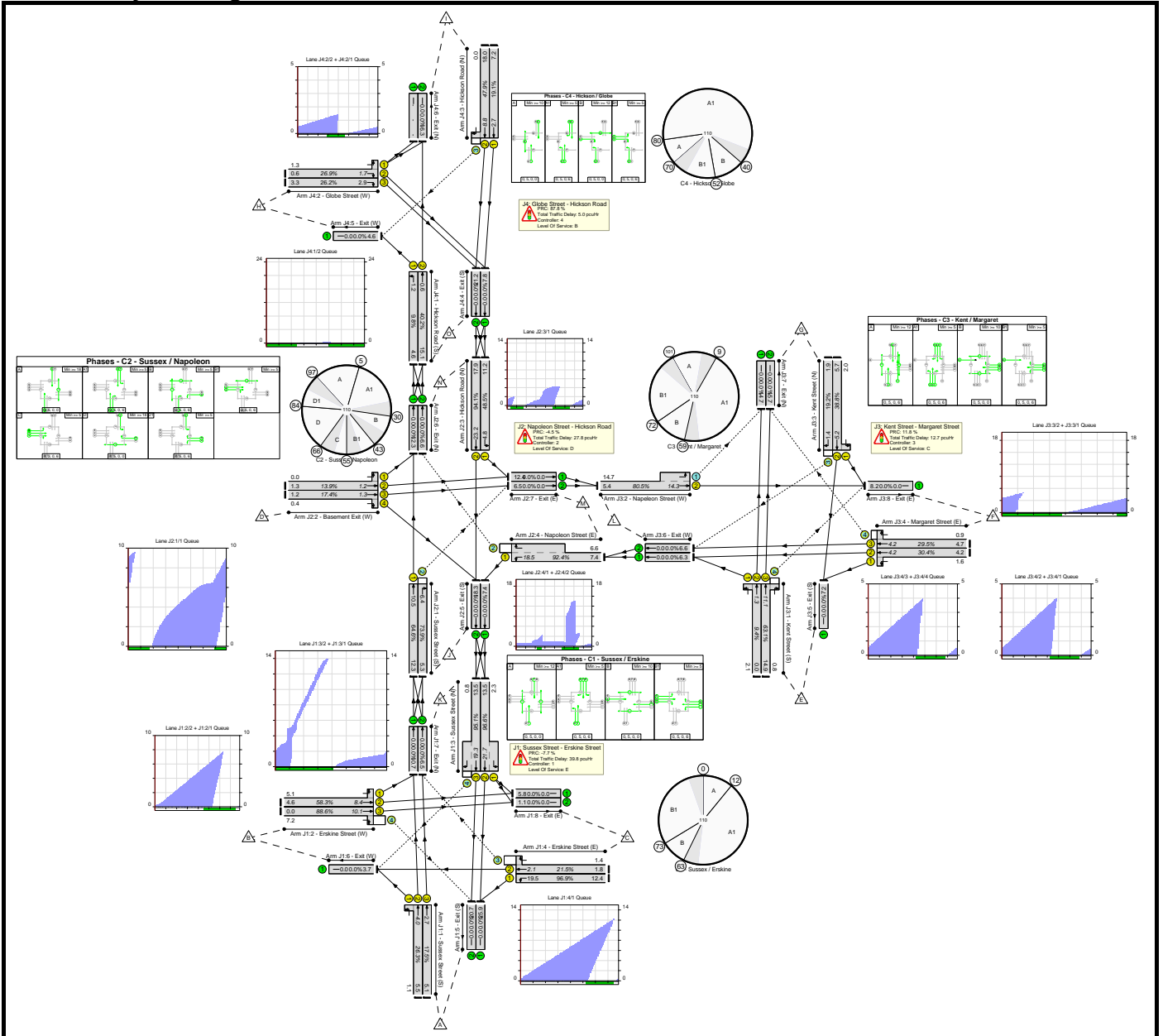
**Network Results**

Item	Lane Description	Lane Type	Deg Sat (%)	Av. Delay Per PCU (s/pcu)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Max. Back of Uniform Queue (pcu)	Mean Max Queue (pcu)
<b>Network: Linsig Modelling</b>	-	-	<b>100.4%</b>	-	-	-	-	-
<b>J1: Sussex Street - Erskine Street</b>	-	-	<b>60.1%</b>	-	-	-	-	-
1/2+1/1	Sussex Street (S) Left Ahead	U	60.1%	37.3	302	1440:1440	7.4	8.2
1/3	Sussex Street (S) Ahead	U	58.2%	32.5	343	1440	8.1	8.8
2/2+2/1	Erskine Street (W) Left Ahead	U	58.9%	30.4	443	1800:1800	10.1	10.8
2/3+2/4	Erskine Street (W) Right Ahead	U+O	45.2%	28.1	295	1800:1440	6.1	6.5
3/2+3/1	Sussex Street (N) Ahead Left	U	40.8%	18.3	318	1800:1800	6.9	7.3
3/3+3/4	Sussex Street (N) Ahead Right	U+O	43.6%	17.2	320	1800:1440	4.1	4.5
4/1	Erskine Street (E) Left	U	46.4%	28.3	342	1800	7.6	8.0
4/2+4/3	Erskine Street (E) Ahead Right	U+O	20.7%	23.0	129	1440:1440	2.1	2.2
<b>J2: Napoleon Street - Hickson Road</b>	-	-	<b>100.4%</b>	-	-	-	-	-
1/1	Sussex Street (S) Ahead	U	100.4%	120.7	542	1800	16.6	28.8
1/2	Sussex Street (S) Right	O	66.2%	35.0	315	1800	8.7	9.6
2/2+2/1	Basement Exit (W) Left Ahead	U	5.4%	45.4	16	1800:1800	0.4	0.4
2/3+2/4	Basement Exit (W) Right Ahead	U	1.9%	44.6	6	1800:1800	0.1	0.1
3/1	Hickson Road (N) Left	U	50.7%	15.4	332	1800	7.1	7.6
3/2	Hickson Road (N) Ahead	U	59.1%	33.0	319	1800	8.6	9.3
4/1+4/2	Napoleon Street (E) Left Right	U+O	100.4%	95.1	639	1800:1800	16.2	29.4
<b>J3: Kent Street - Margaret Street</b>	-	-	<b>77.3%</b>	-	-	-	-	-
1/2+1/1	Kent Street (S) Left Ahead	U	12.5%	24.4	88	1800:1800	1.7	1.8
1/3+1/4	Kent Street (S) Ahead Right	U+O	55.5%	20.1	526	1800:920	10.2	10.8

Basic Results Summary

2/2+2/1	Napeleon Street (W) Left Ahead	U+O	77.3%	24.1	619	920:1800	14.9	16.6
3/2+3/1	Kent Street (N) Ahead Left	U	27.2%	19.9	174	1800:920	3.2	3.4
3/3	Kent Street (N) Right	O	34.6%	35.2	116	1800	2.5	2.8
4/2+4/1	Margaret Street (E) Left Ahead	U	52.3%	33.1	344	1800:1800	7.9	8.5
4/3+4/4	Margaret Street (E) Ahead Right	U+O	51.1%	33.3	333	1800:1800	7.8	8.3
<b>J4: Globe Street - Hickson Road</b>	-	-	<b>62.4%</b>	-	-	-	-	-
1/1	Hickson Road (S) Left	U	13.2%	5.3	206	1800	2.4	2.4
1/2	Hickson Road (S) Ahead	U	62.4%	7.5	686	1800	4.9	5.8
2/2+2/1	Globe Street (W) Right Left	U	31.6%	44.2	114	1800:1800	2.7	2.9
2/3	Globe Street (W) Right	U	45.2%	37.2	244	1800	6.0	6.4
3/1	Hickson Road (N) Ahead	U	0.0%	0.0	0	1800	0.0	0.0
3/2+3/3	Hickson Road (N) Ahead Right	U+O	32.5%	12.9	356	1800:1800	5.2	5.5
C1 - Sussex / Erskine		PRC for Signalled Lanes (%):	49.7	Total Delay for Signalled Lanes (pcuHr):		18.91	Cycle Time (s): 110	
C2 - Sussex / Napoleon		PRC for Signalled Lanes (%):	-11.6	Total Delay for Signalled Lanes (pcuHr):		42.75	Cycle Time (s): 110	
C3 - Kent / Margaret		PRC for Signalled Lanes (%):	16.5	Total Delay for Signalled Lanes (pcuHr):		16.02	Cycle Time (s): 110	
C4 - Hickson / Globe		PRC for Signalled Lanes (%):	44.2	Total Delay for Signalled Lanes (pcuHr):		6.92	Cycle Time (s): 110	
			PRC Over All Lanes (%):	-11.6	Total Delay Over All Lanes(pcuHr):		84.60	

Basic Results Summary  
**Scenario 5: 'PM Mod2'** (FG10: 'PM Future MOD2 Traffic', Plan 1: 'Future (with Basement)')  
**Network Layout Diagram**



Basic Results Summary

**Network Results**

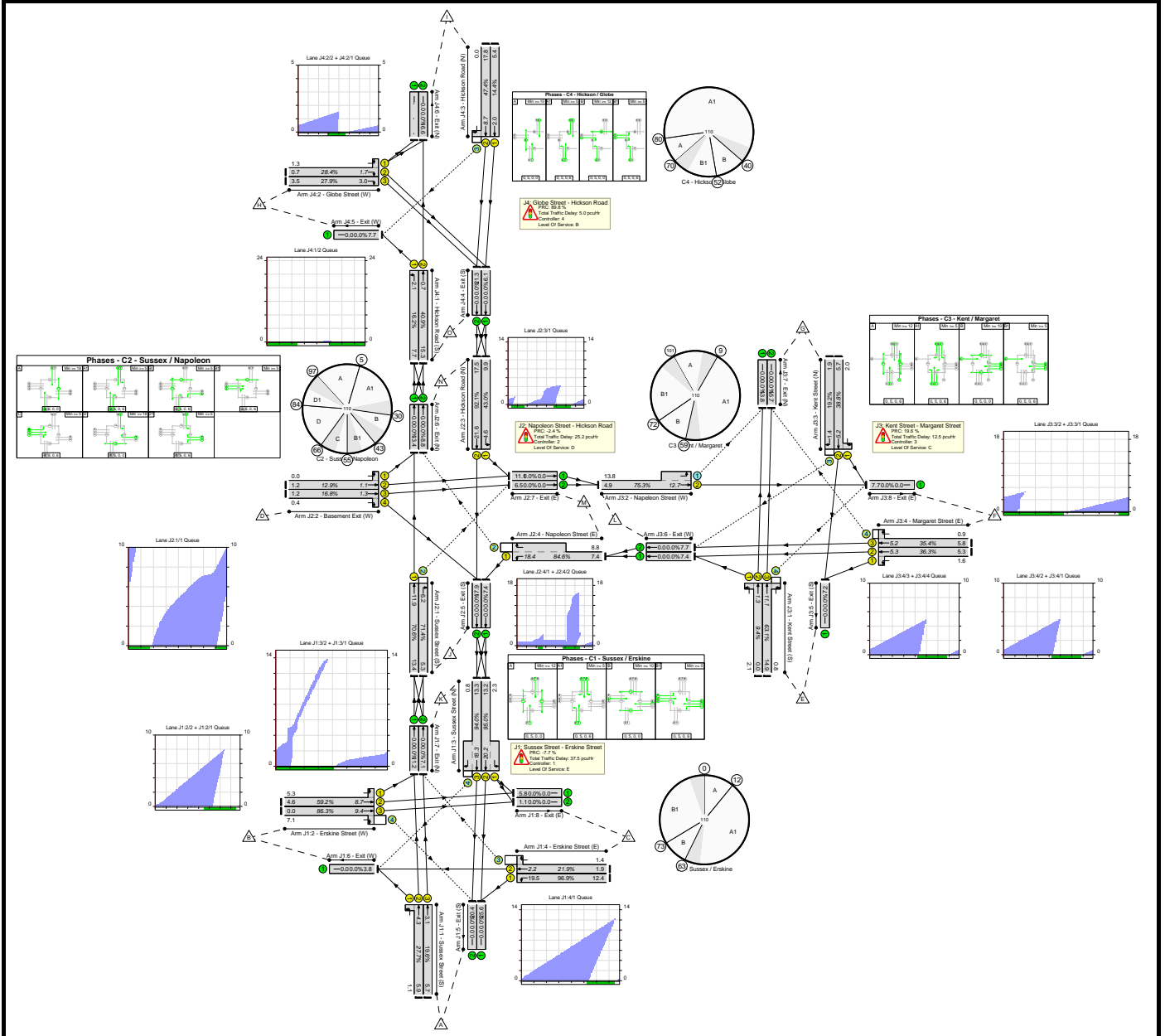
Item	Lane Description	Lane Type	Deg Sat (%)	Av. Delay Per PCU (s/pcu)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Max. Back of Uniform Queue (pcu)	Mean Max Queue (pcu)
<b>Network: Linsig Modelling</b>	-	-	<b>96.9%</b>	-	-	-	-	-
<b>J1: Sussex Street - Erskine Street</b>	-	-	<b>96.9%</b>	-	-	-	-	-
1/2+1/1	Sussex Street (S) Left Ahead	U	26.3%	18.2	216	1800:1440	3.8	4.0
1/3	Sussex Street (S) Ahead	U	17.5%	15.8	166	1800	2.6	2.7
2/2+2/1	Erskine Street (W) Left Ahead	U	58.3%	39.8	320	1800:1800	7.7	8.4
2/3+2/4	Erskine Street (W) Right Ahead	U+O	88.6%	86.0	237	1800:920	6.9	10.1
3/2+3/1	Sussex Street (N) Ahead Left	U	96.6%	61.8	515	920:1800	14.0	21.7
3/3+3/4	Sussex Street (N) Ahead Right	U+O	95.1%	56.6	466	900:1440	12.9	19.3
4/1	Erskine Street (E) Left	U	96.9%	103.7	406	1440	12.2	19.5
4/2+4/3	Erskine Street (E) Ahead Right	U+O	21.5%	31.8	106	1440:1800	2.0	2.1
<b>J2: Napoleon Street - Hickson Road</b>	-	-	<b>94.1%</b>	-	-	-	-	-
1/1	Sussex Street (S) Ahead	U	64.6%	40.1	402	1800	9.6	10.5
1/2	Sussex Street (S) Right	O	73.9%	63.9	174	1800	5.0	6.4
2/2+2/1	Basement Exit (W) Left Ahead	U	13.9%	46.5	41	1800:1800	1.1	1.2
2/3+2/4	Basement Exit (W) Right Ahead	U	17.4%	46.3	54	1800:1800	1.2	1.3
3/1	Hickson Road (N) Left	U	48.5%	16.0	365	1800	4.3	4.8
3/2	Hickson Road (N) Ahead	U	94.1%	65.3	585	1800	17.3	23.2
4/1+4/2	Napoleon Street (E) Left Right	U+O	92.4%	53.6	459	1800:1800	13.6	18.5
<b>J3: Kent Street - Margaret Street</b>	-	-	<b>80.5%</b>	-	-	-	-	-
1/2+1/1	Kent Street (S) Left Ahead	U	9.4%	22.7	69	1440:1800	1.3	1.3
1/3+1/4	Kent Street (S) Ahead Right	U+O	63.1%	21.8	512	1440:920	10.2	11.1



Basic Results Summary

2/2+2/1	Napeleon Street (W) Left Ahead	U+O	80.5%	21.3	658	920:1440	12.3	14.3
3/2+3/1	Kent Street (N) Ahead Left	U	38.8%	22.3	251	1800:920	4.9	5.2
3/3	Kent Street (N) Right	O	19.2%	33.4	62	1800	1.3	1.4
4/2+4/1	Margaret Street (E) Left Ahead	U	30.4%	30.7	189	1800:1800	4.0	4.2
4/3+4/4	Margaret Street (E) Ahead Right	U+O	29.5%	30.7	182	1800:1800	4.0	4.2
<b>J4: Globe Street - Hickson Road</b>	-	-	<b>47.9%</b>	-	-	-	-	-
1/1	Hickson Road (S) Left	U	9.8%	2.0	152	1800	1.1	1.2
1/2	Hickson Road (S) Ahead	U	40.2%	2.9	493	1800	0.3	0.6
2/2+2/1	Globe Street (W) Right Left	U	26.9%	52.9	62	1800:1800	1.5	1.7
2/3	Globe Street (W) Right	U	26.2%	40.9	107	1800	2.7	2.9
3/1	Hickson Road (N) Ahead	U	19.1%	8.2	235	1800	2.6	2.7
3/2+3/3	Hickson Road (N) Ahead Right	U+O	47.9%	11.1	588	1800:1800	8.3	8.8
C1 - Sussex / Erskine		PRC for Signalled Lanes (%):	-7.7	Total Delay for Signalled Lanes (pcuHr):		39.81	Cycle Time (s): 110	
C2 - Sussex / Napoleon		PRC for Signalled Lanes (%):	-4.5	Total Delay for Signalled Lanes (pcuHr):		27.85	Cycle Time (s): 110	
C3 - Kent / Margaret		PRC for Signalled Lanes (%):	11.8	Total Delay for Signalled Lanes (pcuHr):		12.72	Cycle Time (s): 110	
C4 - Hickson / Globe		PRC for Signalled Lanes (%):	87.8	Total Delay for Signalled Lanes (pcuHr):		4.95	Cycle Time (s): 110	
			PRC Over All Lanes (%):	-7.7	Total Delay Over All Lanes(pcuHr):		85.33	

Basic Results Summary  
**Scenario 6: 'PM Mod8'** (FG6: 'PM Future MOD8 Traffic', Plan 1: 'Future (with Basement)')  
**Network Layout Diagram**



Basic Results Summary

**Network Results**

Item	Lane Description	Lane Type	Deg Sat (%)	Av. Delay Per PCU (s/pcu)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Max. Back of Uniform Queue (pcu)	Mean Max Queue (pcu)
<b>Network: Linsig Modelling</b>	-	-	<b>96.9%</b>	-	-	-	-	-
<b>J1: Sussex Street - Erskine Street</b>	-	-	<b>96.9%</b>	-	-	-	-	-
1/2+1/1	Sussex Street (S) Left Ahead	U	27.7%	18.4	229	1800:1440	4.1	4.3
1/3	Sussex Street (S) Ahead	U	19.6%	16.1	186	1800	2.9	3.1
2/2+2/1	Erskine Street (W) Left Ahead	U	59.2%	40.1	325	1800:1800	8.0	8.7
2/3+2/4	Erskine Street (W) Right Ahead	U+O	86.3%	79.8	231	1800:920	6.7	9.4
3/2+3/1	Sussex Street (N) Ahead Left	U	95.0%	53.1	507	920:1800	13.8	20.2
3/3+3/4	Sussex Street (N) Ahead Right	U+O	94.0%	52.0	461	900:1440	12.7	18.3
4/1	Erskine Street (E) Left	U	96.9%	103.7	406	1440	12.2	19.5
4/2+4/3	Erskine Street (E) Ahead Right	U+O	21.9%	31.8	108	1440:1800	2.1	2.2
<b>J2: Napoleon Street - Hickson Road</b>	-	-	<b>92.1%</b>	-	-	-	-	-
1/1	Sussex Street (S) Ahead	U	70.6%	43.7	439	1800	10.7	11.9
1/2	Sussex Street (S) Right	O	71.4%	60.2	174	1800	5.0	6.2
2/2+2/1	Basement Exit (W) Left Ahead	U	12.9%	46.3	38	1800:1800	1.0	1.1
2/3+2/4	Basement Exit (W) Right Ahead	U	16.8%	46.3	52	1800:1800	1.2	1.3
3/1	Hickson Road (N) Left	U	43.0%	15.9	324	1800	4.2	4.6
3/2	Hickson Road (N) Ahead	U	92.1%	59.3	573	1800	16.8	21.6
4/1+4/2	Napoleon Street (E) Left Right	U+O	84.6%	33.2	531	1800:1800	15.8	18.4
<b>J3: Kent Street - Margaret Street</b>	-	-	<b>75.3%</b>	-	-	-	-	-
1/2+1/1	Kent Street (S) Left Ahead	U	9.4%	22.7	69	1440:1800	1.3	1.3
1/3+1/4	Kent Street (S) Ahead Right	U+O	63.1%	21.8	512	1440:920	10.2	11.1

Basic Results Summary

2/2+2/1	Napeleon Street (W) Left Ahead	U+O	75.3%	17.4	613	920:1440	11.2	12.7
3/2+3/1	Kent Street (N) Ahead Left	U	38.8%	22.3	251	1800:920	4.9	5.2
3/3	Kent Street (N) Right	O	19.2%	33.4	62	1800	1.3	1.4
4/2+4/1	Margaret Street (E) Left Ahead	U	36.3%	31.7	225	1800:1800	5.0	5.3
4/3+4/4	Margaret Street (E) Ahead Right	U+O	35.4%	31.7	218	1800:1800	4.9	5.2
<b>J4: Globe Street - Hickson Road</b>	-	-	<b>47.4%</b>	-	-	-	-	-
1/1	Hickson Road (S) Left	U	16.2%	2.2	252	1800	2.0	2.1
1/2	Hickson Road (S) Ahead	U	40.9%	2.9	502	1800	0.3	0.7
2/2+2/1	Globe Street (W) Right Left	U	28.4%	52.9	66	1800:1800	1.5	1.7
2/3	Globe Street (W) Right	U	27.9%	41.2	114	1800	2.9	3.0
3/1	Hickson Road (N) Ahead	U	14.4%	7.9	177	1800	1.9	2.0
3/2+3/3	Hickson Road (N) Ahead Right	U+O	47.4%	11.0	582	1800:1800	8.2	8.7
C1 - Sussex / Erskine		PRC for Signalled Lanes (%):	-7.7	Total Delay for Signalled Lanes (pcuHr):		37.52	Cycle Time (s): 110	
C2 - Sussex / Napoleon		PRC for Signalled Lanes (%):	-2.4	Total Delay for Signalled Lanes (pcuHr):		25.16	Cycle Time (s): 110	
C3 - Kent / Margaret		PRC for Signalled Lanes (%):	19.6	Total Delay for Signalled Lanes (pcuHr):		12.53	Cycle Time (s): 110	
C4 - Hickson / Globe		PRC for Signalled Lanes (%):	89.8	Total Delay for Signalled Lanes (pcuHr):		5.00	Cycle Time (s): 110	
			PRC Over All Lanes (%):	-7.7	Total Delay Over All Lanes(pcuHr):		80.21	