Lend Lease Pty Ltd

# Barangaroo South - R8 & R9 Residential Buildings

## Construction Traffic Management Plan

Rev A | 16 November 2012



Job number 220316

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# 1 Introduction

This report supports a Project Application (MP11_0002) submitted to the Minister for Planning pursuant to Part 3A of the Environmental Planning and Assessment Act 1979 (EP&A Act). The Application seeks approval for construction of two residential flat buildings (known as Buildings R8 and R9) and associated works at Barangaroo South as described in the Overview of Proposed Development section of this report.

## 1.1 Overview of Proposed Development

The R8 and R9 Project Application seeks approval for the construction and use of two residential flat buildings comprising 159 apartments, ground floor retail, allocation of car parking spaces from the Bulk Excavation and Basement Car Parking Project Application, and the construction of the surrounding ancillary temporary public domain and landscaping.

## 1.2 Site Location

Barangaroo is located on the north western edge of the Sydney Central Business District, 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 bounded to the south by a range of new development dominated by large CBD commercial tenants.

The Barangaroo site has been divided into three distinct redevelopment areas (from north to south) – the Headland Park, Barangaroo Central and Barangaroo South.

The R8 and R9 Project Application Site area is located within Barangaroo South. The Project Application Site extends over land generally known and identified in the approved Concept Plan as Block X.

## 1.3 Purpose of this Report

This report has been prepared to accompany the Project Application for the R8 and R9 Residential Building and associated works at Barangaroo South. It addresses the relevant Director-General Requirements for the project. These Director-General Requirements are discussed in the Environmental Assessment Report (EAR) that has been prepared to support the application.

## 1.4 Document Structure

The diagram below illustrates the document structure established for Traffic and Transport Planning related reporting for the R8 and R9 Residential Buildings. There are three supporting documents to inform and feed into the required responses to the Director General's Requirements (DGR's). They are:

1. Transport Management and Accessibility Plan (TMAP) Supplementary to Barangaroo TMAP Stage 1 published by the NSW Government in September 2008.

2. Travel Demand Management Plan
3. Construction Traffic Management Plan

These supporting documents are the Project Application reports which respond to the DGR issues relating to Transport.

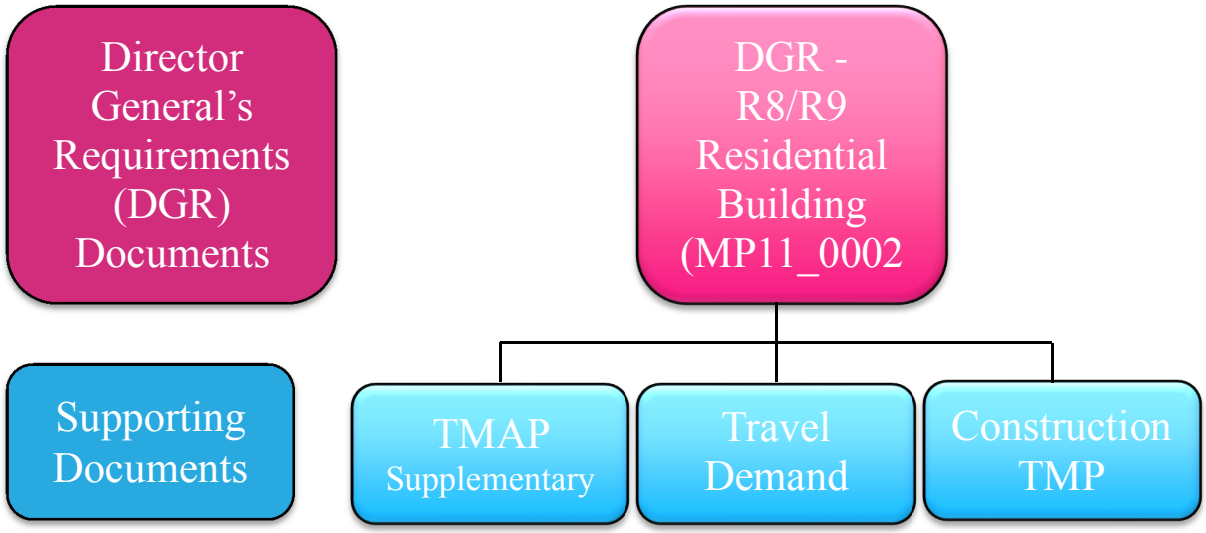



Figure 1 Document Structure

## 1.5 Scope of the Report

This report assesses the forecast construction traffic generated during all stages of the development of the site and its likely impact to the road network, as well as pedestrian safety and amenity issues during the construction of the subject development. It assesses the cumulative traffic impacts associated with the following current and future works:

- Bulk Excavation and Basement Car Parking Works
- C4 Commercial Building
- C5 Commercial Building
- C3 Commercial Building
- R8 & R9 Residential Buildings
- Headland Park and Northern Cove
- Wynyard Walk
- Hickson Road stormwater works

Specific issues addressed in the report include:

- Estimate construction related traffic generation and its anticipated route to and from the site;
- Determine the impact of the construction traffic on the existing road network;
- Assess the pedestrian safety along the site boundary and at the work site vehicular entry and exit points;
- Assess any potential traffic conflicts with car, bus and other vehicles and pedestrian access for the temporary Cruise Passenger Terminal; and
- Address the Hickson Road and Shelley Street pedestrian provisions during construction.

# 2 Existing Traffic Conditions

## 2.1 Road Network

Hickson Road runs along the eastern boundary of the site. It is a wide two lane, two way road that forms a northern extension of Sussex Street to the north of Napoleon Street. Sussex Street runs along the western side of Sydney CBD between Napoleon to the north and Hay Street to the south. It is two way north of King Street and one way southbound south of King Street.

Other local roads adjacent to the site are Napoleon Street and Shelley Street. Napoleon Street provides connection between Kent Street and Hickson Road. It is a relatively wide road and has moderate downward slope from Kent Street to Hickson Road. Shelley Street provides a connection between Hickson Road (to the north) and Erskine Street (to the south).

## 2.2 Traffic Volumes

Traffic counts were undertaken on Hickson Road and Sussex Street by AECOM in November 2011 and are presented in Table 1. The traffic volumes on Hickson Road and Sussex Street progressively increase towards the south as vehicles join this southbound route on the western side of the city. This is particularly evident in the PM peak, when Sussex Street is utilised as a major departure route from the city to the Western Distributor-Anzac Bridge and routes further south and east.

Table 1 Two Way Peak Hour Traffic Volumes on Hickson Road and Sussex Street

| Road | Location | AM Peak | | | PM Peak | | |
|---|---|---|---|---|---|---|---|
| | | NB | SB | Total | NB | SB | Total |
| Hickson Rd | N of Napoleon St | 647 | 250 | 897 | 469 | 659 | 1,128 |
| Sussex St | N of Erskine St | 628 | 619 | 1,247 | 479 | 808 | 1,287 |
| Sussex St | N of King St | 597 | 1,005 | 1,602 | 294 | 1,223 | 1,517 |

Source: AECOM traffic surveys 8th November 2011

## 2.3 Cruise Passenger Terminal Traffic

The Temporary Cruise Passenger Terminal is currently located in a temporary Marquee Facility at Wharf 5. It is anticipated this facility will be relocated to White Bay by June 2013.

## 2.4 Pedestrian Conditions in the Vicinity of the Site

The Sussex Street / Shelley Street intersection is controlled by traffic signals and pedestrian crossing facilities are provided on all three approaches.

Many cruise ship passengers walking via Napoleon Street also currently cross Hickson Road near Napoleon Street where a pedestrian refuge was installed in March 2012 to provide a dedicated two-staged crossing. A zebra crossing is provided on Hickson Road north of Napoleon Street to facilitate pedestrian movements in this area.

Elsewhere, adequate pedestrian footpaths are currently provided on both sides of Hickson Road. The western footpath of Hickson Road will be closed to accommodate construction activities with pedestrians utilising the eastern side.

## 2.5 Main Road Intersections

Most existing road intersections to the south of Barangaroo, along Sussex Street and within the Sydney CBD generally are controlled by traffic signals. The intersections along Sussex Street, i.e. at Erskine Street, King Street and Market Street are controlled by traffic signals.

More recently traffic signals have been installed at Shelley Street on Hickson Road. However to the north of Shelley Street, there are no further intersections controlled by traffic signals.

Intersection surveys were conducted by AECOM on Tuesday 8th November 2011 (a typical weekday outside of school holiday periods). The existing morning and afternoon peak hour intersection traffic volumes at these intersections are illustrated in Figure 2 and Figure 3.


Figure 2 AM Peak Hour Traffic Volumes (AECOM, 2011)

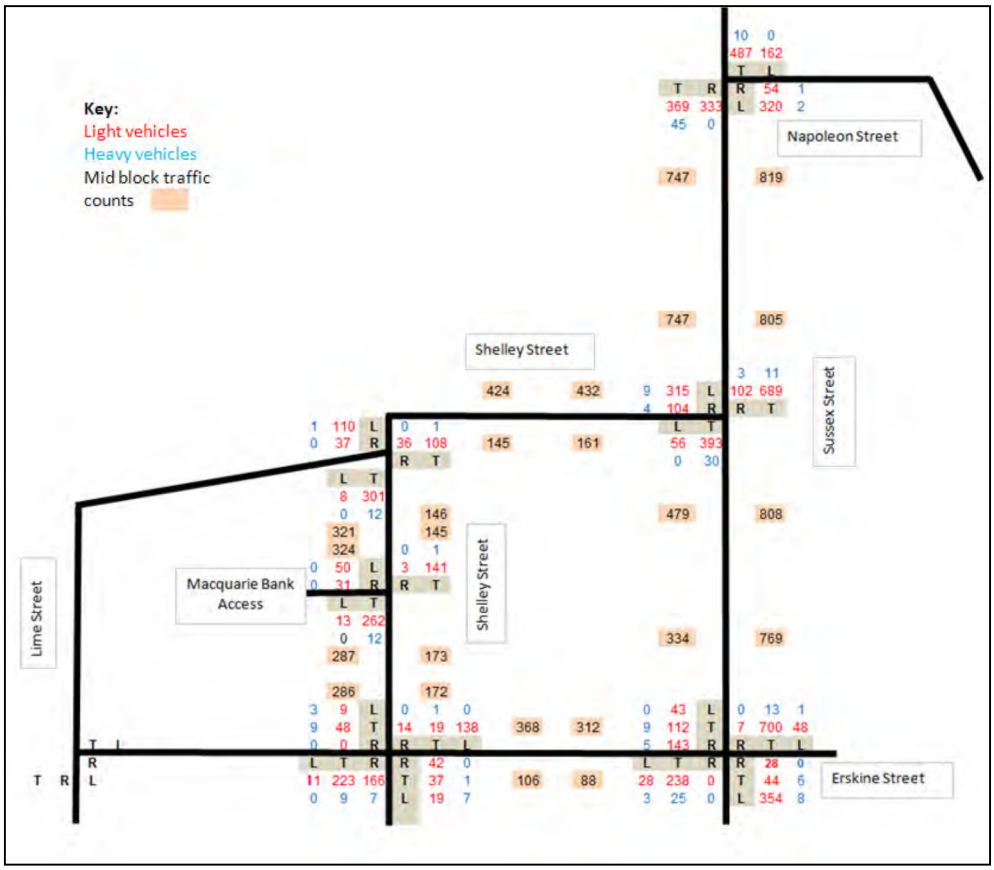



Figure 3 PM Peak Hour Traffic Volumes (AECOM, 2011)

For the Barangaroo South Traffic Study published in December 2011, AECOM utilised the linked intersection analysis program LINSIG to assess the following intersections:

- Napoleon Street & Hickson Road, **Priority Controlled**
- Sussex Street & Shelley Street, **Traffic Signals**
- Sussex Street & Erskine Street, **Traffic Signals**
- Erskine Street & Shelley Street, **Traffic Signals**
- Shelley Street & Lime Street, **Priority Controlled**

The intersection analysis results are summarised for each intersection in Table 2, in terms of:

- Intersection Traffic Level of Service, LOS
- Degree of Saturation, DOS;
- Average Delay per vehicle, AVD and
- Direction and Length of Peak Vehicle Queue, MMQ

Table 2 Summary of Existing Intersection Operations from LINSIG Analysis

| Peak | Intersection | LOS | DOS | AVD (sec)* | Max Queue (m) | Highest Queue Approach |
|---|---|---|---|---|---|---|
| AM | Hickson Road & Napoleon Street **Unsignalised** | A | 0.74 | 10 | 30 | RT from Hickson Road (northbound) |
| | Sussex Street & Shelley Street **Traffic Signals** | C | 0.96 | 36 | 75 | T from Sussex Street (northbound) |
| | Sussex Street & Erskine Street **Traffic Signals** | C | 0.89 | 39 | 88 | L/T from Sussex Street (northbound) |
| | Erskine Street & Shelley Street **Traffic Signals** | B | 0.87 | 19 | 51 | T/R from Shelley Street (northbound) |
| | Shelley Street & Lime Street **Unsignalised** | A | 0.20 | 4 | 0 | n/a |
| PM | Hickson Road & Napoleon Street **Unsignalised** | A | 0.51 | 6 | 17 | RT from Hickson Road (northbound) |
| | Sussex Street & Shelley Street **Traffic Signals** | B | 0.72 | 18 | 38 | T from Sussex Street (northbound) |
| | Sussex Street & Erskine Street **Traffic Signals** | F | 0.99 | 81 | 88 | L/T from Sussex Street (southbound) |
| | Erskine Street & Shelley Street **Traffic Signals** | A | 0.39 | 14 | 15 | T/R from Shelley Street (southbound) |
| | Shelley Street & Lime Street **Unsignalised** | A | 0.25 | 4 | 0 | n/a |

Legend: LOS – Intersection Traffic Level of Service, DOS – Degree of Saturation, AVD – Average Delay per Vehicle, LT – Left Turn, RT – Right Turn, TM – Through Movement

Note* Average Vehicle Delay for an Unsignalised Intersection is for the highest delay movement

Source: AECOM, 2011

# 3 Construction Program Staging and Details

The following sections outline the concurrent developments at the Barangaroo South precinct that will impact on construction traffic associated with the Bulk Excavation and Basement Construction.

## 3.1 Bulk Excavation and Basement Car Park Construction

### 3.1.1 Duration

The basement retention systems construction, excavation and car park/loading dock construction are proposed to be undertaken under the approximate timelines as follows:

- October 2011 –October 2012, Piling and retention system construction, resulting in approximately 16,000 cubic metres of spoil that will be appropriately disposed off site;
- June 2012 – July 2013, Excavation of approximately 330,000 cubic metres of material from site, approximately 50,000 cubic metres of which will be transferred to the site of the proposed Headland Park. The balance of spoil will be appropriately disposed off site.
- November 2012 –April 2015, Construction of Concrete Columns and Slabs for Basement Car Park and loading dock area.

### 3.1.2 Workforce

The proposed site work force for the basement construction will peak at around 500 workers.

### 3.1.3 Truck Movements

It is envisaged that the Bulk Excavation and Basement Car Park construction would generate the following likely average and maximum truck loads per day and per hour during each of the future phases of the 2011-2015 basement construction work:

**Piling and Retention System Construction** (October 2011 – October 2012)

- 59 truck loads per day on average (118 truck movements)
- 66 truck loads per day maximum (132 truck movements)

**Bulk Excavation** (June 2012 – July 2013)

- 177 truck loads per day on average (354 truck movements)
- 190 truck loads per day maximum (380 truck movements)
- 40 truck loads to Headland Park (over an approximate 3 month period) per day maximum (80 truck movements)

**Basement Construction** (November 2012 – April 2015)

- 77 truck loads per day on average (154 truck movements)
- 115 truck loads per day maximum (230 truck movements)

## 3.2 C4 Commercial Building

### 3.2.1 Indicative Duration

The construction of the C4 Commercial Building commenced in early 2012 and is programmed for completion in mid 2015.

- January 2012 – September 2012, Piling for Building C4 in parallel with the basement and C3 works;
- July 2012 – January 2013, Construction of Concrete Columns, Slabs and Cores forming the C4 Sub-structure in parallel with the basement and C3/C5 works; and
- February 2013 – March 2015, Construction of C4 Tower Structure, Facade, Finishes and Fit-out in parallel with C3/C5 works.

### 3.2.2 Workforce

The proposed site work force for the C4 Commercial Building will peak at around 600 workers during the construction of the C4 Tower Structure.

### 3.2.3 Truck Movements

It is envisaged that the C4 Commercial Building construction would generate the following likely average and maximum truck loads per day and per hour during the piling, concrete sub-structure and tower construction stages:

**Piling** (January 2012 – September 2012)

All truck movements related to piling have been included in the Bulk Excavation and Basement Carpark construction (refer to section 3.1.3)

**Construction of Sub-Structure** (July 2012 – January 2013)

All truck movements related to construction of the substructure have been included in the Bulk Excavation and Basement Carpark construction (refer to section 3.1.3)

**Tower Construction, Finishes and Fit-Out** (February 2013 – March 2015)

- 15 truck loads per day on average (30 truck movements)
- 76 truck loads per day maximum (152 truck movements)

## 3.3 C3 Commercial Building

### 3.3.1 Indicative Duration

The construction of the C3 Commercial Building commenced in mid 2012 and is programmed for completion in September 2015.

- August 2012- October 2012, Piling for Building C3 in parallel with the basement and C4 works;
- November 2012 – May 2013, Construction of Concrete Columns, Slabs and Cores forming the C3 Sub-structure in parallel with the basement and C4 works; and
- June 2013 – September 2015, Construction of C3 Tower Structure, Facade, Finishes and Fit-out in parallel with C4 works

### 3.3.2 Workforce

The site work force for the C3 Commercial Building will peak at around 600 workers during the construction of the C3 Tower Structure.

### 3.3.3 Truck Movements

In addition to the basement truck movements it is envisaged that the C3 Commercial Building construction would generate the following likely average and maximum truck loads per day and per hour during the Concrete Sub-Structure and Tower construction stages:

**Piling** (August 2012 – October 2012)

All truck movements related to piling have been included in the Bulk Excavation and Basement Carpark construction (refer to section 3.1.3)

**Concrete Sub-structure Construction** (November 2012 – May 2013)

All truck movements related to construction of the substructure have been included in the Bulk Excavation and Basement Carpark construction (refer to section 3.1.3)

**Tower Construction, Finishes and Fit-Out** (June 2013 – September 2015)

All truck movements relating to the construction of the C3 Tower have been included in the C4 Tower construction, finishes and fit-out (refer to section 3.2.3)

## 3.4 C5 Commercial Building

### 3.4.1 Indicative Duration

The construction of the C5 Commercial Building is commenced in mid 2012 and is programmed for completion in October 2015.

- September 2012- April 2013, Piling for Building C5 in parallel with the basement, C4 and C3 works;

- March 2013 – August 2013, Construction of Concrete Columns, Slabs and Cores forming the C5 Sub-structure in parallel with the basement, C4 and C3 works; and
- September 2013 – October 2015, Construction of C5 Tower Structure, Facade, Finishes and Fit-out in parallel with C4 and C3 works.

### 3.4.2 Workforce

The site work force for the C5 Commercial Building will peak at around 600 workers during the construction of the C5 Tower Structure.

### 3.4.3 Truck Movements

In addition to the basement truck movements it is envisaged that the C5 Commercial Building construction would generate the following likely average and maximum truck loads per day and per hour:

**Piling** (September 2012 – April 2013)

All truck movements related to piling have been included in the Bulk Excavation and Basement Carpark construction (refer to section 3.1.3)

**Concrete Sub-structure Construction** (March 2013 – August 2013)

All truck movements related to construction of the substructure have been included in the Bulk Excavation and Basement Carpark construction (refer to section 3.1.3)

**Tower Construction, Finishes and Fit-Out** (September 2013 – October 2015)

All truck movements relating to the construction of the C5 Tower have been included in the C4 Tower construction, finishes and fit-out (refer to section 3.2.3)

## 3.5 R8 & R9 Residential Buildings

### 3.5.1 Indicative Program

Construction of the R8 and R9 residential buildings is expected to commence in August 2013, and is scheduled for completion in March 2015 in line with the completion of the basement structure.

- August 2013 – November 2013, Piling and earthworks
- November 2013 – June 2014, Structure above ground floor roof
- March 2014 – March 2015, Finishes and fit-out

### 3.5.2 Workforce

The site work force for the R8 and R9 Residential Buildings will peak at around 300 workers.

### 3.5.3 Truck Movements

**Piling and Earthworks** (August 2013 – November 2013)

- 15 trucks per day

**Structure Above Ground Floor Roof** (November 2013 – June 2014)

- 25 trucks per day

**Finishes and Fit Out** (March 2014 – March 2015)

- 25 trucks per day

## 3.6 Barangaroo Headland Park and Northern Cove

### 3.6.1 Approved Concept Plan

On 11 November 2009 the Minister for Planning approved a modification to the Concept Plan which was primarily aimed at achieving a more naturalised design for the northern headland. The Headland Park early works and main works are described in the project approvals MP10_0047 and MP10_0048. All works associated with the Headland Park are by others.

However these works will coincide with the bulk excavation, basement construction and construction of commercial towers and residential buildings, and as a consequence, the cumulative impact needs to be considered. The following information has been extracted from the project applications and provided by the Barangaroo Delivery Authority (BDA). It is discussed here for the purpose of assessing the likely impacts of the development.

### 3.6.2 Scope of Works

**Early Works**

- Demolition of above ground structures and preparation of the site will occur prior to bulk earthworks;
- Sandstone extraction will occur for reuse within the Barangaroo site; and
- The existing sewage pumping station will need to be buried or relocated on this site or onto a nearby site.

**Main Works**

- Demolition or modification of Sydney Harbour Control Tower;
- Shaping of the shoreline involves removing parts of the caisson seawall and removal of material behind the wall; and
- Completion of Headland Park would include shaping of the final landform, landscape treatment, installation of services and infrastructure, construction of roads and car park, etc.

### 3.6.3 Staging

As advised by the BDA, the construction of the main works at Headland Park is proposed to commence in October 2012 and last for approximately 3 years.

### 3.6.4 Construction Traffic Management Plan

A construction traffic management plan for the Headland Park Early works was prepared by Halcrow, dated 21 June 2010. A subsequent construction traffic management plan was prepared by Halcrow for the main works dated 26 October 2010. In addition, the BDA has provided further information in relation to the proposed Headland Park works. Based on this information, the following works are being undertaken:

**Equipment delivery** – semi-trailer low loaders will be used to deliver earth moving and other site equipment. 100 truck movements in total are anticipated.

**Fill Receipt –** Approximately 50,000m$^3$ of fill will be sourced from the Stage 1 Barangaroo works and transported to the Headland Park site. Works will involve the local haulage, spreading and compacting of the fill to form Headland Park.

**Sandstone block excavation and transportation** – on-site extraction of approximately 35,000 m$^3$ of sandstone will take place as part of the early works. Off site truck movements will be up to 20 per weekday with a maximum of 3 truck movements per hour.

**Sewer Construction** – a new sewer will be constructed from Gate 5 to Towns Place – sewer pumping station SPS1129. Minimal truck movements of 2 per day are expected on public roads.

**Staff working on site** – a workforce of up to 50 staff on-site at any one time is anticipated with up to 30 arriving by car.

## 3.7 Wynyard Walk

The Wynyard Walk construction works commenced in mid 2012 with the start of the footpath improvement works on York Street and Margaret Street , with overall completion scheduled for the end of 2015. Traffic management plans considered in this construction impacts assessment are as follows:

- Road and Footpath Works (BPL-R-RW-034) – November 2011
- Tunnel Works (BPL-R-GN-030), June 2012
- Review of Environmental Factors (BPL-R-EN-059[A]), April 2012
- Bridge Works (BPL-R-GN-053), May 2012

The indicative construction timeframe for the project is shown in Figure 4.

| Stage | 2012 | | 2013 | | | | 2014 | | | | 2015 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 |
| Kent Street Tunnel pre-closure activities | | | | | | | | | | | | | | |
| Enabling works | | | | | | | | | | | | | | |
| Stage 1 | | | | | | | | | | | | | | |
| Stage 2 | | | | | | | | | | | | | | |
| Stage 3 | | | | | | | | | | | | | | |
| Stage 4 | | | | | | | | | | | | | | |
| Stage 5 | | | | | | | | | | | | | | |
| Stage 6 | | | | | | | | | | | | | | |
| Stage 7 | | | | | | | | | | | | | | |
| Stage 8 | | | | | | | | | | | | | | |

Figure 4 Wynyard Walk Construction Staging

Up to 18 construction vehicles may be generated in the peak hour during peak construction periods in stages 3 and 4, lasting for up to 9 months. Outside this period however the level of vehicle activity will be significantly less, between 3 and 9 trips per hour.

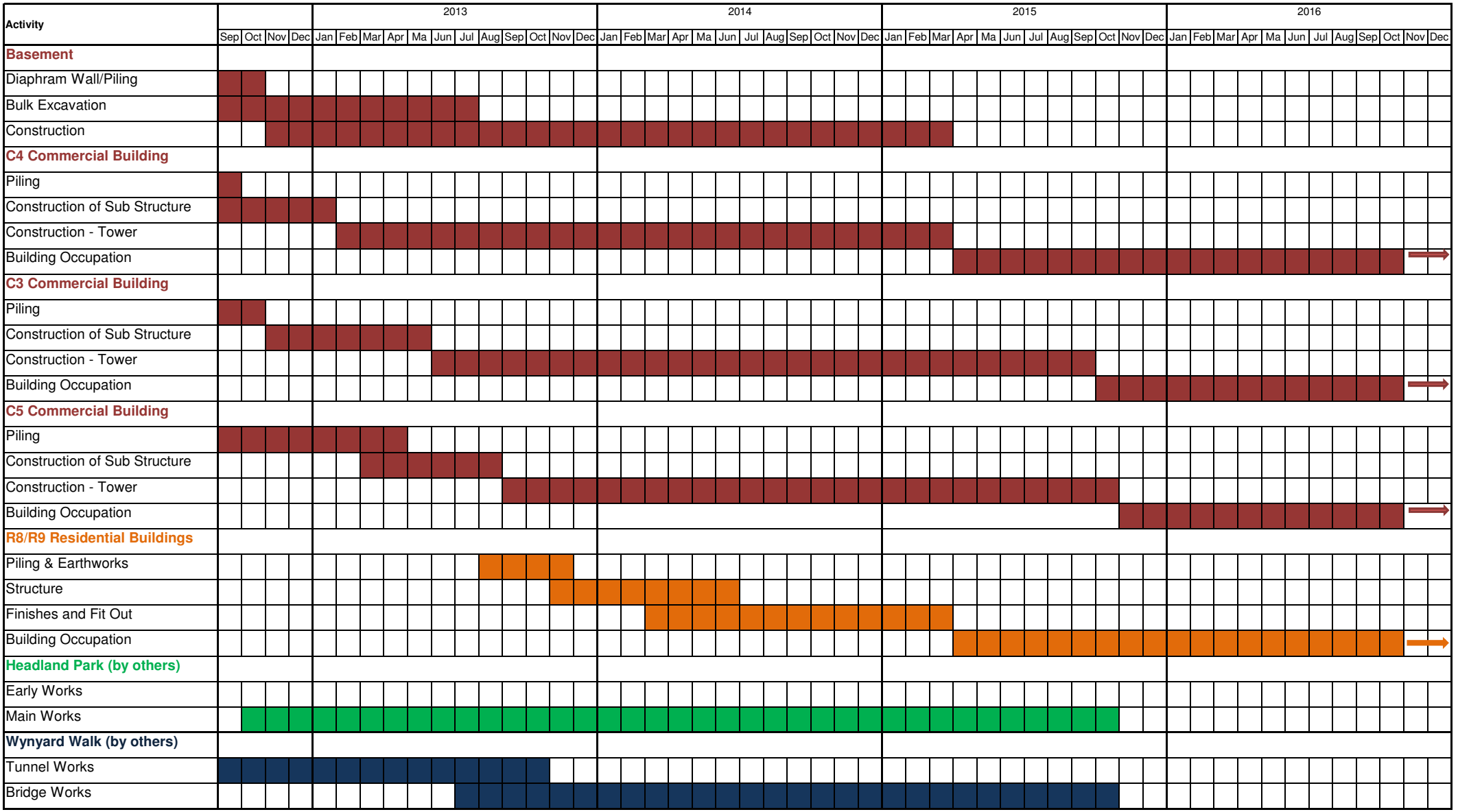
It is estimated that approximately 70% of construction vehicles would approach the worksite from the southern and western parts of Sydney. The remainder would approach from the northern direction (i.e. via the Harbour Bridge and York Street) and not conflict with those accessing the Barangaroo South precinct. Some vehicles departing the Napoleon Street worksite will utilise Sussex Street, however it is expected the two project teams would coordinate with each other to mitigate construction impacts on the local road network.

## 3.8 Combined Construction Program

The construction timing for each phase of the works described in previous sections for Stage 1 of the Barangaroo development, as well as the Headland Park and Wynyard Walk works, are shown in Figure 5[1]

[1] The program milestones and timing are indicative only

## BARANGAROO SOUTH INDICATIVE CONSTRUCTION PROGRAM



# 4 Traffic and Pedestrian Movements and Routes

## 4.1 Overall Principles

The overall principles of the construction stage traffic management proposal will be to ensure:

- Construction access driveways are designed to allow trucks to enter and leave the site in a forward direction;
- Construction access driveways are managed and controlled by site personnel;
- Maintain safety for workers and the public in the vicinity of the worksite;
- Maintain restricted designated truck routes for all truck access, in particular for truck movements associated with spoil excavation and/or transport;
- Construction activity to be carried out in accordance with the approved hours of work;
- Provision of safe, convenient and appropriate environments for pedestrians and cyclists at all times;
- Maintain appropriate capacity for pedestrians along the Hickson Road footpath; and
- Assess potential construction stage traffic impacts on the maximum practical capacity at intersections and where necessary make recommendations to control construction traffic movements at the vicinity of the site.

## 4.2 Hours of Construction

The construction hours proposed are:

- Monday to Friday: 7am – 6pm;
- Saturday: 7am – 5pm; and
- Sunday/ Public Holiday – No work.

## 4.3 Construction Site Access

The construction site access will be via Hickson Road approximately 200m to the north of Napoleon Street.

## 4.4 Anticipated Traffic Routes

From the north and north west, trucks will typically travel via;

- Harbour Bridge – York Street – Margaret Street – Napoleon Street – Hickson Road (inbound); and
- Hickson Road – Napoleon Street – Kent Street – Western Distributor – Harbour Bridge (outbound) to and from the site.

This southbound truck activity would occur through the middle of the day when this route is used but would reduce or be finished before the PM Peak when bus activity is heaviest. This arrangement is presented in Figure 6.

As there is no access for general traffic from the Harbour Bridge to York Street between 6.30am – 9.30am (Monday – Friday), trucks will not use this access until after 9.30am on weekdays. A likely alternate route for trucks approaching from the north would be via the Western Distributor onto Harbour Street in accordance with MP10_0023 condition of consent no. D4(e), which restricts trucks using York Street between 2pm and 8pm.

Use of Wheat Road / Shelley Street will be minimised as trucks will turn right onto Erskine Street from Harbour Street and then left onto Sussex Street to access the site.

It is anticipated that this route would be used sparingly in accordance with MP10_0023 condition of consent number D4(e) as most suppliers would be located to the west and south west.

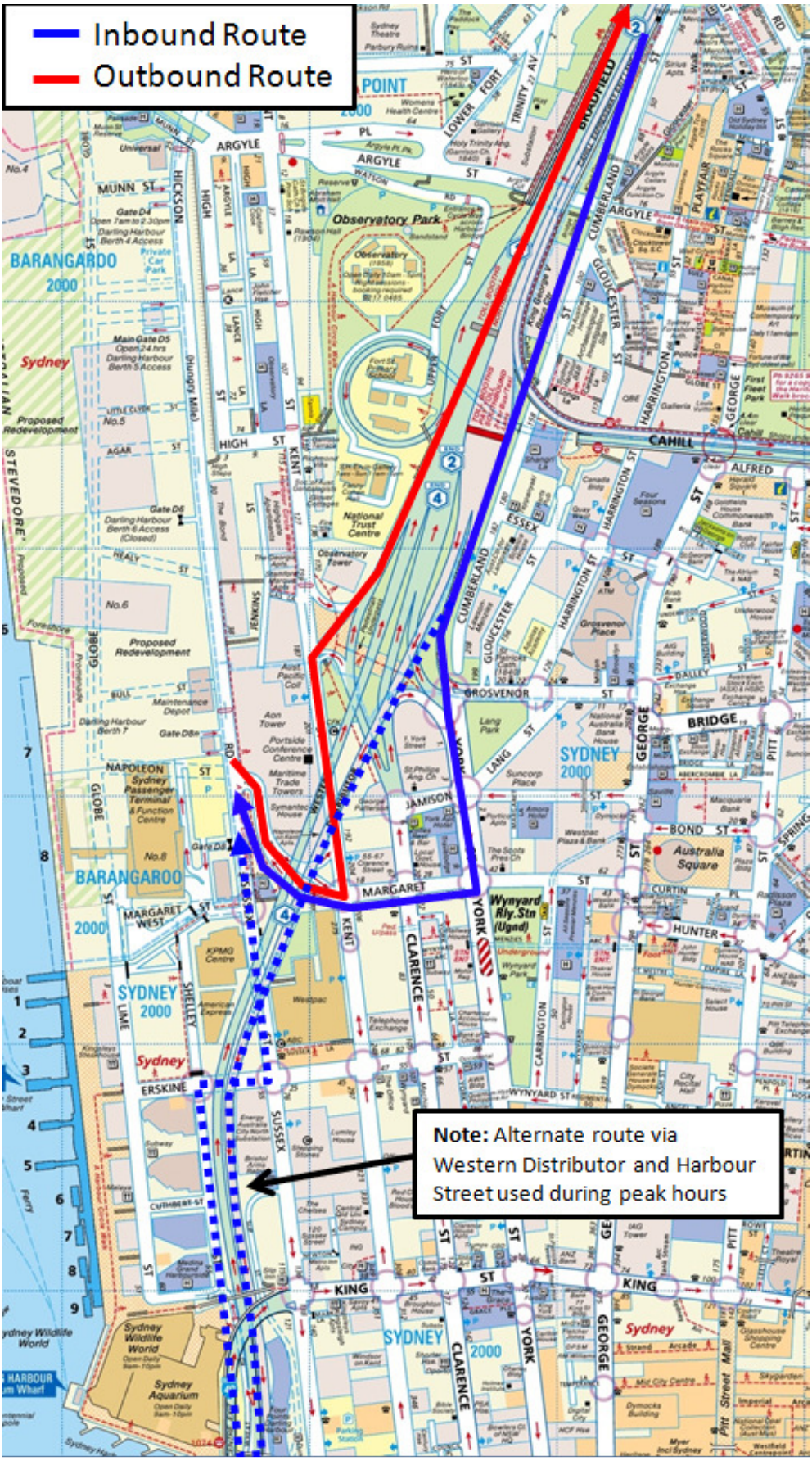



Figure 6 Truck Access Route to/from the North

From the west, trucks will typically travel via;

- Anzac Bridge – Western Distributor – Sussex Street – Hickson Road (inbound) and
- Hickson Road – Sussex Street – Western Distributor – Anzac Bridge (outbound) to and from the site, as shown in Figure 7.

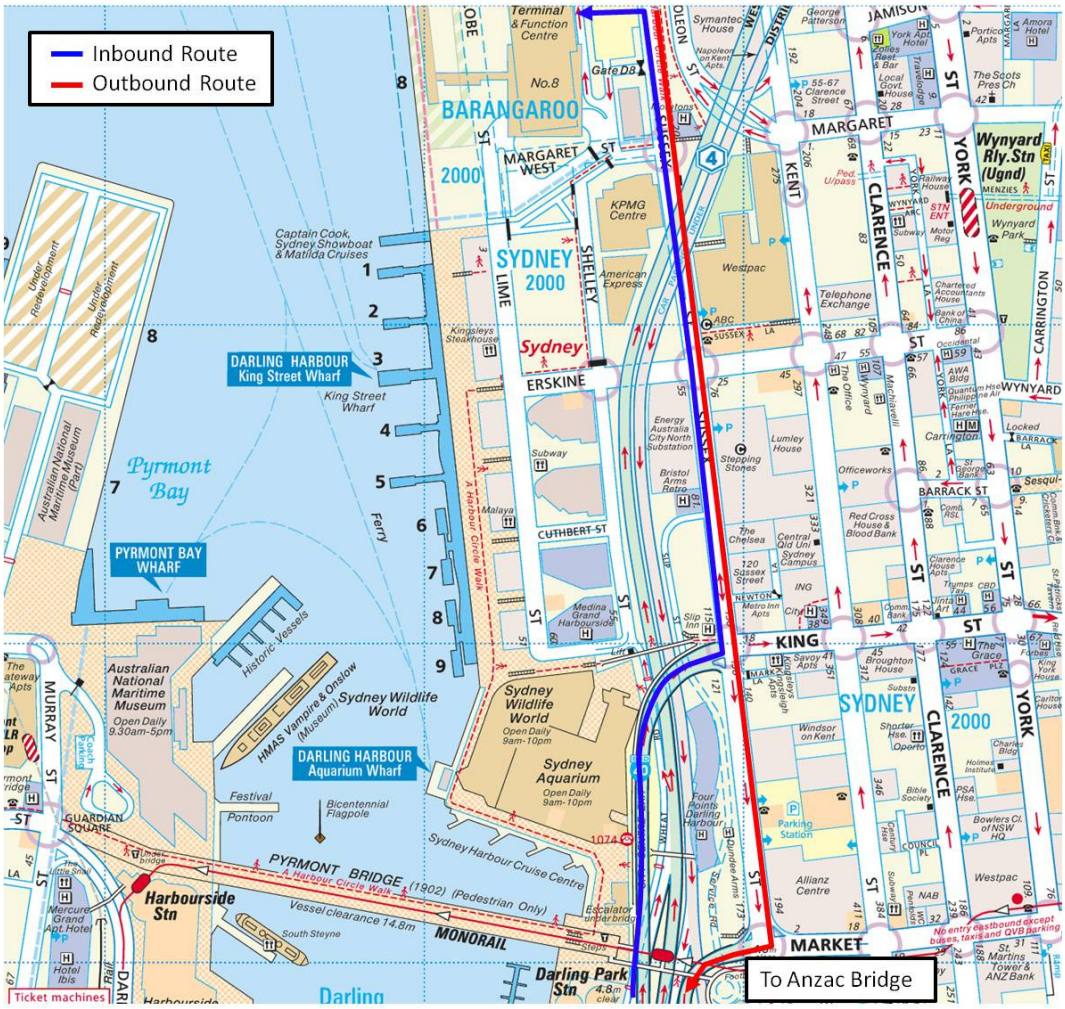



Figure 7 Truck Access Route to/from the West (via Anzac Bridge)

From the south and the east, trucks may utilise the Eastern Distributor and the Cross City Tunnel to access and depart the site, as shown in Figure 8. Harbour Street could be used as a route for inbound traffic once trucks have exited the Cross City Tunnel.

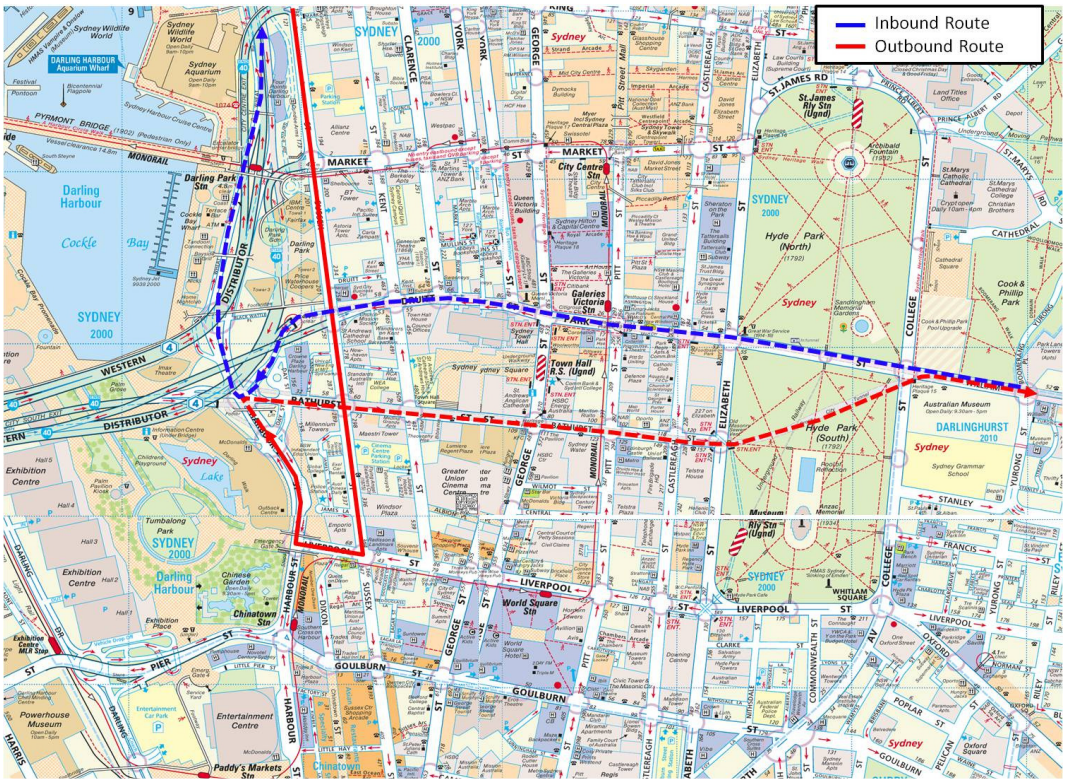



Figure 8 Truck Access Route to/from the South and East

## 4.5 Hourly Construction Traffic Movements

Construction traffic movements will be determined by times of arrival of the construction materials and waste which are to be transported either to or from the site each day.

- The site workforce for each stage of construction will generally arrive at the worksite between 6am-7am on weekdays and depart from the site between 3pm-6pm, normally at around 4 pm, on most weekdays. On days of large concrete pours, these hours of arrival and departure may alter. On-site car parking will not be provided for workers and hence there will be minimal traffic impact arising from personal parking use. The majority of the workforce will travel by train and bus outside the morning and afternoon commuter peak periods, i.e. 8am-9am and 5pm-6pm. Some workers may choose to use the 10 hour long term parking on Hickson Road at $22 or at nearby pay parking stations. These movements are not expected to be high and most would not occur in the peak traffic periods.
- The site truck movements each weekday will normally be evenly distributed over an approximate 10 hour period from approximately 7am to 5pm on most weekdays. On days of large concrete pours, there may however be spikes in the frequency of arrivals and departures associated with the need to deliver concrete from batch plants over shorter periods. Holding areas will be identified on approach routes to supplement timed arrivals where necessary to

avoid truck circulation on city streets in accordance with MP10_0023 condition of consent no. D4(d).

## 4.6 Cumulative Traffic Impacts

An assessment has been made of the cumulative impacts of the construction of the R8 and R9 residential buildings in combination with the basement and bulk excavation, C3, C4 and C5 Commercial buildings and the Headland Park Works[2] and Wynyard Walk works[3] projects. The number of car driver trips for the combined sites has been determined based on the predicted level of workers on the site.

As indicated in Section 3.5.3, the level of construction activity generated by the proposed works is forecast to be minimal, with a maximum of 25 trucks per day arriving to the site. Given this level of activity, it is likely these truck movements will occur outside of the AM and PM peak hours. The traffic modelling has however taken a conservative approach in including some of these truck (and associated car) movements during the peak hours.

The highest combined level of total morning peak hour car/ute and truck traffic movements generated by all the worksites during the R8/R9 construction period will be a total of 351 vehicle movements per hour, forecast to occur in August 2013. This is comprised of:

- Morning Peak Hour 8am -9am, 175 cars in, 55 cars out, 62 trucks in, 59 trucks out
- Afternoon Peak Hour, 5pm - 6pm, 55 cars in, 175 cars out, 59 trucks in, 62 trucks out

Full details of the monthly variations in the total generated peak hour car/ute and truck traffic volumes from the combined worksites is presented in Appendix B of this report.

Consideration has been given to the upcoming stormwater works to occur on Hickson Road. These works are expected to occur over the next six months – with the permanent south works scheduled for completion in February 2013. This is prior to the commencement of the construction of the R8 and R9 residential buildings and has therefore not been assessed in this report.

The impact of these stormwater works on the road network has been previously analysed in the construction traffic management plans prepared by Arup in July 2012 for the C3 (MP11_0044) and C5 (MP10_0277) commercial building project applications.

[2] Barangaroo Headland Park Early Works – Construction Traffic Management Plan and Impact Assessment, Halcrow October 2010
[3] Wynyard Walk Review of Environmental Factors (BPL-R-EN-059[A]), April 2012

## 4.7 Traffic Distribution

The traffic management plans for the Wynyard Walk tunnel and bridge works describes heavy vehicle access and egress routes to the site. This study has adopted these proposed construction routes for the purposes of the LinSig analysis. Consistent with the forecasts in the Wynyard Walk REF, 70% of construction vehicles are forecast to approach the worksite from the southern and western parts of Sydney. The remainder would approach from the northern direction (i.e. via the Harbour Bridge, Western Distributor and Harbour Street). For trucks returning to the north, they would utilise Napoleon Street and then turn left onto Kent Street to approach the Harbour Bridge. Margaret Street would not be used as a construction route during peak hours.

## 4.8 Traffic Modelling

As part of the Wynyard Walk construction works, Shelley Street is being reduced to one-way eastbound from June 2013 to mid 2015– coinciding with the peak construction activity for the Barangaroo South site. The assumed layout of Shelley Street is indicated in Figure 9 and has been adopted for the traffic modelling in this study.

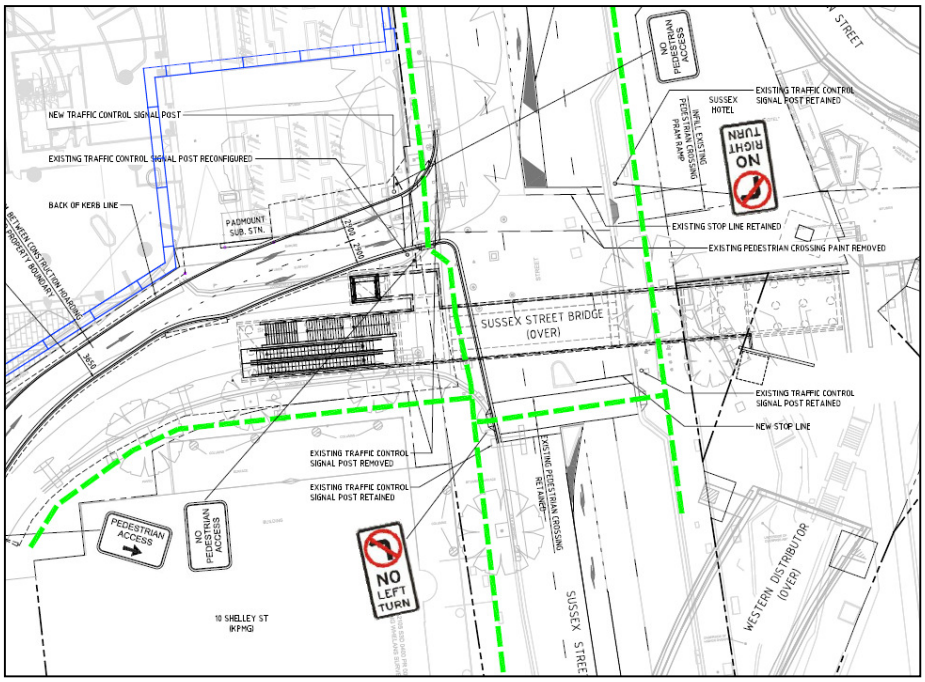



Figure 9 Future Shelley Street one-way Layout

Source: Transport for NSW, June 2012

The traffic modelling for this study has utilised the intersection traffic counts undertaken by AECOM in November 2011. Arup was provided a copy of the AECOM LinSig model used for the Barangaroo South Traffic Study, which has considered the impact of the closure of Shelley Street during the Wynyard Walk construction works. Arup has updated the LinSig model to permit the right turn out of Shelley Street onto Sussex Street, consistent with the layout illustrated in Figure 9. The right turn bay on the southern approach at the Hickson Road / Napoleon Street intersection has been extended to 105m following the closure of Shelley Street to westbound traffic movements.

A maximum cycle time of 110 seconds has been adopted for signalised intersections in the traffic model.

## 4.9 Road Network Impacts

The effect of the estimated additional peak hour traffic during the peak period of construction generated traffic activity in August 2013 (for the Basement Works, C4, C3 and C5 Commercial Buildings, R8/R9 Residential Buildings, Wynyard Walk and Headland Park works combined) has been investigated for each affected intersections. The modelling results for the future peak hour traffic movements from all the construction activities combined are summarised in Table 3.

Table 3 Intersection Analysis

| Peak | Intersection | Existing/Background Traffic Only (Future Road Layout) | | | Construction Peak Traffic (Future Road Layout, Aug 2013) | | |
|---|---|---|---|---|---|---|---|
| | | LOS | DOS | AVD (sec) | LOS | DOS | AVD (sec) |
| AM | Hickson Rd & Napoleon St | A | 0.74 | 10 | A | 0.77 | 7 |
| | Sussex St & Shelley St | B | 0.89 | 26 | C | 0.92 | 36 |
| | Sussex St & Erskine St | C | 0.82 | 36 | D | 0.94 | 46 |
| | Erskine St & Shelley St | B | 0.79 | 16 | B | 0.85 | 19 |
| PM | Hickson Rd & Napoleon St | A | 0.50 | 3 | A | 0.61 | 4 |
| | Sussex St & Shelley St | B | 0.75 | 16 | C | 0.86 | 27 |
| | Sussex St & Erskine St | F | 0.99 | 76 | F | 1.29 | 131 |
| | Erskine St & Shelley St | B | 0.41 | 15 | A | 0.51 | 4 |

**Legend:** AVD – Average Vehicle Delay, LOS – Level of Service, DOS – Degree of Saturation

The results of the LinSig intersection analysis forecast minimal changes in the operation of key intersections surrounding the site as a result of the additional Barangaroo construction traffic, when compared with the base case scenario. The additional construction vehicles associated with the R8 and R9 works has only a minor impact on forecast road network performance compared to that previously forecast (and subsequently approved) in the C3, C4 and C5 commercial building applications.

The greatest impact in terms of road network performance is forecast occur at the Sussex Street / Erskine Street intersection in the PM peak hour. It is recognised that significant vehicle queuing currently occurs in the southbound direction on Sussex Street during this time 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. These intersections effectively act as the 'masters' along Sussex Street and impact on vehicle queues and delays of intersections to the north, particularly Sussex / Erskine Street. This intersection is forecast to operate at capacity in the PM peak hour, both with and without the additional construction traffic generated by Barangaroo South and surrounding developments.

It is unlikely the level of construction activity listed in section 4.6 will occur in the PM peak hour of 5pm – 6pm, given construction activity ceases at 6pm on a daily basis. Construction activity on-site is generally expected to slow down in

afternoons after 4pm. The assumptions made in the traffic model for the PM peak are therefore considered conservative, and it is likely intersections would operate at levels below that forecast in the model.

The full intersection capacity analysis results are included as Appendix A to this report.

## 4.10 On-Site Temporary Concrete Batch Plant

Lend Lease have recently submitted a modification to MP10_0023 for the provision of a temporary on-site concrete batch plant, which is currently being assessed by the Department of Planning and Infrastructure. Presently the concrete required to service the basement construction site would need to be sourced externally off-site and transported to the basement construction site via the local and regional road network. The provision of an on-site concrete batch plant would allow for the production of pre-mixed concrete on-site, confining concrete truck movements to bulk raw materials only – significantly reducing the number of truck movements associated with concrete pours. It is estimated the batch plant will result in a net reduction of more than 20,000 heavy vehicles from the local road network over the life of the project. This is approximately equivalent to a 30% reduction in overall site truck movements.

As the modification is currently being assessed, the reduction in truck movements has not been included in the LinSig intersection analysis. Assuming approval is granted for the on-site batch plant, the performance of key intersections will significantly improve relative to those presented in Table 3.

# 5 Traffic and Pedestrian Management

## 5.1 Construction Vehicle Management

### 5.1.1 Hours of Operation

The proposed site hours of operation, 7am – 6pm on weekdays, are considered to be reasonable and assist the site traffic movements being generated mainly outside the normal commuter peak traffic periods, such that their impacts on the surrounding road network are minimised.

### 5.1.2 Construction Routes

In addition to MP10_0023 – D4(e), which restricts trucks using York Street between 2pm and 8pm, trucks are also not able to use York Street or Clarence Street in the AM peak between 6am and 10am due to existing restrictions. No materials associated with construction are to be transported via Sydney Harbour.

### 5.1.3 Internal Site Vehicle Access and Car Parking Areas

The gatehouse at the access to the site is to be located approximately 40 metres inset from Hickson Road to prevent any queuing on Hickson Road by trucks entering the site. Any truck queuing will occur within on site. All vehicles will enter the site in a forwards direction. The gatehouse will be centred on the access road to prevent trucks parking along the kerbside to enquire about directions on site. Figure 10 indicates a diagram of the proposed construction site access.

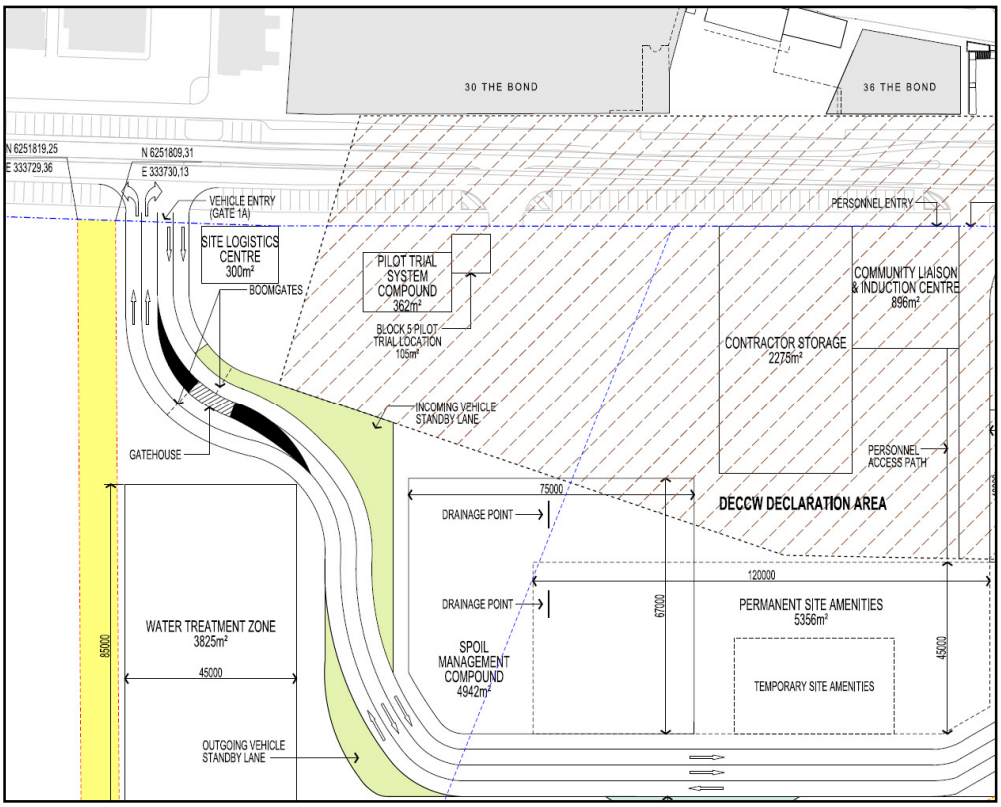



Figure 10 Proposed Construction Site Entry and Exit

An alternative access is proposed on the southern edge of the site off Lime Street near Shelley Street. This site access will be used as an alternate construction access and will only be used occasionally. No on site car parking will be provided for the site construction workforce.

### 5.1.4 Emergency Vehicle Access

Site entries are to be clearly signposted for the benefit of all approaching site traffic, in particular emergency services vehicles.

### 5.1.5 Access for Construction Workers

To reduce the impact on the local road network associated with construction work, no on-site parking is to be provided for construction workers. In this manner it is being treated like any other CBD construction project. The constrained parking environment surrounding the site, coupled with the relatively high cost of long term parking, will ensure the majority of construction workers arrive to the site via public transport. Lend Lease through their site inductions will provide travel information and advice to construction workers about public transport, walking and cycling routes to the Barangaroo south site. The green travel plan to be implemented by Lend Lease aims to maximise and encourage public transport use. This will involve providing no parking for construction workers on site and providing information about public transport availability and fare costs compared with on and off street parking costs.

### 5.1.6 Traffic Control Recommendations

The site traffic control recommendations for each worksite gate entry or exit point (including all appropriate signage) will be determined by means of a Traffic Control Plan to be prepared by an RTA accredited contractor closer to construction commencement.

Bulk Excavation and Basement Car Parking (MP10_0023) condition of consent D4(d) states that truck movements to be staged and coordinated to prevent trucks circulating CBD streets whilst awaiting access to the site.

Construction vehicles will approach the site from areas outside the CBD using major arterial routes such as the M4, M5 etc. Appropriate holding areas which can be accessed easily from these routes will be identified off-site outside the CBD area, with trucks to be called up when needed via an on-site central logistics centre. Once called, there will be room for trucks to be queued on-site, with no queuing on CBD roads to occur as a result of the construction of the Barangaroo Development.

The size of trucks proposed to access the site will be in accordance with Clause 300-3 of the Road Rules in terms of lengthy vehicle restrictions.

The vehicular traffic movements at each of the site entry or exit gates for traffic to and from Hickson Road will potentially need to be controlled by a flagman to ensure no potential traffic safety conflicts occur between the site truck traffic and pedestrians on the adjacent footpath, as per MP10_0023 condition of consent no.D4(c).

Bulk Excavation and Basement Car Parking (MP10_0023) condition of consent D4(c) states that personnel using stop/slow signage are not permitted in Hickson Road or Sussex Street on weekdays between 7am and 9am and 4pm to 7pm. However, personnel using stop/slow signage will be permitted on Hickson Road, north of the intersection of Hickson Road and Napoleon Street, when it is required to ensure safe truck access at designated site access points, provided that vehicles queue lengths generated as a result of the traffic control do not exceed more than six vehicles in either direction.

The removal of the existing parking along the Hickson Road site frontage (on the western side of Hickson Road ) is proposed to be implemented (under a future BDA approval) to create construction work zones at various stages of the works. These will be the subject of separate work zone applications should they be required. Class A Hoardings will be installed adjacent and over the footpath to establish a safe pedestrian footpath zone as required. The primary purpose of the work zone would be for handling of construction materials. The existing traffic lane arrangements will typically be maintained on Hickson Road.

Any activity likely to impact the operational efficiency of the state road network and/or for works within 100m of traffic lights would be the subject of an application to the Transport Management Centre for a road occupancy licence.

## 5.2 Pedestrian Management

### 5.2.1 Pedestrian Routes Approaching the Site

There are a number of existing pedestrian routes which will facilitate movement for construction workers to and from the Barangaroo South site. In addition to these facilities, a Review of Environmental Factors (REF) for a proposed temporary pedestrian bridge over Sussex Street for construction workers was exhibited in June 2012 which would provide a high quality, direct connection for construction workers.

Existing pedestrian crossing facilities on Napoleon Street (pedestrian refuge) and Hickson Road (zebra crossing) will facilitate access for construction workers into the site. Dedicated pedestrian crossing legs at the Margaret Street / Kent Street and Sussex Street / Shelley Street intersections will remain in place during the Wynyard Walk bridge and tunnel works, which will allow safe pedestrian movement across Napoleon Street towards the Barangaroo site.

A pedestrian refuge in the middle of Napoleon Street has recently been installed in March 2012, allowing a two staged crossing of Napoleon Street. This intersection is to be upgraded to include traffic signals at the time of the initial occupancy of the commercial buildings at Barangaroo, which is anticipated to occur in 2015.

A summary of the key pedestrian routes for construction workers accessing the Barangaroo site is presented in Figure 11.

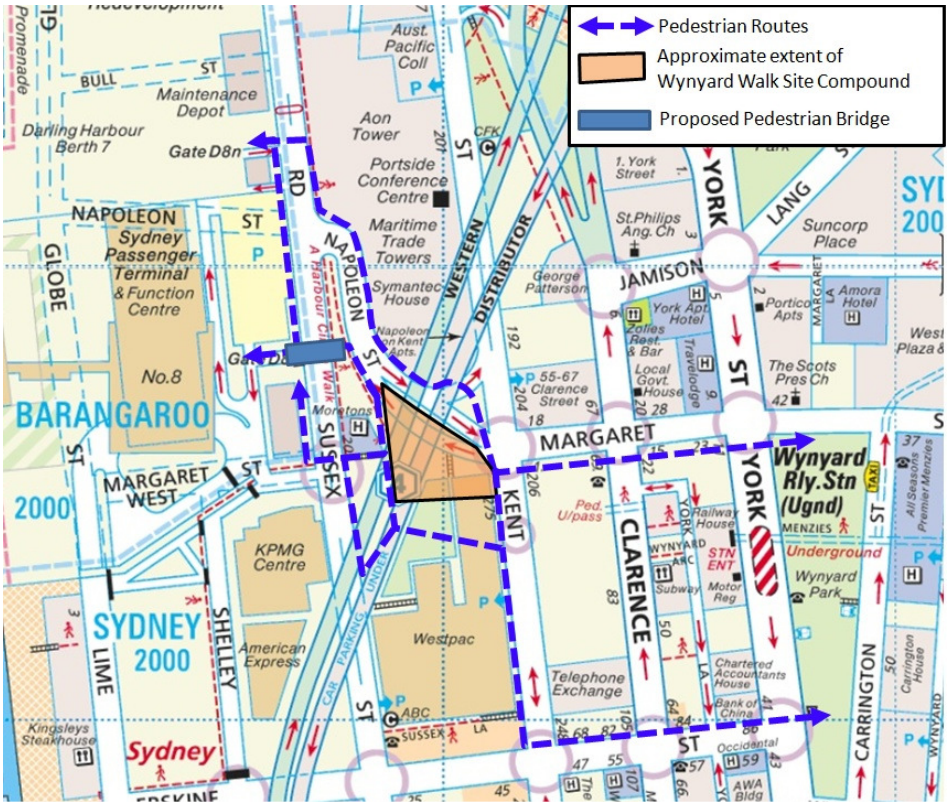


Figure 11 Key Pedestrian Routes to Barangaroo Site

### 5.2.2 Hickson Road Pedestrian Management

With the relocation of the cruise passenger terminal in June 2013 (prior to the commencement of construction of the R8/R9 buildings), pedestrian volumes along Hickson Road adjacent to the work-zones during the construction works will be significantly lower compared with existing levels. On-site traffic controllers will be present in the precinct to manage the movement of heavy vehicles ensure the safety of pedestrians passing through.

Following the recent completion of the diaphragm wall on Hickson Road, the western footpath has been reopened to pedestrians. A pedestrian refuge in the middle of Napoleon Street has recently been installed in March 2012, allowing a two staged crossing of Napoleon Street. This intersection is to be upgraded to include traffic signals at the time of the initial occupancy of the commercial buildings at Barangaroo, which is anticipated to occur in 2015.

### 5.2.3 Pedestrian Management on Barangaroo Public Access Routes

Typically the public access route along the waterfront will be maintained at a 20m width. During construction however, there may be occasions where the width will be reduced, and in the interests of public safety and during the works, the waterfront public access will be no less than 6m in width at these localised sections. The contractor will coordinate with the BDA regarding the actual position of the access and to ensure that these distances are maintained.

The purpose of this reduction in width is to facilitate an adequate safety buffer zone between the pedestrians utilising the waterfront access and the heavy machinery and equipment associated with the construction of the basement perimeter retention systems. These works are likely to include the handling by large pin jib crane of both large steel sheets and steel reinforcement cages in the order of 25m in length. The existing public access along the waterfront will be generally maintained throughout the construction works with some deviations and closures necessary at certain stages of the works. Closure and/or operation of the cross site links at other times will be subject to ongoing risk assessment and further consultation with the Barangaroo Delivery Authority.

When the Cruise Passenger Terminal is in operation, pedestrians will be directed around the facility or back to their origin.

# 6 Conclusions

Arup has prepared this construction staging traffic impacts assessment for the R8 and R9 residential buildings which is planned to occur in parallel with the construction of a basement level car park at the Barangaroo site. The purpose of the assessment is to inform and accompany the R8/R9 Residential Building Project Application (MP11_0002).

The assessment concludes that the construction related traffic impacts arising from the works proposed under the R8/R9 Residential Building Project Application (MP11_0002) can be appropriately managed.

# Appendix A

LinSig Intersection Results

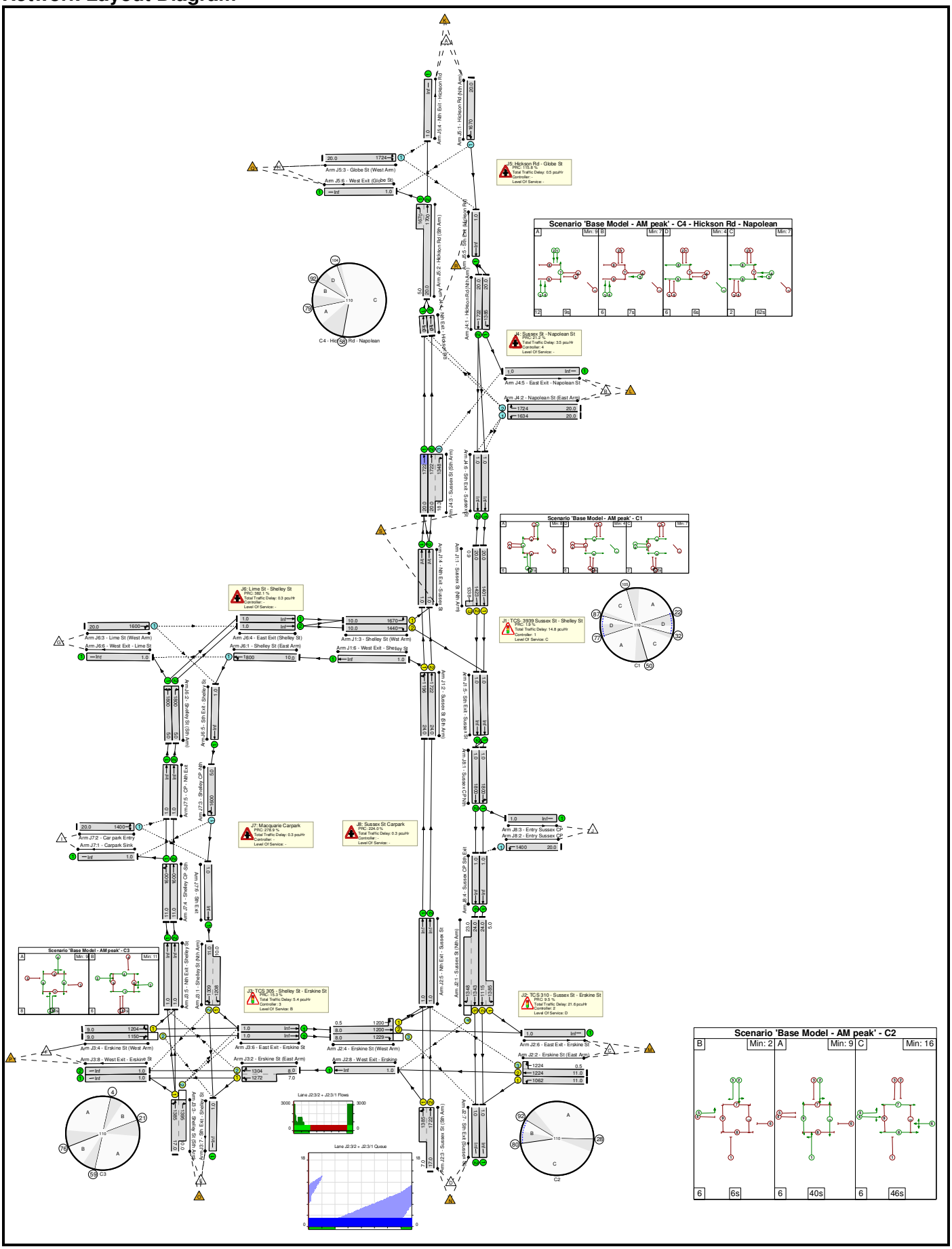
**Barangaroo Construction Traffic**

**User and Project Details**

| | |
|---|---|
| **Project:** | **Barangaroo Transport** |
| **Title:** | **Construction Traffic Flows** |
| **Location:** | Barangaroo, Sydney NSW 2000 |
| **File name:** | AM Construction 2011_v3.lsg3x |
| **Author:** | Eoin Cunningham |
| **Company:** | Arup Pty Ltd |
| **Address:** | Level 10, 201 Kent Street, Sydney |
| **Notes:** | Base model courtesy of AECOM |

**Scenario 1: 'Base Model - AM peak'** (FG1: 'AM Base', Plan 1: 'Network Control Plan 1')

## Network Layout Diagram



## Network Results

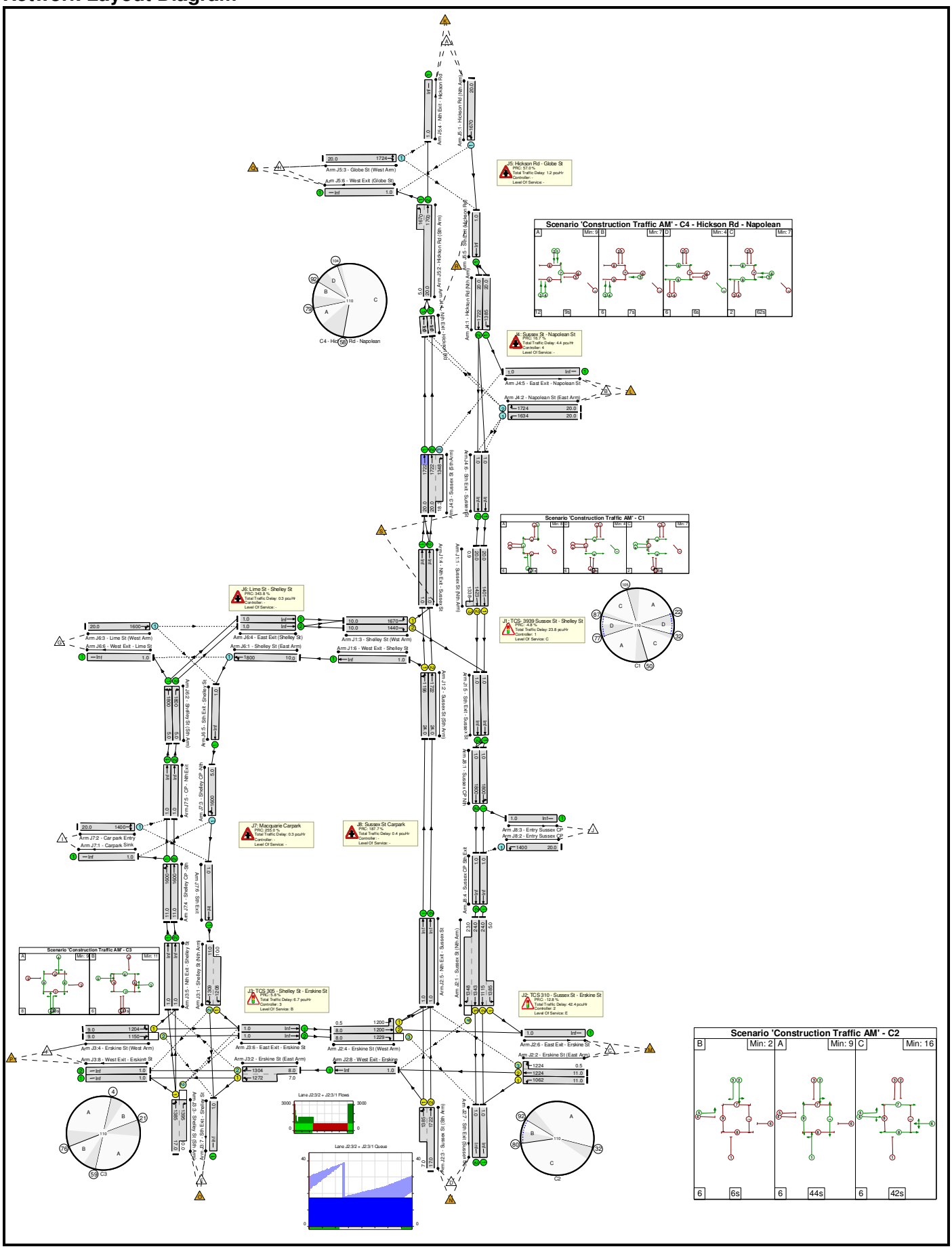
| Item | Lane Description | Lane Type | Deg Sat (%) | Av. Delay Per PCU (s/pcu) | Demand Flow (pcu) | Sat Flow (pcu/Hr) | Max. Back of Uniform Queue (pcu) | Mean Max Queue (pcu) |
|---|---|---|---|---|---|---|---|---|
| **Network: Construction Traffic Flows** | - | - | **88.3%** | - | - | - | - | - |
| **J1: TCS- 3939 Sussex St - Shelley St** | - | - | **88.3%** | - | - | - | - | - |
| 1/1 | Sussex St (Nth Arm) Ahead | U | 69.2% | 24.0 | 388 | 1401 | 4.9 | 6.0 |
| 1/2+1/3 | Sussex St (Nth Arm) Ahead | U | 60.3% | 21.0 | 343 | 1423:1338 | 4.1 | 4.9 |
| 2/1 | Sussex St (Sth Arm) Ahead Left | U | 54.6% | 16.2 | 261 | 1196 | 3.3 | 3.9 |
| 2/2 | Sussex St (Sth Arm) Ahead | U | 68.1% | 15.7 | 469 | 1722 | 5.8 | 6.8 |
| 3/1 | Shelley St (Wst Arm) Left | U | 88.3% | 47.0 | 456 | 1670 | 5.6 | 9.0 |
| 3/2 | Shelley St (Wst Arm) Right | U | 36.6% | 23.6 | 163 | 1440 | 1.7 | 2.0 |
| 4/1 | Nth Exit - Sussex St Ahead | U | 0.0% | 0.0 | 233 | Inf | 0.0 | 0.0 |
| 4/2 | Nth Exit - Sussex St Ahead | U | 0.0% | 0.0 | 925 | Inf | 0.0 | 0.0 |
| 5/1 | Sth Exit - Sussex St Ahead | U | 0.0% | 0.0 | 551 | Inf | 0.0 | 0.0 |
| 5/2 | Sth Exit - Sussex St Ahead | U | 0.0% | 0.0 | 343 | Inf | 0.0 | 0.0 |
| 6/1 | West Exit - Shelley St Ahead | U | 0.0% | 0.0 | 28 | Inf | 0.0 | 0.0 |
| **J2: TCS 310 - Sussex St - Erskine St** | - | - | **82.2%** | - | - | - | - | - |
| 1/2+1/1 | Sussex St (Nth Arm) Left Ahead | U | 60.7% | 21.3 | 365 | 1115:1385 | 9.3 | 10.1 |
| 1/3+1/4 | Sussex St (Nth Arm) Ahead Right | U+O | 53.8% | 34.5 | 394 | 1343:1348 | 26.5 | 27.0 |
| 2/1 | Erskine St (East Arm) Left | U | 71.6% | 39.7 | 325 | 1062 | 8.1 | 9.4 |
| 2/2+2/3 | Erskine St (East Arm) Right Ahead | U+O | 16.9% | 22.9 | 92 | 1224:1224 | 1.4 | 1.5 |
| 3/2+3/1 | Sussex St (Sth Arm) Ahead Left | U | 82.2% | 41.1 | 614 | 1722:1385 | 11.6 | 13.8 |
| 4/2+4/1 | Erskine St (West Arm) Left Ahead | U | 46.7% | 27.7 | 254 | 1200:1200 | 5.8 | 6.2 |
| 4/3 | Erskine St (West Arm) Right | O | 60.5% | 56.3 | 164 | 1229 | 4.7 | 5.5 |
| 5/1 | Nth Exit - Sussex St Ahead | U | 0.0% | 0.0 | 261 | Inf | 0.0 | 0.0 |
| 5/2 | Nth Exit - Sussex St Ahead | U | 0.0% | 0.0 | 469 | Inf | 0.0 | 0.0 |
| 6/1 | East Exit - Erskine St | U | 0.0% | 0.0 | 201 | Inf | 0.0 | 0.0 |
| 7/1 | Sth Exit (Sussex St) | U | 0.0% | 0.0 | 610 | Inf | 0.0 | 0.0 |
| 7/2 | Sth Exit (Sussex St) | U | 0.0% | 0.0 | 478 | Inf | 0.0 | 0.0 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 8/1 | West Exit - Erskine Ahead | U | 0.0% | 0.0 | 189 | Inf | 0.0 | 0.0 |
| **J3: TCS 305 - Shelley St - Erskine St** | **-** | **-** | **78.1%** | **-** | **-** | **-** | **-** | **-** |
| 1/2+1/1 | Shelley St (Nth Arm) Left Ahead Right | O+U | 4.5% | 4.3 | 38 | 1309:1208 | 0.0 | 0.1 |
| 2/2+2/1 | Erskine St (East Arm) Right Left Ahead | O+U | 45.4% | 24.3 | 189 | 1304:1272 | 7.0 | 7.4 |
| 3/1+3/2 | Shelley St (Sth Arm) Ahead Right Left | U+O | 78.1% | 14.1 | 959 | 1385:1395 | 6.3 | 8.1 |
| 4/1 | Erskine St (West Arm) Left Ahead | U | 9.9% | 24.8 | 26 | 1204 | 0.3 | 0.4 |
| 4/2 | Erskine St (West Arm) Ahead Right | O | 7.2% | 24.9 | 18 | 1150 | 0.2 | 0.3 |
| 5/1 | Nth Exit - Shelley St Ahead | U | 0.0% | 0.0 | 380 | Inf | 0.0 | 0.0 |
| 5/2 | Nth Exit - Shelley St Ahead | U | 0.0% | 0.0 | 336 | Inf | 0.0 | 0.0 |
| 6/1 | East Exit - Erskine St Ahead | U | 0.0% | 0.0 | 254 | Inf | 0.0 | 0.0 |
| 6/2 | East Exit - Erskine St Ahead | U | 0.0% | 0.0 | 164 | Inf | 0.0 | 0.0 |
| 7/1 | Sth Exit - Shelley St | U | 0.0% | 0.0 | 56 | Inf | 0.0 | 0.0 |
| 8/1 | West Exit - Erskine St | U | 0.0% | 0.0 | 34 | Inf | 0.0 | 0.0 |
| 8/2 | West Exit - Erskine St | U | 0.0% | 0.0 | 6 | Inf | 0.0 | 0.0 |
| **J4: Sussex St - Napolean St** | **-** | **-** | **74.3%** | **-** | **-** | **-** | **-** | **-** |
| 1/1 | Hickson Rd (Nth Arm) Left | U | 4.1% | 1.4 | 57 | 1385 | 0.0 | 0.0 |
| 1/2 | Hickson Rd (Nth Arm) Ahead | U | 13.9% | 1.2 | 239 | 1722 | 0.0 | 0.1 |
| 2/1 | Napolean St (East Arm) Left | O | 74.3% | 10.4 | 492 | 1634 | 0.0 | 1.4 |
| 2/2 | Napolean St (East Arm) Right | O | 24.5% | 7.3 | 80 | 1724 | 0.0 | 0.2 |
| 3/1 | Sussex St (Sth Arm) Ahead | U | 36.5% | 1.6 | 629 | 1722 | 0.0 | 0.3 |
| 3/2+3/3 | Sussex St (Sth Arm) Ahead Right | U+O | 70.9% | 10.1 | 529 | 1722:1348 | 5.7 | 6.9 |
| 4/1 | Nth Exit - Hickson Rd Ahead | U | 0.0% | 0.0 | 669 | Inf | 0.0 | 0.0 |
| 4/2 | Nth Exit - Hickson Rd Ahead | U | 0.0% | 0.0 | 40 | Inf | 0.0 | 0.0 |
| 5/1 | East Exit - Napolean St | U | 0.0% | 0.0 | 586 | Inf | 0.0 | 0.0 |
| 6/1 | Sth Exit - Sussex St Ahead | U | 0.0% | 0.0 | 388 | Inf | 0.0 | 0.0 |
| 6/2 | Sth Exit - Sussex St Ahead | U | 0.0% | 0.0 | 343 | Inf | 0.0 | 0.0 |
| **J5: Hickson Rd - Globe St** | **-** | **-** | **41.7%** | **-** | **-** | **-** | **-** | **-** |
| 1/1 | Hickson Rd (Nth Arm) Ahead Right | O | 17.7% | 1.3 | 296 | 1670 | 0.0 | 0.1 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 2/2+2/1 | Hickson Rd (Sth Arm) Ahead Left | U | 41.7% | 1.8 | 709 | 1700:1670 | 6.5 | 6.8 |
| 3/1 | Globe St (West Arm) Left Right | O | 0.0% | 0.0 | 0 | 1724 | 0.0 | 0.0 |
| 4/1 | Nth Exit - Hickson Rd | U | 0.0% | 0.0 | 709 | Inf | 0.0 | 0.0 |
| 5/1 | Sth Exit (Hickson Rd) Ahead | U | 0.0% | 0.0 | 296 | Inf | 0.0 | 0.0 |
| 6/1 | West Exit (Globe St) | U | 0.0% | 0.0 | 0 | Inf | 0.0 | 0.0 |
| **J6: Lime St - Shelley St** | **-** | **-** | **18.7%** | **-** | **-** | **-** | **-** | **-** |
| 1/1 | Shelley St (East Arm) Left Ahead | O | 1.6% | 1.0 | 28 | 1800 | 0.0 | 0.0 |
| 2/1 | Shelley St (Sth Arm) Right Left | U | 15.4% | 1.2 | 278 | 1800 | 0.0 | 0.1 |
| 2/2 | Shelley St (Sth Arm) Right | U | 18.7% | 1.2 | 336 | 1800 | 0.0 | 0.1 |
| 3/1 | Lime St (West Arm) Ahead Right | O | 9.1% | 3.5 | 51 | 1600 | 0.0 | 0.0 |
| 4/1 | East Exit (Shelley St) Ahead | U | 0.0% | 0.0 | 241 | Inf | 0.0 | 0.0 |
| 4/2 | East Exit (Shelley St) Ahead | U | 0.0% | 0.0 | 378 | Inf | 0.0 | 0.0 |
| 5/1 | Sth Exit - Shelley St Ahead | U | 0.0% | 0.0 | 37 | Inf | 0.0 | 0.0 |
| 6/1 | West Exit - Lime St | U | 0.0% | 0.0 | 37 | Inf | 0.0 | 0.0 |
| **J7: Macquarie Carpark** | **-** | **-** | **23.8%** | **-** | **-** | **-** | **-** | **-** |
| 1/1 | Carpark Sink | U | 0.0% | 0.0 | 120 | Inf | 0.0 | 0.0 |
| 2/1 | Car park Entry Left Right | O | 3.6% | 3.5 | 19 | 1400 | 0.0 | 0.0 |
| 3/1 | Shelley CP -Nth Right Ahead | O | 3.0% | 1.5 | 37 | 1600 | 0.0 | 0.0 |
| 4/1 | Shelley CP -Sth Left Ahead | U | 23.8% | 1.5 | 380 | 1600 | 0.0 | 0.2 |
| 4/2 | Shelley CP -Sth Ahead | U | 21.0% | 1.4 | 336 | 1600 | 0.0 | 0.1 |
| 5/1 | CP - Nth Exit Ahead | U | 0.0% | 0.0 | 278 | Inf | 0.0 | 0.0 |
| 5/2 | CP - Nth Exit Ahead | U | 0.0% | 0.0 | 336 | Inf | 0.0 | 0.0 |
| 6/1 | Sth Exit Ahead | U | 0.0% | 0.0 | 38 | Inf | 0.0 | 0.0 |
| **J8: Sussex St Carpark** | **ea-** | **-** | **27.8%** | **-** | **-** | **-** | **-** | **-** |
| 1/1 | Sussex CP Nth Left Ahead | U | 27.8% | 1.4 | 500 | 1800 | 0.0 | 0.2 |
| 1/2 | Sussex CP Nth Ahead | U | 21.9% | 1.3 | 394 | 1800 | 0.0 | 0.1 |
| 2/1 | Entry Sussex CP Left | O | 0.0% | 0.0 | 0 | 1400 | 0.0 | 0.0 |
| 3/1 | Entry Sussex CP | U | 0.0% | 0.0 | 135 | Inf | 0.0 | 0.0 |
| 4/1 | Sussex CP Sth Exit Ahead | U | 0.0% | 0.0 | 365 | Inf | 0.0 | 0.0 |
| 4/2 | Sussex CP Sth Exit Ahead | U | 0.0% | 0.0 | 394 | Inf | 0.0 | 0.0 |

**Scenario 2: 'Construction Traffic AM'** (FG3: 'AM Construction and Traffic', Plan 1: 'Network Control Plan 1')

## Network Layout Diagram



## 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) |
|---|---|---|---|---|---|---|---|---|
| **Network: Construction Traffic Flows** | - | - | **101.5%** | - | - | - | - | - |
| **J1: TCS- 3939 Sussex St - Shelley St** | - | - | **94.3%** | - | - | - | - | - |
| 1/1 | Sussex St (Nth Arm) Ahead | U | 79.1% | 29.4 | 443 | 1401 | 5.9 | 7.7 |
| 1/2+1/3 | Sussex St (Nth Arm) Ahead | U | 70.3% | 24.3 | 400 | 1423:1338 | 5.0 | 6.2 |
| 2/1 | Sussex St (Sth Arm) Ahead Left | U | 77.2% | 26.7 | 373 | 1196 | 6.7 | 8.3 |
| 2/2 | Sussex St (Sth Arm) Ahead | U | 84.5% | 28.5 | 590 | 1722 | 8.6 | 11.2 |
| 3/1 | Shelley St (Wst Arm) Left | U | 94.3% | 65.6 | 487 | 1670 | 6.6 | 12.5 |
| 3/2 | Shelley St (Wst Arm) Right | U | 40.9% | 25.1 | 182 | 1440 | 1.9 | 2.3 |
| 4/1 | Nth Exit - Sussex St Ahead | U | 0.0% | 0.0 | 349 | Inf | 0.0 | 0.0 |
| 4/2 | Nth Exit - Sussex St Ahead | U | 0.0% | 0.0 | 1077 | Inf | 0.0 | 0.0 |
| 5/1 | Sth Exit - Sussex St Ahead | U | 0.0% | 0.0 | 625 | Inf | 0.0 | 0.0 |
| 5/2 | Sth Exit - Sussex St Ahead | U | 0.0% | 0.0 | 400 | Inf | 0.0 | 0.0 |
| 6/1 | West Exit - Shelley St Ahead | U | 0.0% | 0.0 | 24 | Inf | 0.0 | 0.0 |
| **J2: TCS 310 - Sussex St - Erskine St** | - | - | **101.5%** | - | - | - | - | - |
| 1/2+1/1 | Sussex St (Nth Arm) Left Ahead | U | 67.7% | 20.7 | 428 | 1115:1385 | 10.6 | 11.7 |
| 1/3+1/4 | Sussex St (Nth Arm) Ahead Right | U+O | 59.1% | 33.6 | 462 | 1343:1348 | 27.3 | 28.0 |
| 2/1 | Erskine St (East Arm) Left | U | 78.3% | 48.6 | 325 | 1062 | 8.7 | 10.4 |
| 2/2+2/3 | Erskine St (East Arm) Right Ahead | U+O | 18.4% | 25.9 | 92 | 1224:1224 | 1.5 | 1.6 |
| 3/2+3/1 | Sussex St (Sth Arm) Ahead Left | U | 101.5% | 112.0 | 802 | 1722:1385 | 21.6 | 39.1 |
| 4/2+4/1 | Erskine St (West Arm) Left Ahead | U | 59.7% | 35.6 | 303 | 1200:1200 | 7.8 | 8.6 |
| 4/3 | Erskine St (West Arm) Right | O | 65.5% | 65.8 | 145 | 1229 | 4.2 | 5.1 |
| 5/1 | Nth Exit - Sussex St Ahead | U | 0.0% | 0.0 | 373 | Inf | 0.0 | 0.0 |
| 5/2 | Nth Exit - Sussex St Ahead | U | 0.0% | 0.0 | 590 | Inf | 0.0 | 0.0 |
| 6/1 | East Exit - Erskine St | U | 0.0% | 0.0 | 201 | Inf | 0.0 | 0.0 |
| 7/1 | Sth Exit (Sussex St) | U | 0.0% | 0.0 | 673 | Inf | 0.0 | 0.0 |
| 7/2 | Sth Exit (Sussex St) | U | 0.0% | 0.0 | 527 | Inf | 0.0 | 0.0 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 8/1 | West Exit - Erskine Ahead | U | 0.0% | 0.0 | 193 | Inf | 0.0 | 0.0 |
| **J3: TCS 305 - Shelley St - Erskine St** | **-** | **-** | **85.1%** | **-** | **-** | **-** | **-** | **-** |
| 1/2+1/1 | Shelley St (Nth Arm) Left Ahead Right | O+U | 4.6% | 4.6 | 39 | 1309:1208 | 0.1 | 0.1 |
| 2/2+2/1 | Erskine St (East Arm) Right Left Ahead | O+U | 46.1% | 24.1 | 193 | 1304:1272 | 7.0 | 7.5 |
| 3/1+3/2 | Shelley St (Sth Arm) Ahead Right Left | U+O | 85.1% | 17.5 | 1039 | 1385:1395 | 7.4 | 10.2 |
| 4/1 | Erskine St (West Arm) Left Ahead | U | 9.9% | 24.8 | 26 | 1204 | 0.3 | 0.4 |
| 4/2 | Erskine St (West Arm) Ahead Right | O | 7.2% | 24.9 | 18 | 1150 | 0.2 | 0.3 |
| 5/1 | Nth Exit - Shelley St Ahead | U | 0.0% | 0.0 | 406 | Inf | 0.0 | 0.0 |
| 5/2 | Nth Exit - Shelley St Ahead | U | 0.0% | 0.0 | 365 | Inf | 0.0 | 0.0 |
| 6/1 | East Exit - Erskine St Ahead | U | 0.0% | 0.0 | 303 | Inf | 0.0 | 0.0 |
| 6/2 | East Exit - Erskine St Ahead | U | 0.0% | 0.0 | 145 | Inf | 0.0 | 0.0 |
| 7/1 | Sth Exit - Shelley St | U | 0.0% | 0.0 | 56 | Inf | 0.0 | 0.0 |
| 8/1 | West Exit - Erskine St | U | 0.0% | 0.0 | 36 | Inf | 0.0 | 0.0 |
| 8/2 | West Exit - Erskine St | U | 0.0% | 0.0 | 4 | Inf | 0.0 | 0.0 |
| **J4: Sussex St - Napolean St** | **-** | **-** | **77.1%** | **-** | **-** | **-** | **-** | **-** |
| 1/1 | Hickson Rd (Nth Arm) Left | U | 7.6% | 1.4 | 105 | 1385 | 0.0 | 0.0 |
| 1/2 | Hickson Rd (Nth Arm) Ahead | U | 20.4% | 1.3 | 351 | 1722 | 0.0 | 0.1 |
| 2/1 | Napolean St (East Arm) Left | O | 77.1% | 12.1 | 492 | 1634 | 0.0 | 1.7 |
| 2/2 | Napolean St (East Arm) Right | O | 31.5% | 10.5 | 80 | 1724 | 0.2 | 0.4 |
| 3/1 | Sussex St (Sth Arm) Ahead | U | 51.7% | 2.5 | 897 | 1722 | 4.5 | 5.1 |
| 3/2+3/3 | Sussex St (Sth Arm) Ahead Right | U+O | 76.1% | 11.9 | 529 | 1722:1348 | 19.1 | 20.7 |
| 4/1 | Nth Exit - Hickson Rd Ahead | U | 0.0% | 0.0 | 937 | Inf | 0.0 | 0.0 |
| 4/2 | Nth Exit - Hickson Rd Ahead | U | 0.0% | 0.0 | 40 | Inf | 0.0 | 0.0 |
| 5/1 | East Exit - Napolean St | U | 0.0% | 0.0 | 634 | Inf | 0.0 | 0.0 |
| 6/1 | Sth Exit - Sussex St Ahead | U | 0.0% | 0.0 | 443 | Inf | 0.0 | 0.0 |
| 6/2 | Sth Exit - Sussex St Ahead | U | 0.0% | 0.0 | 400 | Inf | 0.0 | 0.0 |
| **J5: Hickson Rd - Globe St** | **-** | **-** | **57.3%** | **-** | **-** | **-** | **-** | **-** |
| 1/1 | Hickson Rd (Nth Arm) Ahead Right | O | 17.7% | 1.3 | 296 | 1670 | 0.0 | 0.1 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 2/2+2/1 | Hickson Rd (Sth Arm) Ahead Left | U | 57.3% | 2.7 | 977 | 1700:1670 | 14.0 | 14.6 |
| 3/1 | Globe St (West Arm) Left Right | O | 41.2% | 7.9 | 160 | 1724 | 0.0 | 0.3 |
| 4/1 | Nth Exit - Hickson Rd | U | 0.0% | 0.0 | 709 | Inf | 0.0 | 0.0 |
| 5/1 | Sth Exit (Hickson Rd) Ahead | U | 0.0% | 0.0 | 456 | Inf | 0.0 | 0.0 |
| 6/1 | West Exit (Globe St) | U | 0.0% | 0.0 | 268 | Inf | 0.0 | 0.0 |
| **J6: Lime St - Shelley St** | **-** | **-** | **20.3%** | **-** | **-** | **-** | **-** | **-** |
| 1/1 | Shelley St (East Arm) Left Ahead | O | 1.3% | 1.0 | 24 | 1800 | 0.0 | 0.0 |
| 2/1 | Shelley St (Sth Arm) Right Left | U | 16.6% | 1.2 | 299 | 1800 | 0.0 | 0.1 |
| 2/2 | Shelley St (Sth Arm) Right | U | 20.3% | 1.3 | 365 | 1800 | 0.0 | 0.1 |
| 3/1 | Lime St (West Arm) Ahead Right | O | 9.3% | 3.6 | 51 | 1600 | 0.0 | 0.1 |
| 4/1 | East Exit (Shelley St) Ahead | U | 0.0% | 0.0 | 262 | Inf | 0.0 | 0.0 |
| 4/2 | East Exit (Shelley St) Ahead | U | 0.0% | 0.0 | 407 | Inf | 0.0 | 0.0 |
| 5/1 | Sth Exit - Shelley St Ahead | U | 0.0% | 0.0 | 33 | Inf | 0.0 | 0.0 |
| 6/1 | West Exit - Lime St | U | 0.0% | 0.0 | 37 | Inf | 0.0 | 0.0 |
| **J7: Macquarie Carpark** | **-** | **-** | **25.4%** | **-** | **-** | **-** | **-** | **-** |
| 1/1 | Carpark Sink | U | 0.0% | 0.0 | 120 | Inf | 0.0 | 0.0 |
| 2/1 | Car park Entry Left Right | O | 3.7% | 3.6 | 19 | 1400 | 0.0 | 0.0 |
| 3/1 | Shelley CP -Nth Right Ahead | O | 2.3% | 1.3 | 33 | 1600 | 0.0 | 0.0 |
| 4/1 | Shelley CP -Sth Left Ahead | U | 25.4% | 1.5 | 406 | 1600 | 0.0 | 0.2 |
| 4/2 | Shelley CP -Sth Ahead | U | 22.8% | 1.5 | 365 | 1600 | 0.0 | 0.1 |
| 5/1 | CP - Nth Exit Ahead | U | 0.0% | 0.0 | 299 | Inf | 0.0 | 0.0 |
| 5/2 | CP - Nth Exit Ahead | U | 0.0% | 0.0 | 365 | Inf | 0.0 | 0.0 |
| 6/1 | Sth Exit Ahead | U | 0.0% | 0.0 | 39 | Inf | 0.0 | 0.0 |
| **J8: Sussex St Carpark** | **-** | **-** | **31.3%** | **-** | **-** | **-** | **-** | **-** |
| 1/1 | Sussex CP Nth Left Ahead | U | 31.3% | 1.5 | 563 | 1800 | 0.0 | 0.2 |
| 1/2 | Sussex CP Nth Ahead | U | 25.7% | 1.3 | 462 | 1800 | 0.0 | 0.2 |
| 2/1 | Entry Sussex CP Left | O | 0.0% | 0.0 | 0 | 1400 | 0.0 | 0.0 |
| 3/1 | Entry Sussex CP | U | 0.0% | 0.0 | 135 | Inf | 0.0 | 0.0 |
| 4/1 | Sussex CP Sth Exit Ahead | U | 0.0% | 0.0 | 428 | Inf | 0.0 | 0.0 |
| 4/2 | Sussex CP Sth Exit Ahead | U | 0.0% | 0.0 | 462 | Inf | 0.0 | 0.0 |

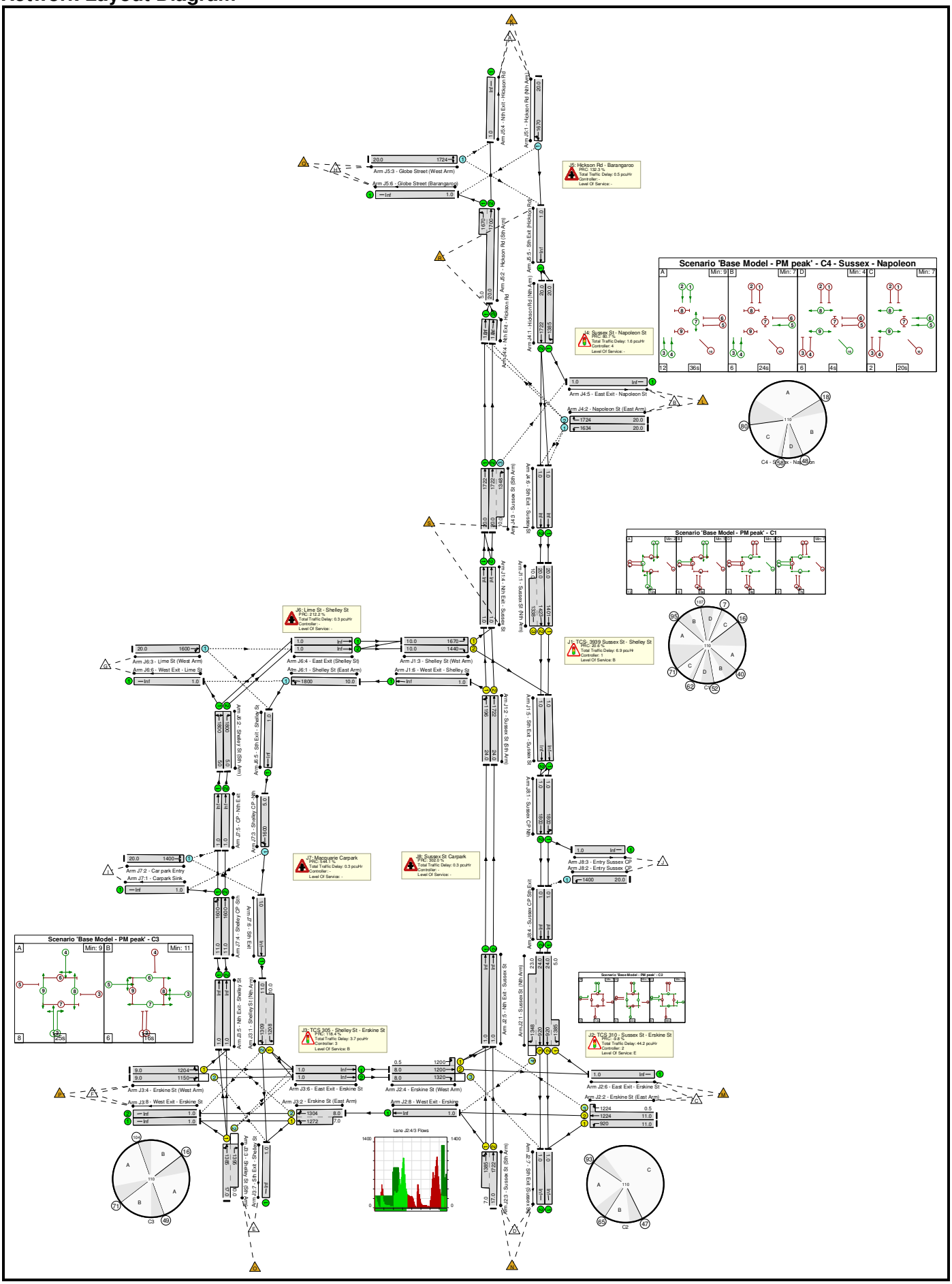
**Barangaroo Construction**

**Project and User Details**

| | |
|---|---|
| **Project:** | **Barangaroo Transport** |
| **Title:** | **LinSig Modelling PM** |
| **Location:** | Barangaroo, Sydney NSW 2000 |
| **Company:** | Arup Pty Ltd |
| **Address:** | Level 10, 201 Kent Street, Sydney |

**Scenario 1: 'Base Model - PM peak'** (FG1: 'Flow Group 1', Plan 1: 'Network Control Plan 1')

## Network Layout Diagram



## Network Results

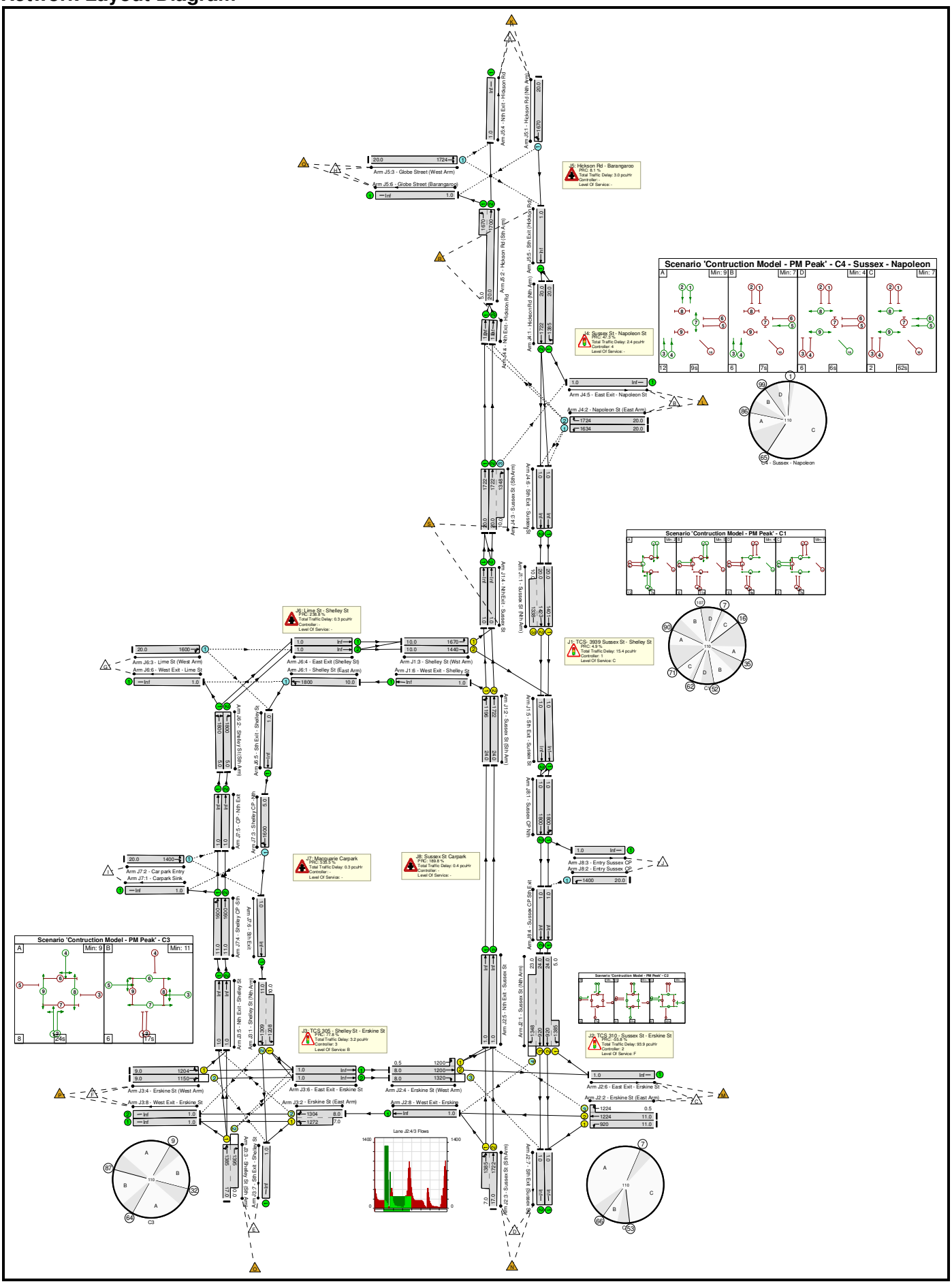
| Item | Lane Description | Lane Type | Deg Sat (%) | Av. Delay Per PCU (s/pcu) | Demand Flow (pcu) | Sat Flow (pcu/Hr) | Max. Back of Uniform Queue (pcu) | Mean Max Queue (pcu) |
|---|---|---|---|---|---|---|---|---|
| **Network: LinSig Modelling PM** | - | - | **98.9%** | - | - | - | - | - |
| **J1: TCS- 3939 Sussex St - Shelley St** | - | - | **74.7%** | - | - | - | - | - |
| 1/1 | Sussex St (Nth Arm) Ahead | U | 51.0% | 12.0 | 403 | 1401 | 3.7 | 4.2 |
| 1/2+1/3 | Sussex St (Nth Arm) Ahead | U | 45.9% | 11.2 | 368 | 1423:1338 | 3.3 | 3.7 |
| 2/1 | Sussex St (Sth Arm) Ahead Left | U | 39.9% | 14.2 | 165 | 1196 | 1.2 | 1.6 |
| 2/2 | Sussex St (Sth Arm) Ahead | U | 51.1% | 15.6 | 304 | 1722 | 3.1 | 3.6 |
| 3/1 | Shelley St (Wst Arm) Left | U | 74.7% | 25.5 | 340 | 1670 | 3.9 | 5.4 |
| 3/2 | Shelley St (Wst Arm) Right | U | 0.0% | 0.0 | 0 | 1440 | 0.0 | 0.0 |
| 4/1 | Nth Exit - Sussex St Ahead | U | 0.0% | 0.0 | 98 | Inf | 0.0 | 0.0 |
| 4/2 | Nth Exit - Sussex St Ahead | U | 0.0% | 0.0 | 644 | Inf | 0.0 | 0.0 |
| 5/1 | Sth Exit - Sussex St Ahead | U | 0.0% | 0.0 | 403 | Inf | 0.0 | 0.0 |
| 5/2 | Sth Exit - Sussex St Ahead | U | 0.0% | 0.0 | 368 | Inf | 0.0 | 0.0 |
| 6/1 | West Exit - Shelley St Ahead | U | 0.0% | 0.0 | 67 | Inf | 0.0 | 0.0 |
| **J2: TCS 310 - Sussex St - Erskine St** | - | - | **98.9%** | - | - | - | - | - |
| 1/2+1/1 | Sussex St (Nth Arm) Left Ahead | U | 97.9% | 123.4 | 368 | 920:1385 | 10.4 | 18.3 |
| 1/3+1/4 | Sussex St (Nth Arm) Ahead Right | U+O | 98.9% | 129.5 | 403 | 920:1348 | 27.0 | 35.9 |
| 2/1 | Erskine St (East Arm) Left | U | 74.8% | 33.9 | 369 | 920 | 8.7 | 10.2 |
| 2/2+2/3 | Erskine St (East Arm) Right Ahead | U+O | 15.1% | 15.5 | 103 | 1224:1224 | 1.1 | 1.2 |
| 3/2+3/1 | Sussex St (Sth Arm) Ahead Left | U | 78.8% | 55.5 | 408 | 1722:1385 | 6.4 | 8.2 |
| 4/2+4/1 | Erskine St (West Arm) Left Ahead | U | 24.6% | 8.6 | 163 | 1200:1200 | 1.2 | 1.4 |
| 4/3 | Erskine St (West Arm) Right | O | 91.5% | 80.9 | 289 | 1320 | 6.4 | 10.5 |
| 5/1 | Nth Exit - Sussex St Ahead | U | 0.0% | 0.0 | 165 | Inf | 0.0 | 0.0 |
| 5/2 | Nth Exit - Sussex St Ahead | U | 0.0% | 0.0 | 304 | Inf | 0.0 | 0.0 |
| 6/1 | East Exit - Erskine St | U | 0.0% | 0.0 | 172 | Inf | 0.0 | 0.0 |
| 7/1 | Sth Exit (Sussex St) | U | 0.0% | 0.0 | 684 | Inf | 0.0 | 0.0 |
| 7/2 | Sth Exit (Sussex St) | U | 0.0% | 0.0 | 628 | Inf | 0.0 | 0.0 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 8/1 | West Exit - Erskine Ahead | U | 0.0% | 0.0 | 150 | Inf | 0.0 | 0.0 |
| **J3: TCS 305 - Shelley St - Erskine St** | **-** | **-** | **41.2%** | **-** | **-** | **-** | **-** | **-** |
| 1/2+1/1 | Shelley St (Nth Arm) Left Ahead Right | O+U | 32.7% | 14.4 | 232 | 1309:1208 | 2.9 | 3.1 |
| 2/2+2/1 | Erskine St (East Arm) Right Left Ahead | O+U | 24.0% | 19.0 | 150 | 1304:1272 | 7.4 | 7.5 |
| 3/1+3/2 | Shelley St (Sth Arm) Ahead Right Left | U+O | 41.2% | 12.3 | 445 | 1385:1395 | 2.6 | 2.9 |
| 4/1 | Erskine St (West Arm) Left Ahead | U | 11.8% | 19.2 | 44 | 1204 | 0.5 | 0.5 |
| 4/2 | Erskine St (West Arm) Ahead Right | O | 12.7% | 19.5 | 45 | 1150 | 0.5 | 0.6 |
| 5/1 | Nth Exit - Shelley St Ahead | U | 0.0% | 0.0 | 169 | Inf | 0.0 | 0.0 |
| 5/2 | Nth Exit - Shelley St Ahead | U | 0.0% | 0.0 | 178 | Inf | 0.0 | 0.0 |
| 6/1 | East Exit - Erskine St Ahead | U | 0.0% | 0.0 | 163 | Inf | 0.0 | 0.0 |
| 6/2 | East Exit - Erskine St Ahead | U | 0.0% | 0.0 | 289 | Inf | 0.0 | 0.0 |
| 7/1 | Sth Exit - Shelley St | U | 0.0% | 0.0 | 53 | Inf | 0.0 | 0.0 |
| 8/1 | West Exit - Erskine St | U | 0.0% | 0.0 | 41 | Inf | 0.0 | 0.0 |
| 8/2 | West Exit - Erskine St | U | 0.0% | 0.0 | 23 | Inf | 0.0 | 0.0 |
| **J4: Sussex St - Napoleon St** | **-** | **-** | **49.8%** | **-** | **-** | **-** | **-** | **-** |
| 1/1 | Hickson Rd (Nth Arm) Left | U | 13.1% | 1.5 | 181 | 1385 | 0.0 | 0.1 |
| 1/2 | Hickson Rd (Nth Arm) Ahead | U | 27.1% | 1.4 | 466 | 1722 | 0.0 | 0.2 |
| 2/1 | Napoleon St (East Arm) Left | O | 49.8% | 5.8 | 305 | 1634 | 0.0 | 0.5 |
| 2/2 | Napoleon St (East Arm) Right | O | 18.0% | 6.2 | 64 | 1724 | 0.0 | 0.1 |
| 3/1 | Sussex St (Sth Arm) Ahead | U | 25.2% | 1.4 | 434 | 1722 | 0.0 | 0.2 |
| 3/2+3/3 | Sussex St (Sth Arm) Ahead Right | U+O | 49.4% | 6.4 | 308 | 1722:1348 | 2.5 | 3.0 |
| 4/1 | Nth Exit - Hickson Rd Ahead | U | 0.0% | 0.0 | 466 | Inf | 0.0 | 0.0 |
| 4/2 | Nth Exit - Hickson Rd Ahead | U | 0.0% | 0.0 | 32 | Inf | 0.0 | 0.0 |
| 5/1 | East Exit - Napoleon St | U | 0.0% | 0.0 | 489 | Inf | 0.0 | 0.0 |
| 6/1 | Sth Exit - Sussex St Ahead | U | 0.0% | 0.0 | 403 | Inf | 0.0 | 0.0 |
| 6/2 | Sth Exit - Sussex St Ahead | U | 0.0% | 0.0 | 368 | Inf | 0.0 | 0.0 |
| **J5: Hickson Rd - Barangaroo** | **-** | **-** | **38.7%** | **-** | **-** | **-** | **-** | **-** |
| 1/1 | Hickson Rd (Nth Arm) Ahead Right | O | 38.7% | 1.8 | 647 | 1670 | 0.0 | 0.3 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 2/2+2/1 | Hickson Rd (Sth Arm) Ahead Left | U | 29.3% | 1.5 | 498 | 1700:1670 | 0.0 | 0.2 |
| 3/1 | Globe Street (West Arm) Left Right | O | 0.0% | 0.0 | 0 | 1724 | 0.0 | 0.0 |
| 4/1 | Nth Exit - Hickson Rd | U | 0.0% | 0.0 | 498 | Inf | 0.0 | 0.0 |
| 5/1 | Sth Exit (Hickson Rd) Ahead | U | 0.0% | 0.0 | 824 | Inf | 0.0 | 0.0 |
| 6/1 | Globe Street (Barangaroo) | U | 0.0% | 0.0 | 0 | Inf | 0.0 | 0.0 |
| **J6: Lime St - Shelley St** | **-** | **-** | **28.8%** | **-** | **-** | **-** | **-** | **-** |
| 1/1 | Shelley St (East Arm) Left Ahead | O | 3.7% | 1.0 | 67 | 1800 | 0.0 | 0.0 |
| 2/1 | Shelley St (Sth Arm) Right Left | U | 11.7% | 1.1 | 211 | 1800 | 0.0 | 0.1 |
| 2/2 | Shelley St (Sth Arm) Right | U | 9.9% | 1.1 | 178 | 1800 | 0.0 | 0.1 |
| 3/1 | Lime St (West Arm) Ahead Right | O | 28.8% | 4.9 | 150 | 1600 | 0.0 | 0.2 |
| 4/1 | East Exit (Shelley St) Ahead | U | 0.0% | 0.0 | 153 | Inf | 0.0 | 0.0 |
| 4/2 | East Exit (Shelley St) Ahead | U | 0.0% | 0.0 | 187 | Inf | 0.0 | 0.0 |
| 5/1 | Sth Exit - Shelley St Ahead | U | 0.0% | 0.0 | 208 | Inf | 0.0 | 0.0 |
| 6/1 | West Exit - Lime St | U | 0.0% | 0.0 | 58 | Inf | 0.0 | 0.0 |
| **J7: Macquarie Carpark** | **-** | **-** | **14.0%** | **-** | **-** | **-** | **-** | **-** |
| 1/1 | Carpark Sink | U | 0.0% | 0.0 | 16 | Inf | 0.0 | 0.0 |
| 2/1 | Car park Entry Left Right | O | 14.0% | 3.6 | 82 | 1400 | 0.0 | 0.1 |
| 3/1 | Shelley CP -Nth Right Ahead | O | 13.0% | 1.3 | 208 | 1600 | 0.0 | 0.1 |
| 4/1 | Shelley CP -Sth Left Ahead | U | 10.6% | 1.3 | 169 | 1600 | 0.0 | 0.1 |
| 4/2 | Shelley CP -Sth Ahead | U | 11.1% | 1.3 | 178 | 1600 | 0.0 | 0.1 |
| 5/1 | CP - Nth Exit Ahead | U | 0.0% | 0.0 | 211 | Inf | 0.0 | 0.0 |
| 5/2 | CP - Nth Exit Ahead | U | 0.0% | 0.0 | 178 | Inf | 0.0 | 0.0 |
| 6/1 | Sth Exit Ahead | U | 0.0% | 0.0 | 232 | Inf | 0.0 | 0.0 |
| **J8: Sussex St Carpark** | **-** | **-** | **22.4%** | **-** | **-** | **-** | **-** | **-** |
| 1/1 | Sussex CP Nth Left Ahead | U | 20.4% | 1.3 | 368 | 1800 | 0.0 | 0.1 |
| 1/2 | Sussex CP Nth Ahead | U | 22.4% | 1.3 | 403 | 1800 | 0.0 | 0.1 |
| 2/1 | Entry Sussex CP Left | O | 0.0% | 0.0 | 0 | 1400 | 0.0 | 0.0 |
| 3/1 | Entry Sussex CP | U | 0.0% | 0.0 | 0 | Inf | 0.0 | 0.0 |
| 4/1 | Sussex CP Sth Exit Ahead | U | 0.0% | 0.0 | 368 | Inf | 0.0 | 0.0 |
| 4/2 | Sussex CP Sth Exit Ahead | U | 0.0% | 0.0 | 403 | Inf | 0.0 | 0.0 |

**Scenario 2: 'Contruction Model - PM Peak'** (FG3: 'Proposed Traffic', Plan 1: 'Network Control Plan 1')

## Network Layout Diagram



## 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) |
|---|---|---|---|---|---|---|---|---|
| **Network: LinSig Modelling PM** | - | - | **128.5%** | - | - | - | - | - |
| **J1: TCS- 3939 Sussex St - Shelley St** | - | - | **88.9%** | - | - | - | - | - |
| 1/1 | Sussex St (Nth Arm) Ahead | U | 61.8% | 13.9 | 488 | 1401 | 4.9 | 5.7 |
| 1/2+1/3 | Sussex St (Nth Arm) Ahead | U | 58.7% | 13.2 | 471 | 1423:1338 | 4.6 | 5.3 |
| 2/1 | Sussex St (Sth Arm) Ahead Left | U | 50.3% | 33.1 | 208 | 1196 | 5.0 | 5.5 |
| 2/2 | Sussex St (Sth Arm) Ahead | U | 59.8% | 32.3 | 356 | 1722 | 8.8 | 9.5 |
| 3/1 | Shelley St (Wst Arm) Left | U | 88.9% | 43.3 | 405 | 1670 | 4.6 | 8.2 |
| 3/2 | Shelley St (Wst Arm) Right | U | 22.0% | 31.6 | 46 | 1440 | 0.6 | 0.7 |
| 4/1 | Nth Exit - Sussex St Ahead | U | 0.0% | 0.0 | 141 | Inf | 0.0 | 0.0 |
| 4/2 | Nth Exit - Sussex St Ahead | U | 0.0% | 0.0 | 761 | Inf | 0.0 | 0.0 |
| 5/1 | Sth Exit - Sussex St Ahead | U | 0.0% | 0.0 | 534 | Inf | 0.0 | 0.0 |
| 5/2 | Sth Exit - Sussex St Ahead | U | 0.0% | 0.0 | 471 | Inf | 0.0 | 0.0 |
| 6/1 | West Exit - Shelley St Ahead | U | 0.0% | 0.0 | 67 | Inf | 0.0 | 0.0 |
| **J2: TCS 310 - Sussex St - Erskine St** | - | - | **128.5%** | - | - | - | - | - |
| 1/2+1/1 | Sussex St (Nth Arm) Left Ahead | U | 102.8% | 134.0 | 475 | 920:1385 | 14.1 | 28.7 |
| 1/3+1/4 | Sussex St (Nth Arm) Ahead Right | U+O | 102.8% | 139.7 | 530 | 920:1348 | 29.5 | 45.2 |
| 2/1 | Erskine St (East Arm) Left | U | 91.9% | 72.7 | 369 | 920 | 10.6 | 15.0 |
| 2/2+2/3 | Erskine St (East Arm) Right Ahead | U+O | 19.3% | 22.6 | 103 | 1224:1224 | 1.4 | 1.6 |
| 3/2+3/1 | Sussex St (Sth Arm) Ahead Left | U | 70.5% | 35.7 | 520 | 1722:1385 | 7.4 | 8.6 |
| 4/2+4/1 | Erskine St (West Arm) Left Ahead | U | 27.1% | 26.9 | 146 | 1200:1200 | 2.9 | 3.1 |
| 4/3 | Erskine St (West Arm) Right | O | 128.5% | 509.6 | 243 | 1320 | 9.1 | 38.1 |
| 5/1 | Nth Exit - Sussex St Ahead | U | 0.0% | 0.0 | 208 | Inf | 0.0 | 0.0 |
| 5/2 | Nth Exit - Sussex St Ahead | U | 0.0% | 0.0 | 356 | Inf | 0.0 | 0.0 |
| 6/1 | East Exit - Erskine St | U | 0.0% | 0.0 | 172 | Inf | 0.0 | 0.0 |
| 7/1 | Sth Exit (Sussex St) | U | 0.0% | 0.0 | 791 | Inf | 0.0 | 0.0 |
| 7/2 | Sth Exit (Sussex St) | U | 0.0% | 0.0 | 709 | Inf | 0.0 | 0.0 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 8/1 | West Exit - Erskine Ahead | U | 0.0% | 0.0 | 150 | Inf | 0.0 | 0.0 |
| **J3: TCS 305 - Shelley St - Erskine St** | **-** | **-** | **50.6%** | **-** | **-** | **-** | **-** | **-** |
| 1/2+1/1 | Shelley St (Nth Arm) Left Ahead Right | O+U | 21.2% | 10.4 | 157 | 1309:1208 | 0.8 | 0.9 |
| 2/2+2/1 | Erskine St (East Arm) Right Left Ahead | O+U | 21.5% | 10.8 | 150 | 1304:1272 | 7.0 | 7.1 |
| 3/1+3/2 | Shelley St (Sth Arm) Ahead Right Left | U+O | 50.6% | 13.1 | 499 | 1385:1395 | 3.5 | 4.0 |
| 4/1 | Erskine St (West Arm) Left Ahead | U | 12.4% | 18.2 | 49 | 1204 | 0.5 | 0.6 |
| 4/2 | Erskine St (West Arm) Ahead Right | O | 10.6% | 18.3 | 40 | 1150 | 0.4 | 0.5 |
| 5/1 | Nth Exit - Shelley St Ahead | U | 0.0% | 0.0 | 210 | Inf | 0.0 | 0.0 |
| 5/2 | Nth Exit - Shelley St Ahead | U | 0.0% | 0.0 | 199 | Inf | 0.0 | 0.0 |
| 6/1 | East Exit - Erskine St Ahead | U | 0.0% | 0.0 | 163 | Inf | 0.0 | 0.0 |
| 6/2 | East Exit - Erskine St Ahead | U | 0.0% | 0.0 | 206 | Inf | 0.0 | 0.0 |
| 7/1 | Sth Exit - Shelley St | U | 0.0% | 0.0 | 53 | Inf | 0.0 | 0.0 |
| 8/1 | West Exit - Erskine St | U | 0.0% | 0.0 | 44 | Inf | 0.0 | 0.0 |
| 8/2 | West Exit - Erskine St | U | 0.0% | 0.0 | 20 | Inf | 0.0 | 0.0 |
| **J4: Sussex St - Napoleon St** | **-** | **-** | **61.1%** | **-** | **-** | **-** | **-** | **-** |
| 1/1 | Hickson Rd (Nth Arm) Left | U | 19.6% | 1.6 | 271 | 1385 | 0.0 | 0.1 |
| 1/2 | Hickson Rd (Nth Arm) Ahead | U | 41.6% | 1.8 | 717 | 1722 | 0.0 | 0.4 |
| 2/1 | Napoleon St (East Arm) Left | O | 54.7% | 7.1 | 305 | 1634 | 0.0 | 0.6 |
| 2/2 | Napoleon St (East Arm) Right | O | 24.0% | 9.3 | 64 | 1724 | 0.2 | 0.4 |
| 3/1 | Sussex St (Sth Arm) Ahead | U | 35.6% | 1.6 | 613 | 1722 | 3.9 | 4.1 |
| 3/2+3/3 | Sussex St (Sth Arm) Ahead Right | U+O | 61.1% | 10.4 | 308 | 1722:1348 | 2.7 | 3.5 |
| 4/1 | Nth Exit - Hickson Rd Ahead | U | 0.0% | 0.0 | 645 | Inf | 0.0 | 0.0 |
| 4/2 | Nth Exit - Hickson Rd Ahead | U | 0.0% | 0.0 | 32 | Inf | 0.0 | 0.0 |
| 5/1 | East Exit - Napoleon St | U | 0.0% | 0.0 | 579 | Inf | 0.0 | 0.0 |
| 6/1 | Sth Exit - Sussex St Ahead | U | 0.0% | 0.0 | 541 | Inf | 0.0 | 0.0 |
| 6/2 | Sth Exit - Sussex St Ahead | U | 0.0% | 0.0 | 481 | Inf | 0.0 | 0.0 |
| **J5: Hickson Rd - Barangaroo** | **-** | **-** | **83.2%** | **-** | **-** | **-** | **-** | **-** |
| 1/1 | Hickson Rd (Nth Arm) Ahead Right | O | 41.3% | 1.8 | 689 | 1670 | 0.0 | 0.4 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 2/2+2/1 | Hickson Rd (Sth Arm) Ahead Left | U | 40.0% | 1.8 | 677 | 1700:1670 | 9.3 | 9.6 |
| 3/1 | Globe Street (West Arm) Left Right | O | 83.2% | 28.0 | 299 | 1724 | 2.1 | 4.4 |
| 4/1 | Nth Exit - Hickson Rd | U | 0.0% | 0.0 | 498 | Inf | 0.0 | 0.0 |
| 5/1 | Sth Exit (Hickson Rd) Ahead | U | 0.0% | 0.0 | 1165 | Inf | 0.0 | 0.0 |
| 6/1 | Globe Street (Barangaroo) | U | 0.0% | 0.0 | 179 | Inf | 0.0 | 0.0 |
| **J6: Lime St - Shelley St** | **-** | **-** | **26.6%** | **-** | **-** | **-** | **-** | **-** |
| 1/1 | Shelley St (East Arm) Left Ahead | O | 3.7% | 1.0 | 67 | 1800 | 0.0 | 0.0 |
| 2/1 | Shelley St (Sth Arm) Right Left | U | 14.0% | 1.2 | 252 | 1800 | 0.0 | 0.1 |
| 2/2 | Shelley St (Sth Arm) Right | U | 11.1% | 1.1 | 199 | 1800 | 0.0 | 0.1 |
| 3/1 | Lime St (West Arm) Ahead Right | O | 26.6% | 4.3 | 150 | 1600 | 0.0 | 0.2 |
| 4/1 | East Exit (Shelley St) Ahead | U | 0.0% | 0.0 | 194 | Inf | 0.0 | 0.0 |
| 4/2 | East Exit (Shelley St) Ahead | U | 0.0% | 0.0 | 283 | Inf | 0.0 | 0.0 |
| 5/1 | Sth Exit - Shelley St Ahead | U | 0.0% | 0.0 | 133 | Inf | 0.0 | 0.0 |
| 6/1 | West Exit - Lime St | U | 0.0% | 0.0 | 58 | Inf | 0.0 | 0.0 |
| **J7: Macquarie Carpark** | **-** | **-** | **14.2%** | **-** | **-** | **-** | **-** | **-** |
| 1/1 | Carpark Sink | U | 0.0% | 0.0 | 16 | Inf | 0.0 | 0.0 |
| 2/1 | Car park Entry Left Right | O | 14.2% | 3.6 | 82 | 1400 | 0.0 | 0.1 |
| 3/1 | Shelley CP -Nth Right Ahead | O | 8.3% | 1.2 | 133 | 1600 | 0.0 | 0.0 |
| 4/1 | Shelley CP -Sth Left Ahead | U | 13.1% | 1.3 | 210 | 1600 | 0.0 | 0.1 |
| 4/2 | Shelley CP -Sth Ahead | U | 12.4% | 1.3 | 199 | 1600 | 0.0 | 0.1 |
| 5/1 | CP - Nth Exit Ahead | U | 0.0% | 0.0 | 252 | Inf | 0.0 | 0.0 |
| 5/2 | CP - Nth Exit Ahead | U | 0.0% | 0.0 | 199 | Inf | 0.0 | 0.0 |
| 6/1 | Sth Exit Ahead | U | 0.0% | 0.0 | 157 | Inf | 0.0 | 0.0 |
| **J8: Sussex St Carpark** | **-** | **-** | **31.1%** | **-** | **-** | **-** | **-** | **-** |
| 1/1 | Sussex CP Nth Left Ahead | U | 30.3% | 1.4 | 546 | 1800 | 0.0 | 0.2 |
| 1/2 | Sussex CP Nth Ahead | U | 31.1% | 1.4 | 559 | 1800 | 0.0 | 0.2 |
| 2/1 | Entry Sussex CP Left | O | 0.0% | 0.0 | 0 | 1400 | 0.0 | 0.0 |
| 3/1 | Entry Sussex CP | U | 0.0% | 0.0 | 0 | Inf | 0.0 | 0.0 |
| 4/1 | Sussex CP Sth Exit Ahead | U | 0.0% | 0.0 | 546 | Inf | 0.0 | 0.0 |
| 4/2 | Sussex CP Sth Exit Ahead | U | 0.0% | 0.0 | 559 | Inf | 0.0 | 0.0 |

# Appendix B

Combined Construction Vehicle Movements

## Cumulative Construction and Operational Traffic Numbers ( Total Vehicles )

| Activity | 2013 | | | | | | | | | 2014 | | | | | | | | | | | | 2015 | | | | | | | | | | | | 2016 | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| Trucks In Am Peak Hour | 53 | 70 | 75 | 75 | 62 | 51 | 42 | 40 | 40 | 36 | 36 | 39 | 39 | 39 | 39 | 36 | 36 | 34 | 34 | 34 | 34 | 34 | 34 | 34 | 31 | 31 | 31 | 31 | 31 | 31 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 20 |
| Trucks Out Am Peak Hour | 51 | 68 | 73 | 73 | 59 | 48 | 39 | 36 | 37 | 33 | 33 | 35 | 35 | 35 | 35 | 33 | 33 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 |
| Trucks In/Out AM Peak | 104 | 138 | 148 | 148 | 121 | 99 | 81 | 76 | 77 | 69 | 69 | 74 | 74 | 74 | 74 | 69 | 69 | 65 | 65 | 65 | 65 | 65 | 65 | 65 | 62 | 62 | 62 | 62 | 62 | 62 | 120 | 120 | 120 | 120 | 120 | 120 | 120 | 120 | 120 | 120 | 120 | 120 | 120 | 120 | 80 |
| Cars In Am Peak Hour | 120 | 135 | 172 | 142 | 175 | 162 | 162 | 173 | 168 | 168 | 168 | 173 | 173 | 173 | 173 | 168 | 168 | 162 | 162 | 162 | 162 | 162 | 162 | 162 | 158 | 158 | 158 | 158 | 158 | 158 | 206 | 194 | 194 | 194 | 194 | 194 | 194 | 194 | 194 | 194 | 194 | 194 | 194 | 194 | 194 |
| Cars Out Am Peak Hour | 38 | 40 | 50 | 50 | 55 | 51 | 51 | 58 | 53 | 47 | 47 | 52 | 52 | 52 | 52 | 47 | 47 | 47 | 47 | 47 | 47 | 47 | 47 | 47 | 55 | 55 | 55 | 55 | 55 | 55 | 104 | 104 | 104 | 104 | 104 | 104 | 104 | 104 | 104 | 104 | 104 | 104 | 104 | 104 | 104 |
| Cars In/Out AM Peak | 158 | 175 | 222 | 192 | 230 | 213 | 213 | 231 | 221 | 215 | 215 | 225 | 225 | 225 | 225 | 215 | 215 | 209 | 209 | 209 | 209 | 209 | 209 | 209 | 213 | 213 | 213 | 213 | 213 | 213 | 310 | 298 | 298 | 298 | 298 | 298 | 298 | 298 | 298 | 298 | 298 | 298 | 298 | 298 | 298 |
| **TOTALS** | **262** | **313** | **370** | **340** | **351** | **312** | **294** | **307** | **298** | **284** | **284** | **299** | **299** | **299** | **299** | **284** | **284** | **274** | **274** | **274** | **274** | **274** | **274** | **274** | **275** | **275** | **275** | **275** | **275** | **275** | **430** | **418** | **418** | **418** | **418** | **418** | **418** | **418** | **418** | **418** | **418** | **418** | **418** | **418** | **378** |