# Lend Lease (Millers Point) Pty Limited

## Barangaroo South - C3 Commercial Building

## Construction Traffic Management Plan - Project Application

Rev B | 7 November 2011

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# 1 Introduction

This report supports a Project Application 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 a commercial building (known as Building C3) and associated works at Barangaroo South as described in the Project Summary Description section of this report.

## 1.1 Background

The 22 hectare Barangaroo site has been divided into three distinct redevelopment areas (from north to south) – the Headland Park, Barangaroo Stage 2 and Barangaroo Stage 1 (herein after referred to as Barangaroo South).

Lend Lease was successfully appointed as the preferred proponent to develop Barangaroo Stage 1 (otherwise known as Barangaroo South) on 20 December 2009.

## 1.2 Planning History & Framework

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$^2$ of gross floor area (GFA) contained within 8 blocks on a total site area of 22 hectares.

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$^2$ of gross floor area (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 allows for a mixed use development involving a maximum of 489,500m$^2$ of gross floor area (GFA) across Barangaroo as a whole.

On 16 December 2010 the Minister approved Modification No. 4 to the Barangaroo Concept Plan. The Approved Concept Plan as modified allows for approximately 563,965m$^2$ Gross Floor Area of mixed use development across the entire Barangaroo site.

This Project Application forms one of a series of individual Applications that Lend Lease will be submitting to deliver Barangaroo South. This Project Application is consistent with the established planning framework for the site, including the approved Concept Plan (as modified).

A Project Application (MP10_0023) has been approved for the bulk excavation and construction of a basement car park to accommodate up to 880 car parking spaces and associated services and infrastructure to support the initial phases of

the future development of Barangaroo South. A Section 75W Modification Application was subsequently submitted seeking to modify MP10_0023 to extend the area of the approved basement to the south. This modification was approved by the Minister for Planning on 3 March 2011.

A further Section 75W application has been submitted to the Department of Planning and Infrastructure (the Department) and is currently being assessed, which seeks the Minister's approval to modify the depth of the excavation and change the reduced levels of the basement structure, using the same construction methodology as detailed and approved as part of the original project application. This includes:

- reduced excavation and bulk earthworks;
- reduced structural works – foundations, basement levels, perimeter retention system etc; and
- installation of associated services and infrastructure to support the initial phases of the future development of Barangaroo South.

A project application for the first commercial building, known as C4, was submitted to the Department of Planning on 29 October 2010. This application sought consent for construction and use of a new commercial Building C4 with a maximum 98,514m$^2$ GFA accommodating commercial and retail uses, a child care centre, bicycle parking and associated use and operation of car parking and loading facilities in the basement. Consent was issued by the Minister on 3 March 2011.

A Section 75W application has been submitted to the Department and is currently being assessed which seeks the Minister's approval to modify certain elements of the approved C4 building, including:

- mix of the uses within the building;
- total GFA;
- shape of floor plates of the podium and the tower elements of the building;
- facade details;
- roof treatment; and
- basement layout.

## 1.3 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 Stage 2 (also known as Barangaroo Central) and Barangaroo South.

The area of land within which development is proposed under this Project Application extends over land generally known and identified in the approved Concept Plan as Block 3 which comprises Lot 5 in DP 876514.

## 1.4 Project Summary Description

This Project Application seeks approval for the construction of a 49 storey building, comprising ground floor retail, a commercial lobby, childcare, podium and office tower, provision for associated cars and bicycle parking and the construction of the surrounding ancillary temporary public domain which includes access streets and landscaping.

## 1.5 Purpose of this Report

This report has been prepared to accompany the Project Application for the C3 Commercial 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.

## 1.6 Document Structure

The diagram below illustrates the document structure established for Traffic and Transport Planning related reports for the Barangaroo development. There are two supporting documents to inform and feed into the required responses to the Director General's Requirements (DGRs). They are:

- Transport Management and Accessibility Plan (TMAP) Supplementary to Barangaroo TMAP Stage 1 published by the NSW Government in September 2008
- Travel Demand Management Plan and
- Construction Traffic Management Plan (i.e. this report).

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

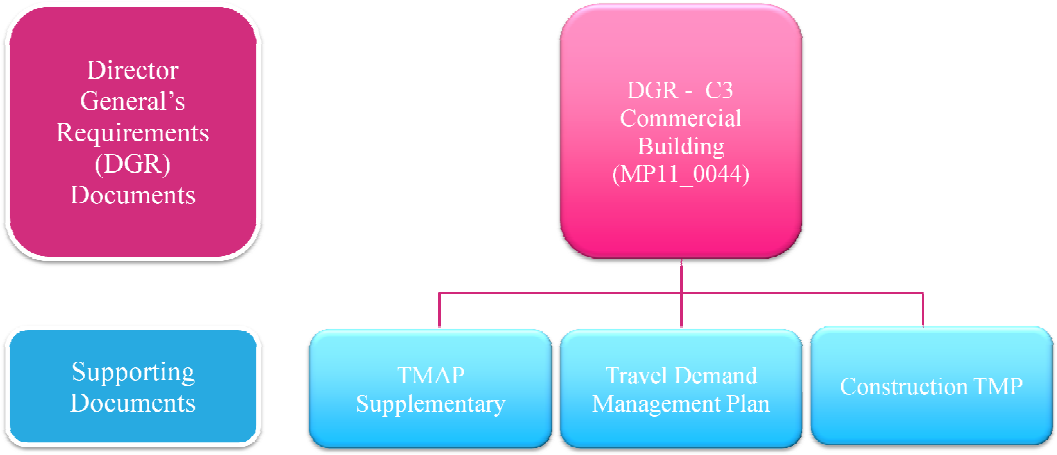



Figure 1 Document Structure

## 1.7 Scope of the Report

The scope of this report is primarily to address the following matters for the C3 Commercial Building of the Barangaroo South precinct:

- 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 which will be operating from Darling Harbour Wharf 5; 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

The Barangaroo site Transport Management and Accessibility Plan (TMAP) was prepared by NSW Ministry of Transport with Masson Wilson Twiney preparing the associated traffic assessment in May 2008. Detailed Paramics traffic simulation modelling was undertaken for the study. Traffic data on Hickson Road and Sussex Street has been updated by Arup and 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. The peak southbound movement in Sussex Street was recorded as 1,336 vehicles in the PM peak hour north of King Street.

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 | 515 | 212 | 727 | 396 | 516 | 912 |
| Sussex St | N of Erskine St | 683 | 638 | 1321 | 427 | 831 | 1258 |
| Sussex St | N of King St | 600 | 1132 | 1732 | 374 | 1336 | 1710 |

Source: Arup traffic surveys 27th April 2010

## 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 March 2014. Vehicles and pedestrians frequently travel from the passenger terminal along Hickson Road. As such, appropriate facilities should be provided for ease of travel. The Barangaroo construction traffic road works and construction activity on Hickson Road, will make provision for this vehicle and pedestrian traffic access which has been surveyed by Arup.

To assess the volume of cruise passenger pedestrians, the terminal at Wharf 5 was surveyed for pedestrian movements on Friday 3 September and Monday 6

September 2010 when the Dawn Princess and the Pacific Jewel respectively docked in the morning and departed in the afternoon. These two ships are representative of the larger ships scheduled to dock at Wharf 5 between July 2010 and December 2011 as shown in Table 2.

Table 2 Number of visits per scheduled ship between July 2010 and December 2011

| Ship | Passenger | Crew | Total People | Ship Visits |
|---|---|---|---|---|
| Dawn Princess | 1950 | 900 | 2850 | 15 |
| Sun Princess | 1950 | 900 | 2850 | 15 |
| Pacific Sun | 1486 | 670 | 2156 | 34 |
| Pacific Jewel | 2014 | 621 | 2635 | 52 |
| Pacific Venus | 720 | 180 | 900 | 1 |
| Spirit of Oceanus | 120 | 50 | 170 | 1 |
| Astor | 650 | 300 | 950 | 1 |
| Silver shadow | 388 | 295 | 683 | 2 |
| Ocean Princess | 826 | 373 | 1199 | 1 |
| Seabourn Sojourn | 450 | 380 | 830 | 1 |
| Asuka II | 960 | 545 | 1505 | 2 |
| Pacific Princess | 826 | 373 | 1199 | 1 |
| Sea Princess | 1950 | 900 | 2850 | 6 |
| Pacific Pearl | 1856 | 514 | 2370 | 21 |
| Seven Seas Voyager | 700 | 447 | 1147 | 1 |
| Amadea | 624 | 292 | 916 | 1 |
| Deutschland | 520 | 260 | 780 | 1 |
| Silver Spirit | 540 | 376 | 916 | 1 |
| Saga Ruby | 655 | 380 | 1035 | 1 |
| C Columbus | 843 | 418 | 1261 | 1 |
| Orion | 106 | 75 | 181 | 1 |
| Volendam | 1432 | 647 | 2079 | 2 |
| Spirit of Adventure | 348 | 180 | 528 | 1 |
| Zaandam | 1432 | 615 | 2047 | 1 |
| Total | | | | 164 |

Pedestrian traffic movements to and from the Cruise Passenger Terminal site at Wharf 5 were surveyed to be 1,300 and 2,000 total two-way (per day) with a break up of these movements shown in Figure 2 and Figure 3. Departing passenger movements generally occur during the morning period and arriving passengers during the afternoon period.

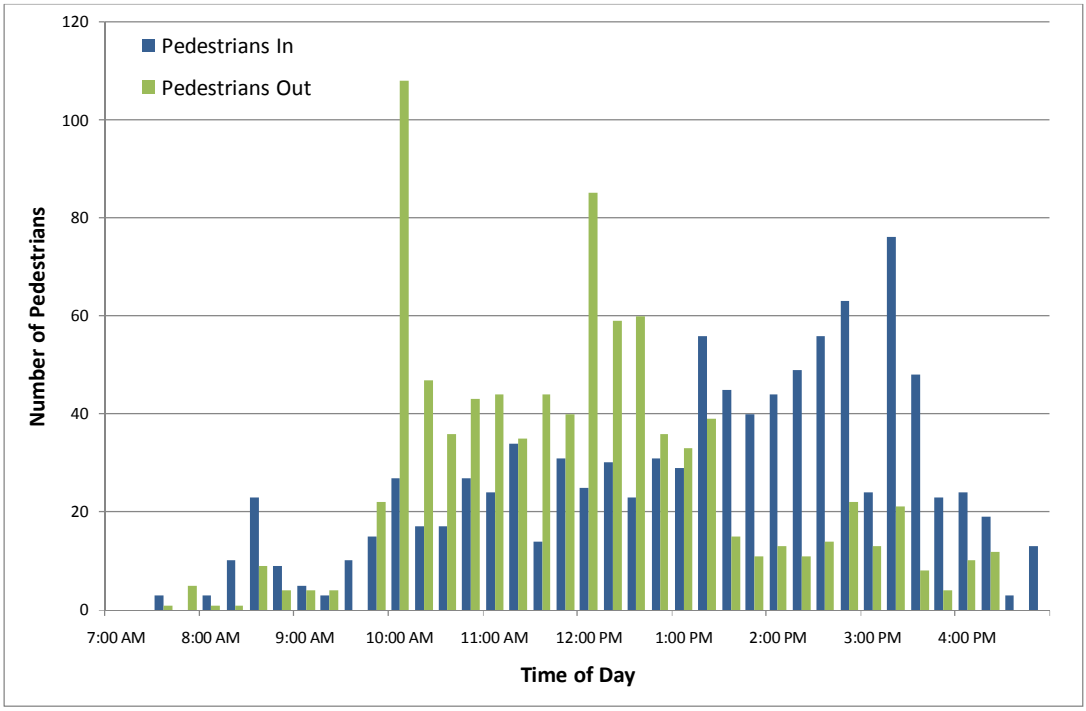



Figure 2 15 minute pedestrian movements to and from Wharf 5 for Dawn Princess

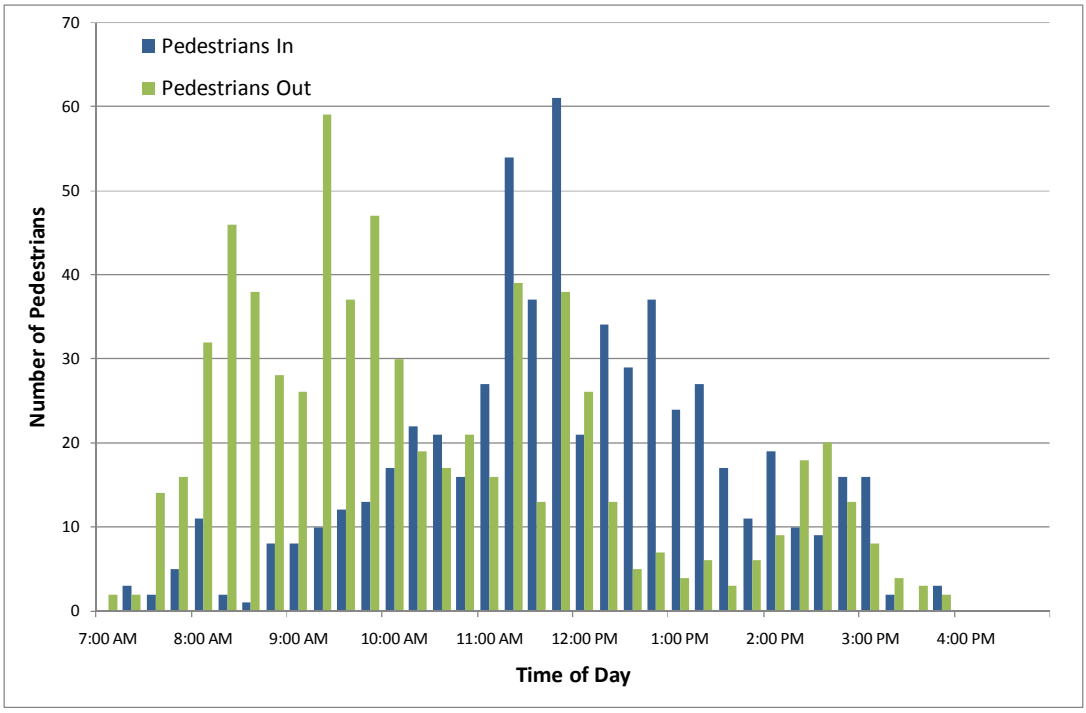



Figure 3 15 minute pedestrian movements to and from Wharf 5 for Pacific Jewel

## 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. On a cruise ship day, pedestrian volumes on Hickson Road are significant.

Many cruise ship passengers walking via Napoleon Street also currently cross Hickson Road near Napoleon Street where there is no pedestrian crossing facility currently provided.

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 on Tuesday 27th April 2010 (a typical weekday outside of school holiday periods). The existing morning (8am – 9am) and afternoon (5pm – 6pm) peak hour intersection traffic volumes at these intersections are illustrated in Figure 4.

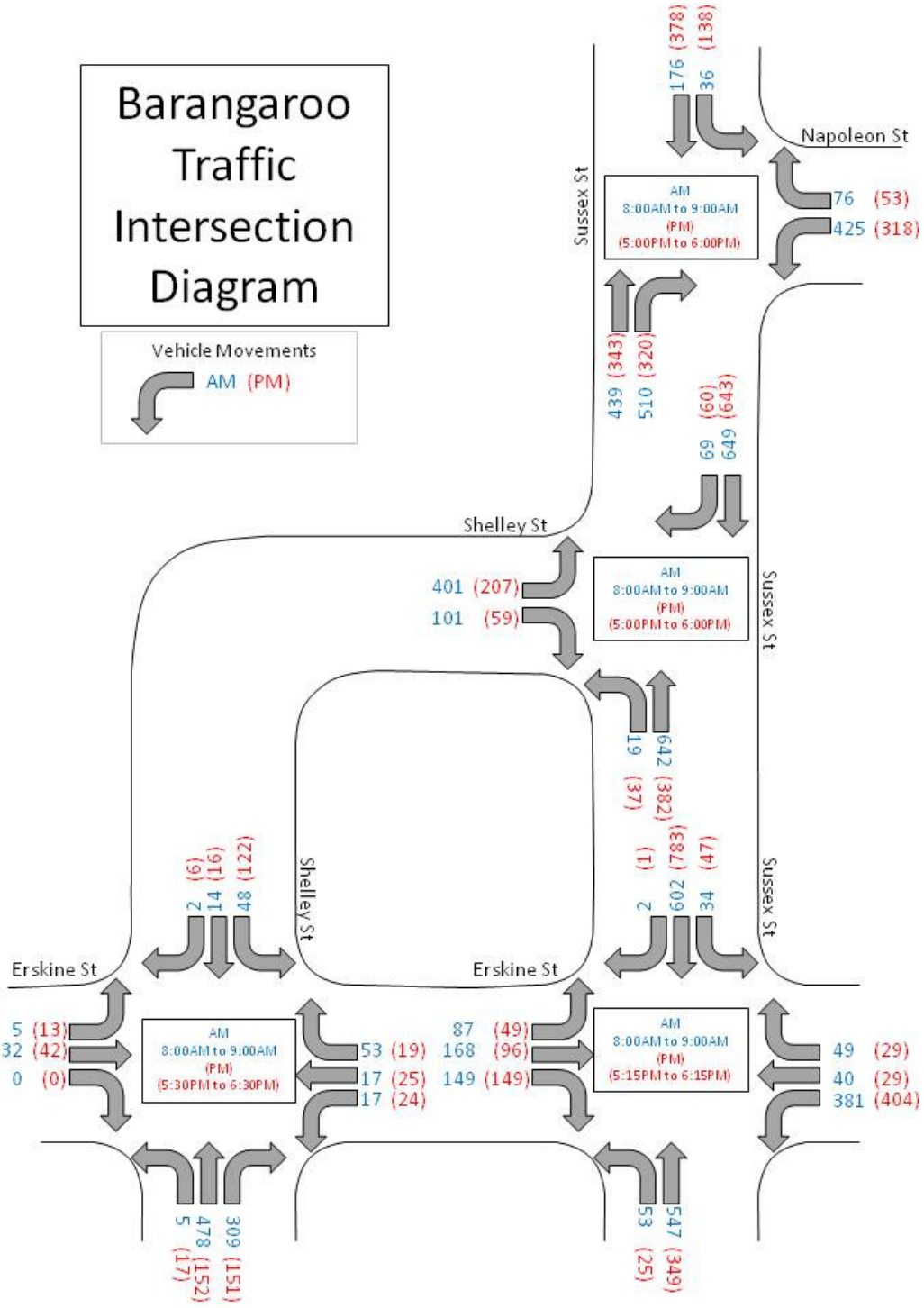



Figure 4 April 2010 Weekday Peak Hour Traffic Volumes

This report examines in detail the existing and future construction stage traffic operations using the linked intersection analysis program LINSIG at a total of four intersections within the Sydney Northern CBD in general locality of the Barangaroo South construction worksite access, namely;

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

The Hickson Road and Napoleon Street intersection is currently unsignalised but is considered likely to require traffic signals for safe and efficient traffic operation in the future. This is likely to occur at the time of the initial occupancy of the commercial buildings at Barangaroo, which is anticipated to occur in 2015.

The current peak hour traffic conditions and traffic operations at key existing intersections have been determined by the LINSIG intersection analysis. The full LINSIG intersection capacity analysis results are included as an attachment in **Appendix A** of this report. The intersection analysis results are summarised for each intersection in Table 3, 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

In the LINSIG analysis, all of the traffic signal controlled intersections are assumed to have linked operation with a fixed 120 second cycle time, except for the Erskine Street and Shelley Street traffic signals which operates at two cycles for each cycle of the other intersections, with an effective 60 second cycle time.

Table 3 Summary of Existing Intersection Operations from LINSIG Analysis

| Peak | Intersection | LOS | DOS | AVD (sec)* | Max Queue (veh) | Highest Queue Approach |
|---|---|---|---|---|---|---|
| **AM** | Hickson Road & Napoleon Street **Unsignalised** | A | 0.65 | 3 | 14 | RT from Hickson Road (south) |
| | Sussex Street & Shelley Street **Traffic Signals** | A | 0.48 | 11 | 7 | LT from Shelley Street (west) |
| | Sussex Street & Erskine Street **Traffic Signals** | B | 0.71 | 21 | 20 | Through from Sussex Street (south) |
| | Erskine Street & Shelley Street **Traffic Signals** | A | 0.57 | 11 | 5 | Through from Shelley Street (south) |
| **PM** | Hickson Road & Napoleon Street **Unsignalised** | A | 0.67 | 4 | 12 | RT from Hickson Road (south) |
| | Sussex Street & Shelley Street **Traffic Signals** | A | 0.32 | 8 | 5 | LT from Shelley Street (west) |
| | Sussex Street & Erskine Street **Traffic Signals** | B | 0.88 | 24 | 12 | LT from Erskine Street (east) |
| | Erskine Street & Shelley Street **Traffic Signals** | A | 0.25 | 12 | 2 | Through from Shelley Street (south) |

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

# 3 Construction Program Staging and Details

## 3.1 Site Establishment/Barangaroo Demolition Works

The Site Establishment and demolition associated with Major Project Approval MP07_0077 (Barangaroo Demolition Works, East Darling Harbour) are completed and as such are no longer relevant to this assessment.

## 3.2 Bulk Excavation and Basement Car Park Construction

### 3.2.1 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. Approximately 6,000 cubic metres of hazardous solid waste and 9,000 cubic metres of restricted solid waste to be removed from the site following treatment;
- November 2012 –April 2015, Construction of Concrete Columns and Slabs for Basement Car Park and loading dock area.

### 3.2.2 Workforce

The proposed site workforce during each of the phases of the basement construction work for excavation and car park construction is estimated to be as follows:

- Piling and retention system construction, 70 construction workers;
- Bulk excavation, 50 construction workers (excluding truck operators); and
- Concrete Column and slab construction, up to 250 construction workers.

These construction workers will generally arrive at the site before 7 am and depart between 4-5 pm on weekdays with some work extending through to 6 pm in busy periods. 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.

### 3.2.3 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)

## 3.3 C4 Commercial Building

### 3.3.1 Indicative Duration

The construction of the C4 Commercial Building is envisaged to commence in December 2011 which is sometime after the commencement of the construction of the basement works. The construction of the C4 Commercial Building is programmed for completion in mid 2015.

- December 2011 - April 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 works; and
- February 2013 – March 2015, Construction of C4 Tower Structure, Facade, Finishes and Fit-out in parallel with C3 works.

### 3.3.2 Workforce

The proposed site work force for the C4 Commercial Building will peak at around 500 workers during the construction of the C4 Tower Structure.

### 3.3.3 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** (December 2011 – April 2012)

All truck movements related to piling have been included in the Bulk Excavation and Basement Carpark construction (refer to section 3.2.3)

**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 3.2.3)

**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)

## 3.4 C3 Commercial Building

### 3.4.1 Indicative Duration

The construction of the C3 Commercial Building is envisaged to commence in April 2012 which is sometime after the commencement of the construction of the basement works. The construction of the C3 Commercial Building is programmed for completion in September 2015.

- April 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

### 3.4.2 Workforce

The proposed site work force for the C3 Commercial Building will peak at around 400 workers during the construction of the C3 Tower Structure.

### 3.4.3 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** (April 2012 – October 2012)

All truck movements related to piling have been included in the Bulk Excavation and Basement Carpark construction (refer to section 3.2.3)

**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 3.2.3)

**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 3.3.3)

## 3.5 C5 Commercial Building

### 3.5.1 Indicative Duration

The construction of the C5 Commercial Building is envisaged to commence in September 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.

### 3.5.2 Workforce

The proposed site work force for the C5 Commercial Building will peak at around 400 workers during the construction of the C5 Tower Structure.

### 3.5.3 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 during the Concrete Sub-Structure and Tower construction stages:

**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 3.2.3)

**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 3.2.3)

**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 3.3.3)

# 4 Barangaroo Headland Park and Northern Cove

## 4.1 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 and are not part of this application.

However these works will coincide with the Bulk excavation, basement construction and construction of the C3, C4 and C5 commercials buildings, and as a consequence the cumulative traffic 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 proposed development.

## 4.2 Scope of Works

### 4.2.1 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.

### 4.2.2 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.

### 4.2.3 Staging

As advised by the BDA, the construction of the main works at Headland Park is proposed to occur between December 2011 and December 2014.

## 4.3 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 50,000$m^3$ 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.

# 5 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 works, are shown in Figure 5.

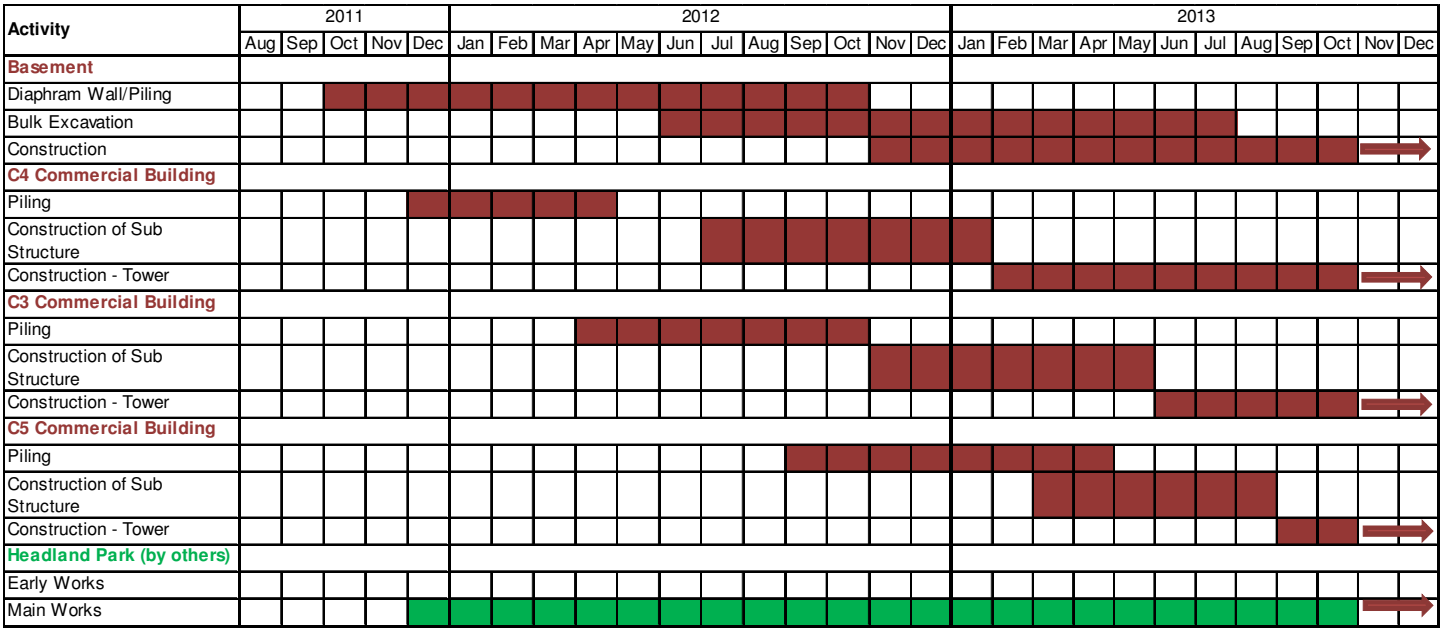



Figure 5 Combined Barangaroo Construction Program

* The program milestones and timing are indicative only

# 6 Traffic and Pedestrian Movements and Routes

## 6.1 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.

## 6.2 Hours of Construction

The construction hours proposed are:

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

## 6.3 Potential Scope for Water Access

As the development site is adjacent trafficable water, there is potential opportunity for the use of water transport for excavated spoil transport from the site. Soil transport by water is being investigated and may be used in order to mitigate any potential traffic implications on the local road network.

## 6.4 Construction Site Access

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

## 6.5 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.

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 Sussex Street in accordance with MP10_0023 condition of consent no. D4(e).

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.

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.

It considered that when the York Street exit from the Harbour Bridge is closed in the morning peak for private vehicles, a likely alternate route for trucks approaching from the north would be via the Western Distributor onto Harbour Street.

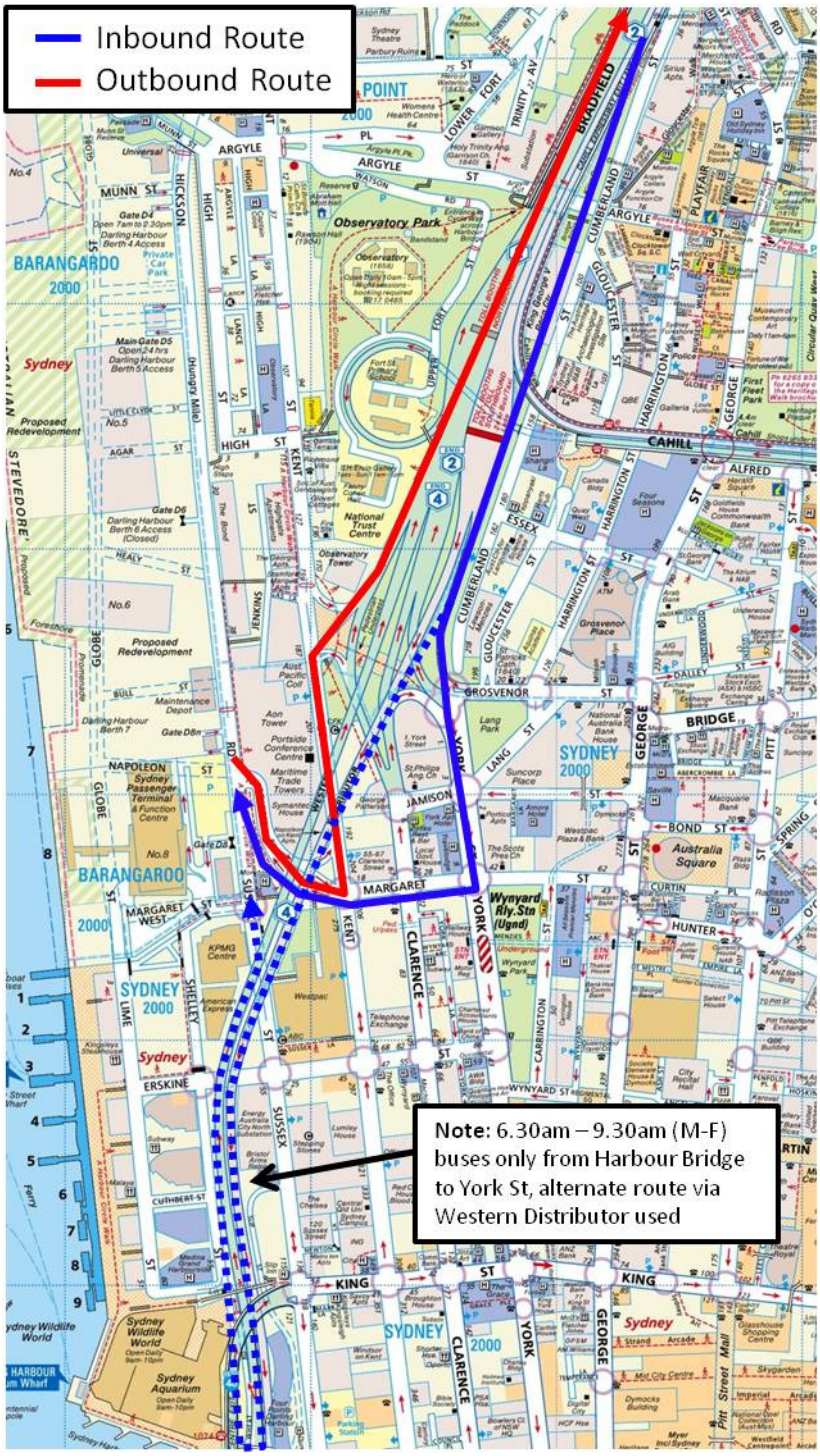



Figure 6 Truck Access Route to/from the North

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.

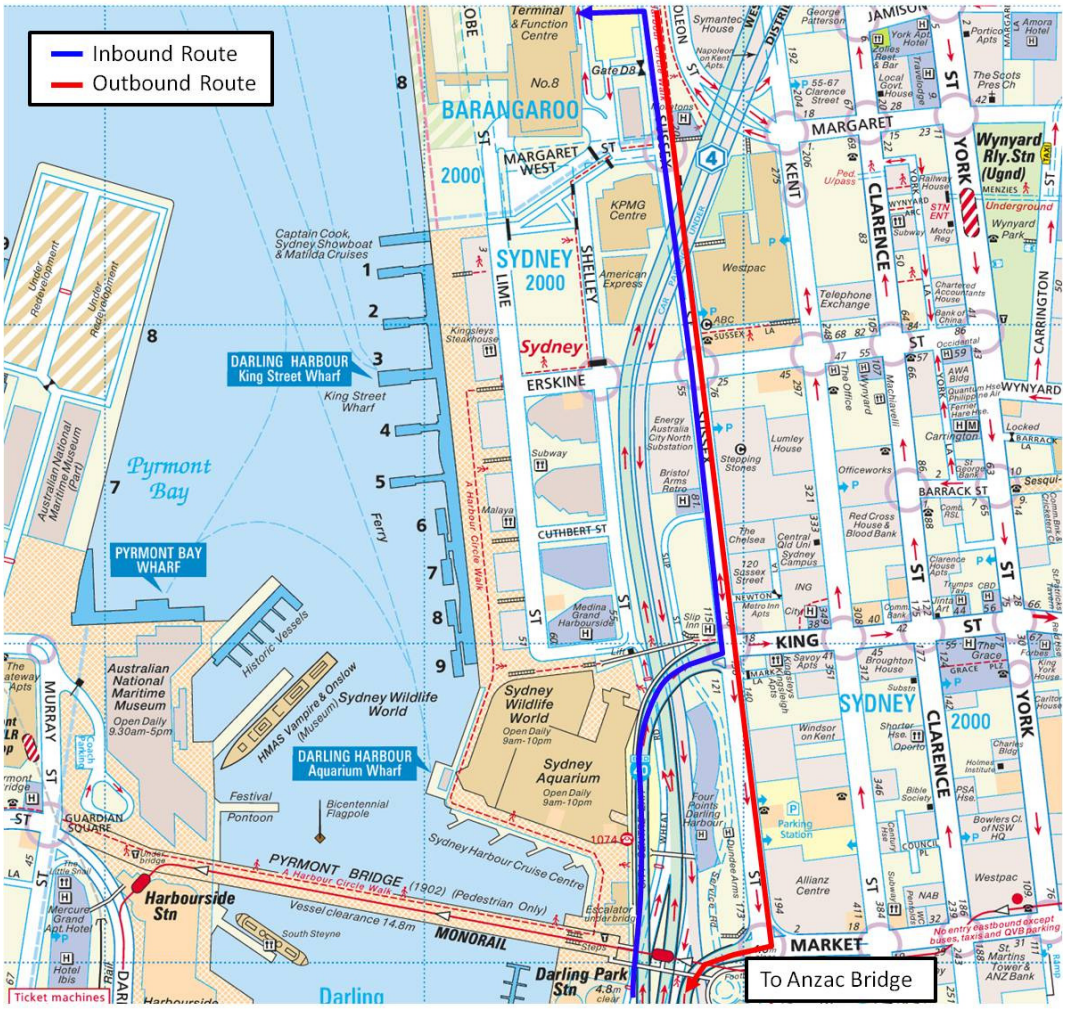



Figure 7 Truck Access Route to/from the West (via Anzac Bridge)

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.

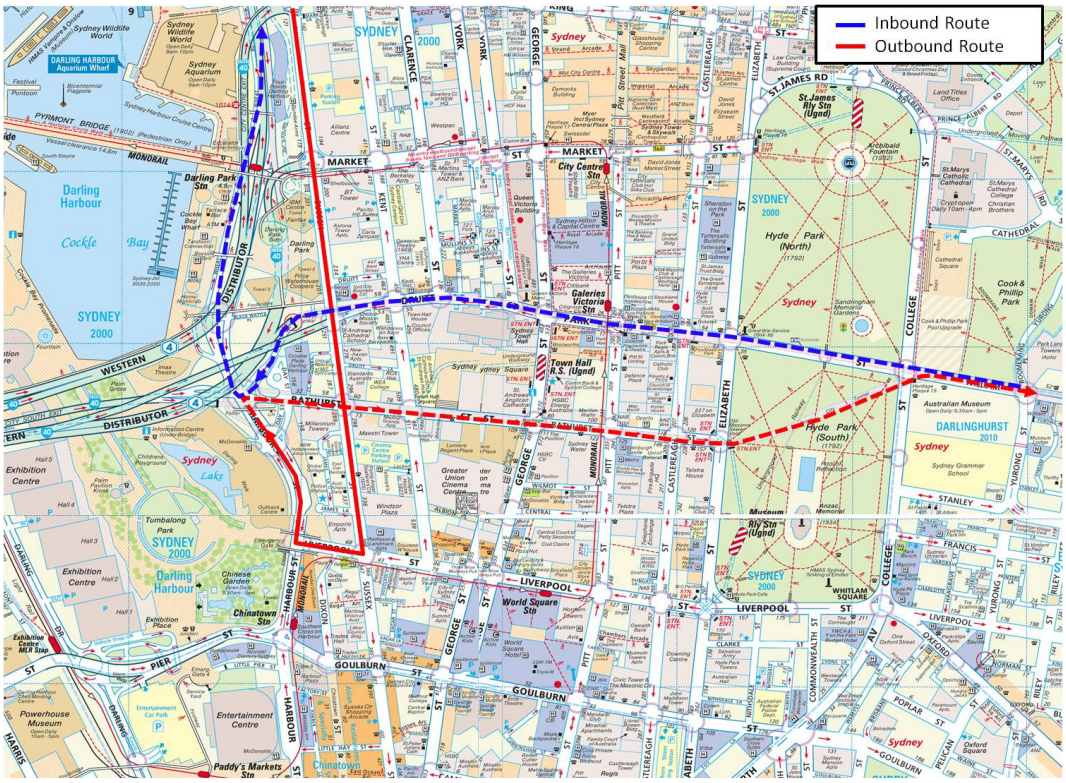


Figure 8 Truck Access Route to/from the South and East

## 6.6 Hourly Construction Traffic Movements

For each phase of the basement construction, the 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. A travel strategy for the construction workforce will be prepared closer to construction 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.

- 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).

## 6.7 Cumulative Impacts

There are no other major construction projects within the vicinity of Barangaroo that are known at this point in time and as a consequence the cumulative construction traffic impacts are confined to developments associated with the Barangaroo development works. Future project applications will factor the likely cumulative traffic impacts into their assessments at the time of submission.

An assessment has been made of the cumulative construction traffic impacts of the Barangaroo South Basement, the C3, C4 and C5 Commercial Buildings and the Headland Park Main Works[1] project. The assessment has considered the peak vehicle movements during the construction period for all of the above mentioned works projects.

The highest combined level of total morning peak hour car/ute and truck traffic movements generated by all the worksites will be a total of 335 vehicle movements per hour, forecast to occur in June 2013. This is comprised of:

- Morning Peak Hour 8am -9am, 172 cars in, 50 cars out, 58 trucks in, 55 trucks out
- Afternoon Peak Hour, 5pm - 6pm, 50 cars in, 172 cars out, 55 trucks in, 58 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.

## 6.8 Traffic Distribution

For the purpose of considering construction traffic impacts, the Sussex Street and Harbour Street routes for access to the south, east and west has been used for vehicle assignment and not the Napoleon Street – Margaret Street route. This is a simplified distribution model and represents a worst-case scenario for the intersections along Sussex Street.

It was considered since the York Street exit from the Harbour Bridge is closed in the morning peak for private vehicles; a likely alternate route for trucks approaching from the north would be via the Western Distributor onto Sussex Street in accordance with MP10_0023 condition of consent no.D4(e). All trucks have therefore been assumed to approach the site from the south in the peak hours, and consequently the Kent Street intersection has not been modelled in this analysis.

[1] Barangaroo Headland Park Early Works – Traffic Impact Assessment and Construction Traffic Management Plan, Halcrow October 2010.

## 6.9 Traffic Impact at Intersections

The effect of the estimated additional peak hour traffic during the peak period of construction generated traffic activity in June 2013 (for the Basement Works, C4 and C3 Commercial and Headland Park works combined) has been investigated for each affected intersection. The LINSIG intersection analysis results for the future peak hour traffic movements from all the construction activities combined are summarised in Table 4.

Table 4 Intersection Analysis

| Peak | Intersection | Existing Traffic (April 2010) | | | | Construction Peak Traffic (June 2013) | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | LOS | DOS | AVD (sec) | MMQ (veh) | LOS | DOS | AVD (sec) | MMQ (veh) |
| AM | Hickson Rd & Napoleon St | A | 0.65 | 3 | 14 | A | 0.68 | 4 | 15 |
| | Sussex St & Shelley St | A | 0.48 | 11 | 7 | B | 0.55 | 11 | 8 |
| | Sussex St & Erskine St | B | 0.71 | 21 | 20 | B | 0.79 | 23 | 17 |
| | Erskine St & Shelley St | A | 0.57 | 11 | 5 | A | 0.61 | 10 | 6 |
| PM | Hickson Rd & Napoleon St | A | 0.67 | 4 | 12 | A | 0.74 | 5 | 12 |
| | Sussex St & Shelley St | A | 0.32 | 8 | 5 | A | 0.36 | 11 | 6 |
| | Sussex St & Erskine St | B | 0.88 | 24 | 12 | B | 0.94 | 28 | 13 |
| | Erskine St & Shelley St | A | 0.25 | 12 | 2 | A | 0.28 | 13 | 3 |

**Legend:** MMQ – Mean Maximum Queue Length (vehicles), AVD – Average Vehicle Delay, LOS – Level of Service, DOS – Degree of Saturation

The results of the intersection analysis, using the LINSIG intersection analysis program, 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 existing situation. All intersections are forecast to operate at a level of service B or better. The full intersection capacity analysis results are included as **Appendix A** to this report.

# 7 Traffic and Pedestrian Management

## 7.1 Construction Vehicle Management

### 7.1.1 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.

### 7.1.2 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. The gatehouse will be centred on the access road to prevent trucks parking along the kerbside to enquire about directions on site. A diagram indicating the proposed construction site access is presented in Figure 9.

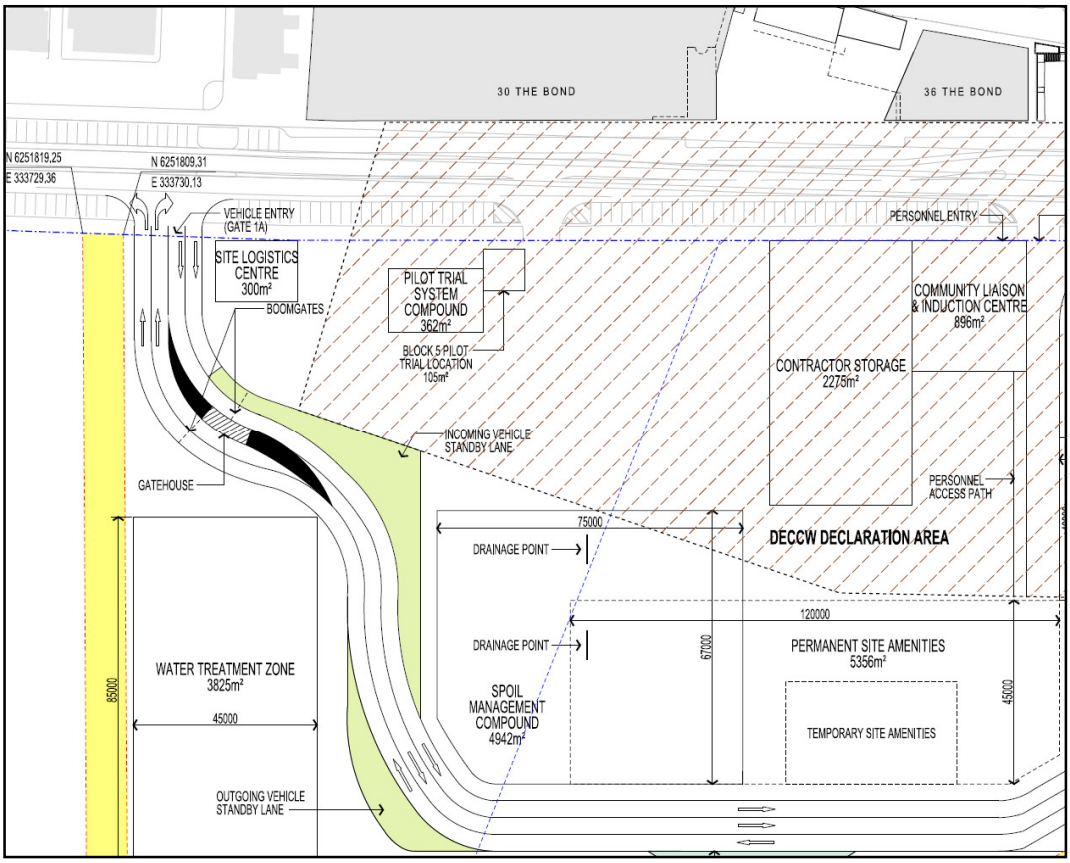



Figure 9 Proposed Construction Site Entry and Exit

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.

### 7.1.3 Emergency Vehicle Access

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

### 7.1.4 Potential Impacts at External Roads and Intersections

The potential effect of the additional site generated construction traffic during both the weekday morning and afternoon peak commuter traffic periods (8am-9am and 5pm-6pm) has been assessed by means of the LINSIG intersection traffic analysis program, for the key intersections surrounding the site.

The proposed construction traffic is forecast to have a minimal impact at key intersections adjacent to the precinct, and by inference at any other major traffic signal controlled intersection within the north-western part of the Sydney CBD. To further minimise the impacts on existing evening traffic peaks along Sussex Street, it is intended that large concrete pours generally be commenced during morning periods wherever possible.

### 7.1.5 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.

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).

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.

### 7.1.6 Hickson Road Construction Zone

A construction zone is proposed as depicted Figure 10. The final extent of the construction zone will be subject to an application and approval by the BDA which will also include the submission of traffic control plans to be prepared by an RTA accredited contractor. The construction zone is to be used for materials handling, with all truck queuing is to occur on site. Where it is impractical to enter

the Barangaroo site to turn around, and to avoid any road safety issues within Hickson Road, trucks will leave the loading zone and head north along Hickson Road to the roundabout at Walsh Bay which will facilitate their departure north, south or east.

## 7.2 Pedestrian Management on Hickson Road

Pedestrian activity observed in the passenger terminal surveys discussed in Section 2.2 is anticipated to remain unchanged during the proposed construction period. 137 pedestrians were observed to enter and exit the site during the 15 minute morning peak (10:00 to 10:15) when a large cruise ship was docked. Cruise ship dockings will occur regularly throughout the construction period. Pedestrians are to be redirected to the eastern footpath of Hickson Road for the duration of the proposed works reducing potential conflicts with vehicles. The extent of the footpath works on Hickson Road during construction is indicated in Figure 10.

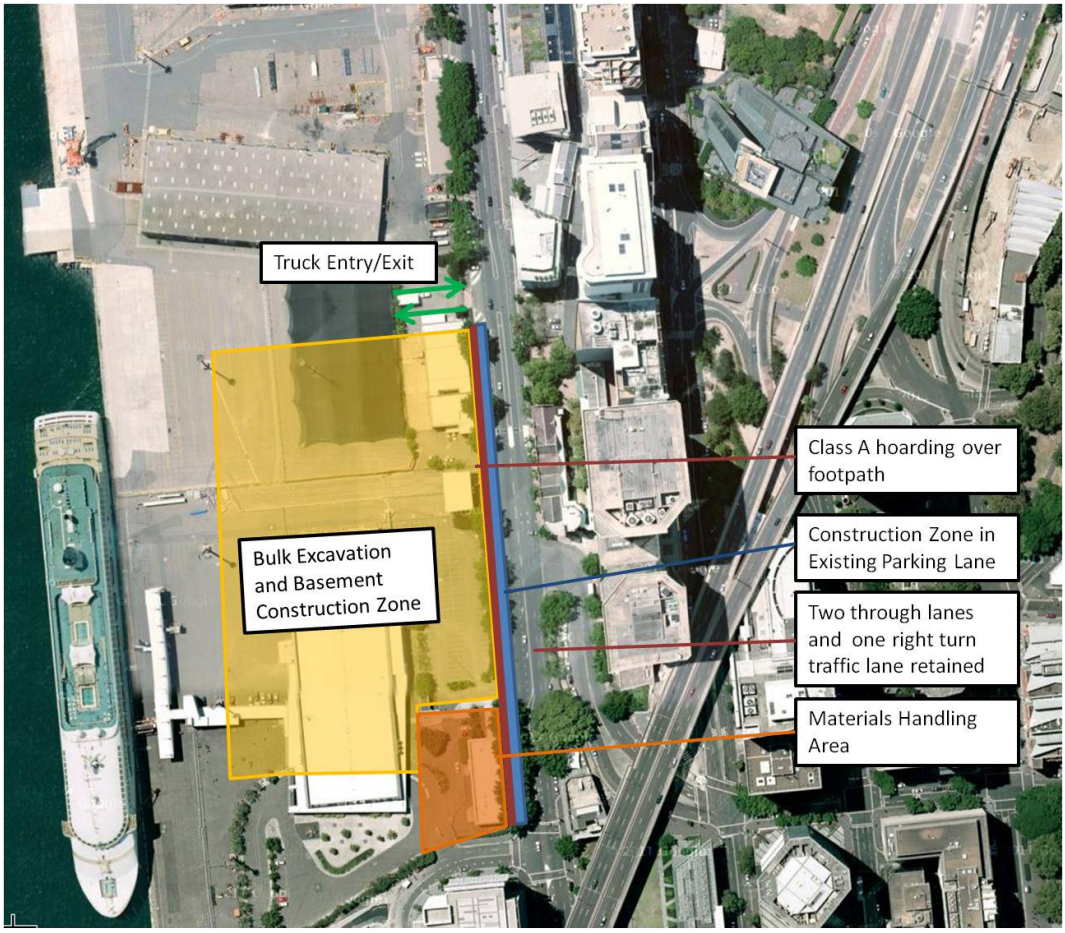



Figure 10 Proposed Pedestrian Footpath Works for Hickson Road

A pedestrian refuge in the middle of Napoleon Street at the Hickson Road intersection has previously been proposed under the original Bulk Excavation and Basement Car Parking Project Application (MP10_0023). This would allow a two staged crossing of Napoleon Street. This intersection is likely 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 formal zebra crossing is being considered by Lend Lease across Napoleon Street (see Figure 11). This crossing has received in principle approval from City of Sydney Council, however further investigation and approval from the road authority is necessary before this can be implemented. This crossing will be considered under a separate application, with traffic analysis to be conducted at an appropriate stage.

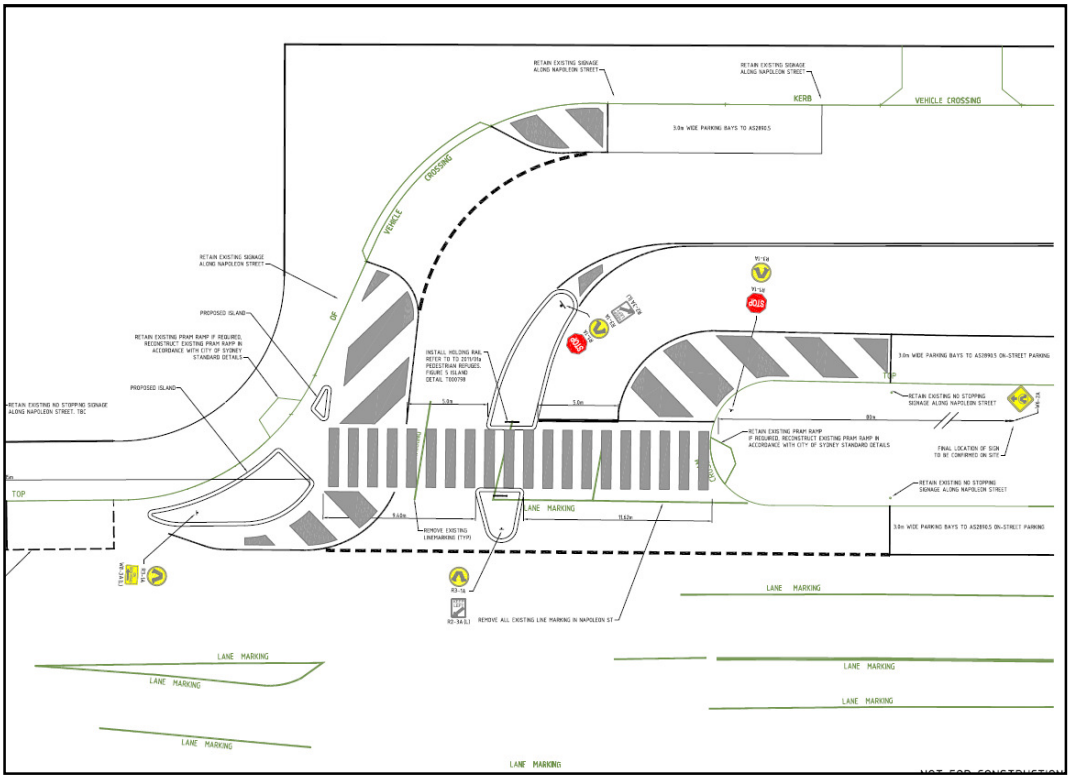



Figure 11 Proposed Zebra Crossing at Napoleon Street and Hickson Road (subject to further investigation and approval)

## 7.3 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.

# 8 Conclusion

Arup has prepared this construction staging traffic impacts assessment for the C3 Commercial Building 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 C3 Commercial Building Project Application (MP11_0044).

The assessment concludes that the construction related traffic impacts arising from the works proposed under the C3 Commercial Building Project Application (MP 11_0044) can be appropriately managed.

# Appendix A

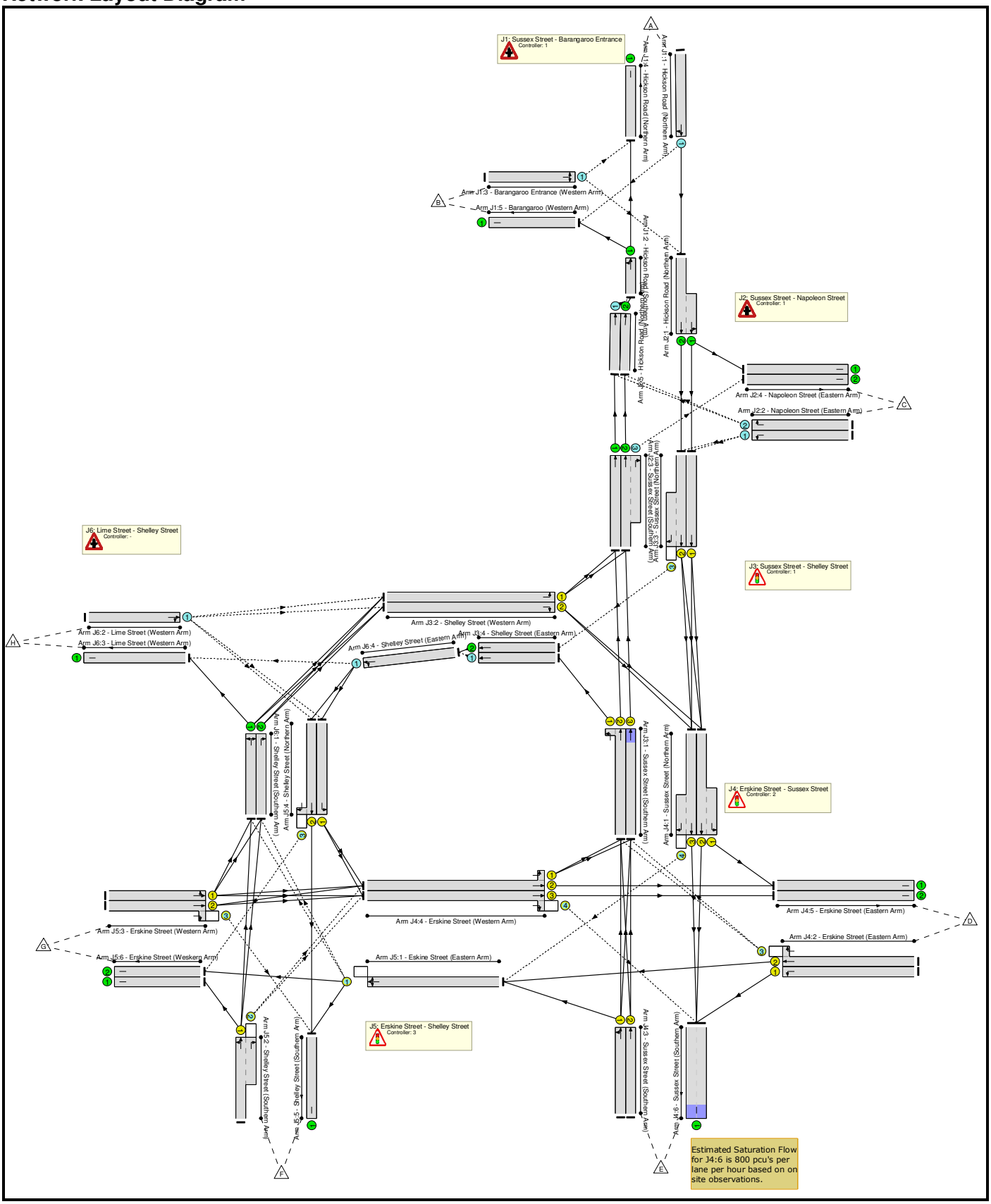
LINSIG Intersection Results

## Existing Traffic Results

### Project and User Details

| | |
|---|---|
| **Project:** | **220316 Barangaroo** |
| **Title:** | **C3 Development** |
| **Company:** | Arup |
| **Address:** | Level 10, 201 Kent Street, Sydney NSW 2000 |
| **Notes:** | Existing Traffic Scenario Model |

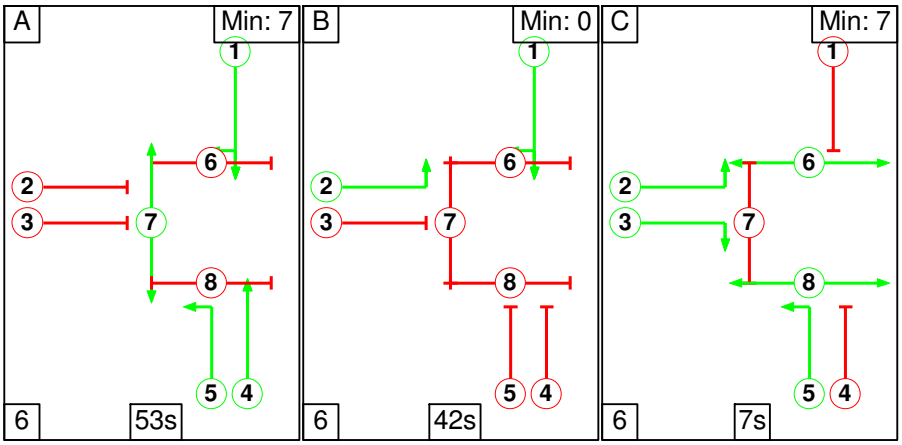
## Network Layout Diagram



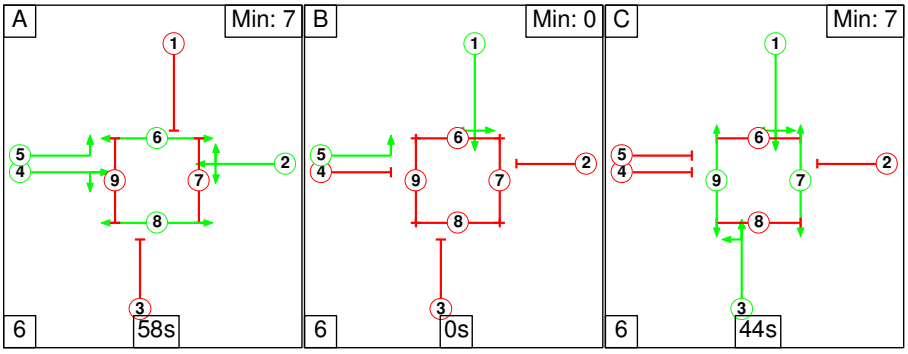
## Stage Sequence Diagram

**Scenario 1: 'AM Existing Scenario'** (FG7: 'PM Construction HGV', Plan 1: 'Network Control Plan 1')

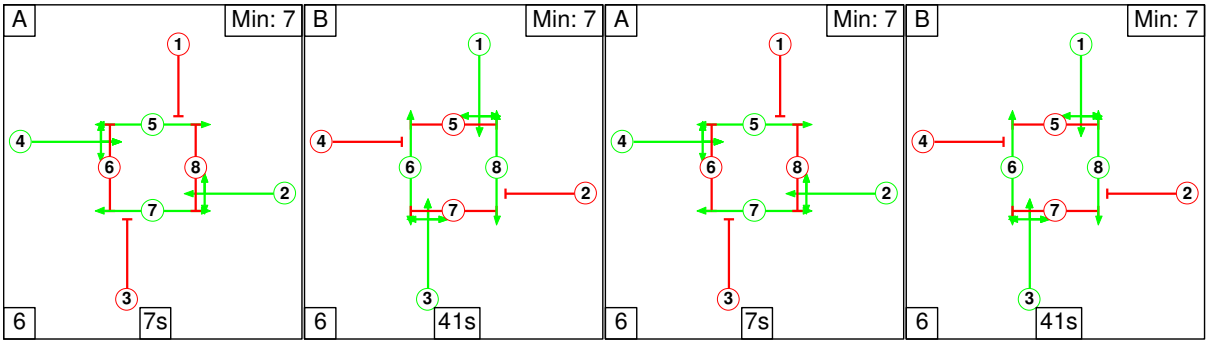
**C1**




**C2**




**C3**



## Network Results

| Item | Lane Description | Controller Stream | Full Phase | Arrow Phase | Deg Sat (%) | Mean Max Queue (pcu) | Av. Delay Per PCU (s/pcu) | Arriving (pcu) | Leaving (pcu) | Turners In Gaps (pcu) | Ignoring Random Delay ? |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Network: C5 Development** | **-** | **N/A** | **-** | | **70.8%** | **-** | **-** | **-** | **-** | **1987** | **-** |
| **J1: Sussex Street - Barangaroo Entrance** | **-** | **N/A** | **-** | | **11.2%** | **-** | **-** | **-** | **-** | **0** | **-** |
| 1/1 | Hickson Road (Northern Arm) Ahead Right | N/A | - | | 11.2% | 0.1 | 1.0 | 217 | 217 | 0 | - |
| 3/1 | Barangaroo Entrance (Western Arm) Left Right | N/A | - | | 0.0% | 0.0 | 0.0 | 0 | 0 | 0 | - |
| **J2: Sussex Street - Napoleon Street** | **-** | **N/A** | **-** | | **65.3%** | **-** | **-** | **-** | **-** | **1334** | **-** |
| 1/2+1/1 | Hickson Road (Northern Arm) Left Ahead | N/A | - | | 11.5% | 0.1 | 1.1 | 217 | 217 | - | - |
| 2/1 | Napoleon Street (Eastern Arm) Left | N/A | - | | 65.3% | 0.9 | 7.6 | 441 | 441 | 441 | - |
| 2/2 | Napoleon Street (Eastern Arm) Right | N/A | - | | 10.2% | 0.5 | 5.2 | 73 | 73 | 73 | - |
| 3/1 | Sussex Street (Southern Arm) Ahead | N/A | - | | 15.7% | 0.1 | 1.2 | 282 | 282 | - | - |
| 3/2+3/3 | Sussex Street (Southern Arm) Right Ahead | N/A | - | | 44.7% | 13.7 | 2.5 | 722 | 722 | 538 | - |
| 5/1 | Hickson Road (Northern Arm) Ahead | N/A | - | | 29.9% | 4.0 | 3.0 | 282 | 282 | 282 | - |
| 5/2 | Hickson Road (Northern Arm) Ahead | N/A | - | | 14.3% | 0.1 | 1.2 | 257 | 257 | - | - |
| **J3: Sussex Street - Shelley Street** | **-** | **N/A** | **-** | | **47.5%** | **-** | **-** | **-** | **-** | **54** | **-** |
| 1/2+1/1 | Sussex Street (Southern Arm) Ahead Left | N/A | C1:4 C1:5 | | 34.6% | 2.0 | 10.7 | 296 | 296 | - | - |
| 1/3 | Sussex Street (Southern Arm) Ahead | N/A | C1:4 | | 44.3% | 3.7 | 13.8 | 415 | 415 | - | - |
| 2/1 | Shelley Street (Western Arm) Left | N/A | C1:2 | | 47.5% | 7.4 | 26.5 | 330 | 330 | - | - |
| 2/2 | Shelley Street (Western Arm) Right | N/A | C1:3 | | 0.0% | 0.0 | 0.0 | 0 | 0 | - | - |
| 3/1 | Sussex Street (Northern Arm) Ahead | N/A | C1:1 | | 17.1% | 1.7 | 2.9 | 282 | 282 | - | - |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 3/2+3/3 | Sussex Street (Northern Arm) Ahead Right | N/A | C1:1 | | 19.4% | 1.9 | 3.1 | 341 | 341 | 17 | - |
| 4/1 | Shelley Street (Eastern Arm) Ahead | N/A | - | | 3.7% | 0.0 | 1.9 | 37 | 37 | 37 | - |
| 4/2 | Shelley Street (Eastern Arm) Ahead | N/A | - | | 1.4% | 0.0 | 0.9 | 28 | 28 | - | - |
| **J4: Erskine Street - Sussex Street** | **-** | **N/A** | **-** | | **70.8%** | **-** | **-** | **-** | **-** | **213** | **-** |
| 1/2+1/1 | Sussex Street (Northern Arm) Left Ahead | N/A | C2:1 | | 34.1% | 5.2 | 25.9 | 288 | 288 | - | - |
| 1/3+1/4 | Sussex Street (Northern Arm) Ahead Right | N/A | C2:1 | | 34.5% | 6.4 | 26.1 | 307 | 307 | 2 | - |
| 2/1 | Erskine Street (Eastern Arm) Left | N/A | C2:2 | | 55.2% | 10.3 | 26.5 | 421 | 421 | - | - |
| 2/2+2/3 | Erskine Street (Eastern Arm) Right Ahead | N/A | C2:2 | | 9.5% | 1.0 | 22.6 | 72 | 72 | 50 | - |
| 3/1 | Sussex Street (Southern Arm) Ahead Left | N/A | C2:3 | | 28.4% | 4.6 | 33.4 | 181 | 181 | - | - |
| 3/2 | Sussex Street (Southern Arm) Ahead | N/A | C2:3 | | 51.5% | 10.8 | 33.8 | 402 | 402 | - | - |
| 4/2+4/1 | Erskine Street (Western Arm) Left Ahead | N/A | C2:4 C2:5 | | 22.3% | 2.9 | 19.1 | 200 | 200 | - | - |
| 4/3+4/4 | Erskine Street (Western Arm) Ahead Right | N/A | C2:4 | | 48.6% | 4.7 | 43.4 | 164 | 164 | 161 | - |
| 6/1 | Sussex Street (Southern Arm) | N/A | - | | 70.8% | 8.0 | 6.1 | 1133 | 1133 | - | - |
| **J5: Erskine Street - Shelley Street** | **-** | **N/A** | **-** | | **56.9%** | **-** | **-** | **-** | **-** | **317** | **-** |
| 1/1 | Eskine Street (Eastern Arm) Left Ahead Right | N/A | C3:2 | | 13.7% | 0.6 | 28.4 | 38 | 38 | 10 | - |
| 2/1+2/2 | Shelley Street (Southern Arm) Right Left Ahead | N/A | C3:3 | | 56.9% | 5.0 | 8.0 | 805 | 805 | 304 | - |
| 3/1 | Erskine Street (Western Arm) Ahead Left | N/A | C3:4 | | 13.5% | 0.3 | 51.0 | 12 | 12 | - | - |
| 3/2+3/3 | Erskine Street (Western Arm) Ahead Right | N/A | C3:4 | | 8.2% | 0.4 | 30.3 | 22 | 22 | 0 | - |
| 4/1 | Shelley Street (Northern Arm) Left | N/A | C3:1 | | 2.8% | 0.2 | 4.5 | 32 | 32 | - | - |

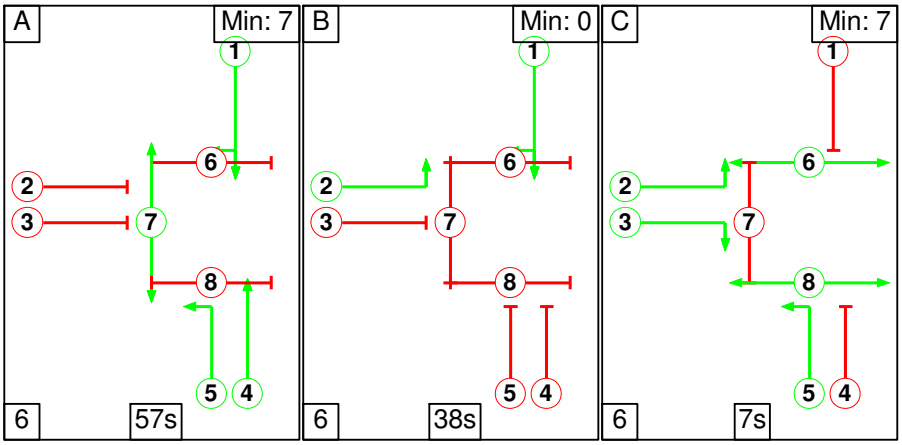
| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 4/2+4/3 | Shelley Street (Northern Arm) Ahead Right | N/A | C3:1 | | 2.0% | 0.1 | 4.4 | 28 | 28 | 3 | - |
| **J6: Lime Street - Shelley Street** | **-** | **N/A** | **-** | | **17.4%** | **-** | **-** | **-** | **-** | **69** | **-** |
| 1/1 | Shelley Street (Southern Arm) Right Left | N/A | - | | 11.2% | 0.1 | 1.2 | 183 | 183 | - | - |
| 1/2 | Shelley Street (Southern Arm) Right | N/A | - | | 17.4% | 0.1 | 1.1 | 330 | 330 | - | - |
| 2/1 | Lime Street (Western Arm) Ahead Right | N/A | - | | 6.1% | 0.0 | 3.7 | 32 | 32 | 32 | - |
| 4/1 | Shelley Street (Eastern Arm) Left Ahead | N/A | - | | 6.5% | 0.0 | 1.9 | 65 | 65 | 37 | - |

| | | | | | |
|---|---|---|---|---|---|
| C1 | PRC for Signalled Lanes (%): | 89.4 | Total Delay for Signalled Lanes (pcuHr): | 5.41 | Cycle Time (s): 120 |
| C2 | PRC for Signalled Lanes (%): | 63.1 | Total Delay for Signalled Lanes (pcuHr): | 16.35 | Cycle Time (s): 120 |
| C3 | PRC for Signalled Lanes (%): | 58.3 | Total Delay for Signalled Lanes (pcuHr): | 2.51 | Cycle Time (s): 120 |
| | PRC Over All Lanes (%): | 27.1 | Total Delay Over All Lanes(pcuHr): | 28.54 | |

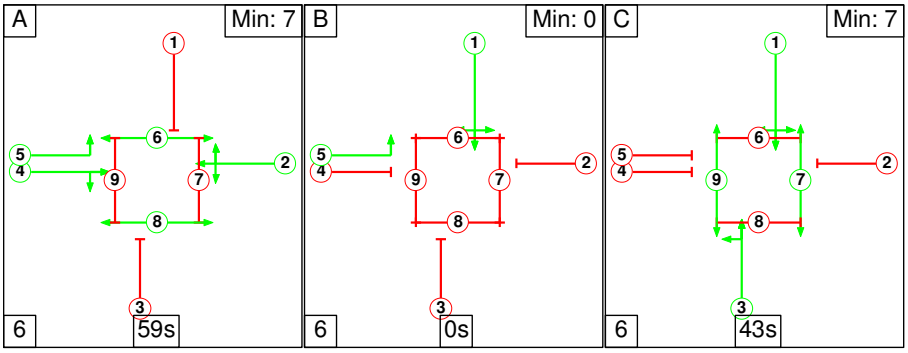
## Stage Sequence Diagram

**Scenario 2: 'PM Existing Scenario'** (FG5: 'PM Existing Traffic', Plan 1: 'Network Control Plan 1')

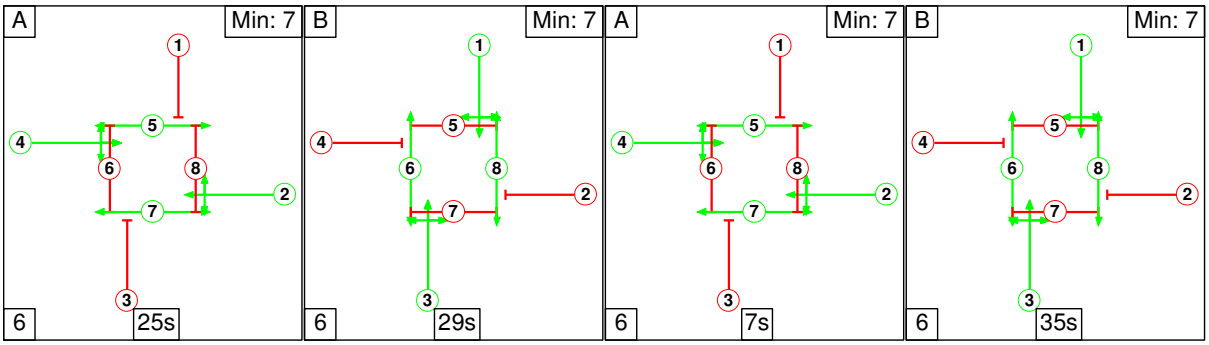
**C1**




**C2**




**C3**



## Network Results

| Item | Lane Description | Controller Stream | Full Phase | Arrow Phase | Deg Sat (%) | Mean Max Queue (pcu) | Av. Delay Per PCU (s/pcu) | Arriving (pcu) | Leaving (pcu) | Turners In Gaps (pcu) | Ignoring Random Delay ? |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Network: C5 Development** | **-** | **N/A** | **-** | | **87.9%** | **-** | **-** | **-** | **-** | **1601** | **-** |
| **J1: Sussex Street - Barangaroo Entrance** | **-** | **N/A** | **-** | | **31.7%** | **-** | **-** | **-** | **-** | **0** | **-** |
| 1/1 | Hickson Road (Northern Arm) Ahead Right | N/A | - | | 31.7% | 0.2 | 1.4 | 615 | 615 | 0 | - |
| 3/1 | Barangaroo Entrance (Western Arm) Left Right | N/A | - | | 0.0% | 0.0 | 0.0 | 0 | 0 | 0 | - |
| **J2: Sussex Street - Napoleon Street** | **-** | **N/A** | **-** | | **66.5%** | **-** | **-** | **-** | **-** | **1009** | **-** |
| 1/2+1/1 | Hickson Road (Northern Arm) Left Ahead | N/A | - | | 33.0% | 0.2 | 1.4 | 615 | 615 | - | - |
| 2/1 | Napoleon Street (Eastern Arm) Left | N/A | - | | 66.5% | 1.0 | 8.7 | 405 | 405 | 405 | - |
| 2/2 | Napoleon Street (Eastern Arm) Right | N/A | - | | 5.7% | 0.3 | 3.2 | 50 | 50 | 50 | - |
| 3/1 | Sussex Street (Southern Arm) Ahead | N/A | - | | 13.4% | 0.1 | 1.2 | 242 | 242 | - | - |
| 3/2+3/3 | Sussex Street (Southern Arm) Right Ahead | N/A | - | | 40.6% | 11.5 | 3.9 | 397 | 397 | 312 | - |
| 5/1 | Hickson Road (Northern Arm) Ahead | N/A | - | | 24.9% | 1.0 | 2.5 | 242 | 242 | 242 | - |
| 5/2 | Hickson Road (Northern Arm) Ahead | N/A | - | | 7.5% | 0.0 | 1.1 | 135 | 135 | - | - |
| **J3: Sussex Street - Shelley Street** | **-** | **N/A** | **-** | | **32.3%** | **-** | **-** | **-** | **-** | **32** | **-** |
| 1/2+1/1 | Sussex Street (Southern Arm) Ahead Left | N/A | C1:4 C1:5 | | 20.4% | 1.0 | 8.0 | 191 | 191 | - | - |
| 1/3 | Sussex Street (Southern Arm) Ahead | N/A | C1:4 | | 24.0% | 1.7 | 10.4 | 241 | 241 | - | - |
| 2/1 | Shelley Street (Western Arm) Left | N/A | C1:2 | | 32.3% | 5.0 | 24.9 | 207 | 207 | - | - |
| 2/2 | Shelley Street (Western Arm) Right | N/A | C1:3 | | 0.0% | 0.0 | 0.0 | 0 | 0 | - | - |
| 3/1 | Sussex Street (Northern Arm) Ahead | N/A | C1:1 | | 25.5% | 2.7 | 3.2 | 420 | 420 | - | - |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 3/2+3/3 | Sussex Street (Northern Arm) Ahead Right | N/A | C1:1 | | 26.5% | 2.7 | 3.2 | 466 | 466 | 32 | - |
| 4/1 | Shelley Street (Eastern Arm) Ahead | N/A | - | | 0.0% | 0.0 | 0.0 | 0 | 0 | 0 | - |
| 4/2 | Shelley Street (Eastern Arm) Ahead | N/A | - | | 2.6% | 0.0 | 1.0 | 51 | 51 | - | - |
| **J4: Erskine Street - Sussex Street** | **-** | **N/A** | **-** | | **87.9%** | **-** | **-** | **-** | **-** | **179** | **-** |
| 1/2+1/1 | Sussex Street (Northern Arm) Left Ahead | N/A | C2:1 | | 49.1% | 7.0 | 28.0 | 408 | 408 | - | - |
| 1/3+1/4 | Sussex Street (Northern Arm) Ahead Right | N/A | C2:1 | | 49.2% | 8.6 | 28.3 | 427 | 427 | 1 | - |
| 2/1 | Erskine Street (Eastern Arm) Left | N/A | C2:2 | | 59.0% | 11.5 | 26.9 | 458 | 458 | - | - |
| 2/2+2/3 | Erskine Street (Eastern Arm) Right Ahead | N/A | C2:2 | | 3.9% | 0.7 | 17.3 | 38 | 38 | 0 | - |
| 3/1 | Sussex Street (Southern Arm) Ahead Left | N/A | C2:3 | | 12.2% | 1.8 | 31.8 | 75 | 75 | - | - |
| 3/2 | Sussex Street (Southern Arm) Ahead | N/A | C2:3 | | 38.3% | 7.4 | 31.8 | 292 | 292 | - | - |
| 4/2+4/1 | Erskine Street (Western Arm) Left Ahead | N/A | C2:4 C2:5 | | 17.6% | 2.2 | 14.9 | 160 | 160 | - | - |
| 4/3+4/4 | Erskine Street (Western Arm) Ahead Right | N/A | C2:4 | | 58.2% | 5.7 | 46.0 | 178 | 178 | 178 | - |
| 6/1 | Sussex Street (Southern Arm) | N/A | - | | 87.9% | 16.4 | 15.7 | 1406 | 1406 | - | - |
| **J5: Erskine Street - Shelley Street** | **-** | **N/A** | **-** | | **24.7%** | **-** | **-** | **-** | **-** | **198** | **-** |
| 1/1 | Eskine Street (Eastern Arm) Left Ahead Right | N/A | C3:2 | | 8.1% | 0.7 | 13.6 | 48 | 48 | 22 | - |
| 2/1+2/2 | Shelley Street (Southern Arm) Right Left Ahead | N/A | C3:3 | | 24.7% | 2.1 | 10.8 | 327 | 327 | 168 | - |
| 3/1 | Erskine Street (Western Arm) Ahead Left | N/A | C3:4 | | 7.0% | 0.4 | 25.1 | 25 | 25 | - | - |
| 3/2+3/3 | Erskine Street (Western Arm) Ahead Right | N/A | C3:4 | | 5.3% | 0.4 | 19.1 | 31 | 31 | 0 | - |
| 4/1 | Shelley Street (Northern Arm) Left | N/A | C3:1 | | 14.0% | 1.4 | 9.7 | 126 | 126 | - | - |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 4/2+4/3 | Shelley Street (Northern Arm) Ahead Right | N/A | C3:1 | | 3.9% | 0.3 | 8.8 | 43 | 43 | 8 | - |
| **J6: Lime Street - Shelley Street** | **-** | **N/A** | **-** | | **29.7%** | **-** | **-** | **-** | **-** | **183** | **-** |
| 1/1 | Shelley Street (Southern Arm) Right Left | N/A | - | | 1.5% | 0.0 | 1.1 | 24 | 24 | - | - |
| 1/2 | Shelley Street (Southern Arm) Right | N/A | - | | 8.2% | 0.0 | 1.0 | 156 | 156 | - | - |
| 2/1 | Lime Street (Western Arm) Ahead Right | N/A | - | | 29.7% | 0.2 | 4.3 | 175 | 175 | 175 | - |
| 4/1 | Shelley Street (Eastern Arm) Left Ahead | N/A | - | | 3.2% | 0.0 | 1.2 | 51 | 51 | 8 | - |

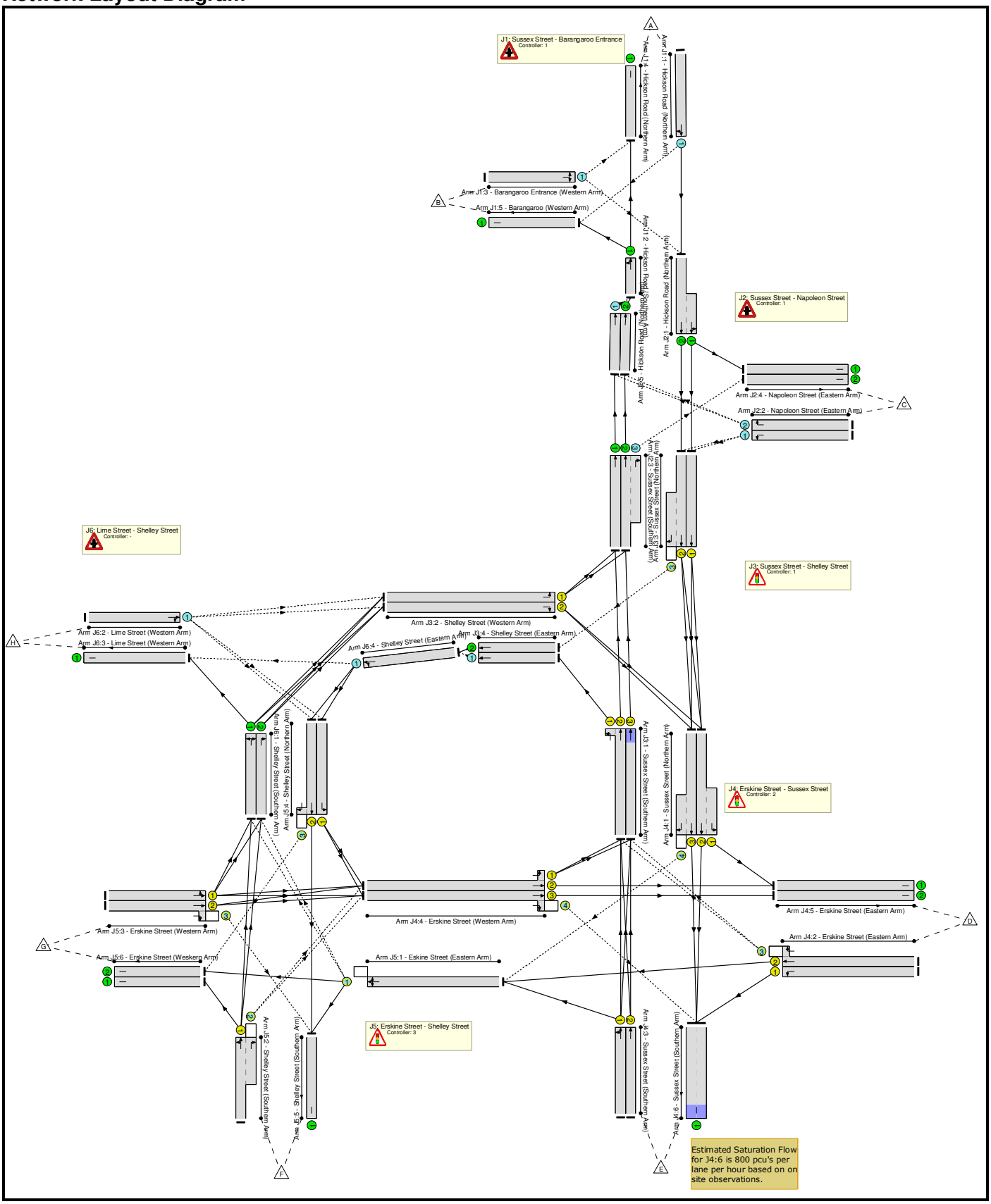
| | | | | | |
|---|---|---|---|---|---|
| C1 | PRC for Signalled Lanes (%): | 178.3 | Total Delay for Signalled Lanes (pcuHr): | 3.34 | Cycle Time (s): 120 |
| C2 | PRC for Signalled Lanes (%): | 52.5 | Total Delay for Signalled Lanes (pcuHr): | 16.32 | Cycle Time (s): 120 |
| C3 | PRC for Signalled Lanes (%): | 263.7 | Total Delay for Signalled Lanes (pcuHr): | 1.94 | Cycle Time (s): 120 |
| | PRC Over All Lanes (%): | 2.4 | Total Delay Over All Lanes(pcuHr): | 30.24 | |

## Construction Traffic Results

### Project and User Details

| | |
|---|---|
| **Project:** | **220316 Barangaroo** |
| **Title:** | **C3 Development** |
| **Company:** | Arup |
| **Address:** | Level 10, 201 Kent Street, Sydney NSW 2000 |
| **Notes:** | Construction Traffic Scenario Model |

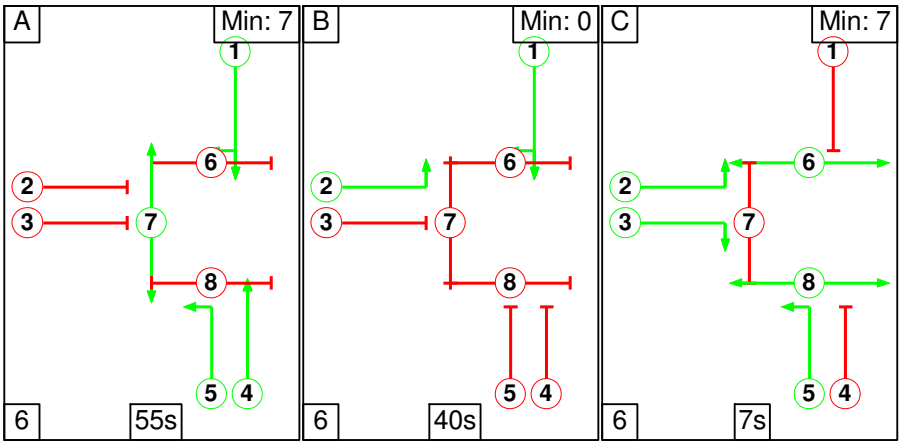
## Network Layout Diagram



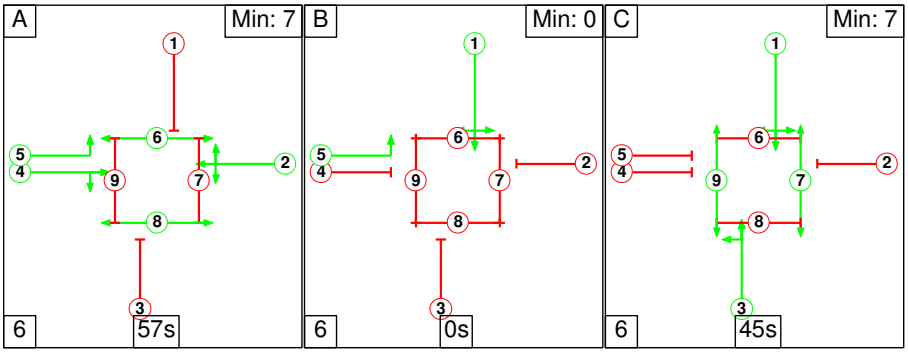
## Stage Sequence Diagram

**Scenario 3: 'AM Construction Peak'** (FG4: 'AM Traffic With Construction', Plan 1: 'Network Control Plan 1')

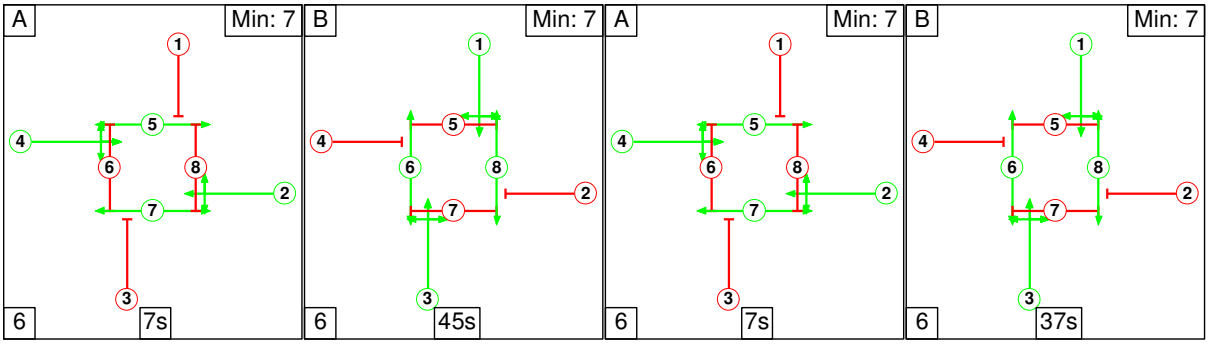
**C1**




**C2**




**C3**



## Network Results

| Item | Lane Description | Controller Stream | Full Phase | Arrow Phase | Deg Sat (%) | Mean Max Queue (pcu) | Av. Delay Per PCU (s/pcu) | Arriving (pcu) | Leaving (pcu) | Turners In Gaps (pcu) | Ignoring Random Delay ? |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Network: C5 Development** | **-** | **N/A** | **-** | | **78.6%** | **-** | **-** | **-** | **-** | **2378** | **-** |
| **J1: Sussex Street - Barangaroo Entrance** | **-** | **N/A** | **-** | | **14.6%** | **-** | **-** | **-** | **-** | **51** | **-** |
| 1/1 | Hickson Road (Northern Arm) Ahead Right | N/A | - | | 14.6% | 0.1 | 1.1 | 283 | 283 | 0 | - |
| 3/1 | Barangaroo Entrance (Western Arm) Left Right | N/A | - | | 11.2% | 0.4 | 7.2 | 51 | 51 | 51 | - |
| **J2: Sussex Street - Napoleon Street** | **-** | **N/A** | **-** | | **68.4%** | **-** | **-** | **-** | **-** | **1499** | **-** |
| 1/2+1/1 | Hickson Road (Northern Arm) Left Ahead | N/A | - | | 18.0% | 0.1 | 1.2 | 334 | 334 | - | - |
| 2/1 | Napoleon Street (Eastern Arm) Left | N/A | - | | 68.4% | 1.1 | 8.6 | 451 | 451 | 451 | - |
| 2/2 | Napoleon Street (Eastern Arm) Right | N/A | - | | 25.3% | 2.0 | 7.9 | 157 | 157 | 157 | - |
| 3/1 | Sussex Street (Southern Arm) Ahead | N/A | - | | 17.7% | 0.1 | 1.2 | 319 | 319 | - | - |
| 3/2+3/3 | Sussex Street (Southern Arm) Right Ahead | N/A | - | | 53.2% | 13.9 | 3.1 | 795 | 795 | 572 | - |
| 5/1 | Hickson Road (Northern Arm) Ahead | N/A | - | | 34.8% | 4.6 | 3.5 | 319 | 319 | 319 | - |
| 5/2 | Hickson Road (Northern Arm) Ahead | N/A | - | | 21.1% | 0.1 | 1.3 | 380 | 380 | - | - |
| **J3: Sussex Street - Shelley Street** | **-** | **N/A** | **-** | | **54.6%** | **-** | **-** | **-** | **-** | **75** | **-** |
| 1/2+1/1 | Sussex Street (Southern Arm) Ahead Left | N/A | C1:4 C1:5 | | 36.8% | 2.0 | 9.7 | 325 | 325 | - | - |
| 1/3 | Sussex Street (Southern Arm) Ahead | N/A | C1:4 | | 49.1% | 3.8 | 12.4 | 477 | 477 | - | - |
| 2/1 | Shelley Street (Western Arm) Left | N/A | C1:2 | | 54.6% | 8.5 | 29.5 | 364 | 364 | - | - |
| 2/2 | Shelley Street (Western Arm) Right | N/A | C1:3 | | 0.0% | 0.0 | 0.0 | 0 | 0 | - | - |
| 3/1 | Sussex Street (Northern Arm) Ahead | N/A | C1:1 | | 18.1% | 1.9 | 2.9 | 298 | 298 | - | - |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 3/2+3/3 | Sussex Street (Northern Arm) Ahead Right | N/A | C1:1 | | 23.1% | 2.3 | 3.3 | 407 | 407 | 23 | - |
| 4/1 | Shelley Street (Eastern Arm) Ahead | N/A | - | | 5.2% | 0.0 | 1.9 | 52 | 52 | 52 | - |
| 4/2 | Shelley Street (Eastern Arm) Ahead | N/A | - | | 2.0% | 0.0 | 0.9 | 38 | 38 | - | - |
| **J4: Erskine Street - Sussex Street** | **-** | **N/A** | **-** | | **78.6%** | **-** | **-** | **-** | **-** | **265** | **-** |
| 1/2+1/1 | Sussex Street (Northern Arm) Left Ahead | N/A | C2:1 | | 40.2% | 6.3 | 25.8 | 344 | 344 | - | - |
| 1/3+1/4 | Sussex Street (Northern Arm) Ahead Right | N/A | C2:1 | | 35.6% | 6.5 | 25.5 | 323 | 323 | 2 | - |
| 2/1 | Erskine Street (Eastern Arm) Left | N/A | C2:2 | | 56.1% | 10.6 | 27.4 | 421 | 421 | - | - |
| 2/2+2/3 | Erskine Street (Eastern Arm) Right Ahead | N/A | C2:2 | | 9.6% | 1.0 | 23.2 | 72 | 72 | 50 | - |
| 3/1 | Sussex Street (Southern Arm) Ahead Left | N/A | C2:3 | | 35.6% | 6.0 | 33.9 | 233 | 233 | - | - |
| 3/2 | Sussex Street (Southern Arm) Ahead | N/A | C2:3 | | 55.3% | 12.0 | 34.0 | 441 | 441 | - | - |
| 4/2+4/1 | Erskine Street (Western Arm) Left Ahead | N/A | C2:4 C2:5 | | 23.0% | 3.1 | 19.4 | 203 | 203 | - | - |
| 4/3+4/4 | Erskine Street (Western Arm) Ahead Right | N/A | C2:4 | | 66.1% | 7.0 | 52.6 | 213 | 213 | 213 | - |
| 6/1 | Sussex Street (Southern Arm) | N/A | - | | 78.6% | 9.9 | 8.3 | 1257 | 1257 | - | - |
| **J5: Erskine Street - Shelley Street** | **-** | **N/A** | **-** | | **60.8%** | **-** | **-** | **-** | **-** | **317** | **-** |
| 1/1 | Eskine Street (Eastern Arm) Left Ahead Right | N/A | C3:2 | | 13.7% | 0.6 | 29.5 | 38 | 38 | 10 | - |
| 2/1+2/2 | Shelley Street (Southern Arm) Right Left Ahead | N/A | C3:3 | | 60.8% | 5.5 | 8.6 | 849 | 849 | 304 | - |
| 3/1 | Erskine Street (Western Arm) Ahead Left | N/A | C3:4 | | 13.5% | 0.3 | 51.1 | 12 | 12 | - | - |
| 3/2+3/3 | Erskine Street (Western Arm) Ahead Right | N/A | C3:4 | | 8.2% | 0.4 | 30.4 | 22 | 22 | 0 | - |
| 4/1 | Shelley Street (Northern Arm) Left | N/A | C3:1 | | 7.3% | 0.5 | 4.5 | 84 | 84 | - | - |

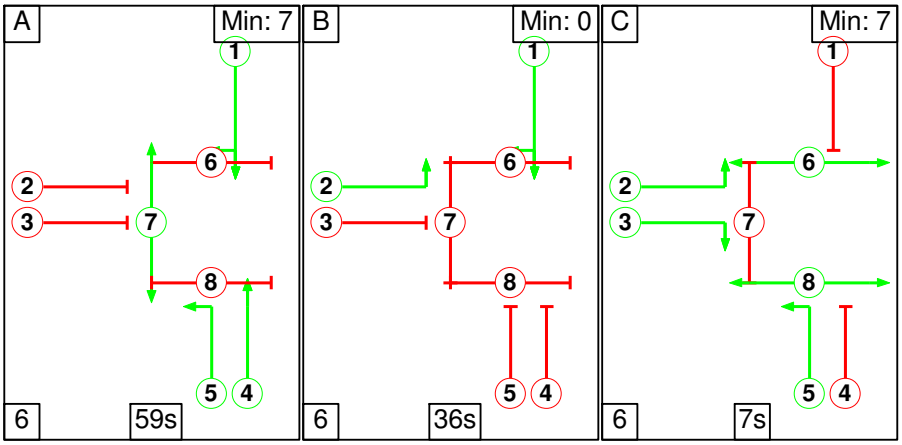
| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 4/2+4/3 | Shelley Street (Northern Arm) Ahead Right | N/A | C3:1 | | 5.3% | 0.4 | 4.3 | 72 | 72 | 3 | - |
| **J6: Lime Street - Shelley Street** | **-** | **N/A** | **-** | | **23.6%** | **-** | **-** | **-** | **-** | **170** | **-** |
| 1/1 | Shelley Street (Southern Arm) Right Left | N/A | - | | 11.9% | 0.1 | 1.2 | 194 | 194 | - | - |
| 1/2 | Shelley Street (Southern Arm) Right | N/A | - | | 19.1% | 0.1 | 1.2 | 363 | 363 | - | - |
| 2/1 | Lime Street (Western Arm) Ahead Right | N/A | - | | 23.6% | 0.2 | 4.7 | 118 | 118 | 118 | - |
| 4/1 | Shelley Street (Eastern Arm) Left Ahead | N/A | - | | 9.2% | 0.1 | 2.0 | 90 | 90 | 52 | - |

| | | | | | | |
|---|---|---|---|---|---|---|
| C1 | PRC for Signalled Lanes (%): | 65.0 | Total Delay for Signalled Lanes (pcuHr): | 6.12 | Cycle Time (s): | 120 |
| C2 | PRC for Signalled Lanes (%): | 36.1 | Total Delay for Signalled Lanes (pcuHr): | 18.99 | Cycle Time (s): | 120 |
| C3 | PRC for Signalled Lanes (%): | 48.1 | Total Delay for Signalled Lanes (pcuHr): | 2.89 | Cycle Time (s): | 120 |
| | PRC Over All Lanes (%): | 14.6 | Total Delay Over All Lanes(pcuHr): | 34.28 | | |

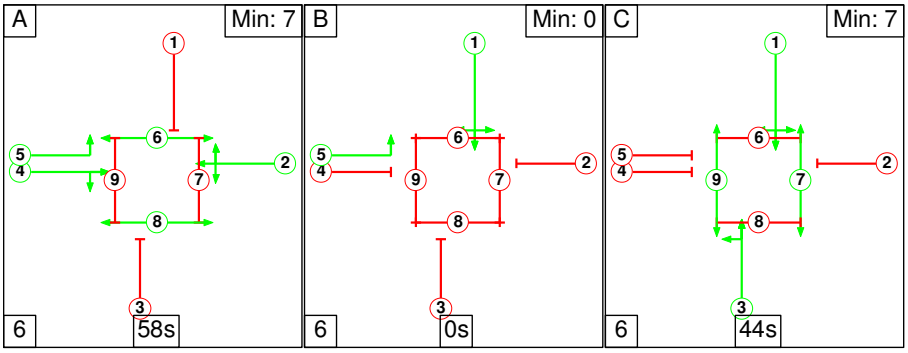
## Stage Sequence Diagram

**Scenario 4: 'PM Construction Peak'** (FG8: 'PM Traffic With Construction', Plan 1: 'Network Control Plan 1')

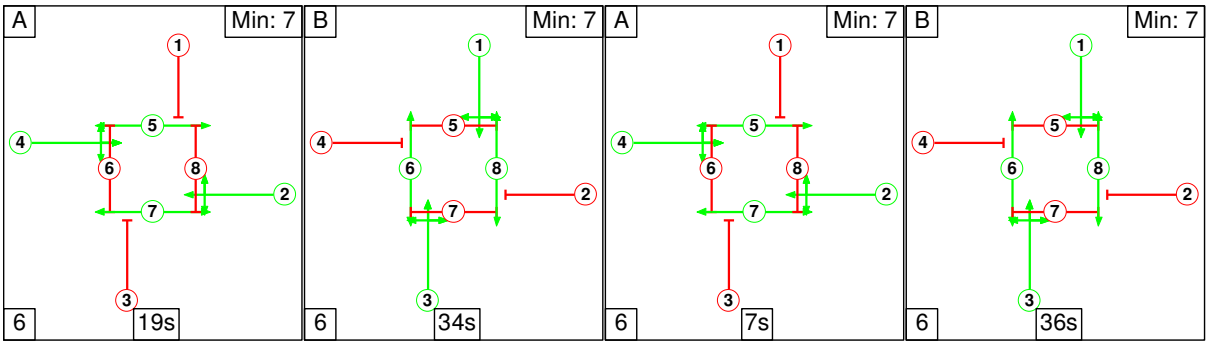
**C1**




**C2**




**C3**



## Network Results

| Item | Lane Description | Controller Stream | Full Phase | Arrow Phase | Deg Sat (%) | Mean Max Queue (pcu) | Av. Delay Per PCU (s/pcu) | Arriving (pcu) | Leaving (pcu) | Turners In Gaps (pcu) | Ignoring Random Delay ? |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Network: C5 Development** | **-** | **N/A** | **-** | | **93.6%** | **-** | **-** | **-** | **-** | **1966** | **-** |
| **J1: Sussex Street - Barangaroo Entrance** | **-** | **N/A** | **-** | | **37.2%** | **-** | **-** | **-** | **-** | **54** | **-** |
| 1/1 | Hickson Road (Northern Arm) Ahead Right | N/A | - | | 37.2% | 0.3 | 1.5 | 721 | 721 | 0 | - |
| 3/1 | Barangaroo Entrance (Western Arm) Left Right | N/A | - | | 21.8% | 0.6 | 12.8 | 54 | 54 | 54 | - |
| **J2: Sussex Street - Napoleon Street** | **-** | **N/A** | **-** | | **74.1%** | **-** | **-** | **-** | **-** | **1204** | **-** |
| 1/2+1/1 | Hickson Road (Northern Arm) Left Ahead | N/A | - | | 42.1% | 0.4 | 1.7 | 775 | 775 | - | - |
| 2/1 | Napoleon Street (Eastern Arm) Left | N/A | - | | 74.1% | 1.4 | 11.5 | 439 | 439 | 439 | - |
| 2/2 | Napoleon Street (Eastern Arm) Right | N/A | - | | 12.3% | 0.7 | 4.3 | 95 | 95 | 95 | - |
| 3/1 | Sussex Street (Southern Arm) Ahead | N/A | - | | 19.3% | 0.1 | 1.2 | 348 | 348 | - | - |
| 3/2+3/3 | Sussex Street (Southern Arm) Right Ahead | N/A | - | | 54.2% | 12.3 | 8.2 | 373 | 373 | 322 | - |
| 5/1 | Hickson Road (Northern Arm) Ahead | N/A | - | | 36.0% | 5.5 | 3.5 | 348 | 348 | 348 | - |
| 5/2 | Hickson Road (Northern Arm) Ahead | N/A | - | | 8.1% | 0.0 | 1.1 | 146 | 146 | - | - |
| **J3: Sussex Street - Shelley Street** | **-** | **N/A** | **-** | | **35.4%** | **-** | **-** | **-** | **-** | **55** | **-** |
| 1/2+1/1 | Sussex Street (Southern Arm) Ahead Left | N/A | C1:4 C1:5 | | 27.9% | 1.1 | 6.8 | 270 | 270 | - | - |
| 1/3 | Sussex Street (Southern Arm) Ahead | N/A | C1:4 | | 22.5% | 1.8 | 10.2 | 234 | 234 | - | - |
| 2/1 | Shelley Street (Western Arm) Left | N/A | C1:2 | | 35.4% | 4.8 | 29.8 | 217 | 217 | - | - |
| 2/2 | Shelley Street (Western Arm) Right | N/A | C1:3 | | 0.0% | 0.0 | 0.0 | 0 | 0 | - | - |
| 3/1 | Sussex Street (Northern Arm) Ahead | N/A | C1:1 | | 26.6% | 3.0 | 3.3 | 438 | 438 | - | - |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 3/2+3/3 | Sussex Street (Northern Arm) Ahead Right | N/A | C1:1 | | 31.7% | 3.3 | 3.5 | 558 | 558 | 55 | - |
| 4/1 | Shelley Street (Eastern Arm) Ahead | N/A | - | | 0.0% | 0.0 | 0.0 | 0 | 0 | 0 | - |
| 4/2 | Shelley Street (Eastern Arm) Ahead | N/A | - | | 4.4% | 0.0 | 1.0 | 85 | 85 | - | - |
| **J4: Erskine Street - Sussex Street** | **-** | **N/A** | **-** | | **93.6%** | **-** | **-** | **-** | **-** | **194** | **-** |
| 1/2+1/1 | Sussex Street (Northern Arm) Left Ahead | N/A | C2:1 | | 54.7% | 9.8 | 27.9 | 461 | 461 | - | - |
| 1/3+1/4 | Sussex Street (Northern Arm) Ahead Right | N/A | C2:1 | | 50.8% | 11.0 | 27.7 | 450 | 450 | 1 | - |
| 2/1 | Erskine Street (Eastern Arm) Left | N/A | C2:2 | | 60.0% | 11.7 | 27.9 | 458 | 458 | - | - |
| 2/2+2/3 | Erskine Street (Eastern Arm) Right Ahead | N/A | C2:2 | | 4.0% | 0.7 | 17.8 | 38 | 38 | 0 | - |
| 3/1 | Sussex Street (Southern Arm) Ahead Left | N/A | C2:3 | | 22.2% | 3.3 | 32.7 | 132 | 132 | - | - |
| 3/2 | Sussex Street (Southern Arm) Ahead | N/A | C2:3 | | 46.0% | 9.4 | 32.6 | 359 | 359 | - | - |
| 4/2+4/1 | Erskine Street (Western Arm) Left Ahead | N/A | C2:4 C2:5 | | 17.3% | 2.1 | 15.2 | 154 | 154 | - | - |
| 4/3+4/4 | Erskine Street (Western Arm) Ahead Right | N/A | C2:4 | | 65.6% | 6.1 | 51.4 | 199 | 199 | 193 | - |
| 6/1 | Sussex Street (Southern Arm) | N/A | - | | 93.6% | 26.1 | 25.2 | 1497 | 1497 | - | - |
| **J5: Erskine Street - Shelley Street** | **-** | **N/A** | **-** | | **28.1%** | **-** | **-** | **-** | **-** | **251** | **-** |
| 1/1 | Eskine Street (Eastern Arm) Left Ahead Right | N/A | C3:2 | | 21.4% | 1.9 | 20.4 | 100 | 100 | 74 | - |
| 2/1+2/2 | Shelley Street (Southern Arm) Right Left Ahead | N/A | C3:3 | | 28.1% | 2.4 | 9.2 | 371 | 371 | 168 | - |
| 3/1 | Erskine Street (Western Arm) Ahead Left | N/A | C3:4 | | 7.6% | 0.3 | 29.6 | 20 | 20 | - | - |
| 3/2+3/3 | Erskine Street (Western Arm) Ahead Right | N/A | C3:4 | | 7.6% | 0.5 | 22.1 | 36 | 36 | 0 | - |
| 4/1 | Shelley Street (Northern Arm) Left | N/A | C3:1 | | 14.4% | 1.3 | 7.7 | 141 | 141 | - | - |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 4/2+4/3 | Shelley Street (Northern Arm) Ahead Right | N/A | C3:1 | | 7.4% | 0.7 | 7.0 | 87 | 87 | 9 | - |
| **J6: Lime Street - Shelley Street** | **-** | **N/A** | **-** | | **34.7%** | **-** | **-** | **-** | **-** | **208** | **-** |
| 1/1 | Shelley Street (Southern Arm) Right Left | N/A | - | | 6.7% | 0.0 | 1.2 | 109 | 109 | - | - |
| 1/2 | Shelley Street (Southern Arm) Right | N/A | - | | 8.8% | 0.0 | 1.0 | 167 | 167 | - | - |
| 2/1 | Lime Street (Western Arm) Ahead Right | N/A | - | | 34.7% | 0.3 | 4.8 | 200 | 200 | 200 | - |
| 4/1 | Shelley Street (Eastern Arm) Left Ahead | N/A | - | | 5.0% | 0.0 | 1.1 | 85 | 85 | 8 | - |

| | | | | | |
|---|---|---|---|---|---|
| C1 | PRC for Signalled Lanes (%): | 154.1 | Total Delay for Signalled Lanes (pcuHr): | 3.92 | Cycle Time (s): 120 |
| C2 | PRC for Signalled Lanes (%): | 37.2 | Total Delay for Signalled Lanes (pcuHr): | 18.72 | Cycle Time (s): 120 |
| C3 | PRC for Signalled Lanes (%): | 219.8 | Total Delay for Signalled Lanes (pcuHr): | 2.38 | Cycle Time (s): 120 |
| | PRC Over All Lanes (%): | -4.0 | Total Delay Over All Lanes(pcuHr): | 39.61 | |

# Appendix B

Construction Traffic Generation

## Cumulative Construction Traffic Numbers ( Total Vehicles )

| Activity | 2011 | | | | | 2012 | | | | | | | | | | | | 2013 | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 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 | 0 | 0 | 7 | 7 | 7 | 7 | 20 | 20 | 20 | 20 | 43 | 43 | 44 | 44 | 44 | 55 | 52 | 43 | 51 | 55 | 58 | 58 | 58 | 51 | 28 | 25 | 25 | 25 | 25 |
| Trucks Out Am Peak Hour | 0 | 0 | 6 | 6 | 6 | 6 | 18 | 18 | 18 | 18 | 41 | 41 | 42 | 42 | 42 | 52 | 50 | 42 | 49 | 53 | 55 | 55 | 55 | 49 | 26 | 23 | 23 | 23 | 23 |
| Cars In Am Peak Hour | 0 | 0 | 10 | 10 | 20 | 20 | 42 | 42 | 62 | 52 | 60 | 85 | 85 | 85 | 85 | 120 | 116 | 101 | 101 | 107 | 107 | 132 | 172 | 166 | 183 | 179 | 179 | 179 | 179 |
| Cars Out Am Peak Hour | 0 | 0 | 3 | 3 | 3 | 3 | 9 | 12 | 18 | 15 | 17 | 23 | 23 | 23 | 23 | 31 | 30 | 26 | 33 | 35 | 35 | 40 | 50 | 48 | 46 | 46 | 46 | 46 | 46 |
| **TOTALS** | **0** | **0** | **26** | **26** | **36** | **36** | **89** | **92** | **118** | **105** | **161** | **192** | **194** | **194** | **194** | **258** | **248** | **212** | **234** | **250** | **255** | **285** | **335** | **314** | **283** | **273** | **273** | **273** | **273** |