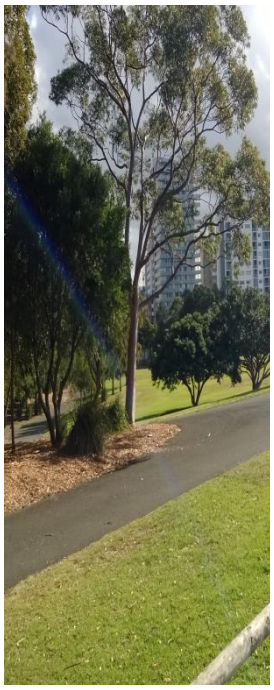


# Landmark Square Precinct

Traffic and Transport Impact Assessment

March 2016

The One Capital Group Pty Ltd

Mott MacDonald

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| 1 | 05.02.2015 | DH | GH | GH | Draft Report |
| 2 | 25.02.2015 | DH | GH | GH | Final Report |
| 3 | 27.02.2015 | LL | GH | GH | Minor Naming Edit & Plan Change |
| 4 | 29.02.2016 | DH | GH/RS | GH | Masterplan Updated - Site A |
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**Information Class: Standard**

# Contents

# 1 Introduction

Mott MacDonald has been engaged by the One Capital Group Pty Ltd to prepare a Traffic and Transport Impact Assessment to support the rezoning of 53 – 75 Forest Road, 108-126 Durham Street and 9 Roberts Lane, Hurstville for high density mixed uses. This site and the subsequent development are identified in this report as Landmark Square Precinct and comprise of Site A and Site B.

The subject site is situated on the boundary of the Hurstville City Centre and within a city centre precinct known as the 'Eastern Bookend Precinct'. The planning of this precinct is identified both in the Hurstville City Council Draft Development Control Plan (DCP) No. 2 and the Hurstville City Centre Transport Management and Access Plan (2013) (TMAP).

## 1.1 Rezoning Proposal

This report has been developed to support a rezoning application that has been prepared by Dickson Rothschild to allow future high density mixed use development on the site. The report appraises the impact from the rezoning of the site and applies worst case traffic and transport impacts that could potentially be associated with development on Site A and Site B.

The proposed mixed use development will comprise of residential, hotel, retail, restaurant, childcare and community land uses. This report provides an assessment of existing and future transport network conditions and identifies the impacts associated with rezoning the site to allow future high density mixed use development. Refer to the Dickson Rothschild maximum site yield schedule in Appendix A.

The land uses contained within Site A generally forms part of the Landmark Square proposal. Site B falls outside of the Landmark Square scheme, however, in planning terms should be considered for rezoning the entire precinct to align with the intention of the Hurstville City Centre growth strategy.

Development on Site A consists of three new towers and includes an outdoor plaza area that will offer useable open space. The spatial allocation in the outdoor plaza will allow for outside dining and for occasional small scale community events (such as small music or food festivals and an outdoor cinema).

Site B is situated to the south east of a single residential tower, with a mixed use offering on the lower floors including retail, a community facility and a small commercial area.

The proposed rezoning of land for high density mixed use development will also include underground car parking, at-grade loading / service / waste collection areas and a separate porte cohere serving a hotel. The site is proposed to be served by vehicular access points, situated on Forest Road, Durham Street and Roberts Lane. The positioning of these access points are aimed to separate sites A and B and offer safe and efficient access to and from the surrounding road network and to different functional areas within the development.

A detailed description of the proposed development is provided in Section 2.

## 1.2 Study Approach

This assessment supports a rezoning application and adopts a worst case traffic and transport appraisal for the entire site with a focus on the impact to the external transport network.

The land use and transport assessment process is consistent the GHD Hurstville City Council Traffic Impact Assessment for Five High Density Developments (November 2015) which appraises the following five future developments in Hurstville:

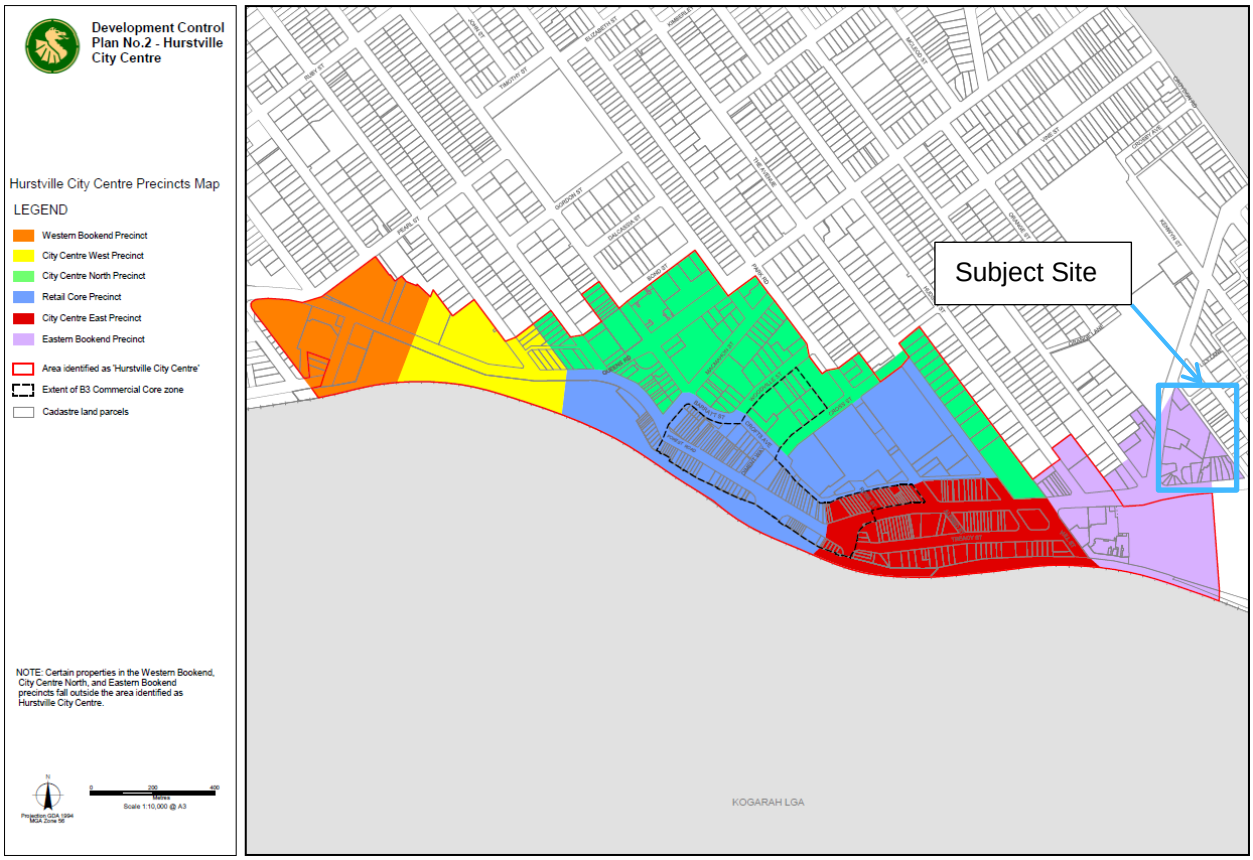
- A planning proposal for land parcels at 108–112 and 124 Forest Road and 1 – 3 Wright Street, Hurstville.
- A planning proposal for East Quarter Stage 3 at 93 Forest Road, Hurstville
- 23-35 Treacy Street, Hurstville.
- 1-5 Treacy Street, Hurstville.
- A planning proposal for the parcels of land at 53-75 Forest Road, 108-126 Durham Street and 9 Roberts Lane (Landmark Square).

The adopted approach also aligns with the recommendations and findings presented in the Hurstville City Centre TMAP.

The assessment assumes that the subject site forms part of Hurstville Draft DCP No. 2 due to its position within the City Centre Eastern Bookend Precinct, its proximity to city centre facilities and accessibility to key transport nodes.

Refer to Figure 1.1 for an understanding of the defined city centre area (outlined in red), the proposed high density mixed use site and the location of area identified as the Hurstville City Centre Eastern Bookend Precinct (purple shaded area).

Figure 1.1: DCP 2 boundary and subject site




Source: Draft DCP No. 2: Appendix 2 – Hurstville City Centre Precincts Map

It is considered that the rezoning of this site to allow development of this nature (high density, mixed use) aligns with the land use and functionality intent of Draft DCP No. 2 (i.e. the development is essentially an extension of the Hurstville City Centre precinct) and will therefore exhibit similar travel characteristics to areas situated within the defined Draft DCP No. 2 boundary.

On this basis the adoption on Draft DCP No. 2 (and therefore Draft DCP No. 2 parking rates) has been applied in the assessment of traffic and transport impacts for this rezoning application.

A detailed appraisal of each development proposed to be situated on the site will be assessed at the development application (DA) submission stage, and will include details on staging, internal site circulation, operational and transport management, parking provision, pedestrian circulation, loading dock design requirements and the overall functional layout.

## 1.3 Study Limitations

The report and assessment is based on the following data:

- Conditions experience during site visits to the existing site, adjacent intersections and surrounding area in the AM (7:30AM – 9:30AM) and PM (4:00PM – 6:00PM) peak periods on Tuesday 9 December 2014.
- Existing traffic turning counts (obtained by SkyHigh traffic consultants on Thursday 4 December 2014). during the AM (6:30AM – 9:30AM) and PM (3:30PM – 6:30PM) peak periods at:
  - Forest Road / Durham Street / Wright Street intersection
  - Forest Road / Lily Street intersection
  - Durham Street / Lily Street intersection
- A 7 day traffic tube count undertaken at Roberts Lane (undertaken by SkyHigh traffic consultants) from Thursday 4 December to Wednesday 10 December).
- Information contained in the Hurstville City Centre Draft DCP No. 2 (available via http://www.hurstville.nsw.gov.au/Draft-Development-Control-Plan-No2---Hurstville-City-Centre.html).
- Information contained in the Hurstville City Centre Transport Management and Access Plan (GHD, 2013).
- Land use information provided by Dickson Rothschild on 17 February 2015, 15 February 2016 and 24 February 2016 for the proposed rezoning of the site.
- Latest RMS trip generation rates released in August 2013 by RMS updating the previous released rates in the RTA Guide to Trip Generating Developments.
- Guide to Traffic Generating Developments (RTA, 2002).
- Information contained in the Mortdale Plaza Roberts Avenue traffic surveys and analysis for a retail development in the Hurstville Local Government Area (LGA) prepared by Hurstville City Council.
- BTS Journey to Work 2011 mode share and travel distribution data for travel zone 2606 (Hurstville) extracted from the BTS JTW Explorer website (http://visual.bts.nsw.gov.au/jtwbasic/) on 30 July 2014.
- Intersection modelling using SIDRA 6.0 Intersection Analysis software tool - version 6.0.24.4877.
- Future land use assumptions in the GHD Traffic Impact Assessment. Refer to Section 6.3 for trip rate data sources.

The road network impacts have been appraised using SIDRA at the following four keys intersections that directly surround the subject site under existing and future conditions:

- Forest Road / Durham Street / Wright Street intersection.
- Forest Road / Lily Street intersection.
- Durham Street / Lily Street intersection.
- Durham Street / Roberts Lane intersection.

Other intersections situated beyond these nodes are not included in this appraisal, which includes the intersection of Lily Street / Railway Parade. The Lily Street / Railway Parade intersection and the rail overpass has been identified in Council planning for upgrade and is confirmed in Hurstville City Centre TMAP as a committed scheme. It is also noted that the Hurstville City Centre TMAP indicates that the upgrade will provide sufficient capacity to facilitate planned levels of growth in the region for the long term.

On this basis this report has assumed that this intersection has the available capacity to accommodate the low levels of traffic growth associated with the proposed rezoning of this site.

## 1.4 Report Structure

This report is structured as follows:

- Section 2 – Proposed Development and Planning Context: Provides an overview of the existing land use and the rezoning proposal including its design characteristics, and its alignment with the Hurstville City Centre Draft DCP No.2 and Hurstville City Centre TMAP.
- Section 3 - Existing Conditions: Provides an understanding of the site, adjacent road network, parking and historical crash trends.
- Section 4 – Site Accessibility: Provides an understanding of the accessibility potential of the site due to its proximity to community facilities and services, major centres and high quality transport nodes and services, and also covers the potential of active transport, mode share and sustainable access planning.
- Section 5 – Parking Requirements: Provides a high level analysis of car and bicycle parking requirements that should be adopted as part of the rezoning of the site for high density mixed use purposes.
- Section 6 – Road Network Appraisal: Provides an assessment of the road network with or without the proposed development, and details traffic generation, traffic distribution, and the performance of surrounding intersections under existing and future traffic conditions.
- Section 7 – Key Findings, Recommendations and Next Step: Summarises the key findings, makes recommendations that should be considered as part of rezoning the site and highlights the next steps that will be considered as part of individual Development Applications for proposed buildings that will be situated on the site known as Landmark Square Precinct.

# 2 Proposed Development and Planning Context

This section provides an understanding of the characteristics of the proposed site, the proposed rezoning and its associated development and how the proposal aligns with Hurstville City Centre Draft DCP No.2 and Hurstville City Centre TMAP.

## 2.1 The Site

The subject site for the proposed development is located on the fringe of the Hurstville City Centre. Figure 2.1 provides an understanding of the proximity of the site and its relationship with the surrounding road network. The figure indicates that the site is bordered by Forest Road to the west, Durham Street to the south and Roberts Lane to the east.

Figure 2.1: Subject site


Source: https://maps.six.nsw.gov.au/

Current land use on the subject site is low density and consists of light industrial and commercial uses and includes a small number of low density residential dwellings. Land use surrounding the site consists of low density residential dwellings to the east (Lily Street), recreation in Kempt Field and high density mixed use development directly to the south of the site known as East Quarter. In addition to this, there are a number of educational facilities situated immediately to the north-west of the site, which includes Hurstville Public School and higher density mixed use and commercial precincts in the Hurstville City Centre to the west.

## 2.2 Proposed Land Use and Facilities

The concept plans for the proposed development that form the basis for this rezoning of the site has been developed by Dickson Rothschild (refer Appendix A for Land Use Yield Schedule).

The plans indicate that the proposed rezoning and its associated development will comprise of:

Site A:

- 150 hotel rooms located in tower 1 and includes:
  - An associated porte cochere area adjacent to the hotel lobby area and is accessed from Forest Road
  - 897m$^2$ Gross Floor Area (GFA) for a hotel function area
- 273 residential apartments across towers 1, 2 and 3, comprising:
  - 27 one bedroom units
  - 196 two bedroom units
  - 50 three bedroom units
- 639m$^2$ GFA retail uses with the potential to accommodate restaurants on the ground floor level.
- 2,511m$^2$ GFA of retail use with the potential to accommodate a supermarket and speciality retail with a frontage to Durham Street.
- A 641m$^2$ GFA child care facility with the approximate capacity to accommodate up to 90 children and 18 staff and is planned to be situated on the first floor.
- An outdoor plaza / event space is also proposed along Forest Road, and will be situated in front of the commercial areas.
- A 2m stratum of land along Roberts Lane to provide for MRV access and manoeuvring to / from the hotel loading bay and waste collection area.
- Underground basement and level 1 car park (to be defined at the DA stage).

Site B:

- 35 residential apartments located in tower 4, comprising:
  - 5 one bedroom units
  - 25 two bedroom units
  - 5 three bedroom units
- 348m$^2$ GFA of commercial uses with the potential to accommodate individual office areas (named SOHO office area) with a frontage to Roberts Lane.
- 754m$^2$ GFA of speciality retail with a frontage to Durham Street.
- A small courtyard area with a 357m$^2$ GFA community facility.
- Underground basement and level 1 car park (to be defined at the DA stage).

The initial concept indicates that parking will be contained in the basement and includes areas for residential, hotel (valet) and retail / supermarket type uses. The location and design of both parking and loading areas is subject to further development, which will be addressed at the DA stage.

## 2.3 Proposed Access

The existing site arrangement provides multiple vehicle access points along Durham Street, Forest Road and Roberts Lane. The aim of the masterplan is to consolidate access points to offer safe and efficient access to and from the surrounding road network.

The proposed site access arrangements to / from the external network is as follows:

Site A:
- Residential entry / exit via Durham Street, with an exit only situated on Roberts Lane.
- Hotel, retail, supermarket and restaurant entry / exit via Forest Road.
- Hotel, retail, supermarket and restaurant loading bay / waste collection positioned on ground level with entry / exit to be defined at the DA stage.

Site B:
- Residential, retail and commercial entry / exit via Durham Street.
- Retail and commercial loading bay positioned on ground floor with entry / exit to be defined at the DA stage.

It additional to the above, the masterplan assessment process has also investigated further consolidation of the access point arrangements to the Landmark Square site. This is achieved through testing the impact from the removal of Forest Road access to Site A. This alternative option was assessed as part of a SIDRA model test and the outcome is presented in Section 6.10.

Refer to Figure 2.2 and Figure 2.3 (alternative option – removal of the Forest Road access point) for proposed Landmark Square access arrangements.

Figure 2.2: Proposed access points – Option 1

Figure 2.3: Proposed access points – Option 2


## 2.4 Planning Review

This planning review provides an understanding of the rezoning application and how it aligns with Hurstville Draft DCP No.2 and Hurstville City Centre TMAP.

### 2.4.1 Hurstville City Centre Draft DCP No. 2

The Draft Hurstville City Council Development Control Plan (DCP) No. 2 has been developed by council to replace DCP No.2 Hurstville City Centre - Amendment No.5.Car parking and bicycle parking requirements have been estimated using Draft Hurstville DCP No. 2 (refer to Section 5.1 for adopted rates). The adoption of lower parking provision rates as per Draft DCP No. 2 aligns with the objectives of the TMAP and is deemed to be appropriate for high density residential development situated in proximity of an

established city centre with high quality transport connections. The provision of cycle parking and adoption of reduction parking rates aligns with the sustainable transport objectives set by Draft DCP No. 2, which will be described in detail at the DA stage.

### 2.4.2 Hurstville City Centre TMAP

The Hurstville City Centre Transport Management and Accessibility Plan (TMAP)[1] provides an integrated transport and land use strategy which is aimed to help Hurstville City Centre achieve its future growth targets. The key focus of the plan is to support new development within the city centre, better manage city centre travel and to minimise its impact on network capacity through:

- Identifying land uses that support growth targets and does not depend on the car for travel.
- Adopting lower off-street car parking provision rates.
- Supporting car sharing schemes.
- Requiring new development to prepare green travel plans and travel demand management measures that aid reductions in car travel.
- Reducing pressure on on-street parking provision through strengthening existing parking restrictions.
- Working with State Government to improve public transport facilities and service provision and encourage more people to travel by public transport.
- Establishing travel mode share targets that encourage greater utilisation of existing public transport facilities and walking and cycling infrastructure for travel.

The relevant targets and recommendations identified in the Hurstville City Centre TMAP, which should be considered by new development proposals are as follows:

- ***LU3*** – Demonstrating the ***merits of a development*** and its ***ability to help manage travel demand*** and achieve sustainable growth within Hurstville City Centre.
- ***RN1 – Support the delivery of committed road infrastructure improvements*** with a focus on its impact and contribution towards future road capacity improvements, particularly at rail crossings.
- ***RN2 – Support 5b Transport management improvements*** with a focus on supporting network reliability, improving he pedestrian environment and encourage walking within, to and from the city centre.
- ***PT1 – Target a Hurstville City Centre mode share of 21%***.
- ***AT1 – Target a Hurstville active transport mode share of 20%***.
- ***AT2, 3 and 4*** focuses on developing Hurstville to become a ***safer and more walking and cycling friendly environment***.
- ***TDM 1, 3 and 4*** – recommend the development of a ***Travel Demand Management package,*** which includes the adoption of reduced parking provision rates, encouraging car sharing schemes and establishing workplace and green travel plans.

This assessment reviews the merits of the rezoning proposal, its alignment with the above recommendations and its ability to deliver a sustainable transport outcome that will assist Hurstville City Centre achieve its growth potential.

[1] Hurstville City Centre Transport Management and Accessibility Plan (GHD, 2013),

# 3 Road Network

This section describes the existing road conditions surrounding the subject site.

## 3.1 Road Hierarchy

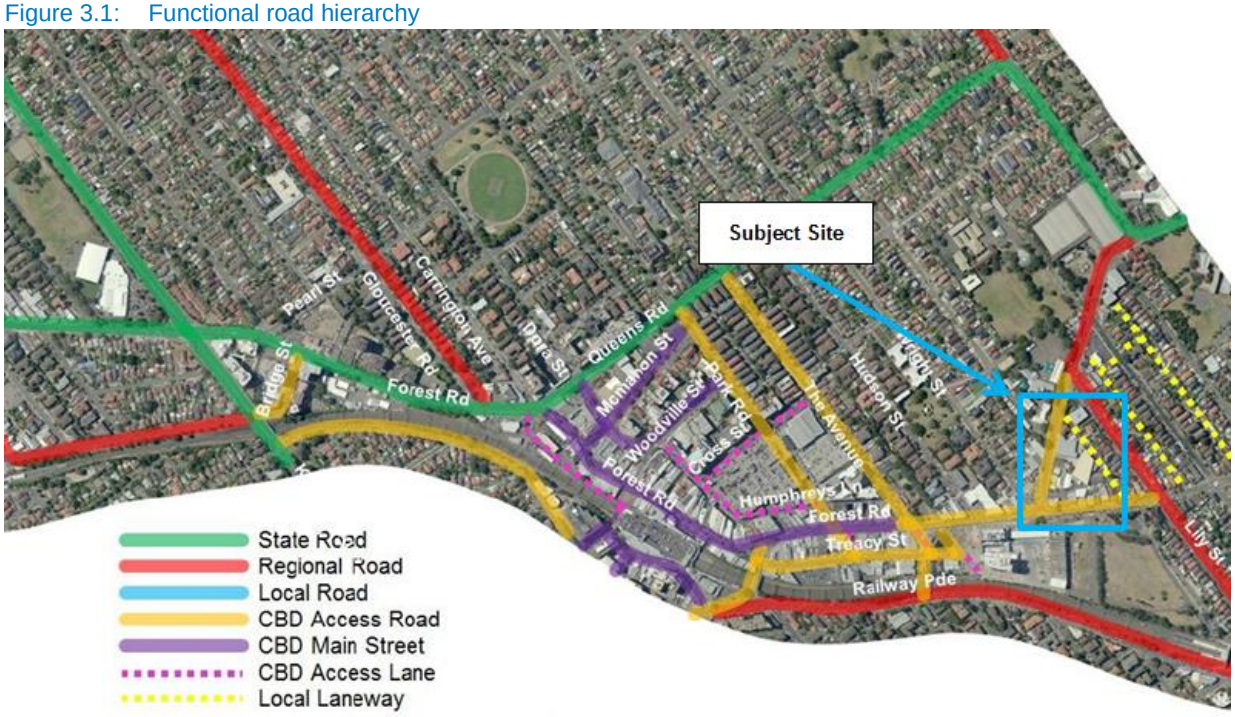
The classification of roads on the existing road network can be used as an indication of the functional role each road plays with respect to the volume of traffic they should appropriately carry. The Roads and Traffic Authority (RTA) now known as Roads and Maritime Services (RMS) have developed a set of road hierarchy classifications detailed in Table 3.1 indicating typical nominal volumes in terms of average annual daily traffic (AADT) serviced by various classes of roads.

Table 3.1: Functional Classification of Roads

| Type of Road | Traffic Volume (AADT) | Peak Hour Volume (vph) |
|---|---|---|
| Arterial Road (State) | >15,000 | 1,500 – 5,600 |
| Sub-Arterial Road (Regional) | 5,000 – 20,000 | 500 – 2,000 |
| Collector Road (Access road) | 2,000 – 10,000 | 200 – 1,000 |
| Local Road | <2,000 | 0 – 200 |

Functional road hierarchy surrounding the subject site and within / surrounding the Hurstville City Centre is presented within Figure 3.1 and has been extracted from the Hurstville TMAP. The figure indicates that the road network directly surrounding the subject site comprises of sub-arterial, collector and local roads.

Figure 3.1: Functional road hierarchy




Source: Hurstville City Centre TMAP (2013)

## 3.2 Forest Road

The Forest Road corridor is a key east-west route, which includes a section that runs through Hurstville City Centre from Queens Road to the west to Lily Street in the east. Due to the complexity of its role and historical changes to the city centre network, Forest Road has multiple functions and in proximity of the site it performs a role as a collector road (city centre access road).

Forest Road has two traffic lanes in each direction adjacent the subject site and is the main eastern gateway and access route to the Hurstville City Centre for the local catchment. Refer to Figure 3.2 for an understanding of the visual characteristics of the Forest Road corridor near Durham Street and the subject site.

Forest Road has a signposted speed limit of 60km/h prior to the Durham Street / Wright Street intersection. A 40km/h school zone speed restriction applies for the northbound and southbound carriageway on school days (8:00AM – 9:30AM and 2:30PM – 4:00PM) between Croydon Road and Durham Street.

Figure 3.2: Forest Road – views north from Durham St and south towards Durham Street


## 3.3 Lily Street

Lily Street is classified as a regional road between Railway Parade and Forest Road with a 60km/h signposted speed limit and 1 lane in each direction (mid-block). Kerbside parking is situated on both sides of Lily Street between Forest Road and Railway Parade. Lily Street provides a north-south connection from Forest Road to Railway Parade and crosses the rail line in one of four locations. A 40km/h school zone signposted speed restriction is situated in the northbound carriageway between Durham Street and Forest Road.

Figure 3.3 provides a visual understanding of the characteristics of Lily Street along the northern and southern section of the road.

Figure 3.3: Lily Street looking south towards Railway Parade and north towards Forest Road.

## 3.4 Durham Street

Durham Street functions as a collector road (CBD access road) providing access for residential land use between Forest Road and Wilson Road and has a signposted speed limit of 50km/h. On-street car parking is available between Forest Road and Lily Street.

Figure 3.4 provides an understanding of the visual characteristics of Durham Street adjacent to the subject site.

Figure 3.4: Durham Street – looking north towards subject site and east from Forest Road

## 3.5 Roberts Lane

Roberts Lane functions as a one-way (southbound) narrow laneway which primarily provides rear lane access to residential and commercial properties to the north and recreational areas and commuter facilities to the south. Car parking is permitted along the eastern kerb only of Roberts Lane adjacent the subject site, with parking restricted by a combination of kerbside parking restrictions and existing vehicle access points to commercial uses on the western side.

South of Durham Street, Roberts Lane provides access to car parking area along Kempt Field and at Allawah Railway Station. Figure 3.5 provides an understanding of the visual characteristics of Roberts Lane at Kempt Field and adjacent to the subject site.

Figure 3.5: Roberts Lane looking north adjacent Kempt Field and south towards Durham Street

## 3.6 Adjacent Intersections

Assessment of adjacent intersections and their existing network performance is provided in Section 7.8 of this report. Key intersections surrounding the site and their method of control are stated as follows:

- Forest Road / Durham Street intersection – priority controlled intersection though holding lines and signage (Forest Road major road). It should be noted that left in and left out only is permitted on the Durham Street and Wright Street approaches to Forest Road.
- Forest Road / Lily Street intersection – signalised with pedestrian crossings on the southern and eastern approaches to the intersection.
- Lily Street / Durham Street intersection – signalised with pedestrian crossings.
- Forest Road / Roberts Lane intersection – priority controlled inbound (southbound only) along Roberts Lane from Forest Road.
- Durham Street / Roberts Lane intersection – priority controlled intersection (Roberts Lane southbound only) though holding lines and signage (Durham Street major road).

## 3.7 Historical Crash Trends

Historical crash data for a 5 year period, between 2009 and 2014, has been analysed for road network in the immediate vicinity of the proposed development. Data appraised includes Forest Road, Lily Street and Durham Street and was obtained from RMS. A review of the data indicated that crash history in this area is not significant when the total traffic volumes in this location are taken into consideration.

The following represents a summary of the crash data:

- A total of 34 crashes, 0 fatalities and 15 injuries were recorded over a 5 year period.
- 20.6% (7) of crashes involved a single vehicle with 79.4% of crashes (27) involving multi-vehicles.
- 2 pedestrian accidents were recorded during this period and included a crash on Lily Street at the Durham Street intersection.
- 82.4% (28) of crashes occurred at intersections, with 17.6% (6) of crashes not associated with an intersection.
- Trends associated with crashes that occur at intersection include:
  - 8 crashes recorded at Forest Road / Durham Street / Wright Street intersection
  - 6 crashes recorded at the Forest Road / Lily Street intersection
  - 14 crashes recorded at the Lily Street / Durham Street intersection
- 12 crashes were recorded over 5 years and associated with right turn manoeuvres and vehicle proceeding in lane as follows:
  - 4 crashes occurred as a result of opposing vehicles turning right and colliding on Forest Road at the Durham Street intersection (right turn into Durham Street)
  - 3 crashes involved opposing movements created by vehicles turning on Forest Road at the Lily Street intersection (the recorded data includes 2 vehicles turning right from Lily Street, with 1 turning right from Forest Road)
  - 5 crashes involved crashes caused a vehicle turning or opposing vehicles turning and crashing at the Lily Street / Durham Street intersection (3 with vehicles turning right from Durham Street east and 2 with vehicles turning right from Lily Street north)
- Crashes generally occurred evenly across the 24 hour time period, with no trends recorded during peak periods.
- The intersection of Lily Street / Durham Street was identified to record the highest number of crashes (including both pedestrian crashes in the area).

The traffic generated by the Landmark Square Precinct is unlikely to change current operating conditions at the above intersections. However, consideration will be given to improving accessibility and safety as part of this project.

## 3.8 Existing On-Street Parking Controls

Site observations indicated that not all kerbside parking areas are controlled through the provision of kerbside regulatory signage. Kerbside parking is mostly fully occupied and due to the lack of restrictions results in a low turnover along Durham Street during AM and PM peaks. The following was noted in relation to existing on-street parking:

- There is unrestricted parking on Lily Street, which accounts for approx. 32 cars parking spaces in total in the vicinity of the subject site.
- There is limited number of parking spaces situated on the east side of Roberts Lane accounting for approximately 10 spaces in the vicinity of the subject site.
- A number of parking bays are reserved for persons with a disability.
- There are approximately 98 spaces situated along southern end of Roberts Lane near Kempt Field (approximately 98 spaces both on-street and off-street).

Car parking controls in the vicinity of the subject site are provided in Figure 3.6.

Figure 3.6: Existing on-street car parking controls


On-street car parking restrictions on Forest Road were observed to be no parking on the eastern kerb between 3:00PM - 7:00 PM, and no parking on the western kerb between 6:30AM – 9:30AM. On-Street car parking restrictions on Durham Street is limited to 1 hour parking between 8:30AM – 6:00PM (Mon – Fri) and 8:30AM - 12:30PM (Sat).

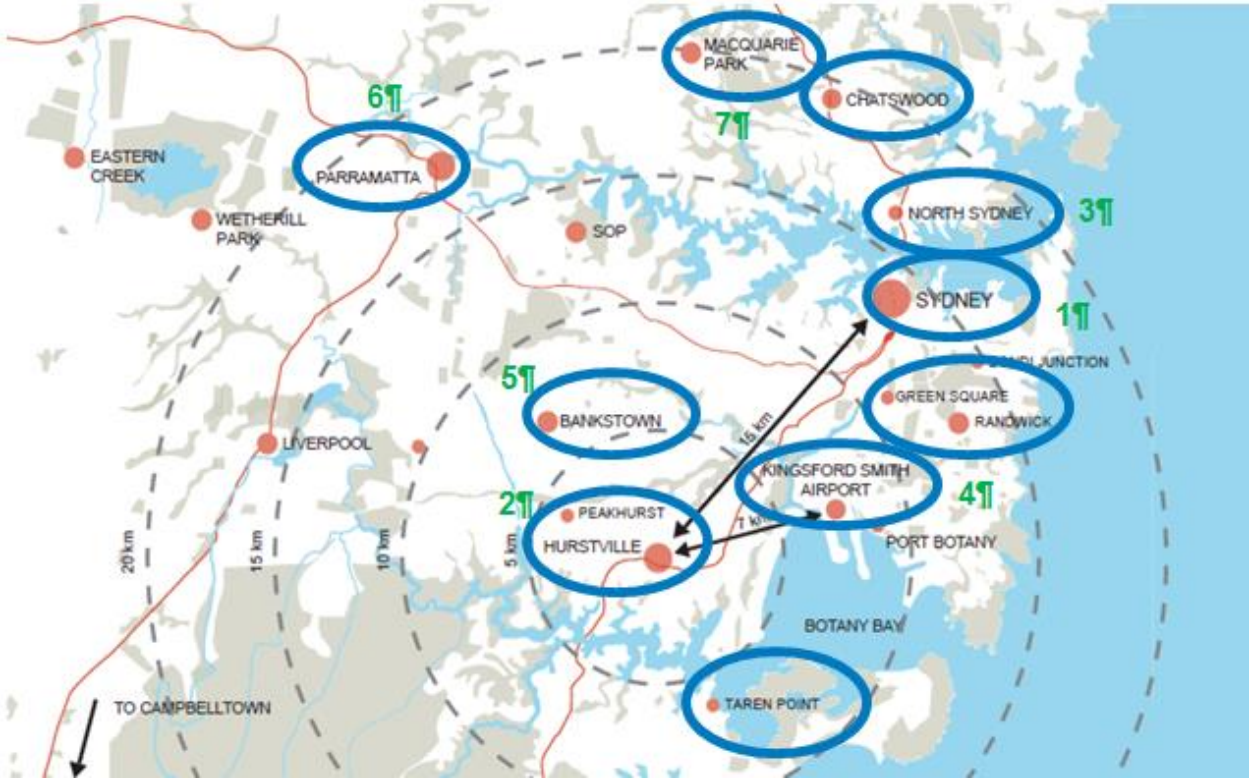
# 4 Site Accessibility Appraisal

This section provides an understanding of the sites accessibility potential and the proposal's ability to provide a sustainable transport outcome that will support planning objectives and recommendations identified in the Hurstville TMAP.

## 4.1 Centres and Regional Travel

The subject site is located less than 800m from the Hurstville City Centre transport interchange, which offers access to Sydney's T4 rail line and rapid and suburban bus routes. Refer to Figure 4.1 for an understanding of the spatial relationship of Hurstville City Centre and other key activity centres in Sydney.

Figure 4.1: Hurstville City Centre and its spatial relationship with other Activity Centres




Source: Hurstville City Centre Master Plan (NSW Government, 2004)

Hurstville City Centre's strategic positioning on the Sydney's transit network provides an opportunity to easily access a number of key activity centres and employment precincts by public transport including:

1. Sydney CBD, which is approximately 15km as the crow flies or 18-21 minute journey by express rail services to Central or Town Hall stations during peak periods.
2. Peakhurst, which is approximately 3-4km as the crow flies or 17 minute journey by Metro bus services during peak periods.
3. North Sydney, which is approximately 17km as the crow flies or 34 minute journey by express rail services during peak periods.

4. Mascot and Green Square employment precincts, which are approximately 7km and 12km as the crow flies, or 24 and -27 minute journeys by express rail services during peak periods.
5. Bankstown, which is approximately 7km as the crow flies or 40 minute journey by Metro bus services during peak periods.
6. Parramatta, which is approximately 18km as the crow flies or 48 minute journey by express rail services during peak periods.
7. Macquarie Park, which is approximately 20km as the crow flies or 58 minute journey by rail services during peak periods.

The above information indicates that Hurstville City Centre and the site currently offers desirable travel times by bus and rail services to key employment centres and local centres situated within Hurstville and Kogarah LGAs. The peak frequency levels of bus and rail services are discussed in Section 4.3, and are noted to offer attractive and convenient service frequency levels during peak periods.

## 4.2 Local Access Potential

This section provides an understanding of the walking distance between the site and key destinations within and surrounding the Hurstville City Centre. The blue dashed circles areas in Figure 4.2 represent an area that is within 400m (5-minute walk) of a rail station.

Figure 4.2: Site accessibility mapping


Source: Hurstville City Centre – Concept City Masterplan, NSW Government and Hurstville City Council (2004)

Key findings include:

- The site is within a 400m walking distance of Allawah Railway Station, which can be accessed by walking via Kempt Field, Roberts Lane or Lily Street.
- The site is within 10 minutes (or 800m) walk of the Hurstville rail station and bus interchange, which offers express rail services to the Sydney CBD.

The plan indicates that the site is situated within easy walking distance of a wide range of land uses and city centre facilities. A summary of key facilities that are within an easy walk or cycle ride of the site is as follows:

### 4.2.1 Retail Opportunities

The site is situated as follows in relation to established shopping and neighbourhood centres:

- East Quarter square located directly across Durham Street.
- 0.3 km to the east of shops along Forest Road.
- 0.4 km to the east of Hurstville Westfield Shopping Centre (including Coles / Myer).
- 0.7 km to the east of Hurstville Central shopping centre (at rail station) – via Forest Road.

### 4.2.2 Community Facilities

The site is situated as follows in relation to surrounding community and educational facilities:

- Hurstville Primary School, Georges River College and Goodstart Learning Centre located directly across Forest Road.
- 0.2 km to the southwest of Sydney Technical High School.
- 0.4 km to the south of Bethany College.
- 0.6 km to the east of Hurstville post office (located in Westfield Shopping Centre).
- 0.6 km to the north of St. George Christian School (over the railway line).
- 0.8 km to the north of St. Raphael's Primary School.
- 0.9 km to the east of Council Offices and Entertainment Centre.
- 0.9 km to the west of Carlton Public School.
- 1.0 km to the east of Hurstville Library.
- 1.1 km to the east of Danebank School.
- 1.8 km to the west of St George and St George Private Hospital.

### 4.2.3 Recreational Facilities

The site is situated as follows in relation to surrounding major recreational facilities:

- Adjacent to Easter Quarter Square and Kempt Field.
- 0.1 km to the east of Woodville Park.
- 0.5 km to the east of cinema at Hurstville Westfield.
- 0.9 km to the south of Hurstville Entertainment Centre.
- 1.1 km east of Hurstville Oval.
- 1.8 km southeast of Hurstville Aquatic Leisure Centre.
- 1.5 km north-west of Kogarah Park and St George Leagues Club (over the railway line).

### 4.2.4 Transport Links Nodes

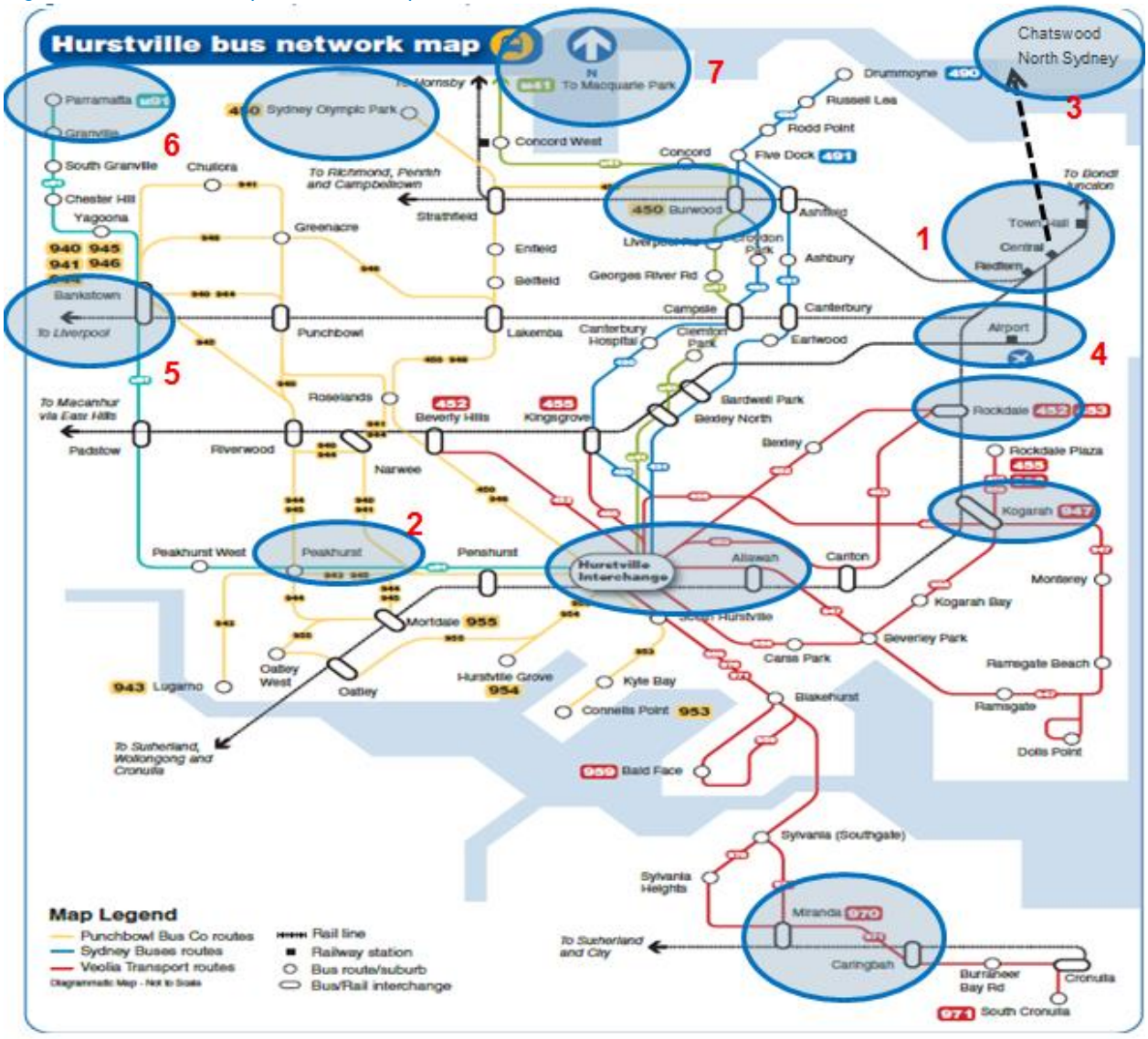
The site is situated as follows in relation to surrounding public transport facilities:

- Adjacent to existing bus services located on Forest Road and Durham Street.
- 0.3 km north of Allawah Rail Station.
- 0.7 km east of Hurstville Rail Station and bus interchanges.

## 4.3 Public Transport

Hurstville City Centre is identified in the Hurstville City Centre TMAP as a strategic transport node on the Sydney transport network. Figure 4.3 indicates that the city centre provides multiple access opportunities by existing public transport infrastructure and services to key activity centres and employment destinations, which are highlighted with blue circles.

Figure 4.3: Public transport network map




Source: http://www.sydneybuses.info/news/news-images/Hurstville_Interchange_brochure.pdf

### 4.3.1 Rail Facilities

#### 4.3.1.1 Allawah Railway Station

Allawah station is situated to the east of Hurstville and services the local centre of Allawah to the south of the site and has suburban rail station characteristics. The station accommodates local all stopping services

running on the T4 Line and offers a formal commuter car park, taxi rank, kiss and ride and bus stop facilities. Further details of station facilities are presented in Figures 4.4.

Figure 4.4: Allawah Railway Station facility provision


Source: http://www.sydneytrains.info/stations/station_details?stationId=77

### 4.3.1.2 Hurstville Railway Station

Hurstville rail station is a part of a high order integrated transport interchange that is served by both rail and bus services. The rail station has two island platforms, which services two separate rail lines and can be accessed via an overhead concourse.

The station is situated within and accessed via the Hurstville Central shopping centre and offers direct access to the northern and southern bus interchanges. The rail lines that pass through the station include T4 Eastern Suburbs and Illawarra Line (T4 Line) operated by Sydney Trains and the South Coast Line operated by NSW Trains. The station is equipped with easy access facilities, passenger information systems and offers all others general facilities expected of a busy city station. Refer to Figure 4.5 for further details.

Figure 4.5: Hurstville Railway Station facility provision


Source: http://www.sydneytrains.info/stations/station_details?stationId=78

As indicated in Section 4.2, both stations are within an approximately 5 minutes and 10 minute walking distance respectively of the site and investigations indicate that there are no major barriers to entry.

Allawah rail station is situated to the south and accessed via the East Quarter precinct and a shared pedestrian and cycle path running through Kempt Field Park (Refer to Figure 4.6). Hurstville rail station is situated to the east of the site and accessed via Treacy Street and the High Street section of Forest Road, and entry is gained via Hurstville Central (Refer to Figure 4.6).

Figure 4.6: Allawah Railway Station and Forest Road east entrance to Hurstville Central / Station

### 4.3.2 Rail Services

Allawah rail station is serviced by the T4 line only and is bypassed by T4 express and South Coast rail services travelling to Sydney CBD. The service frequency for local rail services to Sydney CBD is still high with one timetabled train service every ten minutes during weekday peak periods and a travel time of approximately 26 minutes to Central.

Outside of the weekday peak periods, rail services operate at a frequency of one service every thirty minutes during weekends and off peak periods. Bureau of Travel Statistics information indicates that the station is the 122nd busiest in the Sydney train network with approximately 3,650 passengers on a typical weekday.

As indicated in section 3.3.1, Hurstville rail station is serviced by both the T4 and south coast rail lines, which connect Hurstville and Sydney's southern sub region to Sydney CBD and employment areas beyond. Its position of importance is highlighted by rail service frequency levels and travel times, which is identified in the Hurstville City Centre TMAP to provide service frequency service levels of one train every 6 minutes and a 20 minute travel time to central.

This service quality and its position of importance is highlighted in the 2012 daily passenger flows for Hurstville station, which identified that the station is the 12$^{th}$ busiest[2] in the Sydney Train network with passenger flows of approximately 34,000 on a typical weekday.

Both Allawah and Hurstville rail stations offer fast, frequent, and reliable rail services to Sydney CBD and other key employment and education destinations situated around Sydney. These service levels and the ease of access to the stations from the site will encourage travel by public transport and support the TMAP mode share targets.

[2] Compendium of Sydney Rail Travel Statistics, 8$^{th}$ Edition, Version 1.1, (BTS, 2013)

### 4.3.3 Bus Routes

Refer to Figure 4.7 for a map of bus routes and frequency levels associated with the site and the Hurstville City Centre.

Figure 4.7: Hurstville City Centre bus routes and weekday peak service frequency levels


Source: Hurstville City Centre TMAP (GHD, 2013)

Figure 4.7 indicates that the site is directly served by bus route service 453 and 947 on Durham Street and 452 on Forest Road. The above information also indicates that forty-three (43) bus services pass within 400m of the site during the peak hour with six (6) inbound and outbound services or a 10 minute service frequency passing the site. Bus routes information associated with bus route servicers 453, 947 and 452 was obtained from the NSW transdev website (http://www.transdevnsw.com.au/travel-information/timetable-services/Urban-Buses/). The key destinations that these routes service were identified to be Beverly Hills, Bexley, Rockdale, Kingsgrove, Carlton, Kogarah, Ramsgate and Dolls Point.

### 4.3.4 Hurstville City Centre Bus Services and Facilities

There are two major bus interchanges (Woodville Lane and in Ormonde Parade) within 10 minutes walk of the site. Both bus interchanges provide high quality facilities with bus shelter, service information and accommodate high frequency services.

There are 22 bus route services that travel to Hurstville City Centre and the majority of these services terminate at either the northern or southern interchange. The 22 bus route services includes two Metro bus services, which offer high frequency services that operate from Hurstville's northern bus interchange and provide connection to other major centres in Sydney's West, including Bankstown, Parramatta and Macquarie Park.

The timetabled frequency levels of bus services that pass through the bus interchanges are presented in Figure 4.8.

Figure 4.8: Bus service frequency timetable

| Station Bus Stand | Westfield Bus Stop | Route Number | Bus Route Destination | Bus frequency in minutes AM Peak | Off Peak | PM Peak | Saturday | Sunday |
|---|---|---|---|---|---|---|---|---|
| B | Forest Rd | M41 | Metrobus to Macquarie Park via Campsie, Burwood, Concord Hospital, Ryde & Macquarie Centre | 10 | 15 | 10 | 20 | 20 |
| A | Cross St | 450 | Burwood or Sydney Olympic Park via Roselands | 15 | 30 | 15 | 30 | 60 |
| B | Forest Rd | 452 | Rockdale via Bexley | 20-30 | 30 | 20-30 | 30 | 60 |
| C | Cross St | 452 | Beverly Hills via Patrick St | 20 | 30 | 20 | 30 | 60 |
| B | Forest Rd | 453 | Rockdale via Carlton | - | Limited | - | 2 trips | - |
| B | Forest Rd | 455 | Rockdale Plaza via Kogarah & St George Hospital | 30 | 30 | 30 | 45 | 80-110 |
| C | Cross St | 455 | Kingsgrove via Hodge St | 30 | 30 | 30 | 45 | 80-110 |
| D | Forest Rd | 490 | Drummoyne via Kingsgrove, Campsie, Burwood & Five Dock | 30 | 30 | 30 | 30 | 60 |
| D | Forest Rd | 491 | Five Dock via Bexley North, Earlwood, Canterbury & Ashfield | 30 | 30 | 30 | 30 | 60 |
| A | Cross St | M91 | Metrobus to Parramatta via Peakhurst, Padstow, Bankstown & Chester Hill | 10 | 15 | 10 | 20 | 20 |
| A | Cross St | 940 | Bankstown via Riverwood & Punchbowl | 30 | 30 | 30 | 60 | 60 |
| A | Cross St | 941 | Bankstown via Roselands & Punchbowl | 30 | 30 | 30 | 30 | 60 |
| A | Cross St | 943 | Lugarno via Peakhurst | 20 | 30 | 20 | 30 | 60 |
| A | Cross St | 944 | Bankstown via Riverwood & Roselands | - | 30 | - | 60 | 60 |
| A | Cross St | 945 | Bankstown via Peakhurst & Riverwood | 15 | 30 | 15 | 60 | 60 |
| A | Cross St | 946 | Bankstown via Roselands & Lakemba | 30 | 60 | 30 | 60 | - |
| B | Forest Rd | 947 | Kogarah via Ramsgate & Dolls Point | 15-30 | 30 | 20-30 | 40 | 40-60 |
| 5• | – | 953 | Connells Point via Kyle Bay - Loop Service | 15-30 | 30 | 15 | 30 | 60 |
| 2• | – | 954 | Hurstville Grove via Hillcrest Ave | 20-30 | 30 | 20-30 | 30 | 60 |
| 2• | – | 955 | Mortdale via Oatley & Oatley West | 60 | 60 | 60 | 60 | - |
| 4• | – | 958 | Rockdale Plaza via Carss Park & Kogarah Bay | 15-30(e) | 30 | 30(e) | 60 | - |
| 3• | – | 959 | Bald Face via Blakehurst Shops | 30 | 60 | 30 | 60 | - |
| 3• | – | 970 | Miranda via Sylvania Heights | 30 | 30 | 15 | 30 | 60 |
| 3• | – | 971 | Cronulla via Port Hacking Rd & Miranda | 30 | 30 | 15(c) | 30(d) | 60 |
| 2• | – | N10 | City via Rockdale | # | # | # | 15-30 | 15-30 |
| 2• | – | N10 | Sutherland via Mortdale | # | # | # | 15-30 | 15-30 |
| 2• | – | N11 | City via Rockdale | # | # | # | 60 | 60 |
| 2• | – | N11 | Cronulla via Miranda | # | # | # | 60 | 60 |

**Bus Operator Legend**

Sydney Buses
Punchbowl Bus Co
Veolia Transport
NightRide
M41
M91

Source: http://www.sydneybuses.info/news/news-images/Hurstville_Interchange_brochure.pdf

The coverage and service frequency level offered by current bus services indicates that public transport is an attractive option for residents and workers situated in the proposed development.

### 4.3.5 Summary

The above information indicates that the proposed site is situated near to an existing high quality public transport system offering reliable high frequency services. It is also noted to align with the future planned improvements to bus and rail networks and will assist Hurstville city centre achieve its TMAP recommended mode share targets.

## 4.4 Active Transport

This section provides an overview of the pedestrian and bicycle infrastructure surrounding the subject site.

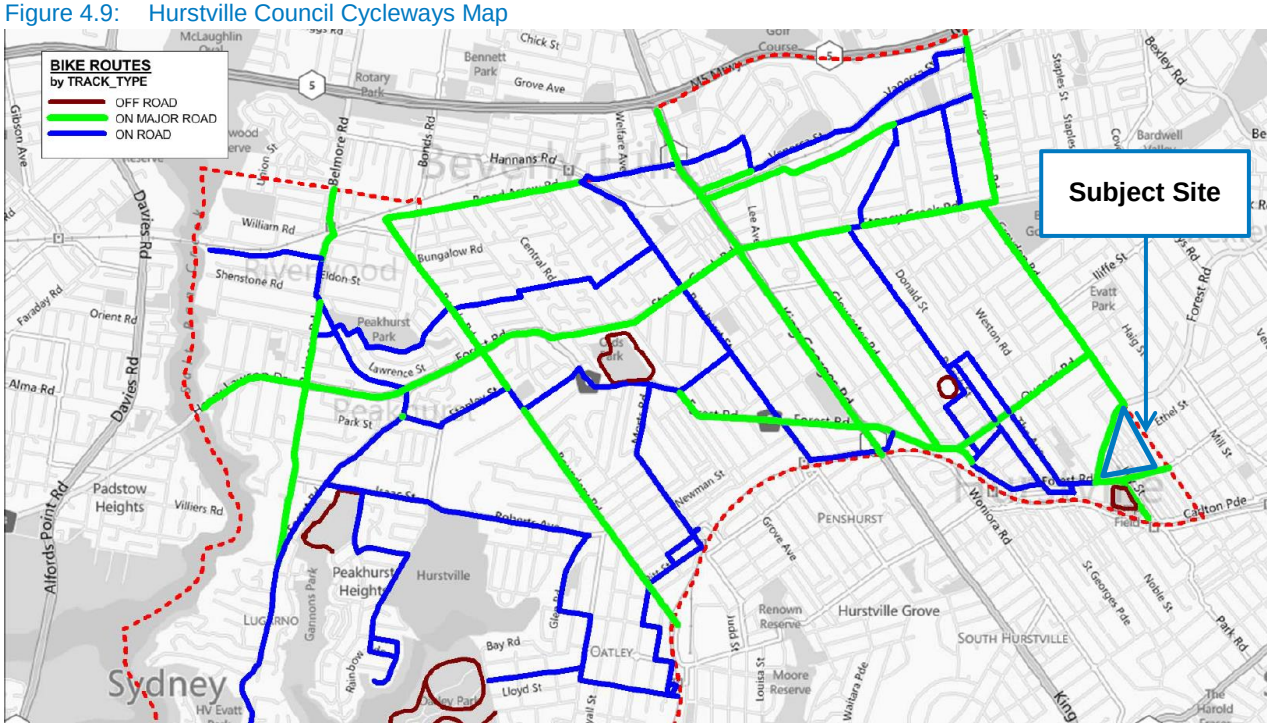
### 4.4.1 Cycling

No formal bicycle lanes were observed to be provided adjacent the subject site, however information contained from the Hurstville City Council website indicates that there are a number of ‘on-road cycle paths’ in close proximity of the site. These types of facilities are typically identified by logos painted on road surfaces and the presence of signage warning motorists and pedestrians to 'watch for cyclists'. Refer to Figure 4.9 for Council’s cycle network map.

Attractive cycling options are available between the subject site and Allawah railway station, via the off road shared-path network in Kempt Field (refer to Figure 4.10).

The review of cycling facilities indicates the cycle network offers a good level of connectivity to all key facilities within and surrounding Hurstville City Centre. The site is currently served by unmarked on-road cycle routes along Forest Road and Durham Street and could benefit from further upgrades.

Figure 4.9: Hurstville Council Cycleways Map




Source: http://www.hurstville.nsw.gov.au/Cycleways.html

Figure 4.10: Existing Off-road shared path in Kempt Field

### 4.4.2 Pedestrian Infrastructure

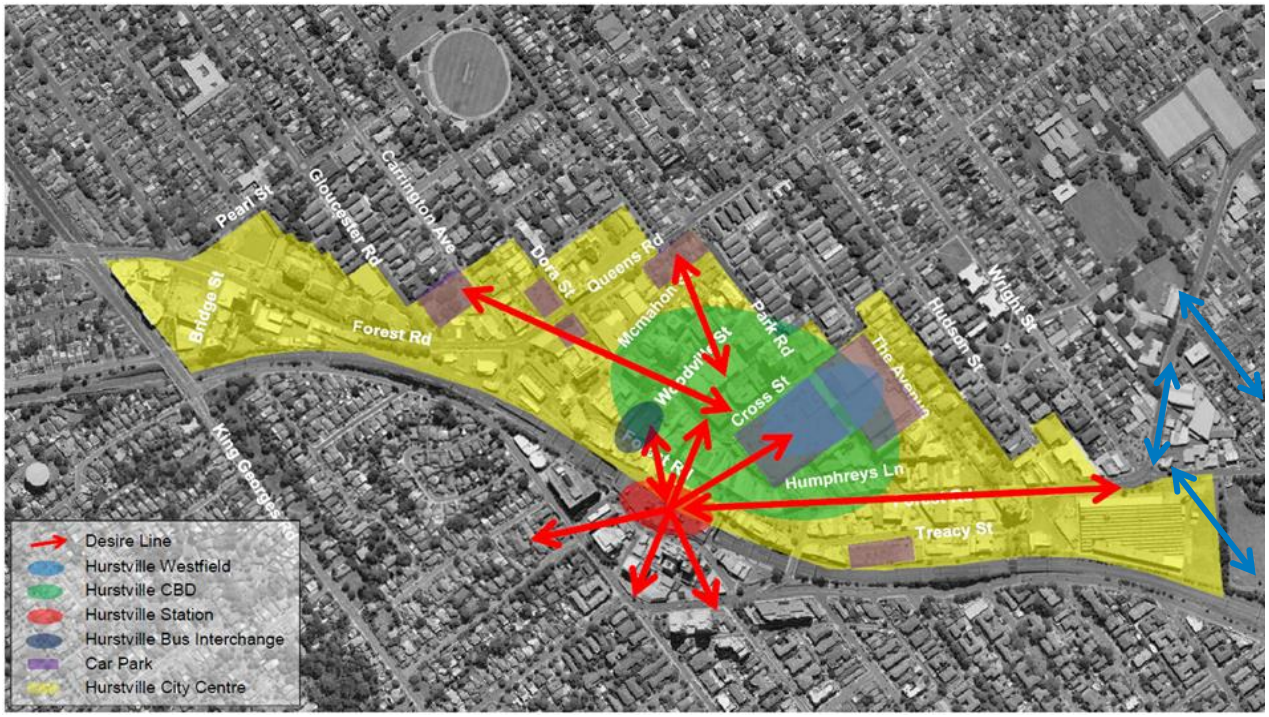
A review of pedestrian infrastructure was undertaken along selected roads to understand the standard and quality of the pedestrian environment between the site and city centre core and Allawah rail station.

The review has identified the following:

- High pedestrian movement was observed at the Forest Road / Lily Street intersection, which includes schoolchildren who arrived by bus and then crossed over Forest Road.
- High pedestrian movement was observed at the Lily Street / Durham Street intersection, generally associated with schoolchildren following Lily Street north.
- Pedestrians wishing to cross Forest Road at Durham Street, use the painted medians as a staged crossing.
- The general pedestrian desire line between Allawah Station, Kempt Field and educational facilities to the North of the site are adequate and attract significant pedestrian movements through Kempt Field.

Figure 4.12 provides a visual representation of key desire lines associated with the Hurstville City Centre (red) and the site (blue).

Figure 4.11: Hurstville City Centre pedestrian desire line map




Source: Hurstville City Centre TMAP (GHD, 2013)

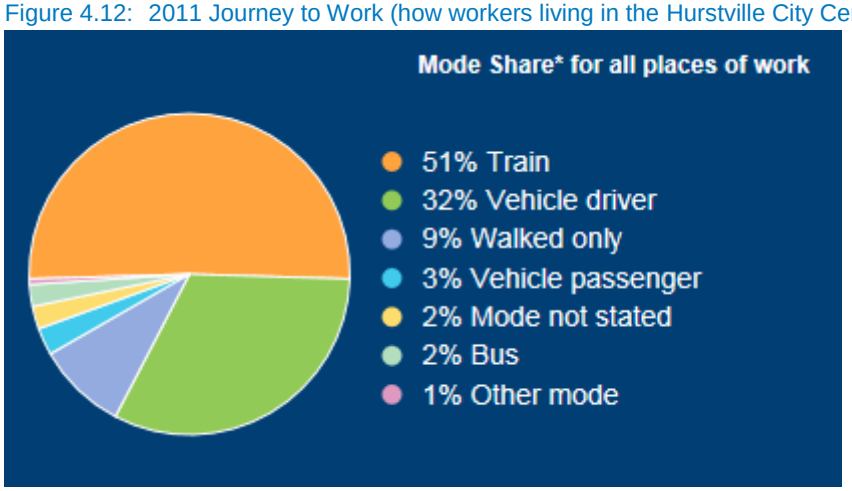
Site observations indicate that streetscape improvements are being adopted along Durham Street, Forest Road, which is associated with the delivery of the East Quarter development. The adoption of similar

improvements will be considered as part of the DA stage and will focus on improving safety and connectivity within the Eastern Bookend with an aim of aligning the project with the objectives of the Hurstville City Centre TMAP. This could potentially include wider footpaths, additional pedestrian crossing options between the site and the surrounding network and shared paths.

## 4.5 Hurstville Transport Mode Share

The latest 2011 JTW data has been extracted from the BTS JTW Explorer website (http://visual.bts.nsw.gov.au/jtwbasic/#2606) for Hurstville City Centre (travel zone 2606). The data obtained from this website is presented in Figures 4.12 and 4.13 and Tables 4.1 and 4.2. Given the proximity of the site to the city centre it is expected that the proposed high density mixed use development will exhibit similar travel characteristics to that shown for residents of Hurstville City Centre.

Figure 4.12: 2011 Journey to Work (how workers living in the Hurstville City Centre commute from the area)

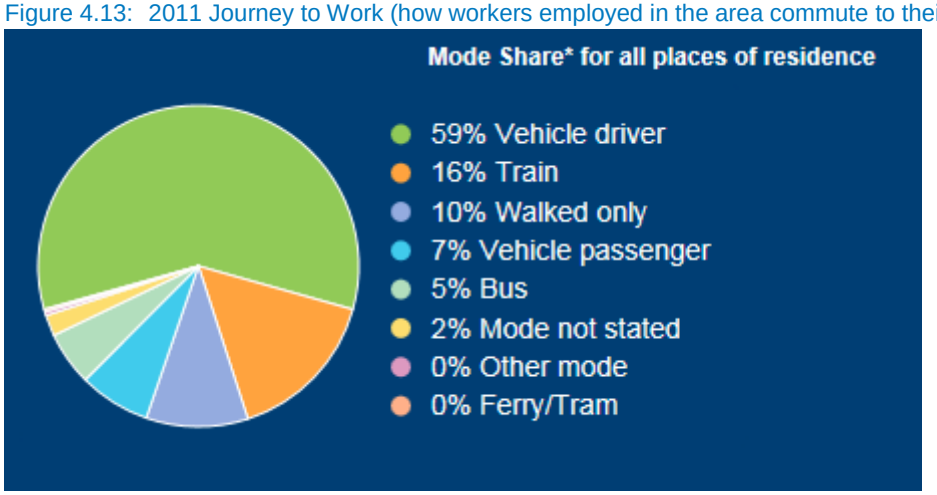



Source: Journey to Work 2011 data for travel zone 2606– bts.nsw.gov.au

Table 4.1: 2011 Journey to Work (living in Hurstville City Centre) -trip destinations and mode share (%)

| Residential Outbound Trips (Destinations) | Total | Car Driver | Bus | Train | Walking | Cycle | Not stated or car passenger |
|---|---|---|---|---|---|---|---|
| Sydney Inner City | 32% | 13% | 0% | **84%** | 1% | 0% | 2% |
| Hurstville | 16% | 28% | 4% | 8% | **51%** | **2%** | 7% |
| Botany | 6% | 43% | 0% | **45%** | 0% | 0% | 12% |
| Kogarah - Rockdale | 6% | 52% | 5% | 26% | 10% | 0% | 7% |
| Cronulla - Miranda - Caringbah | 5% | 46% | 0% | **48%** | 0% | 0% | 6% |
| North Sydney - Mosman | 3% | 9% | 0% | **91%** | 0% | 0% | 0% |
| Eastern Suburbs - North | 3% | 23% | 0% | **77%** | 0% | 0% | 0% |
| Chatswood - Lane Cove | 3% | 22% | 0% | **69%** | 0% | 0% | 9% |
| Canterbury | 3% | 57% | 10% | 20% | 0% | 0% | 13% |
| Sub Total | 78% | | | | | | |

Figure 4.13: 2011 Journey to Work (how workers employed in the area commute to their destination)




Source: Journey to Work 2011 data for travel zone 2606– bts.nsw.gov.au

Table 4.2: 2011 Journey to Work (Working in Hurstville City Centre) - trip destinations and mode share (%)

| Worker Inbound (LGA Origins) | Total | Car Driver | Bus | Train | Walking | Cycle | Not stated or car passengers |
|---|---|---|---|---|---|---|---|
| Average | 100% | 59% | **5%** | **16%** | 10% | 0% | 9% |
| Hurstville | 37% | 50% | 7% | 7% | **24%** | **0%** | 11% |
| Kogarah - Rockdale | 16% | 56% | **5%** | **18%** | 7% | 0% | 13% |
| Sutherland-Menai-Heathcote | 7% | 71% | **0%** | **26%** | 0% | 0% | 4% |
| Bankstown | 6% | 73% | 8% | 8% | 0% | 0% | 10% |
| Canterbury | 6% | 68% | **17%** | **6%** | 0% | 0% | 10% |
| Cronulla - Miranda - Caringbah | 6% | 67% | **1%** | **23%** | 1% | 2% | 5% |
| Other | 22% | | | | | | |

The above data indicates the following:

- On average Hurstville City Centre residents have a journey to work public transport mode share of 53%, which is 32% above the mode share target (21%) recommended in the Hurstville City Centre TMAP.
- On average Hurstville City Centre residents have a journey to work active transport mode share of 10%, which is -10% below the mode share target (20%) recommended in the Hurstville City Centre TMAP, however all public transport trips have a walking component and as a result the recommended TMAP mode share target could be achieved.
- Residents who live in Hurstville City Centre and work in Hurstville LGA achieve an active transport mode share of 53% (predominantly walking), which is 33% above the recommended TMAP mode share target (20%).
- Worker travel trips from Hurstville City Centre to Hurstville LGA and from Hurstville LGA to Hurstville City Centre are the only locations that achieve the active transport mode share target recommended in

the TMAP. However, as indicated above, it is acknowledged that most public transport trips have a walking component and as a result would also have a positive combined contribution to the TMAP active transport mode share target.

- Residents who live in Hurstville city centre and work in Sydney Inner City achieve a public transport mode share of 84% (predominantly rail), which is 63% above the mode share target (21%) recommended in the TMAP.
- Similar trips to Sydney Inner City, Chatswood (69%), Eastern Suburbs (77%) and North Sydney (91%) also achieve high public transport journey to work trip mode share, which are above the TMAP mode share target.

### 4.5.1 Summary of Commuter Travel

The current mode share for journey to work for people living in and travelling from the Hurstville city centre travel zone is presented in Figure 4.12. The information indicates that on average over 50% of people who live in the city centre use the train to travel to work, 10% walk or cycle and only 32% actually drive to work.

The proposed site is suitable for accommodating high density residential growth which is demonstrated through its positive contribution to managing traffic demand and assisting Hurstville city centre achieve its mode share targets set in the Hurstville City Centre TMAP.

### 4.5.2 Summary of Worker Generated Trips

The current mode share for journey to work for people working in the Hurstville City Centre travel zone is presented in Figure 4.13. The information indicates that nearly 60% of people who work in the city centre use their car to travel to work, approximately 10% walk and 21% either travel by bus and train. Further analysis of the data indicates that 53% of people travel from the three neighbouring LGAs of Hurstville, Rockdale and Kogarah that border the city centre, however, despite their proximity they still displayed a high car driver mode share characteristic of 50% or higher. It is also noted that residents of Hurstville achieve a higher active transport mode share.

It can be concluded that there is a heavy dependency on car travel for access to Hurstville City Centre, which is highlighted in the TMAP and proposed to be controlled through:

- Reductions in parking provision for new development.
- Encouraging residential growth within walking distance of the city centre commercial core.
- Strengthening kerbside parking controls within the city centre to discourage all day parking (i.e. short turnover).

The proposed development of the Landmark Square Precinct will align with these objectives.

## 4.6 Sustainable Access Plan (Proposed Development)

The sustainable transport plan for the proposed development consists of the following elements, which will be used to support sustainable transport outcomes for the site.

### 4.6.1 Mode Share

Residential person trip rates can be calculated based on the Guide to Traffic Generating Developments (RMS, 2013) average trip rates for similar activity centres in Sydney and include Chatswood, St Leonards, Parramatta and Strathfield. The data reviewed as part of the rezoning application indicates that rail is a popular mode of travel by residents and that Hurstville city centre is the second highest person trip generator after Sydney CBD. A key focus for managing traffic growth associate with this development will be to encourage people to travel to work by non-car travel mode options.

### 4.6.2 Cycling Provision and Opportunities

The proposed development supports the roll out of cycle path improvements within and to the east of the Hurstville City Centre. Future concept design at the DA stage will consider the capacity needs, ease of access and security in the design for the provision of high quality and secure cycle storage facilities with an aim of aligning with the requirements and intention set in the Hurstville Draft DCP No 2. This will provide the development with a focus on promoting cycling and supporting the active transport mode share targets set within the TMAP for Hurstville City Centre.

### 4.6.3 Walking Provision and Opportunities

The proposed development supports access by walking and has been identified to be a highly desirable location for walk based trips, particularly due to its proximity to Allawah Railway Station and the Hurstville city centre. This includes trips by public transport or to local or regional facilities which are within walking distance of the site, and can be supported by the existing and future provision of signalised or marked pedestrian crossings surrounding the city centre. It is proposed that streetscape improvement concepts be developed at the DA stage of the project as discussed in Section 4.4.7.

### 4.6.4 Public Transport Access

The site provides a highly desirable location for access to the rail and bus network and services for travel to other activity centres. The design for the site will consider access needs to surrounding facilities and initiatives that would promote and increase awareness of the accessibility potential of the site. This will form part of the DA stage for the project and focus on developing a design that will help people with accessibility needs use public transport options to access key facilities within and surrounding the city centre.

### 4.6.5 Green Travel Plan

Green Travel Planning supports travel demand management and existing travel patterns already exhibited by residents of Hurstville city centre. This plan focuses on increasing the use of mass transit (i.e. rail and bus services) and active transport (i.e. walking and cycling) and in doing so, aims to minimise the need and use of private vehicle for travel for access and travelling from the proposed development. The requirements of the green travel plan for the proposed development will be developed once acceptance of the rezoning application is received and will form part of the DA stage for the project.

# 5 Parking Requirements

The car parking requirements identified in this rezoning application are based on the proposed Site A and Site B land use (refer to Section 2.2) and minimum parking rates stipulated within Hurstville Draft DCP No.2. The adoption of these parking rates is supported by Section 4 which highlights the accessibility and connectivity potential of the site in relation to city centre facilities and high quality public transport services.

## 5.1 Car Parking Rates

Table 5.1 provides car parking rates as specified in Draft DCP No. 2.

Table 5.1: Draft DCP No.2 car parking rates

| Land Use | Qty. |
|---|---|
| Residential -1-2 bedrooms | 1 space per dwelling |
| Residential - 3 bedrooms | 2 spaces per dwelling |
| Residential - visitor spaces | 1 space per 4 dwellings (or part thereof). |
| Supermarket Retail | 1 space per 50m$^2$ with a Transport and Parking Assessment Study |
| Retail and restaurant | 1 space per 50m$^2$ |
| Hotel (visitor accommodation) and hotel function | 1 space per 5 bedrooms/unit of accommodation<br>plus the requirements of any associated restaurant/function room etc. |
| Childcare | 1 space per 10 children for drop off and pick up; and 1 space per 2 staff with a Transport Assessment Study. |
| Commercial (SOHO) | 1 space per 100m$^2$ (B4 Mixed Use ) |
| Community facilities | Identify car parking demand through a Transport and Parking Assessment Study. |

Refer to Table 5.2 and Table 5.3 for an understanding of parking allocation developed from the review of proposed Site A and Site B land use yields (refer to section 2.2 and the above parking rates).

Table 5.2: Car parking requirements - Site A

| Land Use | Qty. | Type | Draft DCP No. 2 Requirement | Rate per1 unit or 100m$^2$ | Requirements |
|---|---|---|---|---|---|
| Residential units - 1 or 2 bedroom | 223 | Dwelling | 1 per dwelling | 1.00 | 223 |
| Residential units - 3 bedroom | 50 | Dwelling | 2 per dwelling | 2.00 | 100 |
| Residential visitors | 273 | Dwelling | 1 per 4 dwellings | 0.25 | 69 |
| Supermarket retail | 1060 | GFA | 1 space per 50m$^2$ | 2.00 | 22 |
| Specialist retail | 1451 | GFA | 1 space per 50m$^2$ | 2.00 | 30 |
| Hotel (visitor accommodation) | 150 | Units | 1 per 5 rooms | 0.2 | 30 |
| Hotel Function | 897 | GFA | Based on site requirements | - | 2 |
| Restaurant | 639 | GFA | 1 space per 50m$^2$ | 2.00 | 13 |
| Childcare (Children) | 90 | Children | 1 per 10 children | 0.10 | 9 |

| Land Use | Qty. | Type | Draft DCP No. 2 Requirement | Rate per1 unit or 100m$^2$ | Requirements |
|---|---|---|---|---|---|
| Childcare (Staff) | 18 | Staff | 1 per 2 staff | 0.50 | 9 |
| **Total Parking Requirement** | | | | | **507** |

Table 5.3: Car parking requirements - Site B

| Land Use | Qty. | Type | Draft DCP No. 2 Requirement | Rate per1 unit or 100m$^2$ | Requirements |
|---|---|---|---|---|---|
| Residential units - 1 or 2 bedroom | 30 | Dwelling | 1 per dwelling | 1.00 | 30 |
| Residential units - 3 bedroom | 5 | Dwelling | 2 per dwelling | 2.00 | 10 |
| Residential visitors | 35 | Dwelling | 1 per 4 dwellings | 0.25 | 9 |
| SOHO Commercial | 348 | GFA | 1 space per 100m$^2$ | 1.00 | 4 |
| Specialist retail | 754 | GFA | 1 space per 50m$^2$ | 2.00 | 16 |
| Community facility | 357 | Units | Based on site requirements | - | 5 |
| **Total Parking Requirement** | | | | | **74** |

Table 5.2 indicates that 392 spaces are required for residential units for Site A, which includes 69 visitor spaces. 49 spaces are required for residential units for Site B as per Table 5.3, including 9 visitor spaces. It is noted that for the residential units with 3 bedrooms, 2 spaces per unit are required and there is an opportunity to include stacked parking under the Hurstville Draft DCP No.2 for these unit types (not more than 25% of cars must be stack parked).

The remaining car parking spaces in Site A (115 spaces) are required for retail, hotel, hotel function room, restaurant and child care land uses. 18 of these 115 spaces are required to be reserved for the proposed child care facility. These spaces will be designed as high turnover parking spaces that require a 15 minute maximum stay time restrictions during operating periods as per Section 8 of Draft DCP No. 2.

The remaining car parking spaces in Site B (25 spaces) are required for commercial, specialist retail and the community facility.

Hurstville City Council Draft DCP No. 2 indicates that parking demand for hotel function areas and community facilities is to be considered and based on site requirements. It is anticipated that people who will be attracted to the hotel function facilities will in most cases be already staying at the hotel, and its associated external demand will be minor or not impact on other peak parking uses. Similarly, it is anticipated that users of the community facility will generally be residents from the Site A and Site B apartments. On this basis only two additional spaces for the hotel function and five additional spaces for the community facility have been included in Table 5.1 for these isolated activities.

All of the above equates to a total car parking requirement of 581 spaces for the proposed development (507 for Site A and 74 for Site B), which will be designed in accordance with both Council and Australian Standards at the DA stage of the project.

### 5.1.1 Off-Street Shared Parking

The potential to share the car parking allocation between on-site designated land uses will be explored during the DA stage of the project, which has the potential to reduce total on-site parking provision and result in a more efficient site design.

The following land use groups have the potential to be grouped and shared as part of the total car parking allocation:

- Residential visitors.
- Supermarket retail customers.
- Retail customers.
- Restaurant customers.
- Child care pick up and drop off.

There is also potential to further reduce parking allocation by implementing a car sharing scheme for the Landmark Square Precinct.

## 5.2 On-Street Parking

An initial review has been undertaken of available on-street parking spaces on both Durham Street and Forest Road. The review indicates 8 spaces could be retained along Durham Street and Forest Road, once the proposed development is constructed. This arrangement takes into consideration the requirements for future access points.

This parking allocation is proposed to be controlled through the introduction of time restrictions (short period turnover) and it is estimated that 4 spaces could be made available on Forest Road's eastern kerb and 4 spaces on the Durham Street's northern kerb.

It is also noted that the removal of existing access points provides an opportunity to increase the amount of available on-street parking allocation surrounding the site which will be reviewed at the DA stage.

As indicated in Section 3.8, current kerbside parking controls consist of no parking on Forest Road (between 3pm and 7pm only) and 1 hour parking time restriction on Durham Street (8am – 6pm Mon-Fri and 8am-12pm Sat), which will need to be taken into consideration as part of this scheme. The expansion of the 1 hour parking zone to Forest Road and the extension of time restriction periods on Durham Street would help to better utilise kerbside parking, which could help to service restaurants and other similar type uses that have frontages to these road sections.

## 5.3 Bicycle Parking

The bicycle parking provision stated in Section 5.4.3.3 of Hurstville Draft DCP No.2 is as follows:

- 1 bicycle space per 3 residential units.
- 1 bicycle space per 300m$^2$ of retail floor space.
- 1 bicycle space for every 200m$^2$ of office floor space.

Based on the above and the proposed Site A and Site B land use (refer to Section 2.2), the bicycle parking allocation within the proposed development consists of:

99 bicycle spaces for Site A consisting of:

- 91 resident bicycle spaces.
- 8 retail bicycle spaces.

17 bicycle spaces for Site B consisting of:

- 12 resident bicycle spaces.
- 3 retail bicycle spaces.
- 2 commercial bicycle spaces.

To encourage the increased use of cycling by residents and the workforce for travel, it is recommended that secure bicycle storage racks / rails and/or lockers are provided in secure locations that are positioned both undercover and on the ground floor of the development near the main building access point. Design details associated with the location and type of bicycle parking and end of trip facility provision will be developed as part of the DA stage for this development.

# 6 Road Network Appraisal

This section provides an understanding of assumptions, approach and the network performance outcomes from the assessment of existing and future conditions at key intersections surrounding the site.

## 6.1 Modelling Scenarios

The following scenarios have been modelled using SIDRA:

- **Existing Conditions** – provides an understanding of the network performance at key intersections under current weekday AM and PM peak hour traffic conditions.

- **Scenario 1** - **future development scenario without the proposed development**: represents future intersection operations and consists of existing weekday AM and PM peak hour traffic combined with known future traffic generated from proposed developments at:
  - 1 - 5 Treacy Street.
  - 21 - 35 Treacy Street.
  - East Quarter Stage 3 (contains a frontage and access to Durham Street).
  - 108-112 & 124 Forest Road and 1- 3 Wright Street, Hurstville.

The adoption of the above is consistent with the approach for the GHD Traffic Impact Assessment.

- **Scenario 2** - **future development scenario with delivery of the full master-plan development yield**: represents future intersection operations with Scenario 1 traffic combined with the traffic generated by the proposed Landmark Square precinct.

## 6.2 Modelled Network

The following intersections have been analysed using SIDRA 6.0:

- Forest Road / Durham Street / Wright Street intersection.
- Forest Road / Lily Street intersection.
- Durham Street / Lily Street intersection.
- Durham Street / Roberts Lane intersection - While no turning count was undertaken for this intersection, turning movements (numbers into / from Roberts Lane) have been applied based on a 15 minute snapshot survey and Roberts Lane 7 day tube count.

## 6.3 Data Sources

Traffic volumes and pedestrian movement has been obtained from traffic counts undertaken by SkyHigh Consultants on Thursday 4 December 2014 and signal data (average phase times) were obtained from observations during a site visit on Tuesday 9 December 2014 (refer to Section 1.4).

Background traffic data has also been obtained from the following sources:

- 1 – 5 Tracy Street and 21 – 35 Tracy Street data obtained from Mott MacDonald Transport and Parking Study for 1 – 5 Treacy Street (dated 10 October 2014).

- East Quarter Stage 3 data obtained from GTA Consultants Traffic and Parking Impact Report for the development (dated 8 December 2015).
- 108 Forest Road data obtained from GHD Traffic Impact Assessment for the development (dated August 2014).

Traffic numbers has been extracted from these reports on the assumptions that Council has accepted the trips rates specified within each respective report.

## 6.4 Modelled Time Periods

The time periods modelled as part of this study represent a worst case scenario and were identified from the traffic movement surveys as follows:

- Forest Road / Durham Street / Wright Street intersection:
  - AM - 8:15AM - 9:15AM
  - PM - 5:15PM - 6:15PM
- Forest Road / Lily Street intersection:
  - AM - 8:15AM - 9:15AM
  - PM - 5:00pm - 6:00pm
- Durham Street / Lily Street intersection:
  - AM - 8:00AM - 9:00AM
  - PM - 3:30pm - 4:30PM
- Durham Street / Roberts Lane intersection:
  - AM – 8:00AM – 9:00AM
  - PM – 5:00PM – 6:00PM

## 6.5 Performance Measures

SIDRA is a micro-analytical software tool which calculates the amount of delay experienced by vehicles using an intersection, and provides a Level of Service (LOS) rating to relate this to the operating performance of that intersection.

The ‘Level of Service’ (LoS) is the standard measure used to understand the operational performance of the network and intersections. This is defined as the qualitative assessment of the quantitative effect of factors such as speed, traffic volume, geometric features, delays and freedom of movement.

The level of service (LoS) concept is applied to intersections through measures of effectiveness, as summarised in Table 6.1.

Table 6.1: Measures of effectiveness for LoS definition for intersections

| Intersection Control | Measure of Effectiveness |
|---|---|
| Priority controlled | Degree of Saturation<br>Delay to critical movements (sec/vehicle)<br>Queue length for critical movements |
| Traffic Signals | Average Delay (sec/vehicle)<br>Delay to critical movements<br>Degree of Saturation<br>Cycle Length<br>Queue length for critical movements |
| Roundabout | Average Delay (sec/vehicle)<br>Delay to critical movements<br>Degree of Saturation<br>Queue length for critical movements |

Source: RTA Guide to Traffic Generating Developments (2002)

The assessment of intersection operation is based on criteria outlined in Table 6.2, as defined by the NSW Roads and Maritime Services in the 'Guide to Traffic Generating Developments' (RTA 2002) and will be used to evaluate network conditions.

Table 6.2: Level of Service criteria for intersections (RTA NSW)

| Level of Service | Average Delay per Vehicle (secs/veh) | Traffic Signals, Roundabout | Give Way & Stop Signs |
|---|---|---|---|
| A | < 14 | Good operation | Good operation |
| B | 15 to 28 | Good with acceptable delays & spare capacity | Acceptable delays & spare capacity |
| C | 29 to 42 | Satisfactory | Satisfactory, but accident study required |
| D | 43 to 56 | Operating near capacity | Near capacity & accident study required |
| E | 57 to 70 | At capacity; at signals, incidents will cause excessive delays<br>Roundabouts require other control modes | At capacity, requires other control mode |
| F | > 70 | Over capacity, unstable operation | Over capacity, unstable operation |

Source: RTA Guide to Traffic Generating Developments (2002)

Note:
- The average delay assessed for signalised intersections is over all movements.
- For roundabouts and priority control intersections (with Stop and Give Way signs or operating under the T-junction rule), the critical criterion for assessment is the movement with the highest delay per vehicle.
- Average delay is expressed in seconds per vehicle.

## 6.6 Trip Rates

The traffic generation rates in this assessment are based on the following for the AM and PM peak periods:
- The RMS Guide to Traffic Generating Developments Surveys dated August 2013 (RMS GTGD survey).
- The RTA Guide to Traffic Generating Developments dated 2002 (RTA GTGD).
- Hurstville City Council data on Mortdale Plaza before and after study for the proposed supermarket / retail land use development (http://infoweb.hurstville.nsw.gov.au/infocouncil/Open/2014/11/TAC_06112014_AGN_AT.htm).
- GTA Consultants Traffic and Parking Impact Report for East Quarter Stage 3.
- GHD Traffic Impact Assessment for 108 Forest Road.

Refer to Appendix B for additional detail and justification of adopted traffic generation rates.

Trip generation rates adopted for the proposed Landmark Square Precinct rezoning application are as follows.

**Residential:**

1 bedroom units:
- AM peak rate = 0.08 vehicle trips per unit.
- PM peak rate = 0.04 vehicle trips per unit.

2 bedroom units
- AM peak rate = 0.16 vehicle trips per unit.
- PM peak rate = 0.09 vehicle trips per unit.

3 bedroom units
- AM peak rate = 0.23 vehicle trips per unit.
- PM peak rate = 0.13 vehicle trips per unit.

These rates are based on the RMS GTGD survey and the analysis of similar urban activity centres in Sydney and include Chatswood, St Leonards, Parramatta and Strathfield. Further advice regarding analysis of the similar sites is provided within Appendix B.

**Supermarket and Retail:**
- AM peak rate (weekday) = 1.72 vehicle trips per 100m$^2$ of Gross Leasable Floor Area (GFLA).
- PM peak rate (weekday) = 3.49 vehicle trips per 100m$^2$ of GLFA.

The above rates are based on proposed Mortdale Plaza development review undertaken by Hurstville City Council (refer to Appendix B for further details). A comparison against the Burwood Shopping Centre was also undertaken and highlighted that the Mortdale Plaza trip rates represent a conservative assessment of trip rates in this type of development situated around Hurstville City Centre catchment.

**Hotel:**

- PM peak rate = 0.2 vehicle trips per hotel room.

RTA GTGD advises that hotel trip generation is to be assessed in accordance with a similar site and only provides data for motels. The historical motel rate is 0.4 trips per hotel room in the PM peak. A review of similar hotel proposals indicates that in most cases the motel rate was adopted with discounts applied for reduction in parking.

In the absence of any other information, a trip generation rate of 50% of the historical RTA motel room rate has been adopted. This is based on a number of factors, which includes the consideration of:

- The position of the hotel within an established urban centre with good access to public transport services and within walking distance of other city centre facilities.
- Assumed lower AM and PM peak vehicle trip generation for hotel guest in comparison to motels which are typically built on major road routes and away from urban centres and require a car for access purposes.
- The availability of passing trade from taxis, which is another typical mode of travel for hotel users.
- Council's adopted parking rate for hotel rooms being significantly lower than that specified in the RTA GTGD 2002, which implies the private car mode share is lower than the historical trend for motels (RTA GTGD 2002 parking rate of 1 space per room versus Draft DCP No. 2 rate of 1 space per 5 rooms).

**Restaurant:**

- PM peak rate (weekday) = 5 vehicle trips per 100m$^2$ of GFA.

Restaurant trip generation is based on information provided within the RTA GTGD with PM only considered in this situation to be impacted by the proposal.

**Childcare:**

- AM peak rate = 0.23 vehicle trips per child.
- PM peak rate = 0.13per vehicle trips per child.

Childcare trip generation is based on 'long day-care' rates as specified in the RTA GTGD, which represents a conservative rate.

**Commercial:**

- AM peak rate = 2.86 vehicle trips per 100m$^2$ of GFA.
- PM peak rate = 1.84 vehicle trips per 100m$^2$ of GFA.

Commercial trip generation is based on the RMS GTGD survey which provides specific vehicle based trip rate information for office blocks in Hurstville.

**Community Facility**

The community facility is anticipated to be exclusively used by residents of the Landmark Square Precinct. Any external use from non-residents is expected to occur outside of the AM or PM peak hour. As such no additional peak hour traffic from the proposed community facility has been factored into the assessment below.

## 6.7 Traffic Generation

The traffic generated by the proposed development during AM and PM peak hours is shown in Table 6.3 for Site A and Table 6.4 for Site B. Traffic generation has been estimated using the trip rates specified in Section 6.6.

Table 6.3 and Table 6.4 have also applied separate vehicle movement splits (inbound / outbound movement) for the proposed land uses situated on the site. The rates applied are typical rates and are consistent with the rates used on other similar approved projects in the Hurstville City Centre.

Table 6.3: Traffic generated by the proposed development (Site A)

| Land Use | Qty. | Unit / Item of Measure | Time | Rate | Trip Rate Source | In % | Inbound vehicle trips per hour* | Out % | Outbound vehicle trips per hour* |
|---|---|---|---|---|---|---|---|---|---|
| 1 Bedroom Residential Units | 27 | per unit | AM | 0.08 | RTA (2013) | 10% | 1 | 90% | 3 |
| | | | PM | 0.04 | RTA (2013) | 80% | 2 | 20% | 1 |
| 2 Bedroom Residential Units | 196 | per unit | AM | 0.16 | RTA (2013) | 10% | 4 | 90% | 28 |
| | | | PM | 0.09 | RTA (2013) | 80% | 14 | 20% | 4 |
| 3 Bedroom Residential Units | 50 | per unit | AM | 0.23 | RTA (2013) | 10% | 2 | 90% | 11 |
| | | | PM | 0.13 | RTA (2013) | 80% | 6 | 20% | 2 |
| Supermarket Retail | 795 | GLFA (assume 75% of 1060 GFA) | AM | 1.72 | Mortdale plaza analysis | 80% | 12 | 20% | 3 |
| | | | PM | 3.49 | Mortdale plaza analysis | 50% | 14 | 50% | 14 |
| Retail | 1088 | GLFA (assume 75% of 1451 GFA) | AM | 1.72 | Mortdale plaza analysis | 80% | 16 | 20% | 4 |
| | | | PM | 3.49 | Mortdale plaza analysis | 50% | 19 | 50% | 19 |
| Hotel | 150 | per unit | AM | 0.2 | Aligned to Hurstville DCP parking rates | 50% | 15 | 50% | 15 |
| | | | PM | 0.2 | Aligned to Hurstville DCP parking rates | 50% | 15 | 50% | 15 |
| Hotel Function | 301 | GFA | AM | N/A | N/A | 0% | 0 | 0% | 0 |
| | | | PM | 5 | RTA (2002) - Restaurant rate | 100% | 16 | 0% | 0 |
| Restaurant | 897 | GFA | AM | 0 | N/A | 0% | 0 | 0% | 0 |
| | | | PM | 5 | RTA (2002) - Restaurant rate | 100% | 45 | 0% | 0 |
| Childcare | 90 | per child | AM | 0.7 | RTA (2002) - long-day care rate | 50% | 32 | 50% | 32 |
| | 90 | per child | PM | 0.8 | RTA (2002) - long-day care rate | 50% | 36 | 50% | 36 |
| AM Totals | | | | | | **AM IN** | **82** | **AM OUT** | **96** |
| PM Totals | | | | | | **PM IN** | **167** | **AM OUT** | **91** |

Note:

- GFLA is assumed to equate to 75% of GFA.
- Inbound / outbound traffic generated has been rounded to the nearest integer (high) for a conservative assessment.

Table 6.4: Traffic generated by the proposed development (Site B)

| Land Use | Qty. | Unit / Item of Measure | Time | Rate | Trip Rate Source | In % | Inbound vehicle trips per hour | Out % | Outbound vehicle trips per hour |
|---|---|---|---|---|---|---|---|---|---|
| 1 Bedroom Residential Units | 5 | Units | AM | 0.08 | RMS GTGD survey (2013) | 10% | 1 | 90% | 1 |
| | | | PM | 0.04 | RMS GTGD survey (2013) | 80% | 1 | 20% | 1 |
| 2 Bedroom Residential Units | 25 | Units | AM | 0.16 | RMS GTGD survey (2013) | 10% | 1 | 90% | 4 |
| | | | PM | 0.09 | RMS GTGD survey (2013) | 80% | 3 | 20% | 1 |
| 3 Bedroom Residential Units | 5 | Units | AM | 0.23 | RMS GTGD survey (2013) | 10% | 1 | 90% | 2 |
| | | | PM | 0.13 | RMS GTGD survey (2013) | 80% | 1 | 20% | 1 |
| SOHO Commercial | 348 | GFA in 100m$^2$ | AM | 2.86 | RMS GTGD survey (2013) | 80% | 8 | 20% | 2 |
| | | | PM | 1.84 | RMS GTGD survey (2013) | 20% | 2 | 80% | 6 |
| Retail | 754 | GLFA in 100m$^2$ | AM | 1.72 | Mortdale plaza analysis (refer Appendix C) | 80% | 11 | 20% | 3 |
| | | | PM | 3.49 | Mortdale plaza analysis (refer Appendix C) | 50% | 14 | 50% | 14 |
| Community Facility | 357 | GFA in 100m$^2$ | AM | N/A | No external use | 50% | 0 | 50% | 0 |
| | | | PM | N/A | No external use | 50% | 0 | 50% | 0 |
| AM Totals | | | | | | **AM IN** | **22** | **AM OUT** | **12** |
| PM Totals | | | | | | **PM IN** | **21** | **AM OUT** | **23** |

Note:

- GFLA is assumed to equate to 75% of GFA.
- Inbound / outbound traffic generated has been rounded to the nearest integer (high) for a conservative assessment.

## 6.8 Traffic Distribution

Trip distribution in Table 6.5 is based on data extracted from the 2011 BTS JTW Explorer website - travel zone 2606 (Hurstville City Centre) and has been used to determine direction of travel to / from the development for people using private vehicles. This information is available on the NSW Government website (http://visual.bts.nsw.gov.au/jtwdynamic).

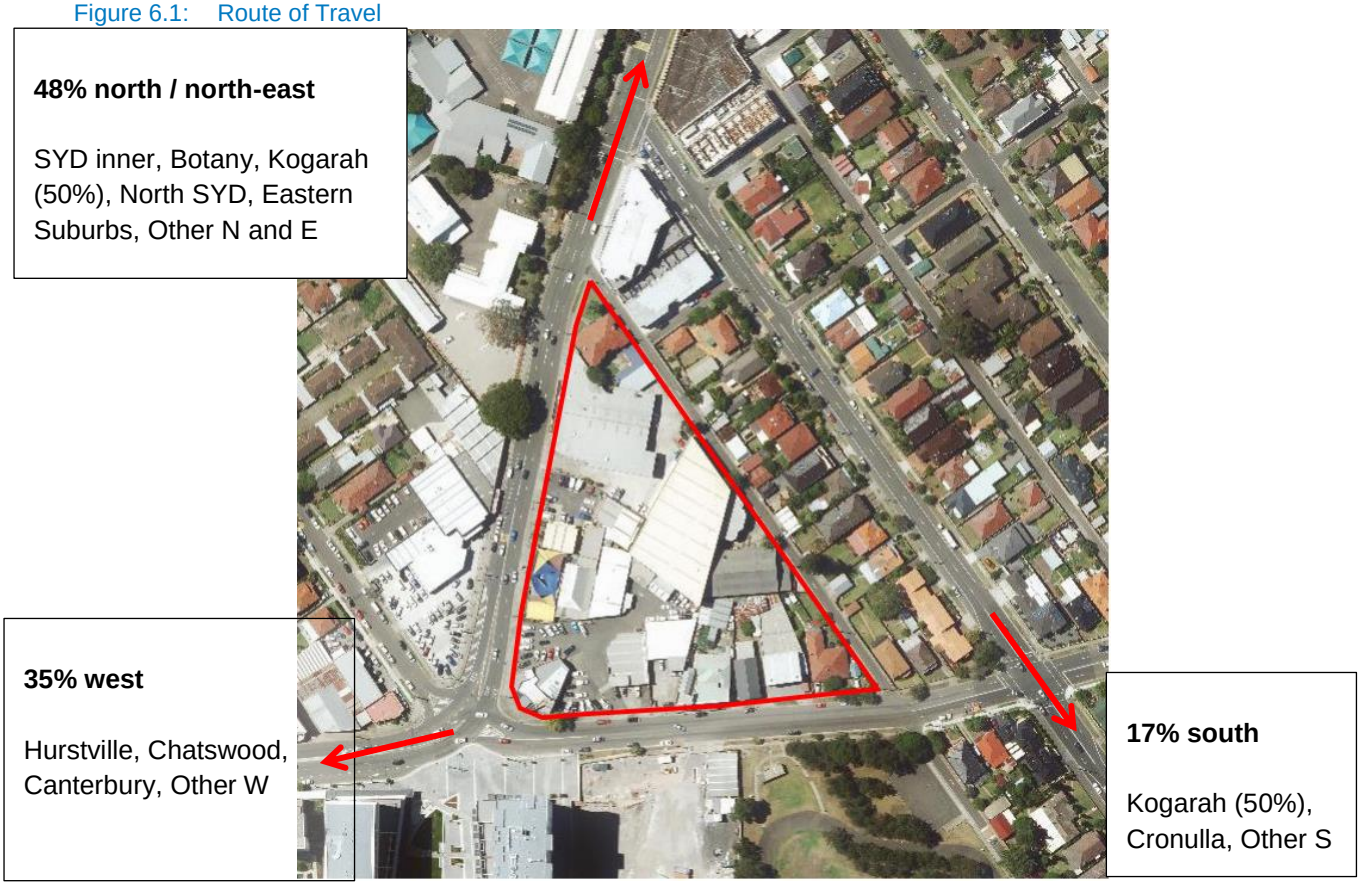
Table 6.5: Traffic distribution and number of vehicle trips based on JTW Data

| Journey to Work 2011 Destination | Trips | % of Total | Driver Mode Share | Vehicle Trips | Vehicle distribution factoring of total vehicle trips | Travel Direction from Proposed Site |
|---|---|---|---|---|---|---|
| Sydney Inner City | 377 | 32% | 13% | 49.01 | 11% | North / North East |
| Hurstville | 187 | 16% | 28% | 52.36 | 12% | West |
| Botany | 74 | 6% | 43% | 31.82 | 7% | North / North East |
| Kogarah - Rockdale | 70 | 6% | 52% | 36.4 | 8% | North / North East & South |
| Cronulla - Miranda - Caringbah | 59 | 5% | 46% | 27.14 | 6% | South |
| North Sydney - Mosman | 40 | 3% | 9% | 3.6 | 1% | North / North East |
| Eastern Suburbs - North | 36 | 3% | 23% | 8.28 | 2% | North / North East |
| Chatswood - Lane Cove | 35 | 3% | 22% | 7.7 | 2% | West |
| Canterbury | 32 | 3% | 57% | 18.24 | 4% | West |
| Other N | 111.6 | 9% | 74% | 82.584 | 19% | North / North East |
| Other E | 23.9 | 2% | 74% | 17.686 | 4% | North / North East |
| Other S | 35.85 | 3% | 74% | 26.529 | 6% | South |
| Other W | 99.65 | 8% | 74% | 73.741 | 17% | West |
| **Totals** | **1181** | **100%** | **-** | **435.09** | **100%** | **-** |

As per Table 6.5, specific routes of travel have been applied based on the location of the development and the specified routes stated in the 2011 BTS JTW data.

This is summarised graphically in Figure 6.1.

Figure 6.1: Route of Travel




Refer to Table 6.5 for assumed distribution per destination.

Table 6.6 and Table 6.7 provides vehicle per hour network distributions for traffic generated by the proposed rezoning application (under a full development scenario) for Site A and Site B.

Table 6.6: Network traffic distribution – Full development (Site A)

| Distribution | % | AM IN | AM OUT | PM IN | PM OUT |
|---|---|---|---|---|---|
| Forest Road north east | 48% | 40 | 47 | 81 | 44 |
| Forest Road west | 35% | 29 | 34 | 59 | 32 |
| Lily Street towards Railway line | 17% | 14 | 17 | 29 | 16 |
| **Totals** | **100%** | **83** | **98** | **169** | **92** |

*Note: All numbers from Table 6.3 have been rounded up to the nearest highest integer resulting in minor increases in traffic along the road network*

Table 6.7: Network traffic distribution – Full development (Site B)

| Distribution | % | AM IN | AM OUT | PM IN | PM OUT |
|---|---|---|---|---|---|
| Forest Road north east | 48% | 11 | 6 | 11 | 12 |
| Forest Road west | 35% | 8 | 5 | 8 | 9 |
| Lily Street towards Railway line | 17% | 4 | 3 | 4 | 4 |
| **Totals** | **100%** | **23** | **14** | **23** | **25** |

*Note: All numbers from Table 6.4 have been rounded up to the nearest highest integer resulting in minor increases in traffic along the road network*

Refer to Appendix C for traffic volume maps used in the modelling of existing and future conditions (with and without development).

## 6.9 Existing Conditions and Scenario 1 (without Landmark Square) Appraisal

The performance of intersections has been appraised using SIDRA. The key performance measures extracted from the models to understand operating conditions are level of service (LoS), degree of saturation (DoS), average delay in seconds and 95% back of queue distance. The following information summarises intersection performance levels for existing conditions and Scenario 1 and is supported by detailed model outputs contained in Appendix D.

### 6.9.1 Forest Road / Durham Street / Wright Street Intersection

The Forest Road / Durham Street / Wright Street intersection provides a link from residential areas to the east of the Hurstville City Centre area and is located to the south west of the site. It also provides a connection to Forest Road for traffic travelling to / from the south via Lily Street and Durham Street and Railway Parade

There are currently a number of access driveways situated in proximity of the intersection. These include an access to the existing commercial land use on the subject site and a construction access (gated) to the East Quarter development on Durham Street.

The intersection is unsignalised with priority given to Forest Road. Durham Street and Wright Street are controlled though holding lines and signage and the arrangement results in left in / left out only into Forest Road. There are high pedestrian demands (approximately 100 per hour) primarily associated with travel along Forest Road.

An aerial view of the existing intersection configuration is shown in Figure 6.2, with the SIDRA intersection layout shown in Figure 6.3.

Figure 6.2: Forest Road / Durham Street / Wright Street intersection – aerial view

Source: https://maps.six.nsw.gov.au/

Figure 6.3: Forest Road / Durham Street / Wright Street existing intersection – SDIRA layout

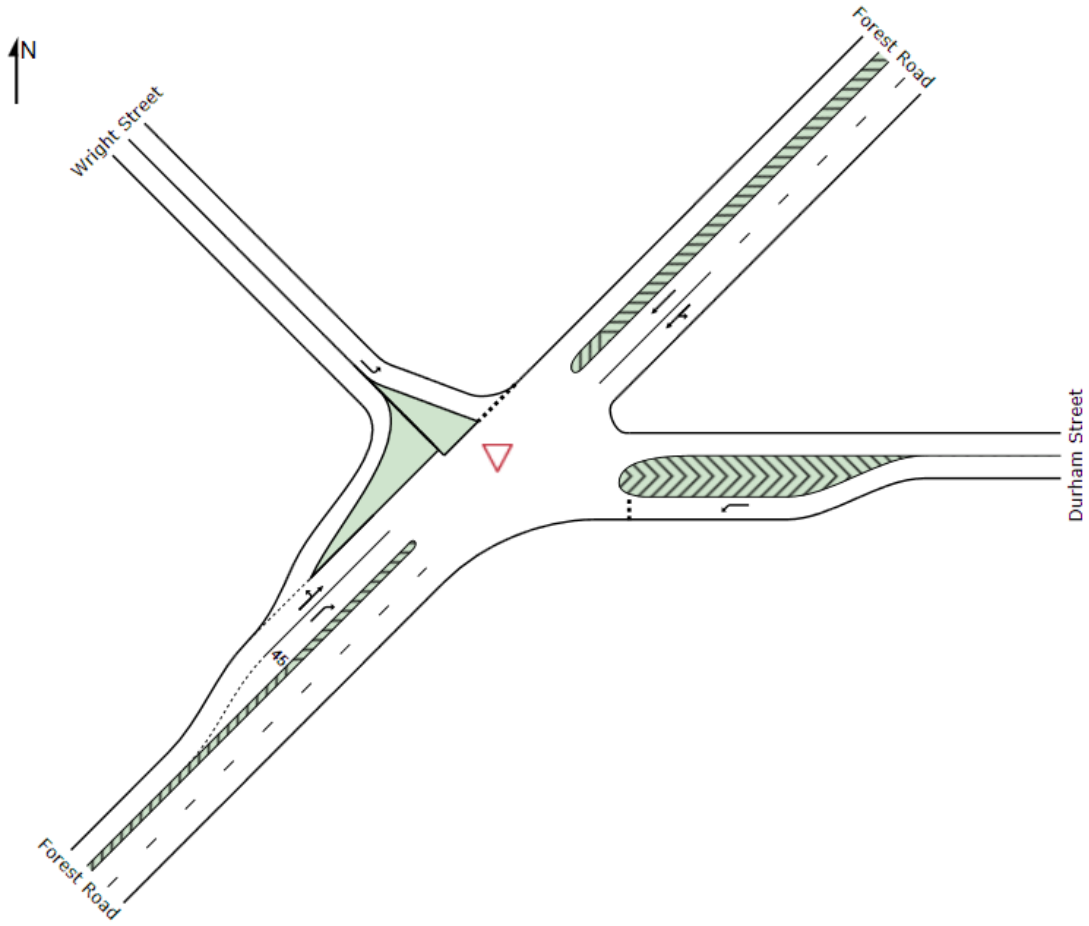


Table 6.8 provides the SIDRA performance results for each modelled scenario (as described in Section 6.1).

Table 6.8: Site 1. Forest Road / Durham Street / Wright Street intersection –SIDRA results

| AM Peak | | | | PM Peak | | | |
|---|---|---|---|---|---|---|---|
| LoS (worst movement) | Degree of Saturation | Average Delay (secs) | 95% Back of Queue (m) | LoS (worst movement) | Degree of Saturation | Average Delay (secs) | 95% Back of Queue (m) |
| Existing Conditions | | | | | | | |
| A | 0.504 | 7.9 | 24 | A | 0.613 | 11.8 | 29 |
| Scenario 1 – Without Landmark Square | | | | | | | |
| A | 0.697 | 13.0 | 41 | D | 0.989 | 51.7 | 141 |

The assessment indicates the following:

- The critical movement is the Forest Road south-west right turn movement into Durham Street. The modelling results indicate that queuing cannot be contained in the existing right turn storage lane (approx. 45m) in the PM peak under Scenario 1 (141m queue).
- The intersection performs at LoS D and 0.989 degree of saturation in the PM peak under Scenario 1.

Based on the above operational deficiencies, it is identified that the intersection controls are required to be upgraded to improve network reliability and safety. The signalisation of the Forest Road / Durham Street intersection would help to improve safety, reduce for right turn movements, and at the same time, improve pedestrian access across Forest Road and Durham Street.

A preliminary appraisal using SIDRA indicates that the signalisation of this intersection with allowance for most movements would operate with a satisfactory LoS in both the AM and PM peak periods (refer to Section 6.10 for further details).

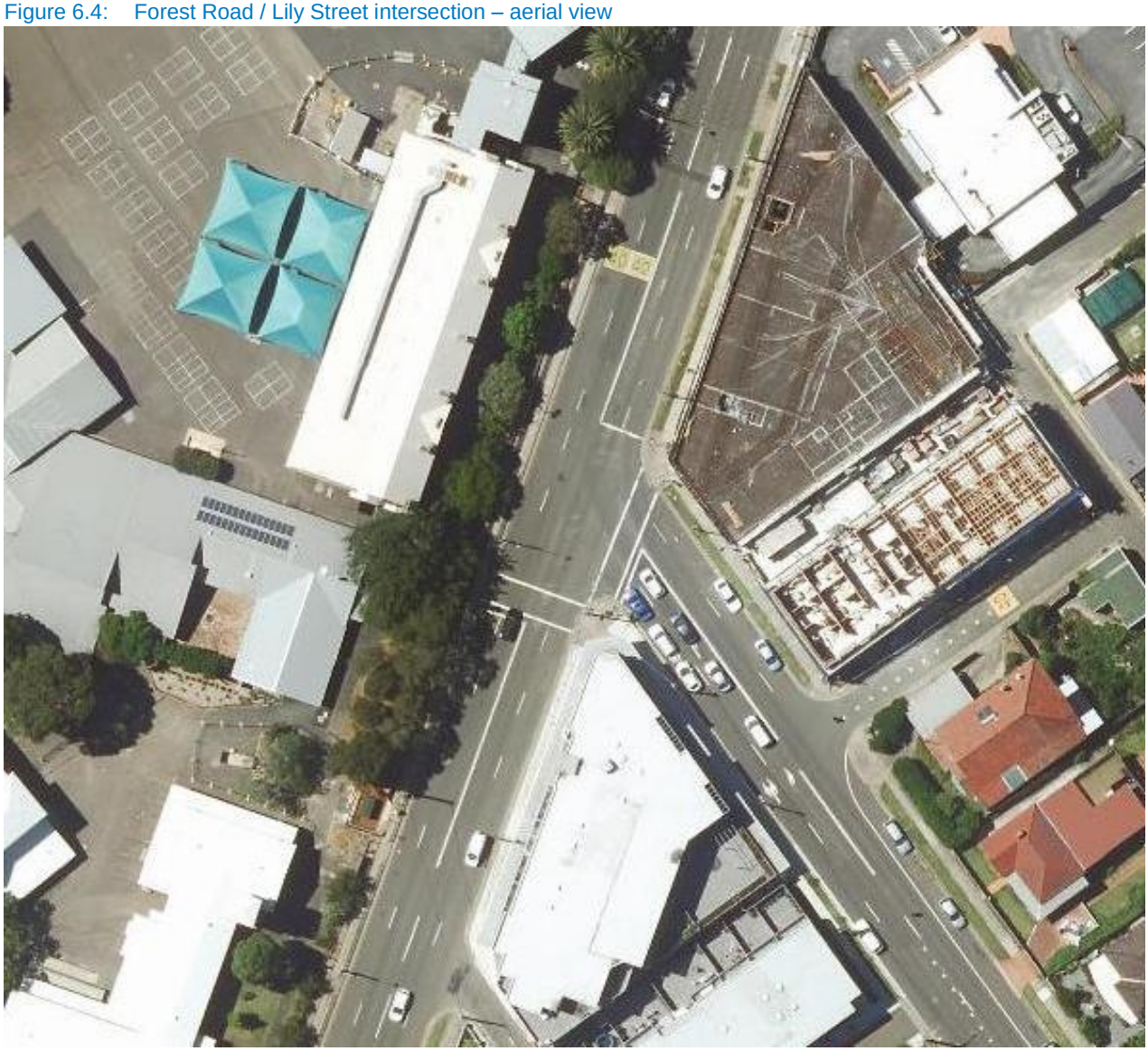
### 6.9.2 Forest Road / Lily Street Intersection

The Forest Road / Lily Street intersection provides a gateway into the Hurstville City Centre and is located north-east of the subject site. It caters for north / south traffic, with Lily Street providing a crossing point of the railway line.

Significant pedestrian movement was observed to travel through the intersection (particularly in the AM peak hour with over 400 people movement recorded between 8:00AM and 9:00AM), primarily associated with the desire lines between educational land use located directly north of the site and school catchment areas along Lily Street and to the south of the rail line or Allawah rail station.

An aerial view of the existing intersection configuration is shown in Figure 6.4, with the SIDRA intersection layout shown in Figure 6.5.

Figure 6.4: Forest Road / Lily Street intersection – aerial view



Source: https://maps.six.nsw.gov.au/

Figure 6.5: Forest Road / Lily Street intersection – SIDRA layout AM

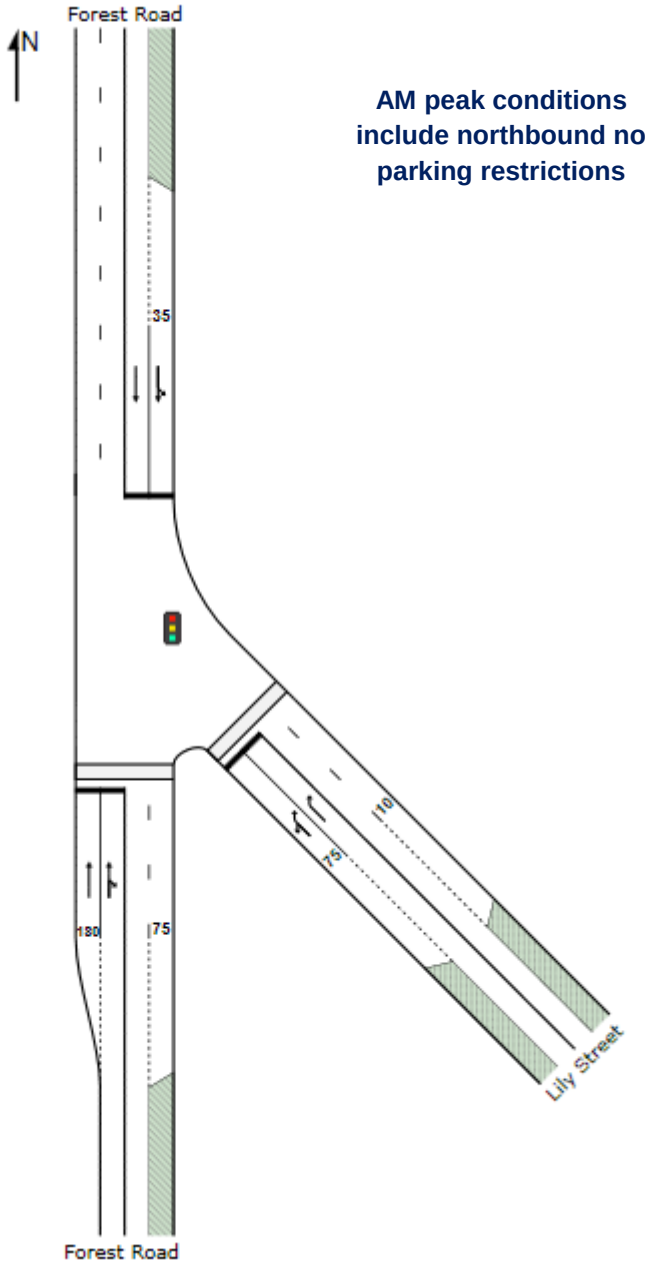
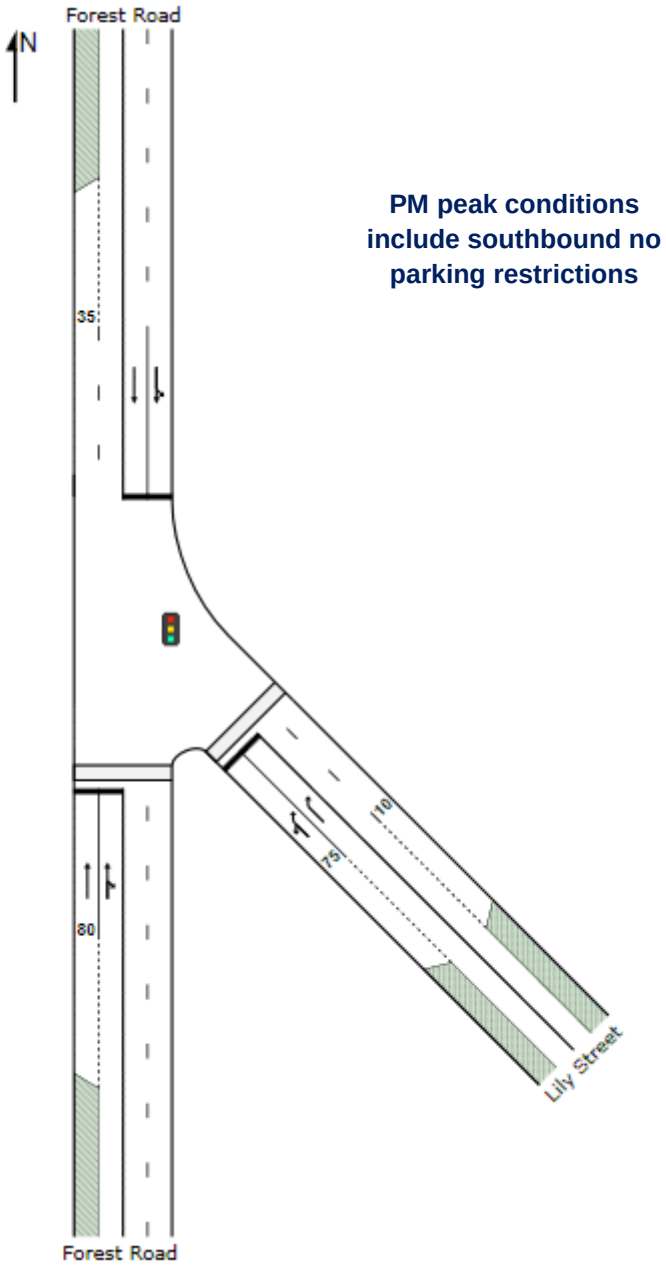


Figure 6.6: Forest Road / Lily Street intersection – SIDRA layout PM




**PM peak conditions include southbound no parking restrictions**

Table 6.9 provides the SIDRA performance results for each modelled scenario (as described in Section 6.1).

Table 6.9: Forest Road / Lily Street intersection –SIDRA results

| AM Peak | | | | PM Peak | | | |
|---|---|---|---|---|---|---|---|
| LoS | Degree of Saturation | Average Delay (secs) | 95% Back of Queue (m) | LoS | Degree of Saturation | Average Delay (secs) | 95% Back of Queue (m) |
| Existing Conditions | | | | | | | |
| A | .689 | 14.1 | 63 (Lily Street south-east/ Forest Road north) | A | 0.734 | 12.4 | 68 (Lily Street south-east) |
| Scenario 1 – Without Landmark Square | | | | | | | |
| A | 0.739 | 14.2 | 92 (Forest Road north) | A | 0.718 | 14.5 | 90 (Forest Road north) |

The assessment indicates the following:

- The intersection performs at a very similar level of performance under Scenario 1 compared to the existing scenario, with no change in Level of Service (LoS).
- The critical movements were observed to be turning movements from Lily Street and through movements from Forest Road (north) in both the AM and PM peaks.

From a traffic operation perspective, no intersection upgrade is required at this intersection under existing or future operating conditions.

### 6.9.3 Durham Street / Lily Street Intersection

The Lily Street / Durham Street intersection connects residential catchments to the east with the Hurstville City Centre and offers access between Forest Road and areas to the south of the rail line.

The intersection is a four way signalised intersection that allows all movements with signalised pedestrian crossings on each approach and is situated to the south-east of the subject site. The intersection is configured with four traffic lanes on all approaches with the capacity of the kerbside lane restricted by kerbside parking in each direction.

Significant pedestrian movement was also observed at the Forest Road / Lily Street intersection with 180 people movement recorded in the AM peak hour and 50 in PM peak hour.

An aerial view of the existing intersection configuration is shown in Figure 6.7, with the SIDRA intersection layout shown in Figure 6.8.

Figure 6.7: Durham Street / Lily Street intersection – aerial view

Source: https://maps.six.nsw.gov.au/

Figure 6.8: Durham Street / Lily Street Intersection - SIDRA layout

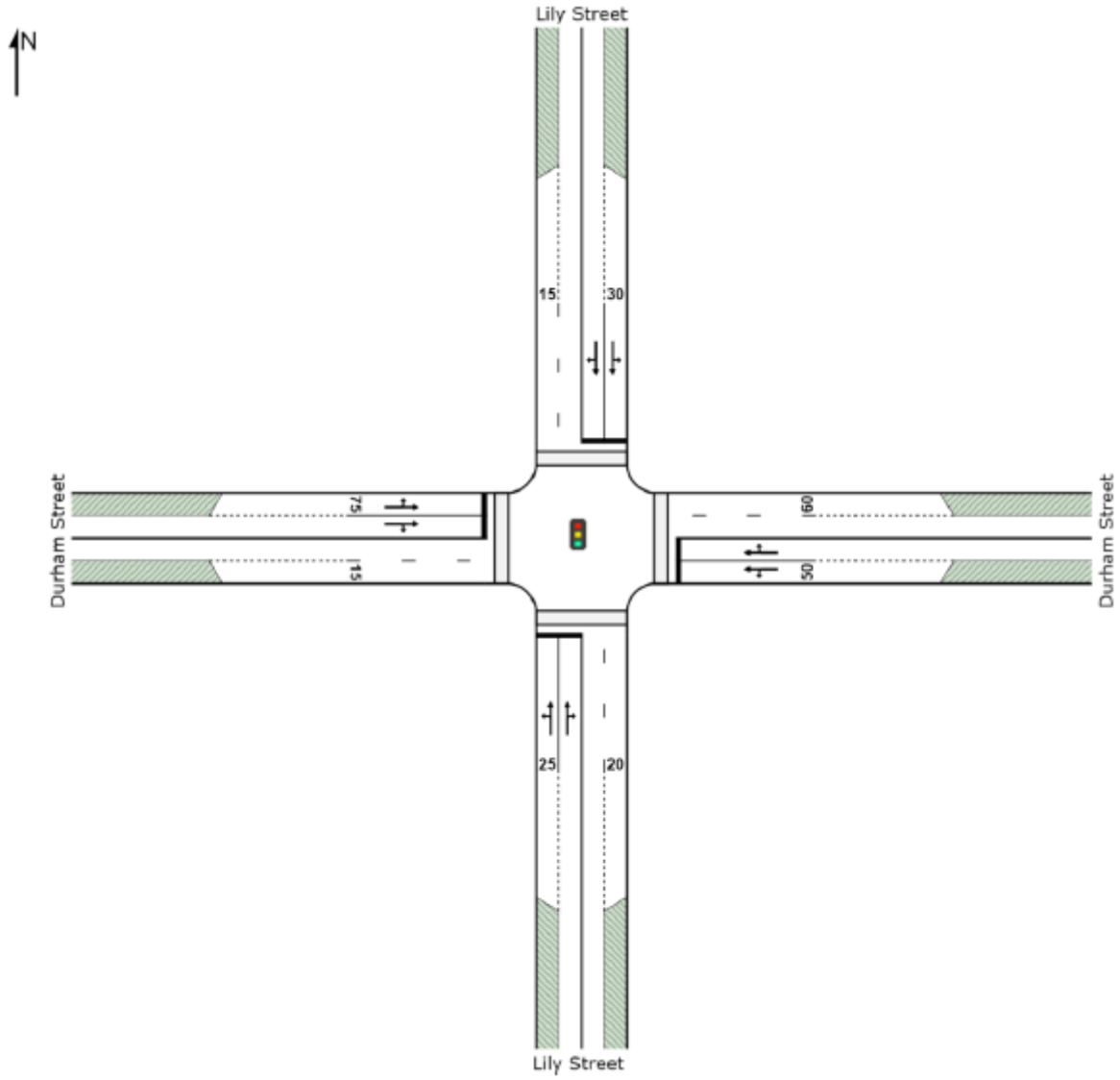


Table 6.10 provides the SIDRA performance results for each modelled scenario (as described in Section 6.1).

Table 6.10: Durham Street / Lily Street intersection –SIDRA results

| AM Peak | | | | PM Peak | | | |
|---|---|---|---|---|---|---|---|
| LoS | Degree of Saturation | Average Delay (secs) | 95% Back of Queue (m) | LoS | Degree of Saturation | Average Delay (secs) | 95% Back of Queue (m) |
| Existing Conditions | | | | | | | |
| B | 0.934 | 23.8 | 171 (Lily Street south) | B | 0.796 | 18.3 | 98 (Lily Street south) |
| Scenario 1 – Without Landmark Square | | | | | | | |
| C | 0.977 | 31.3 | 217 (Lily Street south) | B | 0.858 | 21.4 | 110 (Lily Street south) |

The assessment indicates the following:

- The intersection performs satisfactorily under Scenario 1, with some increases in delay and a change in Level of Service (LoS) from B to C in the AM peak.
- The critical movement in both the AM and PM peak period was the Lily Street southern approach with queues extending to 217m in the AM, which is an increase of 46m from the existing situation.

### 6.9.4 Durham Street / Roberts Lane Intersection

The Durham Street / Roberts Lane intersection primarily provides a local residential and commercial vehicle access route to the regional road network from properties situated on the western side of Lily Street and existing commercial properties situated in the proposed Landmark Square site. Roberts Lane is a one-way road that allows traffic to travel southbound to Durham Street and commuter parking areas situated near Kempt Field or Allawah rail station interchange / car park.

Roberts Lane northern approach is controlled by give-way conditions at the intersection with Durham Street. An aerial view of the existing intersection configuration is shown in Figure 6.9, with the SIDRA intersection layout shown in Figure 6.10.

Figure 6.9: Durham Street / Roberts Lane intersection – aerial view

Source: Source: https://maps.six.nsw.gov.au/

Figure 6.10: Durham Street / Robert Lane – SIDRA layout

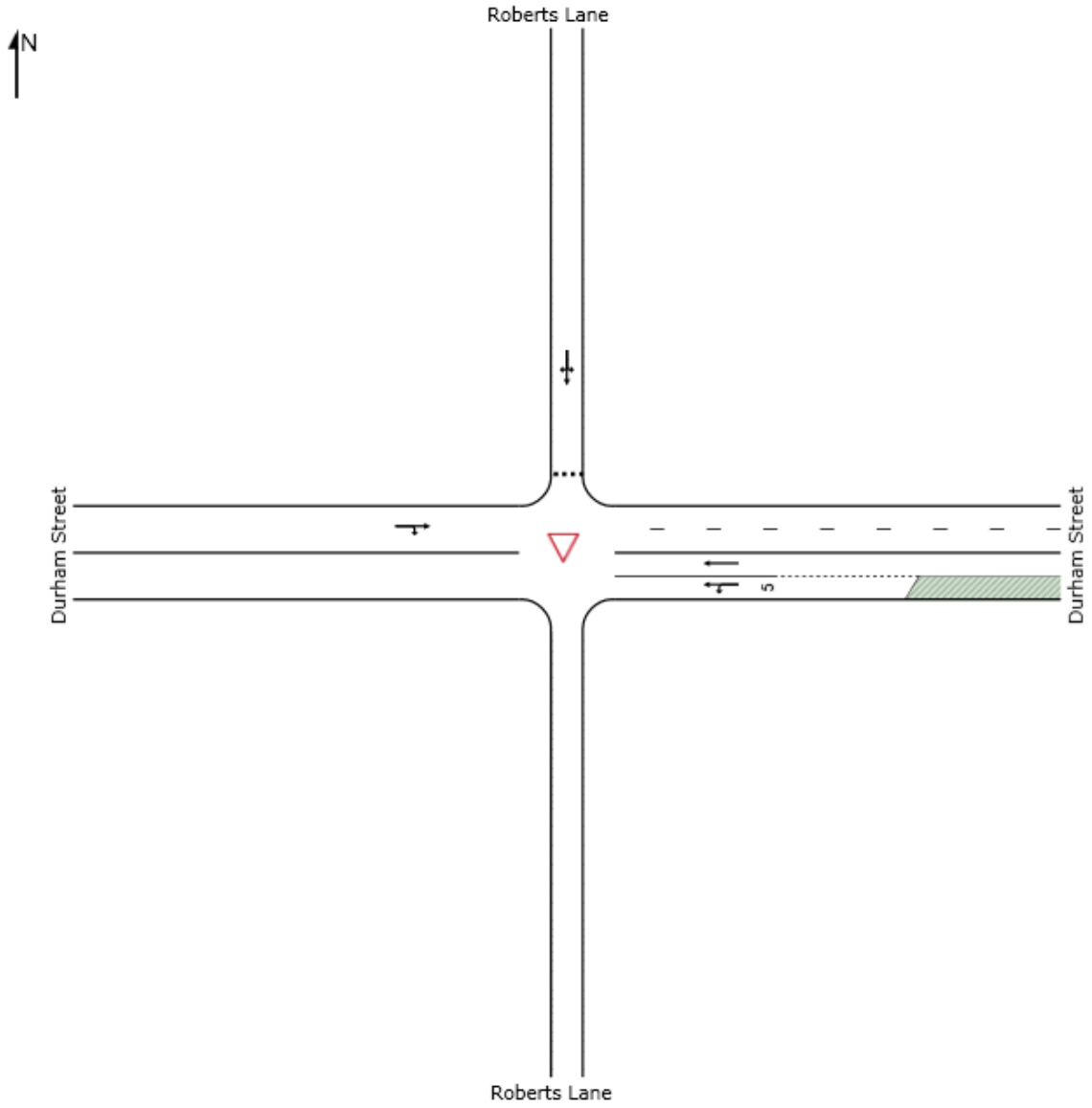


Table 6.11 provides the SIDRA performance results for each modelled scenario (as described in Section 6.1).

Table 6.11: Durham Street / Roberts Lane –SIDRA results

| AM Peak | | | | PM Peak | | | |
|---|---|---|---|---|---|---|---|
| LoS * | Degree of Saturation * | Average Delay (secs) * | 95% Back of Queue (m) * | LoS (worst movement) | Degree of Saturation * | Average Delay (secs) * | 95% Back of Queue (m) * |
| Existing Conditions | | | | | | | |
| A | 0.237 | 13.3 (north approach) | 15 (Durham Street west) | A | 0.209 | 13.3 (north approach) | 15 (Durham Street west) |
| Scenario 1 – Without Landmark Square | | | | | | | |
| B | 0.292 | 17.7 (north approach) | 20 (Durham Street west) | B | 0.313 | 25.9 (north approach) | 30 (Durham Street west) |

The assessment indicates that the intersection performs satisfactory under both existing and future conditions. The critical movement is identified to be the right turn movement from Durham Street (west) into Roberts Lane (south.

### 6.9.5 Scenario 1 Summary

The comparison of intersection operating conditions under existing conditions and scenario 1 future conditions assessment (without Landmark Square) highlighted the following:

- A slight reduction in operating conditions at the Forest Road/Lily Street, Durham Street/Lily Street and Durham Street/Roberts Lane intersections, however LoS is not impacted and queues are contained within the allocated storage areas.
- Capacity constraints were identified at the intersection of Forest Road/Durham Street/Wright Street with the critical movement identified to be the right turn from Forest Road (south-west) into Durham Street.
  - Queuing was identified to overspill the existing right turn facility and extend up to 141m.
  - This queuing will impact on through traffic travelling along Forest Road and results in the intersection operating at a LoS D and a degree of saturation of 0.99.
- Lily Street / Forest Road intersection was identified to operate close to capacity with a recorded degree of saturation of over 0.95 in the future conditions assessment without the inclusion of Landmark Square.
  - The operation of this intersection is impacted by kerbside parking resulting in extensive queuing, which can be better managed through banning of kerbside parking during peak periods (refer to Section 6.10 for further details).

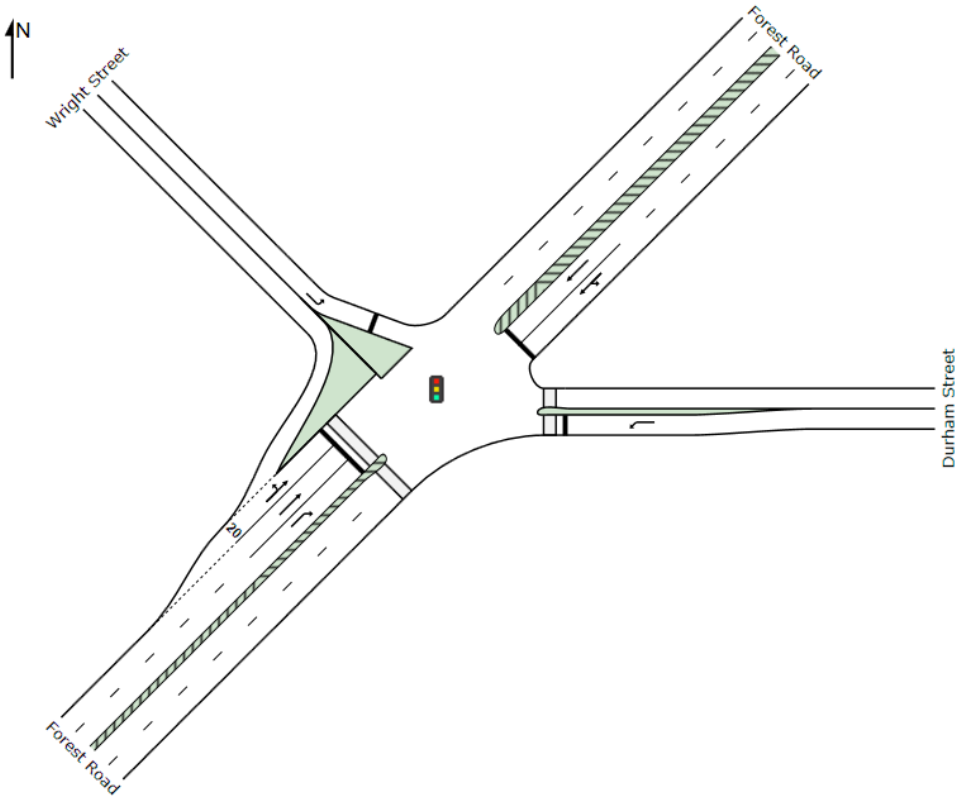
## 6.10 Scenario 2 Appraisal – Future Conditions With Landmark Square

This section compares and summarises SIDRA modelling outputs for Scenario 1 (future conditions without Landmark Square) and Scenario 2 (future conditions with Landmark Square) intersection operating conditions and builds on the information presented in section 6.9. The information presented below is supported by detailed model outputs contained in Appendix D.

### 6.10.1 Forest Road / Durham Street / Wright Street Intersection

Scenario 2 was modelled with traffic signals (identified to be required in section 6.9.1) and the configuration recommended in the GHD Traffic Impact Assessment. The SIDRA layout has been designed with a signalised left turn slip lane from both Durham Street and Wright Street to Forest Road. The Forest Road southern approach is also configured with a designated right turn lane and an additional short through lane to cater for increased through movement along Forest Road under future operating conditions. Refer to Figure 6.11 for the proposed intersection layout with traffic signals.

Figure 6.11: Forest Road / Durham Street / Wright Street intersection– Future SIDRA layout



It additional to the recommendation mentioned in the GHD Traffic Impact Assessment, it is noted that the signalisation of this intersection offers the opportunity to improve the operation of the intersection by introducing an additional right turn movement from Durham Street into Forest Road. To understand the impact from this change an alternative SIDRA model was developed and was used to investigate the possibility for all Landmark Square traffic to access the site via either Durham Street and Roberts Lane as highlighted in section 2.3. This scenario assumes that both East Quarter and Landmark Square traffic previously using Lily Street to travel north would adjust and be instead accommodated via the new right turn. Refer to Appendix C and Appendix D to understand the quantum of traffic that was assumed to be diverted to Forest Road.

Refer to Figure 6.12 for the alternative layout.

Figure 6.12: Forest Road / Durham Street / Wright Street intersection– Future SIDRA layout (right turns on east)

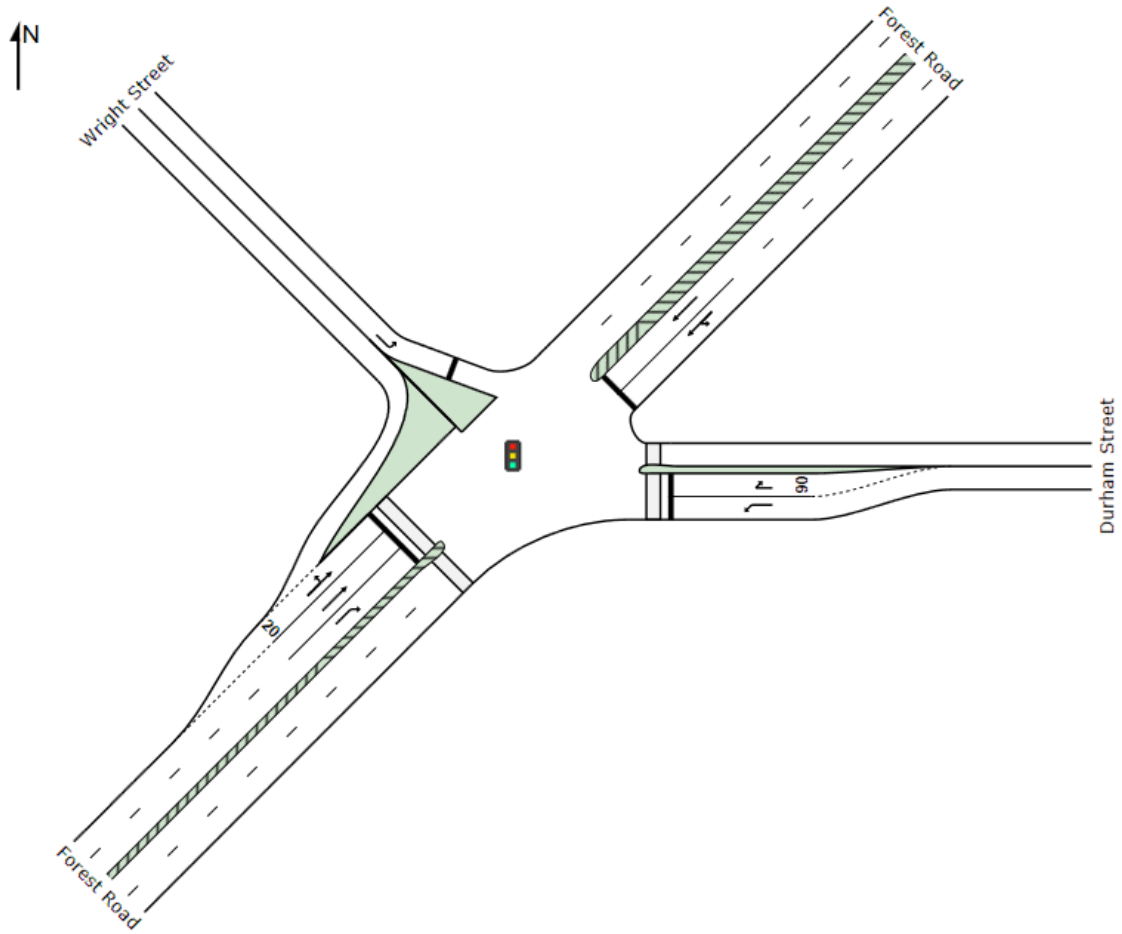


Table 6.12 provides the SIDRA performance results for Scenarios 1 and 2 and the alternative all movement intersection movement option as described in Section 6.1.

Table 6.12: Forest Road / Durham Street / Wright Street – Future Conditions With and Without Appraisal

| AM Peak | | | | PM Peak | | | |
|---|---|---|---|---|---|---|---|
| LoS * | Degree of Saturation * | Average Delay (secs) * | 95% Back of Queue (m) * | LoS (worst movement) | Degree of Saturation * | Average Delay (secs) * | 95% Back of Queue (m) * |
| Future Conditions Scenario 1 – Without Landmark Square (Priority Control) | | | | | | | |
| A | 0.697 | 13.0 | 41 | D | 0.989 | 51.7 | 141 (Forest Road |
| Future Conditions Scenario 2 - With Landmark Square (Signalised) | | | | | | | |
| B | 0.711 | 22.9 | 145 (Durham Street East) | B | 0.787 | 24.1 | 190 (Durham Street East) |
| Future Conditions Scenario 2 – With Landmark Square (Signalised) - Alternative Option With Right Turn Permitted from Durham to Forest Rd | | | | | | | |
| B | 0.726 | 25.2 | 150 (Durham Street East) | C | 0.820 | 29.1 | 195 (Durham Street East) |

The assessment indicates the following:

- Introduction of a signalised intersection would improve safety and operating conditions at the intersection.
- The signalisation of this intersection will improve pedestrian safety and provide a controlled crossing point across both Durham Street and Forest Road.
- SIDRA modelling indicates that a signalised intersection can permit right turn movements between Durham Street and Forest Road and operate with a satisfactory LoS in both AM and PM peak periods under scenario 2 traffic conditions.
- The inclusion of Landmark Square traffic does not impact on the operational performance of this intersection.

### 6.10.2 Lily Street / Forest Road

Table 6.13 provides the SIDRA performance results for the above intersection under Scenarios 1 (future conditions without Landmark Square) and Scenario 2 (future conditions with Landmark Square).

Table 6.13: Forest Road / Lily Street intersection – Future Conditions With and Without Appraisal

| AM Peak | | | | PM Peak | | | |
|---|---|---|---|---|---|---|---|
| LoS | Degree of Saturation | Average Delay (secs) | 95% Back of Queue (m) | LoS | Degree of Saturation | Average Delay (secs) | 95% Back of Queue (m) |
| Future Conditions Scenario 1 – Without Landmark Square | | | | | | | |
| A | 0.739 | 14.2 | 92 (Forest Road north) | A | 0.718 | 14.5 | 90 (Forest Road north) |
| Future Conditions Scenario 2 - With Landmark Square | | | | | | | |
| B | 0.796 | 15.0 | 95 (Forest Road north) | B | 0.728 | 17.6 | 130 (Forest Road north) |

The assessment indicates the following:

- The intersection performs satisfactory under both future conditions modelling scenarios with minor changes in delay and Level of Service (LoS) from A to B.
- The inclusion of Landmark Square traffic does not impact on the operational performance of this intersection.

### 6.10.3 Durham / Lily St

Scenario 1 indicated that the operating capacity and queuing at the intersection could be better managed through banning of kerbside parking during peak periods on the Lily Street southern approach. The proposed parking arrangements are shown in Figure 6.13 and the proposed future layout is consistent with findings shown in the GHD Traffic Impact Assessment.

Figure 6.13: Durham St/ Lily St Intersection –Future SIDRA layout (with expanding kerbside parking restriction)

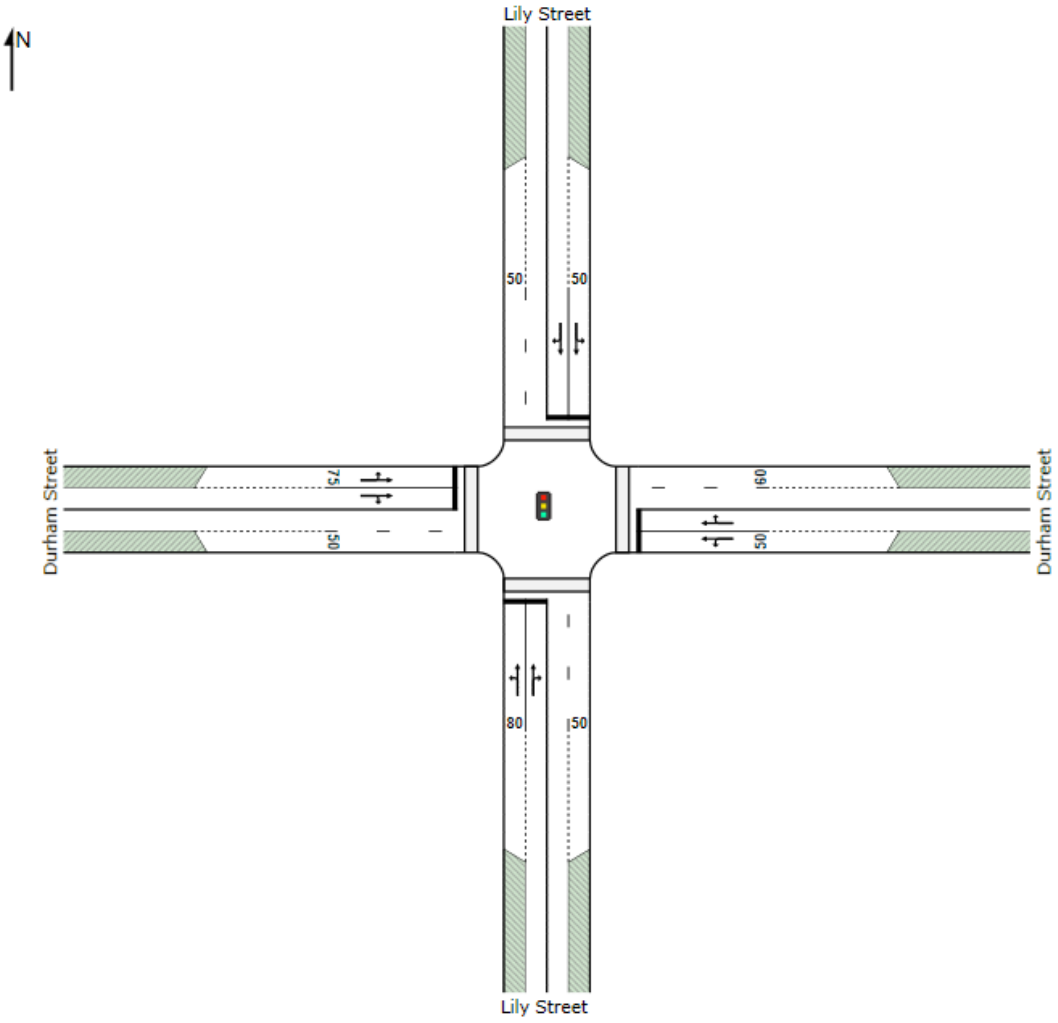


Table 6.14 provides the SIDRA performance results for the above intersection under Scenarios 1 (future conditions without Landmark Square) and Scenario 2 (future conditions with Landmark Square).

Table 6.14: Durham Street / Lily Street intersection – Future Conditions With and Without Appraisal

| AM Peak | | | | PM Peak | | | |
|---|---|---|---|---|---|---|---|
| LoS | Degree of Saturation | Average Delay (secs) | 95% Back of Queue (m) | LoS | Degree of Saturation | Average Delay (secs) | 95% Back of Queue (m) |
| Future Conditions Scenario 1 – Without Landmark Square | | | | | | | |
| C | 0.977 | 31.3 | 217 (Lily Street south) | B | 0.858 | 21.4 | 110 (Lily Street south) |
| Future Conditions Scenario 2 – With Landmark Square | | | | | | | |
| B | 0.942 | 28.8 | 215 (Lily Street south) | B | 0.790 | 19.4 | 105 (Lily Street south) |

The assessment indicates the following:

- That with the proposed intersection amendments (expansion of kerbside parking restrictions during peak periods) and inclusion of the proposed Landmark Square traffic the operation of the intersection improves slightly from the operating conditions displayed under scenario 1.
- The inclusion of Landmark Square traffic does not impact on the operational performance of this intersection.

### 6.10.4 Durham Street / Roberts Lane

Table 6.15 provides the SIDRA performance results for the above intersection under Scenarios 1 (future conditions without Landmark Square) and Scenario 2 (future conditions with Landmark Square).

Table 6.15: Durham Street / Roberts Lane intersection – Scenario 2 SIDRA results

| AM Peak | | | | PM Peak | | | |
|---|---|---|---|---|---|---|---|
| LoS * | Degree of Saturation * | Average Delay (secs) * | 95% Back of Queue (m) * | LoS (worst movement) | Degree of Saturation * | Average Delay (secs) * | 95% Back of Queue (m) * |
| Future Conditions Scenario 1 – Without Landmark Square | | | | | | | |
| B | 0.292 | 17.7 (north approach) | 20 (Durham Street west) | B | 0.313 | 25.9 (north approach) | 30 (Durham Street west) |
| Future Conditions Scenario 2 – With Landmark Square | | | | | | | |
| A | 0.308 | 16.1 (north approach) | 25 (Durham Street west) | A | 0.326 | 25.5 (north approach) | 35 (Durham Street west) |

The assessment indicates the following:

- The modelled operating conditions under scenarios 1 and 2 are similar and in both cases all movements perform satisfactory.
- The inclusion of Landmark Square traffic does not impact on the operational performance of this intersection.

### 6.10.5 Scenario 2 Summary

Table 6.18 provides a summary of the performance of all key intersections under all modelled scenarios and includes:

- Ex – Existing AM and PM peak operation conditions
- 1 – Future conditions without Landmark Square.
- 2 – Future conditions with Landmark Square and the signalisation of Forest Road and Durham Street and expansion of kerbside parking restrictions along Lily Street.
- 2a – Future conditions with Landmark Square and the signalisation of Forest Road and Durham Street with a right turn movement from Durham Street to Forest Road.

Table 6.16: SIDRA result comparison

| Intersection | | | Scenario | | | |
|---|---|---|---|---|---|---|
| | | | Ex | 1 | 2 | 2a |
| Forest Road /Durham Street/Wright Street | AM | LoS | A | A | B | B |
| | | DoS | 0.504 | 0.697 | 0.711 | 0.726 |
| | | Delay | 7.9 | 13 | 22.9 | 25.2 |
| | PM | LoS | A | D | B | C |
| | | DoS | 0.613 | 0.989 | 0.787 | 0.82 |
| | | Delay | 11.8 | 51.7 | 24.1 | 29.1 |
| Forest Road/Lily Street | AM | LoS | A | A | B | |
| | | DoS | 0.689 | 0.739 | 0.796 | |
| | | Delay | 14.1 | 14.2 | 15 | |
| | PM | LoS | A | A | B | |
| | | DoS | 0.667 | 0.718 | 0.728 | |
| | | Delay | 12.2 | 14.5 | 17.6 | |
| Durham Street/Lily Street | AM | LoS | B | C | C | |
| | | DoS | 0.934 | 0.977 | 0.942 | |
| | | Delay | 23.8 | 31.3 | 28.8 | |
| | PM | LoS | B | B | B | |
| | | DoS | 0.796 | 0.858 | 0.79 | |
| | | Delay | 18.3 | 21.4 | 19.4 | |
| Durham Street/Roberts Lane | AM | LoS | A | B | B | |
| | | DoS | 0.237 | 0.292 | 0.308 | |
| | | Delay | 13.6 | 18.1 | 16.3 | |
| | PM | LoS | A | B | B | |
| | | DoS | 0.209 | 0.313 | 0.326 | |
| | | Delay | 13.4 | 25.9 | 25.6 | |

The comparison of intersection operating conditions under scenario 1 future conditions assessment (without Landmark Square) and scenario 2 future conditions assessment (with Landmark Square) highlighted the following:

- The external road network can cater for future traffic generated by all proposed future developments in and around the eastern section of the Hurstville CBD.
- The signalisation of the intersection of Forest Road / Durham Street / Wright Street and extension of peak period kerbside parking restrictions at the intersection of Lily Street / Durham Street benefits the operation of the network and supports the proposed future development of land parcels in and around the eastern section of the Hurstville CBD.
- The proposed rezoning of Landmark Square from low density uses into a high density mixed use development will not impact on the operating performance of the external road network.

## 6.11 Traffic Growth and Contribution

Table 6.16 identifies the estimated percentage increase in traffic at key intersections from 2014 traffic conditions (existing conditions) that resulted from the inclusion of the five proposed developments identified in section 6.1 and Table 6.17.

Table 6.17: Total Percentage Increase In Traffic At Key Intersections

| Intersection | % Increase in Traffic from Existing to Future | |
|---|---|---|
| | AM | PM |
| **Lily Street/ Forest Road** | 24% | 33% |
| **Durham/Wright Road/ Forest Road** | 25% | 36% |
| **Durham St/Roberts Lane** | 27% | 52% |
| **Durham Street / Lily Street** | 13% | 27% |

To accommodate this increase estimated increases in traffic it is proposed to signalise the intersection of Forest Road / Durham Street / Wright Street and extend peak period kerbside parking restriction at the intersection of Lily Street / Durham Street.

It is anticipated that all future developments that generate additional traffic at these intersections will be required to contribution to the proposed upgrades. Table 6.17 provides an understanding of the anticipated traffic growth resulting from each of the proposed developments identified in the GHD traffic report.

Table 6.18: Estimated Percentage Increase In Traffic For Each Proposed Future Development

| Intersection | 1-5 Treacy St | | 21-35 Treacy Street | | East Quarter | | 108 Forest Road | | Landmark Square (Inc. Site B) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | AM | PM | AM | PM | AM | PM | AM | PM | AM | PM |
| **Lily Street/ Forest Road** | 8% | 3% | 13% | 11% | 18% | 27% | 43% | 32% | 19% | 27% |
| **Durham/Wright Road/ Forest Road** | 7% | 3% | 11% | 9% | 24% | 43% | 39% | 27% | 19% | 18% |
| **Durham St/Roberts Lane** | 0% | 0% | 0% | 0% | 77% | 91% | 0% | 0% | 23% | 9% |
| **Durham Street / Lily Street** | 0% | 0% | 0% | 0% | 73% | 86% | 0% | 0% | 27% | 14% |

## 6.12 Event Traffic Management

The Site A proposal includes an outdoor plaza area along the frontage to Forest Road. This area will be developed to cater for various minor, small scale community or private recreational events. While it is anticipated that these small scale community events will be contained on the subject site, the following should be considered from a traffic management perspective:

- That all events should be planned to outside of normal AM and PM weekday peak periods and restricted when possible to evening or on weekends.
- Car parking for events should be planned to be accommodated on site (i.e. outside of peak retail operating hours) within the planned basement parking area and overflow to existing surrounding kerbside and commuter parking facilities should be restricted and only maximised at weekends.
- It is anticipated that a large percentage of people attending these events will be from the local area and parking arrangements should encourage walking and discourage excessive private vehicle usage.
- Existing footpath access from public transport is considered sufficient and will be maintained following completion of the development.

It is not anticipated that proposed events within site A will have an impact on operation of the external road network, and as a result it is not anticipated that road closures, reduced speed limits, changes to existing access or parking restrictions will be required. This will be confirmed as part of further analysis that will be completed as part of the DA stage.

## 6.13 Construction Traffic Management

The management of construction will be analysed during the DA stage once the staging of the proposed development is better understood. The approach taken during construction should consist of the following management principles and planning responsibilities.

### 6.13.1 Construction Traffic Management Principles

The implications from constructing the Landmark Square Precinct has been undertaken at a high level and is likely to consist of the construction traffic management principles:

- Access to the site is recommended via Durham Street (an existing construction access for East Quarter is also located along Durham Street).
- Construction deliveries are also recommended via Durham Street with access to Roberts Lane restricted.
- Impact from construction workers parking on-street will be minimised through the site offering the opportunity to cycle or travel by public transport, which will be encouraged during the construction period for the site.
- Construction will be contained within the site during the majority of the construction period and its impact on the surrounding road network and pedestrian footpaths will be minimised through appropriate traffic control measures.
- Continued pedestrian access via Forest Road and Durham Street shall be maintained when possible during the construction period.
- Planned works that impact on the surrounding road system will be controlled to minimise its impact on commuter peak periods.
- Appropriate traffic control, advanced warning and alternative routes will be presented in the construction traffic management plan and implemented to manage the impact on pedestrian and vehicular movement.

### 6.13.2 Construction Traffic Management Plan (Developer / Contractor)

A detailed construction traffic management plan will be produced as part for the detailed planning of the site and is the responsibility of the preferred contractor. This plan will aim to manage the following:

- Construction worker vehicle parking.
- Construction plant and material deliveries and storage.
- Site entry, access routes, and kerbside occupation.
- Pedestrian access.
- Its impact on Forest Road, Lily Street and Durham Street during weekday commuter peak periods.

To help demonstrate how the above potential impacts are managed this plan will identify the following:

- Construction timeframe and construction staging.
- Number of workers and the critical construction periods.
- Construction parking requirements and information that will be supplied to workers to help them access the site by alternative travel modes.
- Number of deliveries (including type of vehicle) to on-site or offsite storage areas and construction traffic routes.
- Road or footpath occupation needs and traffic management plans.
- Traffic control requirements, signage and plans including kerbside parking changes.
- Management structure, approval process and communication protocols.

# 7 Key Findings, Recommendations and Next Steps

## 7.1 Key Findings

The following key findings have been identified as part of this study:

- **Rezoning application for the Landmark Square Precinct –** The proposal is for the rezoning of a site currently zoned for low density light industrial uses to allow high density mixed use, incorporating residential, retail, hotel, restaurant, childcare, commercial office and community land uses.
- **TMAP planning principles** – The proposed rezoning of the site known as Landmark Square Precinct aligns with relevant planning principles set by the Hurstville City Centre TMAP and includes:
  - Does not impact on the potential future growth of the city centre commercial core, which is reserved to accommodate the majority of planned increases in employment within Hurstville LGA
  - Promotes and supports use of public and active transport modes for travel and helps the city centre achieve the recommended mode share targets
  - Aligns and is able to adopt travel demand measures via reduced parking provision and the inclusion of cycling facilities, which will help manage car generated travel demand from the site and its impact on the surrounding city centre road network
- **Accessibility** – The site is located on the edge of the Hurstville City Centre and offers good levels of access to retail, community facilities, educational services, public transport and recreation facilities, including Kempt Field and Allawah Railway Station.
- **Traffic generation** – traffic generation is minimised through the adoption of a high density mixed use (predominantly residential) development in proximity of Hurstville City Centre and strategic high quality transport nodes.
- **Parking provision** –The site is located within the Eastern Bookend Precinct and supports the adoption of new lower parking provision rates set within the draft DCP No.2.

### Development Requirements

- **Off-street parking supply** – Based on the parking rates specified within Draft DCP No. 2, parking for both Site A and Site B should comprise of 581 off street car parking spaces.
- **Off-street parking design** – All off-street car parking will be designed in accordance with Council DCP and Australian Standards at the DA stage.
- **Cycling provision** - The bicycle parking rates specified Draft DCP No. 2 has been adopted with a proposed bicycle parking allocation for both Site A and Site B of 103 resident bicycle spaces, 11 retail bicycle spaces and 2 commercial bicycle spaces. The location of a secure accessible area together with end of trip facilities will be provided at the DA stage.
- **Development access** – Development access is proposed via Forest Road (hotel, retail and restaurant in / out), Durham Street (residential, in / out and loading dock out) and Roberts Lane (loading in and residential exit). An option to restrict access to the proposed Landmark Square site to Durham Street and Roberts Lane and encourage access to the external network via the proposed signalised intersection at Forest Road / Durham Street / Wright Street was reviewed and confirmed to be viable. Access points will be designed to minimise conflict, improve safety and legibility, and maximise internal circulation.
- **Development access design –** All access points will be designed in accordance with Australian Standards and the final location of access points will be determined at the DA stage.

- **Safety, access and on-street parking** – The consolidation of access points along both Durham Street and Forest Road will provide for the inclusion of additional time controlled on-street parking provision. It will also formalise access to the precinct and ensure that access points are controlled and legible for all users of the surrounding transport network. The consolidation of access points will also help to reduce the number of existing conflict points for pedestrians and cyclists.

### Traffic Impact

- **Traffic generation** - The estimated traffic generation for the proposed rezoning of the site for the Landmark Square Precinct consists of:
  - 178 trips (82 inbound and 96 outbound) in the AM for Site A
  - 258 trips (167 inbound and 91 outbound) in the PM for Site A
  - 34 trips (22 inbound and 12 outbound) in the AM for Site B
  - 44 trips (21 inbound and 23 outbound) in the PM for Site B
- **Network performance** – The SIDRA assessment for scenario 1 has identified similar network capacity constraints to that identified in the GHD Traffic Impact Assessment for the Hurstville CBD. This is confirmed to occur at the intersections of Forest Road / Durham Street / Wright Street and Lily Street / Durham Street. To accommodate traffic generated by future developments in the Hurstville CBD and the proposed rezoning of Landmark Square it was identified that control and operational upgrades are required at these intersections.
- The SIDRA modelling for scenario 2 indicates that all intersections performed satisfactory once the intersection of Forest Road / Durham Street / Wright Street is signalised and modifications to on-street parking arrangements at the Lily Street / Durham Street intersection are implemented.
- The assessment indicated that all proposed future developments in the eastern section of Hurstville CBD, including Landmark Square can be accommodated.
- It is anticipated that all future developments should contribute to road network upgrades surrounding the Hurstville CBD.

## 7.2 Recommendations

The following key recommendations have been identified as part of this study:

- **Car parking provision** – The development will adopt the Draft DCP No. 2 parking rate provision for commercial and residential parking and consider further reductions through the accommodation on site of a car sharing scheme and time sharing of allocated parking spaces during the DA stage.
- **Pedestrian walkways** – The surrounding footpaths adjacent the subject site have the ability to cater for high pedestrian demand, and the future concept design for the proposed development will seek to retain and / or improve and offer suitable connections to surrounding areas.
- **End of trip cycle facilities** – the proposed development will provide both secure ground floor undercover bicycle parking for residential and retail land uses, together with end of trip facilities in accordance with the rates specified within Section 5.3.
- **Green travel plan** – Adoption of the green travel plan (refer to Section 4.6.5) and associated measures will be developed in full as part of the DA stage and should be adopted in the conditions of consent for the building to help manage travel demand. The adoption of the plan will help support and promote travel by alternatives modes of travel to the private vehicle.

- **Traffic management** – Building management and the owners of the hotel and retail / supermarket premises will be responsible for managing deliveries and garbage collection outside of commuter peak periods.
- **Network management** – Network conditions are currently impacted by queuing on Lily Street and it is understood that the scheme associated with the upgrade of Lily Street rail overbridge will consider restricting car parking during peak periods on Lily Street western kerb, to increase the length of the through / left turn lane for access into Durham Street and Lily Street north.
- **Potential network upgrades –** Further investigations to be undertaken at Forest Road / Durham Street intersection during the DA stage. This investigation will be focused towards improving safety, access and connectivity between the site and the surrounding area.
- **Site access** – A detailed intersection layout for site access points on Forest Road and Durham Street will be developed to support the DA stage of the project.
- **Access management** – Consider providing 'keep clear' marking on Durham Street at the intersection of Roberts Lane to reduce the possibility for cars queuing across the intersection and blocking exit from Roberts Lane during peak periods.
- **On-street parking** – Provision for x4 on-street parking bays on Durham Street and x4 on-street car parking bays on Forest Road with parking restrictions that encourage high turnover speciality retail use.
- **Construction traffic management plan** – The developer / contractor to produce a detailed construction traffic management plan and supporting construction stage traffic control plans for the entire construction period to address the construction management principles (refer to Section 6.11).

## 7.3 Next Steps

It is intended that this traffic impact assessment will be updated following the approval of site rezoning application. The following next steps are recommended to inform a future development application:

- Undertake a planning review relevant to access, sustainable transport, car parking and construction management to respond to the requirements set within Draft DCP No. 2.
- Update the traffic impact assessment to include a staging analysis (i.e. traffic generated by each stage).
- Review of vehicle access points design into / from the proposed development (subject to the staging analysis, assess turning traffic into the development to understand if remedial actions that are required on surrounding external roads, i.e. storage lanes).
- Review car park layout, loading bay design and on-site vehicle circulation in accordance with relevant Australia Standards (including a vehicle turn path analysis).
- Review on-site bicycle parking provision and location of pedestrian walkways / connections.
- Development of green travel plan and other travel demand management measures that will help support Hurstville City Council TMAP mode share objectives and targets.

# Appendices

# Appendix A. Proposed Development Yields

| Project: | "Landmark Square" 61-75 Forest Road & 126 Durham Street, HURSTVILLE | | | | Dickson Rothschild |
|---|---|---|---|---|---|
| Project No: | 14-121 | | | | |
| Date: | Mar-16 | | | | |
| | | PLANNING PROPOSAL | | | |
| | | Site A | Site B | 1A Hill Street | Toyota Site | East Quarter |
| **Site area (m²):** | | **10,276m²** | **Approx. 3,794m²** | 2634m² | 4,199m² | 28,100m² |
| | | | | | | |
| **Hurstville LEP 2012** | | | **PROPOSED CONTROLS** | | | |
| Existing Land use | IN2 Light Industrial | | B4 Mixed Use | B4 | B4 | B4 |
| Existing FSR | 1:1 | | | 4.18:1 | 6.78:1 | 2.63:1 |
| Existing GFA | 10,276m² | | | 11,010m² | 28,469m² | 73,903m² |
| Existing Height (m) | 10m | MI | | 45m | 55m | 56m |

Note: all amounts are approximate with a potential variance of up to 5%

| | Retail (sqm) | Commercial GFA (sqm) | Community GFA (sqm) | Childcare GFA (sqm) | Residential GFA (sqm) | Hotel GFA (sqm) | Hotel Rooms (No.) | Total Units (No.) | | | | Total Car Parking Spaces for Uses (No.) | Total Open Space Area (sqm) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Tower A (18 storeys) | Tower B (19 storeys) | Tower C (19 storeys) | Lower Scale Buildings (up to 7 storeys) | | |
| **Site A** | 3,150 | 0 | 0 | 641 | 25,753 | 9,674 | 150 | 81 | 107 | 85 | | 507 | 5,754 |
| **Site B** | 1,005 | 583 | 815 | 0 | 2,897 | 0 | 0 | | | | 35 | 74 | 357 |

| Project: | "Landmark Square" 61-75 Forest Road & 126 Durham Street, HURSTVILLE | | | **Dickson Rothschild** |
|---|---|---|---|---|
| Project No: | 14-121 | | | |
| Date: | Sep-15 | | | |
| | **PLANNING PROPOSAL** | | | |
| | **Site** | **1A Hill Street** | **Toyota Site** | **East Quarter** |
| **Site area (m²):** | **8,546m²** | 2634m² | 4,199m² | 28,100m² |
| **Hurstville LEP 2012** | **PROPOSED CONTROLS** | | | |
| Land use | IN2 Light Industrial | B4 Mixed Use | B4 | B4 | B4 |
| FSR | 1:1 | 4.18:1 | 6.78:1 | 2.63:1 |
| GFA | 8,546m² | 11,010m² | 28,469m² | 73,903m² |
| Height (m) | 10m | 45m | 55m | 56m |

Note: all amounts are approximate with a potential variance of up to 5%

| | | | | | | SITE A - LANDMARK SQUARE | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | BUILDING A | | | BUILDING B | | | BUILDING C | | | | |
| **Level** | **Retail GFA** | **Childcare GFA** | **Residential GFA** | **Hotel GFA** | **Hotel Rooms** | **1 Bdrm** | **2 Bdrm** | **3 Bdrm** | **1 Bdrm** | **2 Bdrm** | **3 Bdrm** | **1 Bdrm** | **2 Bdrm** | **3 Bdrm** | **Unit Totals** | **Car Parking spaces** |
| **Level 18** | | | 1,206 | | | | | | | 6 | 1 | | 3 | 2 | **12** | |
| **Level 17** | | | 1,206 | 364 | | | | | | 6 | 1 | | 3 | 2 | **12** | |
| **Level 16** | | | 1,206 | 792 | 13 | | | | | 6 | 1 | | 3 | 2 | **12** | |
| **Level 15** | | | 1,206 | 792 | 14 | | | | | 6 | 1 | | 3 | 2 | **12** | |
| **Level 14** | | | 1,206 | 792 | 14 | | | | | 6 | 1 | | 3 | 2 | **12** | |
| **Level 13** | | | 1,206 | 792 | 14 | | | | | 6 | 1 | | 3 | 2 | **12** | |
| **Level 12** | | | 1,206 | 792 | 14 | | | | | 6 | 1 | | 3 | 2 | **12** | |
| **Level 11** | | | 1,904 | | | 3 | 6 | | | 6 | 1 | | 3 | 2 | **21** | |
| **Level 10** | | | 1,904 | | | 3 | 6 | | | 6 | 1 | | 3 | 2 | **21** | |
| **Level 09** | | | 1,904 | | | 3 | 6 | | | 6 | 1 | | 3 | 2 | **21** | |
| **Level 08** | | | 1,904 | | | 3 | 6 | | | 6 | 1 | | 3 | 2 | **21** | |
| **Level 07** | | | 1,904 | | | 3 | 6 | | | 6 | 1 | | 3 | 2 | **21** | |
| **Level 06** | | | 1,904 | | | 3 | 6 | | | 6 | 1 | | 3 | 2 | **21** | |
| **Level 05** | | | 1,904 | | | 3 | 6 | | | 6 | 1 | | 3 | 2 | **21** | |
| **Level 04** | | | 1,904 | | | 3 | 6 | | | 6 | 1 | | 3 | 2 | **21** | |
| **Level 03** | | 585 | 1,451 | | | 3 | 6 | | | 1 | 1 | | 3 | 2 | **16** | |
| **Level 02** | | | 522 | 2,788 | 48 | | | | | | | | 3 | 2 | **5** | |
| **Level 01** | | | | 2,562 | 33 | | | | | | | | | | | |
| **Ground** | 1453 | 56 | 106 | | | | | | | | | | | | | 80 |
| **Lower Ground** | 1697 | | | 897 | | | | | | | | | | | | 250 |
| **Basement Level 1** | | | | | | | | | | | | | | | | 120 |
| **Basement Level 2** | | | | | | | | | | | | | | | | |
| **Basement Level 3** | | | | | | | | | | | | | | | | |
| **Total** | **3,150** | **641** | **25,753** | **9,674** | **150** | **27** | **54** | **0** | **0** | **91** | **16** | **0** | **51** | **34** | **273** | **450** |
| **Unit Mix** | | | | | | 9.9% | 19.8% | 0.0% | 0.0% | 33.3% | 5.9% | 0.0% | 18.7% | 12.5% | 100.0% | |
| **Total Rooms (Hotel & Res)** | | | **423** | | **TOTAL UNITS A:** | | | **81** | **TOTAL UNITS B:** | | **107** | **TOTAL UNITS C:** | | **85** | | |
| **Total GFA[1]** | | | **39,218** | | | | | | | | | | | | | |
| **FSR** | | | **4.6 :1** | | | | | | | | | | | | | |

## Notes

**Hurstville LEP 2012 - GFA Definition**

***1. Gross Floor Area*** means the sum of the floor area of each floor of a building measured from the internal face of external walls, or from the internal face of walls separating the building from any other building, measured at a height of 1.4 metres above the floor, and includes:

(a) the area of a mezzanine, and
(b) habitable rooms in a basement or an attic, and
(c) any shop, auditorium, cinema, and the like, in a basement or attic,
but excludes:
(d) any area for common vertical circulation, such as lifts and stairs, and
(e) any basement:
(i) storage, and
(ii) vehicular access, loading areas, garbage and services, and
(f) plant rooms, lift towers and other areas used exclusively for mechanical services or ducting, and
(g) car parking to meet any requirements of the consent authority (including access to that car parking), and
(h) any space used for the loading or unloading of goods (including access to it), and
(i) terraces and balconies with outer walls less than 1.4 metres high, and
(j) voids above a floor at the level of a storey or storey above.

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Nominated Architect: Robert Nigel Dickson
Registration No: 5364



| REV | DESCRIPTION | DATE | ISSUED | CHECKED |
|---|---|---|---|---|
| A | ISSUE FOR COUNCIL MEETING | 21/12/2015 | SC | AC |

PROJECT
LANDMARK SQUARE

61-75 FOREST ROAD & 126 DURHAM STREET, HURSTVILLE

CLIENT
DICKSON ROTHSCHILD

DRAWING
DEVELOPMENT SUMMARY

| PROJECT NO. | DRAWING NO. | REVISION | |
|---|---|---|---|
| 14-121 | A-002 | A | |
| SCALE @ A3 | DATE | DRAWN | AUTHORISED |
| | 17/12/2015 | SC | AC |

# Appendix B. Trip Generation Data

### Residential Trip Generation Data (GTGD Survey, RMS 2013)

RMS traffic and parking surveys for high density mixed use developments were undertaken at a number of different locations around Sydney. The sites that have similar characteristics to Hurstville City Centre and the proposed development of the Landmark Square Precinct include St Leonards, Parramatta, Chatswood and Strathfield. All of the locations selected had shopping centre facilities, major transport hubs and in most situations are positioned within a short rail journey of Sydney CBD.

The range and average values for person and vehicle trip generation rates for the above sites are presented in Tables B.1, B.2 and B.3 for 1 bedroom, 2 bedrooms, 3 bedrooms units. All of the below information is based on the data contained in Appendix B3 of the GTGD Survey (RMS 2013).

Table B.1: Comparison of NSW Activity Centres (1 bedroom high density)

| | Peak hour generation rate in person trips | | Peak hour generation rate in vehicle trips | |
|---|---|---|---|---|
| **Centres and Transport Hubs** | **AM** | **PM** | **AM** | **PM** |
| Chatswood | 0.3 | 0.39 | 0.07 | 0.05 |
| St Leonards | 0.29 | 0.24 | 0.06 | 0.03 |
| Parramatta | 0.45 | 0.31 | 0.13 | 0.06 |
| Strathfield | 0.26 | 0.37 | 0.05 | 0.03 |
| **Total** | **1.3** | **1.31** | **0.31** | **0.17** |
| **Average** | **0.325** | **0.328** | **0.078** | **0.043** |

Table B.2: Comparison of NSW Activity Centres (2 bedroom high density)

| | Peak hour generation rate in person trips | | Peak hour generation rate in vehicle trips | |
|---|---|---|---|---|
| **Centres and Transport Hubs** | **AM** | **PM** | **AM** | **PM** |
| Chatswood | 0.6 | 0.78 | 0.14 | 0.1 |
| St Leonards | 0.58 | 0.48 | 0.12 | 0.06 |
| Parramatta | 0.9 | 0.62 | 0.26 | 0.12 |
| Strathfield | 0.52 | 0.74 | 0.1 | 0.06 |
| **Total** | **2.6** | **2.62** | **0.62** | **0.34** |
| **Average** | **0.650** | **0.655** | **0.155** | **0.085** |

Table B.3: Comparison of NSW Activity Centres (3 bedroom high density)

| | Peak hour generation rate in person trips | | Peak hour generation rate in vehicle trips | |
|---|---|---|---|---|
| **Centres and Transport Hubs** | **AM** | **PM** | **AM** | **PM** |
| Chatswood | 0.9 | 1.17 | 0.21 | 0.15 |
| St Leonards | 0.87 | 0.72 | 0.18 | 0.09 |
| Parramatta | 1.35 | 0.93 | 0.39 | 0.18 |
| Strathfield | 0.78 | 1.11 | 0.15 | 0.09 |
| **Total** | **3.9** | **3.93** | **0.93** | **0.51** |
| **Average** | **0.975** | **0.983** | **0.233** | **0.128** |

The above information highlights that the person trip generation rate is similar to most household types in the peak hour and travel by car does not appear to be the preferred mode of travel. It represents less than 25% of all trips per persons, which includes travel by public transport, walking and cycling.

As a result, the vehicle trip rate for high density residential development in these locations is relatively low with less than:

- 8% of households in the AM peak hour and 5% of households in the PM peak hour generating a car trip from a 1 bedroom unit.
- 16% of households in the AM peak hour and 9% of households in the PM peak hour generating a car trip from a 2 bedroom unit.
- 24% of households in the AM peak hour and 13% of households in the PM peak hour generating a car trip from a 3 bedroom unit
- 17% of households in the AM peak hour and 10% of households in the PM peak hour generate a car trip per unit

The above information indicates that the delivery of high density development in the Hurstville City Centre catchment will help to support the NSW Government residential growth targets for Hurstville as a major centre, the objectives and targets identified in the Hurstville City Centre TMAP for public transport, walking and cycling, and overall help to manage the impact from future increases in traffic.

### Retail Trip Generation Data

Retail and supermarket traffic generation for the proposed development has been based on analysis of Mortdale Plaza, located on Roberts Avenue in Hurstville. As per the Council meeting minutes (http://notesweb.hurstville.nsw.gov.au/ebp+hurstville/ebp_hcc.nsf/ebphomepublic?openpage) the Mortdale Plaza development on Roberts Avenue was approved for the following land uses and yield in 2009:

- Ground floor – Woolworths supermarket (3,790m$^2$ GFA)
- First floor – Bulky goods retail (2,988m$^2$ GFA)
- Second floor – Gym (2,622m$^2$ GFA)

**Total of 9,400m$^2$ of GFA**

This appraisal assumes that the 9,400m$^2$ GFA equates to **7,050m$^2$ GFLA** (75% of GFA)

Council undertook pre-development traffic counts in November 2012 and post-development counts in October 2014 on Roberts Lane and the differences in traffic levels resulting from the opening of the development are presented in Table B.5 (for further details refer to http://infoweb.hurstville.nsw.gov.au/infocouncil/Open/2014/11/TAC_06112014_AGN_AT.htm).

Table B.4: Council Traffic Counts (with + / - difference included)

| Traffic volumes on Roberts Lane (east and west of the access driveway location for Mortdale Plaza) | Pre-Development (2012) | | Post-Development (2014 October) | | Difference (from 2012 to 2014) | | Total |
|---|---|---|---|---|---|---|---|
| | East | West | East | West | East | West | |
| Average Daily Traffic Volume (Veh/day) | 7,087 | 6,945 | 7,686 | 7,778 | +599 | +833 | 1,432 |
| AM Peak Traffic Volume (8-9am, Veh/h) | 739 | 475 | 780 | 555 | +41 | +80 | 121 |
| PM Peak Traffic Volume (5-6pm, Veh/h) | 548 | 692 | 648 | 838 | +100 | +146 | 246 |

The results indicated that the development resulted in 121 additional vehicles in the AM and 246 additional vehicles in the PM along Roberts Avenue (includes both eastbound and westbound traffic) between 2012 and 2014. Based on this finding it can be assumed that the new retail development at Mortdale Plaza achieved a retail traffic generation rate (on the external road network) of:

- 1.72 vehicle trips per 100m$^2$ of GLFA in the AM peak
- 3.49 vehicle trips per 100m$^2$ of GLFA in the PM peak

The relatively low traffic generation rate can be attributed to the position of the retail facility and its likelihood of attracting passing trade/ existing traffic flows and thus will minimise any increases in traffic along Roberts Avenue.

As a conclusion, Council state '*that majority (more than 96%) of the customers of Mortdale Plaza are local residents who pass by the shopping centre on their way to or from their homes and that the centre has not attracted any notable amount of customers from elsewhere.'*

This indicates that some of the growth in traffic on Roberts Avenue can also be attributed to development in the surrounding commercial / residential areas, which would further reduce the rates derived above. The rates highlighted above therefore represent a conservative 'worst case scenario' approach for predicting additional traffic growth relating the retail uses along main road corridors.

The Landmark Square Precinct site is situated on Forest Road and Durham Street and is also likely to attract passing trade to its retail uses. It is also situated in an area currently being planned to accommodate high density residential development and as a result will attract a customer base that can access by walking. It can therefore be concluded that the adoption of the above rates for retail uses that

form part of the rezoning application for the Landmark Square Precinct is a conservative approach for predicting traffic generation relating to retail type uses.

This assumption is supported through a comparison with Burwood Shopping Centre and the surveys undertaken in Appendix F of GTGD Survey (RMS 2013). This indicates that Burwood Shopping Centre similar to Hurstville is a major centre and has similar land use and transport characteristics with both situated in proximity to a rail line, high frequency bus services and have CBD shopping precincts (Forest Road and Burwood Road). The surveys for Burwood Shopping Centre (for a Friday) indicate a retail trip rate of:

- 0.98 vehicle trips per 100m$^2$ of GLFA in the AM peak.
- 2.66 vehicle trips per 100m$^2$ of GLFA in the PM peak.

Whilst these generation rates are lower, it is noted that the Burwood shopping centre has 63,404m$^2$ of GLFA (much higher than Mortdale Plaza and the proposed Landmark Square Precinct) and that the traffic generation rate for larger shopping centres are typically lower due their ability to contain trips or attract trips with multiple trip purposes due to their size.

**Summary of Findings**

The above indicates that the adopted of a trip generation rate (external road network) for the retail / supermarket land use based on the analysis of Mortdale Plaza is appropriate for predicting retail traffic levels that form part of the Landmark Square Precinct rezoning application. The rates to be adopted are:

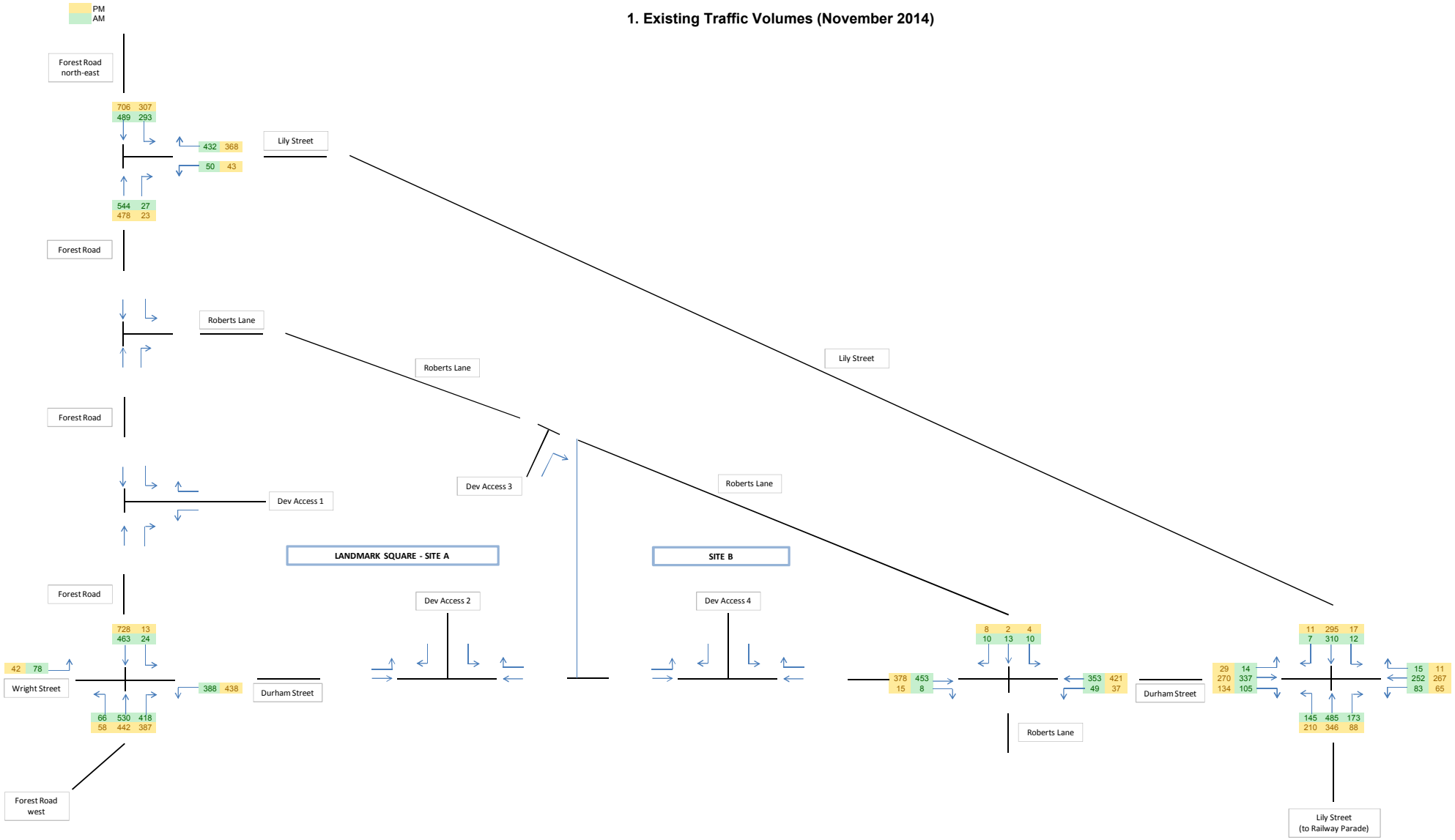
- 1.72 vehicle trips per 100m$^2$ of GLFA in the AM peak
- 3.49 vehicle trips per 100m$^2$ of GLFA in the PM peak

The adoption of the above retail traffic generation rates is based on the following:

- The proposed development is located on Forest Road, which offers the potential to attract passing trade as identified under the Mortdale Plaza assessment.
- The retail shops and supermarket are proposed are ‘speciality’ style (designed to specifically target residents of the development) and will also attract custom from the local catchment.
- The local catchment currently accommodates high density residential development and is planned to expand its existing high density residential development supply, which will encourage people to access by walking.
- Mortdale Plaza site is situated in a lower density environment and is less accessible by non-car modes in comparison to the Landmark Square Precinct site.

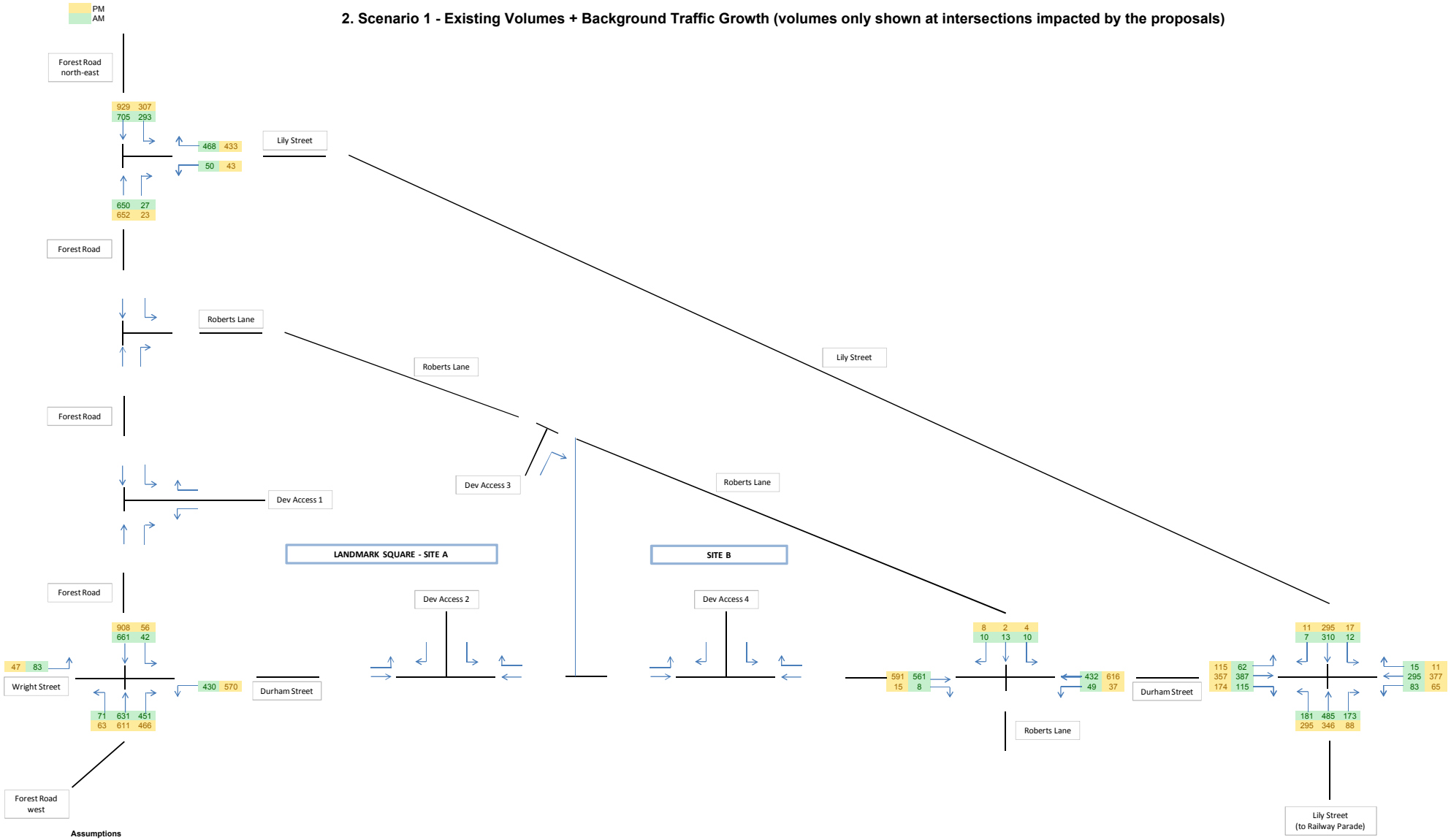
# Appendix C. Traffic Volume Maps

# 1. Existing Traffic Volumes (November 2014)




**Assumptions**
Existing conditions traffic volumes at intersections directly reflect peak hour traffic counts undertaken in November 2014
Traffic volumes at the Roberts Lane / Drham Street intersection are obtained from a snapshot survey suring peak conditions and foctored for an hour against a recorded tube count

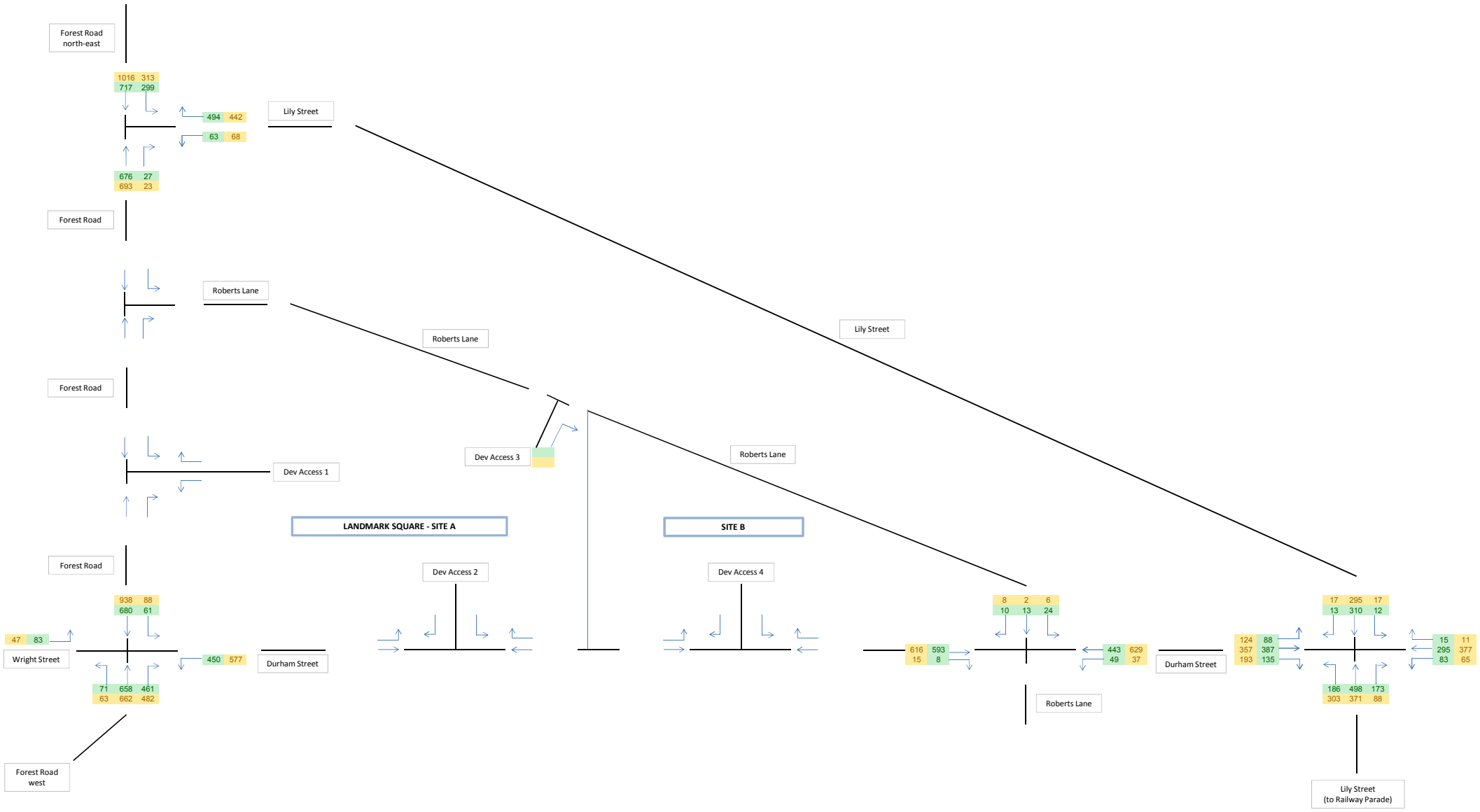
## 2. Scenario 1 - Existing Volumes + Background Traffic Growth (volumes only shown at intersections impacted by the proposals)




**Assumptions**
Existing traffic volumes is 2014 data
Background traffic growth includes traffic generated from:
- 1 - 5 Treacy Street Development
- 21 - 35 Treacy Street Development
- East Quarter Stage 3 Development
- 108 Forest Road Development

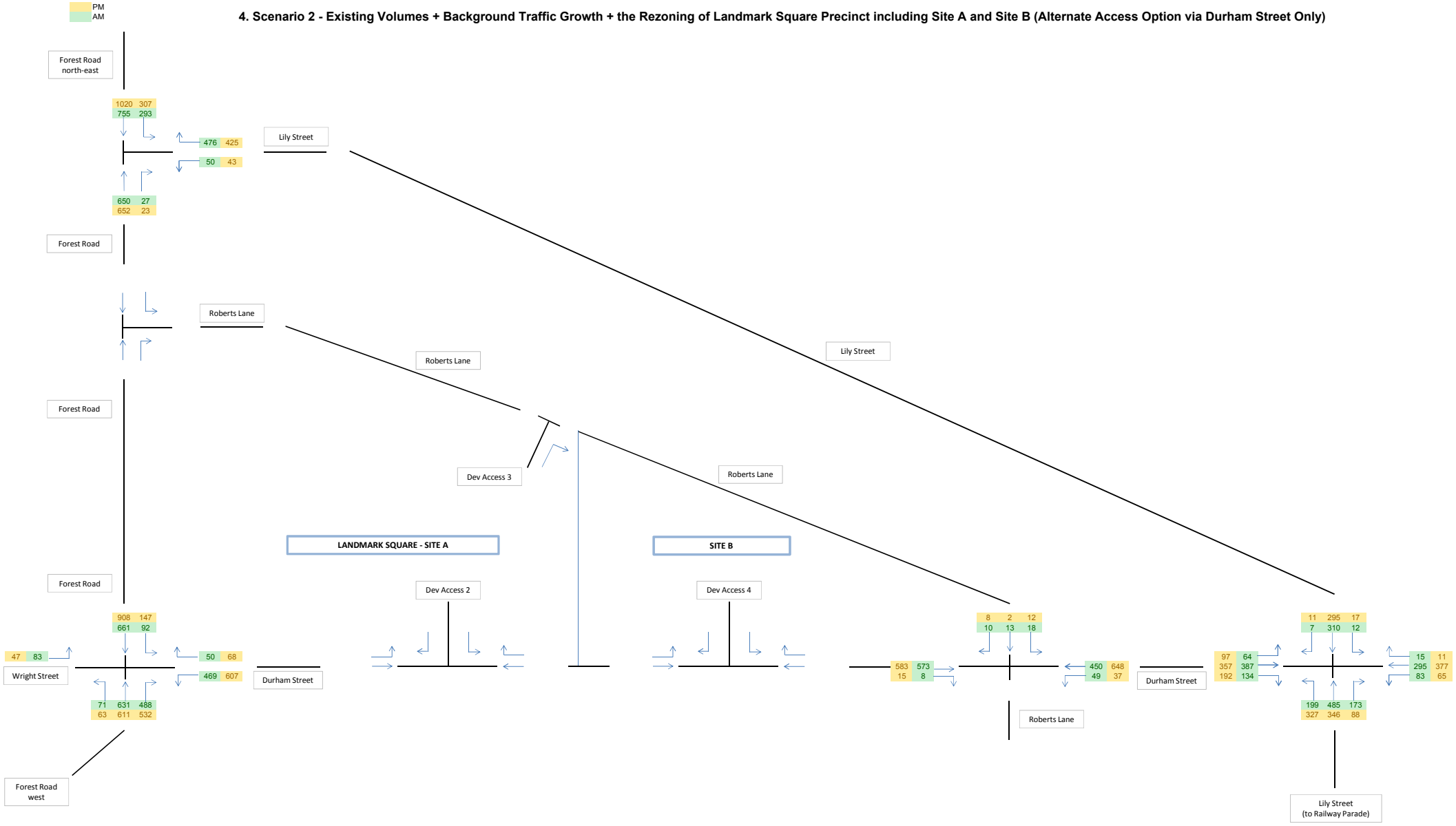
PM
AM

## 3. Scenario 2 - Existing Volumes + Background Traffic Growth + the Rezoning of Landmark Square Precinct - including Site A and Site B (volumes only shown at intersections impacted by the proposals




**Note**
Further consideration of access points to / from the Landmark Square Site A and Site B development, including proposed designs will be undertaken at the Development Application stages

## 4. Scenario 2 - Existing Volumes + Background Traffic Growth + the Rezoning of Landmark Square Precinct including Site A and Site B (Alternate Access Option via Durham Street Only)



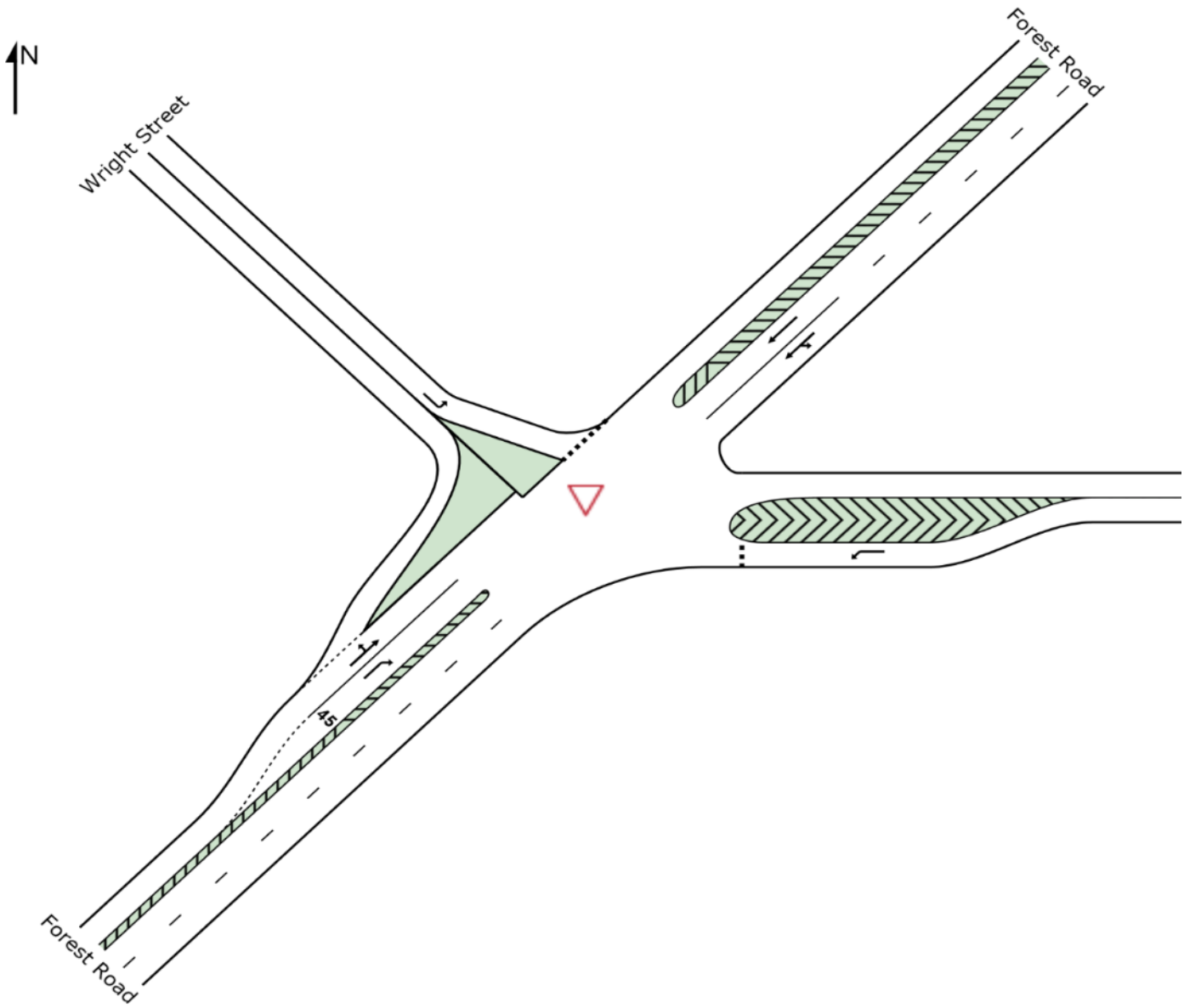

**Note**
Further consideration of access points to / from the Landmark Square Site A and Site B development, including proposed designs will be undertaken at the Development Application stages

# Appendix D. SIDRA Result Summaries

# SITE LAYOUT

## Site: 1. Forest Road / Durham Street / Wright Street_AM Existing

Forest Road / Durham Street / Wright Street (8:15AM - 9:15AM)
Giveway / Yield (Two-Way)



# MOVEMENT SUMMARY

## Site: 1. Forest Road / Durham Street / Wright Street_AM Existing

Forest Road / Durham Street / Wright Street (8:15AM - 9:15AM)
Giveway / Yield (Two-Way)

**Movement Performance - Vehicles**

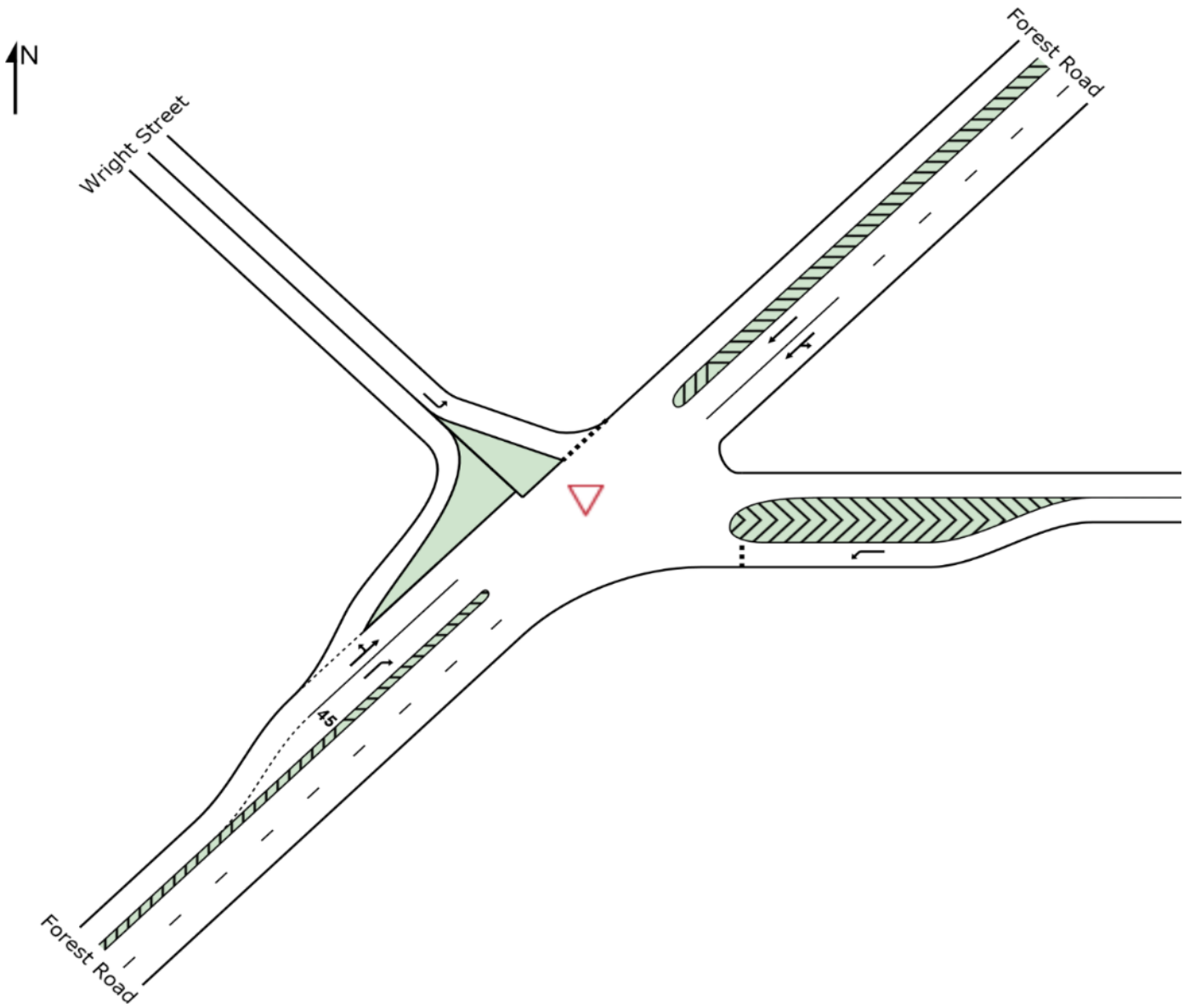
| Mov ID | OD Mov | Demand Flows Total veh/h | HV % | Deg. Satn v/c | Average Delay sec | Level of Service | 95% Back of Queue Vehicles veh | 95% Back of Queue Distance m | Prop. Queued | Effective Stop Rate per veh | Average Speed km/h |
|---|---|---|---|---|---|---|---|---|---|---|---|
| East: Durham Street | | | | | | | | | | | |
| 4a | L1 | 408 | 1.8 | 0.380 | 5.1 | LOS A | 2.0 | 14.1 | 0.41 | 0.58 | 49.2 |
| Approach | | 408 | 1.8 | 0.380 | 5.1 | LOS A | 2.0 | 14.1 | 0.41 | 0.58 | 49.2 |
| NorthEast: Forest Road | | | | | | | | | | | |
| 24b | L3 | 25 | 4.2 | 0.135 | 5.4 | LOS A | 0.0 | 0.0 | 0.00 | 0.06 | 49.5 |
| 25 | T1 | 487 | 2.2 | 0.135 | 0.0 | LOS A | 0.0 | 0.0 | 0.00 | 0.03 | 49.8 |
| Approach | | 513 | 2.3 | 0.135 | 0.3 | NA | 0.0 | 0.0 | 0.00 | 0.03 | 49.8 |
| NorthWest: Wright Street | | | | | | | | | | | |
| 27 | L2 | 82 | 1.3 | 0.111 | 7.6 | LOS A | 0.4 | 3.0 | 0.52 | 0.70 | 48.4 |
| Approach | | 82 | 1.3 | 0.111 | 7.6 | LOS A | 0.4 | 3.0 | 0.52 | 0.70 | 48.4 |
| SouthWest: Forest Road | | | | | | | | | | | |
| 30 | L2 | 69 | 0.0 | 0.328 | 4.4 | LOS A | 0.0 | 0.0 | 0.00 | 0.05 | 50.3 |
| 31 | T1 | 558 | 2.3 | 0.328 | 0.0 | LOS A | 0.0 | 0.0 | 0.00 | 0.05 | 49.6 |
| 32a | R1 | 440 | 3.8 | 0.504 | 7.9 | LOS A | 3.3 | 23.8 | 0.55 | 0.83 | 44.9 |
| Approach | | 1067 | 2.8 | 0.504 | 3.6 | NA | 3.3 | 23.8 | 0.23 | 0.37 | 47.6 |
| All Vehicles | | 2071 | 2.4 | 0.504 | 3.2 | NA | 3.3 | 23.8 | 0.22 | 0.34 | 48.5 |

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

# SITE LAYOUT

## Site: 1. Forest Road / Durham Street / Wright Street_PM Existing

Forest Road / Durham Street / Wright Street (5:15PM - 6:15PM)
Giveway / Yield (Two-Way)



# MOVEMENT SUMMARY

## Site: 1. Forest Road / Durham Street / Wright Street_PM Existing

Forest Road / Durham Street / Wright Street (5:15PM - 6:15PM)
Giveway / Yield (Two-Way)

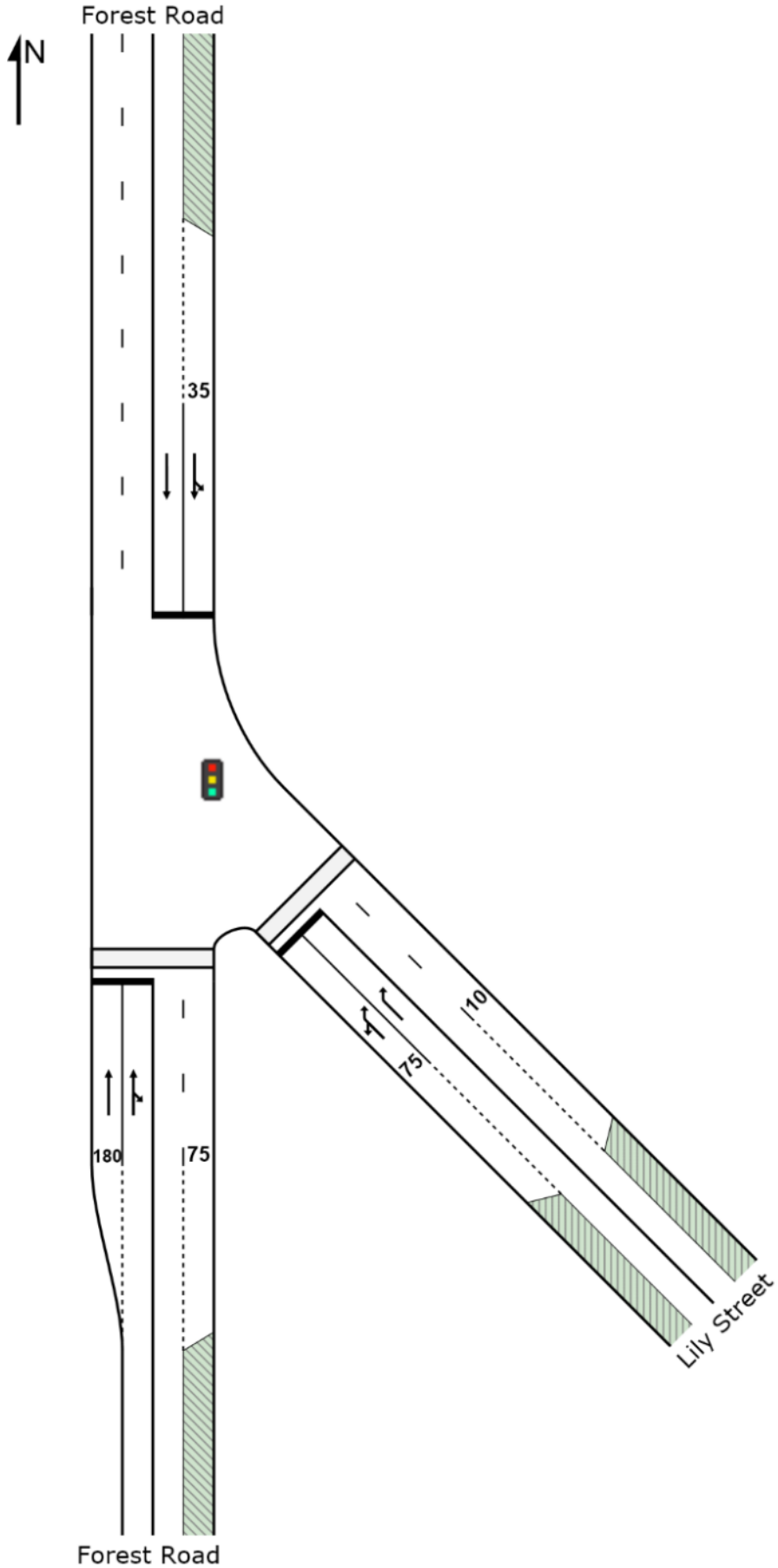
| Movement Performance - Vehicles | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Mov ID | OD Mov | Demand Flows Total veh/h | HV % | Deg. Satn v/c | Average Delay sec | Level of Service | 95% Back of Queue Vehicles veh | Distance m | Prop. Queued | Effective Stop Rate per veh | Average Speed km/h |
| East: Durham Street | | | | | | | | | | | |
| 4a | L1 | 461 | 1.4 | 0.497 | 7.3 | LOS A | 3.8 | 26.6 | 0.57 | 0.81 | 47.9 |
| Approach | | 461 | 1.4 | 0.497 | 7.3 | LOS A | 3.8 | 26.6 | 0.57 | 0.81 | 47.9 |
| NorthEast: Forest Road | | | | | | | | | | | |
| 24b | L3 | 14 | 0.0 | 0.202 | 5.4 | LOS A | 0.0 | 0.0 | 0.00 | 0.02 | 49.7 |
| 25 | T1 | 766 | 1.2 | 0.202 | 0.0 | LOS A | 0.0 | 0.0 | 0.00 | 0.01 | 49.9 |
| Approach | | 780 | 1.2 | 0.202 | 0.1 | NA | 0.0 | 0.0 | 0.00 | 0.01 | 49.9 |
| NorthWest: Wright Street | | | | | | | | | | | |
| 27 | L2 | 44 | 0.0 | 0.053 | 6.7 | LOS A | 0.2 | 1.4 | 0.46 | 0.62 | 49.0 |
| Approach | | 44 | 0.0 | 0.053 | 6.7 | LOS A | 0.2 | 1.4 | 0.46 | 0.62 | 49.0 |
| SouthWest: Forest Road | | | | | | | | | | | |
| 30 | L2 | 61 | 0.0 | 0.273 | 4.4 | LOS A | 0.0 | 0.0 | 0.00 | 0.06 | 50.3 |
| 31 | T1 | 465 | 1.1 | 0.273 | 0.0 | LOS A | 0.0 | 0.0 | 0.00 | 0.06 | 49.6 |
| 32a | R1 | 407 | 1.3 | 0.613 | 11.8 | LOS A | 4.1 | 28.9 | 0.75 | 1.06 | 42.8 |
| Approach | | 934 | 1.1 | 0.613 | 5.5 | NA | 4.1 | 28.9 | 0.33 | 0.50 | 46.4 |
| All Vehicles | | 2219 | 1.2 | 0.613 | 4.0 | NA | 4.1 | 28.9 | 0.27 | 0.39 | 48.0 |

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

# SITE LAYOUT

## Site: 2. Forest Road / Lily Street_AM Existing

Forest Road / Lily Street (8:15am - 9:15am)
Signals - Fixed Time



# MOVEMENT SUMMARY

## Site: 2. Forest Road / Lily Street_AM Existing

Forest Road / Lily Street (8:15am - 9:15am)
Signals - Fixed Time  Cycle Time = 70 seconds (User-Given Phase Times)

**Movement Performance - Vehicles**

| Mov ID | OD Mov | Demand Flows Total veh/h | HV % | Deg. Satn v/c | Average Delay sec | Level of Service | 95% Back of Queue Vehicles veh | 95% Back of Queue Distance m | Prop. Queued | Effective Stop Rate per veh | Average Speed km/h |
|---|---|---|---|---|---|---|---|---|---|---|---|
| South: Forest Road | | | | | | | | | | | |
| 2 | T1 | 573 | 2.0 | 0.278 | 6.7 | LOS A | 5.1 | 36.6 | 0.49 | 0.44 | 53.8 |
| 3b | R3 | 28 | 3.7 | 0.278 | 13.6 | LOS A | 4.3 | 31.0 | 0.51 | 0.47 | 48.3 |
| Approach | | 601 | 2.1 | 0.278 | 7.0 | LOS A | 5.1 | 36.6 | 0.49 | 0.44 | 53.6 |
| SouthEast: Lily Street | | | | | | | | | | | |
| 21b | L3 | 53 | 2.0 | 0.689 | 36.7 | LOS C | 8.4 | 60.9 | 0.98 | 0.86 | 37.5 |
| 23a | R1 | 455 | 3.0 | 0.689 | 34.7 | LOS C | 8.8 | 62.7 | 0.98 | 0.86 | 37.4 |
| Approach | | 507 | 2.9 | 0.689 | 34.9 | LOS C | 8.8 | 62.7 | 0.98 | 0.86 | 37.4 |
| North: Forest Road | | | | | | | | | | | |
| 7a | L1 | 308 | 3.8 | 0.200 | 5.3 | LOS A | 1.1 | 8.2 | 0.22 | 0.62 | 49.8 |
| 8 | T1 | 515 | 2.2 | 0.437 | 7.1 | LOS A | 8.9 | 63.4 | 0.54 | 0.48 | 53.7 |
| Approach | | 823 | 2.8 | 0.437 | 6.4 | LOS A | 8.9 | 63.4 | 0.42 | 0.53 | 52.2 |
| All Vehicles | | 1932 | 2.6 | 0.689 | 14.1 | LOS A | 8.9 | 63.4 | 0.59 | 0.59 | 47.6 |

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

**Movement Performance - Pedestrians**

| Mov ID | Description | Demand Flow ped/h | Average Delay sec | Level of Service | Average Back of Queue Pedestrian ped | Average Back of Queue Distance m | Prop. Queued | Effective Stop Rate per ped |
|---|---|---|---|---|---|---|---|---|
| P1 | South Full Crossing | 361 | 29.7 | LOS C | 0.7 | 0.7 | 0.93 | 0.93 |
| P5 | SouthEast Full Crossing | 169 | 9.3 | LOS A | 0.2 | 0.2 | 0.52 | 0.52 |
| All Pedestrians | | 531 | 23.2 | LOS C | | | 0.80 | 0.80 |

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

# PHASING SUMMARY

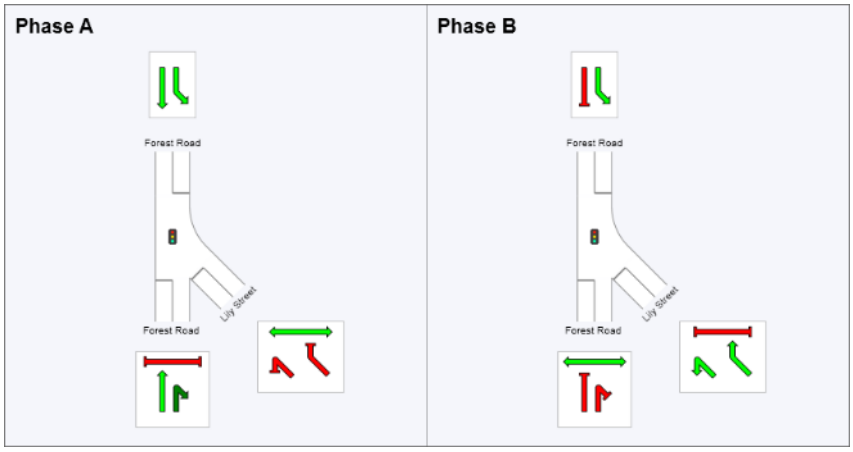
## Site: 2. Forest Road / Lily Street_AM Existing

Forest Road / Lily Street (8:15am - 9:15am)
Signals - Fixed Time  Cycle Time = 70 seconds (User-Given Phase Times)

**Phase times specified by the user**
**Sequence: Variable Phasing**
**Movement Class: All Movement Classes**
**Input Sequence: A, B**
**Output Sequence: A, B**

**Phase Timing Results**

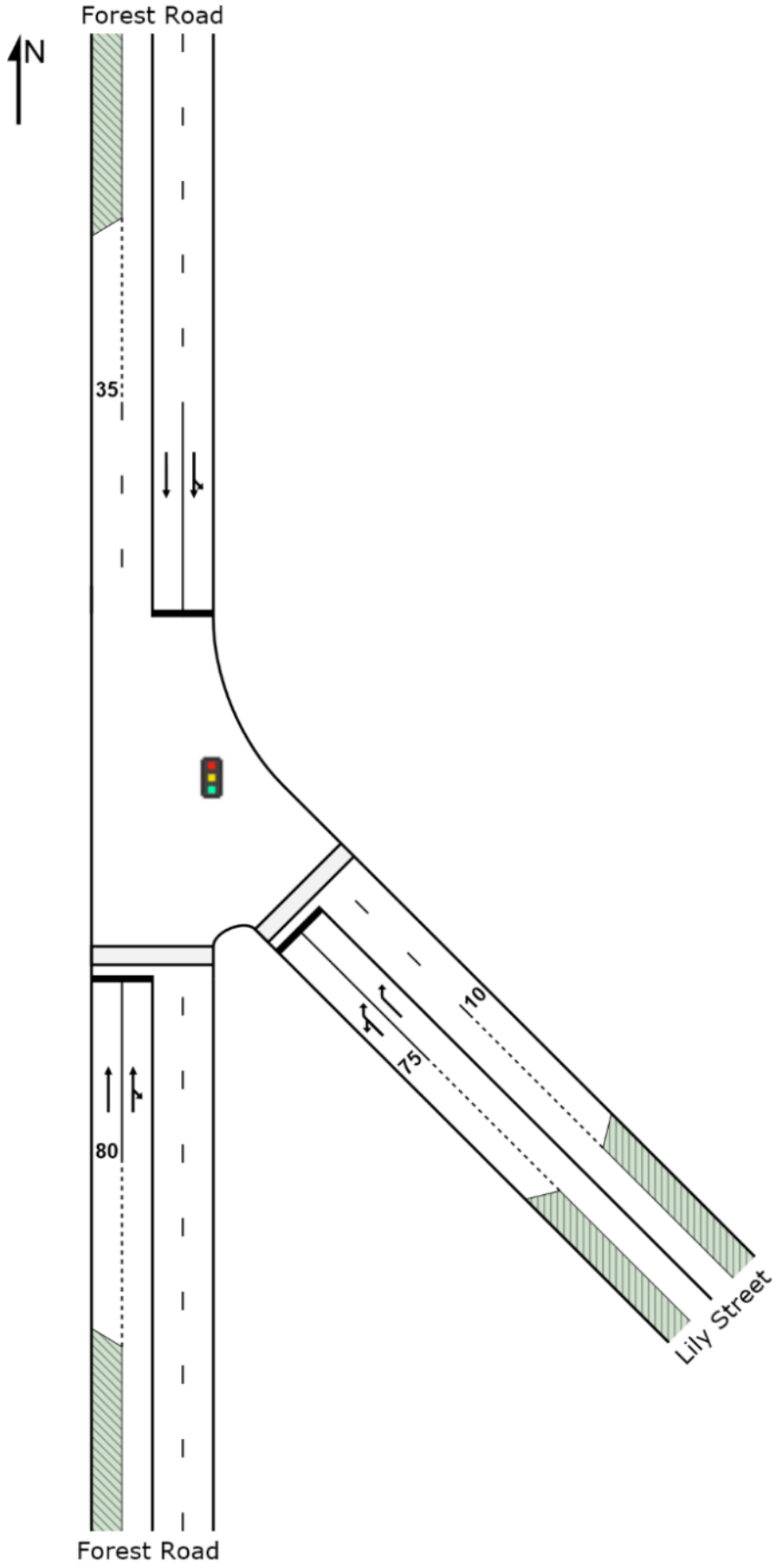
| Phase | A | B |
|---|---|---|
| Reference Phase | Yes | No |
| Phase Change Time (sec) | 0 | 50 |
| Green Time (sec) | 44 | 14 |
| Yellow Time (sec) | 4 | 4 |
| All-Red Time (sec) | 2 | 2 |
| Phase Time (sec) | 50 | 20 |
| Phase Split | 71 % | 29 % |




# SITE LAYOUT

## Site: 2. Forest Road / Lily Street_PM Existing

Forest Road / Lily Street (5:00pm - 6:00pm)
Signals - Fixed Time



# MOVEMENT SUMMARY

## Site: 2. Forest Road / Lily Street_PM Existing

Forest Road / Lily Street (5:00pm - 6:00pm)
Signals - Fixed Time  Cycle Time = 50 seconds (Practical Cycle Time)

**Movement Performance - Vehicles**

| Mov ID | OD Mov | Demand Flows Total veh/h | HV % | Deg. Satn v/c | Average Delay sec | Level of Service | 95% Back of Queue Vehicles veh | 95% Back of Queue Distance m | Prop. Queued | Effective Stop Rate per veh | Average Speed km/h |
|---|---|---|---|---|---|---|---|---|---|---|---|
| South: Forest Road | | | | | | | | | | | |
| 2 | T1 | 503 | 1.0 | 0.511 | 9.9 | LOS A | 7.2 | 51.0 | 0.71 | 0.62 | 51.4 |
| 3b | R3 | 24 | 0.0 | 0.511 | 16.8 | LOS B | 7.2 | 51.0 | 0.75 | 0.66 | 46.5 |
| Approach | | 527 | 1.0 | 0.511 | 10.2 | LOS A | 7.2 | 51.0 | 0.71 | 0.62 | 51.1 |
| SouthEast: Lily Street | | | | | | | | | | | |
| 21b | L3 | 45 | 0.0 | 0.163 | 21.6 | LOS B | 1.5 | 10.6 | 0.79 | 0.74 | 44.1 |
| 23a | R1 | 387 | 1.4 | 0.667 | 22.8 | LOS B | 8.2 | 58.0 | 0.93 | 0.85 | 42.6 |
| Approach | | 433 | 1.2 | 0.667 | 22.7 | LOS B | 8.2 | 58.0 | 0.91 | 0.83 | 42.8 |
| North: Forest Road | | | | | | | | | | | |
| 7a | L1 | 323 | 0.7 | 0.548 | 9.9 | LOS A | 6.7 | 47.6 | 0.71 | 0.71 | 48.1 |
| 8 | T1 | 743 | 1.3 | 0.548 | 8.6 | LOS A | 8.9 | 63.2 | 0.74 | 0.68 | 51.9 |
| Approach | | 1066 | 1.1 | 0.548 | 9.0 | LOS A | 8.9 | 63.2 | 0.73 | 0.69 | 50.7 |
| All Vehicles | | 2026 | 1.1 | 0.667 | 12.2 | LOS A | 8.9 | 63.2 | 0.76 | 0.70 | 48.9 |

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

**Movement Performance - Pedestrians**

| Mov ID | Description | Demand Flow ped/h | Average Delay sec | Level of Service | Average Back of Queue Pedestrian ped | Average Back of Queue Distance m | Prop. Queued | Effective Stop Rate per ped |
|---|---|---|---|---|---|---|---|---|
| P1 | South Full Crossing | 39 | 19.4 | LOS B | 0.0 | 0.0 | 0.88 | 0.88 |
| P5 | SouthEast Full Crossing | 169 | 13.1 | LOS B | 0.2 | 0.2 | 0.73 | 0.73 |
| All Pedestrians | | 208 | 14.2 | LOS B | | | 0.75 | 0.75 |

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

# PHASING SUMMARY

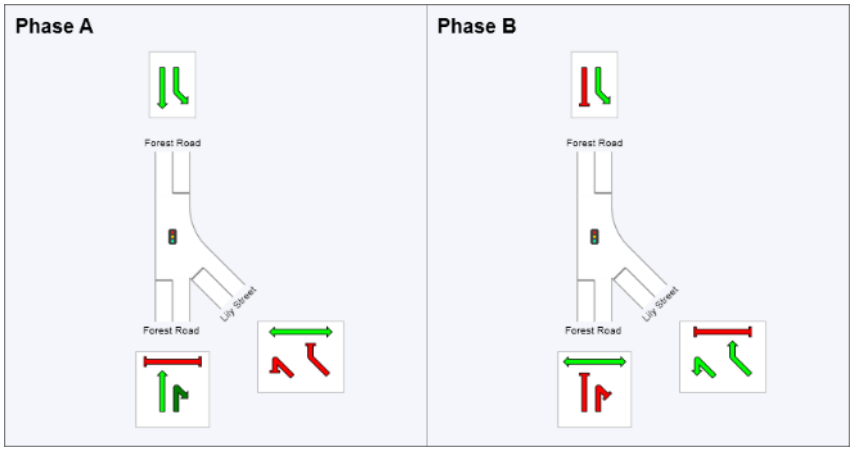
## Site: 2. Forest Road / Lily Street_PM Existing

Forest Road / Lily Street (5:00pm - 6:00pm)
Signals - Fixed Time  Cycle Time = 50 seconds (Practical Cycle Time)

**Phase times determined by the program**
**Sequence: Variable Phasing**
**Movement Class: All Movement Classes**
**Input Sequence: A, B**
**Output Sequence: A, B**

**Phase Timing Results**

| Phase | A | B |
|---|---|---|
| Reference Phase | Yes | No |
| Phase Change Time (sec) | 0 | 30 |
| Green Time (sec) | 24 | 14 |
| Yellow Time (sec) | 4 | 4 |
| All-Red Time (sec) | 2 | 2 |
| Phase Time (sec) | 30 | 20 |
| Phase Split | 60 % | 40 % |







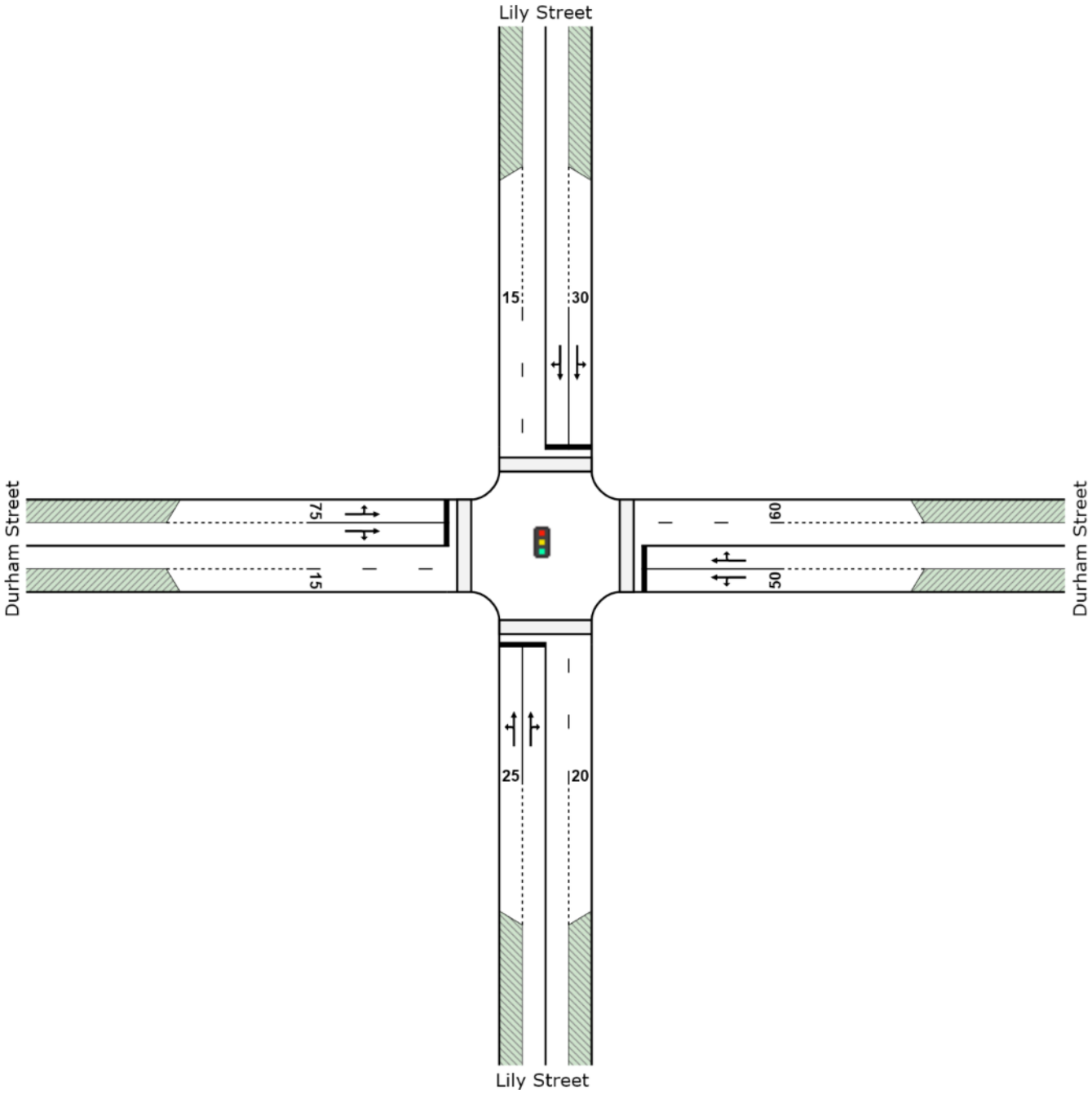


SIDRA INTERSECTION 6

# SITE LAYOUT

## Site: 3. Durham Sreet / Lily Street_AM Existing

Durham Street / Lily Street (8:00am - 9:00am)
Signals - Fixed Time



# MOVEMENT SUMMARY

## Site: 3. Durham Sreet / Lily Street_AM Existing

Durham Street / Lily Street (8:00am - 9:00am)
Signals - Fixed Time  Cycle Time = 55 seconds (User-Given Phase Times)

**Movement Performance - Vehicles**

| Mov ID | OD Mov | Demand Flows Total veh/h | HV % | Deg. Satn v/c | Average Delay sec | Level of Service | 95% Back of Queue Vehicles veh | 95% Back of Queue Distance m | Prop. Queued | Effective Stop Rate per veh | Average Speed km/h |
|---|---|---|---|---|---|---|---|---|---|---|---|
| South: Lily Street | | | | | | | | | | | |
| 1 | L2 | 153 | 0.0 | 0.233 | 13.1 | LOS A | 3.4 | 23.7 | 0.57 | 0.65 | 46.3 |
| 2 | T1 | 511 | 3.5 | 0.934 | 33.2 | LOS C | 23.8 | 170.9 | 0.83 | 1.12 | 38.1 |
| 3 | R2 | 182 | 2.3 | 0.934 | 43.3 | LOS D | 23.8 | 170.9 | 0.88 | 1.20 | 34.1 |
| Approach | | 845 | 2.6 | 0.934 | 31.7 | LOS C | 23.8 | 170.9 | 0.80 | 1.05 | 38.3 |
| East: Durham Street | | | | | | | | | | | |
| 4 | L2 | 87 | 3.6 | 0.333 | 23.2 | LOS B | 3.6 | 25.7 | 0.86 | 0.73 | 40.6 |
| 5 | T1 | 265 | 2.0 | 0.476 | 19.3 | LOS B | 5.0 | 35.6 | 0.89 | 0.74 | 39.2 |
| 6 | R2 | 16 | 0.0 | 0.476 | 24.1 | LOS B | 5.0 | 35.6 | 0.90 | 0.74 | 41.2 |
| Approach | | 368 | 2.3 | 0.476 | 20.4 | LOS B | 5.0 | 35.6 | 0.88 | 0.74 | 39.6 |
| North: Lily Street | | | | | | | | | | | |
| 7 | L2 | 13 | 0.0 | 0.149 | 12.7 | LOS A | 2.1 | 14.8 | 0.54 | 0.46 | 48.5 |
| 8 | T1 | 326 | 3.2 | 0.212 | 7.7 | LOS A | 2.9 | 21.1 | 0.57 | 0.48 | 53.0 |
| 9 | R2 | 7 | 0.0 | 0.212 | 13.6 | LOS A | 2.9 | 21.1 | 0.58 | 0.49 | 48.1 |
| Approach | | 346 | 3.0 | 0.212 | 8.0 | LOS A | 2.9 | 21.1 | 0.56 | 0.48 | 52.7 |
| West: Durham Street | | | | | | | | | | | |
| 10 | L2 | 15 | 0.0 | 0.526 | 24.3 | LOS B | 6.2 | 44.1 | 0.91 | 0.76 | 41.2 |
| 11 | T1 | 355 | 3.0 | 0.752 | 21.8 | LOS B | 6.7 | 48.9 | 0.94 | 0.82 | 38.2 |
| 12 | R2 | 118 | 6.3 | 0.752 | 30.6 | LOS C | 6.7 | 48.9 | 0.99 | 0.95 | 37.6 |
| Approach | | 487 | 3.7 | 0.752 | 24.0 | LOS B | 6.7 | 48.9 | 0.95 | 0.85 | 38.1 |
| All Vehicles | | 2047 | 2.9 | 0.934 | 23.8 | LOS B | 23.8 | 170.9 | 0.81 | 0.85 | 40.4 |

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

**Movement Performance - Pedestrians**

| Mov ID | Description | Demand Flow ped/h | Average Delay sec | Level of Service | Average Back of Queue Pedestrian ped | Average Back of Queue Distance m | Prop. Queued | Effective Stop Rate per ped |
|---|---|---|---|---|---|---|---|---|
| P1 | South Full Crossing | 45 | 21.9 | LOS C | 0.1 | 0.1 | 0.89 | 0.89 |
| P2 | East Full Crossing | 20 | 11.1 | LOS B | 0.0 | 0.0 | 0.64 | 0.64 |
| P3 | North Full Crossing | 39 | 21.9 | LOS C | 0.1 | 0.1 | 0.89 | 0.89 |
| P4 | West Full Crossing | 57 | 11.2 | LOS B | 0.1 | 0.1 | 0.64 | 0.64 |
| All Pedestrians | | 161 | 16.8 | LOS B | | | 0.77 | 0.77 |

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

# PHASING SUMMARY

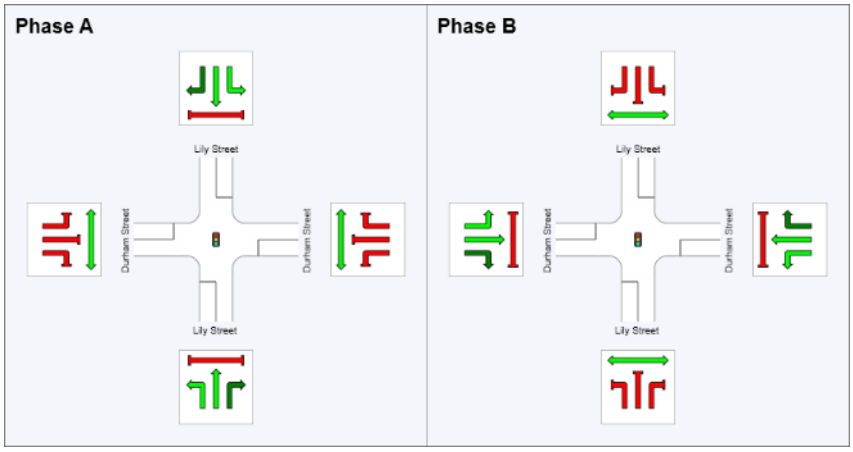
## Site: 3. Durham Sreet / Lily Street_AM Existing

Durham Street / Lily Street (8:00am - 9:00am)
Signals - Fixed Time  Cycle Time = 55 seconds (User-Given Phase Times)

**Phase times specified by the user**
**Sequence: Variable Phasing**
**Movement Class: All Movement Classes**
**Input Sequence: A, B**
**Output Sequence: A, B**

**Phase Timing Results**

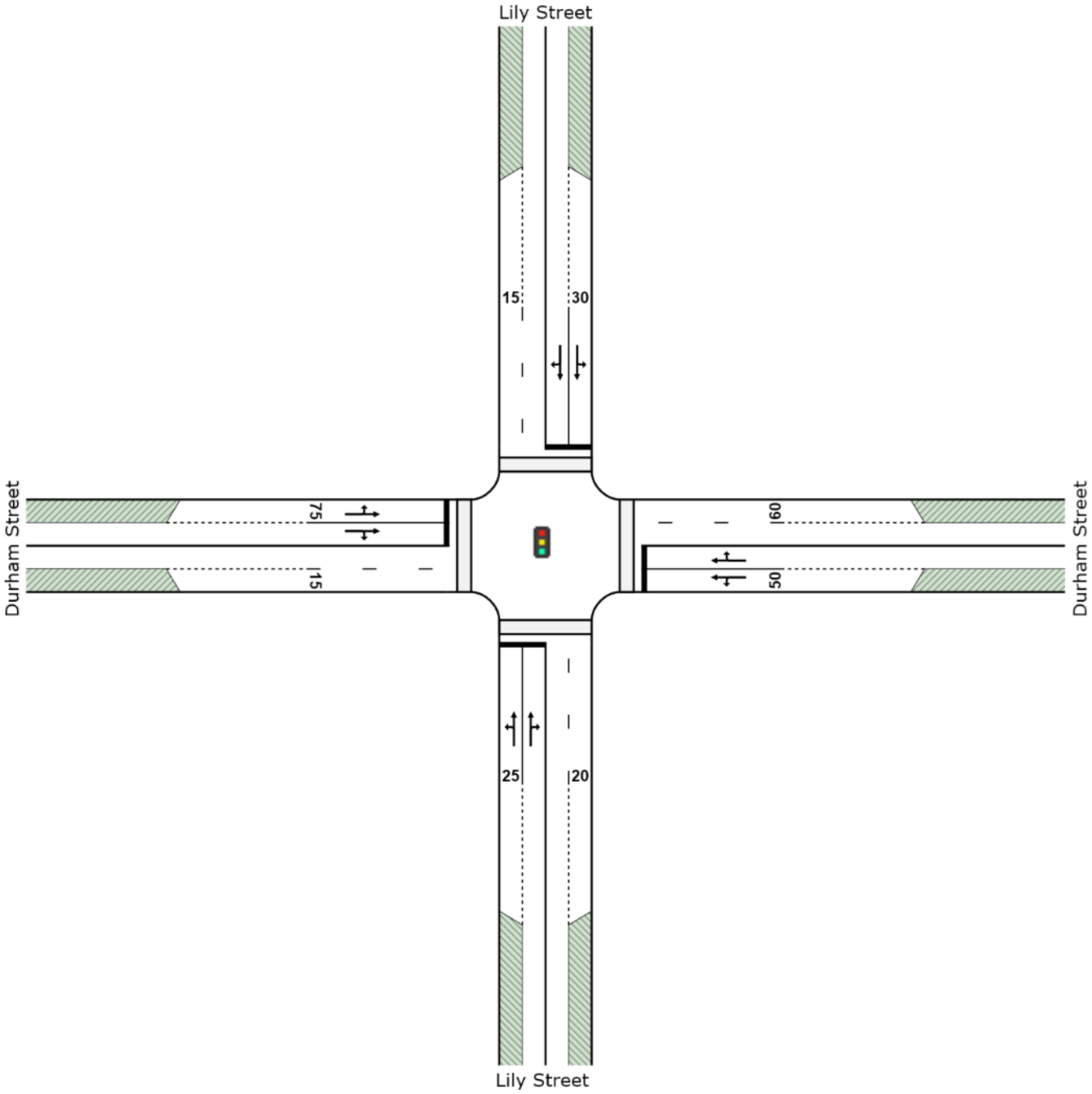
| Phase | A | B |
|---|---|---|
| Reference Phase | Yes | No |
| Phase Change Time (sec) | 0 | 35 |
| Green Time (sec) | 29 | 14 |
| Yellow Time (sec) | 4 | 4 |
| All-Red Time (sec) | 2 | 2 |
| Phase Time (sec) | 35 | 20 |
| Phase Split | 64 % | 36 % |




# SITE LAYOUT

## Site: 3. Durham Sreet / Lily Street_PM Existing

Durham Street / Lily Street (3:30pm - 4:30pm)
Signals - Fixed Time



# MOVEMENT SUMMARY

## Site: 3. Durham Sreet / Lily Street_PM Existing

Durham Street / Lily Street (3:30pm - 4:30pm)
Signals - Fixed Time  Cycle Time = 65 seconds (User-Given Phase Times)

**Movement Performance - Vehicles**

| Mov ID | OD Mov | Demand Flows Total veh/h | HV % | Deg. Satn v/c | Average Delay sec | Level of Service | 95% Back of Queue Vehicles veh | 95% Back of Queue Distance m | Prop. Queued | Effective Stop Rate per veh | Average Speed km/h |
|---|---|---|---|---|---|---|---|---|---|---|---|
| South: Lily Street | | | | | | | | | | | |
| 1 | L2 | 227 | 2.8 | 0.280 | 17.9 | LOS B | 4.6 | 33.0 | 0.67 | 0.75 | 42.7 |
| 2 | T1 | 364 | 3.2 | 0.796 | 21.2 | LOS B | 13.6 | 97.3 | 0.84 | 0.87 | 43.9 |
| 3 | R2 | 93 | 2.3 | 0.796 | 26.8 | LOS B | 13.6 | 97.3 | 0.84 | 0.87 | 40.6 |
| Approach | | 684 | 2.9 | 0.796 | 20.9 | LOS B | 13.6 | 97.3 | 0.79 | 0.83 | 43.0 |
| East: Durham Street | | | | | | | | | | | |
| 4 | L2 | 68 | 3.1 | 0.218 | 19.9 | LOS B | 3.3 | 23.6 | 0.72 | 0.66 | 42.4 |
| 5 | T1 | 281 | 0.4 | 0.311 | 15.8 | LOS B | 4.8 | 33.7 | 0.74 | 0.64 | 40.8 |
| 6 | R2 | 12 | 0.0 | 0.311 | 20.5 | LOS B | 4.8 | 33.7 | 0.75 | 0.63 | 43.0 |
| Approach | | 361 | 0.9 | 0.311 | 16.7 | LOS B | 4.8 | 33.7 | 0.74 | 0.64 | 41.1 |
| North: Lily Street | | | | | | | | | | | |
| 7 | L2 | 18 | 0.0 | 0.176 | 17.2 | LOS B | 2.9 | 20.5 | 0.63 | 0.54 | 45.7 |
| 8 | T1 | 311 | 3.1 | 0.251 | 12.3 | LOS A | 3.9 | 27.9 | 0.66 | 0.56 | 49.6 |
| 9 | R2 | 12 | 0.0 | 0.251 | 18.4 | LOS B | 3.9 | 27.9 | 0.68 | 0.57 | 45.2 |
| Approach | | 340 | 2.8 | 0.251 | 12.8 | LOS A | 3.9 | 27.9 | 0.66 | 0.56 | 49.2 |
| West: Durham Street | | | | | | | | | | | |
| 10 | L2 | 31 | 0.0 | 0.350 | 20.8 | LOS B | 5.8 | 41.0 | 0.77 | 0.66 | 42.7 |
| 11 | T1 | 284 | 1.9 | 0.350 | 17.1 | LOS B | 5.8 | 41.0 | 0.79 | 0.69 | 40.0 |
| 12 | R2 | 141 | 4.5 | 0.501 | 24.5 | LOS B | 5.5 | 40.0 | 0.86 | 0.77 | 39.8 |
| Approach | | 456 | 2.5 | 0.501 | 19.6 | LOS B | 5.8 | 41.0 | 0.81 | 0.71 | 40.1 |
| All Vehicles | | 1841 | 2.4 | 0.796 | 18.3 | LOS B | 13.6 | 97.3 | 0.76 | 0.71 | 42.9 |

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

**Movement Performance - Pedestrians**

| Mov ID | Description | Demand Flow ped/h | Average Delay sec | Level of Service | Average Back of Queue Pedestrian ped | Average Back of Queue Distance m | Prop. Queued | Effective Stop Rate per ped |
|---|---|---|---|---|---|---|---|---|
| P1 | South Full Crossing | 37 | 18.5 | LOS B | 0.1 | 0.1 | 0.76 | 0.76 |
| P2 | East Full Crossing | 11 | 15.6 | LOS B | 0.0 | 0.0 | 0.69 | 0.69 |
| P3 | North Full Crossing | 15 | 18.5 | LOS B | 0.0 | 0.0 | 0.75 | 0.75 |
| P4 | West Full Crossing | 17 | 15.6 | LOS B | 0.0 | 0.0 | 0.69 | 0.69 |
| All Pedestrians | | 79 | 17.5 | LOS B | | | 0.73 | 0.73 |

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

# PHASING SUMMARY

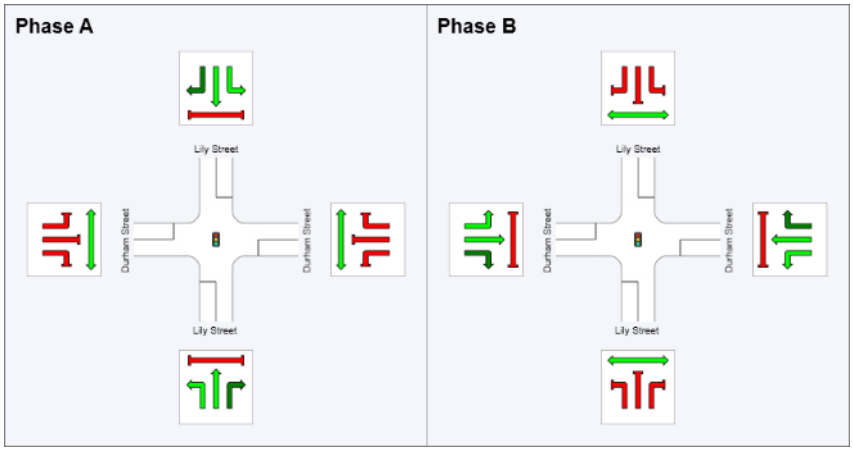
## Site: 3. Durham Sreet / Lily Street_PM Existing

Durham Street / Lily Street (3:30pm - 4:30pm)
Signals - Fixed Time  Cycle Time = 65 seconds (User-Given Phase Times)

**Phase times specified by the user**
**Sequence: Variable Phasing**
**Movement Class: All Movement Classes**
**Input Sequence: A, B**
**Output Sequence: A, B**

**Phase Timing Results**

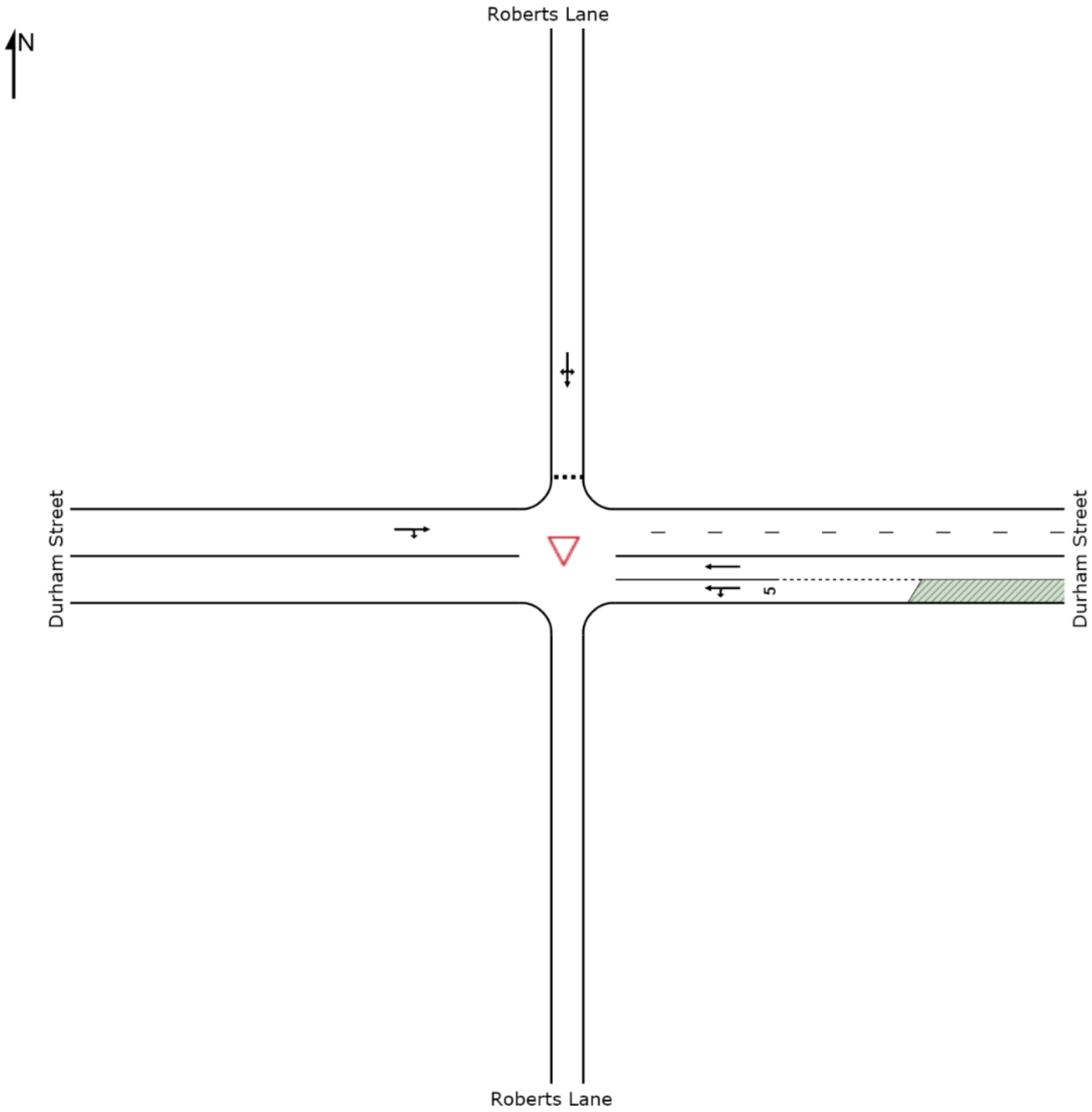
| Phase | A | B |
|---|---|---|
| Reference Phase | Yes | No |
| Phase Change Time (sec) | 0 | 35 |
| Green Time (sec) | 29 | 24 |
| Yellow Time (sec) | 4 | 4 |
| All-Red Time (sec) | 2 | 2 |
| Phase Time (sec) | 35 | 30 |
| Phase Split | 54 % | 46 % |




# SITE LAYOUT

## Site: Durham Street / Roberts Lane_AM Existing

Durham Street / Roberts Lane (8:00am - 9:00am)
Giveway / Yield (Two-Way)



# MOVEMENT SUMMARY

## Site: Durham Street / Roberts Lane_AM Existing

Durham Street / Roberts Lane (8:00am - 9:00am)
Giveway / Yield (Two-Way)

**Movement Performance - Vehicles**

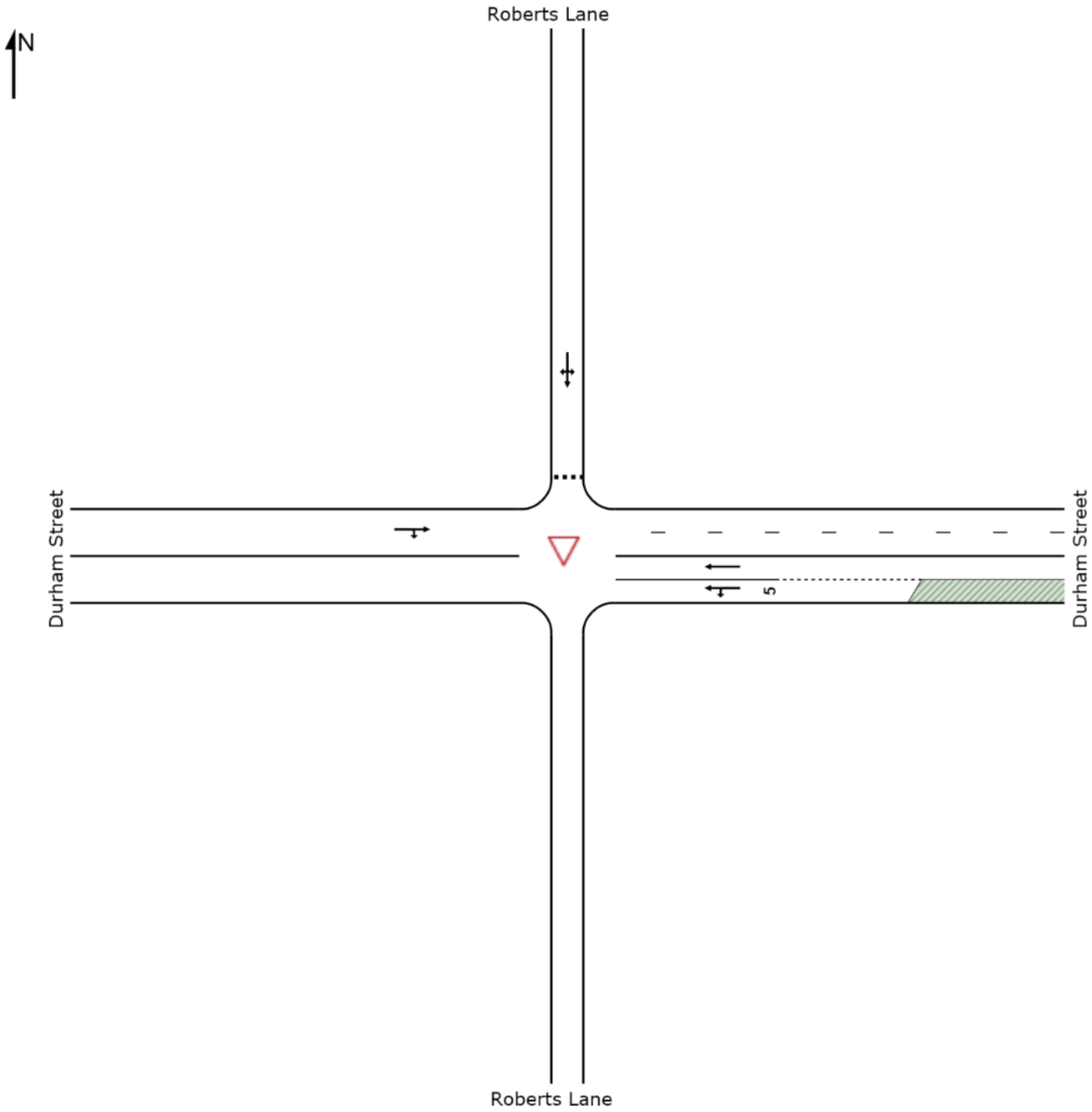
| Mov ID | OD Mov | Demand Flows Total veh/h | HV % | Deg. Satn v/c | Average Delay sec | Level of Service | 95% Back of Queue Vehicles veh | 95% Back of Queue Distance m | Prop. Queued | Effective Stop Rate per veh | Average Speed km/h |
|---|---|---|---|---|---|---|---|---|---|---|---|
| East: Durham Street | | | | | | | | | | | |
| 4 | L2 | 52 | 0.0 | 0.037 | 5.5 | LOS A | 0.0 | 0.0 | 0.00 | 0.44 | 54.7 |
| 5 | T1 | 372 | 1.4 | 0.037 | 0.0 | LOS A | 0.0 | 0.0 | 0.00 | 0.02 | 59.8 |
| Approach | | 423 | 1.2 | 0.183 | 0.7 | NA | 0.0 | 0.0 | 0.00 | 0.07 | 59.1 |
| North: Roberts Lane | | | | | | | | | | | |
| 7 | L2 | 11 | 0.0 | 0.088 | 13.6 | LOS A | 0.3 | 1.8 | 0.67 | 0.81 | 48.2 |
| 8 | T1 | 14 | 0.0 | 0.088 | 12.8 | LOS A | 0.3 | 1.8 | 0.67 | 0.81 | 48.5 |
| 9 | R2 | 11 | 0.0 | 0.088 | 13.6 | LOS A | 0.3 | 1.8 | 0.67 | 0.81 | 48.1 |
| Approach | | 35 | 0.0 | 0.088 | 13.3 | LOS A | 0.3 | 1.8 | 0.67 | 0.81 | 48.3 |
| West: Durham Street | | | | | | | | | | | |
| 11 | T1 | 477 | 3.8 | 0.237 | 2.0 | LOS A | 2.1 | 15.2 | 0.55 | 0.01 | 57.6 |
| 12 | R2 | 8 | 0.0 | 0.237 | 7.6 | LOS A | 2.1 | 15.2 | 0.55 | 0.01 | 56.0 |
| Approach | | 485 | 3.7 | 0.237 | 2.1 | NA | 2.1 | 15.2 | 0.55 | 0.01 | 57.5 |
| All Vehicles | | 943 | 2.5 | 0.237 | 1.9 | NA | 2.1 | 15.2 | 0.31 | 0.07 | 57.8 |

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

# SITE LAYOUT

## Site: Durham Street / Roberts Lane_PM Existing

Durham Street / Roberts Lane (5:00PM - 6:00PM)
Giveway / Yield (Two-Way)



# MOVEMENT SUMMARY

## Site: Durham Street / Roberts Lane_PM Existing

Durham Street / Roberts Lane (5:00PM - 6:00PM)
Giveway / Yield (Two-Way)

**Movement Performance - Vehicles**

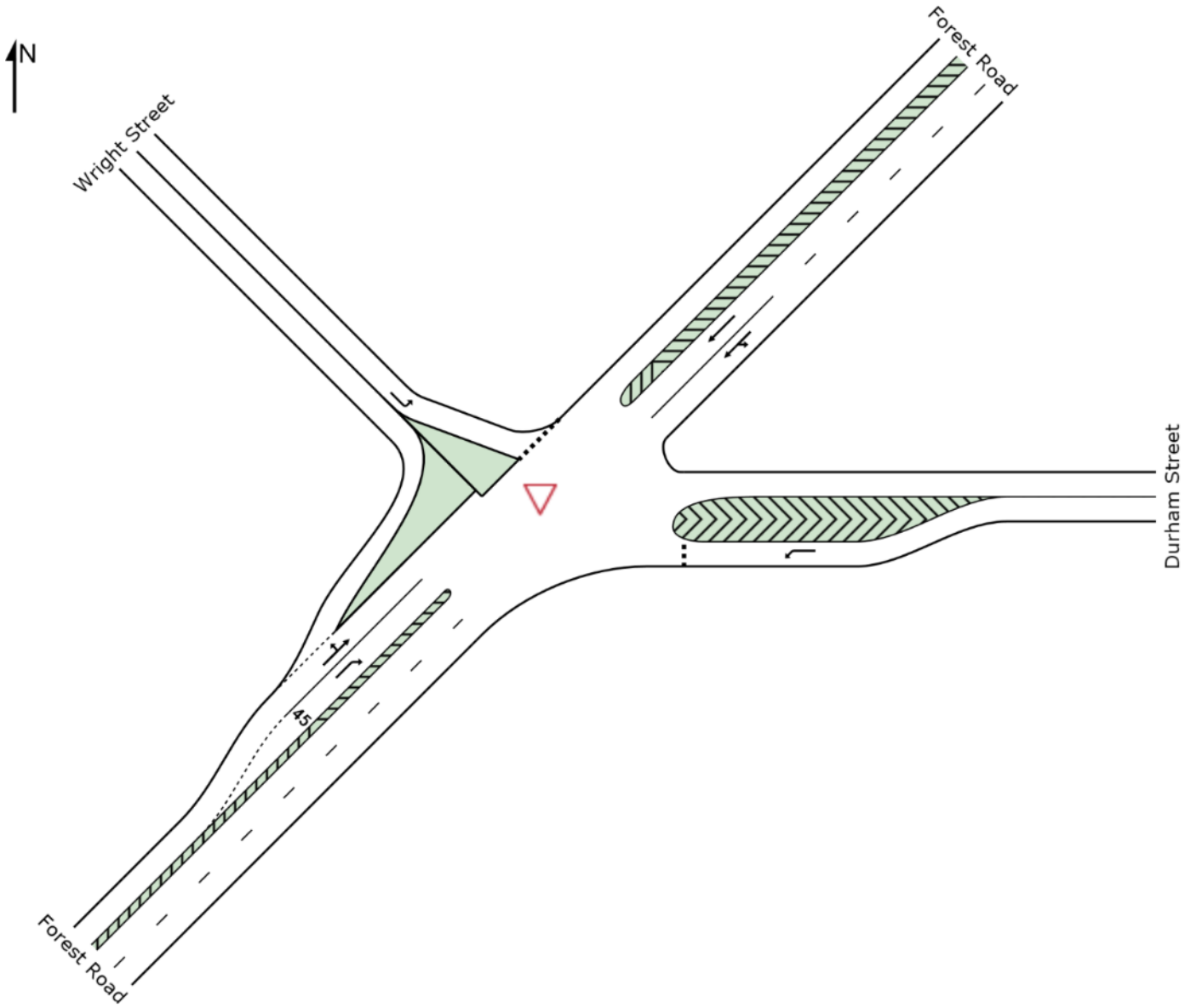
| Mov ID | OD Mov | Demand Flows Total veh/h | HV % | Deg. Satn v/c | Average Delay sec | Level of Service | 95% Back of Queue Vehicles veh | 95% Back of Queue Distance m | Prop. Queued | Effective Stop Rate per veh | Average Speed km/h |
|---|---|---|---|---|---|---|---|---|---|---|---|
| East: Durham Street | | | | | | | | | | | |
| 4 | L2 | 39 | 0.0 | 0.042 | 5.5 | LOS A | 0.0 | 0.0 | 0.00 | 0.29 | 55.9 |
| 5 | T1 | 446 | 0.9 | 0.042 | 0.0 | LOS A | 0.0 | 0.0 | 0.00 | 0.03 | 59.7 |
| Approach | | 485 | 0.9 | 0.209 | 0.5 | NA | 0.0 | 0.0 | 0.00 | 0.05 | 59.4 |
| North: Roberts Lane | | | | | | | | | | | |
| 7 | L2 | 4 | 0.0 | 0.038 | 13.4 | LOS A | 0.1 | 0.8 | 0.64 | 0.79 | 48.2 |
| 8 | T1 | 2 | 0.0 | 0.038 | 12.5 | LOS A | 0.1 | 0.8 | 0.64 | 0.79 | 48.6 |
| 9 | R2 | 8 | 0.0 | 0.038 | 13.4 | LOS A | 0.1 | 0.8 | 0.64 | 0.79 | 48.1 |
| Approach | | 15 | 0.0 | 0.038 | 13.3 | LOS A | 0.1 | 0.8 | 0.64 | 0.79 | 48.2 |
| West: Durham Street | | | | | | | | | | | |
| 11 | T1 | 398 | 1.6 | 0.204 | 2.3 | LOS A | 1.8 | 13.0 | 0.57 | 0.03 | 57.4 |
| 12 | R2 | 16 | 0.0 | 0.204 | 7.9 | LOS A | 1.8 | 13.0 | 0.57 | 0.03 | 55.9 |
| Approach | | 414 | 1.5 | 0.204 | 2.5 | NA | 1.8 | 13.0 | 0.57 | 0.03 | 57.3 |
| All Vehicles | | 914 | 1.2 | 0.209 | 1.6 | NA | 1.8 | 13.0 | 0.27 | 0.05 | 58.2 |

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

# SITE LAYOUT

## Site: 1. Forest Road / Durham Street / Wright Street_AM Scenario 1

Forest Road / Durham Street / Wright Street
Giveway / Yield (Two-Way)



# MOVEMENT SUMMARY

## Site: 1. Forest Road / Durham Street / Wright Street_AM Scenario 1

Forest Road / Durham Street / Wright Street
Giveway / Yield (Two-Way)

**Movement Performance - Vehicles**

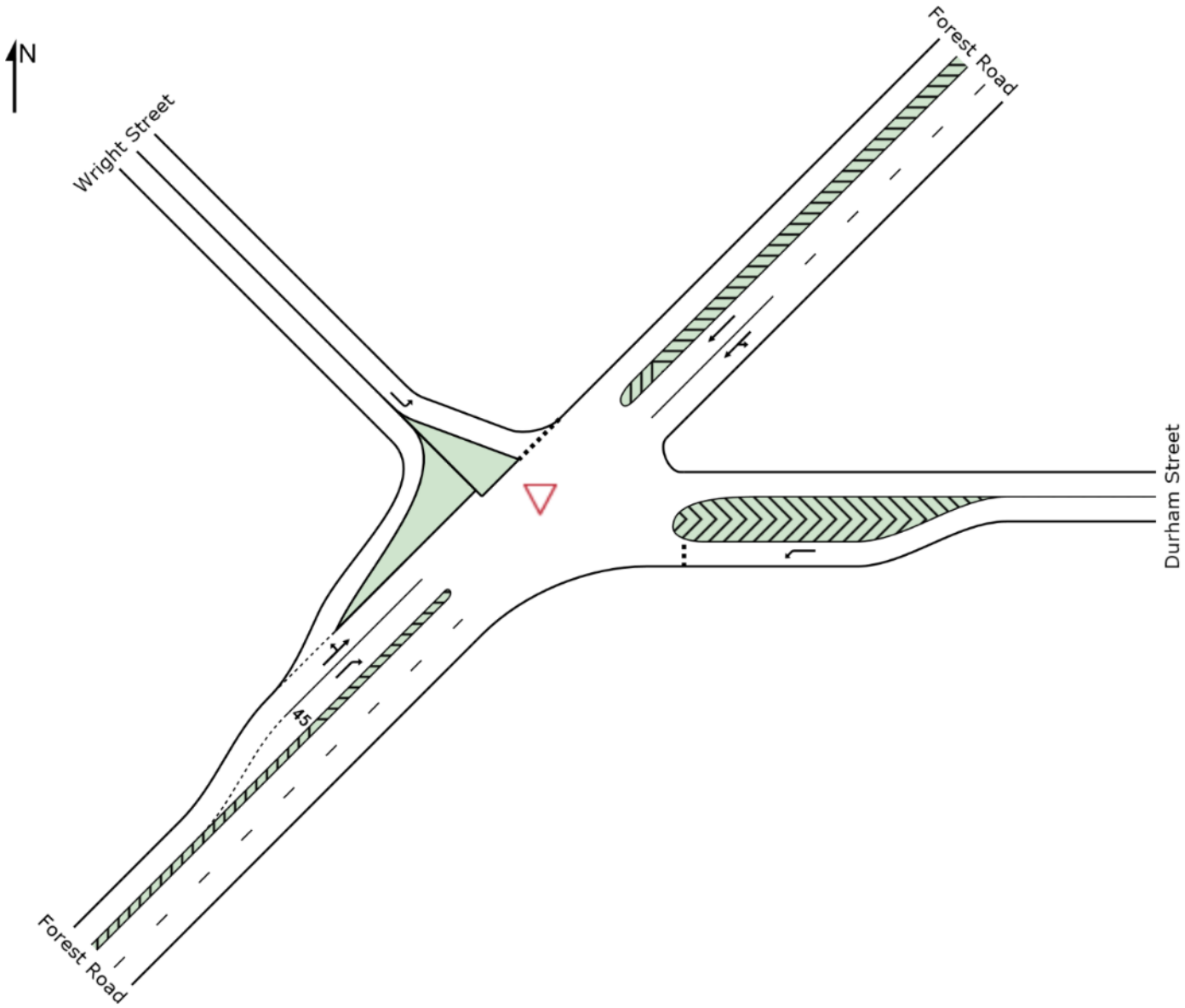
| Mov ID | OD Mov | Demand Flows Total veh/h | HV % | Deg. Satn v/c | Average Delay sec | Level of Service | 95% Back of Queue Vehicles veh | 95% Back of Queue Distance m | Prop. Queued | Effective Stop Rate per veh | Average Speed km/h |
|---|---|---|---|---|---|---|---|---|---|---|---|
| East: Durham Street | | | | | | | | | | | |
| 4a | L1 | 453 | 1.6 | 0.462 | 6.5 | LOS A | 3.2 | 23.1 | 0.52 | 0.72 | 48.4 |
| Approach | | 453 | 1.6 | 0.462 | 6.5 | LOS A | 3.2 | 23.1 | 0.52 | 0.72 | 48.4 |
| NorthEast: Forest Road | | | | | | | | | | | |
| 24b | L3 | 44 | 2.4 | 0.194 | 5.4 | LOS A | 0.0 | 0.0 | 0.00 | 0.08 | 49.4 |
| 25 | T1 | 696 | 1.5 | 0.194 | 0.0 | LOS A | 0.0 | 0.0 | 0.00 | 0.03 | 49.8 |
| Approach | | 740 | 1.6 | 0.194 | 0.3 | NA | 0.0 | 0.0 | 0.00 | 0.04 | 49.7 |
| NorthWest: Wright Street | | | | | | | | | | | |
| 27 | L2 | 87 | 1.2 | 0.137 | 8.7 | LOS A | 0.5 | 3.6 | 0.57 | 0.77 | 47.7 |
| Approach | | 87 | 1.2 | 0.137 | 8.7 | LOS A | 0.5 | 3.6 | 0.57 | 0.77 | 47.7 |
| SouthWest: Forest Road | | | | | | | | | | | |
| 30 | L2 | 75 | 0.0 | 0.385 | 4.4 | LOS A | 0.0 | 0.0 | 0.00 | 0.05 | 50.3 |
| 31 | T1 | 664 | 1.9 | 0.385 | 0.1 | LOS A | 0.0 | 0.0 | 0.00 | 0.05 | 49.6 |
| 32a | R1 | 475 | 3.5 | 0.697 | 13.0 | LOS A | 5.6 | 40.5 | 0.78 | 1.16 | 42.2 |
| Approach | | 1214 | 2.4 | 0.697 | 5.4 | NA | 5.6 | 40.5 | 0.31 | 0.49 | 46.5 |
| All Vehicles | | 2494 | 2.0 | 0.697 | 4.2 | NA | 5.6 | 40.5 | 0.26 | 0.41 | 47.8 |

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

# SITE LAYOUT

## Site: 1. Forest Road / Durham Street / Wright Street_PM Scenario 1

Forest Road / Durham Street / Wright Street
Giveway / Yield (Two-Way)



# MOVEMENT SUMMARY

## Site: 1. Forest Road / Durham Street / Wright Street_PM Scenario 1

Forest Road / Durham Street / Wright Street
Giveway / Yield (Two-Way)

**Movement Performance - Vehicles**

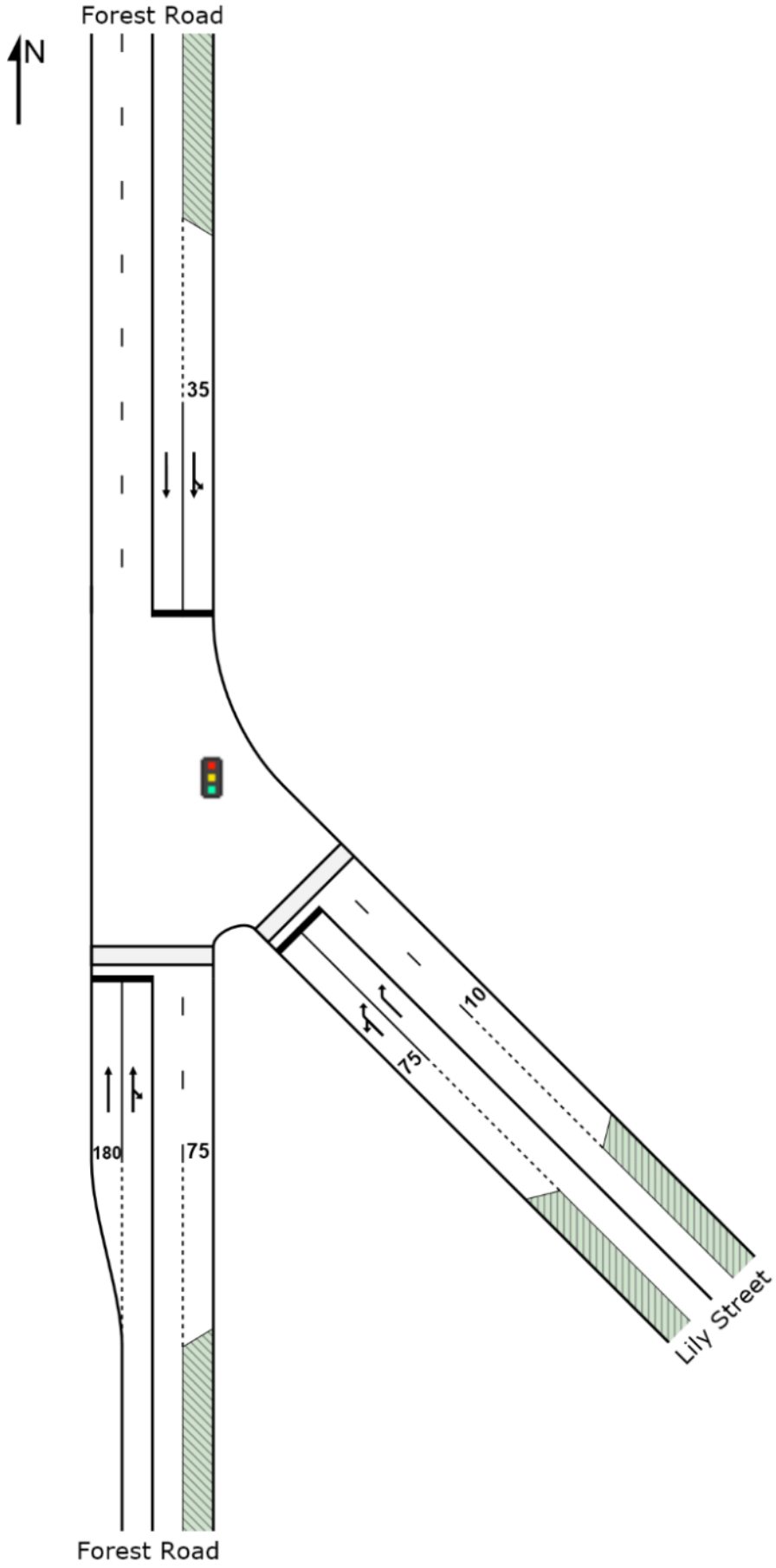
| Mov ID | OD Mov | Demand Flows Total veh/h | HV % | Deg. Satn v/c | Average Delay sec | Level of Service | 95% Back of Queue Vehicles veh | 95% Back of Queue Distance m | Prop. Queued | Effective Stop Rate per veh | Average Speed km/h |
|---|---|---|---|---|---|---|---|---|---|---|---|
| East: Durham Street | | | | | | | | | | | |
| 4a | L1 | 600 | 1.1 | 0.696 | 10.7 | LOS A | 7.9 | 56.0 | 0.73 | 1.12 | 45.9 |
| Approach | | 600 | 1.1 | 0.696 | 10.7 | LOS A | 7.9 | 56.0 | 0.73 | 1.12 | 45.9 |
| NorthEast: Forest Road | | | | | | | | | | | |
| 24b | L3 | 59 | 0.0 | 0.265 | 5.4 | LOS A | 0.0 | 0.0 | 0.00 | 0.07 | 49.4 |
| 25 | T1 | 956 | 1.0 | 0.265 | 0.0 | LOS A | 0.0 | 0.0 | 0.00 | 0.03 | 49.8 |
| Approach | | 1015 | 0.9 | 0.265 | 0.3 | NA | 0.0 | 0.0 | 0.00 | 0.04 | 49.7 |
| NorthWest: Wright Street | | | | | | | | | | | |
| 27 | L2 | 49 | 0.0 | 0.074 | 8.2 | LOS A | 0.3 | 1.9 | 0.54 | 0.72 | 48.0 |
| Approach | | 49 | 0.0 | 0.074 | 8.2 | LOS A | 0.3 | 1.9 | 0.54 | 0.72 | 48.0 |
| SouthWest: Forest Road | | | | | | | | | | | |
| 30 | L2 | 66 | 0.0 | 0.367 | 4.4 | LOS A | 0.0 | 0.0 | 0.00 | 0.05 | 50.4 |
| 31 | T1 | 643 | 0.8 | 0.367 | 0.0 | LOS A | 0.0 | 0.0 | 0.00 | 0.05 | 49.7 |
| 32a | R1 | 491 | 1.1 | 0.989 | 51.7 | LOS D | 19.9 | 140.4 | 0.99 | 2.48 | 29.2 |
| Approach | | 1200 | 0.9 | 0.989 | 21.4 | NA | 19.9 | 140.4 | 0.41 | 1.04 | 38.6 |
| All Vehicles | | 2864 | 0.9 | 0.989 | 11.5 | NA | 19.9 | 140.4 | 0.33 | 0.70 | 43.7 |

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

# SITE LAYOUT

## Site: 2. Forest Road / Lily Street_AM Scenario 1

Forest Road / Lily Street
Signals - Fixed Time



# MOVEMENT SUMMARY

## Site: 2. Forest Road / Lily Street_AM Scenario 1

Forest Road / Lily Street
Signals - Fixed Time  Cycle Time = 70 seconds (User-Given Phase Times)

**Movement Performance - Vehicles**

| Mov ID | OD Mov | Demand Flows Total veh/h | HV % | Deg. Satn v/c | Average Delay sec | Level of Service | 95% Back of Queue Vehicles veh | 95% Back of Queue Distance m | Prop. Queued | Effective Stop Rate per veh | Average Speed km/h |
|---|---|---|---|---|---|---|---|---|---|---|---|
| South: Forest Road | | | | | | | | | | | |
| 2 | T1 | 684 | 1.7 | 0.338 | 7.4 | LOS A | 6.6 | 46.7 | 0.53 | 0.47 | 53.3 |
| 3b | R3 | 28 | 3.7 | 0.338 | 15.0 | LOS B | 5.5 | 39.2 | 0.57 | 0.52 | 47.5 |
| Approach | | 713 | 1.8 | 0.338 | 7.7 | LOS A | 6.6 | 46.7 | 0.53 | 0.47 | 53.0 |
| SouthEast: Lily Street | | | | | | | | | | | |
| 21b | L3 | 53 | 2.0 | 0.739 | 38.0 | LOS C | 9.4 | 67.5 | 0.99 | 0.89 | 37.0 |
| 23a | R1 | 493 | 2.8 | 0.739 | 36.0 | LOS C | 9.7 | 69.3 | 0.99 | 0.89 | 36.9 |
| Approach | | 545 | 2.7 | 0.739 | 36.2 | LOS C | 9.7 | 69.3 | 0.99 | 0.89 | 36.9 |
| North: Forest Road | | | | | | | | | | | |
| 7a | L1 | 308 | 3.8 | 0.284 | 6.7 | LOS A | 3.0 | 21.9 | 0.37 | 0.60 | 49.6 |
| 8 | T1 | 742 | 1.6 | 0.685 | 7.3 | LOS A | 12.9 | 91.5 | 0.59 | 0.55 | 53.2 |
| Approach | | 1051 | 2.2 | 0.685 | 7.1 | LOS A | 12.9 | 91.5 | 0.52 | 0.57 | 52.1 |
| All Vehicles | | 2308 | 2.2 | 0.739 | 14.2 | LOS A | 12.9 | 91.5 | 0.64 | 0.61 | 47.7 |

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

**Movement Performance - Pedestrians**

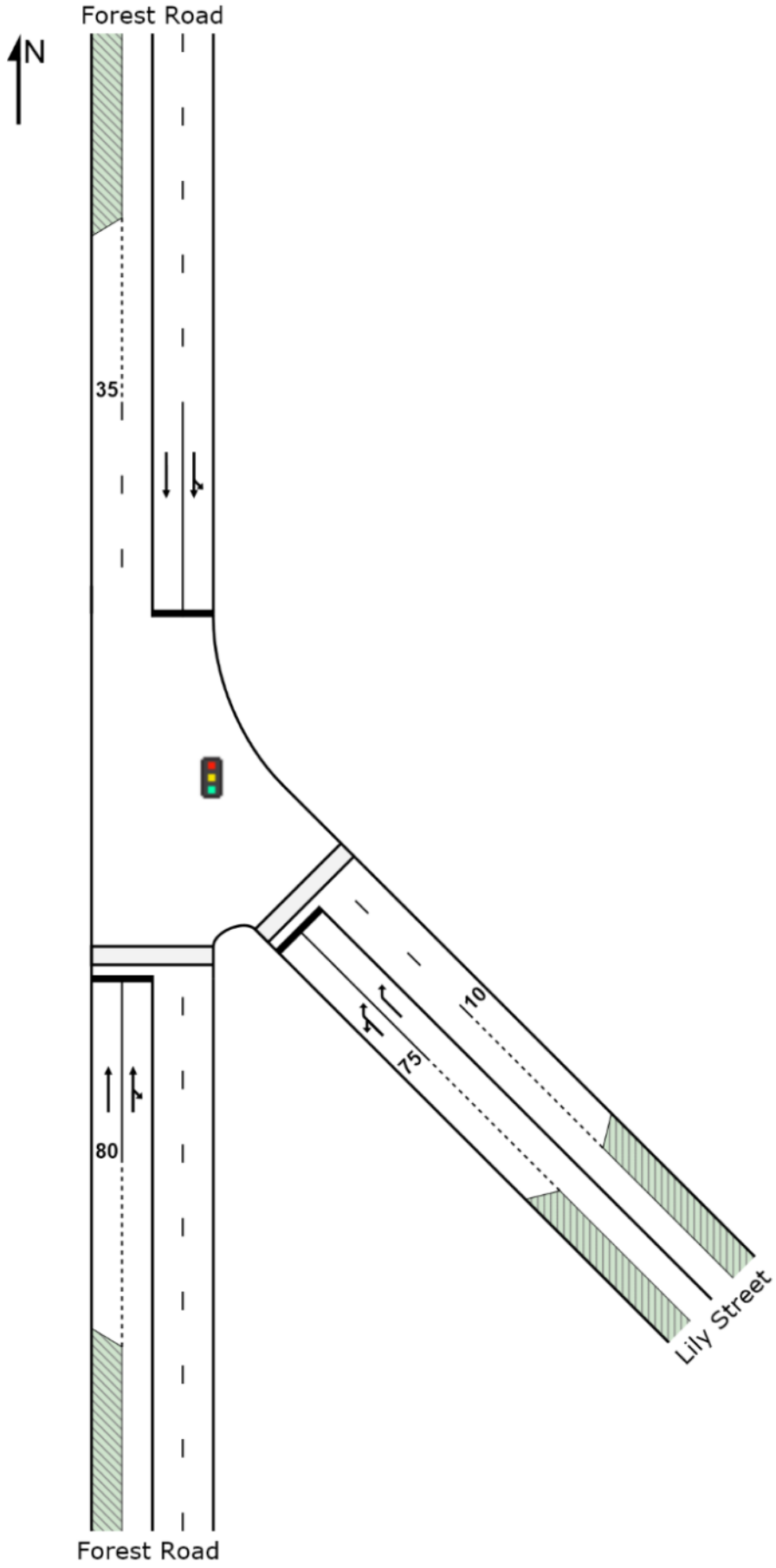
| Mov ID | Description | Demand Flow ped/h | Average Delay sec | Level of Service | Average Back of Queue Pedestrian ped | Average Back of Queue Distance m | Prop. Queued | Effective Stop Rate per ped |
|---|---|---|---|---|---|---|---|---|
| P1 | South Full Crossing | 361 | 29.7 | LOS C | 0.7 | 0.7 | 0.93 | 0.93 |
| P5 | SouthEast Full Crossing | 169 | 9.3 | LOS A | 0.2 | 0.2 | 0.52 | 0.52 |
| All Pedestrians | | 531 | 23.2 | LOS C | | | 0.80 | 0.80 |

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

# SITE LAYOUT

## Site: 2. Forest Road / Lily Street_PM Scenario 1

Forest Road / Lily Street
Signals - Fixed Time



# MOVEMENT SUMMARY

## Site: 2. Forest Road / Lily Street_PM Scenario 1

Forest Road / Lily Street
Signals - Fixed Time  Cycle Time = 50 seconds (Practical Cycle Time)

**Movement Performance - Vehicles**

| Mov ID | OD Mov | Demand Flows Total veh/h | HV % | Deg. Satn v/c | Average Delay sec | Level of Service | 95% Back of Queue Vehicles veh | 95% Back of Queue Distance m | Prop. Queued | Effective Stop Rate per veh | Average Speed km/h |
|---|---|---|---|---|---|---|---|---|---|---|---|
| South: Forest Road | | | | | | | | | | | |
| 2 | T1 | 686 | 0.8 | 0.712 | 12.6 | LOS A | 11.9 | 83.6 | 0.81 | 0.74 | 49.5 |
| 3b | R3 | 24 | 0.0 | 0.712 | 20.1 | LOS B | 11.9 | 83.6 | 0.87 | 0.81 | 44.7 |
| Approach | | 711 | 0.7 | 0.712 | 12.8 | LOS A | 11.9 | 83.6 | 0.82 | 0.74 | 49.4 |
| SouthEast: Lily Street | | | | | | | | | | | |
| 21b | L3 | 45 | 0.0 | 0.176 | 20.8 | LOS B | 1.7 | 12.1 | 0.77 | 0.74 | 44.6 |
| 23a | R1 | 456 | 1.2 | 0.718 | 23.0 | LOS B | 9.8 | 69.1 | 0.93 | 0.87 | 42.5 |
| Approach | | 501 | 1.1 | 0.718 | 22.8 | LOS B | 9.8 | 69.1 | 0.92 | 0.86 | 42.7 |
| North: Forest Road | | | | | | | | | | | |
| 7a | L1 | 323 | 0.7 | 0.706 | 14.1 | LOS A | 11.8 | 82.9 | 0.83 | 0.81 | 45.9 |
| 8 | T1 | 978 | 1.0 | 0.706 | 11.5 | LOS A | 13.0 | 91.8 | 0.85 | 0.79 | 49.9 |
| Approach | | 1301 | 0.9 | 0.706 | 12.2 | LOS A | 13.0 | 91.8 | 0.84 | 0.80 | 48.8 |
| All Vehicles | | 2513 | 0.9 | 0.718 | 14.5 | LOS A | 13.0 | 91.8 | 0.85 | 0.79 | 47.6 |

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

**Movement Performance - Pedestrians**

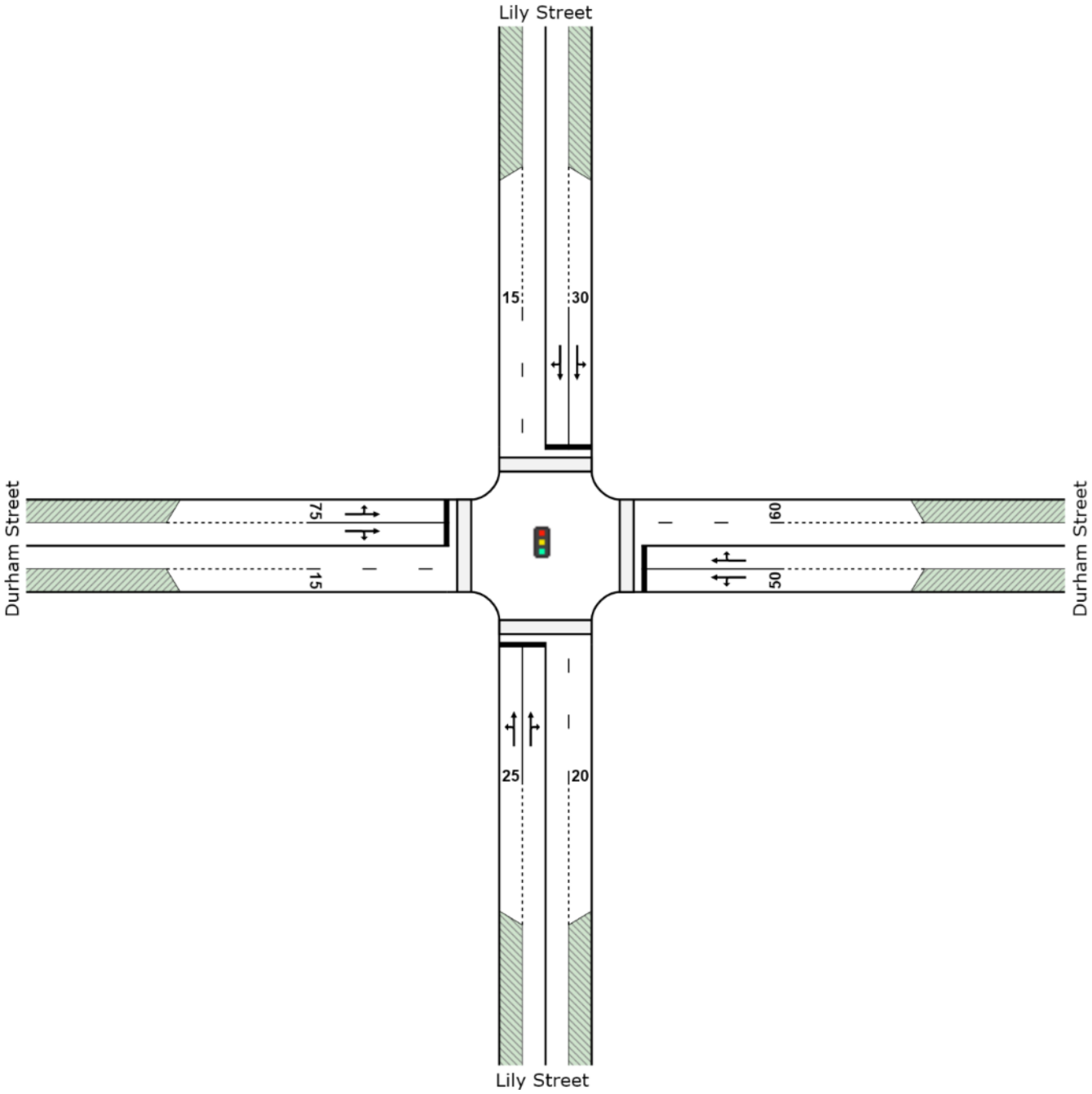
| Mov ID | Description | Demand Flow ped/h | Average Delay sec | Level of Service | Average Back of Queue Pedestrian ped | Average Back of Queue Distance m | Prop. Queued | Effective Stop Rate per ped |
|---|---|---|---|---|---|---|---|---|
| P1 | South Full Crossing | 39 | 18.5 | LOS B | 0.0 | 0.0 | 0.86 | 0.86 |
| P5 | SouthEast Full Crossing | 169 | 13.8 | LOS B | 0.2 | 0.2 | 0.75 | 0.75 |
| All Pedestrians | | 208 | 14.7 | LOS B | | | 0.77 | 0.77 |

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

# SITE LAYOUT

## Site: 3. Durham Sreet / Lily Street_AM Scenario 1

Durham Street / Lily Street
Signals - Fixed Time



# MOVEMENT SUMMARY

## Site: 3. Durham Sreet / Lily Street_AM Scenario 1

Durham Street / Lily Street
Signals - Fixed Time  Cycle Time = 55 seconds (User-Given Phase Times)

**Movement Performance - Vehicles**

| Mov ID | OD Mov | Demand Flows Total veh/h | HV % | Deg. Satn v/c | Average Delay sec | Level of Service | 95% Back of Queue Vehicles veh | Distance m | Prop. Queued | Effective Stop Rate per veh | Average Speed km/h |
|---|---|---|---|---|---|---|---|---|---|---|---|
| South: Lily Street | | | | | | | | | | | |
| 1 | L2 | 191 | 0.0 | 0.244 | 13.2 | LOS A | 3.5 | 24.8 | 0.58 | 0.68 | 45.9 |
| 2 | T1 | 511 | 3.5 | 0.977 | 49.6 | LOS D | 30.1 | 216.6 | 0.87 | 1.32 | 32.5 |
| 3 | R2 | 182 | 2.3 | 0.977 | 59.8 | LOS E | 30.1 | 216.6 | 0.90 | 1.39 | 29.6 |
| Approach | | 883 | 2.5 | 0.977 | 43.9 | LOS D | 30.1 | 216.6 | 0.81 | 1.20 | 34.0 |
| East: Durham Street | | | | | | | | | | | |
| 4 | L2 | 87 | 3.6 | 0.378 | 23.5 | LOS B | 4.1 | 29.6 | 0.87 | 0.74 | 40.6 |
| 5 | T1 | 311 | 1.7 | 0.540 | 20.2 | LOS B | 5.7 | 40.8 | 0.91 | 0.76 | 38.8 |
| 6 | R2 | 16 | 0.0 | 0.540 | 25.3 | LOS B | 5.7 | 40.8 | 0.92 | 0.77 | 40.7 |
| Approach | | 414 | 2.0 | 0.540 | 21.1 | LOS B | 5.7 | 40.8 | 0.90 | 0.76 | 39.3 |
| North: Lily Street | | | | | | | | | | | |
| 7 | L2 | 13 | 0.0 | 0.149 | 12.7 | LOS A | 2.1 | 14.8 | 0.54 | 0.46 | 48.5 |
| 8 | T1 | 326 | 3.2 | 0.213 | 7.7 | LOS A | 2.9 | 21.0 | 0.57 | 0.48 | 53.0 |
| 9 | R2 | 7 | 0.0 | 0.213 | 13.6 | LOS A | 2.9 | 21.0 | 0.58 | 0.49 | 48.1 |
| Approach | | 346 | 3.0 | 0.213 | 8.0 | LOS A | 2.9 | 21.0 | 0.56 | 0.48 | 52.7 |
| West: Durham Street | | | | | | | | | | | |
| 10 | L2 | 65 | 0.0 | 0.661 | 25.8 | LOS B | 8.2 | 58.5 | 0.95 | 0.84 | 40.2 |
| 11 | T1 | 407 | 2.6 | 0.944 | 30.0 | LOS C | 10.8 | 77.9 | 0.97 | 1.01 | 35.0 |
| 12 | R2 | 121 | 6.1 | 0.944 | 49.4 | LOS D | 10.8 | 77.9 | 1.00 | 1.30 | 31.6 |
| Approach | | 594 | 3.0 | 0.944 | 33.5 | LOS C | 10.8 | 77.9 | 0.97 | 1.05 | 34.7 |
| All Vehicles | | 2237 | 2.6 | 0.977 | 31.3 | LOS C | 30.1 | 216.6 | 0.83 | 0.97 | 37.2 |

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

**Movement Performance - Pedestrians**

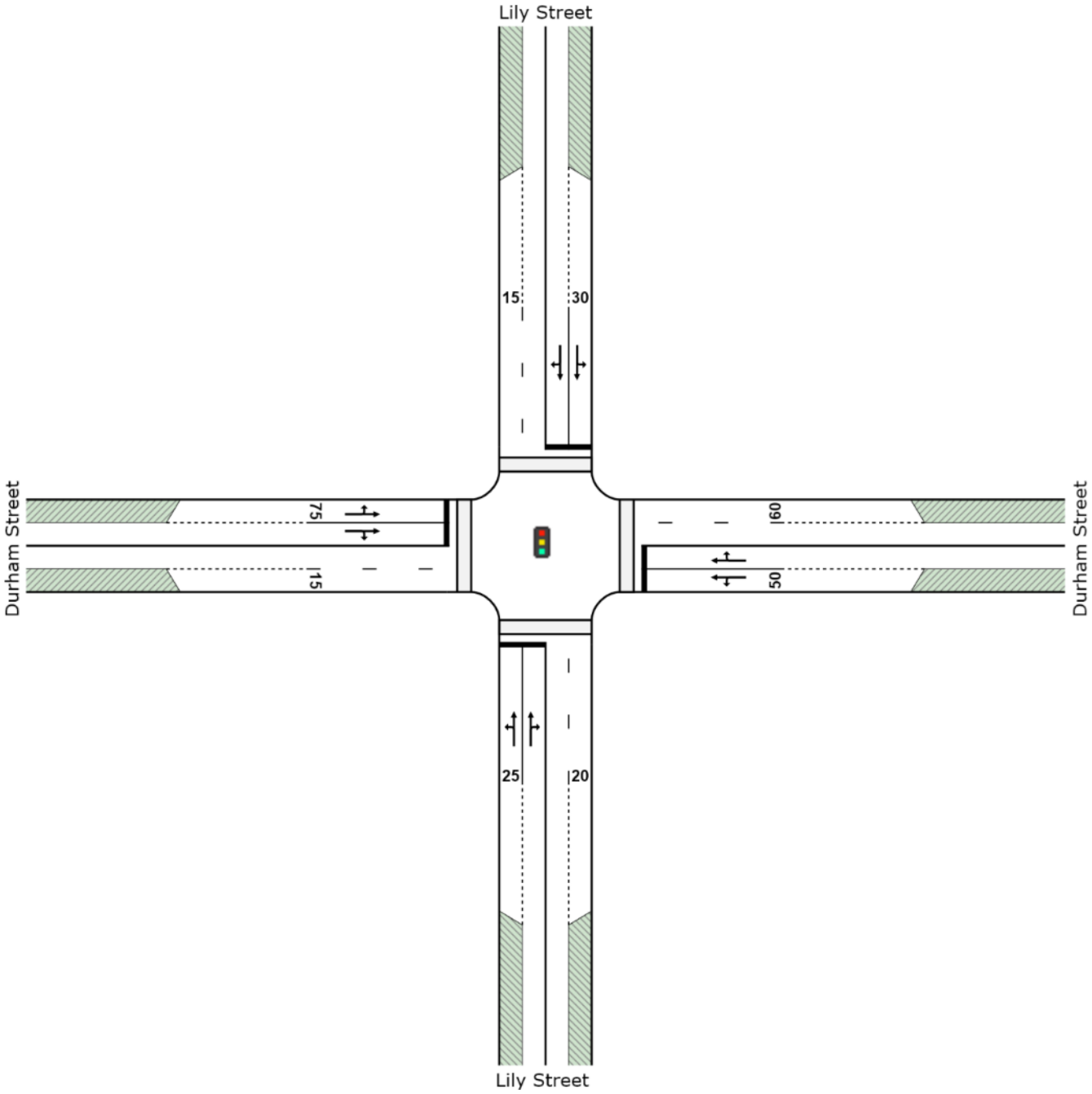
| Mov ID | Description | Demand Flow ped/h | Average Delay sec | Level of Service | Average Back of Queue Pedestrian ped | Distance m | Prop. Queued | Effective Stop Rate per ped |
|---|---|---|---|---|---|---|---|---|
| P1 | South Full Crossing | 45 | 21.9 | LOS C | 0.1 | 0.1 | 0.89 | 0.89 |
| P2 | East Full Crossing | 20 | 11.1 | LOS B | 0.0 | 0.0 | 0.64 | 0.64 |
| P3 | North Full Crossing | 39 | 21.9 | LOS C | 0.1 | 0.1 | 0.89 | 0.89 |
| P4 | West Full Crossing | 57 | 11.2 | LOS B | 0.1 | 0.1 | 0.64 | 0.64 |
| All Pedestrians | | 161 | 16.8 | LOS B | | | 0.77 | 0.77 |

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

# SITE LAYOUT

## Site: 3. Durham Sreet / Lily Street_PM Scenario 1

Durham Street / Lily Street
Signals - Fixed Time



# MOVEMENT SUMMARY

## Site: 3. Durham Sreet / Lily Street_PM Scenario 1

Durham Street / Lily Street
Signals - Fixed Time  Cycle Time = 65 seconds (User-Given Phase Times)

**Movement Performance - Vehicles**

| Mov ID | OD Mov | Demand Flows Total veh/h | HV % | Deg. Satn v/c | Average Delay sec | Level of Service | 95% Back of Queue Vehicles veh | 95% Back of Queue Distance m | Prop. Queued | Effective Stop Rate per veh | Average Speed km/h |
|---|---|---|---|---|---|---|---|---|---|---|---|
| South: Lily Street | | | | | | | | | | | |
| 1 | L2 | 311 | 2.0 | 0.438 | 18.6 | LOS B | 6.6 | 47.3 | 0.71 | 0.77 | 42.4 |
| 2 | T1 | 364 | 3.2 | 0.858 | 27.1 | LOS B | 15.3 | 110.1 | 0.84 | 0.95 | 41.0 |
| 3 | R2 | 93 | 2.3 | 0.858 | 32.7 | LOS C | 15.3 | 110.1 | 0.84 | 0.95 | 38.1 |
| Approach | | 767 | 2.6 | 0.858 | 24.4 | LOS B | 15.3 | 110.1 | 0.79 | 0.88 | 41.2 |
| East: Durham Street | | | | | | | | | | | |
| 4 | L2 | 68 | 3.1 | 0.290 | 20.4 | LOS B | 4.6 | 32.7 | 0.75 | 0.66 | 42.4 |
| 5 | T1 | 397 | 0.3 | 0.414 | 16.9 | LOS B | 6.7 | 46.9 | 0.78 | 0.68 | 40.3 |
| 6 | R2 | 12 | 0.0 | 0.414 | 22.0 | LOS B | 6.7 | 46.9 | 0.80 | 0.68 | 42.3 |
| Approach | | 477 | 0.7 | 0.414 | 17.5 | LOS B | 6.7 | 46.9 | 0.78 | 0.67 | 40.7 |
| North: Lily Street | | | | | | | | | | | |
| 7 | L2 | 18 | 0.0 | 0.177 | 17.2 | LOS B | 2.9 | 20.6 | 0.63 | 0.54 | 45.7 |
| 8 | T1 | 311 | 3.1 | 0.252 | 12.3 | LOS A | 3.9 | 27.8 | 0.66 | 0.56 | 49.6 |
| 9 | R2 | 12 | 0.0 | 0.252 | 18.4 | LOS B | 3.9 | 27.8 | 0.68 | 0.57 | 45.2 |
| Approach | | 340 | 2.8 | 0.252 | 12.8 | LOS A | 3.9 | 27.8 | 0.66 | 0.56 | 49.2 |
| West: Durham Street | | | | | | | | | | | |
| 10 | L2 | 121 | 0.0 | 0.561 | 22.4 | LOS B | 10.2 | 71.7 | 0.85 | 0.76 | 41.5 |
| 11 | T1 | 376 | 1.4 | 0.561 | 21.1 | LOS B | 10.2 | 71.7 | 0.88 | 0.82 | 38.1 |
| 12 | R2 | 183 | 3.4 | 0.802 | 34.5 | LOS C | 10.0 | 71.7 | 0.98 | 1.01 | 36.0 |
| Approach | | 680 | 1.7 | 0.802 | 24.9 | LOS B | 10.2 | 71.7 | 0.90 | 0.86 | 38.0 |
| All Vehicles | | 2264 | 2.0 | 0.858 | 21.4 | LOS B | 15.3 | 110.1 | 0.80 | 0.78 | 41.0 |

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

**Movement Performance - Pedestrians**

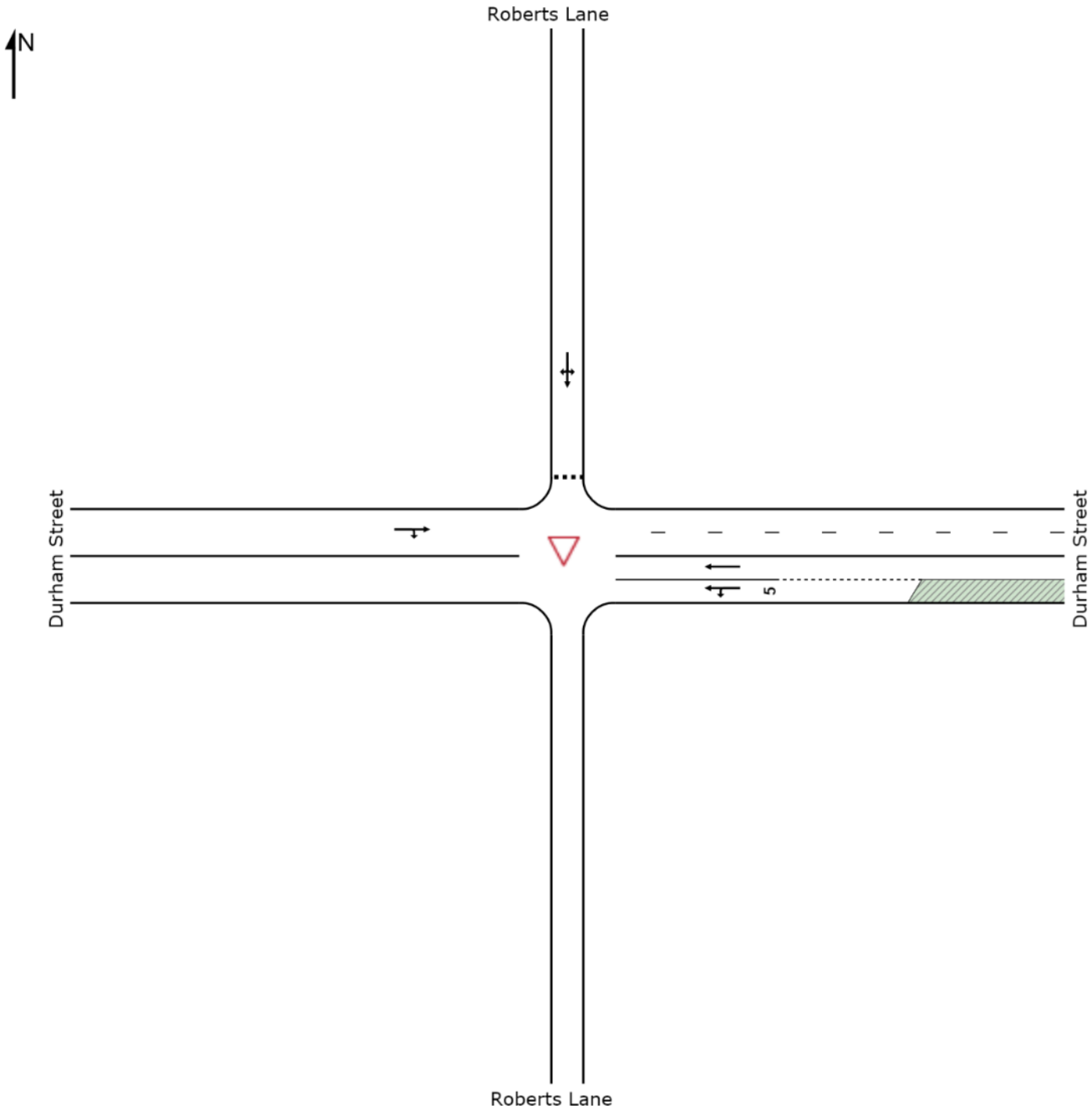
| Mov ID | Description | Demand Flow ped/h | Average Delay sec | Level of Service | Average Back of Queue Pedestrian ped | Average Back of Queue Distance m | Prop. Queued | Effective Stop Rate per ped |
|---|---|---|---|---|---|---|---|---|
| P1 | South Full Crossing | 37 | 18.5 | LOS B | 0.1 | 0.1 | 0.76 | 0.76 |
| P2 | East Full Crossing | 11 | 15.6 | LOS B | 0.0 | 0.0 | 0.69 | 0.69 |
| P3 | North Full Crossing | 15 | 18.5 | LOS B | 0.0 | 0.0 | 0.75 | 0.75 |
| P4 | West Full Crossing | 17 | 15.6 | LOS B | 0.0 | 0.0 | 0.69 | 0.69 |
| All Pedestrians | | 79 | 17.5 | LOS B | | | 0.73 | 0.73 |

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

# SITE LAYOUT

## Site: Durham Street / Roberts Lane_AM Scenario 1

Durham Street / Roberts Lane
Giveway / Yield (Two-Way)



# MOVEMENT SUMMARY

## Site: Durham Street / Roberts Lane_AM Scenario 1

Durham Street / Roberts Lane
Giveway / Yield (Two-Way)

**Movement Performance - Vehicles**

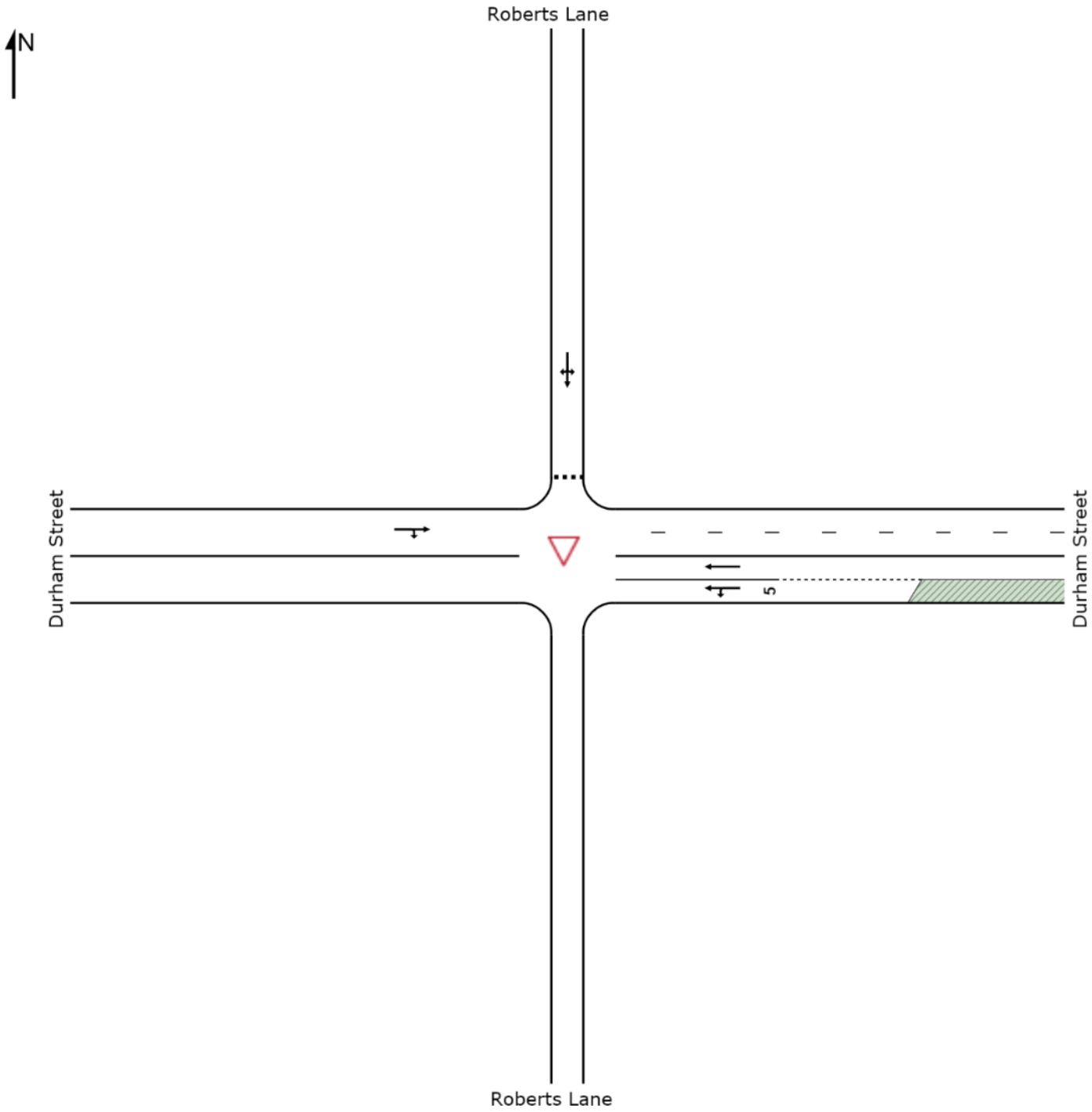
| Mov ID | OD Mov | Demand Flows Total veh/h | HV % | Deg. Satn v/c | Average Delay sec | Level of Service | 95% Back of Queue Vehicles veh | 95% Back of Queue Distance m | Prop. Queued | Effective Stop Rate per veh | Average Speed km/h |
|---|---|---|---|---|---|---|---|---|---|---|---|
| East: Durham Street | | | | | | | | | | | |
| 4 | L2 | 52 | 0.0 | 0.044 | 5.5 | LOS A | 0.0 | 0.0 | 0.00 | 0.37 | 55.3 |
| 5 | T1 | 455 | 1.2 | 0.044 | 0.0 | LOS A | 0.0 | 0.0 | 0.00 | 0.03 | 59.7 |
| Approach | | 506 | 1.0 | 0.219 | 0.6 | NA | 0.0 | 0.0 | 0.00 | 0.06 | 59.2 |
| North: Roberts Lane | | | | | | | | | | | |
| 7 | L2 | 11 | 0.0 | 0.125 | 18.1 | LOS B | 0.4 | 2.5 | 0.78 | 0.88 | 45.5 |
| 8 | T1 | 14 | 0.0 | 0.125 | 17.2 | LOS B | 0.4 | 2.5 | 0.78 | 0.88 | 45.8 |
| 9 | R2 | 11 | 0.0 | 0.125 | 18.1 | LOS B | 0.4 | 2.5 | 0.78 | 0.88 | 45.4 |
| Approach | | 35 | 0.0 | 0.125 | 17.7 | LOS B | 0.4 | 2.5 | 0.78 | 0.88 | 45.6 |
| West: Durham Street | | | | | | | | | | | |
| 11 | T1 | 591 | 3.0 | 0.292 | 2.8 | LOS A | 3.1 | 22.0 | 0.63 | 0.01 | 57.2 |
| 12 | R2 | 8 | 0.0 | 0.292 | 8.4 | LOS A | 3.1 | 22.0 | 0.63 | 0.01 | 55.7 |
| Approach | | 599 | 3.0 | 0.292 | 2.9 | NA | 3.1 | 22.0 | 0.63 | 0.01 | 57.2 |
| All Vehicles | | 1140 | 2.0 | 0.292 | 2.3 | NA | 3.1 | 22.0 | 0.36 | 0.06 | 57.6 |

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

# SITE LAYOUT

## Site: Durham Street / Roberts Lane_PM Scenario 1

Durham Street / Roberts Lane
Giveway / Yield (Two-Way)



# MOVEMENT SUMMARY

## Site: Durham Street / Roberts Lane_PM Scenario 1

Durham Street / Roberts Lane
Giveway / Yield (Two-Way)

**Movement Performance - Vehicles**

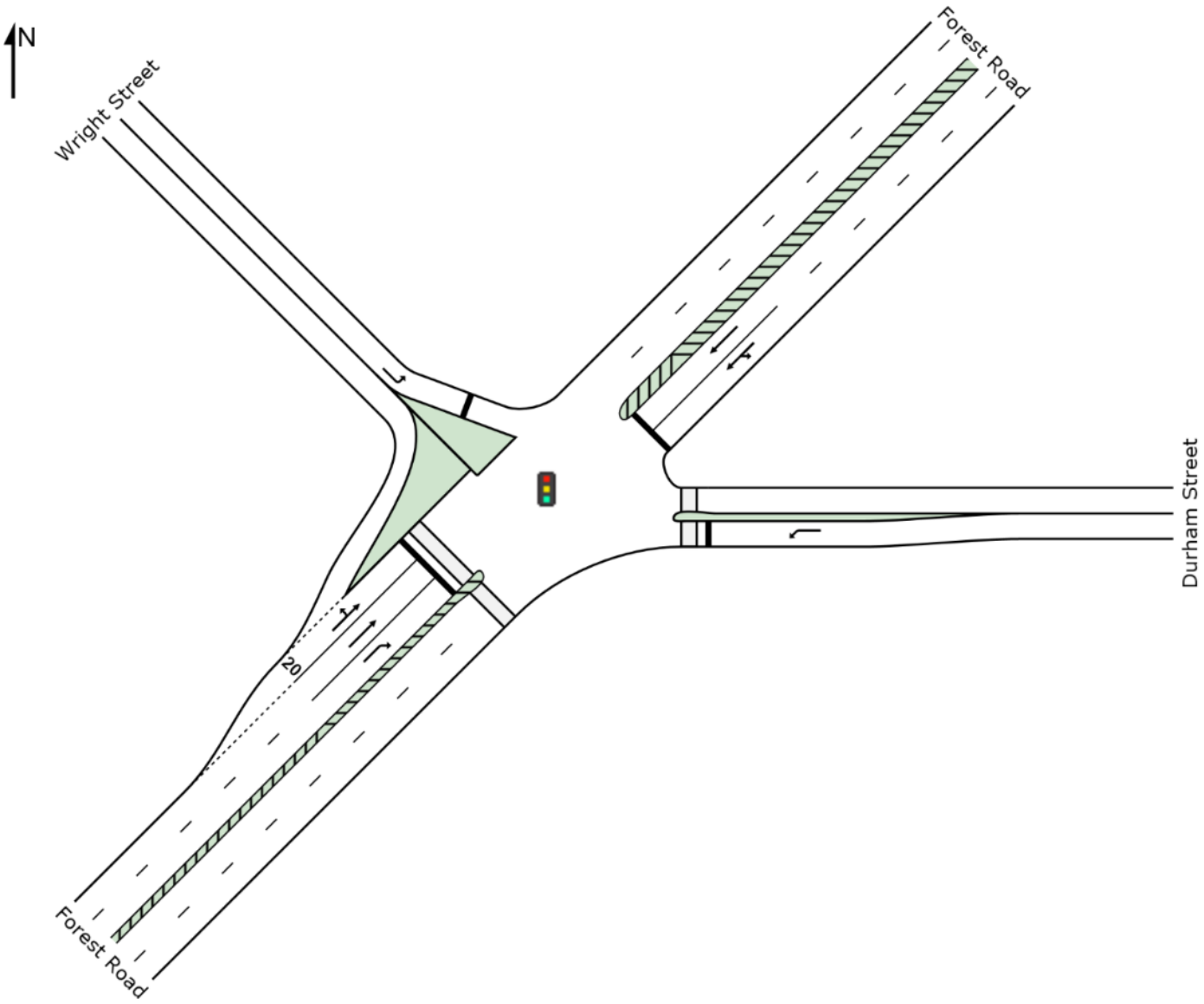
| Mov ID | OD Mov | Demand Flows Total veh/h | HV % | Deg. Satn v/c | Average Delay sec | Level of Service | 95% Back of Queue Vehicles veh | 95% Back of Queue Distance m | Prop. Queued | Effective Stop Rate per veh | Average Speed km/h |
|---|---|---|---|---|---|---|---|---|---|---|---|
| East: Durham Street | | | | | | | | | | | |
| 4 | L2 | 39 | 0.0 | 0.059 | 5.5 | LOS A | 0.0 | 0.0 | 0.00 | 0.20 | 56.6 |
| 5 | T1 | 648 | 0.6 | 0.059 | 0.0 | LOS A | 0.0 | 0.0 | 0.00 | 0.02 | 59.7 |
| Approach | | 687 | 0.6 | 0.296 | 0.3 | NA | 0.0 | 0.0 | 0.00 | 0.03 | 59.5 |
| North: Roberts Lane | | | | | | | | | | | |
| 7 | L2 | 4 | 0.0 | 0.086 | 25.9 | LOS B | 0.2 | 1.6 | 0.85 | 0.91 | 41.4 |
| 8 | T1 | 2 | 0.0 | 0.086 | 25.0 | LOS B | 0.2 | 1.6 | 0.85 | 0.91 | 41.6 |
| 9 | R2 | 8 | 0.0 | 0.086 | 25.9 | LOS B | 0.2 | 1.6 | 0.85 | 0.91 | 41.3 |
| Approach | | 15 | 0.0 | 0.086 | 25.8 | LOS B | 0.2 | 1.6 | 0.85 | 0.91 | 41.4 |
| West: Durham Street | | | | | | | | | | | |
| 11 | T1 | 622 | 1.0 | 0.313 | 4.9 | LOS A | 4.4 | 31.3 | 0.75 | 0.02 | 55.4 |
| 12 | R2 | 16 | 0.0 | 0.313 | 10.4 | LOS A | 4.4 | 31.3 | 0.75 | 0.02 | 54.0 |
| Approach | | 638 | 1.0 | 0.313 | 5.0 | NA | 4.4 | 31.3 | 0.75 | 0.02 | 55.4 |
| All Vehicles | | 1340 | 0.8 | 0.313 | 2.8 | NA | 4.4 | 31.3 | 0.37 | 0.04 | 57.2 |

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

# SITE LAYOUT

## Site: 1a. Forest Road / Durham Street / Wright Street_AM Scenario 2 - Conversion

Forest Road / Durham Street / Wright Street
Signals - Fixed Time




Created: 26 February 2016 10:01:34
SIDRA INTERSECTION 6.0.24.4877

Project: P:\Sydney\Projects\34xxxx\347886\04 Working\2016\5. SIDRA Modelling\Landmark Sq_Scenario 2 AM.sip6
8000266, 6017707, MOTT MACDONALD (CANBERRA), NETWORK / 1PC

# MOVEMENT SUMMARY

## Site: 1a. Forest Road / Durham Street / Wright Street_AM Scenario 2 - Conversion

Forest Road / Durham Street / Wright Street
Signals - Fixed Time  Cycle Time = 120 seconds (Practical Cycle Time)

**Movement Performance - Vehicles**

| Mov ID | OD Mov | Demand Flows Total veh/h | HV % | Deg. Satn v/c | Average Delay sec | Level of Service | 95% Back of Queue Vehicles veh | 95% Back of Queue Distance m | Prop. Queued | Effective Stop Rate per veh | Average Speed km/h |
|---|---|---|---|---|---|---|---|---|---|---|---|
| East: Durham Street | | | | | | | | | | | |
| 4a | L1 | 474 | 1.3 | 0.577 | 31.0 | LOS C | 20.8 | 147.0 | 0.81 | 0.81 | 36.6 |
| Approach | | 474 | 1.3 | 0.577 | 31.0 | LOS C | 20.8 | 147.0 | 0.81 | 0.81 | 36.6 |
| NorthEast: Forest Road | | | | | | | | | | | |
| 24b | L3 | 64 | 0.0 | 0.441 | 24.0 | LOS B | 11.5 | 81.5 | 0.56 | 0.70 | 39.1 |
| 25 | T1 | 716 | 1.3 | 0.441 | 20.4 | LOS B | 12.0 | 84.7 | 0.56 | 0.69 | 42.1 |
| Approach | | 780 | 1.2 | 0.441 | 20.7 | LOS B | 12.0 | 84.7 | 0.56 | 0.69 | 41.8 |
| NorthWest: Wright Street | | | | | | | | | | | |
| 27 | L2 | 87 | 0.0 | 0.217 | 46.2 | LOS D | 4.2 | 29.5 | 0.86 | 0.75 | 32.1 |
| Approach | | 87 | 0.0 | 0.217 | 46.2 | LOS D | 4.2 | 29.5 | 0.86 | 0.75 | 32.1 |
| SouthWest: Forest Road | | | | | | | | | | | |
| 30 | L2 | 75 | 0.0 | 0.711 | 22.9 | LOS B | 12.0 | 84.2 | 0.57 | 0.69 | 39.7 |
| 31 | T1 | 693 | 0.8 | 0.711 | 20.2 | LOS B | 12.0 | 84.2 | 0.56 | 0.68 | 42.2 |
| 32a | R1 | 485 | 1.1 | 0.701 | 18.3 | LOS B | 15.1 | 106.7 | 0.64 | 0.83 | 39.8 |
| Approach | | 1253 | 0.8 | 0.711 | 19.6 | LOS B | 15.1 | 106.7 | 0.59 | 0.74 | 41.1 |
| All Vehicles | | 2594 | 1.0 | 0.711 | 22.9 | LOS B | 20.8 | 147.0 | 0.63 | 0.74 | 40.0 |

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

**Movement Performance - Pedestrians**

| Mov ID | Description | Demand Flow ped/h | Average Delay sec | Level of Service | Average Back of Queue Pedestrian ped | Average Back of Queue Distance m | Prop. Queued | Effective Stop Rate per ped |
|---|---|---|---|---|---|---|---|---|
| P2 | East Full Crossing | 53 | 19.9 | LOS B | 0.1 | 0.1 | 0.58 | 0.58 |
| P8 | SouthWest Full Crossing | 53 | 54.3 | LOS E | 0.2 | 0.2 | 0.95 | 0.95 |
| All Pedestrians | | 105 | 37.1 | LOS D | | | 0.76 | 0.76 |

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

# PHASING SUMMARY

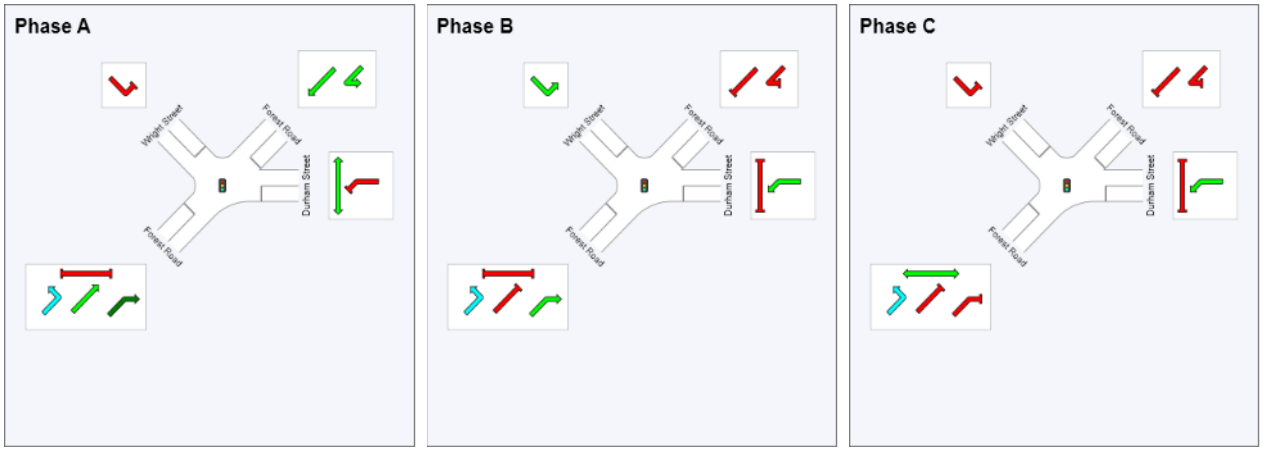
## Site: 1a. Forest Road / Durham Street / Wright Street_AM Scenario 2 - Conversion

Forest Road / Durham Street / Wright Street
Signals - Fixed Time  Cycle Time = 120 seconds (Practical Cycle Time)

**Phase times determined by the program**
**Sequence: Opposed Turns**
**Movement Class: All Movement Classes**
**Input Sequence: A, B, C**
**Output Sequence: A, B, C**

**Phase Timing Results**

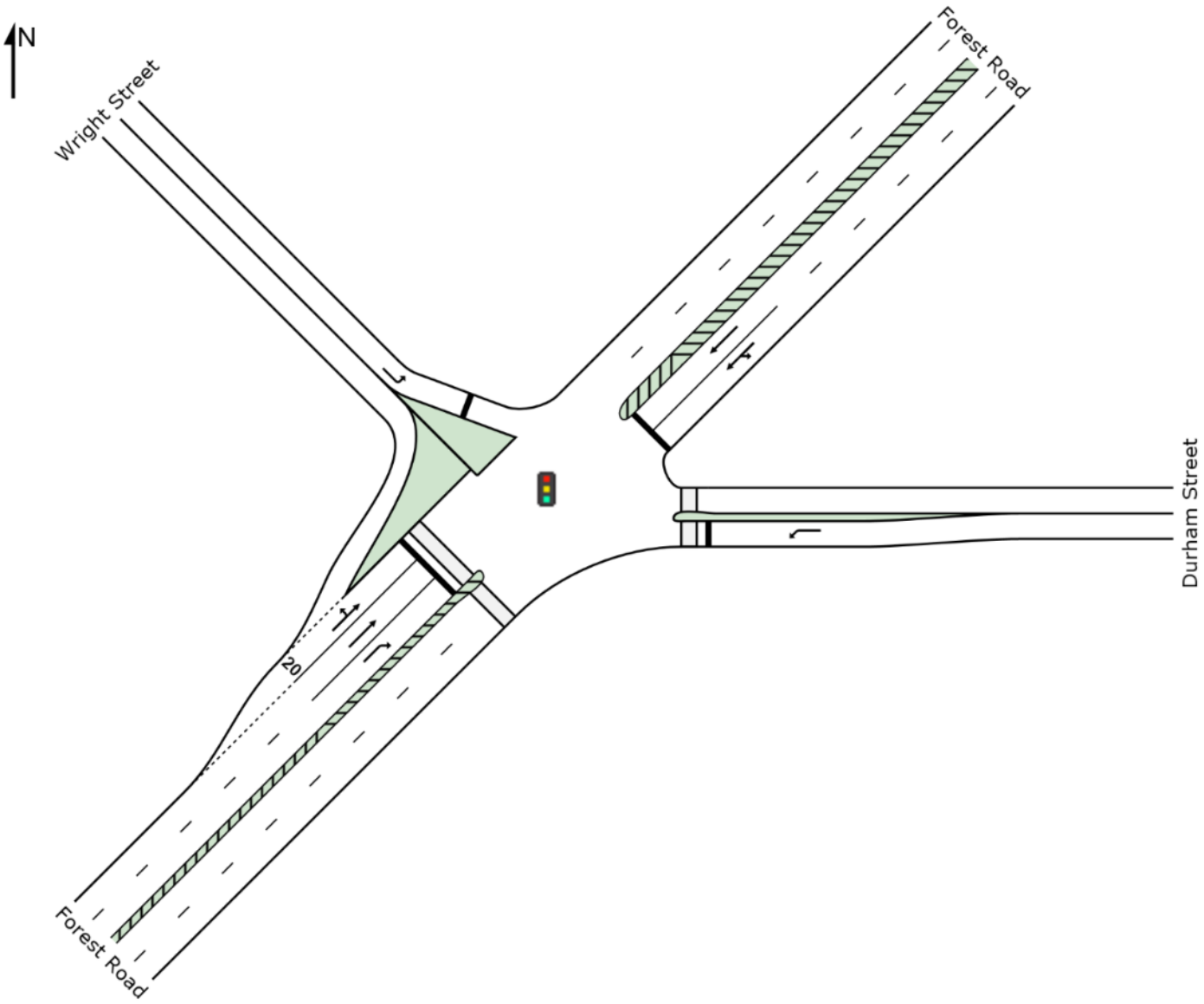
| Phase | A | B | C |
|---|---|---|---|
| Reference Phase | Yes | No | No |
| Phase Change Time (sec) | 0 | 62 | 94 |
| Green Time (sec) | 56 | 26 | 20 |
| Yellow Time (sec) | 4 | 4 | 4 |
| All-Red Time (sec) | 2 | 2 | 2 |
| Phase Time (sec) | 62 | 32 | 26 |
| Phase Split | 52 % | 27 % | 22 % |




# SITE LAYOUT

## Site: 1a. Forest Road / Durham Street / Wright Street_PM Scenario 2 - Conversion

Forest Road / Durham Street / Wright Street
Signals - Fixed Time



# MOVEMENT SUMMARY

## Site: 1a. Forest Road / Durham Street / Wright Street_PM Scenario 2 - Conversion

Forest Road / Durham Street / Wright Street
Signals - Fixed Time  Cycle Time = 120 seconds (Practical Cycle Time)

**Movement Performance - Vehicles**

| Mov ID | OD Mov | Demand Flows Total veh/h | HV % | Deg. Satn v/c | Average Delay sec | Level of Service | 95% Back of Queue Vehicles veh | 95% Back of Queue Distance m | Prop. Queued | Effective Stop Rate per veh | Average Speed km/h |
|---|---|---|---|---|---|---|---|---|---|---|---|
| East: Durham Street | | | | | | | | | | | |
| 4a | L1 | 607 | 1.0 | 0.674 | 29.5 | LOS C | 27.2 | 191.9 | 0.83 | 0.83 | 37.2 |
| Approach | | 607 | 1.0 | 0.674 | 29.5 | LOS C | 27.2 | 191.9 | 0.83 | 0.83 | 37.2 |
| NorthEast: Forest Road | | | | | | | | | | | |
| 24b | L3 | 93 | 0.0 | 0.670 | 31.1 | LOS C | 21.4 | 151.4 | 0.75 | 0.79 | 36.4 |
| 25 | T1 | 987 | 1.0 | 0.670 | 27.5 | LOS B | 22.5 | 157.9 | 0.75 | 0.79 | 39.0 |
| Approach | | 1080 | 0.9 | 0.670 | 27.8 | LOS B | 22.5 | 157.9 | 0.75 | 0.79 | 38.8 |
| NorthWest: Wright Street | | | | | | | | | | | |
| 27 | L2 | 49 | 0.0 | 0.103 | 40.8 | LOS C | 2.2 | 15.4 | 0.80 | 0.71 | 33.7 |
| Approach | | 49 | 0.0 | 0.103 | 40.8 | LOS C | 2.2 | 15.4 | 0.80 | 0.71 | 33.7 |
| SouthWest: Forest Road | | | | | | | | | | | |
| 30 | L2 | 66 | 0.0 | 0.770 | 21.1 | LOS B | 10.9 | 76.8 | 0.50 | 0.69 | 40.5 |
| 31 | T1 | 697 | 0.8 | 0.770 | 17.5 | LOS B | 10.9 | 76.8 | 0.48 | 0.67 | 43.5 |
| 32a | R1 | 507 | 1.0 | 0.787 | 17.5 | LOS B | 14.3 | 101.2 | 0.59 | 0.93 | 40.1 |
| Approach | | 1271 | 0.8 | 0.787 | 17.7 | LOS B | 14.3 | 101.2 | 0.53 | 0.78 | 41.9 |
| All Vehicles | | 3007 | 0.9 | 0.787 | 24.1 | LOS B | 27.2 | 191.9 | 0.67 | 0.79 | 39.6 |

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
The results of iterative calculations indicate a somewhat unstable solution. See the Diagnostics section in the Detailed Output report.

**Movement Performance - Pedestrians**

| Mov ID | Description | Demand Flow ped/h | Average Delay sec | Level of Service | Average Back of Queue Pedestrian ped | Average Back of Queue Distance m | Prop. Queued | Effective Stop Rate per ped |
|---|---|---|---|---|---|---|---|---|
| P2 | East Full Crossing | 53 | 22.9 | LOS C | 0.1 | 0.1 | 0.62 | 0.62 |
| P8 | SouthWest Full Crossing | 53 | 54.3 | LOS E | 0.2 | 0.2 | 0.95 | 0.95 |
| All Pedestrians | | 105 | 38.6 | LOS D | | | 0.79 | 0.79 |

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

# PHASING SUMMARY

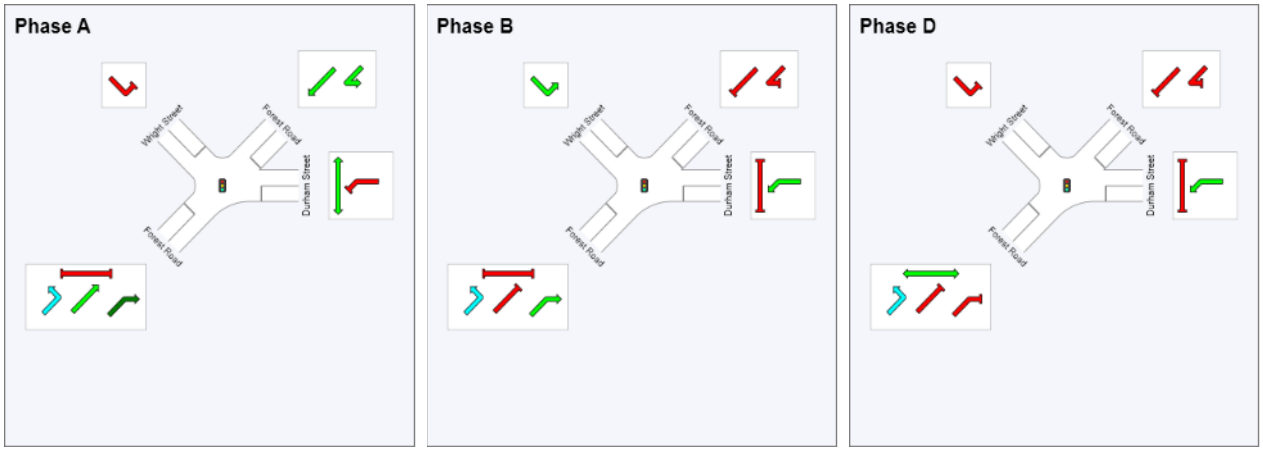
## Site: 1a. Forest Road / Durham Street / Wright Street_PM Scenario 2 - Conversion

Forest Road / Durham Street / Wright Street
Signals - Fixed Time  Cycle Time = 120 seconds (Practical Cycle Time)

**Phase times determined by the program**
**Sequence: Opposed Turns**
**Movement Class: All Movement Classes**
**Input Sequence: A, B, D**
**Output Sequence: A, B, D**

**Phase Timing Results**

| Phase | A | B | D |
|---|---|---|---|
| Reference Phase | Yes | No | No |
| Phase Change Time (sec) | 0 | 57 | 94 |
| Green Time (sec) | 51 | 31 | 20 |
| Yellow Time (sec) | 4 | 4 | 4 |
| All-Red Time (sec) | 2 | 2 | 2 |
| Phase Time (sec) | 57 | 37 | 26 |
| Phase Split | 48 % | 31 % | 22 % |



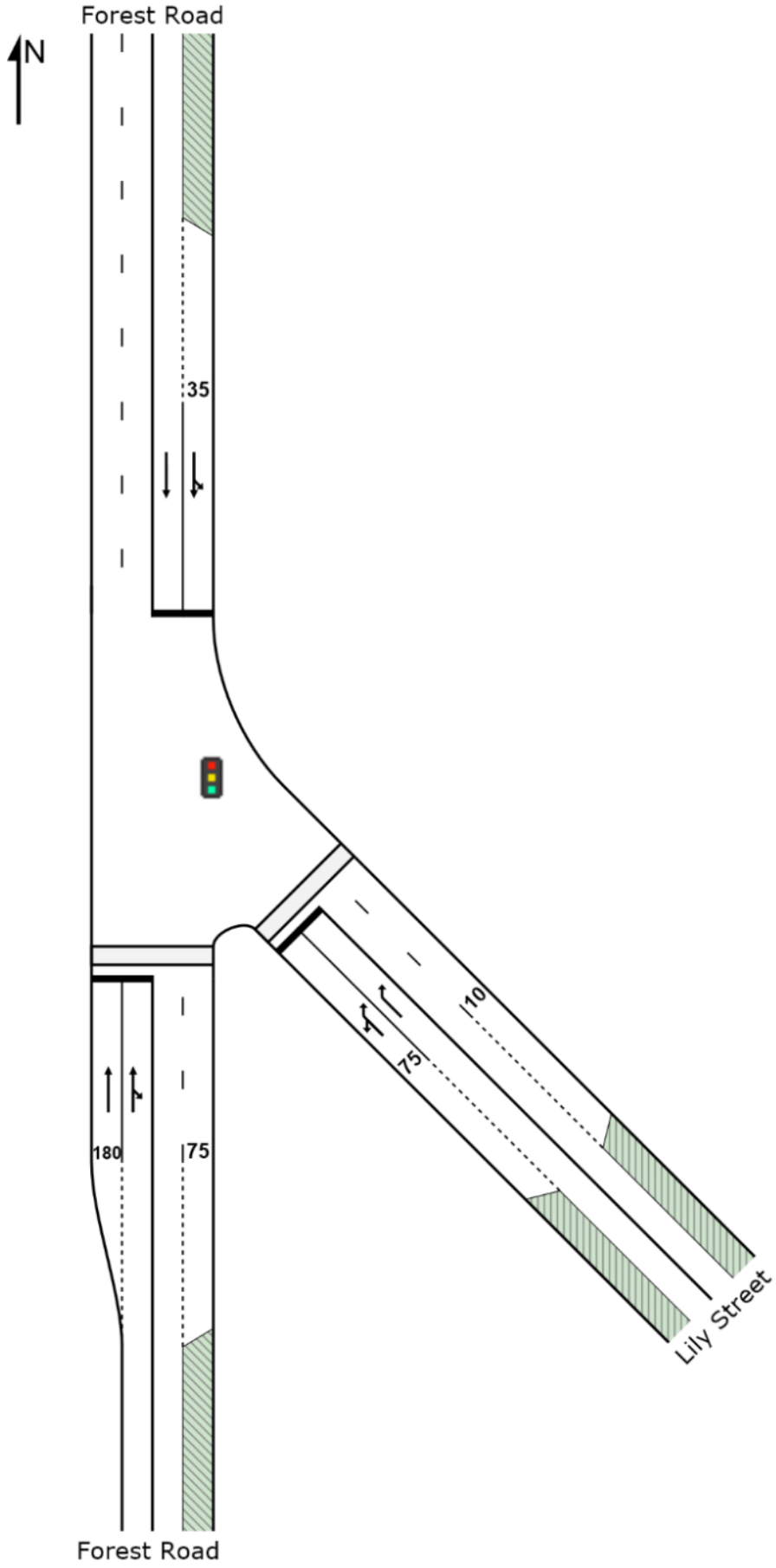


The results of iterative calculations indicate a somewhat unstable solution. See the Diagnostics section in the Detailed Output report.

# SITE LAYOUT

## Site: 2. Forest Road / Lily Street_AM Scenario 2

Forest Road / Lily Street
Signals - Fixed Time



# MOVEMENT SUMMARY

## Site: 2. Forest Road / Lily Street_AM Scenario 2

Forest Road / Lily Street
Signals - Fixed Time  Cycle Time = 70 seconds (User-Given Phase Times)

**Movement Performance - Vehicles**

| Mov ID | OD Mov | Demand Flows Total veh/h | HV % | Deg. Satn v/c | Average Delay sec | Level of Service | 95% Back of Queue Vehicles veh | 95% Back of Queue Distance m | Prop. Queued | Effective Stop Rate per veh | Average Speed km/h |
|---|---|---|---|---|---|---|---|---|---|---|---|
| South: Forest Road | | | | | | | | | | | |
| 2 | T1 | 712 | 1.6 | 0.351 | 7.5 | LOS A | 6.9 | 48.9 | 0.54 | 0.48 | 53.3 |
| 3b | R3 | 28 | 3.7 | 0.351 | 15.0 | LOS B | 5.8 | 41.1 | 0.57 | 0.52 | 47.4 |
| Approach | | 740 | 1.7 | 0.351 | 7.8 | LOS A | 6.9 | 48.9 | 0.54 | 0.48 | 53.0 |
| SouthEast: Lily Street | | | | | | | | | | | |
| 21b | L3 | 66 | 1.6 | 0.796 | 40.2 | LOS C | 10.5 | 75.7 | 1.00 | 0.94 | 36.2 |
| 23a | R1 | 520 | 2.6 | 0.796 | 38.1 | LOS C | 11.0 | 78.2 | 1.00 | 0.94 | 36.1 |
| Approach | | 586 | 2.5 | 0.796 | 38.4 | LOS C | 11.0 | 78.2 | 1.00 | 0.94 | 36.1 |
| North: Forest Road | | | | | | | | | | | |
| 7a | L1 | 315 | 3.7 | 0.291 | 6.7 | LOS A | 3.1 | 22.6 | 0.37 | 0.60 | 49.6 |
| 8 | T1 | 755 | 1.5 | 0.702 | 7.4 | LOS A | 13.2 | 93.5 | 0.59 | 0.56 | 53.2 |
| Approach | | 1069 | 2.2 | 0.702 | 7.2 | LOS A | 13.2 | 93.5 | 0.53 | 0.57 | 52.1 |
| All Vehicles | | 2396 | 2.1 | 0.796 | 15.0 | LOS B | 13.2 | 93.5 | 0.65 | 0.63 | 47.2 |

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

**Movement Performance - Pedestrians**

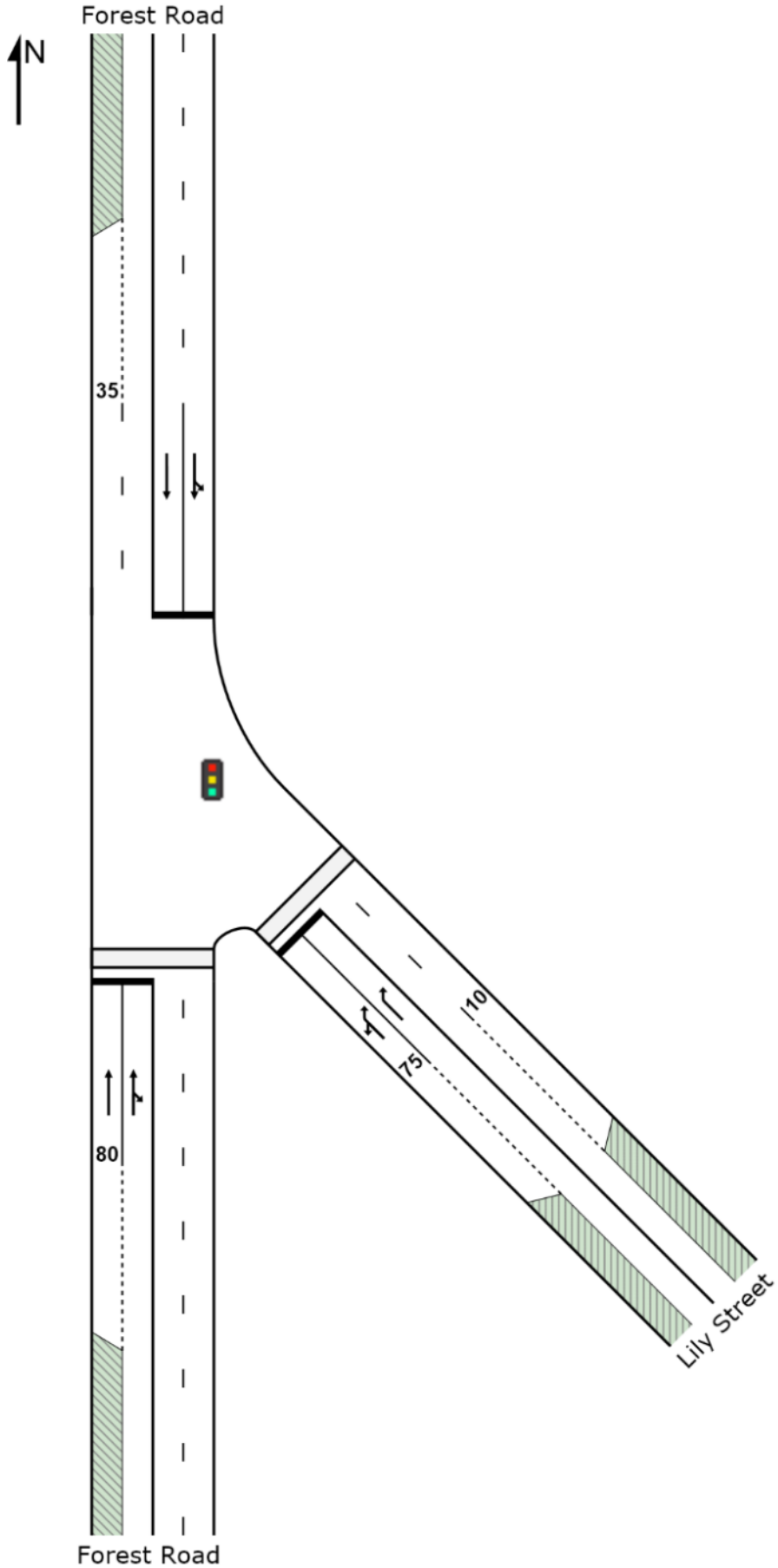
| Mov ID | Description | Demand Flow ped/h | Average Delay sec | Level of Service | Average Back of Queue Pedestrian ped | Average Back of Queue Distance m | Prop. Queued | Effective Stop Rate per ped |
|---|---|---|---|---|---|---|---|---|
| P1 | South Full Crossing | 361 | 29.7 | LOS C | 0.7 | 0.7 | 0.93 | 0.93 |
| P5 | SouthEast Full Crossing | 169 | 9.3 | LOS A | 0.2 | 0.2 | 0.52 | 0.52 |
| All Pedestrians | | 531 | 23.2 | LOS C | | | 0.80 | 0.80 |

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

# SITE LAYOUT

## Site: 2. Forest Road / Lily Street_PM Scenario 2

Forest Road / Lily Street
Signals - Fixed Time



# MOVEMENT SUMMARY

## Site: 2. Forest Road / Lily Street_PM Scenario 2

Forest Road / Lily Street
Signals - Fixed Time  Cycle Time = 70 seconds (Practical Cycle Time)

**Movement Performance - Vehicles**

| Mov ID | OD Mov | Demand Flows Total veh/h | HV % | Deg. Satn v/c | Average Delay sec | Level of Service | 95% Back of Queue Vehicles veh | 95% Back of Queue Distance m | Prop. Queued | Effective Stop Rate per veh | Average Speed km/h |
|---|---|---|---|---|---|---|---|---|---|---|---|
| South: Forest Road | | | | | | | | | | | |
| 2 | T1 | 729 | 1.6 | 0.728 | 15.9 | LOS B | 16.7 | 119.0 | 0.80 | 0.72 | 47.4 |
| 3b | R3 | 24 | 4.3 | 0.728 | 24.1 | LOS B | 16.7 | 119.0 | 0.87 | 0.80 | 42.6 |
| Approach | | 754 | 1.7 | 0.728 | 16.2 | LOS B | 16.7 | 119.0 | 0.81 | 0.73 | 47.2 |
| SouthEast: Lily Street | | | | | | | | | | | |
| 21b | L3 | 72 | 1.5 | 0.175 | 24.8 | LOS B | 2.3 | 17.0 | 0.75 | 0.75 | 42.3 |
| 23a | R1 | 465 | 2.9 | 0.716 | 28.0 | LOS B | 14.0 | 99.7 | 0.93 | 0.86 | 40.2 |
| Approach | | 537 | 2.7 | 0.716 | 27.6 | LOS B | 14.0 | 99.7 | 0.90 | 0.85 | 40.5 |
| North: Forest Road | | | | | | | | | | | |
| 7a | L1 | 329 | 3.5 | 0.712 | 16.7 | LOS B | 17.0 | 121.3 | 0.82 | 0.79 | 44.5 |
| 8 | T1 | 1069 | 1.1 | 0.712 | 13.8 | LOS A | 18.4 | 130.0 | 0.83 | 0.76 | 48.4 |
| Approach | | 1399 | 1.7 | 0.712 | 14.4 | LOS A | 18.4 | 130.0 | 0.83 | 0.77 | 47.4 |
| All Vehicles | | 2689 | 1.9 | 0.728 | 17.6 | LOS B | 18.4 | 130.0 | 0.84 | 0.77 | 45.8 |

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

**Movement Performance - Pedestrians**

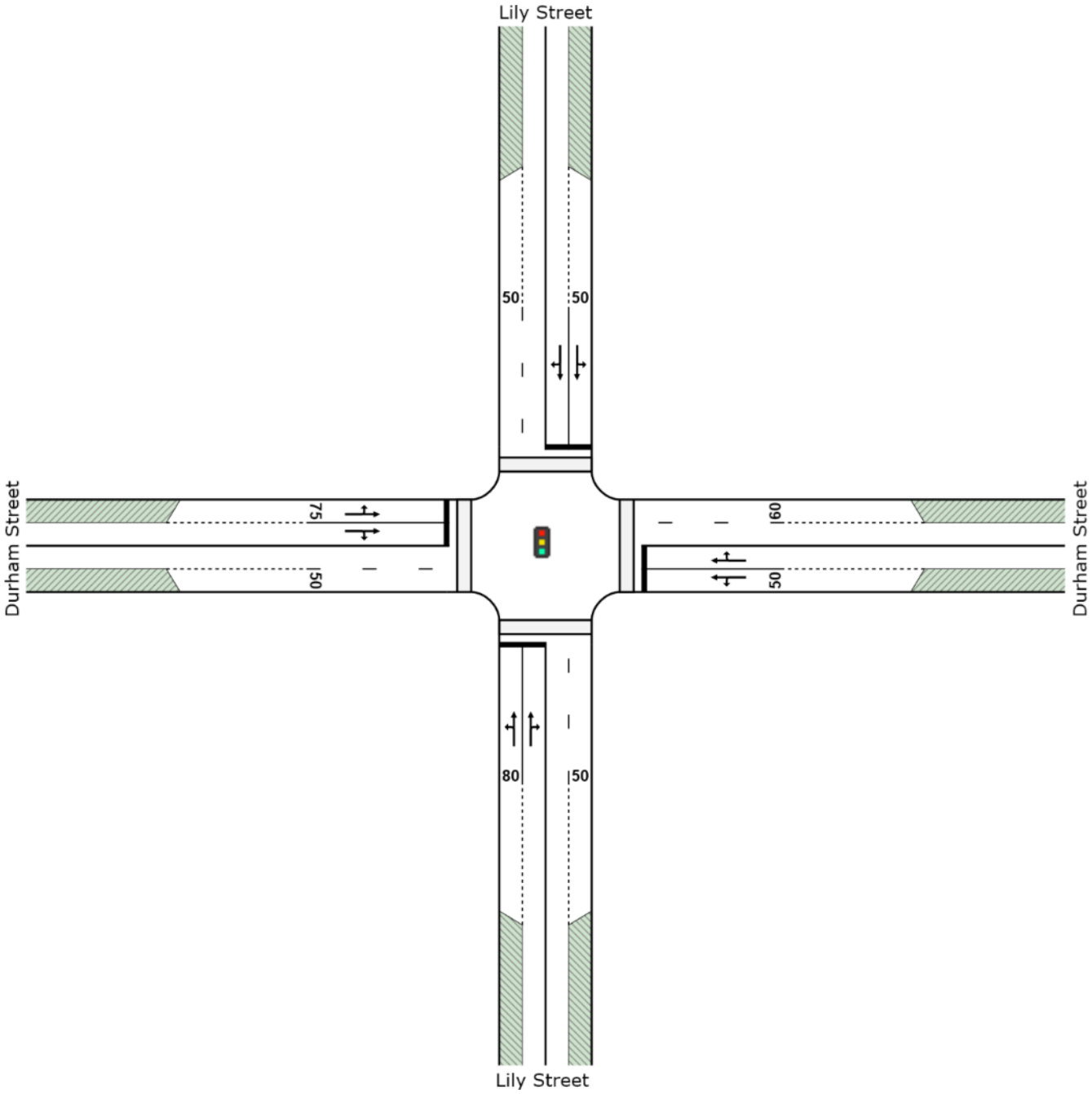
| Mov ID | Description | Demand Flow ped/h | Average Delay sec | Level of Service | Average Back of Queue Pedestrian ped | Average Back of Queue Distance m | Prop. Queued | Effective Stop Rate per ped |
|---|---|---|---|---|---|---|---|---|
| P1 | South Full Crossing | 361 | 21.9 | LOS C | 0.6 | 0.6 | 0.80 | 0.80 |
| P5 | SouthEast Full Crossing | 169 | 14.6 | LOS B | 0.2 | 0.2 | 0.65 | 0.65 |
| All Pedestrians | | 531 | 19.6 | LOS B | | | 0.75 | 0.75 |

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

# SITE LAYOUT

## Site: 3a. Durham Sreet / Lily Street_AM Scenario 2

Durham Street / Lily Street
Signals - Fixed Time



# MOVEMENT SUMMARY

## Site: 3a. Durham Sreet / Lily Street_AM Scenario 2

Durham Street / Lily Street
Signals - Fixed Time  Cycle Time = 60 seconds (User-Given Cycle Time)

**Movement Performance - Vehicles**

| Mov ID | OD Mov | Demand Flows Total veh/h | HV % | Deg. Satn v/c | Average Delay sec | Level of Service | 95% Back of Queue Vehicles veh | 95% Back of Queue Distance m | Prop. Queued | Effective Stop Rate per veh | Average Speed km/h |
|---|---|---|---|---|---|---|---|---|---|---|---|
| South: Lily Street | | | | | | | | | | | |
| 1 | L2 | 196 | 0.0 | 0.236 | 14.2 | LOS A | 3.7 | 25.8 | 0.58 | 0.70 | 45.1 |
| 2 | T1 | 524 | 3.4 | 0.942 | 40.4 | LOS C | 30.1 | 216.3 | 0.98 | 1.26 | 35.5 |
| 3 | R2 | 182 | 2.3 | 0.942 | 48.0 | LOS D | 30.1 | 216.3 | 1.00 | 1.29 | 32.8 |
| Approach | | 902 | 2.5 | 0.942 | 36.3 | LOS C | 30.1 | 216.3 | 0.90 | 1.14 | 36.6 |
| East: Durham Street | | | | | | | | | | | |
| 4 | L2 | 87 | 3.6 | 0.342 | 23.5 | LOS B | 4.3 | 31.0 | 0.84 | 0.73 | 40.6 |
| 5 | T1 | 311 | 1.7 | 0.488 | 20.1 | LOS B | 6.0 | 42.2 | 0.87 | 0.74 | 38.8 |
| 6 | R2 | 16 | 0.0 | 0.488 | 25.3 | LOS B | 6.0 | 42.2 | 0.89 | 0.74 | 40.7 |
| Approach | | 414 | 2.0 | 0.488 | 21.0 | LOS B | 6.0 | 42.2 | 0.87 | 0.74 | 39.3 |
| North: Lily Street | | | | | | | | | | | |
| 7 | L2 | 13 | 0.0 | 0.170 | 13.8 | LOS A | 2.6 | 18.7 | 0.56 | 0.48 | 47.9 |
| 8 | T1 | 326 | 3.2 | 0.243 | 10.1 | LOS A | 3.5 | 25.0 | 0.62 | 0.53 | 51.2 |
| 9 | R2 | 14 | 0.0 | 0.243 | 17.3 | LOS B | 3.5 | 25.0 | 0.67 | 0.57 | 45.8 |
| Approach | | 353 | 3.0 | 0.243 | 10.5 | LOS A | 3.5 | 25.0 | 0.62 | 0.53 | 50.8 |
| West: Durham Street | | | | | | | | | | | |
| 10 | L2 | 93 | 0.0 | 0.650 | 25.9 | LOS B | 9.4 | 66.9 | 0.93 | 0.82 | 40.0 |
| 11 | T1 | 407 | 2.6 | 0.928 | 29.7 | LOS C | 12.0 | 87.1 | 0.96 | 0.98 | 35.0 |
| 12 | R2 | 142 | 5.2 | 0.928 | 48.8 | LOS D | 12.0 | 87.1 | 1.00 | 1.26 | 31.7 |
| Approach | | 642 | 2.8 | 0.928 | 33.4 | LOS C | 12.0 | 87.1 | 0.96 | 1.02 | 34.8 |
| All Vehicles | | 2311 | 2.6 | 0.942 | 28.8 | LOS C | 30.1 | 216.3 | 0.87 | 0.94 | 38.1 |

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

**Movement Performance - Pedestrians**

| Mov ID | Description | Demand Flow ped/h | Average Delay sec | Level of Service | Average Back of Queue Pedestrian ped | Average Back of Queue Distance m | Prop. Queued | Effective Stop Rate per ped |
|---|---|---|---|---|---|---|---|---|
| P1 | South Full Crossing | 45 | 21.7 | LOS C | 0.1 | 0.1 | 0.85 | 0.85 |
| P2 | East Full Crossing | 20 | 12.0 | LOS B | 0.0 | 0.0 | 0.63 | 0.63 |
| P3 | North Full Crossing | 39 | 21.7 | LOS C | 0.1 | 0.1 | 0.85 | 0.85 |
| P4 | West Full Crossing | 57 | 12.1 | LOS B | 0.1 | 0.1 | 0.63 | 0.63 |
| All Pedestrians | | 161 | 17.1 | LOS B | | | 0.75 | 0.75 |

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

# PHASING SUMMARY

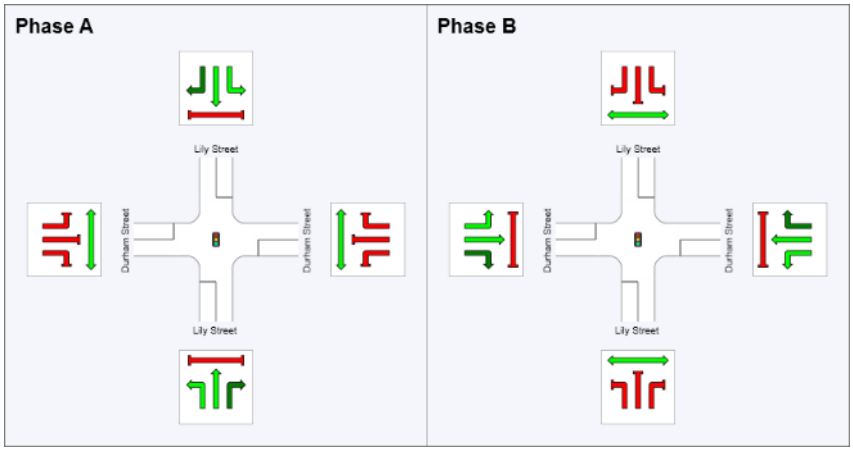
## Site: 3a. Durham Sreet / Lily Street_AM Scenario 2

Durham Street / Lily Street
Signals - Fixed Time  Cycle Time = 60 seconds (User-Given Cycle Time)

**Phase times determined by the program**
**Sequence: Two-Phase**
**Movement Class: All Movement Classes**
**Input Sequence: A, B**
**Output Sequence: A, B**

**Phase Timing Results**

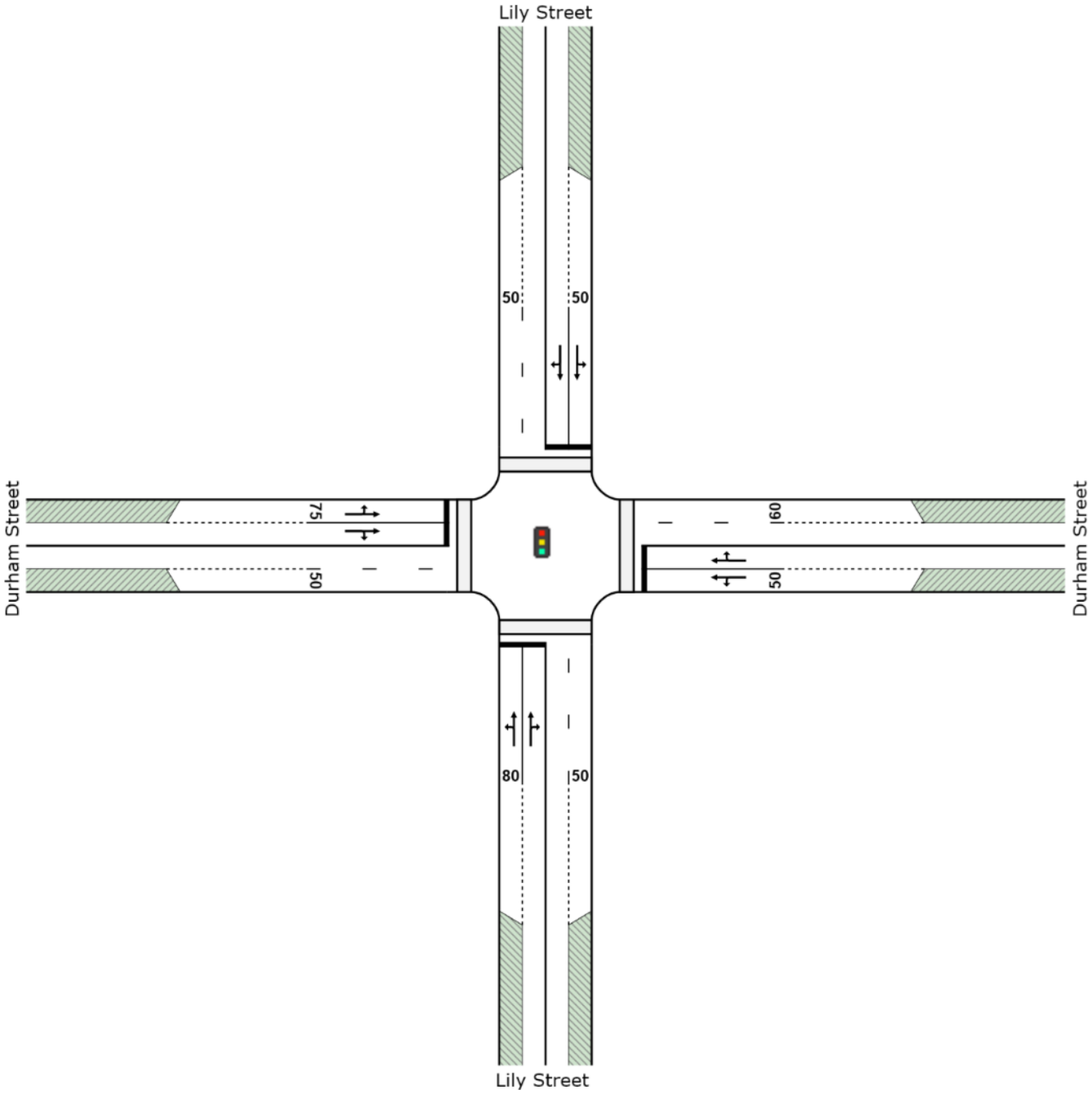
| Phase | A | B |
|---|---|---|
| Reference Phase | Yes | No |
| Phase Change Time (sec) | 0 | 37 |
| Green Time (sec) | 31 | 17 |
| Yellow Time (sec) | 4 | 4 |
| All-Red Time (sec) | 2 | 2 |
| Phase Time (sec) | 37 | 23 |
| Phase Split | 62 % | 38 % |




# SITE LAYOUT

## Site: 3. Durham Sreet / Lily Street_PM Scenario 2

Durham Street / Lily Street
Signals - Fixed Time



# MOVEMENT SUMMARY

## Site: 3. Durham Sreet / Lily Street_PM Scenario 2

Durham Street / Lily Street
Signals - Fixed Time  Cycle Time = 60 seconds (User-Given Cycle Time)

**Movement Performance - Vehicles**

| Mov ID | OD Mov | Demand Flows Total veh/h | HV % | Deg. Satn v/c | Average Delay sec | Level of Service | 95% Back of Queue Vehicles veh | 95% Back of Queue Distance m | Prop. Queued | Effective Stop Rate per veh | Average Speed km/h |
|---|---|---|---|---|---|---|---|---|---|---|---|
| South: Lily Street | | | | | | | | | | | |
| 1 | L2 | 319 | 0.0 | 0.429 | 19.8 | LOS B | 6.9 | 48.2 | 0.77 | 0.79 | 41.8 |
| 2 | T1 | 391 | 4.6 | 0.790 | 22.7 | LOS B | 14.5 | 105.6 | 0.95 | 0.94 | 43.2 |
| 3 | R2 | 93 | 4.5 | 0.790 | 28.3 | LOS B | 14.5 | 105.6 | 0.95 | 0.94 | 40.0 |
| Approach | | 802 | 2.8 | 0.790 | 22.2 | LOS B | 14.5 | 105.6 | 0.88 | 0.88 | 42.2 |
| East: Durham Street | | | | | | | | | | | |
| 4 | L2 | 68 | 4.6 | 0.269 | 17.8 | LOS B | 4.0 | 28.9 | 0.71 | 0.64 | 43.7 |
| 5 | T1 | 397 | 1.3 | 0.384 | 14.2 | LOS A | 5.9 | 41.8 | 0.75 | 0.65 | 41.6 |
| 6 | R2 | 12 | 0.0 | 0.384 | 19.2 | LOS B | 5.9 | 41.8 | 0.77 | 0.65 | 43.7 |
| Approach | | 477 | 1.8 | 0.384 | 14.8 | LOS B | 5.9 | 41.8 | 0.74 | 0.65 | 41.9 |
| North: Lily Street | | | | | | | | | | | |
| 7 | L2 | 18 | 0.0 | 0.214 | 18.4 | LOS B | 3.2 | 22.7 | 0.69 | 0.59 | 45.1 |
| 8 | T1 | 311 | 3.4 | 0.306 | 14.3 | LOS A | 4.0 | 28.7 | 0.73 | 0.62 | 48.2 |
| 9 | R2 | 18 | 0.0 | 0.306 | 21.2 | LOS B | 4.0 | 28.7 | 0.77 | 0.65 | 43.6 |
| Approach | | 346 | 3.0 | 0.306 | 14.9 | LOS B | 4.0 | 28.7 | 0.73 | 0.62 | 47.8 |
| West: Durham Street | | | | | | | | | | | |
| 10 | L2 | 131 | 0.0 | 0.541 | 19.7 | LOS B | 9.4 | 66.6 | 0.82 | 0.74 | 42.8 |
| 11 | T1 | 376 | 2.8 | 0.541 | 17.7 | LOS B | 9.4 | 66.6 | 0.85 | 0.80 | 39.4 |
| 12 | R2 | 203 | 3.6 | 0.772 | 29.8 | LOS C | 9.3 | 67.2 | 0.96 | 0.97 | 37.6 |
| Approach | | 709 | 2.5 | 0.772 | 21.5 | LOS B | 9.4 | 67.2 | 0.88 | 0.83 | 39.5 |
| All Vehicles | | 2335 | 2.5 | 0.790 | 19.4 | LOS B | 14.5 | 105.6 | 0.83 | 0.78 | 42.0 |

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

**Movement Performance - Pedestrians**

| Mov ID | Description | Demand Flow ped/h | Average Delay sec | Level of Service | Average Back of Queue Pedestrian ped | Average Back of Queue Distance m | Prop. Queued | Effective Stop Rate per ped |
|---|---|---|---|---|---|---|---|---|
| P1 | South Full Crossing | 45 | 16.2 | LOS B | 0.1 | 0.1 | 0.73 | 0.73 |
| P2 | East Full Crossing | 20 | 16.9 | LOS B | 0.0 | 0.0 | 0.75 | 0.75 |
| P3 | North Full Crossing | 39 | 16.2 | LOS B | 0.0 | 0.0 | 0.73 | 0.73 |
| P4 | West Full Crossing | 57 | 16.9 | LOS B | 0.1 | 0.1 | 0.75 | 0.75 |
| All Pedestrians | | 161 | 16.5 | LOS B | | | 0.74 | 0.74 |

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

# PHASING SUMMARY

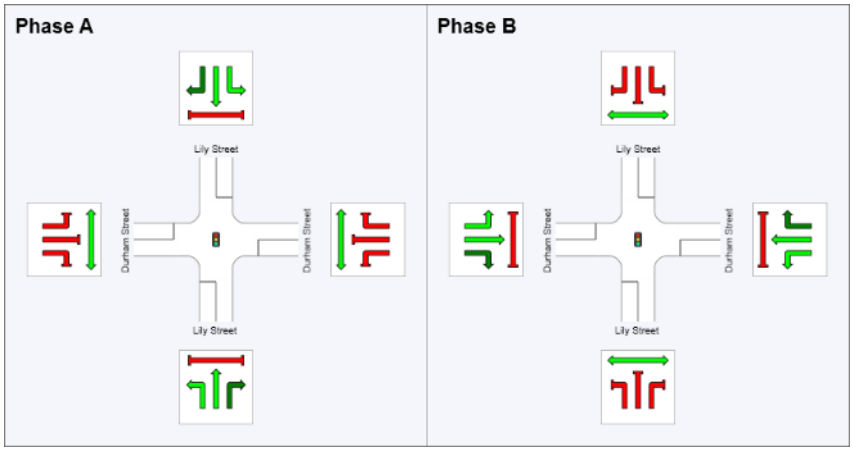
## Site: 3. Durham Sreet / Lily Street_PM Scenario 2

Durham Street / Lily Street
Signals - Fixed Time  Cycle Time = 60 seconds (User-Given Cycle Time)

**Phase times determined by the program**
**Sequence: Two-Phase**
**Movement Class: All Movement Classes**
**Input Sequence: A, B**
**Output Sequence: A, B**

**Phase Timing Results**

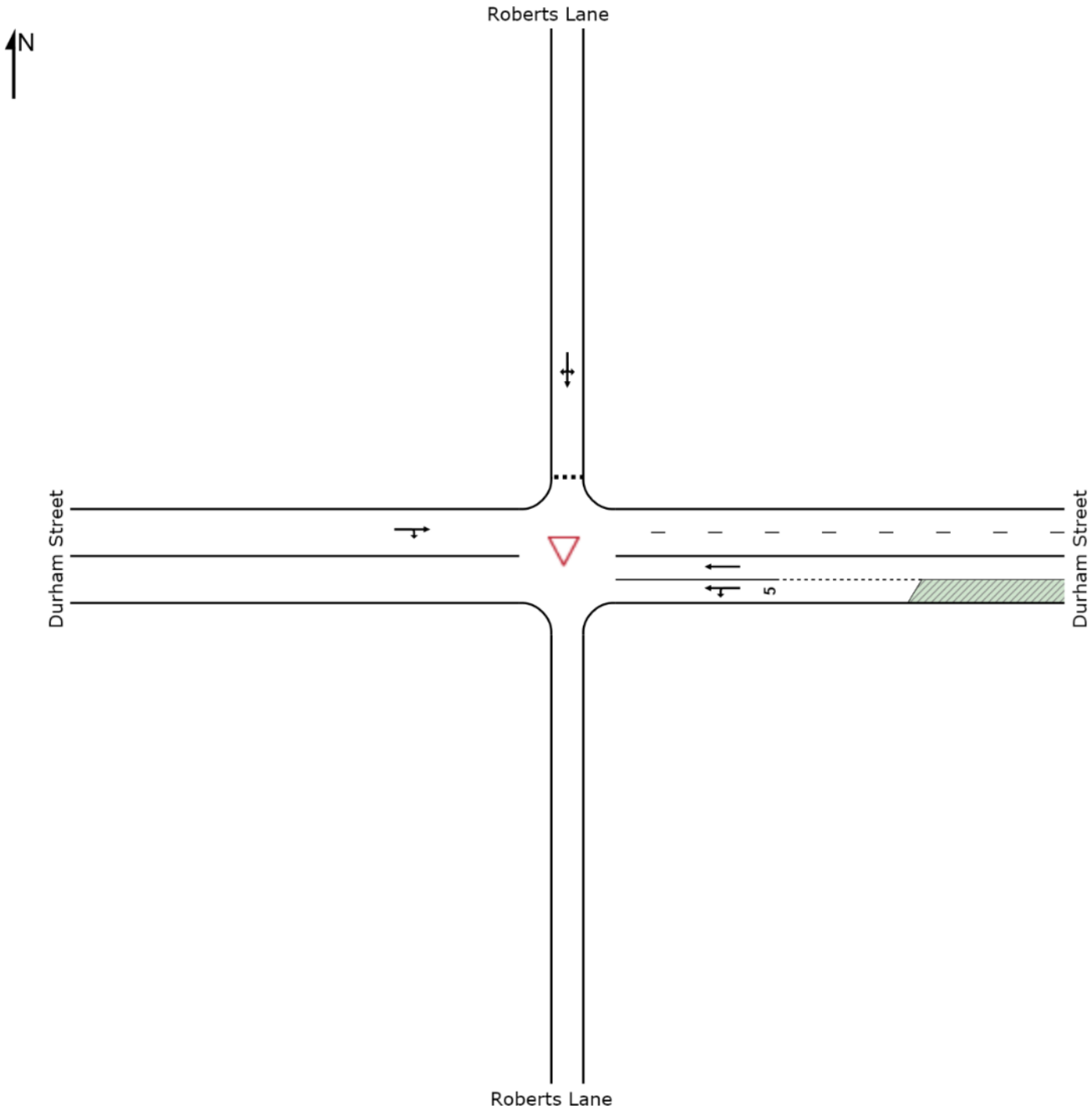
| Phase | A | B |
|---|---|---|
| Reference Phase | Yes | No |
| Phase Change Time (sec) | 0 | 30 |
| Green Time (sec) | 24 | 24 |
| Yellow Time (sec) | 4 | 4 |
| All-Red Time (sec) | 2 | 2 |
| Phase Time (sec) | 30 | 30 |
| Phase Split | 50 % | 50 % |




# SITE LAYOUT

## Site: 4. Durham Street / Roberts Lane_AM Scenario 2

Durham Street / Roberts Lane
Giveway / Yield (Two-Way)



# MOVEMENT SUMMARY

## Site: 4. Durham Street / Roberts Lane_AM Scenario 2

Durham Street / Roberts Lane
Giveway / Yield (Two-Way)

**Movement Performance - Vehicles**

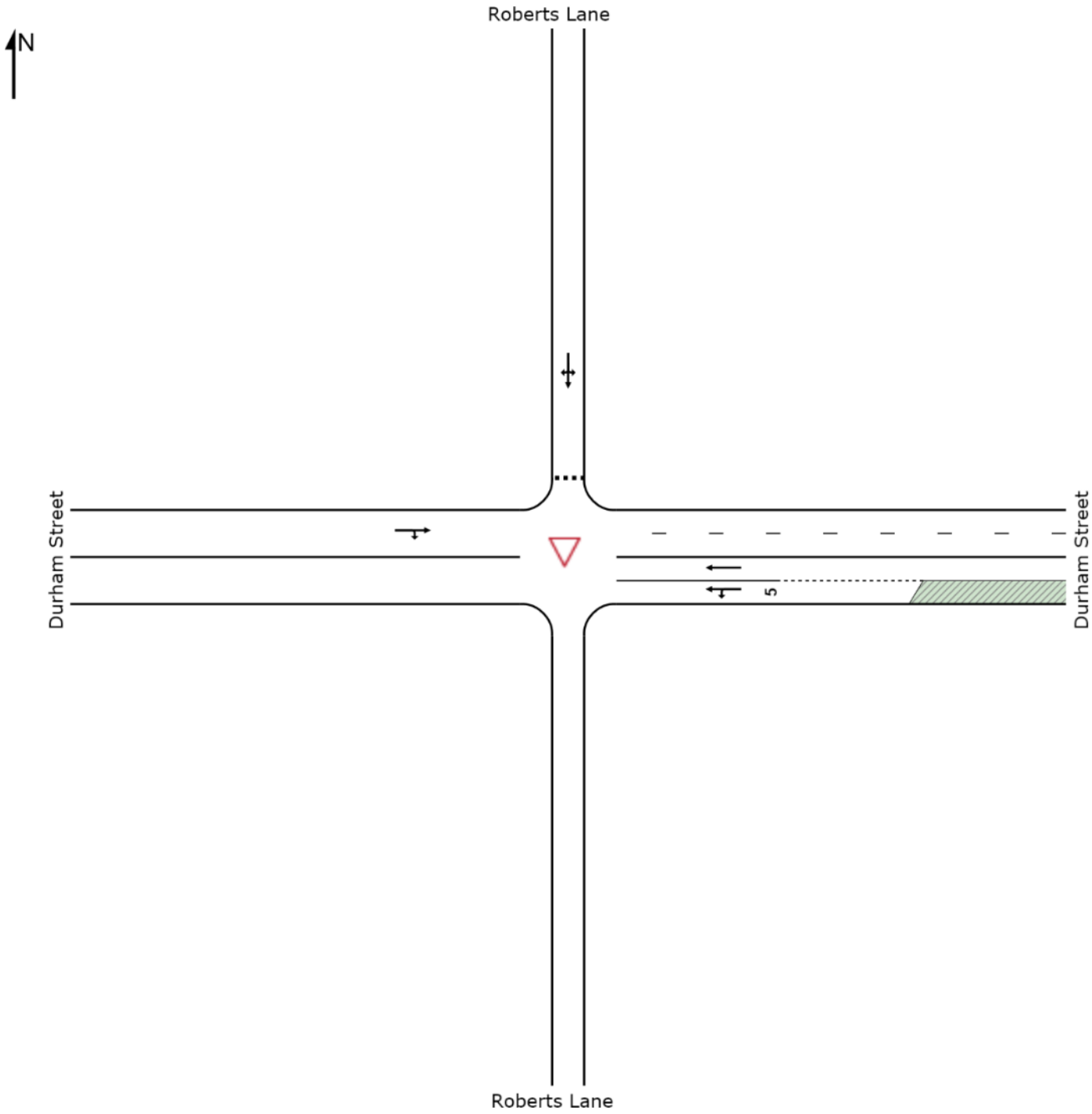
| Mov ID | OD Mov | Demand Flows Total veh/h | HV % | Deg. Satn v/c | Average Delay sec | Level of Service | 95% Back of Queue Vehicles veh | 95% Back of Queue Distance m | Prop. Queued | Effective Stop Rate per veh | Average Speed km/h |
|---|---|---|---|---|---|---|---|---|---|---|---|
| East: Durham Street | | | | | | | | | | | |
| 4 | L2 | 52 | 0.0 | 0.045 | 5.5 | LOS A | 0.0 | 0.0 | 0.00 | 0.36 | 55.4 |
| 5 | T1 | 466 | 1.1 | 0.045 | 0.0 | LOS A | 0.0 | 0.0 | 0.00 | 0.03 | 59.7 |
| Approach | | 518 | 1.0 | 0.224 | 0.6 | NA | 0.0 | 0.0 | 0.00 | 0.06 | 59.3 |
| North: Roberts Lane | | | | | | | | | | | |
| 7 | L2 | 25 | 0.0 | 0.155 | 16.3 | LOS B | 0.4 | 3.1 | 0.75 | 0.88 | 46.4 |
| 8 | T1 | 14 | 0.0 | 0.155 | 15.5 | LOS B | 0.4 | 3.1 | 0.75 | 0.88 | 46.8 |
| 9 | R2 | 11 | 0.0 | 0.155 | 16.3 | LOS B | 0.4 | 3.1 | 0.75 | 0.88 | 46.4 |
| Approach | | 49 | 0.0 | 0.155 | 16.1 | LOS B | 0.4 | 3.1 | 0.75 | 0.88 | 46.5 |
| West: Durham Street | | | | | | | | | | | |
| 11 | T1 | 624 | 2.9 | 0.308 | 3.1 | LOS A | 3.5 | 24.8 | 0.65 | 0.01 | 57.0 |
| 12 | R2 | 8 | 0.0 | 0.308 | 8.6 | LOS A | 3.5 | 24.8 | 0.65 | 0.01 | 55.5 |
| Approach | | 633 | 2.8 | 0.308 | 3.1 | NA | 3.5 | 24.8 | 0.65 | 0.01 | 57.0 |
| All Vehicles | | 1200 | 1.9 | 0.308 | 2.6 | NA | 3.5 | 24.8 | 0.37 | 0.07 | 57.4 |

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

# SITE LAYOUT

## Site: 4. Durham Street / Roberts Lane_PM Scenario 2

Durham Street / Roberts Lane (5:00PM - 6:00PM)
Giveway / Yield (Two-Way)



# MOVEMENT SUMMARY

## Site: 4. Durham Street / Roberts Lane_PM Scenario 2

Durham Street / Roberts Lane (5:00PM - 6:00PM)
Giveway / Yield (Two-Way)

**Movement Performance - Vehicles**

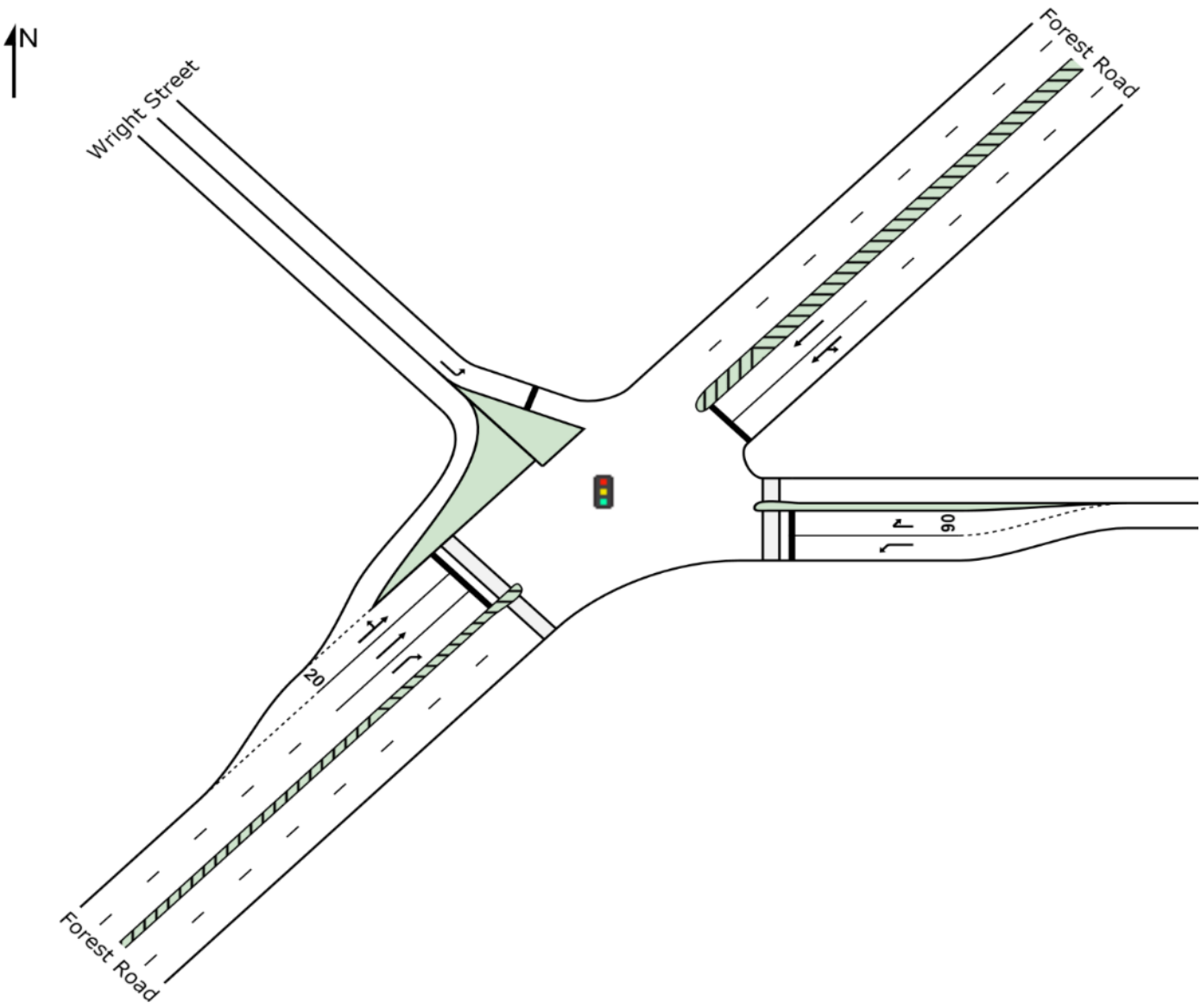
| Mov ID | OD Mov | Demand Flows Total veh/h | HV % | Deg. Satn v/c | Average Delay sec | Level of Service | 95% Back of Queue Vehicles veh | 95% Back of Queue Distance m | Prop. Queued | Effective Stop Rate per veh | Average Speed km/h |
|---|---|---|---|---|---|---|---|---|---|---|---|
| East: Durham Street | | | | | | | | | | | |
| 4 | L2 | 39 | 0.0 | 0.060 | 5.5 | LOS A | 0.0 | 0.0 | 0.00 | 0.20 | 56.7 |
| 5 | T1 | 662 | 0.6 | 0.060 | 0.0 | LOS A | 0.0 | 0.0 | 0.00 | 0.02 | 59.7 |
| Approach | | 701 | 0.6 | 0.302 | 0.3 | NA | 0.0 | 0.0 | 0.00 | 0.03 | 59.5 |
| North: Roberts Lane | | | | | | | | | | | |
| 7 | L2 | 6 | 0.0 | 0.097 | 25.6 | LOS B | 0.2 | 1.7 | 0.84 | 0.91 | 41.5 |
| 8 | T1 | 2 | 0.0 | 0.097 | 24.7 | LOS B | 0.2 | 1.7 | 0.84 | 0.91 | 41.8 |
| 9 | R2 | 8 | 0.0 | 0.097 | 25.6 | LOS B | 0.2 | 1.7 | 0.84 | 0.91 | 41.5 |
| Approach | | 17 | 0.0 | 0.097 | 25.5 | LOS B | 0.2 | 1.7 | 0.84 | 0.91 | 41.5 |
| West: Durham Street | | | | | | | | | | | |
| 11 | T1 | 648 | 1.0 | 0.326 | 5.2 | LOS A | 4.8 | 34.1 | 0.78 | 0.02 | 55.2 |
| 12 | R2 | 16 | 0.0 | 0.326 | 10.7 | LOS A | 4.8 | 34.1 | 0.78 | 0.02 | 53.8 |
| Approach | | 664 | 1.0 | 0.326 | 5.3 | NA | 4.8 | 34.1 | 0.78 | 0.02 | 55.1 |
| All Vehicles | | 1382 | 0.8 | 0.326 | 3.0 | NA | 4.8 | 34.1 | 0.38 | 0.04 | 57.0 |

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

# SITE LAYOUT

## Site: 1b. Forest Road / Durham Street / Wright Street_AM Scenario 2 - Conversion Alt Option

Forest Road / Durham Street / Wright Street
Signals - Fixed Time



# MOVEMENT SUMMARY

## Site: 1b. Forest Road / Durham Street / Wright Street_AM Scenario 2 - Conversion Alt Option

Forest Road / Durham Street / Wright Street
Signals - Fixed Time  Cycle Time = 120 seconds (Practical Cycle Time)

**Movement Performance - Vehicles**

| Mov ID | OD Mov | Demand Flows Total veh/h | HV % | Deg. Satn v/c | Average Delay sec | Level of Service | 95% Back of Queue Vehicles veh | Distance m | Prop. Queued | Effective Stop Rate per veh | Average Speed km/h |
|---|---|---|---|---|---|---|---|---|---|---|---|
| East: Durham Street | | | | | | | | | | | |
| 4a | L1 | 494 | 1.3 | 0.568 | 28.9 | LOS C | 21.0 | 148.3 | 0.79 | 0.80 | 37.4 |
| 6b | R3 | 53 | 0.0 | 0.194 | 53.3 | LOS D | 2.7 | 18.9 | 0.90 | 0.75 | 31.4 |
| Approach | | 546 | 1.2 | 0.568 | 31.3 | LOS C | 21.0 | 148.3 | 0.80 | 0.80 | 36.7 |
| NorthEast: Forest Road | | | | | | | | | | | |
| 24b | L3 | 97 | 0.0 | 0.479 | 26.8 | LOS B | 12.7 | 90.2 | 0.61 | 0.73 | 37.8 |
| 25 | T1 | 696 | 1.4 | 0.479 | 23.2 | LOS B | 13.6 | 95.8 | 0.61 | 0.72 | 40.8 |
| Approach | | 793 | 1.2 | 0.479 | 23.7 | LOS B | 13.6 | 95.8 | 0.61 | 0.72 | 40.4 |
| NorthWest: Wright Street | | | | | | | | | | | |
| 27 | L2 | 87 | 0.0 | 0.195 | 43.5 | LOS D | 4.1 | 28.5 | 0.84 | 0.74 | 32.9 |
| Approach | | 87 | 0.0 | 0.195 | 43.5 | LOS D | 4.1 | 28.5 | 0.84 | 0.74 | 32.9 |
| SouthWest: Forest Road | | | | | | | | | | | |
| 30 | L2 | 75 | 0.0 | 0.726 | 25.9 | LOS B | 12.6 | 88.5 | 0.61 | 0.71 | 38.5 |
| 31 | T1 | 664 | 0.8 | 0.726 | 23.2 | LOS B | 12.6 | 88.5 | 0.60 | 0.71 | 40.8 |
| 32a | R1 | 514 | 1.0 | 0.722 | 20.6 | LOS B | 16.4 | 116.1 | 0.68 | 0.88 | 39.0 |
| Approach | | 1253 | 0.8 | 0.726 | 22.3 | LOS B | 16.4 | 116.1 | 0.63 | 0.78 | 39.9 |
| All Vehicles | | 2679 | 1.0 | 0.726 | 25.2 | LOS B | 21.0 | 148.3 | 0.67 | 0.76 | 39.1 |

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

**Movement Performance - Pedestrians**

| Mov ID | Description | Demand Flow ped/h | Average Delay sec | Level of Service | Average Back of Queue Pedestrian ped | Distance m | Prop. Queued | Effective Stop Rate per ped |
|---|---|---|---|---|---|---|---|---|
| P2 | East Full Crossing | 53 | 23.5 | LOS C | 0.1 | 0.1 | 0.63 | 0.63 |
| P8 | SouthWest Full Crossing | 53 | 54.3 | LOS E | 0.2 | 0.2 | 0.95 | 0.95 |
| All Pedestrians | | 105 | 38.9 | LOS D | | | 0.79 | 0.79 |

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

# PHASING SUMMARY

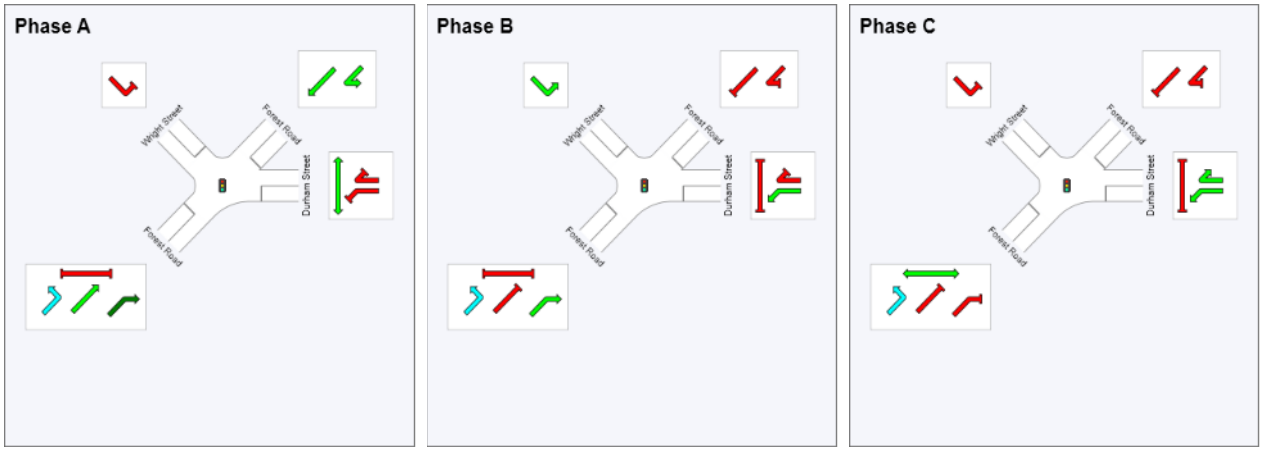
## Site: 1b. Forest Road / Durham Street / Wright Street_AM Scenario 2 - Conversion Alt Option

Forest Road / Durham Street / Wright Street
Signals - Fixed Time  Cycle Time = 120 seconds (Practical Cycle Time)

**Phase times determined by the program**
**Sequence: Opposed Turns**
**Movement Class: All Movement Classes**
**Input Sequence: A, B, C**
**Output Sequence: A, B, C**

**Phase Timing Results**

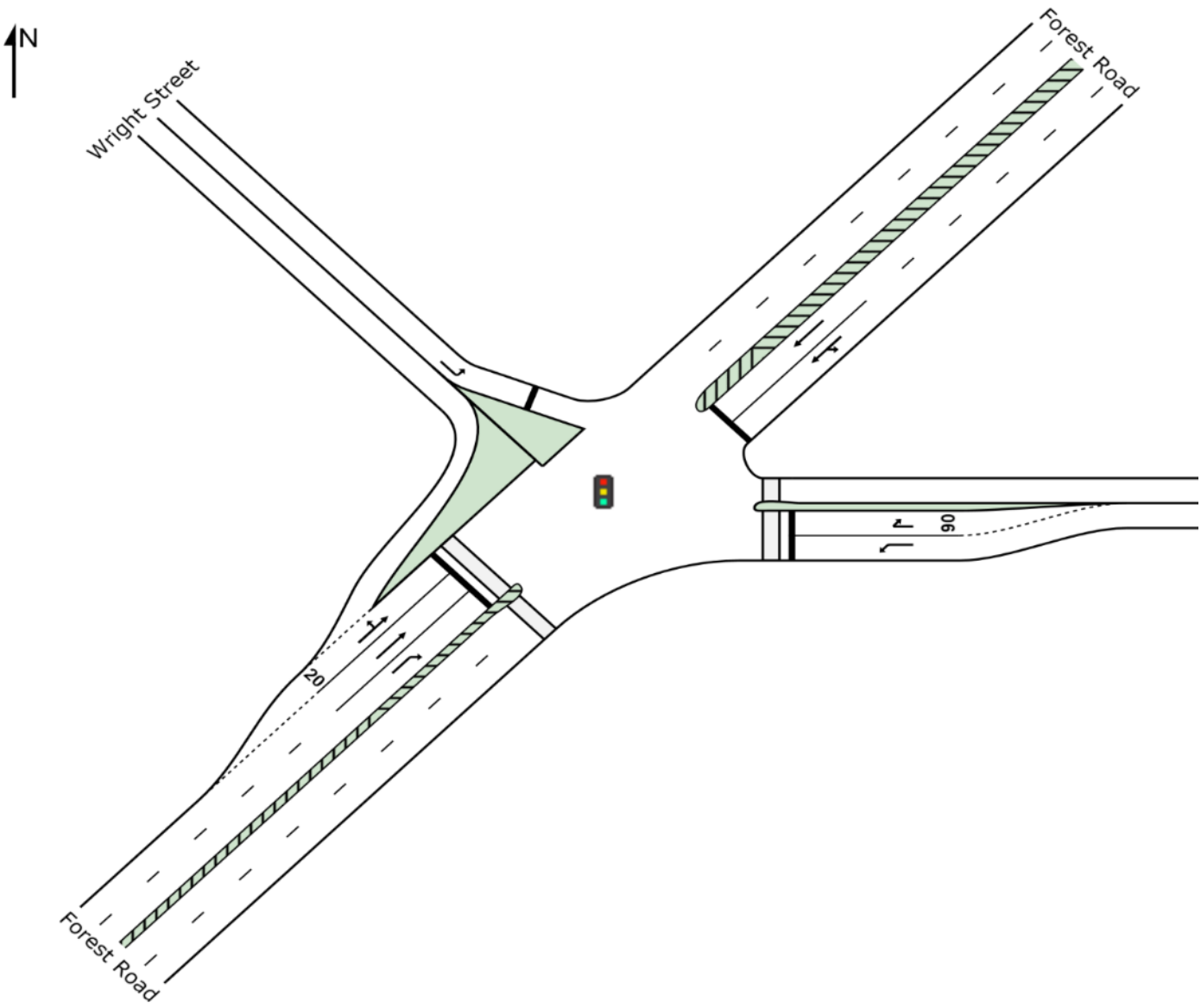
| Phase | A | B | C |
|---|---|---|---|
| Reference Phase | Yes | No | No |
| Phase Change Time (sec) | 0 | 59 | 94 |
| Green Time (sec) | 53 | 29 | 20 |
| Yellow Time (sec) | 4 | 4 | 4 |
| All-Red Time (sec) | 2 | 2 | 2 |
| Phase Time (sec) | 59 | 35 | 26 |
| Phase Split | 49 % | 29 % | 22 % |




# SITE LAYOUT

## Site: 1b. Forest Road / Durham Street / Wright Street_PM Scenario 2 - Conversion Alt Option

Forest Road / Durham Street / Wright Street
Signals - Fixed Time



# MOVEMENT SUMMARY

## Site: 1b. Forest Road / Durham Street / Wright Street_PM Scenario 2 - Conversion Alt Option

Forest Road / Durham Street / Wright Street
Signals - Fixed Time  Cycle Time = 120 seconds (Practical Cycle Time)

**Movement Performance - Vehicles**

| Mov ID | OD Mov | Demand Flows Total veh/h | HV % | Deg. Satn v/c | Average Delay sec | Level of Service | 95% Back of Queue Vehicles veh | 95% Back of Queue Distance m | Prop. Queued | Effective Stop Rate per veh | Average Speed km/h |
|---|---|---|---|---|---|---|---|---|---|---|---|
| East: Durham Street | | | | | | | | | | | |
| 4a | L1 | 639 | 1.0 | 0.701 | 26.0 | LOS B | 26.9 | 190.0 | 0.79 | 0.81 | 38.6 |
| 6b | R3 | 72 | 0.0 | 0.264 | 54.0 | LOS D | 3.7 | 26.1 | 0.91 | 0.77 | 31.2 |
| Approach | | 711 | 0.9 | 0.701 | 28.8 | LOS C | 26.9 | 190.0 | 0.80 | 0.81 | 37.7 |
| NorthEast: Forest Road | | | | | | | | | | | |
| 24b | L3 | 155 | 0.0 | 0.776 | 38.9 | LOS C | 25.8 | 182.7 | 0.88 | 0.85 | 33.7 |
| 25 | T1 | 956 | 1.0 | 0.776 | 34.5 | LOS C | 27.5 | 193.5 | 0.87 | 0.85 | 36.3 |
| Approach | | 1111 | 0.9 | 0.776 | 35.1 | LOS C | 27.5 | 193.5 | 0.87 | 0.85 | 35.9 |
| NorthWest: Wright Street | | | | | | | | | | | |
| 27 | L2 | 49 | 0.0 | 0.089 | 36.7 | LOS C | 2.1 | 14.4 | 0.75 | 0.70 | 35.0 |
| Approach | | 49 | 0.0 | 0.089 | 36.7 | LOS C | 2.1 | 14.4 | 0.75 | 0.70 | 35.0 |
| SouthWest: Forest Road | | | | | | | | | | | |
| 30 | L2 | 66 | 0.0 | 0.803 | 27.0 | LOS B | 12.5 | 87.9 | 0.59 | 0.74 | 38.0 |
| 31 | T1 | 643 | 0.8 | 0.803 | 23.3 | LOS B | 12.5 | 87.9 | 0.57 | 0.73 | 40.8 |
| 32a | R1 | 560 | 0.9 | 0.820 | 23.6 | LOS B | 19.1 | 134.9 | 0.74 | 1.00 | 37.8 |
| Approach | | 1269 | 0.8 | 0.820 | 23.6 | LOS B | 19.1 | 134.9 | 0.65 | 0.85 | 39.2 |
| All Vehicles | | 3140 | 0.8 | 0.820 | 29.1 | LOS C | 27.5 | 193.5 | 0.76 | 0.84 | 37.6 |

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

**Movement Performance - Pedestrians**

| Mov ID | Description | Demand Flow ped/h | Average Delay sec | Level of Service | Average Back of Queue Pedestrian ped | Average Back of Queue Distance m | Prop. Queued | Effective Stop Rate per ped |
|---|---|---|---|---|---|---|---|---|
| P2 | East Full Crossing | 53 | 28.1 | LOS C | 0.1 | 0.1 | 0.68 | 0.68 |
| P8 | SouthWest Full Crossing | 53 | 54.3 | LOS E | 0.2 | 0.2 | 0.95 | 0.95 |
| All Pedestrians | | 105 | 41.2 | LOS E | | | 0.82 | 0.82 |

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

# PHASING SUMMARY

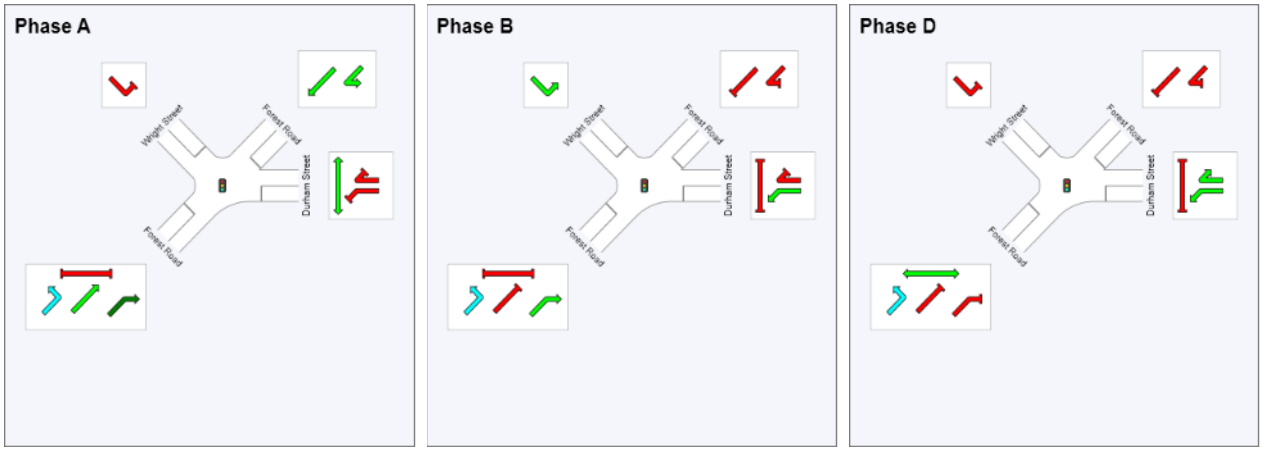
## Site: 1b. Forest Road / Durham Street / Wright Street_PM Scenario 2 - Conversion Alt Option

Forest Road / Durham Street / Wright Street
Signals - Fixed Time  Cycle Time = 120 seconds (Practical Cycle Time)

**Phase times determined by the program**
**Sequence: Opposed Turns**
**Movement Class: All Movement Classes**
**Input Sequence: A, B, D**
**Output Sequence: A, B, D**

**Phase Timing Results**

| Phase | A | B | D |
|---|---|---|---|
| Reference Phase | Yes | No | No |
| Phase Change Time (sec) | 0 | 52 | 94 |
| Green Time (sec) | 46 | 36 | 20 |
| Yellow Time (sec) | 4 | 4 | 4 |
| All-Red Time (sec) | 2 | 2 | 2 |
| Phase Time (sec) | 52 | 42 | 26 |
| Phase Split | 43 % | 35 % | 22 % |






Project: P:\Sydney\Projects\34xxxx\347886\04 Working\2016\5. SIDRA Modelling\Landmark Sq_Scenario 2 AM and PM - Alt Option.sip6
8000266, 6017707, MOTT MACDONALD (CANBERRA), NETWORK / 1PC