Prepared for

REDFERN ROSEHILL PTY LTD

Traffic Impact Assessment Report

Planning Proposal
44-70 Rosehill Street, Redfern

Ref: 0570r01v1
4/05/2018

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Client: Redfern Rosehill Pty Ltd

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Revision History

Revision	Date	Details	Author	Approved by
A	20/04/2018	Draft	T. Lehmann	J. Mulhaire
B	4/05/2018	Issue I	T. Lehmann	J. Mulhaire

Table of Contents

Appendices

1 Introduction

1.1 Overview

Ason Group has been engaged by Redfern Rosehill Pty Ltd, to prepare a Traffic Impact Assessment (TIA) report in support of a Planning Proposal for a mixed-use development (the Proposal) at 44-70 Rosehill Street, Redfern (the Site). The Site is located within the City of Sydney (Council) Local Government Area (LGA) and under Council's Local Environmental Plan (LEP) 2012, the site has a Floor Space Ratio (FSR) of 2.00-2.49 and Height of Building Control of 17.0-18.9m. The Proposal seeks to amend these controls as follows:

- FSR control of 10.40:1
- Height of Buildings Control of 30 metres.

An indicative development yield for the concept scheme has been prepared to inform the subject TIA comprising 312 residential apartments, 2,550 m^2 commercial gross floor area (GFA), and 195 m^2 ancillary retail GFA.

This TIA report provides an assessment of the relevant traffic, transport and parking implications of the Proposal. In preparing this TIA, Ason Group has referenced key planning documents, these include:

- Sydney Development Control Plan 2012
- Sydney Local Environmental Plan 2012
- Transport for New South Wales; Sydney Metro City & Southwest; *Project Update*
- UrbanGrowth NSW Development Corporation: Redfern Waterloo

This TIA also references general access, traffic and parking guidelines, including:

- Roads and Maritime Services, *Guide to Traffic Generating Developments* (RMS Guide)
- RMS Guide to Traffic Generating Developments: Updated Traffic Surveys (RMS TDT2013/04a).
- Australian Standard 2890.1: Parking Facilities – Off Street Car Parking (AS 2890.1)
- Australian Standard 2890.2: Parking Facilities – Off Street Commercial Vehicle Facilities (AS 2890.2)

1.2 Report Structure

The report is structured as follows:

- Section 2 provides a summary of the proposed development
- Section 3 describes the existing site conditions and land use
- Section 4 details the strategic context of the site
- Section 5 describes planned public transport, pedestrian and cycling links.
- Section 6 outlines the parking requirements applicable to the proposed development.
- Section 7 assesses the traffic impacts of the development including the Site's projected trip generation and forecasted network performance
- Section 8 discusses the site access and internal design of the development
- Section 9 provides a summary of the key conclusions.

2 Overview of Proposal

2.1 Summary of Proposed Development

A detailed description of the Proposal is provided in the planning proposal request and architectural plans, prepared by Roberts Day. The key aspects of the concept scheme from a traffic perspective with indicative development yields are summarised below:

- 312 residential units, comprising of:
  - 94 one bedroom units;
  - 187 two bedroom units; and
  - 31 three bedroom units.
- 2,550 m^2 of commercial GFA;
- 195 m^2 of ancillary retail GFA;
- Provision of 243 car parking spaces in 4 levels of basement parking;
- Widening of the Cornwallis Lane for improved pedestrian and vehicular accessibility; and
- Vehicular access from Rosehill Street.

Reference should be made to the concept plans which are submitted separately. Reduced copies of the relevant plans are reproduced at a reduced scale for context below.

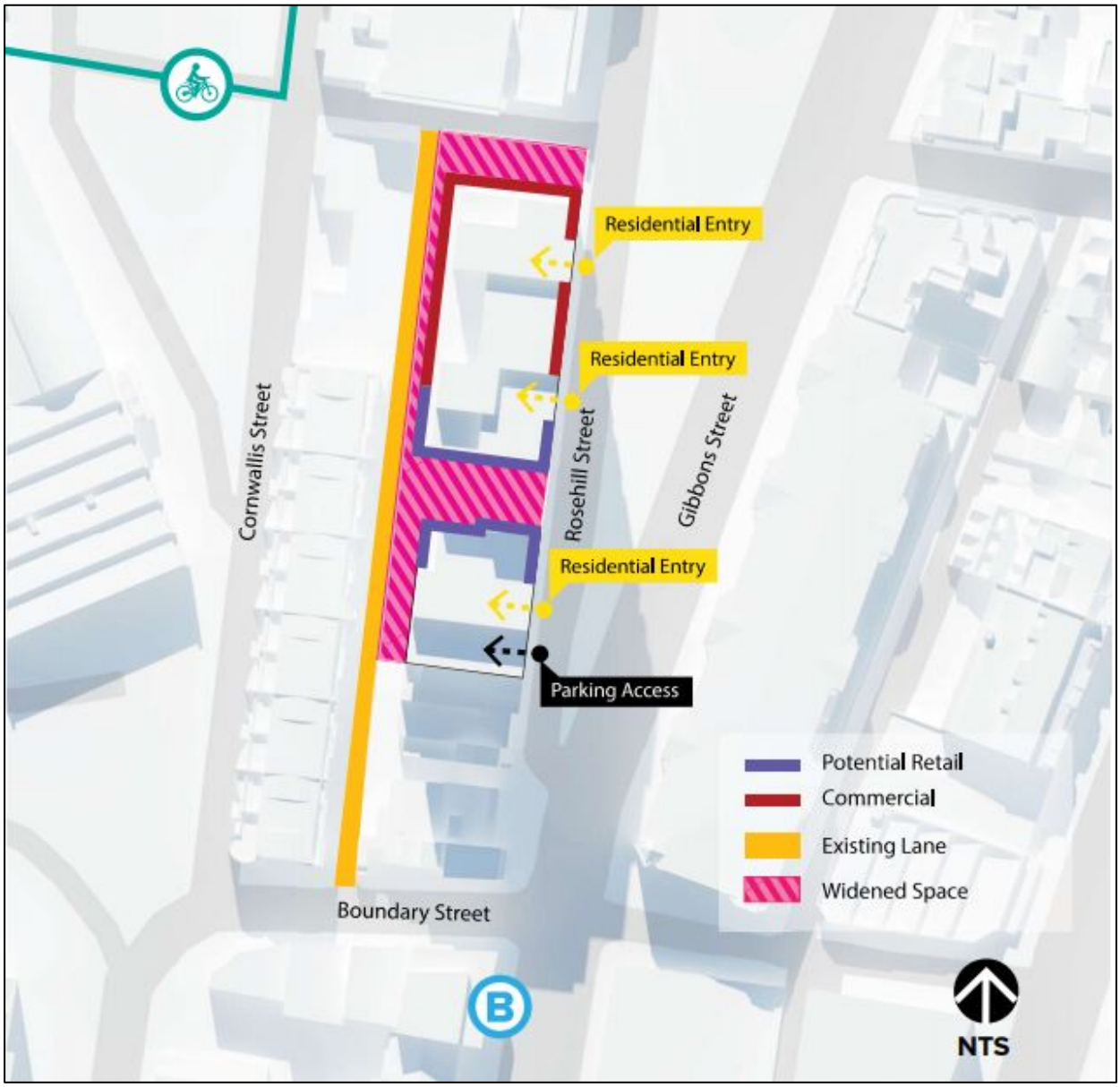


Figure 1: Access Layout

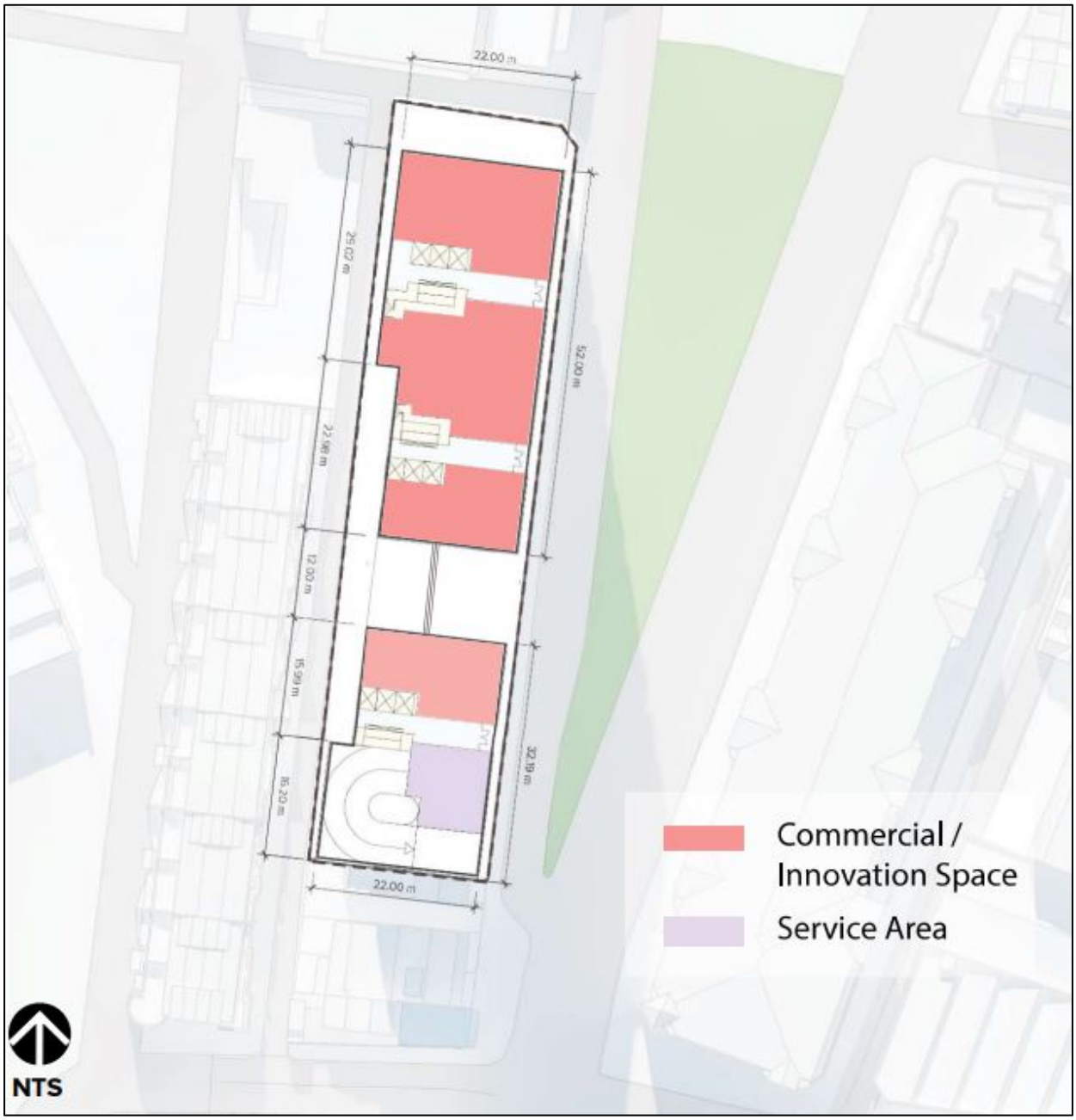


Figure 2: Ground Floor Layout

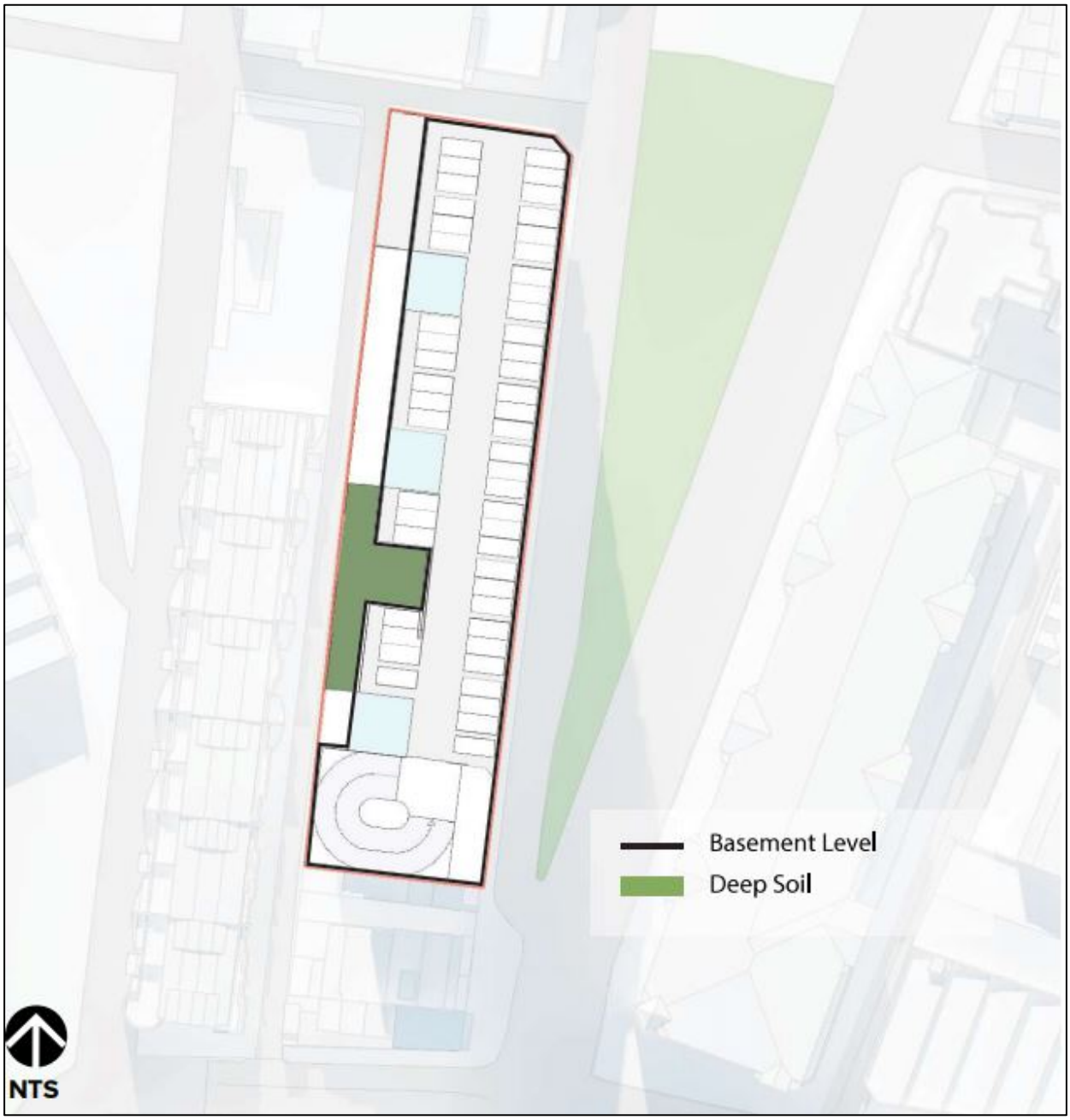


Figure 3: Typical Basement Level Layout

3 Existing Conditions

3.1 Site & Location

The Site is located within City of Sydney LGA in Redfern approximately 2.5 kilometres south of Sydney CBD. The Site has an area of 2,544 m^2 with mixed-use developments surrounding the Site to the north, west and south and the Gibbons Street Reserve to the east. The Site has frontages to Rosehill Street to the east, Margaret Street to the north, Cornwallis Lane to the west, and Boundary Street to the south.

A Site Plan is presented in **Figure 4** which provides an appreciation of the site and the existing conditions.

3.1.1 Existing Land Use and Site Access

The Site is currently zoned B4 Mixed-Use under Council's LEP and is legally known as Lot 1 DP792628. The Site currently consists of 2-storey commercial developments with 23 at-grade parking accessed via two driveways on Rosehill Street.

3.1.2 Existing On-street parking controls

On-street parking is available along Rosehill Street. A two-hour parking restriction between 8AM – 8PM is imposed along Rosehill Street with an exception for vehicles with permits. No Stopping restrictions are enforced opposite the existing site accesses, along Cornwallis Lane, and Boundary Street. No Parking restrictions are imposed along the whole length of Margaret Street.

3.2 Existing Site Generation

On-site field investigations determined that there are 23 at-grade parking spaces provided. The following trip per parking space traffic generation rate has been adopted by multiplying the RMS TDT/04a office traffic generation rates and the RMS Guide parking rates for commercial developments:

- Morning peak period 0.64 trips per space.
- Evening peak period 0.48 trips per space.

This determines the following trip generation rate:

- 15 morning peak hour trips (12 arrival trips, 3 departure trips)
- 11 evening peak hour trips (2 arrival trips, 9 departure trips)

3.3 Road Hierarchy

The key roads providing in the vicinity of the site are summarised below:

- Gibbons Street – A classified RMS Main Road (MR170) that generally runs in a northeast-southwest direction to the east of the Site. It provides access to Rosehill Street and Boundary Street and carries two-four lanes of one-way traffic north-bound only. Restricted kerbside parking is available along both sides of the road. A speed limit of 60km/h applies to the Gibbons Street.
- Wyndham Street – A classified RMS Main Road (MR170) that generally runs in a northeast-southwest direction to the east of the Site. It provides access to Rosehill Street and Boundary Street and carries two-four lanes of one-way traffic north-bound only. Restricted kerbside parking is available along both sides of the road. A speed limit of 60km/h applies to the Gibbons Street.
- Henderson Road – A local collector road that is part of the MR170 that traverses in an east-west direction to the south of the Site. The road provides access to Wyndham Street and Gibbons Street. Restricted kerbside parking is available on both sides of the road. A speed limit of 60km/hr applies to Lindfield Avenue.
- Regent Street – An arterial road that runs parallel to Gibbons Street and Wyndham in the north-south direction to the east of the Site and is part of the MR170. It connects directly to Botany Road and carries two-four lanes of one-way southbound traffic. Restricted kerbside parking is available along both sides of the road. A speed limit of 60km/hr applies to this road. Approximately 60,000 Annual Average Daily Traffic (AADT) pass through the roadway.
- Rosehill Street – A local unclassified one-way street which generally runs in the north-south direction that forms the eastern frontage of the Site and provides connections to Gibbons Street and Margaret lane. The lane is reduced to one-way traffic along the eastern site frontage and is restricted to north-bound traffic. Restricted parking is available along both sides of the road.
- Margaret Street – A narrow local road which runs in an east-west direction with No Parking restrictions along the street.
- Boundary Street – A local road that runs perpendicularly to Gibbons and Cornwallis Street and provides a connection to Henderson Road via Garden Street.
- Cornwallis Lane – A narrow local road which runs in an east-west direction. The road provides road access to the west of the Site the Margaret street and Cornwallis street.

Figure 4: Site and Road Hierarchy

3.4 Existing Intersection Performance

Intersections surveys and on-site field investigations were undertaken at the following key intersections during the morning and evening peak periods to ascertain the existing surrounding road network conditions:

- Wyndham Street / Henderson Road;
- Wyndham Street / Boundary Street / Gibbons Street; and
- Gibbon Street / Lawson Street.

The intersection surveys determined that the peak periods occur at the following times:

- Morning peak period: 7.45-8.45AM
- Evening peak period: 4.45-5.45PM

Figure 5 and **Figure 6** detail the existing traffic volumes of the local road network during the morning and evening peak periods respectively.

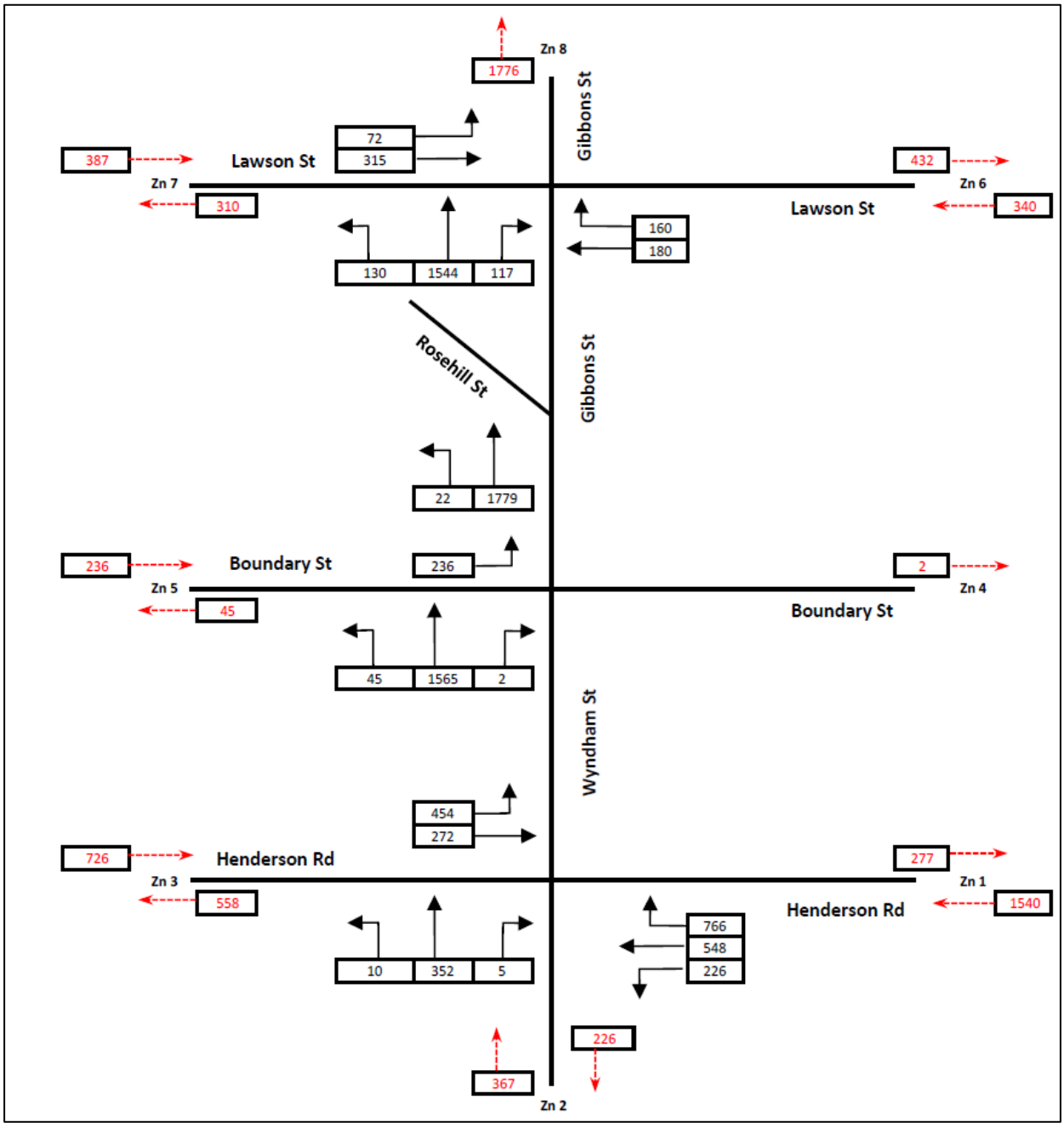


Figure 5: AM Existing Traffic

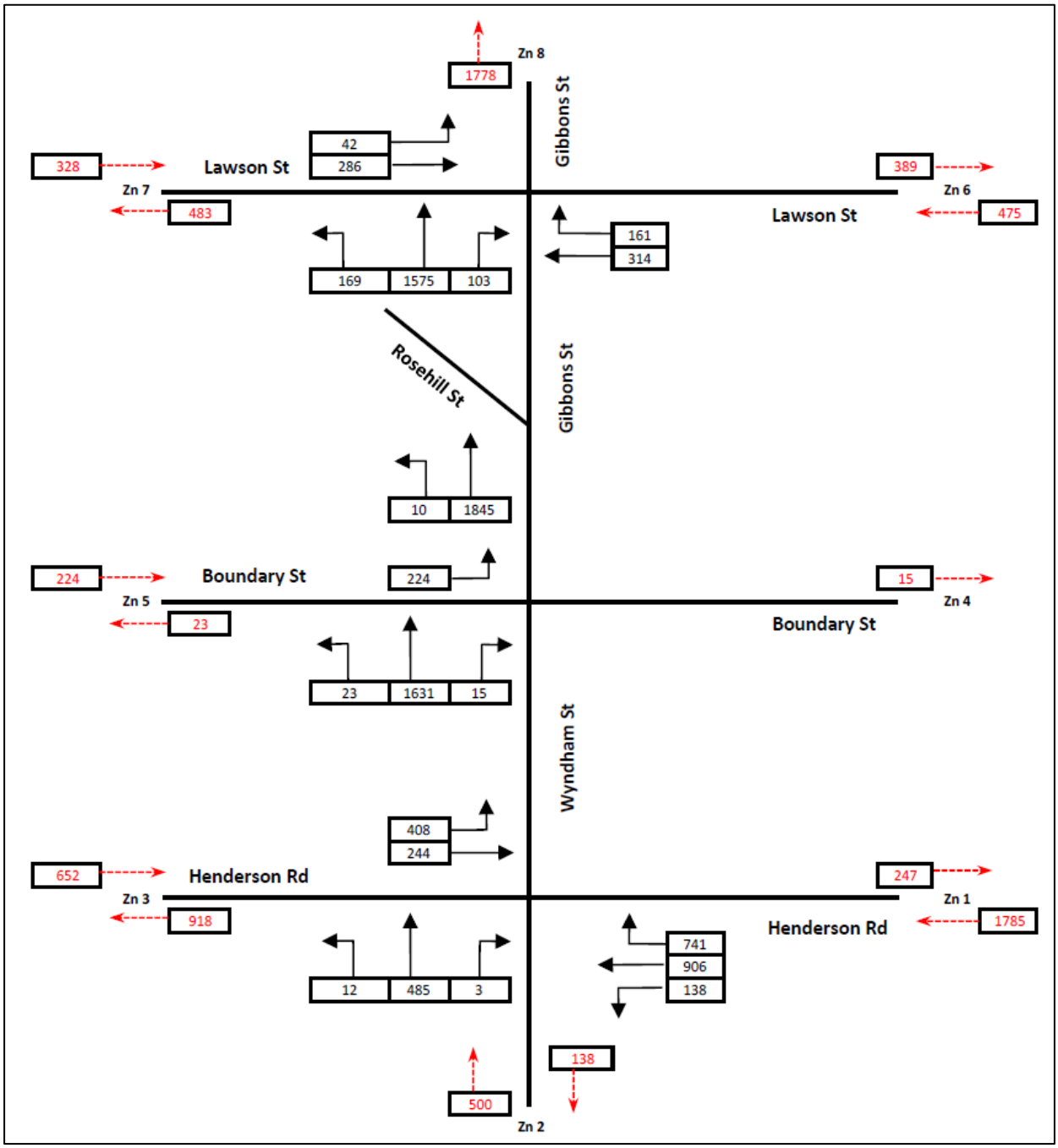


Figure 6: PM Existing Traffic

3.4.1 Baseline SIDRA Performance Testing

The performance of the key intersections has been analysed using the SIDRA Intersection computer program. SIDRA modelling outputs a range of performance measures, in particular:

- *Degree of Saturation (DOS)* – The DOS is defined as the ratio of demand (arrival) flow to capacity. The DOS is used to measure the performance of intersections where a value of 1.0 represents an

intersection at theoretical capacity, above 1.0 represent over-saturated conditions (demand flows exceed capacity) and degrees of saturation below 1.0represent under-saturated conditions (demand flows are below capacity). As the performance of an intersection approaches DOS of 1.0, queue lengths and delays increase rapidly. It is usual to attempt to keep DOS to less than 0.9, with satisfactory intersection operation generally achieved with a OS below 0.8.

- *Average Vehicle Delay (AVD)* – The AVD (or average delay per vehicle in seconds) for intersections also provides a measure of the operational performance of an intersection and is used to determine an intersection's Level of Service (see below). For signalised intersections, the AVD reported relates to the average of all vehicle movements through the intersection. For priority (Give Way, Stop & Roundabout controlled) intersections, the AVD reported is that for the movement with the highest AVD.
- *Level of Service (LOS)* – This is a comparative measure that provides an indication of the operating performance, based on AVD.

The following table provides a recommended baseline for assessment as per the RMS Guide:

Table 1: RMS Level of Service Summary

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

The local network performance is provided in **Table 2** which presents the SIDRA intersection modelling results of the key intersections under the existing scenario.

Table 2: Existing SIDRA Intersection Analysis

Intersection	Period	Degree of Saturation	Average Vehicle Delay (secs)	Level of Service
Wyndham St / Henderson Rd	AM	1.498	132.8	F
	PM	1.243	103.1	F
Wyndham St / Boundary St / Gibbons St	AM	0.755	13.5	A
	PM	0.712	12.7	A
Gibbons St / Lawson St	AM	0.715	22.7	B
	PM	0.680	21.5	B

The analysis indicated that the intersections of Wyndham Street / Boundary Street / Gibbons Street and Gibbons Street / Lawson Street operate at a LOS of B or greater. The intersection of Wyndham Street / Henderson Road operates at a LOS of F with a delay of 132.8 seconds during the morning peak period. On-site field investigations can confirm that the intersection is operating at capacity with queues extending along all legs. Relevant SIDRA Outputs are attached at **Appendix A**.

4 Strategic Context

4.1 Redfern Waterloo Growth Centre

The Site is located within the Redfern Waterloo Growth Centre which includes an Urban Transformation Strategy (The Strategy) for 5 precincts within this Growth Centre. **Figure 7** details the location of the Site within the context of the Growth Centre.

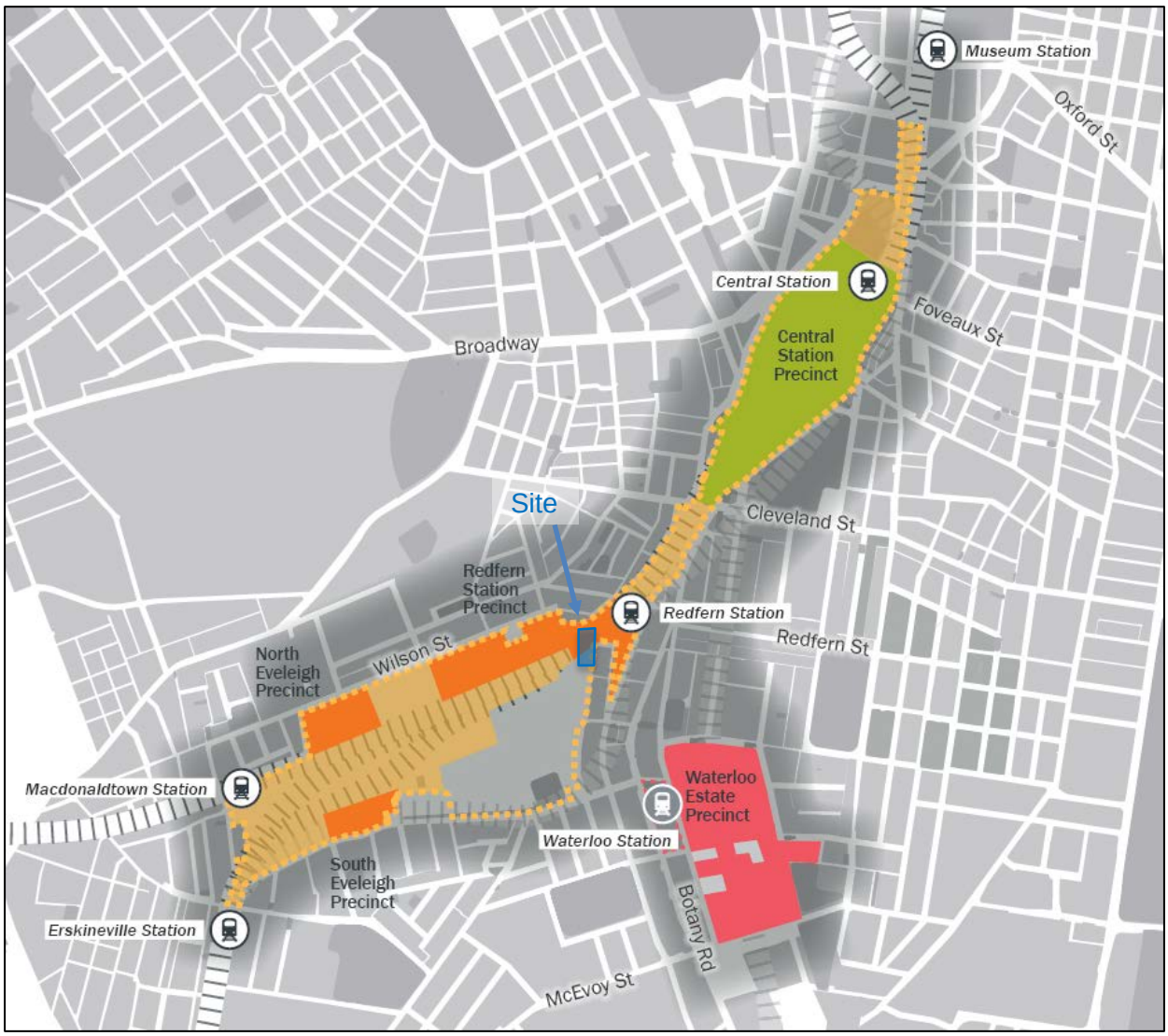


Figure 7: Redfern Waterloo Growth Centre Precincts

It should be noted that while the Site is not within the Redfern Station Precinct, the Precinct includes the Gibbons Street Reserve which the Site is directly adjacent to. The Strategy outlines10 objectives for the Strategy which include improving walking and cycling amenities across the rail corridor and provide improved connections to the rest of city.

Of particular relevance to the Proposal, one of the Strategy objectives identifies Redfern Station for upgrades with TfNSW currently investigating options including a new southern concourse, and accessibility improvements which will improve the existing capacity of Redfern Station. This will greatly improve the accessibility of the Site via public transport and will encourage residents and employees to use alternative modes of transport.

In addition to this, another of the Strategy's key objectives is to integrate high-density mixed-use buildings with existing neighbourhoods. The Proposal meets this objective by providing a unique design with an appropriate density. Furthermore, the Site is located in an ideal location providing residential density to a key local commercial core in the Australian Technology Park.

4.2 Sydney Metro – Waterloo Station

As detailed in the **Figure 7**, the new Waterloo Metro Station will be located between Botany Road and Cope Street, Raglan Street and Wellington Street. The station is approximately 400m (5 minutes' walk) from the Site and will offer an additional mode of transport to residents and employees. **Figure 8** details the location of the Site in relation to the new Waterloo Metro Station.

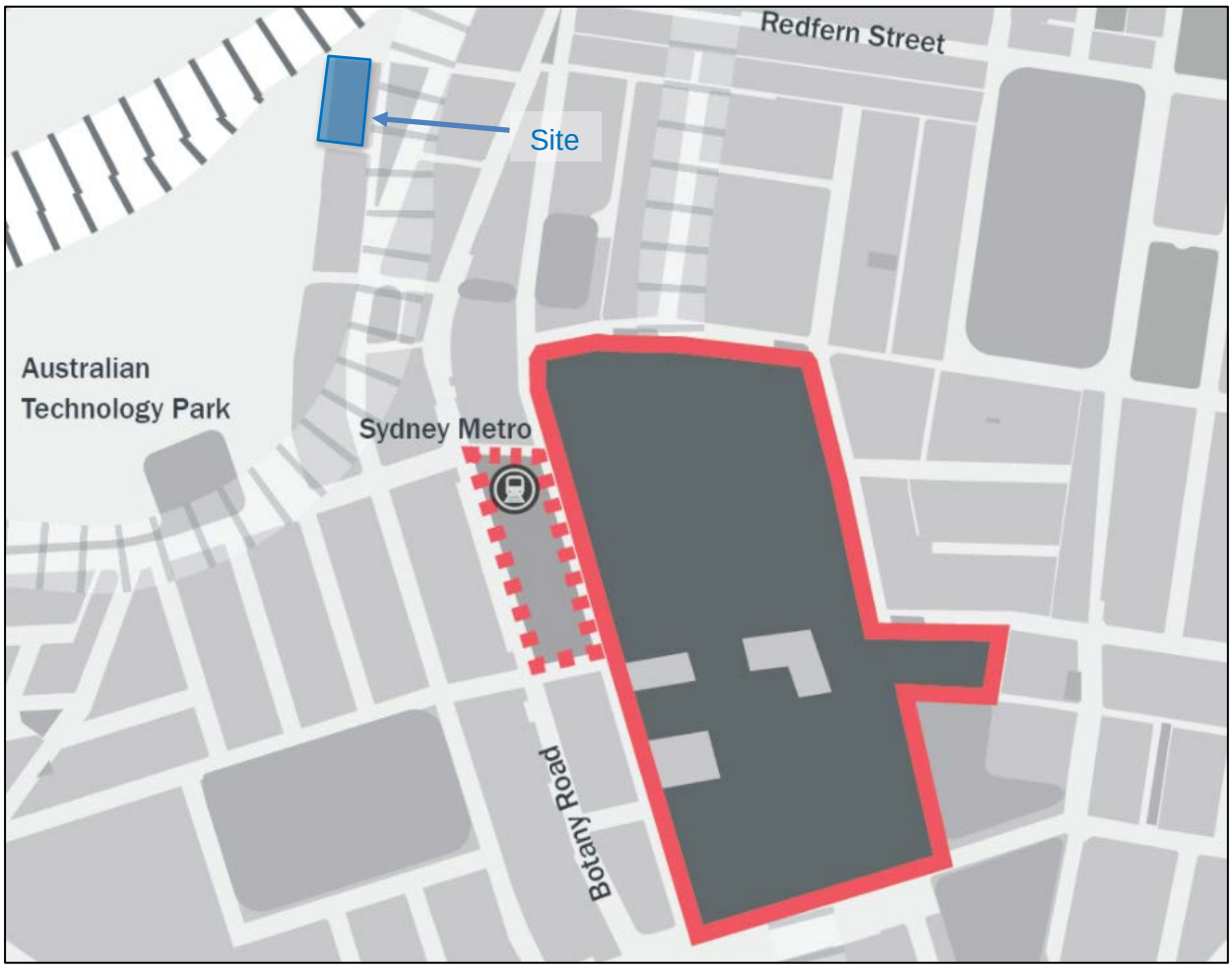


Figure 8: Waterloo Precinct and Waterloo Metro Station

The Waterloo Metro Station will be delivered as a part of the Sydney Metro City and Southwest line that will connect the Sydney Metro Northwest in Chatswood to new CBD stations and then head southwest to Bankstown. The new metro line has a target capacity of 40,000 customers per hour and will provide services every 4 minutes during peak periods. With the delivery of the Waterloo Metro Station, improved cycling and pedestrian amenities will be provided thereby further improving the Growth Centres provision of amenities directed at encouraging residents and employees to use alternative modes of transport. Construction has begun on the Waterloo Metro Station with an anticipated completion date in 2024.

5 Public Transport, Cycling and Pedestrian Access

The Site is well serviced by local public transport infrastructure. The key rail and bus services local to the Site are presented in **Figure 9** and summarised below.

5.1 Railway Services

The Integrated Public Transport Service Planning Guidelines, Sydney Metropolitan Area (Transport for NSW, December 2013) state that rail services influence the travel mode choices of areas within 800 metres walk (approximately 10 minutes) of a railway station. It is therefore noteworthy that the Site is located approximately 350 metres (5 minutes) walking distance to the south of Redfern Station via Rosehill Street. Redfern Station is serviced by a myriad of train line services, with connections to Sydney CBD, Epping, Parramatta, Hornsby, Penrith, Cronulla, Chatswood and regional centres. Accordingly, a significant proportion of future commuters travelling to / from the Site would utilise the train services at Redfern Station.

The below table summarises the peak hour train frequencies:

Table 3: Train Frequencies at Redfern Train Station

Station – Line	To City	From City	Total
Redfern Station - via North Shore, Northern and Western lines			
Morning Peak Hour (8-9AM)	20	10	30
Off Peak Hour	8	8	16
Afternoon Peak Hour (5-6PM)	16	14	30
Redfern Station - via Inner West & Leppington line			
Morning Peak Hour (8-9AM)	12	12	24
Off Peak Hour	8	8	16
Afternoon Peak Hour (5-6PM)	8	12	20
Redfern Station - via Bankstown line			
Morning Peak Hour (8-9AM)	13	18	31
Off Peak Hour	6	6	12
Afternoon Peak Hour (5-6PM)	16	16	32
Redfern Station - via Airport and South line			
Morning Peak Hour (8-9AM)	0	3	3
Off Peak Hour	0	0	0
Afternoon Peak Hour (5-6PM)	0	4	4

The above table demonstrates that the Redfern railway station is well serviced in the peak periods with trains arriving 1-2 minutes in each direction. Furthermore, the station is conveniently located from the Sydney CBD with a 6-minute travel time between Redfern and Town Hall.

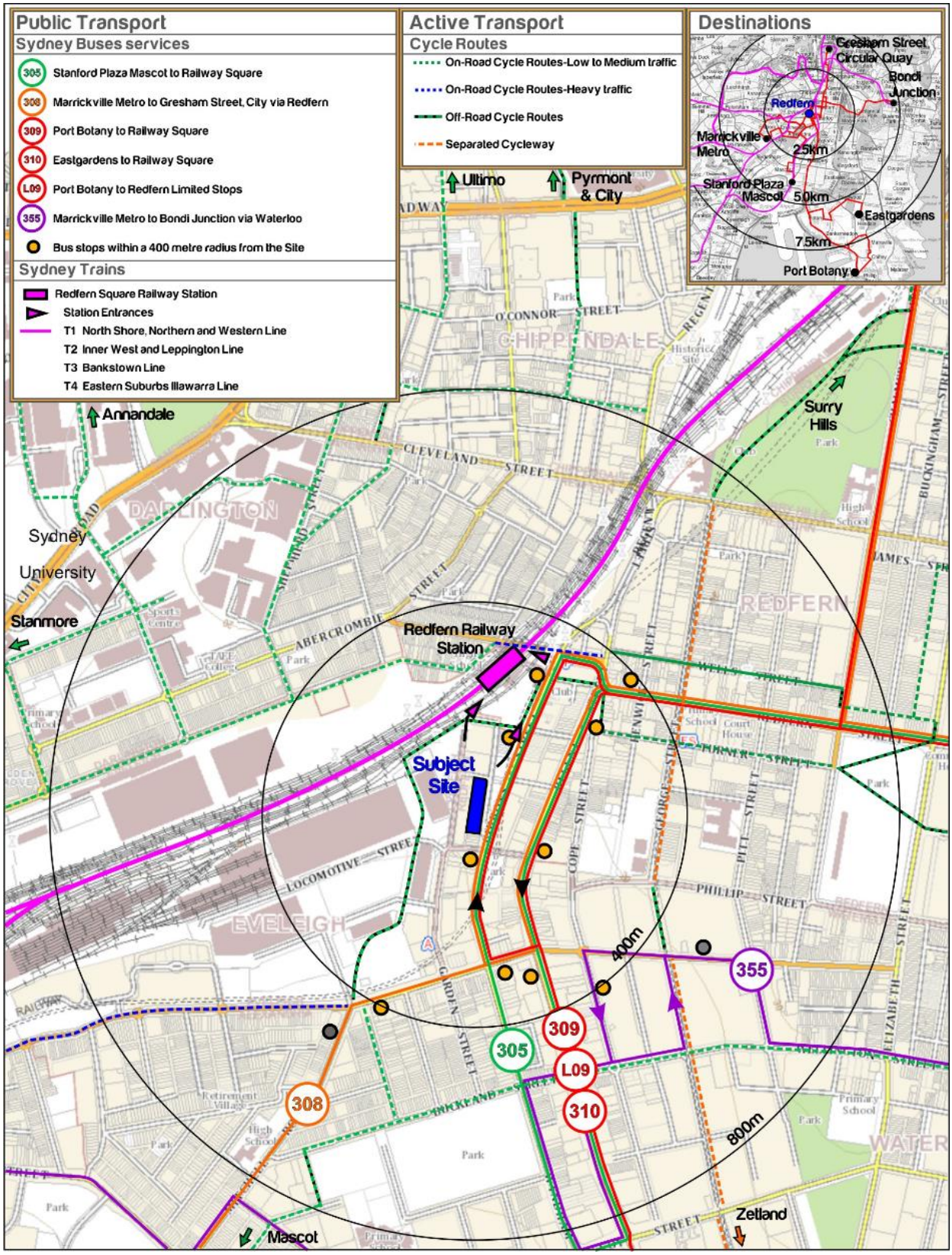


Figure 9: Public Transport Network

5.2 Bus Services

Having regard to the standard bus travel, the Integrated Public Transport Service Planning Guidelines state that bus services influence the travel mode choices of sites within 400 metres (approximately 5 minutes' walk) of a bus stop. The Site is well serviced by a wide selection of bus stops within 400 walking distance of the Site as shown in Figure 9. The existing bus services have been listed in the table below.

Table 4: Existing Bus Services

Route No.	Route	Route Description	Service Frequency
305	Stanford Plaza Mascot to Railway Square	Railway Square, Redfern, Green Square, Mascot	Weekday: Every 20 minutes during the peak, not operating off-peak.
308	Marrickville Metro to Gresham Street, City via Redfern	Sydney CBD, Redfern, Alexandria, St. Peters, Marrickville	Weekday: Every 15-20 minutes during the peak, every 30 minutes off-peak. Weekend: Every 20 minutes during the whole day
309	Port Botany to Railway Square	Sydney CBD, Redfern, Green Square, Mascot, Banksmeadow, Pagewood, Port Botany	Weekday: Every 10-15 minutes during the peak, every 20 minutes off-peak. Weekend: Every 20 minutes during the whole day
310	Eastgardens to Railway Square	Railway Square, Redfern, Waterloo, Roseberry, Mascot, Botany, Pagewood, Eastgardens	Weekday: Every 12-14 minutes during the peak, every 20 minutes off-peak. Weekend: Every 20-30 minutes during the whole day
L09	Port Botany to Redfern Limited Stops	Railway Square Waterloo, Mascot, Botany, Banksmeadow, Port Botany	Weekday: Every 12-20 minutes during the peak, not operating off-peak.
355	Marrickville Metro	Bondi, Moore Park, Surry Hills, Waterloo, Erskineville, Newtown, Enmore	Weekday: Every 30 minutes for the whole day. Weekend: Every 30 minutes until evening

Table 4 demonstrates that the area is well serviced by buses along Wyndham Street / Gibbons Street and Botany Road / Regent Street during the weekday peak, weekday off-peak periods, and weekends. A variety of travel destinations are provided by the bus services to areas such as Sydney CBD, Inner West and Eastern Suburbs. Bus stops are located near the intersection of Wyndham Street / Boundary Street, approximately 100 metres walking distance from the Site, providing access to these services.

5.3 Existing Pedestrian Accessibility

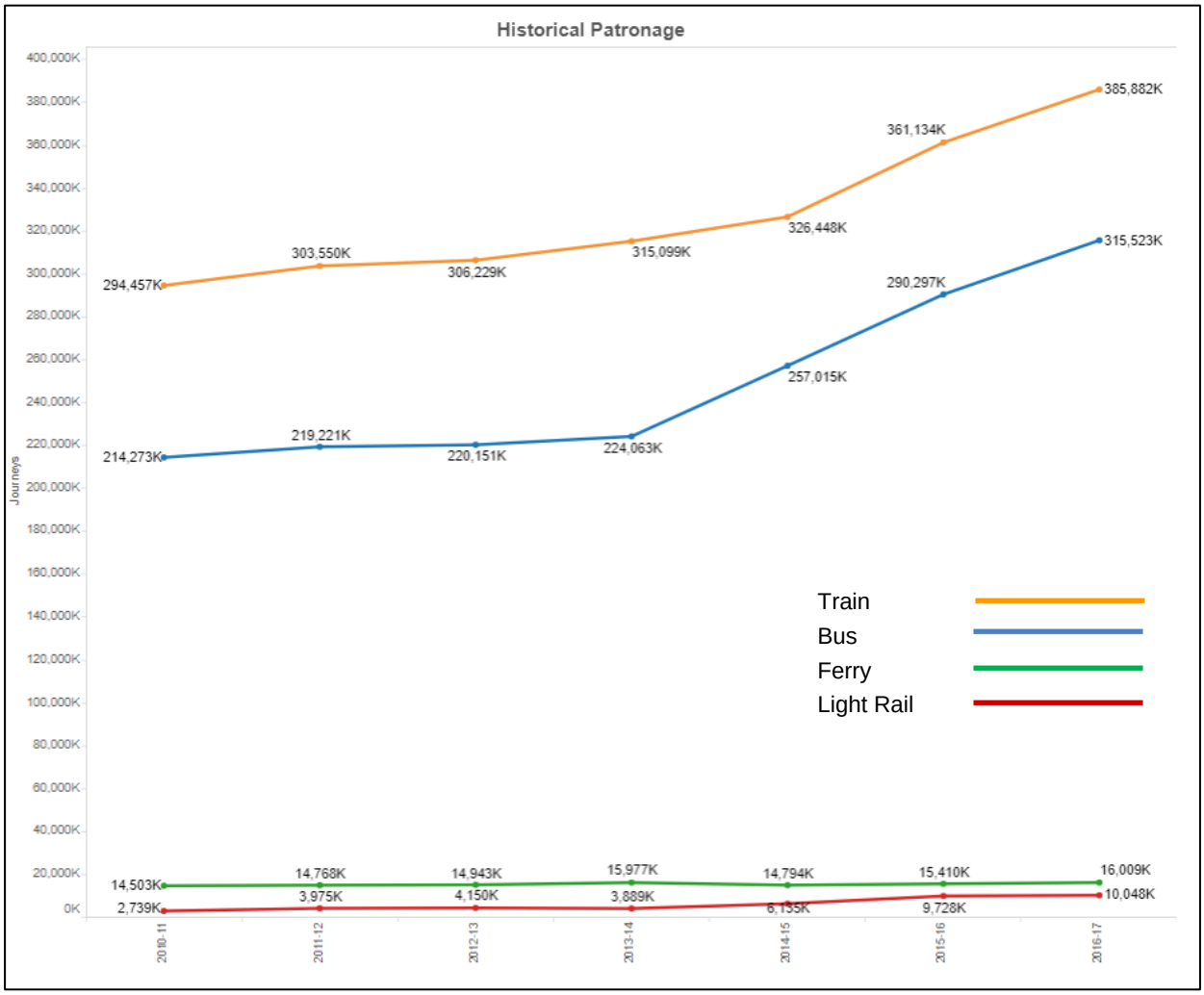
Pedestrian access is provided by footpaths along Rosehill Street and Margaret Street fronting the Site, as well as Gibbons Street to the east. Direct pedestrian access from Rosehill Street to Redfern Station is conveniently available with dedicated footpaths crossing the Gibbons Street Reserve before continuing directly to Redfern Station along Gibbons Street. The current arrangement allows convenient pedestrian access to the railway station to the north and bus stops to the north and south.

5.4 Existing Cycle Routes

There are currently a myriad of available cycling facilities and routes provided within the proximity of the development. With reference to Figure 9**,** a vast bicycle network surrounds the Site. An off-road cycle route is available to the north and west of the Site, allowing convenient cycling to Redfern Station and connecting to an array of on-road cycling routes which travel to the surrounding suburbs. Separated cycleways are available along George Street, connecting Surry Hills to Zetland with minimised traffic disturbance.

5.5 Modal Shift Travel Behaviour

The existing travel behaviour as detailed in Section 5.6 is representative of the shift in travel behaviour throughout Sydney away from private vehicle use. This is further confirmed by data provided by the 2016 Census and from TfNSW. details the patronage of public transport across Sydney beginning from June 2010.



Source: Transport for NSW Data

Figure 10: Public Transport Patronage

As is evident from the above, the overall patronage has increased dramatically equating to an approximately 31% increase over the past 7 years. This increase in patronage is also accompanied by a reduction of private vehicle use of 3%.

With consideration for the Redfern Waterloo Growth Centre – specifically the upgrades to Redfern Station and the new Waterloo Metro Station – the modal shift towards public transport is also anticipated to increase and the use of private vehicles during weekday peak periods would be

It should also be noted that Council stipulates maximum car parking rates for this reason, and to provide more relevant and site-specific data, Ason Group undertook a modal split survey detailed in Section 5.6 below.

5.6 Existing Travel Behaviours

Ason Group undertook a modal survey of the mixed-use development at 7-9 Gibbons Street, Redfern located approximately 250m north of the Site 7-9 Gibbons Street is comprising of 149 residential units, 725 m^2 of commercial GFA, 330 m^2 retail GFA, and a 1,360 m^2 supermarket. The modal survey was undertaken to establish the likely travel behaviours of the future residents of the Proposal. Residents were asked which mode of transport they use to travel to / from work during the morning and evening peak periods and was undertaken over two days (20th March 2018 & 21st March 2018). The average results of the survey are displayed graphically below.

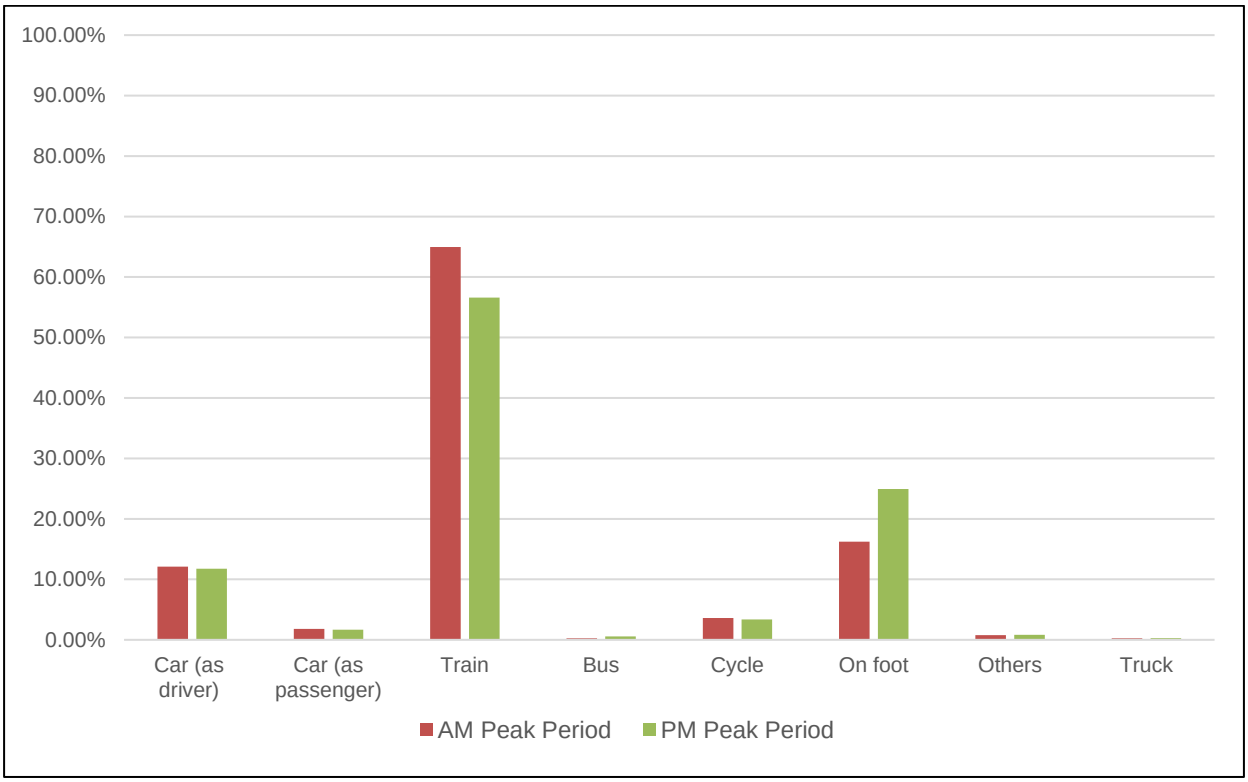


Figure 11: Modal Split – 7-9 Gibbons Street, Redfern

As demonstrated in **Figure 11**, the most popular method of transport is the train with 65% and 57% of resident surveyed utilising it during the morning and evening peak periods respectively. It is also worth noting that the second largest travel mode is by foot with 16% of residents surveyed walking to work in the morning and 25% in the evening.

The Site is anticipated to experience similar modal split noting its close proximity to numerous bus services, Redfern Station and the new Waterloo Metro Station.

6 Parking & Servicing Requirements

6.1 Parking Requirements

Parking for the development has been proposed in accordance with Sydney LEP 2012, Part 7, Division 1, Car parking ancillary to other development. Council's LEP adopts the following car parking rates for residential buildings on sites with Category B in the Land Use and Transport Integration (LUTI) map and Category E for commercial / retail uses as shown in the Public Transport Accessibility Level (PTAL) map. Council's DCP Schedule 7 provides parking rates for motorcycles, accessible parking, car share schemes and, service vehicles.

Residential Parking Rates

The residential maximum parking rates are detailed in the table below:

Table 5: Residential Council Parking Rates

Land Use	Maximum Parking Rate
One bedroom	0.4 spaces per unit
Two bedrooms	0.8 spaces per unit
Three or more bedrooms	1.1 spaces per unit
Visitor	0.05 spaces per unit

Commercial Parking Rates

In Part 7, Division 1, Clause 7.6.2 (d) of SLEP2012, the commercial premises parking requirement on land in Category E with a floor space ratio greater than 2.5:1 is determined using the following formula:

$$M = (G \times A) \div (50 \times T)$$

Where:

M is the maximum number of parking spaces, and

G is the gross floor area of all retail premises in the building in square metres (2,550 m^2), and

A is the site area in square metres (2,544 m^2), and

T is the total gross floor area of all buildings on the site in square metres (26,153 m^2).

Retail Parking Rates

In Part 7, Division 1, Clause 7.6.2 (d) of SLEP2012, the commercial premises parking requirement on land in Category E is as follows:

- 1 parking spaces per 60 m^2 of GFA.

Motorcycle Parking Rates

Council's DCP Schedule 7.8.4 requires the following parking provision for motorcycles:

- 1 motorcycle parking spaces for every 12 spaces.

Accessible Parking Rates

Council's DCP Schedule 7.8.5 requires the following parking provision for Accessible parking:

- 1 Accessible parking space for every 20 car parking spaces; and
- 1 Accessible parking space for every adaptable unit.

Car Share Parking Rates

Council's DCP requires the following minimum parking provision for Car Share parking which are to be provided in addition to the maximum parking spaces permitted in the development:

- Category B – 1 space per 60 Residential car spaces provided.
- Category E – 1 space per 40 Commercial car spaces provided.

Service Vehicle Parking Rates

Council's DCP Schedule 7.8.1 requires the following minimum parking provision for service vehicle parking:

- *Residential*
  - 1 space for the first 50 dwellings, or part thereafter.
  - 0.5 spaces for every 50 dwellings or part thereafter.
- *Commercial Premises*
  - 1 space per 3,300m^2 GFA, or part thereof, for the first 50,000 m^2
- *Retail Premises*

- 1 space per 350m^2 GFA, or part thereof, for the first 2,000 m^2

Application of these applicable parking rates to the indicative development yield results in the following parking requirement are provided in **Table 6** and **Table 7: Other Parking**

Table 6: Maximum Car Parking Rates

Land Use	Yield	Max Parking Requirements	Parking Proposed
One Bedroom	94	38	243
Two Bedroom	187	150	
Three or more Bedroom	31	34	
Visitor	-	16	
Commercial	2,550 m^2	5	
Retail	195 m^2	3	
Total	-	246	243

Application of Council's rates to the indicative development yield results in a maximum requirement of 246 car parking spaces. In response the concept scheme identifies a provision of 243 car parking spaces, which would comply with Council requirements. This matter would be subject to further detailed assessment at the relevant DA stage however demonstrates the ability to provide parking compliance.

Table 7: Other Parking Requirements

Other Parking	Yield	Parking Requirements
Motorcycle	243 spaces	20
Accessible Parking	243 spaces	12 + 1 per adaptable unit
Residential Car Share	238 spaces	4
Commercial Car Share	5 spaces	0
Servicing	312 units, 2,550 m^2 commercial & 195 m^2 retail	5

Generally, other parking requirements can be met and would be addressed at a later stage during the development application phase. The current indicative parking schemes can be amended to fulfil any necessary parking controls required by Council. This matter will be assessed in greater detail at DA stage in liaison with Council and compliance with Council's parking requirements will be further investigated noting that it is likely that this can be achieved.

6.2 Bicycle Parking

Council's DCP Table 3.5 requires the following minimum parking provision for bicycles:

Residential Development

- 1 bicycle parking space for every residential dwelling.
- 1 bicycle parking space for every 10 residential dwellings for visitors.

Commercial Development (Office Premises)

- 1 bicycle parking space per 150 m^2 GFA.
- 1 bicycle parking space per 400 m^2 GFA for visitors

Commercial Development (Cafe)

- 1 bicycle parking space per 250 m^2 GFA.
- 2 + 1 bicycle parking space per 100 m^2 over 100 m^2 GFA for customers.

Accordingly, the bicycle parking requirement is outlined within **Table 8**.

Table 8: Bicycle Parking Requirement

Land Use	No. / Area	Parking Rate	Minimum Requirement	AS 2890.3 Class
Residential				
Residents	312 Unit	1 space / unit	312	Class 1 bike lockers
Visitors	312 Unit	1 space / 10 units	31	Class 3 bike rails
Office				
Staff	2,550 m^2	1 space / 150 m^2	17	Class 2 bike facilities
Visitor	2,550 m^2	1 space / 400 m^2	6	Class 3 bike rails
Retail				
Staff	195 m^2	1 space / 250 m^2	1	Class 2 bike facilities
Visitor	195 m^2	2+ 1 space / 400 m^2 over 100 m^2	3	Class 3 bike rails
Development Parking Requirement			**370**	**-**

As shown above, the proposed development resulted in a minimum requirement of 370 bicycles spaces, comprising (in accordance with Council's DCP):

- 312 Class 1 bike lockers for the residential requirement,
- 18 Class 2 bike facilities for the staff requirement, and
- 40 Class 3 bike rails for the combined visitor requirement.

It is proposed to comply with the bicycle parking requirement at DA stage.

7 Traffic Assessment

7.1 Traffic Generation

The traffic impacts of the proposed development have been assessed having regard for the RMS TDT2013/04a. As detailed in Section 2, the application seeks rezoning which would represent an indicative development yield of 312 residential dwellings, 2,550 m^2 of commercial GFA, and 195 m^2 of retail GFA.

The commercial trip generation rate detailed in the RMS TDT2013/04a of 1.6 trips / 100 m^2 would result in a traffic generation of 41 trips during the morning peak hour. However, as the development is restricted in the amount of commercial parking spaces it can provide (5 spaces), a more suitable trip generation rate is required. Due to the restricted parking provision, a trip generation rate of 1 trip per space has been adopted for the purposed of this assessment.

The retail component is considered to be ancillary to the proposed development and therefore would not contribute to car orientated travel.

Accordingly, the following table details the trip generation rates that were adopted and the subsequent traffic generation for the relevant land uses assuming a general 80:20 split of traffic movements:

Table 4: Trip Generation Rates

Land Use	Yield	Period	Traffic Generation Rate	Traffic Generation
Residential	312 units	AM	0.19 trips / unit	59 trips (12 in, 47 out)
		PM	0.15 trips / unit	47 trips (38 in, 9 out)
Commercial	2,550 m^2	AM	1 trip / space	5 trips (4 in, 1 out)
		PM	1 trip / space	5 trips (1 in, 4 out)

This results in the following total trip generation:

- 64 morning peak hour trips (16 arrival trips, 48 departure trips).
- 52 evening peak hour trips (39 arrival trips, 13 departures trips).

Noting the existing site generation detailed in Section 3.2, the net traffic generation is as follows:

- 49 morning peak hour trips (4 arrival trips, 45 departure trips).
- 41 evening peak hour trips (37 arrival trips, 4 departures trips).

The impacts of these additional trips are assessed further below.

7.2 Traffic Distribution

Based on the survey date of the key intersections as detailed by Figure 5 and Figure 6, the trip distribution of future residents and employees within the development can be determined based on the existing traffic flows within the network. The net trips generated by the development have been assigned to the local road network and is detailed in **Figure 12** and **Figure 13**.

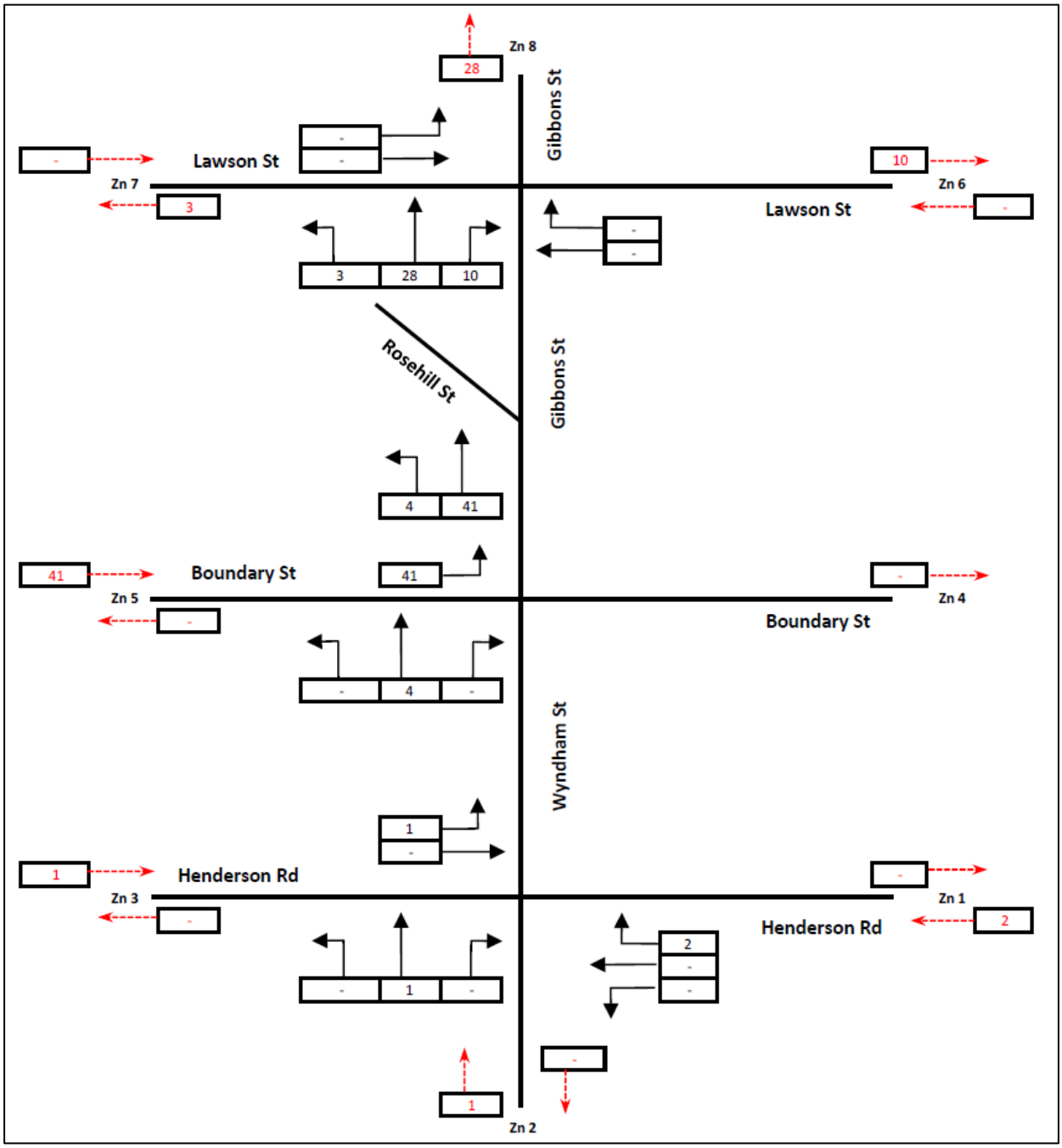


Figure 12: AM Development Traffic

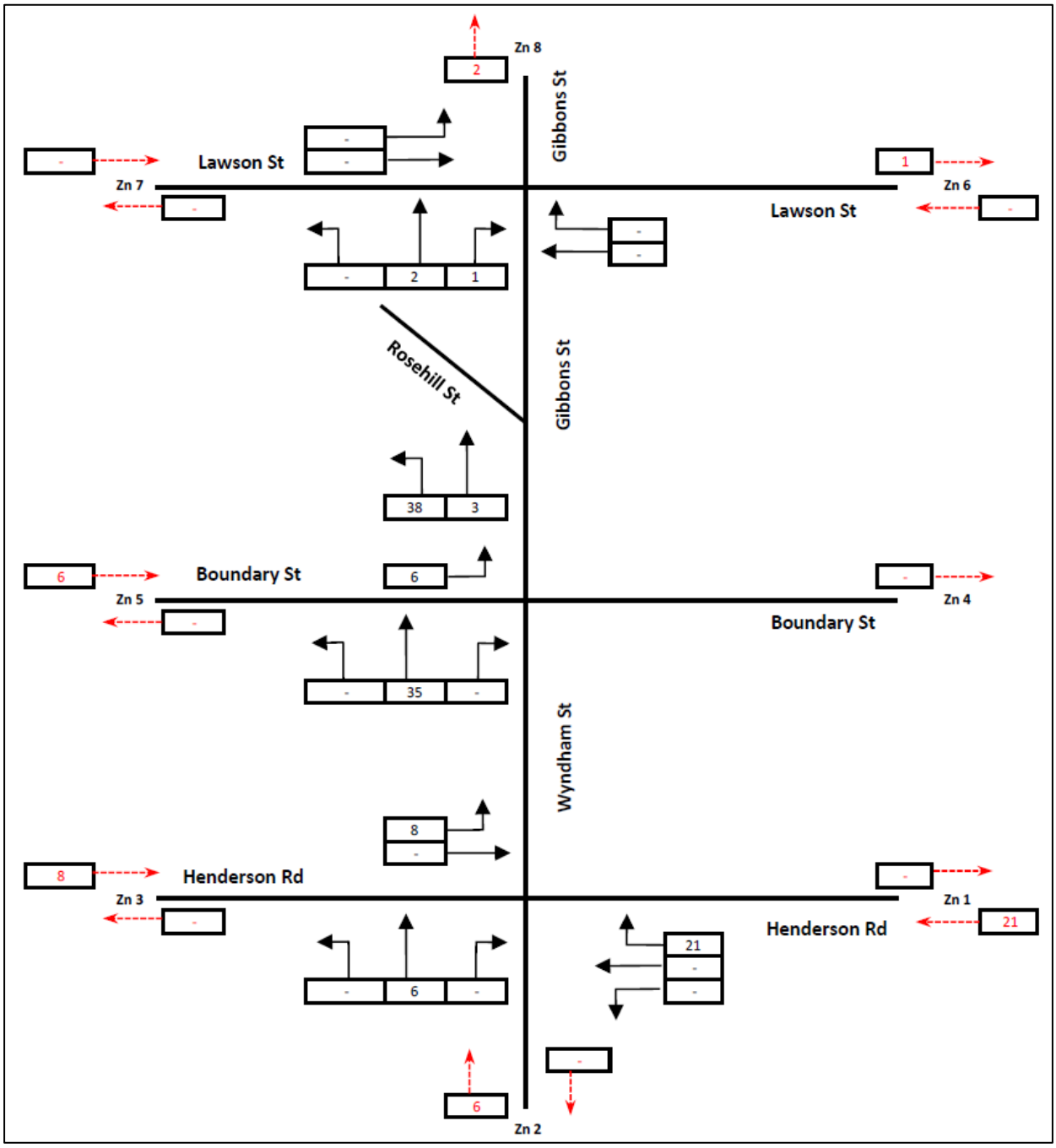


Figure 13: PM Development Traffic

7.3 Traffic Impacts

The impact of the proposed development on the critical intersections in the locality has been assessed as a net increase over and above the existing on-street conditions and the results of this analysis are summarised in **Table 4**.

Table 4: Existing + Development SIDRA Intersection Analysis

Intersection	Scenario	Period	Degree of Saturation	Average Vehicle Delay (secs)	Level of Service
Wyndham St / Henderson Rd	Existing	AM	1.498	132.8	F
		PM	1.243	103.1	F
	Existing + Development	AM	1.500	133.8	F
		PM	1.263	109.5	F
Wyndham St / Boundary St / Gibbons St	Existing	AM	0.755	13.5	A
		PM	0.712	12.7	A
	Existing + Development	AM	0.884	15.6	B
		PM	0.759	13.2	A
Gibbons St / Lawson St	Existing	AM	0.715	22.7	B
		PM	0.680	21.5	B
	Existing + Development	AM	0.731	22.9	B
		PM	0.682	21.5	B

The SIDRA analysis indicates that the traffic volumes arising from the development would result in only minor increases in DOS and AVD and – importantly – LOS would remain unchanged for the intersection of Gibbons Street / Lawson Street. The intersection of Wyndham Street / Boundary Street / Gibbons Street is estimated to operate at LOS B during the morning peak period, within acceptable limits of intersection performance.

While the intersection of Henderson Street / Wyndham Street currently underperforms, it is noteworthy that the development traffic will result in an increase of only 1 and 6.4 seconds during the morning and evening peak periods respectively which is relatively minor and as such, the intersection will continue to operate in a consistent manner.

In summary, the traffic impact analysis concludes that the net traffic generation volumes are of a sufficiently low order that once distributed on to the surrounding road network, the impacts of these volumes at the key intersections would be negligible and the intersections would operate as currently occurs. Further analysis of the critical intersections would be undertaken at the DA stage however the development is supported on traffic planning grounds.

8 Design Commentary

8.1 Relevant Design Standards

The site access, car park and loading areas would be designed to comply with the following relevant Australian Standards:

- AS2890.1 for car parking areas;
- AS2890.2 for commercial vehicle loading areas;
- AS2890.6 for accessible (disabled) parking.

The following characteristics are noteworthy with regard to the design of the site access driveway, loading docks and basement car parking are discussed in **Appendix B**.

- A single entry/exit driveway for residential and commercial vehicles that is to be designed in accordance with AS2890.1 and AS2890.2 design standards.
- All resident parking spaces are designed in accordance with a User Class 1A and are to be provided with a minimum space length of 5.4m, a minimum width of 2.4m, and a minimum 5.8m aisle width
- Dead-end aisles are provided with the required 1.0m aisle extension in accordance with Figure 2.3 of AS2890.1.
- All disabled and adaptable parking spaces are to be provided in accordance with AS2890.6, which requires a space with a clear width of 2.4m and located adjacent to a minimum shared area of 2.4m.

It is expected all future DA architectural plans would be designed to comply with AS 2890.1 and AS 2890.2.

8.2 Service Vehicle Access

The commercial (heavy) vehicle facilities of the development would be designed having regard for the operational requirements of the future tenant and the requirements of AS2890.2. The design of the access and servicing area would be designed in accordance with AS2890.2 and Council's controls. The following characteristics are noteworthy with regard to the design of the commercial vehicle access:

- Service vehicle parking spaces would be located near vehicle entry points and lifts
- Bays are to be located completely within the boundary of the Site, clear of parked vehicles and through traffic.
- Ramps are to be designed in accordance with AS2890.2 widths, grades, and radius.
- Access and servicing area Would be designed to accommodate the largest vehicle entering the Site.

A table for AS2890.2 MRV compliance has been attached in **Appendix B** for reference.

9 Conclusions

The key findings of this Traffic Impact Assessment are:

- The Planning Proposal seeks approval for an increase to the permitted building height on the subject Site, which would allow for a 30-storey mixed-use development and an indicative yield of 312 residential units, 2,550m^2 commercial GFA, 195 m^2 ancillary retail GFA, and 243 parking spaces.
- SIDRA intersection analysis of the existing intersections of Wyndham St / Henderson Rd, Wyndham St / Boundary St / Gibbons St, and Gibbons St / Lawson St has identified that the intersection of Wyndham St / Henderson Rd to be operating at capacity with a Level of Service F and a delay of 132.8 seconds during the morning peak period. The intersections of Wyndham St / Boundary St / Gibbons St, and Gibbons St / Lawson St will operate at a LOS B or greater during both peak periods
- The Site is favourably located to public transport facilities, which will encourage new residents to use alternative transport modes (other than private vehicles) to travel to and from the Site. The Site's proximity to Redfern Station, bus stops and the Site's connectivity to the pedestrian and cycling network makes the Proposal desirable in terms of access to sustainable alternative transport.
- The Site is located within the Redfern Waterloo Growth Centre, specifically adjacent to the Redfern Station Precinct. The Urban Transformation Strategy for the Growth Centre identifies Redfern Station for upgrades which will improve passenger capacity. The completion of the Waterloo Metro Station in 2024 will provide residents and employees and additional mode of transport with train every 4 minutes during peak hour. The Proposal also meets one of the core objectives of the Urban Transformation Strategy by providing a high-density mixed-use development within existing neighbourhoods and provides a unique design while providing a residency complimenting the local commercial core of the Australian Technology Park.
- Having regard for the City of Sydney DCP and LEP car parking rates, the proposed development would result in the maximum of 246 car parking spaces. In response, the concept schemes identify 243 car parking spaces and would ensure that all parking demands generated by the Proposal would be accommodated on-site in compliance.
- The Proposal would generate an additional 49 and 41 trips during the morning and evening peak periods. SIDRA intersection analysis has determined that all key intersections would continue to operate consistently with existing operation.
- The access and basement design would generally be designed having regard for the relevant Australian Standards (AS2890 series). Detailed assessment of the design ensuring compliance with AS2890 and relevant Council controls would be undertaken as part of the DA documentation.

In summary, the Proposal is supportable on traffic planning grounds and will not result in any adverse impacts on the surrounding road network or the availability of on-street parking.

Appendix A

SIDRA Output Results

MOVEMENT SUMMARY

Site: 101 [Gibbons St x Lawson St_AM_EX]

Gibbons St x Lawson St
AM
Existing
Signals - Fixed Time Isolated Cycle Time = 80 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: Gibbons St (370m)											
1	L2	138	0.8	0.217	25.3	LOS B	3.8	26.8	0.74	0.75	32.9
2	T1	1734	6.3	0.715	17.9	LOS B	19.8	146.2	0.85	0.77	42.0
3	R2	136	9.3	0.715	24.9	LOS B	18.6	138.1	0.87	0.80	32.3
Approach		2007	6.1	0.715	18.9	LOS B	19.8	146.2	0.85	0.77	40.7
East: Lawson St (60m)											
5	T1	202	6.3	0.298	19.7	LOS B	5.7	41.8	0.76	0.63	30.4
6	R2	173	2.4	0.549	35.5	LOS C	6.1	43.6	0.96	0.86	22.4
Approach		375	4.5	0.549	27.0	LOS B	6.1	43.6	0.85	0.74	26.0
West: Lawson St (300m)											
10	L2	77	1.4	0.704	41.1	LOS C	7.9	55.7	1.00	0.89	26.0
11	T1	337	1.6	0.704	36.5	LOS C	8.5	60.0	0.99	0.89	19.4
Approach		414	1.5	0.704	37.3	LOS C	8.5	60.0	0.99	0.89	20.9
All Vehicles		2796	5.2	0.715	22.7	LOS B	19.8	146.2	0.87	0.78	35.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
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	235	34.6	LOS D	0.5	0.5	0.93	0.93
P2	East Full Crossing	183	17.0	LOS B	0.3	0.3	0.65	0.65
P3	North Full Crossing	223	33.6	LOS D	0.5	0.5	0.92	0.92
P4	West Full Crossing	264	16.4	LOS B	0.4	0.4	0.64	0.64
All Pedestrians		905	25.5	LOS C			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.

MOVEMENT SUMMARY

Site: 101 [Gibbons St x Lawson St_AM_EX+Dev]

Gibbons St x Lawson St
AM
Existing + Development
Signals - Fixed Time Isolated Cycle Time = 80 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: Gibbons St (370m)											
1	L2	141	0.7	0.222	25.4	LOS B	3.9	27.5	0.74	0.75	32.8
2	T1	1763	6.1	0.731	18.3	LOS B	20.6	151.5	0.86	0.78	41.8
3	R2	146	8.6	0.731	25.6	LOS B	19.4	143.7	0.88	0.81	31.8
Approach		2051	6.0	0.731	19.3	LOS B	20.6	151.5	0.86	0.78	40.4
East: Lawson St (60m)											
5	T1	202	6.3	0.298	19.7	LOS B	5.7	41.8	0.76	0.63	30.4
6	R2	173	2.4	0.549	35.5	LOS C	6.1	43.6	0.96	0.86	22.4
Approach		375	4.5	0.549	27.0	LOS B	6.1	43.6	0.85	0.74	26.0
West: Lawson St (300m)											
10	L2	77	1.4	0.704	41.1	LOS C	7.9	55.7	1.00	0.89	26.0
11	T1	337	1.6	0.704	36.5	LOS C	8.5	60.0	0.99	0.89	19.4
Approach		414	1.5	0.704	37.3	LOS C	8.5	60.0	0.99	0.89	20.9
All Vehicles		2839	5.1	0.731	22.9	LOS B	20.6	151.5	0.88	0.79	35.4

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
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	235	34.6	LOS D	0.5	0.5	0.93	0.93
P2	East Full Crossing	183	17.0	LOS B	0.3	0.3	0.65	0.65
P3	North Full Crossing	223	33.6	LOS D	0.5	0.5	0.92	0.92
P4	West Full Crossing	264	16.4	LOS B	0.4	0.4	0.64	0.64
All Pedestrians		905	25.5	LOS C			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.

MOVEMENT SUMMARY

Site: 101 [Gibbons St x Lawson St_PM_EX]

Gibbons St x Lawson St
PM
Existing
Signals - Fixed Time Isolated Cycle Time = 80 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: Gibbons St (370m)											
1	L2	180	1.2	0.284	25.9	LOS B	5.1	36.1	0.76	0.77	32.6
2	T1	1694	2.1	0.680	17.3	LOS B	18.8	134.3	0.83	0.75	42.5
3	R2	132	17.6	0.680	23.9	LOS B	17.5	128.7	0.84	0.77	32.9
Approach		2005	3.0	0.680	18.5	LOS B	18.8	134.3	0.82	0.75	40.9
East: Lawson St (60m)											
5	T1	332	0.3	0.470	21.3	LOS B	10.0	70.3	0.82	0.70	29.5
6	R2	169	0.0	0.480	31.4	LOS C	5.9	41.0	0.94	0.78	24.0
Approach		501	0.2	0.480	24.7	LOS B	10.0	70.3	0.86	0.73	27.3
West: Lawson St (300m)											
10	L2	45	2.3	0.533	37.8	LOS C	6.3	44.3	0.96	0.78	27.1
11	T1	301	0.0	0.533	33.9	LOS C	6.5	45.7	0.96	0.78	20.2
Approach		346	0.3	0.533	34.4	LOS C	6.5	45.7	0.96	0.78	21.3
All Vehicles		2853	2.2	0.680	21.5	LOS B	18.8	134.3	0.85	0.75	36.1

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
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	191	34.5	LOS D	0.4	0.4	0.93	0.93
P2	East Full Crossing	146	17.0	LOS B	0.2	0.2	0.65	0.65
P3	North Full Crossing	169	33.5	LOS D	0.4	0.4	0.92	0.92
P4	West Full Crossing	266	16.4	LOS B	0.4	0.4	0.64	0.64
All Pedestrians		773	24.8	LOS C			0.78	0.78

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.

MOVEMENT SUMMARY

Site: 101 [Gibbons St x Lawson St_PM_EX+Dev]

Gibbons St x Lawson St
PM
Existing + Development
Signals - Fixed Time Isolated Cycle Time = 80 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: Gibbons St (370m)											
1	L2	180	1.2	0.284	25.9	LOS B	5.1	36.1	0.76	0.77	32.6
2	T1	1696	2.1	0.682	17.3	LOS B	18.9	134.7	0.83	0.75	42.5
3	R2	133	17.5	0.682	23.9	LOS B	17.6	129.0	0.84	0.77	32.9
Approach		2008	3.0	0.682	18.5	LOS B	18.9	134.7	0.83	0.75	40.9
East: Lawson St (60m)											
5	T1	332	0.3	0.470	21.3	LOS B	10.0	70.3	0.82	0.70	29.5
6	R2	169	0.0	0.480	31.4	LOS C	5.9	41.0	0.94	0.78	24.0
Approach		501	0.2	0.480	24.7	LOS B	10.0	70.3	0.86	0.73	27.3
West: Lawson St (300m)											
10	L2	45	2.3	0.533	37.8	LOS C	6.3	44.3	0.96	0.78	27.1
11	T1	301	0.0	0.533	33.9	LOS C	6.5	45.7	0.96	0.78	20.2
Approach		346	0.3	0.533	34.4	LOS C	6.5	45.7	0.96	0.78	21.3
All Vehicles		2856	2.2	0.682	21.5	LOS B	18.9	134.7	0.85	0.75	36.1

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
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	191	34.5	LOS D	0.4	0.4	0.93	0.93
P2	East Full Crossing	146	17.0	LOS B	0.2	0.2	0.65	0.65
P3	North Full Crossing	169	33.5	LOS D	0.4	0.4	0.92	0.92
P4	West Full Crossing	266	16.4	LOS B	0.4	0.4	0.64	0.64
All Pedestrians		773	24.8	LOS C			0.78	0.78

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.

MOVEMENT SUMMARY

Site: 101 [Henderson Rd x Wyndham St_AM_EX]

Henderson Rd x Wyndham St
AM
Existing
Signals - Fixed Time Isolated Cycle Time = 135 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: Wyndham St (210)											
1	L2	11	0.0	1.024	131.1	LOS F	21.6	164.5	1.00	1.35	7.0
2	T1	415	10.7	1.024	126.5	LOS F	21.7	165.7	1.00	1.35	10.0
3	R2	5	0.0	1.024	131.0	LOS F	21.7	165.7	1.00	1.35	7.3
Approach		431	10.3	1.024	126.7	LOS F	21.7	165.7	1.00	1.35	9.9
East: Henderson Rd (75m)											
4	L2	244	2.6	0.315	11.8	LOS A	9.6	69.5	0.38	0.55	34.8
5	T1	612	5.7	0.315	6.6	LOS A	9.7	70.9	0.38	0.40	33.4
6	R2	852	5.3	0.984	63.9	LOS E	42.5	311.2	0.94	1.00	12.3
Approach		1707	5.1	0.984	36.0	LOS C	42.5	311.2	0.66	0.72	16.6
West: Henderson Rd (65m)											
10	L2	513	6.8	1.498	511.8	LOS F	108.4	803.1	1.00	1.86	1.8
11	T1	297	3.5	0.314	44.1	LOS D	7.9	57.1	0.86	0.70	10.5
Approach		809	5.6	1.498	340.3	LOS F	108.4	803.1	0.95	1.43	2.3
All Vehicles		2947	6.0	1.498	132.8	LOS F	108.4	803.1	0.79	1.01	6.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
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	36	6.9	LOS A	0.0	0.0	0.32	0.32
P2	East Full Crossing	71	60.9	LOS F	0.3	0.3	0.95	0.95
P3	North Full Crossing	40	45.7	LOS E	0.1	0.1	0.82	0.82
P4	West Full Crossing	284	58.6	LOS E	1.0	1.0	0.94	0.94
All Pedestrians		431	53.4	LOS E			0.88	0.88

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.

MOVEMENT SUMMARY

Site: 101 [Henderson Rd x Wyndham St_AM_EX+Dev]

Henderson Rd x Wyndham St
AM
Existing + Development
Signals - Fixed Time Isolated Cycle Time = 135 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: Wyndham St (210)											
1	L2	11	0.0	1.027	132.4	LOS F	21.8	165.8	1.00	1.35	6.9
2	T1	416	10.6	1.027	127.8	LOS F	21.9	167.0	1.00	1.35	9.9
3	R2	5	0.0	1.027	132.3	LOS F	21.9	167.0	1.00	1.35	7.2
Approach		432	10.2	1.027	128.0	LOS F	21.9	167.0	1.00	1.35	9.8
East: Henderson Rd (75m)											
4	L2	244	2.6	0.315	11.8	LOS A	9.6	69.5	0.38	0.55	34.8
5	T1	612	5.7	0.315	6.6	LOS A	9.7	70.9	0.38	0.40	33.4
6	R2	854	5.3	0.986	65.0	LOS E	43.1	315.7	0.94	1.01	12.1
Approach		1709	5.0	0.986	36.5	LOS C	43.1	315.7	0.66	0.72	16.4
West: Henderson Rd (65m)											
10	L2	514	6.8	1.500	514.0	LOS F	108.9	806.3	1.00	1.86	1.8
11	T1	297	3.5	0.314	44.1	LOS D	7.9	57.1	0.86	0.70	10.5
Approach		811	5.6	1.500	341.9	LOS F	108.9	806.3	0.95	1.44	2.3
All Vehicles		2952	6.0	1.500	133.8	LOS F	108.9	806.3	0.79	1.01	6.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
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	36	6.9	LOS A	0.0	0.0	0.32	0.32
P2	East Full Crossing	71	60.9	LOS F	0.3	0.3	0.95	0.95
P3	North Full Crossing	40	45.7	LOS E	0.1	0.1	0.82	0.82
P4	West Full Crossing	284	58.6	LOS E	1.0	1.0	0.94	0.94
All Pedestrians		431	53.4	LOS E			0.88	0.88

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.

MOVEMENT SUMMARY

Site: 101 [Henderson Rd x Wyndham St_PM_EX]

Henderson Rd x Wyndham St
PM
Existing
Signals - Fixed Time Isolated Cycle Time = 130 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: Wyndham St (210)											
1	L2	13	0.0	1.172	234.4	LOS F	37.2	266.6	1.00	1.76	4.1
2	T1	526	3.0	1.172	229.8	LOS F	37.2	267.1	1.00	1.76	5.9
3	R2	3	0.0	1.172	234.4	LOS F	37.2	267.1	1.00	1.76	4.2
Approach		542	2.9	1.172	230.0	LOS F	37.2	267.1	1.00	1.76	5.8
East: Henderson Rd (75m)											
4	L2	149	2.8	0.404	12.7	LOS A	13.6	96.9	0.43	0.48	35.6
5	T1	966	1.3	0.404	7.6	LOS A	13.7	96.9	0.43	0.42	32.2
6	R2	812	3.9	0.987	67.3	LOS E	42.5	307.7	0.95	1.02	11.8
Approach		1927	2.5	0.987	33.1	LOS C	42.5	307.7	0.65	0.68	16.7
West: Henderson Rd (65m)											
10	L2	440	2.4	1.243	290.4	LOS F	68.6	489.9	1.00	1.53	3.2
11	T1	260	1.2	0.261	40.8	LOS C	6.5	46.0	0.84	0.68	11.2
Approach		700	2.0	1.243	197.7	LOS F	68.6	489.9	0.94	1.21	3.8
All Vehicles		3169	2.5	1.243	103.1	LOS F	68.6	489.9	0.77	0.98	7.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
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	49	7.1	LOS A	0.1	0.1	0.33	0.33
P2	East Full Crossing	36	58.3	LOS E	0.1	0.1	0.95	0.95
P3	North Full Crossing	68	43.3	LOS E	0.2	0.2	0.82	0.82
P4	West Full Crossing	189	55.8	LOS E	0.7	0.7	0.93	0.93
All Pedestrians		343	46.6	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.

MOVEMENT SUMMARY

Site: 101 [Henderson Rd x Wyndham St_PM_EX+Dev]

Henderson Rd x Wyndham St
PM
Existing + Development
Signals - Fixed Time Isolated Cycle Time = 130 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: Wyndham St (210)											
1	L2	13	0.0	1.185	245.1	LOS F	38.6	276.5	1.00	1.79	3.9
2	T1	533	3.0	1.185	240.5	LOS F	38.6	277.0	1.00	1.79	5.6
3	R2	3	0.0	1.185	245.1	LOS F	38.6	277.0	1.00	1.79	4.1
Approach		548	2.9	1.185	240.7	LOS F	38.6	277.0	1.00	1.79	5.6
East: Henderson Rd (75m)											
4	L2	149	2.8	0.404	12.7	LOS A	13.6	96.9	0.43	0.48	35.6
5	T1	966	1.3	0.404	7.6	LOS A	13.7	96.9	0.43	0.42	32.2
6	R2	834	3.8	1.014	73.6	LOS F	44.3	320.5	0.95	1.03	9.2
Approach		1949	2.5	1.014	36.2	LOS C	44.3	320.5	0.65	0.69	13.6
West: Henderson Rd (65m)											
10	L2	448	2.3	1.263	307.4	LOS F	72.1	514.7	1.00	1.56	3.0
11	T1	260	1.2	0.261	40.8	LOS C	6.5	46.0	0.84	0.68	11.2
Approach		708	1.9	1.263	209.5	LOS F	72.1	514.7	0.94	1.24	3.6
All Vehicles		3206	2.4	1.263	109.5	LOS F	72.1	514.7	0.77	1.00	7.0

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
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	49	7.1	LOS A	0.1	0.1	0.33	0.33
P2	East Full Crossing	36	58.3	LOS E	0.1	0.1	0.95	0.95
P3	North Full Crossing	68	43.3	LOS E	0.2	0.2	0.82	0.82
P4	West Full Crossing	189	55.8	LOS E	0.7	0.7	0.93	0.93
All Pedestrians		343	46.6	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.

MOVEMENT SUMMARY

Site: 102 [Wyndham St x Boundary St x Gibbons St_AM_EX]

Wyndham St x Boundary St x Gibbons St
AM
Existing
Signals - Fixed Time Isolated Cycle Time = 105 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: Wyndham St (200)											
1	L2	48	2.2	0.128	20.6	LOS B	3.0	21.7	0.57	0.57	31.6
2	T1	1767	6.8	0.638	7.9	LOS A	19.9	147.7	0.50	0.46	48.8
3	R2	2	0.0	0.217	11.4	LOS A	5.0	37.0	0.37	0.33	39.1
Approach		1818	6.7	0.638	8.2	LOS A	19.9	147.7	0.50	0.46	48.4
West: Boundary St (165m)											
10	L2	252	1.3	0.755	51.9	LOS D	13.0	92.2	1.00	0.89	22.3
Approach		252	1.3	0.755	51.9	LOS D	13.0	92.2	1.00	0.89	22.3
All Vehicles		2069	6.0	0.755	13.5	LOS A	19.9	147.7	0.56	0.51	42.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
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	67	44.0	LOS E	0.2	0.2	0.92	0.92
P4	West Full Crossing	473	6.3	LOS A	0.5	0.5	0.35	0.35
All Pedestrians		540	11.0	LOS B			0.42	0.42

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.

MOVEMENT SUMMARY

Site: 102 [Wyndham St x Boundary St x Gibbons St_AM_EX+Dev]

Wyndham St x Boundary St x Gibbons St
AM
Existing + Development
Signals - Fixed Time Isolated Cycle Time = 105 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: Wyndham St (200)											
1	L2	48	2.2	0.128	20.7	LOS B	3.0	21.8	0.57	0.57	31.6
2	T1	1772	6.8	0.639	7.9	LOS A	20.0	148.4	0.50	0.46	48.8
3	R2	2	0.0	0.218	11.4	LOS A	5.0	37.1	0.37	0.33	39.1
Approach		1822	6.6	0.639	8.2	LOS A	20.0	148.4	0.50	0.46	48.4
West: Boundary St (165m)											
10	L2	295	1.1	0.884	61.3	LOS E	17.3	122.0	1.00	1.00	20.2
Approach		295	1.1	0.884	61.3	LOS E	17.3	122.0	1.00	1.00	20.2
All Vehicles		2117	5.9	0.884	15.6	LOS B	20.0	148.4	0.57	0.54	40.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
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	67	44.0	LOS E	0.2	0.2	0.92	0.92
P4	West Full Crossing	473	6.3	LOS A	0.5	0.5	0.35	0.35
All Pedestrians		540	11.0	LOS B			0.42	0.42

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.

MOVEMENT SUMMARY

Site: 102 [Wyndham St x Boundary St x Gibbons St_PM_EX]

Wyndham St x Boundary St x Gibbons St
PM
Existing
Signals - Fixed Time Isolated Cycle Time = 105 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: Wyndham St (200)											
1	L2	24	0.0	0.120	16.9	LOS B	3.0	21.3	0.50	0.46	35.9
2	T1	1733	0.9	0.602	7.5	LOS A	16.8	118.3	0.48	0.44	49.3
3	R2	16	0.0	0.205	11.4	LOS A	4.8	34.1	0.37	0.34	38.8
Approach		1773	0.9	0.602	7.6	LOS A	16.8	118.3	0.48	0.44	49.0
West: Boundary St (165m)											
10	L2	238	0.9	0.712	50.4	LOS D	12.0	84.7	1.00	0.86	22.7
Approach		238	0.9	0.712	50.4	LOS D	12.0	84.7	1.00	0.86	22.7
All Vehicles		2011	0.9	0.712	12.7	LOS A	16.8	118.3	0.54	0.49	43.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
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	80	44.0	LOS E	0.2	0.2	0.92	0.92
P4	West Full Crossing	435	6.3	LOS A	0.5	0.5	0.35	0.35
All Pedestrians		515	12.2	LOS B			0.44	0.44

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.

MOVEMENT SUMMARY

Site: 102 [Wyndham St x Boundary St x Gibbons St_PM_EX+Dev]

Wyndham St x Boundary St x Gibbons St
PM
Existing + Development
Signals - Fixed Time Isolated Cycle Time = 105 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: Wyndham St (200)											
1	L2	24	0.0	0.123	17.0	LOS B	3.1	21.8	0.50	0.46	35.9
2	T1	1769	0.9	0.615	7.6	LOS A	17.4	122.9	0.48	0.44	49.2
3	R2	16	0.0	0.210	11.4	LOS A	5.0	35.0	0.37	0.34	38.8
Approach		1809	0.9	0.615	7.7	LOS A	17.4	122.9	0.48	0.44	49.0
West: Boundary St (165m)											
10	L2	254	0.8	0.759	52.1	LOS D	13.2	92.9	1.00	0.89	22.3
Approach		254	0.8	0.759	52.1	LOS D	13.2	92.9	1.00	0.89	22.3
All Vehicles		2063	0.9	0.759	13.2	LOS A	17.4	122.9	0.55	0.50	42.9

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
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	80	44.0	LOS E	0.2	0.2	0.92	0.92
P4	West Full Crossing	435	6.3	LOS A	0.5	0.5	0.35	0.35
All Pedestrians		515	12.2	LOS B			0.44	0.44

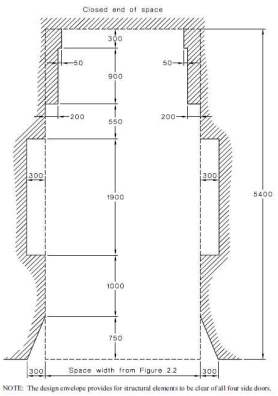
Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

Appendix B

Design Commentary

Car Park Type	Public Car Park
User Class	1A
Number of spaces	243
Number of Accesses	1
Access Road	Local
Access Road Speed	50

Section	Description	AS2890.1 Requirement
Parking Module Design		
2.4.1	Parking module	2.4m x 5.4m
2.4.1	Aisle width	5.8m
2.4.1(b)	Additional parking module clearence	300mm
2.4.1 (b) iii	Disabled parking	Shared Area
2.4.2 (c)	Blind aisle	1.0m Aisle Extension
2.4.6	Gradients within parking module	Max 1:20 Parallel to angle of parking
2.4.7	Gradients within parking module	Max 1:16 in any other direction
2.4.7	Motorcycle parking	Min dimension of 2.5m x 1.2m
	Circulation Roadways	
2.5.2 (a)	Straight - One-way road or ramp	Minimum 3.0m between kerbs
2.5.2 (a)	Straight - Two-way road or ramp	Minimum 5.5m between kerbs
2.5.2 (b)	Curved -One-way roadway or ramp	Compliance with Table 2.2
2.5.2 (c)	Circulation roadway Intersection	Provision for B99 vehicle to pass a B85 Vehicle
2.5.3 (a) / (b)	Max grade longer than 20m	1 in 6 (16.7%)
2.5.3 (c)	Max grade up to 20m	1 in 5 (20%)
	Max grade curved ramp	1 in 5 (20%)(measured along inside kerb / shortest distance)
2.5.3 (d)	Changes in grade - summit	1 in 8 (12.5%)
	Changes in grade - Sag	1 in 6.7 (15%)
2.5.2 (e)	Grade transition	Grade transition of min 2.0m
	Driveway Width Requirements	
3.2.1	Driveway width (Entry)	6 - 9m (combined)
3.2.3	Access driveway location	Compliance with Figure 3.1
3.2.4 (a)	Sightdistances at access driveway	Min. SSD: 45m
3.2.4 (b)	Minimum sight lines for pedestrian saftey	Visual splay at property boundary (Fig 3.3)
3.3 (a)	Gradient at property line	Max grade of 1 in 20 (5%) for first 6.0m
3.3 (b)	Gradient at vehicle control point	Max grade of 1 in 20 (5%) for first 6.0m prior to control point
3.3 (c)	Gradient at queuing area	Max Grade of 1 in 10 for not less than 0.8 of queue length
	Additional Parking Structure Requirements	
5.2	Column location and spacing	Compliance with Figure 5.2
5.3	Headroom requirements - General	min clearence of 2.2m
	Headroom requirements - Disabled	min clearence of 2.5m



NOTE: The design envelope provides for structural elements to be clear of all four side doors.

DIMENSIONS IN MILLIMETRES

FIGURE 5.2 DESIGN ENVELOPE AROUND PARKED VEHICLE TO BE KEPT CLEAR OF COLUMNS, WALLS AND OBSTRUCTIONS

TABLE 2.2

MINIMUM ROADWAY WIDTHS ON CURVED ROADWAYS AND RAMPS

metres

Turn radius R_o (Note 1)	Single lane		Two-way, no separator All cases (Note 3)
	Public facilities (Note 2)	Domestic property	
7.6 to 11.9	3.9	3.6	—
12.0 to 19.9	3.4	3.1	6.7 (Note 4)
20.0 to 50.0	3.2	3.0	6.3
>50.0	3.0	3.0	5.5

NOTES:

1 See Figure 2.9 for Dimension R_o.

2 In New Zealand only, the widths shown for domestic property shall apply also to public facilities.

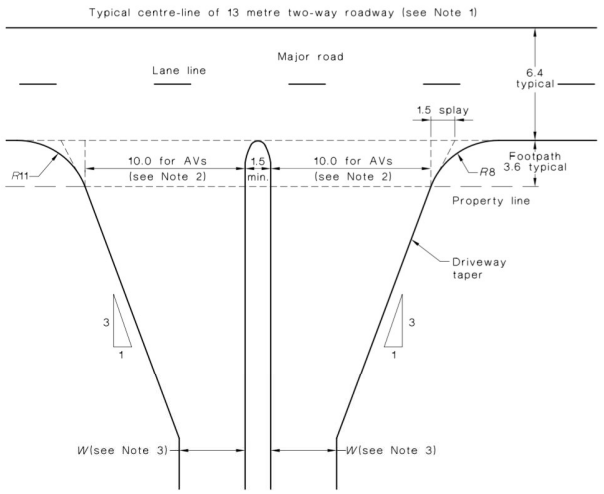
3 For parallel roadways with a median or separator, each roadway width shall be determined separately as a single lane.

4 Applies to R_o range 15.0 m to 19.9 m only (see Clause 2.5.2(b)).

Largest design vehicle	MRV
Access road	Minor
Road frontage speed	50km/hr
Carriageway curve radius (m)	1000

(or type 1000 for a straight road)

Section	Description	AS2890.2 Requirement
	Design Vehicle	
2.2	**Description and Dimensions**	
	Overall length	8.8m
	Design width	2.5m
	Wheel base	5m
	Clearance height	4.5m
	Platform height	0.95m to 1.1m
	Access Driveway and Circulation	
3.3.1	**Minimum circulation width (kerb to kerb)**	
	Single Lane	3.5m
	Two-way (with intervisibility)	6.5m
	Two-way (without intervisibility)	6.5m
3.3.3	**Maximum Gradients**	
	Max forward manoeuvre roadway / ramp grade	1:6.5 (15.4%)
	Max reverse manoeuvre roadway / ramp grade	1:8 (12.5%)
	Max rate of change of grade	1:16 (6.25%) in 7.0m of travel
3.4.3	**Driveway Layout Design Requirements**	
	Access Width	9m, see Figure 3.1
3.4.4	**Maximum Driveway Gradient**	1:20 (5%) for SRV, MRV and HRV
3.4.5	**Sight distance**	
3.4.5 (a)	Sight distance to oncoming traffic	
	5 sec gsp	69m
	8 sec gap	111m
3.4.5 (b)	Sight distance to pedestrians	2.5m (from property boundary) x 2m (from driveway)
	Service Areas	
4.2	**Dimensions of Service Bays**	
	Bay Length	8.8m
	Bay Width	3.5
	Platform Height	0.95m to 1.1m
	Vertical Clearance	4.5m
	Max service bay gradient	1:25 (4%)
4.3.2 (e)	Maximum gradient on service areas	1:6.5 (15.4%) Forward manoeuvres 1:8 (12.5%) Reverse manoeuvres
	Clearances	
5.4	**Manoeuvring Clearances**	
5.4 (a)	Low speed e.g service bay access	300mm on both sides of vehicle
5.4 (b)	Higher speed e.g Site access and circulation	an additional 300mm
5.4 ©	Two vehicles passing one another	300mm on both sides of both vehicle plus a further 300mm



NOTES:

1 In the case illustrated, the HRV can turn left into the driveway entirely from the left lane and can turn out without encroaching over the public roadway centre-line. AVs up to 17 m in length, likewise, can turn in from the left lane and can turn out without encroaching over the centre-line. The design (19.0 m long) AV specified in this Standard can turn into the driveway by using the second lane out from the kerb as permitted by the Australian Road Rules 2000.

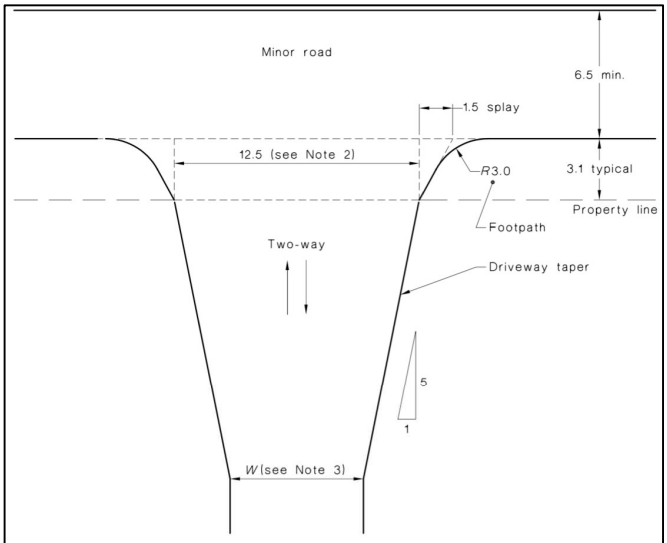
2 The corresponding dimensions for the MRV and SRV are 7 m and 5 m respectively. Larger vehicles may be able to use these narrower driveways depending on the width of public road available for manoeuvring in or out.

3 *W* = width of circulation roadway (see Table 3.1).

4 The access driveway median should be either fully- or semi-mountable kerb.

DIMENSIONS IN METRES

FIGURE 3.2 MINIMUM DESIGN FOR A MAJOR ACCESS DRIVEWAY CATERING FOR HRVs AND AVs



NOTES:

1 In the case illustrated the HRV can turn left into the driveway from the left hand side of the public road. The design (19.0 m long) AV will take up most of the public road width when turning left into or out of the driveway, as will the HRV when turning out.

2 Corresponding dimensions for the MRV and SRV are 9 m and 6 m respectively. Larger vehicles may be able to use these narrower driveways depending on the width of public road available for manoeuvring in or out.

3 *W* = width of circulation roadway (see Table 3.1).

DIMENSIONS IN METRES

FIGURE 3.1 MINIMUM DESIGN FOR AN ACCESS DRIVEWAY ON A MINOR ROAD CATERING FOR HRVs AND AVs