

# Transport and Accessibility Assessment

## Arts and Social Sciences Building

Prepared for University of Wollongong / 01 / November / 2017

171320 - TAAA

## Contents

1.0	Executive Summary	5
2.0	Response to Secretary's Environmental Assessment Requirements	6
3.0	Introduction	10
3.1	Background	10
3.2	Scope of the Report	10
3.3	Reference Documents	10
4.0	Existing Conditions	12
4.1	Site Location	12
4.2	Travel Behaviour	13
4.2.1	UOW Transport Strategy	13
4.2.2	Journey to Work Data	14
4.3	Active Transport	15
4.3.1	Pedestrian	15
4.3.2	Cyclist	15
4.4	Public Transport	18
4.4.1	Bus Services	18
4.4.2	Train Services	20
4.4.3	Taxi	20
4.5	Road Network	20
4.6	Off Street Car Parking	21
4.7	On Street Car Parking	23
4.8	Loading Facilities	24
5.0	Proposed Development	25
5.1	Scope of the Proposed Development	25
5.2	Proposed Occupancy	25
5.3	Active Transport	26
5.3.1	Pedestrian Movements	26
5.3.2	Cyclist Facilities	27
5.4	Public Transport	27
5.5	Carparking	27
5.5.1	Parking Loss	27
5.5.2	Operation of Existing Carpark	28
5.5.3	Parking Demand	29
5.5.4	Proposed Parking	29
5.6	Private Vehicle Access	31

5.7	Loading and Service Facilities	31
5.7.1	Servicing	31
5.7.2	Waste Collection	32
5.8	Sustainable Travel Measures	32
5.9	Construction Access	32
6.0	Road Network Impacts	33
6.1	Traffic Count Data	33
6.1.1	Annual Average Daily Traffic Volumes	34
6.1.2	Peak Hour Volumes	34
6.2	Pre Development Operation	34
6.2.1	Modelling Methodology	34
6.2.2	Results	35
6.3	Traffic Generation	36
6.3.1	Travel Mode	36
6.3.2	Traffic Volumes	37
6.4	Trip Distribution	37
6.4.1	Travel Mode Survey	37
6.4.2	Journey to Work	37
6.4.3	Intersection Count Data	37
6.4.4	Approach and Departure Routes	37
6.5	Post Development Operation	39
6.5.1	Modelling Methodology	39
6.5.2	Results	39
6.6	Future Impact	40
6.6.1	Infrastructure Projects	40
6.7	Summary	41
7.0	Conclusions	43
	Appendix A	1
	Appendix B	1
	Appendix C	i
	Appendix D	1
	Appendix E	1
	Appendix F	1

### Revision Register

Rev	Date	Prepared By	Approved By	Remarks
0	21/09/2017	GC	JS	Draft
1	29/09/2017	GC	JS	For review
2	16/10/2017	GC	JS	Final
3	20/10/2017	GC	JS	Final following UOW comments
4	01/11/2017	GC	JS	Updated gross floor area

## 1.0 Executive Summary

This report provides a review assessment of the proposed Arts and Social Sciences Building at the University of Wollongong's (UOW) Wollongong Campus. The proposed works include: the construction of a proposed four storey building plus plant; the removal of some on grade car parking spaces; and the provision of a new loading facility. The proposed building is intended to co-locate the Faculties of Social Sciences and Law, Humanities and Arts. The proposed development will result in no increase in students, but will allow for future growth of 54 staff on site.

This report covers the existing condition on the site and how the proposed development fits within a transport and traffic framework in response to the Secretary's Environmental Assessment Requirements (SEARs) dated 20<sup>th</sup> July 2017. UOW has a comprehensive Master Plan spanning 2016-2036 which details proposed campus wide strategies with regards to transport, access and parking. The proposed building aligns with the aims of this Master Plan.

The following key items have been identified within this report:

- As part of this development an increase of 54 staff during peak times is expected. As a result of this increase in staff, 78 daily and 39 peak private vehicle trips are expected to be generated as a worst case. Traffic modelling conducted as a part of the preparation of this report has indicated that there is sufficient capacity within the surrounding road network to cater for the development.
- As a result of the increase in staff, 8 peak public transport trips, 5 peak pedestrian trips and 4 peak cyclist trips are expected to be generated. Given the minor increase, it is expected that these trips can be accommodated within the surrounding networks.
- The development will result in a loss of 130 parking spaces on site and an additional demand of 39 spaces. This parking demand will be accommodated through a combination of the expansion of the existing P5 carpark and a proposed leased carpark located at the adjacent NSW TAFE Wollongong site.
- Additional active travel measures such as bicycle parking and end of trip facilities are included within the development in line with UOW's Transport Strategy and continued promotion of sustainable travel modes.
- A loading facility is proposed to cater for servicing and waste collection. A swept path analysis has been conducted for the site using a 12.5m heavy rigid vehicle (HRV) following advice from UOW's Facilities Management.

## 2.0 Response to Secretary's Environmental Assessment Requirements

Under application number SSD 8596 we have been provided with Secretary's Environmental Assessment Requirements (SEARs). These have been issued on the 20 July 2017. Table 1 provides a response to the relevant SEARs.

**Table 1: Response to SEARs**

No	Issue	Comments and References
5	Include a transport and accessibility assessment which details, but is not limited to, the following:	See below for references to where these points have been addressed.
5.1	The current daily and peak hour vehicle, public transport, pedestrian and bicycle movements and existing traffic and transport facilities provided on the road network located adjacent to the proposed development.	The daily and peak hour vehicle movements are discussed in Section 6.1. Existing public transport, pedestrian and bicycle movements and facilities are discussed in Section 4.3.
5.2	The existing and proposed pedestrian and bicycle routes and facilities within the vicinity of and surrounding the site and to public transport facilities as well as measures to maintain road and personal safety in line with CPTED and Accessibility principles.	Existing pedestrian, bicycle and public transport facilities are discussed in Section 4.3 and Section 4.4. Proposed pedestrian, bicycle and public transport facilities are detailed in 5.3.1, 5.3.2 and 5.4. Pedestrian and bicycle parking facilities are located near to the main entries. Pedestrian access to bus services and elsewhere throughout the Campus will be unaffected by the development. Safety design measures in line with CPTED (such as lighting and surveillance) will be further developed in the detailed design stage of the project.
5.3	An estimate of the total daily and peak (AM, PM) trips generated by the proposal, including vehicle, public transport, pedestrian and bicycle trips.	The total daily and peak trips are summarised in the following: <ul style="list-style-type: none"> <li>▪ Vehicle trips within Section 6.3</li> <li>▪ Public transport trips within Section 5.4; and</li> <li>▪ Active transport trips within Section 5.3.</li> </ul>
5.4	The adequacy of public transport, pedestrian and bicycle provisions to meet the likely future demand of the proposed development.	Given the number of trips generated is relatively minor, it is anticipated that these trips can be accommodated within the development. Additional bicycle facilities are proposed

No	Issue	Comments and References
		as part of the development, which will continue to promote sustainable transport choices for existing staff, students and visitors. This is further discussed in Section 5.3.2.
5.5	Impact of the proposed development on existing and future public transport and walking and cycling infrastructure within and surrounding the site.	It is not anticipated that the proposed development will impact the surrounding infrastructure as the number of trips generated are considered to be minor.
5.6	Measures to promote travel choices that support sustainable travel, such as a location-specific sustainable travel plan, provision of end-of-trip facilities, green travel plans and wayfinding strategies.	The University of Wollongong has a current Transport Strategy Report that is further discussed in Section 4.2.1 and Section 5.8.
5.7	Impacts of the development on the adjoining state road network (i.e. cumulative impact of this development) and consideration of traffic impacts on the basis that the Mount Ousley interchange is and is not constructed and the need/associated funding for upgrading or road improvement works (if required), including traffic modelling and analysis to the satisfaction of Roads and Maritime Services.	Roads and Maritime Services (RMS) have been consulted on the impact of the possible Mount Ousley interchange construction.  Traffic modelling has been conducted of relevant intersections near to the site which has indicated that all intersections will continue to operate within an acceptable level of service post development. Refer to Section 6.0 for further details with regards to the traffic modelling conducted for the site.
5.8	Identification of suitable infrastructure required to ameliorate any traffic and safety impacts associated with the development, including identification of pedestrian, cyclist and public transport infrastructure (e.g. additional active transport works/infrastructure proposed).	An existing 10 kilometres per hour shared zone is provided in the adjacent carpark access road and an existing pedestrian (zebra) crossing is provided to safely cross Ring Road at the carpark access road. As part of the works, traffic calming measures have been introduced to narrow the carpark access road by removing 90 degree angled parking on the southern side within the shared zone.  Cyclist infrastructure improvements are proposed in the form of end of trip facilities and secure bike parking.  No further improvements are required in regards to public transport.
5.9	The proposed walking and cycling access arrangements and connections to public transport services.	Pedestrian, cyclist and public transport access is discussed in Sections 5.3.1, 5.3.2 and 5.4 respectively.

No	Issue	Comments and References
5.10	The proposed access arrangements, including car, bus, taxi and emergency vehicle pick-up/drop-off facilities, and measures to mitigate any associated traffic impacts and impacts on public transport, pedestrian and cycle networks.	The proposed access arrangements and post development conditions for vehicles, pedestrians, cyclists and pedestrians are discussed in Sections 5.6, 5.2, 5.4 and 5.7.
5.11	Anticipated increase in staff and student numbers and subsequent implications for car and bicycle demand.	As the development is largely a relocation of existing facilities within the Campus there is no expected increase in student numbers. Whilst noting that the development is not generating staff it is catering for an anticipated staff growth of 54 during peak times.  Following the travel mode survey data collected by the University, the resultant parking demand is discussed in Section 5.5.3 and the cyclist demand is discussed in Section 5.3.2.
5.12	Proposed car and bicycle parking provision for staff, students and visitors, including consideration of the campus wide implications of the loss of parking spaces for the proposed development and the requirements of the relevant parking codes and Australian Standards.	Carparking and bicycle parking arrangements are discussed in Sections 5.5 and 5.3.2 respectively.
5.13	Provision of end of trip facilities (i.e. showers, lockers, change rooms etc.) for the use of employees who choose to walk or cycle to/from work as well as undertake activities during work hours.	A discussion of the end of trip facilities provided within the development is included in Section 5.2.
5.14	Service vehicle access, delivery and loading arrangements and estimated service vehicle movements (including vehicle type and the likely arrival and departure times.	A loading dock and servicing bay is proposed at the development. Service and waste vehicle access is discussed in Section 5.7.
5.15	Traffic and transport impacts during construction and how these impacts will be mitigated for any associated traffic, road safety, pedestrian, cyclists, parking and public transport and the cumulative impact of nearby construction projects, including the preparation of a draft Construction Traffic Management Plan to demonstrate the proposed management of the impact. This Plan should include vehicle routes, number of trucks, hours of operation, access arrangements and traffic control	A Preliminary Construction Traffic Management Plan has been prepared for the site as a part of this Environmental Impact Statement.

No	Issue	Comments and References
	measures for all demolition/construction activities.	
<b>5.16</b>	Relevant Policies and Guidelines: <ul style="list-style-type: none"> <li>▪ Guide to Traffic Generating Developments (Roads and Maritime Services)</li> <li>▪ EIS Guidelines – Road and Related Facilities (DoPI)</li> <li>▪ Cycling Aspects of Austroads Guides</li> <li>▪ NSW Planning Guidelines for Walking and Cycling</li> <li>▪ Austroads Guide to Traffic Management Part 12: Traffic Impacts of Development</li> </ul>	These policies and guidelines have been reviewed during the preparation of this report.

## 3.0 Introduction

### 3.1 Background

UOW's Master Plan 2016-2036 identifies areas of the Wollongong Campus that could be marked for future development including proposed buildings and possible carparking areas. The Master Plan focuses on centralising educational facilities, with supporting carparks along the perimeter of these buildings.

A potential area of development identified within this Master Plan is located at the north-west of the Campus, currently occupied by demountable buildings and an on grade carpark. UOW is proposing to construct a new Arts and Social Sciences Building (Western Building) at this location. This building would allow for the Faculties of Social Sciences and Law, Humanities and Arts to be co-located.

With an estimated capital construction cost of over \$30 million, the proposed development qualifies as a State Significant Development for the purposes of the Environmental Planning and Assessment Act 1979.

Taylor Thomson Whitting (TTW) has been engaged by the University of Wollongong (UOW) to provide an assessment of the proposed Arts and Social Sciences Building (Western Building) with regards to traffic, parking and access. This Transport and Accessibility Impact Assessment has been developed in response to the Secretary's Environmental Assessment Requirements for the site, which have been detailed in Section 2.0 of this report. It is worth noting that while this assessment makes reference to the University's Master Plan, it largely considers the proposed development in isolation to the University's future development.

The new Western Building will be a landmark development for the University of Wollongong (UOW) campus. It will be located adjacent the Campus Ring Road at the western end of the campus. The proposed project will accommodate the diverse functions of The Arts English and Media (TAEM) School and the Health and Society (HAS) School and the School of Geography and Sustainable Communities (SGSC) into a collaborative and engaging hub that will support the ambitions of next generation research and learning. Functions accommodated include specialist teaching spaces, academic and professional staff workplace, informal collaboration spaces as well as other support spaces. The proposed building will be circa 10,000 m<sup>2</sup> gross floor area across four levels plus a plant level.

### 3.2 Scope of the Report

This report is divided into the following sections:

Section 1.0 gives an overview of the report.

Section 2.0 provides a detailed response to each of the project SEARs.

Section 3.0 includes the background and aim of the study.

Section 4.0 covers the existing conditions at the site.

Section 5.0 assesses the proposed Western Building within a traffic and transport context.

Section 6.0 details the existing intersection operation and the impact the redevelopment will have on the road network.

Section 7.0 provides a summary and conclusions.

### 3.3 Reference Documents

The following documents have been reviewed during the preparation of this report:

- Wollongong City Council's Development Control Plan 2009, Local Environmental Plan

2009 and City of Wollongong Bike Plan 2014-2018

- Roads and Maritime Services' (RMS) Guide to Traffic Generating Developments
- Environmental Impact Statement (EIS) Guidelines – Road and Related Facilities (Department of Planning and Infrastructure)
- Cycling Aspects of Austroads Guides
- NSW Planning Guidelines for Walking and Cycling
- Austroads Guide to Traffic Management Part 12: Traffic Impacts of Development
- University of Wollongong Transport Strategy Report: Transport Strategy and Survey 2017 prepared by Cardno (11 August 2017)
- University of Wollongong Transport Survey 2015 – Survey and Strategy Summary prepared by AECOM (6 October 2017)
- 2014-2018 Cycle Plan prepared by Wollongong City Council
- 2016-2036 Wollongong Campus Master Plan prepared by MGS Architects (July 2016)

## 4.0 Existing Conditions

### 4.1 Site Location

The Arts and Social Sciences Building (Western Building) will be located within the Western portion of UOW's Wollongong Campus. The Campus is located within the Wollongong Local Government Area (LGA) and is approximately 2.4 kilometres north-west of the Wollongong CBD and 80 kilometres south of Sydney CBD.

The site is situated adjacent to Ring Road, the Western Car Park (P4) and forested areas. It is currently occupied by a number of demountable buildings (Buildings 45-60) and on grade parking areas. The site lies opposite the Early Start Facility on Ring Road (Building 21).

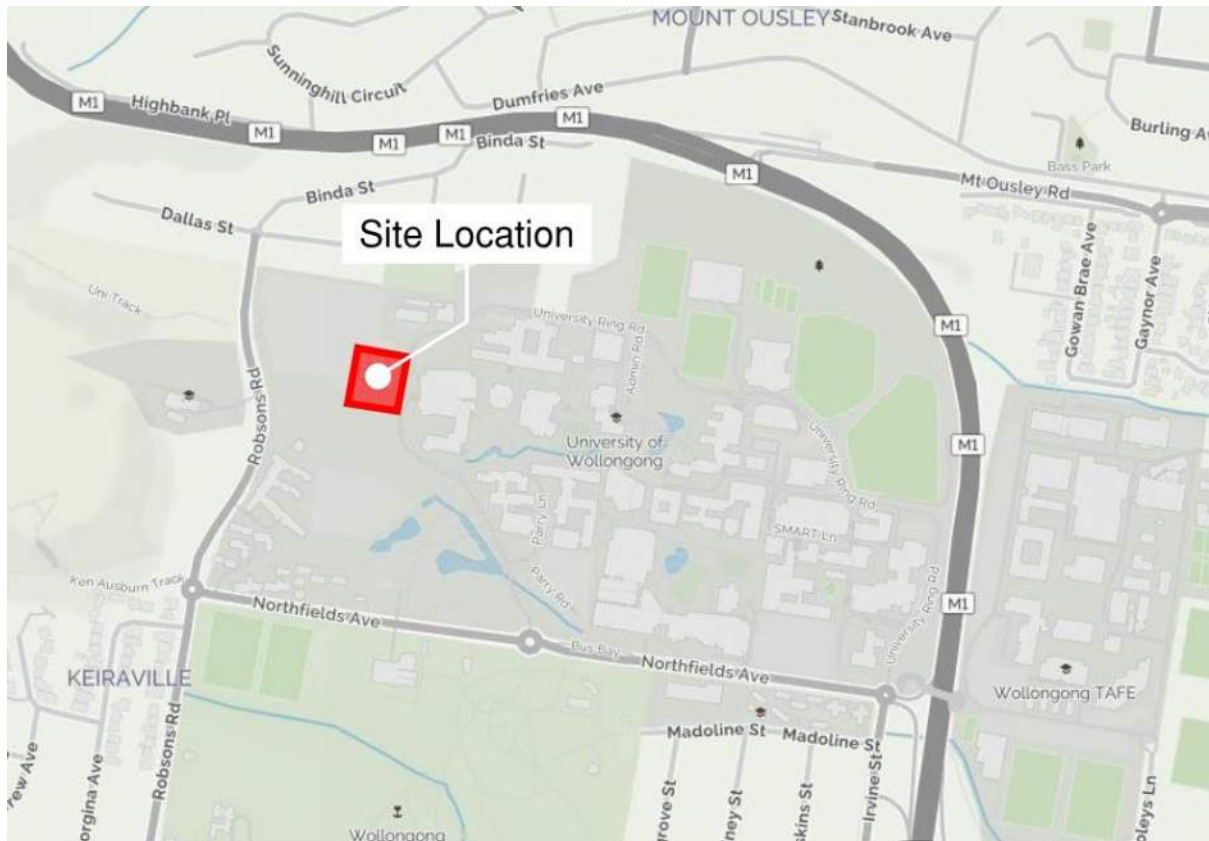


Figure 1: Site Location within Road Network

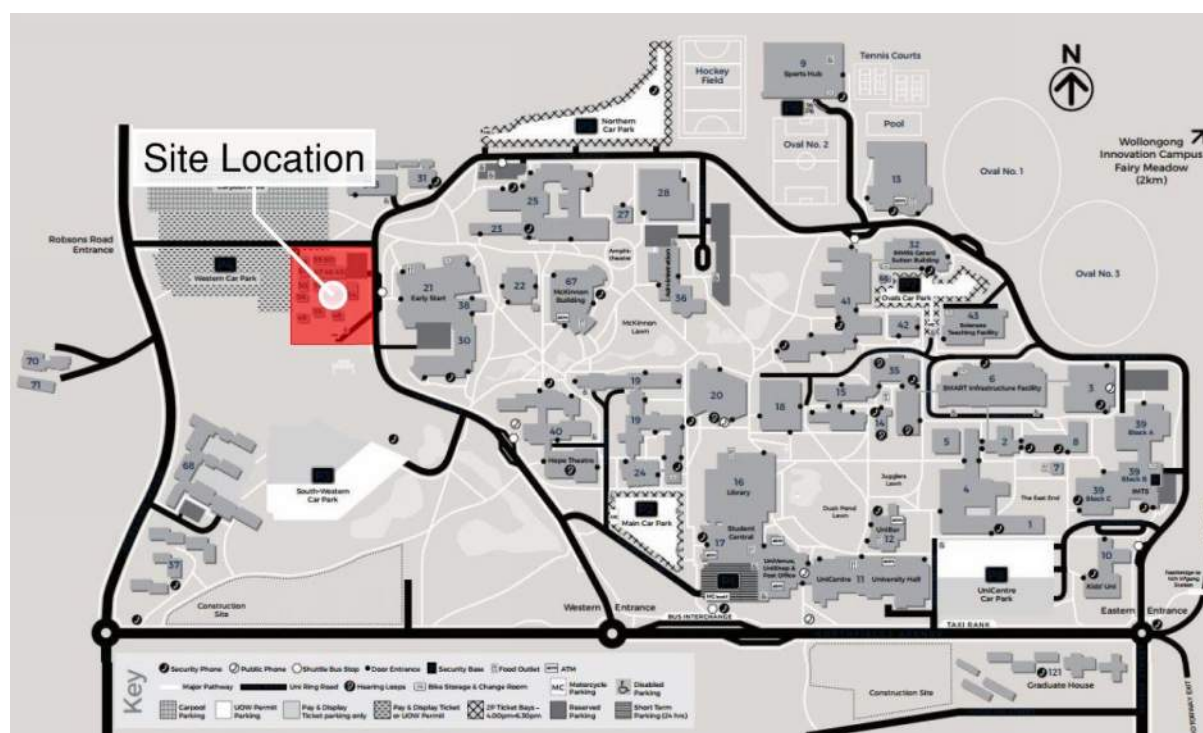


Figure 2: Site Location within Wollongong Campus Map

## 4.2 Travel Behaviour

### 4.2.1 UOW Transport Strategy

The University of Wollongong supports sustainable travel, with the commencement of the UOW Transport Project in 2008. The Project consists of biannual transport surveys, which inform proposed sustainable strategies that are modified according to the results.

As part of this ongoing Project, the University reviews any shift in travel mode from the previous survey and reassesses any previously proposed sustainable travel initiatives. The outcome of the study is a biannual report detailing issues and opportunities for sustainable travel.

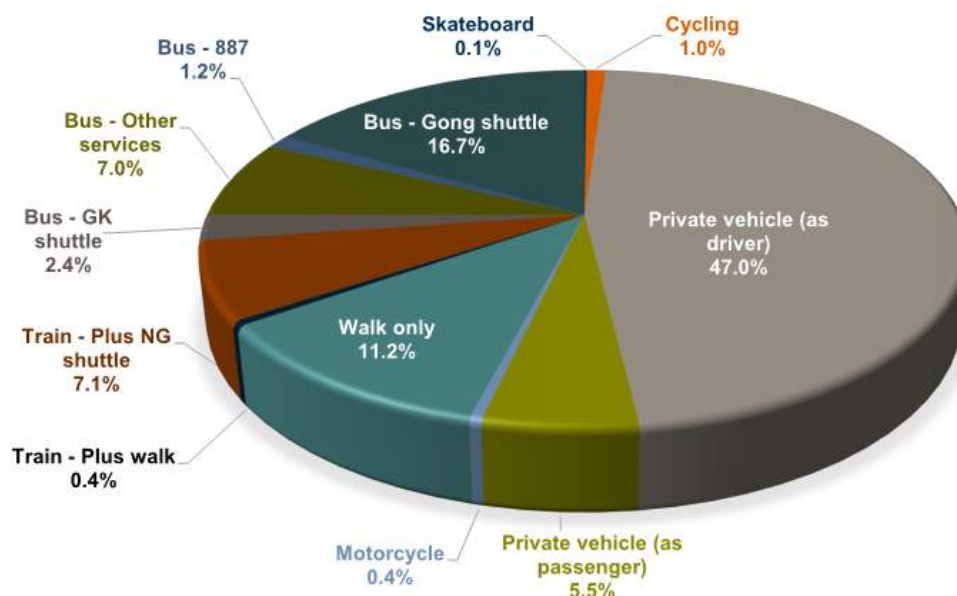
The four strategic transport objectives identified within the Transport Strategy and Survey 2017 are:

- Improve existing campus access constraints to meet current and future demands. This includes increasing connectivity for walking and cycling, ensuring public transport has priority, and improving road safety for pedestrians.
- Improve active transport as a means of accessing the campus through prioritising walkability and accessibility on campus, increasing cyclist infrastructure and providing incentives for travellers to try cycling to campus.
- Improve public and shared transport as a means of accessing the campus. Included in this strategy is the growth of bus services to and from the Wollongong campus to meet current and future demand.
- Maximise the use of UOW parking to meet current and future demands. To reduce reliance on parking, this objective involves reducing vehicle trips through prioritising on-site parking for carpooling.

Initiatives currently in place by UOW through this Transport Strategy include, but are not limited to, free shuttle services to the Campus (refer to Section 4.4.1); the promotion of carpool services and real time parking information (refer to Section 4.6); and the provision of

excess bicycle parking within the Campus (Section 4.3.2). As part of the Transport Strategy, UOW aims to focus on additional student accommodation to promote walking mode share to the Campus.

The 2017 Transport Strategy and Survey headcount data indicates that private vehicles (including motorcycles) currently account for a mode share of 52.9%, public transport a share of 34.8% and active transport a share of 12.3%. A breakdown of the travel mode share to the Campus is detailed within Figure 3.



**Figure 3: Observed Travel Mode to UOW**  
(Source: UOW Transport Strategy and Survey 2017)

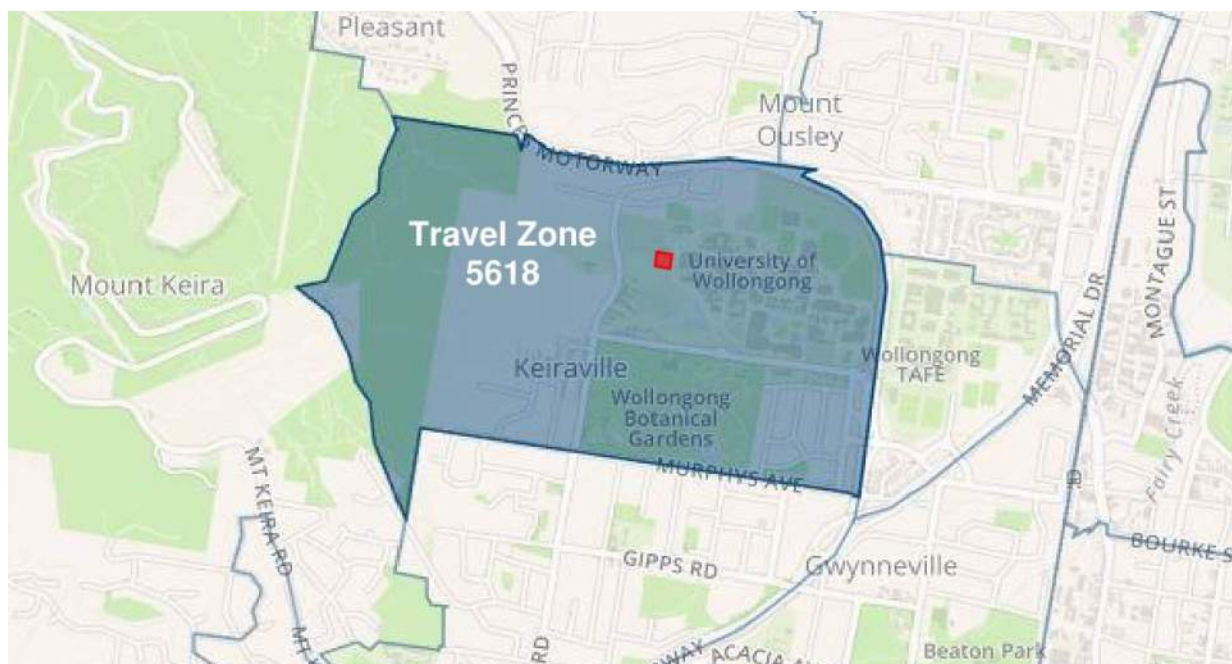
#### 4.2.2 Journey to Work Data

The 2011 Census Journey to Work (JTW) data provides an estimate of travel modes into and out of the surrounding area. JTW data is defined by travel zones (TZ) and the site is located within TZ 5618.

JTW data indicates how workers commute to the selected TZ. This data indicates that 69% of workers travel to the area as a vehicle driver. The next most popular travel modes are 11% by public transport (bus and train) and 8% as a vehicle passenger.

JTW data also includes details about the origin of workers within the given TZ. This data indicates that the majority (64%) of workers travelling to the region are from Wollongong, Dapto – Port Kembla (14%) and Kiama – Shellharbour (11%).

The remainder of the TZ consists largely of low density residential areas, with the other main source of work being the Wollongong Botanical Gardens. Refer to Figure 4 for the location of the site within the TZ.



**Figure 4: Travel Zone Extent**  
(Source: Australian Bureau of Statistics)

## 4.3 Active Transport

### 4.3.1 Pedestrian

The site is located adjacent to a significant east-west desire line from the main campus to the P4 car park. Currently pedestrian access to the site is through the existing P4 car park. An at grade pedestrian zebra crossing is provided across Ring Road from the central Campus, however pedestrians are subsequently required to cross the access road of the car park to reach the site. Kerb ramps are provided to assist pedestrians in crossing this road.

The adjacent car park access road is signposted as a 10 kilometres per hour shared zone.

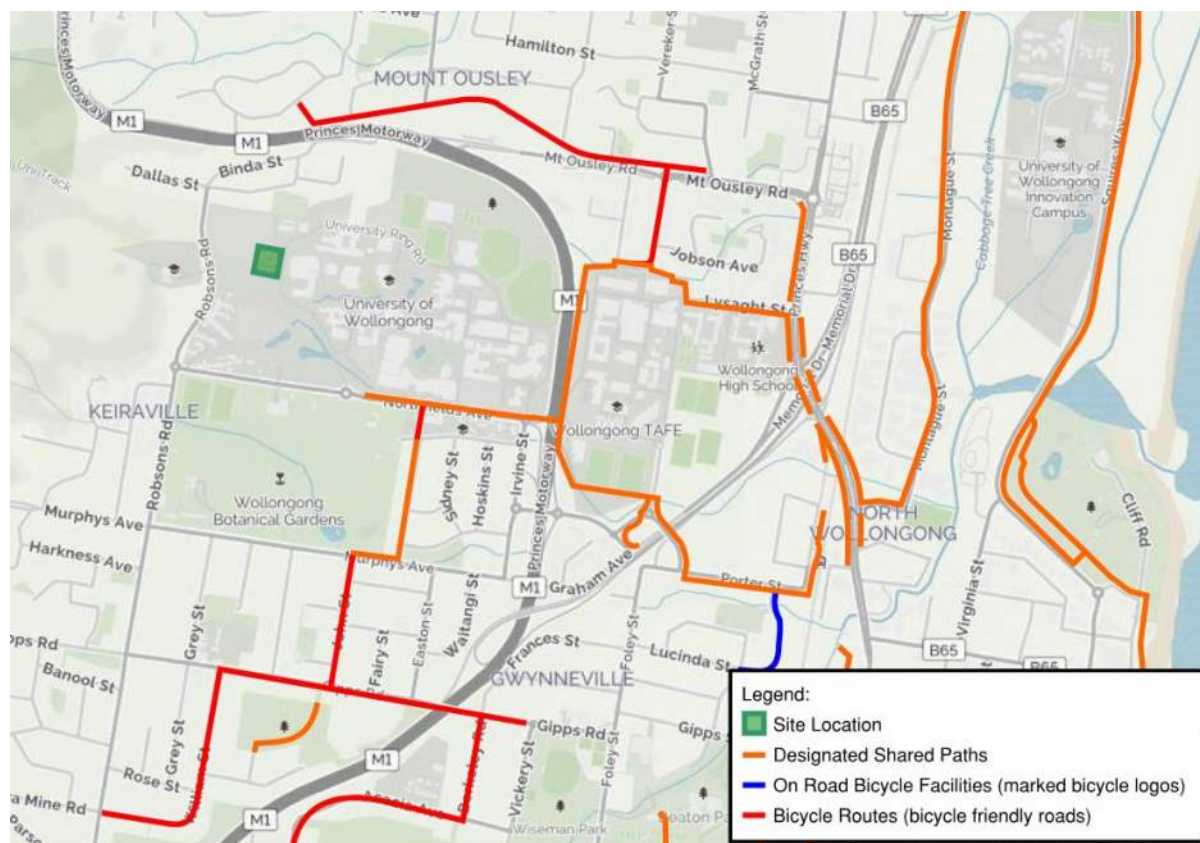
As part of UOW's Master Plan, pedestrian improvements in future works are proposed at this location to increase the pedestrian amenity.

Security escorts for pedestrians travelling outside of daylight hours can be obtained via the "SafeZone App". This encourages pedestrian transport into and out of the Campus as this service also covers the nearby local road network.

Pedestrian footpaths are provided internal to the site to connect the demountables and to the pedestrian paths servicing the adjacent P4 carpark.

### 4.3.2 Cyclist

Cycleways connect the Campus to Fairy Meadow, North Wollongong and Wollongong Train Stations. Northfields Avenue bordering the south of the campus is a shared path. Pathways throughout the main Campus are all shared between cyclists and pedestrians. Refer to Figure 5 for the location of bicycle routes near to the site.



**Figure 5: Bicycle Routes Near to the Site**

UOW encourages cycling as a transport mode to and from the Campus. There are approximately 1,000 bicycle racks throughout the Campus located outside of most buildings. The Campus has an excess supply of bicycle parking against the demand currently experienced by the Campus, intending to encourage sustainable transport modes in line with UOW's Transport Strategy. Refer to Figure 6 for locations of bicycle parking within the Campus. While the majority of provided bicycle parking facilities are within the main Campus, bicycle racks with capacity for two bicycles are located within the site adjacent to Building 54 (refer to Figure 7).

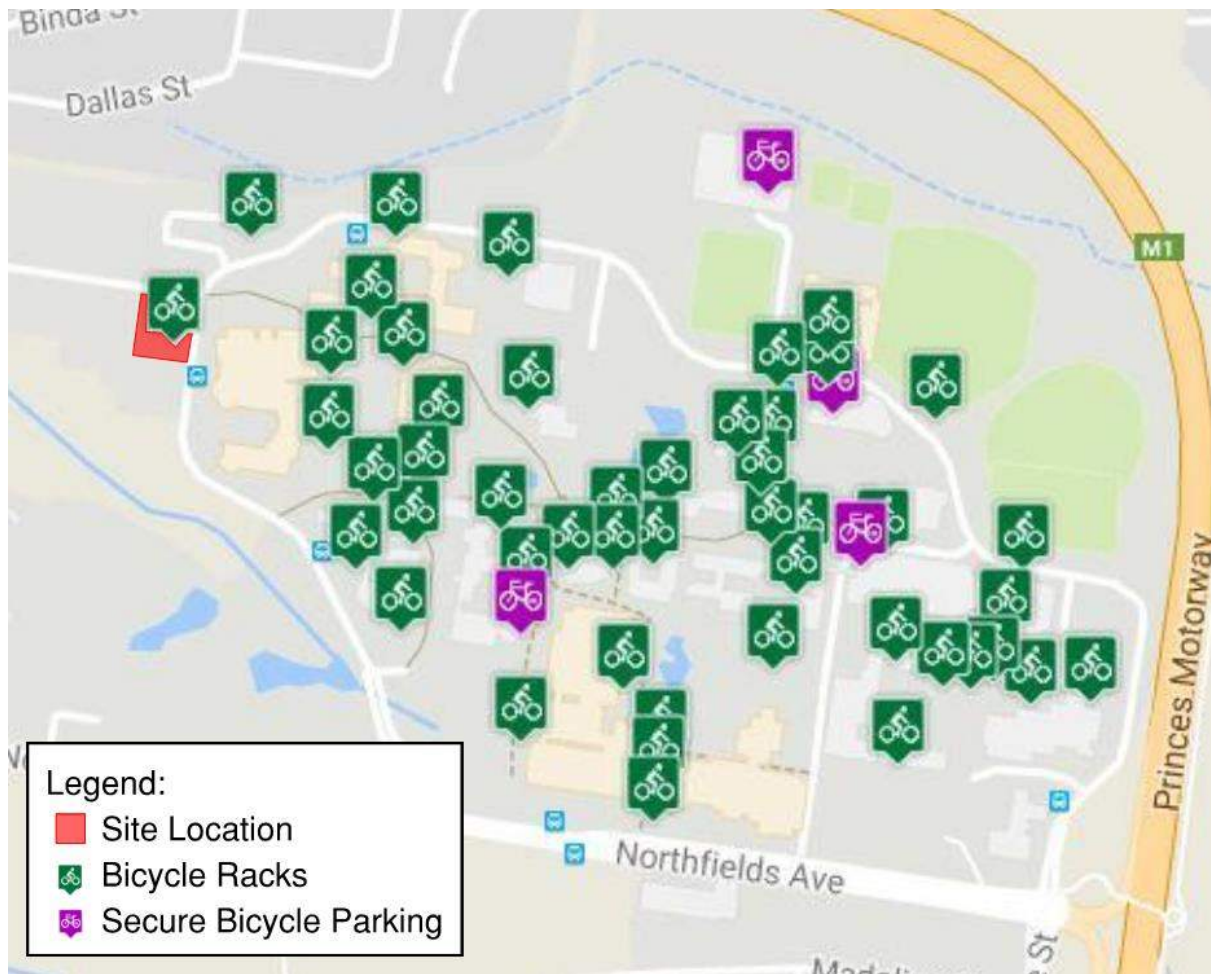


Figure 6: Bicycle Parking Locations



Figure 7: Bicycle Racks Adjacent to Building 54

Six high quality end-of-trip facilities (known as “bike bases”) have been provided within the Campus. These facilities include showers, change rooms and toilets available for free for staff and students. Undercover spaces are available through application and access is granted for 12 months. Lockers are available both short term and long term for a fee. Long term lockers within the bike bases are available at a cost of a \$60 deposit plus \$20 per year.

Two bike maintenance stations are also within the Campus. These stations provide a bike pump and tools to allow cyclists to fix their bicycle. These two stations are located within the central Campus outside Building 20 and Jugglers Lawn.

UOW regularly encourages cycling, introducing initiatives such as:

- UOW Bicycle User Group is an action group who aim to improve and encourage cycling to the Campus. Their main aims include: improving the cycle route between UOW and the Innovation Campus; improving pedestrian and cyclist access to UOW; campaign for better driver-cyclist awareness; and increasing the provision of bicycle lanes on roads within the vicinity of the Campus.
- Ride to Uni Day is held as a part of the annual Ride to Work Day. Cyclists are given free breakfast and bike maintenance.
- Sustainable Transport Breakfast is an annual free breakfast to travellers cycling, walking, carpooling or catching a bus to the Campus.

## 4.4 Public Transport

### 4.4.1 Bus Services

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There is a large bus bay located across the Ring Road from the site; however UOW has advised that this services the Early Start Facility. The bus bay provides drop off and pick up for school groups that visit the Campus facilities. The intent of the bay is to accommodate bus layover; however it has been observed by UOW’s Facilities Management that the bay is rarely used for this purpose.

Bus stops located along the Ring Road are accessed from within the central Campus. The closest bus stop to the site that is used for public transport is located approximately 180 metres walk to the north-east. This bus stop is serviced by the North Gong Shuttle (refer to Table 2 for the locations this bus route services).

The main bus terminal associated with the Campus is located on Northfields Avenue, located about 550 metres walk south-east of the site. The bus routes detailed in Table 2 all operate via this bus terminal.

UOW operates free shuttle buses that are used by over 25% of students, staff and visitors to the Campus (according to the Transport Strategy and Survey 2017). The University provides a free UOW Shuttle App that provides updated timetables and real time bus tracking for some services. These measures have been included to promote sustainable transport in line with UOW’s Transport Strategy.

Bus routes near the Campus are detailed in Figure 8.

**Table 2: Bus Routes Servicing the Site**

Route Number	Areas Served	Frequency During Weekdays
<b>Free UOW Shuttle Buses</b>		
<b>55A and 55C (Gong Shuttle)</b>	Wollongong Station, North Beach and the Innovation Campus	Every 10 minutes 7am to 6pm and every 20 minutes 6pm to 10pm
<b>9 and 9N (North Gong Shuttle)</b>	North Wollongong Station, International House, Ring Road and the Wollongong Campus	The service operates regularly between 7:30am and 9:50pm and aims to match the train schedule
<b>GK (Gwynneville Keiraville)</b>	Keiraville, Northern West Wollongong, Gwynneville, Smiths Hill and the Wollongong Campus	Every 15 minutes during peak times and every 30 minutes between the hours of 7:45am to 1pm and 3:30pm to 10pm
<b>Public Bus Services</b>		
<b>1U</b>	Austinmer to UOW via Thirroul, Woonona, Bulli, Corrimal and Fairy Meadow	Limited
<b>4U</b>	Bulli to UOW via Pendlebury Loop and Woonona	Limited
<b>11</b>	UOW to Wollongong via Keiraville, Westfield Figtree and Coniston	Every hour
<b>53</b>	Stockland Shellharbour to UOW via Flinders Shell Cove, Shellharbour Beach, Warilla, Primbee, Warrawong and Five Islands Road	Every hour
<b>887</b>	Campbelltown to UOW and Wollongong via Appin	Every hour



Figure 8: Bus Routes

#### 4.4.2 Train Services

North Wollongong Station is located roughly 20 minutes' walk away from the campus or a 10 minute bus ride on the Gong Shuttle. The station is serviced by the South Coast Line. Travel time from Central Station in the Sydney CBD is approximately 90 minutes to North Wollongong Station. The location of North Wollongong Station is shown in Figure 8.

#### 4.4.3 Taxi

There is a taxi rank located on Northfields Avenue west of Irvine Street along the northern kerbside.

### 4.5 Road Network

UOW's Wollongong Campus has three main vehicular access points. Two of these access points (Western and Eastern Entrances) are from Northfields Avenue with the third access point from Robsons Road. The UOW Master Plan identifies that the Western Entrance experiences the greatest vehicular traffic as it provides access to four main car parks within

the Campus (P1, P2, P3 and P4). Refer to Figure 9 for the location of the access points in relation to the site.

The Campus is connected to the arterial road network via the Princes Motorway (M1). The Princes Motorway links Wollongong north to Sydney and south to Shellharbour.

The main access road to the Campus is Northfields Avenue, which connects to the Princes Motorway via a two lane roundabout at the intersection of Irvine Street and Northfields Avenue. The majority of Northfields Avenue provides one travelling lane in each direction (eastbound and westbound). On street parking is provided on both the north and south kerbsides at the eastern portion of the avenue. An additional bus only lane is provided in parts of the northern kerbside, leading to a bus terminus with five bays. A bus waiting bay (layover) is also provided on the southern kerbside.

Robsons Road is oriented in a north-south direction with one travelling lane in each direction. An additional parking aisle is provided on the western kerbside in a section of the road.

Ring Road is a road internal to the Wollongong Campus. A number of traffic calming devices including raised speed humps are located along the road, with at grade pedestrian crossings connecting the central campus to the car parks and buildings outside of the Ring Road.

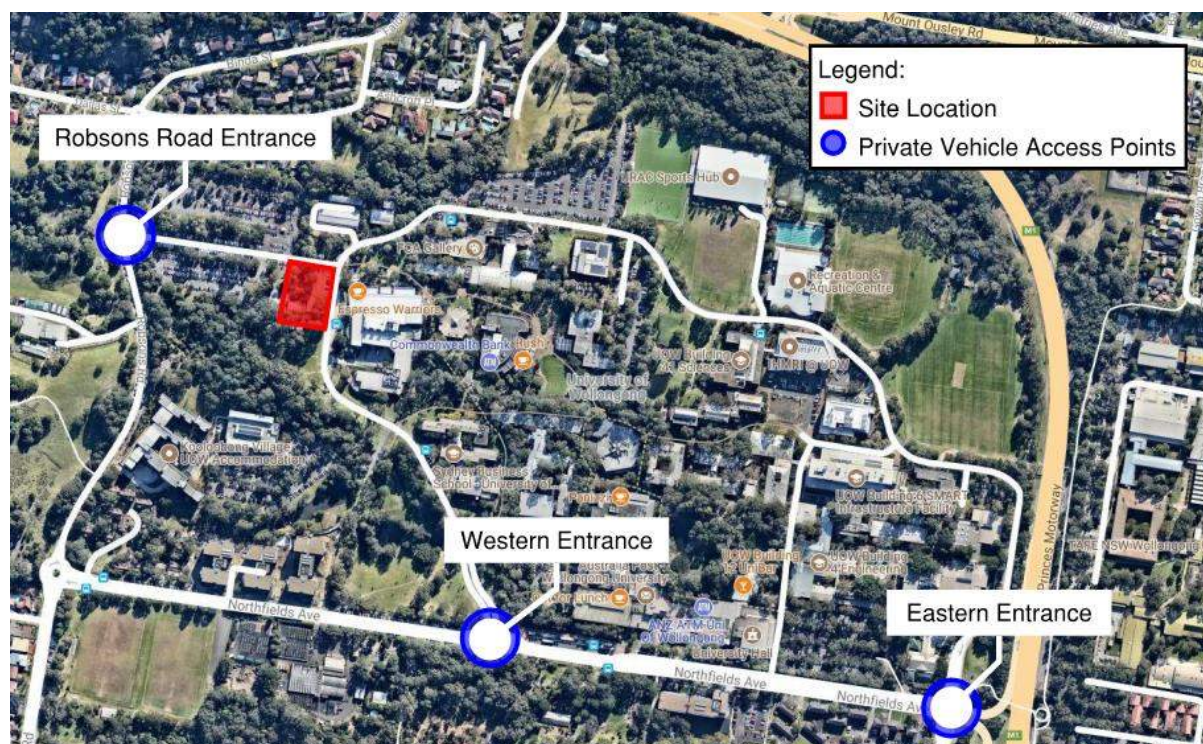


Figure 9: Vehicular Access Points within the Road Network

#### 4.6 Off Street Car Parking

A number of off street car parking spaces are located along the perimeter of the Campus as detailed in Figure 10. There are currently eight major parking locations on the Campus. Most parking stations are on grade (P2, P3, P4, P5, P7 and P8 on Figure 10) with one multi-storey car park (P1) and one basement car park (P6). These car parks are accessed via Northfields Avenue, Unicentre Road, Parry Road, Robsons Road, Ring Road and Sciences Lane.

The site is located adjacent to the P4 car park which is accessed by Robsons Road and Ring Road.

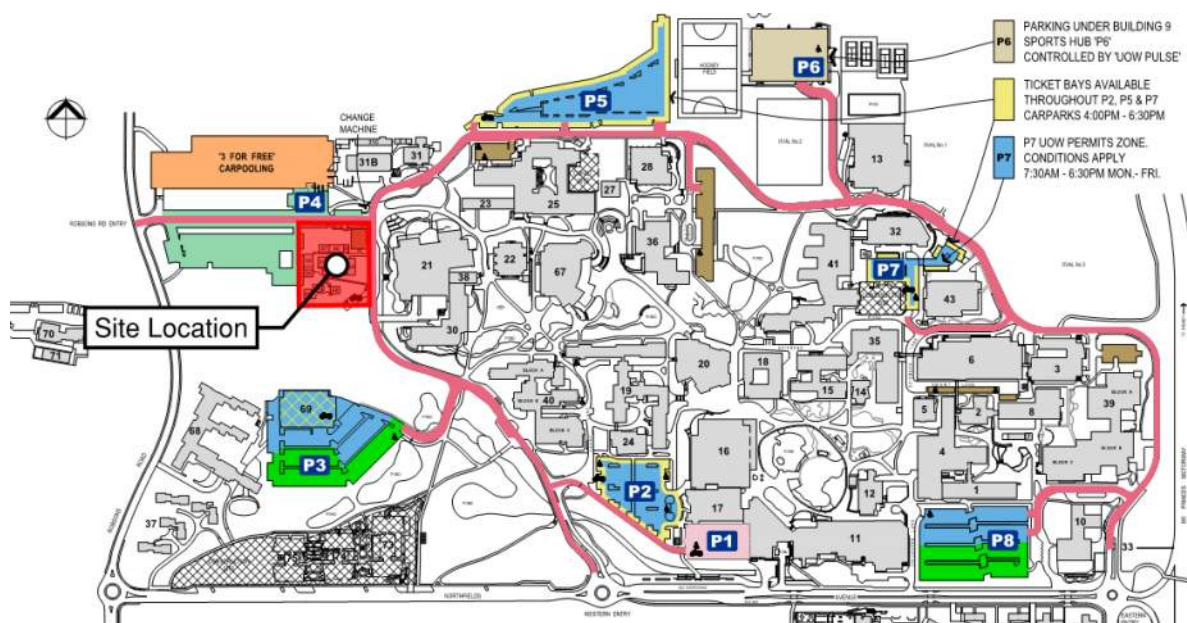


Figure 10: Locations of Off Street Car Parking

According to the Transport Strategy Report 2017, there are currently 3,255 (1,029 ticketed) car parking spaces within the Wollongong Campus and 88 motorcycle spaces. A breakdown of the type of parking is provided in Table 3. UOW provides real time parking availability information at the eight parking locations on their website or on a UOW Parking App.

Table 3: Type of Carparking (Source: Transport Strategy and Survey 2017)

Type of Parking	Available Capacity with the Campus
Ticket	1,029
Permit	934
Carpool	352
Reserved	600
Service/Security/Visitor	73
Accessible	68
Loading/Drop Off	35
Accommodation	164
Motorcycles	88

Ticketed parking is available within the Campus for all users. Limited permit parking is available for staff. Any vehicle parked within the Campus must display a valid parking ticket which is supported by short-term and ‘pay and display’ parking stations. Accessible parking is free of charge. Parking fees are detailed in Table 4.

Vehicles carpooling to the Campus with three or more occupants can park for free. There are 400 parking spaces restricted to carpooling vehicles between 7:30am to 5:45pm Monday to Thursday and 7:30am to 3pm on Friday. An online carpool matching service “CarpoolWorld” is encouraged by UOW to help visitors find other travellers from their area to

carpool with. In this system users provide where they live and when they would like to travel and are subsequently linked with those with a similar travel pattern.

**Table 4: Off Street Parking Fees**

<b>Pay and Display Ticketed Parking</b>	
P3, P4, P8 Carparks	
0 – 4 Hours	\$3.50
4 – 6 Hours	\$7.00
6 Hours +	\$9.60
After 4pm in UOW Permit Bays	
P2 Main Car Park	\$2.30 per hour
P5 Northern Car Park	\$2.30 per hour
P7 Ovals Car Park	\$2.30 per hour
<b>Short Term Parking Stations</b>	
8:30am – 6:30pm, Monday – Friday	
0 – 30 minutes	Free
30 minutes – 1 hour	\$2.30
1 – 2 hours	\$4.40
2 – 4 hours	\$9.00
4 hours +	\$15.00
6:30pm – 8:30am, Monday – Friday, Weekends	
Maximum Charge	\$1.00
<b>Permits</b>	
Reserved (limited, staff only)	\$1,050.00
UOW Entry Permit (staff only)	\$380.00
Motorcycle	\$60.00
Replacement Permit	\$22.00
RMS Mobility Permit Displayed	Free

## 4.7 On Street Car Parking

On street parking is available along Robsons Road and Northfields Avenue, the two bordering roads of the Campus. Additionally there are over 2,000 parking spaces in surrounding neighbourhood streets.

On street parking surveys are conducted biannually on the surrounding streets, with data collected between 2014 and 2017 during February, March and April. Survey times were chosen to compare on street parking occupancy during outside of the semester period (February) and during the semester (March and April). UOW continues to monitor their impact to surrounding networks and continues to focus its Transport Strategy on sustainable transport modes.

UOW's Student Accommodation Strategy has also increased pedestrian mode share by increasing the number of residents within the walking catchment.

## **4.8 Loading Facilities**

Part of the current on grade carpark accessed via Ring Road within the site has an allowance for UOW's facilities management service vehicles. This loading facility has capacity for up to two service vehicles and is signposted "No Parking Facilities Management Division Only". It is expected that this area services the existing demountables within the site.

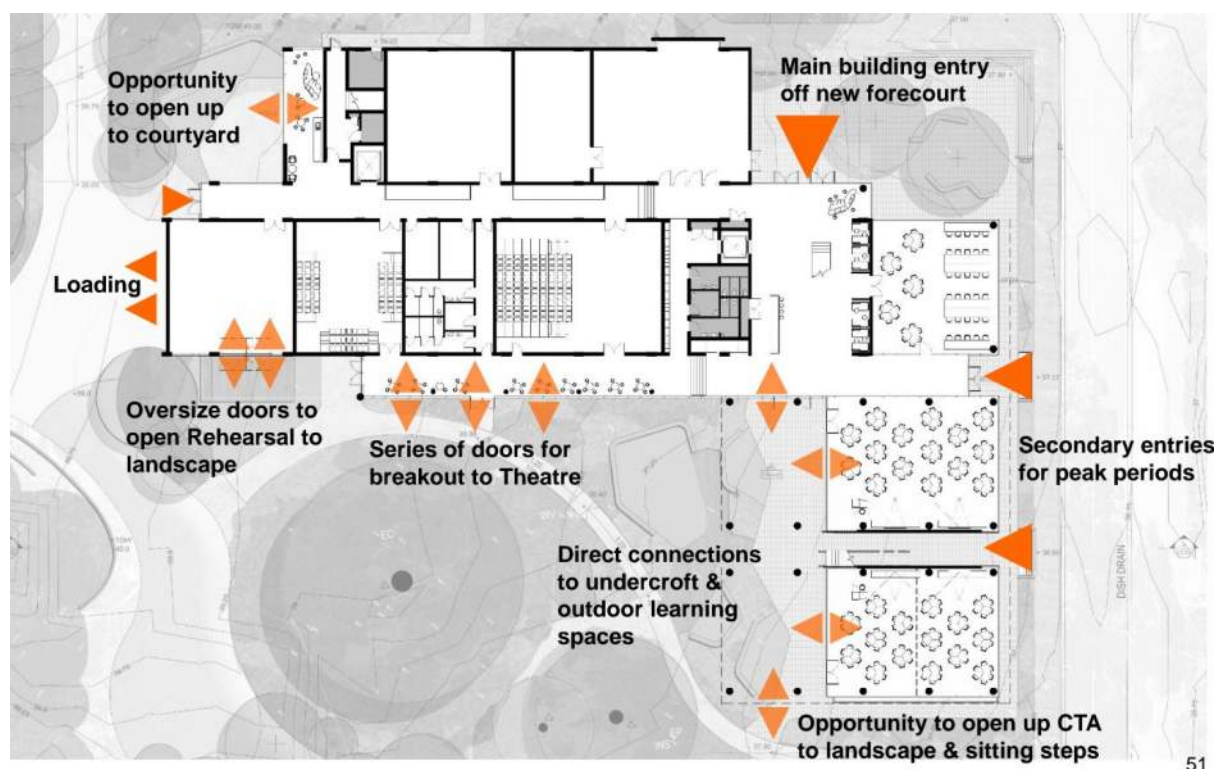
## 5.0 Proposed Development

### 5.1 Scope of the Proposed Development

The new Western Building will be a landmark development for the University of Wollongong (UOW) campus. It will be located adjacent the campus Ring Road at the western end of the campus. The proposed project will accommodate the diverse functions of The Arts English and Media (TAEM) School and the Health and Society (HAS) School and the School of Geography and Sustainable Communities (SGSC) into a collaborative and engaging hub that will support the ambitions of next generation research and learning. Functions accommodated include specialist teaching spaces, academic and professional staff workplace, informal collaboration spaces as well as other support spaces. The proposed building will be circa 10,000sqm gross floor area across four levels plus a plant level.

Ancillary works to the building include a proposed loading dock, landscaping and outdoor communal space. The development is expected to accommodate for the relocation of staff and students on site and also for an additional 54 staff.

Refer to Figure 11 for an architectural plan showing the entries and exits to the proposed Western Building.



**Figure 11: Architectural Entries and External Openings Plan**

*Source: Western Building UOW Schematic Design Report prepared by Hassell August 2017*

### 5.2 Proposed Occupancy

A number of staff are being relocated to the proposed Western Building from elsewhere on the Campus. Locations where staff are currently working will be used as decanting spaces for future developments detailed within UOW's Master Plan. The Master Plan proposes the development of several brownfield sites and therefore users of these sites will require decanting to maintain Campus operations. The space vacated by the relocated staff within the Western Building will be required to decant existing staff and activities occurring in older buildings being demolished whilst construction is underway for potential new development in the same footprint.

There is an expected peak increase in staff of 54 on site at any time during peak times. A further breakdown of the type of staff and comparison to the existing staff numbers is detailed in Table 5.

**Table 5: Increase in Staff (Source: UOW Facilities Management)**

Type of Staff	Number of Staff		Total Staff Increase	Peak Occupancy	Maximum Increase of Staff on Campus
	Existing	Proposed			
Academic	45	68	23	100%	23
Research / HDR <sup>1</sup>	44	106	62	44% <sup>2</sup>	27
Professional	12	16	4	100%	4
<b>TOTAL</b>			<b>89</b>		<b>54</b>

<sup>1</sup>HDR stands for Higher Degree Research

<sup>2</sup>Determined from UOW Annual Space Occupancy Survey

## 5.3 Active Transport

### 5.3.1 Pedestrian Movements

The main building entry will be located at a proposed forecourt area to the north east corner of the site. Additional entries will be provided from Ring Road to the east border of the building.

The location of the main entry aligns with anticipated pedestrian desire lines located in a west-east direction through the central Campus. The main pedestrian pathways linking the site to the Campus are shown in Figure 12.

The site is connected across the P4 carpark access road through the existing signposted shared zone. As part of the Masterplan it is proposed that this shared zone is reinforced along the carpark access road and the Ring Road adjacent to the site.

To improve pedestrian amenity in this area, 90 degree angled parking will be removed from the southern kerbside of the carpark access road within the shared zone. This will reduce the number of reversing movements within the carpark access road.

The development will allow for an anticipated staff growth of 54 staff during peak times, any additional pedestrian trips will be due to this staff increase. Travel mode survey data provided by UOW indicates that 8% of staff travel as a pedestrian. Therefore, an increase of 5 peak hour and 10 daily pedestrian trips can be expected.

Note that there will be additional internal pedestrian trips to the Western Building from rerouting of trips elsewhere within the Campus to the site. This will include staff and students trips that currently travel to the existing Faculties of Social Sciences and Law, Humanities and Arts.



Figure 12: Pedestrian Routes through the Campus

### 5.3.2 Cyclist Facilities

The Western Building will provide a total of 13 secure bicycle spaces in accordance with AS2890.3 located in the north-west corner of the site. These 13 spaces have been provided to support sustainable mode shift targets as defined within the UOW Masterplan and Transport Strategy. These spaces have been provided at a rate of 1 per 10 staff expected to be occupying the building during peak times.

The site will affect two bicycle racks located within the building footprint; the proposed secure spaces will be an improvement to bicycle facilities within the area.

End of trip facilities such as lockers located on the ground floor and a shower on each floor will also be provided to encourage sustainable travel.

Travel mode survey data provided by the University indicates that 6.7% of staff travel by cycling to the Campus. On this basis it is noted that the additional 54 staff would only warrant the need for 4 additional cycle racks, however excess supply is proposed to support the UOW Transport Strategy. There are an expected 4 peak and 8 daily additional cyclist trips generated by the development.

## 5.4 Public Transport

The development will not impact the location of any bus stops along Ring Road.

Mode share data for staff has indicated that 15.1% of staff travel to the Campus using public transport. The increase in 54 staff during the peak would generate approximately 8 peak hour public transport trips and therefore an increase of 16 public transport trips during the day.

## 5.5 Carparking

### 5.5.1 Parking Loss

The proposed development is to be built partially within the existing P4 carpark. With reference to the Concept Landscape Plan prepared by Taylor Brammer, it is estimated that

the site boundary would result in approximately 124 carparking spaces and 7 motorcycle spaces requiring removal as a result of the development. The loss of carparking has been determined following a site inspection of the existing carpark on the 14<sup>th</sup> August 2017, the site survey and historical aerial imaging from Nearmap.

To facilitate circulation of the existing carpark to the west, a further 6 spaces will need to be lost. This results in a total carparking loss of 130 spaces.

The loss of carparking will comprise of 116 ticket spaces, 12 permit holder spaces and 2 accessible spaces in the locations shown in Figure 13. Motorcycle spaces (7) located adjacent to the accessible spaces will be affected.



Figure 13: Expected Parking Loss

### 5.5.2 Operation of Existing Carpark

As a result of the development, access to the two parking aisles to the west of the site will be affected. The remaining carparking will have one entry and exit point for this section of the carpark. Given the number of parking spaces has decreased in this area, the reduction in entries and exits is considered acceptable.

Refer to Figure 14 for the proposed circulation of the existing carpark following completion of the Western Building.

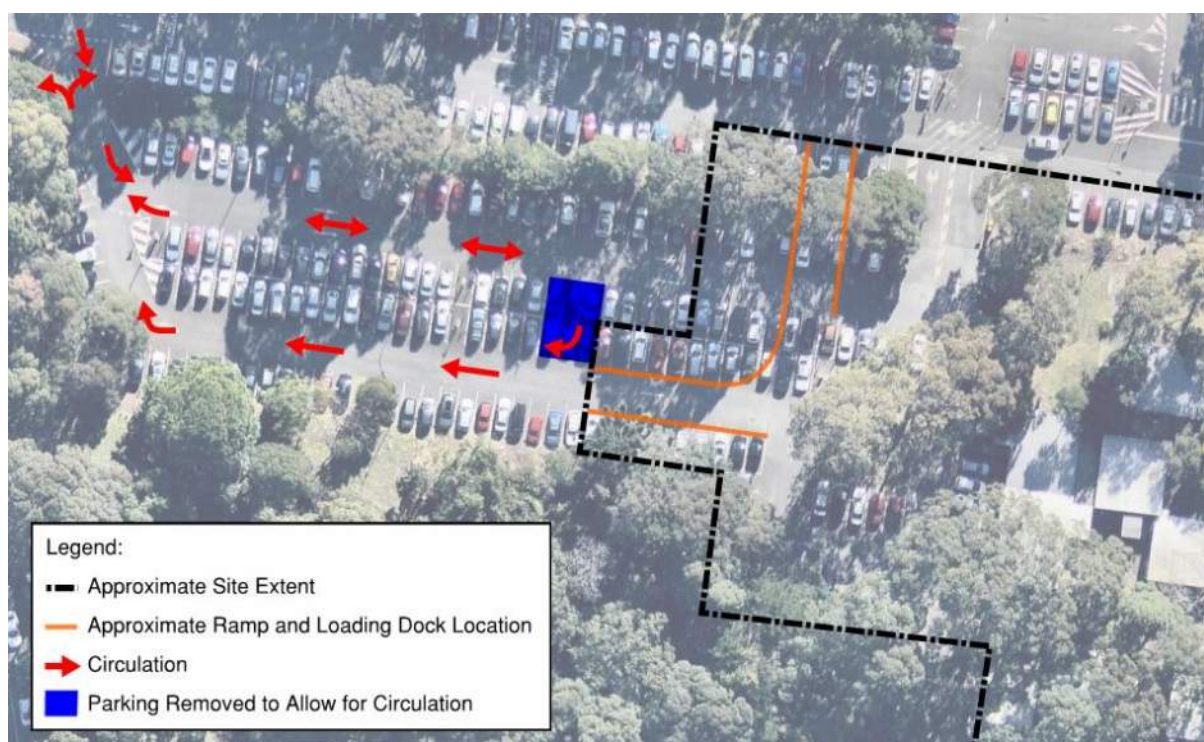


Figure 14: Post Development Circulation

### 5.5.3 Parking Demand

Council's Development Control Plan states that 1 parking space should be provided per staff member for educational facilities. Given the development will result in an increase of 54 staff; this would result in the requirement of 54 parking spaces.

While Council has provided a parking rate, the University has conducted travel mode surveys to determine the behaviour of students and staff travelling to the Campus. As this rate applies specifically to the University, it is considered more appropriate to apply the private vehicle usage rate to determine the parking demand.

The travel mode survey (discussed in further detail in Section 6.3.1) indicates a private vehicle mode share of 79% for full time staff, with approximately 10% of staff travelling by private vehicle doing so as a passenger due to carpooling options and restricted parking on Campus.

Subsequent to the increase in staff and travel mode survey data, an additional 39 parking spaces will be required.

### 5.5.4 Proposed Parking

There will be no proposed parking as a part of this development. To account for the loss of parking, the 130 carparking and 7 motorcycle parking spaces lost and additional demand of 39 will be relocated elsewhere within the University. TTW has been advised by UOW that there will be two areas where the parking demand will be accounted for:

- The P5 carpark extension (DA-2017/376).
- A leased carpark at TAFE NSW Wollongong.

The extension of the P5 carpark is proposed to account for the relocation of carparks within the Campus due to other developments such as the Molecular Life Sciences building to be constructed on the P7 carpark. The carpark shall be designed and constructed in accordance with relevant Australian Standards. The carpark extension is intended to provide an additional net 183 spaces and 8 motorcycle spaces. According to the Traffic Impact

Statement of the Proposed P5 Car Park Extension, of these spaces approximately 80 spaces will be utilised for displaced parking demand as a result of the proposed Molecular Life Sciences Building.

As a result, of the 169 space parking demand from Western Building development, 103 spaces could be accounted for within the proposed P5 carpark extension. The carpark extension is currently with Council for consideration.

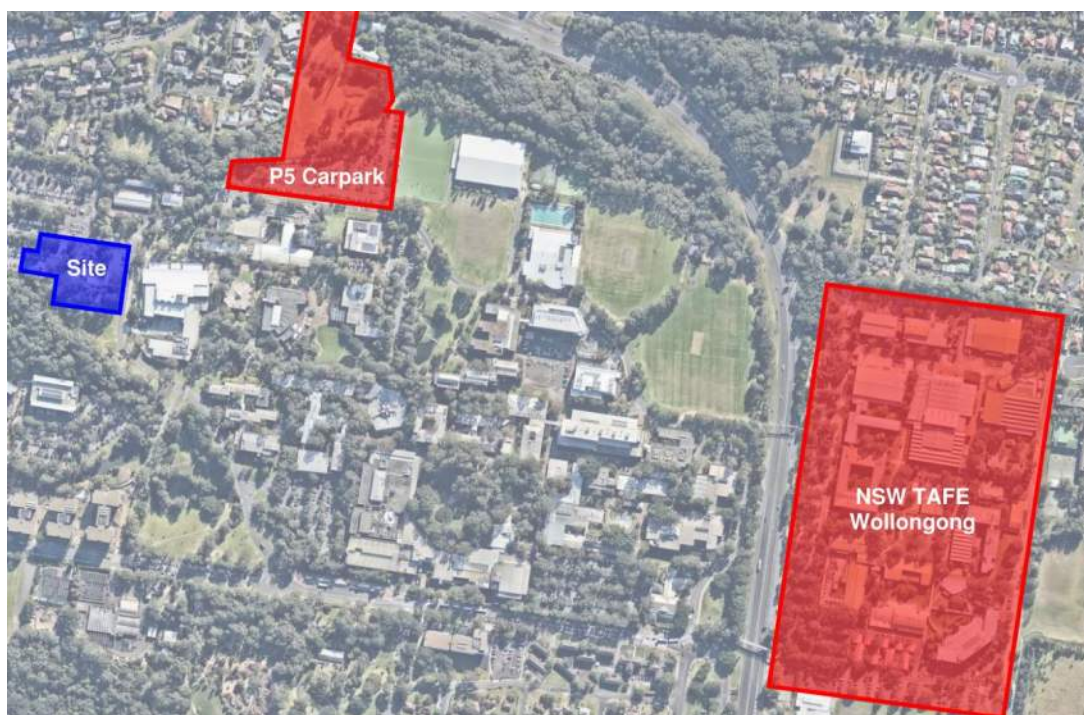
UOW have advised that a leased carpark at the adjacent TAFE NSW Wollongong will accommodate for the additional parking demand of 66 spaces in the interim prior to other carparking areas being built as part of the University's 2016-2036 Wollongong Campus Master Plan.

The location of these two carparks is shown in Figure 15. The parking at the TAFE is provided in the interim prior to an increase in parking being provided as outlined in the Master Plan.

A new lease agreement for 150 spaces at the TAFE has been confirmed to be in place during the construction of the Western Building, that will accommodate for displaced parking as a result of the construction works. While the TAFE carpark is located east of the Princes Motorway, the 2017 Transport Survey indicated that (in a previous leasing arrangement) during peak weekday hours the carpark experienced a usage rate of approximately 75% (excluding Fridays). This data indicates that travellers to the University utilise this carparking effectively.

The Traffic Impact Statement for the P5 Carpark Extension and a letter from TAFE confirming the leasing agreement have been affixed in Appendix A and Appendix B respectively. It is noted that UOW is currently in consultation with TAFE to extend this leasing arrangement.

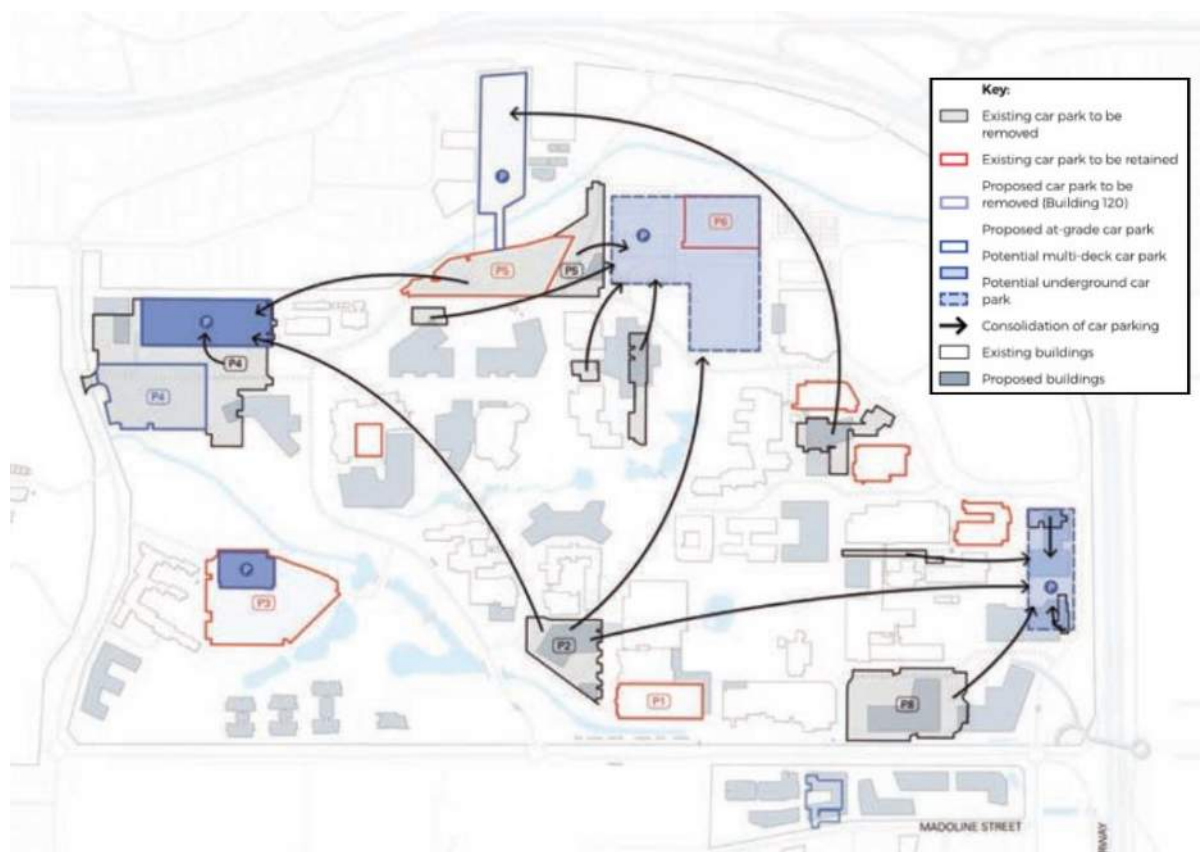
The two accessible spaces and two service vehicle spaces affected by the development are to be relocated to the north of the building at the existing carparking.



**Figure 15: Relocated Carpark Locations**

The Master Plan highlights areas for possible carparking, the most notable being the possibility of a potential multi storey carpark located within the existing P4 carpark. Refer to

Figure 16 for the location of potential carparking areas identified within the Master Plan.



**Figure 16: Carparking Strategy**

Source: 2016-2036 Wollongong Campus Master Plan prepared by University of Wollongong

## 5.6 Private Vehicle Access

As there is no proposed carparking as part of the development, there will be no private vehicle access points within the site. Modifications to the existing private vehicle access will occur as discussed in Section 5.5.2.

Access through the proposed loading dock will be restricted to service vehicles only. As a result, no private vehicles will be allowed to circulate through this area. To restrict vehicle movements, security gates will be installed at the entry and exit to the loading facility. These gates will be situated to allow for a service vehicle to store in the entry ramp prior to reaching the gate so as not to impact the circulation area of the existing P4 carpark.

## 5.7 Loading and Service Facilities

### 5.7.1 Servicing

To facilitate loading of the proposed building, a loading dock is proposed to be accessed from the existing carpark. This facility will be located to the west of the building and access will be via an entry ramp from the north and egress via an exit ramp to the west.

UOW have advised that the loading dock will need to accommodate a “Pantech” sized vehicle for servicing. For the purposes of this assessment, we have assumed that the facility will need to accommodate an 8.8m medium rigid vehicle (MRV).

A swept path analysis of the loading area has been included within Appendix C. Note that the swept path has been conducted with a 12.5m heavy rigid vehicle to account for waste collection vehicles detailed in Section 5.7.2 below.

### 5.7.2 Waste Collection

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For waste collection, UOW's Environment Unit have advised of the following frequencies of collection:

- General waste collection occurs every weekday at most locations prior to 8:30am.
- Mixed recycling and paper collection happens once per week at most locations in the morning.
- Organics are collected once per week in the morning.
- Confidential paper is collected once per fortnight in the morning.

Various truck sizes are used in this collection, however UOW have confirmed that the size of waste vehicles does not exceed a 12.5m heavy rigid vehicle (HRV). Typical waste collection occurs via a front loading truck, with a required 6m vertical clearance at the collection point. Due to this requirement, waste storage has been nominated in an appropriate location for front loading.

To account for possible vehicle sizes, a swept path analysis has been conducted with a HRV to ensure all possible waste collection vehicles can be accommodated within the loading dock area. Refer to Appendix C where the swept path has been affixed.

## 5.8 Sustainable Travel Measures

As discussed in Section 4.2.1, the University of Wollongong has demonstrated continued support for sustainable travel, with the commencement of the UOW Transport Project in 2008.

A site specific Green Travel Plan has not been prepared for the site as the University's Travel Plan adopts a Campus wide approach, which is considered more appropriate for the site.

## 5.9 Construction Access

A Preliminary Construction Traffic Management Plan (CTMP) has been prepared as a part of the Environmental Impact Statement. It is likely that the majority of site access will occur via Robsons Road to avoid internal roads within the Campus.

Note that the Preliminary CTMP is subject to change. A detailed and final CTMP will need to be prepared and approved prior to construction once a Contractor has been appointed and further details are known about the staging of works.

## 6.0 Road Network Impacts

### 6.1 Traffic Count Data

Traffic count data was collected on the 29<sup>th</sup> August 2017 for intersection counts and between the 29<sup>th</sup> August and 4<sup>th</sup> September 2017 for tube counts. Data was collected at the following locations (refer to Figure 17):

#### Intersection Counts

- Northfields Avenue, Irvine Street and the Princes Motorway
- Irvine Street and University Avenue
- University Avenue and the Princes Motorway
- Northfields Avenue and Ring Road
- Northfields Avenue and Robsons Road
- Robsons Road and the P4 Carpark Access
- Ring Road and the P4 Carpark Access

#### Tube Counts

- The P4 Carpark Access
- Ring Road outside of the site location
- Northfields Avenue near the Western Entrance

Consultation with both the University of Wollongong and Roads and Maritime Services (RMS) was undertaken to agree on the scope of investigations. Refer to Appendix D for minutes that were taken during TTW's meeting with RMS.

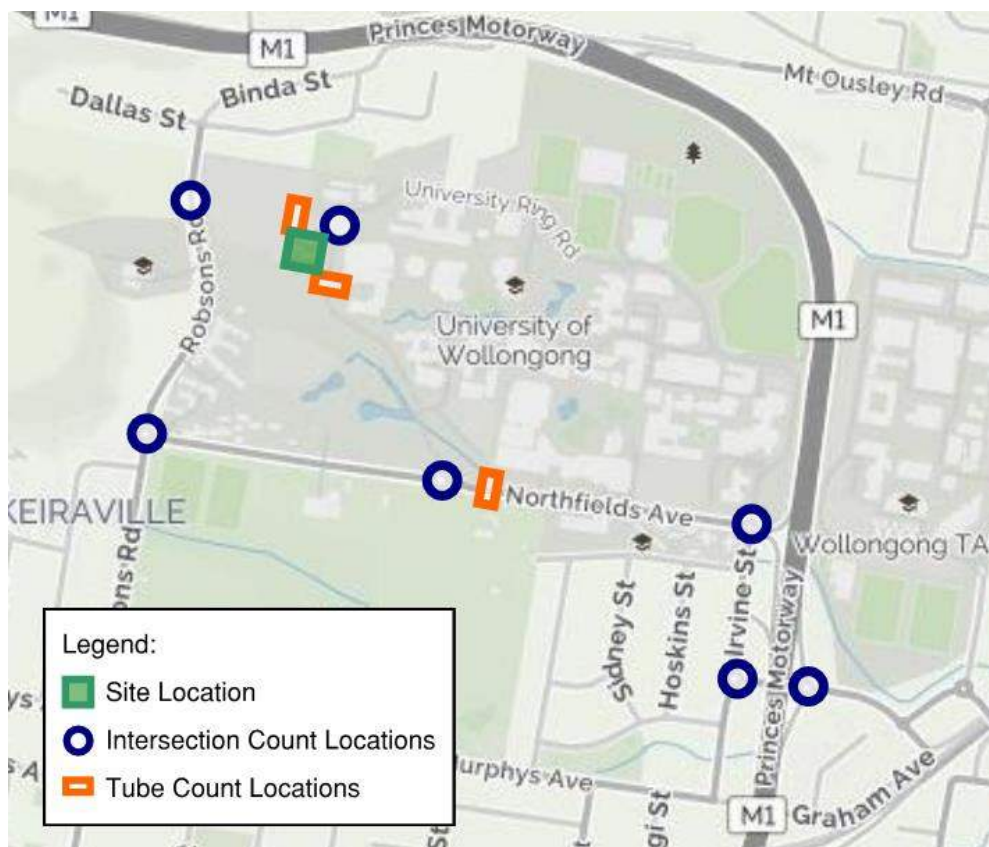


Figure 17: Traffic Count Data Locations

### 6.1.1 Annual Average Daily Traffic Volumes

Seven day tube counts were conducted to determine the average daily traffic in locations near to the site (see Figure 17) during a weekday and across all seven days. The results of these counts are detailed in Table 6. Detailed tube count data has been affixed in Appendix E.

**Table 6: Average Daily Traffic Volumes**

	Weekday Average Daily Traffic (Vehicles)	Seven Day Average Daily Traffic (Vehicles)
<b>P4 Carpark Access</b>	2,222	1,708
<b>Ring Road</b>	2,548	1,954
<b>Northfields Avenue</b>	9,747	7,736

### 6.1.2 Peak Hour Volumes

Intersection counts were conducted from 7:30am to 10:00am and 4:00pm to 6:30pm on Tuesday the 29<sup>th</sup> of August 2017 during semester times to determine the peak hour. This count data separated vehicle turning movements and therefore was used for the purposes of SIDRA modelling.

Peak hour vehicle volumes for each of the seven days were also determined from the tube counts, noting that the peak hour was generally 8:00am to 9:00am and 5:00pm to 6:00pm. A summary of these volumes is detailed in Table 7 with the full dataset affixed in Appendix E.

**Table 7: Peak Hour Traffic Volumes**

	Monday		Tuesday		Wednesday		Thursday		Friday		Saturday		Sunday	
	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
<b>P4 Carpark Access</b>	190	174	376	189	379	194	344	226	358	165	58	65	36	38
<b>Ring Road</b>	184	180	396	233	356	242	309	252	337	212	56	66	29	45
<b>Northfields Avenue</b>	730	882	1037	936	1021	948	1026	907	1004	748	214	264	179	210

## 6.2 Pre Development Operation

### 6.2.1 Modelling Methodology

The adequacy of the capacity of an intersection is judged by whether it can physically and operationally cater for the traffic using it. This considers parameters including the degree of saturation (DoS) and the average delay per vehicle.

Satisfactory operation of an intersection would normally continue up to 42 seconds average delay per vehicle. At this Level of Service (LoS), operating speeds are still reasonable and

acceptable delays are experienced. The recommended criteria for evaluating capacity of intersections are shown in Table 8.

**Table 8: Criteria for Evaluating Capacity of an Intersection**  
 (Source: RMS Guidelines 2002 and Austroads Guide to Traffic Management 2013)

Level of Service	Degree of Saturation	Average Delay per Vehicle
<b>A/B: Good operation</b>	Less than 0.80	Less than 28
<b>C: Satisfactory</b>	0.80 to 0.85	29-42
<b>D: Near capacity, but manageable</b>	0.85 to 0.90	43-56
<b>E: At capacity</b>	0.90 to 1.00	57-70
<b>F: Unsatisfactory, extra capacity required</b>	Over 1.00	Over 70

SIDRA is an RMS approved software package that models an intersection to determine how well it is performing under its demand. Its results take into account traffic volumes, pedestrian volumes, lane geometry, sign control and the nature of the intersection.

SIDRA modelling was undertaken to determine the existing performance of the network at the intersections shown in Figure 17. Following consultation with RMS, the two intersections located along University Avenue were modelled as a network as requested.

### 6.2.2 Results

The analysis undertaken indicates that during typical operation the intersections operate at a high level of service (LoS) “A” or “B” in the morning and afternoon peaks. Refer to Table 9 for the network operation from the existing intersection counts. Note that in accordance with the RMS Traffic Modelling Guidelines, the level of service reported for sign controlled intersections and roundabouts is for the worst movement delay of the intersection. Detailed SIDRA modelling results can be found in Appendix F.

**Table 9: Pre Development Intersection Operation**

Intersection	AM Weekday Peak				PM Weekday Peak			
	Worst Movement		Overall		Worst Movement		Overall	
	LoS	Ave Delay (sec)	LoS	Ave Delay (sec)	LoS	Ave Delay (sec)	LoS	Ave Delay (sec)
Northfields Avenue, Irvine Street and the Princes Motorway	B	19.3	A	11.5	B	24.2	B	17.1
Irvine Street and University Avenue <sup>1</sup>	A	13.2	A	9.4	B	25.7	B	14.9
University Avenue and the Princes Motorway <sup>1</sup>	B	15.8	A	9.4	B	21.3	A	8.3
Northfields Avenue and Ring Road	A	11.3	A	7.9	A	11.3	A	6.7
Northfields Avenue and Robsons Road	A	11.1	A	6.2	A	11.0	A	5.7
Robsons Road and P4 Carpark Access	A	9.6	N/A <sup>2</sup>	4.7	A	8.8	N/A <sup>2</sup>	6.0
Ring Road and P4 Carpark Access	A	9.0	N/A <sup>2</sup>	4.7	A	8.6	N/A <sup>2</sup>	4.3

<sup>1</sup>Note that for these intersections, the results indicated are following a network analysis.

<sup>2</sup>Intersection level of service values are not applicable for two-way sign control as the average delay is not a good level of service measure due to zero delays associated with the major road movement.

## 6.3 Traffic Generation

### 6.3.1 Travel Mode

Refer to Section 4.2 for a summary of the existing travel modes to the site as detailed in UOW Transport Strategy and Survey as well as Journey to Work data for the local area.

The 2017 Transport Strategy and Survey headcount data indicates that private vehicles (including motorcycles) currently account for a mode share of 52.9%. This is supplemented by a reported mode share of 53% for those travelling by car (as a driver and passenger) and motorcycle.

While the 2017 Transport Strategy and Survey did not distinguish separate mode shares between staff and students, the Transport Survey of 2015 stated that full time staff had an

average private vehicle mode share of 79% which is significantly higher than the average private vehicle mode share reported in 2015 across all respondents (55.4%).

Subsequently, it is more appropriate to apply a travel mode rate for staff of 79% for private vehicle usage. It is important to note that this rate includes both drivers and passengers. The 2015 Transport Survey identifies that on average 10% of those arriving by private vehicle do so as passengers due to the carpooling options and restricted parking on Campus (discussed in Section 4.6).

### 6.3.2 Traffic Volumes

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Following an expected increase in 54 staff (as discussed in Section 5.1) and the travel mode survey results discussed previously, it can be expected that 43 staff will travel by private vehicle to the Western Building. Accounting for 10% of these staff being passengers and not drivers who could be using the carpooling options available, 39 vehicle trips will be generated during peak times to the Western Building.

Following an increase of 54 daily staff and the mode split data discussed, 78 daily vehicle trips are expected to be generated by the development.

## 6.4 Trip Distribution

### 6.4.1 Travel Mode Survey

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In UOW's Transport Strategy and Survey 2017 (discussed in Section 4.2.1), the majority of staff and students travelled to the Campus from within the Illawarra Region, with "12.3% living in Wollongong, 6.1% living in Fairy Meadow and 4.4% residing in Gwynneville." Other origins for staff and students are largely to the north and south, with few travelling from the west.

### 6.4.2 Journey to Work

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The 2011 Census Journey to Work (JTW) data indicated that that the majority (64%) of workers travelling to the region are from Wollongong, Dapto – Port Kembla (14%) and Kiama – Shellharbour (11%). Refer to Section 4.2.2 for further discussion of the JTW data.

### 6.4.3 Intersection Count Data

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An inspection of the afternoon peak intersection count data shows the majority of traffic flows to University Avenue and towards the east, with some flows to the Princes Motorway on ramps.

There is a roughly even split of traffic exiting the carpark onto Ring Road and Robsons Road. Those exiting onto Robsons Road largely continue straight through the Northfields Avenue and Robsons Road intersection.

### 6.4.4 Approach and Departure Routes

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The approach and departure routes have been informed by the following:

- Travel Mode Survey and Journey to Work data that indicates the majority of travellers are originating from the north, south or east.
- The available access routes to the Campus are restricted due to the Princes Motorway bordering the north and east of the Campus.
- Traffic count data indicating the current movements through the adjacent intersections.

Following this information, it can be assumed that 45% will originate from the east, 30% from the south and 25% from the north. The approach and departure routes have been detailed in

Figure 18 and Figure 19 respectively.

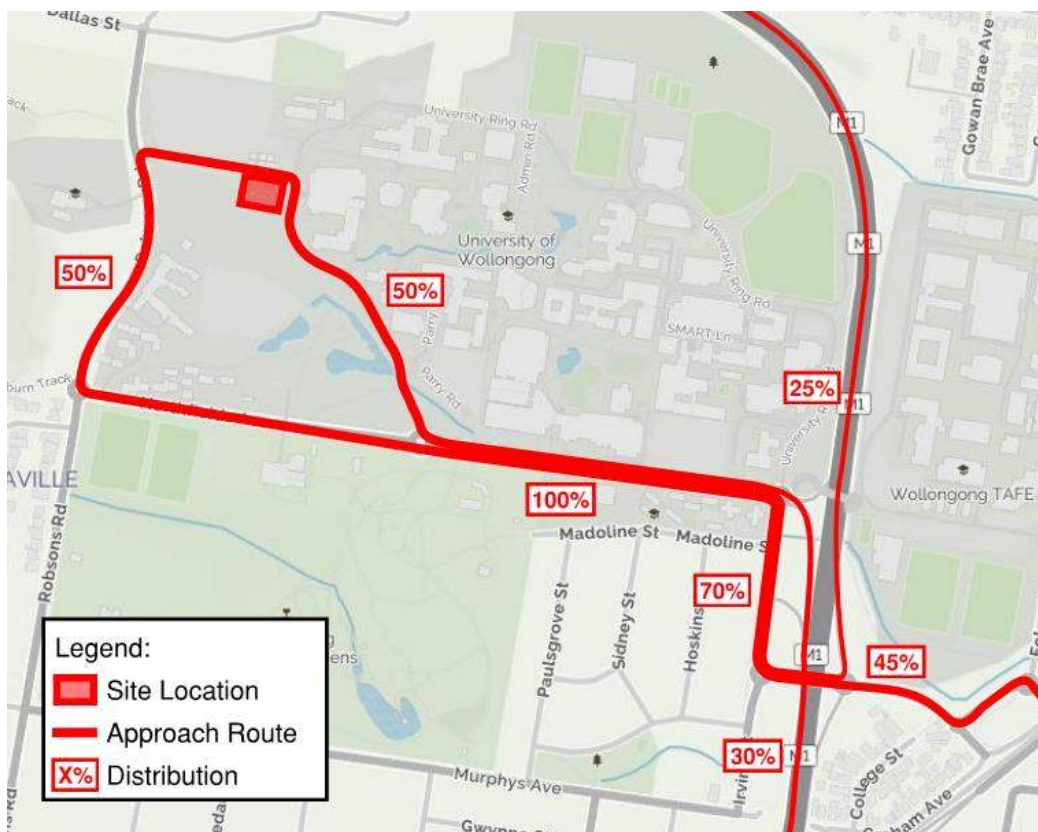


Figure 18: Approach Routes

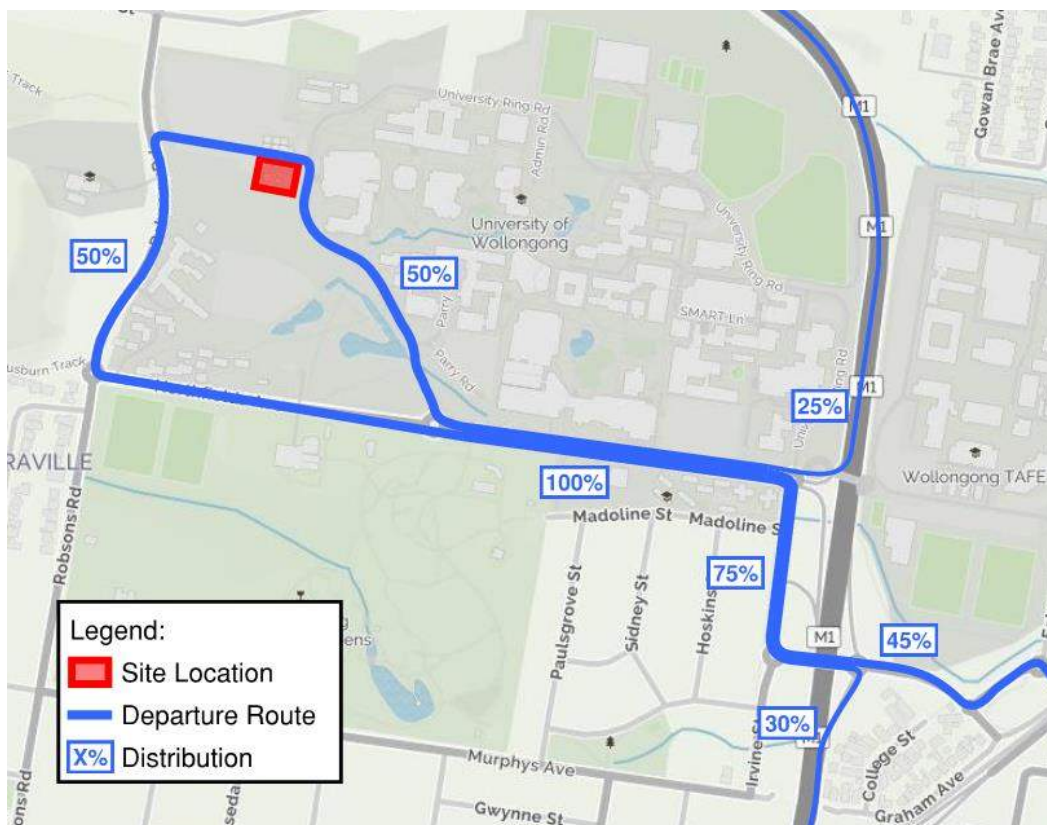


Figure 19: Departure Route

Additional traffic volumes were based on the expected route of travel and the trip distribution shown in Figure 18.

## **6.5 Post Development Operation**

### **6.5.1 Modelling Methodology**

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As the development is expected to be completed in a couple of years, a worst case scenario of two years of background growth of 2% has been applied to the post development model to simulate traffic conditions in the future.

In addition to this 2% growth over two years, additional movements generated by the Western Building were added following the trip generation in Section 6.3 and the distribution in Section 6.4.

### **6.5.2 Results**

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Following the trip distribution discussed in Section 6.4, the additional trips were added to the existing intersection counts. The intersections performed at a level of service identified in Table 10. Note that in accordance with the RMS Traffic Modelling Guidelines, the level of service reported for sign controlled intersections and roundabouts is for the worst movement delay of the intersection.

It is noted that the majority of the intersections are expected to operate at a satisfactory level of service post development. It is noted that the intersection of Irvine Street and University Avenue is expected to operate at a level of service "D" in the PM peak which is near capacity, but manageable and considered within an acceptable level of service. The additional movements through this intersection as a result of the Western Building are expected to be 29 vehicles in both the AM and PM peaks. Given the number of trips generated by the Western Building is relatively minor; the decrease in level of service at this intersection is largely due to worst case background growth.

**Table 10: Post Development Intersection Operation**

Intersection	AM Weekday Peak				PM Weekday Peak			
	Worst Movement		Overall		Worst Movement		Overall	
	LoS	Ave Delay (sec)	LoS	Ave Delay (sec)	LoS	Ave Delay (sec)	LoS	Ave Delay (sec)
Northfields Avenue, Irvine Street and the Princes Motorway	B	21.1	A	12.6	C	37.5	B	24.8
Irvine Street and University Avenue <sup>1</sup>	B	15.2	A	10.7	D	53.1 <sup>2</sup>	C	31.2
University Avenue and the Princes Motorway <sup>1</sup>	B	18.8	A	10.8	B	25.4	A	8.9
Northfields Avenue and Ring Road	A	11.4	A	8.0	A	11.3	A	6.8
Northfields Avenue and Robsons Road	A	11.1	A	6.3	A	11.1	A	5.7
Robsons Road and P4 Carpark Access	A	9.8	N/A <sup>3</sup>	4.8	A	8.8	N/A <sup>3</sup>	6.1
Ring Road and P4 Carpark Access	A	9.2	N/A <sup>3</sup>	4.8	A	8.6	N/A <sup>3</sup>	4.5

<sup>1</sup>Note that for these intersections, the results indicated are following a network analysis.

<sup>2</sup>Note that this movement experiences low vehicle volumes as it is for the u-turn movement. The next worst performing movement is the through from the north approach with an average delay of 46.9 seconds.

<sup>3</sup>Note that intersection level of service values are not applicable for two way sign controlled intersections as there are zero delays associated with major road movements.

## 6.6 Future Impact

### 6.6.1 Infrastructure Projects

Roads and Maritime Services (RMS) has current plans to construct a new interchange on the Princes Highway at the intersection of Mount Ousley Road. The Review of Environmental Factors for this interchange is anticipated for exhibition in November 2017.

The interchange is likely to include a new entrance to the northern section of the Campus, redistributing trips to the north of the Campus and reducing traffic volumes along Northfields Avenue. This will result in improved traffic conditions at the intersections that have been assessed in this report.

Preliminary plans as provided by UOW subsequent to further consultation with RMS for the interchange indicate no adjustments will be required to the proposed P5 carpark extension within the Campus.

## **6.7 Summary**

Intersection modelling was conducted both pre and post development, with the post development modelling allowing for two years of background growth of traffic volumes. It is noted that the intersection of Irvine Street and University Avenue is expected to operate at a level of service “D” during the PM peak, however this is largely due to a worst case background growth scenario.

It is worth noting that should the Mount Ousley Interchange be constructed, an additional access point to the University will result in better operation of these intersections associated with the resulting diversion of trips.

It should also be noted that the additional traffic volumes are considered to be relatively minor. Tube count data on Northfields Avenue (refer to Section 6.1.2) indicates that the increase in traffic as a result of the Western Building will result in an increase in vehicle volumes during peak hours of approximately 3% to 4%.

**Table 11: Comparison of Existing and Future Level of Service**

Intersection	AM Weekday Peak				PM Weekday Peak			
	Worst Movement		Overall		Worst Movement		Overall	
	Existing LoS	Future LoS	Existing LoS	Future LoS	Existing LoS	Future LoS	Existing LoS	Future LoS
Northfields Avenue, Irvine Street and the Princes Motorway	B	B	A	A	B	C	B	B
Irvine Street and University Avenue <sup>1</sup>	A	B	A	A	B	D	B	C
University Avenue and the Princes Motorway <sup>1</sup>	B	B	A	A	B	B	A	A
Northfields Avenue and Ring Road	A	A	A	A	A	A	A	A
Northfields Avenue and Robsons Road	A	A	A	A	A	A	A	A
Robsons Road and P4 Carpark Access	A	A	N/A <sup>2</sup>	N/A <sup>2</sup>	A	A	N/A <sup>2</sup>	N/A <sup>2</sup>
Ring Road and P4 Carpark Access	A	A	N/A <sup>2</sup>	N/A <sup>2</sup>	A	A	N/A <sup>2</sup>	N/A <sup>2</sup>

<sup>1</sup>Note that for these intersections, the results indicated are following a network analysis.

<sup>2</sup>Note that intersection level of service values are not applicable for two way sign controlled intersections as there are zero delays associated with major road movements.

## 7.0 Conclusions

This report has outlined the traffic and transport impacts of the proposed Western Building. The proposed project will accommodate The Arts English and Media (TAEM) School and the Health and Society (HAS) School and the School of Geography and Sustainable Communities (SGSC). The proposed building will result in no increase in students and will facilitate a growth of 54 staff in peak times.

As part of the development, 130 existing parking spaces and 7 motorcycle spaces will be removed. To account for this loss in parking and the increase in demand, these spaces will be relocated into the expansion of the P5 carpark and leased parking located at the adjacent NSW TAFE Wollongong site. As part of the University's Master Plan, it is anticipated that these temporary spaces will eventually be relocated to within UOW's main campus.

Following assessment of the expected vehicle trips generated by the development as a result of the increase in staff (with an allowance for baseline growth), SIDRA modelling has indicated that these additional trips have negligible impact to the local road network performance. These intersections will continue to operate at a satisfactory level of service during the morning and afternoon peaks, noting that the intersection of Irvine Street and University Avenue will operate near capacity, but manageable and within an acceptable level of service.

The expected increase in peak public transport trips, pedestrian trips and cyclist trips is expected to be 8, 5 and 4 trips respectively. Given the minor trip generation of these modes in comparison to the University as a whole, it is expected that these trips can be accommodated within their associated networks. Active travel is supported by the development with the inclusion of end of trip facilities including secure bicycle parking, lockers and showers.

There is a proposed loading facility as part of the works. Following advice from UOW's Facilities Management, the largest vehicle expected to require access to the site is a 12.5m heavy rigid vehicle (HRV) to facilitate waste collection. A swept path analysis has been conducted of this vehicle to ensure that the vehicle is able to manoeuvre within the loading dock.

A Preliminary Construction Traffic Management Plan has been prepared for the site. This Plan will need to be finalised once a contractor has been appointed and the staging of works is finalised.

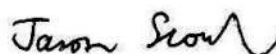
The University has an ongoing Transport Project that supports methods of sustainable travel. As part of this Project, travel mode surveys are conducted biannually with key issues identified and methods proposed to encourage sustainable travel.

Prepared by  
**TAYLOR THOMSON WHITTING  
(NSW) PTY LTD**



**GRACE CARPP**  
Traffic Engineer

Authorised By  
**TAYLOR THOMSON WHITTING  
(NSW) PTY LTD**



**JASON SCOUFIS**  
Traffic Manager

## Appendix A

# Traffic Impact Statement for P5 Carpark Extension

14<sup>th</sup> March 2017

Terry Graham  
EDMISTON JONES  
Level 1 / 147 Crown Street  
Wollongong NSW 2520

**Attention: Terry Graham**

**RE: UoW Proposed P5 Car Park Extension – Traffic Impact Statement**

### **Introduction**

This traffic and transport statement is provided to support the Development Application (DA) for the proposed expansion of the P5 car park, located within University of Wollongong's (UoW) sporting precinct.

The DA which is seeking approval for the expansion of the existing P5 car park, on Lot 1 in DP 507865 located to the west of the UoW Hockey Field, comprises the following parking provisions:

- 192 car spaces;
- Eight motorcycle spaces.

This letter provides an assessment of the subject specific impacts associated with this development application.

### **Context**

As part of the 2016-2036 Master Plan (2016), UoW proposes several new academic buildings within the campus core, some of which would be located over existing car parks, with displacement of the existing car parking facilities.

In order to facilitate the parking provisions within the campus, UoW proposes to consolidate many of the existing car parks located on the periphery of the campus. In doing so it is planned that the extension of the P5 car park would:

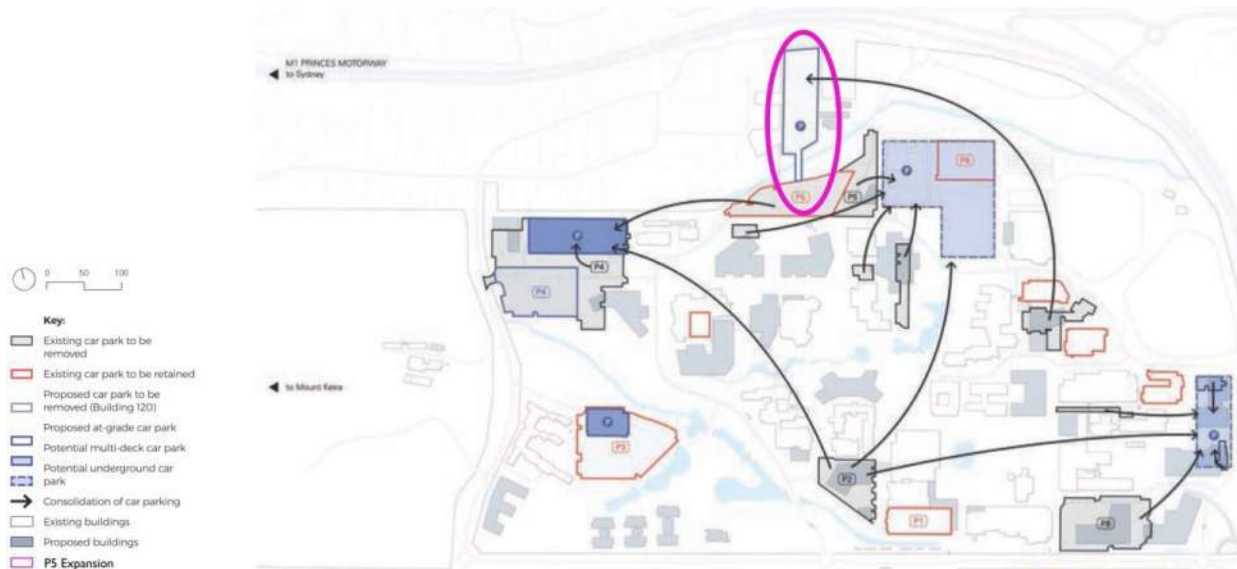
- Minimise the vehicle circulation between the various campus car parks
- Allow additional academic buildings to be developed within the campus core
- Address community concerns and mitigate potential impacts to surrounding residents associated with displaced parking from future developments.

The Master Plan vision to consolidate numerous campus car parks is illustrated in **Figure 1** with car park P5 circled in pink.

It is noted that although **Figure 1**, as identified in the Master Plan, highlights that the extension of the P5 car park would serve the displaced parking demand resulting from the redevelopment of the P7 car park (with approximately 80 spaces), it is noted that the proposed P5 car parking extension (with additional 183 spaces) would also facilitate the displaced car park demands resulting from other car park redevelopments.

In expanding the P5 car park, nine car spaces currently located within the existing P5 car park would be removed to allow access to the expanded portion of the car park.

Figure 1 – 2016-2036 Masterplan Car Park Locations



Source: MGS Architects; 2016

### Traffic Impact

As shown in **Figure 1**, the purpose of the P5 car park expansion is to facilitate the relocation of an existing car park as well as facilitate the development other future development of existing car parks. As a result the expansion of the P5 car park would not generate any additional vehicle trips. Furthermore, the relocation of the car park would not alter the operation of vehicle access points on UOW's surrounding roads network, including Northfields Avenue and Robsons Road. No impact would be anticipated on the parking amenity of the surrounding residential street network due to the lack of a traffic generating development.

Given that there are no net changes in vehicle trip generation and vehicle access arrangements on the surrounding road network, it is concluded that the proposal would will not give rise to adverse impact on the function of the local or regional road network.

If you have any questions regarding the above please do not hesitate to contact me at your convenience.

Kind regards,



Daniel Lee

Principal Consultant

0404 858 682

[daniel@sctconsulting.com.au](mailto:daniel@sctconsulting.com.au)

[sctconsulting.com.au](http://sctconsulting.com.au)



Collaboration | Technical Excellence | Integrity

# UoW P5 EXTENSION

## CIVIL ENGINEERING WORKS PACKAGE

### DEVELOPMENT APPLICATION



SOURCE : NEARMAP.COM.AU (©2015)

#### DRAWING SCHEDULE

DRG No.	DRAWING TITLE
DA1.01	COVER SHEET, DRAWING SCHEDULE AND LOCALITY PLAN
DA1.11	GENERAL ARRANGEMENT PLAN
DA2.01	CONCEPT SEDIMENT AND EROSION CONTROL PLAN
DA2.11	SEDIMENT AND EROSION CONTROL DETAILS
DA3.01	BULK EARTHWORKS CUT TO FILL PLAN
DA4.01	SITWORKS AND GRADING PLAN - SHEET 1
DA4.02	SITWORKS AND GRADING PLAN - SHEET 2
DA5.01	CONCEPT STORMWATER MANAGEMENT PLAN - SHEET 1
DA5.02	CONCEPT STORMWATER MANAGEMENT PLAN - SHEET 2
DA5.11	CATCHMENTS PLAN
DA6.01	SIGNAGE AND LINEMARKING PLAN - SHEET 1
DA6.02	SIGNAGE AND LINEMARKING PLAN - SHEET 2
DA7.01	TYPICAL DETAILS - SHEET 1
DA7.02	TYPICAL DETAILS - SHEET 2
DA7.03	TYPICAL DETAILS - SHEET 3

VERIFIER -

JOB MANAGER: S.NAUWOSKI


DESIGNED: S.NAUWOSKI

DRAWN: D.TENHAVE

**NOT FOR CONSTRUCTION**

REVISION	DESCRIPTION	ISSUED	VER'D	APP'D	DATE
1	ISSUED FOR DEVELOPMENT APPLICATION	D.T		S.N	27.02.17

CLIENT



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ARCHITECT



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Email southcoast@northrop.com.au AIN 81 094 433 100

PROJECT

**UoW P5 EXTENSION**

DRAWING TITLE

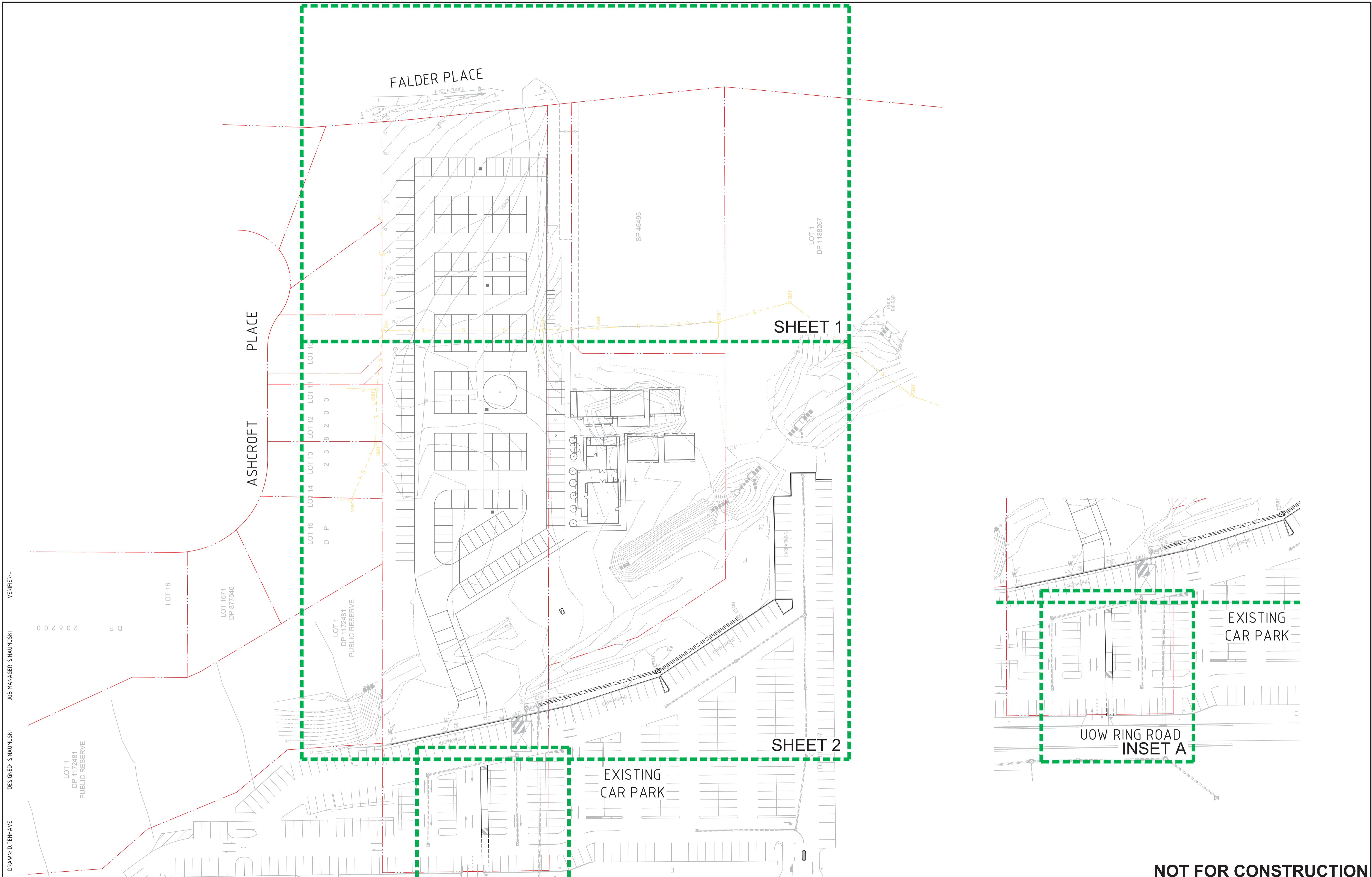
**COVER SHEET, DRAWING SCHEDULE AND LOCALITY PLAN**

JOB NUMBER

**166807**

DRAWING NUMBER	REVISION
<b>DA1.01</b>	<b>1</b>

DRAWING SHEET SIZE = A1



DRAWN: D.TENHAVE  
 DESIGNED: S.NAUWOSKI  
 JOB MANAGER: S.NAUWOSKI  
 VERIFIER: -


REVISION	DESCRIPTION	ISSUED	VER'D	APP'D	DATE
1	ISSUED FOR DEVELOPMENT APPLICATION	D.T		S.N	27.02.17

CLIENT



UNIVERSITY OF WOLLONGONG

ARCHITECT




NORTHROP

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SCALE 1:500 @ A1



PROJECT

**UoW P5 EXTENSION**

DRAWING TITLE

**GENERAL ARRANGEMENT PLAN**

JOB NUMBER

**166807**

DRAWING NUMBER

**DA1.11**

REVISION

**1**

DRAWING SHEET SIZE = A1

**NOT FOR CONSTRUCTION**

## Appendix B

# TAFE NSW Letter Regarding UOW Campus Parking



**TAFE**  
NSW

PO BOX 707  
BROADWAY NSW  
2007 AUSTRALIA

Mr Mark Scott  
Manager, Space Utilisation  
Facilities management Division  
University of Wollongong  
NSW 2522 Australia

Dear Mr Mark Scott

**TAFENSW Region South- Wollongong Campus Parking**

This letter is to confirm that TAFENSW Region South in principle consent to the use of a portion of the existing campus parking (approx. 150 spaces) by the University of Wollongong under licence.

TAFENSW Region South is currently negotiating the terms of the licence which covers a 9 month period, commencing 30 October 2017 and ending 29 June 2018. This period can be extended on the basis of a 1 plus 1 year option if required.

Yours sincerely

A handwritten signature in black ink, appearing to read 'Matthew Bennett'.

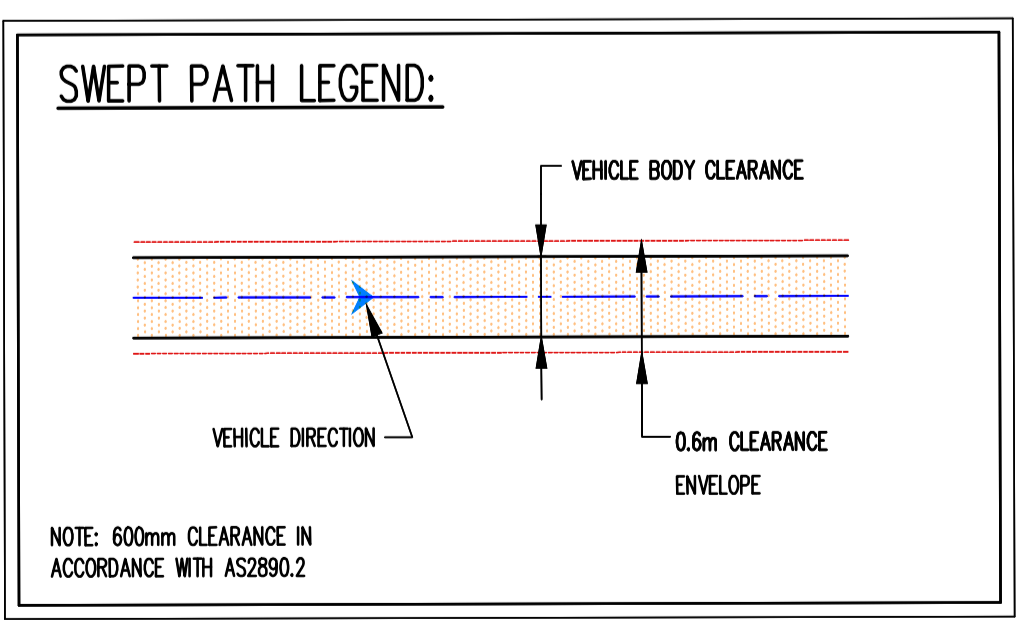
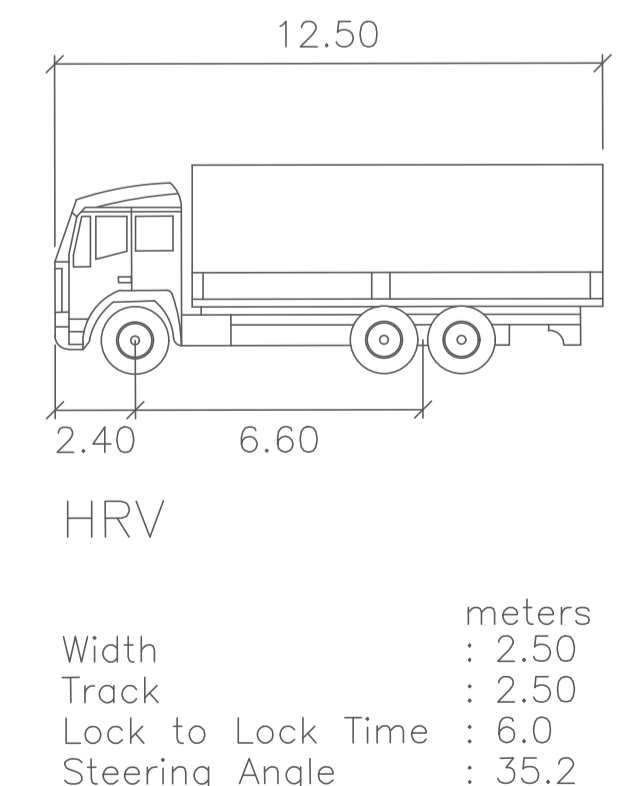
Matthew Bennett  
**Property and Logistics Business Partner**  
**TAFE NSW**  
3 October 2017

## Appendix C

# Swept Path Analysis



File Name: SKC01.dwg - USER: gmac - Plot File Created: Oct 13, 2017 - 2:33pm



A1 ..... 2 1 2 3 4 5 6 7 8 9 10

Rev	Description	Eng	Draft	Date	Rev	Description	Eng	Draft	Date	Rev	Description	Eng	Draft	Date
P1	PRELIMINARY	GC	GC	13/10/17										

Architect

**HASSELL**

HASSELL PTY LTD  
LEVEL 2, PIER 8/9, 23 HICKSON ROAD  
SYDNEY NSW 2000 AUSTRALIA

Civil Engineer

**TTW Taylor Thomson Whitting**

612 9439 7288 | 48 Chandos Street St Leonards NSW 2065

Project

**UNIVERSITY OF WOLLONGONG,  
WESTERN BUILDING  
TRAFFIC WORKS**

Sheet Subject

**TURNING PATH PLANS -  
HEAVY RIGID VEHICLE WASTE  
COLLECTION**

Scale: A1  
1:200

Drawn  
GC

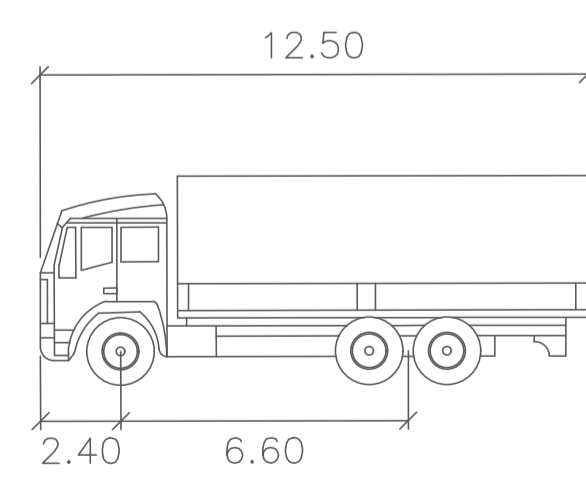
Authorised

Job No  
**171320**

Drawing No  
**SKC01**

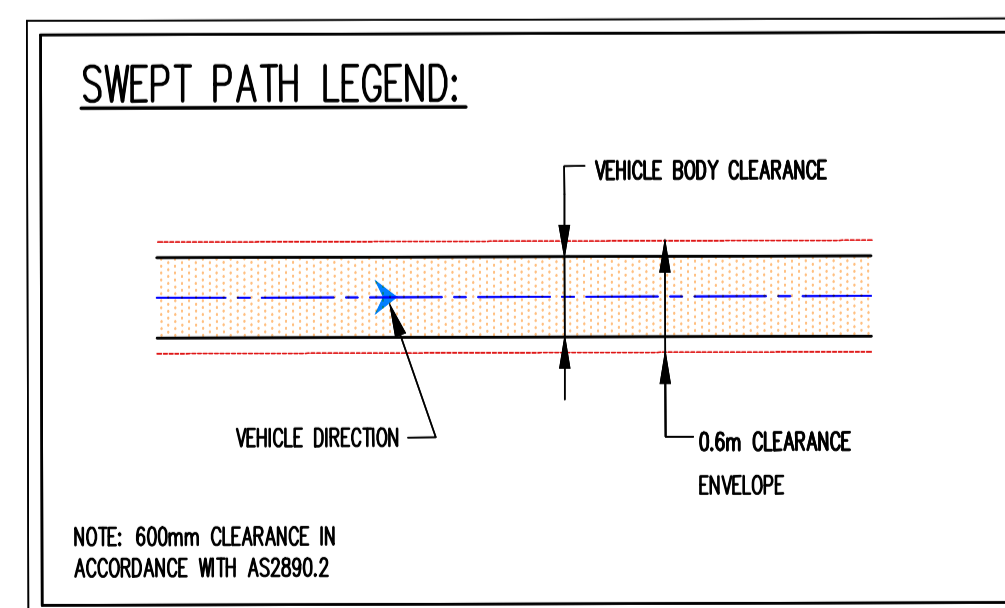
Revision  
**P1**

Plot File Created: Oct 13, 2017 - 2:33pm



HRV

Width : 2.50 meters  
 Track : 2.50  
 Lock to Lock Time : 6.0  
 Steering Angle : 35.2



Filename: SK02.dwg - USER: gmac - Plot File Created: Oct 13, 2017 - 2:33pm

A1 ..... 1 2 3 4 5 6 7 8 9 10

Rev	Description	Eng	Draft	Date	Rev	Description	Eng	Draft	Date	Rev	Description	Eng	Draft	Date
P1	PRELIMINARY	GC	GC	13/10/17										

Architect

**HASSELL**

HASSELL PTY LTD  
 LEVEL 2, PIER 8/9, 23 HICKSON ROAD  
 SYDNEY NSW 2000 AUSTRALIA

Civil Engineer

**TTW** Taylor Thomson Whitting

612 9439 7288 | 48 Chandos Street St Leonards NSW 2065

Project

UNIVERSITY OF WOLLONGONG,  
 WESTERN BUILDING  
 TRAFFIC WORKS

Sheet Subject

TURNING PATH PLANS -  
 HEAVY RIGID VEHICLE  
 LOADING

Scale: A1  
 1:200

Drawn  
 GC

Authorised

Job No  
 171320

Drawing No  
 SKC01

Revision  
 P1

Plot File Created: Oct 13, 2017 - 2:33pm

## Appendix D

# RMS Meeting Minutes

## Record of Meeting Minutes

---

<b>Project</b>	University of Wollongong Arts and Social Sciences Building	<b>Date &amp; Time</b>	7 Sept 2017 3.00 – 3.30
<b>Subject</b>	Meeting with Roads and Maritime Services	<b>Pages</b>	2
<b>Location</b>	90 Crown Street, Wollongong	<b>Job No.</b>	171320 TAAA
<b>Attendee(s)</b>	Paul Yannoulatos (TTW), Technical Director Nathan Boscaro (RMS), Manager Network and Safety Services Rachel McKay, Land Use Development Assessment Officer Tim Webster, (RMS) Project Development Manager Jayd Marsh (RMS), Network and Safety Officer Joanne Parrott (RMS), Network and Safety Manager		

---

### Distribution(s)

---

#### Site Location

PY outlined the site location and proposed works.

#### Access

PY explained the access arrangements will remain unchanged.

#### Parking

There will be some loss of parking due to the new works but it will be replaced by additional parking to the northern carpark and some at the TAFE site. A letter from the University outlining the changes will be part of the SEARS Submission.

#### Traffic Generation

The RMS representatives had no objection to the proposed intersections to be modelled, as tabled at the meeting.

It was agreed that it is envisaged the SIDRA modelling will identify the existing queuing issues currently experienced at the Princes Highway, but the slight increase in traffic generated as a result of the proposed Western Building will have minimal impact.

The Mount Ousley interchange would need to be considered holistically with existing and future projects at the University, which is separate from this application.

It was requested by NB that modelling of the three southern intersections at Northfield be undertaken as a network model.

Overall there were no major concerns raised by RMS.

## Appendix E

# Tube Count Data

**Job No** N3507 - Wollongong University  
**Client** Taylor Thomson Whitting  
**Site** Northfields Avenue - east of Irvine Street  
**Location** Wollongong  
**Site No** 3  
**Start Date** 29-Aug-17  
**Description** Volume Summary  
**Direction** Combined



Hour Starting	Day of Week							W'Day Ave	7 Day Ave
	Mon	Tue	Wed	Thu	Fri	Sat	Sun		
	4-Sep	29-Aug	30-Aug	31-Aug	1-Sep	2-Sep	3-Sep		
AM Peak	730	1037	1021	1026	1004	214	179		
PM Peak	882	936	948	907	748	264	210	<b>9747</b>	<b>7736</b>
0:00	10	0	27	29	29	41	16	19	22
1:00	11	2	9	20	32	22	14	15	16
2:00	24	27	32	46	36	16	9	33	27
3:00	26	10	12	19	15	11	10	16	15
4:00	25	35	27	28	23	7	9	28	22
5:00	59	53	38	48	35	18	6	47	37
6:00	155	173	171	161	188	76	21	170	135
7:00	357	475	410	406	457	70	18	421	313
8:00	<b>730</b>	<b>1037</b>	<b>1021</b>	<b>1026</b>	<b>1004</b>	149	53	964	717
9:00	709	776	822	746	749	189	112	760	586
10:00	517	602	731	699	667	204	177	643	514
11:00	495	610	577	660	696	<b>214</b>	<b>179</b>	608	490
12:00	558	636	731	712	<b>748</b>	259	194	677	548
13:00	595	731	659	721	657	210	195	673	538
14:00	565	671	663	693	667	230	160	652	521
15:00	707	817	884	<b>907</b>	706	240	209	804	639
16:00	<b>882</b>	871	918	848	656	<b>264</b>	201	835	663
17:00	810	<b>936</b>	<b>948</b>	842	592	182	195	826	644
18:00	576	660	771	673	329	162	169	602	477
19:00	350	422	385	426	172	132	<b>210</b>	351	300
20:00	199	228	232	313	150	85	110	224	188
21:00	151	219	233	278	132	60	79	203	165
22:00	71	90	84	122	116	72	72	97	90
23:00	35	26	47	200	101	54	29	82	70
<b>Total</b>	<b>8617</b>	<b>10107</b>	<b>10432</b>	<b>10623</b>	<b>8957</b>	<b>2967</b>	<b>2447</b>	<b>9747</b>	<b>7736</b>

7-19	7501	8822	9135	8933	7928	2373	1862	8464	6651
6-22	8356	9864	10156	10111	8570	2726	2282	9411	7438
6-24	8462	9980	10287	10433	8787	2852	2383	9590	7598
0-24	8617	10107	10432	10623	8957	2967	2447	9747	7736

**Job No** N3507 - Wollongong University  
**Client** Taylor Thomson Whitting  
**Site** University Access - off Northfields Avenue  
**Location** Wollongong  
**Site No** 2  
**Start Date** 29-Aug-17  
**Description** Volume Summary  
**Direction** Combined



Hour Starting	Day of Week							W'Day Ave	7 Day Ave
	Mon	Tue	Wed	Thu	Fri	Sat	Sun		
	4-Sep	29-Aug	30-Aug	31-Aug	1-Sep	2-Sep	3-Sep		
AM Peak	184	396	356	309	337	56	29		
PM Peak	180	233	242	252	212	66	45	<b>2548</b>	<b>1954</b>
0:00	2	0	3	3	2	3	1	2	2
1:00	0	0	1	0	0	7	0	0	1
2:00	6	0	10	9	10	1	3	7	6
3:00	7	0	3	2	1	2	1	3	2
4:00	5	5	6	2	7	4	1	5	4
5:00	4	3	4	7	5	4	2	5	4
6:00	18	22	22	20	55	9	0	27	21
7:00	64	112	91	100	175	8	0	108	79
8:00	<b>184</b>	<b>396</b>	<b>356</b>	<b>309</b>	<b>337</b>	30	9	316	232
9:00	174	269	354	304	262	<b>56</b>	<b>29</b>	273	207
10:00	162	229	305	238	276	<b>56</b>	<b>29</b>	242	185
11:00	126	184	207	190	208	49	26	183	141
12:00	144	194	221	208	<b>212</b>	51	34	196	152
13:00	172	200	160	<b>252</b>	187	58	<b>45</b>	194	153
14:00	154	176	179	177	155	50	22	168	130
15:00	153	190	198	210	157	<b>66</b>	31	182	144
16:00	161	179	216	195	145	39	29	179	138
17:00	<b>180</b>	<b>233</b>	<b>242</b>	202	96	16	21	191	141
18:00	130	141	164	123	64	13	29	124	95
19:00	58	96	83	81	15	9	27	67	53
20:00	23	32	42	54	11	6	15	32	26
21:00	15	29	19	26	13	1	21	20	18
22:00	7	25	14	17	11	6	13	15	13
23:00	4	4	10	11	13	2	6	8	7
<b>Total</b>	<b>1953</b>	<b>2719</b>	<b>2910</b>	<b>2740</b>	<b>2417</b>	<b>546</b>	<b>394</b>	<b>2548</b>	<b>1954</b>

7-19	1804	2503	2693	2508	2274	492	304	2356	1797
6-22	1918	2682	2859	2689	2368	517	367	2503	1914
6-24	1929	2711	2883	2717	2392	525	386	2526	1935
0-24	1953	2719	2910	2740	2417	546	394	2548	1954

**Job No** N3507 - Wollongong University  
**Client** Taylor Thomson Whitting  
**Site** University Access - off Robsons Road  
**Location** Wollongong  
**Site No** 1  
**Start Date** 29-Aug-17  
**Description** Volume Summary  
**Direction** Combined



Hour Starting	Day of Week							W'Day Ave	7 Day Ave
	Mon	Tue	Wed	Thu	Fri	Sat	Sun		
	4-Sep	29-Aug	30-Aug	31-Aug	1-Sep	2-Sep	3-Sep		
AM Peak	190	376	379	344	358	58	36		
PM Peak	174	189	194	226	165	65	38	<b>2222</b>	<b>1708</b>
0:00	2	0	4	1	3	4	0	2	2
1:00	0	0	1	0	1	6	1	0	1
2:00	0	0	2	2	2	1	0	1	1
3:00	2	1	1	2	1	0	6	1	2
4:00	1	6	2	1	1	3	2	2	2
5:00	4	3	1	6	8	1	0	4	3
6:00	8	14	13	17	132	1	1	37	27
7:00	42	87	71	78	311	7	0	118	85
8:00	<b>190</b>	<b>376</b>	<b>379</b>	<b>344</b>	<b>358</b>	21	5	329	239
9:00	173	214	338	252	268	<b>58</b>	23	249	189
10:00	121	210	248	210	282	56	<b>36</b>	214	166
11:00	91	156	176	151	172	42	31	149	117
12:00	114	178	178	173	<b>165</b>	42	22	162	125
13:00	137	171	154	<b>226</b>	120	<b>65</b>	23	162	128
14:00	108	106	134	140	108	32	21	119	93
15:00	92	144	164	184	105	59	13	138	109
16:00	152	149	167	145	119	40	26	146	114
17:00	<b>174</b>	<b>189</b>	<b>194</b>	152	113	18	<b>38</b>	164	125
18:00	113	103	126	99	39	11	37	96	75
19:00	58	77	67	78	32	6	32	62	50
20:00	26	29	46	34	18	7	13	31	25
21:00	22	20	19	20	16	4	19	19	17
22:00	6	11	9	7	8	2	9	8	7
23:00	2	11	7	6	5	2	4	6	5
<b>Total</b>	<b>1638</b>	<b>2255</b>	<b>2501</b>	<b>2328</b>	<b>2387</b>	<b>488</b>	<b>362</b>	<b>2222</b>	<b>1708</b>

7-19	1507	2083	2329	2154	2160	451	275	2047	1566
6-22	1621	2223	2474	2303	2358	469	340	2196	1684
6-24	1629	2245	2490	2316	2371	473	353	2210	1697
0-24	1638	2255	2501	2328	2387	488	362	2222	1708

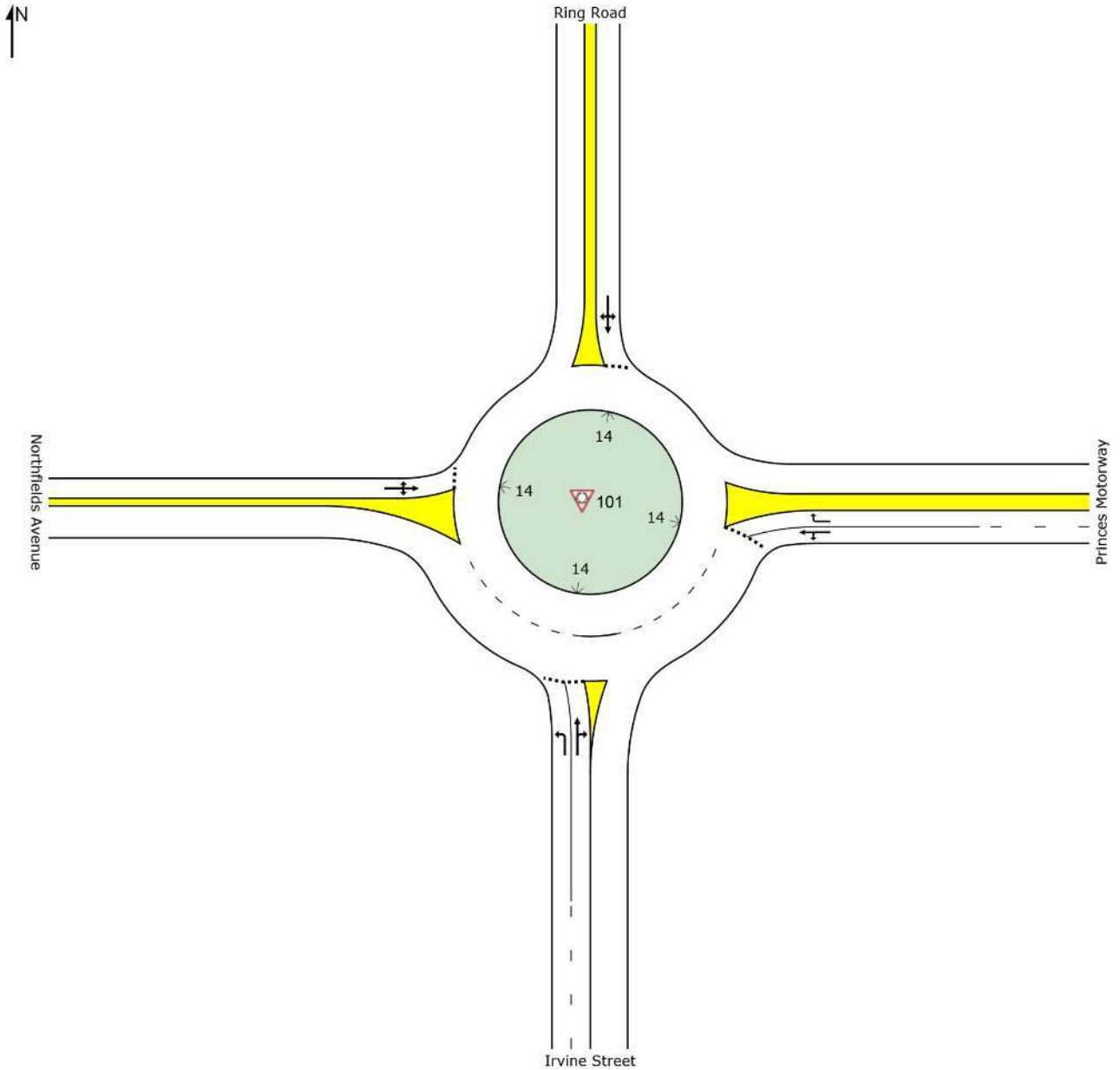
## Appendix F

# SIDRA Modelling Results

# SITE LAYOUT

 Site: 101 [Existing Northfields Ave & Irvine St AM]

New Site  
Roundabout



# MOVEMENT SUMMARY

 Site: 101 [Existing Northfields Ave & Irvine St AM]

New Site  
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows 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: Irvine Street											
1	L2	358	6.8	0.586	11.3	LOS A	3.9	29.1	0.84	1.01	49.1
2	T1	266	0.8	0.589	11.7	LOS A	3.9	27.4	0.84	1.01	49.9
3	R2	69	1.5	0.589	15.4	LOS B	3.9	27.4	0.84	1.01	49.7
Approach		694	3.9	0.589	11.9	LOS A	3.9	29.1	0.84	1.01	49.5
East: Princes Motorway											
4	L2	9	22.2	0.559	10.3	LOS A	5.4	39.1	0.83	0.82	50.1
5	T1	480	4.4	0.559	9.7	LOS A	5.4	39.1	0.83	0.82	51.7
6	R2	493	0.2	0.495	11.6	LOS A	4.2	29.3	0.78	0.78	50.3
Approach		982	2.5	0.559	10.7	LOS A	5.4	39.1	0.81	0.80	51.0
North: Ring Road											
7	L2	15	0.0	0.183	5.5	LOS A	1.1	7.4	0.50	0.58	52.8
8	T1	168	0.0	0.183	5.7	LOS A	1.1	7.4	0.50	0.58	53.9
9	R2	9	0.0	0.183	9.8	LOS A	1.1	7.4	0.50	0.58	53.6
Approach		193	0.0	0.183	5.9	LOS A	1.1	7.4	0.50	0.58	53.8
West: Northfields Avenue											
10	L2	9	0.0	0.447	13.5	LOS A	3.3	28.0	0.90	1.02	45.5
11	T1	14	15.4	0.447	14.6	LOS B	3.3	28.0	0.90	1.02	46.0
12	R2	196	24.7	0.447	19.3	LOS B	3.3	28.0	0.90	1.02	45.4
Approach		219	23.1	0.447	18.7	LOS B	3.3	28.0	0.90	1.02	45.5
All Vehicles		2087	4.9	0.589	11.5	LOS A	5.4	39.1	0.80	0.87	50.1

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.

Roundabout Capacity Model: SIDRA Standard.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

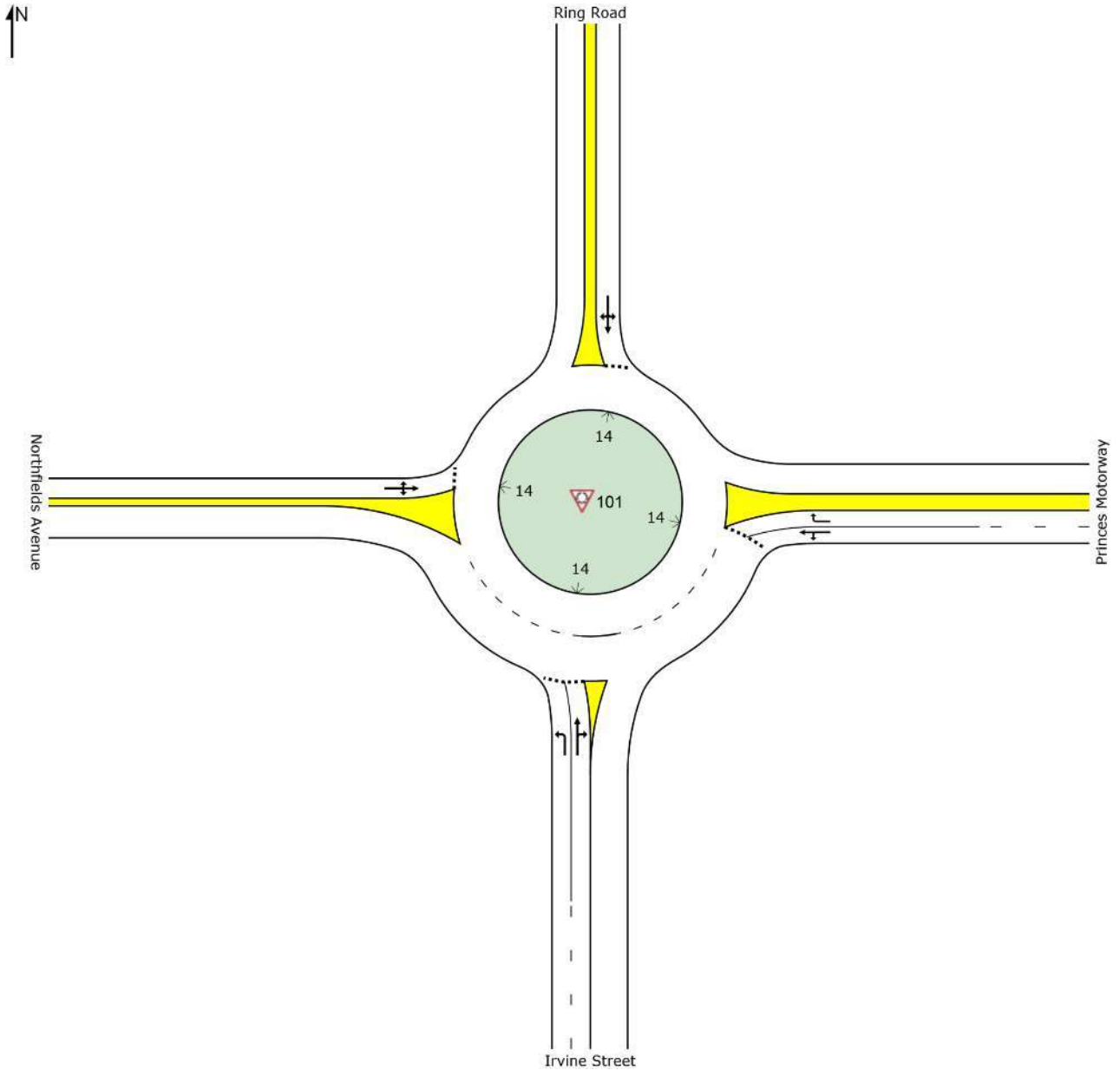
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

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

# SITE LAYOUT

 Site: 101 [Existing Northfields Ave & Irvine St PM]

New Site  
Roundabout



# MOVEMENT SUMMARY

 Site: 101 [Existing Northfields Ave & Irvine St PM]

New Site  
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Irvine Street											
1	L2	147	12.1	0.207	7.4	LOS A	1.0	8.0	0.57	0.72	51.7
2	T1	154	1.4	0.302	6.4	LOS A	1.7	12.1	0.58	0.70	52.4
3	R2	134	0.0	0.302	10.0	LOS A	1.7	12.1	0.58	0.70	52.2
Approach		435	4.6	0.302	7.9	LOS A	1.7	12.1	0.58	0.71	52.1
East: Princes Motorway											
4	L2	13	0.0	0.389	15.5	LOS B	2.9	21.5	0.96	1.00	46.6
5	T1	147	7.9	0.389	16.4	LOS B	2.9	21.5	0.96	1.00	47.2
6	R2	208	0.0	0.381	16.7	LOS B	3.1	21.4	0.98	0.94	47.0
Approach		368	3.1	0.389	16.6	LOS B	3.1	21.5	0.97	0.97	47.1
North: Ring Road											
7	L2	49	0.0	0.707	16.9	LOS B	8.2	57.7	1.00	1.17	46.1
8	T1	373	0.0	0.707	17.2	LOS B	8.2	57.7	1.00	1.17	46.9
9	R2	13	0.0	0.707	21.3	LOS B	8.2	57.7	1.00	1.17	46.7
Approach		435	0.0	0.707	17.3	LOS B	8.2	57.7	1.00	1.17	46.8
West: Northfields Avenue											
10	L2	33	0.0	0.837	19.7	LOS B	14.8	108.1	1.00	1.25	43.0
11	T1	116	0.9	0.837	19.8	LOS B	14.8	108.1	1.00	1.25	43.8
12	R2	527	5.8	0.837	24.2	LOS B	14.8	108.1	1.00	1.25	43.5
Approach		676	4.7	0.837	23.2	LOS B	14.8	108.1	1.00	1.25	43.5
All Vehicles		1914	3.3	0.837	17.1	LOS B	14.8	108.1	0.90	1.06	46.7

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.

Roundabout Capacity Model: SIDRA Standard.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

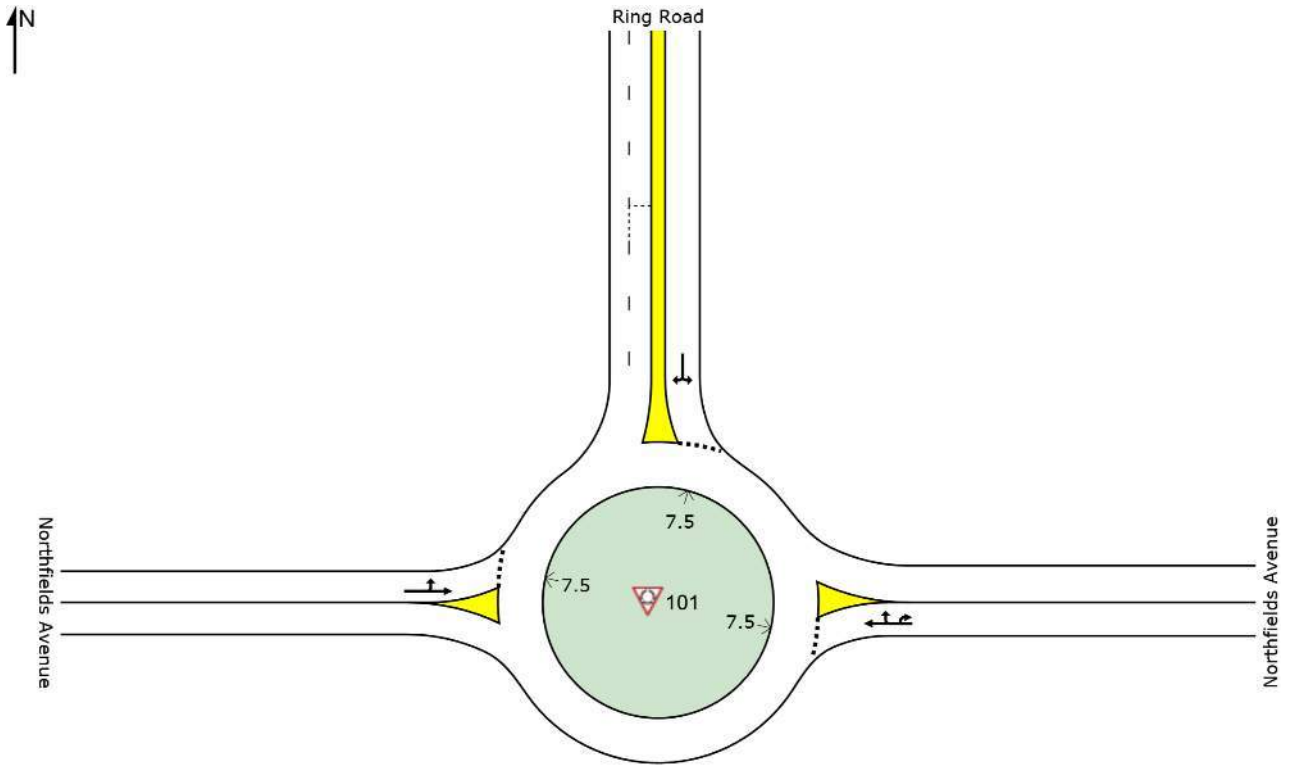
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

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

# SITE LAYOUT

 Site: 101 [Existing Northfields Ave & Ring Rd AM]

New Site  
Roundabout



# MOVEMENT SUMMARY

 Site: 101 [Existing Northfields Ave & Ring Rd AM]

New Site  
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h	
East: Northfields Avenue											
5	T1	148	4.3	0.576	4.6	LOS A	4.7	34.2	0.20	0.59	52.8
6	R2	686	0.5	0.576	8.6	LOS A	4.7	34.2	0.20	0.59	52.6
6u	U	57	63.0	0.576	11.3	LOS A	4.7	34.2	0.20	0.59	50.9
Approach		892	5.1	0.576	8.1	LOS A	4.7	34.2	0.20	0.59	52.5
North: Ring Road											
7	L2	120	7.9	0.127	4.9	LOS A	0.5	4.0	0.26	0.56	53.0
9	R2	35	0.0	0.127	8.9	LOS A	0.5	4.0	0.26	0.56	54.3
Approach		155	6.1	0.127	5.8	LOS A	0.5	4.0	0.26	0.56	53.3
West: Northfields Avenue											
10	L2	101	0.0	0.214	8.8	LOS A	1.2	8.9	0.71	0.78	51.3
11	T1	58	14.5	0.214	9.6	LOS A	1.2	8.9	0.71	0.78	52.0
Approach		159	5.3	0.214	9.1	LOS A	1.2	8.9	0.71	0.78	51.5
All Vehicles		1205	5.2	0.576	7.9	LOS A	4.7	34.2	0.28	0.61	52.5

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.

Roundabout Capacity Model: SIDRA Standard.

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.

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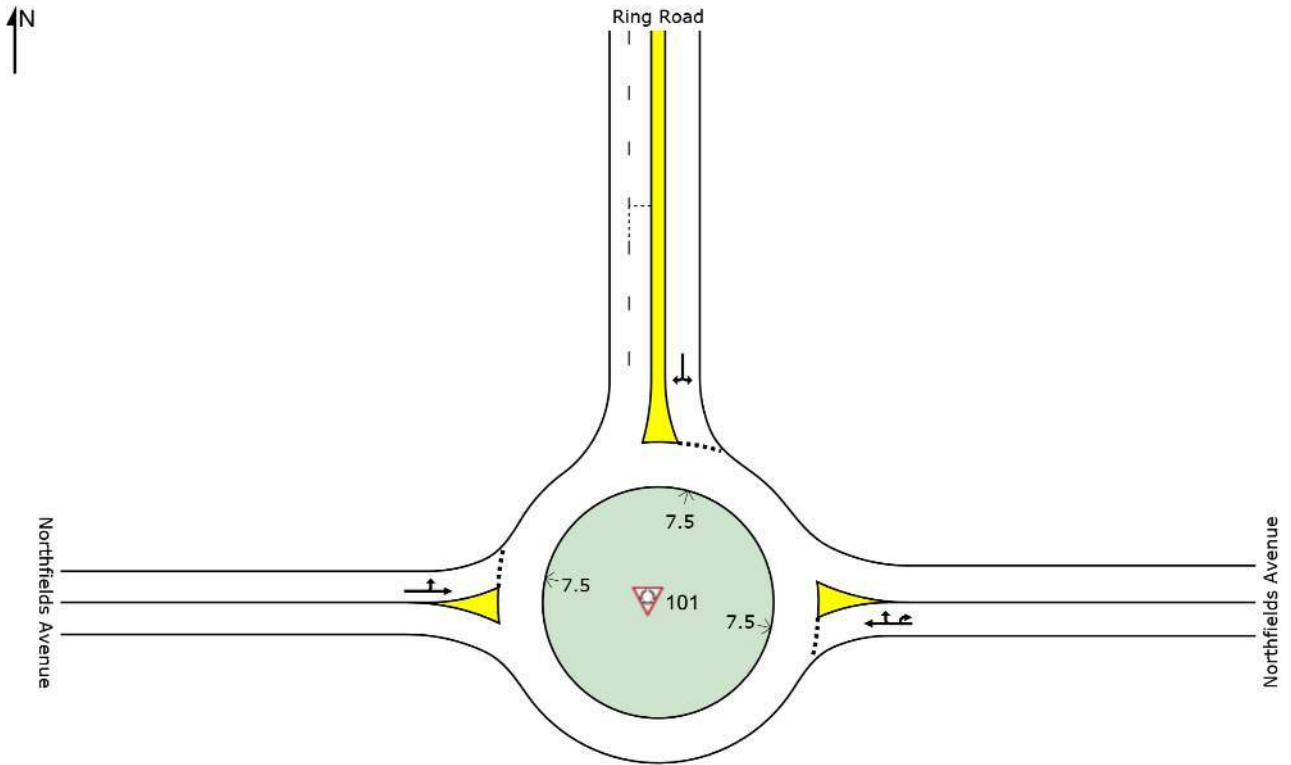
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# SITE LAYOUT

 Site: 101 [Existing Northfields Ave & Ring Rd PM]

New Site  
Roundabout



# MOVEMENT SUMMARY

 Site: 101 [Existing Northfields Ave & Ring Rd PM]

New Site  
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Northfields Avenue											
5	T1	85	6.2	0.261	4.8	LOS A	1.4	10.6	0.25	0.60	52.7
6	R2	197	0.5	0.261	8.8	LOS A	1.4	10.6	0.25	0.60	52.6
6u	U	59	42.9	0.261	11.3	LOS A	1.4	10.6	0.25	0.60	51.7
Approach		341	9.3	0.261	8.2	LOS A	1.4	10.6	0.25	0.60	52.5
North: Ring Road											
7	L2	489	0.6	0.467	5.4	LOS A	2.9	20.2	0.45	0.62	53.0
9	R2	88	0.0	0.467	9.5	LOS A	2.9	20.2	0.45	0.62	54.0
Approach		578	0.5	0.467	6.1	LOS A	2.9	20.2	0.45	0.62	53.1
West: Northfields Avenue											
10	L2	45	0.0	0.181	5.5	LOS A	0.9	6.5	0.42	0.56	53.1
11	T1	152	3.5	0.181	5.8	LOS A	0.9	6.5	0.42	0.56	54.2
Approach		197	2.7	0.181	5.7	LOS A	0.9	6.5	0.42	0.56	53.9
All Vehicles		1116	3.6	0.467	6.7	LOS A	2.9	20.2	0.38	0.60	53.1

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.

Roundabout Capacity Model: SIDRA Standard.

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.

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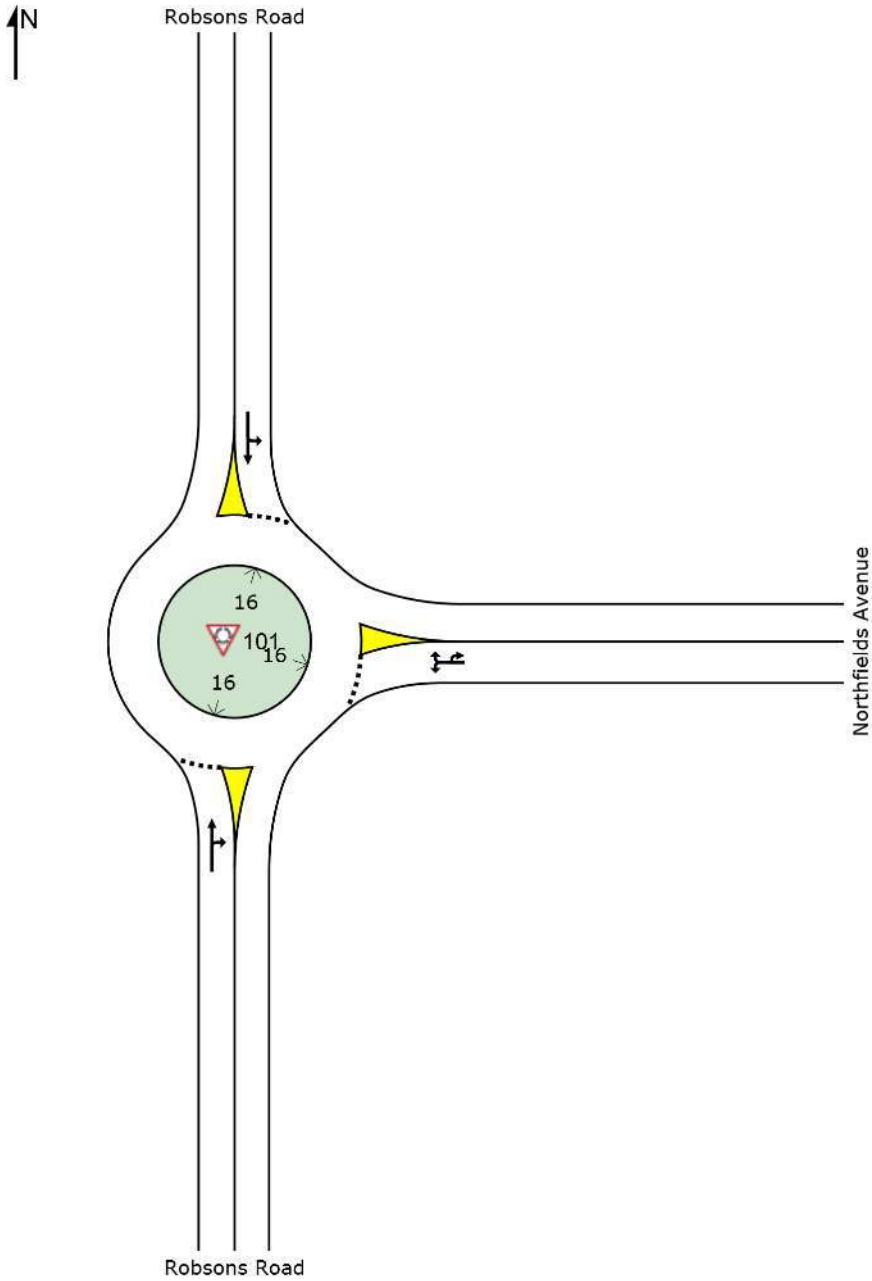
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# SITE LAYOUT

 Site: 101 [Existing Northfields Ave & Robsons Rd AM]

New Site  
Roundabout



# MOVEMENT SUMMARY

 Site: 101 [Existing Northfields Ave & Robsons Rd AM]

New Site  
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back Vehicles veh	of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Robsons Road											
2	T1	181	0.0	0.245	4.6	LOS A	1.2	8.6	0.22	0.54	54.0
3	R2	136	1.6	0.245	8.8	LOS A	1.2	8.6	0.22	0.54	53.7
Approach		317	0.7	0.245	6.4	LOS A	1.2	8.6	0.22	0.54	53.9
East: Northfields Avenue											
4	L2	94	4.5	0.140	4.5	LOS A	0.5	3.9	0.16	0.57	52.8
6	R2	73	4.3	0.140	8.7	LOS A	0.5	3.9	0.16	0.57	53.8
6u	U	5	40.0	0.140	11.1	LOS A	0.5	3.9	0.16	0.57	53.1
Approach		172	5.5	0.140	6.5	LOS A	0.5	3.9	0.16	0.57	53.3
North: Robsons Road											
7	L2	22	4.8	0.075	4.8	LOS A	0.3	2.3	0.27	0.47	53.7
8	T1	67	1.6	0.075	4.9	LOS A	0.3	2.3	0.27	0.47	55.0
Approach		89	2.4	0.075	4.8	LOS A	0.3	2.3	0.27	0.47	54.7
All Vehicles		578	2.4	0.245	6.2	LOS A	1.2	8.6	0.21	0.54	53.8

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.

Roundabout Capacity Model: SIDRA Standard.

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.

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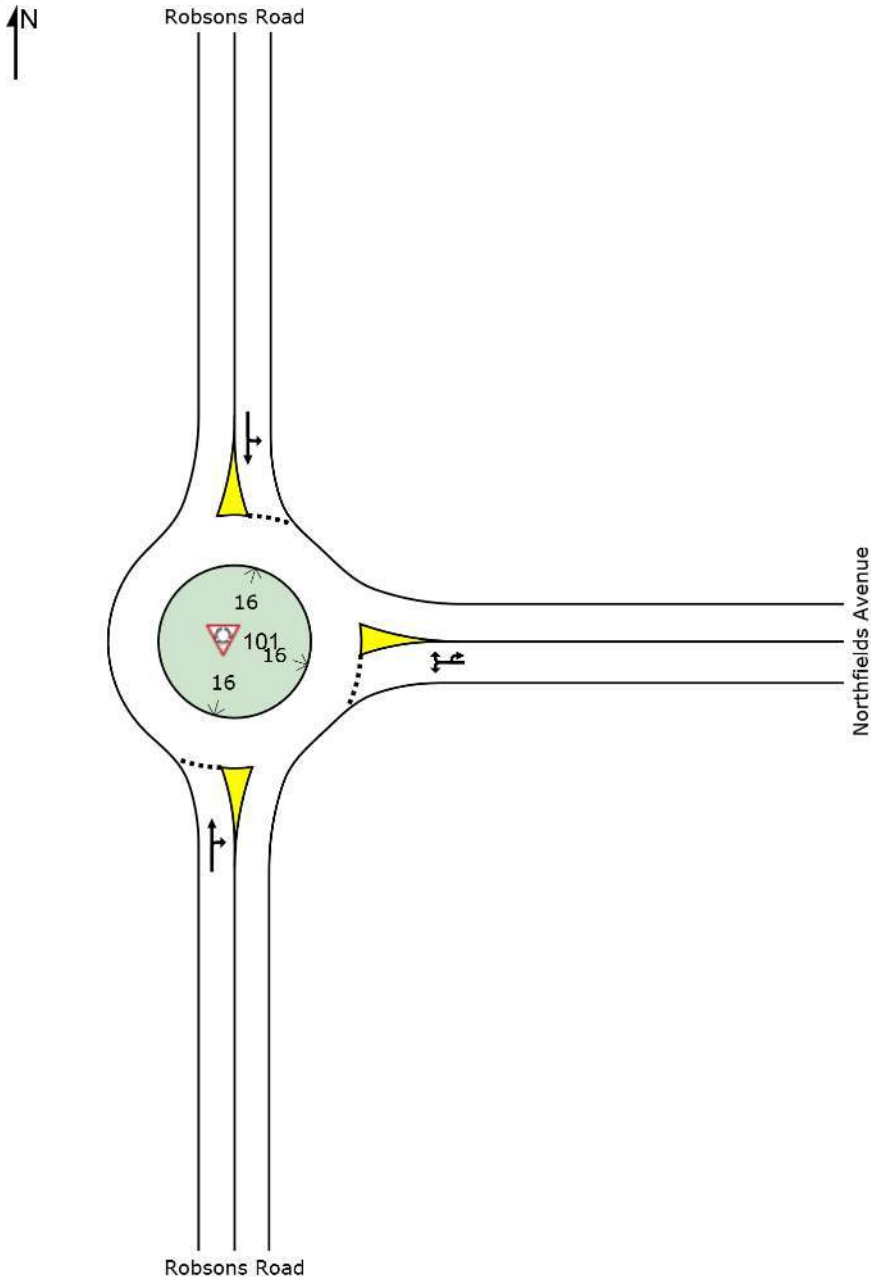
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# SITE LAYOUT

 Site: 101 [Existing Northfields Ave & Robsons Rd PM]

New Site  
Roundabout



# MOVEMENT SUMMARY

 Site: 101 [Existing Northfields Ave & Robsons Rd PM]

New Site  
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows 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: Robsons Road											
2	T1	61	0.0	0.119	4.4	LOS A	0.5	3.9	0.13	0.57	53.8
3	R2	97	5.4	0.119	8.6	LOS A	0.5	3.9	0.13	0.57	53.4
Approach		158	3.3	0.119	7.0	LOS A	0.5	3.9	0.13	0.57	53.5
East: Northfields Avenue											
4	L2	145	2.9	0.164	4.8	LOS A	0.6	4.6	0.27	0.57	53.3
6	R2	23	4.5	0.164	9.1	LOS A	0.6	4.6	0.27	0.57	54.2
6u	U	13	8.3	0.164	11.0	LOS A	0.6	4.6	0.27	0.57	54.9
Approach		181	3.5	0.164	5.8	LOS A	0.6	4.6	0.27	0.57	53.5
North: Robsons Road											
7	L2	72	0.0	0.182	4.6	LOS A	0.8	5.9	0.25	0.47	54.0
8	T1	161	0.0	0.182	4.8	LOS A	0.8	5.9	0.25	0.47	55.1
Approach		233	0.0	0.182	4.7	LOS A	0.8	5.9	0.25	0.47	54.8
All Vehicles		572	2.0	0.182	5.7	LOS A	0.8	5.9	0.22	0.53	54.0

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.

Roundabout Capacity Model: SIDRA Standard.

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.

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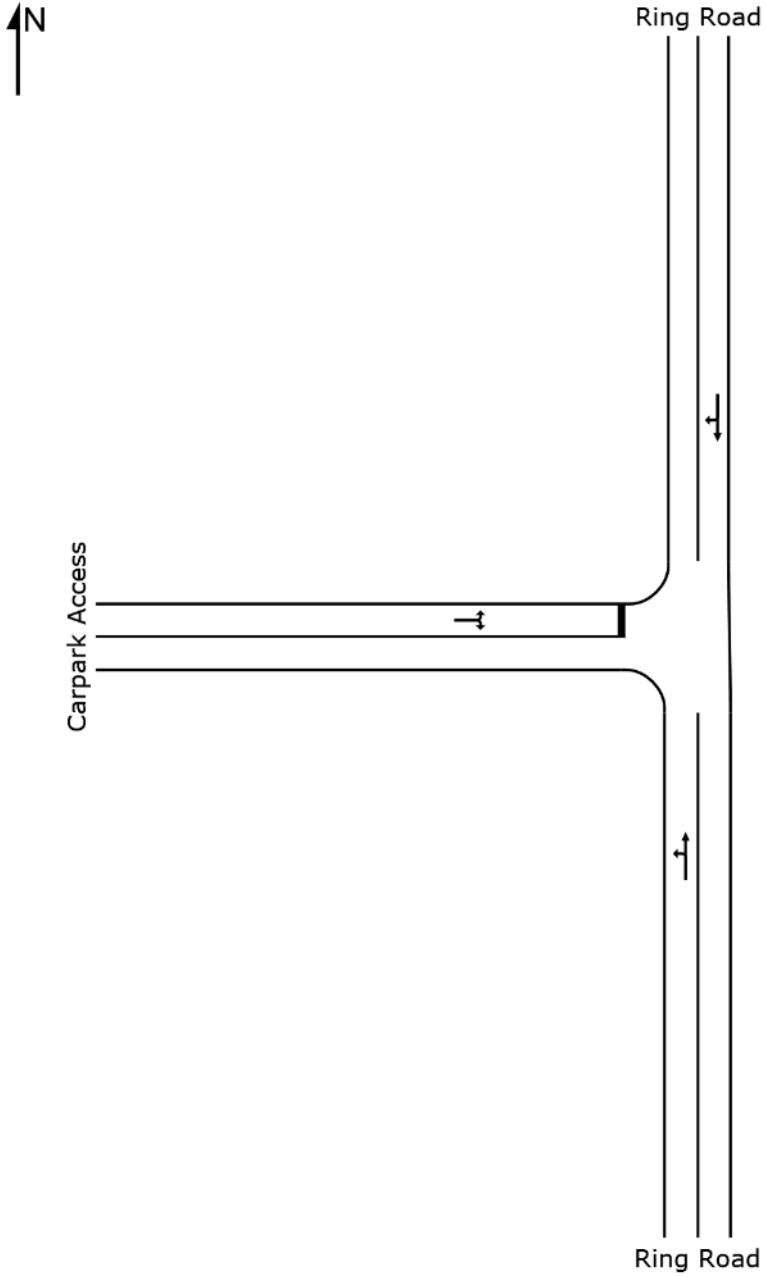
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# SITE LAYOUT

 Site: 101 [Existing Ring Road & Carpark Access AM]

New Site  
Stop (Two-Way)



# MOVEMENT SUMMARY

 Site: 101 [Existing Ring Road & Carpark Access AM]

New Site  
Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows		Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
		Total veh/h	HV %				Vehicles veh	Distance m			
South: Ring Road											
1	L2	282	0.0	0.183	5.6	LOS A	0.0	0.0	0.00	0.48	54.4
2	T1	62	3.4	0.183	0.0	LOS A	0.0	0.0	0.00	0.48	52.3
Approach		344	0.6	0.183	4.6	NA	0.0	0.0	0.00	0.48	54.2
North: Ring Road											
8	T1	55	15.4	0.061	0.8	LOS A	0.3	1.9	0.33	0.24	56.7
9	R2	39	0.0	0.061	3.0	LOS A	0.3	1.9	0.33	0.24	52.9
Approach		94	9.0	0.061	1.7	NA	0.3	1.9	0.33	0.24	55.1
West: Carpark Access											
10	L2	60	1.8	0.074	8.3	LOS A	0.3	2.0	0.15	0.92	29.3
12	R2	25	0.0	0.074	9.0	LOS A	0.3	2.0	0.15	0.92	51.2
Approach		85	1.2	0.074	8.5	LOS A	0.3	2.0	0.15	0.92	36.3
All Vehicles		523	2.2	0.183	4.7	NA	0.3	2.0	0.08	0.51	50.9

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.

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.

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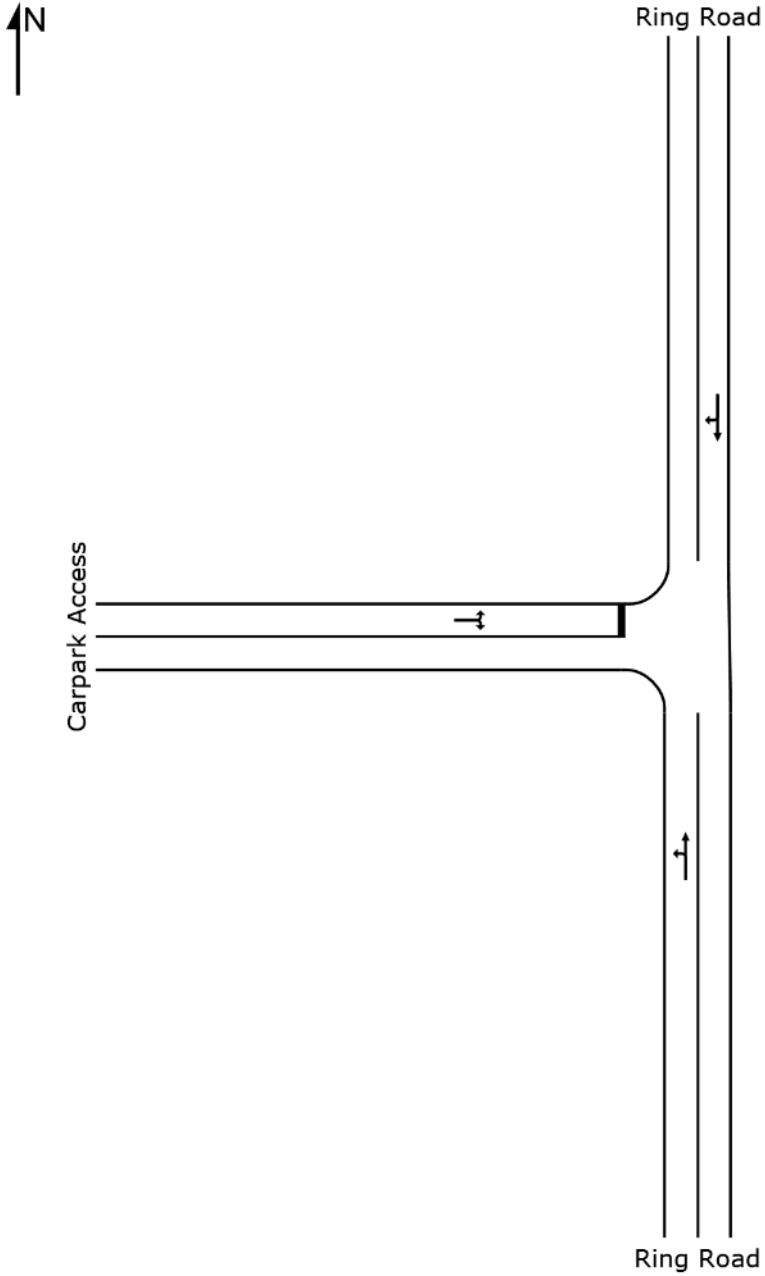
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# SITE LAYOUT

 Site: 101 [Existing Ring Road & Carpark Access PM]

New Site  
Stop (Two-Way)



# MOVEMENT SUMMARY

 Site: 101 [Existing Ring Road & Carpark Access PM]

New Site  
Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Ring Road											
1	L2	37	0.0	0.037	5.5	LOS A	0.0	0.0	0.00	0.30	55.8
2	T1	35	0.0	0.037	0.0	LOS A	0.0	0.0	0.00	0.30	55.0
Approach		72	0.0	0.037	2.9	NA	0.0	0.0	0.00	0.30	55.5
North: Ring Road											
8	T1	86	2.4	0.085	0.1	LOS A	0.3	2.4	0.14	0.21	58.1
9	R2	66	0.0	0.085	2.0	LOS A	0.3	2.4	0.14	0.21	54.1
Approach		153	1.4	0.085	1.0	NA	0.3	2.4	0.14	0.21	56.3
West: Carpark Access											
10	L2	38	0.0	0.139	8.2	LOS A	0.5	3.6	0.16	0.93	29.3
12	R2	106	0.0	0.139	8.6	LOS A	0.5	3.6	0.16	0.93	51.2
Approach		144	0.0	0.139	8.4	LOS A	0.5	3.6	0.16	0.93	45.9
All Vehicles		368	0.6	0.139	4.3	NA	0.5	3.6	0.12	0.51	50.6

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.

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).

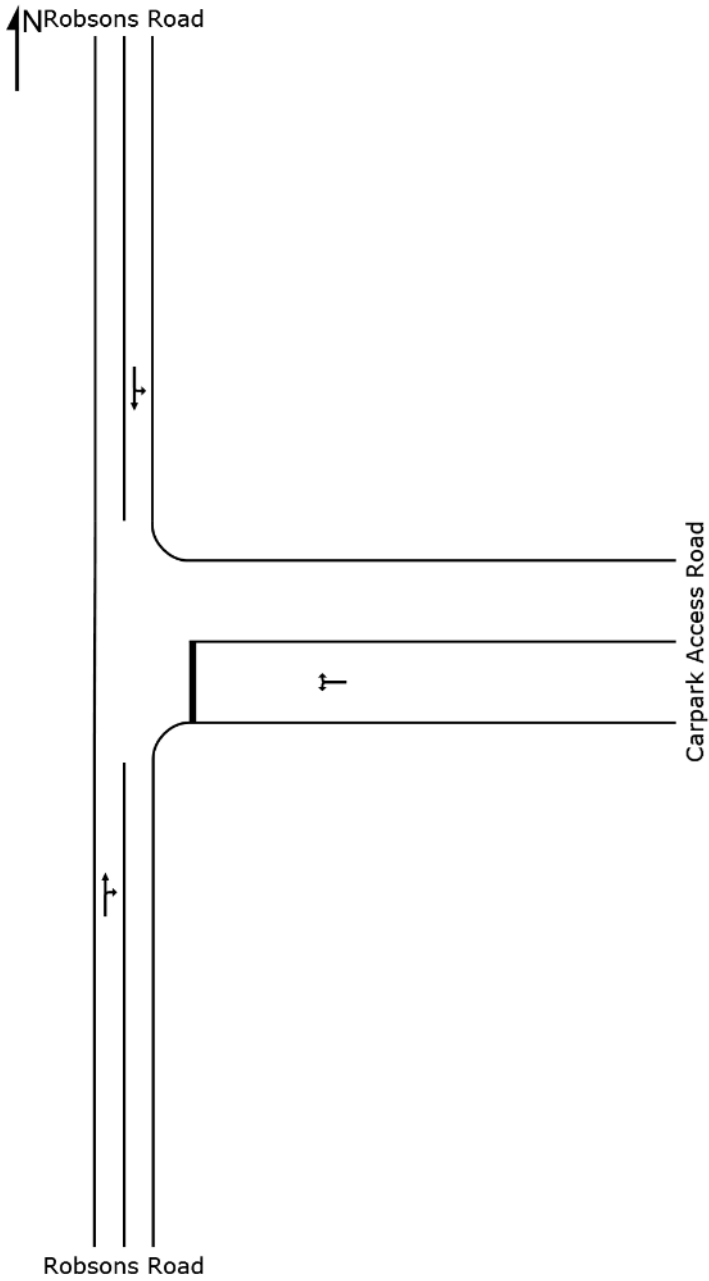
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

# SITE LAYOUT

 Site: 101 [Existing Robsons Rd & Carpark Access AM]

---

New Site  
Stop (Two-Way)



# MOVEMENT SUMMARY

 Site: 101 [Existing Robsons Rd & Carpark Access AM]

New Site  
Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Robsons Road											
2	T1	68	4.6	0.144	0.2	LOS A	0.7	5.2	0.17	0.39	55.6
3	R2	182	1.2	0.144	5.8	LOS A	0.7	5.2	0.17	0.39	54.5
Approach		251	2.1	0.144	4.3	NA	0.7	5.2	0.17	0.39	54.8
East: Carpark Access Road											
4	L2	21	0.0	0.021	8.0	LOS A	0.1	0.5	0.02	0.98	51.5
6	R2	5	0.0	0.021	9.6	LOS A	0.1	0.5	0.02	0.98	51.8
Approach		26	0.0	0.021	8.4	LOS A	0.1	0.5	0.02	0.98	51.6
North: Robsons Road											
7	L2	58	3.6	0.036	5.6	LOS A	0.0	0.0	0.00	0.51	54.0
8	T1	7	0.0	0.036	0.0	LOS A	0.0	0.0	0.00	0.51	55.5
Approach		65	3.2	0.036	5.0	NA	0.0	0.0	0.00	0.51	54.2
All Vehicles		342	2.2	0.144	4.7	NA	0.7	5.2	0.13	0.46	54.4

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.

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).

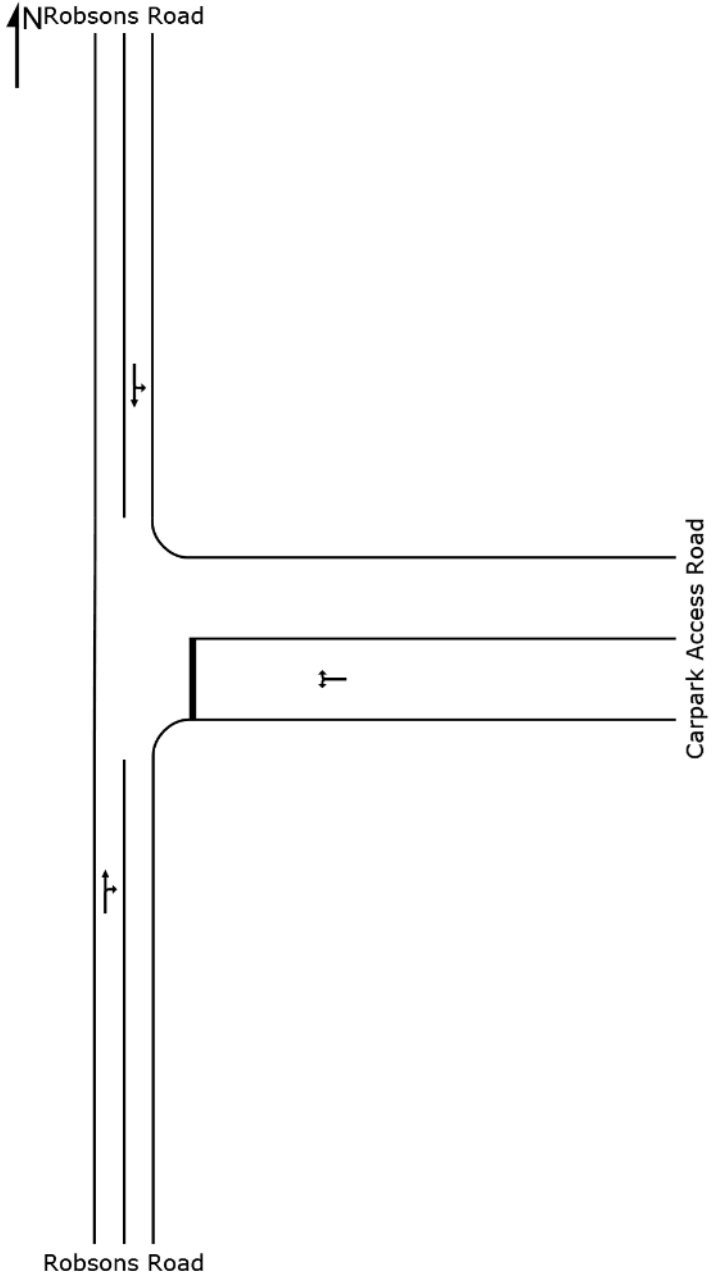
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

# SITE LAYOUT

 Site: 101 [Existing Robsons Rd & Carpark Access PM]

---

New Site  
Stop (Two-Way)



# MOVEMENT SUMMARY

 Site: 101 [Existing Robsons Rd & Carpark Access PM]

New Site  
Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Robsons Road											
2	T1	42	0.0	0.041	0.1	LOS A	0.2	1.1	0.13	0.24	57.2
3	R2	32	0.0	0.041	5.8	LOS A	0.2	1.1	0.13	0.24	56.1
Approach		74	0.0	0.041	2.5	NA	0.2	1.1	0.13	0.24	56.7
East: Carpark Access Road											
4	L2	144	0.0	0.106	8.0	LOS A	0.4	3.1	0.03	0.97	51.7
6	R2	5	0.0	0.106	8.8	LOS A	0.4	3.1	0.03	0.97	52.0
Approach		149	0.0	0.106	8.1	LOS A	0.4	3.1	0.03	0.97	51.8
North: Robsons Road											
7	L2	63	0.0	0.037	5.5	LOS A	0.0	0.0	0.00	0.53	54.0
8	T1	5	0.0	0.037	0.0	LOS A	0.0	0.0	0.00	0.53	55.3
Approach		68	0.0	0.037	5.1	NA	0.0	0.0	0.00	0.53	54.1
All Vehicles		292	0.0	0.106	6.0	NA	0.4	3.1	0.05	0.68	53.5

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.

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.

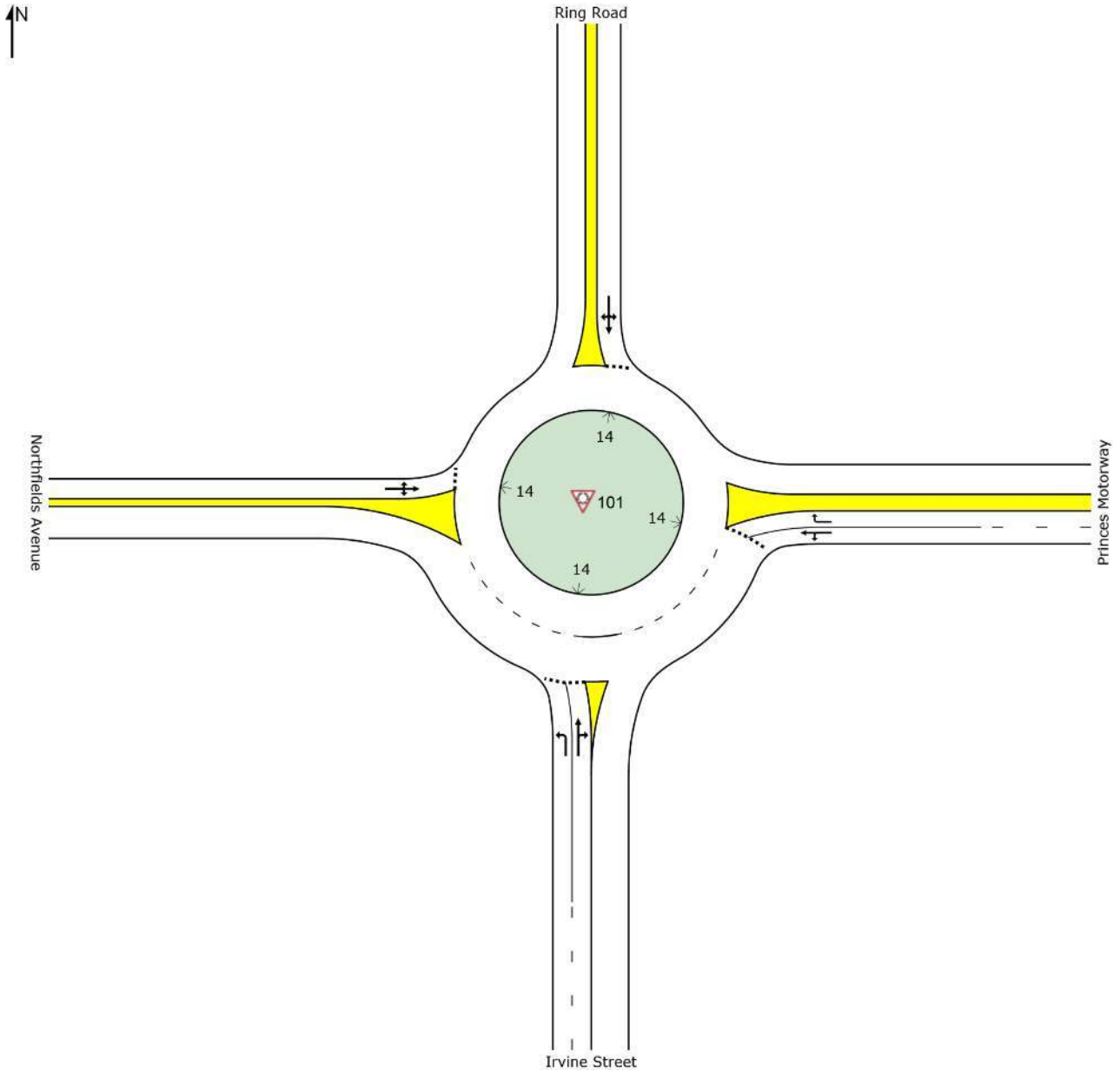
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

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

# SITE LAYOUT

 Site: 101 [Future Northfields Ave & Irvine St AM]

New Site  
Roundabout



# MOVEMENT SUMMARY

 Site: 101 [Future Northfields Ave & Irvine St AM]

New Site  
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back Vehicles veh	of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Irvine Street											
1	L2	401	6.0	0.685	13.2	LOS A	5.1	37.9	0.89	1.07	48.0
2	T1	277	0.8	0.658	13.3	LOS A	4.6	32.6	0.88	1.05	48.8
3	R2	73	1.4	0.658	17.0	LOS B	4.6	32.6	0.88	1.05	48.6
Approach		751	3.6	0.685	13.6	LOS A	5.1	37.9	0.89	1.06	48.3
East: Princes Motorway											
4	L2	9	22.2	0.547	9.5	LOS A	5.2	37.6	0.83	0.79	50.5
5	T1	512	4.1	0.547	9.0	LOS A	5.2	37.6	0.83	0.79	52.2
6	R2	513	0.2	0.579	13.8	LOS A	5.8	41.0	0.85	0.87	48.9
Approach		1034	2.3	0.579	11.3	LOS A	5.8	41.0	0.84	0.83	50.5
North: Ring Road											
7	L2	16	0.0	0.193	5.6	LOS A	1.1	7.9	0.52	0.59	52.8
8	T1	175	0.0	0.193	5.8	LOS A	1.1	7.9	0.52	0.59	53.9
9	R2	9	0.0	0.193	9.9	LOS A	1.1	7.9	0.52	0.59	53.6
Approach		200	0.0	0.193	6.0	LOS A	1.1	7.9	0.52	0.59	53.8
West: Northfields Avenue											
10	L2	9	0.0	0.490	15.2	LOS B	3.9	32.5	0.93	1.06	44.5
11	T1	15	14.3	0.490	16.3	LOS B	3.9	32.5	0.93	1.06	45.1
12	R2	204	23.7	0.490	21.1	LOS B	3.9	32.5	0.93	1.06	44.5
Approach		228	22.1	0.490	20.5	LOS B	3.9	32.5	0.93	1.06	44.5
All Vehicles		2213	4.6	0.685	12.6	LOS A	5.8	41.0	0.84	0.91	49.3

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.

Roundabout Capacity Model: SIDRA Standard.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

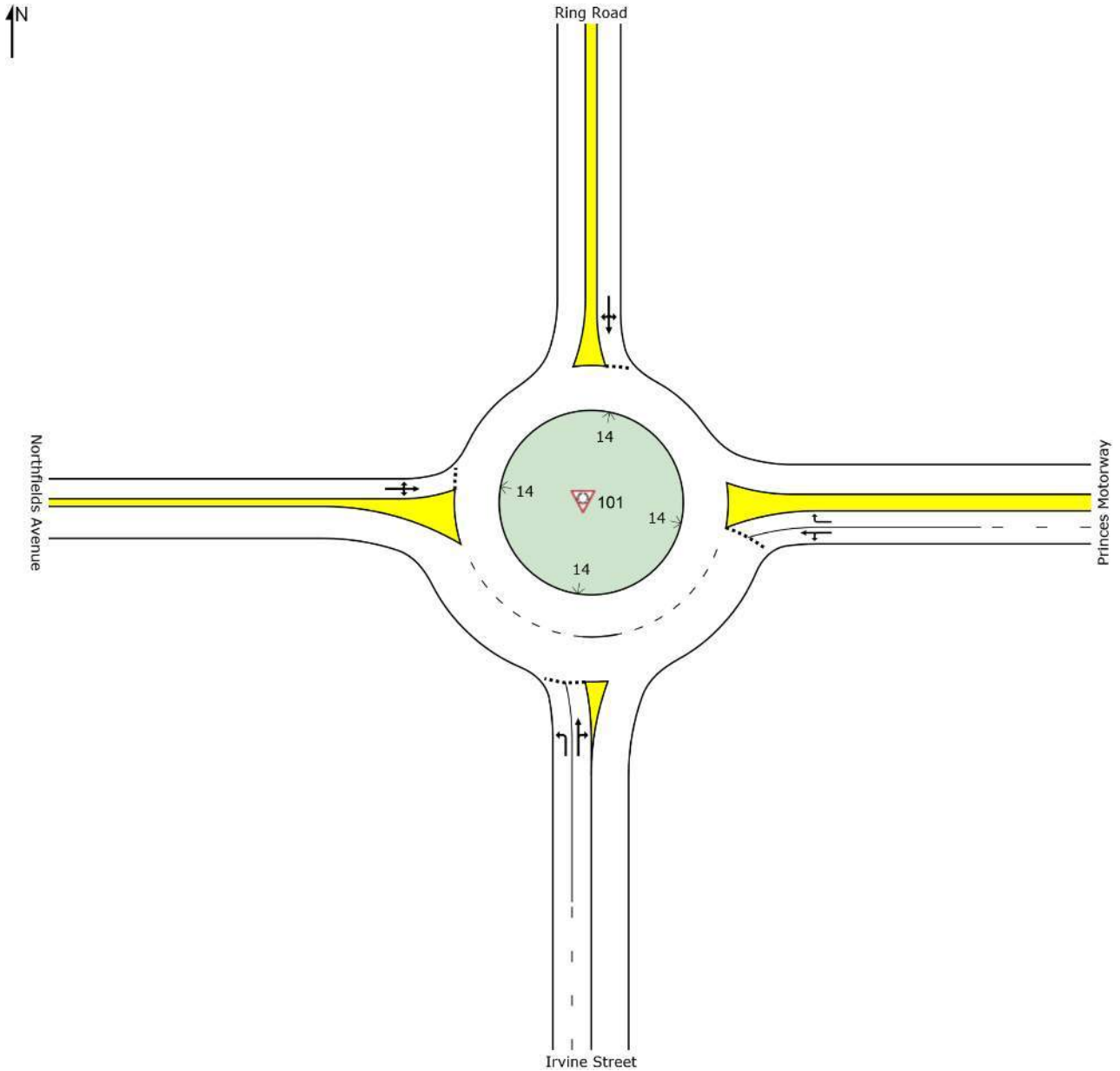
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

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

# SITE LAYOUT

 Site: 101 [Future Northfields Ave & Irvine St PM]

New Site  
Roundabout



# MOVEMENT SUMMARY

 Site: 101 [Future Northfields Ave & Irvine St PM]

New Site  
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Irvine Street											
1	L2	154	11.6	0.219	7.5	LOS A	1.1	8.5	0.58	0.73	51.7
2	T1	160	1.3	0.319	6.5	LOS A	1.8	12.9	0.60	0.71	52.3
3	R2	139	0.0	0.319	10.1	LOS A	1.8	12.9	0.60	0.71	52.2
Approach		453	4.4	0.319	7.9	LOS A	1.8	12.9	0.59	0.72	52.1
East: Princes Motorway											
4	L2	13	0.0	0.449	19.4	LOS B	3.6	26.7	0.99	1.06	44.3
5	T1	154	7.5	0.449	20.4	LOS B	3.6	26.7	0.99	1.06	44.9
6	R2	217	0.0	0.436	19.8	LOS B	3.8	26.8	1.00	1.01	45.3
Approach		383	3.0	0.449	20.0	LOS B	3.8	26.8	1.00	1.03	45.1
North: Ring Road											
7	L2	52	0.0	0.814	26.1	LOS B	11.8	82.7	1.00	1.32	41.4
8	T1	387	0.0	0.814	26.3	LOS B	11.8	82.7	1.00	1.32	42.0
9	R2	13	0.0	0.814	30.4	LOS C	11.8	82.7	1.00	1.32	41.8
Approach		452	0.0	0.814	26.4	LOS B	11.8	82.7	1.00	1.32	41.9
West: Northfields Avenue											
10	L2	34	0.0	0.933	33.0	LOS C	25.3	183.8	1.00	1.59	37.3
11	T1	131	0.8	0.933	33.2	LOS C	25.3	183.8	1.00	1.59	37.8
12	R2	579	5.3	0.933	37.5	LOS C	25.3	183.8	1.00	1.59	37.6
Approach		743	4.2	0.933	36.6	LOS C	25.3	183.8	1.00	1.59	37.7
All Vehicles		2031	3.1	0.933	24.8	LOS B	25.3	183.8	0.91	1.23	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.

Roundabout Capacity Model: SIDRA Standard.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

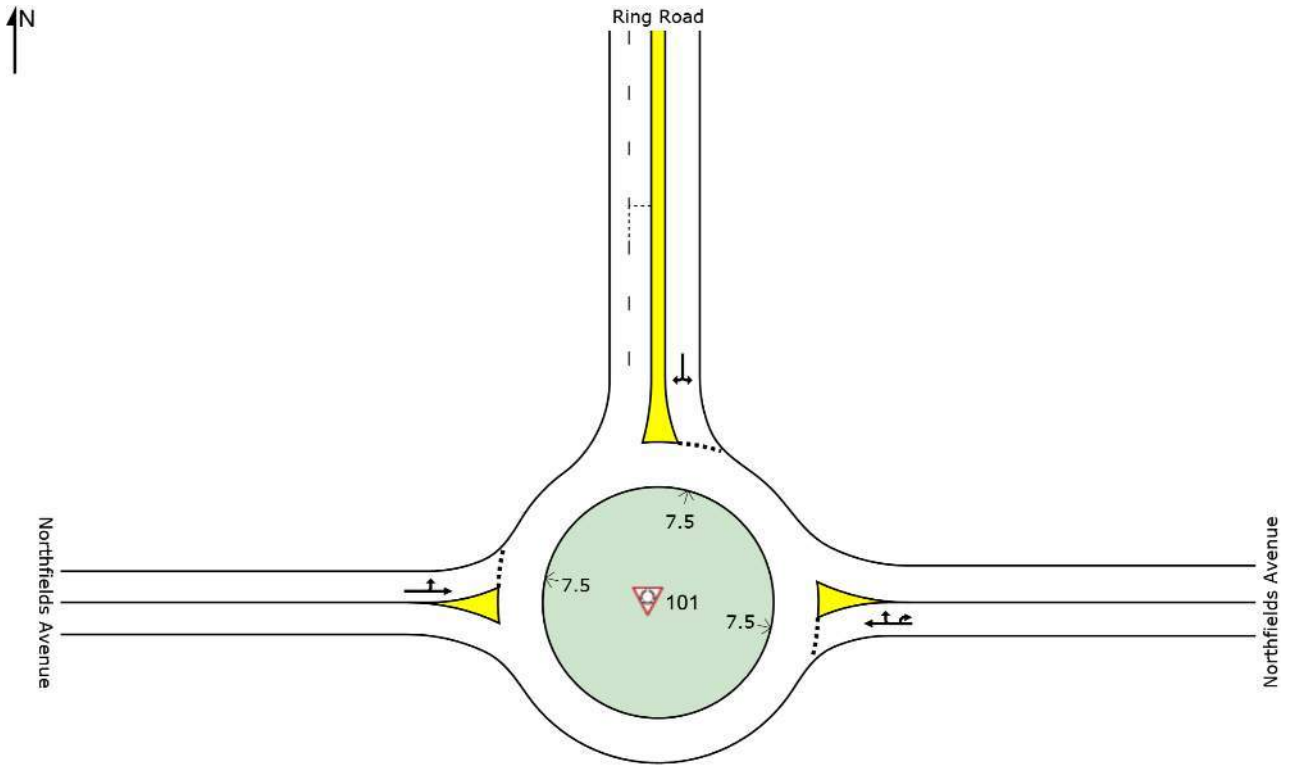
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

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

# SITE LAYOUT

 Site: 101 [Future Northfields Ave & Ring Rd AM]

New Site  
Roundabout



# MOVEMENT SUMMARY

 Site: 101 [Future Northfields Ave & Ring Rd AM]

New Site  
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h	
East: Northfields Avenue											
5	T1	175	3.6	0.624	4.6	LOS A	5.6	40.5	0.23	0.58	52.8
6	R2	735	0.4	0.624	8.6	LOS A	5.6	40.5	0.23	0.58	52.6
6u	U	59	60.7	0.624	11.4	LOS A	5.6	40.5	0.23	0.58	50.9
Approach		968	4.7	0.624	8.1	LOS A	5.6	40.5	0.23	0.58	52.5
North: Ring Road											
7	L2	125	7.6	0.132	4.9	LOS A	0.6	4.2	0.27	0.56	53.0
9	R2	36	0.0	0.132	8.9	LOS A	0.6	4.2	0.27	0.56	54.3
Approach		161	5.9	0.132	5.8	LOS A	0.6	4.2	0.27	0.56	53.3
West: Northfields Avenue											
10	L2	105	0.0	0.234	9.3	LOS A	1.4	10.0	0.74	0.81	50.9
11	T1	60	14.0	0.234	10.2	LOS A	1.4	10.0	0.74	0.81	51.6
Approach		165	5.1	0.234	9.6	LOS A	1.4	10.0	0.74	0.81	51.1
All Vehicles		1295	4.9	0.624	8.0	LOS A	5.6	40.5	0.30	0.61	52.4

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.

Roundabout Capacity Model: SIDRA Standard.

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.

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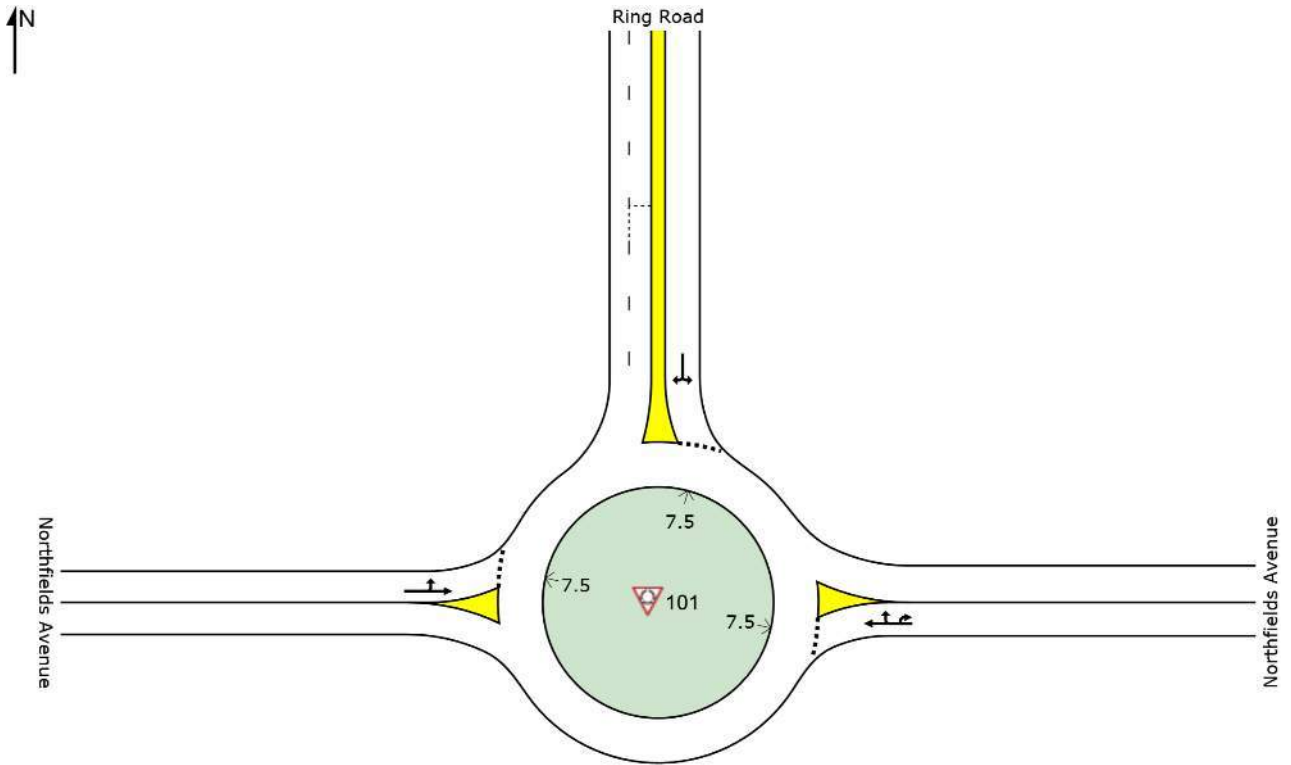
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# SITE LAYOUT

 Site: 101 [Future Northfields Ave & Ring Rd PM]

New Site  
Roundabout



# MOVEMENT SUMMARY

 Site: 101 [Future Northfields Ave & Ring Rd PM]

New Site  
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h	Distance m
East: Northfields Avenue											
5	T1	88	6.0	0.272	4.8	LOS A	1.5	11.4	0.26	0.60	52.7
6	R2	205	0.5	0.272	8.8	LOS A	1.5	11.4	0.26	0.60	52.6
6u	U	61	41.4	0.272	11.3	LOS A	1.5	11.4	0.26	0.60	51.7
Approach		355	8.9	0.272	8.2	LOS A	1.5	11.4	0.26	0.60	52.5
North: Ring Road											
7	L2	531	0.6	0.514	5.7	LOS A	3.3	23.5	0.51	0.64	52.8
9	R2	92	0.0	0.514	9.8	LOS A	3.3	23.5	0.51	0.64	53.8
Approach		622	0.5	0.514	6.3	LOS A	3.3	23.5	0.51	0.64	53.0
West: Northfields Avenue											
10	L2	47	0.0	0.208	5.6	LOS A	1.1	7.6	0.44	0.57	53.0
11	T1	178	3.0	0.208	5.9	LOS A	1.1	7.6	0.44	0.57	54.1
Approach		225	2.3	0.208	5.8	LOS A	1.1	7.6	0.44	0.57	53.9
All Vehicles		1202	3.3	0.514	6.8	LOS A	3.3	23.5	0.42	0.61	53.0

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.

Roundabout Capacity Model: SIDRA Standard.

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.

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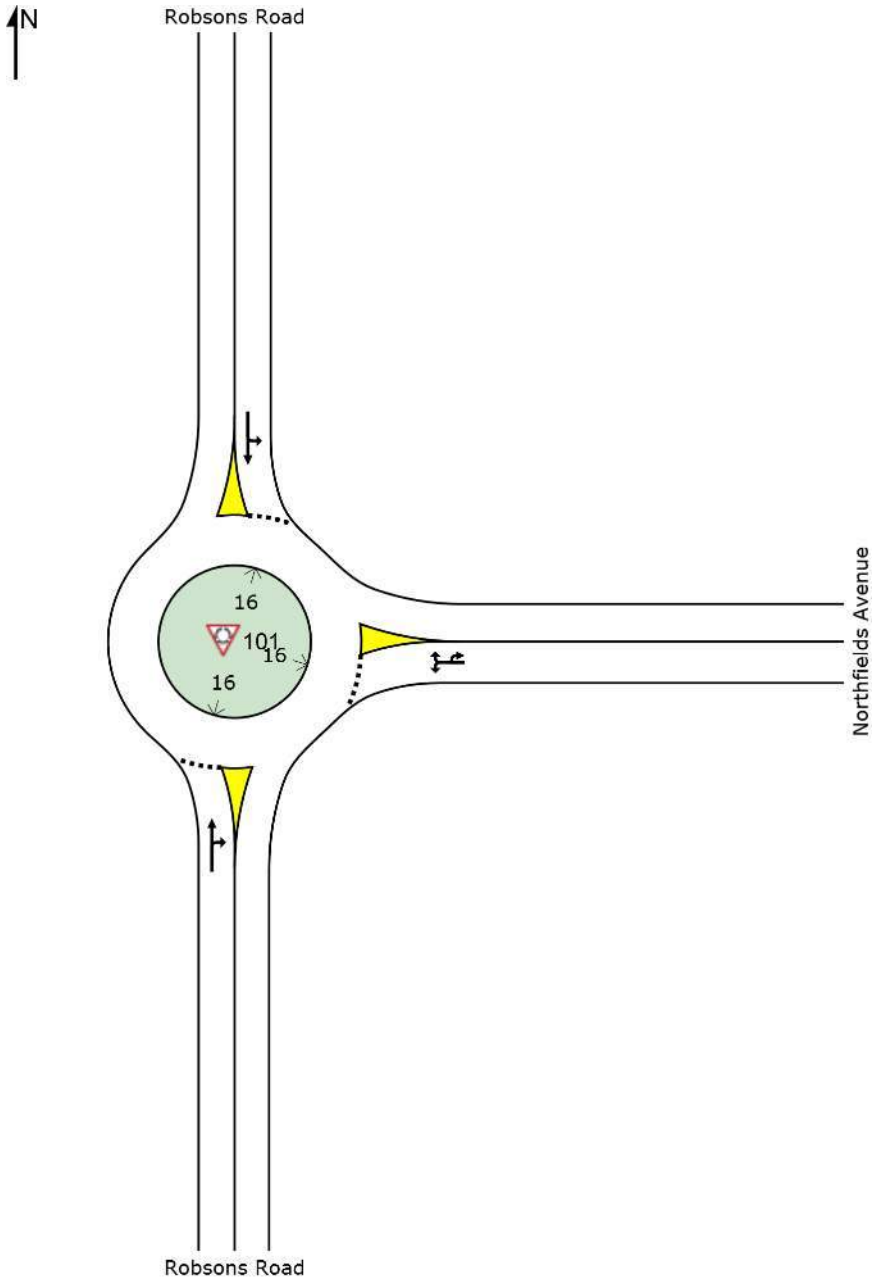
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# SITE LAYOUT

 Site: 101 [Future Northfields Ave & Robsons Rd AM]

New Site  
Roundabout



# MOVEMENT SUMMARY

 Site: 101 [Future Northfields Ave & Robsons Rd AM]

New Site  
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back Vehicles veh	of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Robsons Road											
2	T1	188	0.0	0.263	4.8	LOS A	1.3	9.4	0.26	0.55	53.9
3	R2	141	1.5	0.263	8.9	LOS A	1.3	9.4	0.26	0.55	53.6
Approach		329	0.6	0.263	6.5	LOS A	1.3	9.4	0.26	0.55	53.7
East: Northfields Avenue											
4	L2	98	4.3	0.161	4.5	LOS A	0.6	4.6	0.17	0.58	52.7
6	R2	96	3.3	0.161	8.7	LOS A	0.6	4.6	0.17	0.58	53.7
6u	U	5	40.0	0.161	11.1	LOS A	0.6	4.6	0.17	0.58	52.9
Approach		199	4.8	0.161	6.7	LOS A	0.6	4.6	0.17	0.58	53.1
North: Robsons Road											
7	L2	23	4.5	0.079	4.8	LOS A	0.3	2.5	0.28	0.48	53.7
8	T1	71	1.5	0.079	4.9	LOS A	0.3	2.5	0.28	0.48	55.0
Approach		94	2.2	0.079	4.9	LOS A	0.3	2.5	0.28	0.48	54.6
All Vehicles		622	2.2	0.263	6.3	LOS A	1.3	9.4	0.23	0.55	53.7

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.

Roundabout Capacity Model: SIDRA Standard.

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.

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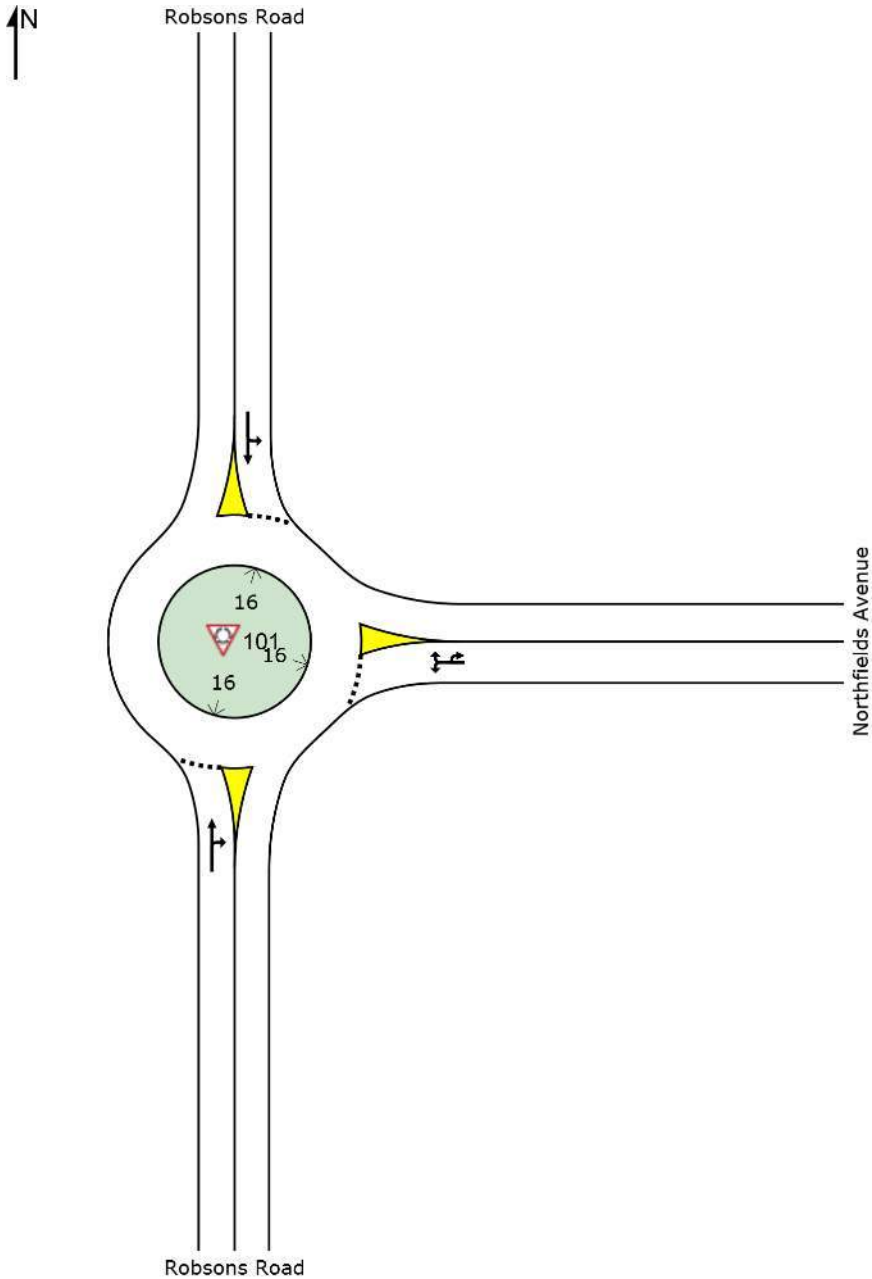
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# SITE LAYOUT

 Site: 101 [Future Northfields Ave & Robsons Rd PM]

New Site  
Roundabout



# MOVEMENT SUMMARY

 Site: 101 [Future Northfields Ave & Robsons Rd PM]

New Site  
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows 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: Robsons Road											
2	T1	63	0.0	0.124	4.4	LOS A	0.6	4.1	0.13	0.57	53.8
3	R2	101	5.2	0.124	8.6	LOS A	0.6	4.1	0.13	0.57	53.3
Approach		164	3.2	0.124	7.0	LOS A	0.6	4.1	0.13	0.57	53.5
East: Northfields Avenue											
4	L2	152	2.8	0.172	4.9	LOS A	0.7	4.9	0.28	0.57	53.3
6	R2	24	4.3	0.172	9.1	LOS A	0.7	4.9	0.28	0.57	54.2
6u	U	13	8.3	0.172	11.1	LOS A	0.7	4.9	0.28	0.57	54.8
Approach		188	3.4	0.172	5.8	LOS A	0.7	4.9	0.28	0.57	53.5
North: Robsons Road											
7	L2	95	0.0	0.205	4.6	LOS A	1.0	6.7	0.26	0.48	53.9
8	T1	167	0.0	0.205	4.8	LOS A	1.0	6.7	0.26	0.48	55.1
Approach		262	0.0	0.205	4.7	LOS A	1.0	6.7	0.26	0.48	54.7
All Vehicles		615	1.9	0.205	5.7	LOS A	1.0	6.7	0.23	0.53	54.0

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.

Roundabout Capacity Model: SIDRA Standard.

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.

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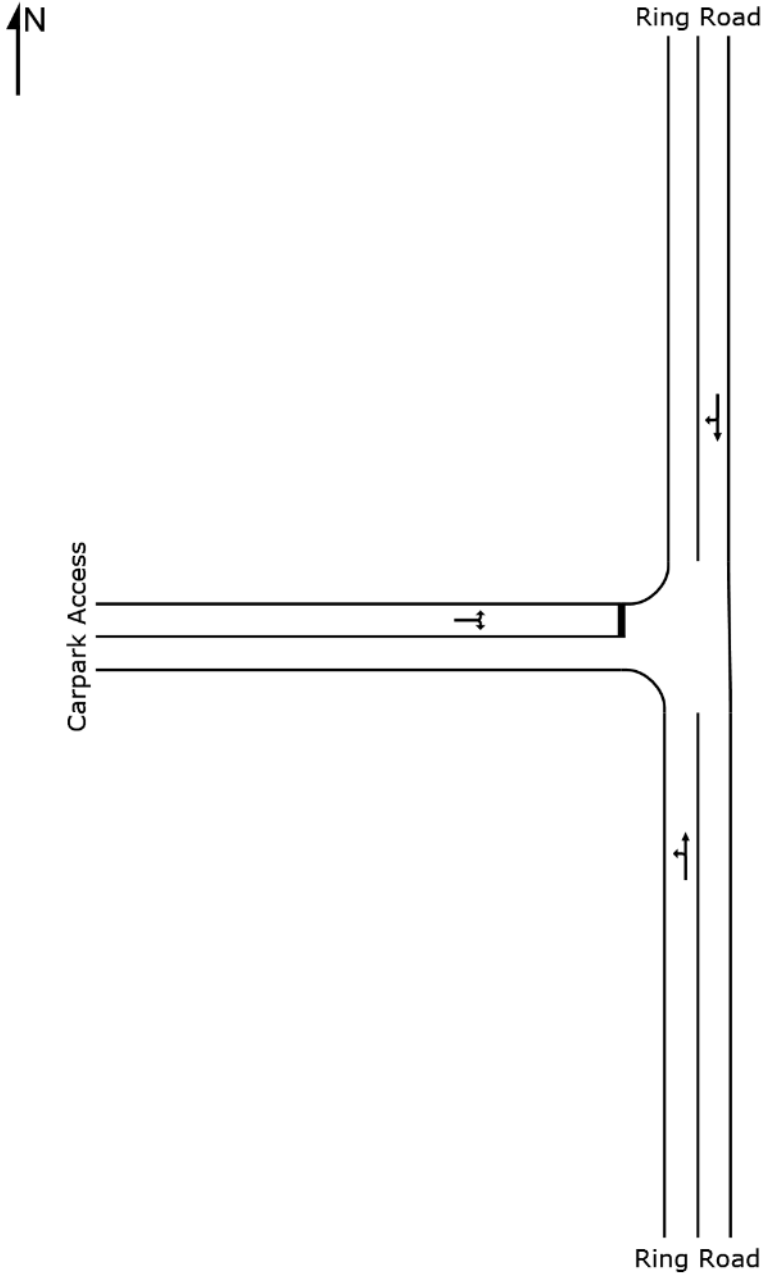
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# SITE LAYOUT

 Site: 101 [Future Ring Road & Carpark Access AM]

New Site  
Stop (Two-Way)



# MOVEMENT SUMMARY

 **Site: 101 [Future Ring Road & Carpark Access AM]**

New Site  
Stop (Two-Way)

Movement Performance - Vehicles												
Mov ID	OD Mov	Demand Flows		Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate per veh	Average Speed km/h	
		Total veh/h	HV %				Vehicles veh	Distance m				
South: Ring Road												
1	L2	315	0.0	0.201	5.6	LOS A	0.0	0.0	0.00	0.48	54.3	
2	T1	64	3.3	0.201	0.0	LOS A	0.0	0.0	0.00	0.48	52.2	
Approach		379	0.6	0.201	4.6	NA	0.0	0.0	0.00	0.48	54.1	
North: Ring Road												
8	T1	57	14.8	0.064	0.9	LOS A	0.3	2.0	0.35	0.24	56.5	
9	R2	40	0.0	0.064	3.2	LOS A	0.3	2.0	0.35	0.24	52.7	
Approach		97	8.7	0.064	1.8	NA	0.3	2.0	0.35	0.24	54.9	
West: Carpark Access												
10	L2	62	1.7	0.078	8.3	LOS A	0.3	2.1	0.16	0.92	29.3	
12	R2	26	0.0	0.078	9.2	LOS A	0.3	2.1	0.16	0.92	51.2	
Approach		88	1.2	0.078	8.6	LOS A	0.3	2.1	0.16	0.92	36.3	
All Vehicles		564	2.1	0.201	4.8	NA	0.3	2.1	0.08	0.51	51.0	

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.

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.

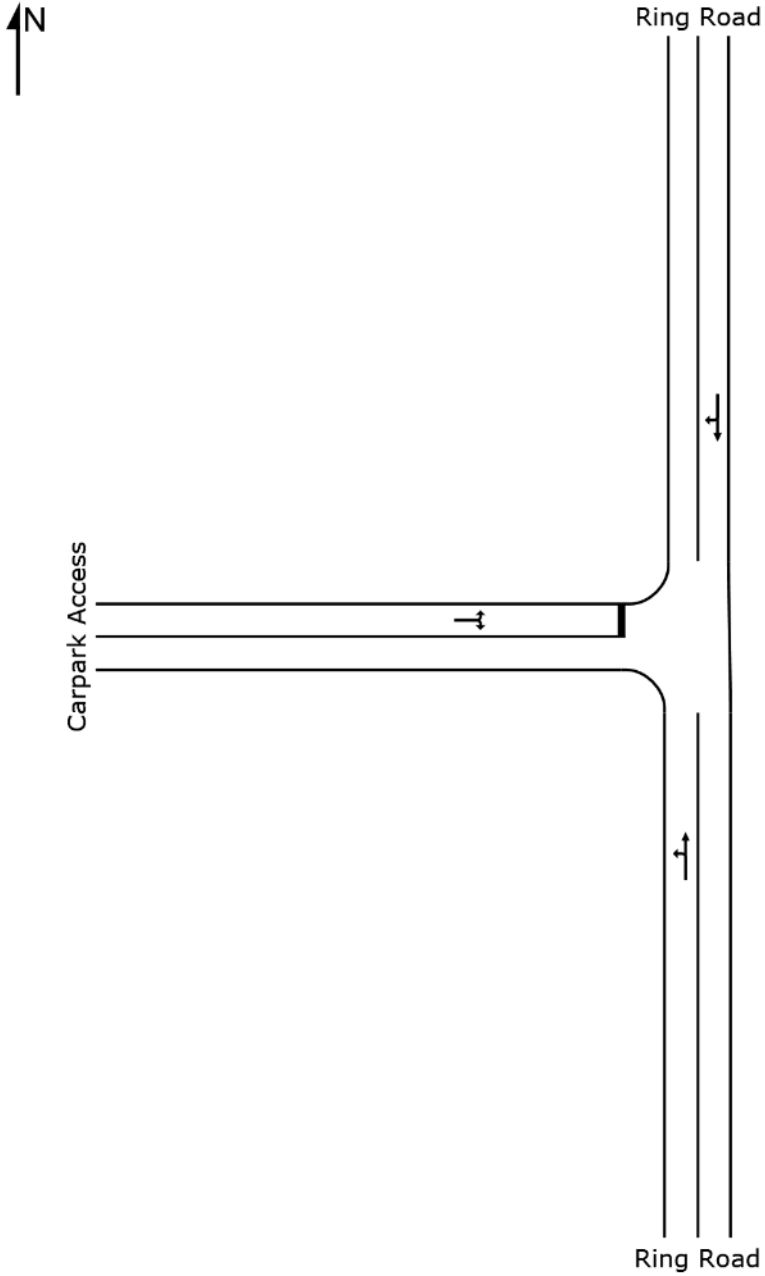
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

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

# SITE LAYOUT

 Site: 101 [Future Ring Road & Carpark Access PM]

New Site  
Stop (Two-Way)



# MOVEMENT SUMMARY

 Site: 101 [Future Ring Road & Carpark Access PM]

New Site  
Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Ring Road											
1	L2	38	0.0	0.038	5.5	LOS A	0.0	0.0	0.00	0.30	55.8
2	T1	36	0.0	0.038	0.0	LOS A	0.0	0.0	0.00	0.30	55.0
Approach		74	0.0	0.038	2.9	NA	0.0	0.0	0.00	0.30	55.5
North: Ring Road											
8	T1	89	2.4	0.089	0.1	LOS A	0.4	2.5	0.14	0.21	58.1
9	R2	69	0.0	0.089	2.0	LOS A	0.4	2.5	0.14	0.21	54.1
Approach		159	1.3	0.089	1.0	NA	0.4	2.5	0.14	0.21	56.3
West: Carpark Access											
10	L2	39	0.0	0.168	8.2	LOS A	0.6	4.4	0.18	0.93	29.2
12	R2	132	0.0	0.168	8.6	LOS A	0.6	4.4	0.18	0.93	51.2
Approach		171	0.0	0.168	8.5	LOS A	0.6	4.4	0.18	0.93	46.6
All Vehicles		403	0.5	0.168	4.5	NA	0.6	4.4	0.13	0.53	50.6

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.

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.

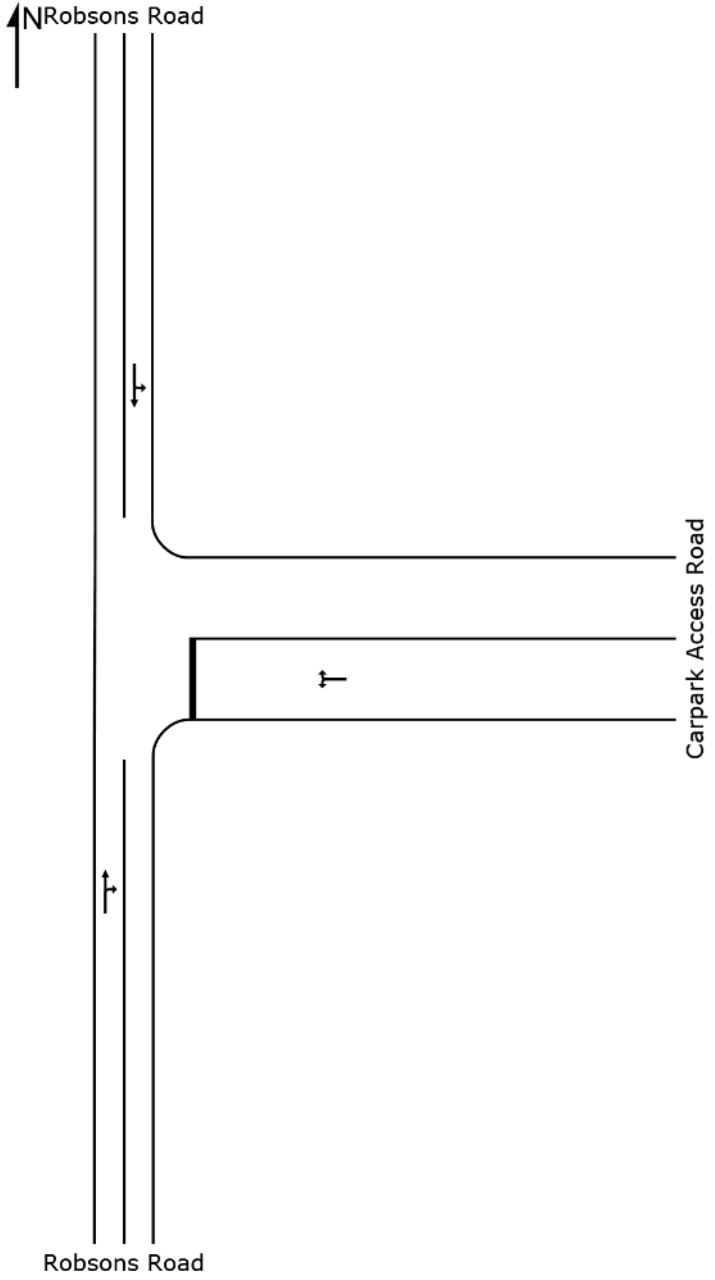
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

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

# SITE LAYOUT

 Site: 101 [Future Robsons Rd & Carpark Access AM]

New Site  
Stop (Two-Way)



# MOVEMENT SUMMARY

 Site: 101 [Future Robsons Rd & Carpark Access AM]

New Site  
Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Robsons Road											
2	T1	72	4.4	0.162	0.2	LOS A	0.8	6.0	0.18	0.40	55.5
3	R2	209	1.0	0.162	5.8	LOS A	0.8	6.0	0.18	0.40	54.4
Approach		281	1.9	0.162	4.4	NA	0.8	6.0	0.18	0.40	54.7
East: Carpark Access Road											
4	L2	22	0.0	0.022	8.0	LOS A	0.1	0.6	0.02	0.98	51.5
6	R2	5	0.0	0.022	9.8	LOS A	0.1	0.6	0.02	0.98	51.8
Approach		27	0.0	0.022	8.4	LOS A	0.1	0.6	0.02	0.98	51.6
North: Robsons Road											
7	L2	60	3.5	0.037	5.6	LOS A	0.0	0.0	0.00	0.52	54.0
8	T1	7	0.0	0.037	0.0	LOS A	0.0	0.0	0.00	0.52	55.5
Approach		67	3.1	0.037	5.0	NA	0.0	0.0	0.00	0.52	54.1
All Vehicles		376	2.0	0.162	4.8	NA	0.8	6.0	0.13	0.46	54.3

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.

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.

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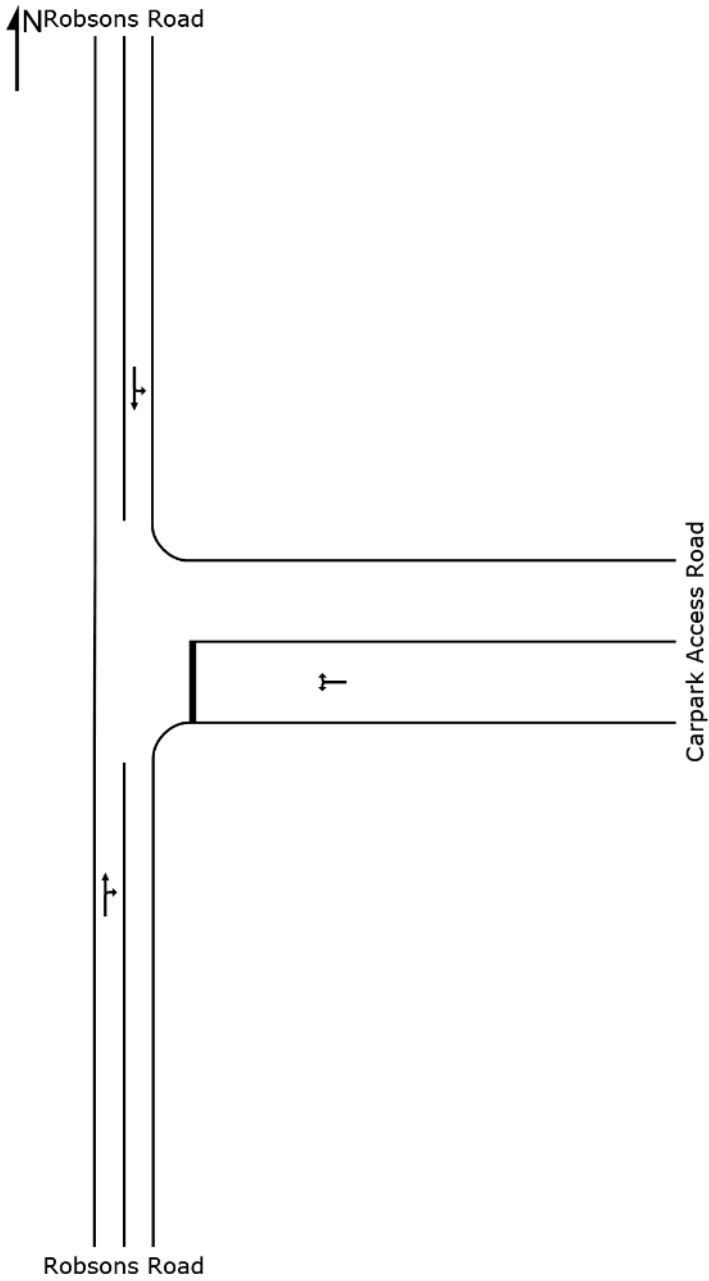
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# SITE LAYOUT

 Site: 101 [Future Robsons Rd & Carpark Access PM]

New Site  
Stop (Two-Way)



# MOVEMENT SUMMARY

 Site: 101 [Future Robsons Rd & Carpark Access PM]

New Site  
Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Robsons Road											
2	T1	44	0.0	0.042	0.1	LOS A	0.2	1.1	0.13	0.23	57.2
3	R2	33	0.0	0.042	5.8	LOS A	0.2	1.1	0.13	0.23	56.1
Approach		77	0.0	0.042	2.5	NA	0.2	1.1	0.13	0.23	56.7
East: Carpark Access Road											
4	L2	171	0.0	0.124	8.0	LOS A	0.5	3.7	0.03	0.97	51.7
6	R2	5	0.0	0.124	8.8	LOS A	0.5	3.7	0.03	0.97	52.0
Approach		176	0.0	0.124	8.1	LOS A	0.5	3.7	0.03	0.97	51.8
North: Robsons Road											
7	L2	65	0.0	0.038	5.5	LOS A	0.0	0.0	0.00	0.54	54.0
8	T1	5	0.0	0.038	0.0	LOS A	0.0	0.0	0.00	0.54	55.3
Approach		71	0.0	0.038	5.1	NA	0.0	0.0	0.00	0.54	54.1
All Vehicles		323	0.0	0.124	6.1	NA	0.5	3.7	0.05	0.70	53.4

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.

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.

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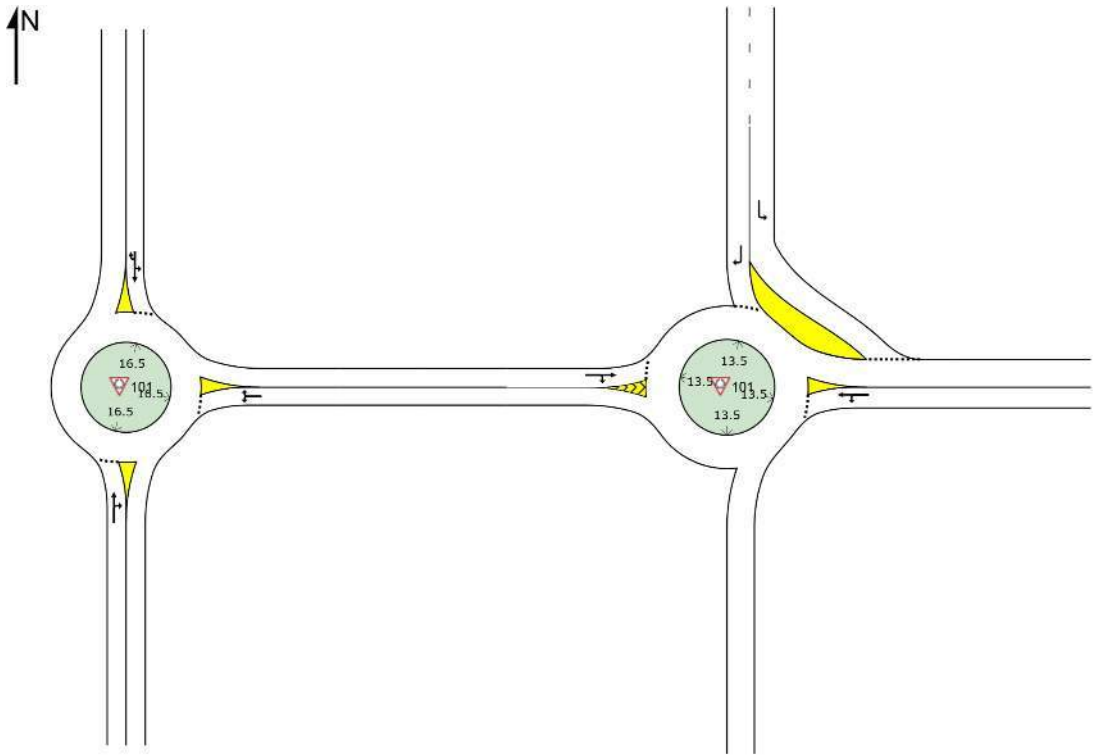
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# NETWORK LAYOUT

Network: N101 [Existing Irvine St, University Ave & Princes Mty AM]

New Network



SITES IN NETWORK	
Site ID	Site Name
▽101	Existing Irvine St & University Ave AM
▽101	Existing Princes Mty & University Ave AM

# MOVEMENT SUMMARY

 Site: 101 [Existing Irvine St & University Ave AM]

 Network: N101 [Existing Irvine St, University Ave & Princes Mty AM]

New Site  
Roundabout

Movement Performance - Vehicles													
Mov ID	OD Mov	Demand Flows Total	Flows HV %	Arrival Flows Total	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles	Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Irvine Street													
2	T1	99	4.3	99	4.3	0.387	8.3	LOS A	2.8	20.2	0.83	0.86	50.9
3	R2	186	2.8	186	2.8	0.387	12.5	LOS A	2.8	20.2	0.83	0.86	44.5
Approach		285	3.3	285	3.3	0.387	11.1	LOS A	2.8	20.2	0.83	0.86	47.5
East: University Avenue													
4	L2	204	0.5	204	0.5	0.751	8.4	LOS A	10.3	74.1	0.87	0.81	44.5
6	R2	619	3.6	619	3.6	0.751	13.2	LOS A	10.3	74.1	0.87	0.81	45.4
Approach		823	2.8	823	2.8	0.751	12.0	LOS A	10.3	74.1	0.87	0.81	45.2
North: Irvine Street													
7	L2	502	9.2	502	9.2	0.661	6.0	LOS A	7.1	52.4	0.72	0.63	48.5
8	T1	257	2.9	257	2.9	0.661	6.0	LOS A	7.1	52.4	0.72	0.63	53.7
9u	U	11	10.0	11	10.0	0.661	12.4	LOS A	7.1	52.4	0.72	0.63	54.0
Approach		769	7.1	769	7.1	0.661	6.1	LOS A	7.1	52.4	0.72	0.63	51.0
All Vehicles		1878	4.7	1878	4.7	0.751	9.4	LOS A	10.3	74.1	0.80	0.74	47.9

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

Roundabout Capacity Model: SIDRA Standard.

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.

Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 0.0 %

Number of Iterations: 5 (maximum specified: 10)

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# MOVEMENT SUMMARY

 Site: 101 [Existing Princes Mty & University Ave AM]

 Network: N101 [Existing Irvine St, University Ave & Princes Mty AM]

New Site  
Roundabout

Movement Performance - Vehicles													
Mov ID	OD Mov	Demand Flows Total	Flows HV %	Arrival Flows Total	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles	Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: University Avenue													
4	L2	99	2.1	99	2.1	0.511	9.8	LOS A	4.0	29.8	0.83	0.92	50.4
5	T1	276	8.0	276	8.0	0.511	10.3	LOS A	4.0	29.8	0.83	0.92	45.4
Approach		375	6.5	375	6.5	0.511	10.1	LOS A	4.0	29.8	0.83	0.92	47.4
North: Princes Motorway Off Ramp													
7	L2	227	3.7	227	3.7	0.249	7.2	LOS A	1.2	8.7	0.56	0.72	52.4
9	R2	508	0.2	508	0.2	0.599	15.8	LOS B	5.1	35.9	0.78	1.02	40.3
Approach		736	1.3	736	1.3	0.599	13.2	LOS A	5.1	35.9	0.71	0.93	45.0
West: University Avenue													
11	T1	561	6.9	561	6.9	0.418	4.3	LOS A	0.0	0.0	0.00	0.51	52.4
12	R2	142	6.7	142	6.7	0.418	8.3	LOS A	0.0	0.0	0.00	0.51	51.9
Approach		703	6.9	703	6.9	0.418	5.1	LOS A	0.0	0.0	0.00	0.51	52.3
All Vehicles		1814	4.5	1814	4.5	0.599	9.4	LOS A	5.1	35.9	0.46	0.76	48.0

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

Roundabout Capacity Model: SIDRA Standard.

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.

Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 0.0 %

Number of Iterations: 5 (maximum specified: 10)

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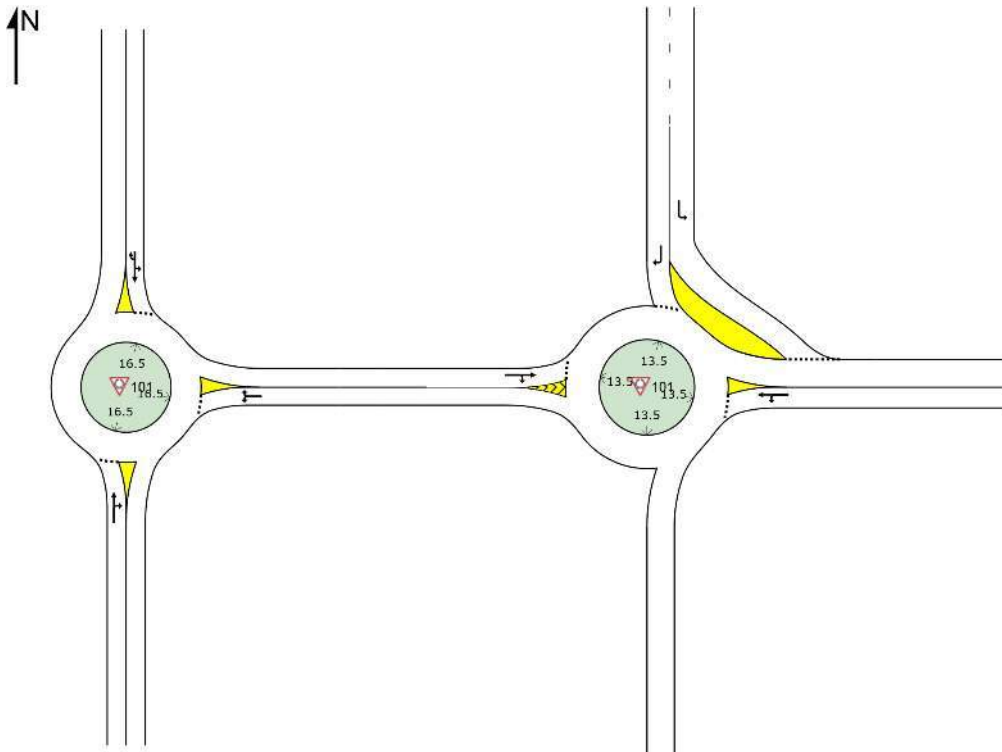
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# NETWORK LAYOUT

Network: N101 [Existing Irvine St, University Ave and Princes Mty PM]

New Network



SITES IN NETWORK	
Site ID	Site Name
▽101	Existing Irvine St & University Ave PM
▽101	Existing Princes Mty & University Ave PM

# MOVEMENT SUMMARY

 Site: 101 [Existing Irvine St & University Ave PM]

 Network: N101 [Existing Irvine St, University Ave and Princes Mty PM]

New Site  
Roundabout

Movement Performance - Vehicles													
Mov ID	OD Mov	Demand Total	Flows HV %	Arrival Total	Flows HV %	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	of Queue Distance	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
		veh/h		veh/h		v/c	sec		veh	m			
South: Irvine Street													
2	T1	114	5.6	114	5.6	0.332	6.2	LOS A	2.1	15.0	0.56	0.70	52.1
3	R2	238	0.9	238	0.9	0.332	10.3	LOS A	2.1	15.0	0.56	0.70	46.5
Approach		352	2.4	352	2.4	0.332	9.0	LOS A	2.1	15.0	0.56	0.70	49.0
East: University Avenue													
4	L2	120	0.0	120	0.0	0.353	4.7	LOS A	2.7	19.7	0.46	0.61	47.3
6	R2	308	5.8	308	5.8	0.353	9.4	LOS A	2.7	19.7	0.46	0.61	48.3
Approach		428	4.2	428	4.2	0.353	8.1	LOS A	2.7	19.7	0.46	0.61	48.0
North: Irvine Street													
7	L2	961	3.2	961	3.2	0.948	19.5	LOS B	31.2	223.6	1.00	1.07	36.7
8	T1	132	1.6	132	1.6	0.948	19.6	LOS B	31.2	223.6	1.00	1.07	45.6
9u	U	9	0.0	9	0.0	0.948	25.7	LOS B	31.2	223.6	1.00	1.07	46.1
Approach		1102	3.0	1102	3.0	0.948	19.5	LOS B	31.2	223.6	1.00	1.07	38.4
All Vehicles		1882	3.1	1882	3.1	0.948	14.9	LOS B	31.2	223.6	0.79	0.90	42.3

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

Roundabout Capacity Model: SIDRA Standard.

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.

Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 0.0 %

Number of Iterations: 5 (maximum specified: 10)

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# MOVEMENT SUMMARY

 Site: 101 [Existing Princes Mty & University Ave PM]

 Network: N101 [Existing Irvine St, University Ave and Princes Mty PM]

New Site  
Roundabout

Movement Performance - Vehicles													
Mov ID	OD Mov	Demand Flows Total	Flows HV %	Arrival Flows Total	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles	Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: University Avenue													
4	L2	160	0.0	160	0.0	0.502	9.4	LOS A	3.7	27.0	0.76	0.88	50.8
5	T1	254	7.1	254	7.1	0.502	9.9	LOS A	3.7	27.0	0.76	0.88	45.9
Approach		414	4.3	414	4.3	0.502	9.7	LOS A	3.7	27.0	0.76	0.88	48.5
North: Princes Motorway Off Ramp													
7	L2	276	3.1	276	3.1	0.344	9.1	LOS A	1.9	13.5	0.69	0.82	51.0
9	R2	179	0.6	179	0.6	0.347	21.3	LOS B	2.3	15.9	0.89	0.97	36.2
Approach		455	2.1	455	2.1	0.347	13.9	LOS A	2.3	15.9	0.77	0.88	46.2
West: University Avenue													
11	T1	763	4.6	763	4.6	0.706	4.3	LOS A	0.0	0.0	0.00	0.55	51.7
12	R2	447	0.7	447	0.7	0.706	8.3	LOS A	0.0	0.0	0.00	0.55	51.5
Approach		1211	3.1	1211	3.1	0.706	5.8	LOS A	0.0	0.0	0.00	0.55	51.6
All Vehicles		2079	3.1	2079	3.1	0.706	8.3	LOS A	3.7	27.0	0.32	0.69	49.4

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

Roundabout Capacity Model: SIDRA Standard.

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.

Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 0.0 %

Number of Iterations: 5 (maximum specified: 10)

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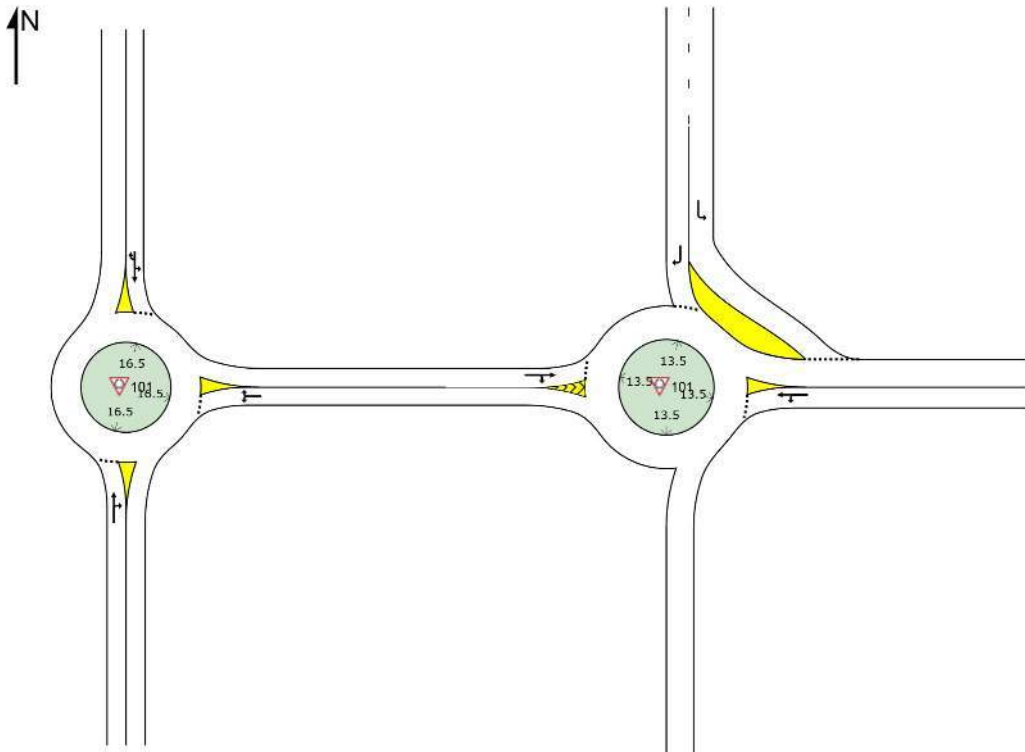
Organisation: TAYLOR THOMSON WHITTING (TTW) PTY LTD | Processed: Tuesday, 19 September 2017 9:50:41 AM

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# NETWORK LAYOUT

Network: N101 [Future Irvine St, University Ave & Princes Mty AM]

New Network



SITES IN NETWORK	
Site ID	Site Name
▽101	Future Irvine St & University Ave AM
▽101	Future Princes Mty & University Ave AM

# MOVEMENT SUMMARY

 Site: 101 [Future Irvine St & University Ave AM]

 Network: N101 [Future Irvine St, University Ave & Princes Mty AM]

New Site  
Roundabout

Movement Performance - Vehicles													
Mov ID	OD Mov	Demand Flows Total	Flows HV %	Arrival Flows Total	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles	Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Irvine Street													
2	T1	103	4.1	103	4.1	0.442	9.4	LOS A	3.5	25.4	0.90	0.92	50.3
3	R2	194	2.7	194	2.7	0.442	13.6	LOS A	3.5	25.4	0.90	0.92	43.6
Approach		297	3.2	297	3.2	0.442	12.2	LOS A	3.5	25.4	0.90	0.92	46.7
East: University Avenue													
4	L2	213	0.5	213	0.5	0.818	10.4	LOS A	13.9	99.7	0.97	0.88	42.7
6	R2	675	3.3	675	3.3	0.818	15.2	LOS B	13.9	99.7	0.97	0.88	43.6
Approach		887	2.6	887	2.6	0.818	14.0	LOS A	13.9	99.7	0.97	0.88	43.4
North: Irvine Street													
7	L2	522	8.9	522	8.9	0.694	6.4	LOS A	8.1	59.7	0.77	0.65	48.2
8	T1	267	2.8	267	2.8	0.694	6.4	LOS A	8.1	59.7	0.77	0.65	53.5
9u	U	11	10.0	11	10.0	0.694	12.8	LOS A	8.1	59.7	0.77	0.65	53.8
Approach		800	6.8	800	6.8	0.694	6.4	LOS A	8.1	59.7	0.77	0.65	50.8
All Vehicles		1984	4.4	1984	4.4	0.818	10.7	LOS A	13.9	99.7	0.88	0.80	46.8

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

Roundabout Capacity Model: SIDRA Standard.

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.

Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 1.0 %

Number of Iterations: 6 (maximum specified: 10)

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Organisation: TAYLOR THOMSON WHITTING (TTW) PTY LTD | Processed: Wednesday, 27 September 2017 11:33:26 AM

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# MOVEMENT SUMMARY

 Site: 101 [Future Princes Mty & University Ave AM]

 Network: N101 [Future Irvine St, University Ave & Princes Mty AM]

New Site  
Roundabout

Movement Performance - Vehicles													
Mov ID	OD Mov	Demand Flows Total	Flows HV %	Arrival Flows Total	Flows HV %	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m		per veh	km/h
East: University Avenue													
4	L2	103	2.0	103	2.0	0.620	12.2	LOS A	5.4	39.7	0.89	1.03	48.9
5	T1	305	7.2	305	7.2	0.620	12.6	LOS A	5.4	39.7	0.89	1.03	43.0
Approach		408	5.9	408	5.9	0.620	12.5	LOS A	5.4	39.7	0.89	1.03	45.1
North: Princes Motorway Off Ramp													
7	L2	237	3.6	237	3.6	0.263	7.4	LOS A	1.3	9.3	0.57	0.73	52.3
9	R2	540	0.2	540	0.2	0.706	18.8	LOS B	6.8	47.7	0.82	1.13	38.0
Approach		777	1.2	777	1.2	0.706	15.3	LOS B	6.8	47.7	0.75	1.01	43.3
West: University Avenue													
11	T1	584	6.7	584	6.7	0.434	4.3	LOS A	0.0	0.0	0.00	0.51	52.4
12	R2	147	6.4	147	6.4	0.434	8.3	LOS A	0.0	0.0	0.00	0.51	51.9
Approach		732	6.6	732	6.6	0.434	5.1	LOS A	0.0	0.0	0.00	0.51	52.3
All Vehicles		1917	4.3	1917	4.3	0.706	10.8	LOS A	6.8	47.7	0.49	0.82	46.6

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

Roundabout Capacity Model: SIDRA Standard.

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.

Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 1.0 %

Number of Iterations: 6 (maximum specified: 10)

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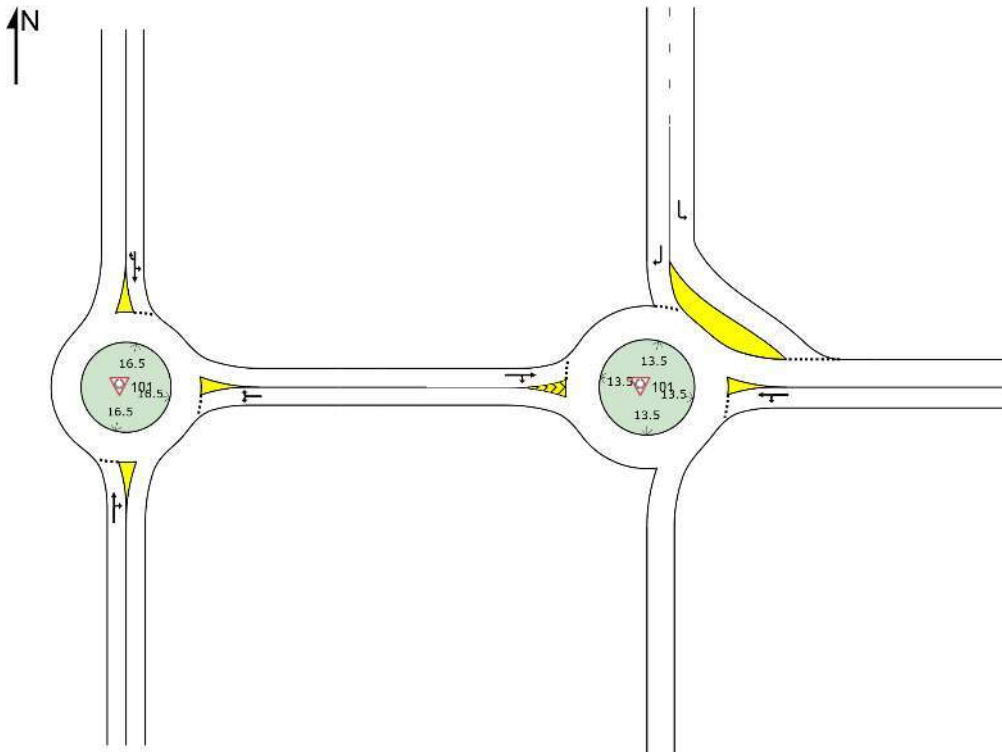
Organisation: TAYLOR THOMSON WHITTING (TTW) PTY LTD | Processed: Wednesday, 27 September 2017 11:33:26 AM

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# NETWORK LAYOUT

Network: N101 [Future Irvine St, University Ave & Princes Mty PM]

New Network



SITES IN NETWORK	
Site ID	Site Name
▽101	Future Irvine St & University Ave PM
▽101	Future Princes Mty & University Ave PM

# MOVEMENT SUMMARY

 Site: 101 [Future Irvine St & University Ave PM]

 Network: N101 [Future Irvine St, University Ave & Princes Mty PM]

New Site  
Roundabout

Movement Performance - Vehicles													
Mov ID	OD Mov	Demand Flows Total	Flows HV %	Arrival Flows Total	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles	Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Irvine Street													
2	T1	118	5.4	118	5.4	0.349	6.3	LOS A	2.2	15.9	0.58	0.70	52.1
3	R2	247	0.9	247	0.9	0.349	10.4	LOS A	2.2	15.9	0.58	0.70	46.4
Approach		365	2.3	365	2.3	0.349	9.1	LOS A	2.2	15.9	0.58	0.70	48.9
East: University Avenue													
4	L2	125	0.0	125	0.0	0.368	4.7	LOS A	2.9	20.8	0.47	0.61	47.3
6	R2	321	5.6	321	5.6	0.368	9.4	LOS A	2.9	20.8	0.47	0.61	48.3
Approach		446	4.0	446	4.0	0.368	8.1	LOS A	2.9	20.8	0.47	0.61	48.0
North: Irvine Street													
7	L2	1031	3.0	1031	3.0	1.020	46.8	LOS D	58.5	419.4	1.00	1.68	23.8
8	T1	137	1.5	137	1.5	1.020	46.9	LOS D	58.5	419.4	1.00	1.68	33.9
9u	U	9	0.0	9	0.0	1.020	53.1	LOS D	58.5	419.4	1.00	1.68	34.2
Approach		1177	2.8	1177	2.8	1.020	46.9	LOS D	58.5	419.4	1.00	1.68	25.4
All Vehicles		1988	3.0	1988	3.0	1.020	31.2	LOS C	58.5	419.4	0.80	1.26	32.2

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

Roundabout Capacity Model: SIDRA Standard.

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.

Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 0.0 %

Number of Iterations: 5 (maximum specified: 10)

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# MOVEMENT SUMMARY

Site: 101 [Future Princes Mty & University Ave PM]

Network: N101 [Future Irvine St, University Ave & Princes Mty PM]

New Site  
Roundabout

Movement Performance - Vehicles													
Mov ID	OD Mov	Demand Flows Total	Flows HV %	Arrival Flows Total	Flows HV %	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Queue Distance	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
		veh/h	%	veh/h	%	v/c	sec		veh	m			
East: University Avenue													
4	L2	166	0.0	166	0.0	0.536	10.2	LOS A	4.3	31.0	0.80	0.92	50.2
5	T1	264	6.8	264	6.8	0.536	10.7	LOS A	4.3	31.0	0.80	0.92	44.9
Approach		431	4.2	431	4.2	0.536	10.5	LOS A	4.3	31.0	0.80	0.92	47.7
North: Princes Motorway Off Ramp													
7	L2	287	2.9	287	2.9	0.368	9.5	LOS A	2.1	14.8	0.71	0.84	50.7
9	R2	186	0.6	186	0.6	0.396	25.4	LOS B	2.9	20.4	0.93	1.04	33.6
Approach		474	2.0	474	2.0	0.396	15.8	LOS B	2.9	20.4	0.80	0.92	44.8
West: University Avenue													
11	T1	812	4.3	799	4.3	0.740	4.3	LOS A	0.0	0.0	0.00	0.55	51.7
12	R2	478	0.7	471	0.7	0.740	8.3	LOS A	0.0	0.0	0.00	0.55	51.5
Approach		1289	2.9	1270 <sup>N1</sup>	2.9	0.740	5.8	LOS A	0.0	0.0	0.00	0.55	51.6
All Vehicles		2194	3.0	2174 <sup>N1</sup>	3.0	0.740	8.9	LOS A	4.3	31.0	0.33	0.71	48.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network 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.  
 Roundabout Capacity Model: SIDRA Standard.  
 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.  
 Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 0.0 %  
 Number of Iterations: 5 (maximum specified: 10)

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