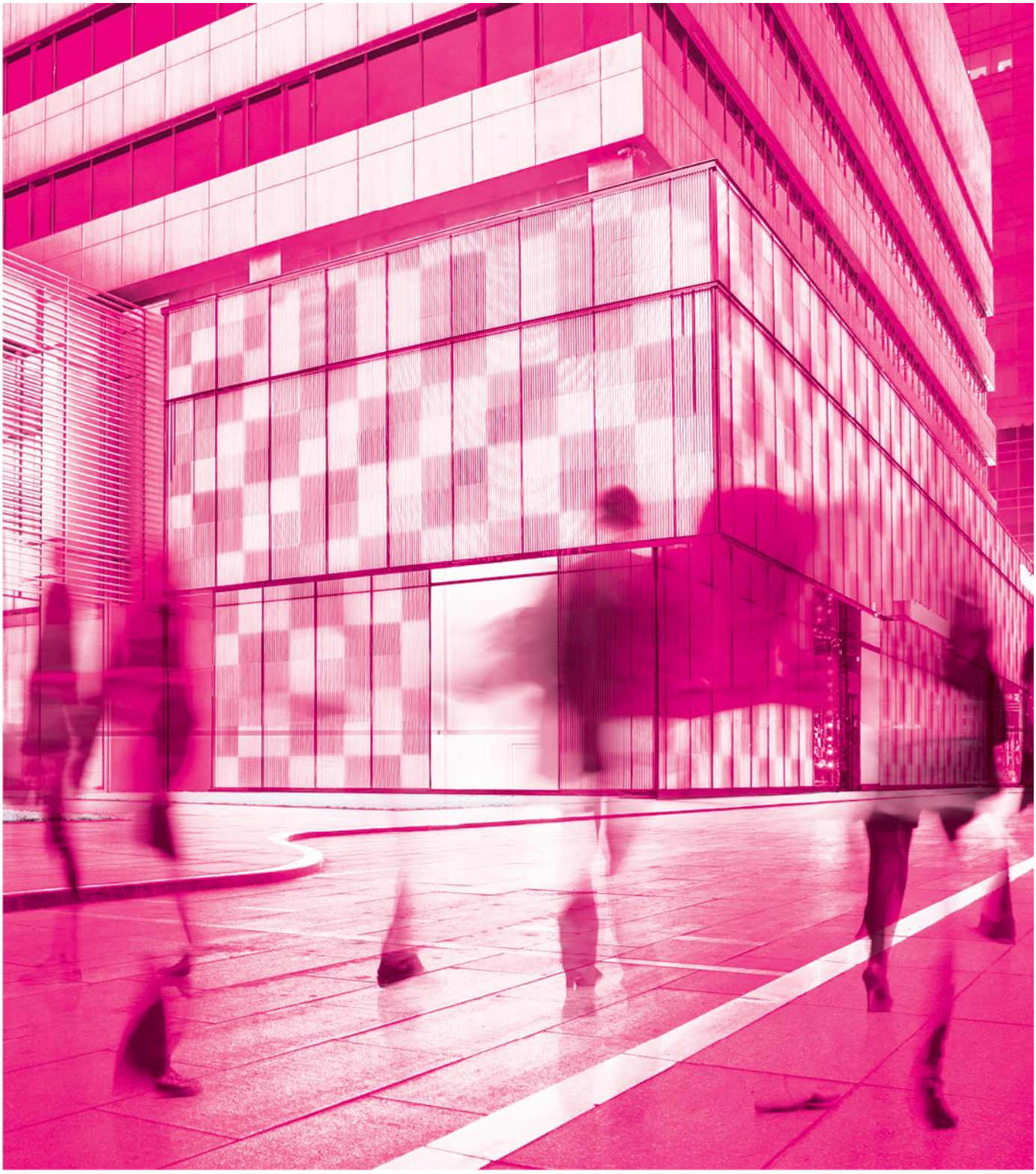

traffic impact assessment;

High St, Penrith (East DA)

For TOGA Group

5 October 2021

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traffic;
civil design;
wayfinding;

ptc.

Document Control

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1. Introduction

ptc. has been engaged by Toga Group to prepare a Traffic Impact Assessment to accompany a Development Application (DA) to Penrith City Council for the construction of a mixed-use development accommodating 357 apartments and 1,036m^2 (GFA) of commercial area within two buildings having a combined basement and a podium for car parking. The location of the site is indicated in Figure 1.

The development application subject to these proceedings is amended by way of changes detailed below:

- Podium - reduction in the scale of the podium from 5 storeys to 4 storeys in the middle section and 2 storeys at the northern and southern ends; decrease in the number of car parking spaces provided within the podium; increased 'sleeving' of car parking provided in the podium with apartments; and enhanced articulation.
- Basement - increased basement car parking from 1 to 3 levels.
- Ground level - enhanced activation of the ground floor through relocation of the through site pedestrian link, redistributing and enlarging commercial floorspace, providing stepped sitting edges to the western colonnade facing John Tipping Grove, and increased landscaping.
- Levels 1 to 3 – increased activation and connection to ground level through additional apartments and enhanced design of communal open space area.
- Towers - reduction in the height of Tower 2 from 37 to 35 storeys, reduction in height of Tower 1 from 14 storeys to 13 storeys, and redesign to increase building articulation.

The proposed development DA20/0148 seeks consent for a mixed-use development comprising two towers of 35 and 13 storeys located above a part 4 and part 2 storey podium providing 357 residential dwellings with ground level commercial tenancies, 3 levels of basement car parking, a new public road and associated site works on the land at 634-638 High Street and 87-93 Union Road, Penrith NSW.

Figure 1: Site Location

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1.1 Purpose of this Report

This report presents the following considerations in relation to the Traffic and Parking assessment of the Proposal:

Section 2	A description of the project;
Section 3	A description of the road network serving the development property;
Section 4	Assessment of the proposed parking provision in the context of the relevant planning control requirements;
Section 5	Determination of the traffic activity associated with the development proposal, and the adequacy of the surrounding road network;
Section 6	Traffic signal and pedestrian crossing warrants assessment;
Section 7	Assessment of the proposed car park, vehicular access and internal circulation arrangements in relation to compliance with the relevant standards, and Council policies; and
Section 8	Conclusion.

1.2 Background

During the assessment of the project, and through discussions with Council and TfNSW, the following development specific considerations have been established and incorporated within the design:

Traffic Signal Warrants Assessment – It is recognised that the DCP identifies the provision of traffic signals at the intersection of High Street and the Civic Centre car park access, which should incorporate the new link road. However, our assessment confirms under the current and post development scenarios, the warrants for a traffic signal control are not met (refer Section 6 of this report) and this has been confirmed by TfNSW. This goes to the timing of the installation and the concept design for the intersection in the interim period and the fact that the need for traffic signal control is not triggered by the proposed development.

Concept Intersection Layout – Noting the DCP reference to traffic signal control, it is imperative that the building location and link road design are able to accommodate the fully upgraded High Street intersection. In this regard, a concept design for the intersection has been developed to confirm enough spatial allowance is provided for a future upgrade, if and when warranted.

TfNSW Tacit Approval – The concept design has been reviewed by TfNSW to ensure that the upgraded intersection layout (and therefore the building locations) will be accepted when assessed as a traffic signal design. TfNSW has confirmed that the signalisation of the intersection is not warranted, but the concept design is endorsed in principle (refer Attachment 3).

Proposed Link Road – The proposed link road will comprise two lanes between Union Lane and Union Road, which will provide two-way movement between Union Road and the car park and loading dock driveways. To the north of Union Lane, the link road will accommodate a single northbound lane connecting with the existing High Street roundabout.

Link Road staging – The link road and the building locations have been designed so that the road and High Street intersection upgrade can occur in three stages, comprising the single lane described above within the TOGA property, a two-lane version when the High Street intersection upgrade occurs (again within the

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TOGA property), and a third stage converting the link road to three lanes using part of the adjacent Urban Apartments property.

Road Network Modelling Scenarios – In line with the request from Council, the road network modelling has been updated to include the 2036, with/without development scenarios, which confirm that the road network performs at an acceptable level of service considering background growth and the envisaged traffic activity associated with the precinct (refer to Section 5 for detailed results).

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2. Proposal

The site is located at 87-91 Union Road / 634-368 High Street in Penrith (Site 1). Toga owns the adjacent site to the west, 640-652 High Street (Site 2), which will be progressed in a separate Development Application. The sites are dissected by John Tipping Grove, which is currently a Council owned road. This document has been prepared to accompany a Development Application on Site 1.

The proposed development comprises two residential buildings including commercial areas and associated parking. Buildings 1 and 2 are connected by a common basement, ground floor and 3 podium levels, for car parking.

By way of background, a development consent was recently granted for a similar development of the site, which comprised 187 apartments and 1,144m^2 of commercial area. The revised scheme, which is the subject of this application comprises 357 apartments and 1,036m^2 (GFA) of commercial area. The proposed parking provision has been increased to satisfy the demand associated with the increase yield and this report presents the revised traffic impact analysis associated with the surrounding road network.

In relation to the proposed road and access arrangements, this application is consistent with the approved scheme and includes a new road connection along the eastern boundary of the site and the provision for the future upgrade of the roundabout at High Street and the Civic Centre car park access.

2.1 Development Site

The site is situated within a B4 Mixed Use Zone in central Penrith with Westfield Penrith and Penrith Train Station to the north/east and the Nepean River to the west. The area north of the site is a commercial core and high-density residential zoning is present in the south.

The site comprises three allotments, legally described as Lot 1 in DP 544302, and Lots 1 and 2 in DP 1202310 and has a site area of 5,402m^2.

The site currently accommodates a car sales business and associated vehicle storage area as well as the display suite associated with the subject development.

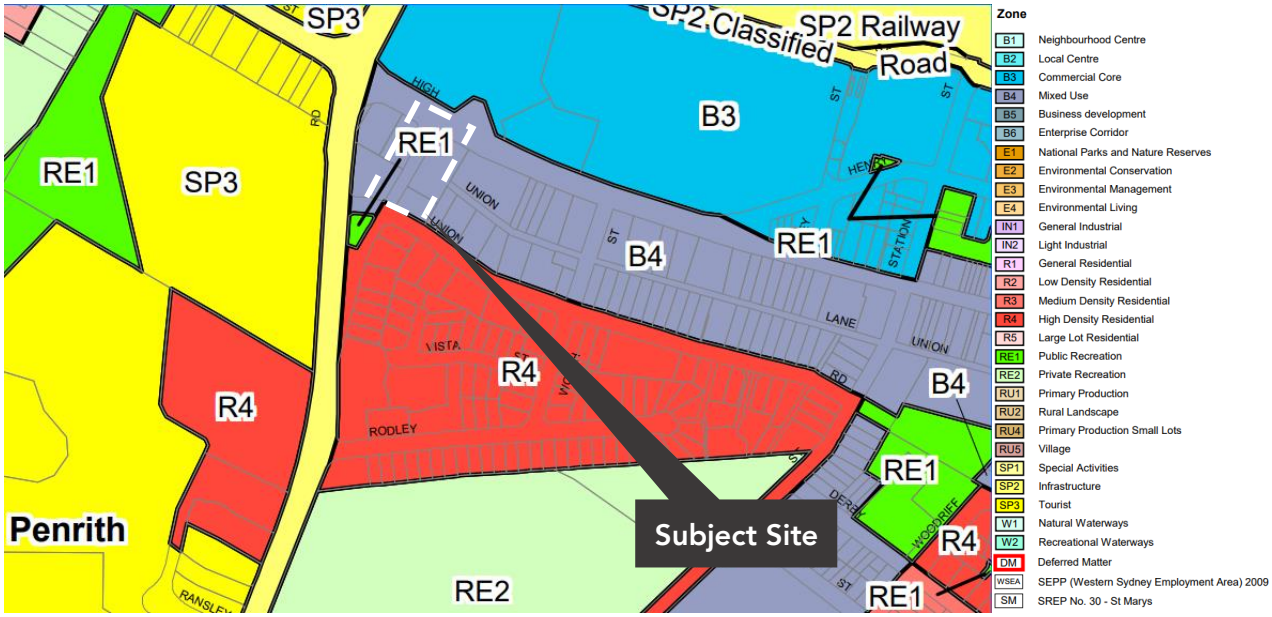

Figure 2: Land Use Map (Source: Penrith Local Environmental Plan 2010)

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2.2 Development Proposal

The development proposal involves the construction of two residential towers, which are connected at the podium, ground and basement levels. The towers are described as Building 1 (northern building = 87 apartments) and Building 2 (southern building = 270), totalling 357 apartments.

The ground level will accommodate 1,036m^2 (GFA) of commercial area divided across the northern and southern parts of the ground floor.

Parking will be provided within 3 levels of basement level and 3 podium levels and will accommodate a total of 406 spaces[1]. Servicing will be accommodated within a shared loading area located centrally within the ground floor.

Access will be provided via a driveway within the Union Road frontage (podium only) and via a new Link Road to be constructed along the eastern boundary of the site. This will provide separate access to the service area and the basement parking. It is noted that the basement and podium access locations have been exchanged compared to the previous design, however the number of parking spaces served by each access remains consistent due to an increase in the size of the basement and associated decrease in the podium. In this regard the traffic generation and distribution established for the purposes of the traffic modelling remains unchanged.

[1] Figure represents overall total parking provision including car parking, car wash, service and loading bays.

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3. EDxisting Transport Facilities

3.1 Road Hierarchy

The subject site is located in Penrith and is primarily serviced by Mulgoa Road, which is a State Road and High Street, which is classified as a Local Road and forms the northern boundary. Access to the site is also available via Union Road and Union Lane.

Figure 3: Road Hierarchy (source: TfNSW Carto 2015)

The NSW administrative road hierarchy comprises the following road classifications, which align with the generic road hierarchy as follows:

State Roads	- Freeways and Primary Arterials (TFNSW Managed)
Regional Roads	- Secondary or sub arterials (Council Managed, Part funded by the State)
Local Roads	- Collector and local access roads (Council Managed)

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3.1.1 Road Network

Table 1: Existing Road Network – Mulgoa Road

Mulgoa Road	
Road Classification	State Road
Alignment	North – South
Number of Lanes	2 lanes in each direction with additional lanes for left and right turns resulting in 4 lanes at the High St intersection
Carriageway Type	Divided
Carriageway Width	8m on either side of the median strip
Speed Limit	60km/h
School Zone	No
Parking Controls	Parking not permitted
Forms Site Frontage	No

Figure 4: Mulgoa Road (northbound)

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Table 2: Existing Road Network – Castlereagh Road (northern extension of Mulgoa Road)

Castlereagh Road	
Road Classification	State Road
Alignment	North – South
Number of Lanes	2 lanes in each direction with additional lanes for left and right turns resulting in 4 lanes at the High St intersection
Carriageway Type	Divided
Carriageway Width	16m
Speed Limit	60km/h
School Zone	No
Parking Controls	Parking not permitted
Forms Site Frontage	No

Figure 5: Castlereagh Road (southbound)

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Table 3: Existing Road Network – High Street

High Street	
Road Classification	Local Road
Alignment	East – West
Number of Lanes	2 lanes in each direction, additional lanes at intersections
Carriageway Type	Divided
Carriageway Width	6m, increasing at Mulgoa Rd intersection
Speed Limit	60km/h West of Mulgoa Rd, 50km/h East of Mulgoa Rd
School Zone	No
Parking Controls	Parking not permitted
Forms Site Frontage	Yes

Figure 6: High Street (westhbound)

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Table 4: Existing Road Network – Union Road

Union Road	
Road Classification	Local Road
Alignment	East – West
Number of Lanes	1 lane in each direction, parking lanes on both sides
Carriageway Type	Undivided
Carriageway Width	10m
Speed Limit	50km/h
School Zone	No
Parking Controls	Unrestricted
Forms Site Frontage	Yes

Figure 7: Union Road (eastbound)

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Table 5: Existing Road Network – Union Lane

Union Lane	
Road Classification	Local Road
Alignment	East – West
Number of Lanes	1 lane in each direction
Carriageway Type	Undivided
Carriageway Width	6m
Speed Limit	50km/h
School Zone	No
Parking Controls	Parking not permitted
Forms Site Frontage	No

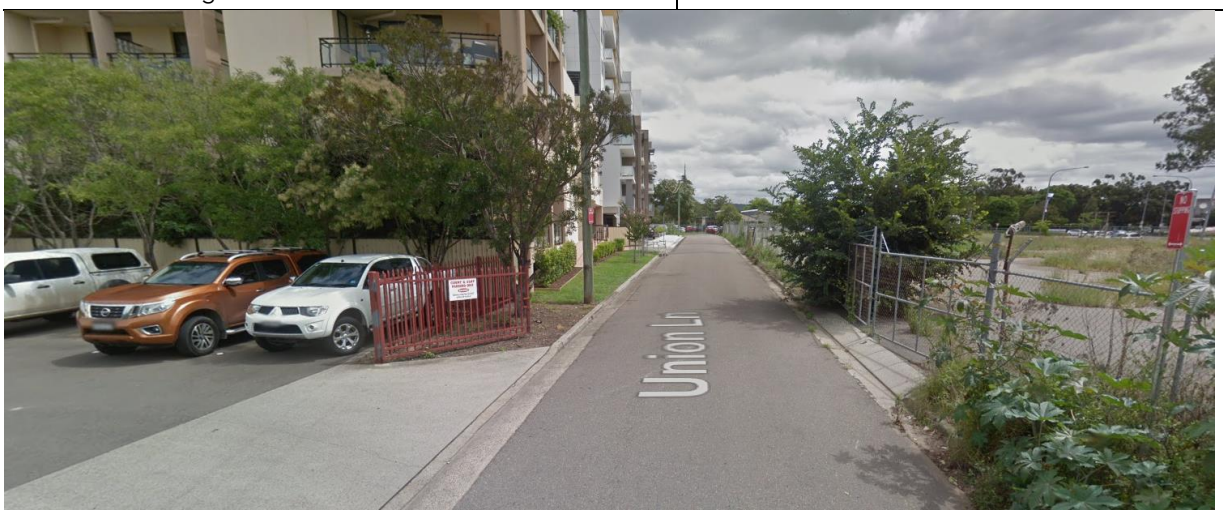

Figure 8: Union Lane (westbound)

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Table 6: Existing Road Network – Worth Street

Worth Street	
Road Classification	Local Road
Alignment	North – South
Number of Lanes	1 lane in each direction south of Union Rd, 2 lanes in each direction north of Union Rd
Carriageway Type	Undivided
Carriageway Width	13m
Speed Limit	50km/h
School Zone	No
Parking Controls	Unrestricted south of Union Rd, very limited unrestricted north of Union Rd
Forms Site Frontage	No

Figure 9: Worth Street (northbound at Union Lane)

3.1.2 Key Intersections

The key intersections within the vicinity of the site are identified as follows:

- Mulgoa Road / High Street: 4-arm signalised intersection
- High Street / Civic Centre: 4-arm priority roundabout
- Mulgoa Road / Union Road: 3-arm priority intersection
- Worth Street / Union Lane: 4-arm priority intersection
- Worth Street / Union Road: 4-arm signalised intersection
- High Street / Worth Street: 4-arm signalised intersection

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3.2 Existing Road Network Operation

Traffic modelling has been prepared using Sidra Intersection 8, which enables the intersections to be assessed as a network.

The model includes traffic volume and lane data provided by TfNSW in relation to the Mulgoa Road upgrade, and traffic survey data and projected volumes provided by Council. It is noted that the data provided by Council was projected to 2020, while the TfNSW data was projected to 2026, therefore key movements within the Council data have been increased by 10% (approximate growth included in the TfNSW model) to align the data sets. This approach was agreed with Council during the preparation of the previous development application and was adopted as the base case for the post-development modelling scenarios.

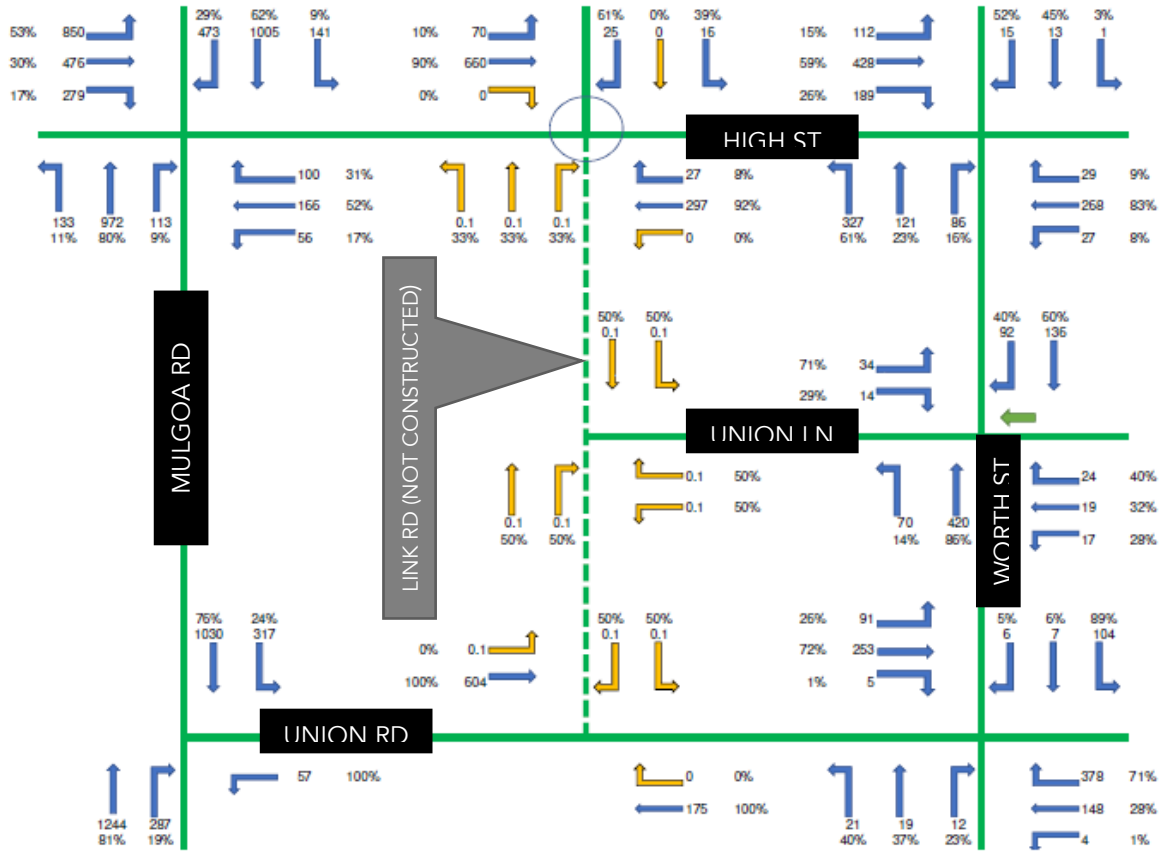

Figure 10 - 2020 AM Peak, Weekday (Existing Road Network, Post Development

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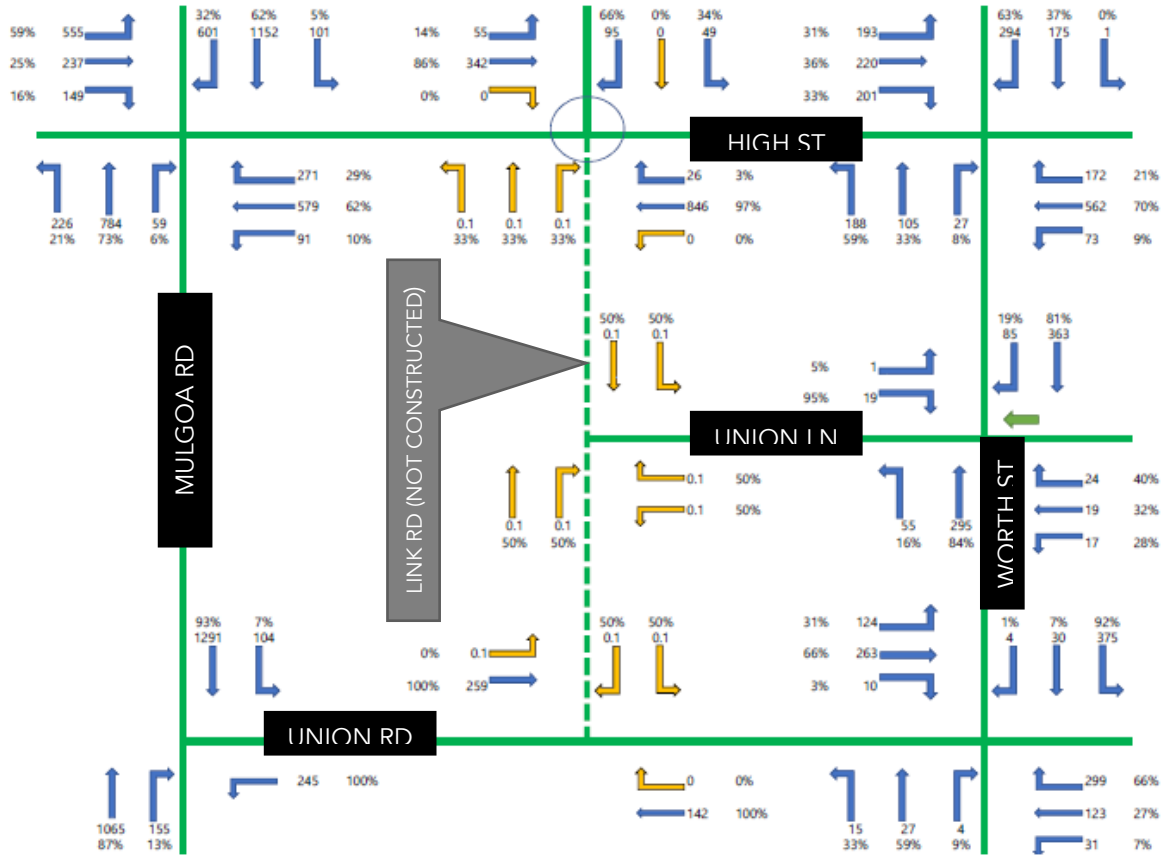

Figure 11 - 2020 PM Peak, Weekday (Existing Road Network, Post Development

3.2.1 SIDRA Modelling Performance Criteria

The surveyed intersections have been modelled with SIDRA Intersection 8 software, a micro-analytical tool for individual intersections and whole-network modelling. SIDRA provides a number of performance indicators, outlined below:

- Degree of Saturation - The total usage of the intersection expressed as a factor of 1 with 1 representing 100% use/saturation (e.g. 0.8 = 80% saturation);
- Average Delay - The average delay encountered by all vehicles passing through the intersection. It is often important to review the average delay of each approach as a side road could have a long delay time, while the large free flowing major road traffic will provide an overall low average delay;
- Level of Service (LoS) - This is a categorisation of average delay, intended for simple reference. TfNSW adopts the bands
- 95% Queue lengths (Q95) - is defined to be the queue length in metres that has only a 5-percent probability of being exceeded during the analysis time period. It transforms the average delay into measurable distance units; and
- Congestion Coefficient (for networks) - the ratio of *desired* travel speed to *average* travel speed.

TfNSW adopts the following LoS classifications[2] outlined in Table 7.

[2] RMS Guide to Traffic Generating Developments 2002

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Table 7 - Levels of Service (LoS)

Level of Service	Average Delay (secs/vehicle)	Traffic Signals, Roundabout	Give Way & Stop Signs
A	<14	Good operation	
B	15 to 28	Good with acceptable delays & spare capacity	Acceptable delays & spare capacity
C	29 to 42	Satisfactory	Satisfactory, but accident study required
D	43 to 56	Operating near capacity	Near capacity & accident study required
E	57 to 70	At capacity. At signals, incidents would cause excessive delays. Roundabouts require other control mode	At capacity, requires other control mode
F	>70	Extra capacity required	Extreme delay, major treatment required

3.2.2 Model Calibration

The intersection of Mulgoa Road/Union Road has been calibrated to ensure that the existing 95th percentile back of queue lengths are contained within the existing dedicated right turn lane (turning from Mulgoa Road into Union Road). The following gap acceptance parameters have been adjusted to calibrate the model:

- Critical Gap – adjusted to 5 seconds
- Follow Up Headway – adjusted to 3 seconds

It is highlighted that the above adjustments to the gap acceptance parameters are within the acceptable range for right turns from a major road across three through lanes specified in Appendix E of the TfNSW Traffic Modelling Guidelines.

3.2.3 Modelling Results

The results of Model 1 are summarised for the AM and PM peak periods in Table 8 and Table 9, respectively. Network LoS diagrams are provided in Attachment 2.

In general, the network is operating within capacity during both AM and PM peak periods, with some congestion at the Mulgoa Road and High Street intersection resulting from right-hand turns approaching or reaching capacity. It is also noted that the right-hand turn from Mulgoa Road onto Union Road is at capacity.

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Table 8 - Existing SIDRA Network Performance Results, AM Peak

Intersection	Peak Period	Average Level of Service *(LoS)*	Average Delay *(sec)*	Worst Degree of Saturation *(DSat)*
1. Mulgoa Road / High Street	8:00am-9:00am	C	39.6	0.803
2. Mulgoa Road / Union Road	8:00am-9:00am	A *(Worst Movement: F)*	8.1 *(Worst Movement: 74.9)*	0.991
3. High Street / Civic Centre	8:00am-9:00am	A	3.9 *(Worst Movement: 9.5)*	0.245
4. High Street / Worth Street	8:00am-9:00am	D	44.4	0.864
5. Worth Street / Union Lane	8:00am-9:00am	A *(Worst Movement: B)*	2.9 *(Worst Movement: 15.4)*	0.270
6. Worth Street / Union Road	8:00am-9:00am	B	28.3	0.873

Table 9 - Existing SIDRA Network Performance Results, PM Peak

Intersection	Peak Period	Average Level of Service *(LoS)*	Average Delay *(sec)*	Worst Degree of Saturation *(DSat)*
1. Mulgoa Road / High Street	4:00pm-5:00pm	D	47.3	0.873
2. Mulgoa Road / Union Road	4:00pm-5:00pm	A *(Worst Movement: B)*	2.3 *(Worst Movement: 26.0)*	0.584
3. High Street / Civic Centre	4:00pm-5:00pm	A	4.3 *(Worst Movement: 9.6)*	0.529
4. High Street / Worth Street	4:00pm-5:00pm	D	54.8	0.918
5. Worth Street / Union Lane	4:00pm-5:00pm	A *(Worst Movement: B)*	2.3 *(Worst Movement: 16.0)*	0.224
6. Worth Street / Union Road	4:00pm-5:00pm	C	29.3	0.861

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3.3 Road Network Amendments

The site is located near the key intersection of Mulgoa Road and High Street which is currently being upgraded by TfNSW as part of the Jane Street and Mulgoa Road Infrastructure Upgrade. The intersection is being expanded to increase the number of approach lanes, has involved the widening of High Street between Mulgoa Road and the roundabout within the site frontage. An extract of the TfNSW works and the completed project are presented below:

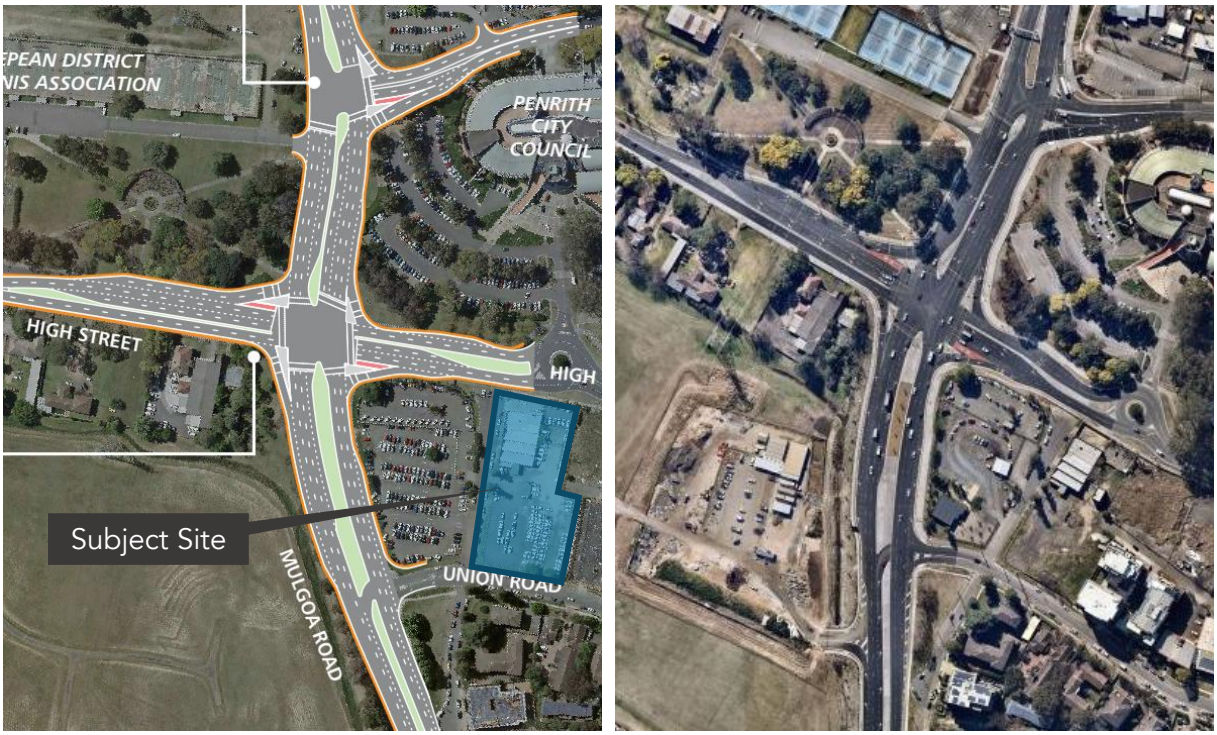

Figure 12 - Jane Street and Mulgoa Road Infrastructure Upgrade

The expanded intersection will increase its capacity in line with expected background growth on the road network. This has been taken in account with regard to the site layout and associated access arrangements, and the road network modelling for the post development (2026) scenario.

As part of the development, Council has requested that Union Lane be converted to a one-way, westbound traffic flow to align with the same control on the sections of Union Lane to the east of Worth Street.

With regard to the proposed road upgrades associated with the development, a new link road is proposed along the eastern boundary of the site, which will connect between High Street and Union Road, also intersecting with Union Lane.

The proposed arrangement (refer Figure 13) will provide one northbound lane (North of Union Lane) with access only onto the existing High Street roundabout.

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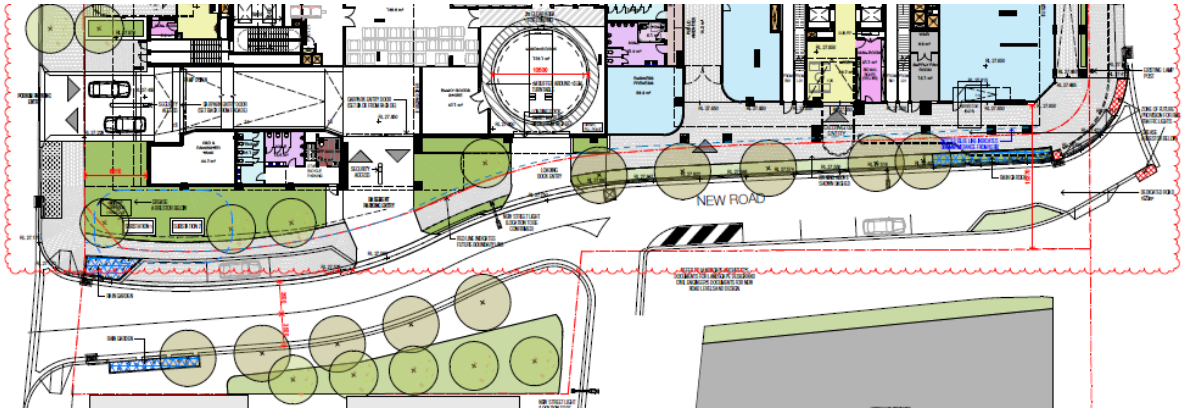

Figure 13 - New Link Road Proposed Arrangement

3.4 Public Transport

The subject site was assessed for its potential accessibility via modes of existing public transport likely to be utilised by prospective residents, employees and visitors of the proposed development. When defining accessibility, the NSW Guidelines to Walking & Cycling (2004) suggest that 400m-800m is a comfortable walking distance.

3.4.1 Trains

The development site is located approximately 700m from Penrith Station, served by the T1 Western Line. This line provides frequency access between Emu Plains and the City, with trains operating at approximately 15min intervals during commuter peak periods. It is envisaged that commuters will choose to use this mode of transport due to greater frequency of services and more extensive network compared to buses.

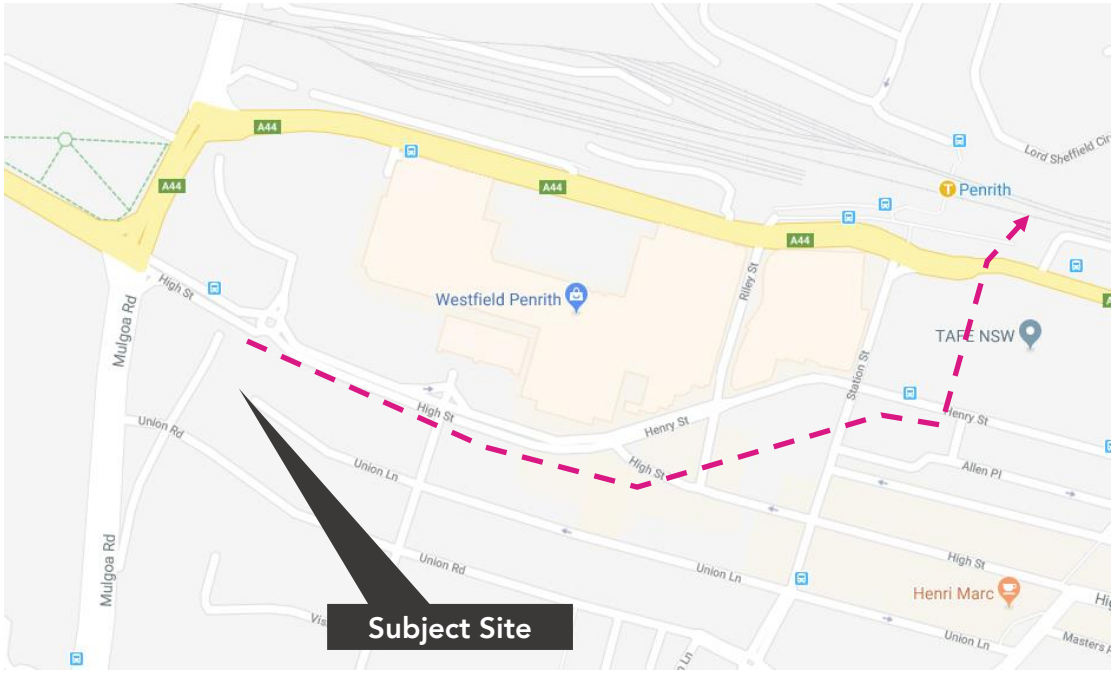

Figure 14 - Walking Route to Penrith Station

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3.4.2 Buses

A number of bus routes were identified operating within walking distance of the proposed development. Nearby bus stops are identified in Figure 15 and summarised in Table 10.

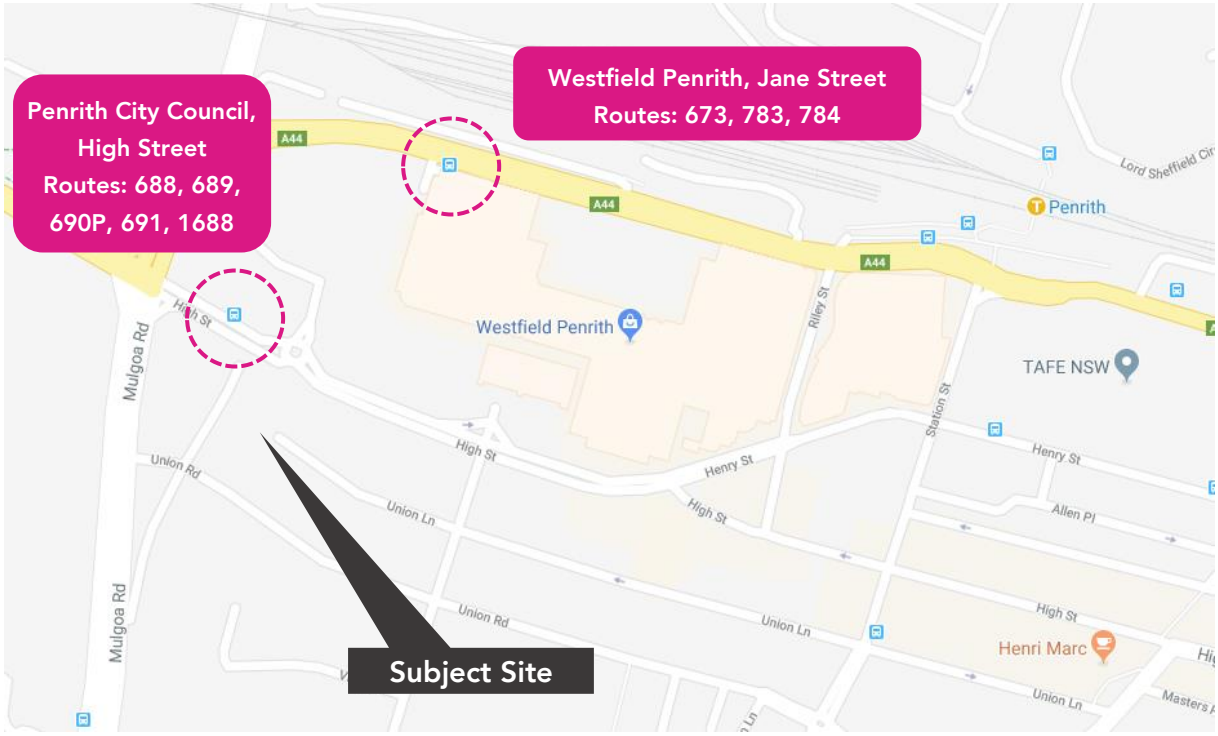

Figure 15 - Nearby Bus Stops

Table 10: Bus Route Summary

Bus Route	Coverage	Operation
673	Penrith to Windsor via Cranebrook	**Mon-Fri** 6 services/day, **Sat** 2 services
783	Jordan Springs to Penrith	**Daily** 30min headway on weekdays, 1hr headway on weekends
784	Penrith to Cranebrook (Loop Service)	**Mon-Fri** 8 services/day (morning/evening only)
688	Penrith to Emu Heights (Loop Service)	**Daily** 1hr headway Mon-Sat, 2hr headway Sun
689	Penrith to Leonay (Loop Service)	**Daily** 1hr headway Mon-Sat, 2hr headway Sun
690P	Springwood to Penrith	**Daily** 1hr headway Mon-Sat, 2 services on Sun
691	Mount Riverview to Penrith	**Daily** 6 services Mon-Fri, 3 services Sat/Sun
1688	Penrith to Leonay & Emu Heights (Loop Service)	**Daily** 3 services Mon-Fri, 1hr headway Sat/Sun

Overall, the site is moderately well serviced by public transport with a range of bus services and frequent train services from Penrith Station.

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4. Parking Provision Assessment

An assessment of parking provisions has been undertaken for the proposed development with reference to the following documents:

- Penrith Development Control Plan (DCP) 2014 - Section 10, Transport Access & Parking;
- Penrith Development Control Plan (DCP) 2014 - Section 11, Penrith City Centre;
- NSW Department of Planning & Environment - Apartment Design Guide (ADG); and
- TFNSW Guide to Traffic Generating Developments (TFNSW Guide) 2002.

4.1 Car Parking Provisions

As per the ADG, development on sites satisfying the following criteria may adopt the minimum car parking requirement for residents and visitors is set out in the TFNSW Guide, or the car parking requirement prescribed by the relevant council (DCP), whichever is less:

- On sites that are within 800 metres of a railway station or light rail stop in the Sydney Metropolitan Area; or
- On land zoned, and sites within 400 metres of land zoned, B3 Commercial Core, B4 Mixed Use or equivalent in a nominated regional centre.

Considering the above, the following car parking provision requirements are relevant to this development, extracted from Section 5 of the TFNSW Guide (for residential component) and Table C10.2 of the DCP (for commercial component):

- As per the TFNSW Guide, high-density residential flat buildings within a metropolitan regional centre (CBD) must provide:
  - 0.4 spaces per 1-bedroom unit;
  - 0.7 spaces per 2-bedroom unit;
  - 1.2 spaces per 3-bedroom unit; and
  - 1 space per 7 units (visitor parking).
- As per the DCP, servicing and visitor parking in residential flat buildings within Penrith City Centre must provide:
  - 1 space per 40 units for service vehicles; and
  - 1 car wash bay for every 50 units, up to a maximum of 4 car wash bays per building.
- As per the DCP, commercial development within Penrith City Centre must provide:
  - 1 space for every 100m^2 of gross floor area (GFA) for commercial office premises; and
  - Up to a maximum of 60% of the total required commercial parking provision may be provided on-site, with the remaining balance to be subject to a contribution plan.

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Based on the above car parking policies, the parking requirements for Building 1 and Building 2 are outlined in Table 11 and Table 12.

Table 11 - Accommodation Schedules

	Use Type	Units/GFA
Building 1	**One-bedroom unit/Studio**	**24**
	Two-bedroom unit	**54**
	Three-bedroom unit	**9**
	Sub-total	**87**
	Commercial	**441m²**

	Use Type	Units/GFA
Building 2	**One-bedroom unit/Studio**	**86**
	Two-bedroom unit	**155**
	Three-bedroom unit	**29**
	Sub-total	**270**
	Commercial	**595m²**

Table 12 - Car Parking Requirements

Use Type	Units/GFA		RMS Parking Provision Rate	Minimum Required Parking	DCP Parking Provision Rate	Minimum Required Parking	Proposed Parking On-Site
One-bedroom unit/Studio	*110*	@	0.4 spaces per unit	44.0	1.0 spaces per unit	110	49
Two-bedroom unit	*209*	@	0.7 spaces per unit	146.3	1.0 spaces per unit	209	209
Three-bedroom unit	*38*	@	1.2 spaces per unit	45.6	2.0 spaces per unit	76	76
Resident Parking	357		Sub-total	**236 (235.9)**		**395**	**334**
Visitor Parking	357	@	1 space per 7 units	51	1 space per 5 units	71	51
Service Vehicle Parking	357	@	1 space per 40 units	9 (8.9)	1 space per 40 units	9	9*
Car Wash bays	357	@	1 space per 50 units (up to max of 4 car wash bays per building)	4	1 space per 50 units (up to max of 4 car wash bays per building)	4	2
Commercial	1,036m²	@	1 space / 100m² GFA	10	1 space / 100m² GFA	10	10
			Total	**310**		**489**	**406**

** Includes 1 dedicated service space within the ground floor loading dock which can be managed to ensure deliveries occur in off-peak periods and do not coincide.*

Based on the minimum requirements of the TfNSW Guide, 310 spaces are required overall. However, the proposed parking provision reflects the regional location of Penrith and the underlying higher car ownership in the Penrith LGA compared with Greater Sydney. The provision of 406 spaces represents a balance between the minimum TfNSW Guide rates and the DCP, recognising the higher car ownership but also the connections to the Penrith centre and public transport.

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4.2 Accessible Parking Requirements

With regard to accessible parking, the DCP refers to the provisions outlined within the NCC 2015 Building Code of Australia (BCA).

Accessible parking is to be provided on the following basis:

- 1 accessible space for each adaptable unit;
- 1 accessible space per 100 residential visitor parking spaces; and
- 1 accessible space per 100 commercial parking spaces.

The proposal has a total of 36 adaptable units. Based on this, the accessible parking requirements have been outlined in Table 13. These spaces are included within the total parking provision. The proposed design is capable of meeting these accessible parking requirements.

Table 13 - Accessible Parking Requirement

Component	Unit of Measurement	Min. Accessible Parking Requirement	Proposed Accessible Parking Provision
Residential	36 Adaptable Units	36	36
Residential Visitor	51 Visitor Parking Spaces	1	1
Commercial	10 Commercial Parking Spaces	1	1
	TOTAL	**38**	**38**

4.3 Motorbike Parking

There is no specific requirement for motorcycle parking within the Penrith DCP, however the proposal includes a provision of 24 spaces, which represents 1 per 17 parking spaces and considered to comprise a suitable provision to allow for a mix of vehicle ownership types.

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4.4 Loading Dock Provisions

The combined commercial GFA of both buildings is 997.7m^2. The DCP stipulates the loading requirements for commercial and industrial developments as per Table 14.

Table 14 - DCP Service Vehicle Requirements

Area	Design Vehicle	Maximum Vehicle Length
Up to 1,500m^2	**Medium Rigid Vehicle (MRV)**	**8.8m**
1,500m^2 to 4,000m^2	**Heavy Rigid Vehicle (HRV)**	**12.5m**
Greater than 4,000m^2	**Articulated Vehicle (AV)**	**19.0m**

While the commercial floor area warrants the provision for Medium Rigid Vehicles, the loading area has been designed to accommodate a 10.5m long Council refuse vehicle, which is considered to be the largest rigid vehicle that is necessary to access the site.

4.5 Bicycle Parking

According to the DCP, bicycle parking must be provided in accordance with the parking rates provided in the NSW Planning Guidelines for Walking and Cycling (2004). These rates have been applied to Building 1 and Building 2 in Table 15.

In regard to the type of bicycle parking, Class B is considered appropriate for a mixed-use building for residents and staff, described in the extract from AS2890.3:2015 below.

B	A secure room or structure, protected from the weather, containing bicycle parking devices that allow users to lock the bicycle frame and both wheels. Users provided with security access devices such as keys, codes or swipe cards for communal cages. Users may provide their own locking devices for individual cages. Chain mesh fencing is not considered suitable. Entrance gates (to the secure bike area) are self-closing and self-locking.	Where available to the general public, or in large workplaces or institutions, some level of direct surveillance may be necessary to reduce the level of theft among users (e.g. CCTV). Facilities should be located in well lit areas, and where passive surveillance is likely. Facilities should be situated as close to the entrance/exit as practicable, e.g. lift core, workplace entrance, etc.	Destination parking—the cyclist works, lives or studies nearby and the facility is generally part of the destination. All day parking where the cyclist continues on to a nearby location, e.g. a workplace, school, university. Transport hub, e.g. railway station. Resident parking at multi-dwelling developments. Restricted access (non-public) compound for schools and workplaces.
C	A bicycle parking space, where the bicycle frame and both wheels can be locked to a bicycle parking device using the owner's own locking device.	Facilities should be located in well lit areas, and where passive surveillance is likely. Facilities should be located as close as practicable to the user's destination.	Short term parking on-street or off-street; retail, libraries, gyms, etc. NOTE: Not appropriate for long term parking (more than two hours).

Figure 16 - Bicycle Parking Class (Extract from Table 1.1 of AS2890.3:2015)

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With regard to visitor bicycle parking, the appropriate classification of bicycle parking facilities to be provided are Class C, which is to be in the form of a publicly accessible bicycle rack.

Table 15 - Bicycle Parking Provisions, Building 1 and Building 2

Use Type	Units (U)/Staff (S)	Bicycle Parking Provision Rate	Required Bicycle Parking	Class
Resident Bicycle Parking	357 (U)	20-30%U	**72 - 107**	B
Visitor Bicycle Parking	357 (U)	5-10%U	**18 - 36**	C
Commercial Staff Bicycle Parking	30 (S)	3-5%S	**1 - 2**	B
Commercial Visitor Bicycle Parking	30 (S)	5-10%S	**2 - 3**	C
Total Bicycle Parking (Building 1 and Building 2):			93 - 148	

A total of 161 resident bicycle parking spaces are able to be accommodated within the resident storage lockers located in the basement and podium level car parks. Furthermore, a total of 18 residential visitor spaces are proposed within a communal bicycle storage facility within the Basement 1 car park.

A total of two commercial staff spaces and two commercial visitor spaces are situated within the ground floor.

The proposed bicycle parking provision meets the minimum provisions outlined within the NSW Planning Guidelines for Walking & Cycling and provides future residents, staff and visitors with a sustainable transport option.

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5. Development Traffic Assessment

5.1 Traffic Generation

The potential traffic generation associated with the proposed development has been established with reference to the following TFNSW material:

- The Guide to Traffic Generating Developments (2002), 'TFNSW Guide'; and
- TFNSW Technical Direction (TDT) 2013/04.

The technical direction contains the most recent TFNSW survey data for high-density residential developments within environments similar to that of the proposed development. The trip generation rate of 0.32 peak hour trips per parking space was agreed with Council prior to the assessment of the current consent and endorsed through the DA approval process. Therefore, this rate has been carried over to the current application and adopted in the following trip generation analysis.

Table 16 - Trip Generation Estimate

Component	Source	Trip Rate	Unit	Peak Hourly Trip Generation
Residential	Site 9 (Regional), Appendix B3, TFNSW TDT 2013/04	**AM:** 0.32 trips / car space **PM:** 0.32 trips / car space* **Daily:** 2.23 trips / car space	406 spaces	142 trips **(AM)** 142 trips **(PM)** 905 trips **(Daily)**
Commercial	"Office Blocks" TFNSW TDT 2013/04	**AM:** 1.6 trips / 100m^2 GFA **PM:** 1.2 trips / 100m^2 GFA **Daily:** 11 trips / 100m^2 GFA	1,036m^2	16 trips **(AM)** 12 trips **(PM)** 110 trips **(Daily)**
			TOTAL TRIPS:	**158 (AM)** **158 (PM)** **1,015 (Daily)**

* the TFNSW data indicates that the evening peak rate is 0.11 trips per parking space, however we have adopted the higher morning rate of 0.32 in order to provide a robust assessment.

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5.2 Traffic Analysis

The projected traffic activity has been applied to the local road network, overlayed onto the existing background traffic (with the Mulgoa Road Upgrade). For a robust assessment, the SIDRA model also includes a cumulative assessment of the road network with the inclusion of the traffic volumes generated by the Urban Apartments development in the neighbouring property.

Models for the 10-year post development scenario have also been run for the background growth (no development) and post-development scenarios and the results are summarised in the following tables, noting that the upgrade works undertaken on Mulgoa Road are included in the 2026 and 2036 models. The 2036 models are named Scenarios 8 and 9 as there have been other intermediate test scenarios run within SIDRA.

	ptc. Model
Scenario 1A	**2020 Existing AM Peak**
Scenario 1B	**2020 Existing PM Peak**
Scenario 2A	**2026 Background Growth AM Peak**
Scenario 2B	**2026 Background Growth PM Peak**
Scenario 3A	**2026 Background Growth + Development AM Peak**
Scenario 3B	**2026 Background Growth + Development PM Peak**
Scenario 4A	**2026 Background Growth + Development + Urban Apartments - AM Peak**
Scenario 4B	**2026 Background Growth + Development + Urban Apartments - PM Peak**
Scenario 8A	**2036 Background Growth - AM Peak**
Scenario 8B	**2036 Background Growth - PM Peak**
Scenario 9A	**2036 Background Growth + Development + Urban Apartments - AM Peak**
Scenario 9B	**2036 Background Growth + Development + Urban Apartments - PM Peak**

Note = LOS for the worst performing movements has been reported as the LOS. The intersection LOS is not applicable for unsignalised intersections since the average delay is not a representative measure of the performance of an intersection due to zero delays associated on the major road. Similarly, the average delay for the critical movement has also been reported on this basis.

The key findings of this model are outlined for the AM and PM peak periods in Table 17.

Table 17 – Road Network Operation, all scenarios

Intersection	Peak Period	Scenario	Level of Service (LOS)	Degree of Saturation (DoS)	Average Delay (s)	95% Back of Queue Length (m)
1. High Street/Mulgoa Road	AM Peak	1A - 2020 Existing	F	1.156	125.5	495.5
		2A - 2026 Background Growth	D	0.868	47.9	166.5
		3A - 2026 Background Growth + Development	D	0.881	48.1	166.5
		4A - 2026 Background Growth + Development + Urban Apartments	D	0.881	48.1	166.5
		8A - 2036 Background Growth	F	1.127	87.8	236.1

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Intersection	Peak Period	Scenario	Level of Service (LOS)	Degree of Saturation (DoS)	Average Delay (s)	95% Back of Queue Length (m)
		9A - 2036 Background Growth + Development + Urban Apartments	F	1.121	90.4	237.3
	PM Peak	1B - 2020 Existing	F	1.156	121.5	347.9
		2B - 2026 Background Growth	F	1.161	124.6	328.8
		3B - 2026 Background Growth + Development	F	1.196	134.7	346.2
		4B - 2026 Background Growth + Development + Urban Apartments	F	1.196	135.3	346.2
		8B - 2036 Background Growth	F	1.400	245.9	582.8
		9B - 2036 Background Growth + Development + Urban Apartments	F	1.424	248.0	600.2
2. Mulgoa Road/Union Road*	AM Peak	1A - 2020 Existing	C	0.729	31.9	51.0
		2A - 2026 Background Growth	F	1.019	106.5	95.0
		3A - 2026 Background Growth + Development	F	1.105	161.9	145.5
		4A - 2026 Background Growth + Development + Urban Apartments	F	1.113	168.3	150.7
		8A - 2036 Background Growth	F	1.422	429.2	308.9
		9A - 2036 Background Growth + Development + Urban Apartments	F	1.550	541.1	369.0
	PM Peak	1B - 2020 Existing	F	1.061	127.2	140.0
		2B - 2026 Background Growth	F	1.147	187.0	195.3
		3B - 2026 Background Growth + Development	F	1.306	318.1	320.5
		4B - 2026 Background Growth + Development + Urban Apartments	F	1.307	319.1	321.2
		8A - 2036 Background Growth	F	1.555	540.0	427.6
		9B - 2036 Background Growth + Development + Urban Apartments	F	1.555	540.0	427.6
3. High Street/Civic Place*	AM Peak	1A - 2020 Existing	A	0.202	8.9	0.4
		2A - 2026 Background Growth	A	0.251	9.3	10.2
		3A - 2026 Background Growth + Development	A	0.271	9.7	11.3
		4A - 2026 Background Growth + Development + Urban Apartments	A	0.278	9.8	11.7
		8A - 2036 Background Growth	A	0.306	3.6	12.8

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Intersection	Peak Period	Scenario	Level of Service (LOS)	Degree of Saturation (DoS)	Average Delay (s)	95% Back of Queue Length (m)
		9A - 2036 Background Growth + Development + Urban Apartments	A	0.332	3.9	14.9
	PM Peak	1B - 2020 Existing	A	0.655	8.9	14.7
		2B - 2026 Background Growth	A	0.734	9.1	17.4
		3B - 2026 Background Growth + Development	A	0.766	10.5	18.6
		4B - 2026 Background Growth + Development + Urban Apartments	A	0.766	10.8	18.6
		8B - 2036 Background Growth	A	0.895	3.8	23.8
		9B - 2036 Background Growth + Development + Urban Apartments	A	0.895	3.8	23.8
4. High Street/Worth Street	AM Peak	1A - 2020 Existing	B	0.375	28.2	64.0
		2A - 2026 Background Growth	B	0.410	28.4	72.4
		3A - 2026 Background Growth + Development	C	0.533	36.9	82.1
		4A - 2026 Background Growth + Development + Urban Apartments	C	0.533	37.4	82.0
		8A - 2036 Background Growth	B	0.405	27.9	71.4
		9A - 2036 Background Growth + Development + Urban Apartments	C	0.543	38.7	84.9
	PM Peak	1B - 2020 Existing	C	0.664	39.6	97.9
		2B - 2026 Background Growth	C	0.808	36.9	97.9
		3B - 2026 Background Growth + Development	C	0.806	36.8	97.9
		4B - 2026 Background Growth + Development + Urban Apartments	C	0.806	36.8	97.9
		8B - 2036 Background Growth	C	0.800	37.0	97.9
		9B - 2036 Background Growth + Development + Urban Apartments	C	0.800	37.0	97.9
5. Worth Street/Union Lane*	AM Peak	1A - 2020 Existing	A	0.138	9.9	3.1
		2A - 2026 Background Growth	A	0.141	10.6	3.3
		3A - 2026 Background Growth + Development	A	0.167	8.0	3.4
		4A - 2026 Background Growth + Development + Urban Apartments	A	0.181	8.1	3.5
		8A - 2036 Background Growth	A	0.135	7.7	3.3

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Intersection	Peak Period	Scenario	Level of Service (LOS)	Degree of Saturation (DoS)	Average Delay (s)	95% Back of Queue Length (m)
		9A - 2036 Background Growth + Development + Urban Apartments	A	0.168	7.9	3.5
	PM Peak	1B - 2020 Existing	B	0.432	22.6	27.7
		2B - 2026 Background Growth	B	0.421	23.2	22.8
		3B - 2026 Background Growth + Development	B	0.423	16.9	37.3
		4B - 2026 Background Growth + Development + Urban Apartments	B	0.476	19.0	37.2
		8B - 2036 Background Growth	B	0.416	15.5	19.9
		9B - 2036 Background Growth + Development + Urban Apartments	B	0.416	15.5	19.9
6. Worth Street/Union Road	AM Peak	1A - 2020 Existing	C	0.488	30.9	72.9
		2A - 2026 Background Growth	C	0.505	31.0	77.9
		3A - 2026 Background Growth + Development	C	0.513	31.1	80.0
		4A - 2026 Background Growth + Development + Urban Apartments	C	0.521	30.9	81.6
		8A - 2036 Background Growth	C	0.498	31.4	67.6
		9A - 2036 Background Growth + Development + Urban Apartments	C	0.498	31.5	72.5
	PM Peak	1B - 2020 Existing	D	0.929	46.0	224.2
		2B - 2026 Background Growth	D	0.916	44.9	215.6
		3B - 2026 Background Growth + Development	D	0.917	45.7	216.3
		4B - 2026 Background Growth + Development + Urban Apartments	D	0.972	52.6	266.1
		8B - 2036 Background Growth	D	0.902	43.6	205.8
		9B - 2036 Background Growth + Development + Urban Apartments	D	0.902	43.6	205.8
7. Union Road/Link Road	AM Peak	1A - 2020 Existing	-	-	-	-
		2A - 2026 Background Growth	-	-	-	-
		3A - 2026 Background Growth + Development	A	0.419	9.9	3.5
		4A - 2026 Background Growth + Development + Urban Apartments	A	0.234	10.0	4.6
		8A - 2036 Background Growth	-	-	-	-

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Intersection	Peak Period	Scenario	Level of Service (LOS)	Degree of Saturation (DoS)	Average Delay (s)	95% Back of Queue Length (m)
		9A - 2036 Background Growth + Development + Urban Apartments	A	0.310	10.0	4.3
	PM Peak	1B - 2020 Existing	-	-	-	-
		2B - 2026 Background Growth	-	-	-	-
		3B - 2026 Background Growth + Development	A	0.226	11.2	2.5
		4B - 2026 Background Growth + Development + Urban Apartments	A	0.230	11.2	2.5
		8B - 2036 Background Growth	-	-	-	-
		9B - 2036 Background Growth + Development + Urban Apartments	A	0.176	10.2	0.8
8. Union Lane/Link Road	AM Peak	1A – 2020 Existing	-	-	-	-
		2A – 2026 Background Growth	-	-	-	-
		3A – 2026 Background Growth + Development	A	0.034	4.5	0.9
		4A – 2026 Background Growth + Development + Urban Apartments	A	0.070	4.5	1.8
		8A – 2036 Background Growth	-	-	-	-
		9A – 2036 Background Growth + Development + Urban Apartments	A	0.070	2.6	1.8
	PM Peak	1B – 2020 Existing	-	-	-	-
		2B – 2026 Background Growth	-	-	-	-
		3B – 2026 Background Growth + Development	A	0.025	4.2	0.6
		4B – 2026 Background Growth + Development + Urban Apartments	A	0.033	4.2	0.8
		8B – 2036 Background Growth	-	-	-	-
		9B – 2036 Background Growth + Development + Urban Apartments	A	0.025	3.9	0.6

5.3 Traffic Impact Summary

When comparing the existing road network performance (Section 3.2.2) with the anticipated future performance (Section 5.2), the model indicates that there are some delays experienced in the network at the intersections of Mulgoa Road/Union Road and High Street/Worth Street. The delays correspond to the right turn movements at both intersections, which already experience delays, whereby the proposal will result in a marginal increases to those delays.

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The intersection of the proposed Link Road and the roundabout performs well within capacity with little queuing on the Link Road. We have included within the analysis some background traffic using the Link Road in order to provide a robust assessment and the results demonstrate that there will more than sufficient capacity.

The intersection of the Link Road and Union Road is demonstrated to perform well within capacity with only minor delays for vehicle exiting the Link Road. In that respect, all traffic activity associated with the development could enter and exit via Union Road.

For the Mulgoa Road/Union Road intersection, the model of the existing scenario indicates that the 95th percentile back-of-queue distance for the right turn movement from Mulgoa Road into Union Road is approximately 111m in the AM peak and 20m in the PM peak. In both the existing AM and PM peaks, the 95th percentile queue lengths are able to be accommodated within the 160m storage capacity of the right turn lane. In the post-development scenario, the 95th percentile back of queue lengths are 659m in the AM peak and 60m in the PM peak, respectively. It is acknowledged that the 95th percentile queue in the AM peak exceeds the 160m storage capacity of the right turn lane.

The large queue lengths indicate that the right turn movement is currently operating beyond the capacity of the intersection during the peak periods, which is likely due to the random arrival of vehicles from the north within the two southbound lanes. The operation of the High Street intersection likely creates gaps between the signal phases that are not being replicated in SIDRA. This leads to a high saturation rate for this movement so that when adding any future traffic growth, extends the queues exponentially. This is not necessarily related to the development traffic, as it is noted the morning peak generates the longer queue, yet the development generates the lowest inbound traffic volume during this peak.

In the PM peak, the 95th percentile queue length of 60m can be sufficiently accommodated within the existing right turn lane on Mulgoa Road. It is noted that the right turn movement relies on a filtered turn across three lanes following the Mulgoa Road upgrade. This would be an unusual outcome; however, we are guided by the fact that this movement has been accommodated within the upgraded road layout.

The driveway intersections with Union Road and the Link Road both indicate that they will not create any notable disruption to those roads.

5.4 Road Network Scenarios

The proposed road network layouts have been retained from the current consent; however, to summarise:

- This application includes the construction of the Link Road along the eastern boundary as a two-way road (two lanes) to the south of Union Lane, which is required to provide entry/exit to the proposed development, i.e. the podium car park and the loading dock driveways.
- While not required to provide access to the development, this application also makes provision for a one-way extension to the Link Road to provide a northbound connection to the High Street roundabout (Link Road Stage 1). At this stage, Union Lane could be converted to one-way westbound, although the timing of this change is at the discretion of Council.
- During the assessment of the current consent a concept design for a traffic signal-controlled intersection at High Street and the Civic Centre access was developed to ensure that the setting out of the building and the Link Road would not preclude the ability to construct this upgrade as and when required. The footprint of the building remains unchanged in the north-east corner, while the road alignment for the Link Road is exactly as per the current consent.

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- The upgrade of the intersection was anticipated in two stages in that the Toga site can accommodate two trafficable lanes comprising a single lane in each direction (Link Road Stage 2), while a third lane to accommodate an additional northbound exit lane could be added within the Urban apartments site (Link Road Stage 3). The concept designs for these two stages have been approved in principle by TFNSW, although it is noted that TFNSW did not consider there to be a warrant for the traffic signals, and the intersection does not trigger the warrants criteria on any of the five warrant assessments. The warrants assessments are not triggered as a result of the increased development yield.
- The Link Road has been designed so that the western kerb alignment remains unchanged throughout the three Link Road stages described above.

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6. Traffic Signal & Pedestrian Crossing Warrants Assessment

An assessment has been undertaken of the warrant for traffic control signals at the intersection of High Street and the Civic Centre access road in Penrith in the context of the addition of a fourth approach from the south, referred to as the Toga Link Road.

The intersection is currently a three-arm roundabout arrangement with High Street forming the east-west axis and the Civic Centre approach being at 90 degrees from the north. The Toga development proposal includes the addition of a fourth approach to the southern side of the roundabout.

The warrants for traffic control signals (TCS) are described in Section 2 of the Traffic Signal Design Guide, published by Roads and Maritime Services (now TFNSW). For the purposes of this statement, text quoted from the Guide is italicised.

Factors Influencing the provision of traffic signals include:

- *traffic flow*
- *Traffic conflict*
- *Traffic accident statistics*
- *Pedestrian requirements*
- *Access to major roads*
- *Cost of installation*
- *Availability of funds*
- *Maintenance costs*
- *Practicality*
- *Feasibility*
- *The signposted speed limit is not more than 80km/h*

There are five warrant criteria, being:

a) Traffic demand

b) Continuous traffic

c) Pedestrian Safety

d) Pedestrian Safety – High Speed Road

e) Crashes

We have assessed the conversion of the intersection against these criteria in the following sections.

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6.1 Traffic Demand

Warrant

For each of four one-hour periods of an average day:

i) The major road flow exceeds 600 vehicles/hour in each direction: and

ii) The minor road flow exceeds 200 vehicles/hour in one direction

Assessment

The major road is High Street. Under current conditions, High Street carries 660 eastbound vehicles and 297 westbound vehicles during the morning peak. During the evening peak, these figures are 342 eastbound vehicles and 846 westbound vehicles. These are the two busiest hours of the day and do not reach the traffic volumes required to meet the Traffic Demand warrant.

This means that the warrant assessment is not met under current traffic conditions.

While the CBD network model and the Mary Street model indicate peak hour volumes that will exceed 600 vehicles per hour in both directions on High Street (in 2026, including the TFNSW Mary Street upgrade volumes), it is not demonstrated that this will occur over four one-hour periods each day. Further, it is unlikely that the flows on the minor roads will meet the warrant. To provide context, the side road currently serves the Civic Centre car park and generates 144 peak hour trips, which does not exceed 200 vehicles during any hour of the day.

6.2 Continuous traffic

Warrant

For each of four one-hour periods of an average day:

i) the major road flow exceeds 900 vehicles/hour in each direction; and

ii) the minor road flow exceeds 100 vehicle/hour in one direction; and

iii) the speed of the traffic on the major road or limited sight distance from the minor road causes undue delay or hazard to the minor road vehicle; and

iv) there is no other nearby traffic site easily accessible to the minor road vehicles.

The traffic flows on High Street do not exceed 900 vehicles/hour in each direction under the current or projected scenarios, therefore this warrant is not met. It is also relevant that the existing roundabout addresses point iii with regard to vehicle speeds and sight distances, while other intersections within the network (e.g. Worth / High and Worth / Union Road) provide traffic signal-controlled access to High Street, satisfying point iv.

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6.3 Pedestrian Safety

Warrant

For each of four one-hour periods of an average day;

i) The pedestrian flow crossing the major road exceeds 150 persons/hour; and

ii) The major road flow exceeds 600 vehicle/hour in each direction or where there is a central median of at least 1.2m wide, 1,000 vehicle/hour in each direction.

The pedestrian flow is not currently occurring as it will relate primarily to the development project once completed, although it should be noted that the traffic flows on High Street have not been demonstrated to meet this warrant under the current and 2026 scenarios.

The original yield for the overall project (both the east and west sites) was expected to accommodate 458 apartments (187 in the eastern side and 271 in the western side) and the warrants assessment for the original project which obtained a DA approval was done based on a holistic potential yield of 458 units. As previously stated, TfNSW confirmed that the warrants were not met to upgrade the roundabout to a signalised intersection. It is noted that the revised residential yield proposed as part the East DA is 357 units. As such, any references to the East DA yield of 357 units will be identified as the 'East DA Scheme' in this assessment.

As a guide to the potential pedestrian volumes, reference is made to the 2016 Census with regard to household size and Journey to Work data to gauge the peak commuter volumes.

The data used in the following analysis is extracted from the Penrith and Penrith City areas within the 2016 Census.

The left-hand table below summarises the household sizes as per the Census, while the right-hand table applies these percentages to the total number of apartments proposed within the overall Toga site (458 apartments) and the East DA Scheme (357 apartments).

The figures for 5 and 6 persons have been removed as the development will provide apartments up to 3 bedrooms, therefore it is unlikely that households of more than 4 will reside within the development. For the purposes of providing a robust assessment, we have made no adjustment to the remaining household distribution to account for the apartment mix, which comprises 90% one and two-bedroom apartments, and would likely result in a lower population.

Persons Per Dwelling			Applied to the Overall Development	Applied to East DA Scheme
1 person	**12,235**	**22%**	**103**	**80**
2 persons	**18,839**	**35%**	**316**	**246**
3 persons	**11,627**	**21%**	**293**	**228**
4 persons	**11,859**	**22%**	**398**	**310**
5 persons	**-**	**0%**		
6 or more persons	**-**	**0%**		
Total	**54,560**	**100%**	**1,110**	**863**

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The pedestrian volume generated by the overall development has been calculated based on the population figure presented above, and reference to the Census journey to work data. As such, the pedestrian volumes generated by the East DA Scheme is evidently less than that of the overall site. It is noted that the following pedestrian crossing warrants assessment has been undertaken based on the original yield of 458 units for the entire site for a robust assessment.

The combined Journey to Work data for Penrith and Penrith CBD is summarised in the following table:

Travel Mode			Applied to Dev Population
Train	10,708	11%	118
Bus	985	1%	11
Tram or Ferry	20	0%	0
Taxi	103	0%	1
Car - as driver	66,426	66%	734
Car - as passenger	4949	5%	55
Truck	1,752	2%	19
Motorbike	444	0%	5
Bicycle	204	0%	2
Walked only	1,568	2%	17
Other	955	1%	11
Worked at home	3,018	3%	33
Did not go to work	8,543	8%	94
Not stated	832	1%	9
	100,507	100%	1,110

The data indicated that 118 residents will travel by train, while 17 will walk and 11 will use bus services. Each of these modes will involve walking to and from the site, and in a worst-case scenario would total 146 people in a single hour. This activity would occur during 2 hours per day and not all of these people will want to access the northern side of High Street, e.g., bus services and employment are located to the east within the CBD, which would be facilitated by a walk along the southern side of High Street, while the station is also located to the east with a logical route being along High Street, Henry Street and Riley Street. There are multiple signal-controlled crossings across High Street along this route.

Pedestrians, other than commuters, comprise school students and shoppers. All schools serving the site (i.e., within walking distance) are located to the east of the site and there is no desire line that would benefit students crossing to the north side of High Street as illustrated overleaf.

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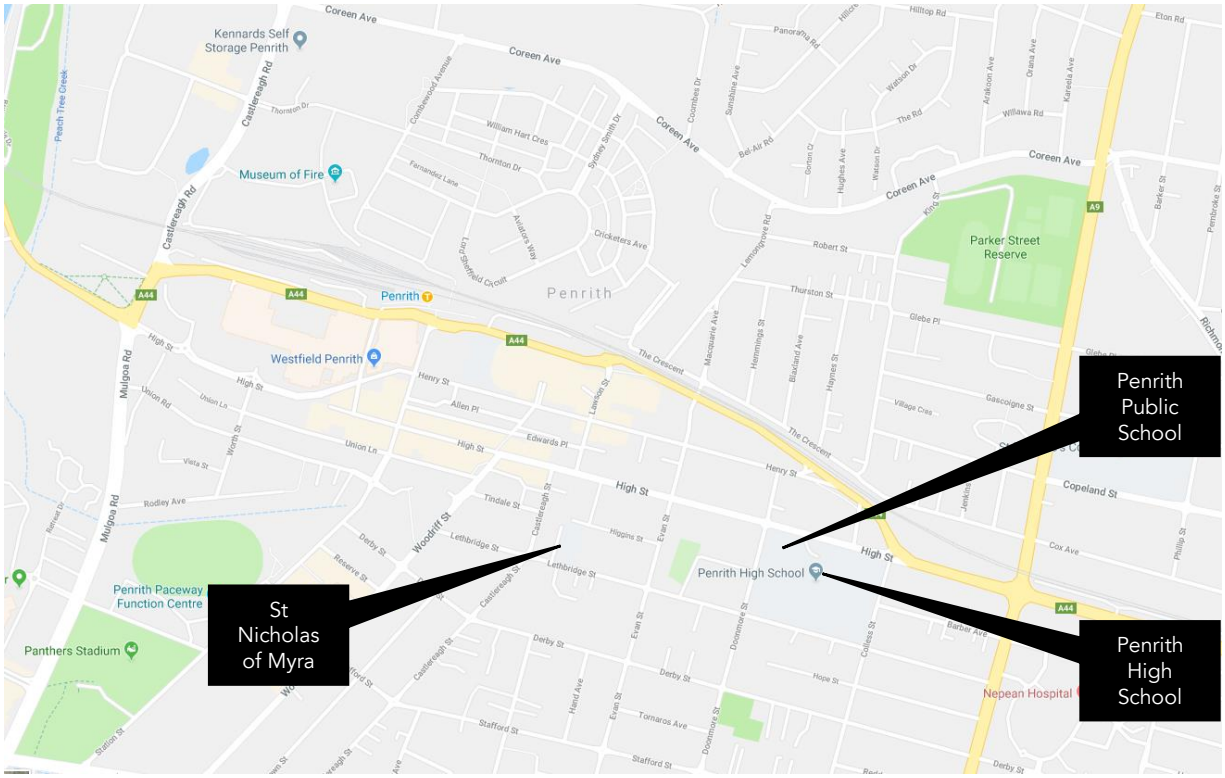

The primary retail destinations serving the site are the CBD, to the east, and Westfield shopping centre, which is located on the northern side of High Street. As illustrated below, there is a convenient walking route to the Westfield using the crossings at Worth Street or walking along High Street to the eastern main entrance.

The primary pedestrian desire lines are illustrated in the following figure and demonstrate that the pedestrian crossings at the High / Worth Street intersection provide a convenient and safe route to the key locations.

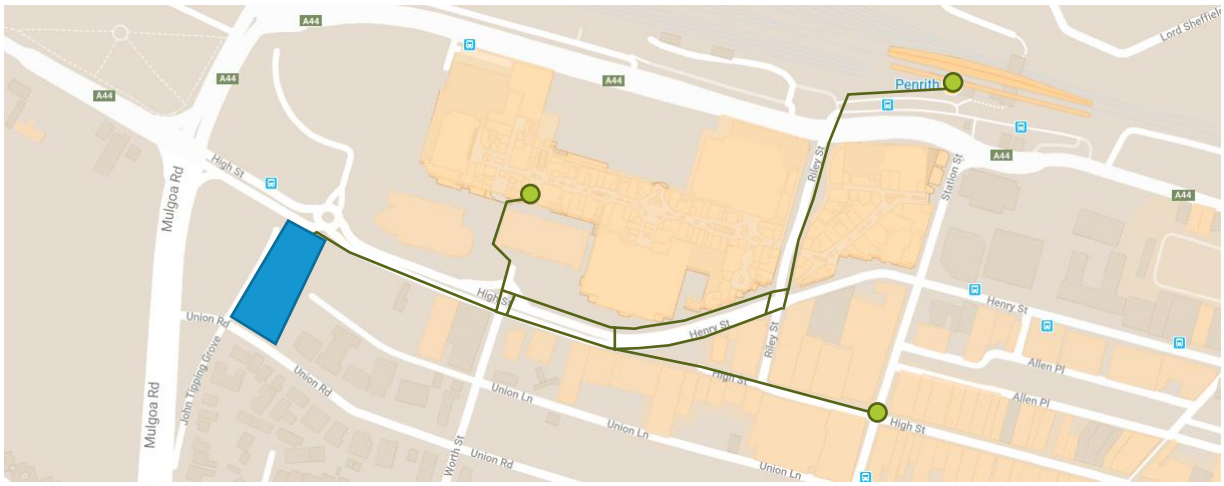

Figure 17 - Primary Walk Destinations

Given that there is no school desire line, and retail activity will mainly occur outside the commuter peak periods (particularly the morning period) the maximum number of people wanting to cross High Street near the site 'could' comprise the train commuters, being 118 people during two hours of the day. This is

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facilitated by the multiple crossings along High Street, including at Mulgoa Road, considering that more than half these residents will be walking from the western part of the site. Following the distribution of pedestrians along High Street, there is no warrant for a crossing (either standalone, or as part of an intersection) between Mulgoa Road and Worth Street.

6.4 Pedestrian Safety – High Speed Road

Warrant

For each of four one-hour periods of an average day;

- *i) The pedestrian flow crossing the major road exceeds 150 persons/hour; and*
- *ii) The major road flow exceeds 450 vehicle/hour in each direction or where there is a central median of at least 1.2m wide, 750 vehicle/hour in each direction, and*
- *iii) The 85th percentile speed on the major road exceeds 75 km/h*

The intersection fails to meet this warrant based on the analysis of the projected pedestrian activity, regardless, it is extremely unlikely that the 85th percentile speed exceeds 75 km/h on any part of High Street in the vicinity of the site.

6.5 Crashes

Warrant

- *i) The intersection has been the site of an average of three or more reported tow-away or casualty traffic accidents per year over a three-year period, where the traffic accidents could have been prevented by traffic signals; and*
- *ii) The traffic flows are at least 80% of the appropriate flow warrants. each of four one-hour periods of an average day;*

The following figure is sourced from the NSW Centre for Road Safety and indicates the Crash and Casualty Statistics for the five-year period from 2013 through 2017. The colour of the symbols represents the severity of the incidents, and the figure shows all types of incident (i.e. not filtered to only show tow-away or casualty accidents. There are no recorded accidents at the intersection of High Street and the Civic Centre access over the five-year period, thereby not meeting the crashes warrant for traffic signals.

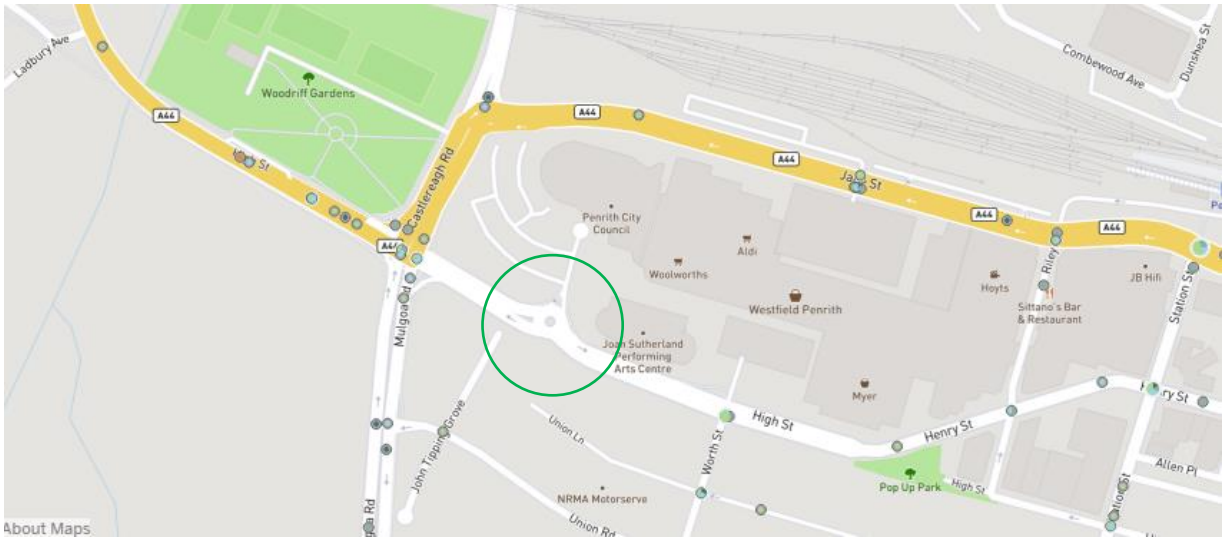

Figure 18 - Five Year Accident Data

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6.6 Pedestrian Safety Measures

The site benefits from signal-controlled pedestrian crossings at the intersection of High Street and Mulgoa Road, which is a distance of 60 metres from the eastern site, and the crossings at Worth Street, which is on the desire line to the major destinations.

In order to encourage the use of these routes, it is recommended that infrastructure be installed along High Street to discourage pedestrians crossing High Street at the roundabout. This may be in the form of fencing, landscaping or other forms of street furniture. It is noted that Penrith Council have adopted the use of pedestrian fencing on High Street and within the CBD as shown in the following images.

Figure 19 - Henry Street, in the vicinity of the development site

Figure 20 - High Street

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Figure 21 - Henry Street / Riley Street

Figure 22 - Adjacent to the Station

6.7 Conclusion

The traffic signals and pedestrian crossing assessment has concluded that the intersection of High Street with the Civic Centre access and the proposed link road does not meet any of the TFNSW warrants for traffic signals or a pedestrian crossing under the current or 2026 traffic volume scenarios for the original overall residential yield of 458 units. Given that the East DA Scheme of 357 units is less than the original scheme for the overall site, it follows that the provision of traffic signals or pedestrian crossing is also not warranted.

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7. Access and Car Park Assessment

The following section details a design assessment of the proposed development with reference to the DCP and the requirements of AS2890.1:2004 (Off-street car parking), AS2890.2:2002 (Off-street Commercial), AS2890.3:2015 (Bicycle Parking) and AS2890.6:2009 (Off-street parking for people with disabilities). It is highlighted that **ptc.**'s assessment of the car park has been conducted acknowledging that the design is currently conceptual and any non-conformities to the standards which have been identified are able to be resolved prior to Construction Certification. As such, further assessment would be required in the CC stage to ensure full compliance is achieved. The purpose of this access and car park assessment is to confirm that the proposed design is capable of meeting the requirements of the relevant Australian Standards.

This section is to be read in conjunction with the following items:

- Architectural Plans prepared by SJB Architects;
    - AR-1-1007 Rev 86 – GA Floor Plan - Basement 03;
    - AR-1-1008 Rev 86 – GA Floor Plan - Basement 02;
    - AR-1-1009 Rev 86 – GA Floor Plan - Basement 01;
    - AR-1-1010 Rev 86 – GA Floor Plan – Ground Floor;
    - AR-1-1011 Rev 86 – GA Floor Plan – Level 01;
    - AR-1-1012 Rev 86 – GA Floor Plan – Level 02;
    - AR-1-1013 Rev 86 – GA Floor Plan – Level 03;
    - AR-1-1014 Rev 86 – GA Floor Plan – Level 04.
- Compliance and Swept Path Assessment is as provided by **ptc.** (Attachment 1).

7.1 Vehicular Access

The proposed development comprises three access points:

- An entry/exit driveway off the proposed link road, serving the basement levels of parking; and
- An entry/exit driveway off Union Road, serving the podium level car park.
- A dedicated driveway on the proposed link road serving the loading dock.

The location of each driveway is on a relatively straight, and level alignment, and as such, sightlines to exiting traffic to through traffic is compliant with AS2890.1. In regard to pedestrian sight lines, pedestrian sight splays of 2m x 2.5m adjacent to the driveways at the property boundary will be kept clear of visual obstructions, as per Figure 3.3 of AS2890.1:2004.

In accordance with Table 3.1 and Table 3.2 of AS2890.1, the determination of the relevant access facility category is based on the user class (Class 1A) and the number of parking spaces provided within each car park. It is noted that the basement car park and podium car parks have been treated as separate car parks as there is no internal interconnectivity between the basement level and the podium levels.

The podium car park is accessed via a local road and accommodates a total of 112 Class 1A parking spaces which corresponds to an access facility category of Category 1. A Category 1 parking facility requires a

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minimum combined driveway width of 6.0m for entry and exit. The proposed driveway width for the podium car park is 7.4m which meets this requirement.

The basement car park and ground floor commercial parking areas are accessed via a local road and accommodates a total of 294 spaces. This results in an access category of Category 3 which in accordance with Table 3.2 of AS2890.1, requires an entry width of 6.0m and an exit width of 4.0m to 6.0m. The proposed driveway width of 7.5m, meets the minimum requirement.

The approximate access driveway for the basement and podium car parks have been assessed to ensure that a B99 design vehicle is able to comfortably pass a B85 design vehicle for two-way circulation. A swept path assessment has been undertaken to demonstrate that the proposed arrangement enables two-way circulation. Consideration has also been given to minimise the driveway crossover width where possible in order to optimise pedestrian amenity.

The driveway width for access to the loading dock is approximately 9.2m at edge of the frontage road, which is able to accommodate access and egress for a 10.5m long Council refuse vehicle as demonstrated by the swept path assessment. A turntable has been provided within the loading dock to allow the refuse vehicle to turn around and exit the site in a forward direction.

7.2 Car Park Arrangement

7.2.1 Typical Requirements

All car parking spaces are to be in accordance with Class 1A parking requirements, classified under AS2890.1:2004 as residential/employee parking, whereby:

- Car Spaces are 2.4m x 5.4m with all door and entry clearances maintained as per the AS parking envelope requirements.
- Aisle widths are at minimum, 5.8m wide, and do not exceed a grade of 5%.
- Clear height clearance of 2.8m will need to be provided within all car park levels, as per C10 of the DCP.
- Where blind aisles occur, a minimum aisle extension of 1m has been provided.
- Ramp grades do not exceed 25%, and transitions are provided to prevent any grade changes in occurring excess of 12.5%.
- Traffic calming is not proposed or considered necessary as the aisles are not of sufficient length to warrant speed reduction measures, i.e. vehicles would be unlikely to exceed 10 kph within the short aisle lengths. It is proposed that 10 kph regulatory signage be included at strategic locations at the entry to each level of the car park to regulate vehicle speed.

The review concludes that the development is able to comply with all relevant AS2890.1 requirements.

7.2.2 Accessible Parking

Regarding disabled parking, spaces will be designed with dimensions 2.4m x 5.4m, with adjacent shared bays of equal dimensions. Shared bays and accessible spaces shall be installed in accordance with AS2890.6:2009, including the installation of bollards and relevant pavement markings. A minimum height clearance of 2.5 metres shall be maintained above all accessible and shared bays.

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It is noted that any obstructions (e.g. columns) which are located within a shared bay or between an accessible and shared bay will need to be signed off by a suitably qualified Accessibility Consultant to ensure that the parking bays are fit-for-purpose.

7.2.3 Bicycle Parking

All bicycle parking spaces are to be provided in accordance with AS2890.3:2015.

Approved bicycle parking devices (BPD's) shall be installed as per the following requirements of AS2890.3:2015:

- Horizontal parking: 1800mm x 500mm;
- Vertical Parking: 1200mm x 500mm;
- Access Aisle: 1500mm OR 2000mm for lockers
- Height Clearance: min. 2200mm height clearance for general access by bicycles (2000mm is permitted for short distances in enclosed structures)

7.3 Loading Dock

The proposed loading area has been designed in accordance with AS2890.2:2018 and performance tested through a swept path assessment of a 10.5m long Council refuse vehicle. The loading area has been designed to accommodate a single 10.5 metre vehicle at any one time.

In order to facilitate access and egress to the loading dock, a turntable has been proposed to allow a 10.5m long Council refuse vehicle to turn around and be able to enter and exit in a forward direction. The proposed turntable has a diameter of 10.5m with an additional 1.0m safety clearance zone around the turntable.

The loading area is designed on a level grade, with a 4.5m height clearance will need to be maintained throughout the area.

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8. Conclusion

ptc. have been engaged by the proponent to assess the proposed development application of the Stage 1, mixed-use building located at 87-91 Union Road / 634-368 High Street in Penrith. This assessment comprises a consideration of all matters in respect to the parking and traffic implications of the development and has been prepared for submission to Council as part of the DA documentation.

Following this assessment, ptc. concludes the following:

- The existing road network is generally operating within capacity, with some congestion however for right turn movements at intersections along High Street and along Mulgoa Road. Alternative modes of travel are well catered for, with bus and train services providing regular public transport throughout the greater Sydney region;
- In accordance with the TfNSW Guide and the DCP, the proposal is required to provide a minimum total of 310 parking spaces;
- In accordance with the NSW Planning Guidelines for Walking & Cycling, bicycle parking must be provided within the range of 93-148 spaces. The proposal will need to comply with this requirement. Residential bicycle parking will be predominantly provided for within the allocated storage lockers, which will be appropriately designed to accommodate bicycles;
- A loading bay within the ground floor loading dock has been provided that is capable of accommodating a 10.5m long Council refuse vehicle. A turntable has been proposed within the loading dock to allow the refuse vehicle to enter and exit the site in a forward direction. This is considered appropriate for the development;
- Based on the proposed parking provisions and commercial floor area, the anticipated traffic generations of the proposal have been estimated in reference to the TFNSW Technical Direction 2013/04. A potential traffic generation of 158 trips are anticipated in the AM and PM peaks;
- A future road network model has been analysed using SIDRA, applying the proposed traffic volumes to the background traffic of the local road network and incorporating the traffic generation associated with the Urban Apartments development for a robust cumulative analysis. In summary, the model indicates that the proposal will be accommodated within the road network and will result in some manageable increase to the delays at some intersections; and
- A design review of the architectural plans has been undertaken, with reference to the AS2890 series. This review determined that the design is capable of complying with the relevant standards, which will need to be demonstrated fully prior to Construction Certification.

In light of the above, the proposal is considered appropriate in the context of traffic and parking, and as such, is endorsed by ptc.

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Attachment 1 - Architectural Drawings

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Nominated Architects: Adam Haddow-7188 | John Pradel-7004

FOR APPROVAL

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86	30.09.2021	ISSUED FOR APPROVAL

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634-638 HIGH ST & 87-89
UNION RD, PENRITH

Drawing Name
1000 OVERALL PLANS
GA FLOOR PLAN - BASEMENT 03

Date	Scale	Sheet Size
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86	30.09.2021	ISSUED FOR APPROVAL

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1000 OVERALL PLANS
GA FLOOR PLAN - BASEMENT 02

Date	Scale	Sheet Size
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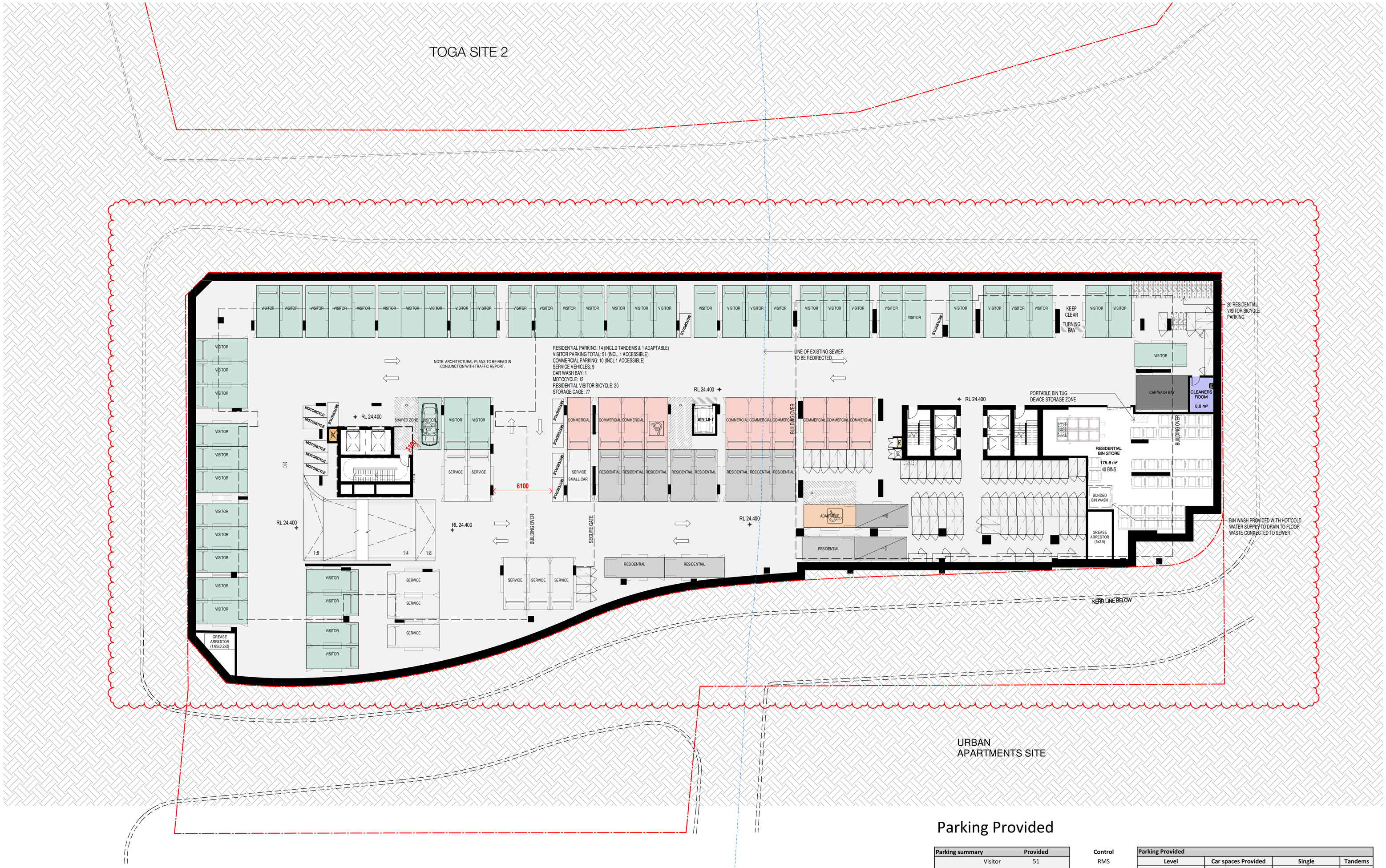

Parking Provided

Parking summary	Provided
Visitor	51
Commercial	10
Service	9
Carwash	2
Subtotal	**72**
Motorcycle spaces	24
Residential	
Single spaces	293
Tandems	41
Subtotal	**334**
Total Parking Provided	**406**

Control
RMS
DCP
DCP
DCP

Parking Provided			
Level	**Car spaces Provided**	**Single**	**Tandems**
Basement 01	85	80	5
Basement 02	104	92	12
Basement 03	105	93	12
Ground		0	
P1	30	26	4
P2	41	37	4
P3	41	37	4
Total	**406**	**365**	**41**

0 2m 4m 10m 20m
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66	24.01.2020	PRELIMINARY ISSUE
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75	20.02.2020	TRAFFIC COORDINATION
76	20.02.2020	ISSUED FOR BASIX COORDIANTION
77	21.02.2020	ISSUED FOR TRAFFIC COORDINATION
81	28.02.2020	DRAFT DA ISSUE
82	03.03.2020	ISSUED FOR COORDINATION
83	04.03.2020	ISSUED FOR DA
85	07.05.2021	ISSUED FOR DA
86	30.09.2021	ISSUED FOR APPROVAL

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GA FLOOR PLAN - BASEMENT 01

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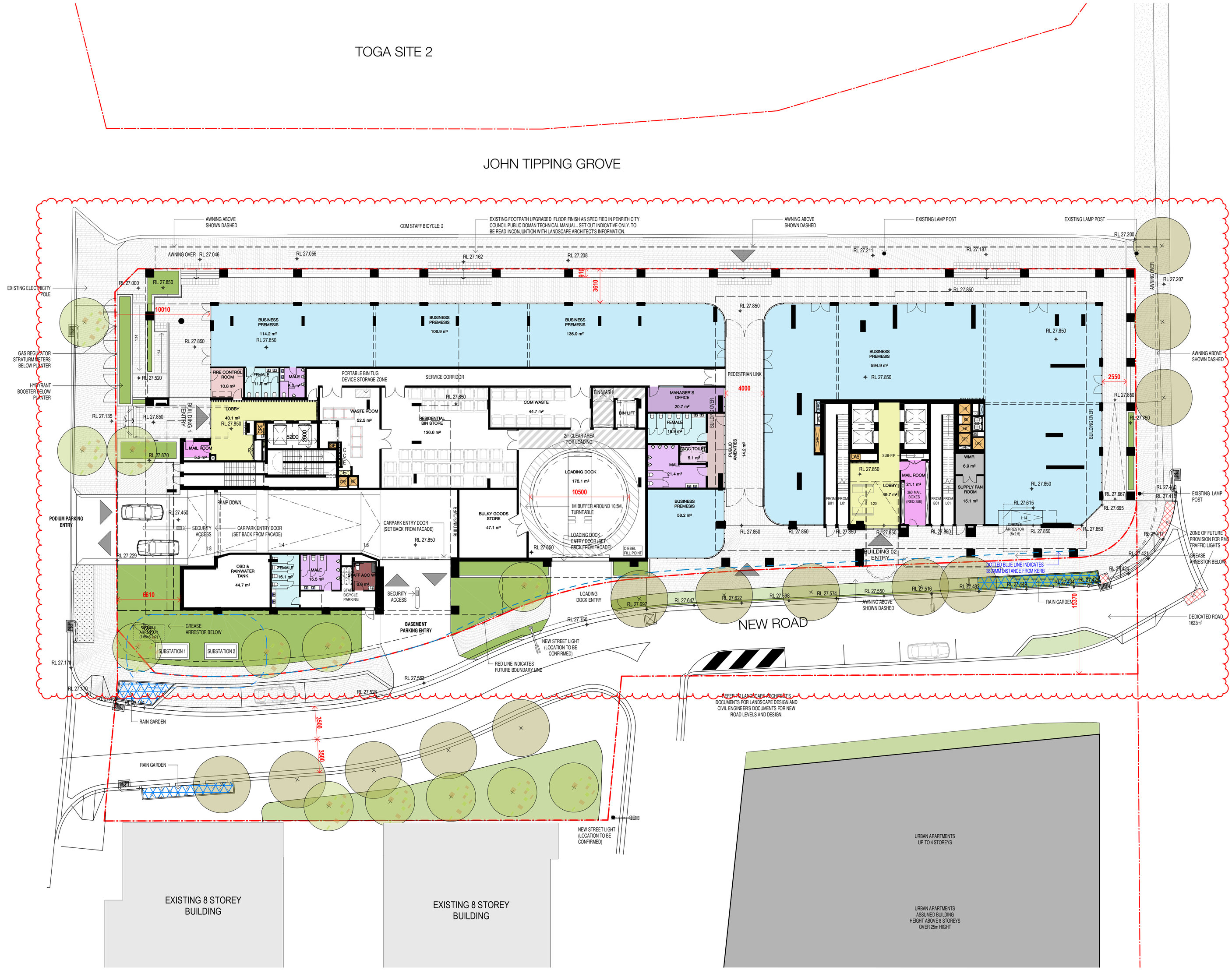

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70	06.02.2020	PRE DA ISSUE
72	13.02.2020	TRAFFIC COORDINATION
75	20.02.2020	TRAFFIC COORDINATION
76	20.02.2020	ISSUED FOR BASIX COORDIANTION
81	28.02.2020	DRAFT DA ISSUE
83	04.03.2020	ISSUED FOR DA
85	07.05.2021	ISSUED FOR DA
86	30.09.2021	ISSUED FOR APPROVAL

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GA FLOOR PLAN - GROUND FLOOR

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FOR APPROVAL

Rev	Date	Revision
66	24.01.2020	PRELIMINARY ISSUE
69	06.02.2020	PRELIMINARY ISSUE - LANDSCAPE UPDATES
70	06.02.2020	PRE DA ISSUE
72	13.02.2020	TRAFFIC COORDINATION
75	20.02.2020	TRAFFIC COORDINATION
76	20.02.2020	ISSUED FOR BASIX COORDIANTION
81	28.02.2020	DRAFT DA ISSUE
83	04.03.2020	ISSUED FOR DA
85	07.05.2021	ISSUED FOR DA
86	30.09.2021	ISSUED FOR APPROVAL

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ROBERT BIRD GROUP

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Client
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Project
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634-638 HIGH ST & 87-89
UNION RD, PENRITH

Drawing Name
1000 OVERALL PLANS
GA FLOOR PLAN - LEVEL 01

Date	Scale	Sheet Size
30.09.2021	1 : 200	@ A1

Drawn	Chk.
GT	MG

Job No.	Drawing No.	Revision
6111	AR-1-1011	/86

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81	28.02.2020	DRAFT DA ISSUE
83	04.03.2020	ISSUED FOR DA
85	07.05.2021	ISSUED FOR DA
86	30.09.2021	ISSUED FOR APPROVAL

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Drawing Name
1000 OVERALL PLANS
GA FLOOR PLAN - LEVEL 02

Date	Scale	Sheet Size
30.09.2021	1 : 200	@ A1

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6111	AR-1-1012	/86

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Nominated Architects: Adam Haddow-7188 | John Pradel-7004

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75	20.02.2020	TRAFFIC COORDINATION
76	20.02.2020	ISSUED FOR BASIX COORDIANTION
81	28.02.2020	DRAFT DA ISSUE
83	04.03.2020	ISSUED FOR DA
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UNION RD, PENRITH

Drawing Name
1000 OVERALL PLANS
GA FLOOR PLAN - LEVEL 03

Date	Scale	Sheet Size
30.09.2021	1 : 200	@ A1

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6111	AR-1-1014	/86

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83	04.03.2020	ISSUED FOR DA
85	07.05.2021	ISSUED FOR DA
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- 1B + ST
- 2B/2BTH
- 2B
- 2B + ST/M
- 3B
- S - STORAGE
- 1800mm PRIVACY SCREENS

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HIGH ST DEVELOPMENT

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UNION RD, PENRITH

Drawing Name
1000 OVERALL PLANS
GA FLOOR PLAN - LEVEL 04

Date	Scale	Sheet Size
30.09.2021	1 : 200	@ A1

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GT	MG

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6111	AR-1-1015	/86

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Attachment 2 - SIDRA Modelling Results

Network Performance Comparison: AM Existing – AM Proposed

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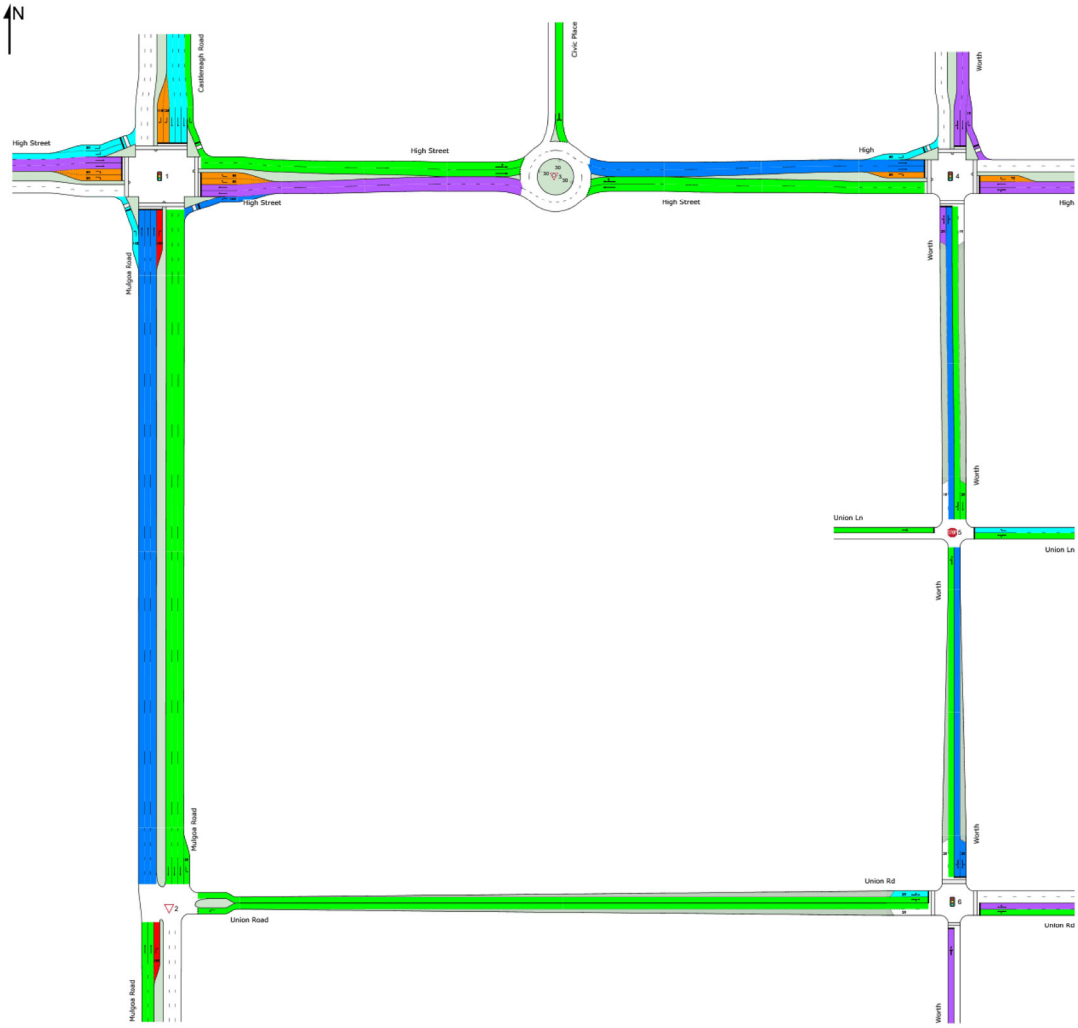
LANE LEVEL OF SERVICE

Lane Level of Service for Network Sites

Network: N101 [2020 Existing AM Peak]

Current Layout with Upgraded High St/Mulgoa Rd & Mulgoa Rd/Union Rd
Network Category: (None)



Colour code based on Level of Service

LOS A	LOS B	LOS C	LOS D	LOS E	LOS F

Delay model settings are specified for individual Sites forming the Network.

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Organisation: PARKING AND TRAFFIC CONSULTANTS | Processed: Thursday, 27 February 2020 11:15:58 AM
Project: Z:\PCI - PROJECT WORK FILES\NSW\TOGA - PENRITH\SIDRA Model\EAST DA Scheme\2020 Existing AM Peak\200227 - Existing Situation - 2020 AM Peak.sip8

MOVEMENT SUMMARY

Site: 1 [1. High and Mulgoa - Upgraded]

Network: N101 [2020 Existing AM Peak]

High Street and Mulgoa Road
Upgraded Intersection
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 130 seconds (Site Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Mulgoa Road														
1	L2	140	2.0	140	2.0	0.144	21.9	LOS B	4.4	31.4	0.54	0.70	0.54	38.3
2	T1	1023	2.0	1023	2.0	0.591	41.6	LOS C	18.4	130.7	0.91	0.78	0.91	29.7
3	R2	119	2.0	119	2.0	0.768	74.0	LOS F	8.0	56.8	1.00	0.88	1.18	7.5
Approach		1282	2.0	1282	2.0	0.768	42.4	LOS C	18.4	130.7	0.88	0.78	0.89	28.3
East: High Street														
4	L2	59	2.0	58	2.0	0.129	28.8	LOS C	2.0	13.9	0.81	0.72	0.81	13.4
5	T1	175	2.0	172	2.0	0.277	52.0	LOS D	4.9	34.5	0.92	0.72	0.92	25.7
6	R2	105	2.0	104	2.0	0.176	56.7	LOS E	2.9	20.4	0.90	0.74	0.90	24.2
Approach		339	2.0	334 N1	2.0	0.277	49.4	LOS D	4.9	34.5	0.90	0.73	0.90	24.2
North: Castlereagh Road														
7	L2	148	2.0	148	2.0	0.148	13.9	LOS A	2.9	20.5	0.52	0.69	0.52	41.6
8	T1	1058	2.0	1058	2.0	0.541	23.3	LOS B	13.5	96.4	0.86	0.74	0.86	34.6
9	R2	498	2.0	498	2.0	0.803	66.7	LOS E	16.3	116.1	1.00	0.91	1.14	28.8
Approach		1704	2.0	1704	2.0	0.803	35.2	LOS C	16.3	116.1	0.87	0.78	0.91	32.1
West: High Street														
10	L2	895	2.0	895	2.0	0.690	26.3	LOS B	15.1	107.6	0.91	0.84	0.91	41.6
11	T1	501	2.0	501	2.0	0.705	54.8	LOS D	15.3	108.6	0.99	0.85	1.02	22.1
12	R2	294	2.0	294	2.0	0.434	56.8	LOS E	8.4	59.5	0.93	0.80	0.93	21.4
Approach		1689	2.0	1689	2.0	0.705	40.1	LOS C	15.3	108.6	0.94	0.84	0.95	32.4
All Vehicles		5015	2.0	5010 N1	2.0	0.803	39.6	LOS C	18.4	130.7	0.90	0.80	0.92	30.7

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.
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.

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate
P1	South Full Crossing	53	59.3	LOS E	0.2	0.2	0.96	0.96
P1S	South Slip/Bypass Lane Crossing	53	26.6	LOS C	0.1	0.1	0.64	0.64
P2	East Full Crossing	53	59.3	LOS E	0.2	0.2	0.96	0.96

P2S	East Slip/Bypass Lane Crossing	53	46.6	LOS E	0.2	0.2	0.85	0.85
P3	North Full Crossing	53	59.3	LOS E	0.2	0.2	0.96	0.96
P3S	North Slip/Bypass Lane Crossing	53	56.4	LOS E	0.2	0.2	0.93	0.93
P4	West Full Crossing	53	45.0	LOS E	0.2	0.2	0.83	0.83
P4S	West Slip/Bypass Lane Crossing	53	34.8	LOS D	0.1	0.1	0.73	0.73
All Pedestrians		421	48.4	LOS E			0.86	0.86

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

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MOVEMENT SUMMARY

Site: 2 [2. Mulgoa and Union - Upgraded]

Network: N101 [2020 Existing AM Peak]

Mulgoa and Union
Upgraded Intersection
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: Mulgoa Road														
2	T1	1309	2.0	1309	2.0	0.343	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
3	R2	302	2.0	302	2.0	0.991	74.9	LOS F	15.6	110.9	1.00	2.11	5.10	17.6
Approach		1612	2.0	1612	2.0	0.991	14.1	NA	15.6	110.9	0.19	0.40	0.96	41.1
East: Union Road														
4	L2	60	2.0	60	2.0	0.063	7.2	LOS A	0.2	1.7	0.36	0.61	0.36	50.7
Approach		60	2.0	60	2.0	0.063	7.2	LOS A	0.2	1.7	0.36	0.61	0.36	50.7
North: Mulgoa Road														
7	L2	334	2.0	334	2.0	0.182	5.6	LOS A	0.0	0.0	0.00	0.58	0.00	38.5
8	T1	1084	2.0	1084	2.0	0.188	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
Approach		1418	2.0	1418	2.0	0.188	1.3	NA	0.0	0.0	0.00	0.14	0.00	57.7
All Vehicles		3089	2.0	3089	2.0	0.991	8.1	NA	15.6	110.9	0.10	0.28	0.51	47.8

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.
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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MOVEMENT SUMMARY

Site: 3 [3. High and Civic]

Network: N101 [2020 Existing AM Peak]

High and Civic
Site Category: (None)
Roundabout

Movement Performance - Vehicles														
Mov ID	Turn	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
East: High Street														
5	T1	313	0.0	313	0.0	0.112	3.6	LOS A	0.5	3.2	0.08	0.37	0.08	44.3
6	R2	28	0.0	28	0.0	0.112	9.3	LOS A	0.4	3.1	0.08	0.41	0.08	41.9
Approach		341	0.0	341	0.0	0.112	4.1	LOS A	0.5	3.2	0.08	0.37	0.08	44.1
North: Civic Place														
7	L2	17	0.0	17	0.0	0.043	4.0	LOS A	0.2	1.4	0.46	0.63	0.46	27.4
9	R2	26	0.0	26	0.0	0.043	9.5	LOS A	0.2	1.4	0.46	0.63	0.46	27.4
Approach		43	0.0	43	0.0	0.043	7.3	LOS A	0.2	1.4	0.46	0.63	0.46	27.4
West: High Street														
10	L2	74	0.0	74	0.0	0.245	3.7	LOS A	1.3	9.0	0.08	0.36	0.08	36.2
11	T1	695	0.0	695	0.0	0.245	3.6	LOS A	1.3	9.0	0.08	0.35	0.08	42.2
Approach		768	0.0	768	0.0	0.245	3.6	LOS A	1.3	9.0	0.08	0.35	0.08	41.4
All Vehicles		1153	0.0	1153	0.0	0.245	3.9	LOS A	1.3	9.0	0.09	0.37	0.09	41.8

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.

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MOVEMENT SUMMARY

Site: 4 [4. High and Worth]

Network: N101 [2020 Existing AM Peak]

High and Worth
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 120 seconds (Site Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Worth														
1	L2	344	2.0	344	2.0	0.864	53.6	LOS D	13.8	97.9	0.90	0.92	1.12	4.7
2	T1	127	2.0	127	2.0	0.697	35.5	LOS C	10.1	72.1	0.82	0.75	0.87	29.0
3	R2	91	2.0	91	2.0	0.697	39.9	LOS C	10.1	72.1	0.82	0.75	0.87	28.4
Approach		562	2.0	562	2.0	0.864	47.3	LOS D	13.8	97.9	0.87	0.85	1.02	15.3
East: High														
4	L2	28	2.0	28	2.0	0.374	49.0	LOS D	7.8	55.3	0.90	0.74	0.90	24.7
5	T1	282	2.0	282	2.0	0.374	43.4	LOS D	7.8	55.8	0.90	0.74	0.90	24.9
6	R2	31	2.0	31	2.0	0.333	69.0	LOS E	1.8	13.2	1.00	0.72	1.00	27.9
Approach		341	2.0	341	2.0	0.374	46.2	LOS D	7.8	55.8	0.91	0.74	0.91	25.3
North: Worth														
7	L2	1	2.0	1	2.0	0.002	42.7	LOS D	0.0	0.3	0.78	0.59	0.78	35.1
8	T1	14	2.0	14	2.0	0.098	49.3	LOS D	1.3	9.0	0.90	0.65	0.90	22.7
9	R2	16	2.0	16	2.0	0.098	55.4	LOS D	1.3	9.0	0.91	0.69	0.91	22.2
Approach		31	2.0	31	2.0	0.098	52.2	LOS D	1.3	9.0	0.90	0.67	0.90	22.9
West: High														
10	L2	118	2.0	118	2.0	0.149	19.1	LOS B	3.1	21.8	0.64	0.71	0.64	40.3
11	T1	451	2.0	451	2.0	0.390	35.7	LOS C	10.4	74.3	0.84	0.71	0.84	32.0
12	R2	199	2.0	199	2.0	0.815	66.4	LOS E	12.4	88.3	1.00	0.90	1.20	8.2
Approach		767	2.0	767	2.0	0.815	41.1	LOS C	12.4	88.3	0.85	0.76	0.90	26.6
All Vehicles		1701	2.0	1701	2.0	0.864	44.4	LOS D	13.8	97.9	0.87	0.78	0.94	23.0

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.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate
P1	South Full Crossing	53	45.2	LOS E	0.2	0.2	0.87	0.87
P2	East Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P3	North Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P3S	North Slip/Bypass Lane Crossing	53	30.9	LOS D	0.1	0.1	0.72	0.72
P4	West Full Crossing	53	39.3	LOS D	0.1	0.1	0.81	0.81

P4S	West Slip/Bypass Lane Crossing	53	29.5	LOS C	0.1	0.1	0.70	0.70
All Pedestrians		316	42.2	LOS E			0.83	0.83

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

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MOVEMENT SUMMARY

Site: 5 [5. Worth and Union Ln]

Network: N101 [2020 Existing AM Peak]

Worth and Union Ln
Site Category: (None)
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: Worth														
1	L2	74	2.0	74	2.0	0.270	3.9	LOS A	5.6	39.7	0.00	0.08	0.00	56.0
2	T1	442	2.0	442	2.0	0.270	0.0	LOS A	5.6	39.7	0.00	0.08	0.00	52.0
Approach		516	2.0	516	2.0	0.270	0.6	NA	5.6	39.7	0.00	0.08	0.00	54.3
East: Union Ln														
4	L2	18	2.0	18	2.0	0.056	8.7	LOS A	0.2	1.7	0.35	0.88	0.35	44.3
5	T1	20	2.0	20	2.0	0.056	14.5	LOS B	0.2	1.7	0.35	0.88	0.35	49.6
6	R2	25	2.0	25	2.0	0.124	14.6	LOS B	0.2	1.7	0.60	0.99	0.60	41.8
Approach		63	2.0	63	2.0	0.124	12.9	LOS A	0.2	1.7	0.45	0.93	0.45	45.8
North: Worth														
8	T1	143	2.0	143	2.0	0.134	1.3	LOS A	0.7	5.1	0.24	0.21	0.24	36.3
9	R2	97	2.0	97	2.0	0.134	6.6	LOS A	0.7	5.1	0.38	0.33	0.38	50.5
Approach		240	2.0	240	2.0	0.134	3.4	NA	0.7	5.1	0.30	0.26	0.30	47.6
West: Union Ln														
10	L2	36	2.0	36	2.0	0.076	10.2	LOS A	0.3	2.3	0.53	0.88	0.53	44.7
12	R2	15	2.0	15	2.0	0.076	15.4	LOS B	0.3	2.3	0.53	0.88	0.53	44.7
Approach		51	2.0	51	2.0	0.076	11.7	LOS A	0.3	2.3	0.53	0.88	0.53	44.7
All Vehicles		869	2.0	869	2.0	0.270	2.9	NA	5.6	39.7	0.15	0.24	0.15	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.
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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MOVEMENT SUMMARY

Site: 6 [6. Worth and Union Rd]

Network: N101 [2020 Existing AM Peak]

Worth and Union Rd
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 90 seconds (Site Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Worth														
1	L2	22	2.0	22	2.0	0.322	48.4	LOS D	2.4	16.8	0.97	0.74	0.97	24.0
2	T1	20	2.0	20	2.0	0.322	42.8	LOS D	2.4	16.8	0.97	0.74	0.97	24.0
3	R2	13	2.0	13	2.0	0.322	48.4	LOS D	2.4	16.8	0.97	0.74	0.97	33.4
Approach		55	2.0	55	2.0	0.322	46.4	LOS D	2.4	16.8	0.97	0.74	0.97	26.8
East: Union Rd														
4	L2	4	2.0	4	2.0	0.138	13.4	LOS A	2.9	20.9	0.45	0.38	0.45	51.7
5	T1	156	2.0	156	2.0	0.138	7.9	LOS A	2.9	20.9	0.45	0.38	0.45	47.7
6	R2	398	2.0	398	2.0	0.873	47.3	LOS D	20.8	148.3	0.98	1.01	1.29	23.7
Approach		558	2.0	558	2.0	0.873	36.0	LOS C	20.8	148.3	0.83	0.83	1.05	27.8
North: Worth														
7	L2	109	0.0	109	0.0	0.241	33.7	LOS C	3.9	27.3	0.84	0.76	0.84	29.4
8	T1	7	0.0	7	0.0	0.040	29.0	LOS C	0.5	3.3	0.83	0.62	0.83	31.4
9	R2	6	0.0	6	0.0	0.040	33.0	LOS C	0.5	3.3	0.83	0.62	0.83	6.8
Approach		123	0.0	123	0.0	0.241	33.3	LOS C	3.9	27.3	0.84	0.74	0.84	28.9
West: Union Rd														
10	L2	96	0.0	96	0.0	0.178	20.4	LOS B	3.9	27.4	0.62	0.65	0.62	30.5
11	T1	266	0.0	266	0.0	0.178	9.2	LOS A	3.9	27.4	0.49	0.45	0.49	49.7
12	R2	5	0.0	5	0.0	0.178	13.2	LOS A	3.9	27.4	0.45	0.39	0.45	50.0
Approach		367	0.0	367	0.0	0.178	12.2	LOS A	3.9	27.4	0.52	0.50	0.52	46.2
All Vehicles		1103	1.1	1103	1.1	0.873	28.3	LOS B	20.8	148.3	0.73	0.71	0.85	33.1

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.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate
P1	South Full Crossing	53	39.3	LOS D	0.1	0.1	0.94	0.94
P2	East Full Crossing	53	39.3	LOS D	0.1	0.1	0.94	0.94
P3	North Full Crossing	53	39.3	LOS D	0.1	0.1	0.94	0.94
P4	West Full Crossing	53	39.3	LOS D	0.1	0.1	0.94	0.94
All Pedestrians		211	39.3	LOS D			0.94	0.94

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

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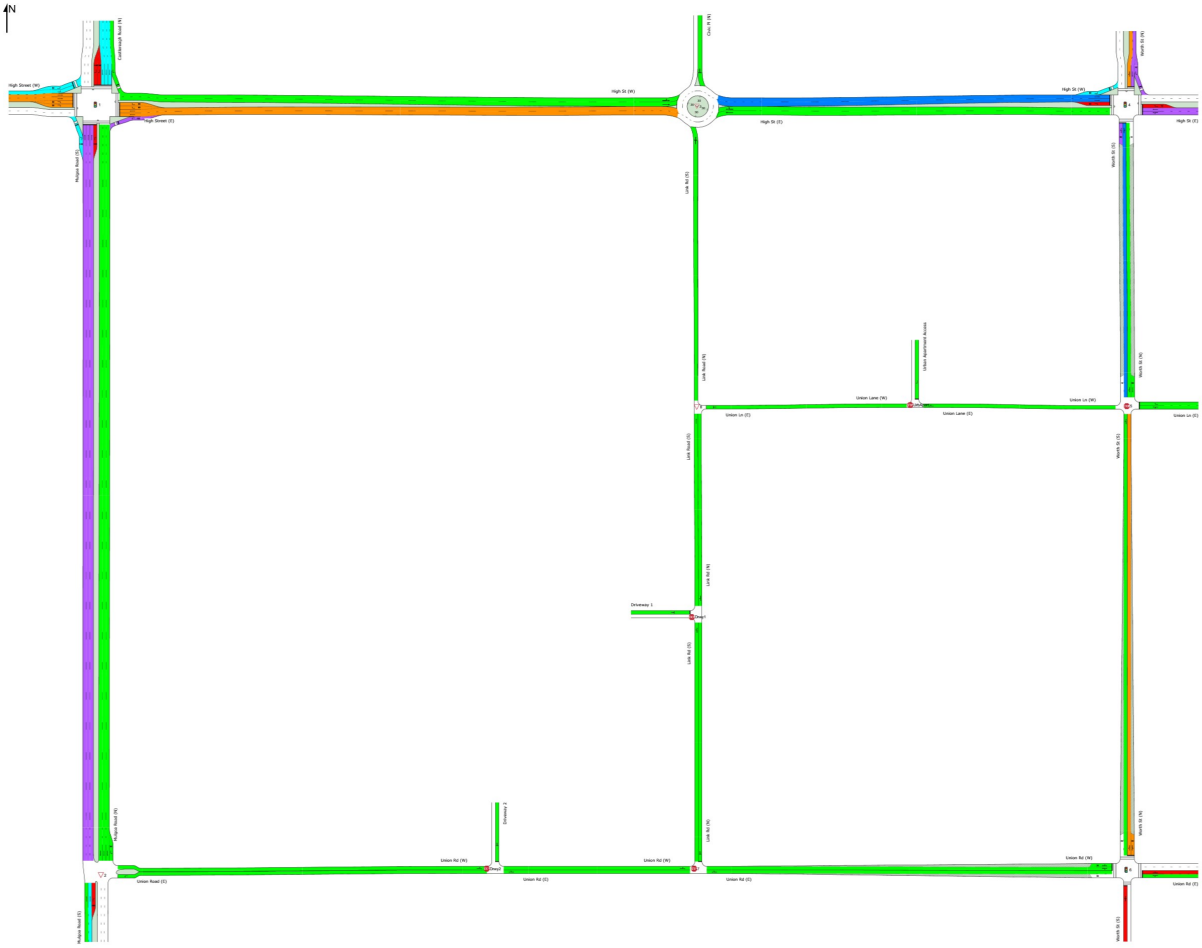
Organisation: PARKING AND TRAFFIC CONSULTANTS | Processed: Thursday, 27 February 2020 11:15:58 AM
Project: Z:\PCI - PROJECT WORK FILES\NSW\TOGA - PENRITH\SIDRA Model\EAST DA Scheme\2020 Existing AM Peak\200227 - Existing Situation - 2020 AM Peak.sip8

LANE LEVEL OF SERVICE

Lane Level of Service for Network Sites

Network: N101 [RMS Upgrade - AM Peak]

East DA Scheme (FSR 6:1)
One-Way Link Northbound to High/ Civic Roundabout
AM Peak
Network Category: (None)



Colour code based on Level of Service

LOS A	LOS B	LOS C	LOS D	LOS E	LOS F

Delay model settings are specified for individual Sites forming the Network.

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Organisation: PARKING AND TRAFFIC CONSULTANTS | Processed: Thursday, 27 February 2020 9:57:37 AM
Project: Z:\PCI - PROJECT WORK FILES\NSW\TOGA - PENRITH\SIDRA Model\EAST DA Scheme\2026 Development AM Peak - One Way NB Link, Roundabout\200227 - East DA Scheme - 2026 Roundabout, Development, Link - AM Peak One-Way Link (FSR 6-1 Volumes).sip8

MOVEMENT SUMMARY

Site: 1 [1. High St and Mulgoa Rd]

Network: N101 [RMS Upgrade - AM Peak]

High Street and Mulgoa Road
East DA Scheme (FSR 6:1)
One-Way Link Northbound to High/ Civic Roundabout
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 140 seconds (Site Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Mulgoa Road (S)														
1	L2	158	2.0	158	2.0	0.165	24.1	LOS B	5.5	39.3	0.56	0.71	0.56	37.1
2	T1	1131	2.0	1131	2.0	0.653	45.7	LOS D	22.3	158.9	0.93	0.81	0.93	28.3
3	R2	111	1.9	111	1.9	0.845	84.0	LOS F	8.3	58.9	1.00	0.93	1.31	6.7
Approach		1399	2.0	1399	2.0	0.845	46.3	LOS D	22.3	158.9	0.89	0.81	0.92	27.2
East: High Street (E)														
4	L2	49	2.1	49	2.2	0.117	44.8	LOS D	2.4	17.4	0.82	0.72	0.82	9.4
5	T1	222	1.4	218	1.4	0.359	57.3	LOS E	6.7	47.6	0.94	0.75	0.94	24.3
6	R2	148	1.4	146	1.4	0.252	61.9	LOS E	4.4	31.3	0.92	0.76	0.92	22.9
Approach		420	1.5	413 N1	1.5	0.359	57.5	LOS E	6.7	47.6	0.92	0.75	0.92	22.7
North: Castlereagh Road (N)														
7	L2	288	1.9	288	1.9	0.272	14.1	LOS A	6.3	44.6	0.53	0.71	0.53	41.4
8	T1	1200	2.0	1200	2.0	0.549	23.2	LOS B	16.2	115.6	0.84	0.72	0.84	34.7
9	R2	593	2.0	593	2.0	0.839	71.2	LOS F	21.2	151.0	1.00	0.93	1.16	27.8
Approach		2081	2.0	2081	2.0	0.839	35.6	LOS C	21.2	151.0	0.84	0.78	0.89	31.8
West: High Street (W)														
10	L2	887	2.0	887	2.0	0.652	26.6	LOS B	15.7	111.6	0.89	0.83	0.89	41.4
11	T1	478	2.0	478	2.0	0.695	59.1	LOS E	15.6	110.9	0.99	0.84	1.01	21.1
12	R2	303	1.9	303	1.9	0.463	61.6	LOS E	9.4	66.7	0.94	0.80	0.94	20.3
Approach		1668	2.0	1668	2.0	0.695	42.3	LOS C	15.7	111.6	0.93	0.83	0.93	31.6
All Vehicles		5568	2.0	5561 N1	2.0	0.845	41.9	LOS C	22.3	158.9	0.89	0.80	0.91	29.8

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.
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.

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate
P1	South Full Crossing	53	64.3	LOS F	0.2	0.2	0.96	0.96
P1S	South Slip/Bypass Lane Crossing	53	27.1	LOS C	0.1	0.1	0.62	0.62
P2	East Full Crossing	53	61.4	LOS F	0.2	0.2	0.94	0.94

P2S	East Slip/Bypass Lane Crossing	53	48.2	LOS E	0.2	0.2	0.83	0.83
P3	North Full Crossing	53	64.3	LOS F	0.2	0.2	0.96	0.96
P3S	North Slip/Bypass Lane Crossing	53	62.4	LOS F	0.2	0.2	0.94	0.94
P4	West Full Crossing	53	47.3	LOS E	0.2	0.2	0.82	0.82
P4S	West Slip/Bypass Lane Crossing	53	37.2	LOS D	0.2	0.2	0.73	0.73
All Pedestrians		421	51.5	LOS E			0.85	0.85

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

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MOVEMENT SUMMARY

Site: 2 [2. Mulgoa Rd and Union Rd]

Network: N101 [RMS Upgrade - AM Peak]

Mulgoa Rd and Union Rd
East DA Scheme (FSR 6:1)
One-Way Link Northbound to High/ Civic Roundabout
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Mulgoa Road (S)														
2	T1	1404	2.0	1404	2.0	0.631	5.2	LOS A	6.6	47.3	0.22	0.00	0.36	51.2
3	R2	374	2.0	374	2.0	1.569	541.7	LOS F	92.5	658.5	1.00	5.40	17.96	3.2
Approach		1778	2.0	1778	2.0	1.569	118.0	NA	92.5	658.5	0.39	1.13	4.06	12.3
East: Union Road (E)														
4	L2	348	1.5	347	1.5	0.384	7.0	LOS A	2.4	16.7	0.55	0.74	0.63	47.6
Approach		348	1.5	347 N1	1.5	0.384	7.0	LOS A	2.4	16.7	0.55	0.74	0.63	47.6
North: Mulgoa Road (N)														
7	L2	351	1.8	350	1.8	0.191	5.6	LOS A	0.0	0.0	0.00	0.58	0.00	38.5
8	T1	1252	2.0	1251	2.0	0.217	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
Approach		1602	2.0	1602	2.0	0.217	1.2	NA	0.0	0.0	0.00	0.13	0.00	57.8
All Vehicles		3728	1.9	3726 N1	1.9	1.569	57.5	NA	92.5	658.5	0.24	0.66	2.00	21.3

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.
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.

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

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MOVEMENT SUMMARY

Site: 3 [3. High St and Civic Roundabout]

Network: N101 [RMS Upgrade - AM Peak]

High and Civic Roundabout
East DA Scheme (FSR 6:1)
One-Way Link Northbound to High/ Civic Roundabout
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Link Rd (S)														
1	L2	94	0.0	93	0.0	0.171	3.3	LOS A	0.8	5.4	0.37	0.60	0.37	29.3
2	T1	4	0.0	4	0.0	0.171	3.6	LOS A	0.8	5.4	0.37	0.60	0.37	53.9
3	R2	94	0.0	93	0.0	0.171	8.8	LOS A	0.8	5.4	0.37	0.60	0.37	29.3
Approach		192	0.0	189 N1	0.0	0.171	6.0	LOS A	0.8	5.4	0.37	0.60	0.37	31.1
East: High St (E)														
5	T1	309	0.0	302	0.0	0.108	3.6	LOS A	0.5	3.2	0.07	0.37	0.07	44.4
6	R2	29	0.0	29	0.0	0.108	9.3	LOS A	0.4	3.1	0.07	0.41	0.07	56.7
Approach		339	0.0	331 N1	0.0	0.108	4.1	LOS A	0.5	3.2	0.07	0.38	0.07	46.9
North: Civic Pl (N)														
7	L2	12	0.0	12	0.0	0.036	5.8	LOS A	0.2	1.2	0.54	0.66	0.54	46.6
9	R2	21	0.0	21	0.0	0.036	11.6	LOS A	0.2	1.2	0.54	0.66	0.54	46.6
Approach		33	0.0	33	0.0	0.036	9.5	LOS A	0.2	1.2	0.54	0.66	0.54	46.6
West: High St (W)														
10	L2	74	0.0	74	0.0	0.309	4.1	LOS A	1.6	10.9	0.21	0.39	0.21	53.2
11	T1	787	0.0	787	0.0	0.309	4.0	LOS A	1.6	10.9	0.21	0.39	0.21	39.7
Approach		861	0.0	861	0.0	0.309	4.0	LOS A	1.6	10.9	0.21	0.39	0.21	42.7
All Vehicles		1424	0.0	1414 N1	0.0	0.309	4.4	LOS A	1.6	10.9	0.21	0.42	0.21	42.9

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.

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

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MOVEMENT SUMMARY

Site: 4 [4. High St and Worth St]

Network: N101 [RMS Upgrade - AM Peak]

High and Worth
East DA Scheme (FSR 6:1)
One-Way Link Northbound to High/ Civic Roundabout
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 130 seconds (Site Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Worth St (S)														
1	L2	384	2.0	358	2.0	0.864	55.4	LOS D	13.7	97.9	0.89	0.91	1.09	4.5
2	T1	134	1.9	125	2.0	0.710	37.1	LOS C	11.0	78.2	0.81	0.75	0.86	28.3
3	R2	104	2.0	97	2.1	0.710	41.5	LOS C	11.0	78.2	0.81	0.75	0.86	27.7
Approach		622	2.0	579 N1	2.0	0.864	49.2	LOS D	13.7	97.9	0.86	0.85	1.00	14.8
East: High St (E)														
4	L2	35	1.8	35	1.8	0.448	54.3	LOS D	9.9	70.5	0.92	0.77	0.92	23.1
5	T1	322	1.9	322	1.9	0.448	48.7	LOS D	10.0	71.1	0.92	0.76	0.92	23.3
6	R2	31	2.0	31	2.0	0.361	74.9	LOS F	2.0	14.3	1.00	0.72	1.00	26.7
Approach		387	1.9	387	1.9	0.448	51.3	LOS D	10.0	71.1	0.93	0.76	0.93	23.7
North: Worth St (N)														
7	L2	1	2.0	1	2.0	0.003	46.8	LOS D	0.1	0.4	0.79	0.59	0.79	33.8
8	T1	14	2.0	14	2.0	0.100	53.6	LOS D	1.4	9.8	0.91	0.65	0.91	21.6
9	R2	16	2.0	16	2.0	0.100	59.7	LOS E	1.4	9.8	0.91	0.69	0.91	21.1
Approach		31	2.0	31	2.0	0.100	56.6	LOS E	1.4	9.8	0.91	0.67	0.91	21.8
West: High St (W)														
10	L2	118	2.0	118	2.0	0.147	20.4	LOS B	3.4	23.9	0.63	0.71	0.63	39.5
11	T1	541	1.8	541	1.8	0.456	38.8	LOS C	13.7	97.7	0.86	0.73	0.86	30.7
12	R2	237	1.9	237	1.9	0.884	76.1	LOS F	16.8	119.7	1.00	0.95	1.30	7.3
Approach		896	1.9	895 N1	1.9	0.884	46.2	LOS D	16.8	119.7	0.87	0.79	0.94	24.9
All Vehicles		1936	1.9	1892 N1	2.0	0.884	48.3	LOS D	16.8	119.7	0.88	0.80	0.96	21.9

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.
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.

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate
P1	South Full Crossing	53	49.2	LOS E	0.2	0.2	0.87	0.87
P2	East Full Crossing	53	59.3	LOS E	0.2	0.2	0.96	0.96
P3	North Full Crossing	53	59.3	LOS E	0.2	0.2	0.96	0.96

P3S	North Slip/Bypass Lane Crossing	53	32.6	LOS D	0.1	0.1	0.71	0.71
P4	West Full Crossing	53	40.1	LOS E	0.2	0.2	0.79	0.79
P4S	West Slip/Bypass Lane Crossing	53	30.5	LOS D	0.1	0.1	0.69	0.69
All Pedestrians		316	45.2	LOS E			0.83	0.83

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

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MOVEMENT SUMMARY

Site: 5 [5. Worth St and Union Ln]

Network: N101 [RMS Upgrade - AM Peak]

Worth St and Union Ln
East DA Scheme (FSR 6:1)
One-Way Link Northbound to High/ Civic Roundabout
Site Category: (None)
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: Worth St (S)														
1	L2	76	1.9	67	2.0	0.246	3.9	LOS A	7.9	56.1	0.00	0.08	0.00	52.0
2	T1	458	1.9	404	2.0	0.246	0.0	LOS A	7.9	56.1	0.00	0.08	0.00	52.0
Approach		534	1.9	471 N1	2.0	0.246	0.6	NA	7.9	56.1	0.00	0.08	0.00	52.0
East: Union Ln (E)														
4	L2	18	2.0	18	2.0	0.060	8.7	LOS A	0.2	1.8	0.37	0.88	0.37	44.5
5	T1	21	1.9	21	1.9	0.060	14.1	LOS A	0.2	1.8	0.37	0.88	0.37	44.5
6	R2	25	2.0	25	2.0	0.112	13.6	LOS A	0.2	1.6	0.58	0.97	0.58	42.7
Approach		64	2.0	64	2.0	0.112	12.4	LOS A	0.2	1.8	0.45	0.92	0.45	43.8
North: Worth St (N)														
8	T1	159	1.8	159	1.8	0.149	1.1	LOS A	0.7	5.3	0.23	0.21	0.23	36.9
9	R2	100	1.9	100	1.9	0.149	6.3	LOS A	0.7	5.3	0.34	0.31	0.34	31.2
Approach		259	1.9	259	1.9	0.149	3.1	NA	0.7	5.3	0.27	0.24	0.27	34.5
All Vehicles		857	1.9	794 N1	2.1	0.246	2.4	NA	7.9	56.1	0.13	0.20	0.13	43.6

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.
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.

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

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MOVEMENT SUMMARY

Site: 6 [6. Worth St and Union Rd]

Network: N101 [RMS Upgrade - AM Peak]

Worth St and Union Rd
East DA Scheme (FSR 6:1)
One-Way Link Northbound to High/ Civic Roundabout
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 150 seconds (Site Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Worth St (S)														
1	L2	22	2.0	22	2.0	0.450	80.6	LOS F	4.0	28.6	1.00	0.76	1.00	17.0
2	T1	20	2.0	20	2.0	0.450	75.0	LOS F	4.0	28.6	1.00	0.76	1.00	17.0
3	R2	13	2.0	13	2.0	0.450	80.5	LOS F	4.0	28.6	1.00	0.76	1.00	25.8
Approach		55	2.0	55	2.0	0.450	78.5	LOS F	4.0	28.6	1.00	0.76	1.00	19.4
East: Union Rd (E)														
4	L2	4	2.0	4	2.0	0.127	11.7	LOS A	3.7	26.4	0.31	0.27	0.31	53.0
5	T1	174	2.0	174	2.0	0.127	6.1	LOS A	3.7	26.4	0.31	0.27	0.31	49.9
6	R2	423	2.0	423	2.0	1.059	157.9	LOS F	57.1	406.4	1.00	1.24	1.77	9.7
Approach		601	2.0	601	2.0	1.059	113.0	LOS F	57.1	406.4	0.80	0.95	1.34	12.8
North: Worth St (N)														
7	L2	116	0.0	116	0.0	0.396	63.1	LOS E	7.5	52.6	0.93	0.78	0.93	20.6
8	T1	7	0.0	7	0.0	0.136	60.1	LOS E	1.9	13.4	0.92	0.71	0.92	21.0
9	R2	22	0.0	22	0.0	0.136	64.0	LOS E	1.9	13.4	0.92	0.71	0.92	3.5
Approach		145	0.0	145	0.0	0.396	63.1	LOS E	7.5	52.6	0.93	0.77	0.93	18.8
West: Union Rd (W)														
10	L2	121	1.7	101	2.1	0.154	15.9	LOS B	4.9	35.2	0.44	0.56	0.44	13.0
11	T1	336	1.9	280	2.3	0.154	7.2	LOS A	4.9	35.2	0.34	0.34	0.34	48.7
12	R2	6	0.0	5	0.0	0.154	9.5	LOS A	4.4	31.4	0.31	0.27	0.31	48.8
Approach		463	1.8	386[N1]	2.2	0.154	9.5	LOS A	4.9	35.2	0.36	0.40	0.36	43.9
All Vehicles		1264	1.7	1187[N1]	1.8	1.059	71.7	LOS F	57.1	406.4	0.68	0.74	0.96	17.4

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.
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.

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate
P1	South Full Crossing	53	66.4	LOS F	0.2	0.2	0.94	0.94
P2	East Full Crossing	53	69.3	LOS F	0.2	0.2	0.96	0.96
P3	North Full Crossing	53	69.3	LOS F	0.2	0.2	0.96	0.96

P4	West Full Crossing	53	69.3	LOS F	0.2	0.2	0.96	0.96
All Pedestrians		211	68.6	LOS F			0.96	0.96

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

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Organisation: PARKING AND TRAFFIC CONSULTANTS | Processed: Thursday, 27 February 2020 9:57:37 AM
Project: Z:\PCI - PROJECT WORK FILES\NSW\TOGA - PENRITH\SIDRA Model\EAST DA Scheme\2026 Development PM Peak - One Way NB Link, Roundabout\200227 - East DA Scheme - 2026 Roundabout, Development, Link - PM Peak One-Way Link (FSR 6-1 Volumes).sip8

MOVEMENT SUMMARY

Site: 7 [7. Union Rd and Link Rd]

Network: N101 [RMS Upgrade - AM Peak]

Union Rd and Link Rd
East DA Scheme (FSR 6:1)
One-Way Link Northbound to High/ Civic Roundabout
Site Category: (None)
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
East: Union Rd (E)														
5	T1	206	0.0	206	0.0	0.119	0.3	LOS A	0.1	1.0	0.08	0.04	0.08	50.7
6	R2	13	0.0	13	0.0	0.119	6.6	LOS A	0.1	1.0	0.08	0.04	0.08	50.7
Approach		219	0.0	219	0.0	0.119	0.7	NA	0.1	1.0	0.08	0.04	0.08	50.7
North: Link Rd (N)														
7	L2	58	0.0	57	0.0	0.368	11.0	LOS A	1.6	11.2	0.68	1.06	0.88	14.6
9	R2	134	0.0	133	0.0	0.368	13.6	LOS A	1.6	11.2	0.68	1.06	0.88	14.6
Approach		192	0.0	190 N1	0.0	0.368	12.8	LOS A	1.6	11.2	0.68	1.06	0.88	14.6
West: Union Rd (W)														
10	L2	20	0.0	19	0.0	0.303	3.9	LOS A	0.0	0.0	0.00	0.02	0.00	57.9
11	T1	702	0.0	571	0.0	0.303	0.0	LOS A	0.0	0.0	0.00	0.02	0.00	57.9
Approach		722	0.0	590 N1	0.0	0.303	0.1	NA	0.0	0.0	0.00	0.02	0.00	57.9
All Vehicles		1133	0.0	999 N1	0.0	0.368	2.7	NA	1.6	11.2	0.15	0.22	0.19	36.0

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.
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.

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

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MOVEMENT SUMMARY

Site: 8 [8. Union Ln and Link Rd]

Network: N101 [RMS Upgrade - AM Peak]

Union Ln and Link Rd
East DA Scheme (FSR 6:1)
One-Way Link Northbound to High/ Civic Roundabout
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Link Road (S)														
2	T1	65	0.0	65	0.0	0.033	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
Approach		65	0.0	65	0.0	0.033	0.0	NA	0.0	0.0	0.00	0.00	0.00	60.0
East: Union Ln (E)														
4	L2	124	0.0	122	0.0	0.154	3.9	LOS A	0.6	4.3	0.14	0.53	0.14	27.8
6	R2	124	0.0	122	0.0	0.154	4.4	LOS A	0.6	4.3	0.14	0.53	0.14	27.8
Approach		248	0.0	244 N1	0.0	0.154	4.2	LOS A	0.6	4.3	0.14	0.53	0.14	27.8
All Vehicles		314	0.0	309 N1	0.0	0.154	3.3	NA	0.6	4.3	0.11	0.42	0.11	29.5

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.
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.

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

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MOVEMENT SUMMARY

Site: Drwy1 [Driveway 1]

Network: N101 [RMS Upgrade - AM Peak]

Driveway 1
East DA Scheme (FSR 6:1)
One-Way Link Northbound to High/ Civic Roundabout
Site Category: (None)
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: Link Rd (S)														
1	L2	33	0.0	32	0.0	0.018	3.9	LOS A	0.0	0.0	0.00	0.53	0.00	29.4
2	T1	1	0.0	1	0.0	0.018	0.0	LOS A	0.0	0.0	0.00	0.53	0.00	30.5
Approach		34	0.0	33 N1	0.0	0.018	3.8	NA	0.0	0.0	0.00	0.53	0.00	29.4
North: Link Rd (N)														
8	T1	124	0.0	122	0.0	0.063	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.2
9	R2	1	0.0	1	0.0	0.063	2.4	LOS A	0.0	0.0	0.00	0.00	0.00	27.0
Approach		125	0.0	123 N1	0.0	0.063	0.0	NA	0.0	0.0	0.00	0.00	0.00	57.6
West: Driveway 1														
10	L2	65	0.0	65	0.0	0.110	6.2	LOS A	0.4	2.9	0.01	0.99	0.01	22.6
12	R2	65	0.0	65	0.0	0.110	6.3	LOS A	0.4	2.9	0.01	0.99	0.01	22.6
Approach		131	0.0	131	0.0	0.110	6.3	LOS A	0.4	2.9	0.01	0.99	0.01	22.6
All Vehicles		289	0.0	286 N1	0.0	0.110	3.3	NA	0.4	2.9	0.00	0.52	0.00	28.0

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.
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.

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

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MOVEMENT SUMMARY

Site: Drwy2 [Driveway 2]

Network: N101 [RMS Upgrade - AM Peak]

Driveway 2
East DA Scheme (FSR 6:1)
One-Way Link Northbound to High/ Civic Roundabout
Site Category: (None)
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
East: Union Rd (E)														
5	T1	269	0.0	269	0.0	0.141	0.1	LOS A	0.0	0.3	0.02	0.01	0.02	57.8
6	R2	3	0.0	3	0.0	0.141	6.7	LOS A	0.0	0.3	0.02	0.01	0.02	42.0
Approach		273	0.0	272 N1	0.0	0.141	0.1	NA	0.0	0.3	0.02	0.01	0.02	57.3
North: Driveway 2														
7	L2	5	0.0	5	0.0	0.041	9.4	LOS A	0.1	0.9	0.62	0.97	0.62	15.9
9	R2	14	0.0	14	0.0	0.041	12.3	LOS A	0.1	0.9	0.62	0.97	0.62	15.9
Approach		19	0.0	19	0.0	0.041	11.5	LOS A	0.1	0.9	0.62	0.97	0.62	15.9
West: Union Rd (W)														
10	L2	7	0.0	7	0.0	0.303	3.9	LOS A	0.0	0.0	0.00	0.01	0.00	33.0
11	T1	717	0.0	584	0.0	0.303	0.0	LOS A	0.0	0.0	0.00	0.01	0.00	59.2
Approach		724	0.0	591 N1	0.0	0.303	0.0	NA	0.0	0.0	0.00	0.01	0.00	58.2
All Vehicles		1016	0.0	882 N1	0.0	0.303	0.3	NA	0.1	0.9	0.02	0.03	0.02	54.7

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.
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.

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

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MOVEMENT SUMMARY

Site: UrbApart [Urban Apartments]

Network: N101 [RMS Upgrade - AM Peak]

Urban Apartments
East DA Scheme (FSR 6:1)
One-Way Link Northbound to High/ Civic Roundabout
Site Category: (None)
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Arrival Flows Total veh/h	Arrival Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
East: Union Lane (E)														
5	T1	191	0.0	184	0.0	0.098	0.0	LOS A	0.0	0.0	0.00	0.02	0.00	57.5
6	R2	7	0.0	7	0.0	0.098	4.0	LOS A	0.0	0.0	0.00	0.02	0.00	55.4
Approach		198	0.0	191 N1	0.0	0.098	0.2	NA	0.0	0.0	0.00	0.02	0.00	57.0
North: Urban Apartment Access														
9	R2	57	0.0	57	0.0	0.052	8.1	LOS A	0.2	1.2	0.26	0.89	0.26	47.9
Approach		57	0.0	57	0.0	0.052	8.1	LOS A	0.2	1.2	0.26	0.89	0.26	47.9
All Vehicles		255	0.0	248 N1	0.0	0.098	2.0	NA	0.2	1.2	0.06	0.22	0.06	50.7

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.
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.

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

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Network Performance Comparison: PM Existing – PM Proposed

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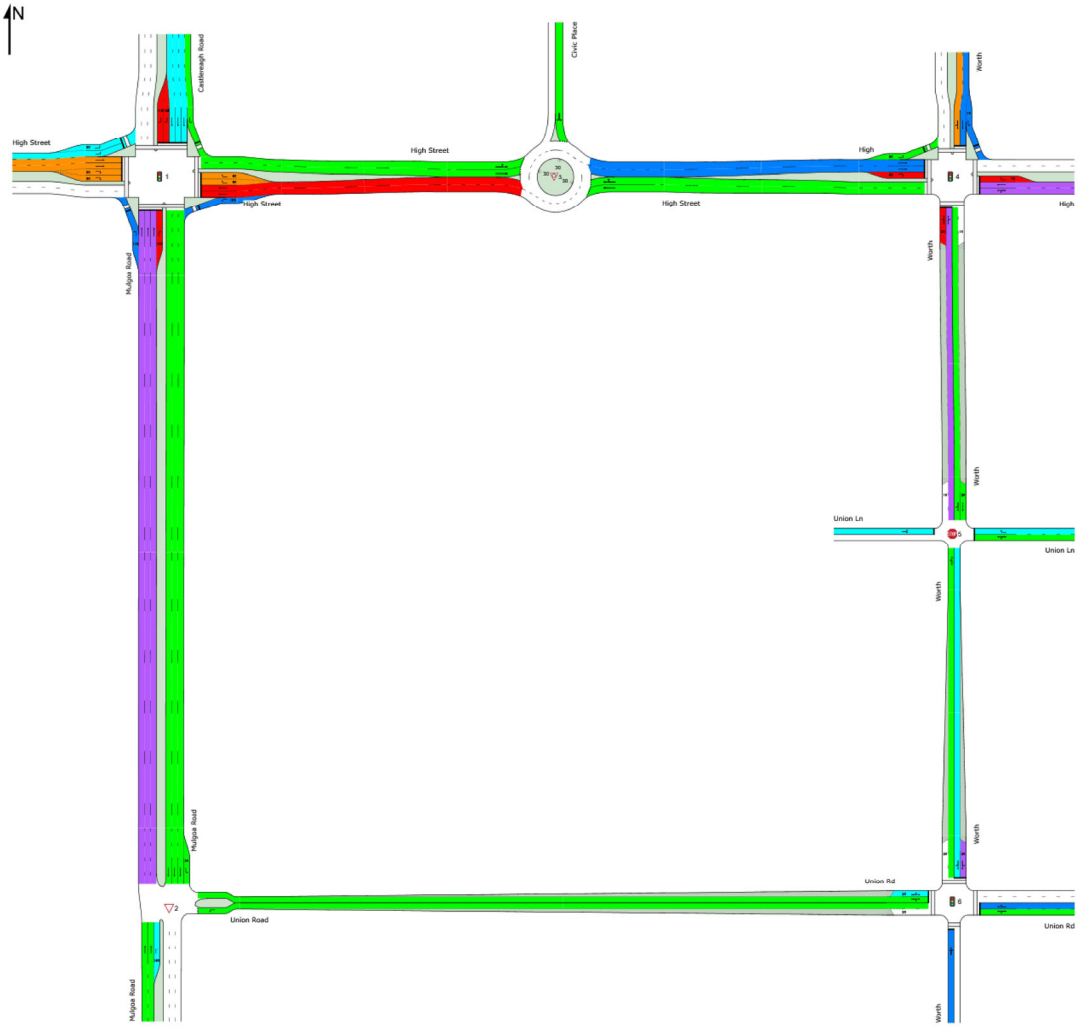
LANE LEVEL OF SERVICE

Lane Level of Service for Network Sites

Network: N102 [2020 Existing PM Peak]

Current Layout with Upgraded High St/Mulgoa Rd & Mulgoa Rd/Union Rd
Network Category: (None)



Colour code based on Level of Service

LOS A	LOS B	LOS C	LOS D	LOS E	LOS F

Delay model settings are specified for individual Sites forming the Network.

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MOVEMENT SUMMARY

Site: 1 [1. High and Mulgoa - Upgraded]

Network: N102 [2020 Existing PM Peak]

High Street and Mulgoa Road
Upgraded Intersection
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 150 seconds (Site Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Mulgoa Road														
1	L2	238	2.0	238	2.0	0.267	29.6	LOS C	10.1	71.6	0.63	0.74	0.63	34.2
2	T1	825	2.0	825	2.0	0.510	48.5	LOS D	16.8	119.7	0.89	0.76	0.89	27.4
3	R2	62	2.0	62	2.0	0.727	88.4	LOS F	4.9	34.7	1.00	0.83	1.18	6.4
Approach		1125	2.0	1125	2.0	0.727	46.7	LOS D	16.8	119.7	0.84	0.76	0.85	27.3
East: High Street														
4	L2	96	2.0	96	2.0	0.218	33.4	LOS C	3.8	27.2	0.84	0.74	0.84	12.0
5	T1	609	2.0	609	2.0	0.873	72.7	LOS F	25.5	181.8	1.00	0.99	1.20	20.9
6	R2	285	2.0	285	2.0	0.403	62.8	LOS E	9.2	65.3	0.92	0.79	0.92	22.7
Approach		991	2.0	991	2.0	0.873	66.1	LOS E	25.5	181.8	0.96	0.91	1.09	21.1
North: Castlereagh Road														
7	L2	106	2.0	106	2.0	0.093	12.2	LOS A	2.0	14.5	0.42	0.66	0.42	43.2
8	T1	1213	2.0	1213	2.0	0.534	25.4	LOS B	18.2	129.2	0.82	0.71	0.82	33.3
9	R2	633	2.0	633	2.0	0.864	77.2	LOS F	24.7	175.7	1.00	0.94	1.18	26.6
Approach		1952	2.0	1952	2.0	0.864	41.5	LOS C	24.7	175.7	0.86	0.78	0.91	30.0
West: High Street														
10	L2	584	2.0	584	2.0	0.435	25.5	LOS B	9.2	65.7	0.80	0.79	0.80	42.0
11	T1	249	2.0	249	2.0	0.389	60.3	LOS E	8.2	58.3	0.94	0.75	0.94	20.8
12	R2	157	2.0	157	2.0	0.257	64.5	LOS E	5.0	35.8	0.91	0.76	0.91	19.7
Approach		991	2.0	991	2.0	0.435	40.4	LOS C	9.2	65.7	0.85	0.78	0.85	32.8
All Vehicles		5058	2.0	5058	2.0	0.873	47.3	LOS D	25.5	181.8	0.87	0.80	0.92	27.9

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.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Pedestrian Back of Queue ped	Distance m	Prop. Queued	Effective Stop Rate
P1	South Full Crossing	53	66.4	LOS F	0.2	0.2	0.94	0.94
P1S	South Slip/Bypass Lane Crossing	53	25.3	LOS C	0.1	0.1	0.58	0.58
P2	East Full Crossing	53	63.6	LOS F	0.2	0.2	0.92	0.92
P2S	East Slip/Bypass Lane Crossing	53	50.5	LOS E	0.2	0.2	0.82	0.82
P3	North Full Crossing	53	69.3	LOS F	0.2	0.2	0.96	0.96
P3S	North Slip/Bypass Lane Crossing	53	69.3	LOS F	0.2	0.2	0.96	0.96
P4	West Full Crossing	53	52.2	LOS E	0.2	0.2	0.84	0.84

P4S	West Slip/Bypass Lane Crossing	53	41.9	LOS E	0.2	0.2	0.75	0.75
All Pedestrians		421	54.8	LOS E			0.85	0.85

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

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MOVEMENT SUMMARY

Site: 2 [2. Mulgoa and Union - Upgraded]

Network: N102 [2020 Existing PM Peak]

Mulgoa and Union
Upgraded Intersection
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Mulgoa Road														
2	T1	1121	2.0	1121	2.0	0.293	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
3	R2	163	2.0	163	2.0	0.584	26.0	LOS B	2.9	20.4	0.89	1.10	1.44	32.7
Approach		1284	2.0	1284	2.0	0.584	3.3	NA	2.9	20.4	0.11	0.14	0.18	54.1
East: Union Road														
4	L2	258	2.0	258	2.0	0.298	8.3	LOS A	1.3	9.5	0.49	0.71	0.49	49.7
Approach		258	2.0	258	2.0	0.298	8.3	LOS A	1.3	9.5	0.49	0.71	0.49	49.7
North: Mulgoa Road														
7	L2	109	2.0	109	2.0	0.060	5.6	LOS A	0.0	0.0	0.00	0.58	0.00	38.5
8	T1	1359	2.0	1359	2.0	0.235	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
Approach		1468	2.0	1468	2.0	0.235	0.4	NA	0.0	0.0	0.00	0.04	0.00	59.3
All Vehicles		3011	2.0	3011	2.0	0.584	2.3	NA	2.9	20.4	0.09	0.14	0.12	56.0

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.
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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MOVEMENT SUMMARY

Site: 3 [3. High and Civic]

Network: N102 [2020 Existing PM Peak]

High and Civic
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
East: High Street														
5	T1	891	0.0	891	0.0	0.529	3.9	LOS A	1.8	12.4	0.18	0.39	0.18	43.1
6	R2	27	0.0	27	0.0	0.529	9.6	LOS A	1.8	12.4	0.18	0.40	0.18	41.7
Approach		918	0.0	918	0.0	0.529	4.1	LOS A	1.8	12.4	0.18	0.39	0.18	43.1
North: Civic Place														
7	L2	52	0.0	52	0.0	0.182	3.3	LOS A	0.6	4.3	0.37	0.63	0.37	28.5
9	R2	100	0.0	100	0.0	0.182	8.8	LOS A	0.6	4.3	0.37	0.63	0.37	28.5
Approach		152	0.0	152	0.0	0.182	7.0	LOS A	0.6	4.3	0.37	0.63	0.37	28.5
West: High Street														
10	L2	58	0.0	58	0.0	0.136	3.7	LOS A	0.6	4.5	0.08	0.36	0.08	36.1
11	T1	360	0.0	360	0.0	0.136	3.6	LOS A	0.6	4.5	0.08	0.35	0.08	42.2
Approach		418	0.0	418	0.0	0.136	3.6	LOS A	0.6	4.5	0.08	0.35	0.08	41.0
All Vehicles		1487	0.0	1487	0.0	0.529	4.3	LOS A	1.8	12.4	0.17	0.40	0.17	41.3

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.

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MOVEMENT SUMMARY

Site: 4 [4. High and Worth]

Network: N102 [2020 Existing PM Peak]

High and Worth
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 130 seconds (Site Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Worth														
1	L2	198	2.0	198	2.0	0.897	75.0	LOS F	13.8	97.9	0.98	0.97	1.37	3.4
2	T1	111	2.0	111	2.0	0.689	54.3	LOS D	8.2	58.3	0.94	0.80	1.02	23.3
3	R2	28	2.0	28	2.0	0.689	58.7	LOS E	8.2	58.3	0.94	0.80	1.02	22.9
Approach		337	2.0	337	2.0	0.897	66.8	LOS E	13.8	97.9	0.97	0.90	1.22	12.2
East: High														
4	L2	77	2.0	77	2.0	0.672	51.3	LOS D	19.5	138.9	0.95	0.83	0.95	23.9
5	T1	592	2.0	592	2.0	0.672	45.3	LOS D	19.5	138.9	0.94	0.81	0.94	24.3
6	R2	181	2.0	181	2.0	0.918	84.3	LOS F	13.5	95.9	1.00	1.00	1.44	25.0
Approach		849	2.0	849	2.0	0.918	54.1	LOS D	19.5	138.9	0.96	0.85	1.05	24.5
North: Worth														
7	L2	1	2.0	1	2.0	0.001	29.9	LOS C	0.0	0.3	0.61	0.59	0.61	39.9
8	T1	184	2.0	184	2.0	0.892	53.2	LOS D	28.8	205.1	0.92	0.83	1.04	21.7
9	R2	309	2.0	309	2.0	0.892	69.3	LOS E	28.8	205.1	1.00	0.99	1.23	18.9
Approach		495	2.0	495	2.0	0.892	63.2	LOS E	28.8	205.1	0.97	0.93	1.16	19.9
West: High														
10	L2	203	2.0	203	2.0	0.206	14.2	LOS A	3.8	26.9	0.55	0.71	0.55	43.9
11	T1	232	2.0	232	2.0	0.206	37.0	LOS C	5.5	39.0	0.79	0.64	0.79	31.5
12	R2	212	2.0	212	2.0	0.884	77.3	LOS F	15.1	107.3	1.00	0.95	1.32	7.2
Approach		646	2.0	646	2.0	0.884	43.0	LOS D	15.1	107.3	0.78	0.76	0.89	25.0
All Vehicles		2327	2.0	2327	2.0	0.918	54.8	LOS D	28.8	205.1	0.91	0.85	1.05	21.8

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.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Pedestrian ped	Back of Queue Distance m	Prop. Queued	Effective Stop Rate
P1	South Full Crossing	53	42.5	LOS E	0.2	0.2	0.81	0.81
P2	East Full Crossing	53	49.2	LOS E	0.2	0.2	0.87	0.87
P3	North Full Crossing	53	59.3	LOS E	0.2	0.2	0.96	0.96
P3S	North Slip/Bypass Lane Crossing	53	34.1	LOS D	0.1	0.1	0.72	0.72
P4	West Full Crossing	53	58.3	LOS E	0.2	0.2	0.95	0.95
P4S	West Slip/Bypass Lane Crossing	53	46.6	LOS E	0.2	0.2	0.85	0.85
All Pedestrians		316	48.3	LOS E			0.86	0.86

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

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MOVEMENT SUMMARY

Site: 5 [5. Worth and Union Ln]

Network: N102 [2020 Existing PM Peak]

Worth and Union Ln
Site Category: (None)
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Arrival Flows Total veh/h	Arrival Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Worth														
1	L2	58	2.0	58	2.0	0.193	3.9	LOS A	0.2	1.2	0.00	0.09	0.00	55.9
2	T1	311	2.0	311	2.0	0.193	0.0	LOS A	0.2	1.2	0.00	0.09	0.00	51.3
Approach		368	2.0	368	2.0	0.193	0.6	NA	0.2	1.2	0.00	0.09	0.00	54.1
East: Union Ln														
4	L2	18	2.0	18	2.0	0.092	9.8	LOS A	0.3	1.9	0.54	0.90	0.54	43.9
5	T1	20	2.0	20	2.0	0.092	15.0	LOS B	0.3	1.9	0.54	0.90	0.54	49.4
6	R2	25	2.0	25	2.0	0.128	15.0	LOS B	0.2	1.7	0.61	1.00	0.61	41.4
Approach		63	2.0	63	2.0	0.128	13.5	LOS A	0.3	1.9	0.57	0.94	0.57	45.5
North: Worth														
8	T1	382	2.0	382	2.0	0.224	0.6	LOS A	4.1	29.2	0.14	0.11	0.14	44.2
9	R2	89	2.0	89	2.0	0.224	6.0	LOS A	4.1	29.2	0.19	0.14	0.19	53.6
Approach		472	2.0	472	2.0	0.224	1.6	NA	4.1	29.2	0.15	0.11	0.15	50.0
West: Union Ln														
10	L2	1	2.0	1	2.0	0.112	9.4	LOS A	0.2	1.5	0.62	0.99	0.62	40.8
12	R2	20	2.0	20	2.0	0.112	16.0	LOS B	0.2	1.5	0.62	0.99	0.62	40.8
Approach		21	2.0	21	2.0	0.112	15.7	LOS B	0.2	1.5	0.62	0.99	0.62	40.8
All Vehicles		924	2.0	924	2.0	0.224	2.3	NA	4.1	29.2	0.13	0.18	0.13	49.2

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.
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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MOVEMENT SUMMARY

Site: 6 [6. Worth and Union Rd]

Network: N102 [2020 Existing PM Peak]

Worth and Union Rd
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 80 seconds (Site Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Worth														
1	L2	16	2.0	16	2.0	0.260	43.4	LOS D	1.8	13.1	0.96	0.72	0.96	26.1
2	T1	28	2.0	28	2.0	0.260	37.8	LOS C	1.8	13.1	0.96	0.72	0.96	26.1
3	R2	4	2.0	4	2.0	0.260	43.3	LOS D	1.8	13.1	0.96	0.72	0.96	35.5
Approach		48	2.0	48	2.0	0.260	40.1	LOS C	1.8	13.1	0.96	0.72	0.96	27.3
East: Union Rd														
4	L2	33	2.0	33	2.0	0.177	17.9	LOS B	3.5	24.9	0.59	0.54	0.59	48.0
5	T1	129	2.0	129	2.0	0.821	12.5	LOS A	13.6	97.1	0.60	0.54	0.60	41.6
6	R2	315	2.0	315	2.0	0.821	39.5	LOS C	13.6	97.1	0.96	0.97	1.22	26.4
Approach		477	2.0	477	2.0	0.821	30.7	LOS C	13.6	97.1	0.84	0.82	1.01	31.0
North: Worth														
7	L2	395	2.0	395	2.0	0.861	43.0	LOS D	11.5	81.6	1.00	0.98	1.28	25.9
8	T1	21	2.0	21	2.0	0.059	24.8	LOS B	0.8	5.5	0.80	0.59	0.80	34.2
9	R2	4	2.0	4	2.0	0.059	28.8	LOS C	0.8	5.5	0.80	0.59	0.80	8.1
Approach		420	2.0	420	2.0	0.861	41.9	LOS C	11.5	81.6	0.99	0.95	1.26	26.1
West: Union Rd														
10	L2	131	2.0	131	2.0	0.227	22.0	LOS B	4.3	30.9	0.69	0.71	0.69	28.7
11	T1	277	2.0	277	2.0	0.227	10.0	LOS A	4.7	33.2	0.54	0.49	0.54	49.2
12	R2	11	2.0	11	2.0	0.227	14.4	LOS A	4.7	33.2	0.52	0.45	0.52	48.8
Approach		418	2.0	418	2.0	0.227	13.8	LOS A	4.7	33.2	0.59	0.56	0.59	44.4
All Vehicles		1363	2.0	1363	2.0	0.861	29.3	LOS C	13.6	97.1	0.81	0.78	0.95	32.5

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.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Pedestrian ped	Back of Queue Distance m	Prop. Queued	Effective Stop Rate
P1	South Full Crossing	53	34.3	LOS D	0.1	0.1	0.93	0.93
P2	East Full Crossing	53	34.3	LOS D	0.1	0.1	0.93	0.93
P3	North Full Crossing	53	34.3	LOS D	0.1	0.1	0.93	0.93
P4	West Full Crossing	53	34.3	LOS D	0.1	0.1	0.93	0.93
All Pedestrians		211	34.3	LOS D			0.93	0.93

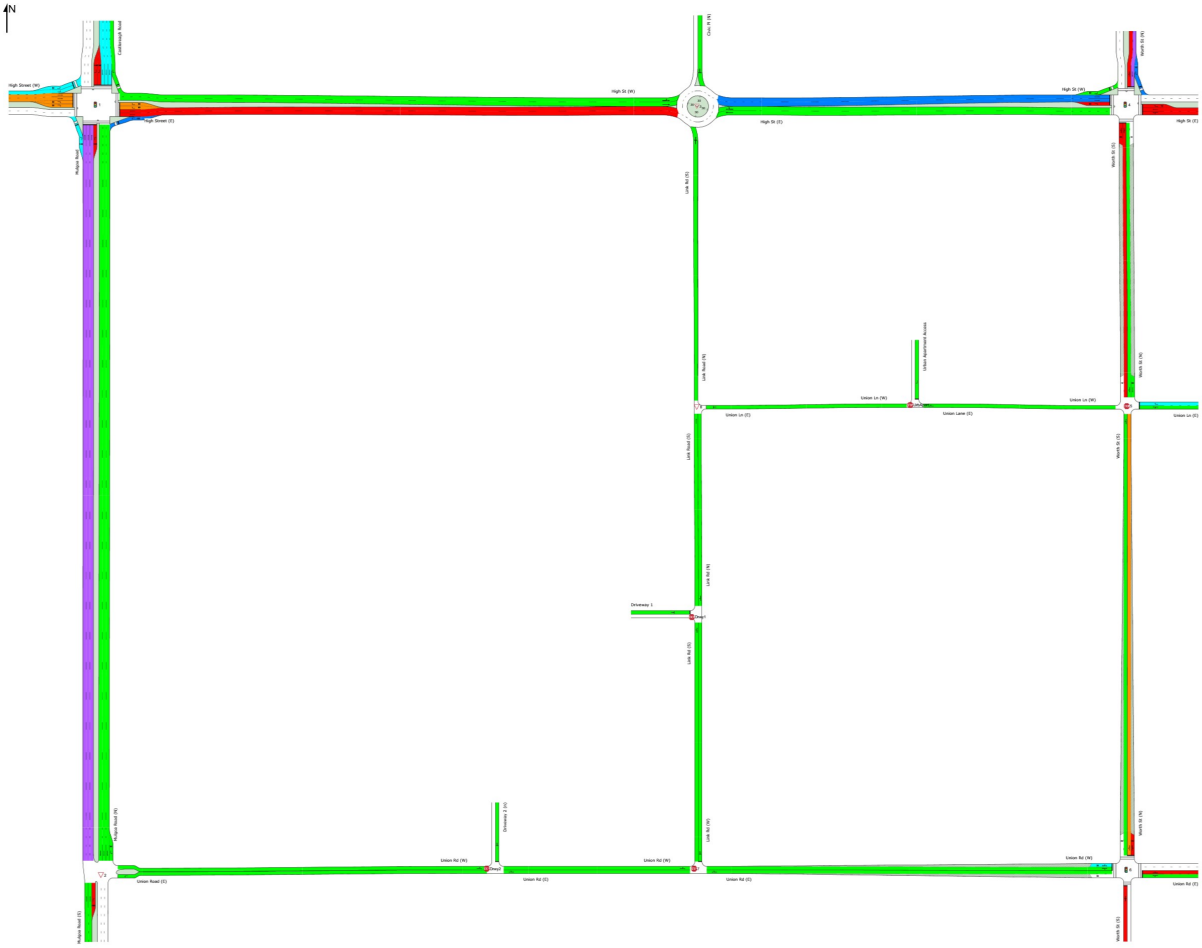
Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

LANE LEVEL OF SERVICE

Lane Level of Service for Network Sites

Network: N101 [RMS Upgrade - PM Peak]

DA Scheme - Option 2
Two Lane, Two-way Access Road
PM Peak
Network Category: (None)



Colour code based on Level of Service

LOS A	LOS B	LOS C	LOS D	LOS E	LOS F

Delay model settings are specified for individual Sites forming the Network.

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Organisation: PARKING AND TRAFFIC CONSULTANTS | Processed: Thursday, 27 February 2020 10:52:09 AM
Project: Z:\PCI - PROJECT WORK FILES\NSW\TOGA - PENRITH\SIDRA Model\EAST DA Scheme\2026 Development PM Peak - One Way NB Link, Roundabout\200227 - East DA Scheme - 2026 Roundabout, Development, Link - PM Peak One-Way Link (FSR 6-1 Volumes).sip8

MOVEMENT SUMMARY

Site: 1 [1. High St and Mulgoa Rd]

Network: N101 [RMS Upgrade - PM Peak]

High Street and Mulgoa Road
East DA Scheme (FSR 6:1)
One-Way Link Northbound to High/ Civic Roundabout
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 150 seconds (Site Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Mulgoa Road														
1	L2	246	2.0	246	2.0	0.266	27.8	LOS B	10.0	71.6	0.61	0.74	0.61	35.1
2	T1	1014	2.0	1014	2.0	0.585	47.6	LOS D	20.8	148.4	0.91	0.78	0.91	27.7
3	R2	91	1.6	91	1.6	0.924	99.3	LOS F	7.7	54.6	1.00	0.99	1.52	5.8
Approach		1351	2.0	1351	2.0	0.924	47.5	LOS D	20.8	148.4	0.86	0.79	0.89	26.9
East: High Street (E)														
4	L2	172	1.6	165	1.5	0.396	35.8	LOS C	7.0	49.8	0.89	0.78	0.89	11.3
5	T1	597	2.0	567	2.0	0.912	81.3	LOS F	25.3	180.2	1.00	1.05	1.30	19.4
6	R2	384	2.0	365	2.0	0.575	67.5	LOS E	12.4	88.2	0.97	0.82	0.97	21.7
Approach		1153	1.9	1097 N1	1.9	0.912	69.9	LOS E	25.3	180.2	0.97	0.93	1.13	19.7
North: Castlereagh Road														
7	L2	208	1.6	208	1.6	0.183	12.8	LOS A	4.3	30.2	0.45	0.68	0.45	42.7
8	T1	1405	2.0	1405	2.0	0.598	24.7	LOS B	21.0	149.6	0.84	0.73	0.84	33.8
9	R2	667	2.0	667	2.0	0.911	85.2	LOS F	27.8	198.1	1.00	0.99	1.27	25.2
Approach		2281	2.0	2281	2.0	0.911	41.3	LOS C	27.8	198.1	0.85	0.80	0.93	29.7
West: High Street (W)														
10	L2	654	2.0	654	2.0	0.487	26.4	LOS B	11.2	79.5	0.82	0.80	0.82	41.5
11	T1	277	1.9	277	1.9	0.431	60.8	LOS E	9.2	65.2	0.95	0.77	0.95	20.7
12	R2	199	1.6	199	1.6	0.325	65.3	LOS E	6.5	45.8	0.93	0.78	0.93	19.5
Approach		1129	1.9	1129	1.9	0.487	41.7	LOS C	11.2	79.5	0.87	0.79	0.87	32.2
All Vehicles		5914	1.9	5858 N1	2.0	0.924	48.2	LOS D	27.8	198.1	0.88	0.82	0.95	27.4

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.
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.

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate
P1	South Full Crossing	53	69.3	LOS F	0.2	0.2	0.96	0.96
P1S	South Slip/Bypass Lane Crossing	53	27.1	LOS C	0.1	0.1	0.60	0.60
P2	East Full Crossing	53	61.8	LOS F	0.2	0.2	0.91	0.91

P2S	East Slip/Bypass Lane Crossing	53	48.9	LOS E	0.2	0.2	0.81	0.81
P3	North Full Crossing	53	69.3	LOS F	0.2	0.2	0.96	0.96
P3S	North Slip/Bypass Lane Crossing	53	69.3	LOS F	0.2	0.2	0.96	0.96
P4	West Full Crossing	53	49.7	LOS E	0.2	0.2	0.82	0.82
P4S	West Slip/Bypass Lane Crossing	53	39.7	LOS D	0.2	0.2	0.73	0.73
All Pedestrians		421	54.4	LOS E			0.84	0.84

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

MOVEMENT SUMMARY

Site: 2 [2. Mulgoa Rd and Union Rd]

Network: N101 [RMS Upgrade - PM Peak]

Mulgoa Road and Union Road
East DA Scheme (FSR 6:1)
One-Way Link Northbound to High/ Civic Roundabout
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Mulgoa Road (S)														
2	T1	1342	2.0	1342	2.0	0.366	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
3	R2	181	1.8	181	1.8	0.943	79.8	LOS F	8.4	59.5	0.99	1.63	3.53	16.8
Approach		1523	1.9	1523	1.9	0.943	9.5	NA	8.4	59.5	0.12	0.19	0.42	45.8
East: Union Road (E)														
4	L2	249	1.8	248	1.8	0.311	7.5	LOS A	1.6	11.3	0.58	0.77	0.62	47.1
Approach		249	1.8	248 N1	1.8	0.311	7.5	LOS A	1.6	11.3	0.58	0.77	0.62	47.1
North: Mulgoa Road (N)														
7	L2	192	1.2	191	1.2	0.104	5.6	LOS A	0.0	0.0	0.00	0.58	0.00	38.5
8	T1	1597	2.0	1591	2.0	0.275	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
Approach		1788	1.9	1782 N1	1.9	0.275	0.6	NA	0.0	0.0	0.00	0.06	0.00	59.0
All Vehicles		3561	1.9	3553 N1	1.9	0.943	4.9	NA	8.4	59.5	0.09	0.17	0.22	52.2

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.
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.

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

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MOVEMENT SUMMARY

Site: 3 [3. High and Civic Roundabout]

Network: N101 [RMS Upgrade - PM Peak]

High and Civic Roundabout
East DA Scheme (FSR 6:1)
One-Way Link Northbound to High/ Civic Roundabout
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Link Rd (S)														
1	L2	52	0.0	50	0.0	0.229	6.2	LOS A	0.8	5.5	0.68	0.73	0.68	23.7
2	T1	2	0.0	2	0.0	0.229	6.6	LOS A	0.8	5.5	0.68	0.73	0.68	50.3
3	R2	52	0.0	50	0.0	0.229	11.7	LOS A	0.8	5.5	0.68	0.73	0.68	23.7
Approach		105	0.0	103 [N1]	0.0	0.229	8.9	LOS A	0.8	5.5	0.68	0.73	0.68	25.2
East: High St (E)														
5	T1	1000	1.9	937	1.9	0.559	4.0	LOS A	2.2	15.6	0.19	0.39	0.19	43.0
6	R2	29	0.0	28	0.0	0.559	9.6	LOS A	2.2	15.6	0.19	0.40	0.19	56.6
Approach		1029	1.9	965 [N1]	1.9	0.559	4.1	LOS A	2.2	15.6	0.19	0.39	0.19	43.9
North: Civic Pl (N)														
7	L2	53	2.0	53	2.0	0.198	5.1	LOS A	0.7	5.0	0.46	0.68	0.46	47.0
9	R2	100	2.0	100	2.0	0.198	10.9	LOS A	0.7	5.0	0.46	0.68	0.46	47.0
Approach		153	2.0	153	2.0	0.198	8.9	LOS A	0.7	5.0	0.46	0.68	0.46	47.0
West: High St (W)														
10	L2	74	2.0	74	2.0	0.260	3.9	LOS A	1.3	9.5	0.17	0.37	0.17	53.4
11	T1	463	1.9	463	1.9	0.260	3.8	LOS A	1.3	9.5	0.17	0.37	0.17	40.4
Approach		537	2.0	537	2.0	0.260	3.9	LOS A	1.3	9.5	0.17	0.37	0.17	44.7
All Vehicles		1824	1.8	1757 [N1]	1.9	0.559	4.7	LOS A	2.2	15.6	0.24	0.43	0.24	43.9

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.

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

MOVEMENT SUMMARY

Site: 4 [4. High St and Worth St]

Network: N101 [RMS Upgrade - PM Peak]

High Street and Worth Street
East DA Scheme (FSR 6:1)
One-Way Link Northbound to High/ Civic Roundabout
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 150 seconds (Site Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Worth St (S)														
1	L2	215	2.0	208	2.0	1.246	303.5	LOS F	13.8	97.9	1.00	1.44	2.51	0.8
2	T1	114	2.0	110	2.0	1.042	145.9	LOS F	13.8	97.9	1.00	1.21	1.85	11.3
3	R2	34	0.0	33	0.0	1.042	150.3	LOS F	13.8	97.9	1.00	1.21	1.85	11.3
Approach		362	1.8	350 N1	1.8	1.246	239.8	LOS F	13.8	97.9	1.00	1.34	2.24	3.8
East: High St (E)														
4	L2	81	1.9	81	1.9	0.903	79.0	LOS F	33.6	238.9	1.00	1.02	1.21	17.7
5	T1	668	1.9	668	1.9	0.903	73.2	LOS F	33.6	238.9	0.99	1.03	1.22	17.8
6	R2	211	2.0	211	2.0	1.232	291.0	LOS F	33.7	239.9	1.00	1.44	2.44	10.0
Approach		960	1.9	960	1.9	1.232	121.4	LOS F	33.7	239.9	0.99	1.12	1.49	13.9
North: Worth St (N)														
7	L2	1	0.0	1	0.0	0.002	38.8	LOS C	0.0	0.3	0.67	0.59	0.67	36.5
8	T1	194	1.9	194	1.9	1.236	161.7	LOS F	65.8	468.2	0.93	1.13	1.58	9.4
9	R2	309	2.0	309	2.0	1.236	294.4	LOS F	65.8	468.2	1.00	1.62	2.40	5.6
Approach		504	2.0	504	2.0	1.236	242.9	LOS F	65.8	468.2	0.97	1.43	2.08	6.6
West: High St (W)														
10	L2	203	2.0	203	2.0	0.179	12.2	LOS A	3.4	24.1	0.45	0.68	0.45	45.5
11	T1	279	1.8	279	1.8	0.178	30.0	LOS C	6.4	45.4	0.68	0.56	0.68	34.6
12	R2	286	1.6	286	1.6	1.232	297.9	LOS F	36.8	261.1	1.00	1.47	2.45	2.0
Approach		768	1.8	768	1.8	1.232	125.1	LOS F	36.8	261.1	0.74	0.93	1.28	11.1
All Vehicles		2595	1.9	2582 N1	1.9	1.246	162.3	LOS F	65.8	468.2	0.91	1.15	1.64	9.4

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.
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.

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate
P1	South Full Crossing	53	51.4	LOS E	0.2	0.2	0.83	0.83
P2	East Full Crossing	53	59.1	LOS E	0.2	0.2	0.89	0.89
P3	North Full Crossing	53	69.3	LOS F	0.2	0.2	0.96	0.96

P3S	North Slip/Bypass Lane Crossing	53	27.7	LOS C	0.1	0.1	0.61	0.61
P4	West Full Crossing	53	69.3	LOS F	0.2	0.2	0.96	0.96
P4S	West Slip/Bypass Lane Crossing	53	59.1	LOS E	0.2	0.2	0.89	0.89
All Pedestrians		316	56.0	LOS E			0.86	0.86

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

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MOVEMENT SUMMARY

Site: 5 [5. Worth St and Union Ln]

Network: N101 [RMS Upgrade - PM Peak]

Worth St and Union Ln
East DA Scheme (FSR 6:1)
One-Way Link Northbound to High/ Civic Roundabout
Site Category: (None)
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Arrival Flows Total veh/h	Arrival Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Worth St (S)														
1	L2	75	1.5	70	1.5	0.194	3.9	LOS A	11.5	81.6	0.00	0.11	0.00	49.9
2	T1	321	2.0	300	2.0	0.194	0.0	LOS A	11.5	81.6	0.00	0.11	0.00	49.9
Approach		396	1.9	370 N1	1.9	0.194	0.7	NA	11.5	81.6	0.00	0.11	0.00	49.9
East: Union Ln (E)														
4	L2	18	0.0	18	0.0	0.109	9.8	LOS A	0.3	2.3	0.56	0.92	0.56	43.3
5	T1	26	0.0	26	0.0	0.109	15.4	LOS B	0.3	2.3	0.56	0.92	0.56	43.3
6	R2	25	0.0	25	0.0	0.130	15.1	LOS B	0.2	1.7	0.62	1.00	0.62	41.2
Approach		69	0.0	69	0.0	0.130	13.8	LOS A	0.3	2.3	0.58	0.95	0.58	42.5
North: Worth St (N)														
8	T1	437	1.7	397	1.8	0.242	0.6	LOS A	13.8	97.9	0.16	0.12	0.16	43.0
9	R2	116	1.5	107	1.5	0.242	6.0	LOS A	13.8	97.9	0.21	0.16	0.21	39.6
Approach		553	1.7	504 N1	1.7	0.242	1.8	NA	13.8	97.9	0.17	0.13	0.17	42.2
All Vehicles		1018	1.7	944 N1	1.8	0.242	2.3	NA	13.8	97.9	0.13	0.18	0.13	44.0

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.
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.

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

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MOVEMENT SUMMARY

Site: 6 [6. Worth St and Union Rd]

Network: N101 [RMS Upgrade - PM Peak]

Worth Street and Union Road
East DA Scheme (FSR 6:1)
One-Way Link Northbound to High/ Civic Roundabout
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 150 seconds (Site Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Worth St (S)														
1	L2	16	0.0	16	0.0	0.344	78.3	LOS F	3.5	24.3	0.98	0.74	0.98	17.5
2	T1	28	0.0	28	0.0	0.344	72.8	LOS F	3.5	24.3	0.98	0.74	0.98	17.5
3	R2	4	0.0	4	0.0	0.344	78.3	LOS F	3.5	24.3	0.98	0.74	0.98	26.5
Approach		48	0.0	48	0.0	0.344	75.1	LOS F	3.5	24.3	0.98	0.74	0.98	18.5
East: Union Rd (E)														
4	L2	33	0.0	33	0.0	0.143	15.5	LOS B	4.8	34.1	0.40	0.40	0.40	49.6
5	T1	147	2.0	147	2.0	0.143	10.0	LOS A	4.8	34.1	0.40	0.40	0.40	44.3
6	R2	359	1.9	359	1.9	1.455	499.9	LOS F	82.1	584.5	1.00	1.80	3.12	3.4
Approach		539	1.8	539	1.8	1.455	336.6	LOS F	82.1	584.5	0.80	1.33	2.21	5.2
North: Worth St (N)														
7	L2	421	2.0	393	2.0	1.397	428.7	LOS F	11.5	81.6	1.00	1.64	2.91	4.2
8	T1	32	0.0	29	0.0	0.448	61.7	LOS E	5.5	38.2	0.95	0.75	0.95	20.8
9	R2	59	0.0	52	0.0	0.448	65.6	LOS E	5.5	38.2	0.95	0.75	0.95	3.5
Approach		512	1.6	474 N1	1.6	1.397	366.1	LOS F	11.5	81.6	0.99	1.49	2.57	4.4
West: Union Rd (W)														
10	L2	163	1.9	163	1.9	0.265	17.2	LOS B	6.6	46.6	0.47	0.63	0.47	11.7
11	T1	339	2.0	339	2.0	0.265	7.3	LOS A	6.6	47.3	0.35	0.35	0.35	48.7
12	R2	12	0.0	12	0.0	0.265	10.2	LOS A	6.6	47.3	0.33	0.30	0.33	48.0
Approach		514	1.9	513 N1	1.9	0.265	10.5	LOS A	6.6	47.3	0.39	0.44	0.39	41.9
All Vehicles		1613	1.7	1575 N1	1.8	1.455	231.2	LOS F	82.1	584.5	0.73	1.07	1.69	6.6

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.
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.

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate
P1	South Full Crossing	53	66.4	LOS F	0.2	0.2	0.94	0.94
P2	East Full Crossing	53	69.3	LOS F	0.2	0.2	0.96	0.96
P3	North Full Crossing	53	69.3	LOS F	0.2	0.2	0.96	0.96

P4	West Full Crossing	53	69.3	LOS F	0.2	0.2	0.96	0.96
All Pedestrians		211	68.6	LOS F			0.96	0.96

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

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MOVEMENT SUMMARY

Site: 7 [7. Union Rd and Link Rd]

Network: N101 [RMS Upgrade - PM Peak]

Union Road and Link Road
East DA Scheme (FSR 6:1)
One-Way Link Northbound to High/ Civic Roundabout
Site Category: (None)
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Arrival Flows Total veh/h	Arrival Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
East: Union Rd (E)														
5	T1	183	1.8	181	1.8	0.121	0.4	LOS A	0.2	1.8	0.14	0.10	0.14	45.6
6	R2	38	0.0	34	0.0	0.121	5.2	LOS A	0.2	1.8	0.14	0.10	0.14	45.6
Approach		221	1.5	215 N1	1.6	0.121	1.1	NA	0.2	1.8	0.14	0.10	0.14	45.6
North: Link Rd (W)														
7	L2	33	0.0	32	0.0	0.148	7.6	LOS A	0.5	3.6	0.46	0.94	0.46	19.7
9	R2	75	1.6	74	1.6	0.148	9.0	LOS A	0.5	3.6	0.46	0.94	0.46	19.7
Approach		107	1.1	106 N1	1.1	0.148	8.5	LOS A	0.5	3.6	0.46	0.94	0.46	19.7
West: Union Rd (W)														
10	L2	79	0.0	79	0.0	0.217	3.9	LOS A	0.0	0.0	0.00	0.12	0.00	48.6
11	T1	288	1.9	288	1.9	0.217	0.0	LOS A	0.0	0.0	0.00	0.12	0.00	48.6
Approach		367	1.5	367	1.5	0.217	0.8	NA	0.0	0.0	0.00	0.12	0.00	48.6
All Vehicles		696	1.5	688 N1	1.5	0.217	2.1	NA	0.5	3.6	0.11	0.24	0.11	38.9

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.
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.

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

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MOVEMENT SUMMARY

Site: 8 [8. Union Ln and Link Rd]

Network: N101 [RMS Upgrade - PM Peak]

Union Lane and Link Road
East DA Scheme (FSR 6:1)
One-Way Link Northbound to High/ Civic Roundabout
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Link Road (S)														
2	T1	16	0.0	16	0.0	0.008	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
Approach		16	0.0	16	0.0	0.008	0.0	NA	0.0	0.0	0.00	0.00	0.00	60.0
East: Union Ln (E)														
4	L2	91	1.9	87	1.9	0.109	3.9	LOS A	0.4	2.9	0.06	0.55	0.06	28.6
6	R2	91	1.9	87	1.9	0.109	4.1	LOS A	0.4	2.9	0.06	0.55	0.06	28.6
Approach		181	1.9	174 N1	1.9	0.109	4.0	LOS A	0.4	2.9	0.06	0.55	0.06	28.6
All Vehicles		197	1.7	190 N1	1.8	0.109	3.7	NA	0.4	2.9	0.05	0.51	0.05	29.2

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.
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.

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

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MOVEMENT SUMMARY

Site: Drwy1 [Driveway 1]

Network: N101 [RMS Upgrade - PM Peak]

Driveway 1
East DA Scheme (FSR 6:1)
One-Way Link Northbound to High/ Civic Roundabout
Site Category: (None)
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: Link Rd (S)														
1	L2	128	0.0	125	0.0	0.068	3.9	LOS A	0.0	0.0	0.00	0.55	0.00	29.2
2	T1	1	0.0	1	0.0	0.068	0.0	LOS A	0.0	0.0	0.00	0.55	0.00	30.2
Approach		129	0.0	126 N1	0.0	0.068	3.9	NA	0.0	0.0	0.00	0.55	0.00	29.2
North: Link Rd (N)														
8	T1	84	2.0	82	2.0	0.043	0.0	LOS A	0.0	0.0	0.01	0.01	0.01	58.6
9	R2	1	0.0	1	0.0	0.043	2.7	LOS A	0.0	0.0	0.01	0.01	0.01	27.0
Approach		85	2.0	83 N1	2.0	0.043	0.0	NA	0.0	0.0	0.01	0.01	0.01	56.4
West: Driveway 1														
10	L2	16	0.0	16	0.0	0.027	6.2	LOS A	0.1	0.7	0.00	0.99	0.00	22.6
12	R2	16	0.0	16	0.0	0.027	6.3	LOS A	0.1	0.7	0.00	0.99	0.00	22.6
Approach		32	0.0	32	0.0	0.027	6.3	LOS A	0.1	0.7	0.00	0.99	0.00	22.6
All Vehicles		246	0.7	240 N1	0.7	0.068	2.9	NA	0.1	0.7	0.00	0.42	0.00	30.1

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.
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.

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

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MOVEMENT SUMMARY

Site: Drwy2 [Driveway 2]

Network: N101 [RMS Upgrade - PM Peak]

Driveway 2
East DA Scheme (FSR 6:1)
One-Way Link Northbound to High/ Civic Roundabout
Site Category: (None)
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
East: Union Rd (E)														
5	T1	226	2.0	225	2.0	0.121	0.0	LOS A	0.0	0.3	0.02	0.01	0.02	57.7
6	R2	5	0.0	5	0.0	0.121	4.8	LOS A	0.0	0.3	0.02	0.01	0.02	42.0
Approach		232	2.0	230 N1	2.0	0.121	0.1	NA	0.0	0.3	0.02	0.01	0.02	56.9
North: Driveway 2 (n)														
7	L2	3	0.0	3	0.0	0.014	7.3	LOS A	0.0	0.3	0.42	0.87	0.42	20.3
9	R2	7	0.0	7	0.0	0.014	8.4	LOS A	0.0	0.3	0.42	0.87	0.42	20.3
Approach		11	0.0	11	0.0	0.014	8.1	LOS A	0.0	0.3	0.42	0.87	0.42	20.3
West: Union Rd (W)														
10	L2	14	0.0	14	0.0	0.150	3.9	LOS A	0.0	0.0	0.00	0.03	0.00	32.6
11	T1	275	2.0	274	2.0	0.150	0.0	LOS A	0.0	0.0	0.00	0.03	0.00	57.0
Approach		288	1.9	288	1.9	0.150	0.2	NA	0.0	0.0	0.00	0.03	0.00	53.6
All Vehicles		531	1.9	529 N1	1.9	0.150	0.3	NA	0.0	0.3	0.02	0.04	0.02	53.2

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.
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.

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

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MOVEMENT SUMMARY

Site: UrbApart [Urban Apartments]

Network: N101 [RMS Upgrade - PM Peak]

Urban Apartments
East DA Scheme (FSR 6:1)
One-Way Link Northbound to High/ Civic Roundabout
Site Category: (None)
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
East: Union Lane (E)														
5	T1	167	2.0	158	2.0	0.109	0.0	LOS A	0.0	0.0	0.00	0.15	0.00	47.3
6	R2	51	0.0	49	0.0	0.109	4.0	LOS A	0.0	0.0	0.00	0.15	0.00	54.2
Approach		218	1.5	207 N1	1.5	0.109	1.0	NA	0.0	0.0	0.00	0.15	0.00	52.2
North: Urban Apartment Access														
9	R2	14	0.0	14	0.0	0.013	8.2	LOS A	0.0	0.3	0.26	0.87	0.26	47.9
Approach		14	0.0	14	0.0	0.013	8.2	LOS A	0.0	0.3	0.26	0.87	0.26	47.9
All Vehicles		232	1.4	221 N1	1.5	0.109	1.4	NA	0.0	0.3	0.02	0.20	0.02	51.5

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.
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.

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

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Attachment 3 - Concept Intersection Design and TfNSW In-principle Approval

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Regards

Alex Black
Development Manager, Development & Construction | **TOGA**

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From: RATHAN Pahee <Pahee.RATHAN@rms.nsw.gov.au>
Sent: Thursday, 14 February 2019 2:32 PM
To: 'council@penrith.city' <council@penrith.city>
Cc: 'kathryn.saunders@penrith.city' <kathryn.saunders@penrith.city>; LANCE David C <David.LANCE@rms.nsw.gov.au>; Alex Black <ablack@toga.com.au>
Subject: Construction of Mixed Use Development - 634-638 High Street, Penrith DA18/0264 SYD18/00573/06

Hi Kathryn,

I refer to your email dated 11 April 2018 and subsequent meetings regarding the abovementioned development.

Roads and Maritime reviewed all the information submitted by Council and the applicant. Roads and Maritime provides the following comments to Council for its consideration in the determination of the development application:

1. Roads and Maritime does not support the replacement of the existing roundabout with Traffic Control Signals (TCS) at present. However, Roads and Maritime will support the attached layout for any future TCS at this location when/if the warrants for installing TCS were met.
2. If the future TCS at this location impacts on the performance of the TCS at the intersection of Mulgoa Road and High Street, then Roads and Maritime will not allow the right turn movements from High Street into the development.
3. In future, traffic movements will be restricted to left-in and left-out only at the intersection of Mulgoa Road and Union Street. This will have impact on the accessibility to the proposed development.

If you like to discuss this matter further, please call me on 8849 2219.

Regards
Pahee

Pahee Rathan
A/Senior Land Use Assessment Coordinator
North West Precinct
T 02 8849 2219 M 0417 246 510
www.rms.nsw.gov.au
Every journey matters

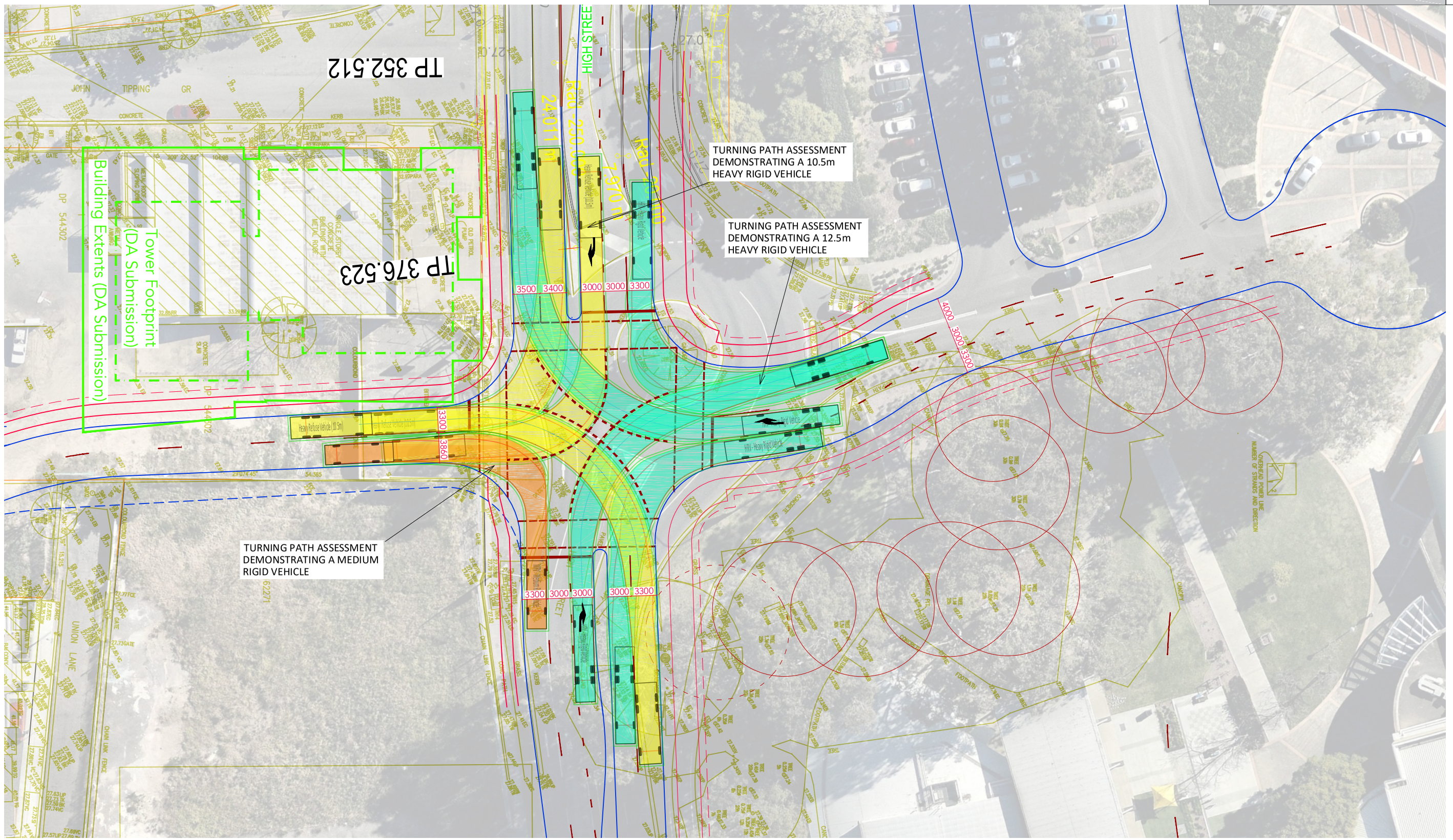
Roads and Maritime Services
27 Argyle Street Parramatta NSW 2150

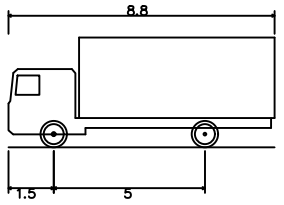
Before printing, please consider the environment

Int 11 - Access Road Alignment - Sharp Civic Alignment (no tree loss) - Two Lanes - Two-way - Within Toga - 16-05-18.dwg

COMMENTS

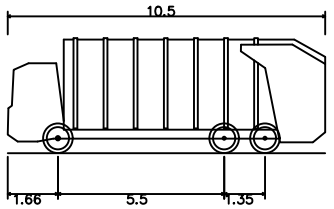
A3





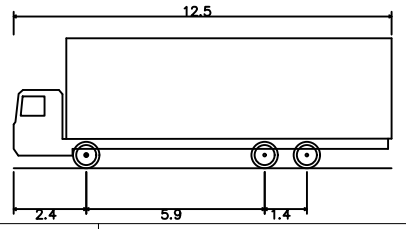
MRV – Medium Rigid Vehicle

Overall Length	8.800m
Overall Width	2.500m
Overall Body Height	3.633m
Min Body Ground Clearance	0.428m
Track Width	2.500m
Lock–to–lock time	4.00s
Curb to Curb Turning Radius	10.000m



Heavy Refuse Vehicle (10.5m)

Overall Length	10.500m
Overall Width	2.800m
Overall Body Height	3.804m
Min Body Ground Clearance	0.356m
Track Width	2.800m
Lock–to–lock time	6.00s
Curb to Curb Turning Radius	11.250m



HRV – Heavy Rigid Vehicle

Overall Length	12.500m
Overall Width	2.500m
Overall Body Height	4.300m
Min Body Ground Clearance	0.417m
Track Width	2.500m
Lock–to–lock time	6.00s
Curb to Curb Turning Radius	12.500m

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REV	DATE	COMMENT	DRAWN	REVIEWED	REV	DATE	COMMENT	DRAWN	REVIEWED
4	16/05/18	Intersection Layout	SW	AM					
3	XXX	XXX	XXX	XXX					
2	XXX	XXX	XXX	XXX					
1	XXX	XXX	XXX	XXX					

PROJECT:

High Street
Penrith

DRAWING TITLE:

Intersection Arrangement, Curved Alignment Civic Access (Retain all Trees) Two Lanes, Two-way Access Road within Toga Site

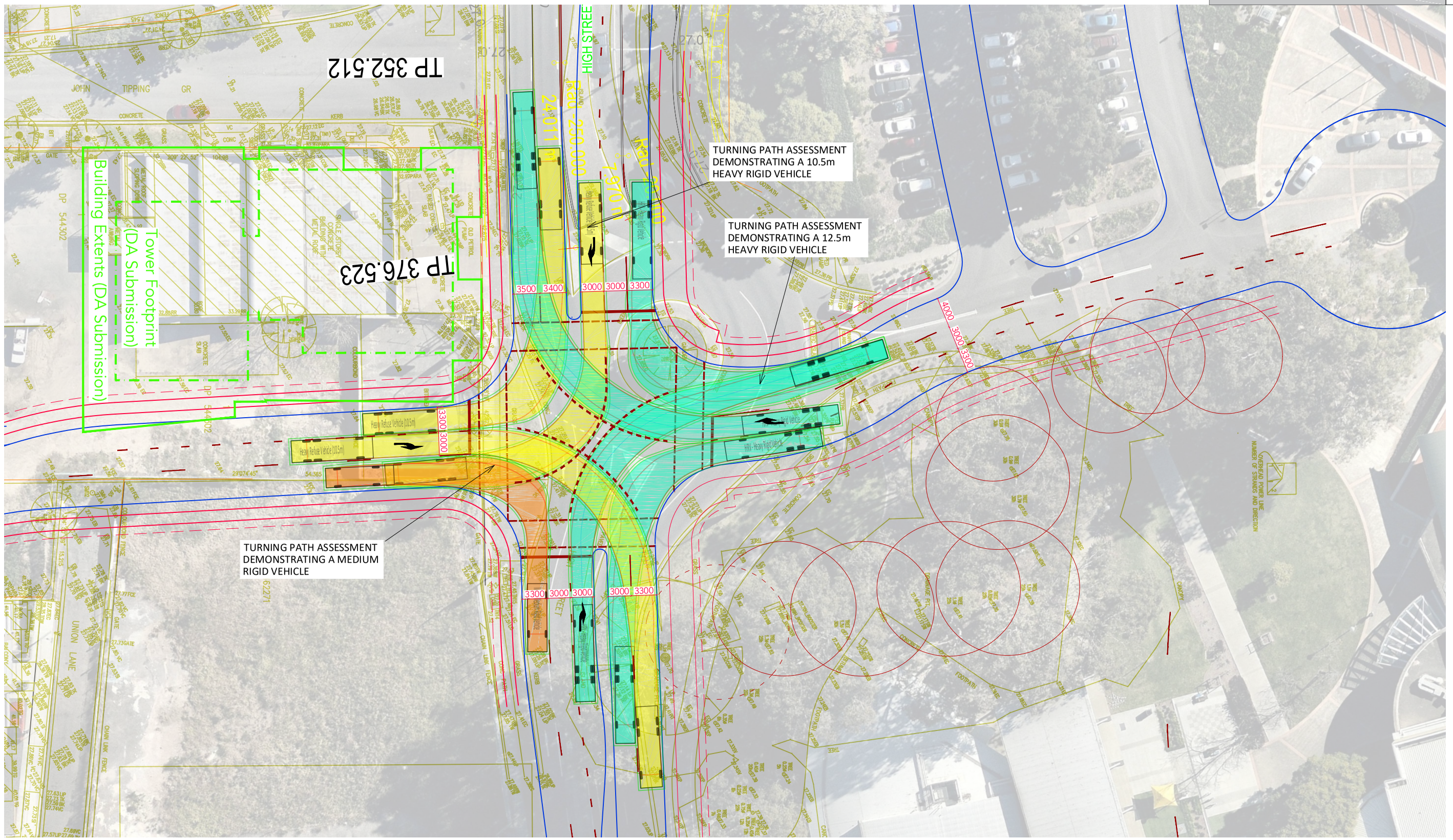
CLIENT:	**TOGA**
DRG. #:	**Int 11**
PROJECT #:	**T2-2069**
SCALE:	**1:250**

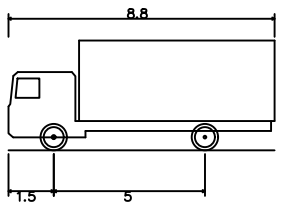
REV: **4**

Int 11B - Access Road Alignment - Sharp Civic Alignment (no tree loss) - Three Lanes - Two-way - Within Toga - 16-05-18.dwg

COMMENTS

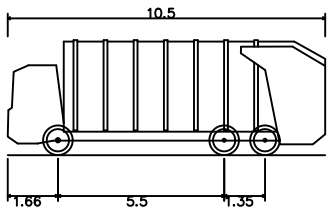
A3





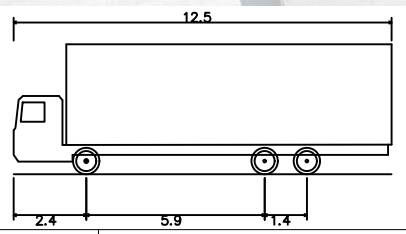
MRV – Medium Rigid Vehicle

Overall Length	8.800m
Overall Width	2.500m
Overall Body Height	3.633m
Min Body Ground Clearance	0.428m
Track Width	2.500m
Lock–to–lock time	4.00s
Curb to Curb Turning Radius	10.000m



Heavy Refuse Vehicle (10.5m)

Overall Length	10.500m
Overall Width	2.800m
Overall Body Height	3.804m
Min Body Ground Clearance	0.356m
Track Width	2.800m
Lock–to–lock time	6.00s
Curb to Curb Turning Radius	11.250m



HRV – Heavy Rigid Vehicle

Overall Length	12.500m
Overall Width	2.500m
Overall Body Height	4.300m
Min Body Ground Clearance	0.417m
Track Width	2.500m
Lock–to–lock time	6.00s
Curb to Curb Turning Radius	12.500m

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REV	DATE	COMMENT	DRAWN	REVIEWED	REV	DATE	COMMENT	DRAWN	REVIEWED
1	16/05/18	Intersection Layout	SW	AM					

PROJECT:

High Street
Penrith

DRAWING TITLE:

Intersection Arrangement, Curved Alignment Civic Access (Retain all Trees) Three Lanes, Two-way Access Road within Toga Site

CLIENT: **TOGA**

DRG. #: **Int 11B**

PROJECT #: **T2-2069**

SCALE: **1:250**

REV: **1**