

traffic impact assessment;

High St, Penrith

For Toga
21st June 2018

parking;
traffic;
civil design;
communication;
ptc.

Document Control

High St, Penrith, Traffic impact assessment

Issue	Date	Issue Details	Author	Reviewed	For the attention of
1	15/03/2018	1 st draft	EY/CS	AM	Jia Ferdandez
2	29/05/2018	Revised Submission	EY/CS	AM	Jia Ferdandez
3	14/06/2018	Revised Final	SW	AM	Jia Ferdandez
4	19/06/2018	Revised Final	SW	AM	Jia Ferdandez
5	20/06/2018	Revised Final	SW / DS	AM	Jia Fernandez
6	21/06/2018	Revised Final	SW / DS	AM	Jia Fernandez

Contact

Andrew Morse

+61 2 8920 0800

+61 414 618 002

andrew.morse@ptcconsultants.co

COMMERCIAL IN CONFIDENCE

The information contained in this document, including any intellectual property rights arising from designs developed and documents created, is confidential and proprietary to **ptc.**

This document may only be used by the person/organisation to whom it is addressed for the stated purpose for which it is provided and must not be imparted to or reproduced, in whole or in part, by any third person without the prior written approval of a **ptc.** authorised representative. **ptc.** reserves all legal rights and remedies in relation to any infringement of its rights in respect of its intellectual property and/or confidential information.

© 2018

ptc.

Suite 102, 506 Miller Street

Cammeray NSW 2062

info@ptcconsultants.co

t + 61 2 8920 0800

ptcconsultants.co

Contents

1. Introduction	1
1.1 Project Summary	1
1.2 Purpose of this Report	2
2. Proposal	3
2.1 Development Site	3
2.2 Development Proposal	4
3. Existing Transport Facilities	5
3.1 Road Hierarchy	5
3.1.1 Road Network	6
3.1.2 Key Intersections	11
3.2 Existing Road Network Operation	12
3.2.1 SIDRA Modelling Performance Criteria	13
3.2.2 Modelling Results	14
3.3 Identified Road Network Amendments	15
3.4 Public Transport	18
3.4.1 Trains	18
3.4.2 Buses	19
4. Parking Provision Assessment	20
4.1 Car Parking Provisions	20
4.2 Accessible Parking Requirements	21
4.3 Loading Dock Provisions	22
4.4 Bicycle Parking	22
5. Development Traffic Assessment	24
5.1 Traffic Generation	24
5.2 Traffic Analysis	24
5.3 Traffic Impact Summary	27
6. Access and Car Park Assessment	28
6.1 Vehicular Access	28
6.2 Car Park Arrangement	28
6.2.1 Typical Requirements	28
6.2.2 Accessible Parking	29
6.3 Loading Dock	29
7. Conclusion	30
Attachment 1 Compliance and Swept Path Assessment Plans	31
Attachment 2 SIDRA Modelling Results	32

Figure 1: Site Location	1
Figure 2: Land Use Map (Source: Penrith Local Environmental Plan 2010)	3
Figure 3 - Isometric Image of the Development (prepared by SJB Architects)	4
Figure 4: Road Hierarchy (source: TfNSW Carto 2015)	5
Figure 5: Mulgoa Road (northbound)	6
Figure 6: Castlereagh Road (southbound)	7
Figure 7: High Street (westbound)	8
Figure 8: Union Road (eastbound)	9
Figure 9: Union Lane (westbound)	10
Figure 10: Worth Street (northbound at Union Lane)	11
Figure 11 - 2020 AM Peak, Weekday (Existing Road Network, Post Development)	12
Figure 12 - 2020 PM Peak, Weekday (Existing Road Network, Post Development)	13
Figure 13 - Jane Street and Mulgoa Road Infrastructure Upgrade	16
Figure 14 - New Link Road Future Arrangement	17
Figure 15 - New Link Road Proposed Interim Arrangement	17
Figure 16: Walking Route to Penrith Station	18
Figure 17: Nearby Bus Stops	19
Figure 18 - Bicycle Parking Class (Extract from Table 1.1 of AS2890.3L2015)	22
Figure 19 - Proposed Driveway Locations	27
Table 1: Existing Road Network – Mulgoa Road	6
Table 2: Existing Road Network – Castlereagh Road (northern extension of Mulgoa Road)	7
Table 3: Existing Road Network – High Street	8
Table 4: Existing Road Network – Union Road	9
Table 5: Existing Road Network – Union Lane	10
Table 6: Existing Road Network – Worth Street	11
Table 7 - Levels of Service (LoS)	14
Table 8 - Existing SIDRA Network Performance Results, AM	14
Table 9 - Existing SIDRA Network Performance Results, PM	15
Table 10: Bus Route Summary	19
Table 11 - Accommodation Schedules	20
Table 12 - Car Parking Requirements	21
Table 13 - Accessible Parking Requirement	21
Table 14 - DCP Service Vehicle Requirements	22
Table 15 - Bicycle Parking Provisions, Building 1	22
Table 16 - Bicycle Parking Provisions, Building 2	23
Table 17 - Trip Generation Estimate	24
Table 18 - Future Road Network Operation, AM (Model 2)	25
Table 19 - Future Road Network Operation, PM (Model 2)	26

1. Introduction

1.1 Project Summary

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 187 apartments and 1,144m² of commercial area within two buildings with a combined basement and podium for car parking. The location of the site is indicated in Figure 1.



Figure 1: Site Location

1.2 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; and
Section 6	Assessment of the proposed car park, vehicular access and internal circulation arrangements in relation to compliance with the relevant standards, and Council policies.
Section 7	Conclusion

2. Proposal

The site is located at 87-91 Union Road / 634-368 High Street in Penrith (Site 1). Toga has another site at 640-652 High Street Penrith (Site 2) which will be progressed in a separate Development Application. Toga's sites are dissected by John Tipping Grove, which is a council owned road. This document has been prepared for the Development Application on Site 01, 87-91 Union Road / 634-368 High Street, Penrith.

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

The development consists of 187 apartments and 1,144m² of commercial area within the ground floor. SJB Architects have been appointed as the architectural team through winning the design excellence competition.

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 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 5,402m².

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

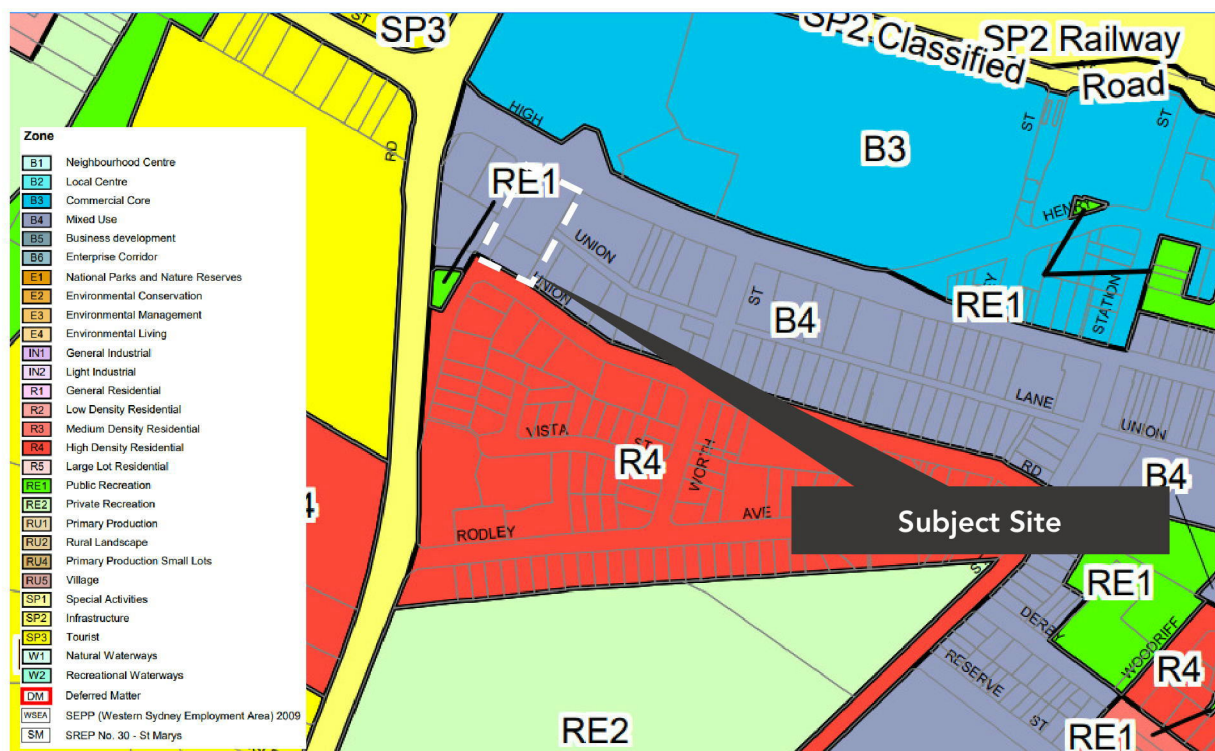


Figure 2: Land Use Map (Source: Penrith Local Environmental Plan 2010)

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 = 81 apartments) and Building 2 (southern building = 106), totalling 187 apartments.

The ground level will accommodate 1,144m² of commercial area divided across the northern and southern parts of the ground floor.

Car parking will be provided within a single basement level and two podium levels and will accommodate a total of 260 spaces. 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 (basement 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 podium parking.

An illustration of the development is presented below.



Figure 3 - Isometric Image of the Development (prepared by SJB Architects)

3. Existing 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.

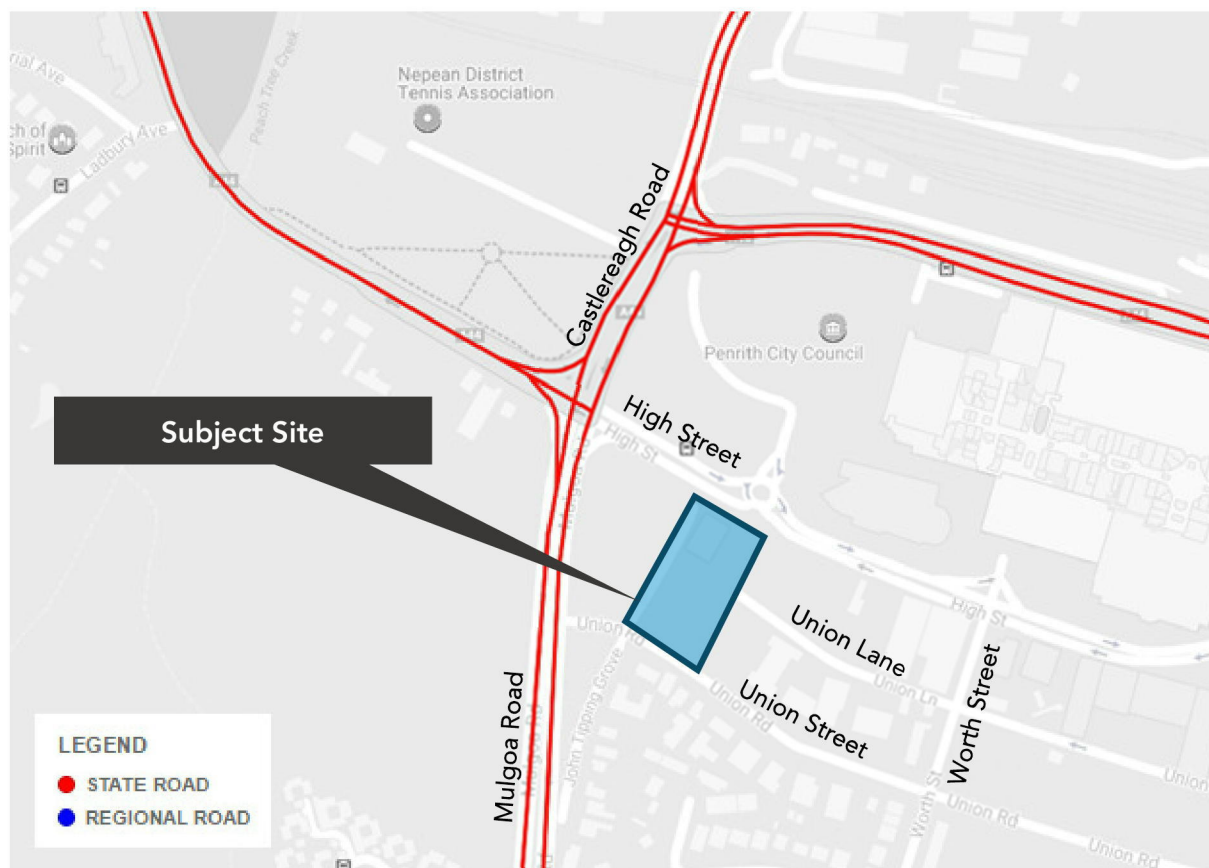


Figure 4: Road Hierarchy (source: TfNSW Carto 2015)

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

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 5: Mulgoa Road (northbound)

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	Yes



Figure 6: Castlereagh Road (southbound)

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 7: High Street (westbound)

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

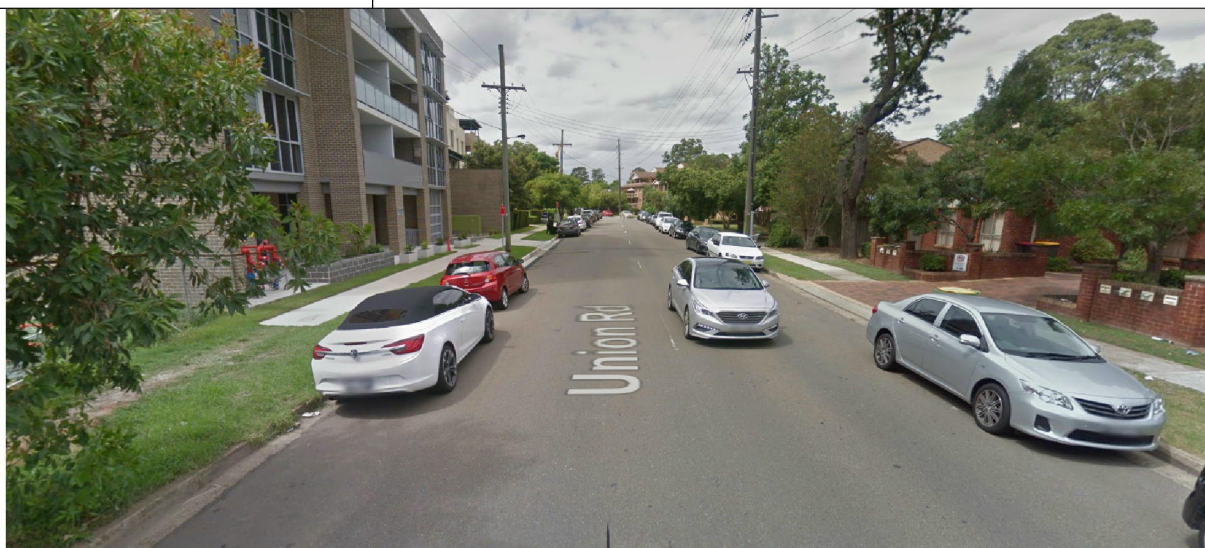


Figure 8: Union Road (eastbound)

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

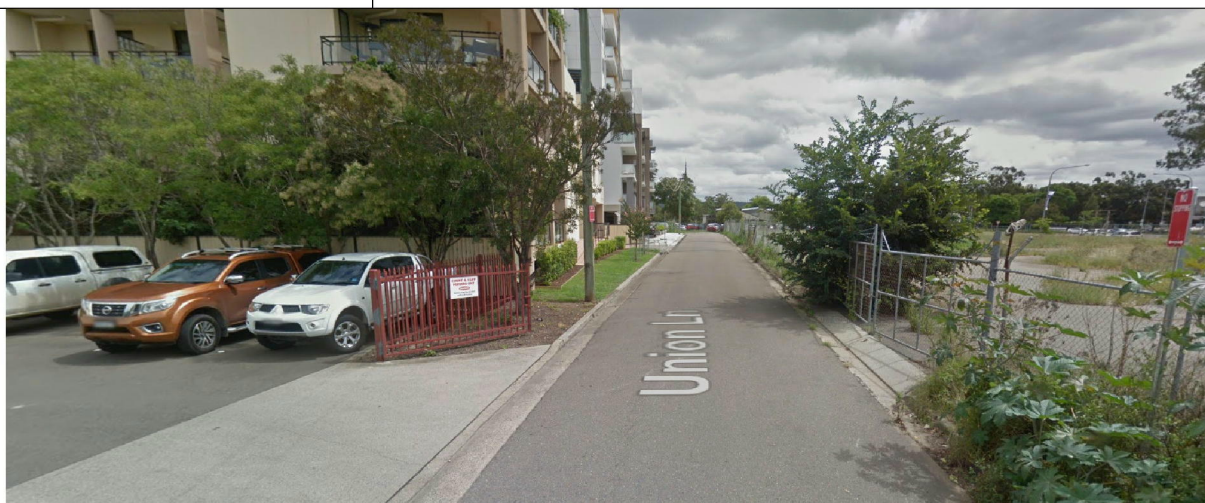


Figure 9: Union Lane (westbound)

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

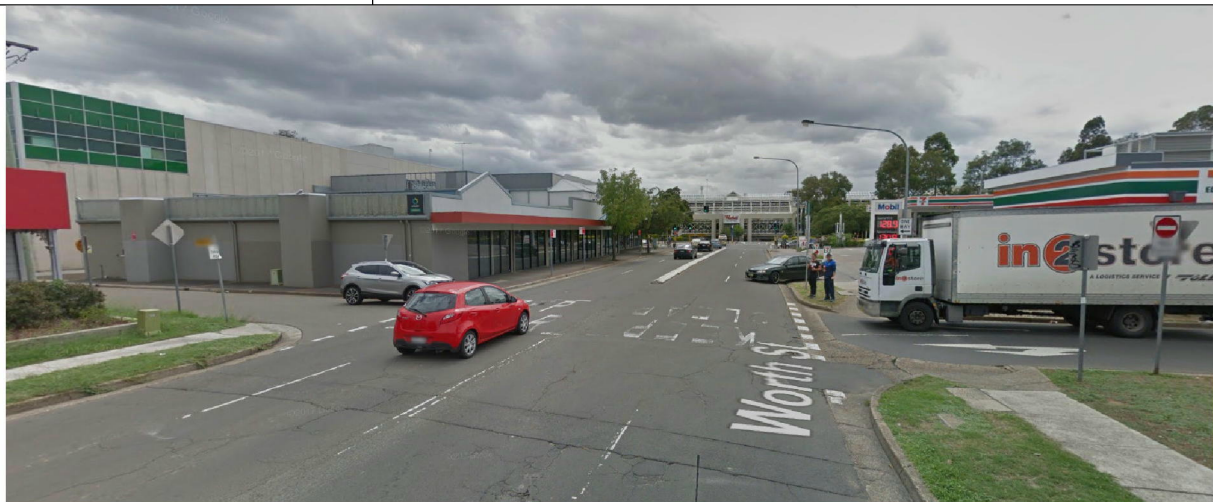


Figure 10: Worth Street (northbound at Union Lane)

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

3.2 Existing Road Network Operation

Traffic modelling has been prepared using Sidra Intersection 7.0, which enables the intersections to be assessed as a network.

The model includes traffic volume and lane data provided by RMS in relation to the Mulgoa Road upgrade, and traffic survey data and projected volumes provided Council.

It is noted that the data provided by Council was projected to 2020, while the RMS data was projected to 2026, therefore key movements within the Council data have been increased by 10% (approximate growth included in the RMS model) to align the data sets.

The development will be constructed over a number of years, therefore only the 2026 volumes have been used as base for the post development model. The existing conditions (pre-development) are based on the RMS and Council 2020 volumes applied to the current road network.

The traffic modelling described in this report considers the following scenarios (AM and PM peaks included in each scenario):

- Model 1 – 2020 RMS and increased Council volumes – Mulgoa Road upgrades - No Development – No Link Road
- Model 2 – 2026 RMS and increased Council volumes – Mulgoa Road upgrades – Post S1 Development and Link Road (See Section 5.2).

The input traffic volumes for the pre-development scenario (Model 1) are presented for the Weekday AM peaks (Figure 11) and PM peaks (Figure 12) below.

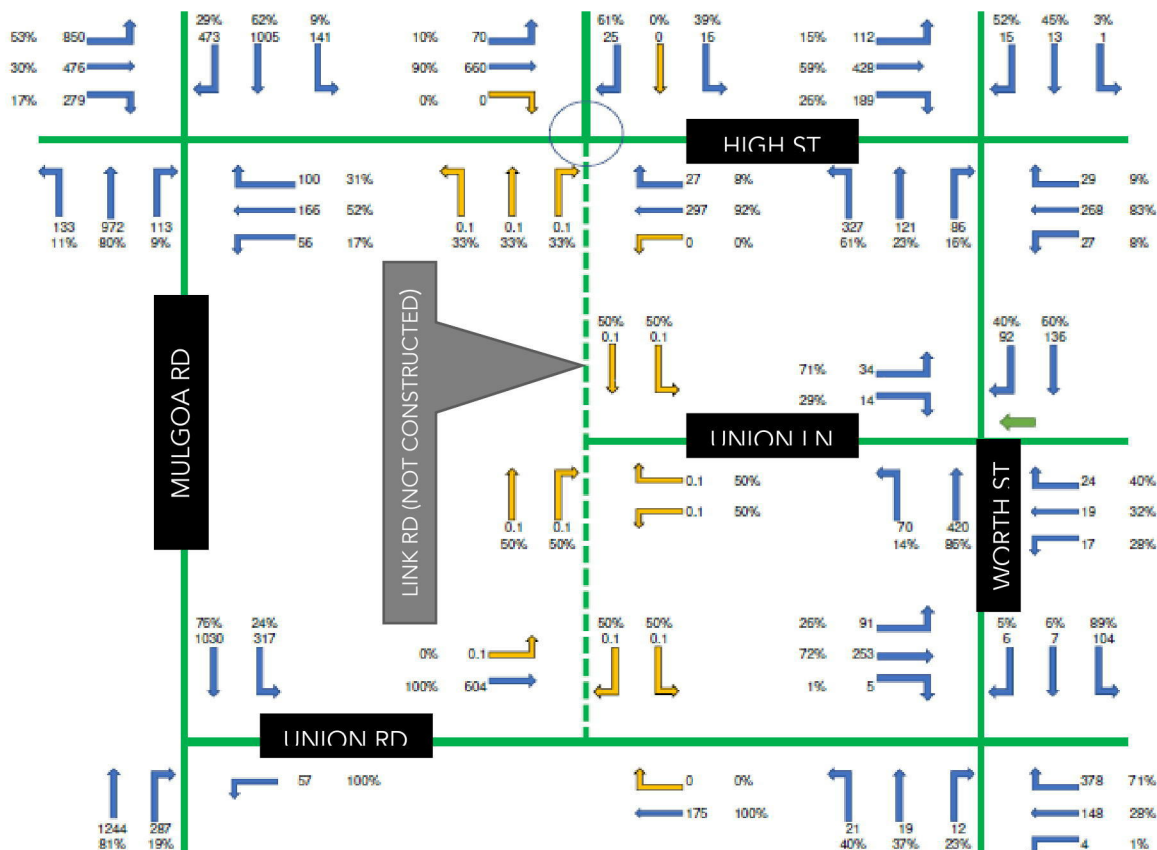


Figure 11 - 2020 AM Peak, Weekday (Existing Road Network, Post Development)

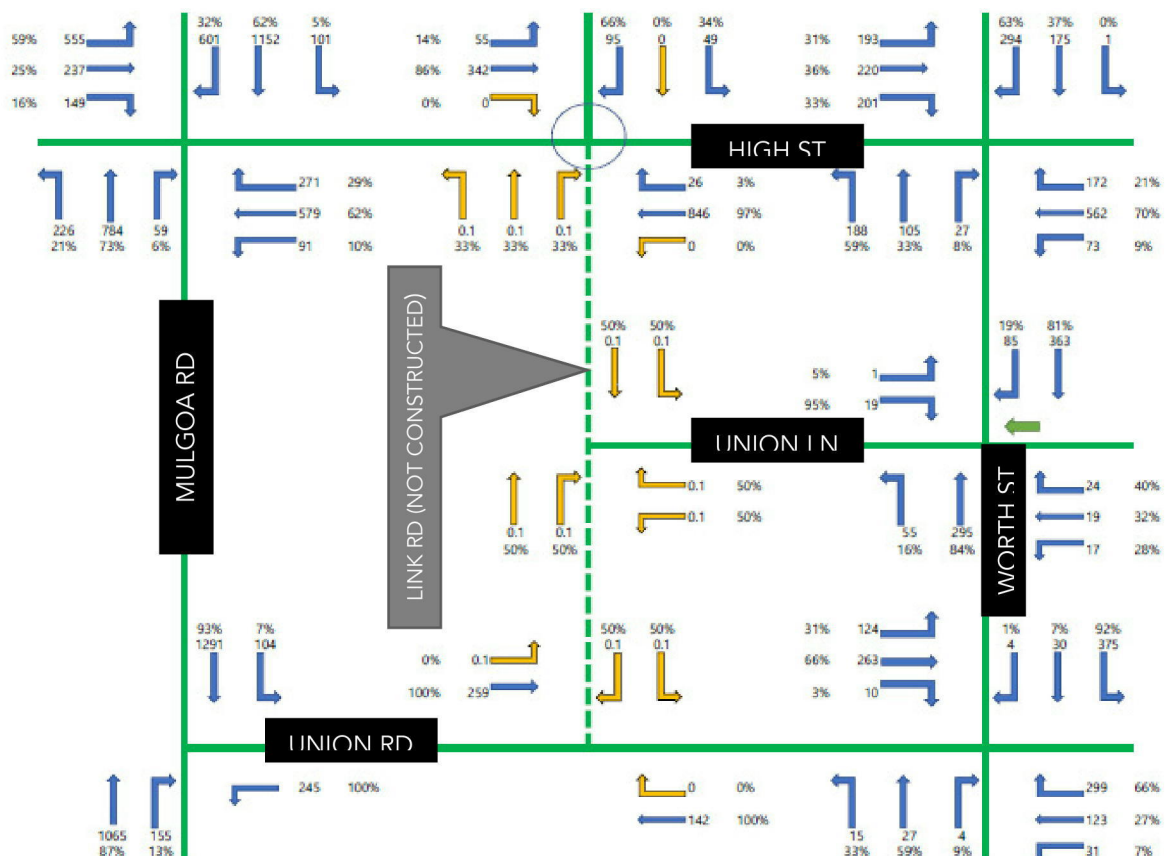


Figure 12 - 2020 PM Peak, Weekday (Existing Road Network, Post Development)

3.2.1 SIDRA Modelling Performance Criteria

The surveyed intersections have been modelled with SIDRA Intersection 7.0 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. RMS 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 measureable distance units; and
- Congestion Coefficient (for networks) - the ratio of *desired* travel speed to *average* travel speed.

RMS adopts the following LoS classifications¹ outlined in Table 7.

¹ RMS Guide to Traffic Generating Developments 2002

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 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, resulting in congestion.

Table 8 - Existing SIDRA Network Performance Results, AM

Intersection	Peak Period	Average Level of Service (LoS)	Average Delay (sec)	Worst Degree of Saturation (DSat)
Mulgoa Road / High Street	8:00am-9:00am	C	39.4	0.803
High Street / Civic Centre	8:00am-9:00am	A	3.9	0.246
Mulgoa Road / Union Road	8:00am-9:00am	A (Worst Movement: F)	33.2	1.315
Worth Street / Union Lane	8:00am-9:00am	A	2.9	0.264
Worth Street / Union Road	8:00am-9:00am	C	29.7	0.902
High Street / Worth Street	8:00am-9:00am	D	43.8	0.847

Table 9 - Existing SIDRA Network Performance Results, PM

Intersection	Peak Period	Average Level of Service (LoS)	Average Delay (worst movement) (sec)	Worst Degree of Saturation (DSat)
Mulgoa Road / High Street	4:00pm-5:00pm	D	46.3	0.843
High Street / Civic Centre	4:00pm-5:00pm	A	4.3	0.504
Mulgoa Road / Union Road	4:00pm-5:00pm	A	3.3	0.786
Worth Street / Union Lane	4:00pm-5:00pm	A	2.4	0.405
Worth Street / Union Road	4:00pm-5:00pm	C	29.1	0.847
High Street / Worth Street	4:00pm-5:00pm	D	54.8	0.918

3.3 Identified Road Network Amendments

The site is located near the key intersection of Mulgoa Road and High Street which is planned to be upgraded by RMS as part of the Jane Street and Mulgoa Road Infrastructure Upgrade. The intersection is being expanded to increase the number of approach lanes, which will involve the widening of High Street between Mulgoa Road and the roundabout within the site frontage. An extract of the RMS works is presented below:



Figure 13 - 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. It is proposed that the conversion would be best undertaken following the upgrade of the High Street roundabout in order to provide improved traffic distribution in the short-term.

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 new link road will be wholly located within the development site providing 2 lanes, 1 northbound and 1 southbound (refer Figure 14). The proposed interim arrangement (refer Figure 15) will provide 1 northbound lane (North of Union Lane) with access only onto the existing High Street roundabout.

Use of the southbound lane (access from the roundabout) will be restricted by the installation of 'F Type' barriers as detailed on the civil plans. This arrangement forms the basis of the DA scheme and the associated traffic modelling presented in Section 5 of this report.

The future alignment of the link road, as shown on Figure 14, will provide 2 lanes north of Union Lane (1 northbound and 1 southbound) with access and egress onto High Street and this will be implemented following the upgrade of the High Street roundabout to a 4-arm signalised intersection (not subject of this DA).

The interim arrangement has been provided to be readily augmented to the signalised intersection.

The new link road has also been provided to be readily augmented to a 3 lane road (2 northbound, 1 southbound) with the third lane provided within lot 10 DP 1162271 (immediately adjacent to the site to the east) should this be determined as a requirement by council at a later stage.

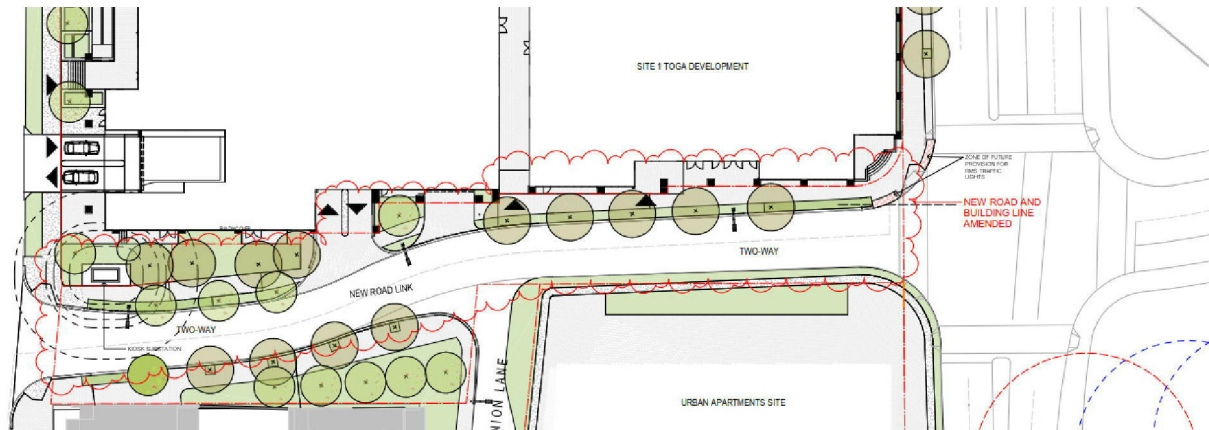


Figure 14 - New Link Road Future Arrangement

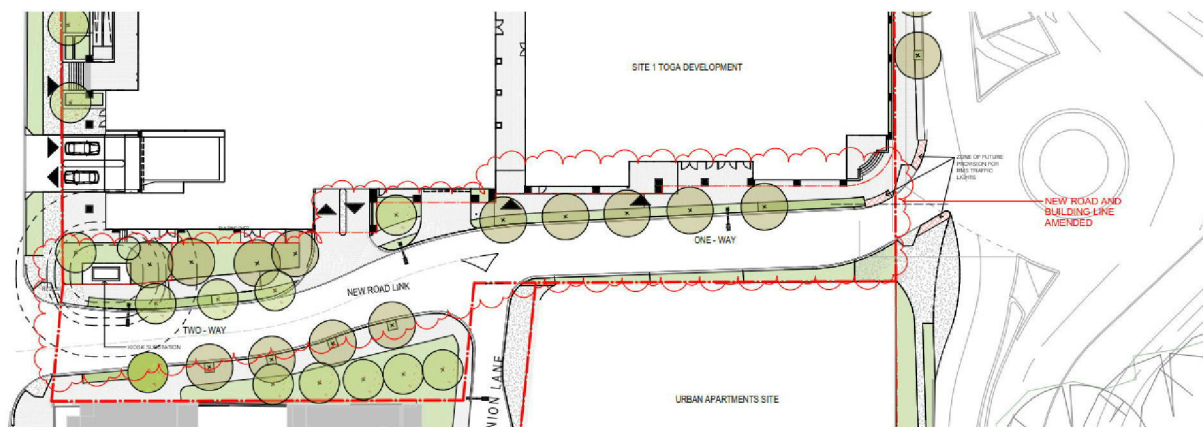


Figure 15 - New Link Road Proposed Interim Arrangement

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 1km walking distance 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. Although situated slightly outside the comfortable walking distance, 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.

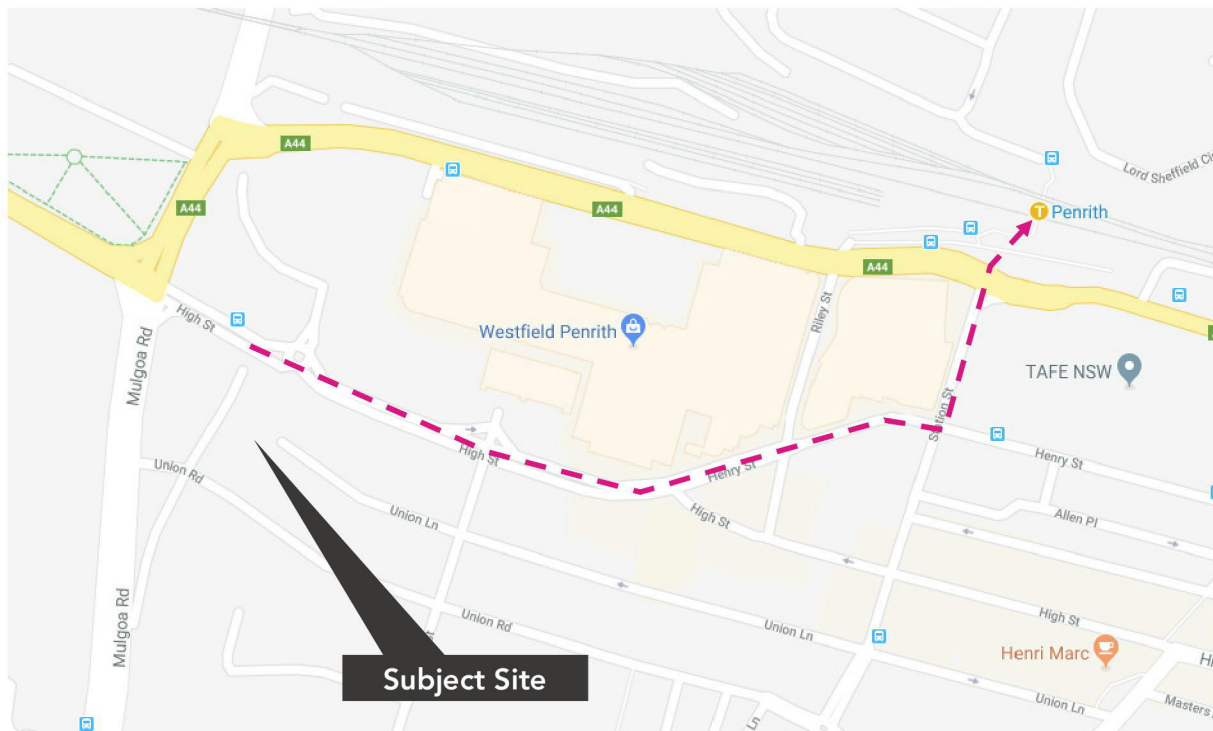


Figure 16: Walking Route to Penrith Station

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 17 and summarised in Table 10.

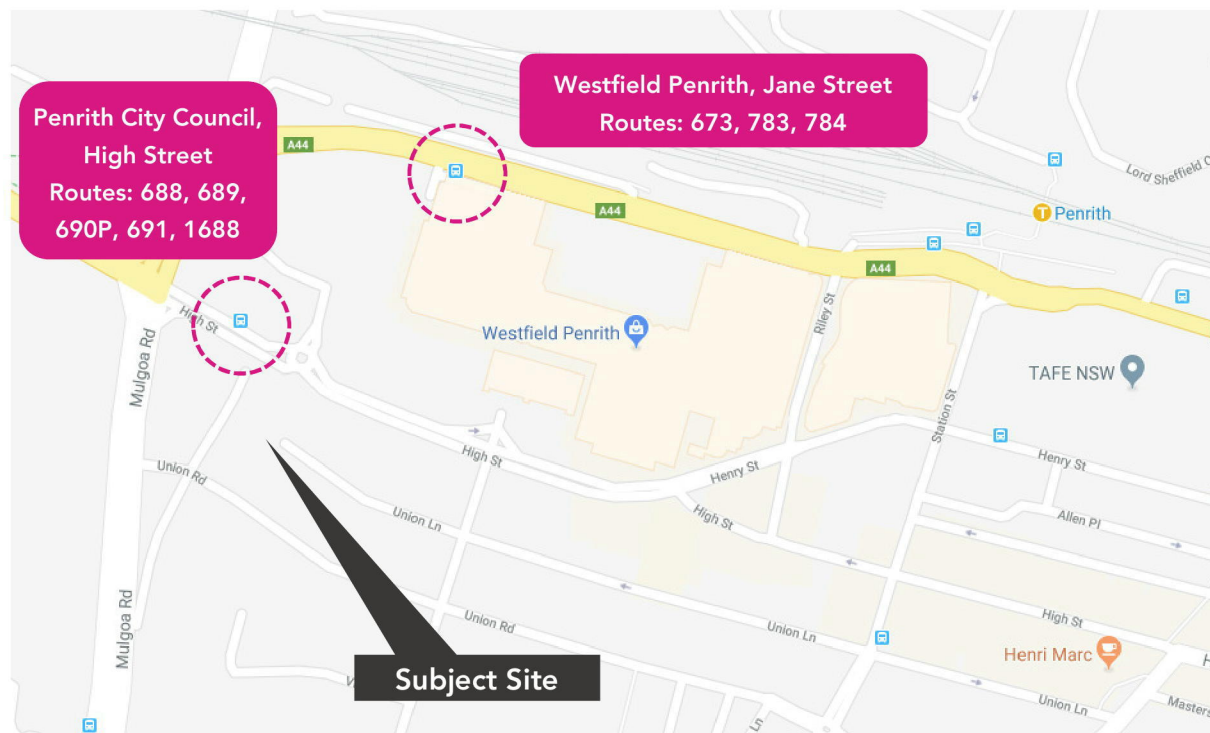


Figure 17: Nearby Bus Stops

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.

4. Parking Provision Assessment

An assessment of parking provisions has been undertaken for the proposed development with reference to the following Sections of the Penrith Development Control Plan (DCP) 2014:

- Section 10, Transport Access & Parking; and
- Section 11, Penrith City Centre.

4.1 Car Parking Provisions

The following car parking provision requirements are relevant to this development, extracted from Table C10.2 of the DCP:

- Residential Flat Buildings must provide:
 - 1 space for each One-bedroom Unit;
 - 1 space for each Two-bedroom Unit;
 - 2 spaces for each unit with three or more bedrooms;
 - 1 space per 40 units for service vehicles
 - 1 visitor space for every 5 dwellings;
 - 1 car wash bay for every 50 units, up to a maximum of 4 car wash bays per building;
- Commercial development within Penrith City Centre must provide:
 - 1 space for every 30m² of gross floor area (GFA)
 - Up to 60% of the commercial parking provision may be provided on-site, with the remaining balance to be subject to a contribution plan.

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	27
	Two-bedroom unit	45
	Three-bedroom unit	9
	Sub-total	81
	Commercial (see Building 2)	0

	Use Type	Units/GFA
Building 2	One-bedroom unit/Studio	36
	Two-bedroom unit	58
	Three-bedroom unit	12
	Sub-total	106
	Commercial	1,144m ²

Table 12 - Car Parking Requirements

Use Type	Units/GFA	DCP Parking Provision Rate	Required Parking	Proposed Parking On-Site	Parking under Contribution
One-bedroom unit/Studio	63	@ 1 spaces per unit	63	63	
Two-bedroom unit	103	@ 1 spaces per unit	103	103	
Three-bedroom unit	21	@ 2 spaces per unit	42	42	
Resident Parking	187	Sub-total:	208	208	0
Visitor Parking	187	@ 0.2 spaces per unit	38	38	0
Service Vehicle Parking	187	@ 1 per 40 units	5	1*	4
Car Wash bays	187	@ 1 per 50	4	3†	1
Commercial	1,144m ²	@ 1 / 100m ² GFA*	11	6	5
Building 1 and 2 Combined Total:			266	256	10

* Comprises of 1 dedicated service space and 3 dual-use space for visitors and service

† The car wash bays will accommodate the balance of the service vehicle spaces, given the low usage

4.2 Accessible Parking Requirements

Accessible parking is to be provided on the following basis:

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

The proposal has a total of 19 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	Accessible Parking Requirement
Residential	19 Adaptable Units	19
Visitor	246 Parking Spaces*	3
	TOTAL:	22

* 206 Residential and 38 Commercial spaces

4.3 Loading Dock Provisions

The combined commercial GFA of both buildings is 1,144m². The DCP stipulates the loading requirements for commercial and industrial developments as per Table 14.

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

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

4.4 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 and Table 16 respectively.

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

B	<p>A secure room or structure, protected from the weather, containing bicycle parking devices that allow users to lock the bicycle frame and both wheels.</p> <p>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.</p> <p>Chain mesh fencing is not considered suitable.</p> <p>Entrance gates (to the secure bike area) are self-closing and self-locking.</p>	<p>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).</p> <p>Facilities should be located in well lit areas, and where passive surveillance is likely.</p> <p>Facilities should be situated as close to the entrance/exit as practicable, e.g. lift core, workplace entrance, etc.</p>	<p>Destination parking—the cyclist works, lives or studies nearby and the facility is generally part of the destination.</p> <p>All day parking where the cyclist continues on to a nearby location, e.g. a workplace, school, university.</p> <p>Transport hub, e.g. railway station.</p> <p>Resident parking at multi-dwelling developments.</p> <p>Restricted access (non-public) compound for schools and workplaces.</p>
----------	--	---	---

Figure 18 - Bicycle Parking Class (Extract from Table 1.1 of AS2890.3L2015)

Table 15 - Bicycle Parking Provisions, Building 1

Use Type	Units (U)/Staff (S)	Parking Provision Rate	Required Parking	Class
Resident Bicycle Parking	81 (U)	20-30%U	16-24	B
Visitor Bicycle Parking	81 (U)	5-10%U	4-8	B
Commercial Staff Bicycle Parking	10 (S)	3-5%S	0-1	B
Commercial Visitor Bicycle Parking	10 (S)	5-10%S	1	B
Total Bicycle Parking:			21-34	

Table 16 - Bicycle Parking Provisions, Building 2

Use Type	Units (U)/ Staff (S)	Parking Provision Rate	Required Parking	Proposed Parking On-Site
Resident Bicycle Parking	106 (U)	20-30%U	21-32	B
Visitor Bicycle Parking	106 (U)	5-10%U	5-11	B
Commercial Staff Bicycle Parking	10 (S)	3-5%S	0-1	B
Commercial Visitor Bicycle Parking	10 (S)	5-10%S	1	B
Total Bicycle Parking:			27-45	

The development will ensure that these bicycle parking provisions are met.

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 RMS material:

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

The technical direction contains the most recent RMS survey data for high-density residential developments within environments similar to that of the proposed development.

Table 17 - Trip Generation Estimate

Component	Source	Trip Rate	Unit	Peak Hourly Trip Rate
Residential	Site 9 (Regional), Appendix B3, RMS TDT 2013/04	AM: 0.32 trips / car space PM: 0.32 trips / car space* Daily: 2.23 trips / car space	260 spaces	83 trips (AM) 83 trips (PM) 580 trips (Daily)
Commercial	"Office Blocks" RMS TDT 2013/04	AM: 1.6 trips / 100m ² GFA PM: 1.2 trips / 100m ² GFA Daily: 11 trips / 100m ² GFA	1,460m ²	24 trips (AM) 19 trips (PM) 160 trips (Daily)
TOTAL TRIPS:				107 (AM) 102 (PM) 740 (Daily)

* the RMS 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.

5.2 Traffic Analysis

The projected traffic activity from the previous section has been applied to the local road network, overlayed onto the existing background traffic (with the Mulgoa Road Upgrade). These future traffic volumes have been modelled using the SIDRA Network modelling tool. This scenarios is identified as Model 2.

The key findings of this model are outlined for the AM and PM peak periods in Table 18 and Table 19 respectively.

Table 18 - Future Road Network Operation, AM (Model 2)

Intersection	Peak Period	Average Level of Service (LoS)	Average Delay (<i>worst movement</i>) (sec)	Worst Degree of Saturation (DSat)
Mulgoa Road / High Street	8:00am-9:00am	C	41.4	0.839
High Street / Civic Centre	8:00am-9:00am	A	4.1	0.288
Mulgoa Road / Union Road	8:00am-9:00am	A (worst Movement: F)	6	2.144
Worth Street / Union Lane	8:00am-9:00am	A	2.4	0.265
Worth Street / Union Road	8:00am-9:00am	C	29.6	0.904
High Street / Worth Street	8:00am-9:00am	D	46.5	0.905
(NEW) Union Lane / Link Road	8:00am-9:00am	A	2.2	0.024
(NEW) Union Road / Link Road	8:00am-9:00am	A	1.0	0.280
(NEW) Driveway 1 / Link Road	8:00am-9:00am	A	2.7	0.054
(NEW) Driveway 2 / Union Road	8:00am-9:00am	A	0.3	0.266

Table 19 - Future Road Network Operation, PM (Model 2)

Intersection	Peak Period	Average Level of Service (LoS)	Average Delay (worst movement) (sec)	Worst Degree of Saturation (DSat)
Mulgoa Road / High Street	4:00pm-5:00pm	D	46.3	0.848
High Street / Civic Centre	4:00pm-5:00pm	A	4.3	0.519
Mulgoa Road / Union Road	4:00pm-5:00pm	A	4.2	0.880
Worth Street / Union Lane	4:00pm-5:00pm	A	2.3	0.429
Worth Street / Union Road	4:00pm-5:00pm	C	29.8	0.822
High Street / Worth Street	4:00pm-5:00pm	E	57.0	0.878
(NEW) Union Lane / Link Road	4:00pm-5:00pm	A	3.4	0.037
(NEW) Union Road / Link Road	4:00pm-5:00pm	A	1.1	0.380
(NEW) Driveway 1 / Link Road	4:00pm-5:00pm	A	2.0	0.040
(NEW) Driveway 2 / Union Road	4:00pm-5:00pm	A	0.5	0.369



Figure 19 - Proposed Driveway Locations

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 no notable change in traffic operation will result following the development, whereby all intersections will continue to operate within capacity. Notwithstanding, right-hand turn movements for the intersections along High Street and Mulgoa Street, which already experience delays, where the proposal will result in minor increases to those delays.

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

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

- Architectural Plans prepared by SJB;
 - AR-1-1009 Rev 11;
 - AR-1-1010 Rev 11;
 - AR-1-1011 Rev 11;
 - AR-1-1012 Rev 11;
- Compliance and Swept Path Assessment is as provided by ptc. (Attachment 1).

6.1 Vehicular Access

The proposed development comprises three access points:

- An entry/exit driveway off the proposed link road, serving the podium levels of parking, with a combined parking provision of 199 spaces; and
- An entry/exit driveway off Union Road, serving the Basement Car Park of 88 parking spaces.
- 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.

6.2 Car Park Arrangement

6.2.1 Typical Requirements

All parking has been reviewed 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 has been 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 10Kph within the short aisle lengths. It is proposed that 10kph regulatory signage be included at strategic locations at the entry to each level of the car park to regulate vehicle speed.

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

6.2.2 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 will be maintained above all accessible and shared bays.

6.3 Loading Dock

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

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

7. 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. conclude 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 DCP, the proposal is required to provide a total of 266 parking spaces,
- In accordance with the DCP, bicycle parking must be provided within the range of 48-79 spaces. The proposal will 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 has been provided that is capable of accommodating a 10.5m heavy rigid refuse vehicle. 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 RMS Technical Direction 2013/04. 107 trips are anticipated in the AM peak, whilst 102 trips are anticipated in the PM peak;
- A future road network model was analysed with SIDRA, applying the proposed traffic volumes to the background traffic of the local road network. In summary, the model indicates that the proposal will not result in any notable difference from existing road network performance, which is generally operating within capacity; and
- A design review of the Architectural plans has been undertaken, with reference to the AS2890 series. This review determined that the design either complies or is capable of complying with the relevant standards, which will be demonstrated fully prior to Construction Certification.

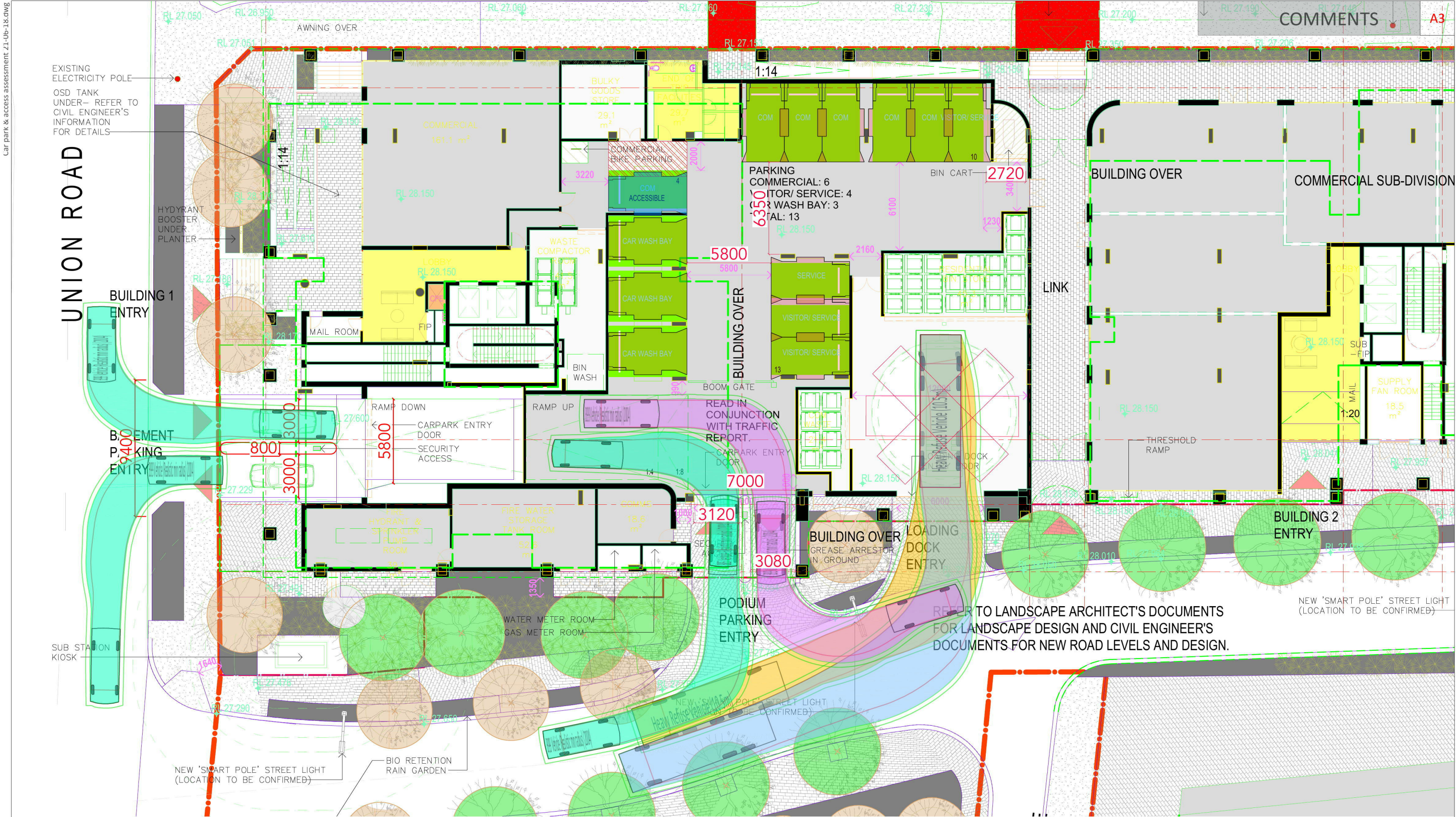
In light of the above, the proposal is considered appropriate in the context of traffic and parking, and as such, is endorsed by ptc.

Attachment 1 Compliance and Swept Path Assessment Plans

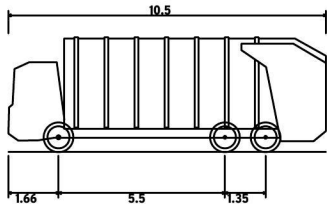
Attachment 2 SIDRA Modelling Results

Network Performance Comparison: AM Existing – AM Proposed

Network Performance Comparison: PM Existing – PM Proposed



The turning paths illustrated in this drawing have been prepared using the Autotrack vehicle modelling software in conjunction with AutoCAD. The vehicle model was prepared by Analytico Pty Ltd based upon vehicle data provided by Austroads. While this modelling represents a conservative assessment of the vehicles ability, it is not possible to account for all vehicle types/characteristics or driver ability.



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

ptc.

Suite 102, 506 Miller Street,
Cammeray NSW 2062
t +61 2 8920 0800
ptcconsultants.co

REV	DATE	COMMENT	DRAWN	REVIEWED	REV	DATE	COMMENT	DRAWN	REVIEWED
6	21/06/18	Updated Layout Assessment	SW/DS	AM					
5	19/06/18	Updated Layout Assessment	SW/DS	AM					
4	28/05/18	Updated Layout Assessment	SW	AM					
3	23/05/18	Option 4 Assessment	SW	AM					

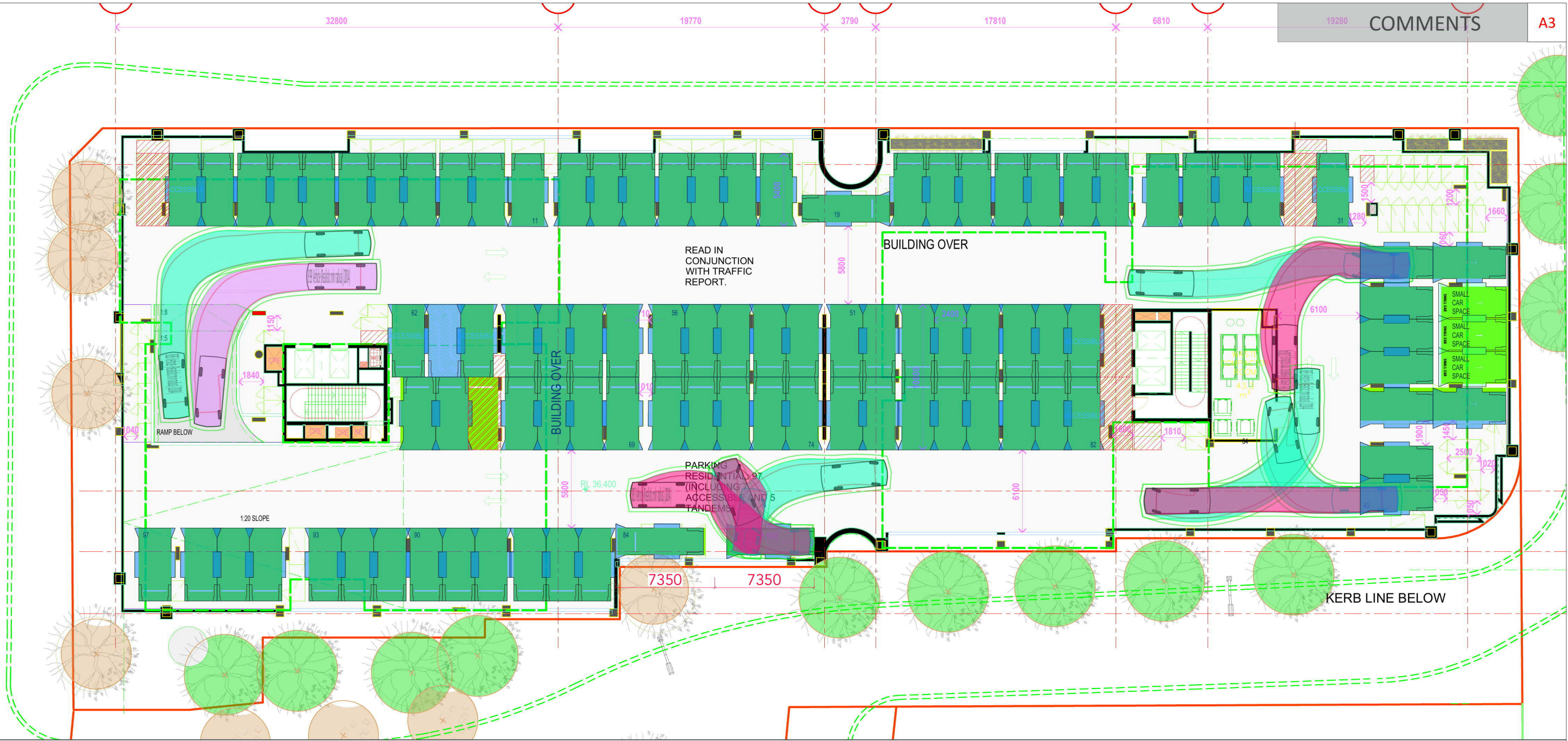
PROJECT:
**High Street
Penrith**

DRAWING TITLE:
**Parking & Access Assessment
Ground Floor
10.5m Service Vehicle Access**

CLIENT: **TOGA**
DRG. #: **DA1-001**
PROJECT #: **T2-2069**
SCALE: **1:250**

REV: 6

REV: 6



TYPICAL

Please note the following compliance requirements:

Height Clearance: 2.2m (min) throughout all areas of the car park accessible to vehicles and bicycles.
2.5m above accessible and shared bays
X wherever access is required for a refuse vehicle (and safety clearance envelope)

Sight Splays:

Visibility splays in the form of a 2.5m x 2m right-angled triangle to be provided (AS2890.1). Ensure design avoids visual obstructions in sight splay (i.e. dense landscaping, tall fencing/walls etc.)

Parking Spaces:

The parking envelopes shown, must be kept clear of all physical obstructions, including height clearance reductions. Ensure that grades within the parking module do not exceed 1:20 (1:40 for accessible bays).

Accessible Spaces: To be designed in accordance with AS2890.6. i.e, standard parking space with adjacent shared bay (2.4m x 5.4m), to be installed as per AS2890.6 requirements (bollard and markings).

Motorcycle Parking:

Motorcycle bays to be designed as a 2.5m x 1.2m envelope (AS2890.1).

Bicycle Parking:

Bicycle spaces are to allow for a envelope of 500mm by 1800mm, with an aisle width of 2000mm for locker storage, or 1500mm for racks.

Control Measures:

Please note recommended control measures, including line markings, signage, bollards, convex mirrors, lights etc.

The turning paths illustrated in this drawing have been prepared using the Autotrack vehicle modelling software in conjunction with AutoCAD. The vehicle model was prepared by Analytico Pty Ltd based upon vehicle data provided by Austroads. While this modelling represents a conservative assessment of the vehicles ability, it is not possible to account for all vehicle types/characteristics or driver ability.

ptc.

Suite 102, 506 Miller Street,
Cammeray NSW 2062
t +61 2 8920 0800
ptcconsultants.co

REV	DATE	COMMENT	DRAWN	REVIEWED	REV	DATE	COMMENT	DRAWN	REVIEWED
6	21/06/18	Updated Layout Assessment	SW/DS	AM					
5	19/06/18	Updated Layout Assessment	SW/DS	AM					
4	28/05/18	Updated Layout Assessment	SW	AM					
XXX	XXX	XXX	XXX	XXX					

PROJECT:

High Street
Penrith

DRAWING TITLE:

Parking & Access Assessment
Podium

CLIENT: TOGA

DRG. #: DA1-003

PROJECT #: T2-2069

SCALE: 1:300

REV: 6

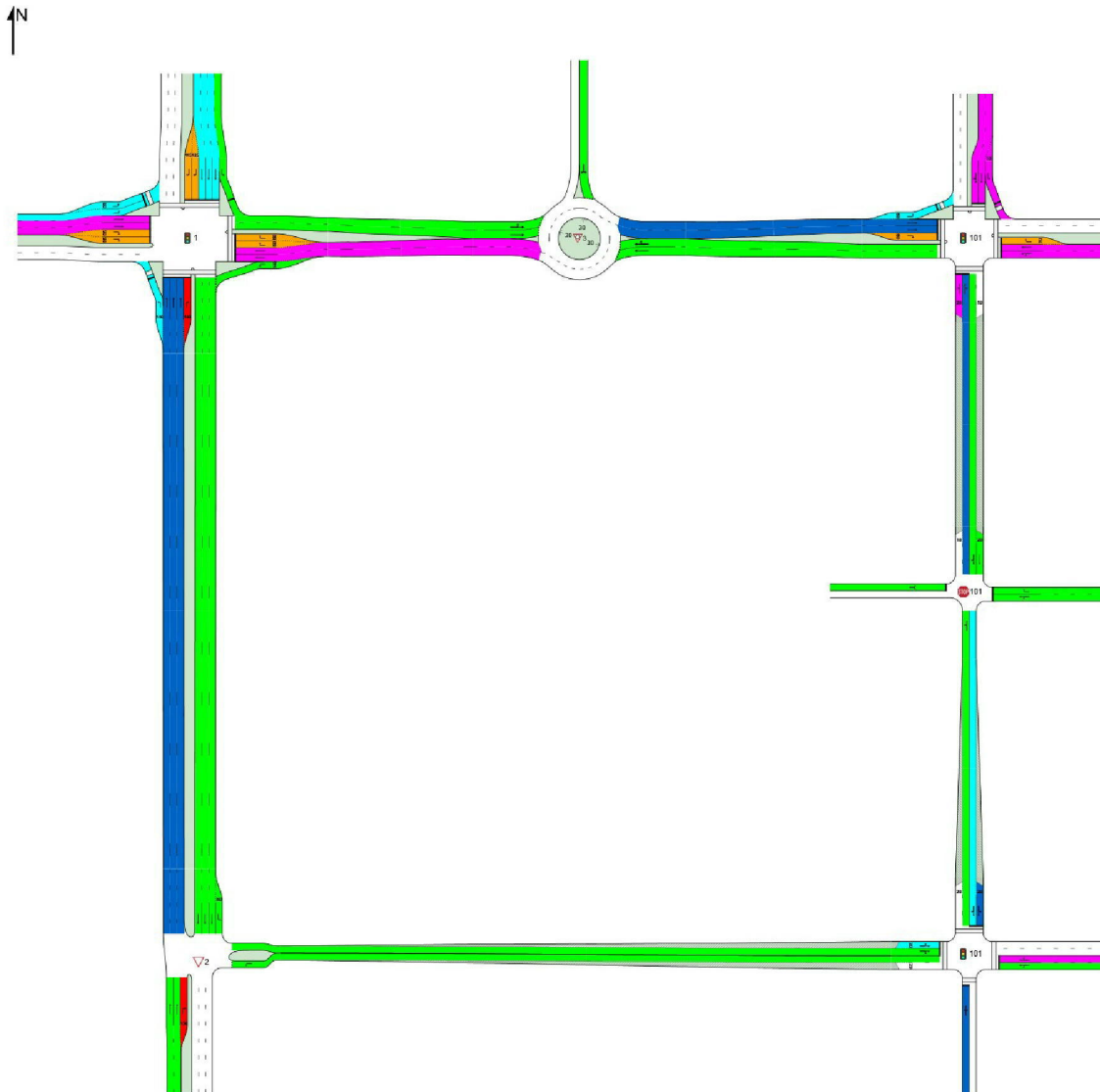


LANE LEVEL OF SERVICE

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



Colour code based on Level of Service



Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab). Delay model settings are specified for individual Sites forming the Network.

SIDRA INTERSECTION 7.0 | Copyright © 2000-2017 Akcelik and Associates Pty Ltd | sidrasolutions.com

Organisation: PARKING AND TRAFFIC CONSULTANTS | Processed: Thursday, 15 March 2018 10:53:28 AM

Project: Z:\PCI - PROJECT WORK FILES\NSW\TOGA - PENRITH\SIDRA Model\180315 - Existing Situation - 2020 AM Peak.sip7

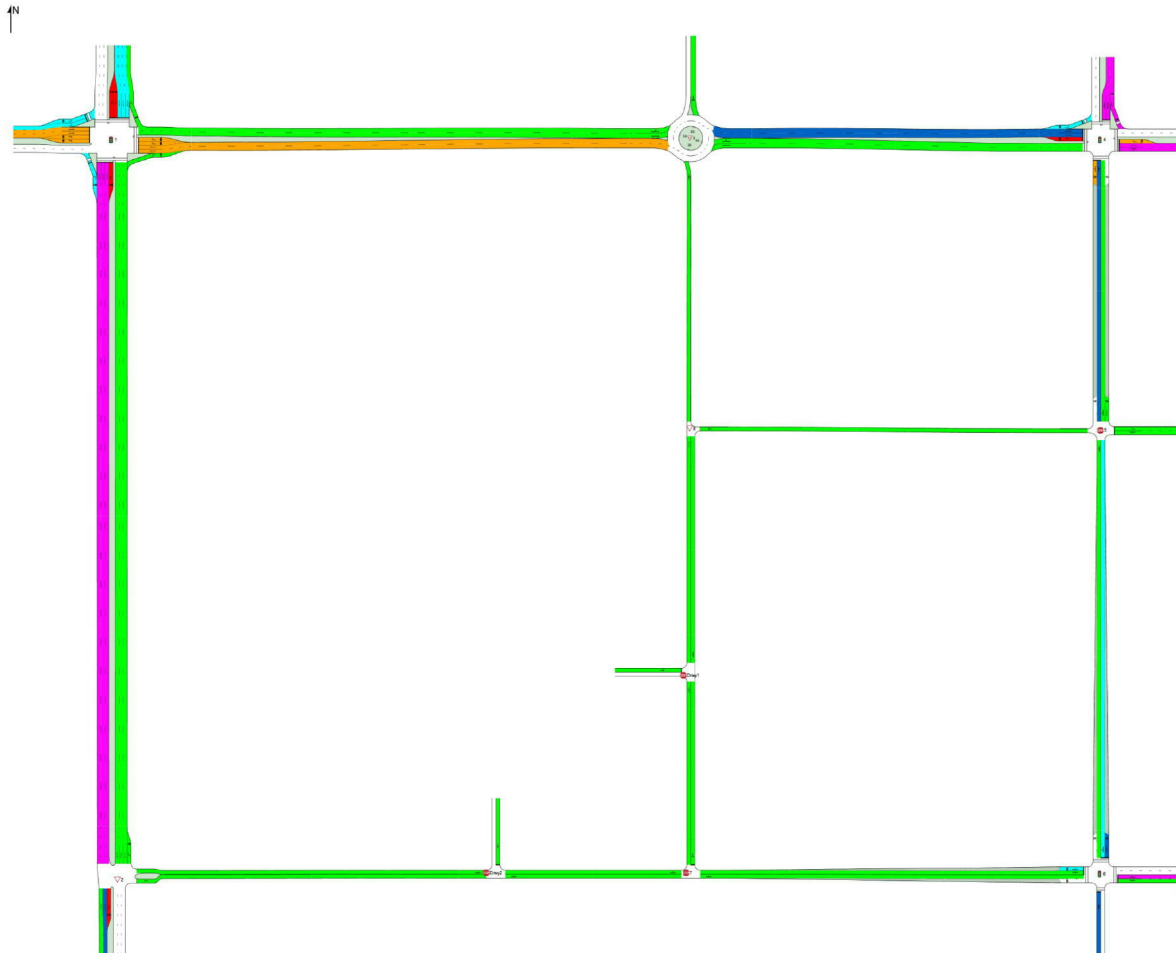
LANE LEVEL OF SERVICE

Lane Level of Service for Network Sites

Network: N401 [RMS Upgrade - Development AM Peak]

DA Scheme - Option 4

One lane, one-way out (Roundabout)



Colour code based on Level of Service



Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab). Delay model settings are specified for individual Sites forming the Network.

SIDRA INTERSECTION 7.0 | Copyright © 2000-2017 Akcelik and Associates Pty Ltd | sidrasolutions.com

Organisation: PARKING AND TRAFFIC CONSULTANTS | Processed: Thursday, 15 March 2018 12:24:59 PM

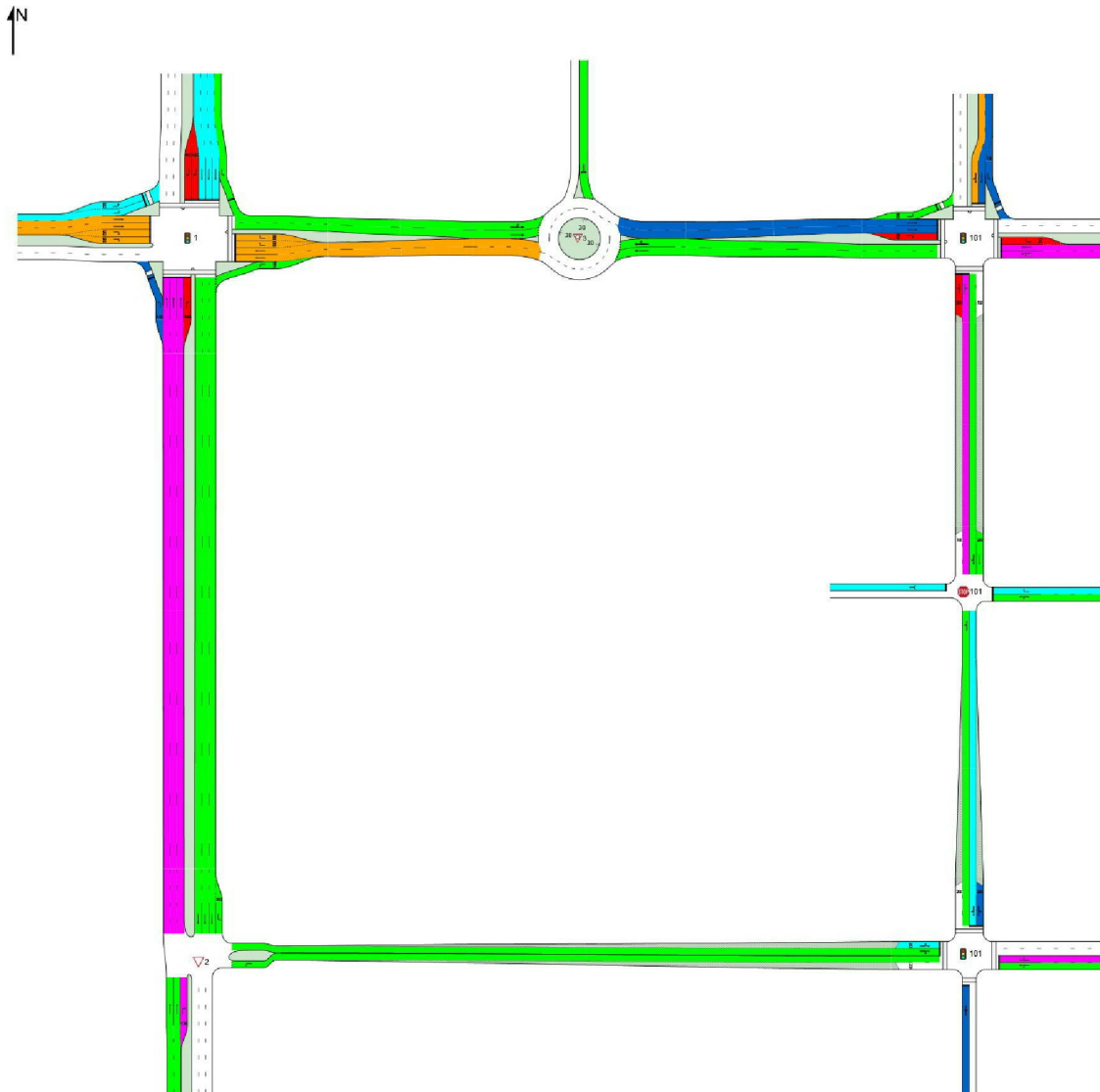
Project: Z:\PCI - PROJECT WORK FILES\NSW\TOGA - PENRITH\SIDRA Model\Revised DA Scheme\180315 - DA Scheme - Existing Roundabout, Development, Link - AM Peak (Option 4).sip7

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



Colour code based on Level of Service



Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab). Delay model settings are specified for individual Sites forming the Network.

SIDRA INTERSECTION 7.0 | Copyright © 2000-2017 Akcelik and Associates Pty Ltd | sidrasolutions.com

Organisation: PARKING AND TRAFFIC CONSULTANTS | Processed: Thursday, 15 March 2018 11:07:53 AM

Project: Z:\PCI - PROJECT WORK FILES\NSW\TOGA - PENRITH\SIDRA Model\180315 - Existing Situation - 2020 PM Peak.sip7

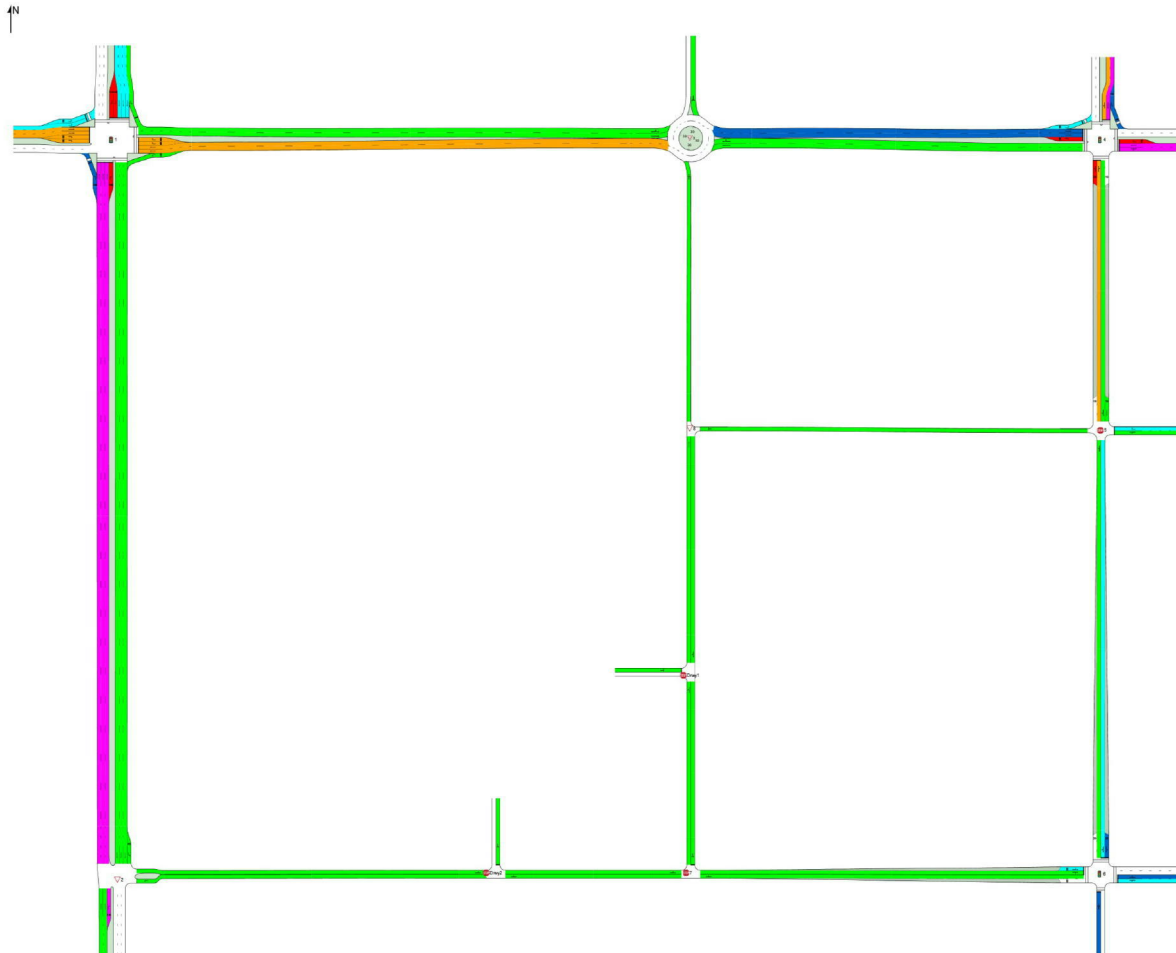
LANE LEVEL OF SERVICE

Lane Level of Service for Network Sites

Network: N401 [RMS Upgrade - Development PM Peak]

DA Scheme - Option 4

One lane, one-way out (Roundabout)



Colour code based on Level of Service



Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab). Delay model settings are specified for individual Sites forming the Network.

SIDRA INTERSECTION 7.0 | Copyright © 2000-2017 Akcelik and Associates Pty Ltd | sidrasolutions.com

Organisation: PARKING AND TRAFFIC CONSULTANTS | Processed: Thursday, 15 March 2018 1:28:14 PM

Project: Z:\PCI - PROJECT WORK FILES\NSW\TOGA - PENRITH\SIDRA Model\Revised DA Scheme\180315 - DA Scheme - Existing Roundabout, Development, Link - PM Peak (Option 4).sip7