TRAFFIC IMPACT ASSESSMENT

THE CREAMERY PRECINCT AT MENANGLE

PREPARED FOR THE CREAMERY PROPERTY TRUST

21/03/2019

Stantec

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The Creamery Property Trust

The Creamery Precinct at Menangle

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1. Introduction

Stantec has been commissioned by The Creamery Property Trust to assess the traffic implications of a neighbourhood centre located to the west of Menangle Railway Station in Menangle, NSW.

The scope of this Traffic Impact Assessment is to assess the capacity of both the existing and proposed road network to accommodate the proposed development in its entirety based on the latest plans, and identify any elements of the surrounding road network that may require improvements or upgrades.

A new frontage road linking Menangle Road with Stevens Road will be constructed as part of Stage 1 of the adjacent Mirvac residential subdivision development. The road will connect to Menangle Road via a new rural auxiliary left turn treatment, providing safe turning facilities for vehicles entering the development.

The latter stages of the Mirvac residential subdivision development will require the upgrading of the existing unsignalised Menangle Road / Station Street intersection to a roundabout, with Mirvac having committed to this via a Voluntary Planning Agreement (VPA) with Wollondilly Shire Council.

By way of summary, it is determined that the proposed Creamery Precinct development can be readily accommodated by the existing and future road network.

2. Background

Stantec has previously prepared a Traffic Impact Assessment for Stage 1 of the adjacent Mirvac residential subdivision (Stantec Stage 1 Report), comprising 97 residential lots, located between the proposed Creamery Precinct neighbourhood centre, Menangle Road and Station Street.

The residential subdivision proposed a new left-in / left-out access on Menangle Road, approximately 400 metres north of Station Street. The access is planned to connect Menangle Road with a new local road which runs along the northern boundary of Stage 1 of the residential subdivision, through to Stevens Road on the eastern side of the development.

The assessment also considered the potential traffic impacts of Stages 2-4 of the subdivision (based on development projections at the time of writing) and the proposed neighbourhood centre (based on the latest development schedule).

By way of summary, the report found that the Menangle Road / Station Street intersection would require upgrading following completion of both the Stage 1 Mirvac residential subdivision development (west of the rail line) and the Creamery Precinct development. Initial SIDRA modelling found that with a concept single lane roundabout layout, the intersection would operate at an excellent Level of Service 'A' in 2032.

Mirvac have committed to the funding and installation of the Menangle Road / Station Street roundabout as part of a VPA with Council.

3. Existing Conditions

The subject site is located immediately to the west of Menangle Railway Station, and north of the planned residential subdivision discussed earlier in this report. **Figure 3-1** below shows the location of the site in relation to the surrounding road network, while **Figure 3-2** shows a recent aerial photograph of the site.

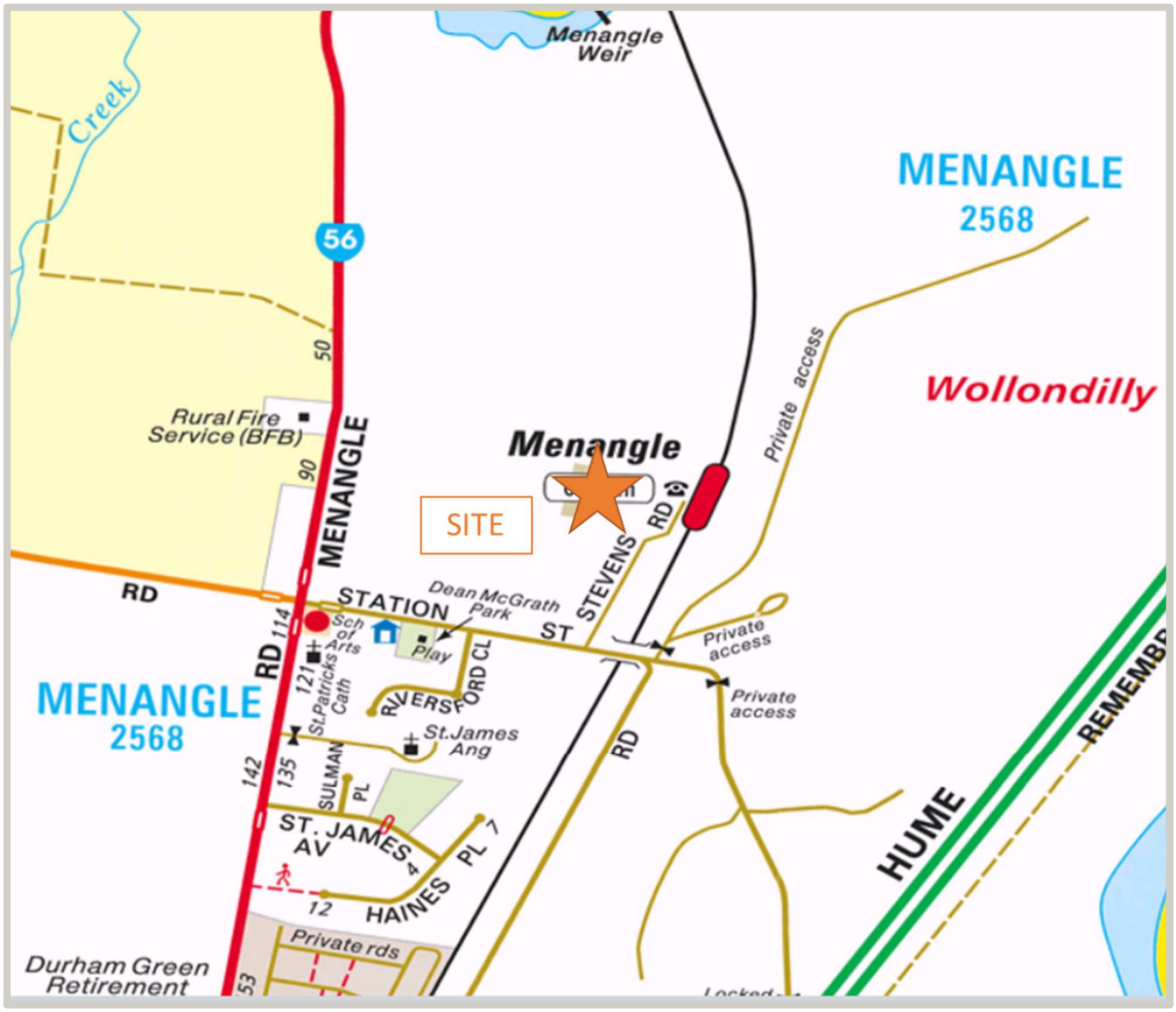

Figure 3-1: Site Location[1]

The site is currently occupied by several buildings, with the remainder of the site being undeveloped. Access is currently provided via several vehicular accesses along Stevens Road.

Notable facilities in the vicinity of the site include the Menangle Railway Station, located at the northern end of Stevens Road, and the Menangle Store, located on the south-eastern corner of the Menangle Road / Station Street intersection.

[1] Source: www.street-directory.com.au

Proposed Creamery Precinct Development - Menangle, NSW

Site Location

Stantec

3-2

NTS

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3.2 Land Use Zoning

The subject site has recently been rezoned from RU1 to B1 (Neighbourhood Centre) and is shown below in **Figure 3-3**.

Figure 3-3: Land Use Zoning[1]

3.3 Local Road Network

Menangle Road is classified as a Regional Road and is under the care and maintenance of Wollondilly Shire Council (Council). It runs in a general northeast-southwest alignment between Picton Road in Maldon and its terminus in Campbelltown. In the vicinity of Menangle township, Menangle Road is a two-lane, two-way road, with each traffic lane being approximately 3.5 metres wide, and has a total carriageway width of approximately 8.9 metres. Menangle Road has a speed limit of 50km/h through Menangle township, and a speed limit of 80km/h to the north and south of Menangle.

Station Street is a local road under the care and maintenance of Council. It runs in an east-west alignment, extending west from Menangle Road to its intersection with Moreton Park Road where it terminates. In the vicinity of Menangle township, Station Street is a two-lane, two-way road, with a total carriageway width of approximately 9.5 metres. At the intersection of Menangle Road / Station Street, it widens to approximately 13 metres, catering for on-street parking on both sides of the road, and an approximate 2.0-metre-wide painted median.

[1] www.planningportal.nsw.gov.au

Stevens Road is also a local road, extending north from the northern side of Station Street. It runs parallel to the Southern Highlands Railway line and provides public access to the Menangle Railway Station. It has an approximate sealed width of 5.2 metres near Station Street, narrowing to approximately 4.0 metres further north.

3.4 Sustainable Transport

The site has very good access to sustainable transport modes, primarily due to it being located adjacent to the Menangle Railway Station, which services the Southern Highlands Line.

Bus stops are located on Menangle Road and Station Street within vicinity of the site. The bus routes that service the bus stops include:

- Route 49 - Camden to Menangle and Razorback (Loop Service);
- Route 899 - Menangle to Campbelltown via Menangle Park; and
- Route 900 - Picton to Campbelltown via Narellan.

The bus network maps for these bus routes are shown in **Figure 3-4** and **Figure 3-5**.

3.5 Walking and Cycling

Pedestrian footpaths are established along Station Street and Menangle Road in the vicinity of the Menangle Local Store. Wide grassed berms are provided on both sides of the roads in the wider area. No dedicated cycle facilities are provided in the vicinity of the site. It is understood that footpath facilities are planned to be provided throughout the residential subdivision to the south.

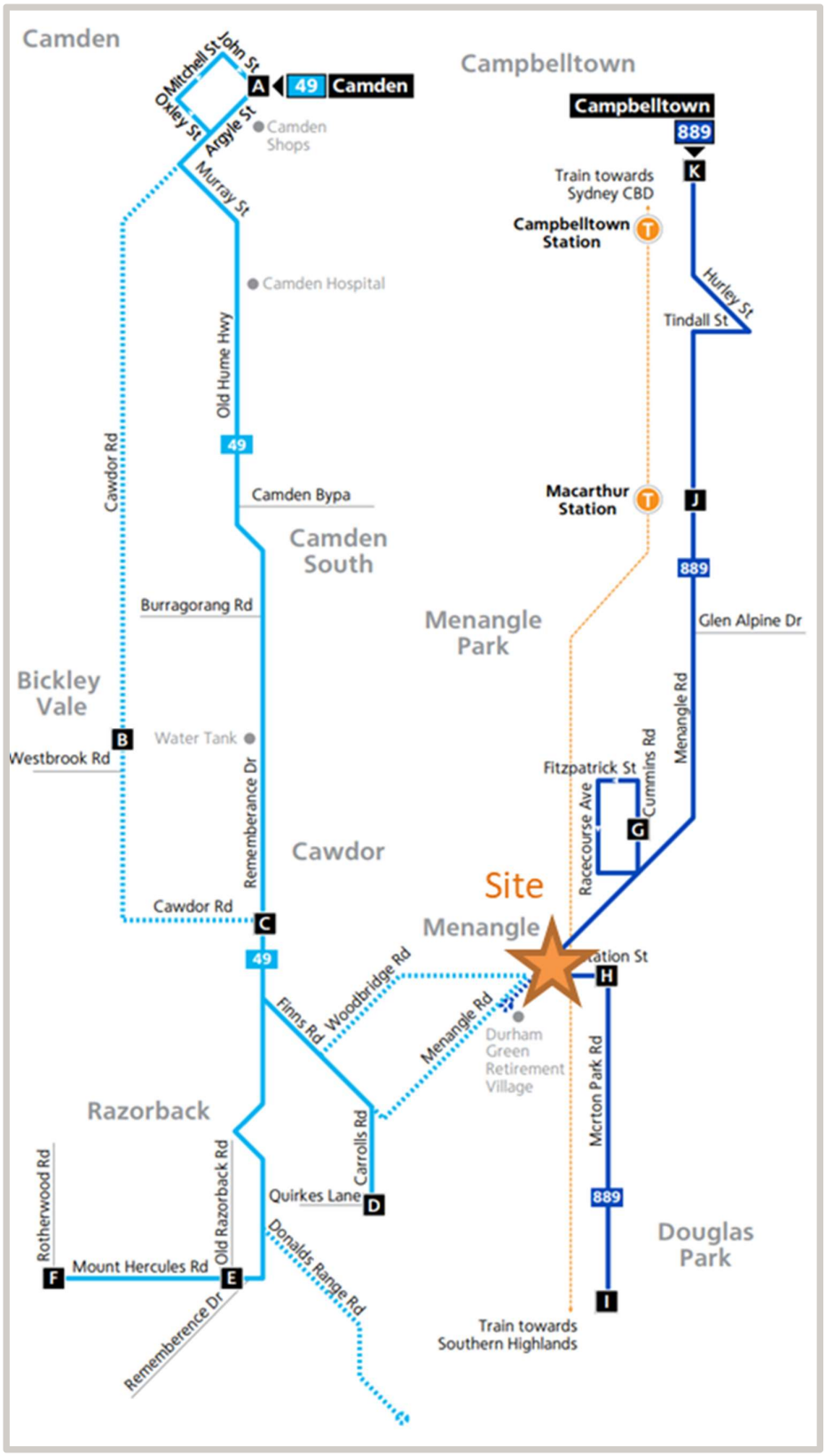


Figure 3-4: Bus Routes 49 and 889[1]

[1] Source: https://busabout.com.au/pdf/timetables/49_889_timetable.pdf

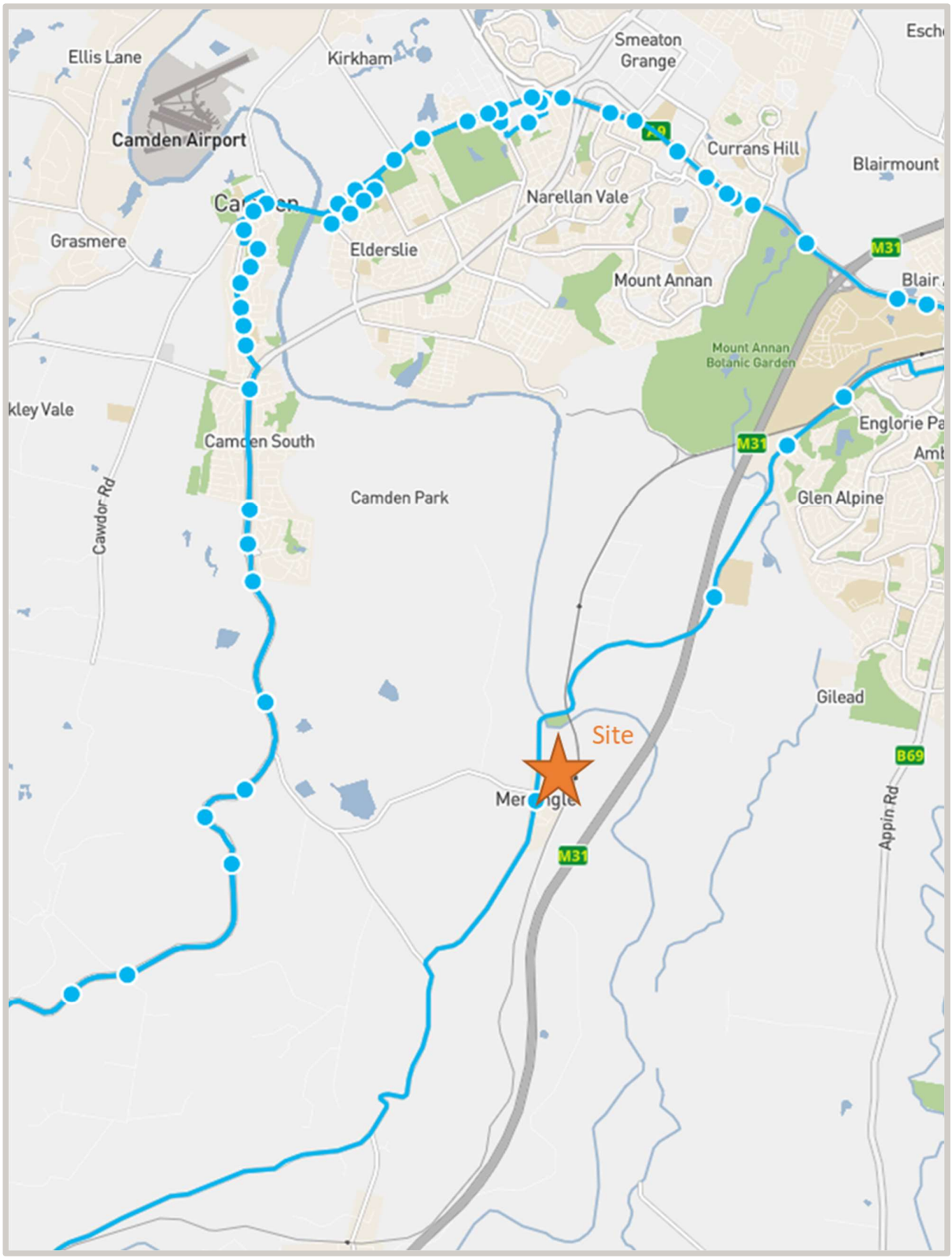


Figure 3-5: Bus Route 900[1]

[1] Source: https://transportnsw.info/routes/details/private-bus-services/900/08900

3.6 Road Safety

A search of the Road Safety Crash and Casualty Statistics Portal has been undertaken for the most recent five-year period 2013 to 2017 inclusive. A search area fronting the subject site has been assessed.

A total of two crashes have been identified within the crash area over the five-year period from 2013 to 2017. The crashes are summarised below:

- Both crashes occurred within 20 metres of the intersection of Menangle Road, Station Street and Woodbridge Road, as follows:
  - One cross-traffic crash resulting in no injuries; and
  - One off-road crash to the left resulting in a collision with an object, resulting in no injuries.
- No crashes occurred at the intersection of Station Street and Moreton Park Road;
- There were zero crashes recorded along Stevens Road or Moreton Park Road within the search area; and
- Zero fatalities were recorded over the five-year period.

Figure 3-6 below shows the location of the recorded crashes between 2013 and 2017.

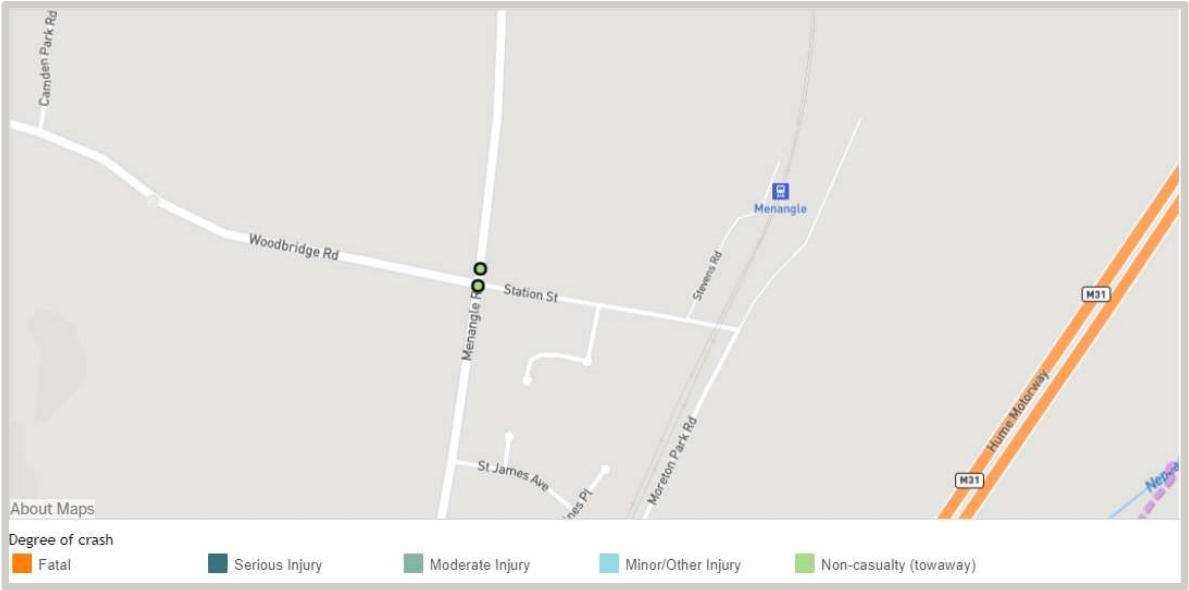


Figure 3-6: Crash Locations[1]

Accordingly, it is considered that there is no apparent evidence of a recurrent, persistent or adverse road crash history within the vicinity of the site that would raise a particular local road safety concern.

[1] Source: NSW Transport for NSW – Centre for Road Safety (http://roadsafety.transport.nsw.gov.au/index.html)

4. Proposed Development

It is proposed to develop the site into a neighbourhood centre known as The Creamery Precinct, with a total GFA of approximately 4,940m². More specifically, the proposed development comprises the land uses shown in **Table 4.1**.

Table 4.1: Proposed Development Schedule

Land Use	Gross Floor Area (m²)	Maximum Capacity	Employees
The Creamery Bistro	150	83 Patrons	10 Employees
The Creamery Wine Bar	30	16 Patrons	2 Employees
The Creamery Bar (internal)	150	83 Patrons	4 Employees
The Creamery Bar (outdoor area)	350	195 Patrons	3 Employees
The Creamery Restaurant	70	40 Patrons	6 Employees
The Creamery Front Courtyard	600	330 Patrons	4 Employees
Rotolactor Function Centre	600	400 Patrons	20 Employees
General Store	65	11 Patrons	2 Employees
Cooking School	65	16 Patrons	2 Employees
Conference Room	50	40 Patrons	1 Employee
Hotel	500	24 Guests	6 Employees
Event Shed (Markets)	880	250 Patrons	80 Operators
Children's Play Area	980	140 Children	1 Employee
Bakery (drive through)	N/A	34 Patrons	3 Employees
Bakery Rear Café/Bar	450	113 Patrons	10 Employees

The proposal also comprises approximately 485 car parking spaces across four separate car parking spaces as follows:

- 130 car parking spaces in the northern car park;
- 150 car parking spaces in the southern car park;
- 20 car parking spaces in the hotel car park; and
- 185 car parking spaces in a dedicated employee car park.

In addition, 55 motorcycle and scooter parking spaces are proposed to be provided in a dedicated parking area.

Site access is proposed to be via a new east-west road along the southern side of the site, which will connect Menangle Road to Stevens Road, with the planned Stage 1 of the Mirvac residential subdivision on the southern side of the road.

Operational hours are proposed to vary between each land use, and are discussed further in Section 5 of this report.

A complete development schedule has been included for reference in **Appendix A**, with proposed development plans included in **Appendix B**.

5. Proposed Operations

The proposed operations schedule lists the planned days and hours of operations for each land use within the proposed development. The schedule also includes expected patron capacities and staff requirements and is summarised in **Table 5.1**, with the full proposed development schedule provided in Appendix A.

Table 5.1: Proposed Development Operational Hours

Land Use	Proposed Weekday Operational Hours	Proposed Weekend Operational Hours
The Creamery Bistro	11:00am – 10:00pm	9:00am – 10:00pm
The Creamery Wine Bar	4:00pm – 2:00am	12:00pm – 2:00am
The Creamery Bar (internal)	10:00am – 2:00am	9:00am – 2:00am
The Creamery Bar (outdoor area)	12:00pm – 2:00am	10:00am – 2:00am
The Creamery Restaurant	12:00pm – 10:00pm	12:00pm – 10:00pm
The Creamery Front Courtyard	7:00am – 10:00pm	7:00am – 10:00pm
Rotolactor Function Centre	12:00pm – 3:00am	12:00pm – 3:00am
General Store	7:00am – 5:00pm	7:00am – 5:00pm
Cooking School	7:00pm – 10:00pm (Fridays only)	7:00pm – 10:00pm
Conference Room	9:00am – 4:00pm	Closed
Hotel	24 Hours	24 Hours
Event Shed (Markets)	Closed	8:00am – 12:00pm
Children's Play Area	11:00am – 10:00pm	11:00am – 10:00pm
Bakery (drive through)	7:00am – 10:00pm	7:00am – 10:00pm
Bakery Rear Café / Bar	7:00am – 10:00pm	7:00am – 10:00pm

6. Site Access

Vehicular access to the proposed Creamery Precinct development is proposed to be via several access locations along the new east-west road which runs along the northern boundary of Stage 1 of the planned Mirvac residential subdivision.

The access points will provide vehicular access to car parking areas, bus areas, drive through facilities and the function centre arrival court.

It is currently unknown what the speed limit of the new east-west road will be when operational, however given the future nature of the traffic environment, it is likely that it will be a low speed environment across the site frontage. Accordingly, it is considered that the provision of several access locations along the site frontage will not have an adverse impact on the future local traffic environment.

6.1 Service Vehicles

A loading area is provided along the eastern side of the site, accessed via a secure access road. The loading area is adjacent to a number of the dining and bar developments, providing convenient access to the venues. Service vehicles are expected to be able to reverse into the loading area, and will be able to enter and exit the site in a forward direction.

6.2 Porte Cochere

A porte cochere is proposed to be provided in front of the function centre, allowing larger vehicles such as coaches and minibuses to access the site and pick-up / drop-off passengers. The porte cochere is intended to also serve as a taxi and private vehicle pick-up / drop-off area.

7. Traffic Assessment

7.1 Existing Traffic Volumes

Traffic movement counts were commissioned by Stantec on Thursday 3 May 2018 and Saturday 23 February 2019 for the intersection of Menangle Road / Station Street. Full results are included for reference in **Appendix C**.

The results have been summarised into weekday AM and PM and weekend peak hour turning movement counts (**Figure 7-1**), and peak hour road volumes (**Table 7.1**) along Menangle Road north of Station Street, and Station Street to the east of Menangle Road, given in vehicles per hour (vph).

Table 7.1: Traffic Volumes Along Menangle Road (North) and Station Street

Approach Road	Direction	AM Peak Hour (vph)	PM Peak Hour (vph)	Weekend Peak Hour (vph)
Menangle Road (North)	Northbound	753	285	252
	Southbound	218	566	260
Station Street	Eastbound	19	31	27
	Westbound	41	24	22

The traffic volumes, as shown in the table above, are estimated to be accurate on the roads at locations adjacent to the intersection. Due to the small number of developments along Menangle Road to the north of the intersection and Station Street to the east of the intersection, these peak hour volumes are also considered to be applicable for both of these roads.

It is noted that the weekday surveys were undertaken in May 2018 while the weekend surveys were undertaken in February 2019. It is considered that the 2018 surveys are still relevant given that they were recorded within the previous 12 months at time of writing of this report.

7.2 Trip Generation

The RTA *Guide to Traffic Generating Developments [2002]* (RTA Guide) and RMS' *Guide to Traffic Generation Developments – Technical Direction 2013 04a* (TDT 2013/04a) specify traffic generation rates for different land uses.

Due to the nature of the proposed Creamery Precinct development, it is considered that the weekday evening peak hour of the development would fall outside the commuter peak hour as established in the surveys (4:30pm-5:30pm).

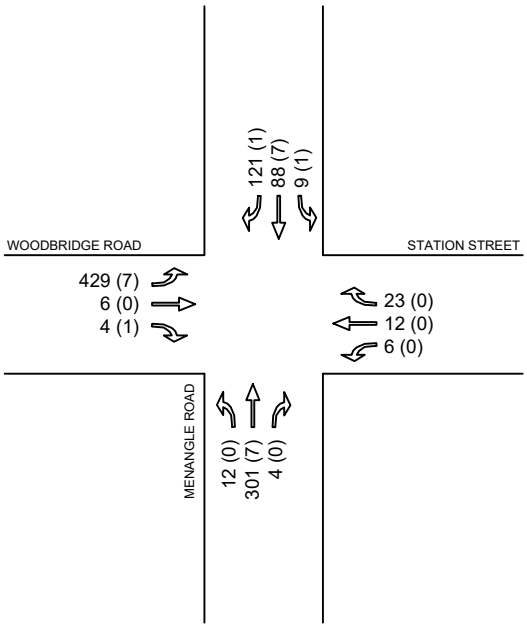
Accordingly, commentary has been provided on an additional scenario for the 6:00pm-7:00pm period, using the existing survey data and the projected development traffic during this period, discussed in Section 7.2.4 of this report. By way of summary, however, the network peak hour is expected to accommodate a greater volume of traffic than a later peak hour, and has therefore been adopted for the purposes of this assessment.

7.2.1 Assumptions

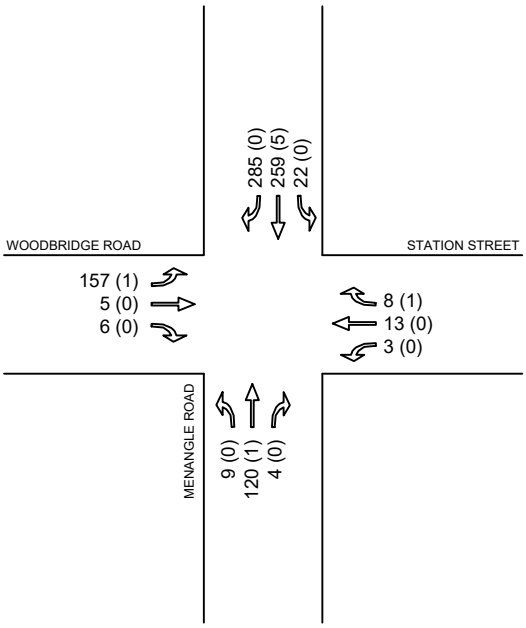
Trip generation analyses has been calculated based on the following rates and assumptions:

- 20% of traffic generated by the restaurant / bar land uses would travel to the east (to the future stages of the Mirvac residential subdivision) or internally within Stage 1 of the subdivision (or translate to a pedestrian movement instead of a vehicular movement given the rural nature of the development and the presence of alcohol at these proposed developments);
- 20% of the trips associated with the drive through bakery would be associated with the adjacent residential subdivision, and therefore are considered as 'passer-by' trips (trips already on the road network); and
- Where capacities are discussed in time periods of more than one hour, it is conservatively assumed that each development is constantly at capacity, with at least one full turnover occurring during the peak hour (for weekday evening development peak and weekend midday and evening peak periods).

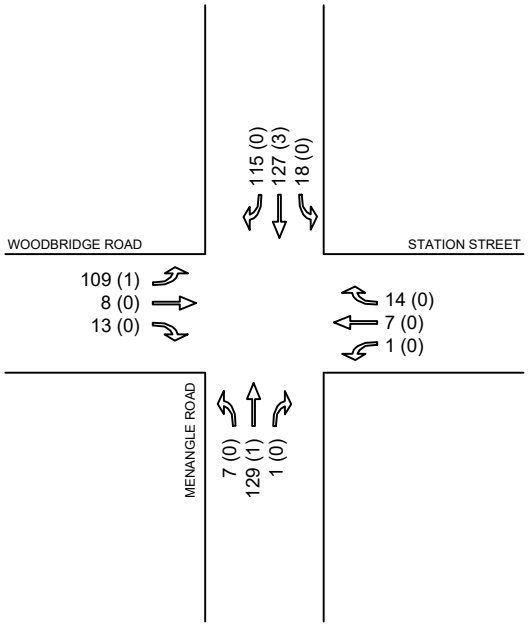
Legend
xx Total Vehicles
(xx) Heavy Vehicles



Thursday, 3 May 2018
AM PEAK HOUR
7:30am-8:30am



Thursday, 3 May 2018
PM PEAK HOUR
4:30pm-5:30pm



Saturday, 23 Feb 2019
MIDDAY PEAK HOUR
11:45am-12:45pm

Menangle Road / Station Street Intersection

Surveyed Traffic Volumes

Stantec

7-1

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7.2.2 Vehicle Occupancies

Vehicle occupancies have been adopted as shown in **Table 7.2**, and are detailed further below.

Table 7.2: Adopted Vehicle Occupancy Rates

Proposed Development	Adopted Vehicle Occupancy Rate (persons/veh)	Source
The Creamery Bistro	2.2	RTA Guide (for restaurants)
The Creamery Wine Bar	2.2	RTA Guide (for restaurants)
The Creamery Bar (internal)	2.2	RTA Guide (for restaurants)
The Creamery Bar (outdoor area)	2.2	RTA Guide (for restaurants)
The Creamery Restaurant	2.2	RTA Guide (for restaurants)
The Creamery Front Courtyard	2.2	RTA Guide (for restaurants)
Rotolactor Function Centre	2.5	See Section 7.2.2.1
General Store	N/A	See Section 7.2.2.2
Cooking School	1.5	See Section 7.2.2.3
Conference Room	1.0	See Section 7.2.2.4
Hotel	1.5	See Section 7.2.2.5
Event Shed (Markets)	2.3	RTA Guide (for markets)
Children's Play Area	N/A	N/A
Bakery (drive through)	N/A	See Section 7.2.2.6
Bakery Rear Café / Bar	2.2	RTA Guide (for restaurants)

7.2.2.1 Function Centre

Given the rural nature of the site, and the likelihood of alcohol being served (such as weddings, parties and large-scale events), it was assumed that higher occupancies would be experienced for vehicles travelling to and from the site.

7.2.2.2 General Store

It is considered that the General Store will be the type of store that will mainly sell tourist-related souvenirs and local products, as opposed to a general convenience store. Accordingly, all traffic associated with the store is assumed to be 'passer-by' traffic, or traffic that is travelling to the site for other purposes. As such, no additional traffic is assumed to be generated by the General Store.

7.2.2.3 Cooking School

The Cooking School was assumed to have an equivalent balance of one and two occupants per vehicle, resulting in an average occupancy of 1.5 per vehicle.

7.2.2.4 Conference Room

It is conservatively assumed that the majority of people attending conferences would arrive in individual vehicles and park on-site. In reality, some patrons will likely utilise the local public transport services or car share. Accordingly, a passenger occupancy rate of 1.0 people per vehicle represents a conservative estimate of car occupancy associated with the conference room.

7.2.2.5 Hotel

It is assumed that occupants of vehicles travelling to the hotel would have an average occupancy of 1.5 people per vehicle, with few guests travelling to the site via public transport.

7.2.2.6 Bakery (Drive Through)

Based on an average service time of just over three minutes, it is estimated that approximately 17 vehicles per hour will access the drive through component of the bakery. Because there are no passengers exiting the vehicles and entering the bakery itself, vehicle occupancy is not considered to be a relevant factor when calculating expected trip generation associated with the drive through component of the bakery.

7.2.3 Trip Generation

Based on the above assumptions, the adopted trip generation rates for each land use within the proposed development are shown in **Table 7.3.**

Several assumptions have been made based on the expected peak times for each individual land use. During the network PM peak hour (4:30pm to 5:30pm) for example, The Creamery drinking and dining developments are open, however the expected peak hour for restaurants is typically later than this.

Similarly, the Event Shed only operates until 12:00pm on weekend days, and therefore the weekend peak hour has been selected to capture the completion of the Event Shed and the opening of some of the dining and bar developments. This midday period was also forecast to generate a higher volume of traffic than the weekend evening peak hour.

Accordingly, the following peak periods have been assessed as part of this assessment:

- AM Network peak hour (7:30am to 8:30am);
- PM Network peak hour (4:30pm to 5:30pm); and
- Weekend peak hour (11:45am to 12:45pm).

Table 7.3: Adopted Trip Generation Rates for Proposed Development

Proposed Land Use	Size / Capacity	Trip Generation Rate (vph per person / 100m² GFA)		
		Network AM Peak	**Network PM Peak**	**Weekend Peak**
The Creamery Bistro	83 Patrons (per two hours) 10 Staff	N/A	83 pats @ 2.2 pat/veh[1] 1.0 trip per staff	83 pats @ 2.2 pat/veh .5 trip per staff[2]
The Creamery Wine Bar	16 Patrons (per two hours) 2 Staff	N/A	16 pats @ 2.2 pat/veh[1] 1.0 trip per staff	16 pats @ 2.2 pat/veh[2] 1.0 trip per staff
The Creamery Bar (internal)	83 Patrons (per two-four hours) 7 Staff	N/A	278 pats @ 2.2 pat/veh[1] 1.0 trip per staff	278 pats @ 2.2 pat/veh[2] 2.0 trips per staff
The Creamery Bar (outdoor area)	195 Patrons (per two-four hours) 3 Staff	N/A		
The Creamery Restaurant	40 Patrons (per two hours) 6 Staff	N/A	40 pats @ 2.2 pat/veh[1] 1.0 trip per staff	40 pats @ 2.2 pat/veh[2] 1.0 trip per staff
The Creamery Front Courtyard	330 Patrons (per two-four hours) 4 Staff	330 pats @ 2.2 pat/veh[3] 1.0 trip per staff	330 pats @ 2.2 pat/veh[1] 1.0 trip per staff	330 pats @ 2.2 pat/veh 1.0 trip per staff
Rotolactor Function Centre	400 Patrons 20 Staff	N/A	N/A	400 pats @ 2.5 pats/veh
General Store	65m² 2 Staff	5.0 trips per 100m²	5.0 trips per 100m²	5.0 trips per 100m²
Cooking School	16 Patrons 2 Staff	N/A	N/A	N/A

[1] Assumes development operates at 60% capacity during peak hour, i.e. 60% capacity leaving and 60% capacity new patrons arriving during same 60-minute period

[2] Assumes development operates at 100% capacity during peak hour, i.e. 100% capacity leaving and 100% capacity new patrons arrive during same 60-minute period

[3] Assumes development operates at 40% capacity during peak hour, i.e. 40% capacity leaving and 40% capacity new patrons arriving during same 60-minute period

Proposed Land Use	Size / Capacity	Trip Generation Rate (vph per person / 100m² GFA)		
Conference Room	40 Patrons 1 Staff	40 pats @ 1.2 pat/veh 1.0 trip per staff	N/A	N/A
Hotel	24 Patrons per day 6 Staff	24 pats @ 1.5 pat/veh[1]	24 pats @ 1.5 pat/veh[1]	24 pats @ 1.5 pat/veh[1]
Event Shed (Markets)	250 Patrons 80 Operators	N/A	N/A	250 pats @ 2.3 pats/veh 1.0 trip per operator[2]
Children's Play Area	980m² 140 Children 1 Staff	N/A[3]	N/A[3]	N/A[3]
Bakery (drive through)	34 Patrons (per hour) 3 Staff	2.0 trips per patron 1.0 trip per staff	2.0 trips per patron	2.0 trips per patron 2.0 trips per staff
Bakery Rear Café / Bar	113 Patrons (every 1.5 hours) 10 Staff	113 pats @ 2.2 pat/veh 1.0 trip per staff	113 pats @ 2.2 pat/veh	113 pats @ 2.2 pat/veh 1.0 trip per staff

The table above outlines the adopted trip generation rates used for the proposed development, and caters for the expected operational state of each land use at differing times of the day. It should be noted that for The Creamery dining and bar developments, it is assumed that 20% of trips generated by the developments will originate from the neighbouring residential development, and 20% of trips generated by the drive through bakery will be associated with the subdivision.

Table 7.4 shows the expected trip generation for the proposed development based on the above trip generation rates and assumptions.

Table 7.4: Expected Trip Generation for Proposed Development

Proposed Land Use	Size / Capacity	Expected Trip Generation (vph)		
		Network AM Peak	**Network PM Peak**	**Weekend Peak**
The Creamery Bistro	83 Patrons (per two hours) 10 Staff	0	46	66
The Creamery Wine Bar	16 Patrons (per two hours) 2 Staff	0	11	16
The Creamery Bar (internal)	83 Patrons (per two-four hours) 7 Staff	0	129	225
The Creamery Bar (outdoor area)	195 Patrons (per two-four hours) 3 Staff	0		
The Creamery Restaurant	40 Patrons (per two hours) 6 Staff	0	12	40
The Creamery Front Courtyard	330 Patrons (per two-four hours) 4 Staff	124	75	124
Rotolactor Function Centre	400 Patrons 20 Staff	0	49	135
General Store	65m² 2 Staff	4	4	4

[1] Staff trips assumed to arrive outside of 60-minute period
[2] Assumes each operator leaves the site within the peak hour
[3] Children's play area is considered an ancillary land use, and the vehicle trips that it would likely generate have been incorporated within the other land uses

Proposed Land Use	Size / Capacity	Expected Trip Generation (vph)		
Cooking School	16 Patrons 2 Staff	0	0	0
Conference Room	40 Patrons 1 Staff	0	0	0
Hotel	24 Patrons per day 6 Staff	23	5	22
Event Shed (Markets)	250 Patrons 80 Operators	0	0	150
Children's Play Area	980m^2 140 Children 1 Staff	0	0	0
Bakery (drive through)	34 Patrons (per hour) 3 Staff	30	28	64
Bakery Rear Café / Bar	113 Patrons (every 1.5 hours) 10 Staff	100	63	94
Total:		**281**	**422**	**940**

7.2.4 Proposed Development Weekday PM Peak Hour

Due to the nature of the proposed development, the weekday PM peak hour of the development is expected to occur later than the network PM peak hour. Traffic survey data shows that the 6:00pm to 7:00pm weekday hour represents approximately 326 vehicles per hour less than the network PM peak hour, or 63% of the recorded 4:30pm to 5:30pm volumes. By way of summary, using the same methods described above but assuming that the restaurants and dining developments operate at 90% capacity and have full turnover during the peak hour, the projected development traffic generation is 284 vehicles per hour more than the proposed development during the network PM peak hour. Accordingly, as the net difference is approximately 40 vehicles less than the network PM peak hour, the network PM peak hour has been considered for this assessment.

7.3 Trip Distribution

Trip distribution percentages and directional splits have been estimated based on traffic survey data and first principles. For the purposes of this assessment, the following trip distribution percentages have been adopted, shown in **Table 7.5**.

Table 7.5: Adopted Inbound / Outbound Trip Distribution

Proposed Land Use	Adopted Inbound / Outbound Splits					
	Network AM Peak		**Network PM Peak**		**Weekend Peak**	
	Inbound	Outbound	Inbound	Outbound	Inbound	Outbound
The Creamery Bistro	N/A	N/A	80%	20%	70%	30%
The Creamery Wine Bar	N/A	N/A	80%	20%	80%	20%
The Creamery Bar (internal)	N/A	N/A	80%	20%	70%	30%
The Creamery Bar (outdoor area)	N/A	N/A	80%	20%	70%	30%
The Creamery Restaurant	N/A	N/A	80%	20%	80%	20%
The Creamery Front Courtyard	80%	20%	80%	20%	70%	30%
Rotolactor Function Centre	N/A	N/A	80%	20%	90%	10%
General Store	50%	50%	50%	50%	50%	50%
Cooking School	N/A	N/A	N/A	N/A	N/A	N/A

Proposed Land Use	Adopted Inbound / Outbound Splits					
	Network AM Peak		Network PM Peak		Weekend Peak	
	Inbound	Outbound	Inbound	Outbound	Inbound	Outbound
Conference Room	N/A	N/A	N/A	N/A	N/A	N/A
Hotel	20%	80%	80%	20%	50%	50%
Event Shed (Markets)	N/A	N/A	N/A	N/A	10%	90%
Bakery (drive through)	50%	50%	50%	50%	50%	50%
Bakery Rear Café / Bar	50%	50%	80%	20%	70%	30%

It is noted that some uses have not been assigned directional splits during peak hours. This is due to proposed operational hours of the land use not falling within the three peak hours as identified in the table above. The cooking school (week nights and weekend nights) and conference room (during weekdays) fall outside of all of the identified peak hours, and would reasonably be expected to be able to be accommodated by the off-peak traffic environment.

Accordingly, the trips expected to be generated by the proposed Creamery Precinct development shown in **Table 7.4** have been adopted for the purposes of this assessment.

7.4 Future Traffic Growth

A 2% annual growth rate has been adopted for future year traffic analyses, which is considered to be conservative given the rural nature of the area. It is estimated that the proposed development will be complete toward the end of 2021, allowing for three and a half years of traffic growth for background volumes (weekday) and three years growth for the Saturday volumes. The forecasted 2021 peak hour traffic volumes shown in **Figure 7-2**.

As mentioned earlier in this report, a residential subdivision is being planned for the surrounding land area, with Stage 1 (97 residential lots) expected to be complete by 2020, and Stages 2-4 expected to be complete by 2022. The scale of the Mirvac residential subdivision has been estimated at 350 lots, based on the recently approved planning proposal, subject to further assessment in the relevant Development Applications.

A 2032 model scenario has also been analysed, which represents a 10-year period after the completion of Stages 2-4 of the subdivision. Similarly, 14.5 years and 14 years of traffic growth have been applied to the existing weekday and weekend volumes respectively for the 2032 model scenario. These forecasted peak hour volumes are shown in **Figure 7-3**.

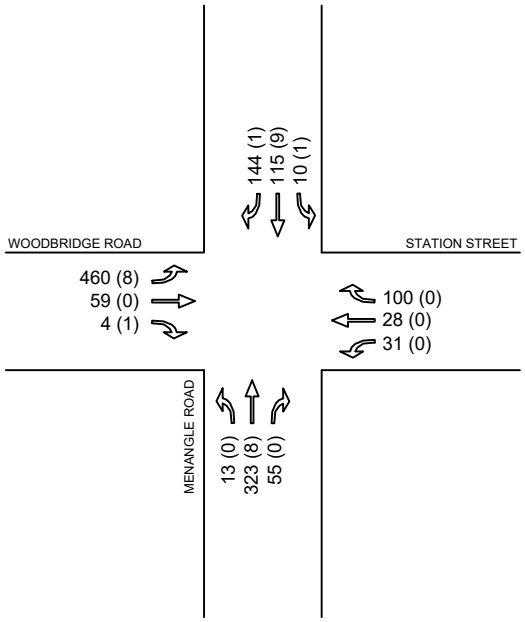
7.5 Heavy Vehicle Percentage

It is assumed that the current heavy vehicle percentages at each of the movements at the Menangle Road / Station Street intersection will remain the same in future modelling years. It is expected that the proposed development will generate a minimal amount of heavy vehicle movements during the network peak hours, and these movements have been accounted for in the retention of the heavy vehicle percentage.

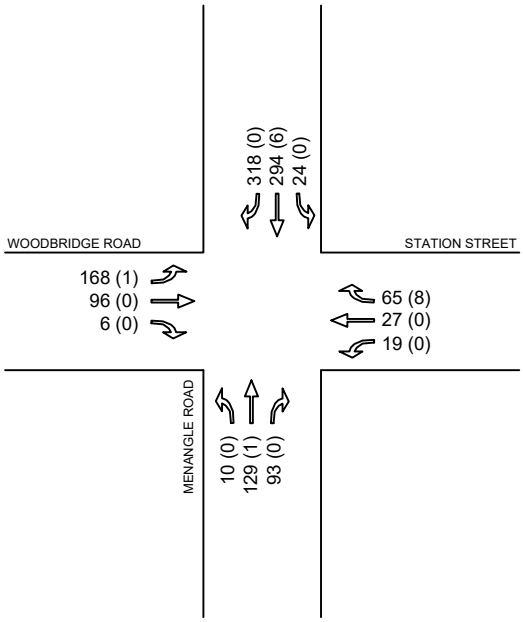
7.6 SIDRA Analysis

Intersection analysis for the Menangle Road / Station Street intersection was undertaken for the existing modelling scenarios described in the following sections, using the software package SIDRA (Signalised and unsignalised Intersection Design and Research Aid). The full SIDRA movement summaries have been included for reference in **Appendix D**, while the concepts of intersection delay and level of service are included in **Appendix E**.

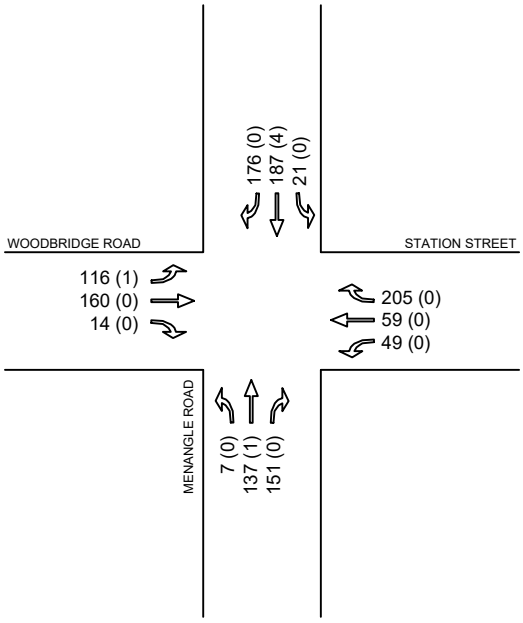
Legend
xx Total Vehicles
(xx) Heavy Vehicles



AM PEAK HOUR
7:30am-8:30am



PM PEAK HOUR
4:30pm-5:30pm



MIDDAY PEAK HOUR
11:45am-12:45pm

Menangle Road / Station Street Intersection

Post Development Peak Hour Traffic Volumes (2021)

Stantec

7-2

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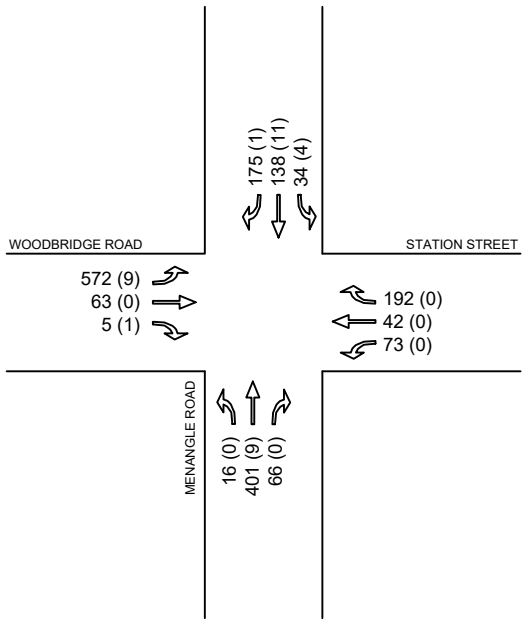
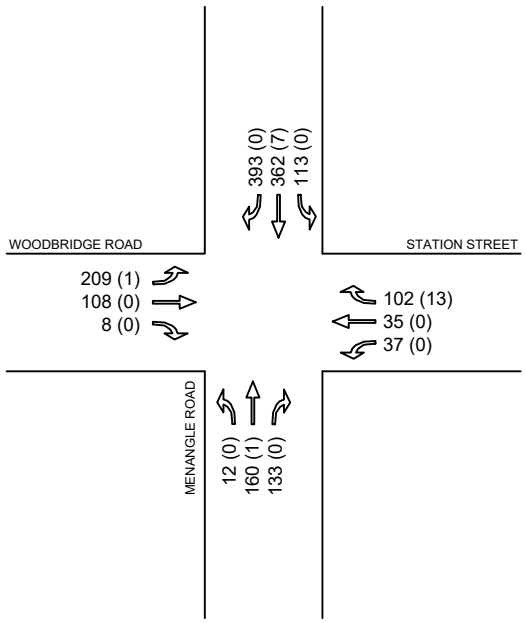
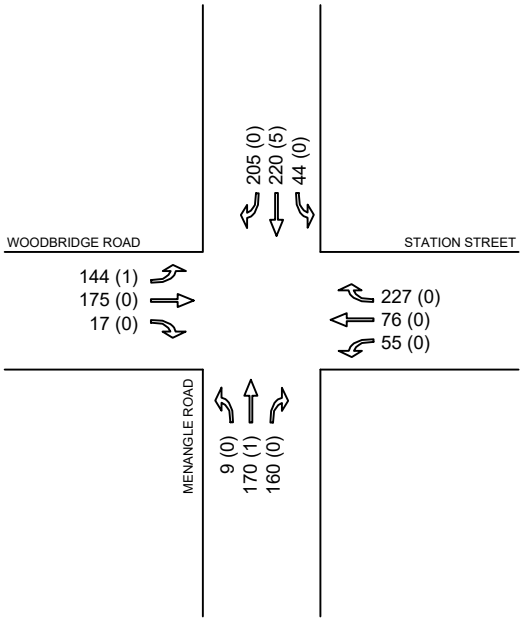
Legend
xx Total Vehicles
(xx) Heavy Vehicles



AM PEAK HOUR
7:30am-8:30am



PM PEAK HOUR
4:30pm-5:30pm



MIDDAY PEAK HOUR
11:45am-12:45pm

Menangle Road / Station Street Intersection

Plus 10-Year Peak Hour Traffic Volumes (2032)

Stantec

7-3

X:\brSYD\16000\16082 - The Creamery At Menangle - Traffic Assessment\DWGs\TDG\16082-01SA.dwg

7.6.1 Existing Volumes

The intersection was analysed using the layout as shown in **Figure 7-4**.

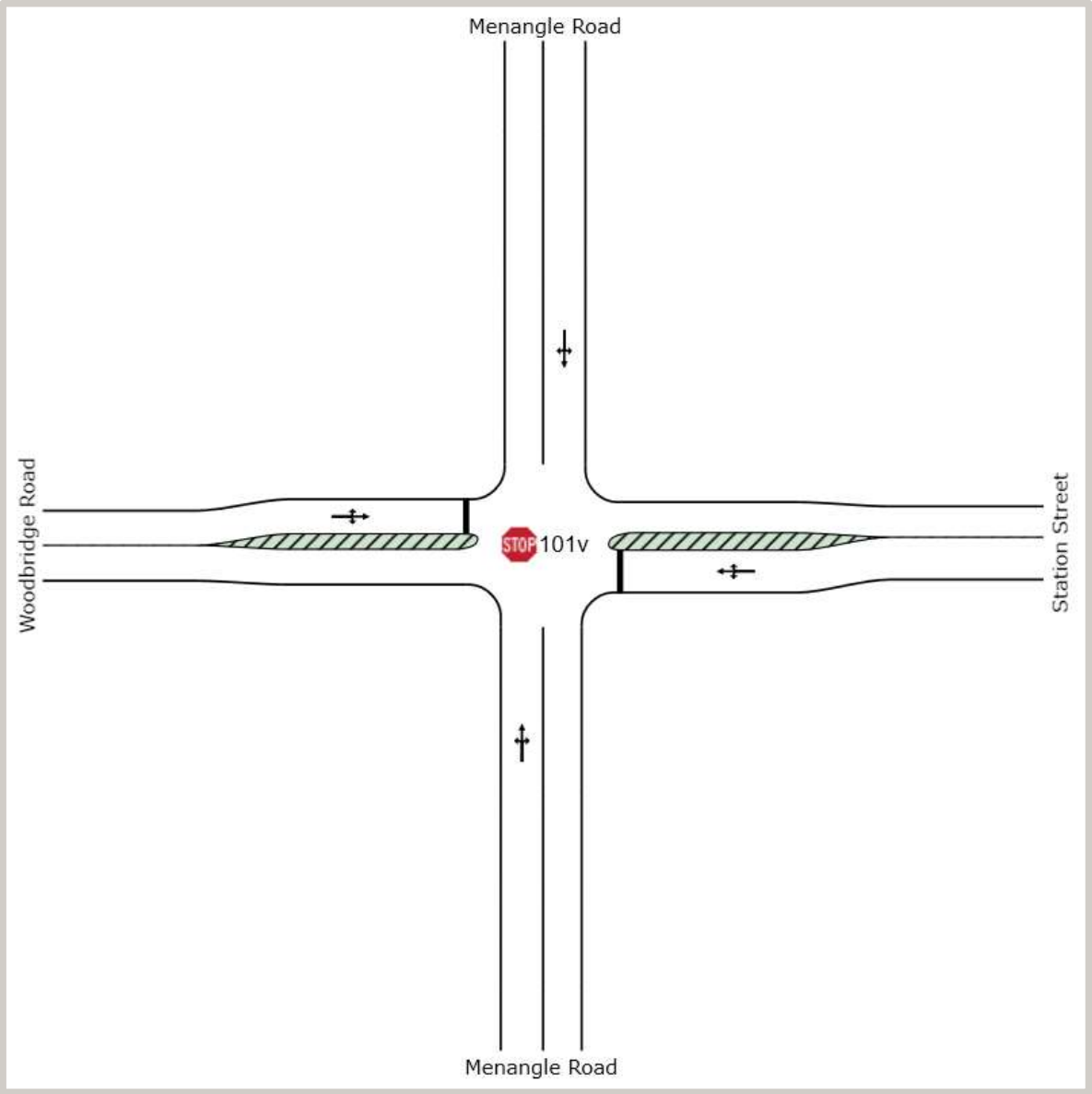


Figure 7-4: Adopted SIDRA Existing Menangle Road / Station Street Intersection Layout

The intersection was analysed using single lanes on each approach to conservatively estimate a worst-case scenario, whereby vehicles wishing to turn in opposite directions of each other (e.g. left and right) from the same approach would be forced to queue, rather than being able to perform the manoeuvre simultaneously. The SIDRA results for the existing scenario are summarised in **Table 7.6** and **Table 7.7.**

Table 7.6: Menangle Road / Station Street SIDRA Analysis – Weekday Peak Hours (Existing)

Approach Road	Turning Movement	AM Peak Hour			PM Peak Hour		
		Level of Service (LoS)	Degree of Saturation (DoS)	95%ile Queue (m)	Level of Service (LoS)	Degree of Saturation (DoS)	95%ile Queue (m)
Menangle Road (South)	Left	A	0.160	0.3	A	0.068	0.3
	Through	A			A		
	Right	A			A		
Station Street (East)	Left	A	0.117	2.6	A	0.063	1.5
	Through	A			A		
	Right	B			B		
Menangle Road (North)	Left	A	0.148	5.6	A	0.332	14.0
	Through	A			A		
	Right	A			A		
Woodbridge Road (West)	Left	A	0.461	22.6	A	0.157	4.6
	Through	A			A		
	Right	B			B		

Table 7.7: Menangle Road / Station Street SIDRA Analysis – Saturday Peak Hour (Existing)

Approach Road	Turning Movement	Saturday Peak Hour		
		Level of Service (LoS)	Degree of Saturation (DoS)	95%ile Queue (m)
Menangle Road (South)	Left	A	0.069	0.1
	Through	A		
	Right	A		
Station Street (East)	Left	A	0.037	0.9
	Through	A		
	Right	A		
Menangle Road (North)	Left	A	0.151	5.2
	Through	A		
	Right	A		
Woodbridge Road (West)	Left	A	0.124	3.5
	Through	A		
	Right	A		

As can be seen from the tables above, the intersection currently operates at a very good LoS 'B' in the weekday AM and PM peak hours, and an excellent LoS 'A' in the Saturday peak hour. The largest 95th percentile queue length occurs on Woodbridge Road in the weekday AM peak, and Menangle Road (north) in the weekday PM peak. These queue lengths are relatively small and represent two to three vehicles attempting to either left turn (merge) onto Menangle Road from Woodbridge Road, or perform a right turn from Menangle Road onto Woodbridge Road across traffic.

On-site observations of the queue lengths on Woodbridge Road in the AM period were larger than those reflected in the existing scenario SIDRA model shown in Table 7.6. It is believed that this was due to one or two vehicles showing hesitation to take gaps in the northbound vehicle flow which would be considered to be acceptable, thereby causing longer than normal queues to form. In some cases, the queues are not at rest, but more moving at slow speeds while each vehicle navigates the 90 degree turn onto Menangle Road.

7.6.2 Post Development (2021)

As discussed in Section 7.4 of this report, a 2% annual growth rate was applied for three and a half years for weekday volumes and three years for the existing light vehicle volumes, assuming that the proposed development is complete by the end of 2021. The intersection layout is unchanged from the layout modelled in the existing model. **Table 7.8** and **Table 7.9** summarise the SIDRA analyses for the 2021 model year.

Table 7.8: Menangle Road / Station Street SIDRA Analysis – Weekday Peak Hours (Post Development 2021)

Approach Road	Turning Movement	AM Peak Hour			PM Peak Hour		
		Level of Service (LoS)	Degree of Saturation (DoS)	95%ile Queue (m)	Level of Service (LoS)	Degree of Saturation (DoS)	95%ile Queue (m)
Menangle Road (South)	Left	A	0.207	2.9	A	0.146	5.0
	Through	A			A		
	Right	A			A		
Station Street (East)	Left	B	0.664	20.6	B	0.526	16.3
	Through	B			B		
	Right	C			C		
Menangle Road (North)	Left	A	0.185	7.2	A	0.375	16.5
	Through	A			A		
	Right	A			A		
Woodbridge Road (West)	Left	A	0.621	40.3	A	0.451	18.6
	Through	B			B		
	Right	B			B		

Table 7.9: Menangle Road / Station Street SIDRA Analysis – Saturday Peak Hour (Post Development 2021)

Approach Road	Turning Movement	Saturday Peak Hour		
		Level of Service (LoS)	Degree of Saturation (DoS)	95%ile Queue (m)
Menangle Road (South)	Left	A	0.181	6.6
	Through	A		
	Right	A		
Station Street (East)	Left	C	0.927	82.0
	Through	D		
	Right	D		
Menangle Road (North)	Left	A	0.224	8.3
	Through	A		
	Right	A		
Woodbridge Road (West)	Left	A	0.470	19.7
	Through	B		
	Right	B		

As can be seen from the tables above, the intersection is expected to operate at a good LoS 'C' during the weekday network peak hours, and an LoS 'D' during the Saturday midday peak hour following completion of Stage 1 of the Mirvac residential subdivision development and the proposed Creamery Precinct development. The 95th percentile queue lengths can be expected to grow longer on each approach, in particular the Woodbridge Road approach during the weekday AM peak hour and the Station Street approach during the Saturday peak hour. A DoS level of over 0.900 indicates that the intersection in its current form would operate over capacity albeit only during the Saturday peak hour. Accordingly, it is considered that the intersection in its current form and layout would still accommodate

the proposed development in 2021, however additional capacity may be required to accommodate the Saturday peak hour projected volumes.

7.6.3 Menangle Road / Station Street Intersection Upgrade

As discussed in Section 7.6.2 of this report, the intersection of Menangle Road / Station Street is expected to operate at LoS 'C' during the weekday peak hours, and LoS 'D' in the weekend peak hour following completion of the proposed Creamery Precinct development.

It is understood that Mirvac have committed to the upgrading of the Menangle Road / Station Street intersection to a roundabout as part of a VPA with Council following development of Stage 1 of the residential subdivision, expected to be sometime in 2020 or 2021. A single lane roundabout is the most likely solution to accommodate the forecasted increase in traffic growth through Menangle, and is recommended to be implemented following the completion of Stage 1 of the Mirvac residential subdivision and the proposed Creamery Precinct development.

Additional modelling has been undertaken for a single lane roundabout at the Menangle Road / Station Street intersection, with the modelled layout shown in **Figure 7-5.** The SIDRA results for the 2021 post development scenario are shown in **Table 7.10** and **Table 7.11**, with full movement summaries included in Appendix D.

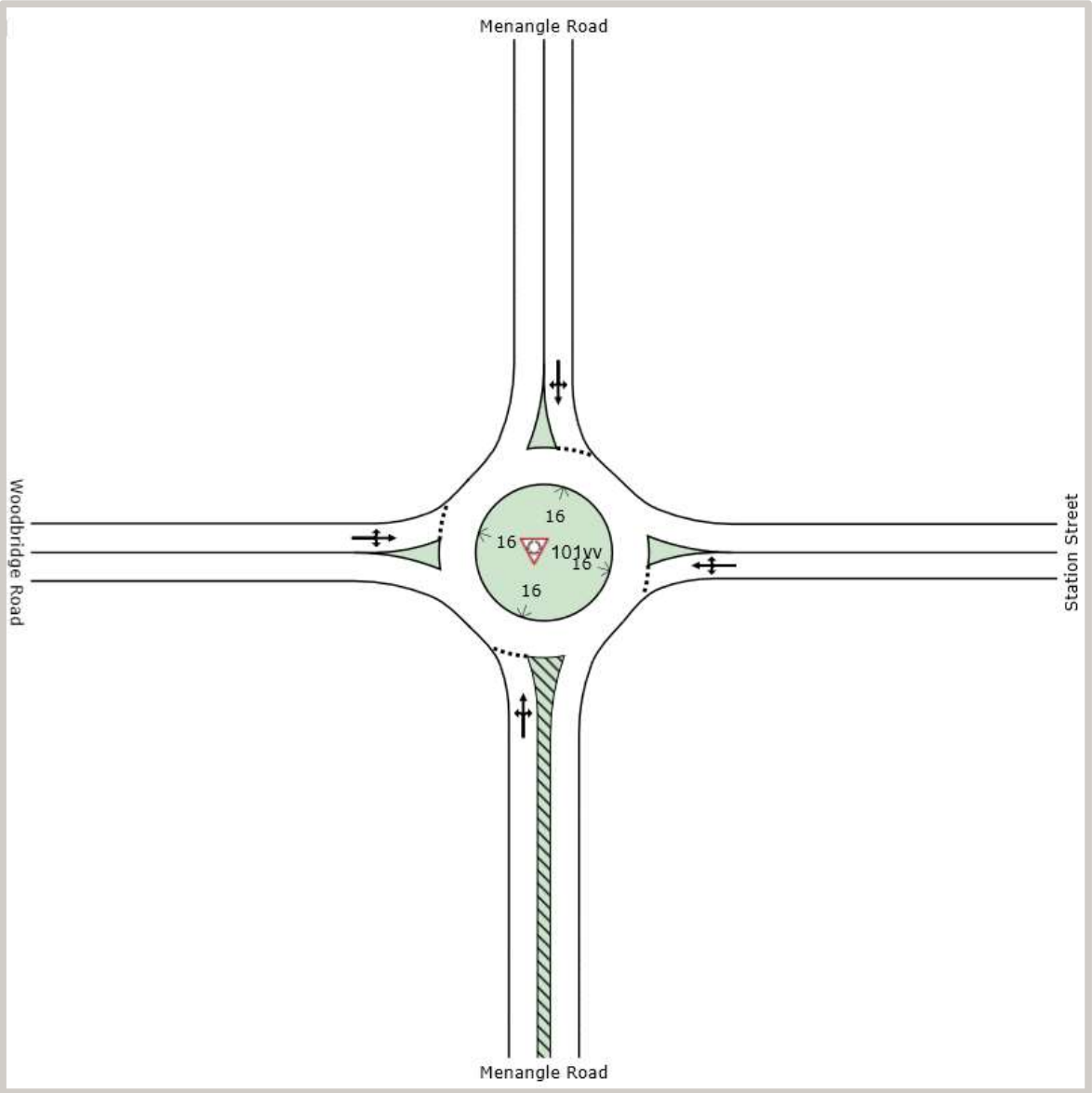


Figure 7-5: Modelled Menangle Road / Station Street Single Lane Roundabout

Table 7.10: Menangle Road / Station Street Roundabout SIDRA Analysis – Weekday Peak Hours (Post Development 2021)

Approach Road	Turning Movement	AM Peak Hour			PM Peak Hour		
		Level of Service (LoS)	Degree of Saturation (DoS)	95%ile Queue (m)	Level of Service (LoS)	Degree of Saturation (DoS)	95%ile Queue (m)
Menangle Road (South)	Left	A	0.427	18.8	A	0.293	11.7
	Through	A			A		
	Right	A			A		
Station Street (East)	Left	A	0.175	6.7	A	0.188	8.2
	Through	A			A		
	Right	A			A		
Menangle Road (North)	Left	A	0.231	9.4	A	0.557	30.2
	Through	A			A		
	Right	A			A		
Woodbridge Road (West)	Left	A	0.621	41.3	A	0.272	10.9
	Through	A			A		
	Right	A			A		

Table 7.11: Menangle Road / Station Street Roundabout SIDRA Analysis – Saturday Peak Hour (Post Development 2021)

Approach Road	Turning Movement	Saturday Peak Hour		
		Level of Service (LoS)	Degree of Saturation (DoS)	95%ile Queue (m)
Menangle Road (South)	Left	A	0.381	16.2
	Through	A		
	Right	A		
Station Street (East)	Left	A	0.392	18.2
	Through	A		
	Right	A		
Menangle Road (North)	Left	A	0.397	17.6
	Through	A		
	Right	A		
Woodbridge Road (West)	Left	A	0.342	14.5
	Through	A		
	Right	A		

As can be seen from the tables above, the upgrading of the intersection to a single lane roundabout has a positive impact on the LoS, DoS and 95th percentile queue lengths for all approaches during each peak hour. Most noticeably the Station Street right turn movement improves from LoS 'C' and 'D' with the existing intersection layout to LoS 'A' with a roundabout.

Accordingly, it is considered that the implementation of a single lane roundabout at the intersection of Menangle Road / Station Street will improve traffic flow through the intersection during all peak hours.

7.6.4 Plus 10-year Horizon (2032)

7.6.4.1 Existing Intersection Layout

A future year horizon of 2032 has been selected in order to capture the future impacts of the background developments, particularly Stages 2-4 of the planned Mirvac residential subdivision to the east of the rail line, which is expected to be complete in 2022.

Accordingly, background traffic growth rates of 2% have been applied for 14.5 and 14 years for the weekday and Saturday volumes, respectively. The intersection layout is unchanged from the layout modelled in the existing model. **Table 7.12** and **Table 7.13** summarise the SIDRA analyses for the 2032 model year.

Table 7.12: Menangle Road / Station Street SIDRA Analysis – Weekday Peak Hours (Plus 10-year Horizon 2032)

Approach Road	Turning Movement	AM Peak Hour			PM Peak Hour		
		Level of Service (LoS)	Degree of Saturation (DoS)	95%ile Queue (m)	Level of Service (LoS)	Degree of Saturation (DoS)	95%ile Queue (m)
Menangle Road (South)	Left	A	0.257	4.4	A	0.218	8.5
	Through	A			A		
	Right	A			A		
Station Street (East)	Left	F	> 1.000	> 500	F	> 1.000	379.6
	Through	F			F		
	Right	F			F		
Menangle Road (North)	Left	A	0.250	10.5	A	0.514	29.6
	Through	A			A		
	Right	A			A		
Woodbridge Road (West)	Left	B	0.864	104.1	C	0.869	82.2
	Through	C			E		
	Right	D			E		

Table 7.13: Menangle Road / Station Street SIDRA Analysis – Saturday Peak Hour (Plus 10-year Horizon 2032)

Approach Road	Turning Movement	Saturday Peak Hour		
		Level of Service (LoS)	Degree of Saturation (DoS)	95%ile Queue (m)
Menangle Road (South)	Left	A	0.213	7.9
	Through	A		
	Right	A		
Station Street (East)	Left	F	> 1.000	493.6
	Through	F		
	Right	F		
Menangle Road (North)	Left	A	0.277	10.9
	Through	A		
	Right	A		
Woodbridge Road (West)	Left	A	0.635	33.3
	Through	B		
	Right	B		

As can be seen from the tables above, the Menangle Road / Station Street intersection is projected to be operating at LoS 'F' in the plus 10-year 2032 scenario during each peak hour. The approach to the intersection that would be affected the most would be Station Street, with 95th percentile queue lengths exceeding several hundred metres if the intersection remains in its current form. The DoS indicates that the intersection would be operating well above its current capacity.

7.6.4.2 Proposed Single Lane Roundabout

The single lane roundabout discussed in Section 7.6.3 of this report has been modelled using the same 2032 projected volumes, to analyse the plus 10-year horizon modelling scenario with the roundabout.

Table 7.14 and **Table 7.15** summarise the SIDRA analyses for the 2032 model year.

Table 7.14: Menangle Road / Station Street Roundabout SIDRA Analysis – Weekday Peak Hours (Plus 10-year Horizon 2032)

Approach Road	Turning Movement	AM Peak Hour			PM Peak Hour		
		Level of Service (LoS)	Degree of Saturation (DoS)	95%ile Queue (m)	Level of Service (LoS)	Degree of Saturation (DoS)	95%ile Queue (m)
Menangle Road (South)	Left	A	0.607	37.9	A	0.293	11.7
	Through	A			A		
	Right	A			A		
Station Street (East)	Left	A	0.358	15.8	A	0.188	8.2
	Through	A			A		
	Right	A			A		
Menangle Road (North)	Left	A	0.301	13.4	A	0.557	30.2
	Through	A			A		
	Right	A			A		
Woodbridge Road (West)	Left	C	0.924	150.1	A	0.272	10.9
	Through	C			A		
	Right	C			A		

Table 7.15: Menangle Road / Station Street Roundabout SIDRA Analysis – Saturday Peak Hour (Plus 10-year Horizon 2032)

Approach Road	Turning Movement	Saturday Peak Hour		
		Level of Service (LoS)	Degree of Saturation (DoS)	95%ile Queue (m)
Menangle Road (South)	Left	A	0.470	23.1
	Through	A		
	Right	A		
Station Street (East)	Left	A	0.483	25.6
	Through	A		
	Right	A		
Menangle Road (North)	Left	A	0.496	24.4
	Through	A		
	Right	A		
Woodbridge Road (West)	Left	A	0.423	19.7
	Through	A		
	Right	A		

As can be seen from the tables above, the Menangle Road / Station Street can be expected to remain operating at acceptable levels of service in the 2032 future year as a single lane roundabout. The roundabout would operate at an excellent LoS 'A' during the weekday PM and Saturday peak hours, and a good LoS 'C' during the weekday AM peak hour. No additional traffic is projected to be added to the Woodbridge Road left turn movement as a result of the proposed Creamery Precinct development, nor as a result of the Mirvac residential subdivision development. As such, the future projection of LoS 'C' can be attributed to the forecasted 2% annual growth in vehicles wishing to turn left from Woodbridge Road onto Menangle Road.

It is understood that there are additional road network improvements in the wider Menangle area that may eventuate in the next 10 or so years, which would provide the developing area with alternative routes of travel to the north and south rather than Menangle Road. These improvements would likely alleviate some of the demand for traffic along Menangle Road and Woodbridge Road, and in particular the left turn movement from Woodbridge Road to Menangle Road at the Menangle Road / Station Street intersection.

Accordingly, it is considered that the upgrading of the Menangle Road / Station Street intersection to a single lane roundabout would be a satisfactory solution to accommodate the increasing traffic demands through the intersection.

7.7 Intersection Upgrade – Traffic Signals

RMS' *Traffic Signal Design Section 2 – Warrants* lists five warrants that would typically allow consideration for an intersection to be upgraded to a signalised intersection. The traffic volume related warrants are listed below:

(a) Traffic Demand:

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

(i) The major road flow exceeds 600vph in each direction; and

(ii) The minor road flow exceeds 200vph in one direction.

(b) Continuous Traffic:

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

(i) The major road flow exceeds 900vph in each direction; and

(ii) The minor road flow exceeds 100vph in one direction; and

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

(iv) There is no other nearby signal site easily accessible to the minor road vehicles.

As shown in Figure 7-3, the volumes on the major road (Menangle Road) are forecast to be a maximum of approximately 870vph in the southbound direction during the weekday PM peak hour. However, the northbound volumes in the same peak hour are projected to be approximately 300vph. The total major road flow does not exceed 600vph during any other peak hour, thereby not meeting any of the above traffic volume warrants for a signalised intersection.

The other three warrants are related to pedestrian safety and crash history, effectively requiring over 150 pedestrians per hour for four one hour periods of an average day, or requiring an average of three or more reported tow-away or casualty traffic accidents per year over a three year period in addition to the traffic flows being at least 80% of the flows listed above.

It is therefore concluded that the Menangle Road / Station Street intersection with its projected 2032 volumes is not expected to satisfy any of these warrant conditions, and accordingly it is not anticipated that the intersection would be required to be upgraded to a signalised intersection as a result of the proposed Creamery Precinct and Mirvac developments.

8. Parking Assessment

8.1 Parking Requirement

Control 2.10.10 a) of Council's Development Control Plan (DCP) sets out parking at the rate specified in **Table 8.1**. A number of land uses are not defined in the DCP specifically, and these are discussed in further detail below, with the land uses assigned a parking rate based on the operations of the development.

Table 8.1: Wollondilly Shire Council Car Parking Rates

Proposed Land Use	Council Land Use Classification	Proposed Size	Car Parking Requirement	Number of Required Spaces
The Creamery Bistro	Food and Drink Premises	150m^2 83 Patrons	The greatest of: 12 spaces per 100m2 GFA; or 1 space per 5 seats (internal and external); or 1 space per 2 seats (internal)	18 spaces
The Creamery Wine Bar		30m^2 16 Patrons		4 spaces
The Creamery Bar (internal)		150m^2 83 Patrons		18 spaces
The Creamery Bar (outdoor area)		350m^2 195 Patrons		42 spaces
The Creamery Restaurant		70m^2 40 Patrons		9 spaces
The Creamery Front Courtyard		600m^2 330 Patrons		72 spaces
Rotolactor Function Centre	Function Centre	600m^2	15 spaces per 100m^2 GFA	90 spaces
General Store	Neighbourhood Shops	65m^2	2.5 spaces per 100m^2 GFA	2 spaces
Cooking School	Undefined	16 Patrons 2 Employees	See below	See below (13 spaces)
Conference Room	Undefined	50m^2	See below	See below (35 spaces)
Hotel	Undefined	14 rooms 6 employees	See below	See below (20 spaces)
Event Shed (Markets)	Markets	40 stalls	3.0 spaces per stall	120 spaces

Proposed Land Use	Council Land Use Classification	Proposed Size	Car Parking Requirement	Number of Required Spaces
Bakery (drive through)	Food and Drink Premises	450m^2 113 Patrons	The greatest of: 12 spaces per 100m2 GFA; or 1 space per 5 seats (internal and external); or 1 space per 2 seats (internal)	54 spaces
Bakery Rear Café / Bar				
Total:				**497 spaces**

It is noted that parking rates for the cooking school, conference room and the hotel are undefined in Council's DCP. For the purposes of this assessment, first principles methods have been assumed for the proposed land uses for the parking assessment only:

- Cooking School – it was assumed for the trip generation analysis that the car occupancy rate for the cooking school would be 1.5 persons per vehicle, and one person per vehicle for staff. Based on the proposed capacity of 16 patrons and two employees, a total parking demand of 13 spaces is expected for the cooking school.
- Conference Room – given the rural nature of the site, it was assumed that the conference room would have a car occupancy rate of 1.2 persons per vehicle, and the conference room would have a maximum capacity of 40 patrons and one employee. Accordingly, it is estimated that the car parking demand for the conference room would be 35 spaces.
- Hotel – the proposed hotel has 14 rooms and 6 employees. It is assumed that each room would have a parking demand of one space, plus one space per employee. Accordingly, it is assumed that the hotel has a parking demand of 20 spaces.

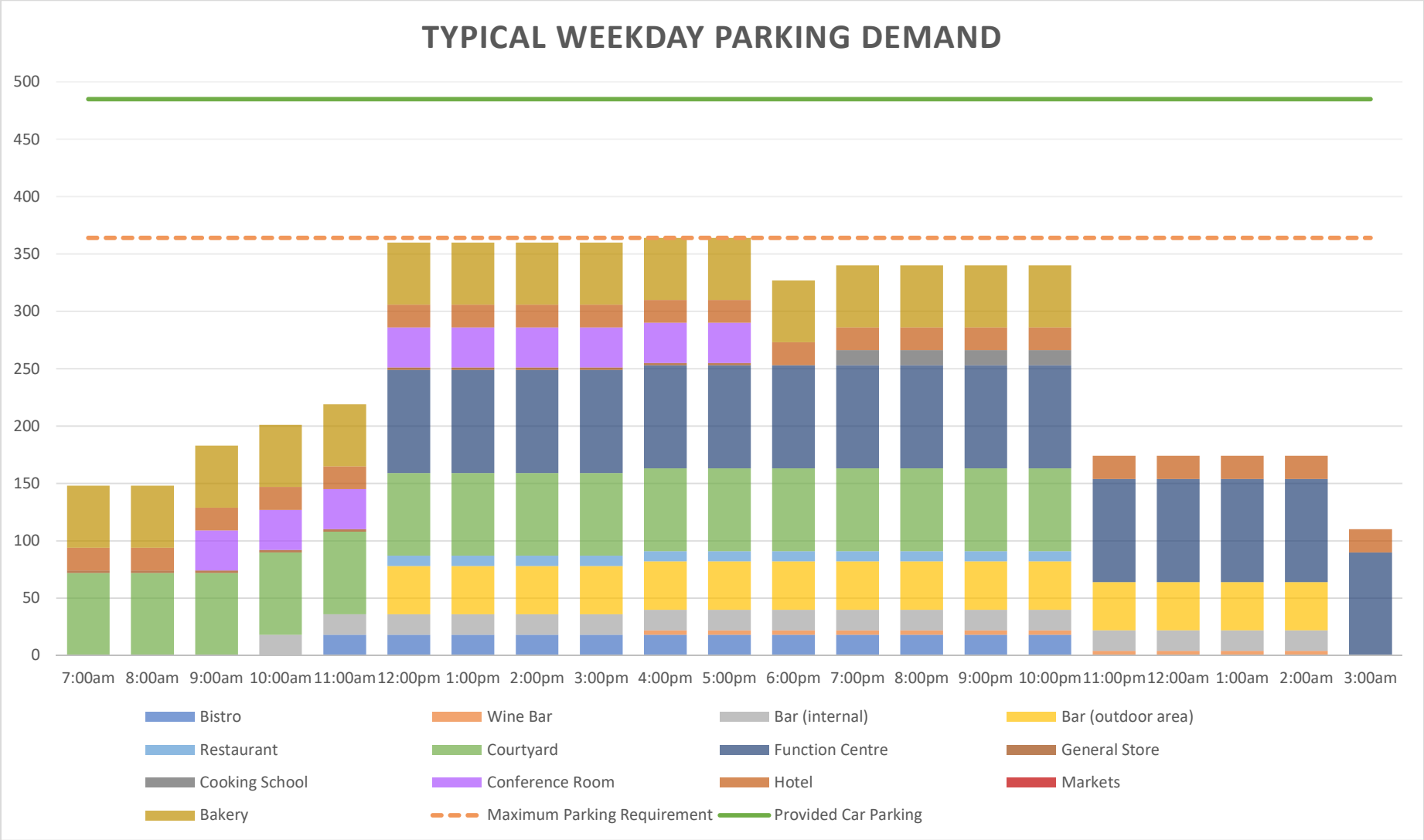
As the drive through component of the bakery is a drive through service, it does not require any fixed car parking spaces.

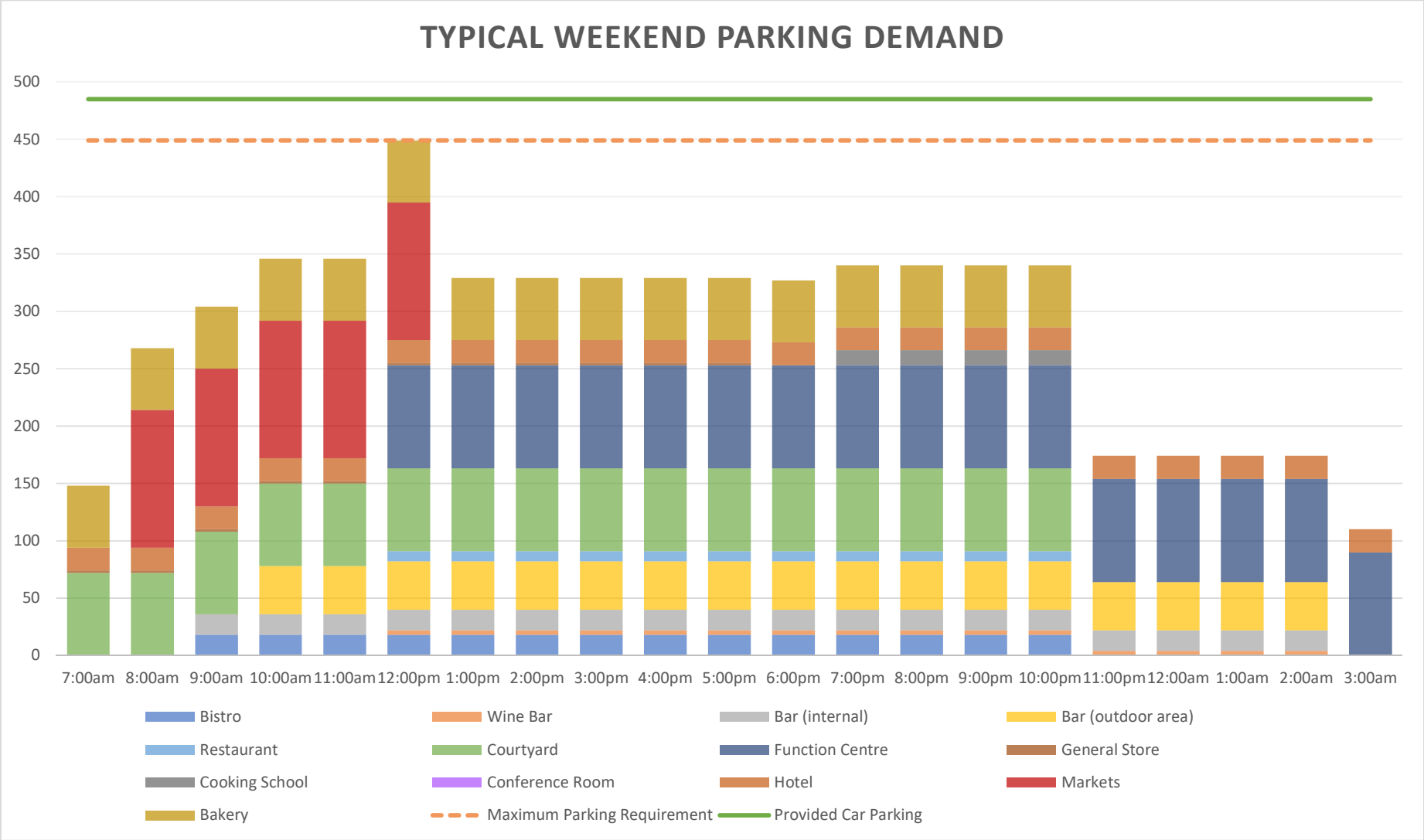
Due to the nature of the proposed Creamery Precinct development, it is important to clarify that all of the parking requirement / demand is not expected to happen simultaneously, and therefore the true maximum required parking number is different from that shown in **Table 8.1**.

Figure 8-1 and **Figure 8-2** show the expected parking demand throughout a typical weekday and weekend day, respectively. The figures assume that all land uses operate at maximum capacity from the moment they open their doors to the closing time, which is considered a conservative estimate of the parking demand of the proposed development.

By way of summary, a maximum parking demand of 364 vehicles is expected during a typical weekday, and a maximum parking demand of 449 vehicles is expected during the weekend. As discussed above, the assessment assumes that each land use experiences their maximum parking demand during all hours of operation, which for the weekend days culminates in the maximum parking demand occurring at 12:00pm, when the market event is ending and the function centre and several of The Creamery dining developments open. A number of visitors are likely to utilise multiple land uses on the site, which is not taken into account in this assessment, and accordingly it is considered that the maximum parking demands shown in the figures below represents a worst-case scenario for the proposed development.

The proposed car parking provision is discussed further in the following section.


TYPICAL WEEKDAY PARKING DEMAND
500
450
400
350
300
250
200
150
100
50
0
7:00am
8:00am
9:00am
10:00am
11:00am
12:00pm
1:00pm
2:00pm
3:00pm
4:00pm
5:00pm
6:00pm
7:00pm
8:00pm
9:00pm
10:00pm
11:00pm
12:00am
1:00am
2:00am
3:00am
Bistro
Wine Bar
Bar (internal)
Bar (outdoor area)
Restaurant
Courtyard
Function Centre
General Store
Cooking School
Conference Room
Hotel
Markets
Bakery
Maximum Parking Requirement
Provided Car Parking


TYPICAL WEEKEND PARKING DEMAND
500
450
400
350
300
250
200
150
100
50
0
7:00am
8:00am
9:00am
10:00am
11:00am
12:00pm
1:00pm
2:00pm
3:00pm
4:00pm
5:00pm
6:00pm
7:00pm
8:00pm
9:00pm
10:00pm
11:00pm
12:00am
1:00am
2:00am
3:00am
Bistro
Wine Bar
Bar (internal)
Bar (outdoor area)
Restaurant
Courtyard
Function Centre
General Store
Cooking School
Conference Room
Hotel
Markets
Bakery
Maximum Parking Requirement
Provided Car Parking

8.2 Proposed Parking Supply

It is proposed to provide car parking and motorcycle parking on the site across four different areas, outlined in **Table 8.2**.

Table 8.2: Proposed Parking Provision

Car Park	Operating Hours	Parking Area	Number of Spaces
Southern Paddock Car Park	7:00am to 12:00am	5,250m^2	150 spaces
Northern Paddock Car Park	7:00am to 3:00am	4,550m^2	130 spaces
Hotel Car Park	24 hours a day	700m^2	20 spaces
Employee Car Park	7:00am to 3:00am	-	185 spaces
Motorcycle and Scooter Parking	Secure Access	310m^2	55 spaces (motorcycles and scooters)
Total:			**485 car spaces** **55 motorcycle spaces**

Accordingly, it is considered that the proposed car parking provision will be satisfactory to accommodate the expected car parking demand of the proposed Creamery Precinct development.

9. Conclusion

Stantec has been asked by The Creamery Property Trust to undertake an assessment of the proposed Creamery Precinct neighbourhood centre development in Menangle, NSW.

Based on the above assessment, the following is concluded:

- Turning movement count results from Thursday 3 May 2018 and Saturday 23 February 2019 revealed that the intersection of Menangle Road / Station Street experiences a relatively low level of traffic during the weekday AM and PM peak hours, and on Saturdays. SIDRA analysis of this intersection suggests that the intersection currently operates at a very good level of service 'B' during the weekday AM and PM peak hours, and level of service 'A' during the Saturday midday peak hour.
- Access to the site is proposed to be via a new east-west road linking Menangle Road with Stevens Road, which will run along the northern side of Stage 1 of the adjacent Mirvac residential subdivision.
- The proposed neighbourhood centre is expected to generate in the order of 281 vph, 422 vph and 940 vph during the weekday AM, PM and weekend midday peak hours, respectively. With the addition of this traffic to the existing intersection operations, and allowing for a conservative annual growth rate of 2% along Menangle Road, Station Street and Woodbridge Road, it was found that the could be expected to operate at a level of service 'C' during the weekday peak hours, and LoS 'D' during the Saturday peak hour following completion of both the proposed Creamery Precinct as well as the planned Stage 1 (97 residential lot) Mirvac residential subdivision adjacent to the site.
- The consideration of additional traffic from the latter stages of the adjacent subdivision is expected to warrant some upgrading of the Menangle Road / Station Street intersection, confirmed by the 2032 'plus 10-year' horizon model, which factors in a further 10 years of traffic growth following expected completion of the residential subdivision in 2022.
- Preliminary traffic modelling indicates that there are options available to upgrade the intersection to accommodate the future levels of traffic, and that Mirvac have committed to upgrading the intersection to a single lane roundabout (via a Voluntary Planning Agreement with Council). This would occur prior to any development of the latter stages of the residential subdivision to the east of the railway line.
- The intersection has been modelled for both the 2021 and 2032 scenarios with a single lane roundabout configuration. It was found that the upgraded intersection could accommodate the forecasted levels of traffic with the worst case level of service being 'C' in the weekday AM peak in 2032. This does not take into account the possibility of road network improvements within the wider Menangle area, which may reduce the existing left turn demand for vehicles travelling from Woodbridge Road to Menangle Road.
- The expected parking requirement and demand throughout a typical weekday and weekend day is expected to be able to be accommodated by the proposed 485 car parking spaces on-site, provided across multiple car parking areas and in addition to a 55 space motorcycle and scooter car park.

It is therefore concluded that the proposed Creamery Precinct development would not be expected to have any adverse impacts on the surrounding road network (both existing and future), and that there are no traffic engineering reasons that would preclude the proposed development from proceeding.

Appendices

Appendix A Development Schedule

The Creamery at Menangle

Population Schedule

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	Operation Times	Area	Formula	Theoretical Maximum Capacity	Employees Required	Comments
The Creamery Bistro	11am – 10pm Mon – Fri 9am – 10pm Sat, Sun	150m²	1.8m² / Patron	83 Patrons (every 2 hrs)	10 Employees	
The Creamery Wine Bar	4pm – 2am Mon - Fri 12pm – 2am Sat, Sun	30m2		16 Patrons (every 2 hrs)	2 Employees	
The Creamery Bar (internal)	10am – 2am Mon – Fri 9am – 2am Sat, Sun	150m²	1.8m² / Patron	83 Patrons (every 2-4 hrs)	4 Employees	
The Creamery Bar (outdoor area)	12pm – 2am Mon – Fri 10am – 2am Sat, Sun	350m²	1.8m² / Patron	195 Patrons (every 2-4 hrs)	3 Employees	
The Creamery Restaurant (up-stairs)	12pm – 10pm Mon - Sun	70m²	1.8m² / Patron	40 Patrons (every 2 hrs)	6 Employees	
The Creamery Front Courtyard	7am – 10pm Mon - Sun	600m²	1.8m² / Patron	330 Patrons (every 2-4 hrs)	4 Employees	
				747 Patrons	**29 Employees**	
Rotolactor Function Centre (internal) + Marquee	12pm – 3am Mon - Sun	600m²	1.5m² / Patron	400 Patrons	20 Employees	Conservatively assumed fully booked 7 nights/week
General Store	7am – 5pm Mon - Sun	65m²		-----	2 Employees	
Cooking School	7pm – 10pm Fri, Sat, Sun	65m²		16 Patrons	2 Employees	
Conference Room	9am – 4pm Mon - Fri	50m²	1.25m² / Patron	40 Patrons	1 Employee	Conservatively assumed fully booked 5 days/week
Hotel	24/7 – Mon - Sun	500m²	4 Star 30-34m² / Room 1.86m² / Room for services	14 Rooms x 1.7 people = 24 Guests / day	6 Employees	Conservatively assumed fully booked out 7 days/week
Hotel (parking)	24/7 – Mon - Sun	700m²	35m² / Car	20 Cars	-----	
Event Shed (market event)	8am – 12pm Sat, Sun	880m² Market space Remainder for circulation and seating	22m² / Stall	250 Patrons (per hour)	40 Stalls x 2 Operators = 80 Operators	Conservatively assumed operating both Sat and Sun markets
				480 Patrons **(+ 250 Patrons Sat/Sun 8am – 12 noon)**	**31 Employees** **(+ 80 Operators Sat/Sun 8.00am-12.00 noon)**	

The Creamery at Menangle

rothelowman

Population Schedule

Children's Play Area	11am – 10pm Mon - Sun	980m²	7m² / Child	140 Children (previously included in density calcs)	1 Employee	
Bakery (drive through)	7am - 10pm Mon - Sun		3.5 Minutes per order	17 Cars / Hour = 34 Patrons (stay in car)	3 Employees	
Bakery Rear Café/Bar (including lemon grove)	7am – 10pm Mon - Sun	450m²	4m² / Patron	113 Patrons (every 1.5 hours)	10 Employees	
				113 Patrons	**16 Employees**	
Southern Paddock Parking Lot	7am - 12am	5250m²	35m² / Car	150 cars		
Northern Paddock Parking Lot	7am – 3am	4550m²	35m² / Car	130 cars		
Motorcycle + Scooter Parking Lot	7am – 3am	310m²	Calculated from motorcycle/ scooter park widths	55 Motorcycles + Scooters		
Dedicated employee car park located south of Menangle train station				185 spaces		
				Maximum Patrons on site at any one time = 1340 Patrons **(Plus Stall Patrons Sat/Sun 8am – 12 noon = 250 Patrons)** **Theoretical Maximum Total Patrons at any one time = 1590 Patrons**	**Maximum Employees at any one time = 75 Employees (Plus 80 Stall operators Sat/Sun 8am – 12 noon)** **Theoretical Maximum Total Employees/ Operators at any one time = 155 Persons**	

<u>Theoretical maximum capacity on site at any one time (assuming all venues operating except the Farmers Market)</u>

Employees = 75

Patrons (including children) = 1340

Total Persons = 1415 Persons on site at any one time

<u>Theoretical maximum capacity on site at any one time (assuming all venues operating / Farmers Market operating (Sat/Sun 8am – 12 noon)</u>

Employees (75) and Stall Operators (80) = 155 Persons

Patrons (including children and farmers market patrons = 1590 Persons

Total Persons = 1745 persons on site at any one time

Appendix B Development Plans

PRELIMINARY

Revisions

Project
The Creamery, Menangle
15 Menangle Road + 45 Stevens Road, Menangle

Drawing **SITE MASTERPLAN**

Project No **217166**

Date **03/04/18**

Author **JC**

Scale: @ A1 **1 : 2000**

Drawing No. **SK00.02**

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4/06/2018 4:48:25 PM

LEGEND

NUMBER	LOCATION
1	TRAIN STATION
2	STATION PARKING
3	FOOTPATH
4	LOADING
5	AMENITIES
6	ENTRY SCULPTURE
7	ENTRY WALK
8	BAR
9	MOTORCYCLE PARKING
10	CHILDREN'S PLAY AREA
11	BRATS OBSERVATION SHED
12	GENERAL STORE / COOKING SCHOOL / MEETING ROOM
13	MICRO BREWERY, DISTILLERY, BISTRO & RESTAURANT
14	TACO STAND
15	MUSEUM SHED
16	VEGETABLE GARDENS
17	KIDS FARM
18	KIDS FARM PADDOCK
19	HOTEL & EXTENSION
20	HOTEL PARKING
21	LEMON GROVE
22	FUNCTION CENTRE ARRIVAL COURT
23	ROTOLACTOR FUNCTION CENTRE
24	MARQUEE SPACE
25	FARMERS OPEN MARKET HALL
26	OAK TRUFFLE FOREST
27	FUNCTION CENTRE GRASSED PARKING / CAR CLUB
28	GRASSED FARMERS MARKET/OVERFLOW PARKING
29	PERFORMANCE STAGE
30	GRASSED AMPHITHEATRE

PRELIMINARY

Revisions

Project **The Creamery, Menangle**
15 Menangle Road + 45 Stevens Road, Menangle

Drawing **BUILDINGS MASTERPLAN**

Project No **217166** Date **03.04.18** Author **JC** Scale: @ A1 **1 : 500** Drawing No. **SK00.03**

0 5m 10m 20m 50m 100m

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Appendix C Traffic Survey Data

TRANS TRAFFIC SURVEY

TURNING MOVEMENT SURVEY

trafficsurvey.com.au

Intersection of Mengangle Rd and Station St, Menangle

Date:	Thu 03/05/18
Weather:	Fine
Suburban:	Menangle
Customer:	TDG

North:	Mengangle Rd
East:	Station St
South:	Mengangle Rd
West:	Woolbridge Rd

Survey Start	AM:	7:00	PM:	16:00
Vehicular Peakhour		**Pedestrians Peakhour**		
AM:	7:30 AM-8:30 AM	AM:	N/A	
PM:	4:30 PM-5:30 PM	PM:	N/A	

All Vehicles

Time		North Approach Mengangle Rd				East Approach Station St				South Approach Mengangle Rd				West Approach Woolbridge Rd				Hourly Total	
Period Start	**Period End**	**U**	**R**	**SB**	**L**	**U**	**R**	**WB**	**L**	**U**	**R**	**NB**	**L**	**U**	**R**	**EB**	**L**	**Hour**	**Peak**
7:00	7:15	0	23	16	1	0	4	0	1	0	1	42	4	0	1	1	75	809	
7:15	7:30	0	15	10	1	0	4	4	1	0	1	51	2	0	0	0	71	904	
7:30	7:45	0	24	13	2	0	5	2	0	0	0	66	5	0	0	0	101	1015	Peak
7:45	8:00	0	25	22	3	0	4	2	0	0	1	81	3	0	3	1	117	1014	
8:00	8:15	0	26	19	2	0	6	4	4	0	3	86	1	0	0	2	111	893	
8:15	8:30	0	46	34	2	0	8	4	2	0	0	68	3	0	1	3	100	775	
8:30	8:45	0	45	24	3	0	7	1	0	0	1	59	2	0	1	4	70	646	
8:45	9:00	0	30	13	1	0	5	0	2	0	2	45	3	0	3	2	35	552	
9:00	9:15	0	24	19	5	0	4	2	0	0	3	41	5	0	2	1	40	514	
9:15	9:30	0	20	15	4	0	2	2	0	0	1	42	3	0	4	3	46		
9:30	9:45	0	20	21	2	0	4	5	1	0	1	39	3	0	3	1	23		
9:45	10:00	0	16	14	2	0	2	1	0	0	0	32	3	0	2	3	28		
16:00	16:15	0	69	46	7	0	3	4	2	0	0	25	3	0	3	2	35	848	
16:15	16:30	0	75	56	6	0	3	5	0	0	1	31	1	0	2	0	32	871	
16:30	16:45	0	68	57	5	0	2	2	0	0	1	45	5	0	3	2	42	891	Peak
16:45	17:00	0	70	52	4	0	1	0	1	0	1	25	1	0	0	2	48	878	
17:00	17:15	0	70	75	4	0	2	10	2	0	2	25	1	0	1	1	29	884	
17:15	17:30	0	77	75	9	0	3	1	0	0	0	25	2	0	2	0	38	825	
17:30	17:45	0	55	72	6	0	3	1	2	0	1	30	2	0	2	0	45	748	
17:45	18:00	0	72	55	6	0	4	0	0	0	0	33	3	0	3	0	35	659	
18:00	18:15	0	64	40	6	0	1	3	1	0	1	18	5	0	3	0	21	565	
18:15	18:30	0	70	41	7	0	3	0	0	0	0	16	1	0	0	0	17		
18:30	18:45	0	46	35	3	0	1	1	0	0	0	18	1	0	2	0	23		
18:45	19:00	0	37	31	3	0	1	1	0	0	0	16	1	0	6	2	19		

Peak Time		North Approach Mengangle Rd				East Approach Station St				South Approach Mengangle Rd				West Approach Woolbridge Rd				Peak
Period Start	**Period End**	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L	**total**
7:30	8:30	0	121	88	9	0	23	12	6	0	4	301	12	0	4	6	429	1015
16:30	17:30	0	285	259	22	0	8	13	3	0	4	120	9	0	6	5	157	891

TRANS TRAFFIC SURVEY

trafficsurvey.com.au

TURNING MOVEMENT SURVEY

Intersection of Station Rd and Menangle Rd, Menangle

GPS *-34.127034, 150.738495*

Date:	Sat 23/02/19
Weather:	Overcast
Suburban:	Menangle
Customer:	TDG

North:	Menangle Rd
East:	Station Rd
South:	Menangle Rd
West:	Station Rd

Survey	AM:	9:00 AM-12:00 PM
Period	PM:	12:00 PM-6:00 PM
Traffic	AM:	11:45 AM-12:45 PM
Peak	PM:	4:00 PM-5:00 PM

All Vehicles

Time		North Approach Menangle Rd				East Approach Station Rd				South Approach Menangle Rd				West Approach Station Rd				Hourly Total	
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L	Hour	Peak
9:00	9:15	0	17	17	2	0	4	1	3	0	1	39	3	0	3	1	32	518	
9:15	9:30	0	20	32	6	0	4	0	1	0	3	38	1	0	2	2	26	512	
9:30	9:45	0	29	27	3	0	4	1	0	0	2	26	5	0	3	3	29	524	
9:45	10:00	0	16	25	4	0	3	0	1	0	1	39	6	0	2	1	30	518	
10:00	10:15	0	13	11	6	0	4	3	1	0	3	40	6	0	3	2	25	515	
10:15	10:30	0	22	24	4	0	2	0	2	0	0	49	4	0	1	1	38	529	
10:30	10:45	0	18	22	6	0	5	3	2	0	0	31	1	0	5	4	29	504	
10:45	11:00	0	22	29	1	0	3	1	0	0	1	37	3	0	4	0	24	507	
11:00	11:15	0	35	25	4	0	1	2	1	0	1	32	2	0	4	4	20	522	
11:15	11:30	0	23	30	3	0	2	0	1	0	0	24	1	0	6	0	32	527	
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11:45	12:00	0	32	36	2	0	3	2	0	0	0	30	2	0	5	2	26	549	Peak
12:00	12:15	0	24	34	4	0	3	4	0	0	0	33	1	0	4	3	26	538	
12:15	12:30	0	21	28	4	0	6	1	1	0	1	31	3	0	2	3	27	535	
12:30	12:45	0	38	29	8	0	2	0	0	0	0	35	1	0	2	0	30	524	
12:45	13:00	0	21	34	6	0	4	2	0	0	1	32	2	0	1	3	23	507	
13:00	13:15	0	30	29	8	0	5	5	2	0	0	25	3	0	3	1	22	486	
13:15	13:30	0	21	32	5	0	4	1	1	0	0	24	2	0	1	2	24	488	
13:30	13:45	0	28	31	3	0	2	2	1	1	1	26	4	0	3	2	24	501	
13:45	14:00	0	26	30	2	0	4	0	1	0	2	16	2	0	3	1	21	491	
14:00	14:15	0	31	43	5	0	4	1	1	0	0	19	6	0	4	3	18	510	
14:15	14:30	0	19	31	6	0	8	6	1	0	0	28	0	0	6	3	22	497	
14:30	14:45	0	17	37	6	0	4	1	2	0	0	26	2	0	3	3	17	492	
14:45	15:00	0	38	34	6	0	1	1	3	0	0	21	0	0	2	1	20	479	
15:00	15:15	0	32	22	6	0	3	1	0	0	1	23	3	0	3	1	27	472	
15:15	15:30	0	28	36	1	0	1	4	0	0	1	29	3	0	2	0	20	513	
15:30	15:45	0	20	33	2	0	0	0	0	0	0	20	2	1	1	1	25	533	
15:45	16:00	0	24	31	5	0	3	0	0	0	1	26	5	0	3	2	20	565	
16:00	16:15	0	28	45	4	0	6	2	0	0	1	33	5	0	1	2	36	584	Peak
16:15	16:30	0	17	40	5	0	7	2	0	0	0	28	4	0	1	1	40	570	
16:30	16:45	0	30	28	3	0	3	1	1	0	0	35	5	0	0	2	29	574	
16:45	17:00	0	25	28	2	0	4	3	0	0	2	30	1	0	7	2	35	562	
17:00	17:15	0	29	20	2	0	1	1	0	0	1	38	2	0	6	0	49	531	
17:15	17:30	0	27	22	6	0	2	2	0	0	2	33	5	0	3	2	45		
17:30	17:45	0	30	25	3	0	2	0	0	0	0	26	0	0	1	2	36		
17:45	18:00	0	18	17	2	0	3	0	0	0	1	32	2	0	3	1	29		

Peak Time		North Approach Menangle Rd				East Approach Station Rd				South Approach Menangle Rd				West Approach Station Rd				Peak
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L	total
11:45	12:45	0	115	127	18	0	14	7	1	0	1	129	7	0	13	8	109	549
16:00	17:00	0	100	141	14	0	20	8	1	0	3	126	15	0	9	7	140	584

Appendix D SIDRA Analysis

MOVEMENT SUMMARY

Site: 101v [Menangle Road - Station Street - Existing - AM Peak]

Menangle Road / Station Street
Existing AM Peak - Priority Controlled
7:30am - 8:30am
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Menangle Road											
1	L2	13	0.0	0.160	4.7	LOS A	0.0	0.3	0.01	0.03	49.3
2	T1	317	2.3	0.160	0.0	LOS A	0.0	0.3	0.01	0.03	49.8
3	R2	4	0.0	0.160	4.9	LOS A	0.0	0.3	0.01	0.03	49.3
Approach		334	2.2	0.160	0.2	NA	0.0	0.3	0.01	0.03	49.8
East: Station Street											
4	L2	6	0.0	0.117	7.8	LOS A	0.4	2.6	0.52	0.95	41.5
5	T1	13	0.0	0.117	10.9	LOS A	0.4	2.6	0.52	0.95	41.5
6	R2	24	0.0	0.117	19.4	LOS B	0.4	2.6	0.52	0.95	41.5
Approach		43	0.0	0.117	15.2	LOS B	0.4	2.6	0.52	0.95	41.5
North: Menangle Road											
7	L2	9	11.1	0.148	5.9	LOS A	0.8	5.6	0.41	0.36	46.5
8	T1	93	8.0	0.148	1.1	LOS A	0.8	5.6	0.41	0.36	47.1
9	R2	127	0.8	0.148	5.9	LOS A	0.8	5.6	0.41	0.36	46.6
Approach		229	4.1	0.148	3.9	NA	0.8	5.6	0.41	0.36	46.8
West: Woodbridge Road											
10	L2	452	1.6	0.461	10.3	LOS A	3.2	22.6	0.54	0.99	44.0
11	T1	6	0.0	0.461	13.5	LOS A	3.2	22.6	0.54	0.99	43.9
12	R2	4	25.0	0.461	18.4	LOS B	3.2	22.6	0.54	0.99	43.7
Approach		462	1.8	0.461	10.4	LOS A	3.2	22.6	0.54	0.99	44.0
All Vehicles		1068	2.4	0.461	6.1	NA	3.2	22.6	0.35	0.55	46.1

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
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.

MOVEMENT SUMMARY

Site: 101v [Menangle Road - Station Street - Existing - PM Peak]

Menangle Road / Station Street
Existing PM Peak - Priority Controlled
4:30pm - 5:30pm
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Menangle Road											
1	L2	9	0.0	0.068	4.9	LOS A	0.0	0.3	0.04	0.05	49.1
2	T1	126	0.8	0.068	0.1	LOS A	0.0	0.3	0.04	0.05	49.6
3	R2	4	0.0	0.068	5.6	LOS A	0.0	0.3	0.04	0.05	49.1
Approach		140	0.8	0.068	0.5	NA	0.0	0.3	0.04	0.05	49.5
East: Station Street											
4	L2	3	0.0	0.063	8.6	LOS A	0.2	1.5	0.62	0.97	42.1
5	T1	14	0.0	0.063	12.9	LOS A	0.2	1.5	0.62	0.97	42.0
6	R2	8	12.5	0.063	19.3	LOS B	0.2	1.5	0.62	0.97	41.9
Approach		25	4.2	0.063	14.5	LOS A	0.2	1.5	0.62	0.97	42.0
North: Menangle Road											
7	L2	23	0.0	0.332	5.1	LOS A	2.0	14.0	0.28	0.29	47.2
8	T1	273	1.9	0.332	0.5	LOS A	2.0	14.0	0.28	0.29	47.6
9	R2	300	0.0	0.332	5.2	LOS A	2.0	14.0	0.28	0.29	47.1
Approach		596	0.9	0.332	3.0	NA	2.0	14.0	0.28	0.29	47.3
West: Woodbridge Road											
10	L2	165	0.6	0.157	8.0	LOS A	0.7	4.6	0.25	0.89	44.7
11	T1	5	0.0	0.157	14.0	LOS A	0.7	4.6	0.25	0.89	44.6
12	R2	6	0.0	0.157	15.6	LOS B	0.7	4.6	0.25	0.89	44.7
Approach		177	0.6	0.157	8.4	LOS A	0.7	4.6	0.25	0.89	44.7
All Vehicles		938	0.9	0.332	4.0	NA	2.0	14.0	0.25	0.38	47.0

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

MOVEMENT SUMMARY

Site: 101v [Menangle Road - Station Street - Existing - Sat Peak]

Menangle Road / Station Street
Existing Sat Peak - Priority Controlled
11:45am - 12:45pm
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Menangle Road											
1	L2	7	0.0	0.069	4.6	LOS A	0.0	0.1	0.01	0.03	49.3
2	T1	136	0.8	0.069	0.0	LOS A	0.0	0.1	0.01	0.03	49.8
3	R2	1	0.0	0.069	5.0	LOS A	0.0	0.1	0.01	0.03	49.3
Approach		144	0.7	0.069	0.3	NA	0.0	0.1	0.01	0.03	49.8
East: Station Street											
4	L2	1	0.0	0.037	7.9	LOS A	0.1	0.9	0.45	0.91	43.8
5	T1	7	0.0	0.037	9.5	LOS A	0.1	0.9	0.45	0.91	43.8
6	R2	15	0.0	0.037	11.2	LOS A	0.1	0.9	0.45	0.91	43.8
Approach		23	0.0	0.037	10.5	LOS A	0.1	0.9	0.45	0.91	43.8
North: Menangle Road											
7	L2	19	0.0	0.151	5.0	LOS A	0.7	5.2	0.23	0.27	47.4
8	T1	134	2.4	0.151	0.3	LOS A	0.7	5.2	0.23	0.27	47.8
9	R2	121	0.0	0.151	5.1	LOS A	0.7	5.2	0.23	0.27	47.3
Approach		274	1.2	0.151	2.8	NA	0.7	5.2	0.23	0.27	47.6
West: Woodbridge Road											
10	L2	115	0.9	0.124	8.0	LOS A	0.5	3.5	0.27	0.89	44.8
11	T1	8	0.0	0.124	9.9	LOS A	0.5	3.5	0.27	0.89	44.7
12	R2	14	0.0	0.124	10.5	LOS A	0.5	3.5	0.27	0.89	44.8
Approach		137	0.8	0.124	8.4	LOS A	0.5	3.5	0.27	0.89	44.8
All Vehicles		578	0.9	0.151	3.8	NA	0.7	5.2	0.19	0.38	47.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
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.

MOVEMENT SUMMARY

Site: 101v [Menangle Road - Station Street - Future 2021 - AM Peak]

Menangle Road / Station Street
Future 2021 AM Peak
7:30am - 8:30am
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Menangle Road											
1	L2	14	0.0	0.207	5.0	LOS A	0.5	3.4	0.10	0.09	48.7
2	T1	340	2.5	0.207	0.1	LOS A	0.5	3.4	0.10	0.09	49.2
3	R2	58	0.0	0.207	5.1	LOS A	0.5	3.4	0.10	0.09	48.7
Approach		412	2.0	0.207	1.0	NA	0.5	3.4	0.10	0.09	49.1
East: Station Street											
4	L2	33	0.0	0.664	18.0	LOS B	3.5	24.2	0.72	1.16	34.9
5	T1	29	0.0	0.664	23.3	LOS B	3.5	24.2	0.72	1.16	34.8
6	R2	105	0.0	0.664	39.5	LOS C	3.5	24.2	0.72	1.16	34.8
Approach		167	0.0	0.664	32.5	LOS C	3.5	24.2	0.72	1.16	34.8
North: Menangle Road											
7	L2	11	10.0	0.185	6.1	LOS A	1.0	7.1	0.43	0.35	46.5
8	T1	121	7.8	0.185	1.2	LOS A	1.0	7.1	0.43	0.35	47.1
9	R2	152	0.7	0.185	6.0	LOS A	1.0	7.1	0.43	0.35	46.6
Approach		283	4.1	0.185	4.0	NA	1.0	7.1	0.43	0.35	46.8
West: Woodbridge Road											
10	L2	484	1.7	0.621	12.2	LOS A	5.8	41.1	0.64	1.14	42.8
11	T1	62	0.0	0.621	18.1	LOS B	5.8	41.1	0.64	1.14	42.7
12	R2	4	25.0	0.621	26.8	LOS B	5.8	41.1	0.64	1.14	42.5
Approach		551	1.7	0.621	13.0	LOS A	5.8	41.1	0.64	1.14	42.8
All Vehicles		1413	2.1	0.664	10.0	NA	5.8	41.1	0.45	0.68	44.0

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

MOVEMENT SUMMARY

Site: 101v [Menangle Road - Station Street - Future 2021 - PM Peak]

Menangle Road / Station Street
Future 2021 PM Peak
4:30pm - 5:30pm
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Menangle Road											
1	L2	11	0.0	0.146	5.8	LOS A	0.7	5.0	0.36	0.26	47.3
2	T1	136	0.8	0.146	0.9	LOS A	0.7	5.0	0.36	0.26	47.7
3	R2	98	0.0	0.146	5.9	LOS A	0.7	5.0	0.36	0.26	47.2
Approach		244	0.4	0.146	3.1	NA	0.7	5.0	0.36	0.26	47.5
East: Station Street											
4	L2	20	0.0	0.526	15.1	LOS B	2.2	16.3	0.83	1.12	35.8
5	T1	28	0.0	0.526	23.1	LOS B	2.2	16.3	0.83	1.12	35.7
6	R2	68	12.3	0.526	37.7	LOS C	2.2	16.3	0.83	1.12	35.6
Approach		117	7.2	0.526	30.3	LOS C	2.2	16.3	0.83	1.12	35.7
North: Menangle Road											
7	L2	25	0.0	0.375	5.2	LOS A	2.3	16.5	0.31	0.29	47.1
8	T1	309	2.0	0.375	0.5	LOS A	2.3	16.5	0.31	0.29	47.6
9	R2	335	0.0	0.375	5.3	LOS A	2.3	16.5	0.31	0.29	47.1
Approach		669	0.9	0.375	3.1	NA	2.3	16.5	0.31	0.29	47.3
West: Woodbridge Road											
10	L2	177	0.6	0.451	9.8	LOS A	2.6	18.6	0.39	0.97	42.1
11	T1	101	0.0	0.451	20.4	LOS B	2.6	18.6	0.39	0.97	42.0
12	R2	6	0.0	0.451	23.8	LOS B	2.6	18.6	0.39	0.97	42.1
Approach		284	0.4	0.451	13.9	LOS A	2.6	18.6	0.39	0.97	42.0
All Vehicles		1315	1.3	0.526	7.8	NA	2.6	18.6	0.38	0.50	44.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
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.

MOVEMENT SUMMARY

Site: 101v [Menangle Road - Station Street - Future 2021 - Sat Peak]

Menangle Road / Station Street
Future 2021 Sat Peak
11:45am - 12:45pm
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Menangle Road											
1	L2	7	0.0	0.181	5.4	LOS A	0.9	6.6	0.32	0.30	47.1
2	T1	144	0.7	0.181	0.7	LOS A	0.9	6.6	0.32	0.30	47.5
3	R2	159	0.0	0.181	5.4	LOS A	0.9	6.6	0.32	0.30	47.1
Approach		311	0.3	0.181	3.2	NA	0.9	6.6	0.32	0.30	47.3
East: Station Street											
4	L2	52	0.0	0.927	36.5	LOS C	11.7	82.0	0.85	1.88	30.6
5	T1	62	0.0	0.927	42.7	LOS D	11.7	82.0	0.85	1.88	30.5
6	R2	216	0.0	0.927	51.5	LOS D	11.7	82.0	0.85	1.88	30.5
Approach		329	0.0	0.927	47.5	LOS D	11.7	82.0	0.85	1.88	30.5
North: Menangle Road											
7	L2	22	0.0	0.224	5.1	LOS A	1.2	8.3	0.26	0.27	47.3
8	T1	197	2.7	0.224	0.4	LOS A	1.2	8.3	0.26	0.27	47.7
9	R2	185	0.0	0.224	5.1	LOS A	1.2	8.3	0.26	0.27	47.2
Approach		404	1.3	0.224	2.8	NA	1.2	8.3	0.26	0.27	47.5
West: Woodbridge Road											
10	L2	122	0.9	0.470	9.7	LOS A	2.8	19.7	0.46	1.01	42.3
11	T1	168	0.0	0.470	15.8	LOS B	2.8	19.7	0.46	1.01	42.2
12	R2	15	0.0	0.470	19.4	LOS B	2.8	19.7	0.46	1.01	42.3
Approach		305	0.3	0.470	13.6	LOS A	2.8	19.7	0.46	1.01	42.2
All Vehicles		1349	0.5	0.927	16.2	NA	11.7	82.0	0.46	0.84	40.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
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.

MOVEMENT SUMMARY

Site: 101vv [Menangle Road - Station Street - Future 2021 - AM Peak - Roundabout]

Menangle Road / Station Street
Future 2021 AM Peak - Single Lane Roundabout
7:30am - 8:30am
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Menangle Road											
1	L2	14	0.0	0.427	5.2	LOS A	2.6	18.8	0.56	0.62	45.7
2	T1	340	2.5	0.427	5.2	LOS A	2.6	18.8	0.56	0.62	46.6
3	R2	58	0.0	0.427	9.2	LOS A	2.6	18.8	0.56	0.62	46.6
Approach		412	2.0	0.427	5.8	LOS A	2.6	18.8	0.56	0.62	46.6
East: Station Street											
4	L2	33	0.0	0.175	4.9	LOS A	1.0	6.7	0.48	0.64	45.2
5	T1	29	0.0	0.175	4.8	LOS A	1.0	6.7	0.48	0.64	46.0
6	R2	105	0.0	0.175	8.9	LOS A	1.0	6.7	0.48	0.64	46.1
Approach		167	0.0	0.175	7.4	LOS A	1.0	6.7	0.48	0.64	45.9
North: Menangle Road											
7	L2	11	10.0	0.231	3.8	LOS A	1.3	9.4	0.32	0.54	45.6
8	T1	121	7.8	0.231	3.8	LOS A	1.3	9.4	0.32	0.54	46.5
9	R2	152	0.7	0.231	7.7	LOS A	1.3	9.4	0.32	0.54	46.6
Approach		283	4.1	0.231	5.9	LOS A	1.3	9.4	0.32	0.54	46.5
West: Woodbridge Road											
10	L2	484	1.7	0.621	8.7	LOS A	5.8	41.3	0.81	0.91	44.4
11	T1	62	0.0	0.621	8.6	LOS A	5.8	41.3	0.81	0.91	45.3
12	R2	4	25.0	0.621	13.6	LOS A	5.8	41.3	0.81	0.91	45.0
Approach		551	1.7	0.621	8.7	LOS A	5.8	41.3	0.81	0.91	44.5
All Vehicles		1413	2.1	0.621	7.1	LOS A	5.8	41.3	0.60	0.72	45.7

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

MOVEMENT SUMMARY

Site: 101vv [Menangle Road - Station Street - Future 2021 - PM Peak - Roundabout]

Menangle Road / Station Street
Future 2021 PM Peak - Single Lane Roundabout
4:30pm - 5:30pm
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Menangle Road											
1	L2	11	0.0	0.293	5.9	LOS A	1.7	11.7	0.61	0.71	45.0
2	T1	136	0.8	0.293	5.9	LOS A	1.7	11.7	0.61	0.71	45.9
3	R2	98	0.0	0.293	9.9	LOS A	1.7	11.7	0.61	0.71	45.9
Approach		244	0.4	0.293	7.5	LOS A	1.7	11.7	0.61	0.71	45.9
East: Station Street											
4	L2	20	0.0	0.188	7.6	LOS A	1.1	8.2	0.73	0.80	43.8
5	T1	28	0.0	0.188	7.6	LOS A	1.1	8.2	0.73	0.80	44.6
6	R2	68	12.3	0.188	12.2	LOS A	1.1	8.2	0.73	0.80	44.5
Approach		117	7.2	0.188	10.3	LOS A	1.1	8.2	0.73	0.80	44.4
North: Menangle Road											
7	L2	25	0.0	0.557	4.6	LOS A	4.3	30.2	0.54	0.61	45.2
8	T1	309	2.0	0.557	4.6	LOS A	4.3	30.2	0.54	0.61	46.1
9	R2	335	0.0	0.557	8.6	LOS A	4.3	30.2	0.54	0.61	46.1
Approach		669	0.9	0.557	6.6	LOS A	4.3	30.2	0.54	0.61	46.1
West: Woodbridge Road											
10	L2	177	0.6	0.272	4.7	LOS A	1.5	10.9	0.50	0.58	46.3
11	T1	101	0.0	0.272	4.7	LOS A	1.5	10.9	0.50	0.58	47.2
12	R2	6	0.0	0.272	8.7	LOS A	1.5	10.9	0.50	0.58	47.3
Approach		284	0.4	0.272	4.8	LOS A	1.5	10.9	0.50	0.58	46.6
All Vehicles		1315	1.3	0.557	6.7	LOS A	4.3	30.2	0.56	0.64	46.0

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

MOVEMENT SUMMARY

Site: 101vv [Menangle Road - Station Street - Future 2021 - Sat Peak - Roundabout]

Menangle Road / Station Street
Future 2021 Saturday Peak - Single Lane Roundabout
11:45am - 12:45pm
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Menangle Road											
1	L2	7	0.0	0.381	6.4	LOS A	2.3	16.2	0.66	0.76	44.6
2	T1	144	0.7	0.381	6.3	LOS A	2.3	16.2	0.66	0.76	45.5
3	R2	159	0.0	0.381	10.4	LOS A	2.3	16.2	0.66	0.76	45.5
Approach		311	0.3	0.381	8.4	LOS A	2.3	16.2	0.66	0.76	45.5
East: Station Street											
4	L2	52	0.0	0.392	6.2	LOS A	2.6	18.2	0.68	0.76	44.4
5	T1	62	0.0	0.392	6.1	LOS A	2.6	18.2	0.68	0.76	45.3
6	R2	216	0.0	0.392	10.2	LOS A	2.6	18.2	0.68	0.76	45.3
Approach		329	0.0	0.392	8.8	LOS A	2.6	18.2	0.68	0.76	45.2
North: Menangle Road											
7	L2	22	0.0	0.397	5.2	LOS A	2.5	17.6	0.58	0.67	45.1
8	T1	197	2.1	0.397	5.2	LOS A	2.5	17.6	0.58	0.67	46.0
9	R2	185	0.0	0.397	9.2	LOS A	2.5	17.6	0.58	0.67	46.1
Approach		404	1.0	0.397	7.0	LOS A	2.5	17.6	0.58	0.67	46.0
West: Woodbridge Road											
10	L2	122	0.9	0.342	6.1	LOS A	2.1	14.5	0.66	0.71	45.6
11	T1	168	0.0	0.342	6.1	LOS A	2.1	14.5	0.66	0.71	46.5
12	R2	15	0.0	0.342	10.1	LOS A	2.1	14.5	0.66	0.71	46.6
Approach		305	0.3	0.342	6.3	LOS A	2.1	14.5	0.66	0.71	46.2
All Vehicles		1349	0.5	0.397	7.6	LOS A	2.6	18.2	0.64	0.72	45.7

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

MOVEMENT SUMMARY

Site: 101v [Menangle Road - Station Street - Future 2032 - AM Peak]

Menangle Road / Station Street
Future 2032 AM Peak - Priority Controlled
7:30am - 8:30am
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Menangle Road											
1	L2	17	0.0	0.257	5.3	LOS A	0.6	4.5	0.12	0.09	48.6
2	T1	422	2.2	0.257	0.2	LOS A	0.6	4.5	0.12	0.09	49.1
3	R2	69	0.0	0.257	5.3	LOS A	0.6	4.5	0.12	0.09	48.6
Approach		508	1.9	0.257	1.0	NA	0.6	4.5	0.12	0.09	49.0
East: Station Street											
4	L2	77	0.0	2.123	1032.3	LOS F	115.9	811.3	1.00	6.02	3.2
5	T1	44	0.0	2.123	1036.7	LOS F	115.9	811.3	1.00	6.02	3.2
6	R2	202	0.0	2.123	1054.1	LOS F	115.9	811.3	1.00	6.02	3.2
Approach		323	0.0	2.123	1046.5	LOS F	115.9	811.3	1.00	6.02	3.2
North: Menangle Road											
7	L2	36	11.8	0.250	6.7	LOS A	1.4	10.5	0.51	0.38	46.3
8	T1	145	8.0	0.250	1.7	LOS A	1.4	10.5	0.51	0.38	46.9
9	R2	184	0.6	0.250	6.7	LOS A	1.4	10.5	0.51	0.38	46.4
Approach		365	4.6	0.250	4.7	NA	1.4	10.5	0.51	0.38	46.6
West: Woodbridge Road											
10	L2	602	1.6	0.864	20.6	LOS B	14.7	104.1	0.83	1.74	38.9
11	T1	66	0.0	0.864	31.8	LOS C	14.7	104.1	0.83	1.74	38.8
12	R2	5	20.0	0.864	46.8	LOS D	14.7	104.1	0.83	1.74	38.7
Approach		674	1.6	0.864	21.9	LOS B	14.7	104.1	0.83	1.74	38.9
All Vehicles		1871	2.0	2.123	189.9	NA	115.9	811.3	0.60	1.77	13.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
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.

MOVEMENT SUMMARY

Site: 101v [Menangle Road - Station Street - Future 2032 - PM Peak]

Menangle Road / Station Street
Future 2032 PM Peak - Priority Controlled
4:30pm - 5:30pm
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Menangle Road											
1	L2	13	0.0	0.218	6.9	LOS A	1.2	8.5	0.49	0.32	46.8
2	T1	168	0.6	0.218	1.8	LOS A	1.2	8.5	0.49	0.32	47.2
3	R2	140	0.0	0.218	6.9	LOS A	1.2	8.5	0.49	0.32	46.8
Approach		321	0.3	0.218	4.2	NA	1.2	8.5	0.49	0.32	47.0
East: Station Street											
4	L2	39	0.0	1.641	611.0	LOS F	51.0	379.6	1.00	4.42	5.1
5	T1	37	0.0	1.641	621.5	LOS F	51.0	379.6	1.00	4.42	5.1
6	R2	107	12.7	1.641	642.9	LOS F	51.0	379.6	1.00	4.42	5.1
Approach		183	7.5	1.641	631.8	LOS F	51.0	379.6	1.00	4.42	5.1
North: Menangle Road											
7	L2	119	0.0	0.514	5.7	LOS A	4.2	29.6	0.40	0.31	46.8
8	T1	381	1.9	0.514	0.9	LOS A	4.2	29.6	0.40	0.31	47.2
9	R2	414	0.0	0.514	5.8	LOS A	4.2	29.6	0.40	0.31	46.7
Approach		914	0.8	0.514	3.7	NA	4.2	29.6	0.40	0.31	46.9
West: Woodbridge Road											
10	L2	220	0.5	0.869	34.6	LOS C	11.7	82.2	0.55	1.56	31.4
11	T1	114	0.0	0.869	60.6	LOS E	11.7	82.2	0.55	1.56	31.3
12	R2	8	0.0	0.869	61.6	LOS E	11.7	82.2	0.55	1.56	31.4
Approach		342	0.3	0.869	43.9	LOS D	11.7	82.2	0.55	1.56	31.3
All Vehicles		1760	1.3	1.641	77.0	NA	51.0	379.6	0.51	0.98	24.0

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

MOVEMENT SUMMARY

Site: 101v [Menangle Road - Station Street - Future 2032 - Sat Peak]

Menangle Road / Station Street
Future 2032 Sat Peak
11:45am - 12:45pm
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Menangle Road											
1	L2	9	0.0	0.213	5.7	LOS A	1.1	7.9	0.37	0.29	47.1
2	T1	179	0.6	0.213	0.9	LOS A	1.1	7.9	0.37	0.29	47.5
3	R2	168	0.0	0.213	5.7	LOS A	1.1	7.9	0.37	0.29	47.1
Approach		357	0.3	0.213	3.3	NA	1.1	7.9	0.37	0.29	47.3
East: Station Street											
4	L2	58	0.0	1.355	341.7	LOS F	70.5	493.6	1.00	5.30	8.5
5	T1	80	0.0	1.355	348.2	LOS F	70.5	493.6	1.00	5.30	8.5
6	R2	239	0.0	1.355	357.8	LOS F	70.5	493.6	1.00	5.30	8.5
Approach		377	0.0	1.355	353.3	LOS F	70.5	493.6	1.00	5.30	8.5
North: Menangle Road											
7	L2	46	0.0	0.277	5.3	LOS A	1.5	10.9	0.31	0.28	47.1
8	T1	232	2.3	0.277	0.6	LOS A	1.5	10.9	0.31	0.28	47.6
9	R2	216	0.0	0.277	5.4	LOS A	1.5	10.9	0.31	0.28	47.1
Approach		494	1.1	0.277	3.1	NA	1.5	10.9	0.31	0.28	47.3
West: Woodbridge Road											
10	L2	152	0.7	0.635	12.5	LOS A	4.7	33.3	0.55	1.13	40.3
11	T1	184	0.0	0.635	21.6	LOS B	4.7	33.3	0.55	1.13	40.3
12	R2	18	0.0	0.635	26.3	LOS B	4.7	33.3	0.55	1.13	40.3
Approach		354	0.3	0.635	17.9	LOS B	4.7	33.3	0.55	1.13	40.3
All Vehicles		1581	0.5	1.355	89.9	NA	70.5	493.6	0.54	1.67	22.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
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.

MOVEMENT SUMMARY

Site: 101vv [Menangle Road - Station Street - Future 2032 - AM Peak - Roundabout]

Menangle Road / Station Street
Future 2032 AM Peak - Single Lane Roundabout
7:30am - 8:30am
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Menangle Road											
1	L2	17	0.0	0.607	8.4	LOS A	5.3	37.9	0.77	0.86	44.4
2	T1	422	2.2	0.607	8.4	LOS A	5.3	37.9	0.77	0.86	45.2
3	R2	69	0.0	0.607	12.4	LOS A	5.3	37.9	0.77	0.86	45.3
Approach		508	1.9	0.607	9.0	LOS A	5.3	37.9	0.77	0.86	45.2
East: Station Street											
4	L2	77	0.0	0.358	5.7	LOS A	2.3	15.8	0.61	0.71	44.8
5	T1	44	0.0	0.358	5.6	LOS A	2.3	15.8	0.61	0.71	45.6
6	R2	202	0.0	0.358	9.7	LOS A	2.3	15.8	0.61	0.71	45.7
Approach		323	0.0	0.358	8.2	LOS A	2.3	15.8	0.61	0.71	45.4
North: Menangle Road											
7	L2	36	11.8	0.301	4.0	LOS A	1.8	13.4	0.37	0.55	45.5
8	T1	145	8.0	0.301	3.9	LOS A	1.8	13.4	0.37	0.55	46.5
9	R2	184	0.6	0.301	7.9	LOS A	1.8	13.4	0.37	0.55	46.5
Approach		365	4.6	0.301	5.9	LOS A	1.8	13.4	0.37	0.55	46.4
West: Woodbridge Road											
10	L2	602	1.6	0.924	31.5	LOS C	21.2	150.1	1.00	1.69	34.8
11	T1	66	0.0	0.924	31.4	LOS C	21.2	150.1	1.00	1.69	35.3
12	R2	5	20.0	0.924	36.6	LOS C	21.2	150.1	1.00	1.69	35.2
Approach		674	1.6	0.924	31.5	LOS C	21.2	150.1	1.00	1.69	34.8
All Vehicles		1871	2.0	0.924	16.4	LOS B	21.2	150.1	0.75	1.07	41.1

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

MOVEMENT SUMMARY

Site: 101vv [Menangle Road - Station Street - Future 2032 - PM Peak - Roundabout]

Menangle Road / Station Street
Future 2032 PM Peak - Single Lane Roundabout
4:30pm - 5:30pm
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Menangle Road											
1	L2	11	0.0	0.293	5.9	LOS A	1.7	11.7	0.61	0.71	45.0
2	T1	136	0.8	0.293	5.9	LOS A	1.7	11.7	0.61	0.71	45.9
3	R2	98	0.0	0.293	9.9	LOS A	1.7	11.7	0.61	0.71	45.9
Approach		244	0.4	0.293	7.5	LOS A	1.7	11.7	0.61	0.71	45.9
East: Station Street											
4	L2	20	0.0	0.188	7.6	LOS A	1.1	8.2	0.73	0.80	43.8
5	T1	28	0.0	0.188	7.6	LOS A	1.1	8.2	0.73	0.80	44.6
6	R2	68	12.3	0.188	12.2	LOS A	1.1	8.2	0.73	0.80	44.5
Approach		117	7.2	0.188	10.3	LOS A	1.1	8.2	0.73	0.80	44.4
North: Menangle Road											
7	L2	25	0.0	0.557	4.6	LOS A	4.3	30.2	0.54	0.61	45.2
8	T1	309	2.0	0.557	4.6	LOS A	4.3	30.2	0.54	0.61	46.1
9	R2	335	0.0	0.557	8.6	LOS A	4.3	30.2	0.54	0.61	46.1
Approach		669	0.9	0.557	6.6	LOS A	4.3	30.2	0.54	0.61	46.1
West: Woodbridge Road											
10	L2	177	0.6	0.272	4.7	LOS A	1.5	10.9	0.50	0.58	46.3
11	T1	101	0.0	0.272	4.7	LOS A	1.5	10.9	0.50	0.58	47.2
12	R2	6	0.0	0.272	8.7	LOS A	1.5	10.9	0.50	0.58	47.3
Approach		284	0.4	0.272	4.8	LOS A	1.5	10.9	0.50	0.58	46.6
All Vehicles		1315	1.3	0.557	6.7	LOS A	4.3	30.2	0.56	0.64	46.0

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

MOVEMENT SUMMARY

Site: 101vv [Menangle Road - Station Street - Future 2032 - Sat Peak - Roundabout]

Menangle Road / Station Street
Future 2032 Sat Peak - Single Lane Roundabout
11:45am - 12:45pm
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Menangle Road											
1	L2	9	0.0	0.470	7.7	LOS A	3.3	23.1	0.75	0.86	44.0
2	T1	179	0.6	0.470	7.7	LOS A	3.3	23.1	0.75	0.86	44.9
3	R2	168	0.0	0.470	11.8	LOS A	3.3	23.1	0.75	0.86	44.9
Approach		357	0.3	0.470	9.6	LOS A	3.3	23.1	0.75	0.86	44.9
East: Station Street											
4	L2	58	0.0	0.483	7.5	LOS A	3.7	25.6	0.77	0.85	43.9
5	T1	80	0.0	0.483	7.5	LOS A	3.7	25.6	0.77	0.85	44.7
6	R2	239	0.0	0.483	11.5	LOS A	3.7	25.6	0.77	0.85	44.7
Approach		377	0.0	0.483	10.0	LOS A	3.7	25.6	0.77	0.85	44.6
North: Menangle Road											
7	L2	46	0.0	0.496	5.7	LOS A	3.5	24.4	0.66	0.71	44.9
8	T1	232	2.3	0.496	5.7	LOS A	3.5	24.4	0.66	0.71	45.8
9	R2	216	0.0	0.496	9.7	LOS A	3.5	24.4	0.66	0.71	45.9
Approach		494	1.1	0.496	7.4	LOS A	3.5	24.4	0.66	0.71	45.8
West: Woodbridge Road											
10	L2	152	0.7	0.423	6.9	LOS A	2.8	19.7	0.74	0.78	45.3
11	T1	184	0.0	0.423	6.9	LOS A	2.8	19.7	0.74	0.78	46.2
12	R2	18	0.0	0.423	10.9	LOS A	2.8	19.7	0.74	0.78	46.2
Approach		354	0.3	0.423	7.1	LOS A	2.8	19.7	0.74	0.78	45.8
All Vehicles		1581	0.5	0.496	8.5	LOS A	3.7	25.6	0.72	0.79	45.3

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

Appendix E Concepts of Intersection Delay and Level of Service

Concepts of Carriageway Capacity and Level of Service

The capacity of major streets within an urban area can be based on an assessment of their operating Level of Service.

Level of service is defined within Austroads' *Guide to Traffic Management Part 3: Traffic Studies and Analysis* as:

'... a qualitative measure describing operational conditions within a traffic stream, and their perception by motorists and/or passengers. A level of service definition generally describes these conditions in terms of factors such as speed and travel time, freedom to manoeuvre, traffic interruptions, comfort and convenience, and safety.'

Levels of service (LoS) are designated from 'A' to 'F' from best (free flow conditions) to worst (forced flow with stop start operation, long queues and delays) as follows:

LEVELS OF SERVICE

A - Free flow (almost no delays)

B - Stable flow (slight delays)

C - Stable flow (acceptable delays)

D - Approaching unstable flow (tolerable delays)

E - Unstable flow (congestion; intolerable delays), and

F - Forced flow (jammed)

A service volume, as defined by Austroads, is the maximum number of vehicles that can pass over a given section of roadway in one direction during one hour while operating conditions are maintained at a specified level of service. It is suggested that ideally arterial and sub-arterial roads should not exceed service volumes at LoS 'C'. At this level, whilst most drivers are restricted in their freedom to manoeuvre, operating speeds are still reasonable and acceptable delays experienced. However, in urban situations, arterial and sub-arterial roads operating at LoS 'D' are still considered adequate. Traffic volumes along urban roads with interrupted and uninterrupted flow conditions are included in **Table E1** and **Table E2** respectively.

Table E1: Level of Service of Interrupted Flow Conditions along Urban Roads (One Way Hourly Volumes)

Reference	Description	Level of Service					
		A	B	C	D	E	F
2U	2 Lane Undivided	540	630	720	810	900	-
4UP	4 Lane Undivided with two parking lanes	540	630	720	810	900	-
4U	4 Lane Undivided with some parking	900	1050	1200	1350	1500	-
4UC	4 Lane Undivided with clearways	1080	1260	1440	1620	1800	-
4D	4 Lane Divided with clearways	1140	1330	1520	1710	1900	-
6U	6 Lane Undivided	1440	1680	1920	2160	2400	-
6D	6 Lane Divided with clearways	1740	2030	2320	2610	2900	-

Table E2: Level of Service of Uninterrupted Flow Conditions along Urban Roads (One Way Hourly Volumes)

Reference	Description	Level of Service					
		A	B	C	D	E	F
2U	2 Lane Undivided	760	880	1000	1130	1260	-
4UP	4 Lane Undivided with two parking lanes	1260	1470	1680	1890	2100	-
4U	4 Lane Undivided with some parking	1510	1760	2010	2270	2520	-
4UC	4 Lane Undivided with clearways	1600	1860	2130	2400	2660	-
4D	4 Lane Divided with clearways	2250	2620	3000	3380	3740	-
6U	6 Lane Undivided	2440	2840	3250	3660	4060	-
6D	6 Lane Divided with clearways	760	880	1000	1130	1260	-

Guidelines for Evaluation of Intersection Operation

The *RTA Guide to Traffic Generating Developments (October 2002, Issue 2.2)*, details the assessment of intersections. The assessment of the level of service of an intersection is based on the evaluation of the following Measures of Effectiveness:

(a) Average delay (seconds/veh) (all forms of control)

(b) Delay to critical movement (seconds/veh) (all forms of control)

(c) Degree of saturation (traffic signals and roundabouts)

(d) Cycle length (traffic signals)

SIDRA was used to calculate the relevant intersection parameters. The SIDRA software is an advanced lane-based micro-analytical tool for design and evaluation of individual intersections and networks of intersections including modelling of separate movement classes (light vehicles, heavy vehicles, buses, cyclists, large trucks, light rail / trams and so on). It provides estimates of capacity, level of service and a wide range of performance measures, including; delay, queue length and stops for vehicles and pedestrians, as well as fuel consumption, pollution emissions and operating costs.

It can be used to analyse signalised intersections (fixed-time / pretimed and actuated), signalised and unsignalised pedestrian crossings, roundabouts (unsignalised), roundabouts with metering signals, fully-signalised roundabouts, two-way stop sign and give-way / yield sign control, all-way stop sign control, single point interchanges (signalised), freeway diamond interchanges (signalised, roundabout, sign control), diverging diamond interchanges and other alternative intersections and interchanges. It can also be used for uninterrupted traffic flow conditions and merge analysis.

The best indicator of the level of service at an intersection is the average delay experienced by vehicles at that intersection. For traffic signals, the average delay over all movements should be taken. For roundabouts and priority control intersections (with Stop and Give Way signs or operating under the T-junction rule) the critical movement for level of service assessment should be that with the highest average delay.

With traffic signals, delays per approach tend to be equalised, subject to any over-riding requirements of signal co-ordination as well as to variations within individual movements. With roundabouts and priority - control intersections, the critical criterion for assessment is the movement with the highest delay per vehicle. With this type of control the volume balance might be such that some movements suffer high levels of delay while other movements have minimal delay. An overall average delay for the intersection of 25 seconds might not be satisfactory if the average delay on one movement is 60 seconds.

The average delay for LoS 'E' should be no more than 70 seconds. The accepted maximum practical cycle length for traffic signals under saturated conditions is 120 - 140 seconds. Under these conditions 120 seconds is near maximum for two and three phase intersections and 140 seconds near maximum for more complex phase designs. Drivers and pedestrians expect cycle lengths of these magnitudes and their inherent delays in peak hours. A cycle length of 140 seconds for an intersection which is almost saturated has an average vehicle delay of about 70 seconds, although this can vary. If the average vehicle delay is more than 70 seconds, the intersection is assumed to be at LoS 'F'.

Table E3 sets out average delays for different levels of service. There is no consistent correlation between definitions of levels of service for road links as defined elsewhere in this section, and the ranges set out in Table E3. In assigning a level of service, the average delay to the motoring public needs to be considered, keeping in mind the location of the intersection. For example, drivers in inner urban areas of Sydney have a higher tolerance of delay than drivers in country areas. Table E3 provides a recommended baseline for assessment.

Table E3: Level of Service Criteria for Intersections

Level of Service	Average Delay per Vehicle (sec/veh)	Traffic Signals	Priority Controlled
A	0 < x < 14	Good operation	Good operation
B	14 < x < 28	Good with acceptable delays and spare capacity	Acceptable delays and spare capacity
C	28 < x < 42	Satisfactory	Satisfactory, but crash history study required
D	42 < x < 56	Operating near capacity	Operating near capacity and crash history study required
E	56 < x	At capacity, incidents will cause excessive delays	At capacity, requires other control mode

The figures in Table E3 are intended as a guide only. Any particular assessment should take into account site-specific factors including maximum queue lengths (and their effect on lane blocking), the influence of nearby intersections and the sensitivity of the location to delays. In many situations, a comparison of the current and future average delay provides a better appreciation of the impact of a proposal, and not simply the change in the level of service.

The intersection degree of saturation (DoS) can also be used to measure the performance of isolated intersections. The DoS value can be determined by computer based assessment programs. At intersections controlled by traffic signals, both queue length and delays increase rapidly as DoS approaches 1.0. An upper limit of 0.900 is appropriate, however when DoS exceeds 0.850, overflow queues start to become a problem. Satisfactory intersection operation is generally achieved with a DoS of about 0.700 - 0.800. (Note that these figures are based on isolated signalised intersections with cycle lengths of 120 seconds. In co-ordinated signal systems DoS might be actively maximised at key intersections).

Although in some situations additional traffic does not alter the level of service, particularly where the level of service is 'E' or 'F', additional capacity may still be required. This is particularly appropriate for LoS 'F', where small increases in flow can cause disproportionately greater increases in delay. In this situation, it is advisable to consider means of control to maintain the existing level of absolute delay. Suggested criteria for the evaluation of the capacity of signalised intersections based on the DoS are summarised below in **Table E4**.

Table E4: Criteria for Evaluating Capacity of Signalised Intersections

Level of Service	Optimum Cycle Length (seconds)	Movement Degree of Saturation (DoS)	Intersection Degree of Saturation (DoS)
A – Very good	< 90	< 0.70	< 0.70
B – Good	< 90	< 0.70	< 0.70
C – Satisfactory	90 – 120	0.70 – 0.80	0.70 – 0.85
D - Poor	120 – 140	0.80 – 0.85	0.85 – 0.90
E/F – Extra capacity required	> 140	> 0.85	> 0.90

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