URBIS

TRAFFIC IMPACT ASSESSMENT – MATER MARIA COLLEGE, WARRIEWOOD

Prepared for

CATHOLIC SCHOOLS OFFICE, DIOCESE OF BROKEN BAY

7 September 2021

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1. INTRODUCTION

1.1. PURPOSE

This Traffic Impact Assessment (TIA) has been prepared by Urbis on behalf of the Catholic Schools Office (Diocese of Broken Bay). The TIA accompanies a Development Application (DA) to increase the approved student cap for Mater Maria College, Warriewood (the College).

This report is structured into the following sections:

- **Section 2** describes the site and existing transport conditions in the locality;
- **Section 3** assesses the parking demand and statutory requirements for the proposal;
- **Section 4** provides an estimate of the peak period traffic impact anticipated to be generated by the proposal onto the surrounding local road network; and
- **Section 5** provides a summary and conclusions of the TIA.

1.2. PROPOSAL OVERVIEW

The existing consent permits a maximum enrolment capacity of 850 students. The College is currently operating above this cap, with approximately 1,040 student enrolments. It is therefore proposed to increase the enrolment capacity to 1,100 students to meet the needs of the locality.

No physical works are required.

1.3. BACKGROUND AND KEY ISSUES

The proposed student increase was previously proposed in an application to modify the original development consent. Council requested this modification application be withdrawn based on statutory planning matters and traffic matters, detailed in a letter dated 16 September 2019. A summary of the traffic matters is as follows:

- The traffic data is outdated and fails to consider additional traffic resulting from recent local development.
- The impact assessment is limited to Forest Road (school entrance) and fails to consider the impact of cars diverted to other local streets when access is blocked during peak times, including the secondary pedestrian access on Angophora Circuit.
- The traffic assessment fails to consider the impact of student parking (observed dominance of red p-plates during school hours).

Following this advice, the proponent attended a pre-lodgement meeting with Council on 21st July 2020 to understand these issues further. The comments from Council's Traffic Engineer are as follows:

- *The applicant is seeking approval to increase the school student limit from 850 to 1,100.*
- *The applicant will be required to submit a Traffic Impact Assessment that demonstrates that the increase in student numbers will not have a negative impact on the surrounding local traffic network.*
- *Further, the applicant will need to ensure that the number of parking spaces required by the increase in student population can and will be accommodated wholly within the site.*
- *The submission should also include a 'Dropoff/pick-up management plan' to be adopted by the school at all times during morning and afternoon pick-up/drop-off periods.*
- *All assumptions in terms of parking and traffic generation must be in accordance with Council's DCP and the RMS Guide To Traffic Generating Developments.*
- *All assessments should take into account the currently approved development and proposed development, not the existing scenario.*
- *The development will be required to provide an evacuation plan that demonstrates the school can control egress from the site through the Garden Street or Macpherson Street. This will be included as an operational condition of the future consent.*

The need for this is generated to prevent the development trying to evacuate to the north in the event of a Bushfire emergency and impacting on the network at the Ponderosa and Mona Vale Road intersection.

The Evacuation plan would detail how this is to occur and what measures they would be able to put in place to manage a self-evacuation of the campus. I am putting the onus on the School to develop this as not to be onerous in the first instance and this would allow Council to use a simple submit and approve condition operationally.

These matters are directly addressed in this report to satisfy Council that there will not be unacceptable traffic or parking impacts on the locality.

2. EXISTING CONDITIONS

2.1. THE COLLEGE SITE

The site is located at 5 Forest Road, Warriewood and is legally described as Lot 13 in DP 1083731. It is located on the lower Warriewood Escarpment at the western end of the Warriewood Valley, and has an area of approximately 51,500 sqm.

The site currently comprises ten buildings including administration, classrooms, a lecture theatre, a gymnasium, and a library. Construction has commenced for the new multi-use building approved as part of the most recent modification (N1038/00/2).

2.2. LOCAL ROAD NETWORK

Vehicle access to the school is primarily via Forest Road where the car park entrance, formal drop off area and main pedestrian entrance are located.

The two key intersections used to access the school are the two roundabouts on Casuarina Drive (Forest Road/Casuarina Drive/Macpherson Street and Angophora Circuit/Casuarina Drive/Callistemon Way).

Figure 1 shows an aerial image of the site and the local road network.

Figure 1 – Site and Locality

Source: Nearmap

2.3. PUBLIC TRANSPORT

There are limited public bus connections between the school and local areas. However, there are many school services in the morning and afternoon peak periods providing access for north (Avalon), south (Manly) and east (Terrey Hills) residing students.

Table – Local Public Transport Services

Service	Coverage	Location	Walking Distance	Frequency	
				AM	PM
182	Mona Vale - Narrabeen	30 Macpherson Street	400 metres	60 min	60 min
185	Mona Vale – Warringah Mall via Warriewood	163 Macpherson Street	800 metres	30 min	30 min

Source: Transport for NSW, 2020, via Google Maps

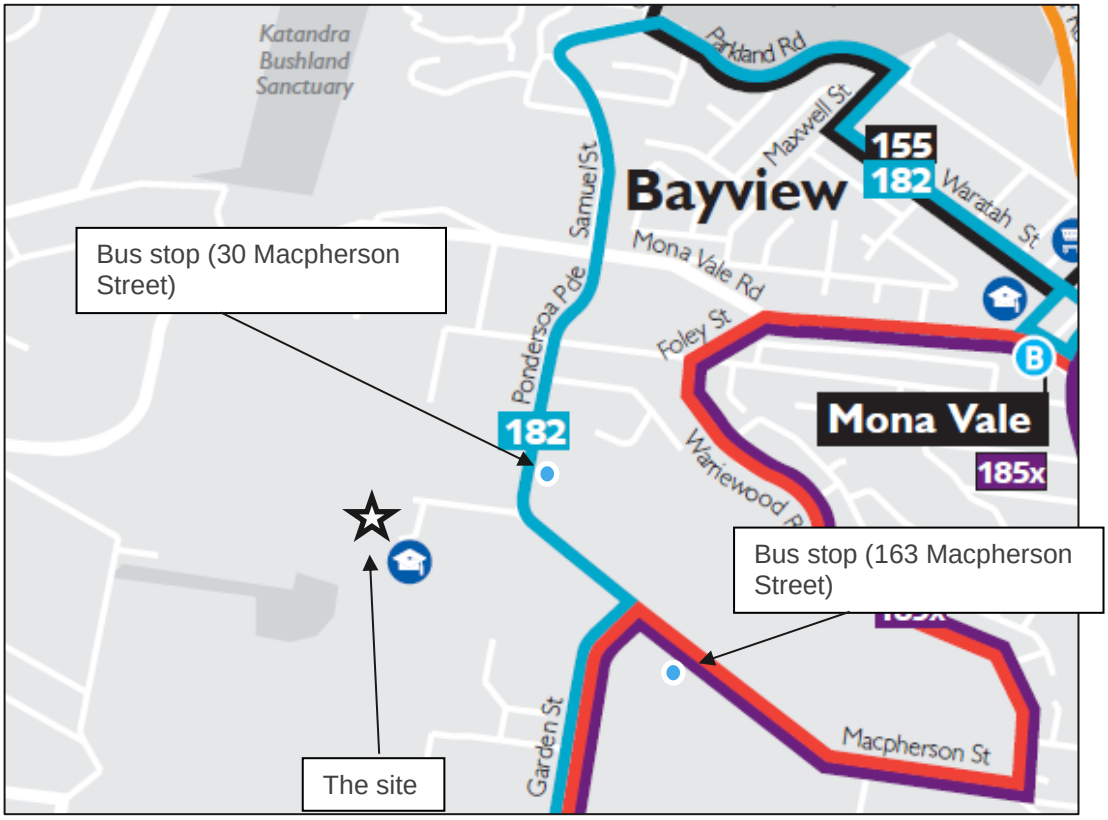
Table 1 – School Bus Services

Service	Coverage	Service	
		AM	PM
103	Forestway Shopping Centre to Mater Maria	X	
162	Terrey Hills to Sacred Heart PS via North Narrabeen	X	
224	Mater Maria to Mona Vale Road		X
248	Narrabeen Sports HS to Frenchs Forest PS		X
630	North Narrabeen Public School to Mater Maria		X[1]
632	Pittwater HS to Collaroy		X
633	Pittwater HS to Mater Maria		X[1]
635	Cromer Heights to Sacred Heart PS	X	
636	Warringah Mall to Pittwater HS	X	
637	Beacon Hill to Pittwater HS	X	
641	Mater Maria to Collaroy Plateau		X
642	Mater Maria to Manly Wharf		X
643	Mona Vale Primary to Narrabeen Park Parade (Warriewood)	X	X
645	Mater Maria to McCarrs Creek	X	
646	Mater Maria to Sacred Heart School (Mona Vale)	X	

647	Cromer HS to Mater Maria	X	
648	Avalon to Mater Maria	X	X[1]
649	Pittwater HS to Beacon Hill		X
650	Mater Maria to Sacred Heart School (Mona Vale)		X
651	Mater Maria to Palm Beach		X
664	Mater Maria to Avalon	X	X
742	Careel Head Road (Avalon) to Narrabeen Public School	X	

Source: Transport for NSW, 2020 *Note: X[1] = bus terminates at Mater Maria College in the PM.*

Figure 2 – Bus Network Map



Source: Transport for NSW

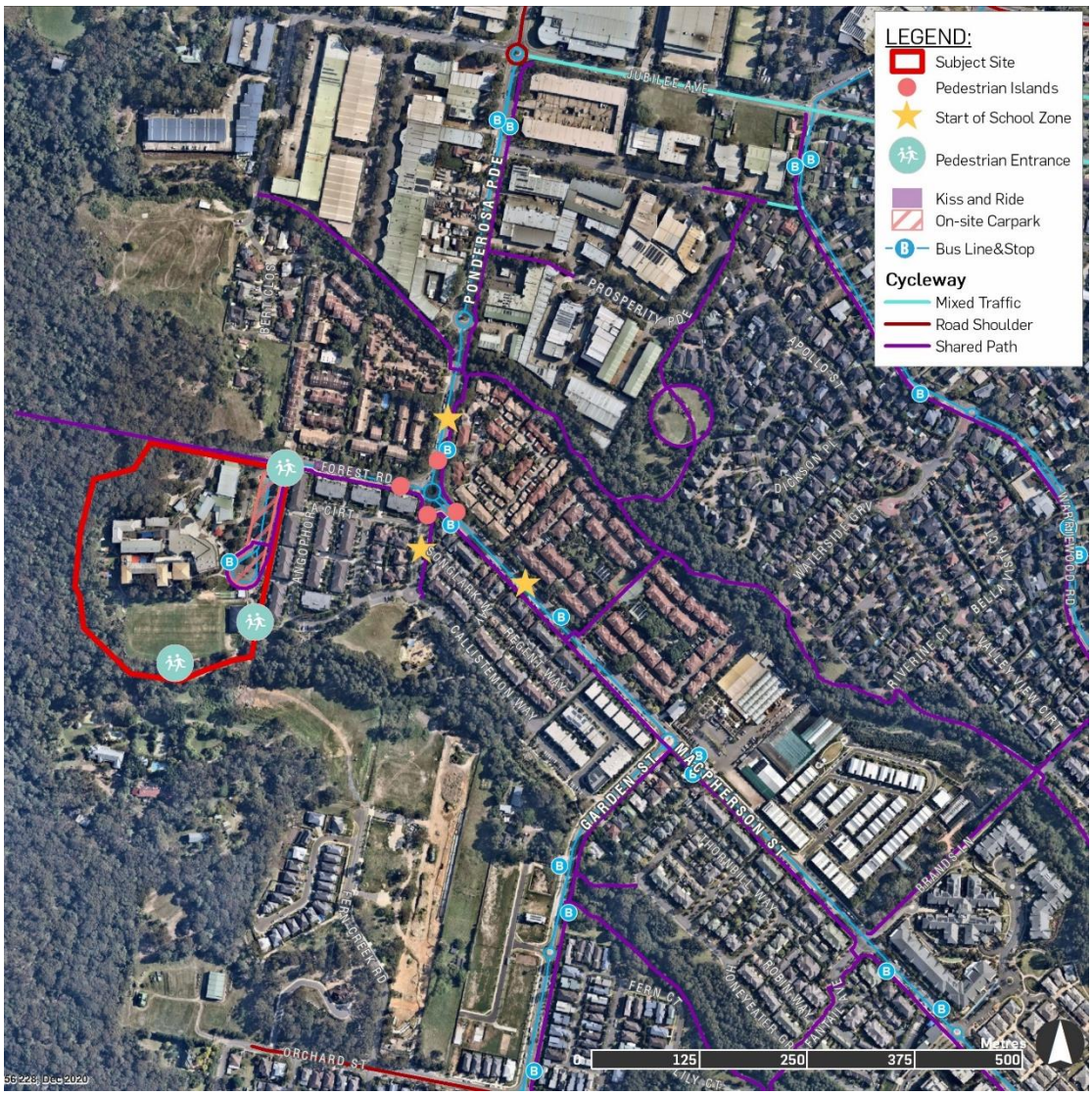
2.4. ACTIVE TRANSPORT

The local road network (including Forrest Road, Macpherson Street and Casuarina Drive) provides shared footpaths on both sides of the road. Pedestrian islands are available in all directions at the roundabout at the Forest Road and Casuarina Drive intersection. This facilitates safe pedestrian access to the school from the surrounding residential areas and bus stops.

A more detailed analysis of active transport travel options is provided in the Green Travel Plan provided with this application.

Figure 3 shows active travel infrastructure around the site.

Figure 3 – Active Travel Network



3. PARKING ASSESSMENT

3.1. CAR PARKING PROVISION REQUIREMENTS

The College is in the amalgamated Northern Beaches Local Government Area (LGA), with parking requirements to be drawn from the former Pittwater Council's Development Control Plan (DCP) 2014 until new documents are generated by Council.

The statutory car parking provision requirements for 'schools' and 'educational establishments' are not listed under Pittwater Council's DCP 2014. However, the objectives for off-street parking remain relevant and should be considered.

Statutory requirements will therefore be guided by the Roads and Maritime Services (RMS)*Trip Generations Surveys, Schools Analysis Report* 2014.

3.1.1. DCP Objectives

The following are 'outcomes' for off-street vehicle parking requirements in the DCP:

- *An adequate number of parking and service spaces that meets the demands generated by the development.*
- *Functional parking that minimises rainwater runoff and adverse visual or environmental impacts while maximising pedestrian and vehicle safety.*
- *Safe and convenient parking.*

These outcomes have been considered in this assessment to meet the objectives of the DCP and determine the appropriate car parking requirement.

3.1.2. RMS Trip Generation Surveys

The RMS *Trip Generations Surveys, Schools Analysis Report* 2014 is a comprehensive study of trip generation and parking rates for schools. It is informed by extensive surveys, making it an appropriate tool to benchmark the College against other schools.

Section 4.7 of the RMS Report provides parking demand rates per student and staff per student. These two rates were generally found to be similar. The peak parking demand per student is provided below, which will be used to assess the parking requirements for the College.

Table 2 – Peak Parking Demand Per Student

School Type	Average	Minimum	Maximum
All	0.10	0.03	0.21
Primary	0.10	0.03	0.21
Secondary	0.11	0.06	0.21

Source: RMS Trip Generations Surveys, Schools Analysis Report 2014

3.2. EXISTING PARKING DEMAND

Parking demand surveys were undertaken in the surrounding areas at 9:30-10:30am and 1:00-2:00pm on Tuesday 11th August 2020. This timeframe was chosen to capture parking activity during school hours.

Figure 4 provides a map of the on-street and off-street parking areas surrounding the site.

Findings of the surveys are provided in Sections 3.2.1 and 3.2.2. Assumptions are as follows:

- Vehicles observed in the on-site car spaces were staff, except for the visitor spaces, time restricted spaces and the bus bay. The five disabled spaces on-site were included in staff parking numbers.
- Staff parking was on-site only, and no staff vehicles were parked on the street.
- Vehicles observed in surrounding streets with p-plates were students. All other vehicles on-street were residents or other travellers non-school related.

Figure 4 – Warriewood Parking Survey Reference Map

Source: Matrix

3.2.1. On-Street Parking Demand

The full results of this survey are provided in **Appendix A** and have been summarised in **Table 4**.

Key findings of the survey are as follows:

- There are 174 on-street parking spaces available on Forest Road, Casuarina Drive, Callistemon Way and Angophora Circuit.
- Most spaces (84%) have no time restrictions. Of the 28 spaces with time restrictions, 27 are restricted to four hours and one is restricted to one hour. This is potentially an attractor for students to use personal vehicles to access the school.
- There was similar occupancy of spaces observed in the morning and afternoon.

- Cars with P-Plates were observed only on Angophora Circuit and Casuarina Drive, where there is a secondary pedestrian access to the school.
- Most cars with P-Plates were observed in Angophora Circuit between Casuarina Drive and the school, using 50% of the available parking. Notwithstanding, Angophora Circuit has 15% capacity remaining to accommodate local parking for residents.

Table 3 – On Street Parking Survey

Road	Restriction	Restriction Hours	Supply	9:30-10:30AM		1:00-2:00PM	
				All Vehicles	Red P Plates	All Vehicles	Red P Plates
Forest Rd	No Restriction	–	24	16	0	14	0
No. of Cars			24	16	0	14	0
Capacity Used (%)			–	53%	0%	47%	0%
Casuarina Drive	No Restriction	–	7	7	2	7	2
No. of Cars			7	7	2	7	2
Capacity Used (%)			–	100%	29%	100%	29%
Callistemon Way	No Restriction	–	23	10	0	11	0
	4P	9am-5pm (every day)	17	15	0	4	0
No. of Cars			40	25	0	15	0
Capacity Used (%)			–	63%	0%	38%	0%
Angophora Circuit	No Restriction	–	92	78	37	77	39
	4P	9am-5pm (every day)	10	8	3	8	5
	1P	7am-5pm (Monday to Friday)	1	0	0	1	0
No. of Cars			103	86	40	86	44
Capacity Used (%)			–	83%	39%	83%	43%
Total No. of Cars			174	134	42	122	46
Total Capacity Used (%)			–	77%	24%	70%	26%

3.2.2. Off-Street Parking Demand

The full results of this survey are provided in **Appendix A** and have been summarised in **Table 5**.

Key findings of the survey are as follows:

- The on-site school car park consists of 97 spaces, with 91 of these available to staff ('no restriction' and 'disabled' spaces).
- The car park is not available to students. Only one car with P-Plates was in a disabled space in the afternoon period.
- The total occupation rate of the staff spaces was approximately 85%, indicating that there is still capacity to accommodate parking for additional staff.

Table 4 – Off Street Parking Survey Summary

Type	**Hours Applicable**	**Supply**	**9:30-10:30AM**		**1:00-2:00PM**	
			All Vehicles	**Red P Plates**	**All Vehicles**	**Red P Plates**
Visitor Parking	9:30am-2:30pm	2	2	0	1	0
Bus Bay	–	1	1	0	1	0
No Restriction	–	86	75	0	75	0
Disabled	–	5	3	0	2	1
P30min	–	3	1	0	2	0
No. of Cars		97	82	0	81	1
Capacity Used (%)		–	85%	0%	84%	1%

3.3. APPROVED AND PROPOSED PARKING DEMAND

Parking demand forecasting was calculated using two methods:

1. Existing demand parking rate
2. RMS average parking rates for schools

3.3.1. Existing Demand Parking Rate

The existing staff and student numbers and the observed parking demand from the survey were used to formulate a parking rate. This was applied to the approved and proposed staff and student numbers to calculate the demand. These calculations are shown in **Table 6**.

Table 5 – Parking Rate Based on Existing Demand

	Current Demand			Approved		Proposed	
	Current Number	**Peak parking demand observed during the survey**	**Parking rate (rounded up to nearest 2nd decimal point)**	**Approved Number**	**Demand Based on Approved Numbers (rounded up to nearest whole number)**	**Future Number**	**Future Demand Based on Proposed Numbers (rounded up to nearest whole number)**
Staff	105	78	0.75	100	75	120	90
Students	1,038	46	0.05	850	43	1,100	55
Total Demand	124			118		145	

3.3.2. RMS Guidelines

The RMS *Trip Generations Surveys, Schools Analysis Report* 2014 is summarised in Section 3.1.2 of this report. It includes peak parking demands for schools, based on student numbers. The secondary school rates are higher than primary school rates, as they include student parking demand as well.

The secondary school rates were applied to the future student numbers to establish average, minimum and maximum future demand for staff and students combined.

The primary school rates were applied to the future student numbers to establish future demand of staff only. This was then deducted by the combined demand to establish average, minimum and maximum future demand for students only.

These calculations are shown in **Table 7**.

Table 6 – Peak parking demand per student

Number of Students		**Combined Parking (Secondary School Rates)**		
		Av (0.11)	**Min (0.06)**	**Max (0.21)**
Approved	850	94	51	179
Proposed	1,100	121	66	231

3.3.3. Parking Demand Conclusions

Based on current behaviour, the approved student capacity (850) would have demand for approximately 118 parking spaces. This exceeds the capacity of the existing on-site car park by approximately 27 spaces and would require some vehicles to park on the street as per the existing situation. If current behaviour continues, 145 on-site car parking spaces will be required to accommodate the parking demand associated with 1,100 students. This would include 55 spaces for students.

Section 3.3.2 of this TIA indicates that the school currently has a larger reliance on private vehicles than the RMS Guidelines suggest is likely for secondary schools. Further, the abovementioned travel behaviour indicates the demand associated with the approved and proposed student caps both exceed the existing on-site parking provision.

Behavioural changes and strategies could reduce this parking demand and therefore reduce the number of on-site parking spaces required. Reducing parking demand by encouraging the use of sustainable travel modes can have the following wider benefits:

- Reduction in vehicle traffic in the local network, potentially reducing congestion in morning and afternoon peaks.
- Reduction in cars parking on surrounding local residential streets.
- Increasing physical activity in students, staff, and parents.
- Reduction in local pollution.
- Improved street amenity.

Considering the above benefits, and in line with Council's comments at the pre-lodgement meeting held on 21st July 2020, a Green Travel Plan has been prepared and submitted with this application. This Plan aims to reduce reliance on private vehicles across the school community, with a focus on reducing student parking demand. This is a better long-term outcome than the development of a new on-site car park.

3.4. DROP-OFF/PICK-UP AREA

The school drop-off and pick-up area is located on Forest Road and has six spaces. These spaces have a 2-minute parking restriction from 8:30am to 9:00am and 2pm to 4pm on school days.

Surveys of this area were conducted from 7:30am to 9:30am and 2pm to 4pm on Tuesday 11th August 2020. These timeframes were chosen to capture vehicle activity during peak times (before and after school pick-up). The survey also observed drop-off and pick up activity in areas outside of the designated zone.

The full results of this survey are provided in **Appendix A** and have been summarised in **Table 8**.

Key findings of the survey are as follows:

- Activity is significantly larger in the morning with approximately seven times more drop-offs than afternoon pick-ups.
- Drop-off activity was highest between 8:00am and 9:00am, and pick-up activity was concentrated between 3:15pm to 3:30pm.
- Most activity occurs in the designated area, with only a small portion (13%) occurring in other parking areas or on the roadside when the designated area was full. The Green Travel Plan submitted with this application aims to reduce use of private vehicles for school trips and may address this.
- Some drop-off activity was observed to occur on the road, which can be dangerous. A Management Plan is provided below, which will be communicated to new and existing parents. This addresses Council's comment from the pre-lodgement meeting held on 21st July 2020.

Table 7 – Forest Road Drop-Off/Pick Up Survey Results Summary

Area	Restriction	Activity	
		7:30am to 9:30am	2:00pm to 4:00pm
Drop-off & pick up zone	P2min	183	13
Other parking areas	No Restriction	14	4
On-Road	NA	2	11
Total		199	28

Drop-Off / Pick-Up Management Plan

Rules and Regulations

- A Kiss and Ride or School Drop-off Pick-up Zone operates as a “No Parking” location in accordance with Australian Road Rules
- Vehicles are not to occupy the drop-off / pick-up parking spaces for longer than what is permitted by signage.
- Stopping for more than 2 minutes is prohibited in a “No Parking” restricted area
- You must always stay within 3 metres of your vehicle.
- Students are to enter the parked vehicle from the kerbside door only, wherever possible.
- Students and parents are not to perform drop-off / pick-up activity within the travel lanes along Forest Road.
- Never call out the children from across the road – it is very dangerous.
- Parents are not to double park, block driveways or undertake U-turn manoeuvres.
- Children should be capable of getting into the car unassisted in order to be picked up; parents must remain in the vehicle.
- Parking inspectors may impose penalties for illegal parking practices.
- Make sure the hand brake is applied when the vehicle is stationary.
- Vehicles are to adhere to Australian Road Rules and regulatory signage at all times.

Safety Tips

- Students should stay buckled up until the vehicle has stopped in the ‘Drop-off and Pick-up’ area.
- Student should make sure the school bag and other items are in a safe position, for example on the floor.
- Students should be ready to get out of the car with their belongings when the car has stopped and they have unbuckled the seatbelt.
- Students should always get in and out of the backseat of the vehicle through the kerbside door – the rear footpath-side door.

4. TRAFFIC IMPACT ASSESSMENT

4.1. TRAFFIC GENERATION SCENARIOS

The following 3 scenarios have been considered in the traffic assessment:

1) The school operating at the approved capacity = 850 students
2) The school operating at the current capacity = 1038 students
3) The school operating at the proposed capacity = 1100 students

Table 4.2 of the RMS *Trip Generations Surveys, Schools Analysis Report* 2014 provides average vehicle trips rates for secondary schools (excerpt shown in **Table 9**).

Table 8 – Summary of vehicle trip generation per student

School Type	Period	Average	Minimum	Maximum	Range
All	AM	0.62	0.16	1.35	1.19
	PM	0.43	0.11	1.09	0.98
Primary	AM	0.88	0.43	1.35	0.92
	PM	0.71	0.14	1.09	0.95
Secondary	AM	0.47	0.16	0.83	0.67
	PM	0.27	0.11	0.51	0.40

Table 10 summarises the anticipated trip generation levels, based on the average rates for AM and PM peak hour periods for Secondary Schools, for each scenario considered.

Table 9 – Summary of trip generation levels for each scenario

Scenario	Trips generated in the AM peak hour	Trips generated in the PM peak hour
Approved capacity (850 students)	400 trips	230 trips
Current capacity (1038 students)	488 trips	281 trips
Proposed capacity (1100 students)	517 trips	297 trips

4.2. KEY INTERSECTIONS

Vehicle access to the school is primarily via Forest Road, however, there is also a second pedestrian entrance on Angophora Circuit. Accordingly, the two key intersections used to access the school are the two roundabouts on Casuarina Drive (Forest Road/Casuarina Drive/Macpherson Street and Angophora Circuit/Casuarina Drive/Callistemon Way). These see the highest impact due to the significant turning movements generated by the school.

Figure 5 and **Figure 6** show the modelled layout of these two intersections in SIDRA.

Figure 5 – Forest Road/Casuarina Drive/Macpherson Street Intersection

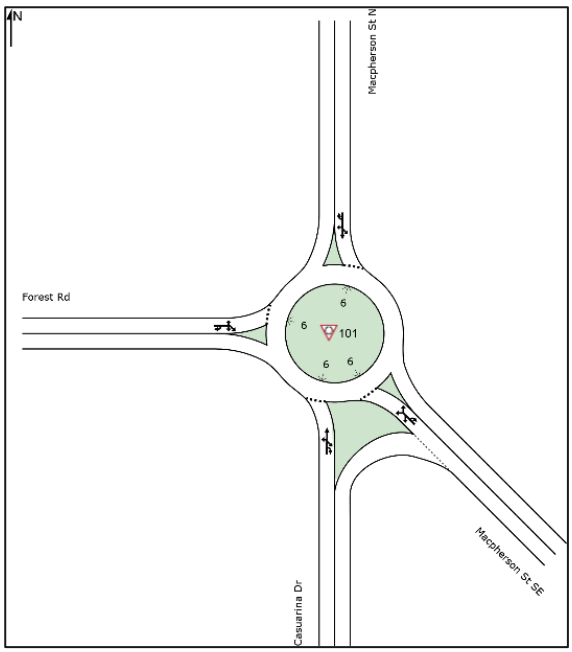
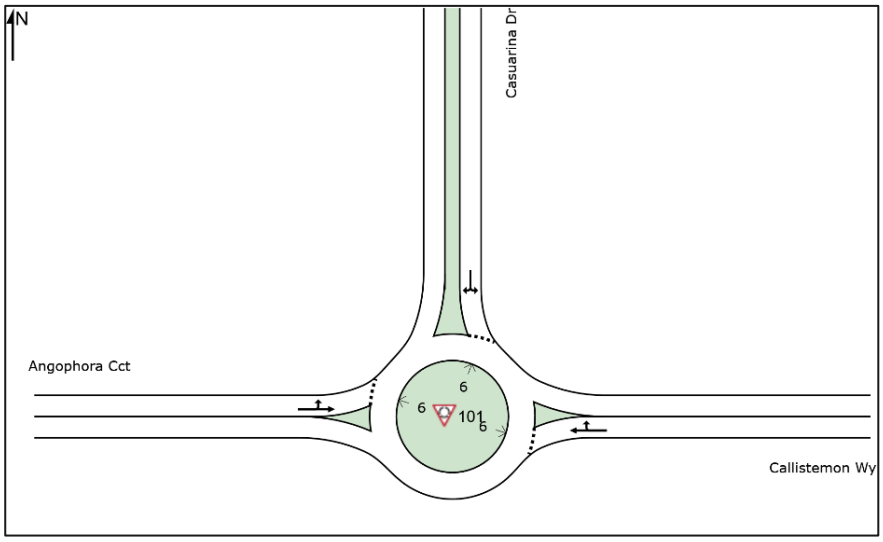


Figure 6 – Angophora Circuit/Casuarina Drive/Callistemon Way Intersection



4.3. CURRENT TRAFFIC VOLUMES

To determine the existing traffic volumes, a traffic movement survey was undertaken at the two intersections mentioned above, on a weekday when the school was in operation. Data was captured during the AM between 7:30 am and 9:30 am (based on the school opening time) and the PM peak between 2:00 pm and 4:00 pm (based on the school closing time). **Figure 7** and **Figure 8** illustrate the vehicle movements obtained in the survey for AM and PM peak periods. Detailed survey results are provided in **Appendix A**.

Figure 7 – Existing AM and PM Peak Hour Traffic Volumes at Forest Road/Casuarina Drive/Macpherson Street Intersection

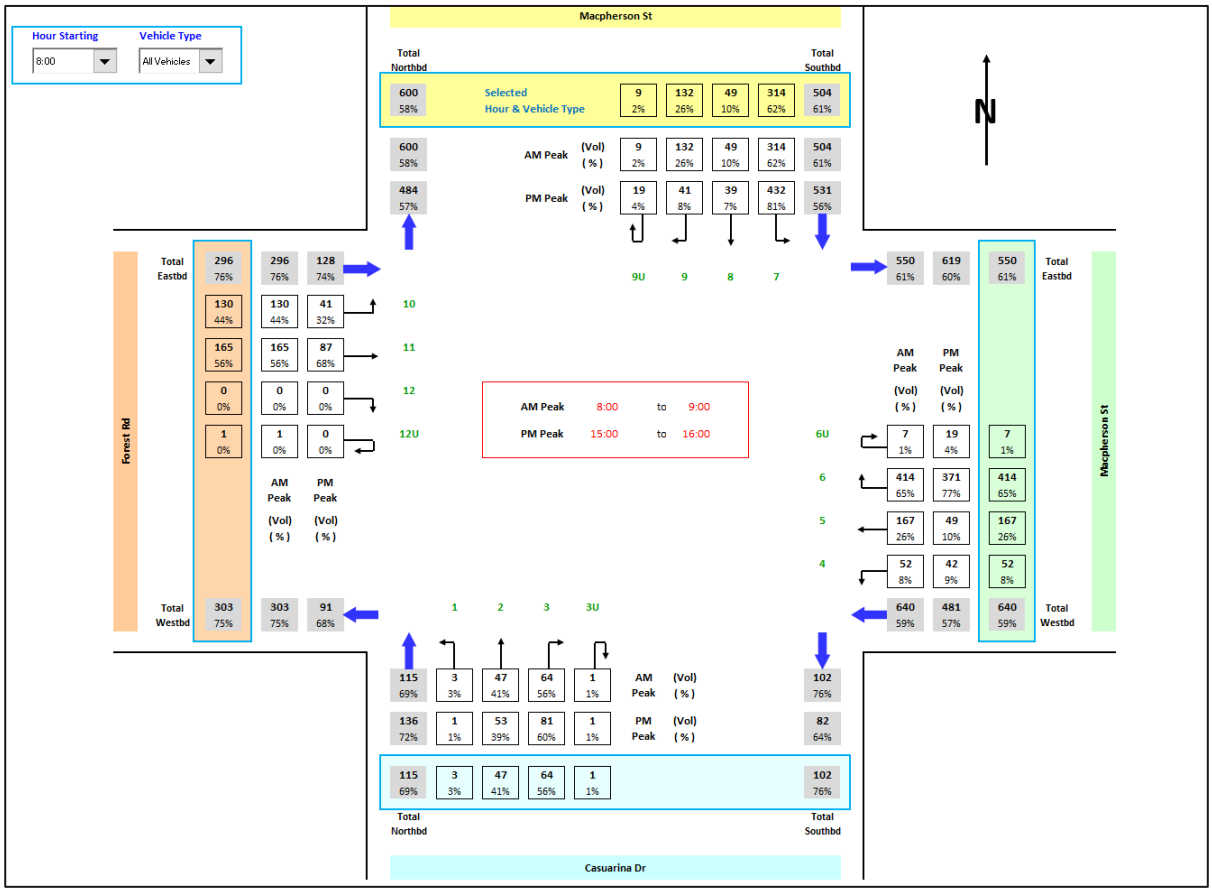
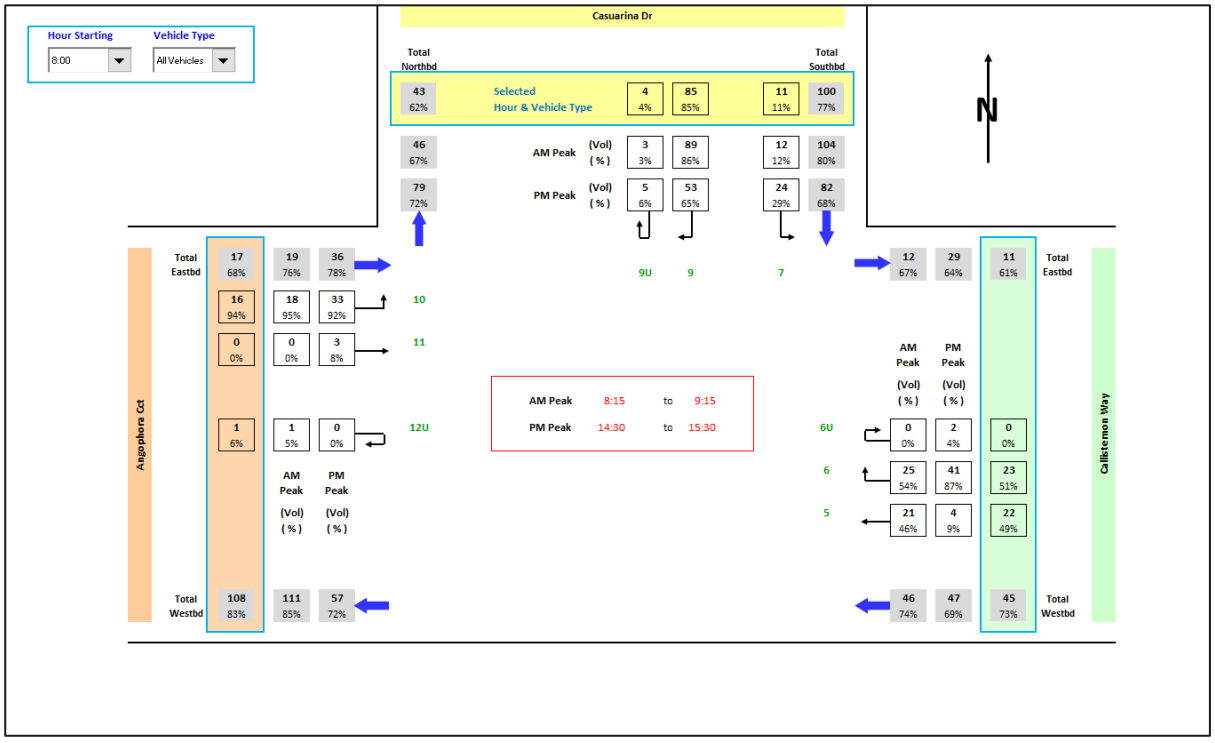


Figure 8 – Existing AM and PM Peak Hour Traffic Volumes (Angophora Circuit/Casuarina Drive/Callistemon Way)



4.4. TRAFFIC DISTRIBUTION

The traffic distribution assumptions adopted for each scenario in this assessment are outlined in **Table 11**.

Table 10 – Summary of traffic distribution assumptions

Scenario	Trips generated in the AM peak hour	Trips generated in the PM peak hour
Current capacity (1,038 students)	As captured in the traffic surveys.	As captured in the traffic surveys.
Approved capacity (850 students)	88 trips less than the current scenario (based on **Table 8**). The above trips have been **subtracted** from the current scenario. They were assumed to be drop offs and subsequent exits (25%/25% from/to McPherson Street north and 25%/25% from/to McPherson Street east). Number of vehicles entering or exiting Angophora Cct to access on-street parking was assumed to be the same (worst case) as the current capacity scenario which was captured in the traffic surveys.	51 trips less than the current scenario (based on **Table 8**). The above trips have been **subtracted** from the current scenario. They were assumed to be pick-ups and subsequent exits (25%/25% from/to McPherson Street north and 25%/25% from/to McPherson Street east). Number of vehicles entering or exiting Angophora Cct to access on-street parking was assumed to be the same (worst case) as the current capacity scenario which was captured in the traffic surveys.
Proposed capacity (1,100 students)	29 trips more than the current scenario (based on **Table 8**). The above trips have been **added** to the current scenario. They were assumed to be drop offs and subsequent exits (25%/25% from/to McPherson Street north and 25%/25% from/to McPherson Street east). Number of vehicles entering or exiting Angophora Cct to access on-street parking was assumed to be the same (worst case) as the current capacity scenario which was captured in the traffic surveys. Although the proposed capacity is higher than the current capacity, measures are currently underway to deter students from driving to school and using on-street parking on Angophora Cct.	16 trips more than the current scenario (based on **Table 8**). The above trips have been **added** from the current scenario. They were assumed to be pick-ups and subsequent exits (25%/25% from/to McPherson Street north and 25%/25% from/to McPherson Street east). Number of vehicles entering or exiting Angophora Cct to access on-street parking was assumed to be the same (worst case) as the current capacity scenario which was captured in the traffic surveys. Although the proposed capacity is higher than the current capacity, measures are currently underway to deter students from driving to school and using on-street parking on Angophora Cct.

Figure 9 and **Figure 10** show the traffic distribution levels (for the additional trips) determined for each scenario considered.

Figure 9 – Traffic distribution in the AM peak hour

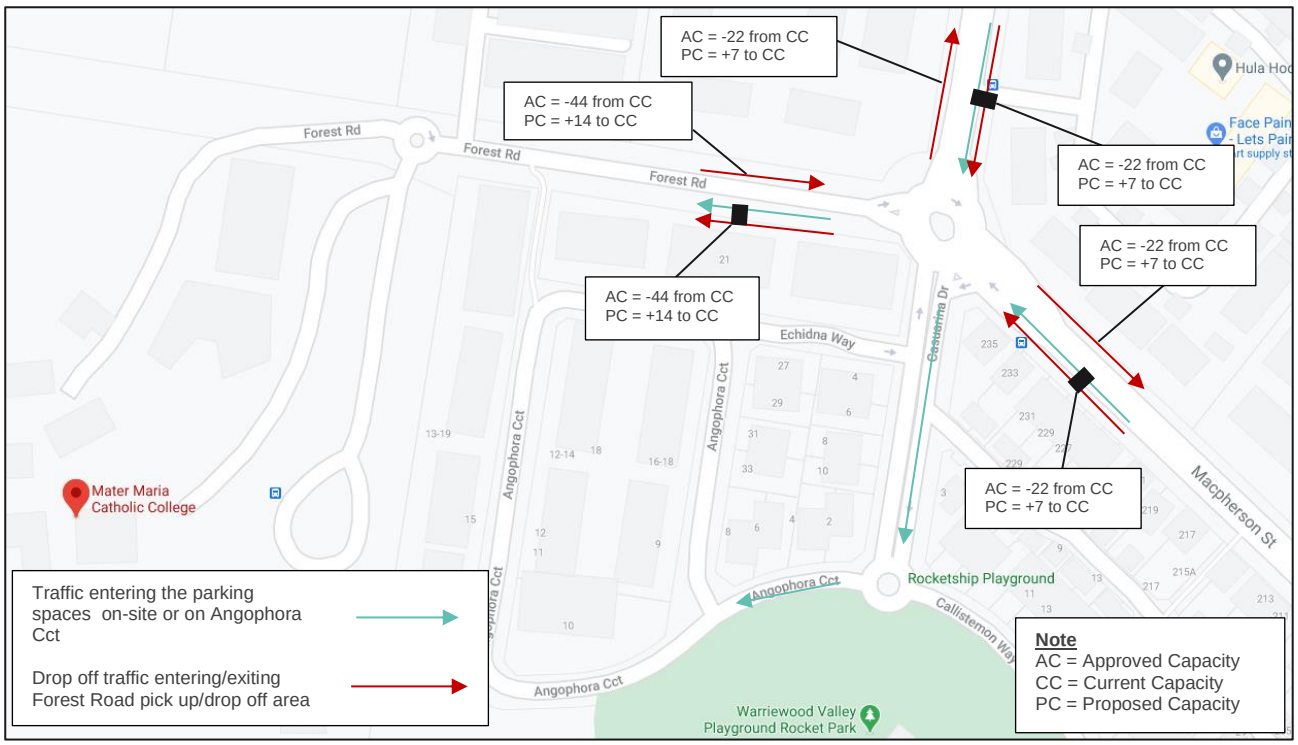
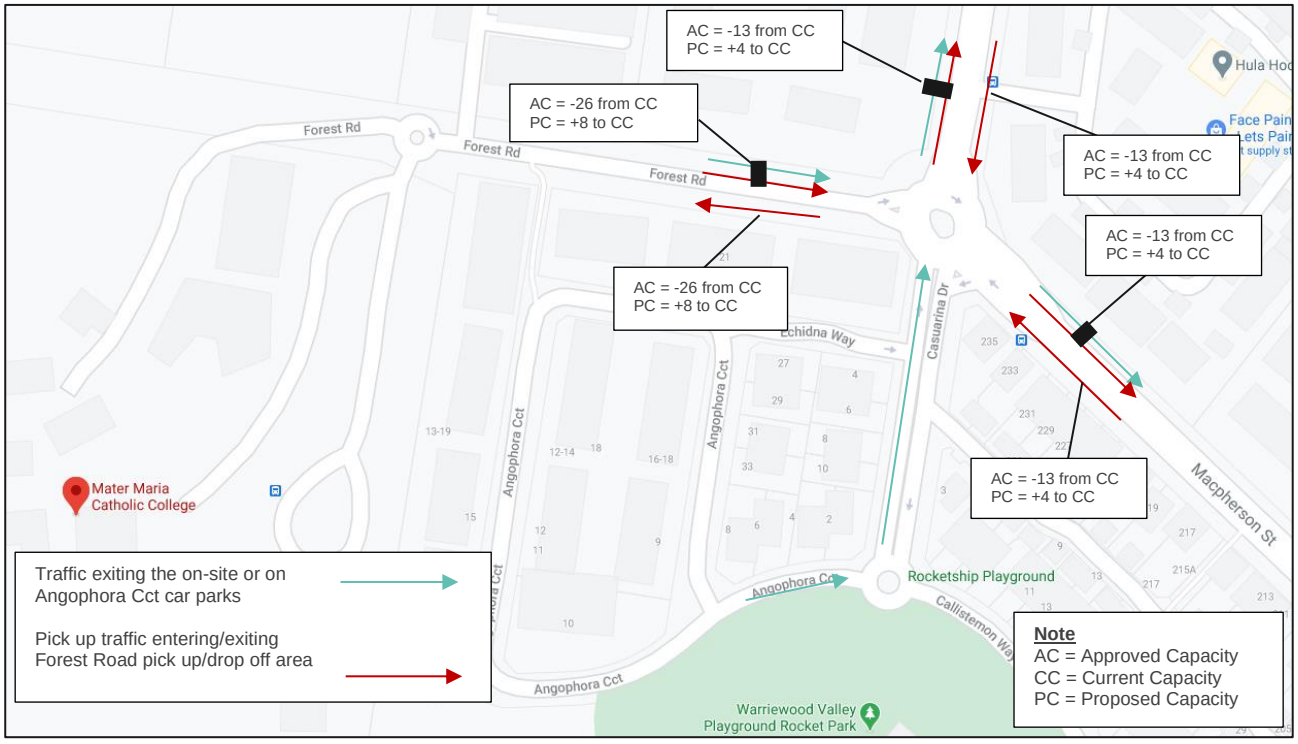


Figure 10 – Traffic distribution in the PM peak hour



4.5. INTERSECTION PERFORMANCE CRITERIA

The key intersections for this study are currently operating as three/four-leg roundabouts. The existing intersection operations have been assessed, using the SIDRA solution package (developed by the Akcelik & Associates).

The main criteria of average delay and respective levels of service (LoS) used for SIDRA intersection assessment are based on the *Guide to Traffic Generating* Developments (RMS, 2002). **Table 12** illustrates the relationship between the average delay and the level of service for roundabouts.

Table 11 – Performance Criteria for Roundabouts

Level of Service (LoS)	Average Delay (s)	Performance
A	<14	Good operation
B	15 to 28	Good with acceptable delays and spare capacity
C	29 to 42	Satisfactory operations
D	43 to 56	Operating near capacity
E	57 to 70	Operating at capacity –require other control mode
F	>70	Operating over capacity – extra capacity required

Source: Guide to traffic Generating Developments (RMS, 2002)

4.6. INTERSECTION PERFORMANCE

The following 3 scenarios have been assessed in this study:

1) Scenario 1 - Current situation (current capacity): Using the existing traffic flows, based on the survey results presented in **Figure 7** and **Figure 8**, as inputs, the current intersection performance results in both AM and PM peak hours were obtained from SIDRA (it is noted that in the SIDRA model, the vehicle speeds were set to the school zone speed limit of 40 km/hr, as applicable during each peak hour period). **Table 13** outlines the summary of the SIDRA intersection modelling results for this scenario.
2) Scenario 2 – Approved student cap. Corrections were made to the traffic volumes from the current situation to determine the AM and PM peak hour traffic at McPherson Street/Casuarina Drive/Forest Road intersection for this scenario, as shown in **Figure 9** and **Figure 10**. The traffic volumes at Angophora Cct/Casuarina Drive/Callistemon Way intersection was assumed to be the same as in Scenario 1 (see the justification presented in **Table 9**. **Table 14** outlines the summary of the SIDRA intersection modelling results for this scenario.
3) Scenario 3 – Proposed student cap. Same approach was used as in Scenario 2. **Table 15** outlines the summary of the SIDRA intersection modelling results for this scenario.

Detailed SIDRA modelling outputs are provided at **Appendix B**.

Table 12 – Current Performance of Key Intersections (Scenario 1)

Intersection	Peak Period	Average Delay (s) for worst movement	LoS for worst movement	95% Queue Length (m) at the worst movement
Forest Road/Casuarina Drive/Macpherson Street	AM Peak (7:30-9:30am)	15.9	B	49.2 (McPherson Street East)
	PM Peak (2:00-4:00pm)	13.4	B	31.2 (McPherson Street North)
Angophora Circuit/Casuarina Drive/Callistemon Way	AM Peak (7:30-9:30am)	7.9	A	2.2 (Casuarina Drive)
	PM Peak (2:00-4:00pm)	7.7	A	1.8 (Casuarina Drive)

Table 13 – Performance of Key Intersections (Scenario 2)

Intersection	Peak Period	Average Delay (s) for worst movement	LoS for worst movement	95% Queue Length (m) at the worst movement
Forest Road/Casuarina Drive/Macpherson Street	AM Peak (7:30-9:30am)	15.2	B	49.2 (McPherson Street East)
	PM Peak (2:00-4:00pm)	12.9	B	29.2 (McPherson Street North)
Angophora Circuit/Casuarina Drive/Callistemon Way	AM Peak (7:30-9:30am)	Results are the same as for Scenario 1		
	PM Peak (2:00-4:00pm)			

Table 14 – Performance of Key Intersections (Scenario 3)

Intersection	Peak Period	Average Delay (s) for worst movement	LoS for worst movement	95% Queue Length (m) at the worst movement
Forest Road/Casuarina Drive/Macpherson Street	AM Peak (7:30-9:30am)	16.3	B	52.6 (McPherson Street East)
	PM Peak (2:00-4:00pm)	13.4	B	31.9 (McPherson Street North)
Angophora Circuit/Casuarina Drive/Callistemon Way	AM Peak (7:30-9:30am)	Results are the same as for Scenario 1		
	PM Peak (2:00-4:00pm)			

The results demonstrate:

- The Forest Road/Casuarina Drive/Macpherson Street roundabout is currently operating at a Level of Service B. This level of service is retained in the approved capacity and proposed capacity scenarios, which indicate that the proposed additional enrolments are unlikely to have any adverse impacts on the existing operations of this intersection.
- The Angophora Circuit/Casuarina Drive/Callistemon Way roundabout is currently operating at a Level of Service A. This level of service is retained in the approved capacity and proposed capacity scenarios, which indicate that the proposed additional enrolments are unlikely to have any adverse impacts on the existing operations of this intersection.

5. CONCLUSIONS

This TIA assesses the proposal to increase the approved student cap for Mater Maria College, Warriewood. The key findings are as follows:

- The school currently has a larger reliance on private vehicles than the RMS Guidelines suggest is likely for secondary schools, and parking demand exceeds on-site parking provision in the three tested scenarios (approved, current, and proposed). The proposed Green Travel Plan will address this long-standing issue, with strategies to create a mode shift toward sustainable travel across the school community and a focus on reducing student parking demand. This is considered a better outcome than the development of a new on-site car park.
- The two key intersections used to access the school on Casuarina Drive have the same level of service (A & B) in the three tested scenarios (approved, current, and proposed), indicating that the proposed additional enrolments are unlikely to have any adverse impacts on the existing operations of these intersections.
- A drop-off/pick-up management plan is provided to address safety and operational issues, which is to be adopted by the school during morning and afternoon drop-off/pick-up periods.

This TIA demonstrates that allowing additional enrolments at the school will not have any significant impacts on the local road network. The Green Travel Plan approach offers the opportunity to address long-standing issues often associated with secondary schools by reducing congestion, reducing cars parking in surrounding residential streets, reducing local pollution, and increasing physical activity in students.

DISCLAIMER

This report is dated 7 September 2021 and incorporates information and events up to that date only and excludes any information arising, or event occurring, after that date which may affect the validity of Urbis Pty Ltd **(Urbis)** opinion in this report. Urbis prepared this report on the instructions, and for the benefit only, of Catholic Schools Office, Diocese of Broken Bay **(Instructing Party)** for the purpose of Traffic Impact Assessment **(Purpose)** and not for any other purpose or use. To the extent permitted by applicable law, Urbis expressly disclaims all liability, whether direct or indirect, to the Instructing Party which relies or purports to rely on this report for any purpose other than the Purpose, and to any other person which relies or purports to rely on this report for any purpose whatsoever (including the Purpose).

In preparing this report, Urbis was required to make judgements which may be affected by unforeseen future events, the likelihood and effects of which are not capable of precise assessment.

All surveys, forecasts, projections and recommendations contained in or associated with this report are made in good faith and on the basis of information supplied to Urbis at the date of this report, and upon which Urbis relied. Achievement of the projections and budgets set out in this report will depend, among other things, on the actions of others over which Urbis has no control.

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This report has been prepared with due care and diligence by Urbis and the statements and opinions given by Urbis in this report are given in good faith and in the reasonable belief that they are correct and not misleading, subject to the limitations above.

APPENDIX A PARKING DEMAND SURVEY RESULTS

Table 15 – On street parking demand survey results

Street Name	Side of Street	Between	Restriction	Applicable Hours	Supply	9:30		13:00	
						All Vehicles	Red P Plates	All Vehicles	Red P Plates
Forest Rd	South	Casuarina Dr & Mater Maria Catholic College	No Stopping						
			No Restriction		7	5	0	5	0
			P2min	Drop off & Pick up Area 8am-9:30am, 2pm-4pm(School days)	6	0	0	0	0
			No Stopping						
	North	Mater Maria Catholic College & Macpherson St	No Stopping						
			No Restriction		17	11	0	9	0
			No Stopping						
Total					**30**	**16**	**0**	**14**	**0**
% Capacity						**53%**	**0%**	**47%**	**0%**
Casuarina Dr	East	Macpherson St & Songlark Way	No Stopping						
		Songlark Way & Callistemon Way	No Restriction		4	4	1	4	1
	West	Angophora Cct & Echidna Way	No Restriction		3	3	1	3	1
		Echidna Way & Forest Rd	No Stopping						
Total					**7**	**7**	**2**	**7**	**2**
% Capacity						**100%**	**29%**	**100%**	**29%**
Callistemon Way	South	Lomandra Way & Casuarina Dr	No Stopping						
			No Restriction (90 angle)		12	9	0	9	0
			No Restriction		5	1	0	2	0
			4P	9am-5pm(Everyday)	8	6	0	2	0
			No Restriction		6	0	0	0	0
			4P	9am-5pm(Everyday)	9	9	0	2	0
	North	Casuarina Dr & Songlark Way	No Parking						
		Songlark Way & Lomandra Way	No Parking						
			No Stopping						
Total					**40**	**25**	**0**	**15**	**0**
% Capacity						**63%**	**0%**	**38%**	**0%**
Angophora Cct (Outside)	South	Casuarina Dr & House No. 22	4P	9am-5pm(Everyday)	10	8	3	8	5
			No Restriction		11	11	11	11	11
			No Restriction (90 angle)		8	8	4	8	5
			1P	7am-5pm(Mon-Fri)	1	0	0	1	0
	West	House No. 22 & House No. 13-19	No Restriction		7	7	2	6	3
			No Stopping						
			No Restriction		11	9	5	10	6
	North	House No. 21 & Echidna Way	No Stopping						
			No Restriction		6	6	3	4	2
	East	Echidna Way & House No. 8	No Restriction		11	9	4	8	4
Angophora Cct (Inside)	West	House No. 9 & Echidna Way	No Restriction		13	10	5	9	5
	South	Echidna Way & House No. 18	No Restriction		8	4	2	5	2
			No Stopping						
	East	House No. 18 & House No. 10	No Stopping						
			No Restriction		17	14	1	16	1
			No Stopping						
	North	House No. 10 & Angophora Cct	No Stopping						
			No Parking						
		Angophora Cct & Casuarina Dr	No Parking						
Total					**103**	**86**	**40**	**86**	**44**
% Capacity						**83%**	**39%**	**83%**	**43%**

Table 16 – Off street parking demand survey results

Street Name	Restriction	Applicable Hours	Supply	9:30		13:00	
				All Vehicles	Red P Plates	All Vehicles	Red P Plateds
Off St Car Park	Visitor Parking	9:30am-2:30pm	2	2	0	1	0
	Bus Bay		1	1	0	1	0
	No Restriction		76	74	0	73	0
	Disabled		3	1	0	2	1
	P30min		3	1	0	2	0
	Disabled		2	2	0	0	0
	No Restriction	Pink Line	10	1	0	2	0
Total			**97**	**82**	**0**	**81**	**1**
% Capacity				**85%**	**0%**	**84%**	**1%**

APPENDIX B DETAILED SIDRA ASSESSMENT RESULTS

Scenario 1

MOVEMENT SUMMARY

Site: 101 [Forest Rd/ Macpherson St/ Casuarina Dve (AM Peak) (Site Folder: Scenario 1)]

New Site
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total	INPUT VOLUMES HV]	DEMAND FLOWS [Total	DEMAND FLOWS HV]	Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE [Veh.	95% BACK OF QUEUE Dist]	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		veh/h	veh/h	veh/h	%	v/c	sec		veh	m				km/h
South: Casuarina Dr														
1	L2	3	0	3	0.0	0.238	12.5	LOS B	1.4	9.8	0.79	0.91	0.79	30.4
2	T1	47	0	47	0.0	0.238	12.5	LOS B	1.4	9.8	0.79	0.91	0.79	27.9
3b	R3	64	0	64	0.0	0.238	14.8	LOS B	1.4	9.8	0.79	0.91	0.79	39.4
3u	U	1	0	1	0.0	0.238	15.5	LOS B	1.4	9.8	0.79	0.91	0.79	26.5
Approach		115	0	115	0.0	0.238	13.8	LOS B	1.4	9.8	0.79	0.91	0.79	35.4
SouthEast: Macpherson St SE														
21b	L3	52	0	52	0.0	0.650	8.6	LOS A	6.9	49.2	0.73	0.72	0.76	42.8
21a	L1	167	7	167	4.2	0.650	8.7	LOS A	6.9	49.2	0.73	0.72	0.76	43.7
23a	R1	414	4	414	1.0	0.650	9.6	LOS A	6.9	49.2	0.73	0.72	0.76	43.4
23u	U	7	1	7	14.3	0.650	12.1	LOS B	6.9	49.2	0.73	0.72	0.76	47.8
Approach		640	12	640	1.9	0.650	9.3	LOS A	6.9	49.2	0.73	0.72	0.76	43.5
North: Macpherson St N														
7a	L1	314	8	314	2.5	0.583	9.0	LOS A	5.0	36.0	0.71	0.76	0.74	42.7
8	T1	49	0	49	0.0	0.583	8.9	LOS A	5.0	36.0	0.71	0.76	0.74	32.2
9	R2	132	3	132	2.3	0.583	10.7	LOS B	5.0	36.0	0.71	0.76	0.74	35.9
9u	U	9	0	9	0.0	0.583	12.0	LOS B	5.0	36.0	0.71	0.76	0.74	27.6
Approach		504	11	504	2.2	0.583	9.5	LOS A	5.0	36.0	0.71	0.76	0.74	40.4
West: Forest Rd														
10	L2	130	4	130	3.1	0.504	13.0	LOS B	3.8	27.5	0.82	0.97	0.96	31.0
12a	R1	165	8	165	4.8	0.504	14.1	LOS B	3.8	27.5	0.82	0.97	0.96	40.3
12	R2	1	0	1	0.0	0.504	14.5	LOS B	3.8	27.5	0.82	0.97	0.96	29.8
12u	U	1	0	1	0.0	0.504	15.9	LOS B	3.8	27.5	0.82	0.97	0.96	34.2
Approach		297	12	297	4.0	0.504	13.7	LOS B	3.8	27.5	0.82	0.97	0.96	37.0
All Vehicles		1556	35	1556	2.2	0.650	10.5	LOS B	6.9	49.2	0.75	0.79	0.79	40.7

MOVEMENT SUMMARY

Site: 101 [Forest Rd/ Macpherson St/ Casuarina Dve (PM Peak) (Site Folder: Scenario 1)]

New Site
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES	DEMAND FLOWS	Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed

		[Total	HV]	[Total	HV]				[Veh.	Dist]				
		veh/h	veh/h	veh/h	%	v/c	sec		veh	m				km/h
South: Casuarina Dr														
1	L2	1	0	1	0.0	0.211	10.0	LOS A	1.2	8.1	0.66	0.81	0.66	32.8
2	T1	53	1	53	1.9	0.211	10.1	LOS B	1.2	8.1	0.66	0.81	0.66	30.1
3b	R3	81	0	81	0.0	0.211	12.3	LOS B	1.2	8.1	0.66	0.81	0.66	41.5
3u	U	1	0	1	0.0	0.211	13.0	LOS B	1.2	8.1	0.66	0.81	0.66	28.7
Approach		136	1	136	0.7	0.211	11.4	LOS B	1.2	8.1	0.66	0.81	0.66	38.0
SouthEast: Macpherson St SE														
21b	L3	42	1	42	2.4	0.434	6.8	LOS A	3.5	25.4	0.43	0.62	0.43	44.0
21a	L1	49	11	49	22.4	0.434	7.2	LOS A	3.5	25.4	0.43	0.62	0.43	43.2
23a	R1	371	9	371	2.4	0.434	7.7	LOS A	3.5	25.4	0.43	0.62	0.43	44.7
23u	U	19	0	19	0.0	0.434	9.7	LOS A	3.5	25.4	0.43	0.62	0.43	49.6
Approach		481	21	481	4.4	0.434	7.7	LOS A	3.5	25.4	0.43	0.62	0.43	44.7
North: Macpherson St N														
7a	L1	428	0	428	0.0	0.555	7.9	LOS A	4.4	31.2	0.62	0.69	0.62	44.2
8	T1	39	0	39	0.0	0.555	7.9	LOS A	4.4	31.2	0.62	0.69	0.62	33.8
9	R2	41	6	41	14.6	0.555	10.1	LOS B	4.4	31.2	0.62	0.69	0.62	35.9
9u	U	19	0	19	0.0	0.555	10.9	LOS B	4.4	31.2	0.62	0.69	0.62	20.8
Approach		527	6	527	1.1	0.555	8.2	LOS A	4.4	31.2	0.62	0.69	0.62	42.3
West: Forest Rd														
10	L2	41	3	41	7.3	0.226	10.8	LOS B	1.2	9.4	0.68	0.84	0.68	32.7
12a	R1	87	14	87	16.1	0.226	12.3	LOS B	1.2	9.4	0.68	0.84	0.68	41.4
12	R2	1	0	1	0.0	0.226	12.0	LOS B	1.2	9.4	0.68	0.84	0.68	31.8
12u	U	1	0	1	0.0	0.226	13.4	LOS B	1.2	9.4	0.68	0.84	0.68	36.3
Approach		130	17	130	13.1	0.226	11.8	LOS B	1.2	9.4	0.68	0.84	0.68	39.2
All Vehicles		1274	45	1274	3.5	0.555	8.7	LOS A	4.4	31.2	0.56	0.70	0.56	42.5

MOVEMENT SUMMARY

Site: 101 [Casuarina Dr / Angophora Cct / Callistemon Wy (AM Peak) (Site Folder: Scenario 1)]

New Site
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[Total	HV]	[Total	HV]				[Veh.	Dist]				
		veh/h	veh/h	veh/h	%	v/c	sec		veh	m				km/h
East: Callistemon Wy														
5	T1	21	0	21	0.0	0.040	5.4	LOS A	0.2	1.3	0.23	0.58	0.23	52.7
6	R2	25	0	25	0.0	0.040	7.9	LOS A	0.2	1.3	0.23	0.58	0.23	52.2
Approach		46	0	46	0.0	0.040	6.7	LOS A	0.2	1.3	0.23	0.58	0.23	52.4
North: Casuarina Dr														
7	L2	12	0	12	0.0	0.064	5.3	LOS A	0.3	2.2	0.01	0.67	0.01	51.9
9	R2	92	0	92	0.0	0.064	7.4	LOS A	0.3	2.2	0.01	0.67	0.01	52.1
Approach		104	0	104	0.0	0.064	7.2	LOS A	0.3	2.2	0.01	0.67	0.01	52.1
West: Angophora Cct														
10	L2	18	0	18	0.0	0.016	5.5	LOS A	0.1	0.5	0.12	0.55	0.12	52.9
11	T1	1	0	1	0.0	0.016	5.0	LOS A	0.1	0.5	0.12	0.55	0.12	53.7

Approach	19	0	19	0.0	0.016	5.4	LOS A	0.1	0.5	0.12	0.55	0.12	53.0
All Vehicles	169	0	169	0.0	0.064	6.9	LOS A	0.3	2.2	0.09	0.63	0.09	52.3

MOVEMENT SUMMARY

Site: 101 [Casuarina Dr / Angophora Cct / Callistemon Wy (PM Peak) (Site Folder: Scenario 1)]

New Site
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total	INPUT VOLUMES HV]	DEMAND FLOWS [Total	DEMAND FLOWS HV]	Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE [Veh.	95% BACK OF QUEUE Dist]	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		veh/h	veh/h	veh/h	%	v/c	sec		veh	m				km/h
East: Callistemon Wy														
5	T1	4	0	4	0.0	0.038	5.2	LOS A	0.2	1.2	0.18	0.62	0.18	52.1
6	R2	41	0	41	0.0	0.038	7.7	LOS A	0.2	1.2	0.18	0.62	0.18	51.7
Approach		45	0	45	0.0	0.038	7.5	LOS A	0.2	1.2	0.18	0.62	0.18	51.8
North: Casuarina Dr														
7	L2	24	0	24	0.0	0.053	5.4	LOS A	0.3	1.8	0.03	0.65	0.03	52.1
9	R2	58	0	58	0.0	0.053	7.4	LOS A	0.3	1.8	0.03	0.65	0.03	52.4
Approach		82	0	82	0.0	0.053	6.8	LOS A	0.3	1.8	0.03	0.65	0.03	52.3
West: Angophora Cct														
10	L2	33	0	33	0.0	0.030	5.6	LOS A	0.1	1.0	0.15	0.54	0.15	52.8
11	T1	3	0	3	0.0	0.030	5.1	LOS A	0.1	1.0	0.15	0.54	0.15	53.6
Approach		36	0	36	0.0	0.030	5.5	LOS A	0.1	1.0	0.15	0.54	0.15	52.9
All Vehicles		163	0	163	0.0	0.053	6.7	LOS A	0.3	1.8	0.10	0.62	0.10	52.3

Scenario 2

MOVEMENT SUMMARY

Site: 101 [Forest Rd/ Macpherson St/ Casuarina Dve (AM Peak) - Copy (2) (Site Folder: Scenario 2 (AC))]

New Site
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total	INPUT VOLUMES HV]	DEMAND FLOWS [Total	DEMAND FLOWS HV]	Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE [Veh.	95% BACK OF QUEUE Dist]	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		veh/h	veh/h	veh/h	%	v/c	sec		veh	m				km/h
South: Casuarina Dr														
1	L2	3	0	3	0.0	0.230	12.2	LOS B	1.3	9.3	0.78	0.89	0.78	30.7
2	T1	47	0	47	0.0	0.230	12.2	LOS B	1.3	9.3	0.78	0.89	0.78	28.2
3b	R3	64	0	64	0.0	0.230	14.5	LOS B	1.3	9.3	0.78	0.89	0.78	39.6
3u	U	1	0	1	0.0	0.230	15.2	LOS B	1.3	9.3	0.78	0.89	0.78	26.7

Approach		115	0	115	0.0	0.230	13.5	LOS B	1.3	9.3	0.78	0.89	0.78	35.7
SouthEast: Macpherson St SE														
21b	L3	52	0	52	0.0	0.625	8.3	LOS A	6.2	44.1	0.70	0.71	0.71	43.1
21a	L1	145	7	145	4.8	0.625	8.4	LOS A	6.2	44.1	0.70	0.71	0.71	44.0
23a	R1	414	4	414	1.0	0.625	9.2	LOS A	6.2	44.1	0.70	0.71	0.71	43.8
23u	U	7	1	7	14.3	0.625	11.7	LOS B	6.2	44.1	0.70	0.71	0.71	48.1
Approach		618	12	618	1.9	0.625	9.0	LOS A	6.2	44.1	0.70	0.71	0.71	43.8
North: Macpherson St N														
7a	L1	314	8	314	2.5	0.561	8.3	LOS A	4.5	32.1	0.67	0.72	0.67	43.5
8	T1	49	0	49	0.0	0.561	8.2	LOS A	4.5	32.1	0.67	0.72	0.67	33.1
9	R2	130	3	130	2.3	0.561	9.9	LOS A	4.5	32.1	0.67	0.72	0.67	36.8
9u	U	9	0	9	0.0	0.561	11.2	LOS B	4.5	32.1	0.67	0.72	0.67	28.2
Approach		502	11	502	2.2	0.561	8.8	LOS A	4.5	32.1	0.67	0.72	0.67	41.2
West: Forest Rd														
10	L2	108	4	108	3.7	0.430	11.9	LOS B	2.9	20.9	0.78	0.92	0.84	32.0
12a	R1	143	8	143	5.6	0.430	13.0	LOS B	2.9	20.9	0.78	0.92	0.84	41.2
12	R2	1	0	1	0.0	0.430	13.3	LOS B	2.9	20.9	0.78	0.92	0.84	30.9
12u	U	1	0	1	0.0	0.430	14.7	LOS B	2.9	20.9	0.78	0.92	0.84	35.4
Approach		253	12	253	4.7	0.430	12.5	LOS B	2.9	20.9	0.78	0.92	0.84	38.1
All Vehicles		1488	35	1488	2.4	0.625	9.9	LOS A	6.2	44.1	0.71	0.77	0.72	41.4

MOVEMENT SUMMARY

Site: 101 [Forest Rd/ Macpherson St/ Casuarina Dve (PM Peak) - Copy (2) (Site Folder: Scenario 2 (AC))]

New Site
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total	INPUT VOLUMES HV]	DEMAND FLOWS [Total	DEMAND FLOWS HV]	Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE [Veh.	95% BACK OF QUEUE Dist]	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		veh/h	veh/h	veh/h	%	v/c	sec		veh	m				km/h
South: Casuarina Dr														
1	L2	1	0	1	0.0	0.208	9.9	LOS A	1.1	8.0	0.65	0.81	0.65	32.9
2	T1	53	1	53	1.9	0.208	9.9	LOS A	1.1	8.0	0.65	0.81	0.65	30.3
3b	R3	81	0	81	0.0	0.208	12.2	LOS B	1.1	8.0	0.65	0.81	0.65	41.7
3u	U	1	0	1	0.0	0.208	12.9	LOS B	1.1	8.0	0.65	0.81	0.65	28.9
Approach		136	1	136	0.7	0.208	11.3	LOS B	1.1	8.0	0.65	0.81	0.65	38.1
SouthEast: Macpherson St SE														
21b	L3	42	1	42	2.4	0.423	6.7	LOS A	3.3	24.3	0.42	0.62	0.42	44.0
21a	L1	36	11	36	30.6	0.423	7.4	LOS A	3.3	24.3	0.42	0.62	0.42	42.5
23a	R1	371	9	371	2.4	0.423	7.7	LOS A	3.3	24.3	0.42	0.62	0.42	44.7
23u	U	19	0	19	0.0	0.423	9.7	LOS A	3.3	24.3	0.42	0.62	0.42	49.6
Approach		468	21	468	4.5	0.423	7.7	LOS A	3.3	24.3	0.42	0.62	0.42	44.7
North: Macpherson St N														
7a	L1	415	0	415	0.0	0.532	7.7	LOS A	4.1	29.2	0.58	0.68	0.58	44.5
8	T1	39	0	39	0.0	0.532	7.7	LOS A	4.1	29.2	0.58	0.68	0.58	34.1
9	R2	41	6	41	14.6	0.532	9.8	LOS A	4.1	29.2	0.58	0.68	0.58	36.2
9u	U	19	0	19	0.0	0.532	10.7	LOS B	4.1	29.2	0.58	0.68	0.58	20.9

Approach		514	6	514	1.2	0.532	8.0	LOS A	4.1	29.2	0.58	0.68	0.58	42.5
West: Forest Rd														
10	L2	28	3	28	10.7	0.184	10.8	LOS B	1.0	7.7	0.67	0.82	0.67	32.4
12a	R1	74	14	74	18.9	0.184	12.2	LOS B	1.0	7.7	0.67	0.82	0.67	41.2
12	R2	1	0	1	0.0	0.184	11.9	LOS B	1.0	7.7	0.67	0.82	0.67	31.8
12u	U	1	0	1	0.0	0.184	13.3	LOS B	1.0	7.7	0.67	0.82	0.67	36.3
Approach		104	17	104	16.3	0.184	11.9	LOS B	1.0	7.7	0.67	0.82	0.67	39.3
All Vehicles		1222	45	1222	3.7	0.532	8.6	LOS A	4.1	29.2	0.53	0.69	0.53	42.6

Scenario 3

MOVEMENT SUMMARY

Site: 101 [Forest Rd/ Macpherson St/ Casuarina Dve (AM Peak) - Copy (Site Folder: Scenario 3 (PC))]

New Site
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[Total	HV]	[Total	HV]				[Veh.	Dist]				
		veh/h	veh/h	veh/h	%	v/c	sec		veh	m				km/h
South: Casuarina Dr														
1	L2	3	0	3	0.0	0.243	12.7	LOS B	1.4	10.1	0.80	0.91	0.80	30.2
2	T1	47	0	47	0.0	0.243	12.7	LOS B	1.4	10.1	0.80	0.91	0.80	27.7
3b	R3	64	0	64	0.0	0.243	15.0	LOS B	1.4	10.1	0.80	0.91	0.80	39.2
3u	U	1	0	1	0.0	0.243	15.7	LOS B	1.4	10.1	0.80	0.91	0.80	26.3
Approach		115	0	115	0.0	0.243	14.0	LOS B	1.4	10.1	0.80	0.91	0.80	35.2
SouthEast: Macpherson St SE														
21b	L3	52	0	52	0.0	0.664	9.0	LOS A	7.4	52.6	0.76	0.74	0.80	42.4
21a	L1	174	7	174	4.0	0.664	9.1	LOS A	7.4	52.6	0.76	0.74	0.80	43.4
23a	R1	414	4	414	1.0	0.664	10.0	LOS A	7.4	52.6	0.76	0.74	0.80	43.0
23u	U	7	1	7	14.3	0.664	12.5	LOS B	7.4	52.6	0.76	0.74	0.80	47.5
Approach		647	12	647	1.9	0.664	9.7	LOS A	7.4	52.6	0.76	0.74	0.80	43.1
North: Macpherson St N														
7a	L1	314	8	314	2.5	0.596	9.4	LOS A	5.4	38.3	0.73	0.77	0.77	42.4
8	T1	49	0	49	0.0	0.596	9.3	LOS A	5.4	38.3	0.73	0.77	0.77	31.8
9	R2	139	3	139	2.2	0.596	11.0	LOS B	5.4	38.3	0.73	0.77	0.77	35.5
9u	U	9	0	9	0.0	0.596	12.3	LOS B	5.4	38.3	0.73	0.77	0.77	27.3
Approach		511	11	511	2.2	0.596	9.8	LOS A	5.4	38.3	0.73	0.77	0.77	40.0
West: Forest Rd														
10	L2	137	4	137	2.9	0.529	13.5	LOS B	4.1	30.0	0.83	0.99	1.00	30.6
12a	R1	172	8	172	4.7	0.529	14.6	LOS B	4.1	30.0	0.83	0.99	1.00	39.9
12	R2	1	0	1	0.0	0.529	14.9	LOS B	4.1	30.0	0.83	0.99	1.00	29.5
12u	U	1	0	1	0.0	0.529	16.3	LOS B	4.1	30.0	0.83	0.99	1.00	33.8
Approach		311	12	311	3.9	0.529	14.1	LOS B	4.1	30.0	0.83	0.99	1.00	36.6

All Vehicles	1584	35	1584	2.2	0.664	10.9	LOS B	7.4	52.6	0.77	0.81	0.83	40.3

MOVEMENT SUMMARY

Site: 101 [Forest Rd/ Macpherson St/ Casuarina Dve (PM Peak) - Copy (Site Folder: Scenario 3 (PC))]

New Site
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[Total	HV]	[Total	HV]				[Veh.	Dist]				
		veh/h	veh/h	veh/h	%	v/c	sec		veh	m				km/h
South: Casuarina Dr														
1	L2	1	0	1	0.0	0.212	10.1	LOS B	1.2	8.2	0.67	0.82	0.67	32.7
2	T1	53	1	53	1.9	0.212	10.2	LOS B	1.2	8.2	0.67	0.82	0.67	30.1
3b	R3	81	0	81	0.0	0.212	12.4	LOS B	1.2	8.2	0.67	0.82	0.67	41.5
3u	U	1	0	1	0.0	0.212	13.1	LOS B	1.2	8.2	0.67	0.82	0.67	28.6
Approach		136	1	136	0.7	0.212	11.5	LOS B	1.2	8.2	0.67	0.82	0.67	37.9
SouthEast: Macpherson St SE														
21b	L3	42	1	42	2.4	0.441	6.8	LOS A	3.6	26.0	0.44	0.63	0.44	44.0
21a	L1	53	11	53	20.8	0.441	7.2	LOS A	3.6	26.0	0.44	0.63	0.44	43.3
23a	R1	371	9	371	2.4	0.441	7.8	LOS A	3.6	26.0	0.44	0.63	0.44	44.6
23u	U	19	0	19	0.0	0.441	9.8	LOS A	3.6	26.0	0.44	0.63	0.44	49.6
Approach		485	21	485	4.3	0.441	7.7	LOS A	3.6	26.0	0.44	0.63	0.44	44.7
North: Macpherson St N														
7a	L1	428	0	428	0.0	0.563	8.0	LOS A	4.5	31.9	0.63	0.70	0.63	44.2
8	T1	39	0	39	0.0	0.563	8.0	LOS A	4.5	31.9	0.63	0.70	0.63	33.7
9	R2	45	6	45	13.3	0.563	10.1	LOS B	4.5	31.9	0.63	0.70	0.63	36.0
9u	U	19	0	19	0.0	0.563	11.0	LOS B	4.5	31.9	0.63	0.70	0.63	20.8
Approach		531	6	531	1.1	0.563	8.3	LOS A	4.5	31.9	0.63	0.70	0.63	42.2
West: Forest Rd														
10	L2	45	3	45	6.7	0.238	10.8	LOS B	1.3	10.0	0.69	0.84	0.69	32.7
12a	R1	91	14	91	15.4	0.238	12.3	LOS B	1.3	10.0	0.69	0.84	0.69	41.4
12	R2	1	0	1	0.0	0.238	12.1	LOS B	1.3	10.0	0.69	0.84	0.69	31.8
12u	U	1	0	1	0.0	0.238	13.4	LOS B	1.3	10.0	0.69	0.84	0.69	36.3
Approach		138	17	138	12.3	0.238	11.8	LOS B	1.3	10.0	0.69	0.84	0.69	39.2
All Vehicles		1290	45	1290	3.5	0.563	8.8	LOS A	4.5	31.9	0.57	0.70	0.57	42.4

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