

Dapto Public School

Traffic Impact Assessment

18-114 | 4 October 2019 | Revision D

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Document control

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B	01.07.19	Revised Issue	SETB	JC	AP
C	30.09.19	SIDRA Analysis Added	SETB	AP	AP
D	04.10.19	Revised Report	SETB	AP	AP

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1. Introduction

It is proposed to re-develop the existing Dapto Public School (herein referred to as 'The School'). The School is located at the corner of Sierra Drive and Fairwater Drive. Refer to Figure 1 below for the location.

As part of the proposed works, The School will be extended to cater for approximately 870 students and 51 staff, increasing from the current maximum of 738 students and 36 staff (Note: student and staff projections are based on advice provided by the Department of Education in June 2019). The proposed re-development is to take place over 2 stages and involves the construction of a new building, alterations and additions to existing buildings and the removal of existing demountables.

This report has been prepared to address traffic issues associated with the redevelopment of the public school including parking, bus zones and traffic generated by the site. Woolacotts undertook a traffic survey on the 2nd of April 2019 to assess the operation of the existing parking, pick up/drop off zones, bus zones and Fairwater Drive intersection.

Traffic requirements for the site have been determined using the RMS *Guide to Traffic Generating Developments*. Where this does not provide guidance, reference is made to existing conditions.

The School is located in the Wollongong City Council Local Government Area and assessment will include the requirements of the Wollongong Development Control 2009. It is understood that the proposed development will also be assessed by the Roads and Maritime Service.



Figure 1 – Site Location

2. Existing conditions

2.1 The site and existing roads

The School is located in Dapto, a suburb of Wollongong in the Illawarra region of New South Wales. The Site borders Sierra Drive along the eastern and southern boundaries, and residential properties on the northern and western boundaries. The site area is approximately 29,040m². Refer to Figure 2 below.

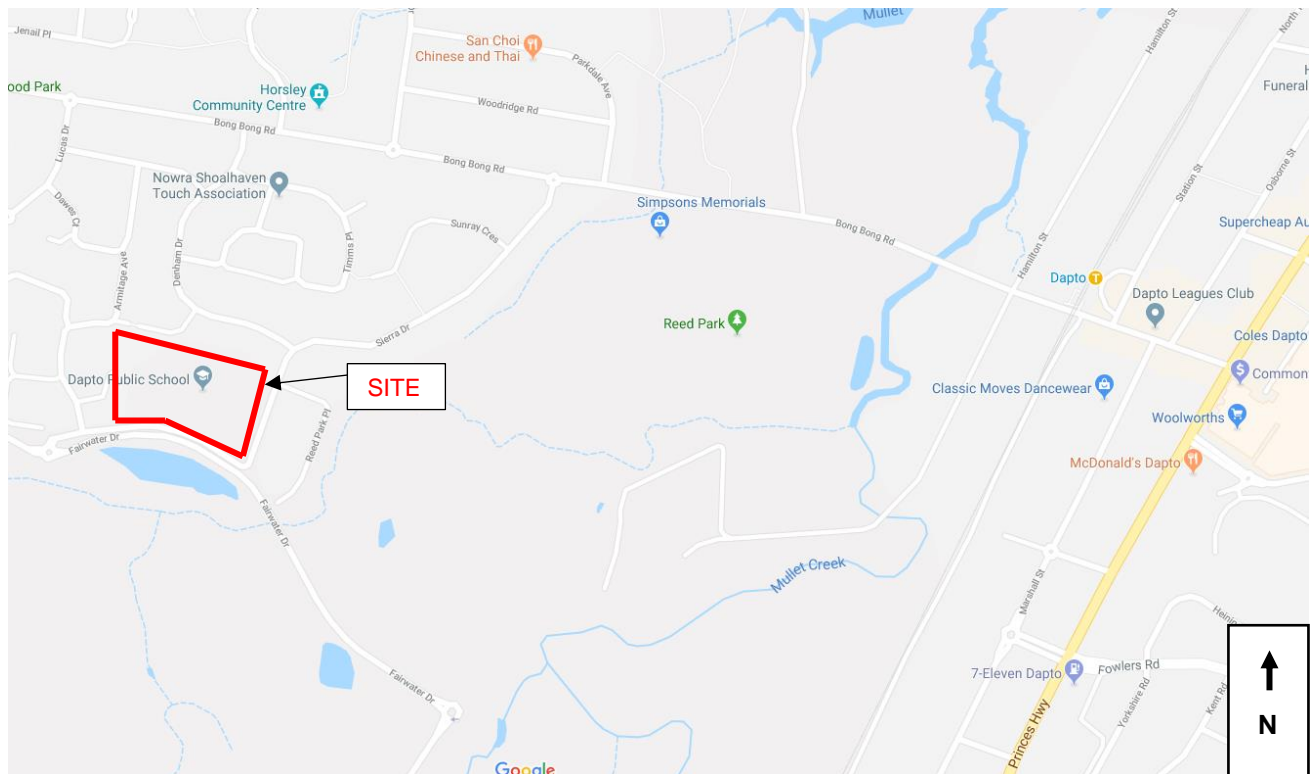


Figure 2 – Site Surrounding Area

2.2 Surrounding Roads

The main local, collector and arterial roads servicing the existing school include: the Princes Highway, Bong Bong Drive, Fairwater Drive and Sierra Drive.

The Princes Highway is located approximately 1.8km south-east of the site. The stretch of highway adjacent to the site is a sealed four lane road extending north-west to south-east. This section of highway has two lanes of traffic in each direction and a speed limit of 60km/hr.

Bong Bong Drive is a sealed two-lane collector road with one lane of traffic in each direction. The section of road adjacent to the site runs east to west. The eastern end of Bong Bong Road connects to The Princes Highway via a signalised T intersection. The road has a speed limit of 60km/hr within the locality of the site.

Fairwater Drive is a two-lane sealed collector road with one lane of traffic in each direction. This road services residential houses and the existing school. The road runs east to west and has a speed limit of 50km/hr (40km/hr during school times).

Sierra Drive is a two-lane sealed local road with one lane of traffic in each direction. This road also services residential houses and the existing school. The road runs north to south and has a speed limit of 50km/hr (40km/hr during school times).

2.2 Public transport

School Bus Network

The School has one local school bus company servicing the area, known as Premier Illawarra. This company runs four school bus services in the morning and four in the afternoon. Refer summary in Table 1 below:

Table 1 – School Bus Service Timetable		
Bus Service	Bus Route	Dapto Public School bus times
Morning	West Dapto Road – Dapto HS – St Johns – Dapto PS – St Josephs	8:17am – Drop off
Morning	West Dapto Road/Darkes Road Wongawilli– Dapto PS	8:33am – Drop off
Morning	Fowlers/P.Hwy – Koonawarra – Kanahooka – Dapto PS	8:50am – Drop off
Morning	Sunnybank – Dapto PS	8:50am – Drop off
Afternoon	Dapto PS - Wongawilli	3:00pm – Pick up
Afternoon	Dapto PS – Kanahooka - Koonawarra	3:00pm – Pick up
Afternoon	Dapto PS - Homestead	3:03pm – Pick up
Afternoon	Dapto PS – Sunnybank roundabout	3:10pm – Pick up

Public Bus Network

The closest public bus stop to The School is located at the Bong Bong Road/Denham Drive intersection. This is approximately 600m from The School and an approximate 8 minute walk. Due to this distance and the provision of school bus services, it is assumed that students will not be using the public bus. The bus routes for this station are summarised in Table 2 below:

Table 2 – Public Bus Service Timetable	
Bus Service	Bus Route
31	Wollongong to Dapto to Horsley
33	Dapto to Brooks Reach

Rail Networks

The closest train station is Dapto Station which is approximately 1.6km from The School. Due to this distance it is assumed that staff/students will not be using this service.

2.3 Drop off / pick up zones

Drop off / pick up zones are required at schools to provide a safe location where students can be dropped off and picked up. They also assist in reducing traffic congestion in the area. The School currently has two designated drop off/ pick up bays. Both bays are located along the site's southern boundary along Sierra Drive, as an extension of the roadway. Refer to Figure 3 below.



Figure 3 – Drop off/ Pick up Zones

The drop off / pick up zone on the western side (Zone 1) is approximately 145m long and has a capacity of approximately 23 cars. The drop off / pick up zone on the eastern side (Zone 2) is for disability occupants only and is approximately 45m long. It has a capacity of approximately 7 cars. Both of these drop off / pick up zones are only operational between 8am – 9:30am and 2:30pm – 4:00pm (sign posted as no parking during these times). This allows the zones to be used for parking at other times.

2.4 Bus zone arrangement

The School currently has one designated bus bay located on the southern end of Sierra Drive. Refer to Figure 4 below. The bus bay forms an extension of the roadway and is approximately 45m long. The bus bay has a capacity of approximately 2 “standard” buses at one time (based on the State Transit’s Bus Infrastructure Guide). The bus zone has a time limit of 8:00-9:30am and 2:30-4:00pm. This allows the zone to be used for parking at other times. The times of operation also allow a buffer around the times required by the buses, so that all vehicles have been moved from the zone when required. Time operated bus zones are typical at most schools.



Figure 4 – Bus Bay Arrangement

2.5 Parking

On-site Parking

The School has an existing sealed asphalt car park located in the south eastern corner of the site. This car park is accessible off Sierra Drive and has 33-line marked parking spaces (including one disabled). Refer to Figure 6 below. This car park has been signposted as staff only.

Off-site Parking

Within proximity to The School, off-site parking is available along Sierra Drive. Refer to Figure 5 below. There are three parking bays on the southern side of the road and two parking bays on the eastern side of Sierra Drive:

- Parking Bay 1 is around 25m long and a capacity of approximately 4 cars
- Parking Bay 2 is around 135m long and a capacity of approximately 21 cars
- Parking Bay 3 is around 40m long and a capacity of approximately 6 cars
- Parking Bays 4 and 5 are around 12m long and a capacity of approximately 2 cars each

Parking bays 1-3 are not signposted suggesting that they do not have time limits and are available for parking 24 hours 7 days a week. Parking bays 4 and 5 are signposted as 15-minute parking between 8am – 9:30am and 2:30pm – 4:00pm.

The total off-site parking along the southern end of Sierra Drive during school hours is approximately 35 cars.

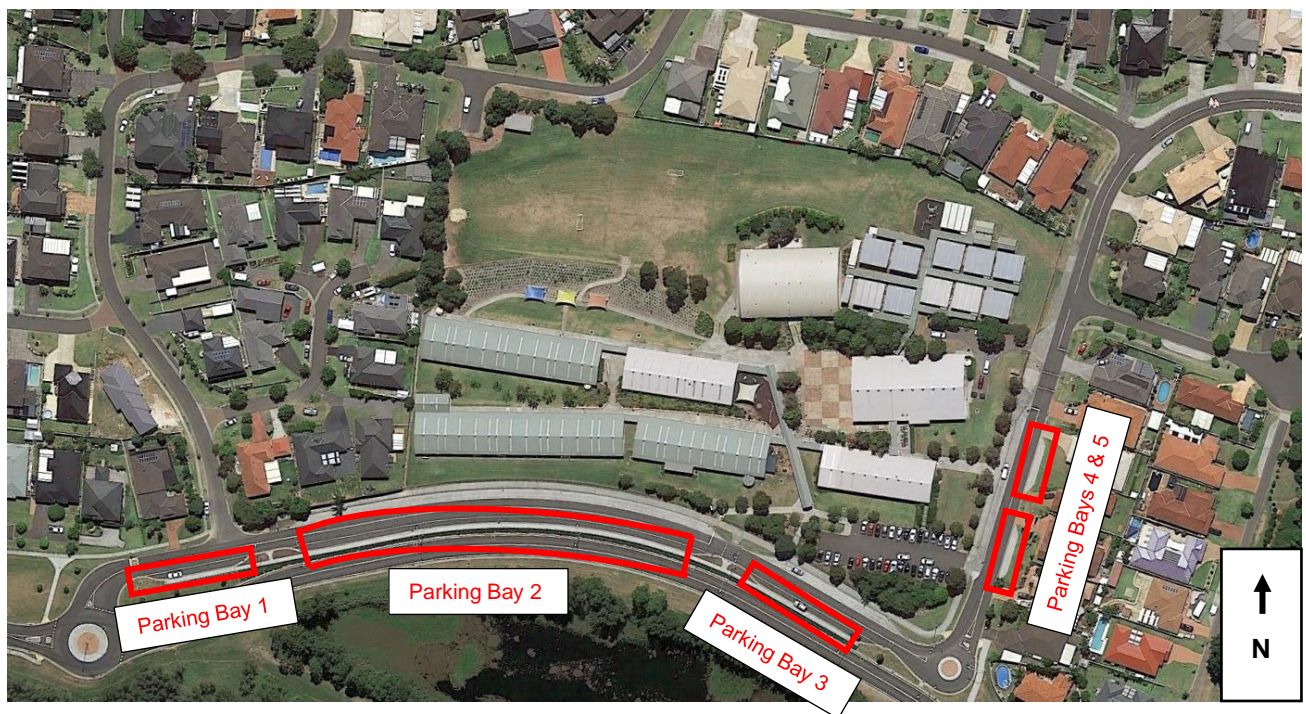


Figure 5 – Off-Site Parking

2.5 Access

Driveways

There are two main access driveways to the existing school, both of which are off the southern end of Sierra Drive. Refer to Figure 6 below. The southern driveway provides vehicular access to the staff car park while the northern driveway provides access to the service bay.



Figure 6 – School Access

2.6 Existing Traffic

Woolacotts undertook a traffic survey on the 2nd of April 2019 to assess the existing traffic situation at The School and the adjacent roundabout. The survey took place between the 8am - 10am and 2pm - 4pm for The School traffic and 7am – 9:30am and 2pm – 6pm for the intersection traffic. The following observations made:

Drop off / pick up

- Between 8:00am – 10:00am, there were a total of 322 cars dropping off students to school
- Between 2:00pm – 4:00pm, there were a total of 148 cars picking up students from school
- The peak traffic periods were 30 minutes long and took place between 8:30am - 9:00am and 2:45pm - 3:15pm
- Between 8:30am – 9:00am, there were approximately 274 cars dropping off students to school
- Between 2:45pm and 3:15pm, there were approximately 126 cars picking up students from school
- Typical drop off times from 8:30am - 9:00am were approximately 30 – 50 seconds
- Typical pick up times from 2:45pm - 3:15pm ranged from approximately 5 - 20 minutes
- Drop off / pick up typically occurred in the following areas:
 - Drop off / pick up zones 1 and 2
 - Parking Bays 1-5
- Drop off / pick up zones reached capacity multiple times during the AM and PM peak
- The following areas / zones were misused for drop off / pick up
 - Zone 2 (disability parking only) – Refer Figure 3
 - Bus zone
 - Service zone

On-site Parking

- 40 cars were parked in the staff car park by 9:30am
- 7 cars were parked in the service vehicle area by 9:30am

Off-site Parking

AM Peak

- 8 cars were parked in Parking Bays 2 & 3 before 8am (less than 30%). These were staff cars.

PM Peak

- 23 cars were parked in Parking Bays 2 & 3 at 2:30pm

Fairwater Drive / Sierra Drive Roundabout

- The commuter peaks were between 8:30am – 9am (AM peak) and 2:30pm - 3pm (PM peak)
 - Between 8:30am and 9am, 652 vehicles passed through the roundabout
 - Between 2:30pm and 3pm, 376 vehicles passed through the roundabout
- During the AM peak the roundabout performed satisfactory with no long delays (i.e. no more than 5 cars in a queue)
- During the PM peak between 2:52pm – 2:59pm traffic congestion from Sierra Drive extended all the way to the roundabout which paused the traffic flow for 7 minutes

2.7 Existing cyclists and pedestrians

The main pedestrian access to The School will be from Sierra Drive. There are pedestrian footpaths on the southern and eastern boundaries of The School. Multiple entry points will be provided along the frontage, to access various parts of The School. There are two pedestrian crossings on Sierra Drive. Refer to Figure 7 below.

These pedestrian crossings are not line marked (i.e. there is no zebra crossing). As a result, removeable signs are hung by school staff to indicate that children are crossing.



Figure 7 – Pedestrian Crossings

3. The development and impact

3.1 Proposed works

The development proposed for the site consists of:

- New 2 & 3 storey buildings – 20 homebases, WC's, stairs and lift
- New library extension
- New admin extension
- Removal of existing demountables

The expansion of The School will cater for a total of 870 students and 51 staff, increasing from the current maximum of 738 students and 36 staff.

3.2 Public transport and bus zones

Public transport options and the existing bus zone layout are to remain as is.

3.3 Drop off / pick up

The existing school has 738 students and 36 staff. The traffic survey undertaken on the 2nd of April 2019 had shown a total of 322 cars dropping students off from 8am – 10am and a total of 148 cars picking students up from 2pm – 4pm. This gives a student to cars ratio of 0.44 (8am – 10am) and 0.20 (2pm – 4pm).

The proposed development will result in an additional 132 students. Pro-rata of the above ratio results in 58 additional cars from 8am – 10am and 27 additional cars from 2pm-4pm. This gives a total of 380 cars (8am – 10am) and 175 cars (2pm – 4pm).

The peak traffic periods for The School are 30 minutes long, taking place between 8:30am - 9:00am and 2:45pm - 3:15pm. The traffic survey revealed that the 30-minute peak is approximately 85% of the total drop off / pick up number. Hence for the proposed re-development:

- AM Peak = 323 cars
- PM Peak = 149 cars

The existing drop off / pick up zone (Zone 1) is approximately 145m long and has capacity for approximately 23 cars. Considering the 30-minute peak period and the AM and PM peak car numbers, the proposed time available for each car to unload / pick up is:

- AM Peak = 128 seconds
- PM Peak = 4 minutes and 38 seconds

Compared to the typical unload time from the survey (30 – 50 seconds for the AM peak) there is sufficient time to get out of vehicles. Furthermore, parking bays 1 – 5 are available for drop off / pick up (the existing survey revealed that less than 30% of these parking bays were used for all day parking). The 5 to 20 minute pick up time from the survey (the PM peak) resulted in stationary traffic up to the Fairwater Drive / Sierra Drive roundabout for 7 minutes.

Additionally, the traffic survey showed the existing drop off / pick up zone reaching capacity multiple times. The reason for this is that large clusters of cars arrived just before 9am in the AM peak and just after 3pm in the PM peak. To minimise large clusters the following recommendations could be adopted:

- Encourage parents to stagger their arrivals for the AM drop off and PM pickup. Noting that many classes have family members in multiple classes so the opportunity to stagger pick up times more than 10-15 minutes is limited.
- Encourage parents to not wait in the drop off / pick up zone if a student is not ready to be picked up.
- Parents should consider sustainable transport measures where feasible
- Parents can park around the local streets and walk the students to school. Local streets within 500m of The School include Armitage Avenue, Reed Park Place, Sierra Drive, Denham Drive etc.
- Parents dropping off / picking up students in unauthorized zones (e.g. the service bay) or performing illegal moves (e.g. u -turns). To reduce the extent of this occurring enforcement of the road rules by the road authority is required

3.4 Parking

Chapter E3: Car Parking, Access, Servicing/Service Facilities and Traffic Management of the Wollongong Development Control 2009 details the minimum car parking requirements for developments. For educational establishments, the DCP requires the following:

- 1 space for every staff member

Staff numbers provided by the Department of Education indicate that the proposed development will result in a total of 51 staff, an increase of 15 from existing staff numbers. The existing staff car park has 33-line marked parking spaces (1 accessible parking space), hence an additional 17 spaces (including 1 accessible parking space) is required.

In addition to the above staff numbers, the existing parking survey revealed the following:

- 40 cars were parked in the designated staff car park
- 7 cars were parked in the service vehicle area
- and 8 cars were parked all day on Sierra Drive

All of the above cars were observed to have been parked for most of the day from 9:30am to 2:30pm. This survey data suggests that in addition to staff, parents and/or ancillary staff are also utilizing the school's parking facilities. For this reason, it is proposed to provide an additional 10 spaces for ancillary staff/parents, resulting in a total 28 spaces (including 2 accessible parking spaces).

It is proposed to provide a new car park attached to the northern side of the existing service bay. This new car park will result in 28 additional parking spaces. *Note: the new car park will have a total of 30 spaces to allow for the modification of the existing staff car park to convert 5 spaces into 3 accessible spaces (as this is closer to the main entrance to the school).*

The proposed car park will have an access driveway off the existing service bay. Refer to Figure 8 below for the location of the proposed car park and Appendix A for the proposed car park plan.

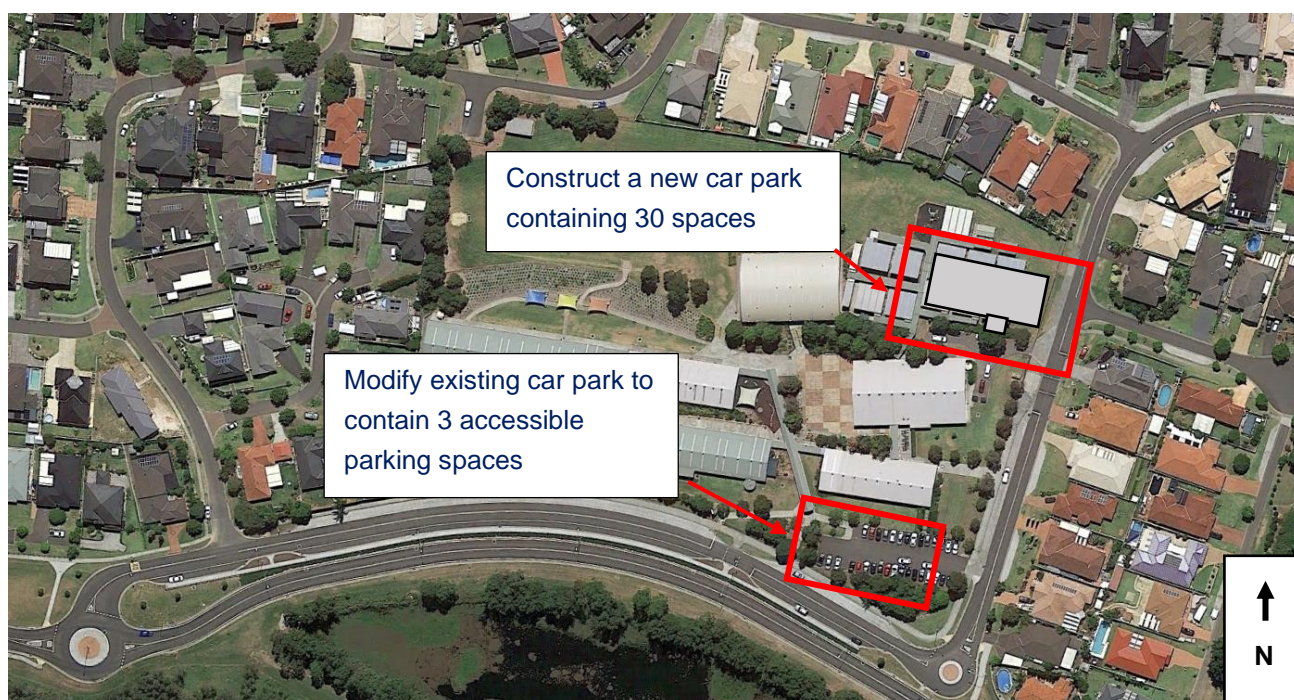


Figure 8 – Location of Proposed Car Park

3.5 Access

Driveways

The two existing access driveways off Sierra Drive are to remain as is. Refer to Figure 6.

Emergency vehicle access

Emergency vehicle access to the existing school will not be altered, access is available to both the staff parking area and service bay.

3.6 Traffic generation and modal split

The RMS *Guide to Traffic Generating Developments* does not give advice on traffic generation for educational establishments. Therefore, estimates need to be made based on data from the existing survey and knowledge of the development.

As the site is a school, the following traffic movements will occur:

- Staff will arrive in the morning, typically in the 30minutes before school starts. Some staff will be in earlier, to undertake administrative tasks. Based on the projected staff parking numbers, this will result in approximately 15 additional vehicle movements to The School.
- Parents dropping off students typically arrive 30minutes before school begins. Based on projected student numbers this will generate 58 additional vehicles.
- Staff will depart in the afternoon, after classes finish. Leaving times will vary depending on administrative tasks required. Typically, all movements will occur in the hour after classes finish. We have estimated that there will be 15 additional vehicles leaving after school finishes.
- Parents will typically arrive just before or just after classes finish, pick up students and then depart. Based on projected student numbers this will generate 27 additional vehicles.
- Visitors and deliveries will occur throughout the day.

In summary, the traffic generated during the morning and afternoon peaks when The School is at peak capacity is estimated as follows:

- AM peak
 - 73 additional vehicles driving to The School
 - 58 additional vehicles leaving The School
- PM peak
 - 27 additional vehicles driving to school
 - 42 additional vehicles leaving The School

Impact of generated traffic

The impact of the additional generated traffic on the Fairwater Drive / Sierra Drive Intersection has been modelled in SIDRA. Refer to Section 4 '*Intersection operation and SIDRA analysis*' below.

3.7 Pedestrians and cyclists

Existing pedestrian access points to the site are to remain as is. It is recommended as part of the regular road safety reviews conducted by the road authority that safety measures for cyclists and pedestrians are considered including such measures as wombat crossings, segregated bike paths, etc.

To facilitate students and staff riding to school, bicycle storage racks will be provided in accordance with the Wollongong Development Control 2009.

Chapter E3: Car Parking, Access, Servicing/Service Facilities and Traffic Management of the Wollongong Development Control 2009 details the minimum bicycle parking requirements for developments. For educational establishments, the DCP requires the following:

- 1 bicycle space per 10 students above grade 4

The School will be extended to cater for approximately 132 additional students. Averaging these student projections from kindergarten to year 6 gives 19 additional students per year group, hence years 5 and 6 will have 38 students. This results in a minimum 4 additional bicycle spaces as per Council's DCP requirements. Table 1: Bicycle End-of-trip Facilities in the Chapter E3 of the DCP states that less than 5 bicycle spaces does not require showers, change cubicles or personal lockers.

To facilitate students and staff riding/walking to school, 4 additional bicycle spaces will be added to the Bike Parking area adjacent Block B Hall. The School currently has 72 places for bikes. Refer to the Green Travel Plan prepared by Woolacotts for further details.

4. Intersection operation and SIDRA analysis

To understand the operation of the Sierra Drive / Fairwater Drive intersection, both the existing and anticipated future traffic volumes for the intersection were modelled using SIDRA. The following sections detail the results of this analysis.

4.1 Existing Conditions

Intersection layout

The existing intersection consists of the following:

- Fairwater Drive has one lane in each direction on the eastern and western legs of the intersection
- Sierra Drive has one lane in each direction on the northern leg of the intersection

Refer to the existing layout below.



Figure 9 – Fairwater Drive / Sierra Drive Intersection

Existing traffic

Woolacotts undertook a traffic survey on the 2nd of April 2019 to assess the existing traffic situation at the Sierra Drive / Fairwater Drive intersection. The survey took place between the 7am – 9:30am and 2pm – 6pm. The 30 minute intersection peaks took place between 8:30 – 9am (AM peak) and 2:30 – 3pm (PM peak). Refer to Figure 10 and 11 below for the existing traffic numbers during the 30 minute AM and PM peaks.

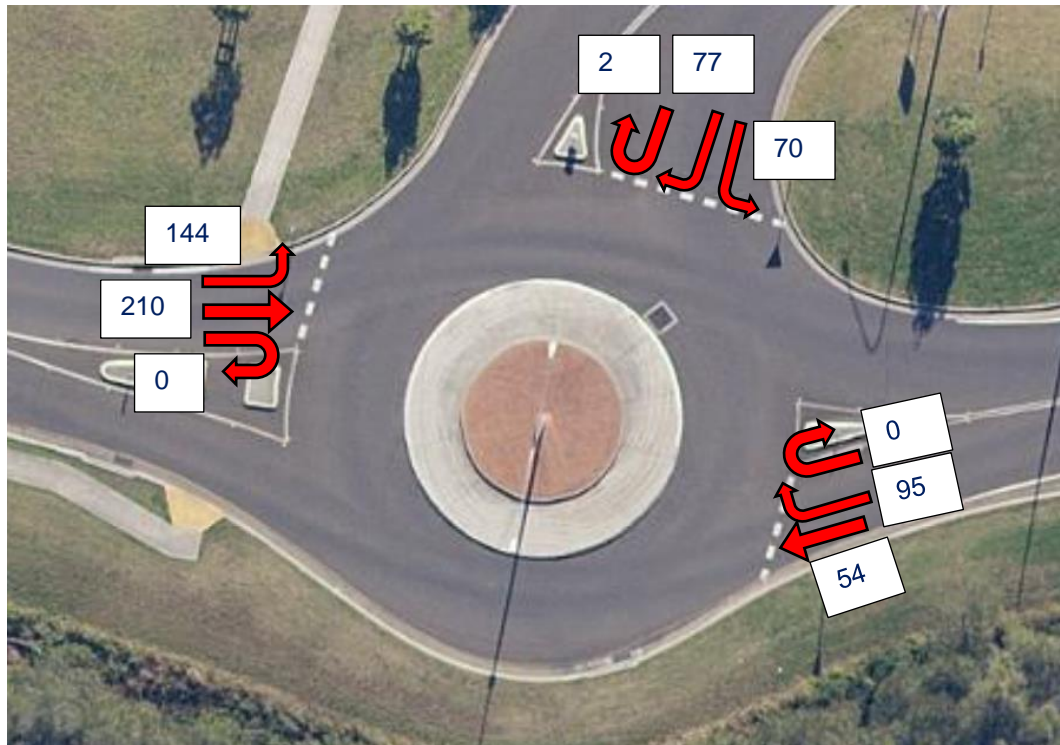


Figure 10 – Existing AM Peak Traffic Volumes

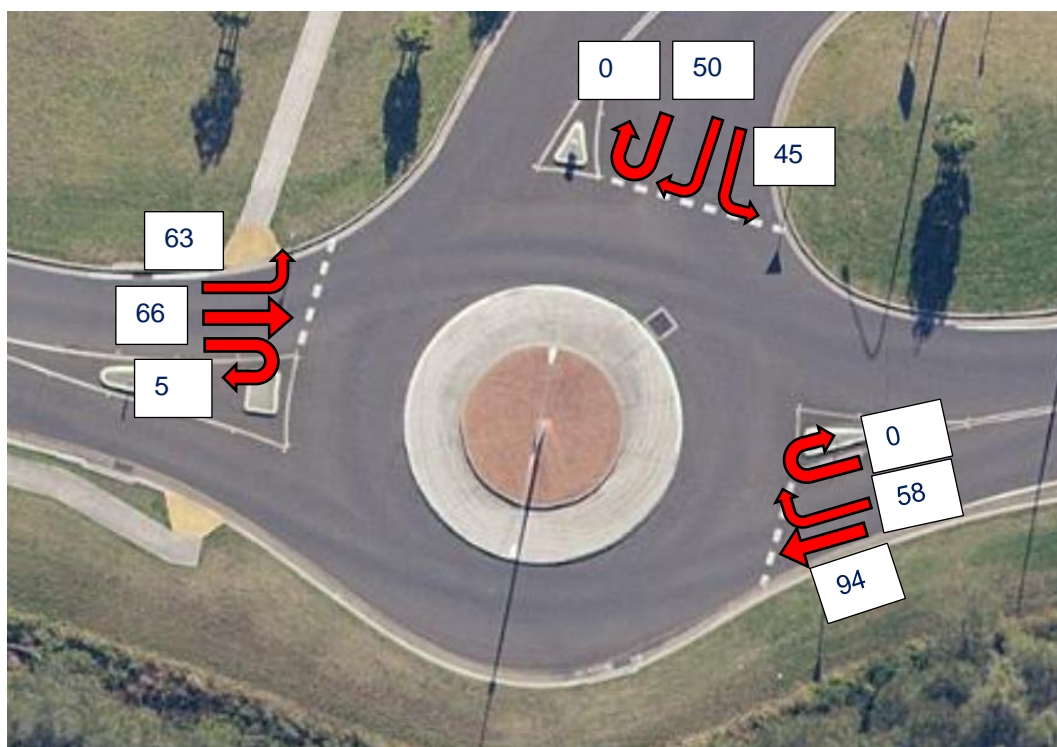


Figure 11 – Existing PM Peak Traffic Volumes

Pedestrians and cyclists

There is an existing unmarked pedestrian crossing on the western leg of the intersection, extending north-south. This crossing connects the existing pedestrian footpath along the southern side Fairwater Drive to the pedestrian footpath along the western side of Sierra Drive. Refer to Figure 9 above.

During the intersection survey period, only 4 pedestrians were counted using the existing pedestrian crossing during the morning period (7am to 9:30am) and 10 during the afternoon period (2pm to 6pm). These pedestrian counts all occurred during the AM and PM peak, and consisted of parents / students travelling to and from school.

There were no cyclists observed passing through the intersection or using the intersection crossing during the survey period.

The existing crossing is unmarked (i.e. not a Zebra crossing), therefore cars are not required to stop for pedestrians wanting to cross. As a result, pedestrians are expected to cross when safe to do so. This means that pedestrians will not impact intersection performance.

SIDRA Analysis

The existing traffic volumes through the Fairwater Drive / Sierra Drive Intersection during the AM and PM peaks were modelled in SIDRA. Refer to the results in Figure 12 and 13 below. The analysis found that the existing traffic volumes gave acceptable delays with level of service of A across each leg of the intersection for the AM and PM peaks. Refer to Appendix B for detailed SIDRA output.

Lane Level of Service

Site: 101 [Dapto PS - AM Peak]

Fairwater Drive / Sierra Drive Intersection
Site Category: AM PEAK
Roundabout

	Approaches			Intersection
	East	North	West	
LOS	A	A	A	A

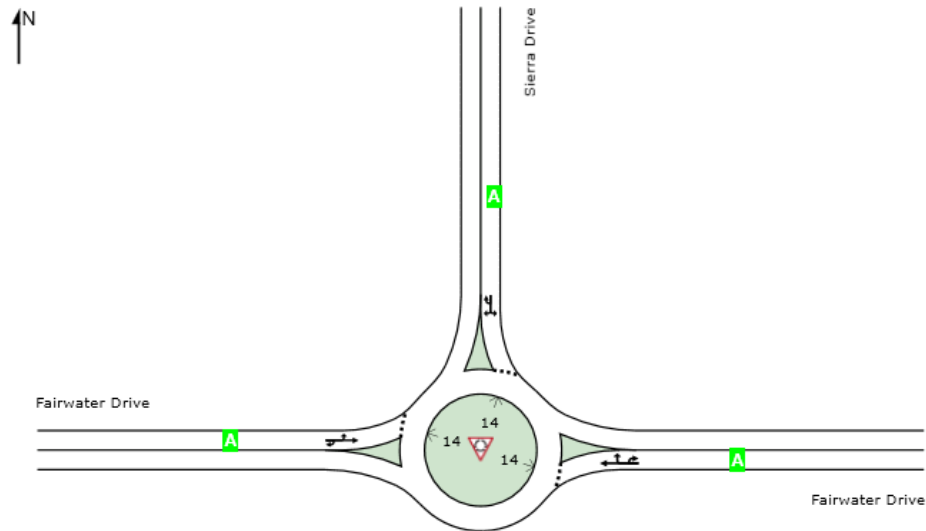


Figure 12 – Existing AM Peak SIDRA Results

Lane Level of Service

Site: 101 [Dapto PS - PM Peak]

Fairwater Drive / Sierra Drive Intersection
Site Category: PM PEAK
Roundabout

	Approaches			Intersection
	East	North	West	
LOS	A	A	A	A

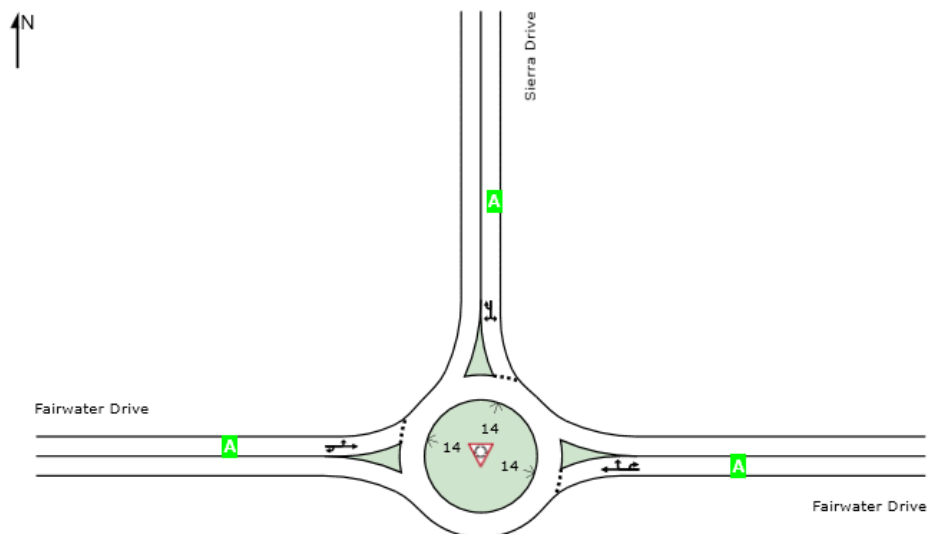


Figure 13 – Existing PM Peak SIDRA Results

4.2 Future Conditions

Future traffic

The estimated future traffic generated by the proposed development is discussed in Section 3.6 'Traffic generation and modal split' above. A summary of this traffic generation during the school's AM and PM peaks is as follows:

- AM peak
 - 73 additional vehicles driving to The School
 - 58 additional vehicles leaving The School
- PM peak
 - 27 additional vehicles driving to school
 - 42 additional vehicles leaving The School

The AM peak for the school (8:30am to 9:00am) aligns with the AM peak of the intersection (8:30am to 9:00am), while the PM peak for the school (2:45pm to 3:15pm) starts 15 minutes later than the PM peak for the intersection (2:30pm to 3:00pm). For the purposes of modelling, the PM peak for the school was conservatively assumed to align with the PM peak of the intersection.

Lane Distribution

To determine the lane distribution of generated traffic through the Fairwater Drive / Sierra Drive intersection, the following assumptions were made:

- The traffic going straight through the intersection via Fairwater Drive does not contribute to school traffic
- 85% of generated school traffic arriving / leaving the school, during the AM and PM peaks, passes through the Fairwater Drive / Sierra Drive intersection; as opposed to travelling through the network of residential streets to the north of the intersection
- During the AM peak, staff pass through the intersection once, by turning onto Sierra Drive from Fairwater Drive to park for the day.
- During the PM peak, staff pass through the intersection once, by turning onto Fairwater Drive from Sierra Drive to leave for the day.
- Parents that pass through the intersection to drop off / pick up students can turn around on Sierra Drive after drop off / pick and come back through the intersection the way they came. This is due to the existing roundabout on Sierra Drive located adjacent the south eastern corner of The School, refer to Figure 5 above. During the AM and PM peaks, it is assumed that 70% of the generated school traffic use the Sierra Drive roundabout to come back through the intersection the way they came.
- The portion of generated vehicles turning left / right from Fairwater Drive to Sierra Drive will be based on the ratio of existing vehicles turning left / right, deduced from traffic counts.
- The portion of generated vehicles turning left / right from Sierra Drive to Fairwater Drive will be based on the ratio of existing vehicles turning left / right, deduced from traffic counts.

Refer to Figures 14 and 15 below for the total future traffic volumes (existing traffic plus generated traffic) during the 30 minute AM and PM peaks.

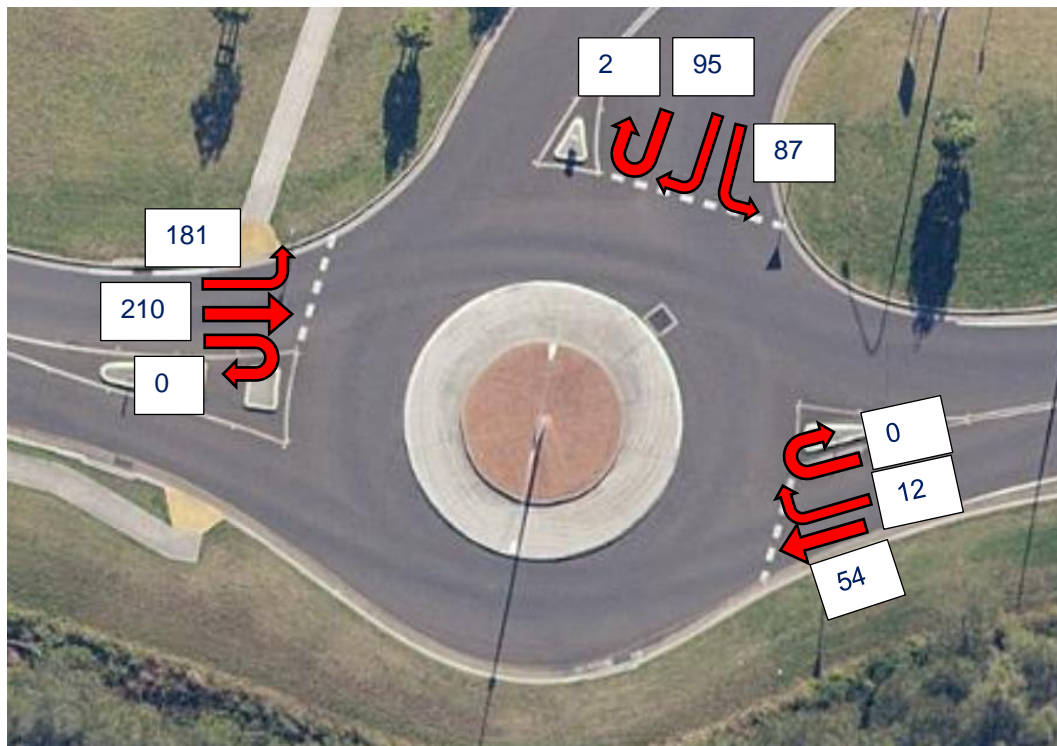


Figure 14 – Future AM Peak Traffic Volumes

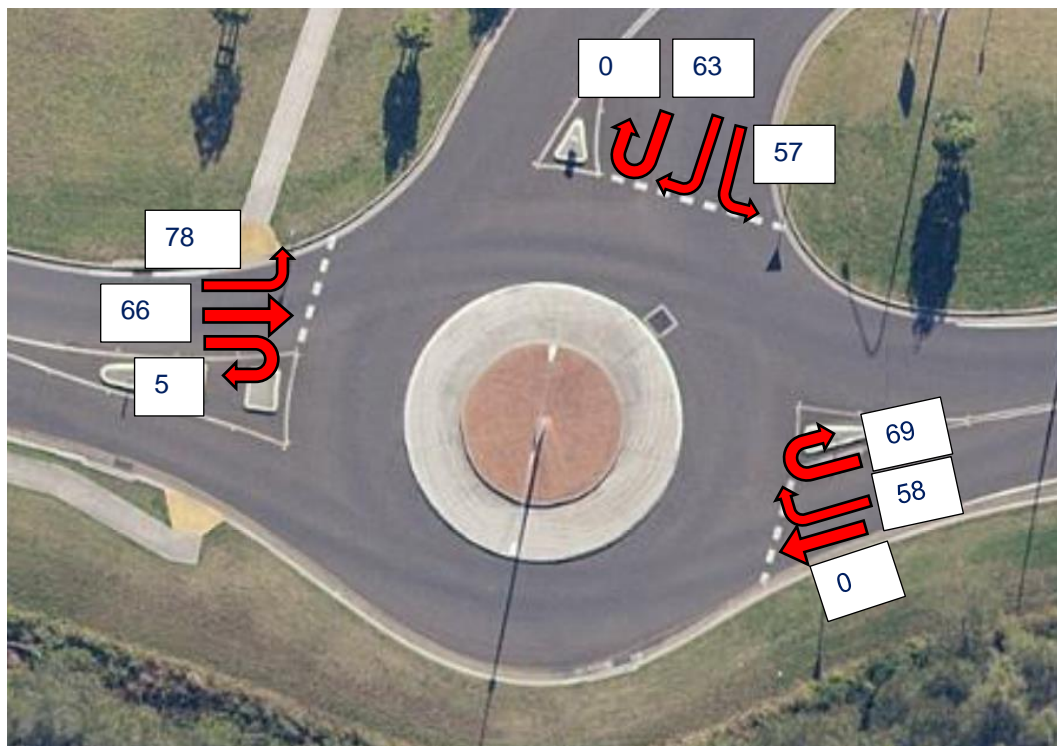


Figure 15 – Future PM Peak Traffic Volumes

Pedestrians and cyclists

It is anticipated that the number of pedestrians / cyclists will increase with the proposed development. However as stated above, as the existing crossing is unmarked (i.e. not a Zebra crossing) cars are not required to stop for pedestrians wanting to cross, as a result, pedestrians are expected to cross when safe to do so. This means that pedestrians / cyclists will not impact intersection performance.

SIDRA Analysis

The anticipated future traffic volumes through the Fairwater Drive / Sierra Drive Intersection during the AM and PM peaks were modelled in SIDRA. Refer to the results in Figure 16 and 17 below. The analysis found that the future traffic volumes gave acceptable delays with level of service of A across each leg of the intersection for the AM and PM peaks. Refer to Appendix B for detailed SIDRA output.

Lane Level of Service

Site: 101 [Dapto PS - AM Peak - Future]

Fairwater Drive / Sierra Drive Intersection
Site Category: AM PEAK
Roundabout

	Approaches			Intersection
	East	North	West	
LOS	A	A	A	A

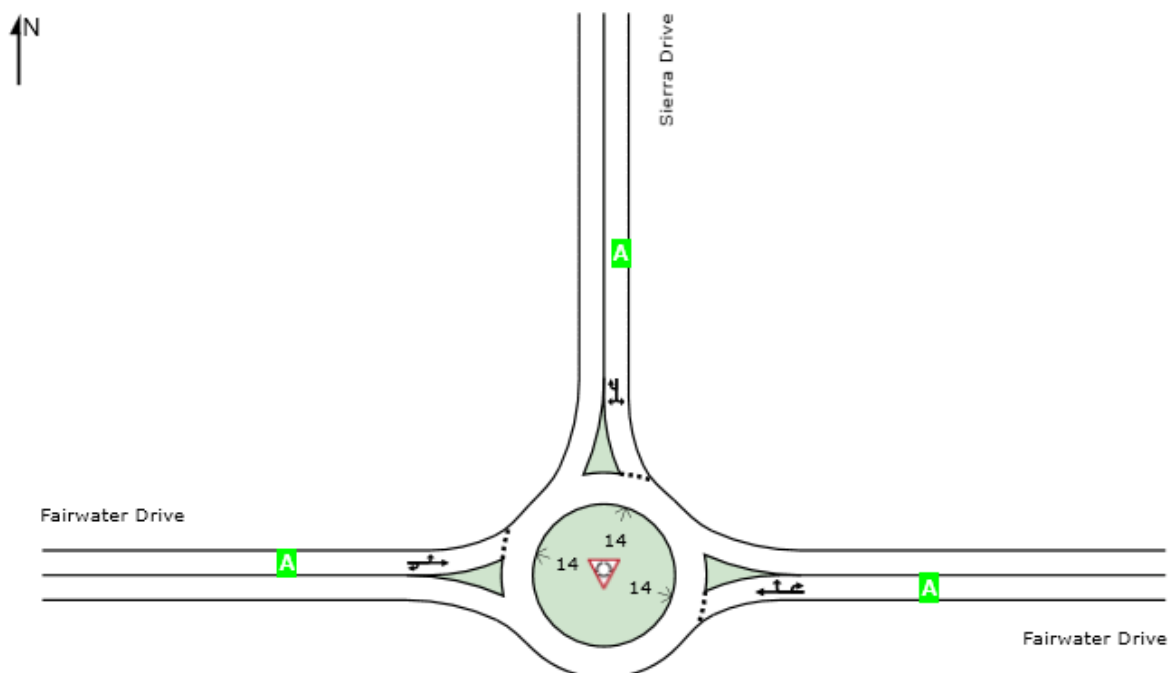


Figure 16 – Future AM Peak SIDRA Results

Lane Level of Service

Site: 101 [Dapto PS - PM Peak - Future]

Fairwater Drive / Sierra Drive Intersection
 Site Category: PM PEAK
 Roundabout

	Approaches			Intersection
	East	North	West	
LOS	A	A	A	A

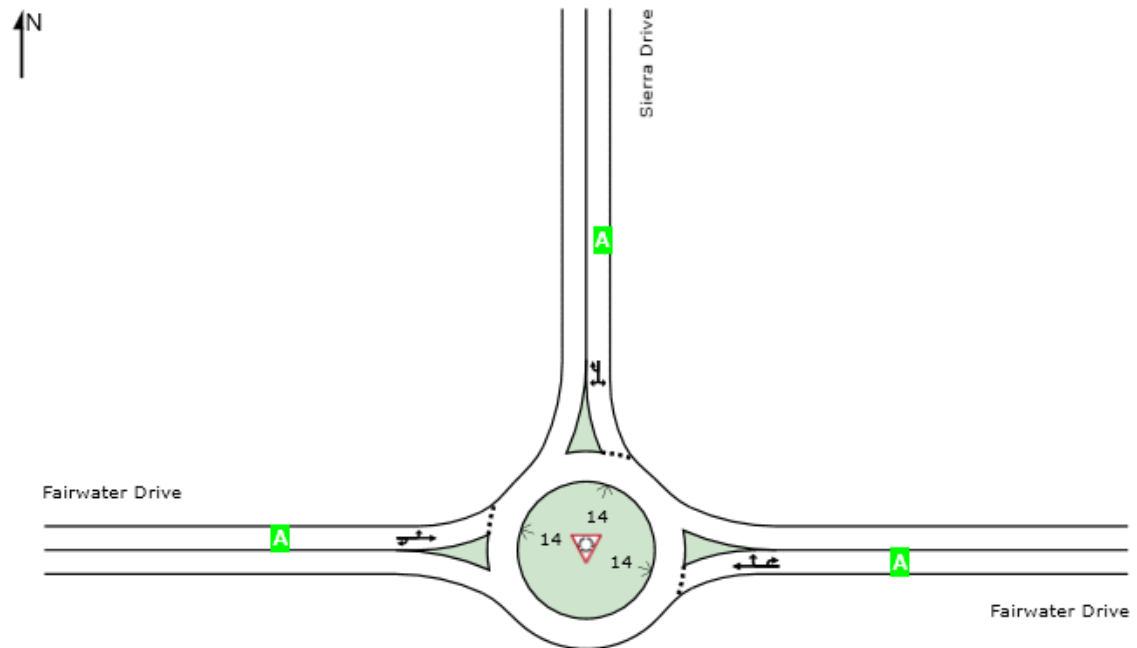


Figure 16 – Future PM Peak SIDRA Results

4.3 Comparison of Existing and Future Intersection Performance

Table 3 below presents a comparison of the average delays and level of service for the AM and PM peaks for the Fairwater Drive / Sierra Drive Intersection, for both existing and future traffic volumes.

The comparison shows that the future generated traffic has a very slight increase in delay for the intersection (2.1 seconds in the AM peak and 0.3 seconds in the PM peak) and does not change the level of service for the intersection, which is A.

Table 3 – Summary of SIDRA Analysis – AM / PM Peak					
Road	Movement	Average Delay (seconds) and Level of Service			
		AM Peak		PM Peak	
		Existing	Future	Existing	Future
Fairwater Drive (Eastern Leg)	Right turn	9.6s / A	9.9s / A	9.1s / A	9.3s / A
	Straight	5.7s / A	6.1s / A	5.3s / A	5.5s / A
	U-turn	11.2s / A	11.6s / A	10.9s / A	11.0s / A
Fairwater Drive (Western Leg)	Left turn	6.5s / A	10.0 / A	5.1s / A	5.3s / A
	Straight	6.8s / A	10.2s / A	5.3s / A	5.5s / A
	U-turn	12.3s / A	15.7s / B	10.9s / A	11.1s / A
Sierra Drive (Northern Leg)	Left turn	7.9s / A	8.4s / A	5.2s / A	5.3s / A
	Right turn	12.0s / A	12.5s / A	9.3s / A	9.4s / A
	U-turn	12.3s / A	14.1s / A	11.1s / A	11.1s / A
Intersection	-	7.8s / A	9.9s / A	6.5s / A	6.8s / A

4 Construction traffic

The main access to the construction site will be from Sierra Drive, off Fairwater Drive. Truck movements will occur throughout construction, with delivery of materials occurring on a daily basis, throughout the day. The largest number of truck movements is typically during concrete pours, when up to 30 trucks a day could be attending the site.

Contractors' vehicles will generally arrive in the morning and leave at the end of the working day. Additional movements of these vehicles may occur at lunch, with groups of contractors driving to the town centre to purchase food and drinks. Parking for contractors' vehicles will be provided on site.

Pedestrian and cyclist routes past the site shall be protected during construction where required. Fencing and/or hoarding in accordance with the relevant standards will be provided around the site to provide protection and prevent unauthorised access. Where works are required in the public domain, safe routes will be provided around the worksite, which will require a site-specific management plan. All vehicles leaving the site and crossing a pathway will be required to be going forwards (and not reverse). At times when large pedestrian movements occur at a site access, a traffic controller shall be provided at the gate when vehicles arrive or leave.

5 Conclusion

It is proposed to re-develop the existing Dapto Public School. As part of the proposed works, The School will be extended to cater for an increase of 132 students and 15 staff.

The only viable public transport option for The School is school bus services. The closest public bus station and railway station are over 500m away and as such, it is assumed that students/staff will not be using these services. School bus services includes four runs in the morning and four in the afternoon. Public transport options and the existing bus zone layout are to remain as is.

Traffic generation numbers and existing data show that the existing drop off/ pick up zones have sufficient capacity for the additional generated traffic with reasonable time periods, i.e. maximum drop off time of 2 minutes and maximum pick up time of 5 minutes. The traffic survey undertaken by Woolacotts revealed in the PM peak parents were taking between 5 – 20 minutes to pick up their children, which resulted in stationary traffic up to the Fairwater Drive / Sierra Drive roundabout for 7 minutes. Hence, to ensure the drop off / pick up zone runs smoothly, the following recommendations should be adopted:

- Encourage parents to stagger their arrivals for the AM drop off and PM pickup. Noting that many classes have family members in multiple classes so the opportunity to stagger pick up times more than 10-15 minutes is limited.
- Encourage parents to not wait in the drop off / pick up zone if a student is not ready to be picked up.
- Encourage parents to consider sustainable transport measures
- Parents can park around the local streets and walk the students to school. Local streets within 500m of The School include Armitage Avenue, Reed Park Place, Sierra Drive, Denham Drive etc.
- Staff to aid the movement of children from the school to awaiting parents
- Parents dropping off / picking up students in unauthorized zones (e.g. the service bay) or performing illegal moves (e.g. u -turns). To reduce the extent of this occurring enforcement of the road rules by the road authority is required

With respect to the carparking, it is proposed to provide 27 additional parking spaces in a new car park onsite. This car park will be attached to the northern side of the existing service bay and contain a total 30 spaces. These additional 3 spaces will result from the modification of the existing staff car park to contain 3 accessible spaces (this reduces the existing car park size from 33 spaces to 31 spaces).

Pedestrian and vehicular access to the existing school will remain as is.

The impact of the additional generated traffic on the Fairwater Drive / Sierra Drive Intersection during the AM and PM peaks was modelled in SIDRA. The results of this analysis were compared to existing traffic conditions (also modelled in SIDRA). The comparison of these results shows that the future generated traffic has a very slight increase in delay for the intersection (2.1 seconds in the AM peak and 0.3 seconds in the PM peak) and does not change the level of service for the intersection, which is A.

Therefore, as the generated traffic from the proposed development does not change the level of service of the Fairwater Drive / Sierra Drive intersection (during the AM and PM peaks), the proposed development is acceptable from a traffic perspective.

Appendix A

Proposed Car Park Plans

				SCALE 1:200 @ A1	
DRAWN		CHECKED		VERIFIED	
				Date	
				MAY 2019	
DRAWING NUMBER					REVISION
PROJECT	DISCIPLINE	PHASE	SERIES NUMBER		
3228	CIV-DD-	CP_001	B		

Appendix B

SIDRA Output

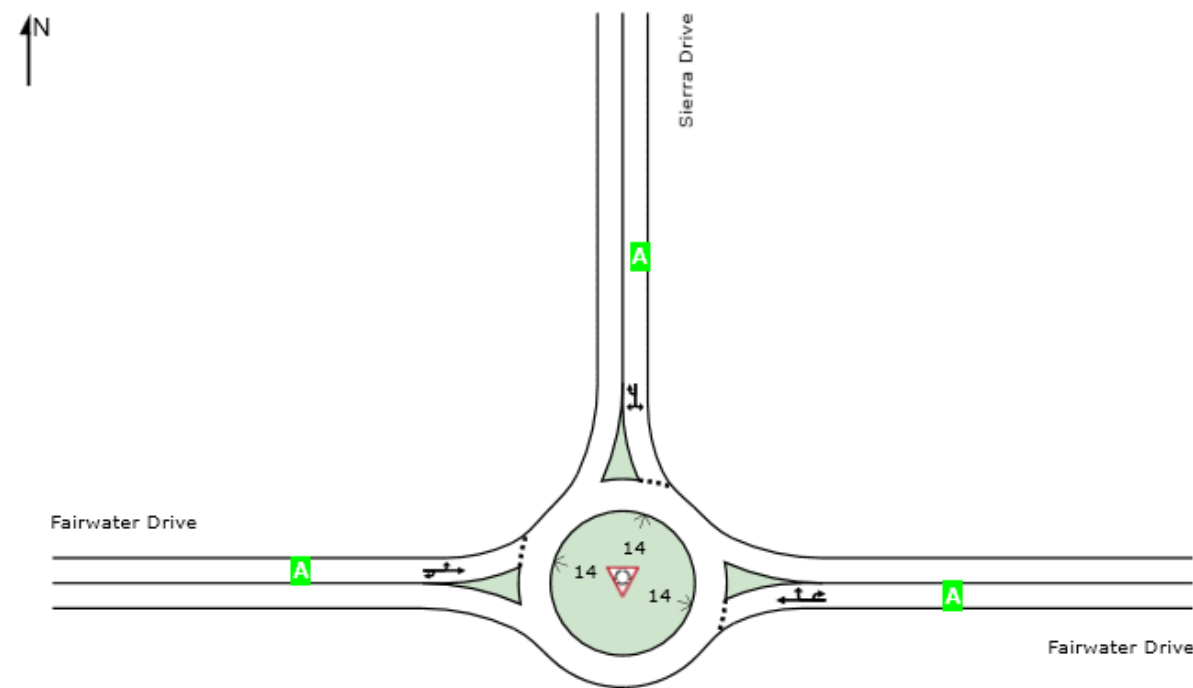
LANE LEVEL OF SERVICE

Lane Level of Service

 **Site: 101 [Dapto PS - AM Peak]**

Fairwater Drive / Sierra Drive Intersection
Site Category: AM PEAK
Roundabout

	Approaches			Intersection
	East	North	West	
LOS	A	A	A	A



Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

MOVEMENT SUMMARY

Site: 101 [Dapto PS - AM Peak]

Fairwater Drive / Sierra Drive Intersection
Site Category: AM PEAK
Roundabout

Movement Performance - Vehicles												
Mov ID	Turn	Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
East: Fairwater Drive												
5	T1	108	5.0	0.276	5.7	LOS A	2.0	14.5	0.48	0.61	0.48	53.4
6	R2	190	5.0	0.276	9.6	LOS A	2.0	14.5	0.48	0.61	0.48	52.8
6u	U	2	0.0	0.276	11.2	LOS A	2.0	14.5	0.48	0.61	0.48	55.3
Approach		300	5.0	0.276	8.2	LOS A	2.0	14.5	0.48	0.61	0.48	53.0
North: Sierra Drive												
7	L2	140	5.0	0.374	7.9	LOS A	2.7	19.8	0.75	0.79	0.75	51.3
9	R2	154	5.0	0.374	12.0	LOS A	2.7	19.8	0.75	0.79	0.75	48.5
9u	U	4	0.0	0.374	13.6	LOS A	2.7	19.8	0.75	0.79	0.75	48.6
Approach		298	4.9	0.374	10.1	LOS A	2.7	19.8	0.75	0.79	0.75	50.1
West: Fairwater Drive												
10	L2	288	5.0	0.642	6.5	LOS A	6.6	48.0	0.73	0.64	0.73	49.6
11	T1	420	5.0	0.642	6.8	LOS A	6.6	48.0	0.73	0.64	0.73	54.1
12u	U	2	0.0	0.642	12.3	LOS A	6.6	48.0	0.73	0.64	0.73	52.3
Approach		710	5.0	0.642	6.7	LOS A	6.6	48.0	0.73	0.64	0.73	52.7
All Vehicles		1308	5.0	0.642	7.8	LOS A	6.6	48.0	0.68	0.67	0.68	52.2

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.
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.

LANE LEVEL OF SERVICE

Lane Level of Service

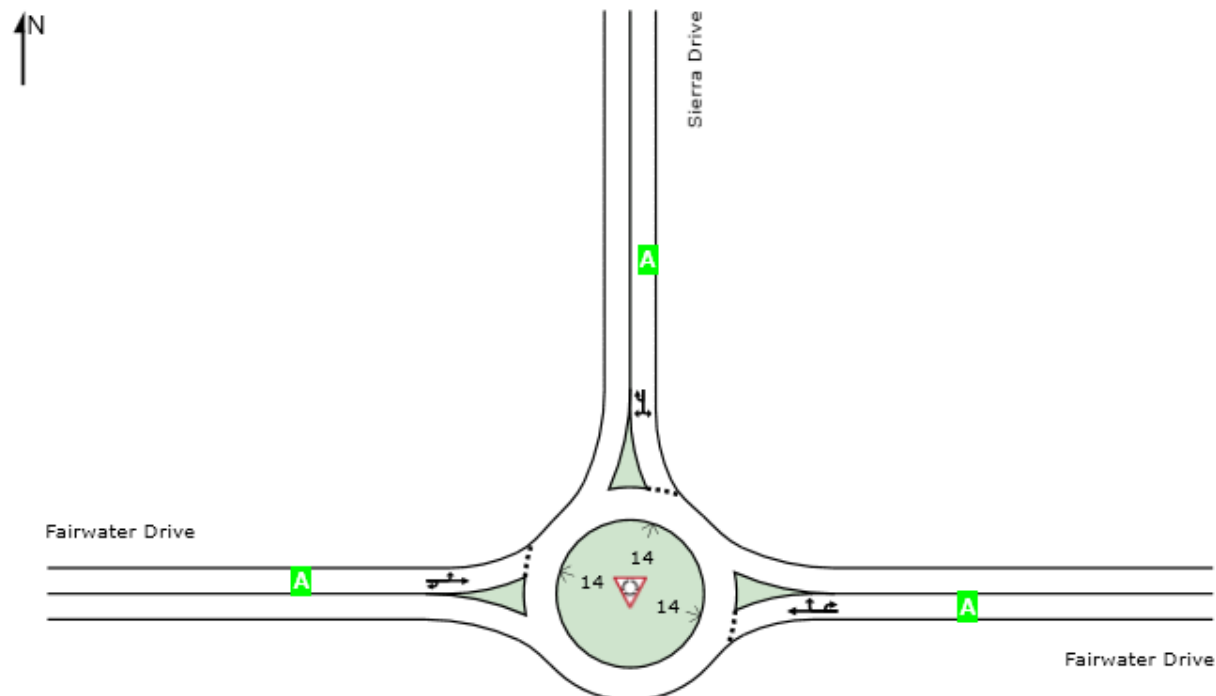
 **Site: 101 [Dapto PS - PM Peak]**

Fairwater Drive / Sierra Drive Intersection

Site Category: PM PEAK

Roundabout

	Approaches			Intersection
	East	North	West	
LOS	A	A	A	A



Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Lane LOS values are based on average delay per lane.

Intersection and Approach LOS values are based on average delay for all lanes.

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

MOVEMENT SUMMARY

Site: 101 [Dapto PS - PM Peak]

Fairwater Drive / Sierra Drive Intersection
Site Category: PM PEAK
Roundabout

Movement Performance - Vehicles												
Mov ID	Turn	Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
East: Fairwater Drive												
5	T1	188	5.0	0.255	5.3	LOS A	1.7	12.6	0.37	0.55	0.37	54.2
6	R2	116	5.0	0.255	9.1	LOS A	1.7	12.6	0.37	0.55	0.37	53.6
6u	U	2	0.0	0.255	10.9	LOS A	1.7	12.6	0.37	0.55	0.37	55.9
Approach		306	5.0	0.255	6.8	LOS A	1.7	12.6	0.37	0.55	0.37	54.0
North: Sierra Drive												
7	L2	90	5.0	0.173	5.2	LOS A	1.1	7.8	0.39	0.60	0.39	52.8
9	R2	100	5.0	0.173	9.3	LOS A	1.1	7.8	0.39	0.60	0.39	50.5
9u	U	2	0.0	0.173	11.1	LOS A	1.1	7.8	0.39	0.60	0.39	50.9
Approach		192	4.9	0.173	7.4	LOS A	1.1	7.8	0.39	0.60	0.39	51.8
West: Fairwater Drive												
10	L2	126	5.0	0.228	5.1	LOS A	1.5	10.9	0.37	0.52	0.37	51.1
11	T1	132	5.0	0.228	5.3	LOS A	1.5	10.9	0.37	0.52	0.37	55.1
12u	U	10	0.0	0.228	10.9	LOS A	1.5	10.9	0.37	0.52	0.37	53.7
Approach		268	4.8	0.228	5.4	LOS A	1.5	10.9	0.37	0.52	0.37	53.5
All Vehicles		766	4.9	0.255	6.5	LOS A	1.7	12.6	0.37	0.55	0.37	53.4

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

LANE LEVEL OF SERVICE

Lane Level of Service

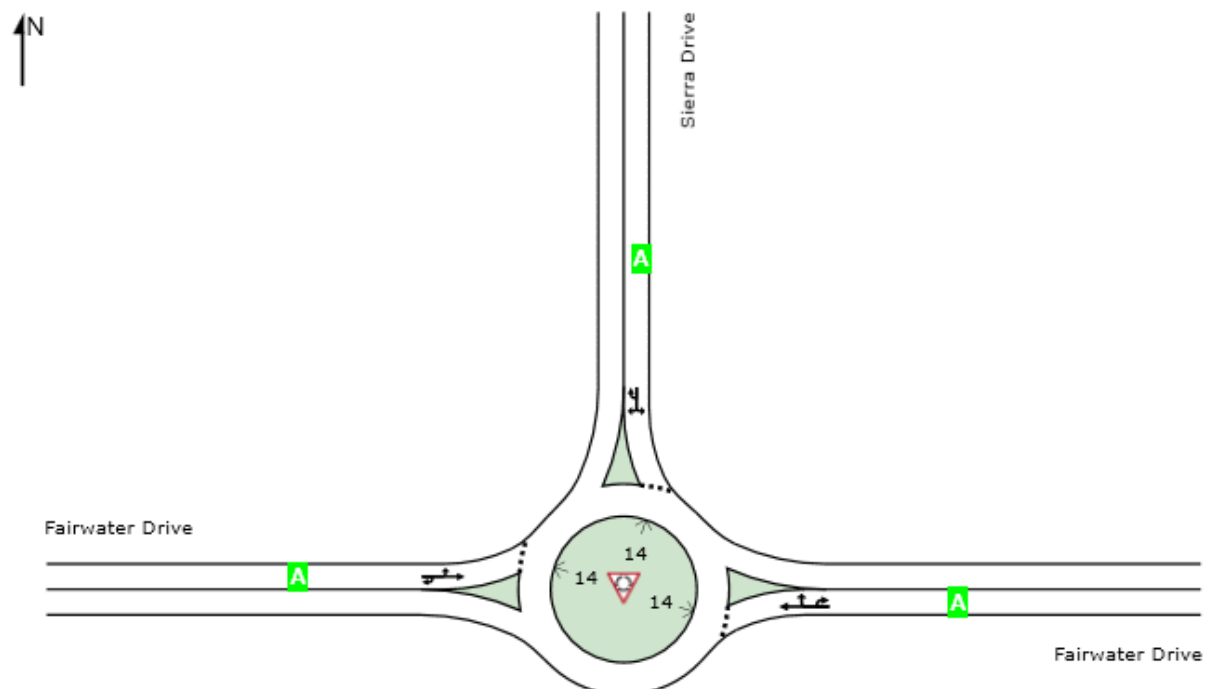
 **Site: 101 [Dapto PS - AM Peak - Future]**

Fairwater Drive / Sierra Drive Intersection

Site Category: AM PEAK

Roundabout

	Approaches			Intersection
	East	North	West	
LOS	A	A	A	A



Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Lane LOS values are based on average delay per lane.

Intersection and Approach LOS values are based on average delay for all lanes.

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

MOVEMENT SUMMARY

Site: 101 [Dapto PS - AM Peak - Future]

Fairwater Drive / Sierra Drive Intersection
Site Category: AM PEAK
Roundabout

Movement Performance - Vehicles												
Mov ID	Turn	Total veh/h	Demand Flows HV %	Deg. Sain v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
East: Fairwater Drive												
5	T1	108	5.0	0.337	6.1	LOS A	2.6	18.7	0.56	0.65	0.56	53.1
6	R2	240	5.0	0.337	9.9	LOS A	2.6	18.7	0.56	0.65	0.56	52.4
6u	U	2	0.0	0.337	11.6	LOS A	2.6	18.7	0.56	0.65	0.56	55.0
Approach		350	5.0	0.337	8.8	LOS A	2.6	18.7	0.56	0.65	0.56	52.7
North: Sierra Drive												
7	L2	174	5.0	0.472	8.4	LOS A	3.9	28.1	0.82	0.83	0.84	51.0
9	R2	190	5.0	0.472	12.5	LOS A	3.9	28.1	0.82	0.83	0.84	48.0
9u	U	4	0.0	0.472	14.1	LOS A	3.9	28.1	0.82	0.83	0.84	48.1
Approach		368	4.9	0.472	10.6	LOS A	3.9	28.1	0.82	0.83	0.84	49.7
West: Fairwater Drive												
10	L2	362	5.0	0.756	10.0	LOS A	11.3	82.2	0.91	0.82	1.06	47.5
11	T1	420	5.0	0.756	10.2	LOS A	11.3	82.2	0.91	0.82	1.06	52.5
12u	U	2	0.0	0.756	15.7	LOS B	11.3	82.2	0.91	0.82	1.06	50.1
Approach		784	5.0	0.756	10.1	LOS A	11.3	82.2	0.91	0.82	1.06	50.7
All Vehicles		1502	5.0	0.756	9.9	LOS A	11.3	82.2	0.80	0.78	0.89	51.0

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

LANE LEVEL OF SERVICE

Lane Level of Service

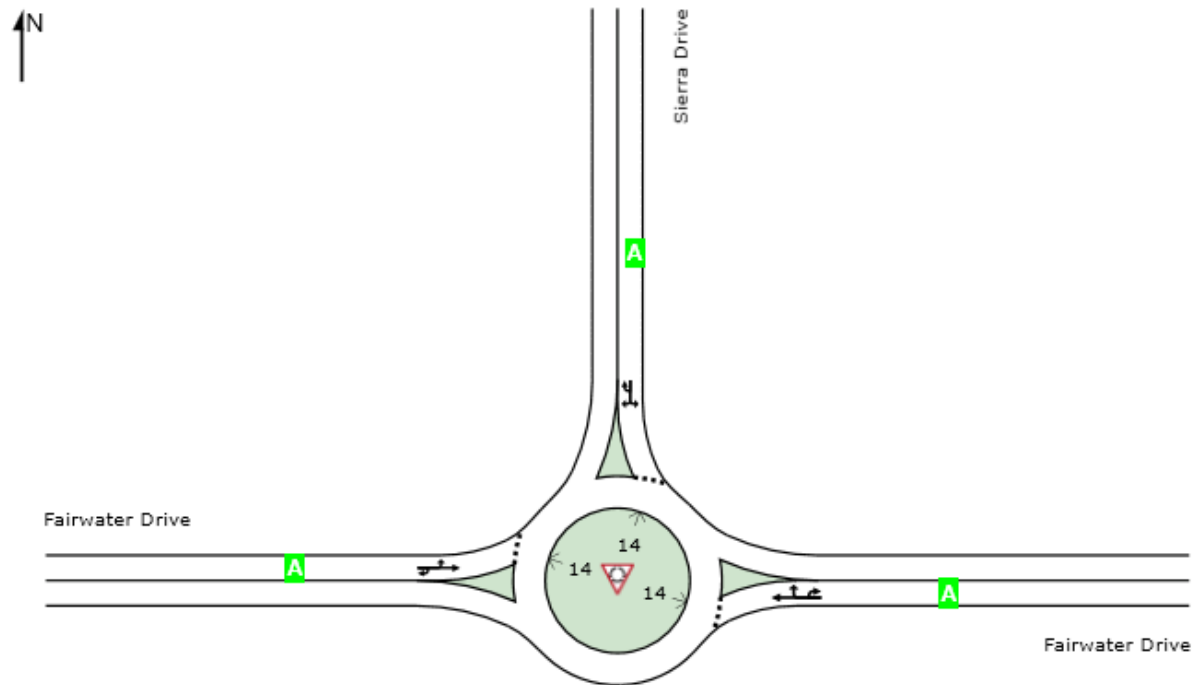
 **Site: 101 [Dapto PS - PM Peak - Future]**

Fairwater Drive / Sierra Drive Intersection

Site Category: PM PEAK

Roundabout

	Approaches			Intersection
	East	North	West	
LOS	A	A	A	A



Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Lane LOS values are based on average delay per lane.

Intersection and Approach LOS values are based on average delay for all lanes.

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

MOVEMENT SUMMARY

Site: 101 [Dapto PS - PM Peak - Future]

Fairwater Drive / Sierra Drive Intersection
Site Category: PM PEAK
Roundabout

Movement Performance - Vehicles												
Mov ID	Turn	Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
East: Fairwater Drive												
5	T1	116	5.0	0.225	5.5	LOS A	1.5	10.7	0.40	0.59	0.40	53.8
6	R2	138	5.0	0.225	9.3	LOS A	1.5	10.7	0.40	0.59	0.40	53.2
6u	U	2	0.0	0.225	11.0	LOS A	1.5	10.7	0.40	0.59	0.40	55.6
Approach		256	5.0	0.225	7.6	LOS A	1.5	10.7	0.40	0.59	0.40	53.5
North: Sierra Drive												
7	L2	114	5.0	0.215	5.3	LOS A	1.4	10.2	0.41	0.60	0.41	52.8
9	R2	126	5.0	0.215	9.4	LOS A	1.4	10.2	0.41	0.60	0.41	50.5
9u	U	2	0.0	0.215	11.1	LOS A	1.4	10.2	0.41	0.60	0.41	50.9
Approach		242	5.0	0.215	7.4	LOS A	1.4	10.2	0.41	0.60	0.41	51.8
West: Fairwater Drive												
10	L2	156	5.0	0.261	5.3	LOS A	1.8	12.8	0.42	0.54	0.42	50.9
11	T1	132	5.0	0.261	5.5	LOS A	1.8	12.8	0.42	0.54	0.42	55.0
12u	U	10	0.0	0.261	11.1	LOS A	1.8	12.8	0.42	0.54	0.42	53.6
Approach		298	4.8	0.261	5.6	LOS A	1.8	12.8	0.42	0.54	0.42	53.2
All Vehicles		796	4.9	0.261	6.8	LOS A	1.8	12.8	0.41	0.57	0.41	52.9

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