TRANSPORT IMPACT ASSESSMENT

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1. Introduction and Background

Shawmac Pty Ltd has been commissioned by EIW Architects on behalf of the Department of Finance, Building Management and Works (BMW) to prepare a Transport Impact Assessment (TIA) for the proposed Sunningdale Primary School to be located on 35 Sunningdale Road, Yanchep.

This TIA has been prepared in accordance with the BMW *Primary School Brief* as well as the Western Australian Planning Commission (WAPC) *Transport Impact Assessment Guidelines*. The assessment considers the following key matters:

- The site and surrounding road network;
- Traffic generation characteristics;
- Traffic distribution assessment and network assignment;
- Parking assessment and management;
- Road safety assessment;
- Pedestrian and cyclist demand and facilities assessment; and
- Public transport accessibility.

2. Proposed Development

2.1. Student Numbers

The school is proposed to be a standard pattern primary school. The development also includes provision for 6 transportable classrooms to be provided in the future to accommodate a further 160 students (20 kindergarten students and 140 pre-primary to year 6 students). The proposed ultimate school population is summarised in **Table 1.**

Table 1: Student Numbers

Category	Stream	Number of Students	Student Number (Full Time Equivalent)
Standard Pattern	Kindergarten	40	20
	Pre-primary to Year 6	390	390
	Sub Total	**430**	**410**
Transportable Classrooms	Kindergarten	20	10
	Pre-primary to Year 6	140	140
	Sub Total	**160**	**150**
Ultimate	Kindergarten	60	30
	Pre-primary to Year 6	530	530
	Total	**590**	**560**

Based on the typical ratio of 1 staff member per 10 students, the estimated staff population at the school would be 56 staff.

2.2. Car Parking and Access Arrangement

68 car parking bays are proposed on the school site including 33 bays off Sunningdale Road and 35 bays off Moorpark Avenue. Street parking will also be provided along the two frontage roads with approximately 63 bays to be constructed. The central row of 14 street bays on Sunningdale Road is proposed to be used as a Kiss and Drive facility during the school peak periods to allow for high turnover pick-up and drop-off trips.

A site plan showing the proposed car parking supply and access arrangement is illustrated in **Figure 1**.

Figure 1: Proposed Car Parking and Access Arrangement

3. The Site and Surrounding Road Network

3.1. Site Location and Land Use

The site is located on 35 Sunningdale Road, Yanchep in the City of Wanneroo. The site is bounded by Moorpark Avenue, Sunningdale Road and St Andrews Park. The site location is shown in **Figure 2**.

Figure 2: Site Location

The site is currently undeveloped and uncleared, with surrounding area consisting of existing residential development.

3.2. Road Network

3.2.1. Road Hierarchy

The hierarchy of the local road network according to the Main Roads WA *Road Information Mapping System* is shown in **Figure 3**.

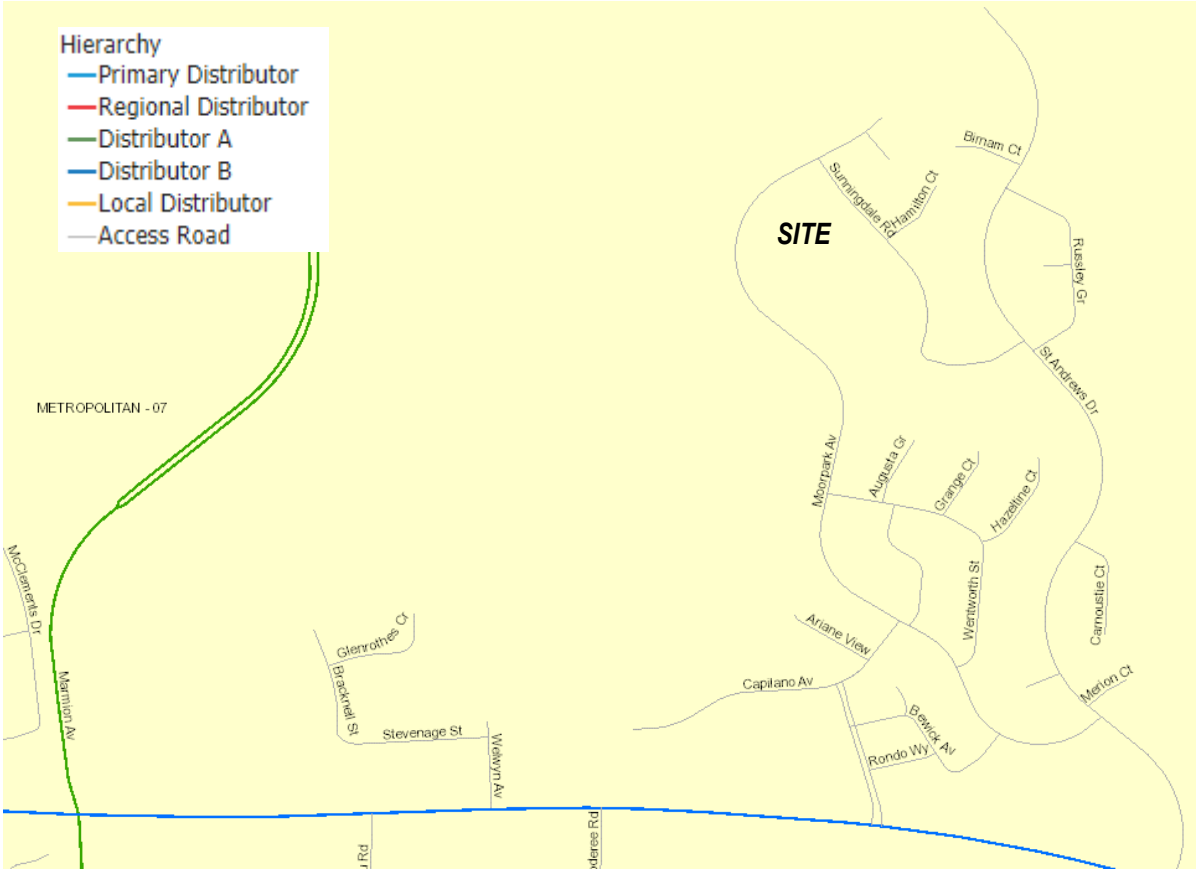

Figure 3: Road Network Hierarchy

3.2.2. Carriageway Width and Cross Section

The configuration of the perimeter roads and other relevant roads are summarised in **Table 2**.

Table 2: Road Configuration

Road and Location	Road Type	Cross Section	Width (approx.)	Speed Limit
Sunningdale Road	Access Road	Single carriageway – 2 lanes	7.5m	50 km/h
Moorpark Avenue	Access Road	Single carriageway – 2 lanes	8.0m	50 km/h
St Andrews Drive	Access Road	Dual carriageway – 2 lanes	10.0m	50 km/h
Spinnaker Boulevard	Access Road	Dual carriageway – 2 lanes	12.0m	50 km/h
Yanchep Beach Road	Distributor B	Single carriageway – 2 lanes	7.0m	60 km/h

3.2.3. Daily and Peak Hour Traffic Flows

The latest available traffic counts were obtained from the City of Wanneroo as summarised in **Figure 4**. Traffic volumes for Sunningdale Road and Spinnaker Boulevard were not available and were assumed based on its level of connectivity to surrounding traffic generators and attractors. Where peak hour data was not available, it was assumed that the peak hour volumes is equivalent to 10% of the daily traffic volumes. Where directional volumes were not available, it was assumed that the traffic is split evenly in both directions.

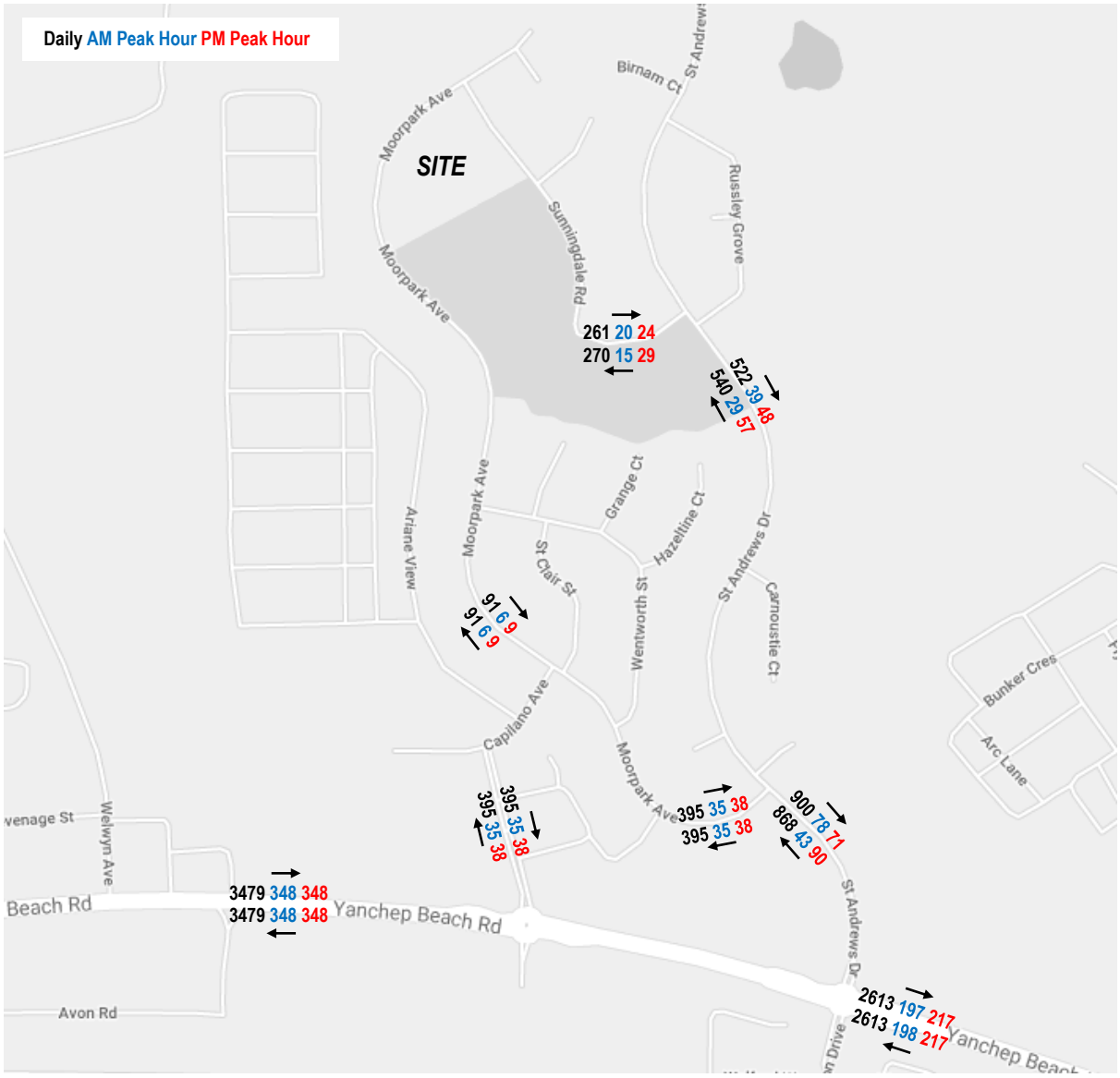

Figure 4: Existing Average Weekday Traffic (AWT)

3.3. Future Road Network

The site is located within a developing area and adjacent to the future Yanchep City Centre. The Yanchep City Structure Plan is proposing a city centre, a railway station, residential development, mixed use, business, industrial, special use and strategic open space developments as shown in **Figure 5**.

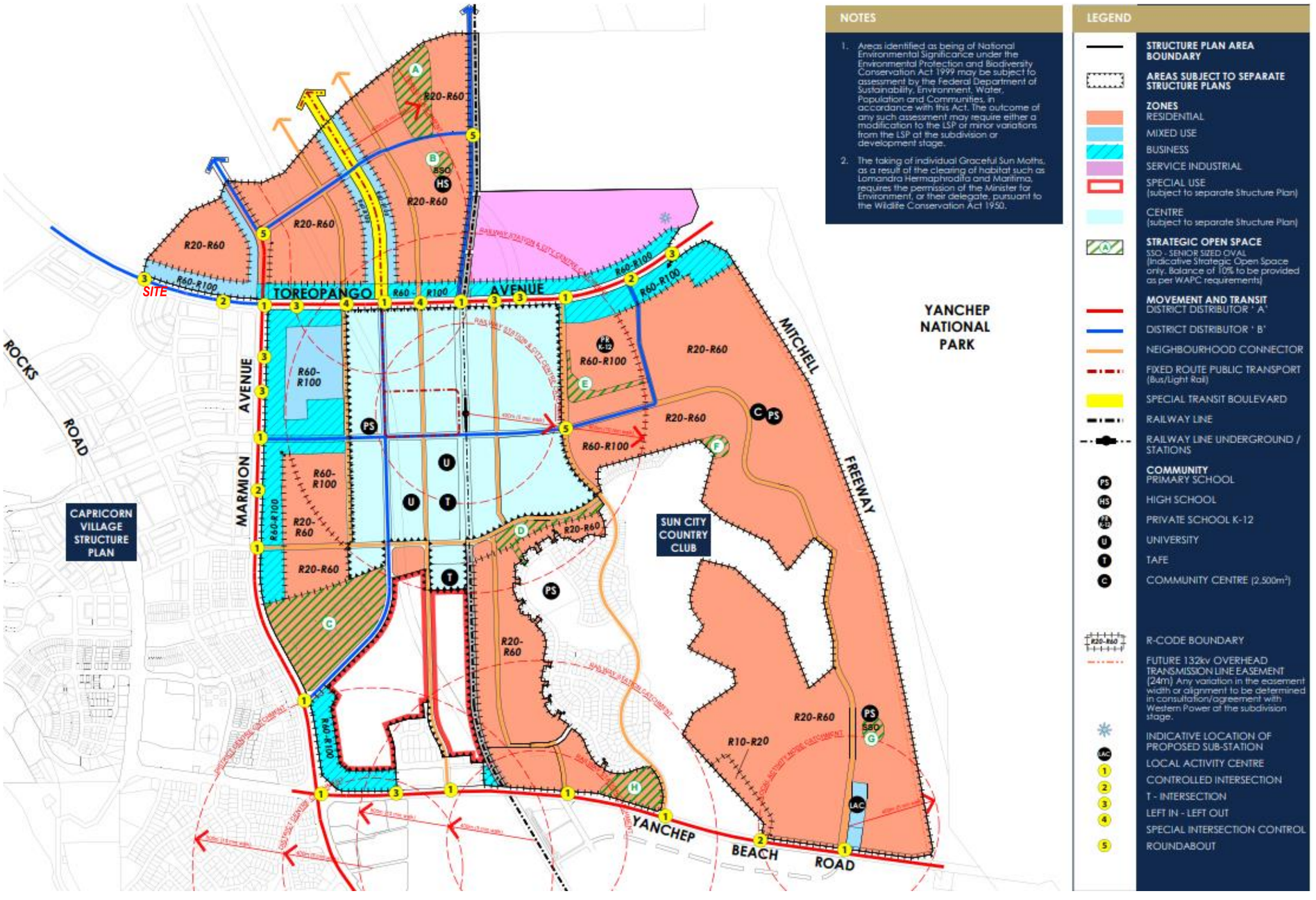

Figure 5: Yanchep City Structure Plan

The key changes to the road network that are relevant to the school include:

- The extension of St Andrews Drive north of the existing cul-de-sac and along the eastern boundary of the centre zone.
- The extension of Capilano Avenue through to Vertex Yanchep development to the east and several new road connections from Vertex Yanchep to Moorpark Avenue. Two new road connections are proposed along the school frontages as shown in **Figure 6**. The nib between number 111 and 115 Moorpark Avenue will form part of a strategic open space as per the Yanchep City Structure Plan in **Figure 5**.

Figure 6: New Road Connections Adjacent to the School

4. Traffic Generation Characteristics

4.1. Assessment Year

This assessment is based on the year that the school is proposed to be open which is 2021.

4.2. Time Periods for Assessment

The time periods for assessment include the weekday morning peak period (7:30 to 9:00 am) and afternoon peak period (2:30 to 4:00 pm). The morning and afternoon peak periods broadly coincide with the typical weekday peak periods. In terms of parking impacts, the afternoon pick-up period puts greatest demand on available parking spaces as parents arrive prior to the end of the school day, park and wait to pick up their children.

4.3. Traffic Generation

The vehicular traffic generation rates for primary schools according to the WAPC *Transport Assessment Guidelines* is 0.5 vehicle trips per child to school and 0.5 trips per child from school during each of the morning and afternoon peak hours (i.e. 1 trip per student per peak period) based on the PARTS surveys.

The BMW guidelines also recommends that for new schools, a daily rate of 2.6 trips per student is appropriate. These rates includes staff vehicle trips.

The school traffic generation is summarised in **Table 3**. It is noted that the FTE student number has been used as this is the realistic number of students that would be attending at any one time. The ultimate school population including the transportable classrooms has been assessed.

Table 3: School Traffic Generation

Streams	Units
Student Number (FTE)	560
Staff Numbers	56
Daily Trip Generation Rate	2.6 trips per student
Peak Hour Vehicle Trip Generation Rate	38.5% of the Daily Generation
Daily Trips (Staff & Students)	1,456 trips (728 in / 728 out)
AM/PM Peak Trips (Students and Staff)	560 (280 in / 280 out)

4.4. Distribution

The local intake area for the school is not known at this stage however based on the development density the distribution of the school generated traffic has been assumed as shown in **Figure 7**. The distribution has been based on the existing road network layout. As the surrounding area is developed, the road network becomes more permeable and the distribution will be more spread out. Therefore the current distribution is considered to represent the 'worst-case' scenario.

Figure 7: Traffic Distribution

4.5. Network Assignment of School Traffic

The school generated traffic has been assigned to the road network based on the assumed distribution as shown in **Figure 8**.

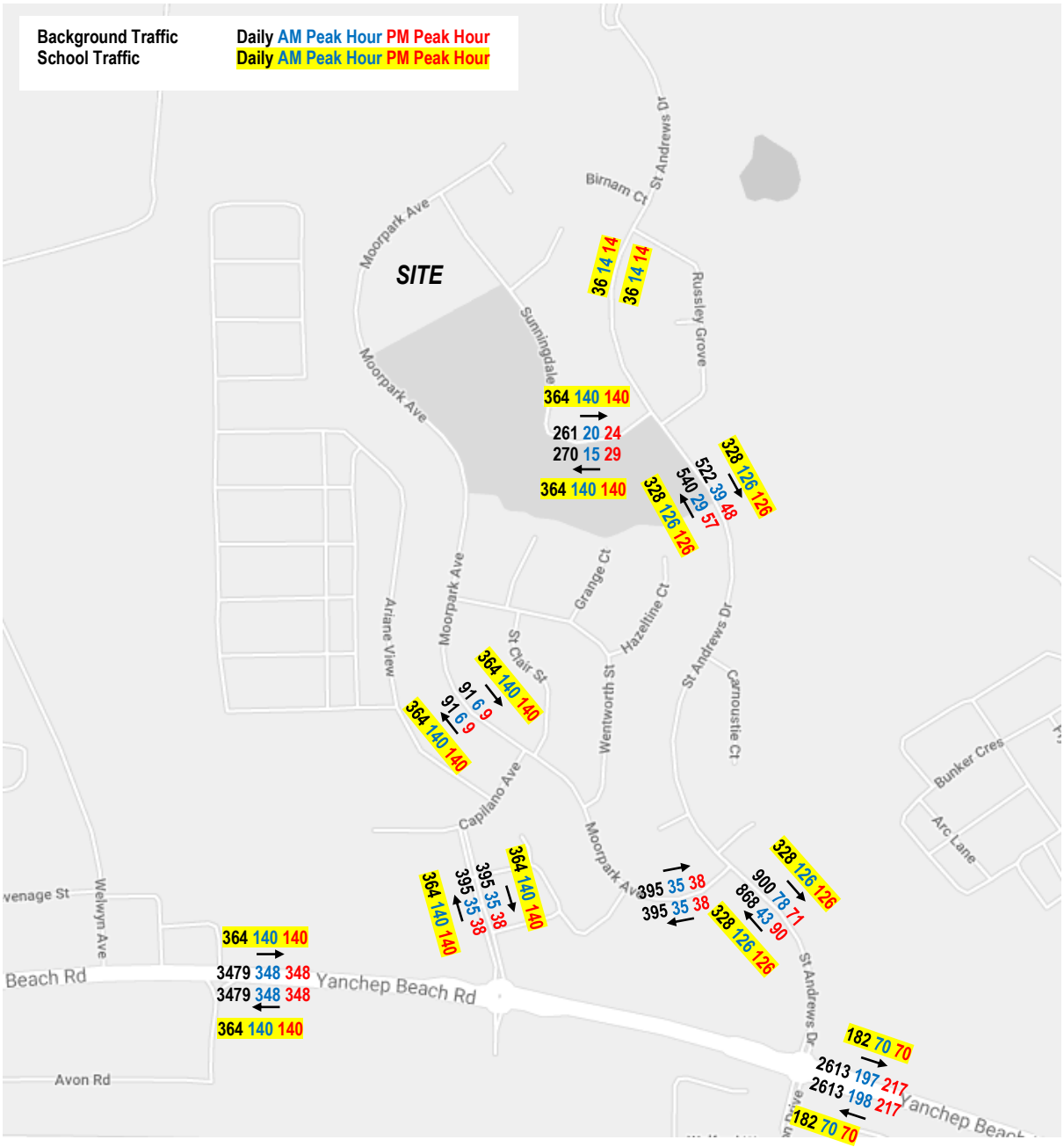

Figure 8: Assignment of Distributed Traffic

4.6. Network Capacity

4.6.1. Mid-block Capacity

Table 5.1 of Austroads *Guide to Traffic Management Part 3: Traffic Studies and Analysis* (AGTM06) as shown below in **Table 4** provides the typical mid-block capacities for urban roads with interrupted flow.

Table 4: Typical Mid-Block Capacities for Urban Roads with Interrupted Flow

Type of Lane	One-way Mid-Block Capacity (vph)
Median or inner lane	
Divided Road	1,000
Undivided Road	900
Middle Lane (of a Three-Lane Carriageway)	
Divided Road	900
Undivided Road	1,000
Kerb lane	
Adjacent to Parking Lane	900
Occasional Parked Vehicles	600
Clearway Conditions	900

The resulting traffic volumes as shown in **Figure 8** are well within the theoretical capacity of the roads and therefore the school is not expected to have an unacceptable impact on the adjacent road network at mid-block locations.

4.6.2. Intersection Capacity

SIDRA Intersection 8 has been used to assess the peak hour capacity and performance of Yanchep Beach Road / St Andrews Drive / Mapleton Drive and Yanchep Beach Road / Spinnaker Boulevard / Barakee Entrance roundabouts. The site crossovers have not been modelled as these are restricted to entry only or exit only and will primarily accommodate staff movements.

SIDRA is a commonly used intersection modelling tool used by traffic engineers for all types of intersections. Outputs for four standard measures of operational performance can be obtained, being Degree of Saturation (DoS), Average Delay, Queue Length, and Level of Service (LoS).

- Degree of Saturation is a measure of how much physical capacity is being used with reference to the full capability of the particular movement, approach, or overall intersection. A DoS of 1.0 equates to full theoretical capacity although in some instances this level is exceeded in practice. SIDRA uses maximum

acceptable DoS of 0.90 for signalised intersections for its Design Life analysis. Design engineers typically set a maximum DoS threshold of 0.95 for new intersection layouts or modifications.

- Average Delay reports the average delay per vehicle in seconds experienced by all vehicles in a particular lane, approach, or for the intersection as a whole. For severely congested intersections the average delay begins to climb exponentially.
- Queue Length measures the length of approach queues. In this document we have reported queue length in terms of the length of queue at the 95th percentile (the maximum queue length that will not be exceeded for 95 percent of the time). Queue lengths provide a useful indication of the impact of signals on network performance. It also enables the traffic engineer to consider the likely impact of queues blocking back and impacting on upstream intersections and accesses.
- Level of Service is a combined appreciation of queuing incidence and delay time incurred, producing an alphanumeric ranking of A through F. A LoS of A indicates an excellent level of service whereby drivers delay is at a minimum and they clear the intersection at each change of signals or soon after arrival with little if any queuing. Values of B through D are acceptable in normal traffic conditions. Whilst values of E and F are typically considered undesirable, within central business district areas with significant vehicular and pedestrian numbers, corresponding delays/queues are unavoidable and hence, are generally accepted by road users.

Table 2 of the WAPC TIA Guidelines Volume 4 (shown as **Table 5**) outlines the thresholds for intersection operation based on the average delay.

Table 5: WAPC TIA Guidelines – Thresholds for Intersection Operation

Criteria	Average Delay
Signalised intersections:	
• Average delay for all vehicles passing through the intersection	<55 secs
• Average delay for any individual vehicle, pedestrian or cyclist movement	<65 secs
Priority intersections (roundabouts, give way and stop):	
• Average delay for all vehicles on the non-priority arms (, that is, have to give way or stop)	<35 secs
• Average delay for any individual vehicle, pedestrian or cyclist movement	<45 secs
Right turn lanes:	Less than available storage length (95th percentile queue)
• Exclusive turning movement queue length	

This intersections have been modelled based on the existing intersection geometry. Two scenarios have been modelled including the existing scenario and the future scenario with the school traffic added. The results of the assessment are summarised in **Table 6** and attached in **Appendix A**.

The peak hour volumes were derived from the background traffic data and the traffic generation. Several assumptions were made for the direction split of volumes on the roundabout legs and the heavy vehicle percentages.

Table 6: SIDRA Results Summary Outputs

Intersection	Assessment Period	Scenario	Worst DoS	95%ile Queue (m)	Average Delay (s)	Worst Delay (s)	Average LoS	Worst LoS
Yanchep Beach Road / Spinnaker Boulevard / Barakee Entrance	AM Peak	Existing	0.254	11.0	5.3	9.1	A	A
		Future	0.347	17.1	6.2	10.3	A	B
	PM Peak	Existing	0.254	11.0	5.3	9.1	A	A
		Future	0.348	17.2	6.2	10.3	A	B
Yanchep Beach Road / St Andrews Drive / Mapleton Drive	AM Peak	Existing	0.198	8.1	5.3	9.1	A	A
		Future	0.236	9.9	6.0	9.7	A	A
	PM Peak	Existing	0.205	8.5	5.3	9.1	A	A
		Future	0.244	10.3	6.1	9.7	A	A

The results indicate this intersection is currently operating within capacity during both peak periods. With the additional of the school traffic, the peak hour operation only changes slightly with small changes to the saturation, average delay and predicted queue lengths. Both intersections are predicted to operate within the thresholds of acceptable operation as per **Table 5**.

To account for the various assumptions, a sensitivity analysis has been undertaken by doubling the input traffic flows. The results of this analysis are summarised in **Table 7**.

Table 7: SIDRA Results Summary Outputs – Sensitivity Analysis – 200% Increase in all Input Flows

Intersection	Assessment Period	Scenario	Worst DoS	95%ile Queue (m)	Average Delay (s)	Worst Delay (s)	Average LoS	Worst LoS
Yanchep Beach Road / Spinnaker Boulevard / Barakee Entrance	AM Peak	Existing	0.542	33.5	6.1	11.1	A	B
		Future	0.745	67.9	8.6	14.3	A	B
	PM Peak	Existing	0.543	33.7	6.1	11.1	A	B
		Future	0.748	68.5	8.8	14.4	A	B
Yanchep Beach Road / St Andrews Drive / Mapleton Drive	AM Peak	Existing	0.418	22.1	6.1	22.1	A	B
		Future	0.553	33.9	8.2	12.0	A	B
	PM Peak	Existing	0.434	23.4	6.1	10.4	A	B
		Future	0.574	37.1	8.3	12.4	A	B

As above, all measures of operational performance (including delay) remain within acceptable thresholds when the input volumes are doubled and both roundabouts would be expected to operation within capacity.

It is therefore concluded that there is adequate capacity in the existing road network to accommodate the school traffic. As the road network develops, the distribution of school traffic will spread out and the impact of the school traffic at the roundabouts would reduce.

Long Term Scenario

According to the Yanchep-Two Rocks District Structure Plan, the future traffic projection for Yanchep Beach Road in the vicinity of the site is 20,000 vpd which is about 300% of the existing background traffic flows. An additional sensitivity analysis has been undertaken for the long-term post-development scenario by increasing the background traffic flows by 300%. The results of this analysis are summarised in **Table 8**.

Table 8: SIDRA Results Summary Outputs – Long Term Sensitivity Analysis – 300% Increase in Background Traffic

Intersection	Assessment Period	Worst DoS	95%ile Queue (m)	Average Delay (s)	Worst Delay (s)	Average LoS	Worst LoS
Yanchep Beach Road / Spinnaker Boulevard / Barakee Entrance	AM Peak	0.983	366.2	22.9	34.6	C	C
	PM Peak	0.988	389.2	24.9	37.7	C	D
Yanchep Beach Road / St Andrews Drive / Mapleton Drive	AM Peak	0.761	78.3	10.6	17.9	B	B
	PM Peak	0.795	91.1	11.3	18.5	B	B

As above, under the long-term scenario, the existing Yanchep Beach Road / St Andrews Drive / Mapleton Drive roundabout would still operate within capacity. The existing Yanchep Beach Road / Spinnaker Boulevard / Barakee Entrance roundabout is predicted to operate close to but just within capacity and may eventually need upgrading. It is noted that the road reservation for Yanchep Beach Road appears to allow for the provision of a four-lane dual carriageway and dual lane roundabouts which would provide additional capacity for future traffic growth.

The need for any upgrades should be assessed in the future as development progresses.

5. Parking Assessment

5.1. Car Parking

There are 68 car parking bays proposed on the school site, including two accessible parking bays. Street parking is also proposed along Moorpark Avenue and Sunningdale Road, with 63 bays available for school use. The total car parking supply for the school is therefore 131 bays.

5.1.1. City of Wanneroo Requirements

The minimum car parking requirement as per the City of Wanneroo *Town Planning Scheme No. 2* (TPS2) is calculated in **Table 9.**

Table 9: City of Wanneroo TPS2 Parking Requirement

Stream	Bay Type	Car Parking Requirement	Students (FTE)	Bays Required
Early Childhood (Kindergarten)	Pick-up / Drop-off	8 bays	30	8
Pre-primary to Year 6	Staff and Visitor	46 bays for the first 475 students and then 10 for every 100 students or part thereof afterwards	530	52
	Pick-up / Set-down	14 bays for every 100 students or part thereof which may be provided in the road reserve		74
Total				**134**

5.1.2. BMW Requirements

The minimum car parking requirement as per the BMW *Primary School Brief* is calculated in **Table 10.**

Table 10: BMW Primary School Brief Parking Requirement

Stream	Bay Type	Car Parking Requirement	Students (FTE)	Bays Required
Early Childhood (Kindergarten)	Pick-up / Drop-off	15 bays	30	15
Pre-primary to Year 6	Staff	10 bays per 100 PP-Y6 students Minimum 46 bays for new schools	530	53
	Pick-up / Drop-off	14 bays per 100 PP-Y6 students Minimum 60 bays for new schools		75
Total				**143**

As above, the minimum car parking requirements for the total school population including transportable classrooms is 134 bays based on the City of Wanneroo standards and 143 bays based on the BMW standards.

The proposed 131 bays is 3 bays short of the City of Wanneroo requirements and 12 bays short of the BMW requirements.

As the site is located adjacent to the future Yanchep City Centre and within reasonable walking distance of the future Yanchep Railway Station, there is opportunity to maximise the use of alternative transport modes among students and staff and to reduce the dependency on passenger vehicles.

In order to justify the variation from the calculated car parking requirements, it is recommended that the school implements and overall traffic and parking management strategy that includes some or all of the following measures:

- Provide bicycle parking that meets or exceeds the BMW Primary School Brief requirements and encourage as many students, parents and staff to cycle to and from school. This could include running regular bicycle safety programs and providing incentives for students who cycle.
- Proper management of the Kiss and Drive facility to maximise the efficiency and turnover of this facility. This would include a commitment from the school to make staff available every school day to supervise pick-up/drop-offs and to ensure proper use.
- Provision of dual use paths along Moorpark Avenue and Sunningdale Road for the extent of the school boundary.
- Recommendation to the City of Wanneroo to close the path gap along Sunningdale Road between the school boundary and St Andrews Drive.
- Participation in walking, cycling and public transport programs (Your Move, Walking school bus etc.) to encourage alternative transport modes.

If required, a detailed School Traffic and Parking Management Plan can be prepared outlining the above strategy for distribution to staff and parents.

It is also noted that the transportable classrooms would only be implemented as needed in the future and that the proposed parking provision is in excess of what would be required for the standard pattern primary school that would be constructed initially.

5.2. Bay Allocation

As mentioned previously, the central row of bays proposed along Sunningdale Road will be used as a Kiss and Drive Facility during the peak drop-off and pick-up periods on school days. Outside of the school peak periods, the bays can be used as unrestricted street parking. Signage and pavement marking will required to restrict these bays.

6. Road Safety Assessment

6.1. Crash History

The crash history of the boundary roads at mid-block locations and intersections for the 5 year period ending December 2018 was obtained from the MRWA Reporting Centre. There were no crashes in the immediate vicinity of the site. The only recorded crashes in 5 years occurred at the intersection of St Andrews Drive / Yanchep Beach Road / Mapleton Drive roundabout as shown in **Figure 9**.

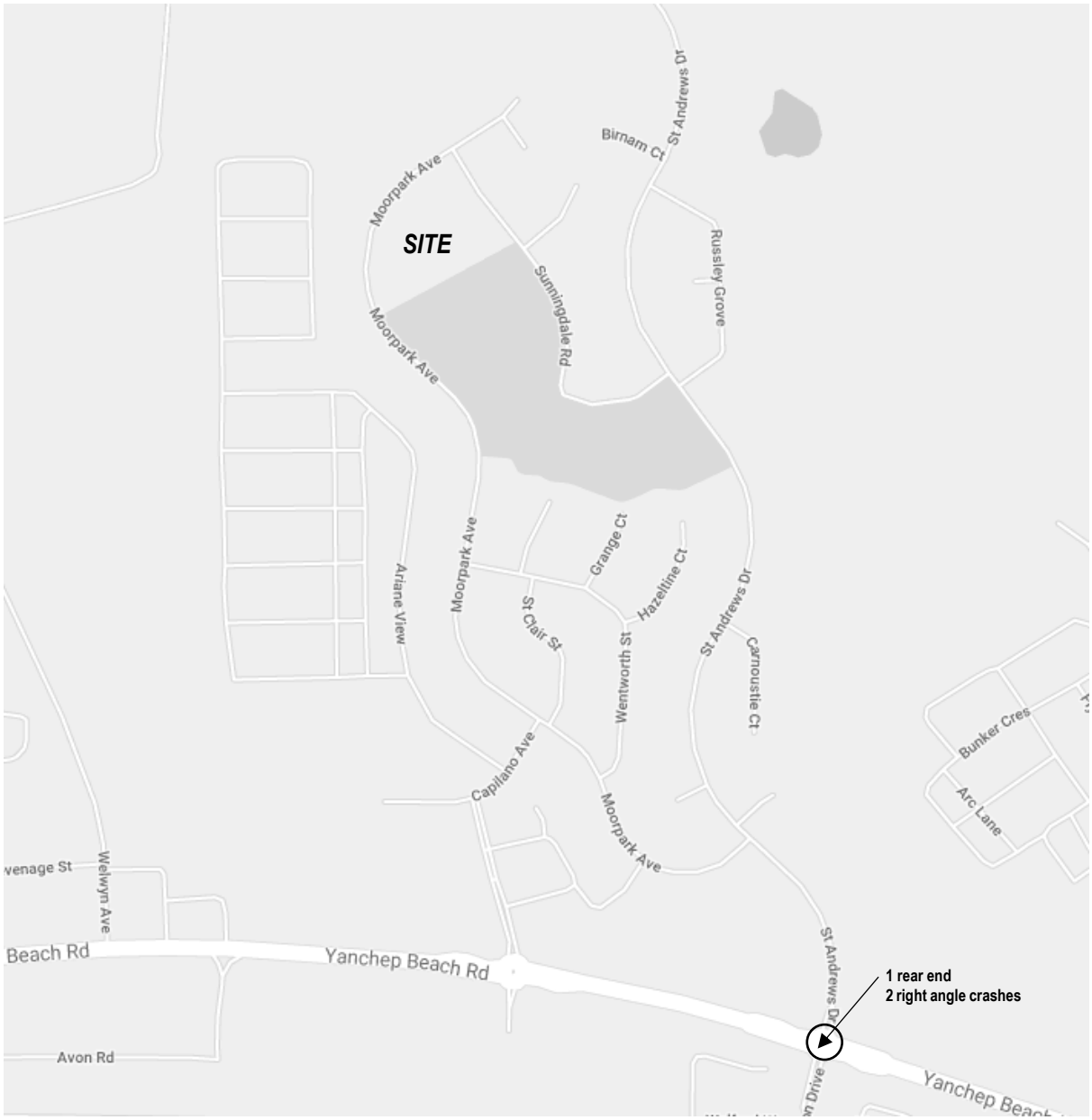

Figure 9: Crash History January 2014 to December 2018

A review of the crash history and the layout of the road network did not identify any safety issues. While the school will increase traffic volumes on the road network, there is no indication that the proposed development would increase the risk of crashes to an unacceptable level.

The standard 40km/h school speed zone would apply from 7:30 to 9:00 am and from 2:30 to 4:00 pm.

Appropriate signage and pavement markings will be required to enforce the speed limit during these times.

6.2. Vehicle Access

The proposed school crossovers have been assessed for sight distance in accordance with Australian Standard AS 2890.1-2004 *Parking Facilities - Off-street car parking*. Based on the frontage road speed of 40 km/h (school zone speed limit) the minimum required sight distance is 35 metres (55 metres desirable).

A review of the sight distance from the proposed exit crossovers is shown in **Figure 10** and **Figure 11**.

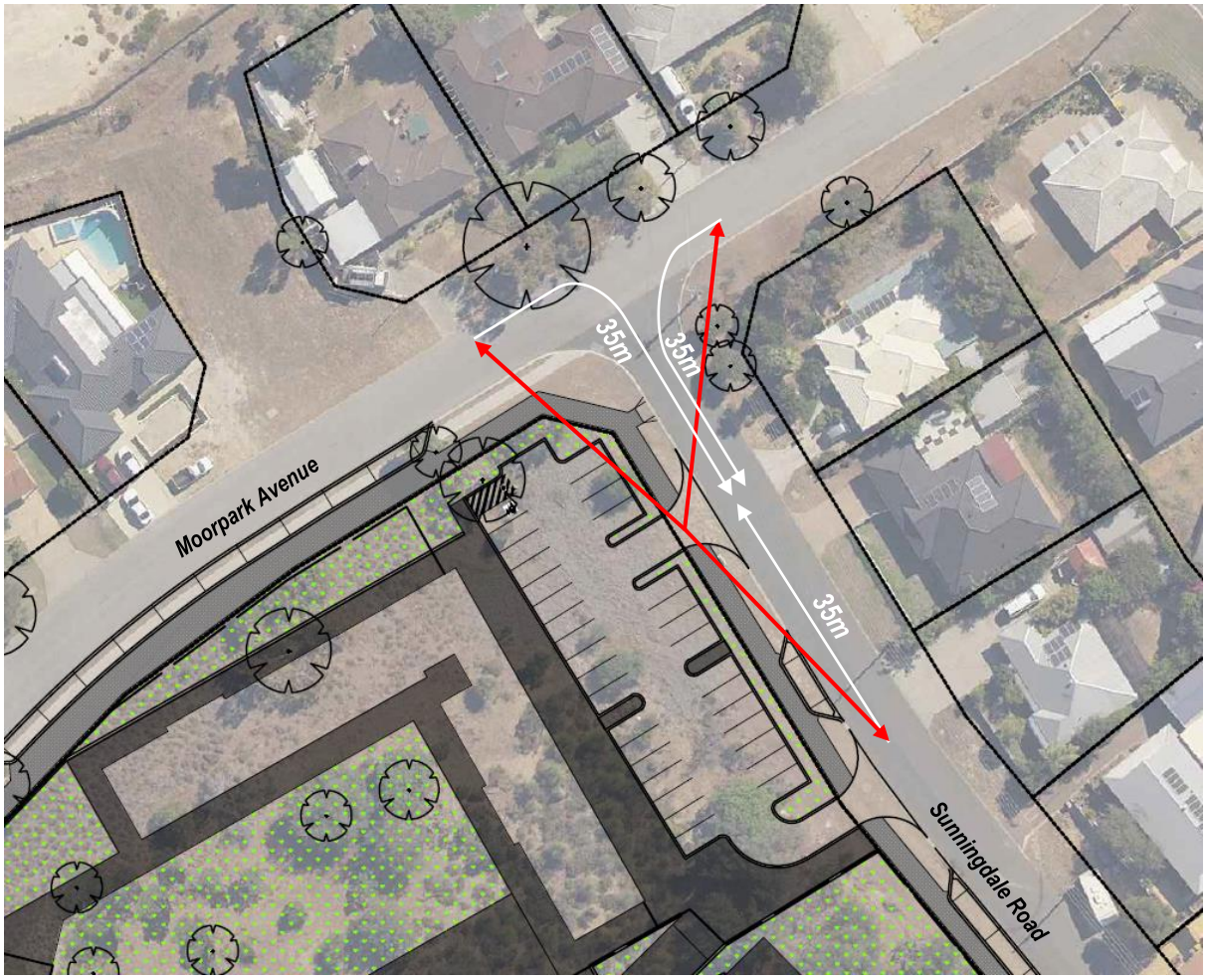

Figure 10: Crossover Sight Distance – Sunningdale Road

Figure 11: Crossover Sight Distance – Moorpark Avenue

As shown, the minimum 35 metres sight distance is achieved at both exit crossovers.

7. Pedestrian and Cyclist Accessibility

7.1. Path Network

The existing path network in the vicinity of the school includes:

- a 1.5 metre path along the school (east) side of Moorpark Avenue that continues down to St Andrews Drive;
- a 1.5 metre path along the full length of St Andrews Drive that widens and switches sides north of Birnam Court; and
- a pedestrian access way (PAW) between the Hamilton Court and Birnam Court cul-de-sacs.

A new shared path with is proposed within the verge along Moorpark Avenue behind the proposed street parking. The path will extend along the length of the school frontage and will be a minimum 2.5m wide.

A new shared path is also proposed along the school (west) side of Sunningdale Road along the extent of the lot boundary. This path will be 2.5m wide or more in most sections. The path will be narrowed to 2.2m in some sections behind proposed parking bays where there is limited room within the existing verge. The existing and proposed path network is shown in **Figure 12**.

As shown, there will be a section of Sunningdale Road between the end of the school boundary and St Andrews Drive that will have no path connection. It has been recommended to the City of Wanneroo that the City considers completing the path along this section to tie into the path proposed by the school development. Ultimately, this connection will increase pedestrian and cyclist accessibility to the school and to St Andrews Park.

Figure 12: Existing and Proposed Path Network

7.2. Bicycle Parking

7.2.1. City of Wanneroo Requirements

TPS2 refers to the Austroads guidelines for the recommended provision of bicycle parking. Austroads *Guide to Traffic Management Part 11: Parking* (AGTM11) recommends that 1 space is provided for every 5 students over Year 4. Assuming that there are 140 students over Year 4 (25% of student population), 28 bicycle spaces are recommended.

7.2.2. BMW Requirements

According to the BMW *Primary School Brief*, a standard pattern primary is to have two bicycle parking facilities, catering for a total of 48 student bicycles. For other cases, the bicycle cycling provision should be provided in accordance with advice from the Roads and Traffic Authority (now Roads and Maritime Services) of New South Wales *Guide to Traffic Generating Developments* which indicates the following:

- 1 rack or bay for every 25 to 35 staff (3%-5%); and
- 1 rack or bay for every 10 children.

The recommended bicycle parking supply based on the ultimate school population including transportable classrooms is calculated in **Table 11.**

Table 11: Bicycle Parking Requirements

Stream	Bicycle Parking Requirement	Number	Bays Required
Staff	1 rack or bay for every 25 to 35 staff	56	2
Students	1 rack or bay for every 10 children	560	56
Total			58

As above, the calculated bicycle requirement is 58 bicycle spaces.

The school plan indicate two proposed bicycle parking areas, one in front of Teaching Block 3 adjacent to Sunningdale Road and one in front of Teaching Block 4 adjacent to Moorpark Avenue. It is recommended that at least 58 bicycle parking spaces are provided over these two areas. In order to justify the proposed parking shortfall, extra bicycle parking above this requirement should be provided where possible to encourage as many staff, students and parents to cycle to school. This should be accompanied by walking and cycling education programs such as the Department of Transport's Your Move program.

8. Public Transport Accessibility

Existing public transport services to the general area is limited to the Transperth Bus Route 491 which operates between Butler Station and Two Rocks via Marmion Avenue. There are stops located on Sunningdale Road and Moorpark Avenue along the St Andrews Park frontage within short walking distance of the school site. The services that deviate via St Andrews and stop near the school site are relatively infrequent during the day but there are several that operate during the school morning and afternoon peak periods.

Based on the ages of primary school students, the demand for public transport is relatively low and the existing public transport service is considered sufficient to accommodate the demand. As the surrounding area and the surrounding road network develops, there may be increased demand to introduce additional services or extend existing services. The demand for additional or extended services should be monitored as the school population increases. If there is demonstrated demand, the school and the City of Wanneroo and the school should liaise with PTA with regards to increasing public transport services.

Figure 13 shows the location of the existing bus stops near the school.

As mentioned previously, the Yanchep City Structure Plan proposes a new railway station within the future city centre located north-west of the school site. The Yanchep Station is proposed as an extension to the existing Joondalup Railway Line. The Structure Plan indicates that the school will be within the 800 metre (10 minute) walking catchment of the station and city centre.

According to Metronet, the Yanchep Station will include a bus interchange with 14 bus stands. It is understood that construction of the rail extension is expected to begin later this year.

Figure 13: Existing Bus Stops

9. Conclusion

A detailed Transport Impact Assessment of the proposed Sunningdale Primary School in accordance with the BMW *Primary School Brief* concluded the following:

- Under current network conditions, the school generated traffic would not have an unacceptable impact on the existing operation of the adjacent road network.
- A subsequent analysis of the long term scenario based on traffic projections suggests that general traffic growth along Yanchep Beach Road resulting from development of the surrounding area may necessitate the upgrade of this road and its intersections. It is noted that this requirement is not triggered by the development of the school.
- The proposed parking provision is short of the calculated City of Wanneroo requirements by 3 bays and the calculated BMW requirements by 12 bays. This shortfall will be compensated by various proposed traffic and parking management measures including (but not limited to) a properly managed kiss and drive facility, adequate pedestrian/cyclist infrastructure and the promotion of alternative transport modes among students, parents and staff. It is also noted that the transportable classrooms would only be implemented as needed in the future and that the proposed parking provision is in excess of what would be required for the standard pattern primary school that would be constructed initially.
- All proposed vehicle crossovers will achieve the minimum required sight distance.
- The existing and proposed path network is adequate for the safe and efficient movement of pedestrians and cyclists travelling to and from the school except for a gap in the path along Sunningdale Road between the extent of the school boundary and St Andrews Drive. It has been recommended that the City of Wanneroo considers constructing this section of path to close this gap.
- The calculated bicycle parking requirement according to Austroads guidelines is 28 spaces. The calculated BMW bicycle parking requirements is higher at 58 spaces. In order to support the proposed variation in car parking, it is recommended that 58 or more bicycle spaces are provided to encourage cycling among the school population.
- The existing public transport service is considered sufficient to accommodate the demand, with a potential of added bus availability in future development.
- No other safety issues were identified.

Appendix A - SIDRA Outputs

MOVEMENT SUMMARY

Site: 101 [Spinnaker/Yanchep Beach/Barakee - Existing AM]

Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Barakee Entrance												
1	L2	25	2.0	0.046	4.0	LOS A	0.2	1.6	0.40	0.55	0.40	48.7
2	T1	1	2.0	0.046	3.9	LOS A	0.2	1.6	0.40	0.55	0.40	44.7
3	R2	25	2.0	0.046	8.5	LOS A	0.2	1.6	0.40	0.55	0.40	48.6
Approach		51	2.0	0.046	6.2	LOS A	0.2	1.6	0.40	0.55	0.40	48.6
East: Yanchep Beach Road												
4	L2	41	2.0	0.203	4.2	LOS A	1.1	8.4	0.23	0.46	0.23	49.0
5	T1	191	8.2	0.203	4.5	LOS A	1.1	8.4	0.23	0.46	0.23	54.5
6	R2	41	2.0	0.203	9.1	LOS A	1.1	8.4	0.23	0.46	0.23	51.1
Approach		273	6.3	0.203	5.1	LOS A	1.1	8.4	0.23	0.46	0.23	53.3
North: Spinnaker Boulevard												
7	L2	18	2.0	0.035	4.4	LOS A	0.2	1.3	0.45	0.57	0.45	46.7
8	T1	1	2.0	0.035	4.3	LOS A	0.2	1.3	0.45	0.57	0.45	44.5
9	R2	18	2.0	0.035	8.8	LOS A	0.2	1.3	0.45	0.57	0.45	49.8
Approach		37	2.0	0.035	6.5	LOS A	0.2	1.3	0.45	0.57	0.45	48.2
West: Yanchep Beach Road												
10	L2	52	2.0	0.254	4.2	LOS A	1.5	11.0	0.23	0.46	0.23	50.3
11	T1	244	8.2	0.254	4.5	LOS A	1.5	11.0	0.23	0.46	0.23	54.5
12	R2	52	2.0	0.254	9.0	LOS A	1.5	11.0	0.23	0.46	0.23	52.0
Approach		348	6.3	0.254	5.1	LOS A	1.5	11.0	0.23	0.46	0.23	53.6
All Vehicles		709	5.8	0.254	5.3	LOS A	1.5	11.0	0.25	0.47	0.25	52.9

MOVEMENT SUMMARY

Site: 101 [Spinnaker/Yanchep Beach/Barakee - Future AM - with School Traffic]

Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Barakee Entrance												
1	L2	25	2.0	0.052	4.8	LOS A	0.3	1.9	0.50	0.60	0.50	48.4
2	T1	1	2.0	0.052	4.7	LOS A	0.3	1.9	0.50	0.60	0.50	44.3
3	R2	25	2.0	0.052	9.2	LOS A	0.3	1.9	0.50	0.60	0.50	48.2
Approach		51	2.0	0.052	6.9	LOS A	0.3	1.9	0.50	0.60	0.50	48.3
East: Yanchep Beach Road												
4	L2	41	2.0	0.245	5.1	LOS A	1.5	10.8	0.44	0.55	0.44	48.0
5	T1	191	8.2	0.245	5.4	LOS A	1.5	10.8	0.44	0.55	0.44	53.5
6	R2	41	2.0	0.245	9.9	LOS A	1.5	10.8	0.44	0.55	0.44	49.9
Approach		273	6.3	0.245	6.0	LOS A	1.5	10.8	0.44	0.55	0.44	52.3
North: Spinnaker Boulevard												
7	L2	18	2.0	0.168	4.6	LOS A	0.9	6.5	0.49	0.68	0.49	46.2
8	T1	1	2.0	0.168	4.5	LOS A	0.9	6.5	0.49	0.68	0.49	44.0
9	R2	158	0.2	0.168	10.3	LOS B	0.9	6.5	0.49	0.68	0.49	49.3
Approach		177	0.4	0.168	9.7	LOS A	0.9	6.5	0.49	0.68	0.49	49.0
West: Yanchep Beach Road												
10	L2	192	0.5	0.347	4.2	LOS A	2.4	17.1	0.26	0.47	0.26	51.8
11	T1	244	8.2	0.347	4.5	LOS A	2.4	17.1	0.26	0.47	0.26	54.7
12	R2	52	2.0	0.347	9.1	LOS A	2.4	17.1	0.26	0.47	0.26	52.2
Approach		488	4.5	0.347	4.9	LOS A	2.4	17.1	0.26	0.47	0.26	53.4
All Vehicles		989	4.2	0.347	6.2	LOS A	2.4	17.1	0.37	0.53	0.37	52.0

MOVEMENT SUMMARY

Site: 101 [Spinnaker/Yanchep Beach/Barakee - Existing PM]

Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Barakee Entrance												
1	L2	25	2.0	0.046	4.1	LOS A	0.2	1.6	0.41	0.56	0.41	48.7
2	T1	1	2.0	0.046	4.0	LOS A	0.2	1.6	0.41	0.56	0.41	44.7
3	R2	25	2.0	0.046	8.5	LOS A	0.2	1.6	0.41	0.56	0.41	48.6
Approach		51	2.0	0.046	6.2	LOS A	0.2	1.6	0.41	0.56	0.41	48.6
East: Yanchep Beach Road												
4	L2	42	2.0	0.210	4.2	LOS A	1.2	8.7	0.23	0.46	0.23	49.0
5	T1	198	8.2	0.210	4.5	LOS A	1.2	8.7	0.23	0.46	0.23	54.5
6	R2	42	2.0	0.210	9.1	LOS A	1.2	8.7	0.23	0.46	0.23	51.1
Approach		282	6.4	0.210	5.1	LOS A	1.2	8.7	0.23	0.46	0.23	53.3
North: Spinnaker Boulevard												
7	L2	19	2.0	0.037	4.4	LOS A	0.2	1.3	0.45	0.57	0.45	46.7
8	T1	1	2.0	0.037	4.3	LOS A	0.2	1.3	0.45	0.57	0.45	44.5
9	R2	19	2.0	0.037	8.8	LOS A	0.2	1.3	0.45	0.57	0.45	49.8
Approach		39	2.0	0.037	6.5	LOS A	0.2	1.3	0.45	0.57	0.45	48.2
West: Yanchep Beach Road												
10	L2	52	2.0	0.254	4.2	LOS A	1.5	11.0	0.23	0.46	0.23	50.3
11	T1	244	8.2	0.254	4.5	LOS A	1.5	11.0	0.23	0.46	0.23	54.5
12	R2	52	2.0	0.254	9.1	LOS A	1.5	11.0	0.23	0.46	0.23	52.0
Approach		348	6.3	0.254	5.1	LOS A	1.5	11.0	0.23	0.46	0.23	53.6
All Vehicles		720	5.8	0.254	5.3	LOS A	1.5	11.0	0.26	0.48	0.26	52.9

MOVEMENT SUMMARY

Site: 101 [Spinnaker/Yanchep Beach/Barakee - Future PM - with School Traffic]

Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Barakee Entrance												
1	L2	25	2.0	0.052	4.8	LOS A	0.3	1.9	0.51	0.60	0.51	48.4
2	T1	1	2.0	0.052	4.7	LOS A	0.3	1.9	0.51	0.60	0.51	44.2
3	R2	25	2.0	0.052	9.2	LOS A	0.3	1.9	0.51	0.60	0.51	48.2
Approach		51	2.0	0.052	7.0	LOS A	0.3	1.9	0.51	0.60	0.51	48.2
East: Yanchep Beach Road												
4	L2	42	2.0	0.253	5.1	LOS A	1.5	11.2	0.45	0.55	0.45	48.0
5	T1	198	8.2	0.253	5.4	LOS A	1.5	11.2	0.45	0.55	0.45	53.5
6	R2	42	2.0	0.253	9.9	LOS A	1.5	11.2	0.45	0.55	0.45	49.9
Approach		282	6.4	0.253	6.0	LOS A	1.5	11.2	0.45	0.55	0.45	52.3
North: Spinnaker Boulevard												
7	L2	19	2.0	0.170	4.6	LOS A	0.9	6.6	0.50	0.68	0.50	46.2
8	T1	1	2.0	0.170	4.5	LOS A	0.9	6.6	0.50	0.68	0.50	44.0
9	R2	159	0.2	0.170	10.3	LOS B	0.9	6.6	0.50	0.68	0.50	49.3
Approach		179	0.4	0.170	9.6	LOS A	0.9	6.6	0.50	0.68	0.50	49.0
West: Yanchep Beach Road												
10	L2	192	0.5	0.348	4.2	LOS A	2.4	17.2	0.26	0.47	0.26	51.8
11	T1	244	8.2	0.348	4.5	LOS A	2.4	17.2	0.26	0.47	0.26	54.6
12	R2	52	2.0	0.348	9.1	LOS A	2.4	17.2	0.26	0.47	0.26	52.2
Approach		488	4.5	0.348	4.9	LOS A	2.4	17.2	0.26	0.47	0.26	53.3
All Vehicles		1000	4.2	0.348	6.2	LOS A	2.4	17.2	0.37	0.53	0.37	52.0

MOVEMENT SUMMARY

Site: 101 [St Andrews/Yanchep Beach/Mapleton - Existing AM]

Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Mapleton Drive												
1	L2	25	2.0	0.045	3.8	LOS A	0.2	1.6	0.36	0.54	0.36	47.0
2	T1	1	2.0	0.045	3.7	LOS A	0.2	1.6	0.36	0.54	0.36	46.0
3	R2	25	2.0	0.045	8.2	LOS A	0.2	1.6	0.36	0.54	0.36	49.9
Approach		51	2.0	0.045	6.0	LOS A	0.2	1.6	0.36	0.54	0.36	48.5
East: Yanchep Beach Road												
4	L2	30	2.0	0.153	4.3	LOS A	0.8	6.0	0.24	0.47	0.24	50.1
5	T1	139	8.2	0.153	4.5	LOS A	0.8	6.0	0.24	0.47	0.24	54.4
6	R2	30	2.0	0.153	9.1	LOS A	0.8	6.0	0.24	0.47	0.24	51.5
Approach		199	6.3	0.153	5.2	LOS A	0.8	6.0	0.24	0.47	0.24	53.3
North: St Andrews Drive												
7	L2	39	2.0	0.072	4.1	LOS A	0.4	2.6	0.41	0.57	0.41	48.7
8	T1	1	2.0	0.072	4.0	LOS A	0.4	2.6	0.41	0.57	0.41	45.8
9	R2	39	2.0	0.072	8.5	LOS A	0.4	2.6	0.41	0.57	0.41	48.8
Approach		79	2.0	0.072	6.3	LOS A	0.4	2.6	0.41	0.57	0.41	48.8
West: Yanchep Beach Road												
10	L2	41	2.0	0.198	4.2	LOS A	1.1	8.1	0.20	0.46	0.20	49.3
11	T1	191	8.2	0.198	4.4	LOS A	1.1	8.1	0.20	0.46	0.20	54.6
12	R2	41	2.0	0.198	9.0	LOS A	1.1	8.1	0.20	0.46	0.20	51.3
Approach		273	6.3	0.198	5.0	LOS A	1.1	8.1	0.20	0.46	0.20	53.3
All Vehicles		602	5.4	0.198	5.3	LOS A	1.1	8.1	0.25	0.48	0.25	52.2

MOVEMENT SUMMARY

Site: 101 [St Andrews/Yanchep Beach/Mapleton - Future AM - with School Traffic]

Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Mapleton Drive												
1	L2	25	2.0	0.099	4.2	LOS A	0.5	3.7	0.44	0.55	0.44	48.5
2	T1	57	0.0	0.099	5.4	LOS A	0.5	3.7	0.44	0.55	0.44	51.5
3	R2	25	2.0	0.099	8.7	LOS A	0.5	3.7	0.44	0.55	0.44	51.2
Approach		107	1.0	0.099	5.9	LOS A	0.5	3.7	0.44	0.55	0.44	50.8
East: Yanchep Beach Road												
4	L2	30	2.0	0.219	4.6	LOS A	1.3	9.3	0.34	0.54	0.34	48.8
5	T1	139	8.2	0.219	4.9	LOS A	1.3	9.3	0.34	0.54	0.34	53.1
6	R2	100	0.6	0.219	9.4	LOS A	1.3	9.3	0.34	0.54	0.34	53.0
Approach		269	4.7	0.219	6.5	LOS A	1.3	9.3	0.34	0.54	0.34	52.7
North: St Andrews Drive												
7	L2	109	0.7	0.187	4.9	LOS A	1.1	7.5	0.46	0.58	0.46	51.7
8	T1	57	0.0	0.187	5.4	LOS A	1.1	7.5	0.46	0.58	0.46	50.9
9	R2	39	2.0	0.187	8.7	LOS A	1.1	7.5	0.46	0.58	0.46	52.1
Approach		205	0.8	0.187	5.8	LOS A	1.1	7.5	0.46	0.58	0.46	51.6
West: Yanchep Beach Road												
10	L2	41	2.0	0.236	4.9	LOS A	1.3	9.9	0.39	0.53	0.39	48.6
11	T1	191	8.2	0.236	5.2	LOS A	1.3	9.9	0.39	0.53	0.39	53.6
12	R2	41	2.0	0.236	9.7	LOS A	1.3	9.9	0.39	0.53	0.39	50.2
Approach		273	6.3	0.236	5.8	LOS A	1.3	9.9	0.39	0.53	0.39	52.4
All Vehicles		854	3.8	0.236	6.0	LOS A	1.3	9.9	0.40	0.55	0.40	52.1

MOVEMENT SUMMARY

Site: 101 [St Andrews/Yanchep Beach/Mapleton - Existing PM]

Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Mapleton Drive												
1	L2	25	2.0	0.045	3.9	LOS A	0.2	1.6	0.38	0.54	0.38	47.0
2	T1	1	2.0	0.045	3.8	LOS A	0.2	1.6	0.38	0.54	0.38	46.0
3	R2	25	2.0	0.045	8.3	LOS A	0.2	1.6	0.38	0.54	0.38	49.8
Approach		51	2.0	0.045	6.0	LOS A	0.2	1.6	0.38	0.54	0.38	48.4
East: Yanchep Beach Road												
4	L2	33	2.0	0.166	4.3	LOS A	0.9	6.6	0.24	0.47	0.24	50.1
5	T1	152	8.2	0.166	4.5	LOS A	0.9	6.6	0.24	0.47	0.24	54.4
6	R2	33	2.0	0.166	9.1	LOS A	0.9	6.6	0.24	0.47	0.24	51.5
Approach		218	6.3	0.166	5.2	LOS A	0.9	6.6	0.24	0.47	0.24	53.3
North: St Andrews Drive												
7	L2	36	2.0	0.067	4.1	LOS A	0.3	2.4	0.42	0.57	0.42	48.7
8	T1	1	2.0	0.067	4.0	LOS A	0.3	2.4	0.42	0.57	0.42	45.8
9	R2	36	2.0	0.067	8.6	LOS A	0.3	2.4	0.42	0.57	0.42	48.8
Approach		73	2.0	0.067	6.3	LOS A	0.3	2.4	0.42	0.57	0.42	48.7
West: Yanchep Beach Road												
10	L2	42	2.0	0.205	4.2	LOS A	1.1	8.5	0.21	0.46	0.21	49.3
11	T1	198	8.2	0.205	4.4	LOS A	1.1	8.5	0.21	0.46	0.21	54.5
12	R2	42	2.0	0.205	9.0	LOS A	1.1	8.5	0.21	0.46	0.21	51.2
Approach		282	6.4	0.205	5.1	LOS A	1.1	8.5	0.21	0.46	0.21	53.2
All Vehicles		624	5.5	0.205	5.3	LOS A	1.1	8.5	0.26	0.48	0.26	52.3

MOVEMENT SUMMARY

Site: 101 [St Andrews/Yanchep Beach/Mapleton - Future PM - with School Traffic]

Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Mapleton Drive												
1	L2	25	2.0	0.100	4.3	LOS A	0.5	3.7	0.45	0.56	0.45	48.4
2	T1	57	0.0	0.100	5.5	LOS A	0.5	3.7	0.45	0.56	0.45	51.4
3	R2	25	2.0	0.100	8.7	LOS A	0.5	3.7	0.45	0.56	0.45	51.2
Approach		107	1.0	0.100	6.0	LOS A	0.5	3.7	0.45	0.56	0.45	50.7
East: Yanchep Beach Road												
4	L2	33	2.0	0.233	4.6	LOS A	1.4	10.1	0.35	0.54	0.35	48.9
5	T1	152	8.2	0.233	4.9	LOS A	1.4	10.1	0.35	0.54	0.35	53.2
6	R2	103	0.6	0.233	9.4	LOS A	1.4	10.1	0.35	0.54	0.35	53.0
Approach		288	4.8	0.233	6.5	LOS A	1.4	10.1	0.35	0.54	0.35	52.7
North: St Andrews Drive												
7	L2	106	0.7	0.183	5.0	LOS A	1.0	7.3	0.47	0.58	0.47	51.8
8	T1	57	0.0	0.183	5.5	LOS A	1.0	7.3	0.47	0.58	0.47	51.0
9	R2	36	2.0	0.183	8.7	LOS A	1.0	7.3	0.47	0.58	0.47	52.2
Approach		199	0.7	0.183	5.8	LOS A	1.0	7.3	0.47	0.58	0.47	51.7
West: Yanchep Beach Road												
10	L2	42	2.0	0.244	4.9	LOS A	1.4	10.3	0.40	0.53	0.40	48.6
11	T1	198	8.2	0.244	5.2	LOS A	1.4	10.3	0.40	0.53	0.40	53.6
12	R2	42	2.0	0.244	9.7	LOS A	1.4	10.3	0.40	0.53	0.40	50.1
Approach		282	6.4	0.244	5.8	LOS A	1.4	10.3	0.40	0.53	0.40	52.4
All Vehicles		876	3.9	0.244	6.1	LOS A	1.4	10.3	0.40	0.55	0.40	52.1