Lignum Road, Moama NSW

Proposed K-12 School

Traffic Impact Assessment Report

Client:

Clarke Hopkins Clarke

Project No. 200523

FINAL3 Report – 7/10/2022

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Draft	8/10/21	Initial draft to the client	Stuart Redman / Bernadette Sargeant	Kate Kennedy
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Final2	07/06/22	Response to SEARs comments	Bernadette Sargeant / Stuart Redman	Ali Abdou
Final3	07/10/22	Additional update to SEARs comments	Chris Blair	Stuart Redman / Kate Kennedy

EXECUTIVE SUMMARY

Trafficworks has been engaged by Clarke Hopkins Clarke, on behalf of the Diocese of Wilcania-Forbes, to undertake a traffic impact assessment of the proposed K-12 school development on Lignum Road in Moama, New South Wales (NSW).

The traffic impact assessment for the proposed development was undertaken to:

- estimate the traffic generation and distribution associated with the proposed development
- determine the following:
    - suitability of the proposed access locations
    - traffic impacts on the existing road network
    - required contributions based on the traffic generation
    - car parking demands of the proposed development
- identity and recommend any necessary remedial measures and treatments

This report has been updated in response to comments relating to the NSW Department of Planning and Environment Secretary's Environmental Assessment Requirements (SEAR).

A summary of the site and the proposed development is shown below.

<table>
<tr><td>Address</td><td colspan="3">Lignum Road, Moama NSW</td></tr>
<tr><td>Zoning</td><td colspan="3">General Residential (R1)</td></tr>
<tr><td>Proposed development</td><td colspan="3">K-12 School (390 students)</td></tr>
<tr><td>Road Network</td><td colspan="3"><u>Lignum Road</u>
• 6.4 m wide two-way sealed local road
• default rural speed limit of 50 km/h</td></tr>
<tr><td rowspan="4">Traffic Generation</td><td></td><td>AM (vph)</td><td>PM (vph)</td></tr>
<tr><td>Primary</td><td>258</td><td>212</td></tr>
<tr><td>Secondary</td><td>63</td><td>43</td></tr>
<tr><td>Total</td><td>321</td><td>255</td></tr>
<tr><td>Recommendations</td><td colspan="3">It is recommended that:
• Recommendation 1: the visibility requirement of 69 m for a 50 km/h speed zone is achieved during the detailed design
• Recommendation 2: landscaping for the first 2.0 m x 2.5 m adjacent to the exit lane be kept clear of visual obstructions over 900 mm in height to ensure drivers have clear sightlines to pedestrians on the footpath
• Recommendation 3: the required contributions to the cost of intersection upgrades be discussed and agreed upon with the Council.</td></tr>
</table>

Referenced documents

References used in the preparation of this report include the following:

- *RTA Guide to Traffic Generating Developments Version 2.2A, October 2002 (RTA Guide)*
- *Transport for NSW: Definitions and notes to support road crash data*
- *Austroads Guide to Traffic Management - Part 7* (AGTM7)
- *AS2890.1:2004 – Parking Facilities (Off-street car parking)*
- *Local Government Infrastructure Design Association - Infrastructures Design Manual*
- *Murray Shire Council*
    - *Moama North West Master Plan (2009)*
    - *Murray Local Environmental Plan (2011)*
    - *Murray Development Control Plan (2012)*
    - *Engineering Guidelines for Subdivisions and Development Standards (2012)*
- *Traffic Impact Assessment Report: Arthurs Estate, Moama NSW,* prepared by Trafficworks, dated August 2019

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1 INTRODUCTION

Trafficworks has been engaged by Clarke Hopkins Clarke, on behalf of the Diocese of Wilcania-Forbes, to undertake a traffic impact assessment of the proposed K-12 school development on Lignum Road in Moama, New South Wales (NSW).

This report has been updated in response to comments relating to the NSW Department of Planning and Environment Secretary's Environmental Assessment Requirements (SEAR).

2 RESPONSE TO SEARS

Two (2) rounds of comments were received from the Planning Secretary's environmental assessment requirements (SEARs) about the proposed school development.

The relevant SEARs comments and Trafficworks responses are detailed in Table 1.

Table 1: Trafficworks response to SEARs comments

SEAR Comment (Initial)	SEAR Comment (Follow-Up)	Trafficworks Response
Provide a transport and accessibility impact assessment, which includes, but is not limited to the following:		
Analysis of the existing transport network to at least the existing or proposed enrolment boundary, including:		
road hierarchy.	No further comment.	The road hierarchy is discussed in Section 3.2
pedestrian, cycle and public transport infrastructure.	No further comment.	Pedestrians/cyclists are discussed in Section 3.5 Public transport is discussed in Section 3.6
details of current daily and peak hour vehicle movements based on traffic surveys and existing traffic studies relevant to the locality.	No further comment.	The available peak hour traffic volume data based on the TIA prepared by Planright for the Arthurs Estate are in Table 2 in Section 3.3 of this report.

SEAR Comment (Initial)	SEAR Comment (Follow-Up)	Trafficworks Response
existing transport operation for 1hr before and after (existing or proposed) bell times such as span of service, the frequency for public transport and school buses, pedestrian phasing for signals.	No further comment.	As discussed in Section 3.6 of the report, the existing bus route 5 in the vicinity of the subject site (Boyes Street) does not operate during school pick-up and drop-off. It is anticipated that the existing town service bus route (Route 3) will be rerouted as part of the development. The current timetable for a nearby stop indicates that services will be during school drop-off and pick-up (refer to Table 4). In addition, it is anticipated that the school will provide a school bus service that will reduce reliance on public transport. There are currently no traffic or pedestrian-operated signals in the vicinity of the subject site.
existing performance levels of nearby intersections utilising appropriate traffic modelling methods (such as SIDRA network modelling).	*Strictly speaking all of these matters are required to be addressed in order to comply with the SEARs. Reliance on a traffic assessment for another DA not previously assessed by the Department is not considered to be adequate. However, if the applicant wants to rely on the results of this assessment, the relevant findings of that report must at least be replicated in each relevant part of this TIA to provide an answer to each of these matters.*	As discussed in Section 3.2 of the Trafficworks TIA, an assessment of the existing operation of nearby intersections was undertaken as part of the approval for the Arthurs Estate. The TIA prepared for Arthurs Estate accounted for the proposed school development. This report has been provided in Attachment C with the relevant sections referenced in this report.

SEAR Comment (Initial)	SEAR Comment (Follow-Up)	Trafficworks Response
Details of the proposed development, including:		
map of the proposed access which identifies public roads, bus routes, footpaths and cycleways.	No further comment.	The development plan for the school is provided in Attachment A. The pedestrian and cycling facilities will connect with the facilities provided within the Arthurs Estate. The road network, pedestrian and cycling facilities within the Arthurs Estate is discussed in the TIA prepared for the Arthurs Estate, which is provided in Attachment C.
pedestrian site access and vehicular access arrangements, including for service and emergency vehicles and loading/unloading, including swept path analysis demonstrating the largest design vehicle entering and leaving the site and moving in each direction through intersections along the proposed transport routes.	No further comment.	The development plan is provided in Attachment A, and swept paths for the design vehicle are provided in Attachment B.

SEAR Comment (Initial)	SEAR Comment (Follow-Up)	Trafficworks Response
car and motorcycle parking, bicycle parking and end-of-trip facilities.	Not provided, as above.	41 staff car parking bays and 35 kiss and drop car parking bays have been shown on the development plan. Constructing additional car parking to the south of the oval is recommended. No motorcycle parking will be provided. Changerooms and showers are proposed in the reception and administration buildings. Two (2) bicycle hoops are provided behind the administration building to satisfy the 4 staff bicycle space requirement. 15 bicycle hoops are provided to the south of the gymnasium to satisfy the 30 student bicycle space requirement.
drop-off / pick-zone(s) and arrival/departure bus bay(s).	No further comment.	The development plan is provided in Attachment A.
pedestrian, public transport or road infrastructure improvements or safety measures.	No further comment.	The road infrastructure improvements required are detailed in the TIA prepared for the approved Arthurs Estate development and provided in Attachment C. It is anticipated that the existing town centre bus service will be rerouted as part of the development. However, this will be subject to discussions with Council / the bus operator.
details to demonstrate that no vehicular access is proposed directly to the Cobb Highway via its intersection with Kiely Road and that access is proposed (where possible) from the south via Boyes Road and from the north via Lignum Road.	No further comment.	The development plan is provided in Attachment A.

SEAR Comment (Initial)	SEAR Comment (Follow-Up)	Trafficworks Response
Analysis of the impacts due to the operation of the proposed development, including:		
proposed modal splits for all users of the development including vehicle, pedestrian, bicycle riders, public transport, school buses and other sustainable travel modes for AM and PM peaks considering comparable schools.	Not provided, as above.	As discussed in Section 5.2 of this report, an assessment of the impacts on the operation of nearby intersections based on the proposed development was undertaken as part of the approval for the Arthurs Estate. The TIA prepared for Arthurs Estate accounted for the proposed school development and is provided in Attachment C with the outcomes summarised in this report.
details of the distribution on the road network of the trips generated by the proposed development.	No further comment.	Refer to the TIA prepared for the approved Arthurs Estate development in Attachment C
estimated total daily and peak hour vehicular trip generation.		
a clear explanation and justification of the: assumed growth rate applied.		
volume and distribution of proposed trips on the road network to be generated, shown diagrammatically for easy interpretation.		
type and frequency of design vehicles accessing the site.		

Details of the performance of nearby intersections with the additional traffic generated by the development both at the commencement of operation and in 10 years (using SIDRA network modelling or similar traffic model) including:		
with and without development scenarios.	Not provided, as above.	Refer to the TIA prepared for the approved Arthurs Estate development provided in Attachment C and referenced within this report.
95th percentile back of queue lengths.		
delays and level of service on all legs for the relevant intersections.		
electronic data for TfNSW review.		
necessary road network infrastructure upgrades that are required to maintain existing levels of service on the road network including necessary concept plans and documentation.	Not provided, as above.	Refer to the TIA prepared for the approved Arthurs Estate development provided in Attachment C and referenced within this report. The cost contribution for the infrastructure upgrades based on the traffic volumes generated by the proposed school development is discussed in Section 5.3 of the Trafficworks TIA.
any future intersection treatment with Lignum or Kiely Roads (as relevant) designed in accordance with relevant standards and considering the relevant design speed.	No further comment.	The TIA prepared for the approved Arthurs Estate development details the future intersection treatments at the Lignum Road / Perricoota Road to support the development, including the proposed school. It is understood that Keily Road will be a no-through road, and therefore no intersection treatment is required.
cumulative traffic impacts from any surrounding approved development(s).	No further comment.	Refer to the TIA for the approved Arthurs Estate development provided in Attachment C.

adequacy of pedestrian, bicycle, service vehicles and public transport infrastructure and operations to accommodate the development.	Not clearly provided, as above.	The adequacy of the proposed loading is discussed in Section 6.3 of the Trafficworks TIA report. The development plan for the school is provided in Attachment A. The pedestrian and cycling facilities will connect with the facilities provided within the Arthurs Estate. The road network, pedestrian and cycling facilities within the Arthurs Estate is discussed in the TIA prepared for the Arthurs Estate. It is anticipated that the existing town centre bus service will be rerouted as part of the development. However, this will be subject to discussions with Council / the bus operator. Bicycle and end-of-trip facilities have been proposed, as discussed in Section 5.4.
adequacy of car and motorcycle parking and bicycle parking provisions when assessed against the relevant car/bicycle parking codes and standards.	Not provided.	Car parking requirements are detailed in Section 6.1 of this report. Bicycle parking requirements are detailed in Section 6.4 of this report. There is no requirement for motorcycle parking.

adequacy of the drop-off/pick-up zone(s) and bus bay(s), including assessment of any related queuing during peak-hour access.	The analysis of the pick-up area is based only on comparison with one other (much larger school) and it is unclear if the location of the school / catchment etc is comparable with the proposed school. Further, the analysis of that school finds that there is queueing associated with the pick-up drop off and therefore that there is a potential shortage of spaces compared to demand. The adequacy of the drop-off area therefore has not been adequately assessed. Further analysis is required. Consider likely dwell times and likely number of users during peak times based on similar schools to provide a more accurate analysis. There is no assessment of likely demand for bus services and therefore adequacy of the bus bays.	Refer to Section 5.2 of the Trafficworks TIA report. Bus parking assessment has been undertaken in Section 6.2.
adequacy of the existing / proposed pedestrian infrastructure to enable convenient and safe access to and from the site for all users.	Not addressed	The road network, pedestrian and cycling facilities within the Arthurs Estate is discussed in the TIA prepared for the Arthurs Estate, which is provided at Attachment C.
Measures to ameliorate any adverse traffic and transport impacts due to the development based on the above analysis, including:		
travel demand management programs to increase sustainable transport (such as a Green Travel Plan / School Transport Plan).	These matters have not been addressed / provided and are required to be addressed as part of EIS to comply with SEARs – at least a preliminary version of the GTP addressing these matters should be provided as part of the EIS for assessment – with final versions potentially to be approved post consent.	A Green Travel Plan has been prepared separately for the proposed school that addresses these issues. This will be finalised once the school is in operation and will be continuously updated and maintained.
arrangements for the Travel Coordinator roles.		
governance arrangements or relationships with state and local government transport providers to update road safety.		

infrastructure improvements or protection measures, including details of timing and method of delivery.		Refer to the TIA for the approved Arthurs Estate development provided in Attachment C and referenced within this report.
a preliminary school transport plan detailing operational traffic and access management plan for the site, pedestrian entries, the drop-off/pick-up zone(s) and bus bay(s).	*Not provided and required as part of EIS to comply with SEARs*	A Green Travel Plan has been prepared separately for the proposed school that addresses these issues. Details on the various operational items of the school are also detailed in Section 5 of this report.
Analysis of the impacts of the traffic generated during the construction of the proposed development, including:		
construction vehicle routes, types and volumes.	*Not provided and required as part of EIS to comply with SEARs*	A Traffic Management Plan has been prepared separately for the proposed school.
construction program (duration and milestones).		
on-site car parking and access arrangements for construction, emergency and construction worker vehicles.		
cumulative impacts associated with other construction activities in the locality (if any).		
road safety at identified intersections near the site due to conflicts between construction vehicles and existing traffic in the locality.		
measures to mitigate impacts, including ensuring the safety of pedestrians and cyclists during construction.		
a preliminary Construction Traffic and Pedestrian Management Plan.	*Not provided and required as part of EIS to comply with SEARs*	A Traffic Management Plan has been prepared separately for the proposed

3 EXISTING CONDITIONS

3.1 Subject site

The subject site (Lot 76 of DP751159) is located approximately 1.5 km northwest of the Moama town centre within the Murray River Council (the Council). The subject site falls within a General Residential (R1) Zone and comprises vacant land bounded by Kiely Road to the north and Lignum Road to the west.

The subject site is located within the Development Plan for the Arthurs Estate residential subdivision. The subject site and the surrounding area are shown in Figure 1, and the zoning map is shown in Figure 2.

Figure 1: Location Plan (reproduced with permission from Melway Publishing Pty Ltd)

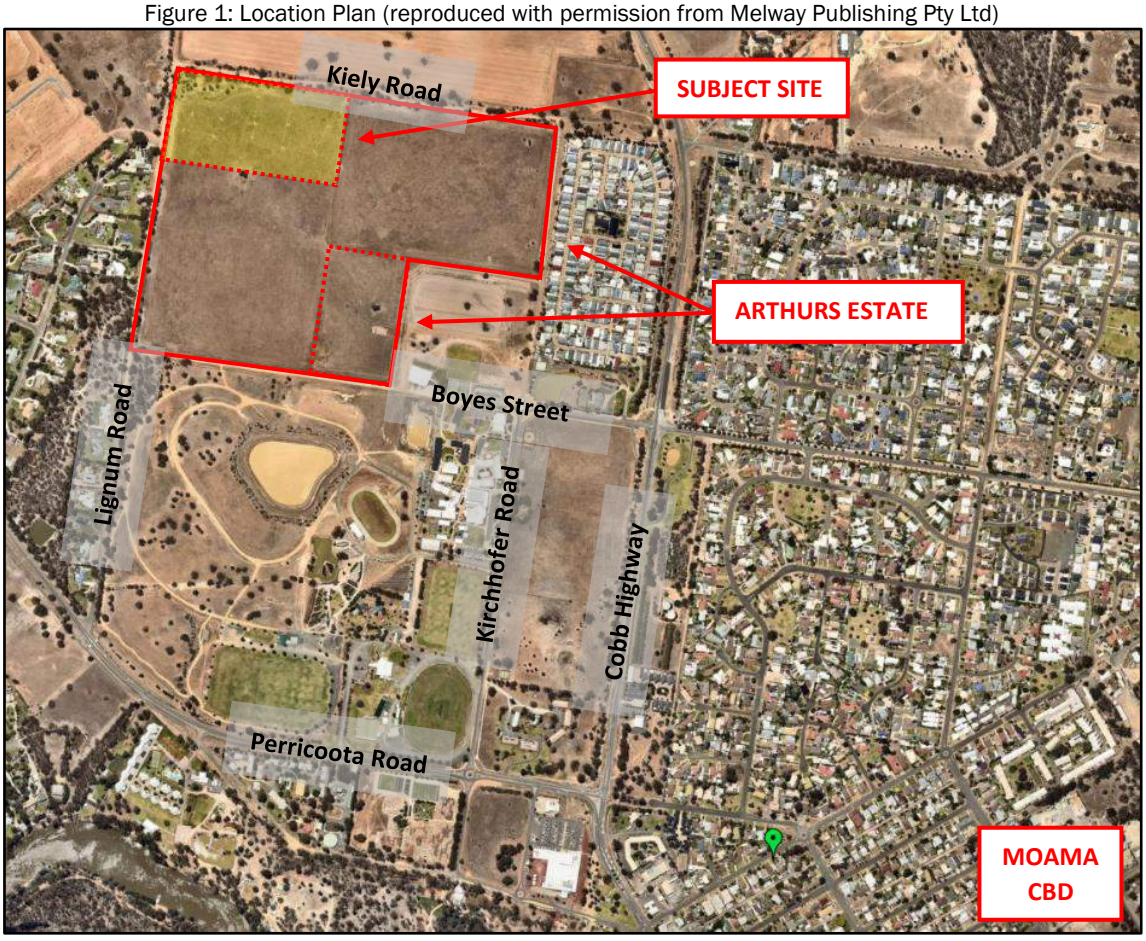
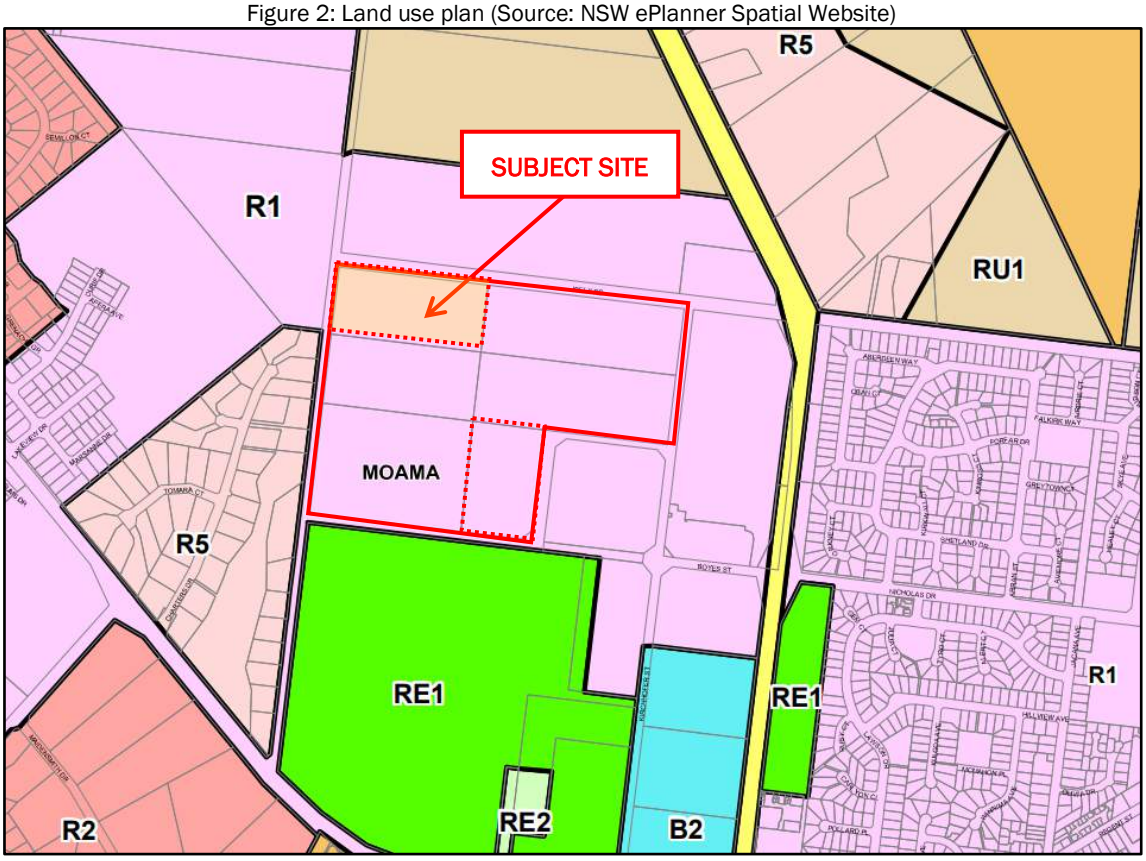


Figure 2: Land use plan (Source: NSW ePlanner Spatial Website)



3.2 Road network

Lignum Road is a local access street managed by the Council. It is generally aligned in a north-south direction, approximately 2 km in length, and provides a connection to Perricoota Road to the south and Martin Road to the north (Refer to Photos 1 and 2).

Photo 1: Lignum Road looking south (works were occurring at the time of the inspection to construct and seal the road)

Lignum Road is a two-way sealed local road (recently constructed and sealed for the full length by the Council) near the proposed development with a road width of approximately 6.4 m. The default urban speed limit of 50 km/h is applicable along this section of Lignum Road.

Photo 2: Lignum Road looking north

Kiely Road, adjacent to the subject site, is an unmade road within a tree-lined road reserve managed by the Council. It is generally aligned in an east-west direction. No access is proposed to/from the subject site. Hence the road will not need to be constructed as part of the proposed development on the subject site.

3.3 Traffic volumes

Existing traffic count volumes for the surrounding road network were obtained from Council for the Traffic Impact Assessment report for the Arthurs Estate Development Plan (provided in Attachment C), prepared by Trafficworks, dated August 2019.

For this assessment, it has been assumed that the directional split for the road network travelling to/from the Moama township is 60% / 40% in the AM peak and 40% / 60% in the PM peak.

The peak two-way traffic volumes (vehicles per hour) are summarised in Table 2.

3.4 Crash history

The *Transport for NSW (TfNSW) - Crash and casualty statistics* database details all injury crashes on roads throughout the state. Scrutiny of these records in the last five-year period (2015 - 2019) indicates that no casualty crashes occurred within the vicinity of the subject site.

Hence it can be concluded that the roads near the subject site do not have a traffic safety problem that requires urgent remedial action.

Table 2: Existing traffic volumes (Source: Planright Traffic Impact Assessment Arthurs Estate, Moama)

Year	Road	Location	Peak Volume Two-way (vph)[1]
2015	Meninya Street	at Crossing	1,683
2014	Cobb Highway	south of Nicholas Drive	613
2014	Cobb Highway	north of Nicholas Drive	140
2015	Perricoota Road	west of Cobb Highway	1,113
2014	Kirchhofer Street	north of Perricoota road	155
2015	Lignum Road	north of Perricoota road	12
2014	Boyes Street	west of Cobb Highway	136
2015	Perricoota Road	west of Lignum Road	1,102
-	Nicholas Drive	west of Cobb Highway	385

3.5 Pedestrians and cyclists

There are currently no footpaths or cycle paths near the subject site along Lignum Road.

An existing shared path runs along the southern side of Perricoota Road with a pedestrian refuge near Lignum Road, providing a convenient crossing location for pedestrians.

3.6 Public transport

No bus services currently travel near the subject site along Lignum Road and Kiely Road. There is one bus stop on Boyes Street approximately 165 m east of the Kirchhofer Street intersection on Route 5 (5 Echuca – 24 Lane).

The timetable for route 5 (reproduced in Table 3) does not currently coincide with school pick-up and drop-off times.

Table 3: Route 5 – Boyes Street timetable

Route 5 – Boyes Street	Timetable		
To Echuca	9:43 am	11:48 am	1:48 pm
To 24 Lane	11:17 am	1:17 pm	5:17 pm

It is noted that the town service bus (route 3: Circular Echuca - Moama) may be rerouted as a result of the development to service the Arthurs Estate, including the proposed school and the existing Moama Anglican School (refer to Figure 3).

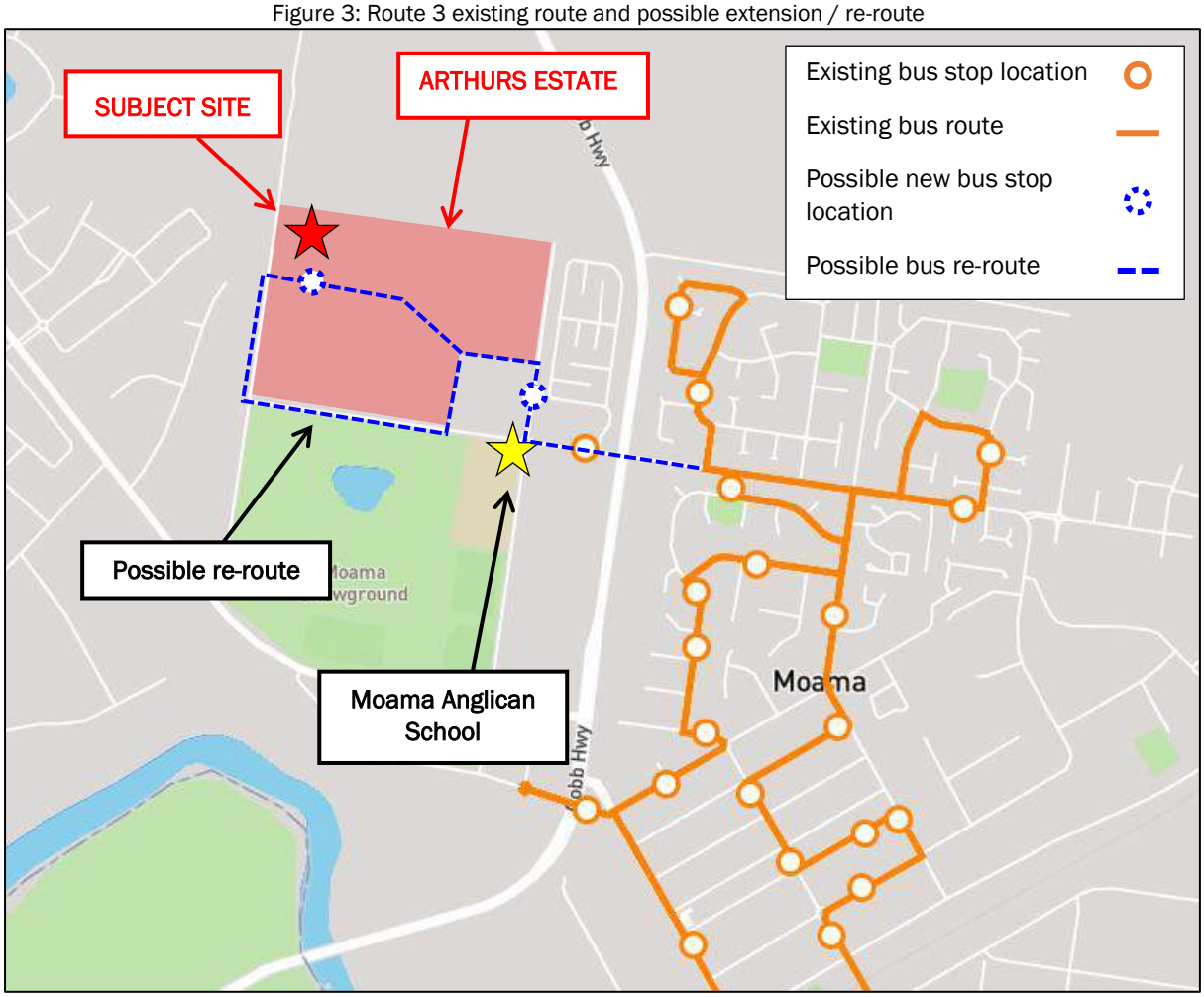
The existing route timetable for the closest stop (Nile Street) is reproduced in Table 4. The timetable indicates existing service times that could service the school during drop-off /pick-up times.

[1] Peak volumes are based on the peak hour volumes being 10% of daily traffic volume

Table 4: Route 3 - Nile Street timetable

Route 3 – Nile Street	Timetable					
AM	*8:22 am*	*8:51 am*	*8:57 am*	10:22 am	10:57 am	
PM	12:22 pm	12:57 pm	2:22 pm	2:57 pm	*4:22 pm*	4:57 pm

Figure 3: Route 3 existing route and possible extension / re-route



4 PROPOSED DEVELOPMENT

4.1 Proposed development summary

It is proposed to construct a K-12 school developed over three phases, as detailed in Table 5.

Table 5: Stages of development

Phase	Student numbers		
	Primary school	Secondary school	Total
1	90	30	120
2	210	120	330
3	210	180	390

In addition, a café is proposed within the school canteen, which will be open to the public during the afternoon school pick-up and will likely service parents, students and school staff.

A total of 102 on-site car parking spaces are proposed on-site, including

- 41 staff only car parking spaces (including one disabled bay)
- 35 parents kiss and drop car parking spaces (including one disabled bay)
- 26 overflow parking spaces.

Vehicular access to the site is proposed via two crossovers to Lignum Road and pedestrian-only access to the adjoining Arthurs Estate residential subdivision.

The proposed development plans are shown in Attachment A.

4.2 Traffic generation

A report titled *Roads and Maritime Services[2] Trip Generation Surveys, Schools Analysis Report* was prepared by GTA Consultants on behalf of TfNSW to determine contemporary trip generation data for primary and secondary schools within metropolitan and regional NSW. This report was used to estimate traffic generation from the proposed school, which recommends:

- for a school within a regional area, an average for:
    - Primary schools:
        - AM peak hour of 1.23 trips per student
        - PM peak hour of 1.01 trips per student
    - Secondary schools:
        - AM peak hour of 0.35 trips per student
        - PM peak hour of 0.24 trips per student

[2] Roads and Maritime Services (RMS) are now part of Transport for NSW (TfNSW)

Table 6 shows the summary traffic generation from the proposed school at full development.

Table 6: Anticipated traffic generation

Land Use	Quantity	Unit	RMS Traffic Generation Rate		Development Traffic Generation	
			AM Peak Hour Trips (per unit)	PM Peak Hour Trips (per unit)	AM Peak Hour Trips (vph)	PM Peak Hour Trips (vph)
Primary School	210	Students	1.23	1.01	258	212
Secondary School	180	Students	0.35	0.24	63	43
				TOTAL	321	255

It is noted that the proposed café will be open to the public. However, it is anticipated that the café will serve the school community (i.e. the parents/guardians, students and teachers at the school). Therefore it is not expected to generate any additional traffic.

Therefore, the proposed school with 390 students is anticipated to generate up to 321 vehicles per hour (vph) in the AM drop-off peak hour and up to 255 vph in the PM pick-up peak hour.

Conclusion 1: the proposed K-12 school with 390 students is anticipated to generate up to 321 vehicles per hour (vph) in the AM drop-off peak hour and up to 255 vph in the PM pick-up peak hour.

4.3 Arthurs Estate traffic impact assessment

The traffic impact assessment of the overall Arthurs Estate development on the surrounding road network was submitted as part of the approved Development Plan and is provided in Attachment C. The assessment of the Arthurs Estate was based on the subject site being a primary school with 300 students.

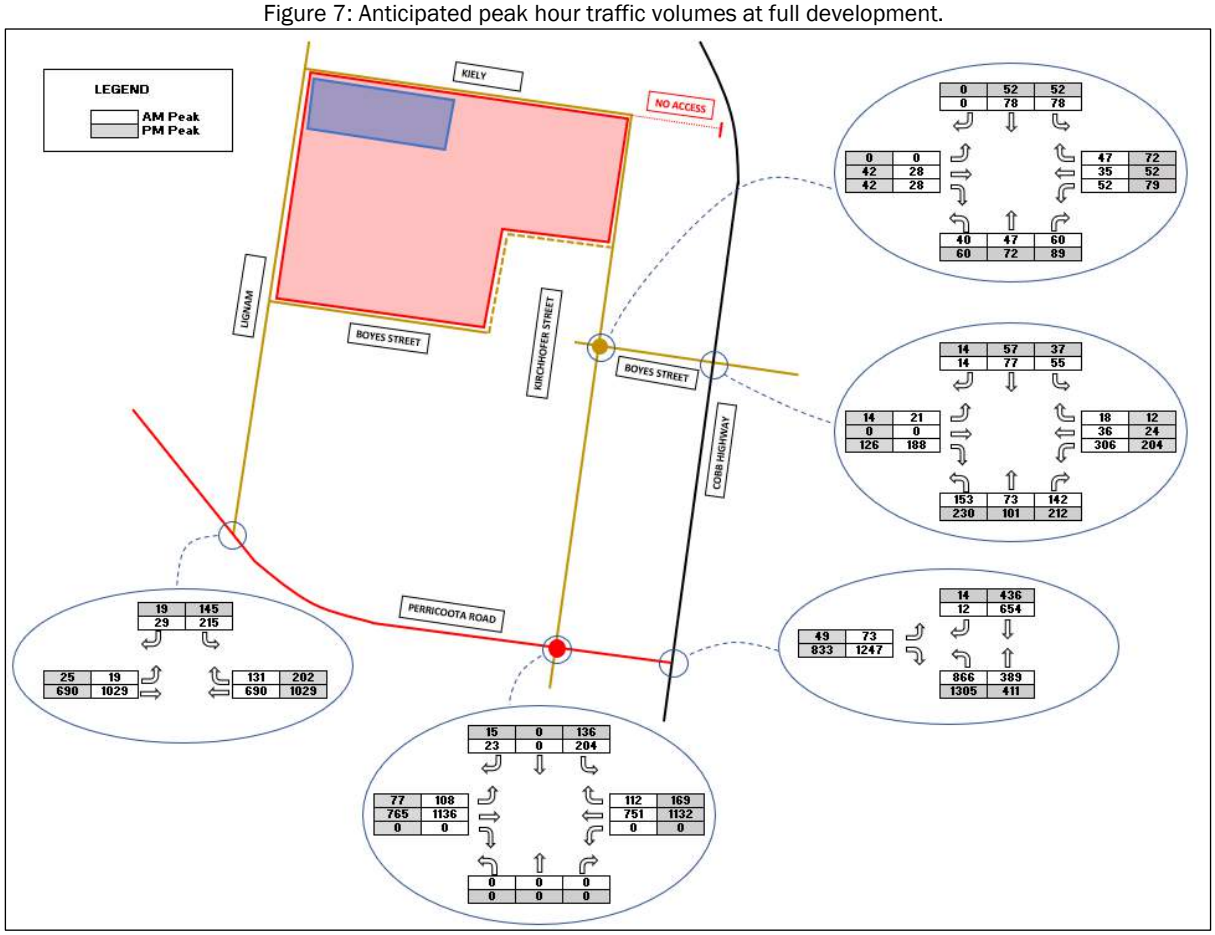
The Arthurs Estate development application reviewed the likely traffic generation and distribution of the provided estate at full development (including the subject site of the proposed K-12 school).

4.3.1 Traffic generation and distribution

The traffic report outlines several traffic generation and distribution assumptions with the anticipated traffic volumes summarised in Figure 7 with the full methodology and calculations provided in Section 3.3 of the attached report (Attachment C).

This resulted in peak hour traffic volumes at full development of the Arthurs Estate, as shown in Figure 7.

Figure 7: Anticipated peak hour traffic volumes at full development.



4.3.2 Intersection analysis

A network intersection analysis was undertaken at the following intersections:

- Perricoota Road and Lignum Road
- Perricoota Road and Kirchhofer Street
- Cobb Highway and Perricoota Road
- Cobb Highway and Boyes Street
- Kirchhofer Street and Boyes Street

4.3.3 Summary

The Arthurs Estate traffic impact assessment at full development is summarised as follows:

- the intersections along Perricoota Road at Cobb Highway, Kirchhofer Street and Lignum Road operate at very poor conditions, resulting in long queue length and delays
- it is acknowledged that the Perricoota Road / Cobb Highway intersection will be upgraded to a signalised intersection by 2023. The upgrade is expected to address the traffic demand on the intersections along Perricoota Road.
- Consider the installation of a roundabout at the Perricoota Road / Lignum Road intersection to improve the overall queue lengths and average delays.

- Consider installing a roundabout at the Cobb Highway / Boyes Street intersection to improve road safety.

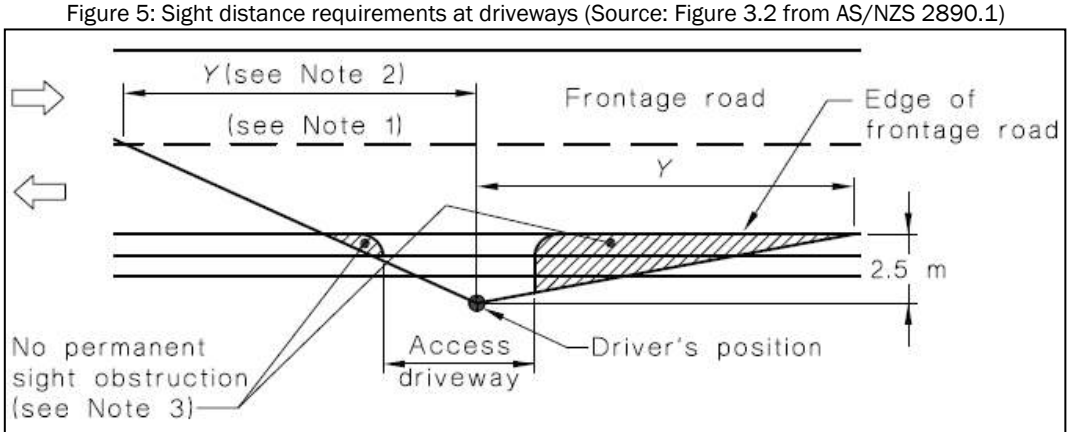
5 ASSESSMENT

5.1 Sight distance

Section 3.2.4 in AS/NZS 2980.1 *Parking Facilities – Part 1: Off-street car parking* sets out Entering Sight Distance (ESD) criteria for a driver exiting an access driveway to traffic on the frontage road and sight distance to pedestrians as outlined below.

a) ***Entering sight distance:*** Unsignalised access driveways shall be located so that the intersection sight distance along the frontage road available to drivers leaving the driveway is at least that shown in Figure 3.2 of AS/NZS 2890.1 (reproduced in Figure 5 below).

Figure 5: Sight distance requirements at driveways (Source: Figure 3.2 from AS/NZS 2890.1)

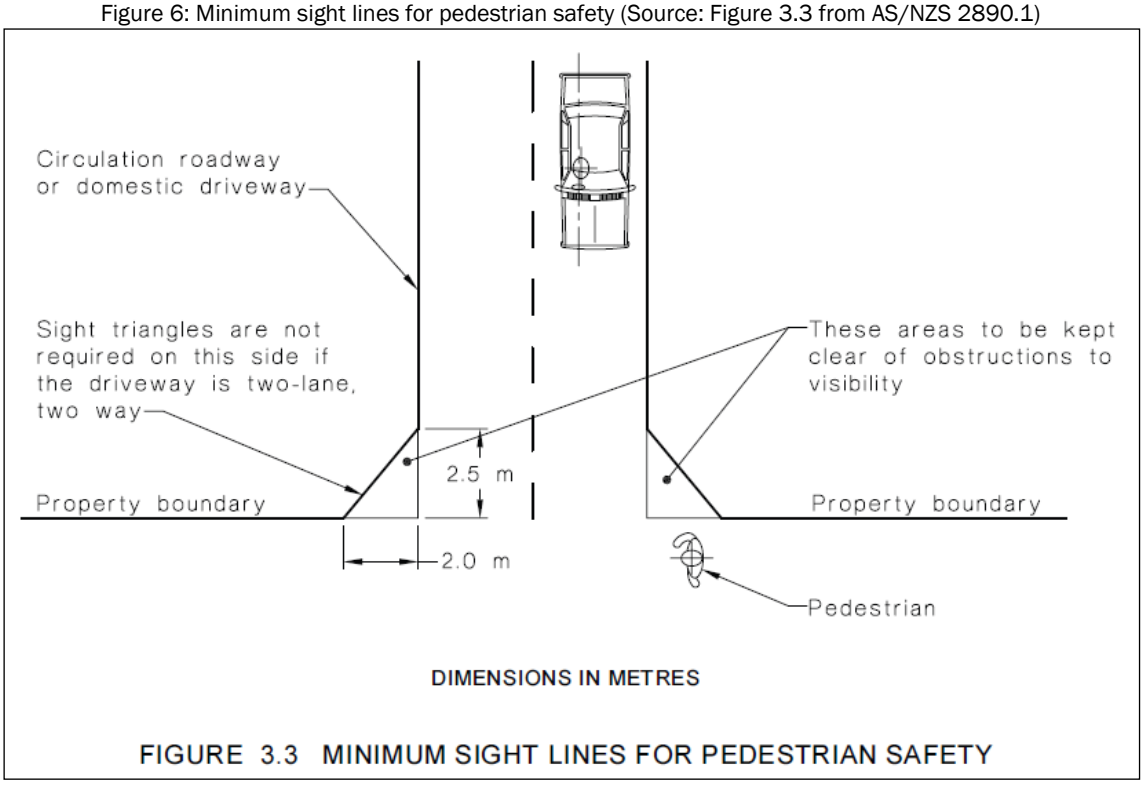


Frontage road speed (Note 4) km/h	Distance (Y) along frontage road m		
	Access driveways other than domestic (Note 5)		Domestic property access (Note 6)
	Desirable 5 s gap	Minimum SSD	
40	55	35	30
50	69	45	40
60	83	65	55
70	97	85	70
80	111	105	95
90	125	130	Use values from 2nd and 3rd columns
100	139	160	
110	153	190	

Recommendation 1: the visibility requirement of 69 m for a 50 km/h speed zone is achieved during detailed design.

b) ***Sight distance to pedestrians:*** Clear sight lines, as shown in Figure 3.3 of AS/NZS 2890.1 (reproduced in Figure 6), shall be provided at the property line to ensure adequate visibility between vehicles leaving the property and pedestrians on the frontage road footpath.

Figure 6: Minimum sight lines for pedestrian safety (Source: Figure 3.3 from AS/NZS 2890.1)



A clear area of 2.0 m x 2.5 m is available on the exit side of the accessways to provide sight lines to pedestrians. It is recommended that landscaping in this area be low lying to ensure drivers have clear sightlines to pedestrians on the footpath.

Recommendation 2: landscaping for the first 2.0 m x 2.5 m adjacent to the exit lane be kept clear of visual obstructions over 900 mm in height to ensure drivers have clear sightlines to pedestrians on the footpath.

5.2 Impact on the existing road network

A comparison between the approved primary school detailed in Section 3.3 and Attachment C and the proposed K-12 school is summarised in Table 7 below.

Table 7: Comparison of approved DP school and proposed K-12 school

Land Use	Approved DP school			Proposed K-12 school		
	Primary	Secondary	TOTAL	Primary	Secondary	TOTAL
Student numbers	300	-	300	210	180	360
Peak hour traffic generation rate	1.23	-	-	1.23	0.35	-
Peak hour traffic generation	369		369	258	63	321

Based on the above, the proposed K-12 school will generate up to 321 vehicles during the peak hour. Therefore, the approved Development Plan with a primary school with 300 students (369 trips in the peak hour) would impact the surrounding road network more than the proposed K-12 school.

Therefore, the approved development plan has been approved as part of the planning process for the Arthurs Estate and the following mitigation works were identified:

- Installation of a roundabout at the Perricoota Road / Lignum Road intersection
- Installation of a roundabout at the Cobb Highway / Boyes Street intersection.

Conclusion 2: the traffic impact of the proposed school has already been assessed and approved as part of the planning process for the overall Arthurs Estate.

The traffic associated with the school is anticipated to be the primary traffic generator along this section of Lignum Road. Therefore, any impacts resulting from queues or delays related to the school will predominately impact traffic associated with the school, as there will be negligible non-school traffic using this section of Lignum Road. It is noted that the school peak hours typically occur for a period of 15-minutes during the school pick-up and drop-off.

Given that the existing and future land use fronting Lignum Road is residential, it is anticipated that future residents that may be impacted by queues and delays at the school access will likely seek alternative routes (i.e. Lignum Road / Martin Street / Cobb Highway) during school pick-up and drop-off times.

In addition, the cross-section of Lignum Road in the vicinity of the subject site is constrained by several substantial trees that restrict widening opportunities.

Therefore, the proposed access is anticipated to have a negligible impact on the overall operation of Lignum Road and no mitigation measures are considered warranted.

Conclusion 3: the proposed access is anticipated to have a negligible impact on the overall operation of Lignum Road, and no mitigation measures are considered warranted.

5.3 Intersection upgrade contribution

The Arthurs Estate development identified upgrade works required to key intersections impacted by the proposed subdivision as a result of the development, including:

- Installation of a roundabout at the Perricoota Road / Lignum Road intersection
- Installation of a roundabout at the Cobb Highway / Boyes Street intersection.

The contributions required by each component to the upgrade works based on the traffic volumes associated with the proposed K-12 school and traffic volumes associated with the Arthurs Estate development plan (excluding the primary school) are summarised in Table 8 (based on the design year of 2030).

Table 8: Intersection upgrade contributions

Intersection	Peak Period	Anticipated 2030 traffic volumes[3]	Arthurs Estate traffic volumes (excl school traffic)	Proposed K-12 school traffic volumes
Cobb Highway / Boyes Street intersection	AM	1020	58	97
		87%	**5%**	**8%**
	PM	1008	58	97
		87%	**5%**	**8%**
Perricoota Road / Lignum Road intersection	AM	1727	157	189
		83%	**8%**	**9%**
	PM	1724	157	182
		84%	**8%**	**8%**

Conclusion 4: the proposed K-12 school will contribute:

- 8% of the total post-development traffic volumes at the Perricoota Road / Lignum Road intersection upgrade
- 9% of the total post-development traffic volumes at the Cobb Highway / Lignum Road intersection.

Recommendation 3: the required contributions to the cost of intersection upgrades be discussed and agreed upon with the Council.

5.4 Pedestrian and cyclist facilities

End of trip facilities (including changerooms and showers) are proposed within the reception and administration building and in the shared facilities building. Two (2) hoops (four spaces) are provided behind the administration building, with 15 hoops (30 spaces) located to the south of the gymnasium.

The Association of Pedestrian and Bicycle Professionals (APBP) *Bicycle Parking Guidelines 2010* recommend a school bicycle parking requirement of:

Long-term bicycle parking

- 1 space for every 10 employees plus
- 1 space for every 20 students of planning capacity (high school students only).

Short-term bicycle parking

- 1 space for every 20 students of planning capacity

It should be noted that the guidelines do not recommend long-term bicycle parking storage for primary school students.

[3] Based on a compound annual growth rate of 3%

Based on the ratios above, the bicycle car parking requirement is as follows:

Staff

- 4 long term bicycle parking spaces

Students

- 9 long term bicycle spaces
- 20 short-term bicycle parking spaces

Long-term bicycle parking spaces are typically required to be secured and undercover within bicycle storage cages with access restricted by keys or access cards. However, a school is already a secured environment.

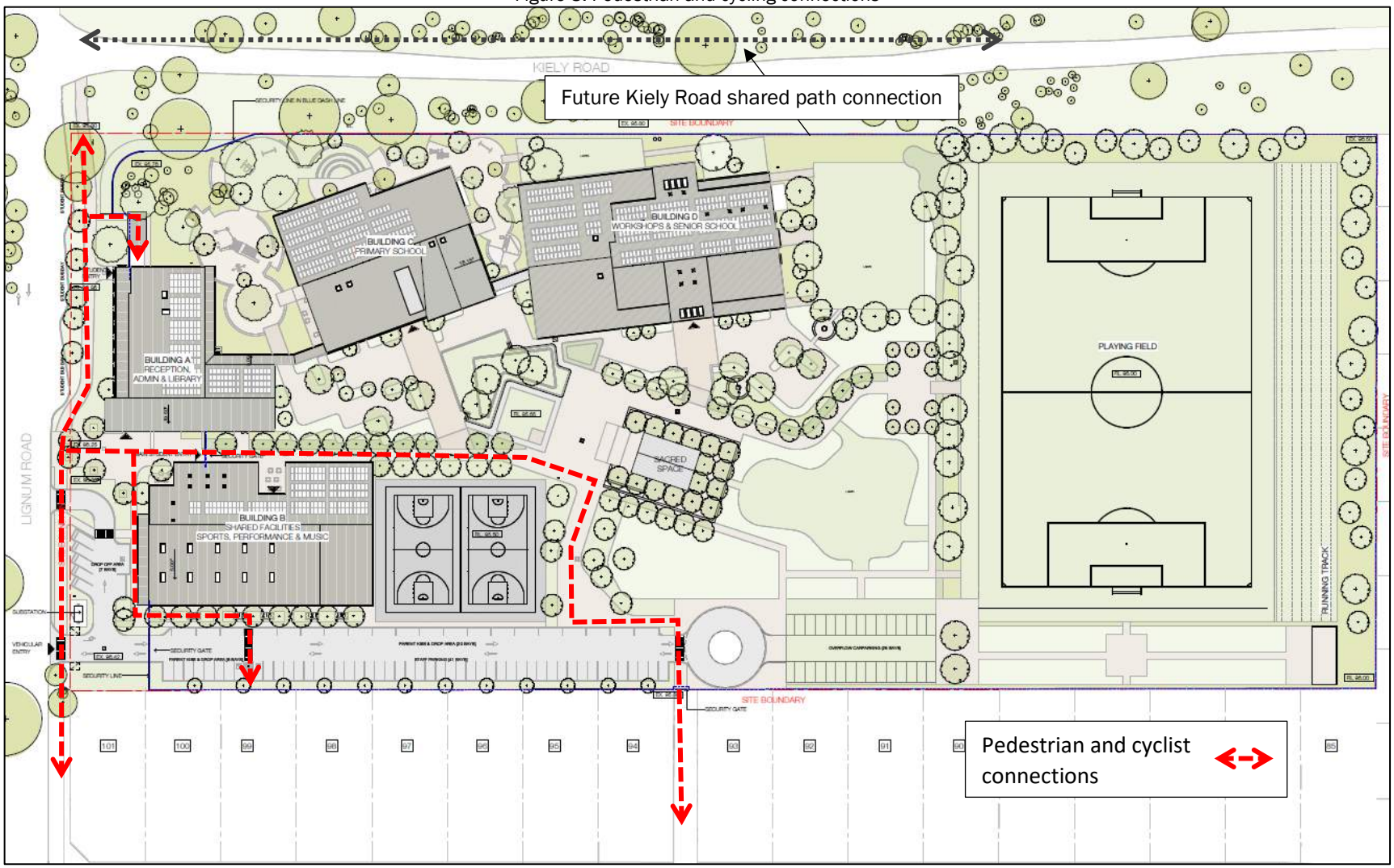
As mentioned previously, the proposed development plans show two (2) bicycle hoops (with a capacity of four (4) bicycle parking spaces) behind the administration area for staff use and 15 bicycle hoops (with a capacity for 30 bicycle parking spaces) located to the south of the gymnasium for student use.

Conclusion 5: The provision of staff and student bicycle parking satisfies the estimated bicycle parking demand for the site.

The pedestrian and cycling facilities within the subject site will connect with the pedestrian/cycling facilities within the Arthurs Estate, which will link to the Moama Anglican Grammar school.

The pedestrian and cycling routes within the subject site are shown in Figure 8.

Figure 8: Pedestrian and cycling connections



6 CAR PARKING

A report was prepared for Roads and Maritime Services (RMS, now TfNSW) titled *Roads and Maritime Services Trip Generation Surveys and Schools Analysis Report* to determine contemporary trip generation data for 'Schools' within Metropolitan Sydney and Regional NSW in February 2014.

This report was developed to supplement the RTA Guide to Traffic Generating Developments and a Technical Direction (TFT 2013/04) and provide updated trip generation and parking surveys at schools to assist with assessing transport impacts when planning new schools.

The following sections utilise the Schools Analysis Report, the RTA Guide to Traffic Generating Developments, and a case study of similarly typed schools to determine the car parking requirements for the school.

6.1 Car parking requirements

The car parking requirements of a school are comprised of two components: long-term staff/visitor car parking and short-term parent pick-up/drop-off car parking. These components are discussed below.

Whilst the proposed café will be open to the public, it is anticipated that the café will serve the school community (i.e. the parents/guardians and students at the school) and therefore is not expected to generate additional car parking demand.

Long-stay car parking demand

The *Roads and Maritime Services Trip Generation Surveys and Schools Analysis Report* prepared on behalf of TfNSW determined car parking rates for primary and secondary schools within metropolitan and regional NSW based on surveys.

The report indicates that the car parking demand should be viewed as long-term school-generated traffic throughout the day. The surveys were undertaken just after the start and before the end of school outside the peak car parking period of school drop-off/pick-up.

The analysis report indicates that primary and secondary schools generate a similar peak car parking demand with a surveyed average peak car parking demand of *0.1 car parking spaces per student*. Based on the above rate, the proposed K-12 school with 390 students will generate a peak car parking demand of 39 car parking spaces.

The proposal includes providing 41 staff car parking spaces on-site to the south of the subject site. Therefore, the likely long-term car parking demand generated throughout the school day will be fully contained within these nominated areas.

Conclusion 6: the proposed parking provision of 41 staff parking spaces on-site is anticipated to accommodate the staff car parking demand associated with the proposed K-12 school.

Peak school pick-up/drop-off car parking demand

The nearby Moama Anglican Grammar School is a fair comparison; given that it is a K-12 school, it has a higher student population of approximately 700 students.

A review of the school handbook instructs parents to park in Brick Alley or the car parking area off Boyes Road. It notes that parking will not occur along Kirchhofer Street as this will be utilised by buses. All other parking areas have been prohibited for parent parking, which is enforced by a combination of local laws and school policies.

It also nominates the area in front of the school administration building for short-term visitor parking but only outside bus times. The following figure was extracted from the school website detailing parking locations.

Figure 9: Parking Information (Moama Anglican Grammar School)

A review of the parking areas nominated for parent parking also shows that it would be shared with staff and visitors. On this basis, approximately 28 off-street parking spaces are provided off Brick Alley, and 79 off-street parking spaces are provided off Boyles Road for a total off-street capacity of 107, with another 40 spaces nominated along the Brick Alley frontage directly accessed off the roadway.

Additional staff parking has been provided, with approximately 30 spaces along the rear access street to the west of the school, with space for about 40 more vehicles to the west of the sports oval to the south. The rear access road and sports oval spaces have been nominated for Year 12 student parking, but that has been excluded in this high-level assessment.

On this basis, 217 parking spaces have been provided across the site, with 147 spaces nominated for staff and parents and 70 spaces for staff.

A review of aerial photographs of Moama Anglican Grammar School during the middle of the day has identified between 70-90 parking spaces vacant spaces within the areas nominated for parents. Applying this rate to the 700 students provides a parent kiss-and-drop car parking rate between 0.10 to 0.13 spaces per student.

Trafficworks has been involved with traffic assessments for the Marist College in Bendigo (Victoria), a K-12 school with up to 1,250 students. As this school includes high school students, the car parking demand of Marist College provides a good comparison of the likely car parking demand of the proposed K-12 school.

Marist College provides 112 parking spaces for parents to drop off / pick up students (including 18 parallel and 94 x 90-degree car parking spaces), as shown in Figure 9. It is noted that a separate car parking area is provided for staff.

Figure 9: Marist College drop-off/pick-up car park

With 1,250 students, Marist College has a drop-off/pick-up car parking provision of 0.09 spaces per student (112 car parking spaces /1,250 students).

Adopting the parking rate range of 0.09 to 0.13 spaces per student results in a parent kiss and drop car parking supply of 35 to 51 parking spaces. The proposed provision of 61 car parks (including the 26 overflow parking spaces in the southeast) would satisfy the short-term car parking demand.

Conclusion 7: the proposed car parking provision of 61 on-site parking spaces satisfies the short-term car parking demand of the school.

6.2 Bus parking

The *Schools Analysis Report* prepared for TfNSW undertook observational surveys near the 22 surveyed schools to determine the proportion of school users that walked, drove or took buses to access the site. The report provided mode split information for both primary and secondary schools.

Figure 10 below provides an extract from the report that summarises the mode splits.

Figure 10: Mode Split Survey Extract (School Analysis Report, TfNSW 2014)

School Type	Period	Car	Bus	Walk
All	AM	49%	16%	34%
	PM	38%	22%	40%
Primary	AM	56%	4%	40%
	PM	46%	3%	49%
Secondary	AM	45%	26%	29%
	PM	34%	36%	30%

Rounding to nearest 1%

Based on the information above, the peak bus used for the combined schools is 22% during the PM peak. Adopting this usage rate on the proposed student capacity of 390 students will result in up to 86 students utilising buses to access the site.

Information provided on the TfNSW website states that a standard bus has a capacity of 58 people (43 seated and 15 standing). On this basis, the expected number of students likely to use buses to access the school can be accommodated in the seated capacity of two standard buses. The three (3) proposed bus bays provide enough capacity for these buses.

6.3 Car park access and layout

Car parking dimensions

The dimensions of the:

- proposed 90-degree car parking spaces (5.4 m long x 2.8 m wide, accessed via a 6.6 m wide accessway) exceed the requirements of AS2890.1:2004
- angled car parking spaces (5.4 m long x 2.8 m wide, accessed via a 6.6 m wide accessway) exceed the requirements of AS2890.1:2004
- parallel car parking spaces (6.6 m long x 2.3 m wide) exceed the requirements of AS2890.1:2004.

Disabled car parking spaces are required under the Building Code of Australia at a rate of '*1 space for every 100 car parking spaces or part thereof* and are to be designed per AS2890.6.

Conclusion 8: the proposed car parking provision of two disabled car parking spaces satisfies the Building Code of Australia.

Drop-off/pick-up

The drop-off/pick-up car parking provides parallel spaces to enable convenient entry/exit to the spaces (as the car parking is typically a short-term demand) and to ensure passengers can safely exit the vehicle onto the footpath.

Conclusion 9: the proposed car park access and layout are generally per the relevant requirements.

Bus parking

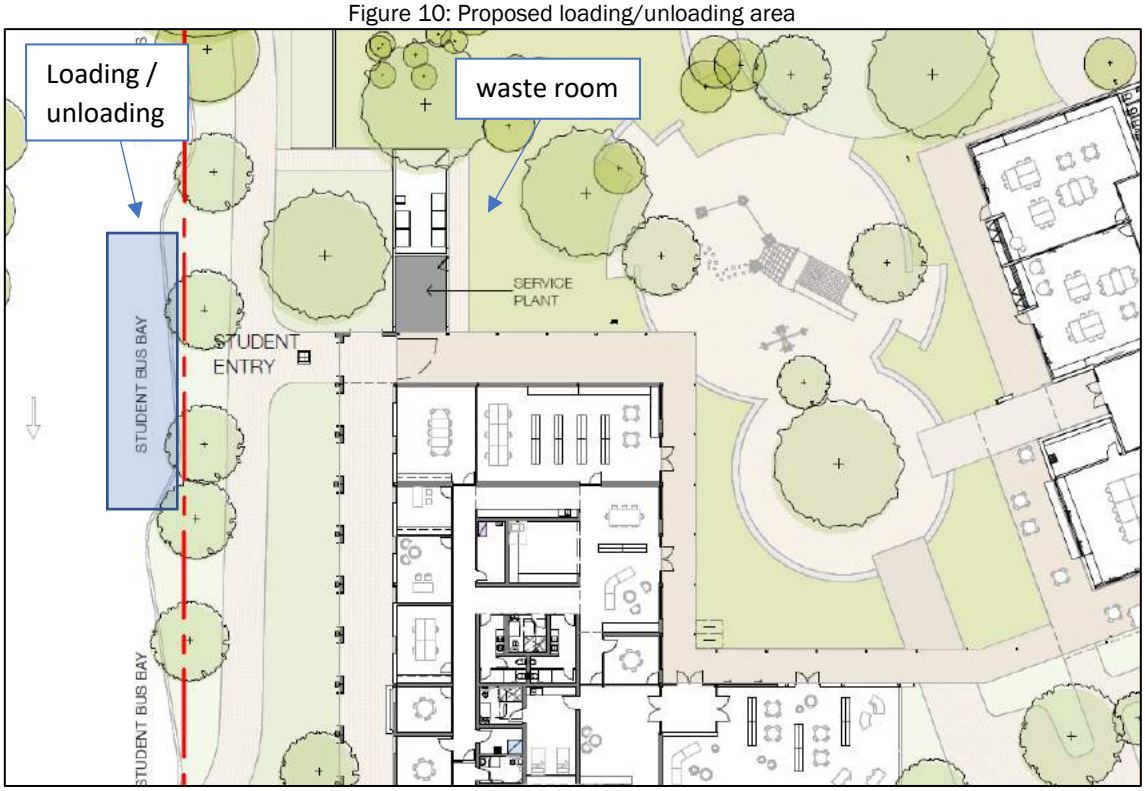
Three indented bus bays are proposed on Lignum Road north of the school access. Swept path analysis (refer to Attachment B) indicates that three buses can prop within the bus bays without

impeding through traffic on Lignum Road and can enter and exit each space without performing a reversing manoeuvre.

6.4 Loading

Loading associated with the school will be undertaken from the school bus bays outside of peak pick-up/drop-off times. The loading/unloading area is shown in Figure 10.

Figure 10: Proposed loading/unloading area



Conclusion 10: the proposed loading facility is considered adequate for the site.

7 CONCLUSIONS

A traffic impact assessment was undertaken for the proposed K-12 school development on Lignum Road in Moama, New South Wales (NSW). The key findings from this assessment are summarised below.

- the proposed K-12 school with 390 students is anticipated to generate up to 321 vehicles per hour (vph) in the AM drop-off peak hour and up to 255 vph in the PM pick-up peak hour
- the traffic impact of the proposed school has already been assessed and approved as part of the planning process for the overall Arthurs Estate
- the proposed access is anticipated to have a negligible impact on the overall operation of Lignum Road, and no mitigation measures are considered warranted
- the proposed K-12 school will contribute:
    - 8% of the total post-development traffic volumes at the Perricoota Road / Lignum Road intersection upgrade
    - 9% of the total post-development traffic volumes at the Cobb Highway / Lignum Road intersection
- the proposed car parking provision of:
    - 41 car parking spaces on-site are anticipated to accommodate the staff car parking demand associated with the proposed K-12 school
    - 61 car parking spaces on-site (including the 26 overflow spaces)are anticipated to accommodate the parent kiss and drop car parking demand associated with the proposed K-12 school
    - two disabled car parking spaces satisfy the Building Code of Australia
- the proposed car park access and layout are generally per the relevant requirements
- the proposed loading facility is considered adequate for the site.

There are no traffic engineering reasons that should prevent the development from proceeding.

- **Recommendation 1:** the visibility requirement of 69 m for a 50 km/h speed zone is achieved during the detailed design
- **Recommendation 2**: landscaping for the first 2.0 m x 2.5 m adjacent to the exit lane be kept clear of visual obstructions over 900 mm in height to ensure drivers have clear sightlines to pedestrians on the footpath
- **Recommendation 3:** the required contributions to the cost of intersection upgrades be discussed and agreed upon with the Council.

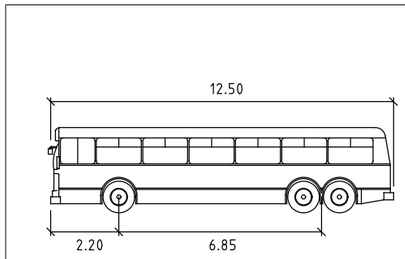
There are no traffic engineering reasons that should prevent the development from proceeding.

ATTACHMENT A – DEVELOPMENT PLANS

Figure A1: Site Plan

Figure A2: Precinct Master Plan (Ground Floor)

ATTACHMENT B – SWEPT PATH ASSESSMENT



BUS meters

Width	: 2.50
Track	: 2.50
Lock to Lock Time	: 6.0
Steering Angle	: 36.6

SERVICE PLANT
STUDENT ENTRY
MAIN PUBLIC ENTRY
SECURITY GATE
SPORTS HALL
SECURITY GATE
PARENT KISS & DROP AREA [8 BAYS]
SECURITY LINE
DROP OFF AREA [7 BAYS]
SITE BOUNDARY
SUBSTATION
VEHICULAR ENTRY
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LONG RIGID BUS AUSTROADS 2013 (MD)
CH 000.0
CH 020.0
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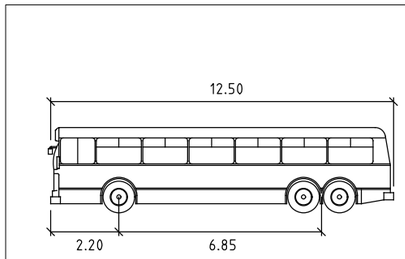

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LONG RIGID BUS AUSTROADS 2013 (MD)
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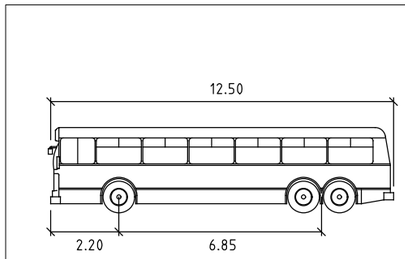

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SITE BOUNDARY
SUBSTATION
VEHICULAR ENTRY
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LONG RIGID BUS
AUSTROADS 2013 (MD)
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AUSTROADS 2013 (MD)
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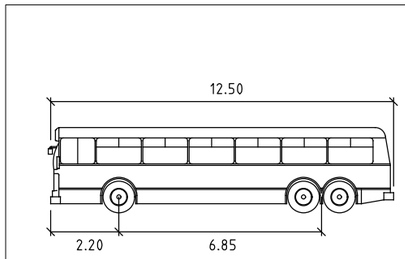

BUS meters

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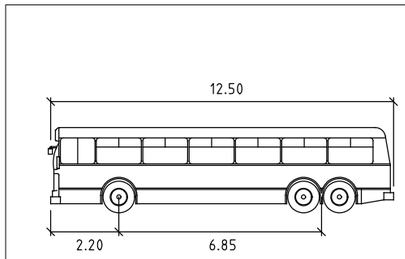

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SERVICE PLANT
STUDENT ENTRY
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PARENT KISS & DROP AREA [8 BAYS]
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SUBSTATION
VEHICULAR ENTRY
SRM
LONG RIGID BUS
AUSTROADS 2013 (MD)
STUDENT BUS RAMP
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CLIENT
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SCALE OF METRES
0 5 10

Moama K12 College
Murray River Council

Swept Path Assessment

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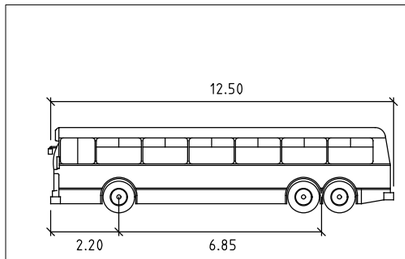

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SUBSTATION
VEHICULAR ENTRY
SRM
LONG RIGID BUS AUSTROADS 2013 (AU)
STUDENT BUS PARKING
3.0%
CH 0.0
CH 100.0
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CH 300.0
CH 400.0
CH 500.0
CH 600.0
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CH 1000.0
CH 1020.0

Drawing Record

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P4	GL	SRM	10.12.21	PRELIMINARY ISSUE FOR COMMENT

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N E S W

SCALE OF METRES
0 5 10

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Murray River Council

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106	200523-SPA-105	P4

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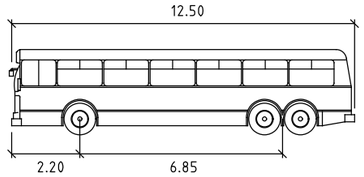

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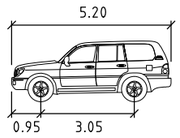

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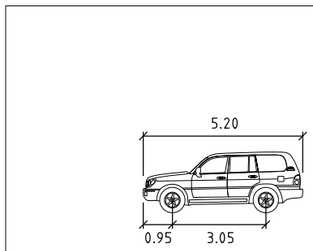

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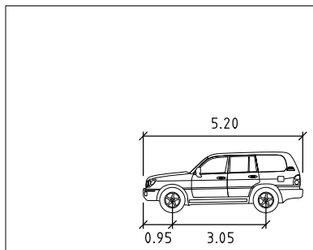

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SERVICE PLANT
STUDENT ENTRY
MAIN PUBLIC ENTRY
SECURITY GATE
SPORTS HALL
SECURITY GATE
PARENT KISS & DROP AREA [8 BAYS]
SECURITY LINE
DROP OFF AREA [7 BAYS]
SITE BOUNDARY
SUBSTATION
VEHICULAR ENTRY
STUDENT BUS BAY
SRM
CH 0.0
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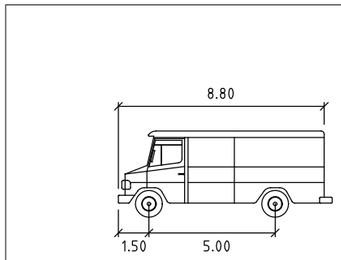

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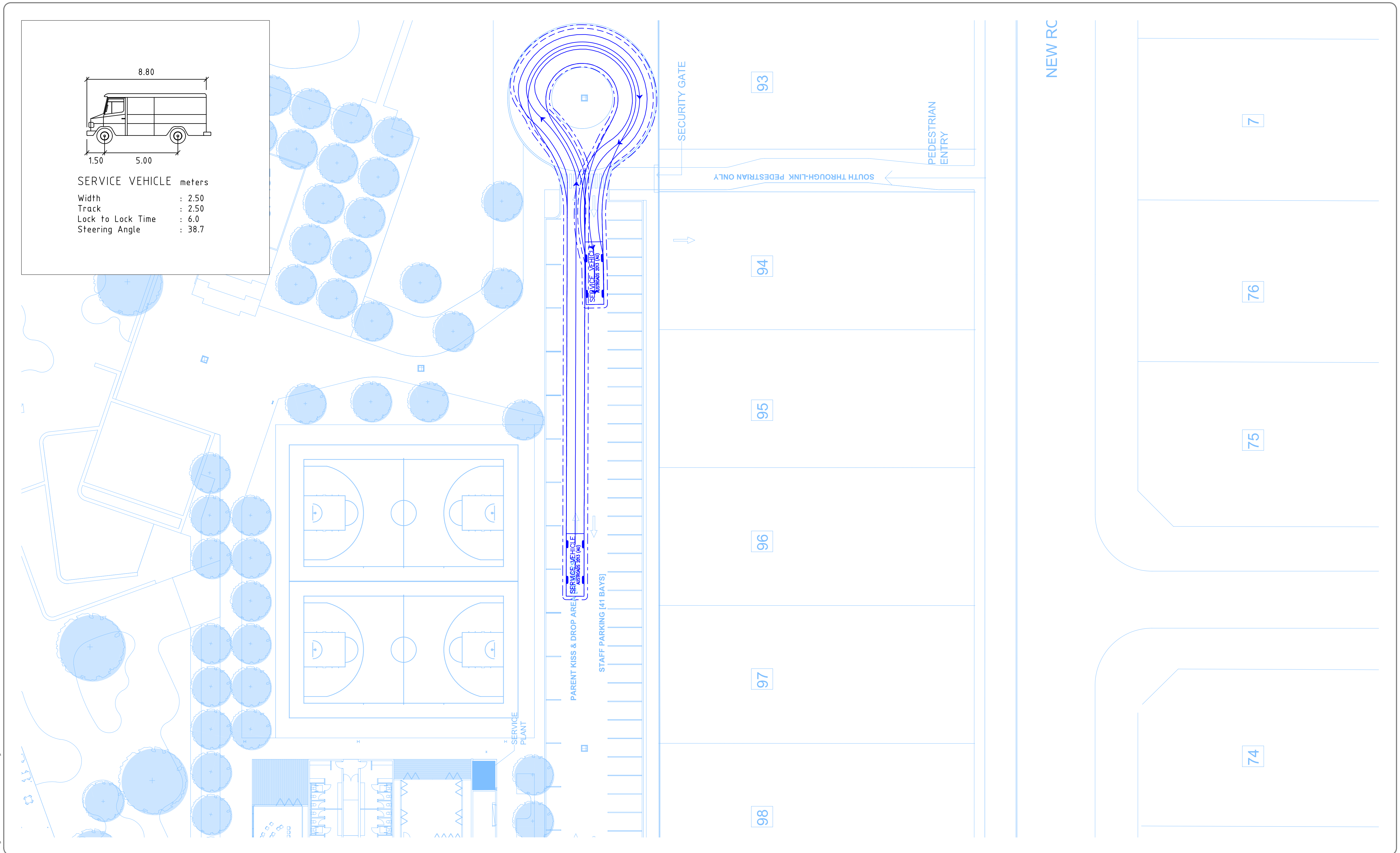

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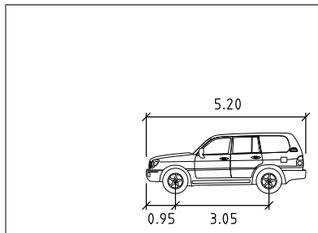

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SHEET NO.	DRAWING NO.	ISSUE
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ATTACHMENT C – ARTHURS ESTATE TIAR

Arthurs Estate, Moama NSW

Traffic Impact Assessment Report

Client:

Laurie Aurthur

Project No. 180880

Final Report – 29/08/19

1st Floor 132 Upper Heidelberg Road Ivanhoe Vic 3079
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Document Control				
Report Title		Arthurs Estate Moama, NSW – Traffic Impact Assessment Report		
Project Number		180880		
Client		Laurie Aurthur		
Client Contact		Nick Ritchie (of North East Survey Design)		
Rev	Date Issued	Revision Details / Status	Prepared by	Authorised by
Draft	21/08/19	Draft	David Do / Stuart Redman	Ali Abdou
Final	29/08/19	Final	David Do / Stuart Redman	Ali Abdou

EXECUTIVE SUMMARY

Trafficworks has been engaged by North East Survey Design (on behalf of Laurie Aurthur) to undertake a traffic impact assessment of the proposed development of Arthurs Estate in Moama, New South Wales (NSW).

The subject site is located approximately 1.5 km north-west of the Moama town centre within Murray River Council. The subject site comprises land enclosed by Kiely Road to the north, Boyes Street to the south, Kirchhofer Road to the east and Lignum Road to the west.

A traffic impact assessment was previously conducted by Planright in August 2017. However, since this time the Cobb Highway access via Kiely Road has been removed by Transport for New South Wales (formerly NSW Roads and Maritime Services) and a new primary school has been proposed. An updated traffic impact assessment has been prepared with consideration of the above changes.

The traffic impact assessment for the updated residential subdivision was undertaken to:

- estimate the traffic generation and distribution associated with the proposed development including the school
- determine the suitability of the proposed access locations
- determine the likely traffic impacts on the existing road network
- identity and recommend any necessary remedial measures and treatments
- determine the likely required contributions based on the traffic generation

A summary for the site and the proposed development is shown below.

Address	Lot 73 of DP751159 (known as Lignum Road, Moama, NSW) Lot 1301 of DP1186616 (known as Boyes Street, Moama, NSW) Lot 76 of DP751159 (known as Lignum Road, Moama, NSW)[1]
Zoning	General Residential (R1) Zone
Proposed development	Residential subdivision School (primary)
Road Network	Subject Site: • Lignum Road • Kiely Road • Lignum Road • Kirchhofer Street Surrounding Roads: • Perricoota Road • Cobb Highway (State Arterial)
Traffic Generation	A total peak hour traffic volume of 623 vehicles per hour (vph), of which the: • residential lots generate 254 vph • proposed school generates 369 vph

[1] Not owned by our client.

Recommendations	**Recommendation 1:** The sight distance for each accessway should be ensured to meet the minimum SISD of 97 m during development. **Recommendation 2:** No action is required before the Cobb Highway / Perricoota Road intersection upgrade. A review of the network is recommended after the completion of the Cobb Highway / Perricoota Road intersection upgrade due to the change in the traffic conditions. **Recommendation 3:** Consider the installation of a roundabout at the Perricoota Road / Lignum Road intersection to improve the overall queue lengths and average delays. **Recommendation 4:** Consider the installation of a roundabout at the Cobb Highway / Boyes Street intersection to improve road safety. **Recommendation 5:** Ensure all internal roads are designed and constructed in accordance with the IDM. **Recommendation 6:** Implementing of speed zoning and traffic calming for the road layout in accordance to AGTM8 and Murray Shire Council: *Engineering Guidelines for Subdivisions and Development Standards.* **Recommendation 7:** Ensure all intersections are to be designed to have clear visibility and meet minimum SISD criterion. **Recommendation 8:** Restrict on-street car parking on approach to 90-degree bends within the road network. **Recommendation 9:** All roads should be designed to provide enough space for an 8.8 m emergency/service vehicle to travel through the network safely. **Recommendation 10:** Temporary court bowl cul-de-sac treatment should be implemented at the termination of all roads for each stage. **Recommendation 11:** All footpath and shared path road crossings should be designed to meet adequate pedestrian sight distance requirements and landscaping proposed should be carefully considered to ensure drivers' line of sight to pedestrians is maximised. **Recommendation 12:** Consultation between land developers and Council is recommended to assess the cumulative traffic impact from other developments, develop a strategic plan for the network and proportionately allocate funding for the required treatments.

Referenced Documents

References used in the preparation of this report include the following:

- *RTA Guide to Traffic Generating Developments Version 2.2A, October 2002 (RTA Guide)*
- *Transport for NSW: Definitions and notes to support road crash data*
- *Austroads Guide to Road Design - Part 4A* (AGRD4)
- *Austroads Guide to Traffic Management - Part 6* (AGTM6)
- *Austroads Guide to Traffic Management - Part 8* (AGTM8)
- *Austroads Guide to Road Design - Part 4* (AGRD4)
- *Local Government Infrastructure Design Association - Infrastructures Design Manual*
- *Murray Shire Council*
    - *Moama North West Master Plan (2009)*
    - *Murray Local Environmental Plan (2011)*
    - *Murray Development Control Plan (2012)*
    - *Engineering Guidelines for Subdivisions and Development Standards (2012)*
- *Planright – Traffic Impact Assessment Report: Arthurs Estate, Moama. August 2017 (Ver 1.0)*
- *Moama Anglican Grammar School Mater Plan 2016 (Ver 1.0)*

TABLE OF CONTENTS

1 INTRODUCTION

Trafficworks has been engaged by North East Survey Design (on behalf of Laurie Aurthur) to prepare a traffic impact assessment of the proposed development of Arthurs Estate in Moama, New South Wales.

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- determine the likely traffic impacts on the existing road network
- identity and recommend any necessary remedial measures and treatments
- determine the likely required contributions based on the traffic generation

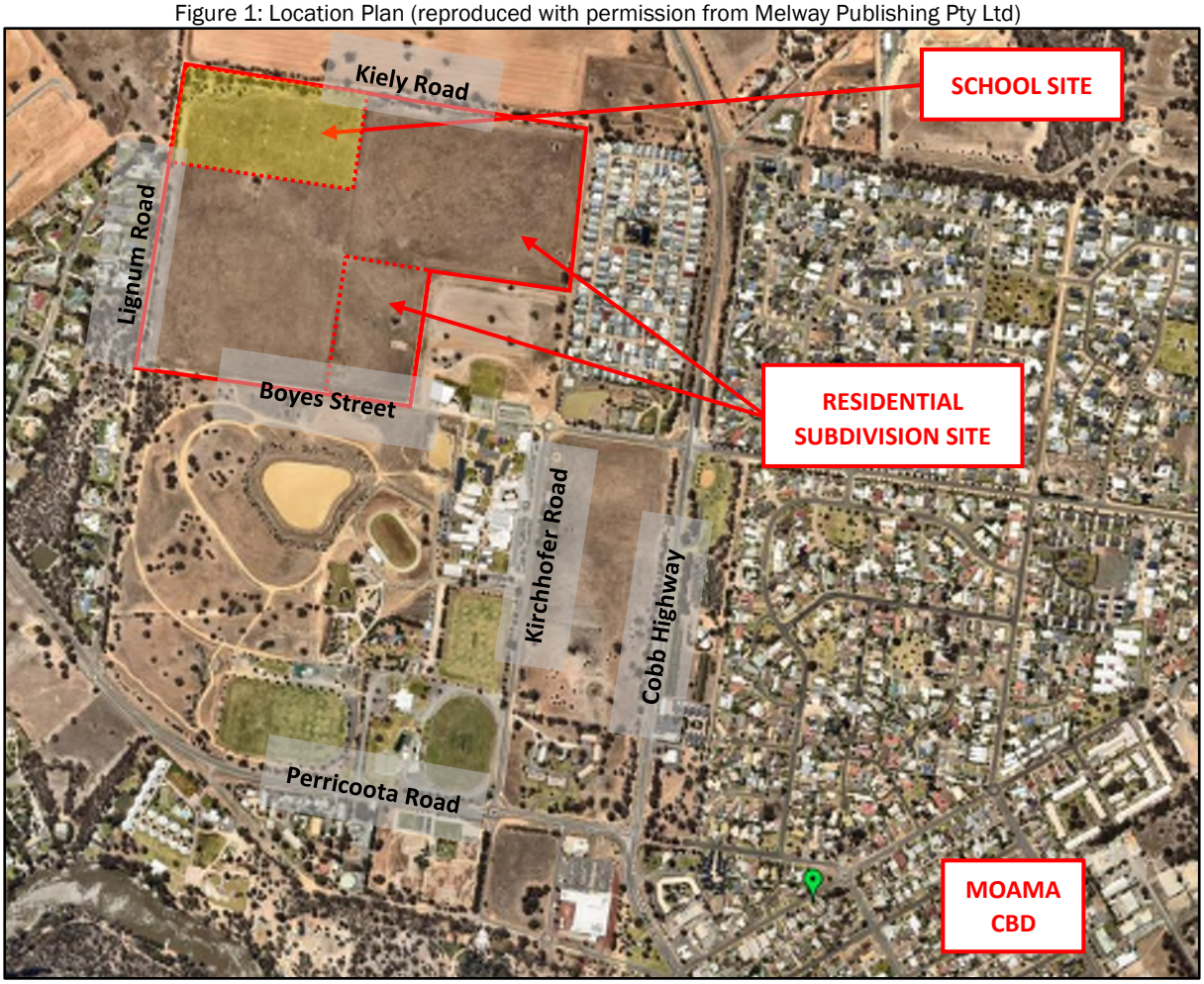
2 EXISTING CONDITIONS

2.1 Subject Site

The subject site is located approximately 1.5 km north-west of the Moama town centre within the Murray River Council. The subject site comprises land enclosed by Kiely Road to the North, Boyes Street to the South, Kirchhofer Road to the east and Lignum Road to the West. The subject site and the surrounding area are shown in Figure 1.

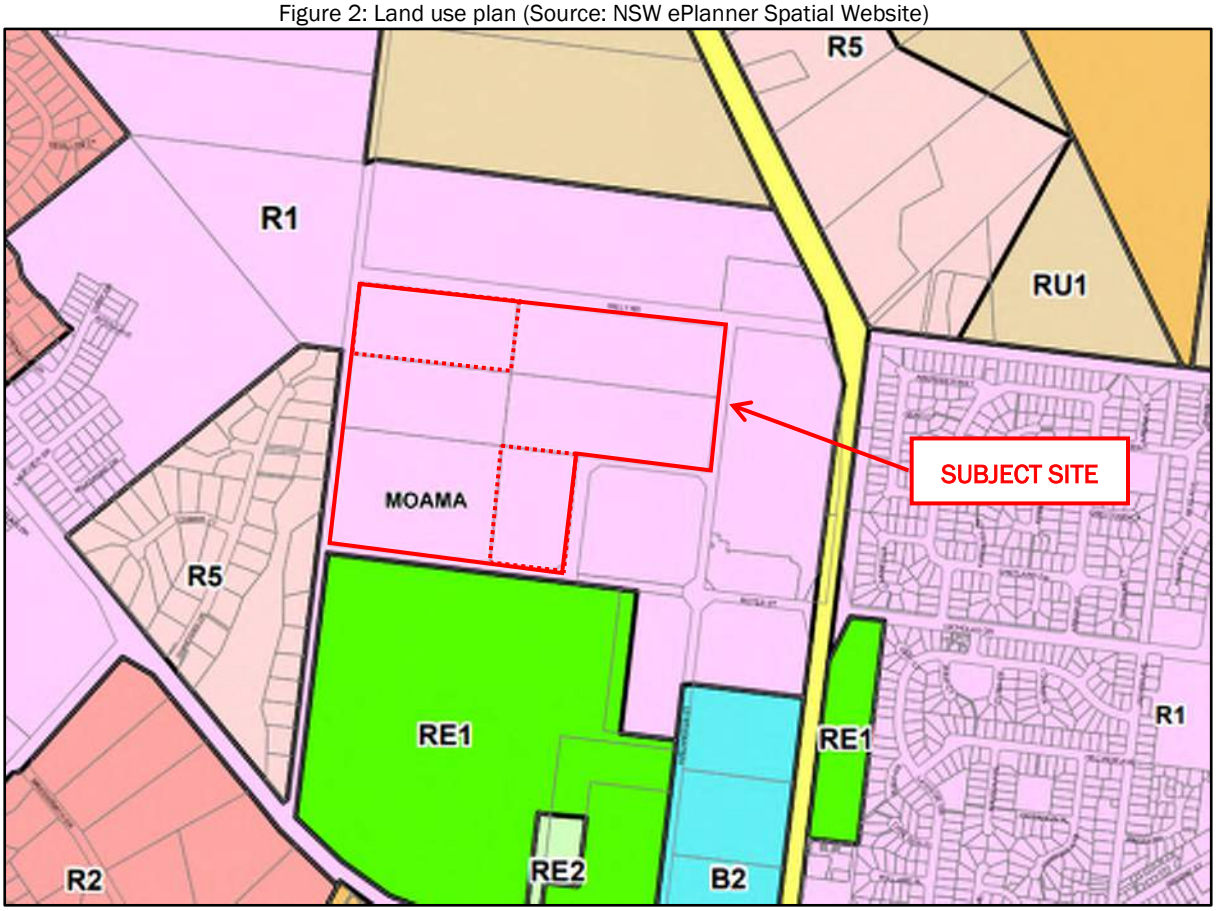
The site falls within a General Residential (R1) Zone, refer to Figure 2.

Figure 1: Location Plan (reproduced with permission from Melway Publishing Pty Ltd)



- Residential Subdivision:
    - Lot 73 of DP751159 (known as Lignum Road, Moama, NSW)
    - Lot 1301 of DP1186616 (known as Boyes Street, Moama, NSW)
- School Site:
    - Lot 76 of DP751159 (known as Lignum Road, Moama, NSW)

Figure 2: Land use plan (Source: NSW ePlanner Spatial Website)



2.2 Road Network

The road network surrounding the subject site as well as major road linkage is explained in the subsequent sections based on the Murray Shire Council: *Moama North West Master Plan.*

2.2.1 Cobb Highway

Cobb Highway (B75) is a primary state arterial road managed by the Transport for NSW. It is generally aligned in a north-eastern south-western direction and provides connection between Moama to the south and the Deniliquin to the north (Refer Photos 1 and 2).

Near the subject site the Cobb Highway is a two-lane, two-way road with approximately 3.4m traffic lanes flanked by 1.2m sealed shoulders. A posted speed limit of 80 km/h currently applies on the Cobb Highway (note the posted speed is reduced to 50 km/h towards Perricoota Road).

It is noted that there will be an upgrade at the intersection of Cobb Highway and Perricoota Road into a signalised intersection to be delivered 2023 by Transport for NSW.

Photo 1: Cobb Highway looking south

Photo 2: Cobb Highway looking north

2.2.2 Perricoota Road

Perricoota Road is a local collector road managed by Murray River Council. It is generally aligned in a north-western south-eastern direction and provides connection between the Moama to the south and the Caldwell to the north (Refer Photos 3 and 4).

Near the subject site, Perricoota Road is a two-lane, two-way road with approximately 3.4 m traffic lanes flanked by 1.3 m sealed shoulders. A posted speed limit of 80 km/h currently applies on Perricoota Road (note the posted speed is reduced to 50 km/h towards the Kirchhofer Street intersection).

Photo 3: Perricoota Road looking west

Photo 4: Perricoota Road looking east

2.2.3 Lignum Road

Lignum Road is a local access street managed by the Murray River Council. It is generally aligned in a north-south direction approximately 2 km in length and provides a connection to Perricoota Road to the south and Martin Road to the North (Refer Photos 5 and 6).

Lignum Road is a two-way unsealed local road near the proposed development and sealed towards the south with a road width of approximately 6.4 m. The default rural speed limit of 50 km/h applies along this section of Lignum Road.

Photo 5: Lignum Road looking south

Photo 6: Lignum Road looking north

2.2.4 Kirchhofer Street

Kirchhofer street (also known as Racecourse Lane) is a local access street managed by the Murray River Council. It is generally aligned in a north-south direction approximately 1.4 km in length and provides a connection to Perricoota Road to the south and Kiely Road to the north (Refer Photos 7 and 8).

Kirchhofer Street is a two-way unsealed local street near the proposed development with a road width of approximately 6.4 m and sealed near the school with traffic lanes of 3.9 m. The default urban speed limit of 50 km/h applies along this section of Kirchhofer Street with a time-based speed limit of 40 km/h during school zone times.

Photo 7: Kirchhofer Street looking south

Photo 8: Kirchhofer Street looking north

2.2.5 Boyes Street

Boyes Street is a local access street managed by the Murray River Council. Due to the expansion of Moama Anglican Grammar, Boyes Street discontinues at the Kirchhofer Street intersection. It is generally aligned in an east-west and provides a connection to Lignum Road to the west and the school to the east approximately 500 m in length. Then a connection to Kirchhofer Street to the east and Cobb Highway to the west (Refer Photos 9 and 10).

Boyes Street is a two-way unsealed local street with a road width of approximately 6.8 m east of the school and a two-way sealed local street with approximately 3.5 m traffic lanes. The default urban speed limit of 50 km/h applies along the east section of Boyes Street and a time based school speed limit of 40 km/h past the school.

Photo 9: Boyes Street looking east

Photo 10: Boyes Street looking west

2.2.6 Kiely Road

Kiely Road is a local access road managed by the Murray River Council. It is generally aligned in an east-west direction approximately 750 m in length and provides a connection to Lignum Road to the west and Kirchhofer Street to the east (Refer to Photo 11).

Kiely Road is a two-way narrow local street with a road width of approximately 5.0 m. The default urban speed limit of 50 km/h applies along this section of Kiely Road.

Photo 11: Kiely Road looking east

2.3 Traffic Volumes

Existing traffic count volumes for the traffic network were obtained from Murray River Council through the Planright Traffic Impact Assessment report on Arthurs Estate, Moama dated August 2017. It has been assumed that the directional split on each of the road network travelling from/to the Moama town region is 60%/40% in the AM peak and 40%/60% in the PM peak. The peak two-way traffic volumes (vehicles per hour) are summaries in Table 1:

Table 1: Existing traffic volumes (Source: Planright Traffic Impact Assessment Arthurs Estate, Moama)

Year	Road	Location	Peak Volume Two-way (vph)[2]
2015	Meninya Street	At Crossing	1,683
2014	Cobb Highway	South of Nicholas Drive	613
2014	Cobb Highway	North of Nicholas Drive	140
2015	Perricoota Road	West of Cobb Highway	1,113
2014	Kirchhofer Street	North of Perricoota road	155
2015	Lignum Road	North of Perricoota road	12
2014	Boyes Street	West of Cobb Highway	136
2015	Perricoota Road	West of Lignum Road	1,102
-	Nicholas Drive	West of Cobb Highway	385

2.4 Crash History

The *NSW Government's Transport for NSW - Crash and casualty statistics* database details all injury crashes on roads throughout the state. Scrutiny of these records in the last five-year period (2013 - 2017) indicate that there were multiple casualty crashes resulting in:

- one moderately injured have occurred near the subject site at the intersection of Kirchhofer Street and Boyes Street in 2014
- three minor casualty crashes occurred on the Cobb Highway between Beer Road and Boyes Street, one in 2013 and two in 2015
- three minor casualty crashes occurred at the intersection of Merool Road and Perricoota Road, two in 2013 and one in 2017

Although there were seven casualty crashes within the surrounding road network, analysis of the crash type from *Transport for NSW: Definitions and notes to support road crash data* determined that no trends in crashes have been established. Hence it can be concluded that the roads near the subject site do not have a traffic safety problem that requires urgent remedial action.

[2] Peak volumes are based on the peak hour volumes being 10% of daily traffic volume

2.5 Pedestrians and Cyclists

There are currently no footpaths or cycle paths along Lignum Road, Kiely Road, Kirchhofer Street and Boyes Street near the subject site. In the south-east quadrant of the site, there is a footpath around the intersection of Kirchhofer Street and Boyes Road near Moama Anglican Grammar. Murray Shire Council Master Plan for North West Moama details the development for Pedestrian and Cycle Linkages through the site.

2.6 Public Transport

There are currently no bus services that travel along Lignum Road and Kiely Road near the subject site. There is one bus stop on Boyes Street approximately 165 m east of the Kirchhofer Street intersection on the Route 5 (5 Echuca – 24 Lane).

For this reason, public transport needs are not considered further in this TIAR.

3 PROPOSED DEVELOPMENT

3.1 Proposed Development Summary

The proposed development consists of:

- residential subdivision, comprising of 301 lots (with 11 Stages)
- proposed school site, forecast to be completed by 2023 (on land owned by others)

Vehicular access to the site is proposed via multiple access points on Lignum Road, Boyes Road, Kiely Road and Kirchhofer Street.

3.2 Infrastructure Design Manual Standard Cross-Sections

The Infrastructure Design Manual (IDM) has been developed by Councils in regional Victoria to ensure consistent requirements and standards for the design and development of infrastructure.

The design criteria for roads, as set out in IDM are summarised in the subsequent sections. It is recommended that these criteria be used as a guide for detailed design of the internal road network.

Generally, the Infrastructure Design Manual applies for council within regional Victoria, however it has been utilised by Murray Shire Council. Murray Shire Council also adopted the *Engineering Guidelines for Subdivisions and Development Standards* for general requirements for subdivisions and development. The urban road characteristics are generally similar.

3.2.1 Collector / Connector Street

Collector / connector streets carry higher volumes of traffic and connect access places and access streets through and between neighbourhoods. A summary of the design criteria for a collector / connecter street is:

- traffic volumes between 2,500 - 6,000 vpd
- 11.6 m carriageway width consisting of 3.5 m traffic lanes and 2.3 m marked parking bays on both sides
- operating speeds of around 30 - 50 km/h
- minimum verge width of 6.0 m to accommodate services
- 1.5 m wide pedestrian paths on both sides of the road
- minimum road reserve width up to 24.0 m

3.2.2 Access Street

Access Street provides local residential access where traffic is subservient, speed and traffic volumes are low and pedestrian movements are facilitated. A summary of the design criteria for this type of road is:

- traffic volumes between 1,000 - 2500 vpd

- 7.3 m carriageway width with unmarked parking on both sides
- operating speeds of around 20 - 30 km/h
- minimum verge width of 3.5 m to accommodate services
- 1.5 m wide pedestrian paths on both sides of the road
- minimum road reserve width up to 16.0 m

3.2.3 Access Lane

Access Lanes provide side or rear access to parking within a lot that has another street frontage. A summary of the design criteria for an Access Lanes is:

- the traffic volumes are approximately 300 vehicles per day (vpd)
- operating speeds between 15 km/h – 25 km/h
- 7.0 m carriageway width with no parking.

This cross section is based on the standard cross sections within the Engineering Design and Construction Manual (prepared by the VPA, formerly known as the Growth Areas Authority (GAA)).

This cross section applies to the Access Lane proposed within stage 6.

3.3 Trip Generation and Distribution

3.3.1 Traffic Generation

The reference document commonly used to estimate likely traffic volumes from a development is the RTA Guide to Traffic Generating Developments Version 2.2A, October 2002. This provides information regarding traffic generation and parking requirements, based on surveys undertaken by Transport for NSW, for use in the assessment of development applications.

The RTA *Guide to Traffic Generating Developments 2002* used to estimate traffic generation from developments recommends:

- for residential houses (conventional lots)
    - a daily trip rate of 9 trips per dwelling
    - a weekday peak hour rate of 0.85 trips per dwelling

A report titled *Roads and Maritime Services Trip Generation Surveys, Schools Analysis Report was prepared* on behalf of Transport for NSW to determine contemporary trip generation data for primary and secondary schools within metropolitan and regional NSW. This report was used to estimate traffic generation from the proposed school, which recommends:

- for a primary school within the regional area
    - an average AM peak hour of 1.23 trips per student
    - an average PM peak hour of 1.01 trips per student

Table 2 shows the summary traffic generation from the proposed primary school and development stages at full development.

Table 2: Development traffic volumes at full development

Land Use	Stage	Quantity	Unit	RTA Traffic Generation Rate		Development Traffic Generation	
				Daily Vehicle Trips (per unit)	Peak Vehicle Trips (per unit)	Daily Vehicle Trips (vpd)	Peak Vehicle Trips (vph)
Conventional Residential Lots	1	31	Dwelling	9	0.85	279	26
	2	31	Dwelling	9	0.85	279	26
	3	27	Dwelling	9	0.85	243	23
	4	32	Dwelling	9	0.85	288	27
	5	26	Dwelling	9	0.85	234	22
	6	32	Dwelling	9	0.85	288	27
	7	18	Dwelling	9	0.85	162	15
	8	24	Dwelling	9	0.85	216	20
	9	25	Dwelling	9	0.85	225	21
	10	27	Dwelling	9	0.85	243	23
	11	28	Dwelling	9	0.85	252	24
					Sub Total	2,709	254
Proposed Primary School		300	Students		1.23[3]	672	369
TOTAL						**3,381**	**623**

Stage 1 of the development has been previously approved by Council and is forecast to be completed (a conservative forecast) by the end of 2020, with the following stages to be completed one per year.

The total traffic generation for all stages is 254 vph, and the proposed school is forecast to be completed by 2023, approximately when stage 4 is completed.

Conclusion 1: The proposed development at completion is likely to generate a peak hour traffic volume of 623 vph with the residential lots and school generating 254 vph and 369 vph respectively.

3.3.2 Traffic Distribution

The proposed development and primary school when completed generates an overall peak traffic movement of 623 vehicle trips in the peak hour. Most of the vehicle trips entering and exiting the proposed development location are predicted to be travelling to and from the Echuca/Moama region for employment and shopping purposes.

[3] Based on the higher average peak of 1.23 trips per student for the AM peak hour

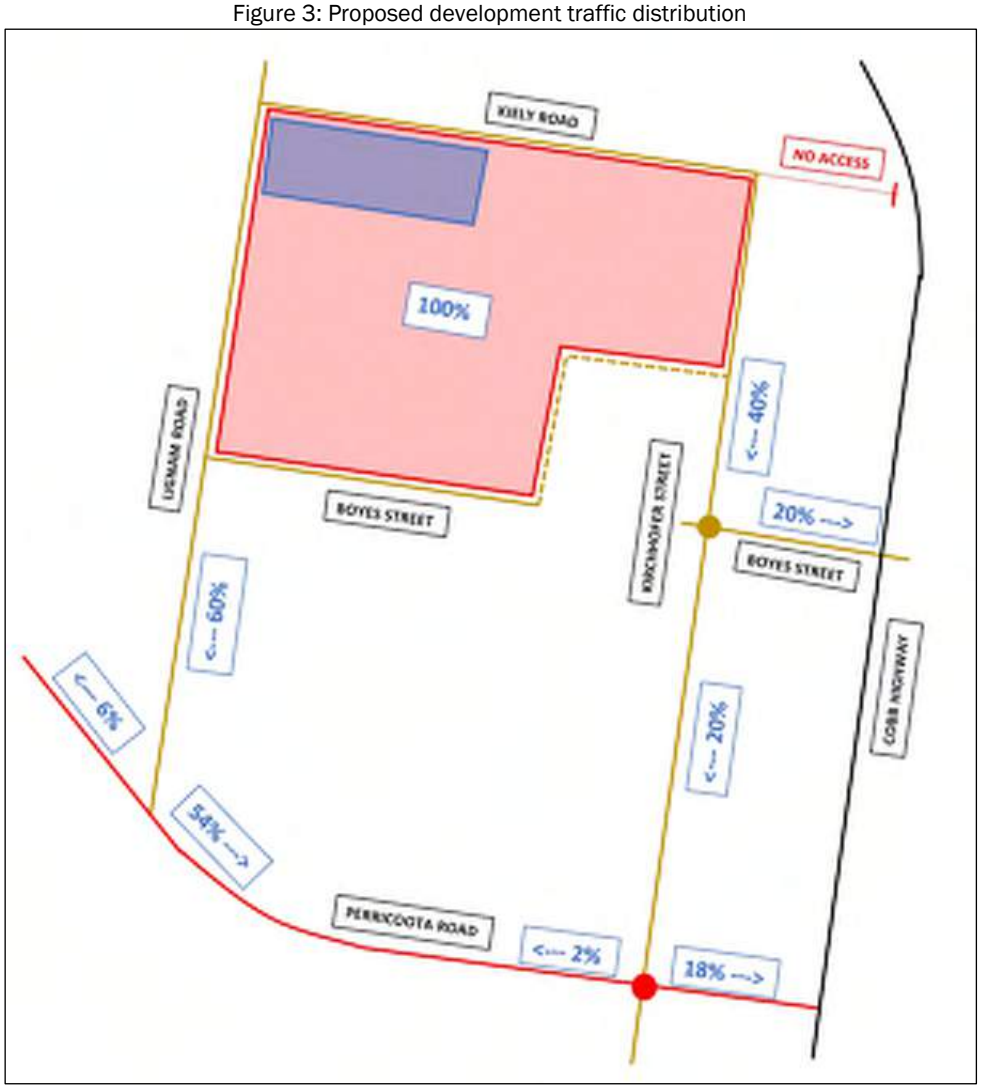
Due to the proposed school, it is considered that 60% of the vehicles will travel along Lignum Road towards Perricoota Road with a split of 90% east towards Cobb Highway and 10% to the west.

It is understood that there will be no access onto Cobb Highway through Kiely Road. Thus, the remaining 40% of vehicles will travel along Kirchhofer Street. At the intersection, 50% will travel east via Boyes Street to Cobb Highway where 90% will head south to Moama CBD and 10% will head towards the north.

The other 50% will continue along Kirchhofer Street to Perricoota Road where 90% will head east to Cobb Highway and the remaining 10% will travel west. At Cobb Highway and Perricoota Road intersection, 95% of vehicles will continue south to the Moama CBD and the remaining 5% will travel north.

Figure 3 shows the traffic distribution from the proposed development along the road network.

Figure 3: Proposed development traffic distribution



3.3.3 Anticipated Traffic Volumes

Figure 4 shows the anticipated peak hour traffic volumes for the proposed development.

Peak hour traffic flow for the proposed development would generally be distributed as follows:

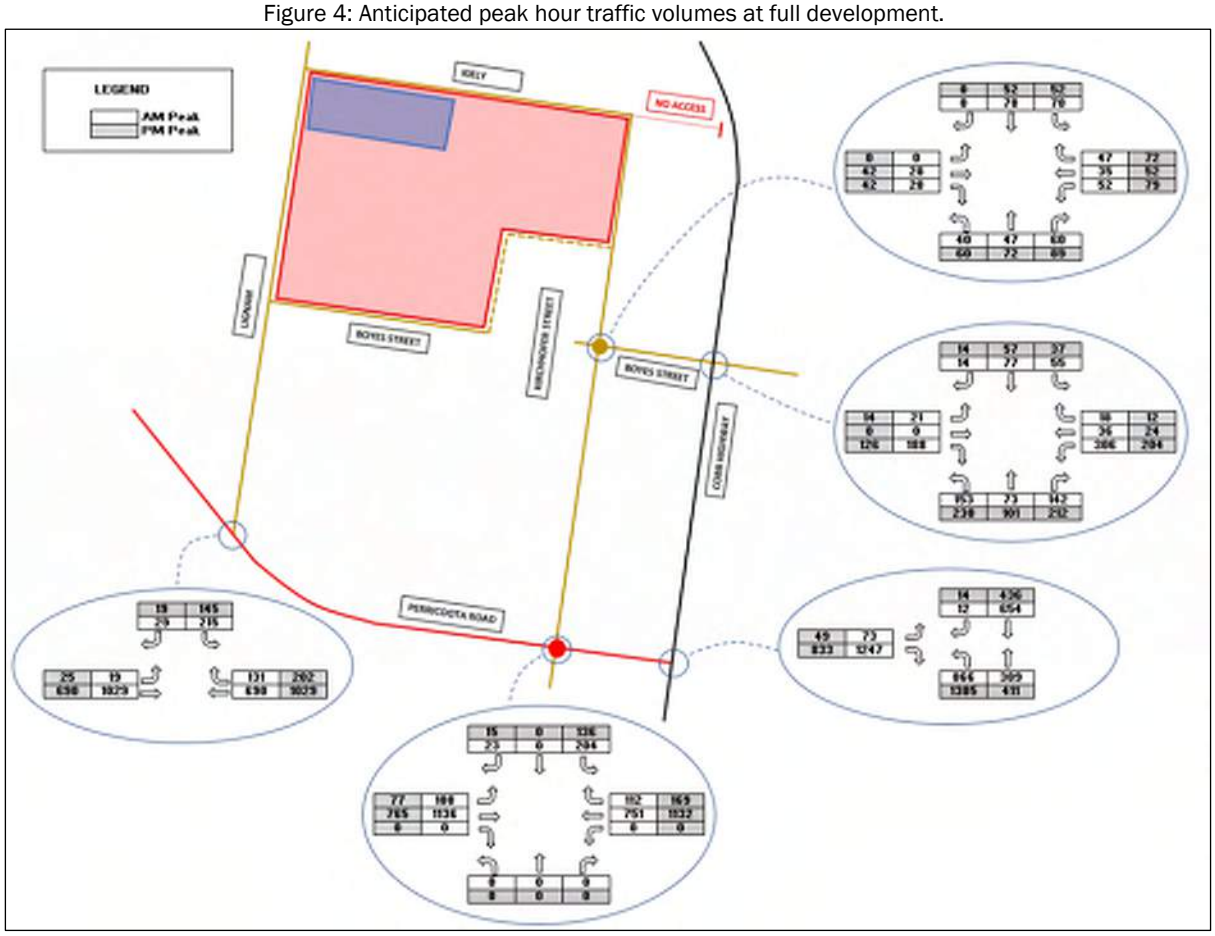
AM peak	80% leaving	20% entering
PM peak	30% leaving	70% entering

This assumes that all traffic generated will be to and from the proposed development with no allowance for the low level of internal trips that may occur.

Peak hour traffic flow for the proposed school would generally be distributed as follows:

AM peak	50% leaving	50% entering
PM peak	50% leaving	50% entering

Figure 4: Anticipated peak hour traffic volumes at full development.

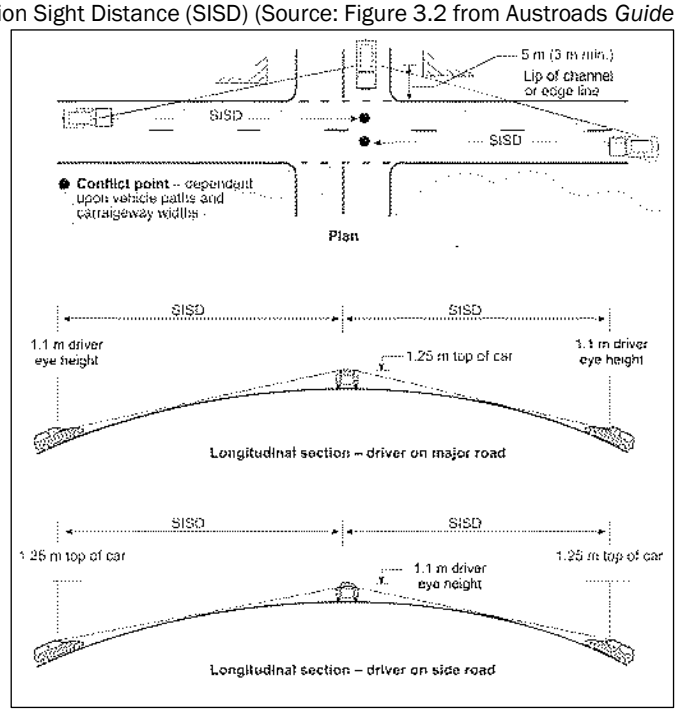


4 ASSESSMENT

4.1 Sight Distance

The visibility criterion normally applied to intersections is Safe Intersection Sight Distance (SISD). This is nominated in the Austroads Guide to Road Design, Part 4A (AGRD4) as the minimum distance which should be provided on the major road at any intersection (refer to Section 3.2.2 in AGRD4A) and provides sufficient distance for a driver of a vehicle on the major road to observe a vehicle from the minor access approach moving into a collision situation (e.g. in the worst case, stalling across the traffic lanes) and to decelerate to a stop before reaching the collision point (refer Figure 5).

Figure 5: Safe Intersection Sight Distance (SISD) (Source: Figure 3.2 from Austroads *Guide to Road Design Part 4A*)



The minimum SISD criterion specified in Table 3.2 of the Austroads Guide requires clear visibility for a desirable minimum distance of 123 m, relating to the general reaction time R_T of 2.0 seconds and a design speed[4] of 50 km/h. This sight distance is applicable to Lignum Road, Kiely Road, Boyes Street and Kirchhofer Street along the subject site frontage.

During the construction of the proposed development and school, the sight distance for each accessway should be ensured to meet the minimum SISD of 97 m.

Conclusion 2: The minimum SISD of 97 m for a design speed of 50 km/h applies for all accessway for the proposed development.

Recommendation 1: The sight distance for each accessway should be ensured to meet the minimum SISD of 97 m during development.

[4] Design Speed = Operational Speed

4.2 Impact on Existing Road Network

SIDRA software was utilised to analyse the intersections to determine the anticipated intersection operations for the proposed development.

The program produces statistics and information on the operation of an intersection but typically the main characteristics used to assess the operation of the intersection are the Degree of Saturation (DOS), the 95th percentile queue lengths and the average delay.

An explanation of the intersection operating characteristics is shown in Table 3.

Table 3: Definitions of intersection operation characteristics

Degree of Saturation (DOS)			Operation
Sign control	Roundabout	Traffic Signals	
< 0.6	< 0.6	< 0.6	Excellent operating conditions, minimal delays
0.6 - 0.699	0.6 - 0.699	0.6 - 0.699	Very good operating conditions, minimal delays
0.7 - 0.799	0.7 - 0.849	0.7 - 0.899	Good operating conditions, delays and queuing increasing
0.8 - 0.899	0.85 - 0.949	0.9 - 0.949	Fair operating conditions, delays and queues growing. Any interruption to flow such as minor incidents causes increasing delays
0.9 – 1.0	0.95 – 1.0	0.95 – 1.0	Poor operating conditions, flows starting to breakdown and queues and delays increase rapidly.
> 1.0	> 1.0	> 1.0	Very poor operating conditions with queues and delays increasing rapidly. Once queues develop it takes a significant time for queues to dissipate resulting in long delays to traffic movements

4.2.1 Intersection Analysis

A network intersection analysis was undertaken at the following intersections:

- Perricoota Road and Lignum Road
- Perricoota Road and Kirchhofer Street
- Cobb Highway and Perricoota Road
- Cobb Highway and Boyes Street
- Kirchhofer Street and Boyes Street

A practical DOS of 0.80 for sign-controlled intersections and 0.85 for roundabout intersections was used as the maximum acceptable degree of saturation. A DOS below these values, intersections results in good or better operating conditions. Above the values, the intersection results in an increase in delays and queues.

Existing and projected, with and without the development conditions were analysed with SIDRA. A summary of the SIDRA assessment is provided in Table 4 and 5 and the full SIDRA results are shown in Attachment A.

Table 4: SIDRA results for Perricoota Road / Lignum Road, Perricoota Road / Kirchhofer Street and Cobb Highway / Perricoota Road.

	Movements	Existing						Projected without Development						Projected with Development					
		DOS		95% Queue (m)		Average Delay (sec)		DOS		95% Queue (m)		Average Delay (sec)		DOS		95% Queue (m)		Average Delay (sec)	
		AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
Perricoota Road / Lignum Road	Perricoota Road (east approach)	0.284	0.423	0.2	0.3	6.3	6.2	0.398	0.558	0.9	0.8	6.6	6.3	0.798	0.882	43.3	52.0	23.0	16.4
	Lignum Road (north approach)	0.025	0.017	0.2	0.1	13.5	12.4	0.133	0.066	0.8	0.5	32.4	29.3	2.421	1.066	282.7	42.6	1302.0	155.7
	Perricoota Road (northwest approach)	0.422	0.281	0.0	0.0	6.2	6.2	0.845	0.389	0.0	0.0	6.7	6.2	0.596	0.481	120.4	0.0	6.3	6.3
Perricoota Road / Kirchhofer Street	Cemetery Road (south approach)	0.005	0.005	0.1	0.1	7.5	9.9	0.006	0.009	0.1	0.1	9.3	15.3	0.008	0.018	0.1	0.3	11.8	28.5
	Perricoota Road (east approach)	0.334	0.485	8.7	14.7	3.7	3.7	0.463	0.674	14.5	31.0	3.7	3.8	0.587	0.850	22.5	77.7	4.0	4.2
	Kirchhofer Street (north approach)	0.363	0.113	3.9	1.4	8.4	6.4	0.495	0.303	5.8	3.2	10.4	7.7	0.710	0.431	10.8	4.6	16.3	7.6
	Perricoota Road (west approach)	1.027	0.503	182.0	8.7	39.7	3.9	1.452	1.064	758.3	161.4	415.9	72.9	1.745	1.429	789.6	553.8	679.0	398.1
Cobb Highway / Perricoota Road	Cobb Highway (south approach)	0.260	0.389	4.5	7.8	3.1	3.4	0.466	0.697	9.2	22.1	3.1	3.5	0.577	0.872	13.7	60.3	3.2	3.7
	Cobb Highway (north approach)	0.197	0.131	0.1	0.1	0.1	0.1	0.272	0.183	0.2	0.1	0.1	0.1	0.307	0.206	0.5	0.5	0.2	0.3
	Perricoota Road (west approach)	1.787	1.170	234.9	160.7	678.3	167.8	5.437	4.455	234.9	234.9	3766.2	2937.7	8.601	8.096	234.9	234.9	6473.3	6049.1

Table 5: SIDRA results for Cobb Highway / Boyes Street and Kirchhofer Street.

	Movements	Existing						Projected without Development						Projected with Development					
		DOS		95% Queue (m)		Average Delay (sec)		DOS		95% Queue (m)		Average Delay (sec)		DOS		95% Queue (m)		Average Delay (sec)	
		AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
Cobb Highway / Boyes Street	Cobb Highway (south approach)	0.103	0.152	1.4	2.1	3.9	3.8	0.141	0.212	1.9	3.1	4.0	3.9	0.153	0.227	2.1	3.4	4.0	4.0
	Nicholas Drive (east approach)	0.244	0.165	3.1	1.9	5.2	5.2	0.357	0.247	5.0	3.0	5.7	5.7	0.366	0.258	5.1	3.2	5.8	6.0
	Cobb Highway (north approach)	0.035	0.024	0.2	0.1	2.3	2.4	0.048	0.033	0.2	0.2	2.3	2.4	0.057	0.047	0.4	0.4	2.4	2.6
	Boyes Street (west approach)	0.214	0.141	2.4	1.5	10.6	10.1	0.394	0.274	5.3	3.2	17.5	15.2	0.684	0.467	13.1	6.5	26.6	20.3
Kirchhofer Street / Boyes Street	Kirchhofer Street (south approach)	0.057	0.086	0.8	1.2	5.7	5.8	0.069	0.120	1.0	1.8	5.7	5.8	0.100	0.183	1.5	3.0	5.3	5.6
	Boyes Street (east approach)	0.049	0.075	0.8	1.2	3.6	3.6	0.067	0.104	1.1	1.7	3.6	3.7	0.115	0.172	1.9	2.9	5.4	5.3
	Kirchhofer Street (north approach)	0.003	0.003	0.0	0.0	5.0	5.3	0.003	0.003	0.0	0.0	5.2	5.5	0.138	0.100	2.3	1.6	4.1	4.5
	Moama Anglican Grammar (west approach)	0.034	0.052	0.5	0.8	4.1	4.2	0.048	0.075	0.8	1.2	4.1	4.4	0.053	0.087	0.8	1.4	4.7	5.4

Existing Conditions Summary

SIDRA analysis revealed that at existing conditions, all intersections perform at excellent operating conditions except for Perricoota Road / Kirchhofer Street and Cobb Highway / Perricoota Road. Both intersections contain a DOS of over 1.0, which indicates that the intersections are operating at very poor conditions along Perricoota Road.

Projected Conditions Summary (with/without Development traffic)

SIDRA analysis of the projected volumes was also considered, with and without the development to compare the proposed school and development at existing conditions. The intersections at Perricoota Road / Kirchhofer Street and Cobb Highway / Perricoota continue to operate at very poor conditions with queue length extending approximately 1.0 km west on Perricoota Road. With the development at completion, these queue lengths extend to past the Perricoota Road / Lignum Road intersection causing additional queues along Lignum Road.

It is acknowledged there will be an upgrade at the intersection of Cobb Highway / Perricoota Road into a signalised intersection by 2023 as part of the Echuca Moama Bridge project. This upgrade is to address the current operating conditions at the Cobb Highway / Perricoota Road intersection, which will reduce the queues along Perricoota Road and at Lignum Road intersection.

As stage 1 of the development has been approved, the traffic generation from this stage is likely to have minimal impact.

Furthermore, the projected traffic from the proposed development up to stage 4, is unlikely to contribute more than 10% of the overall traffic volumes at the following intersections:

- Perricoota Road / Lignum Road
- Perricoota Road / Kirchhofer Street

Therefore, no action is required before the upgrade of Cobb Highway / Perricoota Road intersection. A review of the network is recommended after the completion of the upgrade of Cobb Highway / Perricoota Road intersection due to the change in the traffic conditions.

Preliminary SIDRA Analysis for Perricoota Road / Lignum Road intersection

A SIDRA analysis was conducted on the Perricoota Road and Lignum Road intersection to assess a preliminary roundabout intersection with and without the development based on the projected volumes. The analysis show that without the development the roundabout intersection operates with a DOS of over 0.9, which indicates the intersection is operating above practical capacity. With the addition of development, the intersection also operates above practical capacity with a DOS of over 1.0.

From the analysis, it can be concluded that the poor operating conditions at the Perricoota Road and Lignum Road intersection can be attributed to the existing traffic volumes along Perricoota Road, ultimately turning right into Cobb Highway.

Conclusion 3: SIDRA analysis revealed that at existing conditions, intersections along Perricoota Road at Cobb Highway, Kirchhofer Street and Lignum Road operate at very poor conditions, resulting in long queue length and delays.

Conclusion 4: It is acknowledged that the Perricoota Road / Cobb Highway intersection will be upgraded to a signalised intersection by 2023. The upgrade is expected to address the traffic demand on the intersections along Perricoota Road.

Conclusion 5: The projected traffic from the proposed development up to stage 4 is unlikely to contribute more than 10% of the overall traffic volumes at the Perricoota Road / Lignum Road and Perricoota Road / Kirchhofer Street intersections.

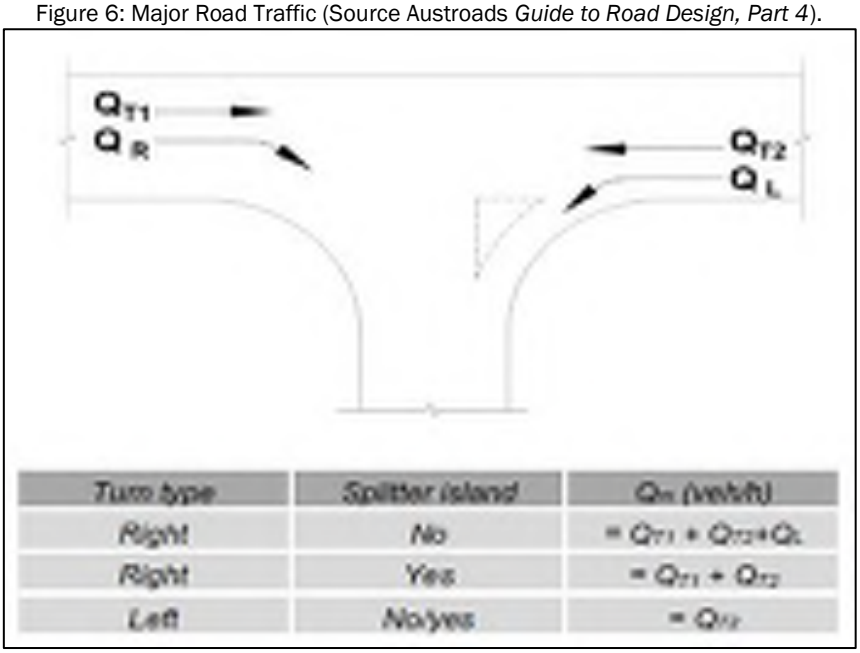
Recommendation 2: No action is required before the Cobb Highway / Perricoota Road intersection upgrade. A review of the network is recommended after the completion of the Cobb Highway / Perricoota Road intersection upgrade due to the change in the traffic conditions.

4.3 Turn Provisions

The traffic turning from major roads into minor roads should not delay through traffic. The type of turn treatment is determined based on speed environment and the combination of through and turning traffic volumes. Figure 2.26 of the Austroads *Guide to Traffic Management – Part 6 (AGTM6)* (reproduced in Figure 6) is used for the selection of intersection treatments.

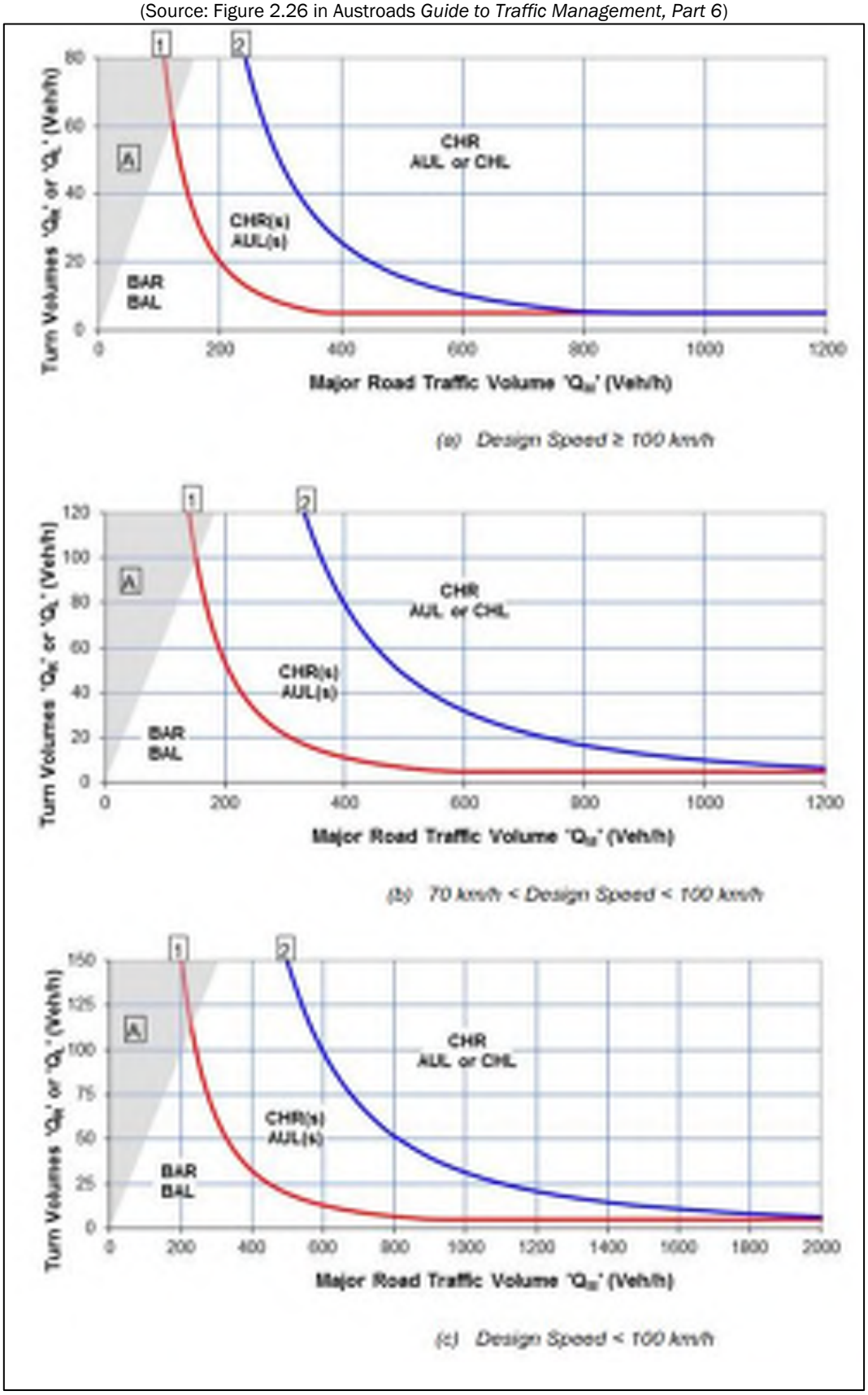
Using Figure A11 from the Austroads *Guide to Road Design– Part 4* (AGRD4) (see Figure 6) the major road traffic parameters Q_M can be established and applied to the graph in Figure 7 to determine the turn treatments required at each intersection.

Figure 6: Major Road Traffic (Source Austroads *Guide to Road Design, Part 4*).



Turn type	Splitter island	Q_M (veh/h)
Right	No	$= Q_{T1} + Q_{T2} + Q_L$
Right	Yes	$= Q_{T1} + Q_{T2}$
Left	No/yes	$= Q_{T2}$

Figure 7 - Warrant for turn treatments on the major road at unsignalised intersections[5]
(Source: Figure 2.26 in Austroads *Guide to Traffic Management, Part 6*)



[5] Figure 6(a) has a design speed of <70 km/h, not ≥100 km/h

4.3.1 Perricoota Road / Lignum Road

Table 6 summarises the anticipated through traffic volumes and turning traffic volumes at the Perricoota Road/ Lignum Road intersection. Figure 8 determines the turning warrants required at the intersection based on these traffic volumes. However, right turn treatment volumes have exceeded pass the boundary of AGTM6 turning warrant figures.

Table 6 - Design year AM and PM peak hour turn parameters at the Perricoota Road/ Lignum Road Intersection for use in Figure 6 (a).

Major	Minor Road	Peak Period	Left Turn Q_L (vph)	Right Turn Q_R (vph)	Through Q_T (vph)		Q_M Left Turn	Q_M Right Turn
Perricoota Road	Lignum Road	AM	9	48	Q_{T1}	508	762	1279
					Q_{T2}	762		
		PM	10	72	Q_{T1}	762	508	1280
					Q_{T2}	508		

Turning warrants assessment revealed that the Perricoota Road/ Lignum Road intersection warrants for a channelised right (CHR) treatment and an auxiliary left (AUL) treatment for a design speed of 90 km/h at full development. At Stage 4 of development with the proposed primary school is when the AUL and CHR treatments are triggered.

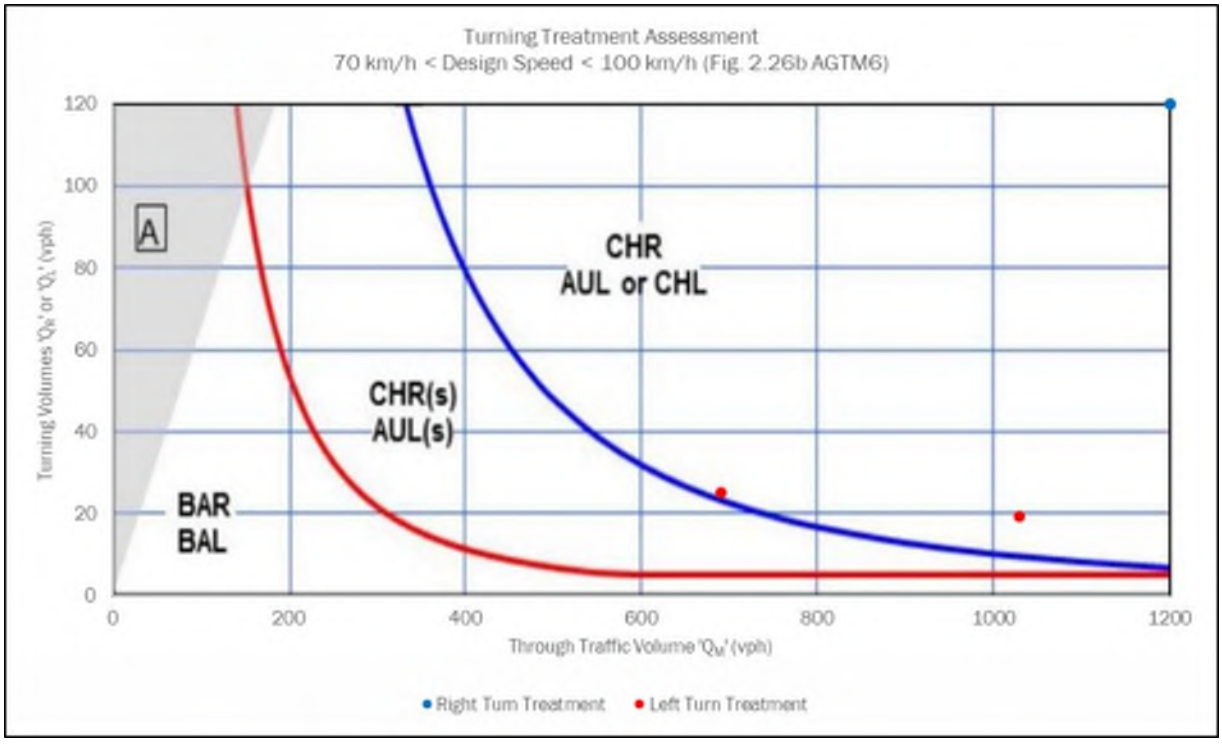
The previous traffic impact assessment report conducted by Planright indicated that the intersection required a channelised right (CHR) treatment and an auxiliary left - short (AUL) treatment. The difference in the left turning warrant is due to the additional traffic generated by the proposed primary school.

Although turning warrants indicate an AUL and CHR treatment is required, SIDRA analysis with the provision of an AUL and a CHR revealed that the Perricoota Road/ Lignum Road intersection will continue to operate above practical capacity. A roundabout intersection would improve the overall queue lengths and average delays at full development; however, the roundabout is likely to operate above practical capacity.

Conclusion 6: The Perricoota Road / Lignum Road intersection warrants for a CHR and an AUL treatment. SIDRA analysis with the provision of an AUL and a CHR revealed that the Perricoota Road/ Lignum Road intersection will continue to operate above practical capacity.

Recommendation 3: Consider the installation of a roundabout at the Perricoota Road / Lignum Road intersection to improve the overall queue lengths and average delays.

Figure 8 – Turning treatment assessment – Perricoota Road / Lignum Road



4.3.2 Cobb Highway / Perricoota Road

Table 7 summarises the anticipated through traffic volumes and turning traffic volumes at the Cobb Highway / Perricoota Road intersection. Figure 9 determines the turning warrants required at the intersection based on these traffic volumes. However, left turn treatment volumes has exceeded past the boundary of AGTM6 turning warrant figures.

Table 7 - Design year AM and PM peak hour turn parameters at the Cobb Highway / Perricoota Road Intersection for use in Figure 6 (a).

Major	Minor Road	Peak Period	Left Turn Q_L (vph)	Right Turn Q_R (vph)	Through Q_T (vph)		Q_M Left Turn	Q_M Right Turn
Cobb Highway	Perricoota Road	AM	651	12	Q_{T1}	435	258	692
					Q_{T2}	258		
		PM	977	13	Q_{T1}	290	258	547
					Q_{T2}	258		

Turning warrants assessment revealed that the Cobb Highway / Perricoota Road intersection warrants for a channelised right – short (CHR(s)) treatment and an Auxiliary Left – short (AUL(s)) treatment for a design speed of 60 km/h at full development.

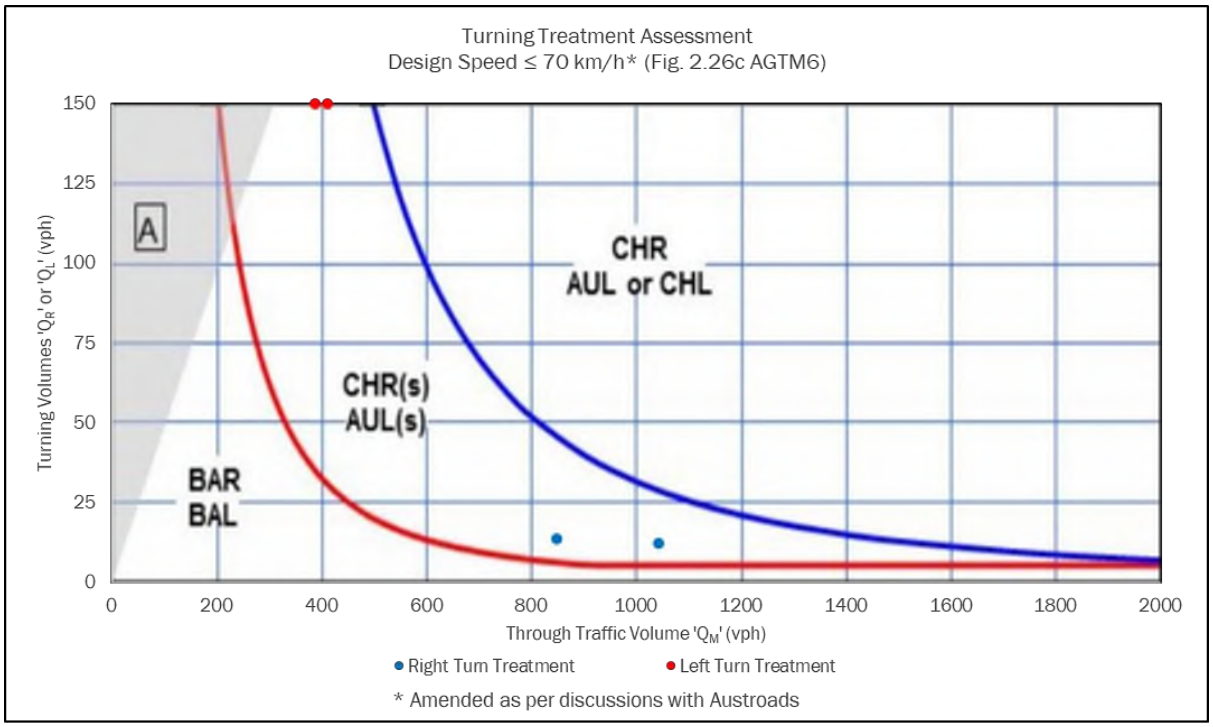
The Planright report also warrants for a channelised right (CHR) treatment and an Auxiliary Left (AUL) treatment. The existing left turn on Cobb Highway contains an AUL arrangement.

As mentioned previously, it has been advised by Transport for NSW that the Cobb Highway / Perricoota Road intersection will be upgraded into a signalised intersection by 2023. Therefore, no action is required at the intersection.

Conclusion 7: The Cobb Highway / Perricoota Road intersection warrants for a CHR(s) and an AUL(s) treatment.

Conclusion 8: The current left turn at the Cobb Highway / Perricoota Road intersection contains an AUL treatment. Transport for NSW has advised that the intersection will be upgraded into a signalised intersection and this will satisfy the warrants at the intersection (i.e. no further action required).

. Figure 9 – Turning treatment assessment – Cobb Highway / Perricoota Road



4.3.3 Cobb Highway / Boyes Street

Table 8 summarises the anticipated through traffic volumes and turning traffic volumes at the Cobb Highway / Boyes Street intersection. Figure 10 determines the turning warrants required at the intersection based on these traffic volumes. However, left turn treatment volumes has exceeded past the boundary of AGTM6 turning warrant figures.

Table 8 - Design year AM and PM peak hour turn parameters at the Cobb Highway / Boyes Street Intersection for use in Figure 6 (a).

Major	Minor Road	Peak Period	Left Turn Q_L (vph)	Right Turn Q_R (vph)	Through Q_T (vph)		Q_M Left Turn	Q_M Right Turn
Cobb Highway	Boyes Street	AM	153	14	Q_{T1}	77	152	229
					Q_{T2}	215		
		PM	601	14	Q_{T1}	57	228	280
					Q_{T2}	314		

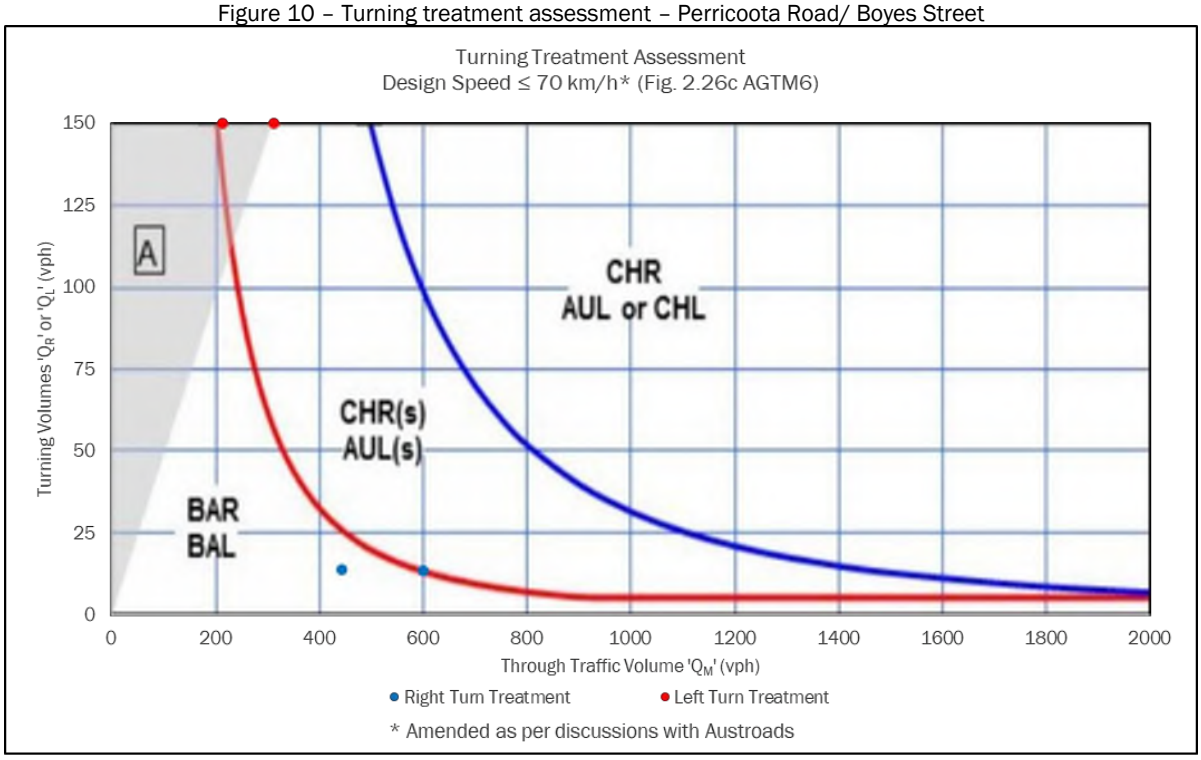
Turning warrants assessment revealed that the Cobb Highway / Boyes Street intersection just warrants for a channelised right - short (CHR(S)) treatment and an Auxiliary left (AUL) treatment for a design speed of 60 km/h at full development.

The Planright report indicated that a CHR(s) and an AUL(s) treatment is required on Cobb Highway for both Boyes Street / Nicholas Drive. The difference in the left turning warrant is also due to the additional traffic generated by the proposed primary school.

The intersection currently contains a BAR treatment and an AUL treatment. The warrant for a CHR(s) is triggered after stage 9 with the proposed primary school.

Conclusion 9: The Cobb Highway / Boyes Street intersection warrants for a CHR(S) and an AUL treatment.

Figure 10 – Turning treatment assessment – Perricoota Road/ Boyes Street



It is assumed that majority of the traffic generated from the development travelling to and from Boyes Street will predominately be right-out from Boyes Street and left-in from Cobb Highway into Boyes Street. Figure 11 shows the turning warrant for the Cobb Highway / Boyes Street intersection projected to 2030 without the development. Traffic turning right into Boyes street from the development is 5 vehicles in the AM peak and 8 vehicles in the PM peak. It is expected that the traffic turning right into Boyes Street from Cobb Highway will be negligible by the development.

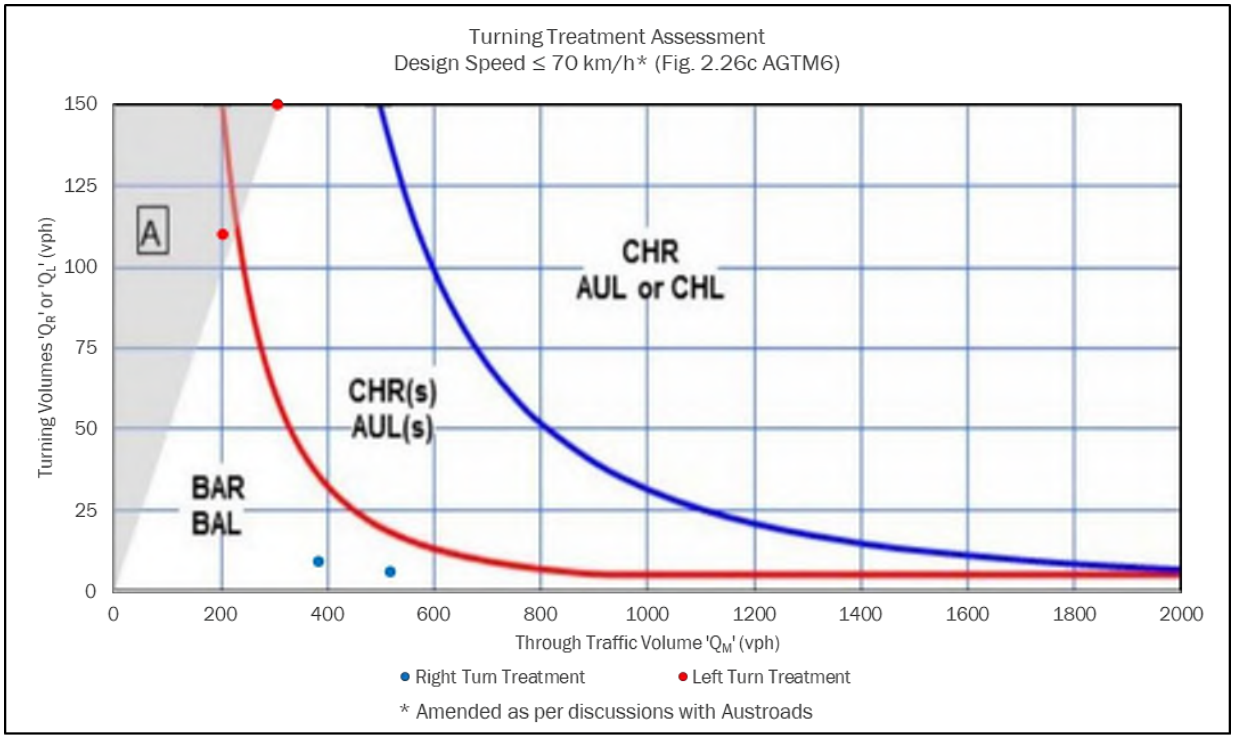
The Moama Anglican Grammar Master Plan indicates there will be an expansion to the school. Due to limited information, the school expansion was not considered as part of the turning warrant analysis. However, the traffic generated from the school expansion may contribute additional vehicles turning right from Cobb Highway and vehicles crossing from Nicholas Drive into Boyes Street.

Currently there is no known treatment to be implemented in the Cobb Highway / Boyes Street intersection. To improve road safety and reduce vehicle casualty crashes at Cobb Highway / Boyes Street it is recommended that a roundabout intersection to be considered.

Conclusion 10: Traffic generated from the Moama Anglican Grammar school expansion may contribute additional vehicles turning right from Cobb Highway and vehicles crossing from Nicholas Drive into Boyes Street.

Recommendation 4: Consider the installation of a roundabout at the Cobb Highway / Boyes Street intersection to improve road safety.

Figure 11 – Turning treatment assessment without development – Perricoota Road/ Boyes Street

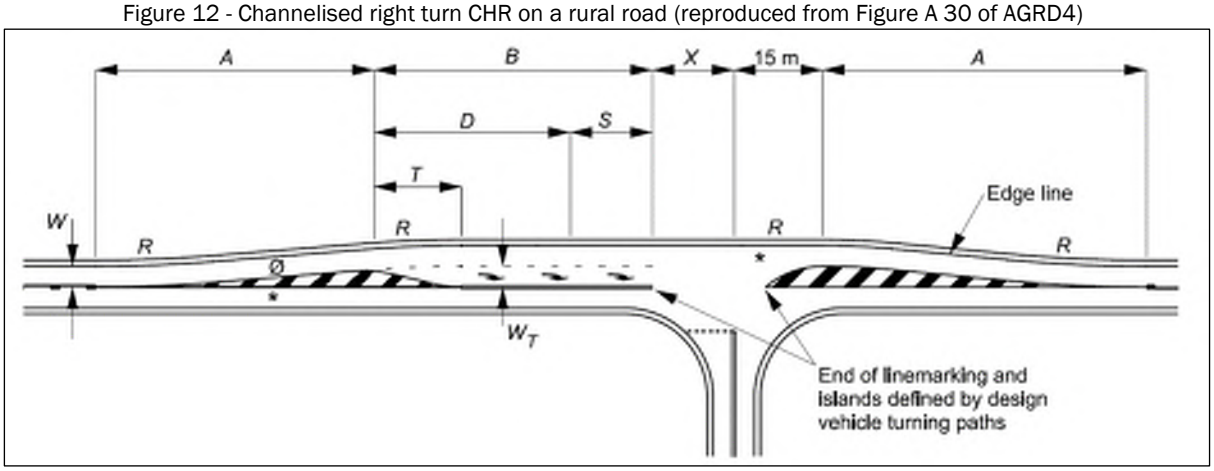


4.3.4 Right Turns

<u>Right Turning Lane on Perricoota Road</u>

As indicated above, Perricoota Road at the Lignum Road intersection meets the warrant for a CHR treatment.

Figure 12 - Channelised right turn CHR on a rural road (reproduced from Figure A 30 of AGRD4)



The minimum dimensions of the CHR treatment are detailed in Figure 12 (reproduced from Figure A 29 of AGRD4)) for a design speed of 90km/h and, subject to detailed design, intersection analysis and road grades should comprise the following:

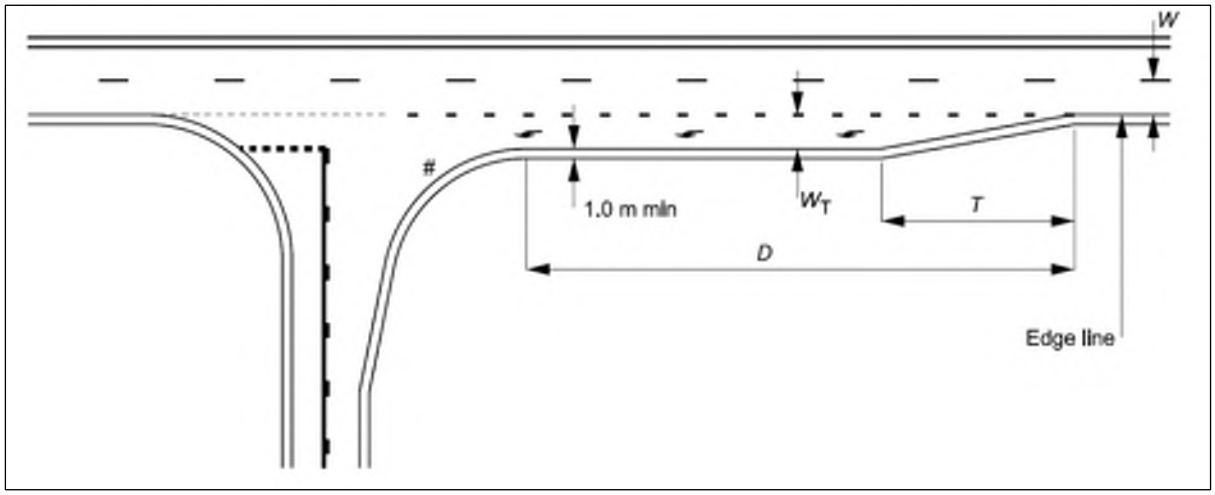
- Nominal width of turn lane W_T = 3.0 m
- Nominal through lane width W = 3.5 m
- Taper length T = 25m
- Lateral movement length A = 75m
- Length of deceleration D = 70m
- Storage length S = 12.5m (single unit truck / bus design vehicle)
- Total length of turn lane including taper length and storage B = 82.5m (S + D)
- Distance X = 10 – 15m, dependent on detailed design consideration of design vehicle turning paths.

4.3.5 Left Turns

<u>Left Turning Lane on Perricoota Road</u>

As indicated above, Perricoota Road at the Lignum Road intersection meets the warrants for an AUL treatment.

Figure 13 – Auxiliary left turn AUL on a rural road (reproduced from Figure 8.3 of AGRD4A)



The minimum dimensions of the AUL treatment are detailed in Figure 13 (reproduced from Figure 8.3 of AGRD4A) for a design speed of 90km/h and, subject to detailed design, intersection analysis and road grades should comprise the following:

- Nominal width of turn lane W_T = 3.0 m
- Nominal through lane width W = 3.6 m
- Taper length T = 25 m
- Length of deceleration D = 125 m

5 DEVELOPMENT INTERNAL ROAD LAYOUT

The proposed internal road network and access points onto the abutting road network (shown in Attachment A) generally meets good urban design principles and offers a high level of road amenity, connectivity and permeability.

The proposed internal network should meet the urban road characteristics and requirements set out in the *Infrastructure Design Manual (IDM)* and Murray Shire Council: *Engineering Guidelines for Subdivisions and Development Standards.*

5.1 Road Design

It is anticipated that the following roads adjacent to the subject site will ultimately become Collector / Connector roads:

- Lignum Road
- Kiely Road
- Kirchhofer Street
- Boyes Street (including the re-aligned Boyes Street)

In Stage 6 some lots are proposed to provide rear access to garages with another street frontage. The remaining internal road network within the subject site would be access streets.

These roads should be designed to meet the requirements / characteristics from the IDM as discussed in section 3.2 of this report.

Recommendation 5: Ensure all internal roads are designed and constructed in accordance with the IDM.

5.2 Speed zoning and traffic calming

It is expected that the proposed development will operate under the default urban 50 km/h speed limit. The design of the Local Access streets should aim to meet the Murray Shire Council: *Engineering Guidelines for Subdivisions and Development Standards* target speeds of 30 km/h and be self-enforceable through the installation of traffic calming devices along long straight sections of road.

Austroads Guide to Traffic Management Part 8: Local Area Traffic Management (AGTM8) indicates that street section lengths (i.e. between slow or near-stop conditions) should be kept below 200 m – 250 m for target speeds of around 50 km/h.

Recommendation 6: Implementing of speed zoning and traffic calming for the road layout in accordance to AGTM8 and Murray Shire Council: *Engineering Guidelines for Subdivisions and Development Standards.*

5.3 Intersection design

The proposed development contains one roundabout intersection with the remaining intersections are “T” intersections, which enhances safety and minimises potential confusion for motorists at intersections.

The intersections should be designed to minimise confusion and ensure that intersection priority is clear. Generally, each of the intersections within the proposed layout must have a clear intersection priority.

Consideration should be given to installing give-way line-marking and signage to reinforce the intended priority at the following intersections:

- north-south internal road and Kiely Road
- east-west internal road (Boyes Street realignment) and Kirchhofer Road

The intersections also should be designed in locations to ensure suitable safe intersection sight distances can be provided. The minimum SISD criterion specified in AGRD4A requires clear visibility for a desirable minimum distance of 97 m, for a design speed of 50 km/h. This sight distance is applicable to each of the internal intersections proposed within the development site. Any landscaping within the verge near an intersection should be positioned so that it will not obscure or obstruct drivers’ line of sight.

Recommendation 7: Ensure all intersections are to be designed to have clear visibility and meet minimum SISD criterion.

5.4 On-street car parking

On-street kerbside car parking is proposed to be permitted along both sides of each of the access streets and external collector roads. Car parking is restricted on approach to intersections (based on statutory requirements) to ensure that adequate sight distances are provided in each direction along the frontage road.

Furthermore, car parking should be restricted through any 90-degree bends within the road network to maximise the sight distance around the bend and to allow two-way operation along the carriageway.

Recommendation 8: Restrict on-street car parking on approach to 90-degree bends within the road network.

5.5 Emergency and service vehicle access

All roads within the development need to provide enough space so that emergency vehicles, waste collection vehicles and street-cleaning vehicles can carry out their functions while travelling in a forward direction only, throughout the development.

Roads should be designed to cater for an 8.8 m service vehicle negotiating the road network in a forward direction, specifically ensuring that service vehicles will be able to safely negotiate sharp curves in the road alignment and through all intersections within the site.

Recommendation 9: All roads should be designed to provide enough space for an 8.8 m emergency/service vehicle to travel through the network safely.

5.6 Termination of internal roads

Many of the internal roads are proposed to be temporarily terminated at different stages throughout the development for the internal roads. In the interim, the internal roads will always need to allow for service vehicles to travel in a forward direction. Therefore, the provision of a temporary court bowl cul-de-sac treatment should be implemented at each location where an internal road is to be truncated.

Recommendation 10: Temporary court bowl cul-de-sac treatment should be implemented at the termination of all roads for each stage.

5.7 Pedestrian and cycle network

A network of pedestrian and cycling linkages are proposed within the development site as part of the Moama North West Master plan. This includes the provision of shared space along an access road between Kiely Road and Boyes Street through the site. Extended pedestrian and cycling linkages are also proposed along Kiely Road and Lignum Road.

These paths will link the proposed primary school with Moama Anglican Grammar and will support recreational and commuter paths to help provide sustainable travel options for residents.

All footpath and shared path road crossings within the development site will need to be designed to meet adequate pedestrian sight distance requirements. Any landscaping proposed within the verge will need to be carefully considered to ensure drivers' line of sight to pedestrians is maximised.

Recommendation 11: All footpath and shared path road crossings should be designed to meet adequate pedestrian sight distance requirements and landscaping proposed should be carefully considered to ensure drivers' line of sight to pedestrians is maximised.

6 STRATEGIC NETWORK PLANNING

It should be noted that the above assessment only considers the proposed development and the adjoining proposed primary school. It does not consider the current school expansion of Moama Anglican Grammar and future developments along Lignum Road and the north-western developments as part of the Moama North West Masterplan.

The Moama Anglican Grammar School Masterplan have proposed to expand the school near Boyes Street to provide additional amenities and sporting facilities. The proposed expansion is likely to generate additional traffic along the road and at the Cobb Highway / Boyes Street intersection.

The Moama North West Masterplan indicated that majority of the area is proposed to be residential lots to be developed in the short to medium term. There is currently limited information on the proposed developments. However, it is anticipated that the traffic volumes along the Lignum Road will increase due to these developments and is likely to result in unsatisfactory operating conditions at the Perricoota Road / Lignum Road intersection. The masterplan includes road upgrades for Lignum Road between Martin Road and Boyes Street. These upgrades do not include the section of Lignum Road between Boyes Street and Perricoota Road.

It is understood that there is currently no strategic plan to upgrade the Cobb Highway / Boyes Street and Perricoota Road / Lignum Road intersections. The proposed development with the adjoining proposed primary school on its own is likely to have a minor impact on the surrounding road network. However, in combination with other proposed developments, these intersections are likely to operate at unsatisfactory conditions. Additional treatments at the Cobb Highway / Boyes and Perricoota Road / Lignum Road intersection will be required for the road network to operate at an acceptable level.

Consultation between other land developers and council is recommended to assess the cumulative traffic impact from current and future developments at the Cobb Highway / Boyes Street and Perricoota Road / Lignum Road intersection, develop a strategic plan for the road network and proportionately allocate funding for the required treatments at the intersections.

Conclusion 11: This assessment only considers the proposed development and primary school and does not consider current and future developments in the surrounding road network. It is anticipated that the traffic volumes will increase from other developments and is likely to result in unsatisfactory operating conditions at the Cobb Highway / Boyes Street and Perricoota Road / Lignum Road intersection.

Recommendation 12: Consultation between land developers and Council is recommended to assess the cumulative traffic impact from other developments, develop a strategic plan for the network and proportionately allocate funding for the required treatments.

7 CONCLUSIONS

Trafficworks has been engaged by North East Survey Design to undertake a traffic impact assessment of the proposed development of Arthurs Estate in Moama, NSW.

The key findings from this assessment are summarised below:

- **Conclusion 1:** The proposed development at completion is likely to generate a peak hour traffic volume of 623 vph with the residential lots and school generating 254 vph and 369 vph respectively.
- **Conclusion 2:** The minimum SISD of 97 m for a design speed of 50 km/h applies for all accessway for the proposed development.
- **Conclusion 3:** SIDRA analysis revealed that at existing conditions, intersections along Perricoota Road at Cobb Highway, Kirchhofer Street and Lignum Road operate at very poor conditions, resulting in long queue length and delays.
- **Conclusion 4:** It is acknowledged that the Perricoota Road / Cobb Highway intersection will be upgraded to a signalised intersection by 2023. The upgrade is expected to address the traffic demand on the intersections along Perricoota Road.
- **Conclusion 5:** The projected traffic from the proposed development up to stage 4 is unlikely to contribute more than 10% of the overall traffic volumes at the Perricoota Road / Lignum Road and Perricoota Road / Kirchhofer Street intersections.
- **Conclusion 6:** The Perricoota Road / Lignum Road intersection warrants for a CHR and an AUL treatment. SIDRA analysis with the provision of an AUL and a CHR revealed that the Perricoota Road / Lignum Road intersection will continue to operate above practical capacity.
- **Conclusion 7:** The Cobb Highway / Perricoota Road intersection warrants for a CHR(s) and an AUL(s) treatment.
- **Conclusion 8:** The current left turn at the Cobb Highway / Perricoota Road intersection contains an AUL treatment. Transport for NSW has advised that the intersection will be upgraded into a signalised intersection and this will satisfy the warrants at the intersection (i.e. no further action required).
- **Conclusion 9:** The Cobb Highway / Boyes Street intersection warrants for a CHR(S) and an AUL treatment.
- **Conclusion 10:** Traffic generated from the Moama Anglican Grammar school expansion may contribute additional vehicles turning right from Cobb Highway and vehicles crossing from Nicholas Drive into Boyes Street.
- **Conclusion 11:** This assessment only considers the proposed development and primary school and does not consider current and future developments in the surrounding road network. It is anticipated that the traffic volumes will increase from other developments and is likely to result in unsatisfactory operating conditions at the Cobb Highway / Boyes Street and Perricoota Road / Lignum Road intersection.

The key recommendations are outlined below:

- **Recommendation 1:** The sight distance for each accessway should be ensured to meet the minimum SISD of 97 m during development.
- **Recommendation 2:** No action is required before the Cobb Highway / Perricoota Road intersection upgrade. A review of the network is recommended after the completion of the Cobb Highway / Perricoota Road intersection upgrade due to the change in the traffic conditions.
- **Recommendation 3:** Consider the installation of a roundabout at the Perricoota Road / Lignum Road intersection to improve the overall queue lengths and average delays.
- **Recommendation 4:** Consider the installation of a roundabout at the Cobb Highway / Boyes Street intersection to improve road safety.
- **Recommendation 5:** Ensure all internal roads are designed and constructed in accordance with the IDM.
- **Recommendation 6:** Implementing of speed zoning and traffic calming for the road layout in accordance to AGTM8 and Murray Shire Council: *Engineering Guidelines for Subdivisions and Development Standards.*
- **Recommendation 7:** Ensure all intersections are to be designed to have clear visibility and meet minimum SISD criterion.
- **Recommendation 8:** Restrict on-street car parking on approach to 90-degree bends within the road network.
- **Recommendation 9:** All roads should be designed to provide enough space for an 8.8 m emergency/service vehicle to travel through the network safely.
- **Recommendation 10:** Temporary court bowl cul-de-sac treatment should be implemented at the termination of all roads for each stage.
- **Recommendation 11:** All footpath and shared path road crossings should be designed to meet adequate pedestrian sight distance requirements and landscaping proposed should be carefully considered to ensure drivers' line of sight to pedestrians is maximised.
- **Recommendation 12:** Consultation between land developers and Council is recommended to assess the cumulative traffic impact from other developments, develop a strategic plan for the network and proportionately allocate funding for the required treatments.

The traffic impact assessment report found that at existing and projected conditions, part of the surrounding road network operates at poor conditions particularly at intersections along Perricoota Road.

However, it is concluded that the proposed development prior to stage 4 would not provide additional adverse impact on the safety or the operation of the surrounding road network, provided the above recommendations are implemented.

Consultation between land developers and council is recommended to assess the cumulative traffic impact from other developments at the Cobb Highway / Boyes Street and Perricoota Road / Lignum Road intersections, develop a strategic plan for the road network and proportionately allocate funding for the required treatments

ATTACHMENT A – SIGNAL PHASING / SURVEY DATA SIDRA RESULTS

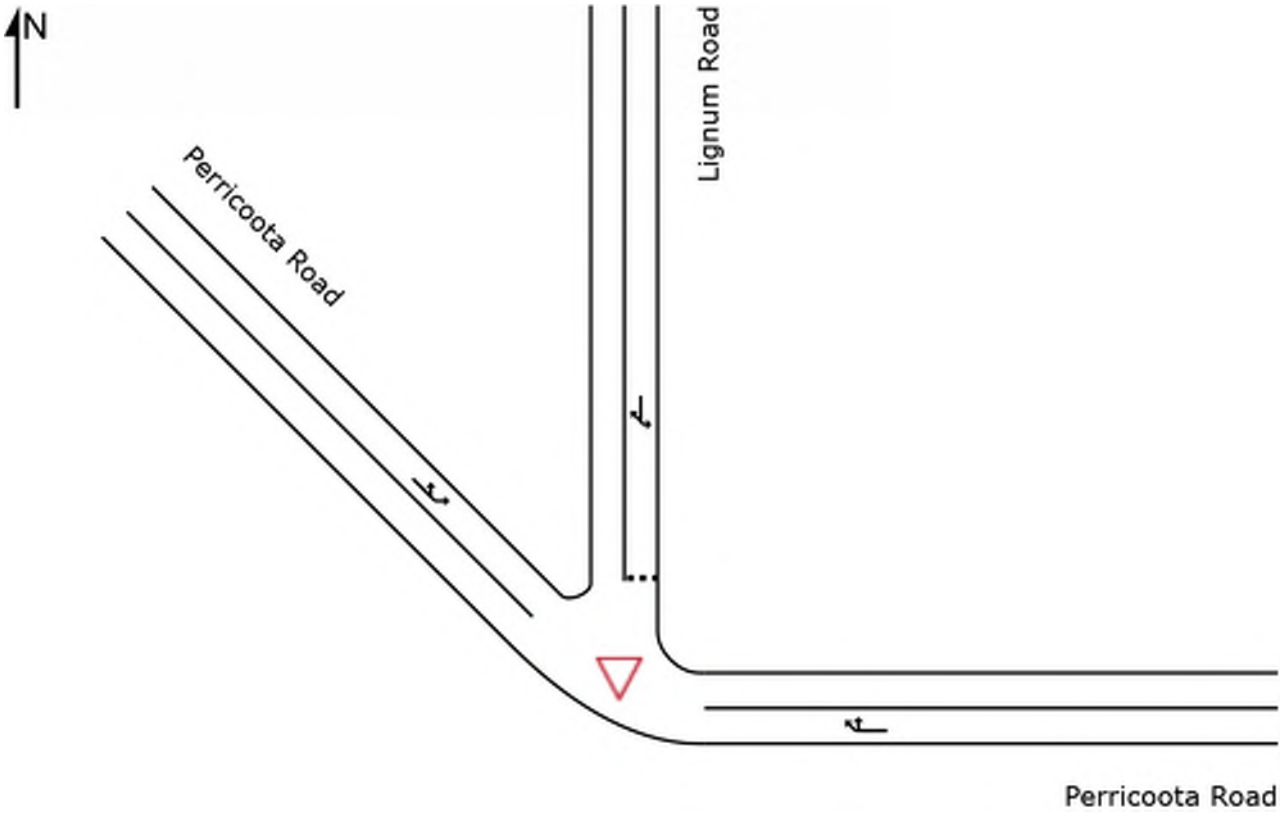
USER REPORT FOR NETWORK SITE

Project: 180880_SIDRA_190801 | **Template: Site User Report**

Site: [Existing before Development - Perricoota Road / Lignum Road Intersection - AM] | **Network: 10 [Network Existing before Development - AM]**

New Site
Site Category: -
Giveway / Yield (Two-Way)

Site Layout



Lane Use and Performance

	Demand Flows		Arrival Flows		Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	Aver. Back of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	Total veh/h	HV %	Total veh/h	HV %	veh/h	v/c	%	sec		Veh	Dist m		m	%	%
East: Perricoota Road															
Lane 1	522	5.0	522	5.0	1838	0.284	100	6.3	LOS A	0.0	0.2	Full	790	0.0	0.0
Approach	522	5.0	522	5.0		0.284		6.3	NA	0.0	0.2				
North: Lignum Road															
Lane 1	8	2.0	8	2.0	343	0.025	100	13.5	LOS B	0.0	0.2	Full	540	0.0	0.0
Approach	8	2.0	8	2.0		0.025		13.5	LOS B	0.0	0.2				
NorthWest: Perricoota Road															
Lane 1	783	5.0	783	5.0	1855	0.422	100	6.2	LOS A	0.0	0.0	Full	450	0.0	0.0
Approach	783	5.0	783	5.0		0.422		6.2	NA	0.0	0.0				
Intersection	1314	5.0	1314	5.0		0.422		6.3	NA	0.0	0.2				

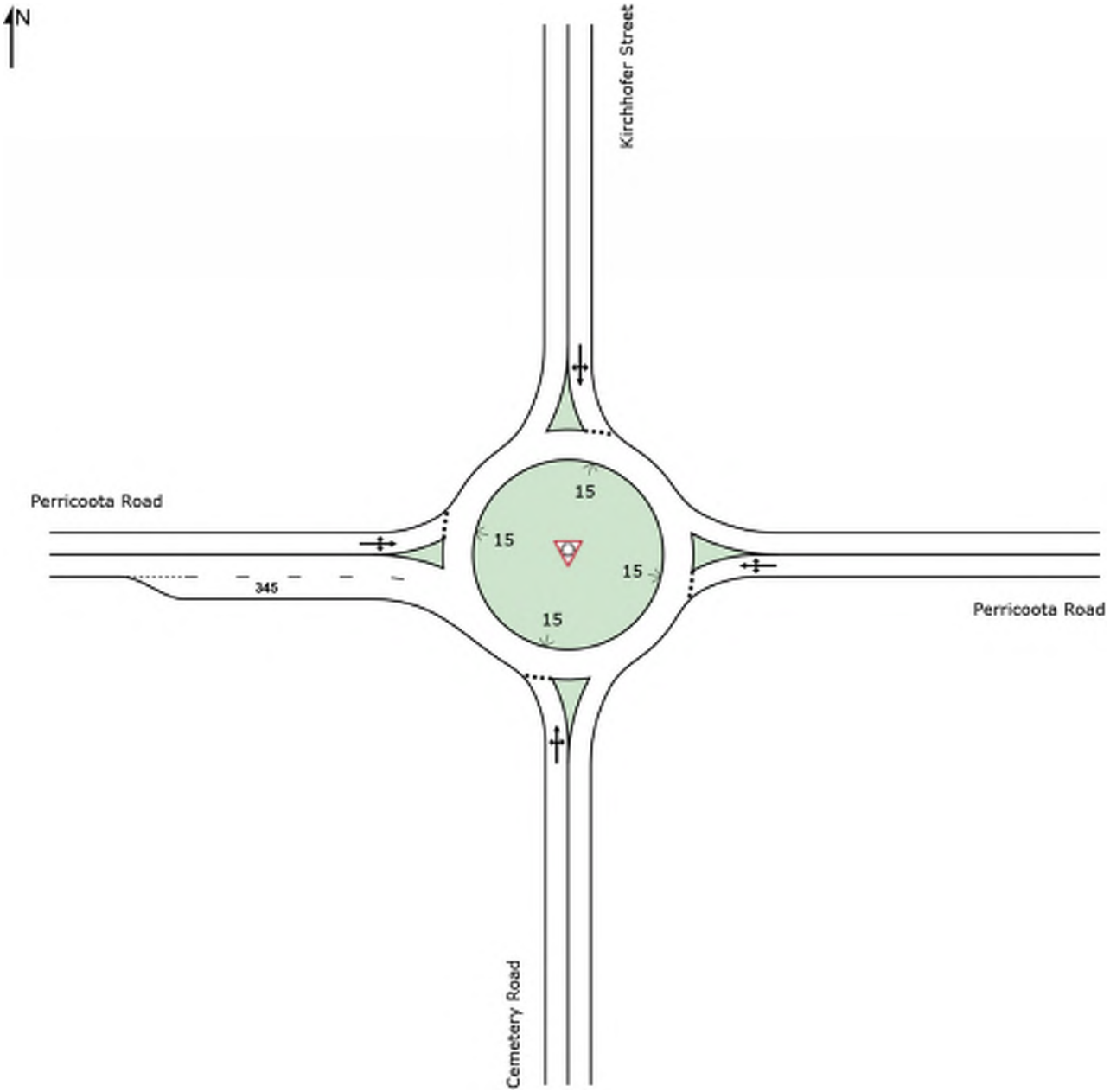
Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
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.

Site: [Existing before Development - Perricoota Road / Kirchhofer Street Intersection - AM]

Network: 10 [Network Existing before Development - AM]

New Site
Site Category: -
Roundabout

Site Layout



Lane Use and Performance

	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	Aver. Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Cemetery Road															
Lane 1[d]	3	0.0	3	0.0	630	0.005	100	7.5	LOS A	0.0	0.1	Full	200	-25.0[N3]	0.0
Approach	3	0.0	3	0.0		0.005		7.5	LOS A	0.0	0.1				
East: Perricoota Road															
Lane 1[d]	528	4.7	528	4.7	1581	0.334	100	3.7	LOS A	1.2	8.7	Full	235	0.0	0.0
Approach	528	4.7	528	4.7		0.334		3.7	LOS A	1.2	8.7				
North: Kirchhofer Street															
Lane 1[d]	115	2.0	115	2.0	316	0.363	100	8.4	LOS A	0.5	3.9	Full	680	-47.0[N3]	0.0
Approach	115	2.0	115	2.0		0.363		8.4	LOS A	0.5	3.9				
West: Perricoota Road															
Lane 1[d]	783	4.7	783	4.7	763	1.027	100	39.7	LOS D	25.0	182.0	Full	790	-47.3[N3]	0.0
Approach	783	4.7	783	4.7		1.027		39.7	LOS D	25.0	182.0				
Intersection	1429	4.5	1429	4.5		1.027		23.8	LOS C	25.0	182.0				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
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.

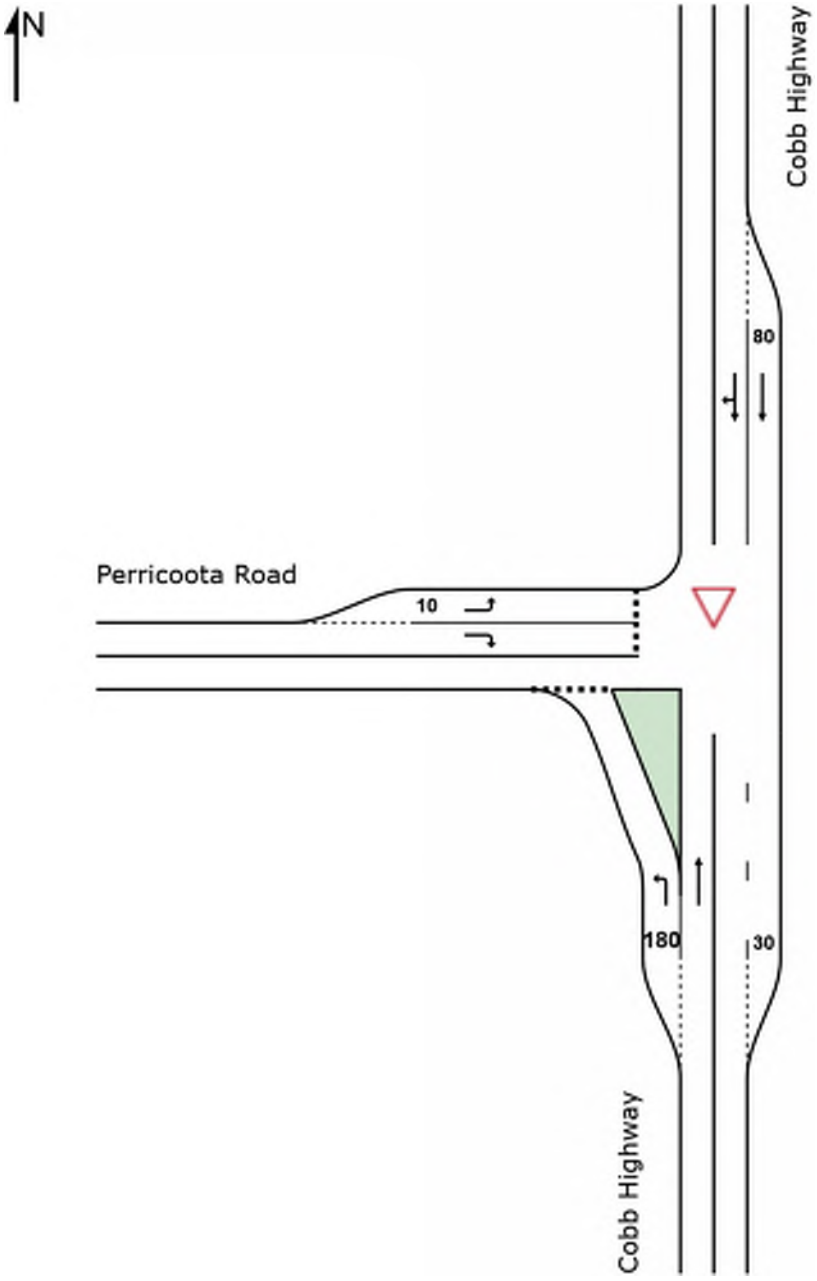
d Dominant lane on roundabout approach
N3 Capacity Adjustment due to downstream lane blockage determined by the program.

Site: [Existing before Development - Cobb Highway / Perricoota Road Intersection - AM]

Network: 10 [Network Existing before Development - AM]

New Site
Site Category: -
Giveway / Yield (Two-Way)

Site Layout



Lane Use and Performance

	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	Aver. Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Cobb Highway															
Lane 1	535	5.0	535	5.0	2058	0.260	100	4.6	LOS A	0.6	4.5	Short	180	0.0	NA
Lane 2	263	10.0	263	10.0	1841	0.143	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	798	6.6	798	6.6		0.260		3.1	LOS A	0.6	4.5				
North: Cobb Highway															
Lane 1	87	10.0	87	10.0	1841	0.047	24[6]	0.0	LOS A	0.0	0.0	Short	80	0.0	NA
Lane 2	363	9.9	363	9.9	1840	0.197	100	0.1	LOS A	0.0	0.1	Full	685	0.0	0.0
Approach	449	9.9	449	9.9		0.197		0.1	NA	0.0	0.1				
West: Perricoota Road															
Lane 1	48	5.0	48	5.0	1641	0.030	100	5.3	LOS A	0.1	0.4	Short	10	0.0	NA
Lane 2	744	5.0	744	5.0	417[1]	1.787	100	722.1	LOS F	32.2[N4]	234.9[N4]	Full	235	0.0	49.9
Approach	793	5.0	793	5.0		1.787		678.3	LOS F	32.2	234.9				
Intersection	2040	6.7	2040	6.7		1.787		264.8	NA	32.2	234.9				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
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.

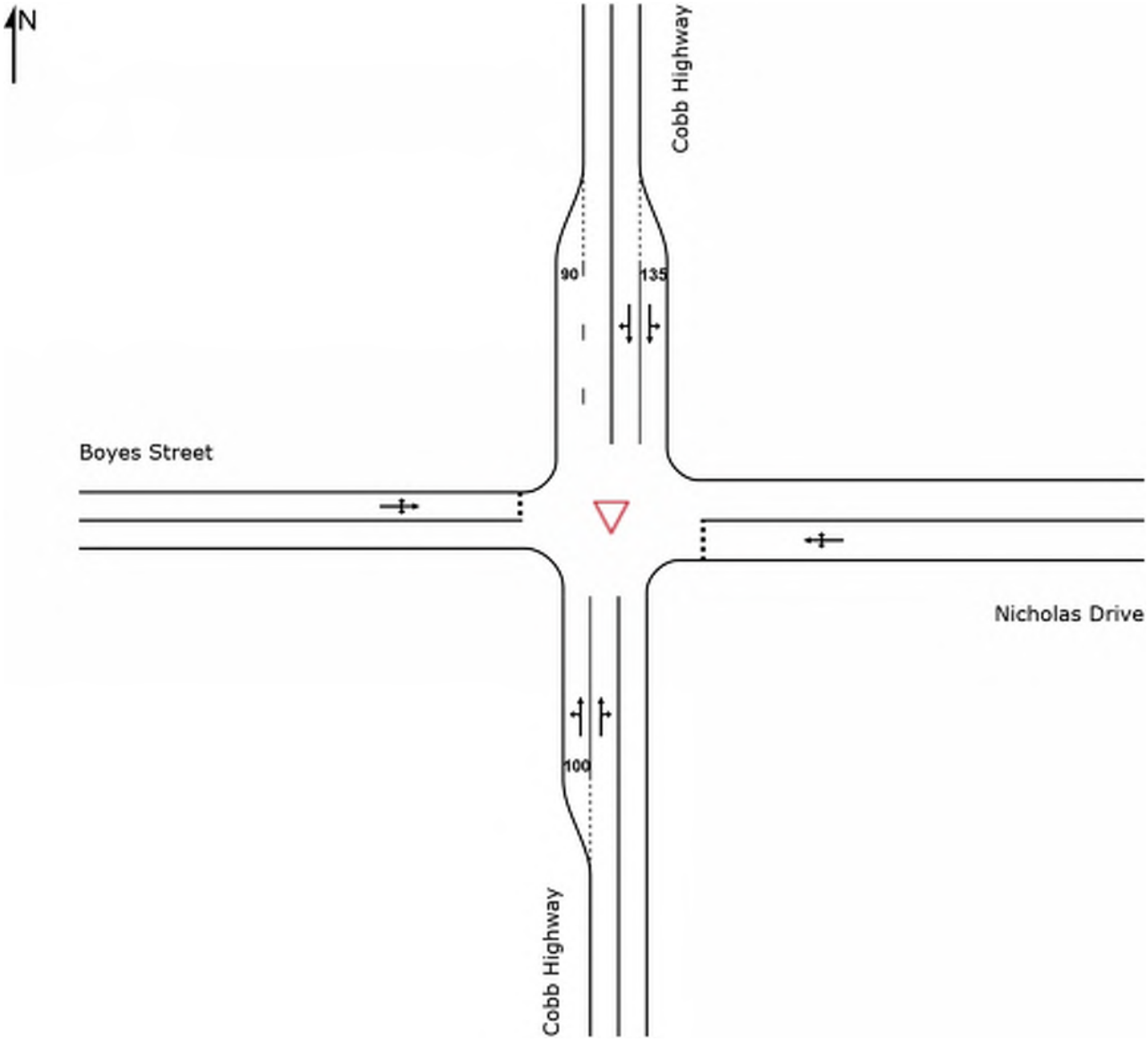
1 Reduced capacity due to a short lane effect. Short lane queues may extend into the full-length lanes. Some upstream delays at entry to short lanes are not included.
6 Lane under-utilisation due to downstream effects
N4 Average back of queue has been restricted to the available queue storage space.

Site: [Existing before Development - Cobb Highway / Boyes Street - AM]

Network: 10 [Network Existing before Development - AM]

Site Category: -
Giveway / Yield (Two-Way)

Site Layout



Lane Use and Performance

	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	Aver. Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Cobb Highway															
Lane 1	93	2.8	93	2.8	1841	0.051	49[6]	4.2	LOS A	0.0	0.0	Short	100	0.0	NA
Lane 2	146	4.1	146	4.1	1421	0.103	100	3.8	LOS A	0.2	1.4	Full	685	0.0	0.0
Approach	239	3.6	239	3.6		0.103		3.9	NA	0.2	1.4				
East: Nicholas Drive															
Lane 1	274	2.0	274	2.0	1123	0.244	100	5.2	LOS A	0.4	3.1	Full	500	0.0	0.0
Approach	274	2.0	274	2.0		0.244		5.2	LOS A	0.4	3.1				
North: Cobb Highway															
Lane 1	42	2.0	42	2.0	1841	0.023	66[5]	4.6	LOS A	0.0	0.0	Short	135	0.0	NA
Lane 2	61	9.0	61	9.0	1750	0.035	100	0.7	LOS A	0.0	0.2	Full	500	0.0	0.0
Approach	103	6.2	103	6.2		0.035		2.3	NA	0.0	0.2				
West: Boyes Street															
Lane 1	100	2.0	100	2.0	468	0.214	100	10.6	LOS B	0.3	2.4	Full	240	0.0	0.0
Approach	100	2.0	100	2.0		0.214		10.6	LOS B	0.3	2.4				
Intersection	716	3.1	716	3.1		0.244		5.1	NA	0.4	3.1				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
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.

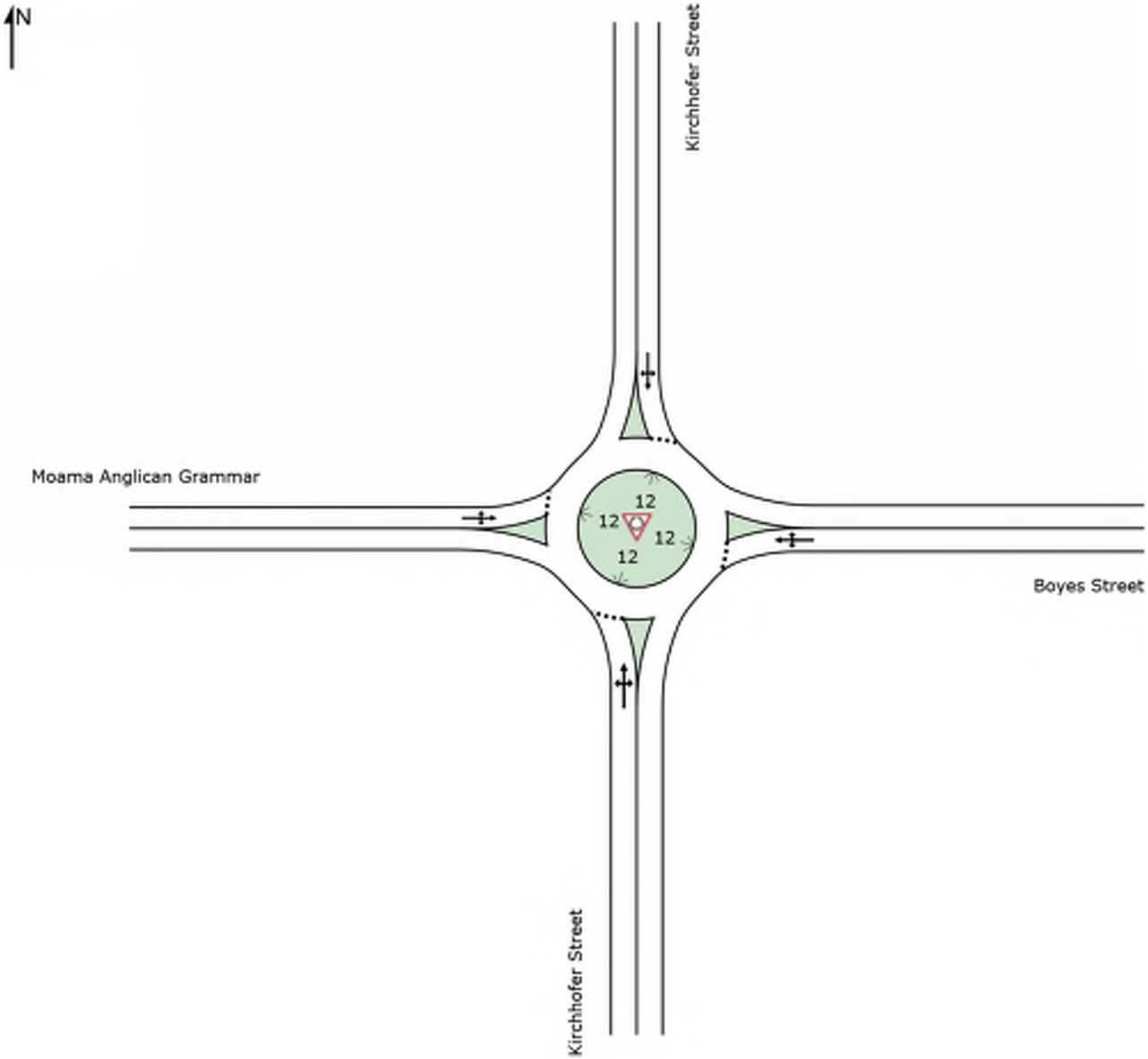
5 Lane under-utilisation found by the program
6 Lane under-utilisation due to downstream effects

Site: [Existing before Development - Kirchhofer Street / Boyes Street - AM]

Network: 10 [Network Existing before Development - AM]

Site Category: -
Roundabout

Site Layout



Lane Use and Performance

	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	Aver. Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Kirchhofer Street															
Lane 1[d]	77	2.0	77	2.0	1355	0.057	100	5.7	LOS A	0.1	0.8	Full	680	0.0	0.0
Approach	77	2.0	77	2.0		0.057		5.7	LOS A	0.1	0.8				
East: Boyes Street															
Lane 1[d]	67	2.0	67	2.0	1365	0.049	100	3.6	LOS A	0.1	0.8	Full	240	0.0	0.0
Approach	67	2.0	67	2.0		0.049		3.6	LOS A	0.1	0.8				
North: Kirchhofer Street															
Lane 1[d]	3	0.0	3	0.0	1221	0.003	100	5.0	LOS A	0.0	0.0	Full	230	0.0	0.0
Approach	3	0.0	3	0.0		0.003		5.0	LOS A	0.0	0.0				
West: Moama Anglican Grammar															
Lane 1[d]	43	2.0	43	2.0	1256	0.034	100	4.1	LOS A	0.1	0.5	Full	30	0.0	0.0
Approach	43	2.0	43	2.0		0.034		4.1	LOS A	0.1	0.5				
Intersection	191	1.9	191	1.9		0.057		4.5	LOS A	0.1	0.8				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
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.

d Dominant lane on roundabout approach

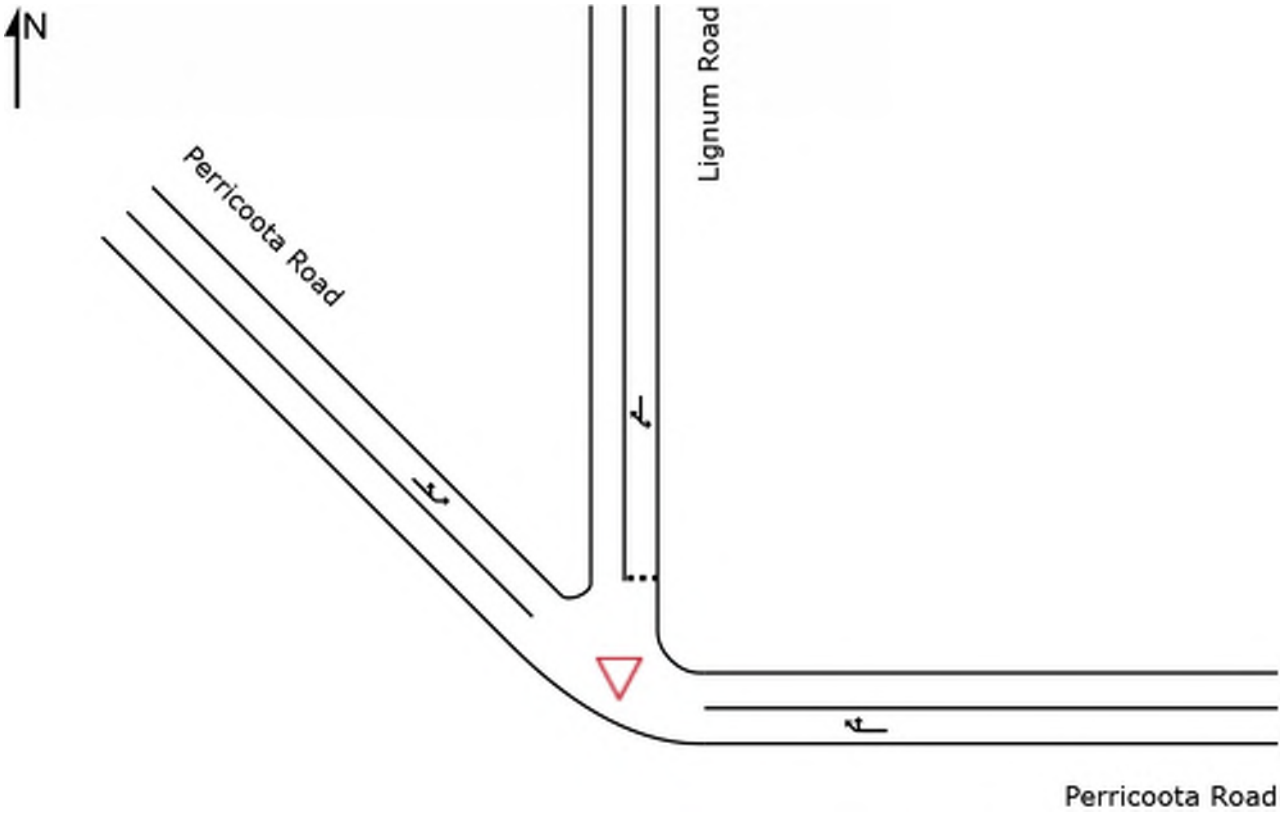
USER REPORT FOR NETWORK SITE

Project: 180880_SIDRA_190801 | **Template: Site User Report**

Site: [Existing before Development - Perricoota Road / Lignum Road Intersection - PM] | **Network: 12 [Network Existing before Development - PM]**

New Site
Site Category: -
Giveway / Yield (Two-Way)

Site Layout



Lane Use and Performance

	Demand Flows		Arrival Flows		Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	Aver. Back of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	Total veh/h	HV %	Total veh/h	HV %	veh/h	v/c	%	sec		Veh	Dist m		m	%	%
East: Perricoota Road															
Lane 1	782	5.0	782	5.0	1849	0.423	100	6.2	LOS A	0.0	0.3	Full	790	0.0	0.0
Approach	782	5.0	782	5.0		0.423		6.2	NA	0.0	0.3				
North: Lignum Road															
Lane 1	6	2.0	6	2.0	376	0.017	100	12.4	LOS B	0.0	0.1	Full	540	0.0	0.0
Approach	6	2.0	6	2.0		0.017		12.4	LOS B	0.0	0.1				
NorthWest: Perricoota Road															
Lane 1	521	5.0	521	5.0	1856	0.281	100	6.2	LOS A	0.0	0.0	Full	450	0.0	0.0
Approach	521	5.0	521	5.0		0.281		6.2	NA	0.0	0.0				
Intersection	1309	5.0	1309	5.0		0.423		6.2	NA	0.0	0.3				

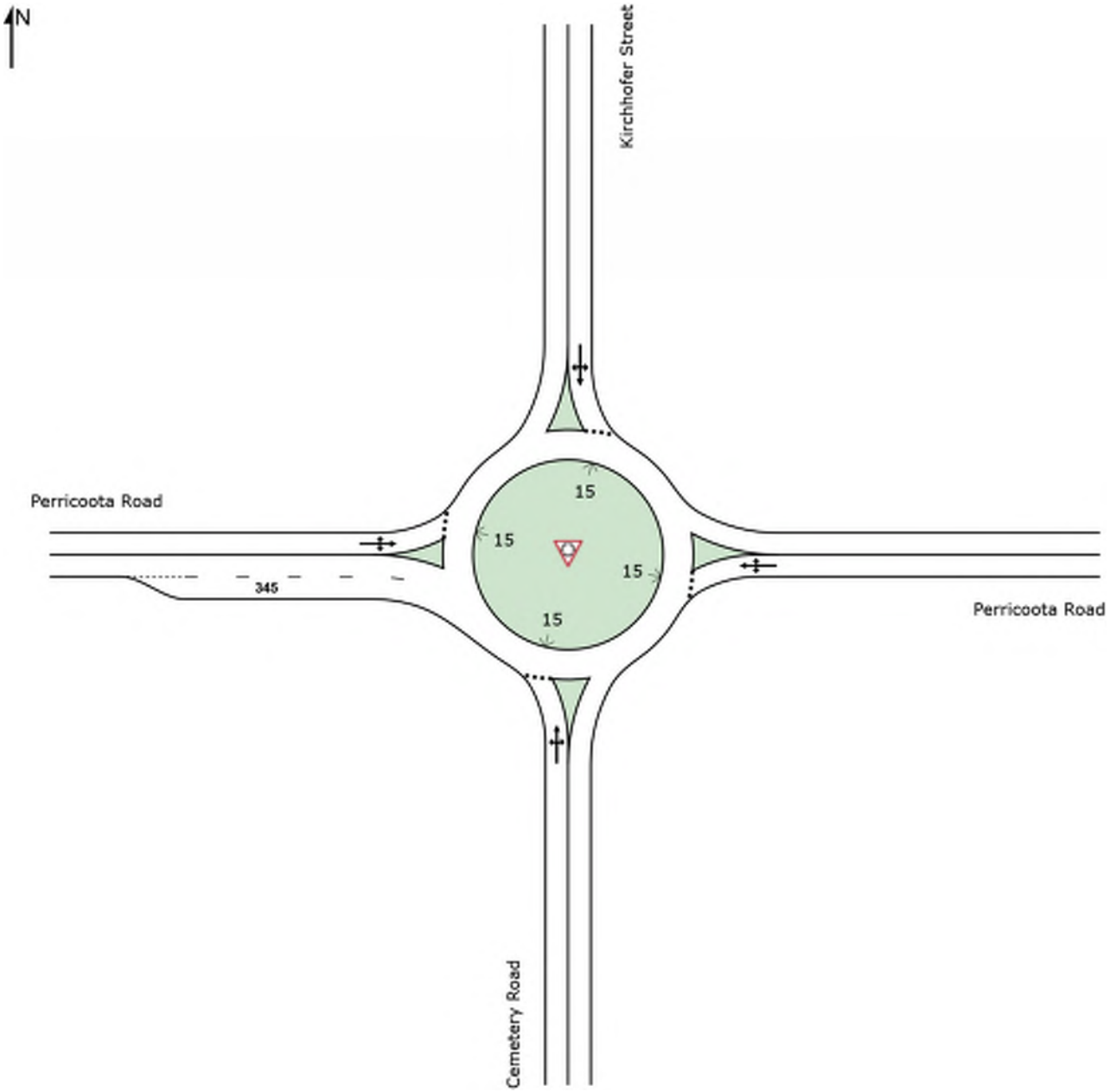
Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
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.

Site: [Existing before Development - Perricoota Road / Kirchhofer Street Intersection - PM]

Network: 12 [Network Existing before Development - PM]

New Site
Site Category: -
Roundabout

Site Layout



Lane Use and Performance

	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	Aver. Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Cemetery Road															
Lane 1[d]	3	0.0	3	0.0	608	0.005	100	9.9	LOS A	0.0	0.1	Full	200	-9.5[N3]	0.0
Approach	3	0.0	3	0.0		0.005		9.9	LOS A	0.0	0.1				
East: Perricoota Road															
Lane 1[d]	793	4.7	793	4.7	1634	0.485	100	3.7	LOS A	2.0	14.7	Full	235	0.0	0.0
Approach	793	4.7	793	4.7		0.485		3.7	LOS A	2.0	14.7				
North: Kirchhofer Street															
Lane 1[d]	77	2.0	77	2.0	678	0.113	100	6.4	LOS A	0.2	1.4	Full	680	-21.9[N3]	0.0
Approach	77	2.0	77	2.0		0.113		6.4	LOS A	0.2	1.4				
West: Perricoota Road															
Lane 1[d]	528	4.7	528	4.7	1050	0.503	100	3.9	LOS A	1.2	8.7	Full	790	-22.1[N3]	0.0
Approach	528	4.7	528	4.7		0.503		3.9	LOS A	1.2	8.7				
Intersection	1401	4.5	1401	4.5		0.503		3.9	LOS A	2.0	14.7				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
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.

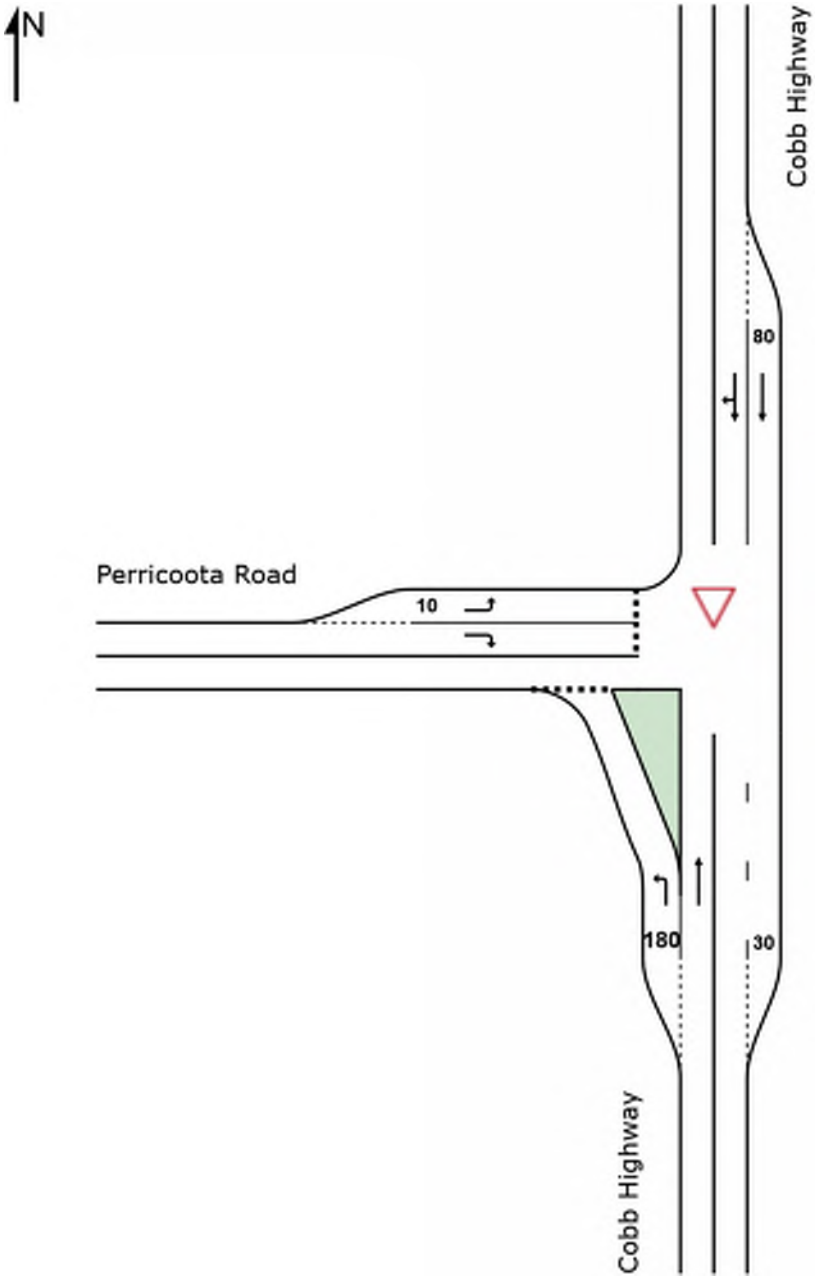
d Dominant lane on roundabout approach
N3 Capacity Adjustment due to downstream lane blockage determined by the program.

Site: [Existing before Development - Cobb Highway / Perricoota Road Intersection - PM]

Network: 12 [Network Existing before Development - PM]

New Site
Site Category: -
Giveway / Yield (Two-Way)

Site Layout



Lane Use and Performance

	Demand Flows		Arrival Flows		Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	Aver. Back of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	Total veh/h	HV %	Total veh/h	HV %	veh/h	v/c	%	sec		Veh	Dist m		m	%	%
South: Cobb Highway															
Lane 1	802	5.0	802	5.0	2061	0.389	100	4.6	LOS A	1.1	7.8	Short	180	0.0	NA
Lane 2	263	10.0	263	10.0	1841	0.143	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	1065	6.2	1065	6.2		0.389		3.4	LOS A	1.1	7.8				
North: Cobb Highway															
Lane 1	58	10.0	58	10.0	1841	0.031	24[6]	0.0	LOS A	0.0	0.0	Short	80	0.0	NA
Lane 2	241	9.9	241	9.9	1840	0.131	100	0.1	LOS A	0.0	0.1	Full	685	0.0	0.0
Approach	299	9.9	299	9.9		0.131		0.1	NA	0.0	0.1				
West: Perricoota Road															
Lane 1	32	5.0	32	5.0	1641	0.019	100	5.3	LOS A	0.0	0.3	Short	10	0.0	NA
Lane 2	496	5.0	496	5.0	424[1]	1.170	100	178.2	LOS F	22.0	160.7	Full	235	0.0	23.9
Approach	527	5.0	527	5.0		1.170		167.8	LOS F	22.0	160.7				
Intersection	1892	6.5	1892	6.5		1.170		48.7	NA	22.0	160.7				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
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.

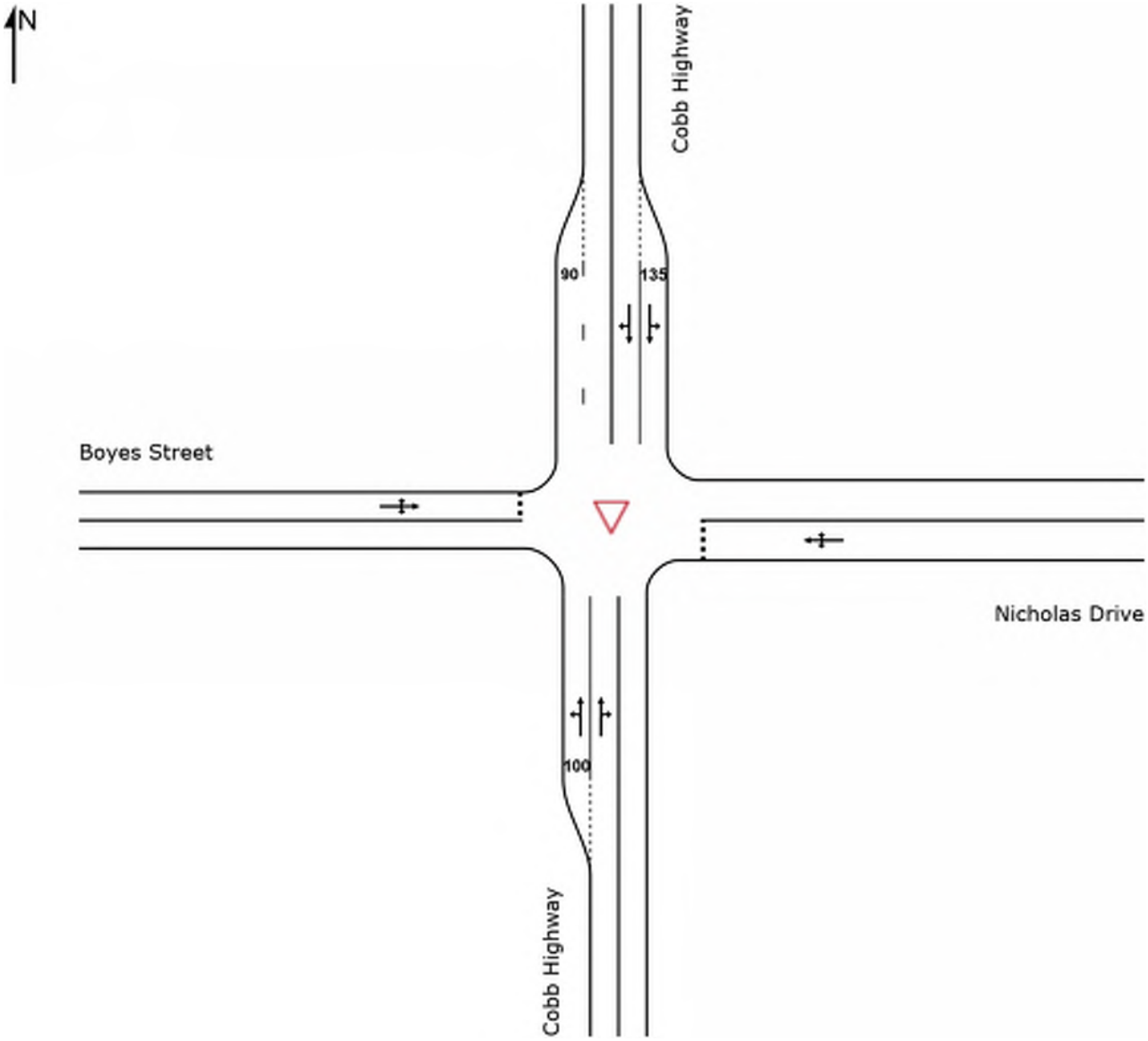
1 Reduced capacity due to a short lane effect. Short lane queues may extend into the full-length lanes. Some upstream delays at entry to short lanes are not included.
6 Lane under-utilisation due to downstream effects

Site: [Existing before Development - Cobb Highway / Boyes Street - PM]

Network: 12 [Network Existing before Development - PM]

Site Category: -
Giveway / Yield (Two-Way)

Site Layout



Lane Use and Performance

	Demand Flows		Arrival Flows		Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	Aver. Back of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	Total veh/h	HV %	Total veh/h	HV %	veh/h	v/c	%	sec		Veh	Dist m		m	%	%
South: Cobb Highway															
Lane 1	137	2.7	137	2.7	1841	0.074	49[6]	4.2	LOS A	0.0	0.0	Short	100	0.0	NA
Lane 2	221	4.2	221	4.2	1457	0.152	100	3.6	LOS A	0.3	2.1	Full	685	0.0	0.0
Approach	358	3.6	358	3.6		0.152		3.8	NA	0.3	2.1				
East: Nicholas Drive															
Lane 1	182	2.0	182	2.0	1103	0.165	100	5.2	LOS A	0.3	1.9	Full	500	0.0	0.0
Approach	182	2.0	182	2.0		0.165		5.2	LOS A	0.3	1.9				
North: Cobb Highway															
Lane 1	28	2.0	28	2.0	1841	0.015	65[5]	4.6	LOS A	0.0	0.0	Short	135	0.0	NA
Lane 2	41	9.0	41	9.0	1723	0.024	100	0.8	LOS A	0.0	0.1	Full	500	0.0	0.0
Approach	69	6.1	69	6.1		0.024		2.4	NA	0.0	0.1				
West: Boyes Street															
Lane 1	67	2.0	67	2.0	478	0.141	100	10.1	LOS B	0.2	1.5	Full	240	0.0	0.0
Approach	67	2.0	67	2.0		0.141		10.1	LOS B	0.2	1.5				
Intersection	677	3.3	677	3.3		0.165		4.7	NA	0.3	2.1				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
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.

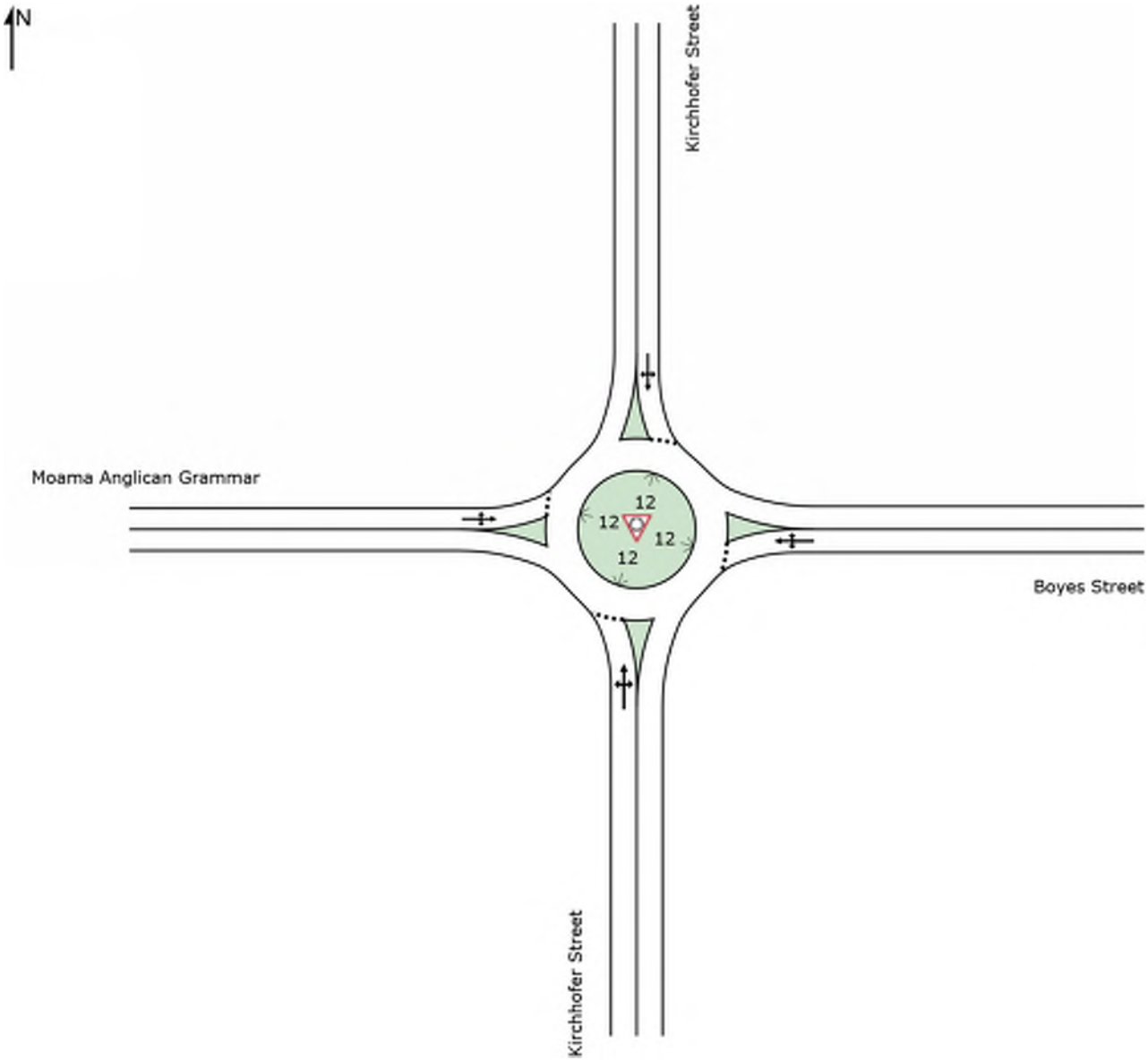
5 Lane under-utilisation found by the program
6 Lane under-utilisation due to downstream effects

Site: [Existing before Development - Kirchhofer Street / Boyes Street - PM]

Network: 12 [Network Existing before Development - PM]

Site Category: -
Roundabout

Site Layout



Lane Use and Performance

	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	Aver. Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Kirchhofer Street															
Lane 1[d]	115	2.0	115	2.0	1338	0.086	100	5.8	LOS A	0.2	1.2	Full	680	0.0	0.0
Approach	115	2.0	115	2.0		0.086		5.8	LOS A	0.2	1.2				
East: Boyes Street															
Lane 1[d]	101	2.0	101	2.0	1351	0.075	100	3.6	LOS A	0.2	1.2	Full	240	0.0	0.0
Approach	101	2.0	101	2.0		0.075		3.6	LOS A	0.2	1.2				
North: Kirchhofer Street															
Lane 1[d]	3	0.0	3	0.0	1168	0.003	100	5.3	LOS A	0.0	0.0	Full	230	0.0	0.0
Approach	3	0.0	3	0.0		0.003		5.3	LOS A	0.0	0.0				
West: Moama Anglican Grammar															
Lane 1[d]	64	2.0	64	2.0	1224	0.052	100	4.2	LOS A	0.1	0.8	Full	30	0.0	0.0
Approach	64	2.0	64	2.0		0.052		4.2	LOS A	0.1	0.8				
Intersection	283	2.0	283	2.0		0.086		4.6	LOS A	0.2	1.2				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
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.

d Dominant lane on roundabout approach

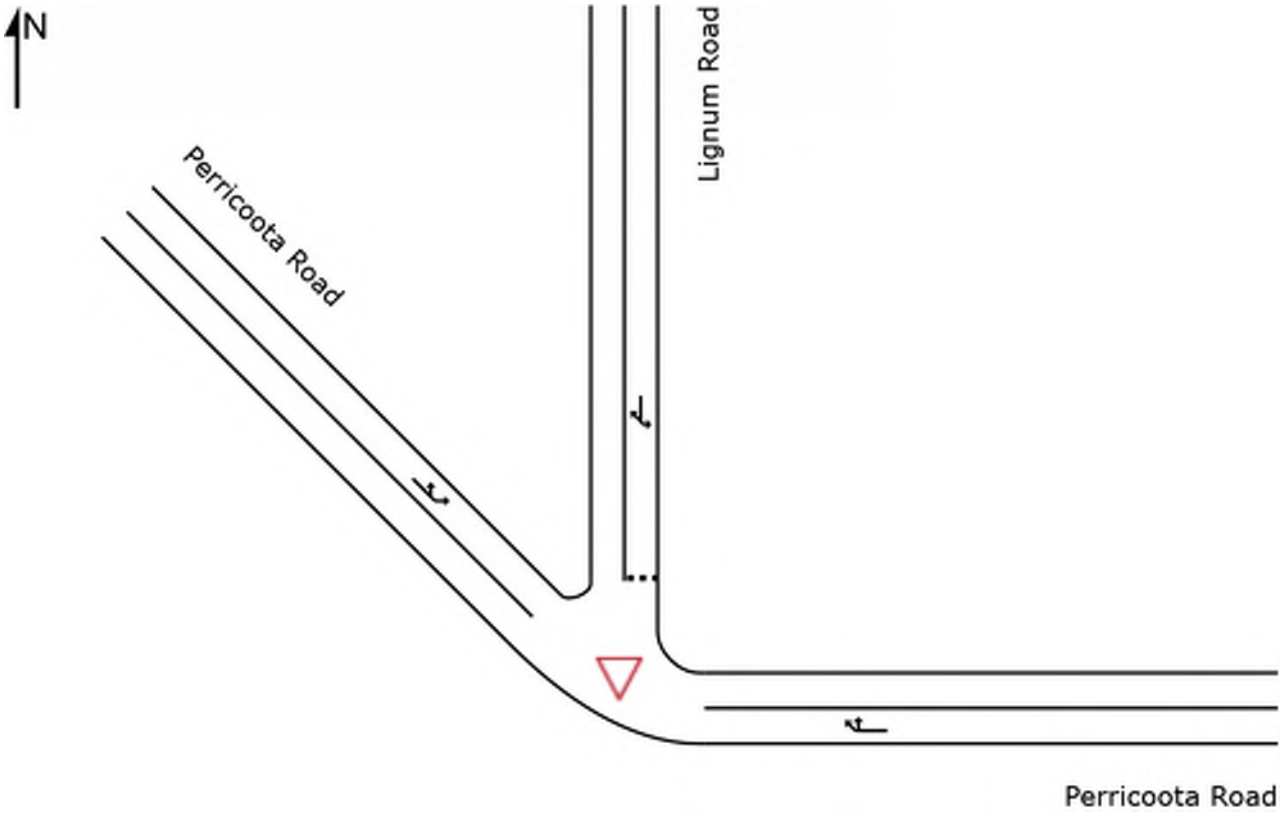
USER REPORT FOR NETWORK SITE

Project: 180880_SIDRA_190801 | **Template: Site User Report**

Site: [Projected without Development - Perricoota Road / Lignum Road Intersection - AM] | **Network: 11 [Network Projected without Development - AM]**

New Site
Site Category: -
Giveway / Yield (Two-Way)

Site Layout



Lane Use and Performance

	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	Aver. Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
East: Perricoota Road															
Lane 1	722	5.0	722	5.0	1812	0.398	100	6.6	LOS A	0.1	0.9	Full	790	0.0	0.0
Approach	722	5.0	722	5.0		0.398		6.6	NA	0.1	0.9				
North: Lignum Road															
Lane 1	13	2.0	13	2.0	95	0.133	100	32.4	LOS D	0.1	0.8	Full	540	-18.3 N3	0.0
Approach	13	2.0	13	2.0		0.133		32.4	LOS D	0.1	0.8				
NorthWest: Perricoota Road															
Lane 1	1084	5.0	1084	5.0	1284	0.845	100	6.7	LOS A	0.0	0.0	Full	450	-30.8 N3	0.0
Approach	1084	5.0	1084	5.0		0.845		6.7	NA	0.0	0.0				
Intersection	1819	5.0	1819	5.0		0.845		6.8	NA	0.1	0.9				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
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.

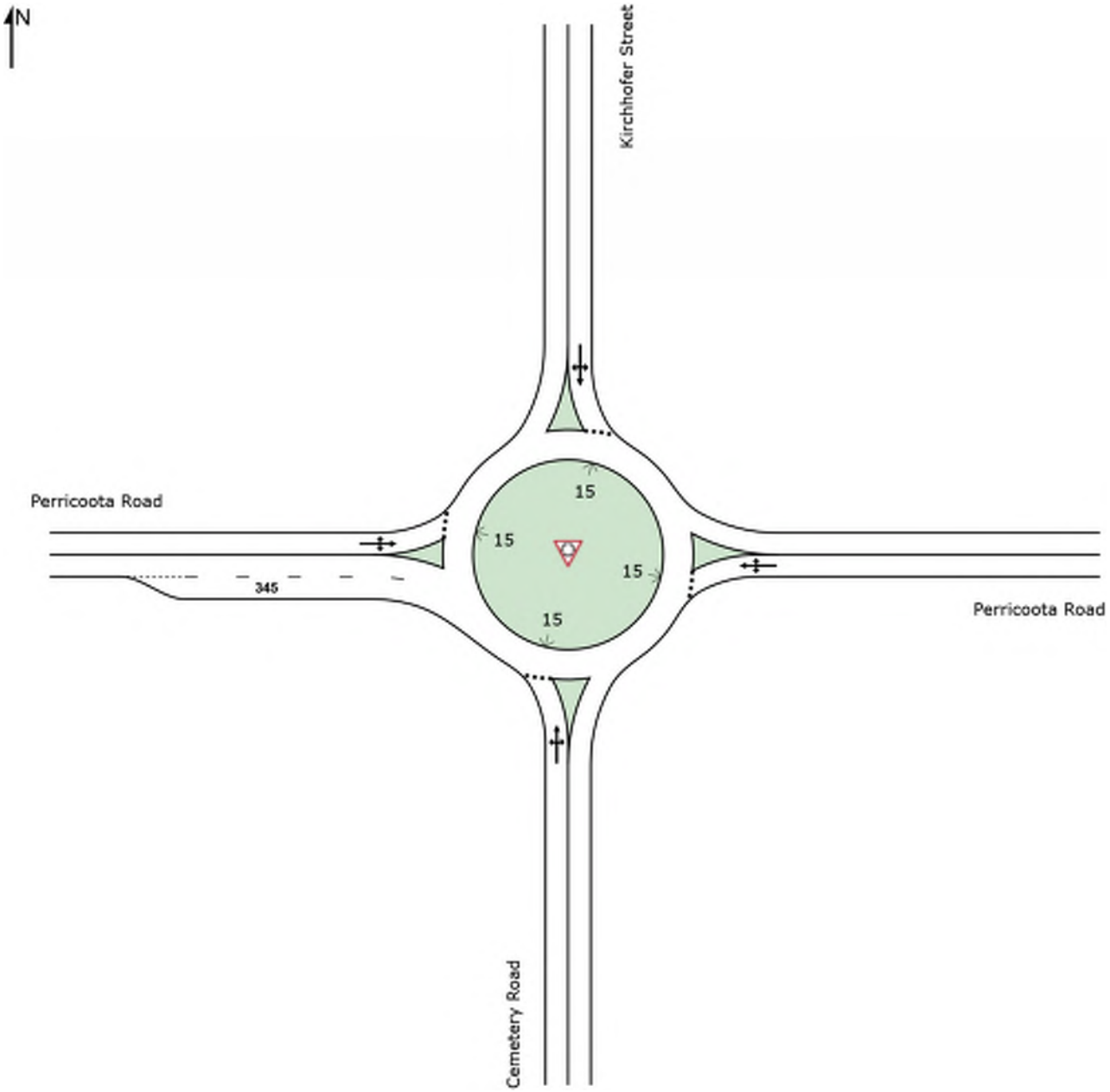
N3 Capacity Adjustment due to downstream lane blockage determined by the program.

Site: [Projected without Development - Perricoota Road / Kirchhofer Street Intersection - AM]

Network: 11 [Network Projected without Development - AM]

New Site
Site Category: -
Roundabout

Site Layout



Lane Use and Performance

	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	Aver. Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Cemetery Road															
Lane 1[d]	3	0.0	3	0.0	523	0.006	100	9.3	LOS A	0.0	0.1	Full	200	-25.0[N3]	0.0
Approach	3	0.0	3	0.0		0.006		9.3	LOS A	0.0	0.1				
East: Perricoota Road															
Lane 1[d]	731	4.7	730	4.7	1579	0.463	100	3.7	LOS A	2.0	14.5	Full	235	0.0	0.0
Approach	731	4.7	730	4.7		0.463		3.7	LOS A	2.0	14.5				
North: Kirchhofer Street															
Lane 1[d]	158	2.0	157	2.0	318	0.495	100	10.4	LOS B	0.8	5.8	Full	680	-47.1[N3]	0.0
Approach	158	2.0	157[N1]	2.0		0.495		10.4	LOS B	0.8	5.8				
West: Perricoota Road															
Lane 1[d]	1085	4.7	1085	4.7	748	1.452	100	415.9	LOS F	104.1	758.3	Full	790	-47.3[N3]	45.6
Approach	1085	4.7	1085	4.7		1.452		415.9	LOS F	104.1	758.3				
Intersection	1977	4.5	1976[N1]	4.5		1.452		230.7	LOS F	104.1	758.3				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
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.

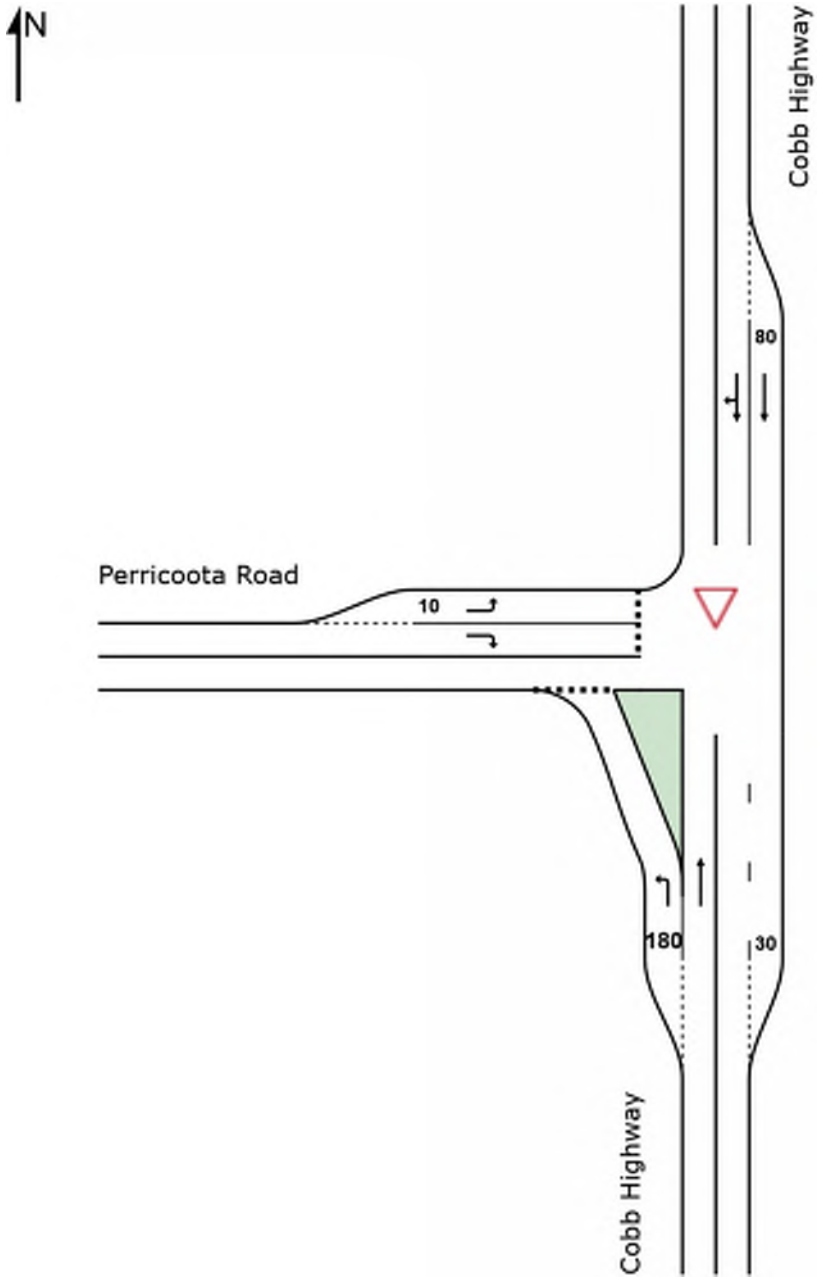
d Dominant lane on roundabout approach
N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.
N3 Capacity Adjustment due to downstream lane blockage determined by the program.

Site: [Projected without Development - Cobb Highway / Perricoota Road Intersection - AM]

Network: 11 [Network Projected without Development - AM]

New Site
Site Category: -
Giveway / Yield (Two-Way)

Site Layout



Lane Use and Performance

	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	Aver. Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Cobb Highway															
Lane 1	740	5.0	740	5.0	1588	0.466	100	4.6	LOS A	1.3	9.2	Short	180	0.0	NA
Lane 2	364	10.0	364	10.0	1841	0.198	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	1104	6.6	1104	6.6		0.466		3.1	LOS A	1.3	9.2				
North: Cobb Highway															
Lane 1	120	10.0	119	10.1	1840	0.065	24[6]	0.0	LOS A	0.0	0.0	Short	80	0.0	NA
Lane 2	501	9.9	496	10.0	1827	0.272	100	0.1	LOS A	0.0	0.2	Full	685	0.0	0.0
Approach	621	9.9	615[N1]	10.0		0.272		0.1	NA	0.0	0.2				
West: Perricoota Road															
Lane 1	66	5.0	53	5.0	1105	0.048	100	6.0	LOS A	0.1	0.5	Short	10	0.0	NA
Lane 2	1029	5.0	828	5.0	152	5.437	100	4008.5	LOS F	32.2[N4]	234.9[N4]	Full	235	0.0	49.9
Approach	1096	5.0	881[N1]	5.0		5.437		3766.2	LOS F	32.2	234.9				
Intersection	2821	6.7	2601[N1]	7.3		5.437		1277.7	NA	32.2	234.9				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
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.

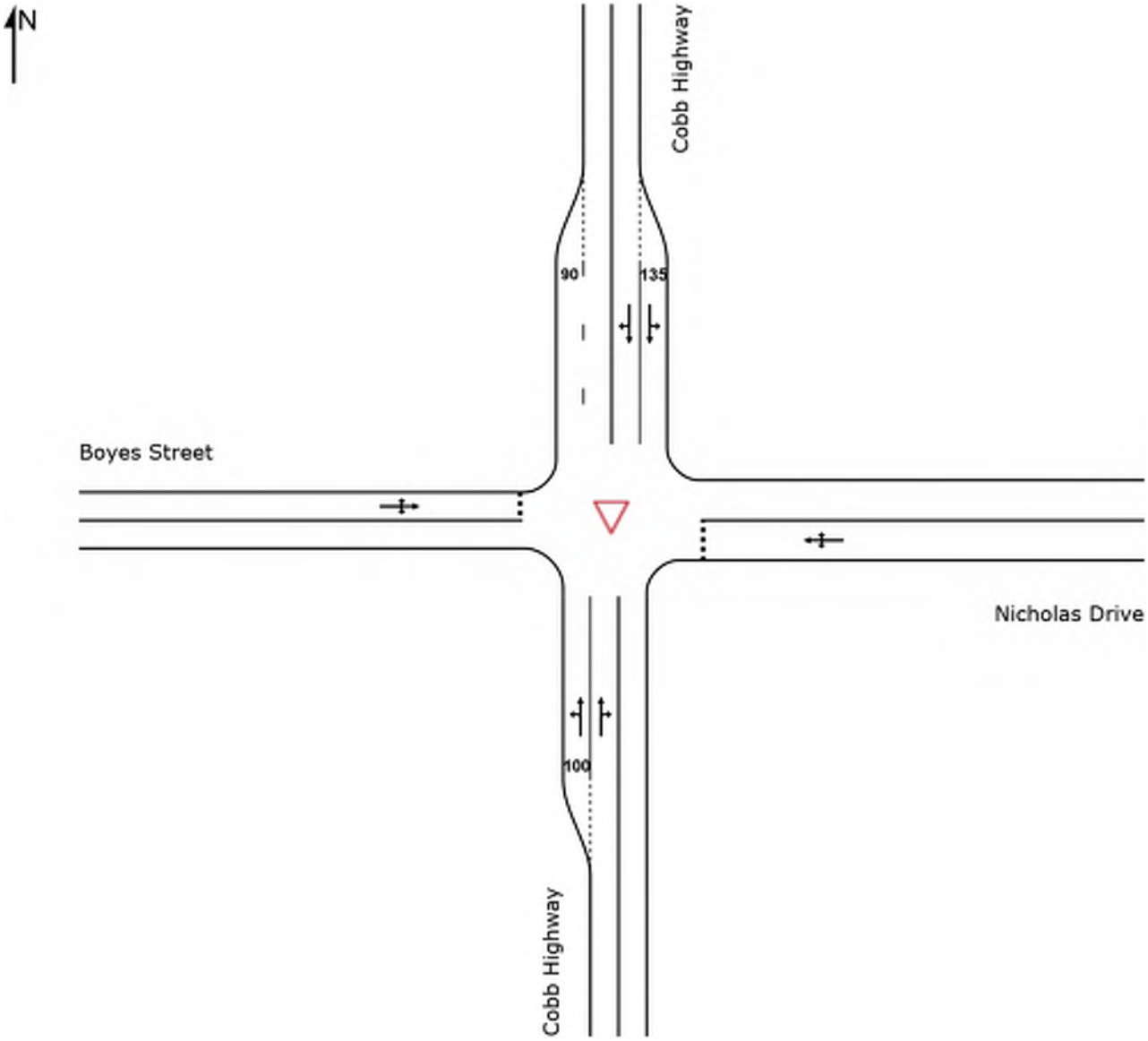
6 Lane under-utilisation due to downstream effects
N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.
N4 Average back of queue has been restricted to the available queue storage space.

Site: [Projected without Development - Cobb Highway / Boyes Street - AM]

Network: 11 [Network Projected without Development - AM]

Site Category: -
Giveway / Yield (Two-Way)

Site Layout



Lane Use and Performance

	Demand Flows		Arrival Flows		Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	Aver. Back of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	Total veh/h	HV %	Total veh/h	HV %	veh/h	v/c	%	sec		Veh	Dist m		m	%	%
South: Cobb Highway															
Lane 1	131	2.9	128	3.0	1840	0.069	49[6]	4.0	LOS A	0.0	0.0	Short	100	0.0	NA
Lane 2	200	4.0	195	4.1	1379	0.141	100	4.0	LOS A	0.3	1.9	Full	685	0.0	0.0
Approach	332	3.6	322[N1]	3.6		0.141		4.0	NA	0.3	1.9				
East: Nicholas Drive															
Lane 1	379	2.0	379	2.0	1062	0.357	100	5.7	LOS A	0.7	5.0	Full	500	0.0	0.0
Approach	379	2.0	379	2.0		0.357		5.7	LOS A	0.7	5.0				
North: Cobb Highway															
Lane 1	58	2.0	58	2.0	1841	0.031	66[5]	4.6	LOS A	0.0	0.0	Short	135	0.0	NA
Lane 2	83	9.1	83	9.1	1742	0.048	100	0.7	LOS A	0.0	0.2	Full	500	0.0	0.0
Approach	141	6.2	141	6.2		0.048		2.3	NA	0.0	0.2				
West: Boyes Street															
Lane 1	139	2.0	131	2.0	334	0.394	100	17.5	LOS C	0.7	5.3	Full	240	0.0	0.0
Approach	139	2.0	131[N1]	2.0		0.394		17.5	LOS C	0.7	5.3				
Intersection	991	3.1	974[N1]	3.2		0.394		6.2	NA	0.7	5.3				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Lane LOS values are based on average delay per lane.
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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.

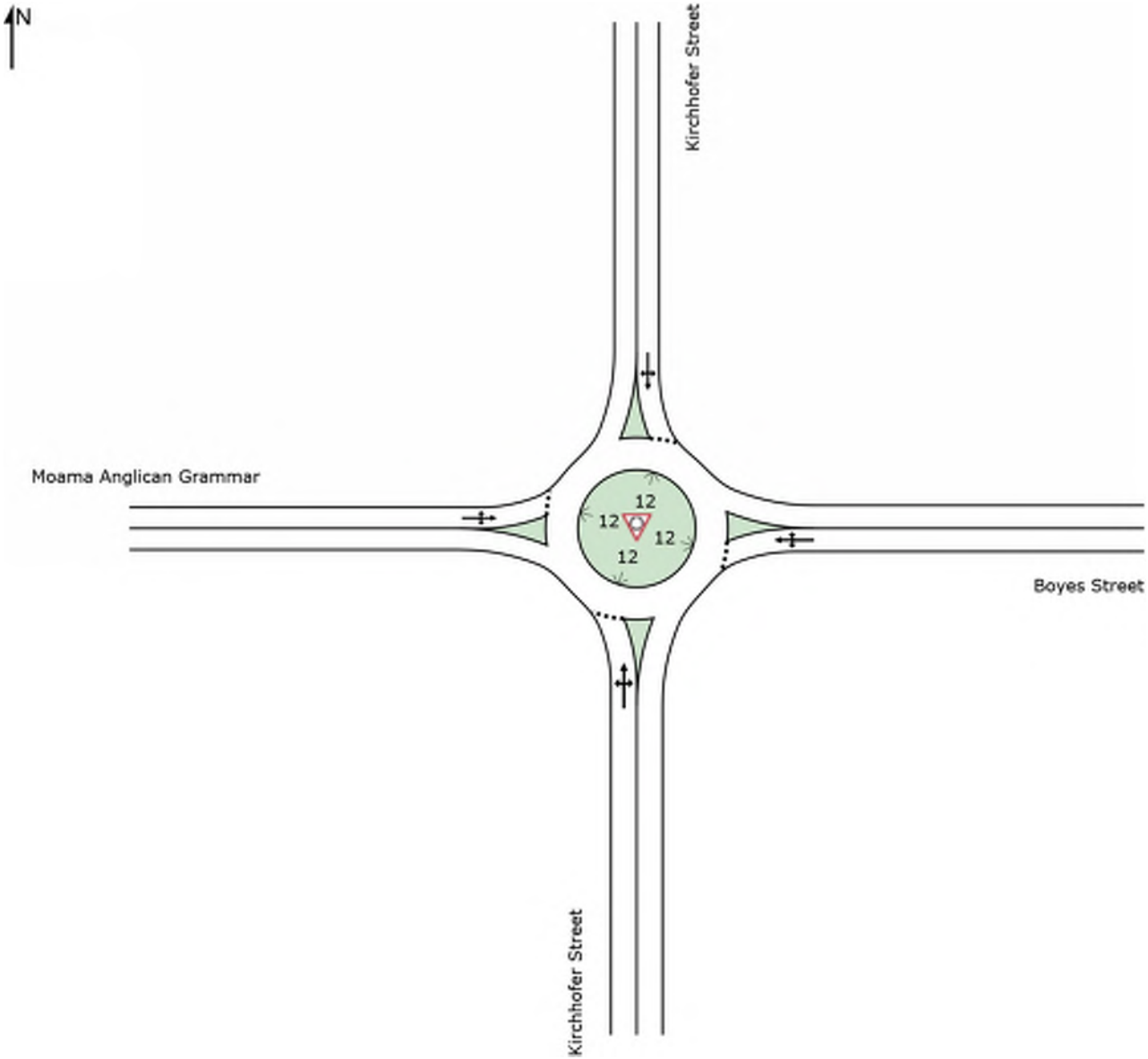
5 Lane under-utilisation found by the program
6 Lane under-utilisation due to downstream effects
N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

Site: [Projected without Development - Kirchhofer Street / Boyes Street - AM]

Network: 11 [Network Projected without Development - AM]

Site Category: -
Roundabout

Site Layout



Lane Use and Performance

	Demand Flows		Arrival Flows		Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	Aver. Back of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	Total veh/h	HV %	Total veh/h	HV %	veh/h	v/c	%	sec		Veh	Dist m		m	%	%
South: Kirchhofer Street															
Lane 1[d]	106	2.0	92	2.0	1333	0.069	100	5.7	LOS A	0.1	1.0	Full	680	0.0	0.0
Approach	106	2.0	92[N1]	2.0		0.069		5.7	LOS A	0.1	1.0				
East: Boyes Street															
Lane 1[d]	93	2.0	91	2.0	1351	0.067	100	3.6	LOS A	0.1	1.1	Full	240	0.0	0.0
Approach	93	2.0	91[N1]	2.0		0.067		3.6	LOS A	0.1	1.1				
North: Kirchhofer Street															
Lane 1[d]	3	0.0	3	0.0	1189	0.003	100	5.2	LOS A	0.0	0.0	Full	230	0.0	0.0
Approach	3	0.0	3	0.0		0.003		5.2	LOS A	0.0	0.0				
West: Moama Anglican Grammar															
Lane 1[d]	60	2.0	60	2.0	1243	0.048	100	4.1	LOS A	0.1	0.8	Full	30	0.0	0.0
Approach	60	2.0	60	2.0		0.048		4.1	LOS A	0.1	0.8				
Intersection	262	2.0	246[N1]	2.1		0.069		4.5	LOS A	0.1	1.1				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
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.

d Dominant lane on roundabout approach
N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

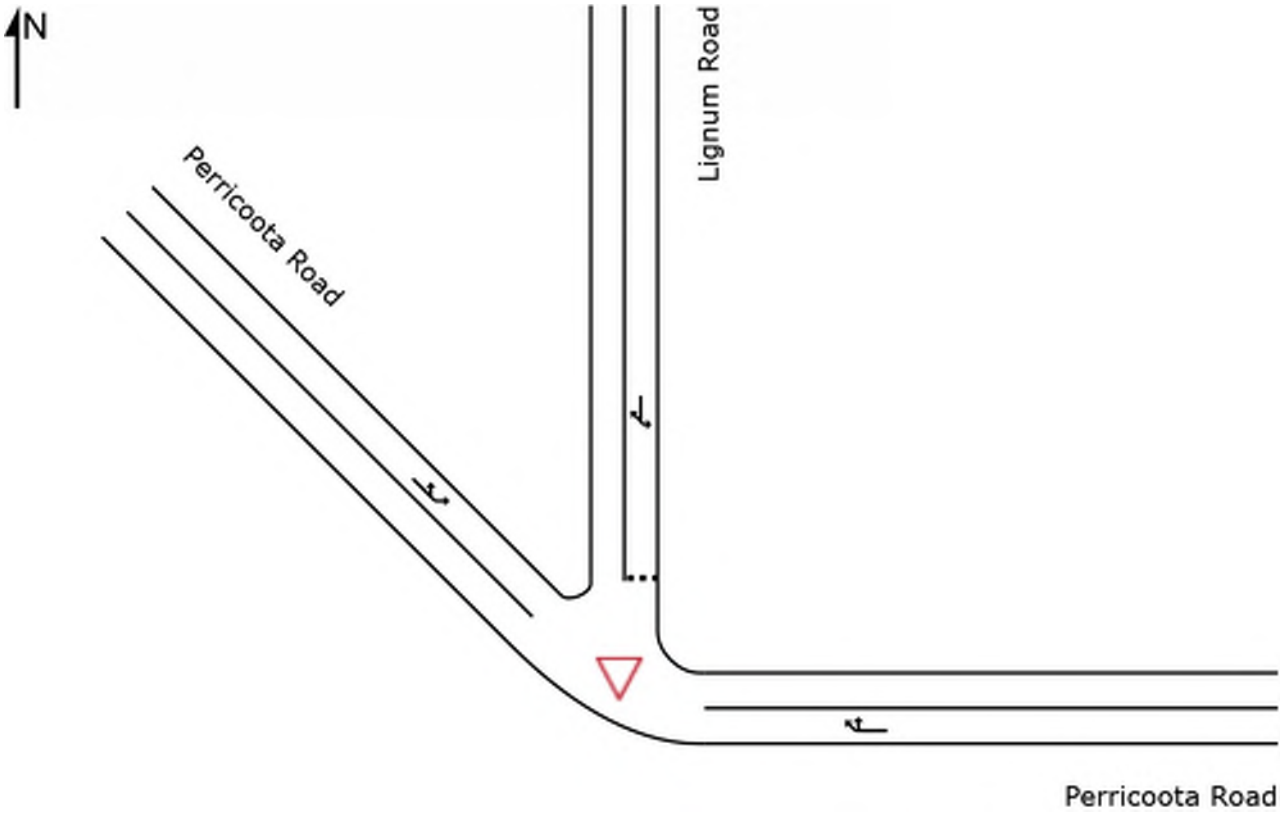
USER REPORT FOR NETWORK SITE

Project: 180880_SIDRA_190801 | **Template: Site User Report**

Site: [Projected without Development - Perricoota Road / Lignum Road Intersection - PM] | **Network: 13 [Network Projected without Development - PM]**

New Site
Site Category: -
Giveway / Yield (Two-Way)

Site Layout



Lane Use and Performance

	Demand Flows		Arrival Flows		Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	Aver. Back of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	Total veh/h	HV %	Total veh/h	HV %	veh/h	v/c	%	sec		Veh	Dist m		m	%	%
East: Perricoota Road															
Lane 1	1083	5.0	1083	5.0	1841	0.588	100	6.3	LOS A	0.1	0.8	Full	790	0.0	0.0
Approach	1083	5.0	1083	5.0		0.588		6.3	NA	0.1	0.8				
North: Lignum Road															
Lane 1	8	2.0	8	2.0	128	0.066	100	29.3	LOS D	0.1	0.5	Full	540	0.0	0.0
Approach	8	2.0	8	2.0		0.066		29.3	LOS D	0.1	0.5				
NorthWest: Perricoota Road															
Lane 1	722	5.0	722	5.0	1856	0.389	100	6.2	LOS A	0.0	0.0	Full	450	0.0	0.0
Approach	722	5.0	722	5.0		0.389		6.2	NA	0.0	0.0				
Intersection	1814	5.0	1814	5.0		0.588		6.4	NA	0.1	0.8				

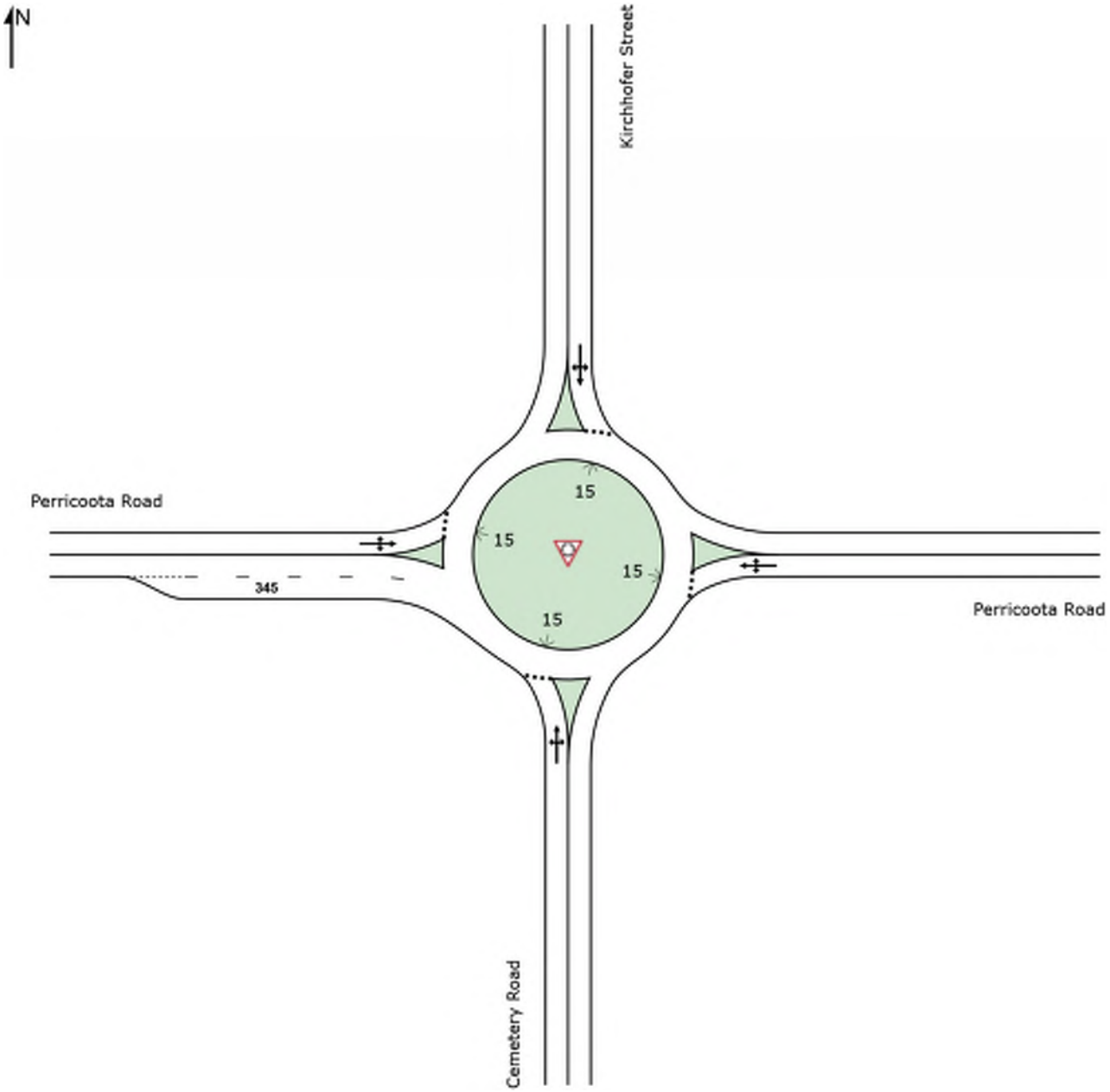
Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
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.

Site: [Projected without Development - Perricoota Road / Kirchhofer Street Intersection - PM]

Network: 13 [Network Projected without Development - PM]

New Site
Site Category: -
Roundabout

Site Layout



Lane Use and Performance

	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	Aver. Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Cemetery Road															
Lane 1[d]	3	0.0	3	0.0	342	0.009	100	15.3	LOS B	0.0	0.1	Full	200	-25.0[N3]	0.0
Approach	3	0.0	3	0.0		0.009		15.3	LOS B	0.0	0.1				
East: Perricoota Road															
Lane 1[d]	1097	4.7	1097	4.7	1628	0.674	100	3.8	LOS A	4.3	31.0	Full	235	0.0	0.0
Approach	1097	4.7	1097	4.7		0.674		3.8	LOS A	4.3	31.0				
North: Kirchhofer Street															
Lane 1[d]	105	2.0	105	2.0	347	0.303	100	7.7	LOS A	0.4	3.2	Full	680	-47.0[N3]	0.0
Approach	105	2.0	105	2.0		0.303		7.7	LOS A	0.4	3.2				
West: Perricoota Road															
Lane 1[d]	731	4.7	731	4.7	687	1.064	100	72.9	LOS F	22.2	161.4	Full	790	-47.3[N3]	0.0
Approach	731	4.7	731	4.7		1.064		72.9	LOS F	22.2	161.4				
Intersection	1936	4.5	1936	4.5		1.064		30.1	LOS C	22.2	161.4				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
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.

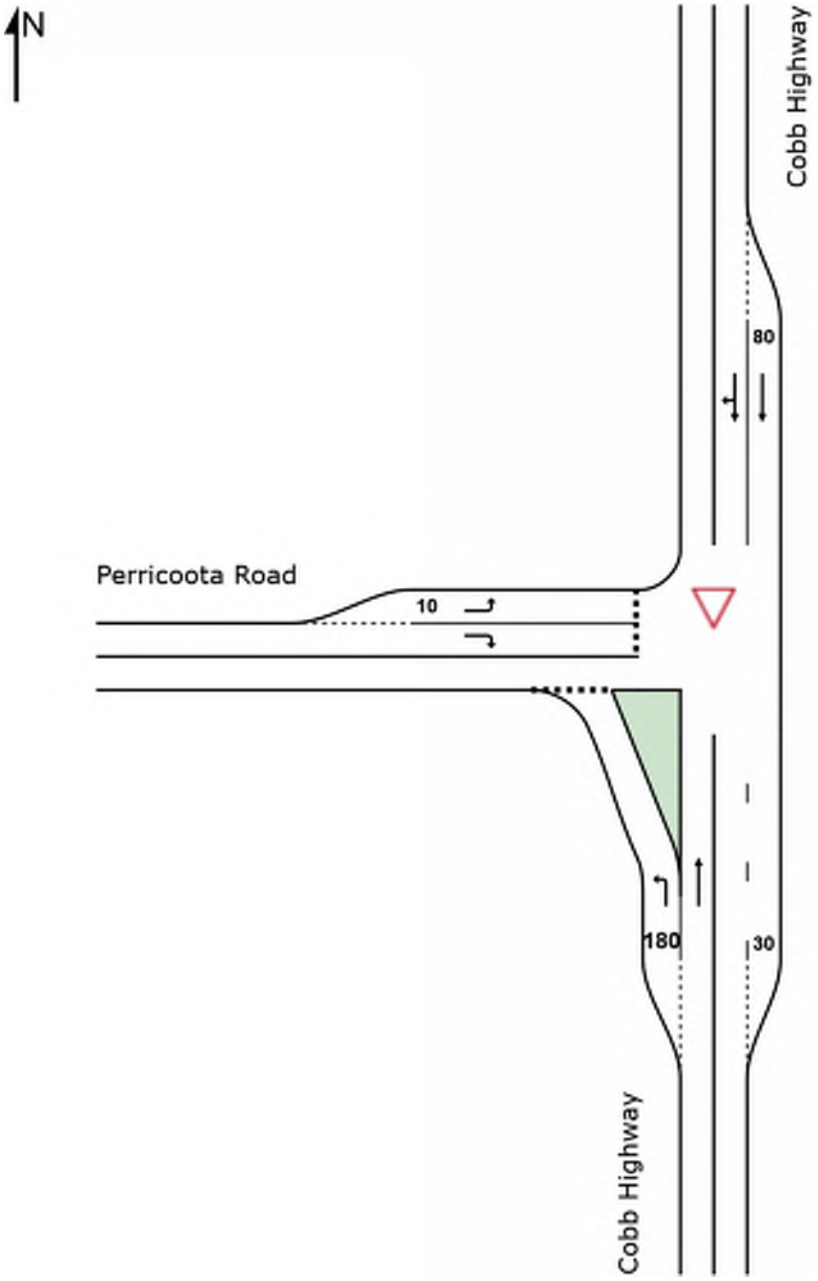
d Dominant lane on roundabout approach
N3 Capacity Adjustment due to downstream lane blockage determined by the program.

Site: [Projected without Development - Cobb Highway / Perricoota Road Intersection - PM]

Network: 13 [Network Projected without Development - PM]

New Site
Site Category: -
Giveway / Yield (Two-Way)

Site Layout



Lane Use and Performance

	Demand Flows		Arrival Flows		Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	Aver. Back of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	Total veh/h	HV %	Total veh/h	HV %	veh/h	v/c	%	sec		Veh	Dist m		m	%	%
South: Cobb Highway															
Lane 1	1109	5.0	1109	5.0	1591	0.697	100	4.6	LOS A	3.0	22.1	Short	180	0.0	NA
Lane 2	364	10.0	364	10.0	1841	0.198	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	1474	6.2	1474	6.2		0.697		3.5	LOS A	3.0	22.1				
North: Cobb Highway															
Lane 1	80	10.0	80	10.0	1841	0.044	24[6]	0.0	LOS A	0.0	0.0	Short	80	0.0	NA
Lane 2	334	9.9	334	9.9	1828	0.183	100	0.1	LOS A	0.0	0.1	Full	685	0.0	0.0
Approach	415	9.9	415	9.9		0.183		0.1	NA	0.0	0.1				
West: Perricoota Road															
Lane 1	44	5.0	44	5.0	1104	0.040	100	6.0	LOS A	0.1	0.4	Short	10	0.0	NA
Lane 2	686	5.0	686	5.0	154	4.455	100	3126.5	LOS F	32.2[N4]	234.9[N4]	Full	235	0.0	49.9
Approach	731	5.0	731	5.0		4.455		2937.7	LOS F	32.2	234.9				
Intersection	2619	6.5	2619	6.5		4.455		821.4	NA	32.2	234.9				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
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NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
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.

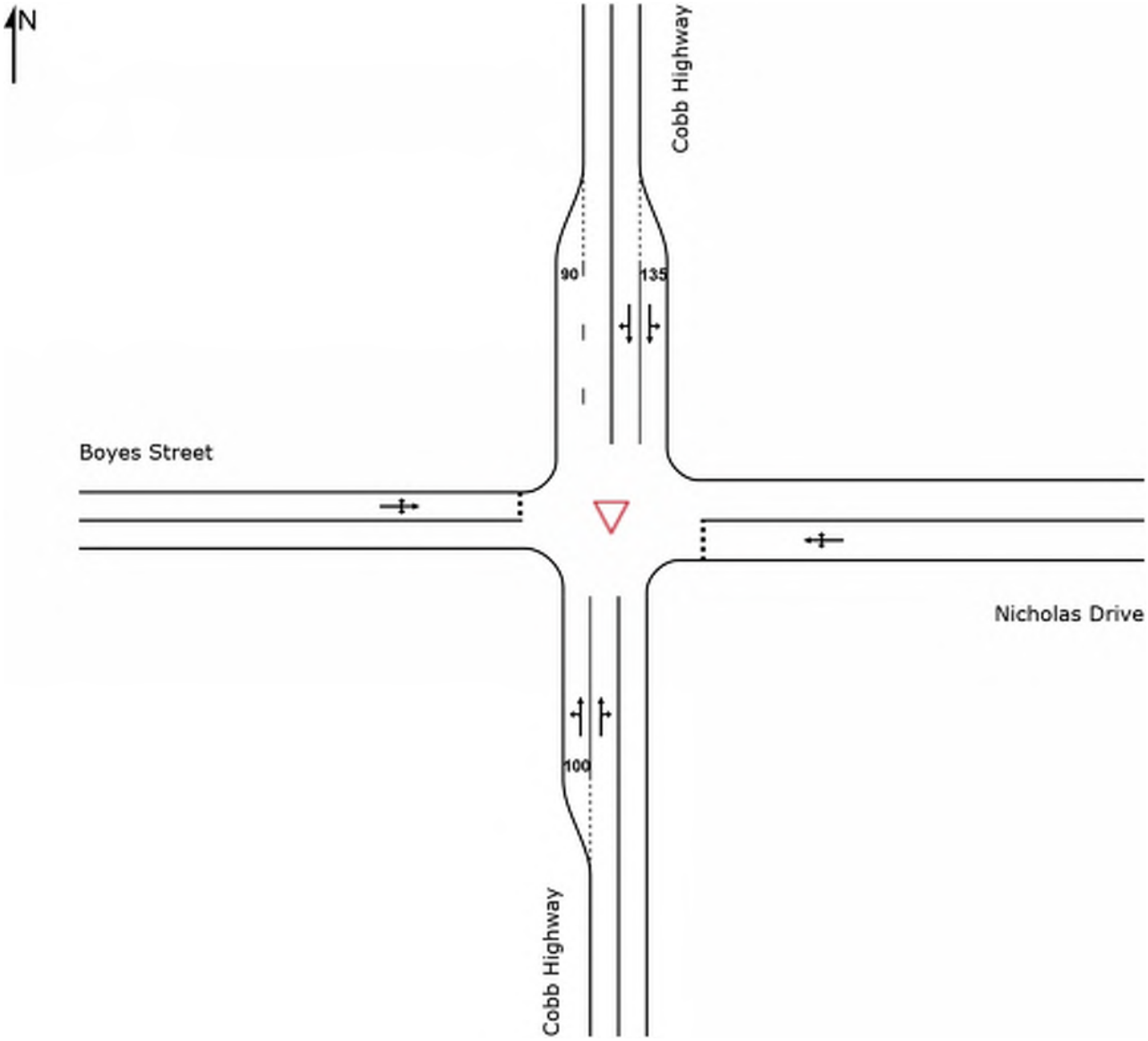
6 Lane under-utilisation due to downstream effects
N4 Average back of queue has been restricted to the available queue storage space.

Site: [Projected without Development - Cobb Highway / Boyes Street - PM]

Network: 13 [Network Projected without Development - PM]

Site Category: -
Giveway / Yield (Two-Way)

Site Layout



Lane Use and Performance

	Demand Flows		Arrival Flows		Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	Aver. Back of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	Total veh/h	HV %	Total veh/h	HV %	veh/h	v/c	%	sec		Veh	Dist m		m	%	%
South: Cobb Highway															
Lane 1	192	2.8	192	2.8	1841	0.104	49[6]	4.2	LOS A	0.0	0.0	Short	100	0.0	NA
Lane 2	304	4.1	304	4.1	1429	0.212	100	3.8	LOS A	0.4	3.1	Full	685	0.0	0.0
Approach	496	3.6	496	3.6		0.212		3.9	NA	0.4	3.1				
East: Nicholas Drive															
Lane 1	253	2.0	253	2.0	1022	0.247	100	5.7	LOS A	0.4	3.0	Full	500	0.0	0.0
Approach	253	2.0	253	2.0		0.247		5.7	LOS A	0.4	3.0				
North: Cobb Highway															
Lane 1	39	2.0	39	2.0	1841	0.021	65[5]	4.6	LOS A	0.0	0.0	Short	135	0.0	NA
Lane 2	56	9.1	56	9.1	1712	0.033	100	0.8	LOS A	0.0	0.2	Full	500	0.0	0.0
Approach	95	6.2	95	6.2		0.033		2.4	NA	0.0	0.2				
West: Boyes Street															
Lane 1	94	2.0	94	2.0	342	0.274	100	15.2	LOS C	0.4	3.2	Full	240	0.0	0.0
Approach	94	2.0	94	2.0		0.274		15.2	LOS C	0.4	3.2				
Intersection	937	3.3	937	3.3		0.274		5.4	NA	0.4	3.2				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
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Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

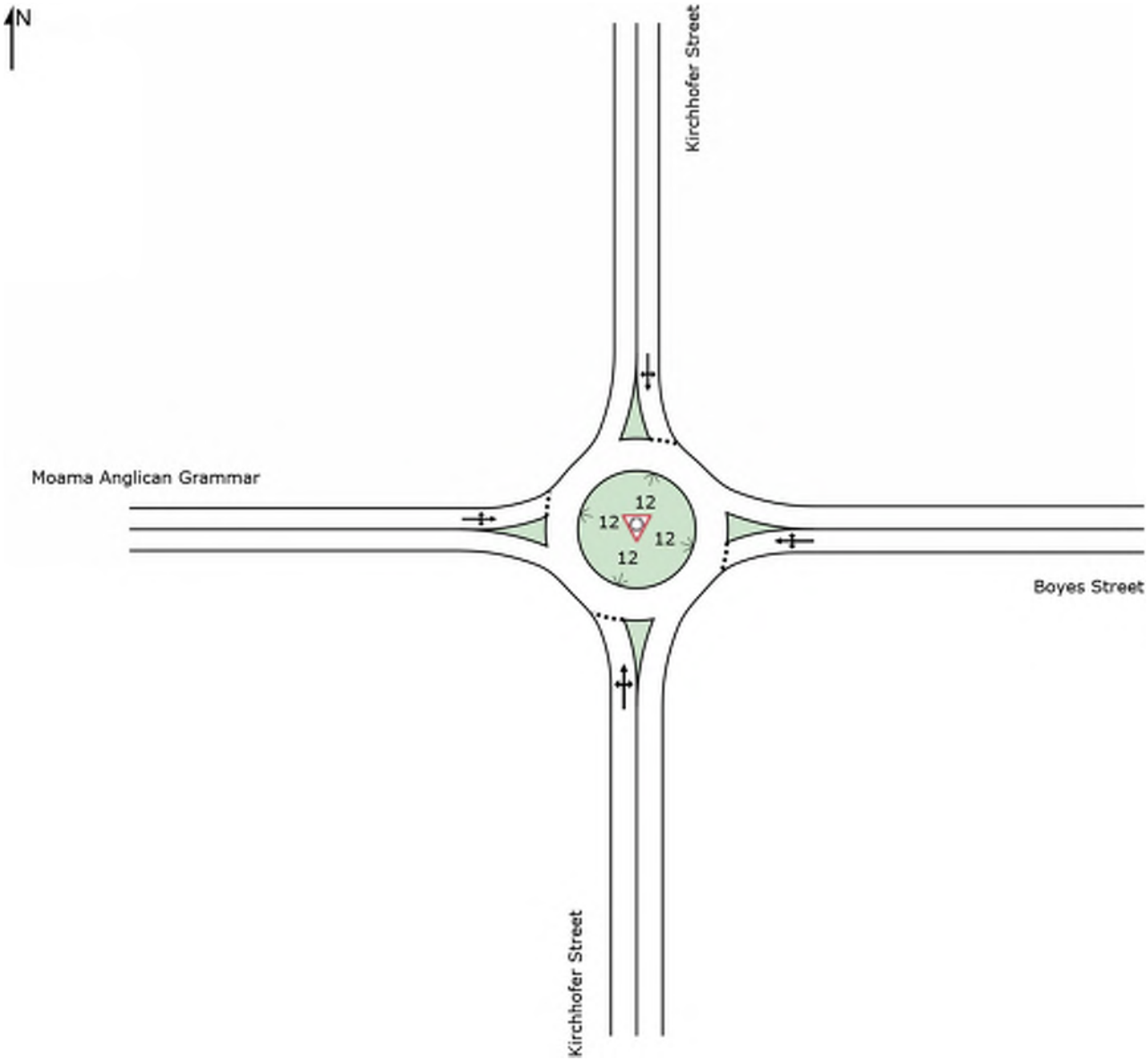
5 Lane under-utilisation found by the program
6 Lane under-utilisation due to downstream effects

Site: [Projected without Development - Kirchhofer Street / Boyes Street - PM]

Network: 13 [Network Projected without Development - PM]

Site Category: -
Roundabout

Site Layout



Lane Use and Performance

	Demand Flows		Arrival Flows		Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	Aver. Back of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	Total veh/h	HV %	Total veh/h	HV %	veh/h	v/c	%	sec		Veh	Dist m		m	%	%
South: Kirchhofer Street															
Lane 1[d]	158	2.0	158	2.0	1321	0.120	100	5.8	LOS A	0.3	1.8	Full	680	0.0	0.0
Approach	158	2.0	158	2.0		0.120		5.8	LOS A	0.3	1.8				
East: Boyes Street															
Lane 1[d]	139	2.0	139	2.0	1333	0.104	100	3.7	LOS A	0.2	1.7	Full	240	0.0	0.0
Approach	139	2.0	139	2.0		0.104		3.7	LOS A	0.2	1.7				
North: Kirchhofer Street															
Lane 1[d]	3	0.0	3	0.0	1113	0.003	100	5.5	LOS A	0.0	0.0	Full	230	0.0	0.0
Approach	3	0.0	3	0.0		0.003		5.5	LOS A	0.0	0.0				
West: Moama Anglican Grammar															
Lane 1[d]	89	2.0	89	2.0	1190	0.075	100	4.4	LOS A	0.2	1.2	Full	30	0.0	0.0
Approach	89	2.0	89	2.0		0.075		4.4	LOS A	0.2	1.2				
Intersection	389	2.0	389	2.0		0.120		4.7	LOS A	0.3	1.8				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
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.

d Dominant lane on roundabout approach

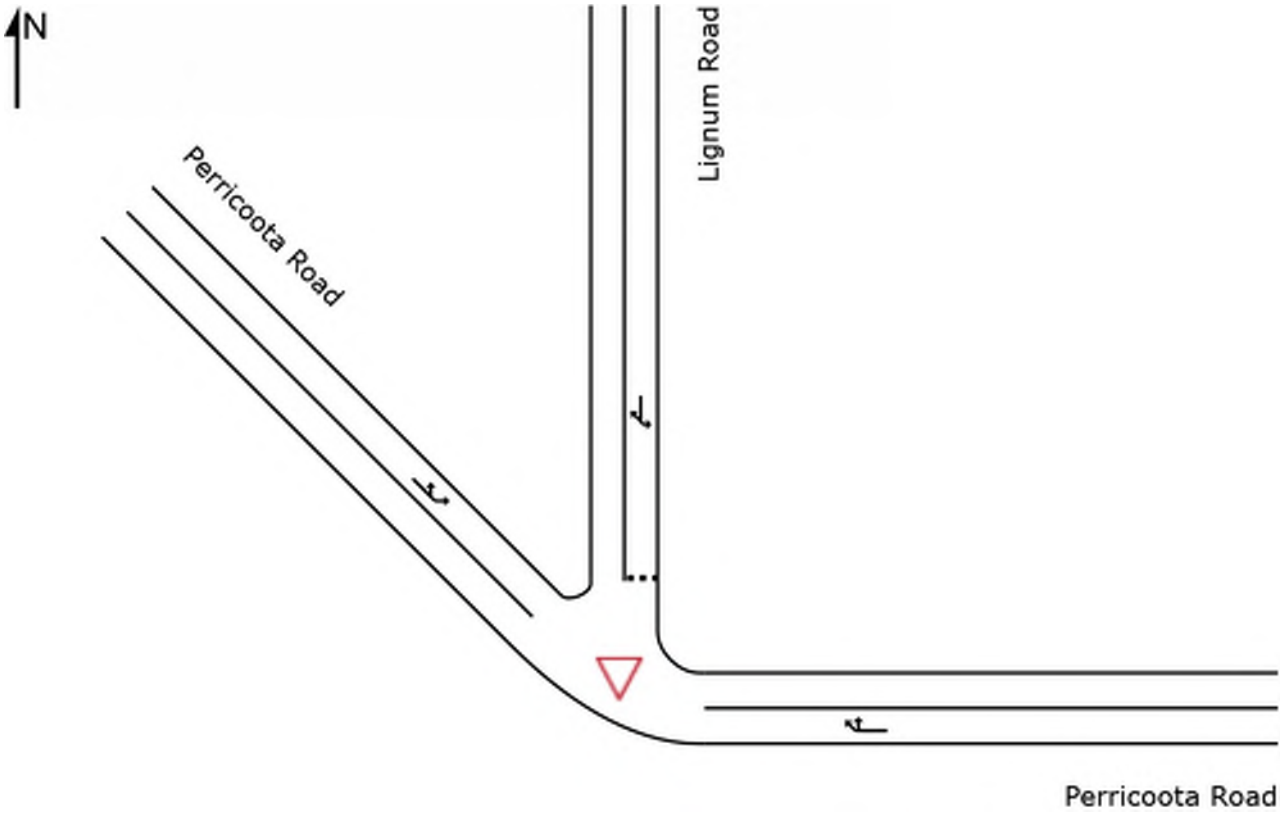
USER REPORT FOR NETWORK SITE

Project: 180880_SIDRA_190801 | **Template: Site User Report**

Site: [Projected with Development - Perricoota Road / Lignum Road Intersection - AM] | **Network: 8 [Network Projected with Development - AM]**

New Site
Site Category: -
Giveway / Yield (Two-Way)

Site Layout



Lane Use and Performance

	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	Aver. Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
East: Perricoota Road															
Lane 1	864	4.5	864	4.5	1082	0.798	100	23.0	LOS C	6.0	43.3	Full	790	0.0	0.0
Approach	864	4.5	864	4.5		0.798		23.0	NA	6.0	43.3				
North: Lignum Road															
Lane 1	258	2.0	258	2.0	107	2.421	100	1302.0	LOS F	39.7	282.7	Full	540	-46.8 N3	13.4
Approach	258	2.0	258	2.0		2.421		1302.0	LOS F	39.7	282.7				
NorthWest: Perricoota Road															
Lane 1	1103	4.9	1103	4.9	1852	0.596	100	6.3	LOS A	16.5 N5	120.4 N5	Full	450	0.0	20.8
Approach	1103	4.9	1103	4.9		0.596		6.3	NA	16.5	120.4				
Intersection	2225	4.4	2225	4.4		2.421		162.9	NA	39.7	282.7				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
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.

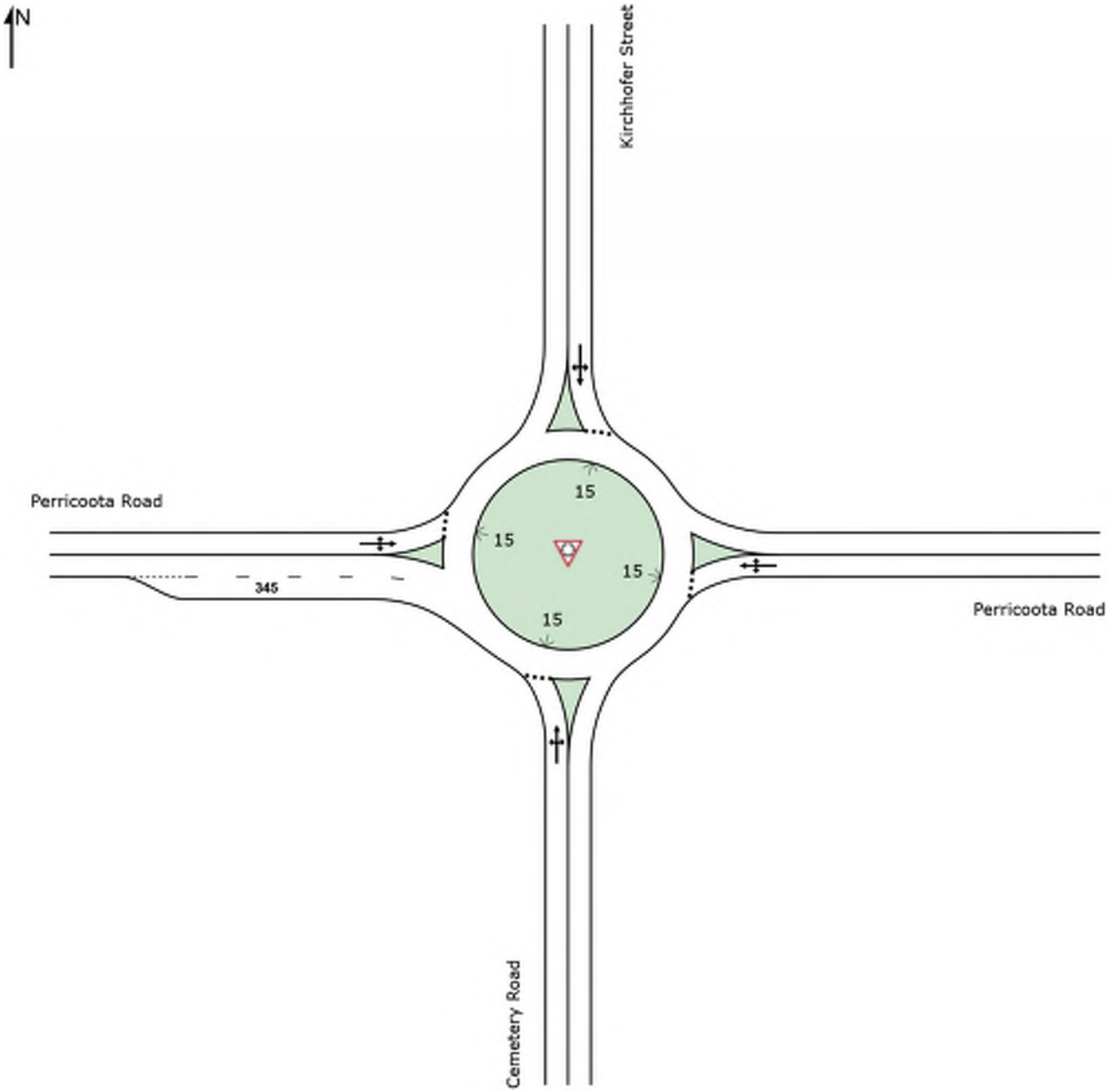
N3 Capacity Adjustment due to downstream lane blockage determined by the program.
N5 Continuous Lane results determined by Back of Queue values of downstream lanes.

Site: [Projected with Development - Perricoota Road / Kirchhofer Street Intersection - AM]

Network: 8 [Network Projected with Development - AM]

New Site
Site Category: -
Roundabout

Site Layout



Lane Use and Performance

	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	Aver. Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Cemetery Road															
Lane 1[d]	3	0.0	3	0.0	415	0.008	100	11.8	LOS B	0.0	0.1	Full	200	-25.0[N3]	0.0
Approach	3	0.0	3	0.0		0.008		11.8	LOS B	0.0	0.1				
East: Perricoota Road															
Lane 1[d]	911	4.6	910	4.6	1551	0.587	100	4.0	LOS A	3.1	22.5	Full	235	0.0	0.0
Approach	911	4.6	910[N1]	4.6		0.587		4.0	LOS A	3.1	22.5				
North: Kirchhofer Street															
Lane 1[d]	240	2.0	238	2.0	335	0.710	100	16.3	LOS B	1.5	10.8	Full	680	-47.2[N3]	0.0
Approach	240	2.0	238[N1]	2.0		0.710		16.3	LOS B	1.5	10.8				
West: Perricoota Road															
Lane 1[d]	1312	4.7	1206	5.0	691	1.745	100	679.0	LOS F	108.2[N4]	789.6[N4]	Full	790	-47.7[N3]	49.9
Approach	1312	4.7	1206[N1]	5.0		1.745		679.0	LOS F	108.2	789.6				
Intersection	2465	4.4	2357[N1]	4.6		1.745		350.5	LOS F	108.2	789.6				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
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.

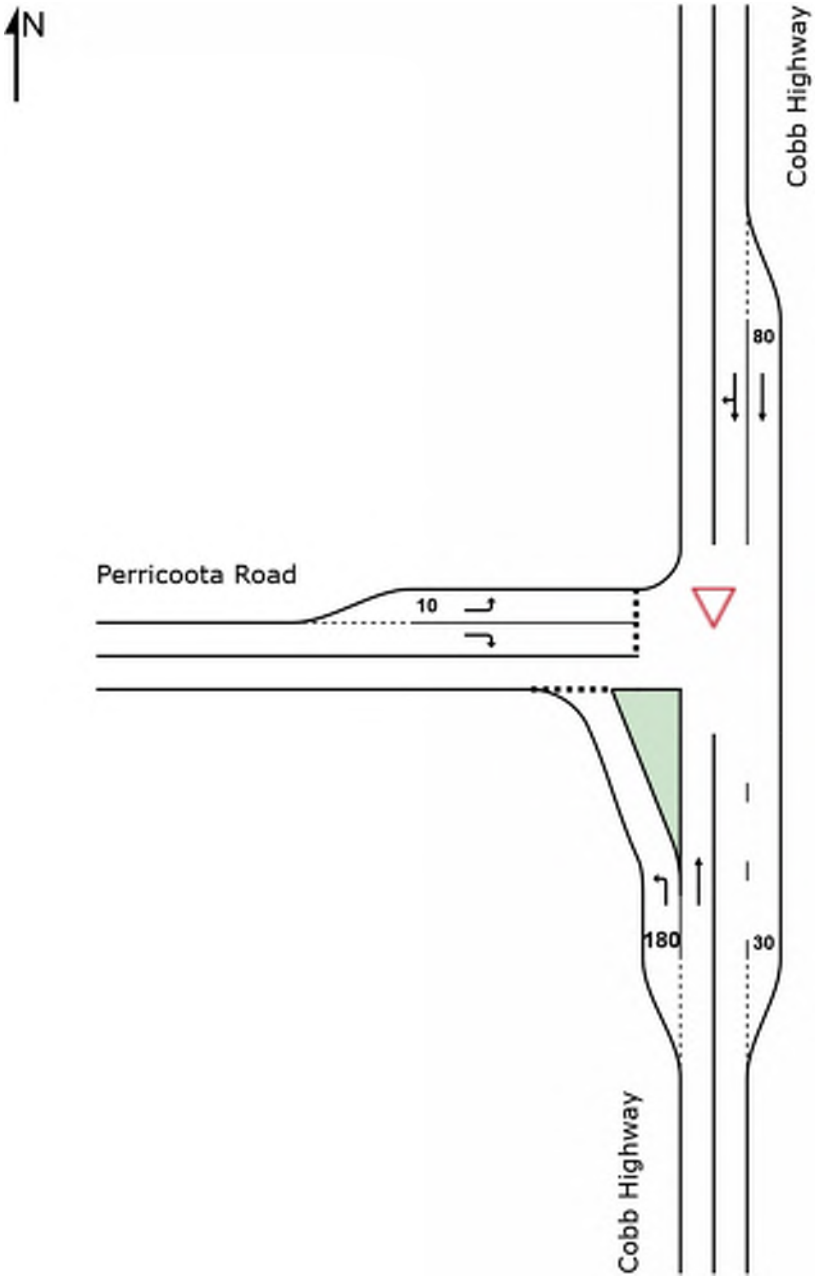
d Dominant lane on roundabout approach
N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.
N3 Capacity Adjustment due to downstream lane blockage determined by the program.
N4 Average back of queue has been restricted to the available queue storage space.

Site: [Projected with Development - Cobb Highway / Perricoota Road Intersection - AM]

Network: 8 [Network Projected with Development - AM]

New Site
Site Category: -
Giveway / Yield (Two-Way)

Site Layout



Lane Use and Performance

	Demand Flows		Arrival Flows		Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	Aver. Back of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	Total veh/h	HV %	Total veh/h	HV %	veh/h	v/c	%	sec		Veh	Dist m		m	%	%
South: Cobb Highway															
Lane 1	912	5.0	912	5.0	1580	0.577	100	4.6	LOS A	1.9	13.7	Short	180	0.0	NA
Lane 2	409	10.0	409	10.0	1841	0.222	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	1321	6.5	1321	6.5		0.577		3.2	LOS A	1.9	13.7				
North: Cobb Highway															
Lane 1	136	10.0	134	10.1	1839	0.073	24[6]	0.0	LOS A	0.0	0.0	Short	80	0.0	NA
Lane 2	565	9.9	556	10.0	1813	0.307	100	0.2	LOS A	0.1	0.5	Full	685	0.0	0.0
Approach	701	9.9	691[N1]	10.0		0.307		0.2	NA	0.1	0.5				
West: Perricoota Road															
Lane 1	78	5.0	51	5.1	1045	0.049	100	6.3	LOS A	0.1	0.5	Short	10	0.0	NA
Lane 2	1314	5.0	863	5.1	100	8.601	100	6856.7	LOS F	32.1[N4]	234.9[N4]	Full	235	0.0	49.9
Approach	1392	5.0	914[N1]	5.1		8.601		6473.3	LOS F	32.1	234.9				
Intersection	3414	6.6	2926[N1]	7.7		8.601		2024.2	NA	32.1	234.9				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
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.

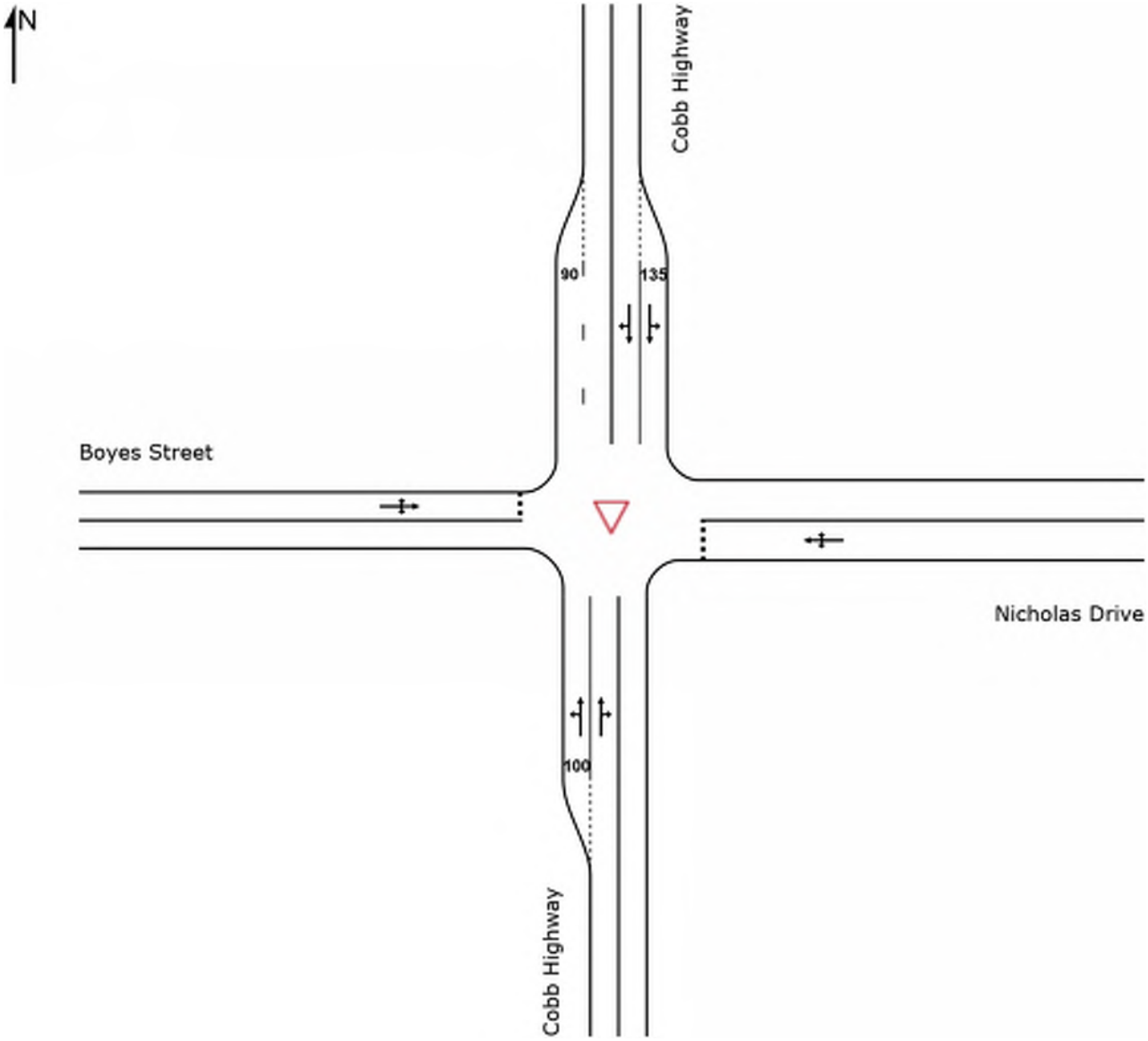
6 Lane under-utilisation due to downstream effects
N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.
N4 Average back of queue has been restricted to the available queue storage space.

Site: [Projected with Development - Cobb Highway / Boyes Street - AM]

Network: 8 [Network Projected with Development - AM]

Site Category: -
Giveway / Yield (Two-Way)

Site Layout



Lane Use and Performance

	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	Aver. Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Cobb Highway															
Lane 1	161	2.0	152	2.1	1840	0.083	54[5]	4.6	LOS A	0.0	0.0	Short	100	0.0	NA
Lane 2	226	4.7	214	4.8	1400	0.153	100	3.6	LOS A	0.3	2.1	Full	685	0.0	0.0
Approach	387	3.6	366[N1]	3.7		0.153		4.0	NA	0.3	2.1				
East: Nicholas Drive															
Lane 1	379	2.0	379	2.0	1037	0.366	100	5.8	LOS A	0.7	5.1	Full	500	0.0	0.0
Approach	379	2.0	379	2.0		0.366		5.8	LOS A	0.7	5.1				
North: Cobb Highway															
Lane 1	58	2.0	58	2.0	1841	0.031	55[5]	4.6	LOS A	0.0	0.0	Short	135	0.0	NA
Lane 2	96	8.8	96	8.8	1688	0.057	100	1.0	LOS A	0.0	0.4	Full	500	0.0	0.0
Approach	154	6.2	154	6.2		0.057		2.4	NA	0.0	0.4				
West: Boyes Street															
Lane 1	225	2.0	213	2.0	312	0.684	100	26.6	LOS D	1.8	13.1	Full	240	0.0	0.0
Approach	225	2.0	213[N1]	2.0		0.684		26.6	LOS D	1.8	13.1				
Intersection	1145	3.1	1112[N1]	3.2		0.684		8.7	NA	1.8	13.1				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
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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.

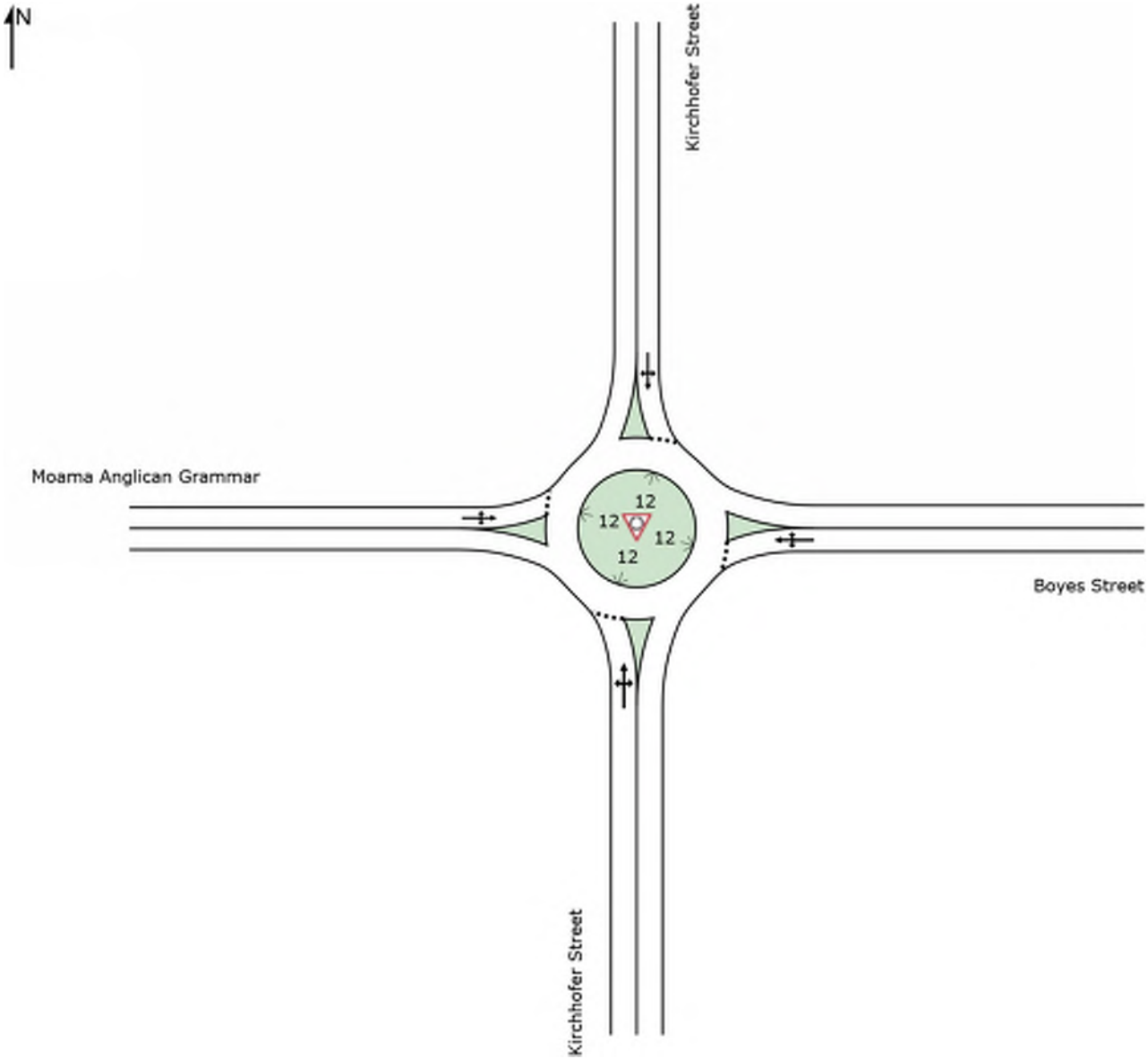
5 Lane under-utilisation found by the program
N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

Site: [Projected with Development - Kirchhofer Street / Boyes Street - AM]

Network: 8 [Network Projected with Development - AM]

Site Category: -
Roundabout

Site Layout



Lane Use and Performance

	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	Aver. Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Kirchhofer Street															
Lane 1[d]	155	2.0	124	2.0	1238	0.100	100	5.3	LOS A	0.2	1.5	Full	680	0.0	0.0
Approach	155	2.0	124[N1]	2.0		0.100		5.3	LOS A	0.2	1.5				
East: Boyes Street															
Lane 1[d]	141	2.0	136	2.0	1182	0.115	100	5.4	LOS A	0.3	1.9	Full	240	0.0	0.0
Approach	141	2.0	136[N1]	2.0		0.115		5.4	LOS A	0.3	1.9				
North: Kirchhofer Street															
Lane 1[d]	165	2.0	165	2.0	1197	0.138	100	4.1	LOS A	0.3	2.3	Full	230	0.0	0.0
Approach	165	2.0	165	2.0		0.138		4.1	LOS A	0.3	2.3				
West: Moama Anglican Grammar															
Lane 1[d]	60	2.0	60	2.0	1140	0.053	100	4.7	LOS A	0.1	0.8	Full	30	0.0	0.0
Approach	60	2.0	60	2.0		0.053		4.7	LOS A	0.1	0.8				
Intersection	521	2.0	485[N1]	2.1		0.138		4.8	LOS A	0.3	2.3				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
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.

d Dominant lane on roundabout approach
N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

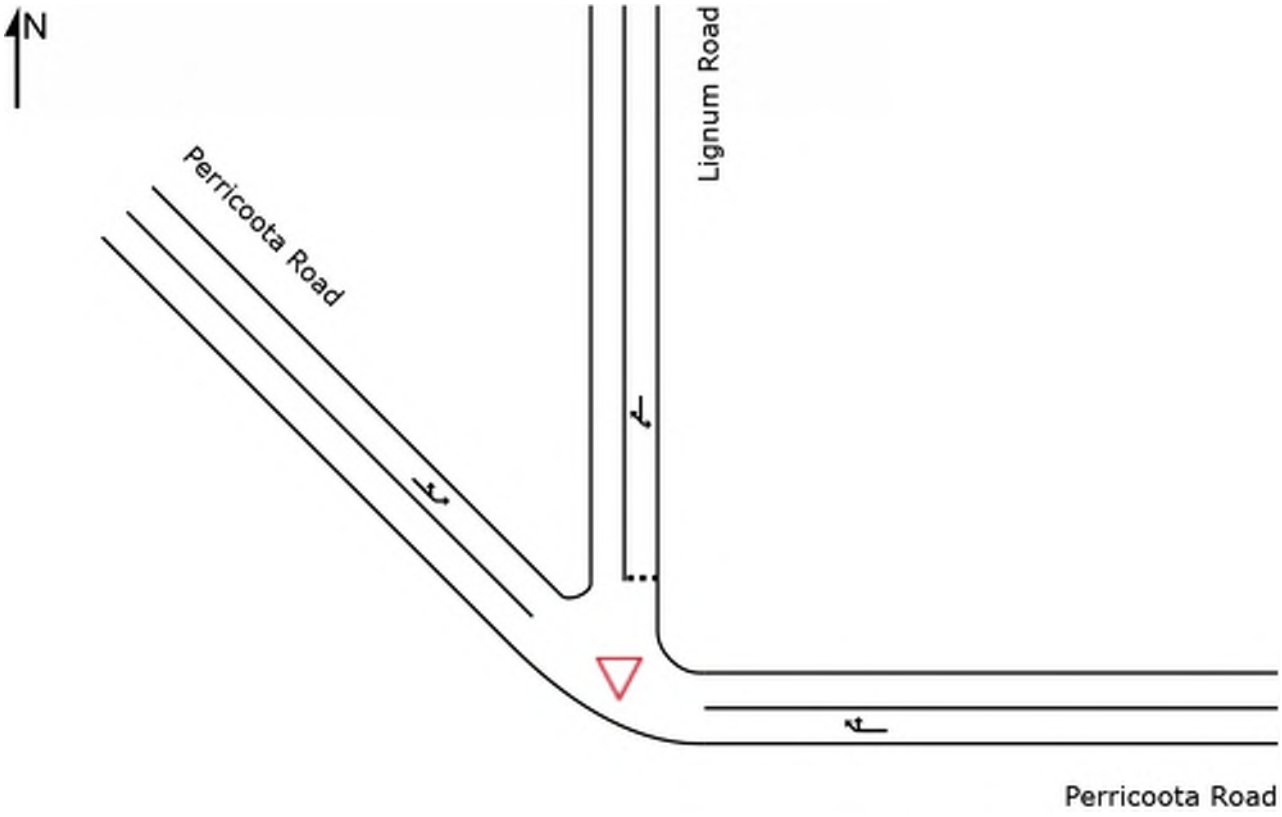
USER REPORT FOR NETWORK SITE

Project: 180880_SIDRA_190801 | **Template: Site User Report**

Site: [Projected with Development - Perricoota Road / Lignum Road Intersection - PM] | **Network: 9 [Network Projected with Development - PM]**

New Site
Site Category: -
Giveway / Yield (Two-Way)

Site Layout



Lane Use and Performance

	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	Aver. Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
East: Perricoota Road															
Lane 1	1297	4.5	1297	4.5	1471	0.882	100	14.9	LOS B	7.2	52.0	Full	790	0.0	0.0
Approach	1297	4.5	1297	4.5		0.882		14.9	NA	7.2	52.0				
North: Lignum Road															
Lane 1	173	2.0	173	2.0	162	1.066	100	156.7	LOS F	6.0	42.6	Full	540	-14.1 N3	0.0
Approach	173	2.0	173	2.0		1.066		156.7	LOS F	6.0	42.6				
NorthWest: Perricoota Road															
Lane 1	753	4.9	753	4.9	1565	0.481	100	4.9	LOS A	0.0	0.0	Full	450	-15.2 N3	0.0
Approach	753	4.9	753	4.9		0.481		4.9	NA	0.0	0.0				
Intersection	2222	4.4	2222	4.4		1.066		22.5	NA	7.2	52.0				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
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NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
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Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

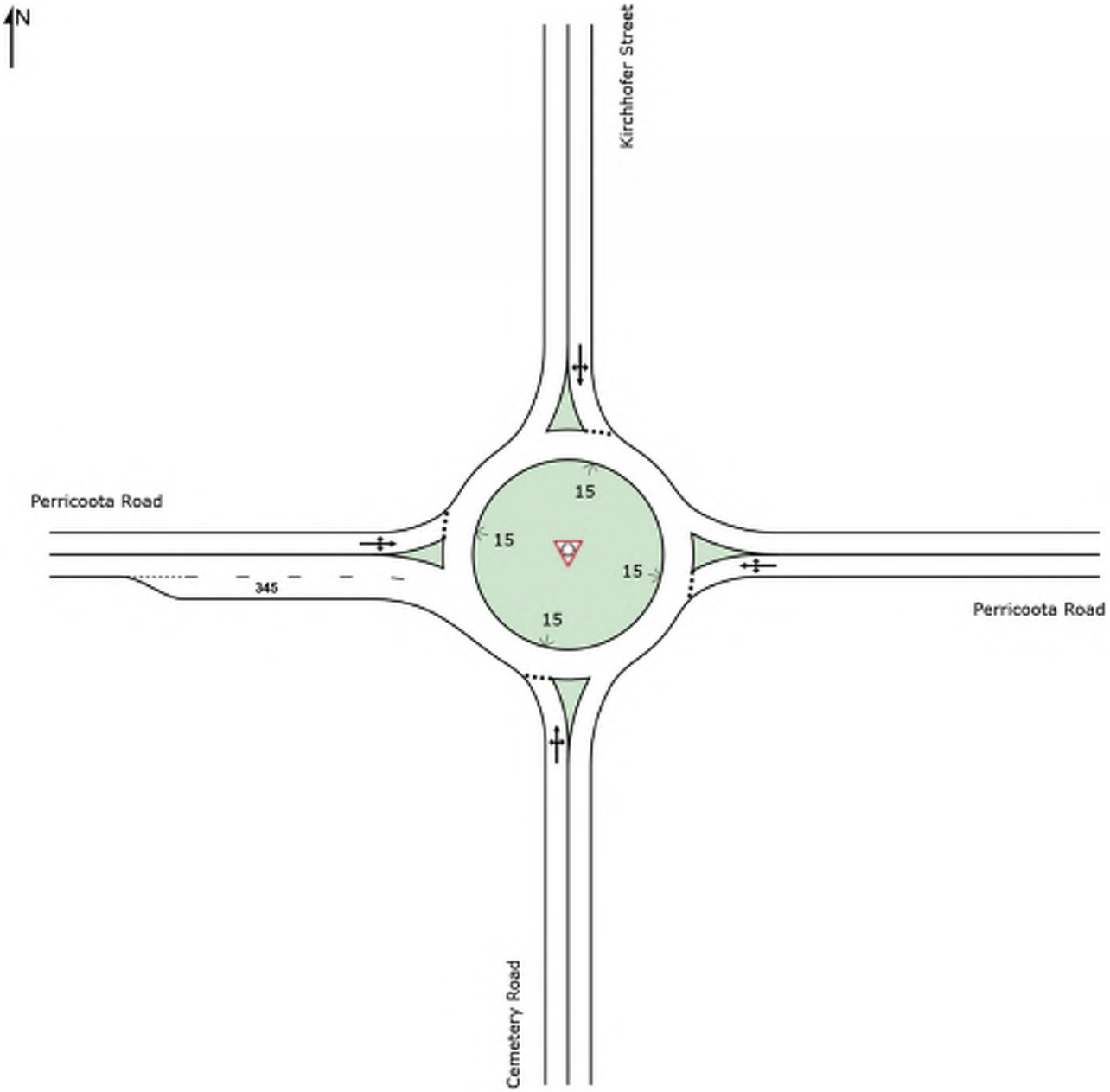
N3 Capacity Adjustment due to downstream lane blockage determined by the program.

Site: [Projected with Development - Perricoota Road / Kirchhofer Street Intersection - PM]

Network: 9 [Network Projected with Development - PM]

New Site
Site Category: -
Roundabout

Site Layout



Lane Use and Performance

	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	Aver. Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Cemetery Road															
Lane 1[d]	3	0.0	3	0.0	179	0.018	100	29.6	LOS C	0.0	0.3	Full	200	-25.0[N3]	0.0
Approach	3	0.0	3	0.0		0.018		29.6	LOS C	0.0	0.3				
East: Perricoota Road															
Lane 1[d]	1373	4.6	1373	4.6	1614	0.850	100	5.4	LOS A	10.7	77.7	Full	235	0.0	0.0
Approach	1373	4.6	1373	4.6		0.850		5.4	LOS A	10.7	77.7				
North: Kirchhofer Street															
Lane 1[d]	160	2.0	159	2.0	370	0.431	100	8.6	LOS A	0.6	4.6	Full	680	-47.2[N3]	0.0
Approach	160	2.0	159[N1]	2.0		0.431		8.6	LOS A	0.6	4.6				
West: Perricoota Road															
Lane 1[d]	887	4.7	887	4.7	621	1.429	100	399.3	LOS F	76.0	553.8	Full	790	-47.5[N3]	25.1
Approach	887	4.7	887	4.7		1.429		399.3	LOS F	76.0	553.8				
Intersection	2423	4.5	2422[N1]	4.5		1.429		149.9	LOS F	76.0	553.8				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
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Intersection and Approach LOS values are based on average delay for all lanes.
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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.

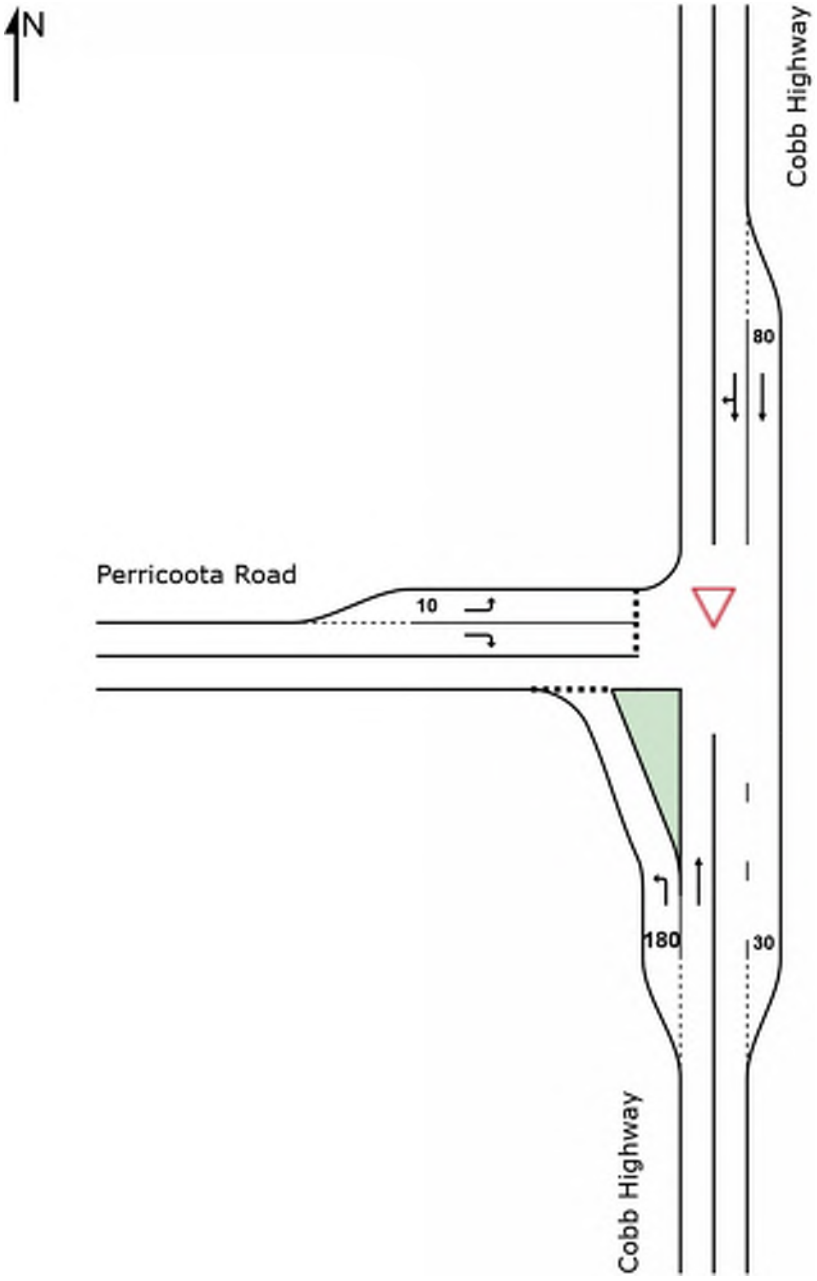
d Dominant lane on roundabout approach
N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.
N3 Capacity Adjustment due to downstream lane blockage determined by the program.

Site: [Projected with Development - Cobb Highway / Perricoota Road Intersection - PM]

Network: 9 [Network Projected with Development - PM]

New Site
Site Category: -
Giveway / Yield (Two-Way)

Site Layout



Lane Use and Performance

	Demand Flows		Arrival Flows		Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	Aver. Back of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	Total veh/h	HV %	Total veh/h	HV %	veh/h	v/c	%	sec		Veh	Dist m		m	%	%
South: Cobb Highway															
Lane 1	1375	5.0	1375	5.0	1576	0.872	100	6.0	LOS A	8.3	60.3	Short	180	0.0	NA
Lane 2	434	10.0	434	10.0	1841	0.236	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	1808	6.2	1808	6.2		0.872		4.6	LOS A	8.3	60.3				
North: Cobb Highway															
Lane 1	94	5.0	93	5.0	1898	0.049	24[6]	0.0	LOS A	0.0	0.0	Short	80	0.0	NA
Lane 2	381	5.2	378	5.2	1836	0.206	100	0.5	LOS A	0.1	0.5	Full	685	0.0	0.0
Approach	475	5.2	472[N1]	5.2		0.206		0.4	NA	0.1	0.5				
West: Perricoota Road															
Lane 1	52	5.0	42	5.0	1015	0.042	100	7.4	LOS A	0.1	0.5	Short	10	0.0	NA
Lane 2	877	5.0	720	5.0	89	8.096	100	6405.5	LOS F	32.2[N4]	234.9[N4]	Full	235	0.0	49.9
Approach	928	5.0	762[N1]	5.0		8.096		6050.0	LOS F	32.2	234.9				
Intersection	3212	5.7	3042[N1]	6.0		8.096		1518.8	NA	32.2	234.9				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
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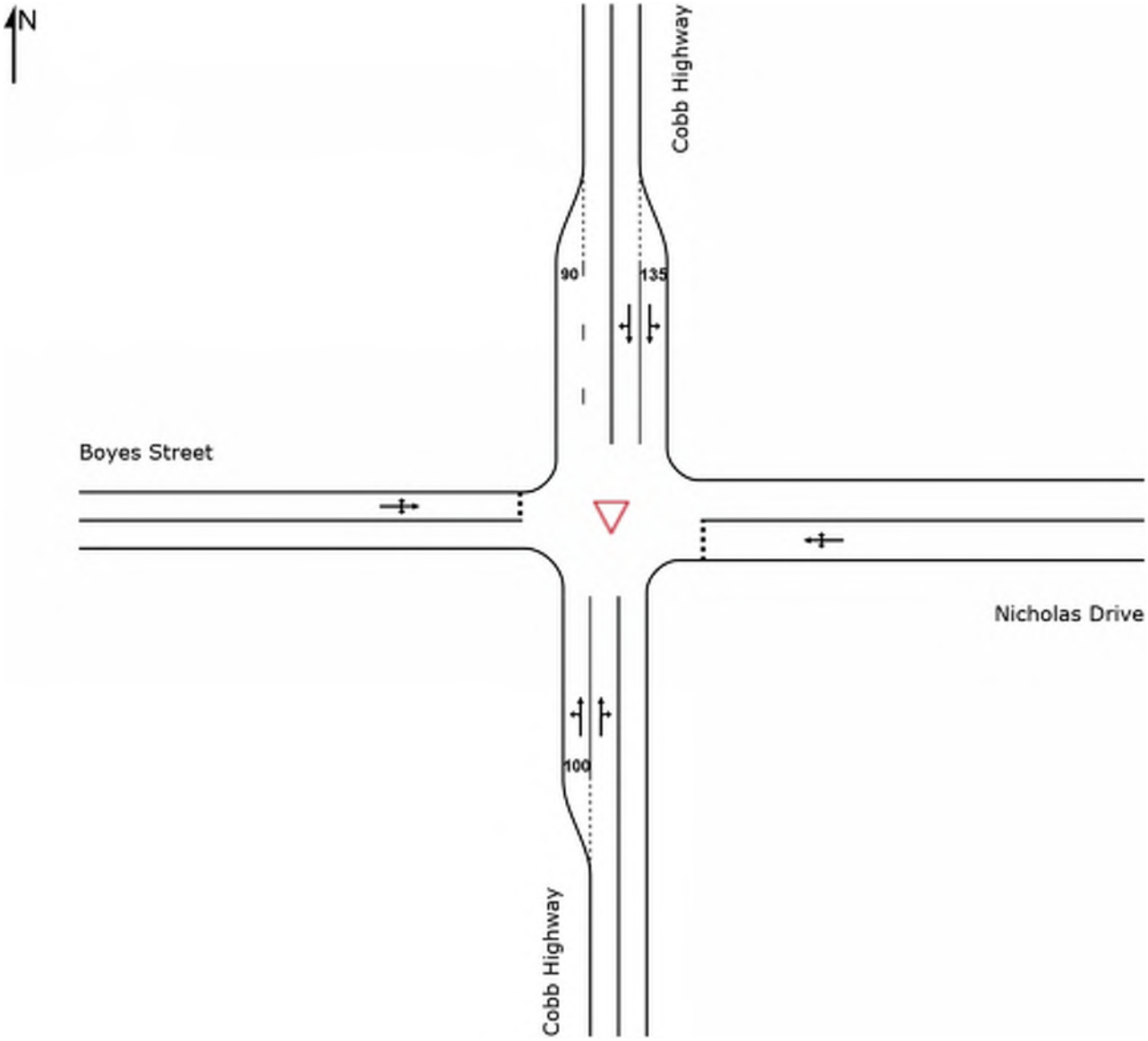
6 Lane under-utilisation due to downstream effects
N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.
N4 Average back of queue has been restricted to the available queue storage space.

Site: [Projected with Development - Cobb Highway / Boyes Street - PM]

Network: 9 [Network Projected with Development - PM]

Site Category: -
Giveway / Yield (Two-Way)

Site Layout



Lane Use and Performance

	Demand Flows		Arrival Flows		Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	Aver. Back of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	Total veh/h	HV %	Total veh/h	HV %	veh/h	v/c	%	sec		Veh	Dist m		m	%	%
South: Cobb Highway															
Lane 1	243	2.0	240	2.0	1840	0.130	57[5]	5.6	LOS A	0.0	0.0	Short	100	0.0	NA
Lane 2	329	4.6	325	4.6	1434	0.227	100	4.2	LOS A	0.5	3.4	Full	685	0.0	0.0
Approach	573	3.5	565[N1]	3.5		0.227		4.8	NA	0.5	3.4				
East: Nicholas Drive															
Lane 1	253	2.0	253	2.0	979	0.258	100	7.0	LOS A	0.4	3.2	Full	500	0.0	0.0
Approach	253	2.0	253	2.0		0.258		7.0	LOS A	0.4	3.2				
North: Cobb Highway															
Lane 1	39	2.0	39	2.0	1841	0.021	45[5]	5.6	LOS A	0.0	0.0	Short	135	0.0	NA
Lane 2	75	8.4	75	8.4	1583	0.047	100	1.8	LOS A	0.1	0.4	Full	500	0.0	0.0
Approach	114	6.2	114	6.2		0.047		3.1	NA	0.1	0.4				
West: Boyes Street															
Lane 1	148	2.0	144	2.0	309	0.467	100	21.2	LOS C	0.9	6.5	Full	240	0.0	0.0
Approach	148	2.0	144[N1]	2.0		0.467		21.2	LOS C	0.9	6.5				
Intersection	1087	3.2	1075[N1]	3.3		0.467		7.3	NA	0.9	6.5				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
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.

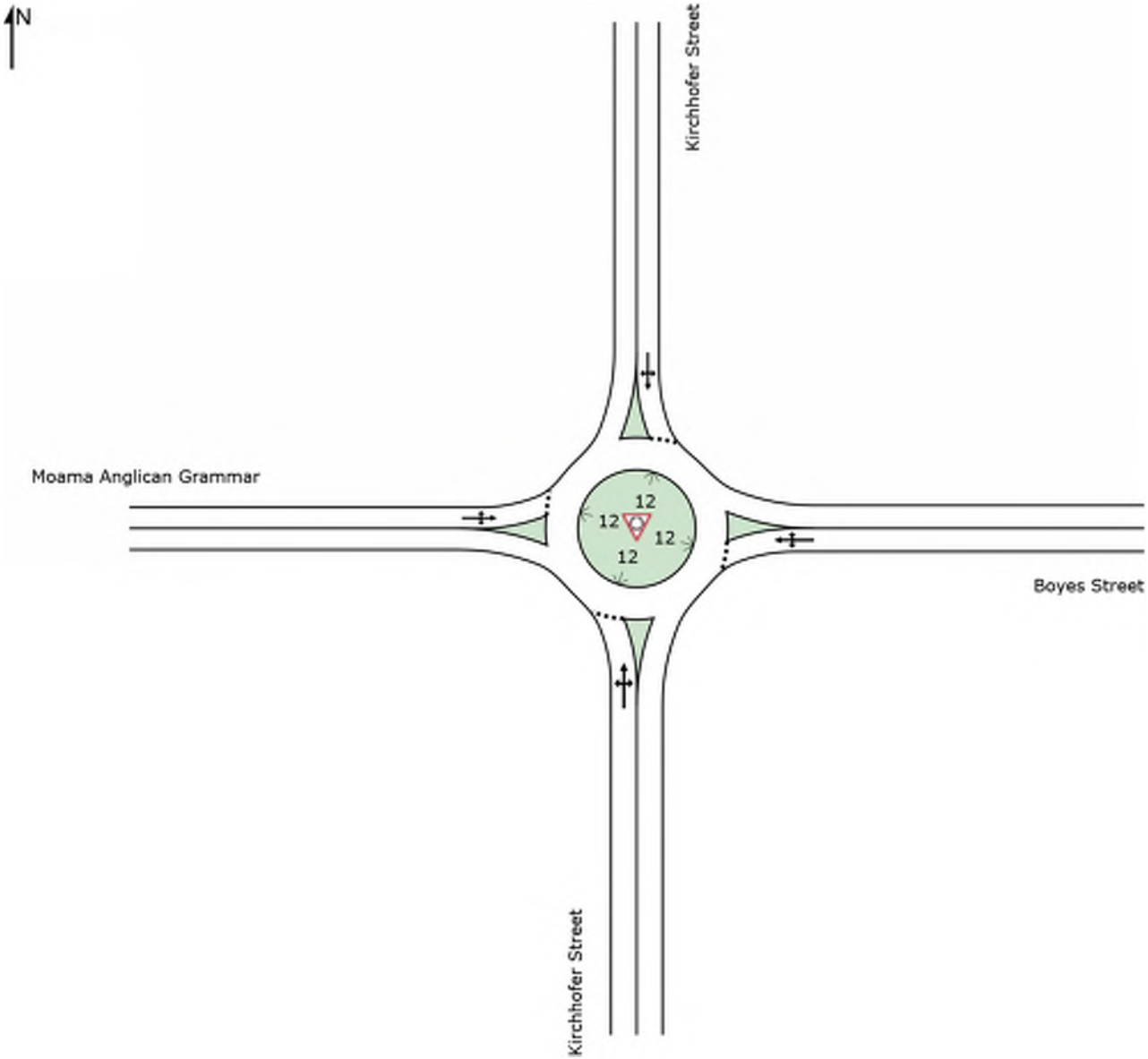
5 Lane under-utilisation found by the program
N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

Site: [Projected with Development - Kirchhofer Street / Boyes Street - PM]

Network: 9 [Network Projected with Development - PM]

Site Category: -
Roundabout

Site Layout



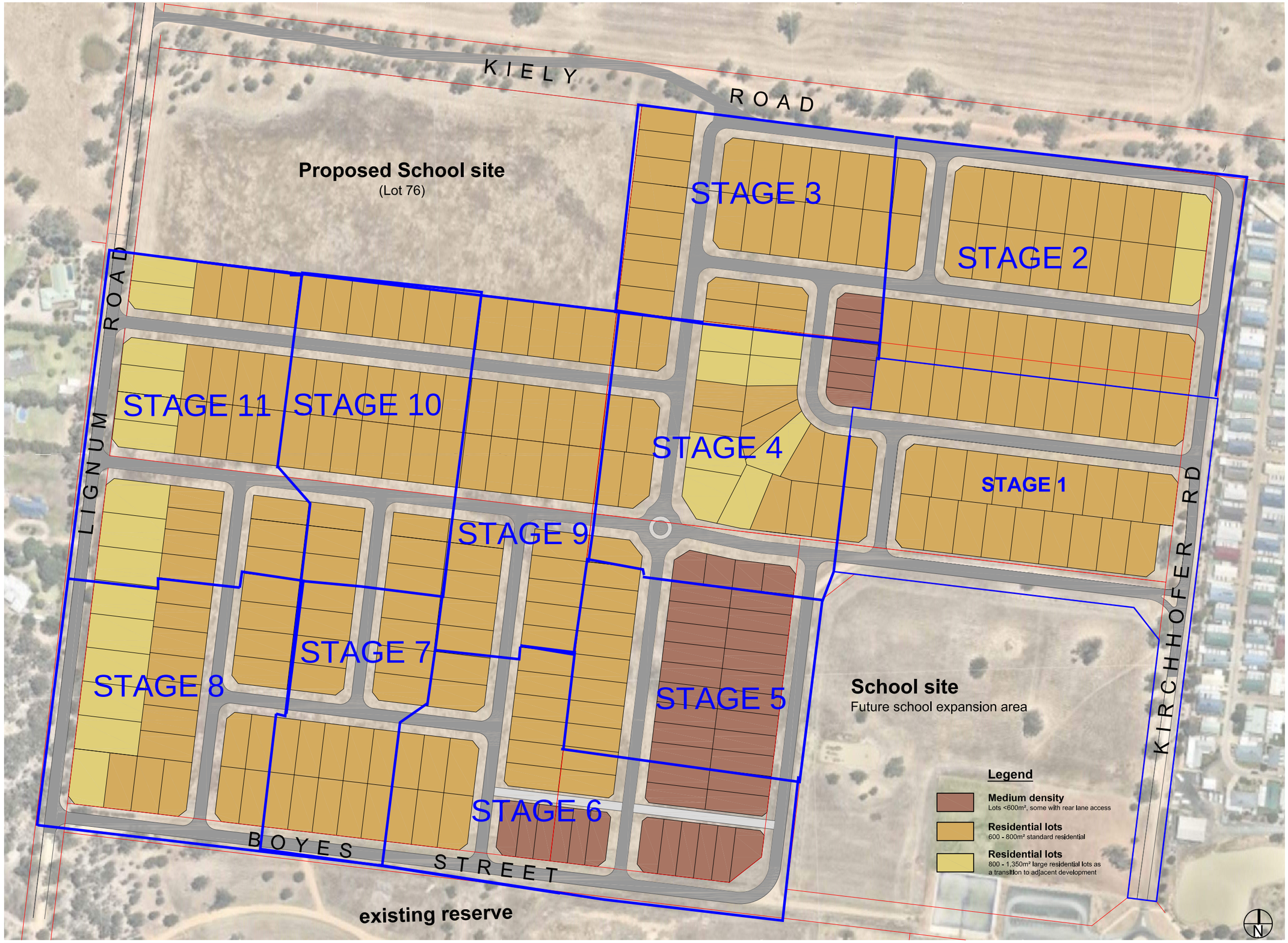
Lane Use and Performance

	Demand Flows		Arrival Flows		Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	Aver. Back of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	Total veh/h	HV %	Total veh/h	HV %	veh/h	v/c	%	sec		Veh	Dist m		m	%	%
South: Kirchhofer Street															
Lane 1[d]	234	2.0	218	2.0	1194	0.183	100	6.8	LOS A	0.4	3.0	Full	680	0.0	0.0
Approach	234	2.0	218[N1]	2.0		0.183		6.8	LOS A	0.4	3.0				
East: Boyes Street															
Lane 1[d]	215	2.0	213	2.0	1237	0.172	100	6.4	LOS A	0.4	2.9	Full	240	0.0	0.0
Approach	215	2.0	213[N1]	2.0		0.172		6.4	LOS A	0.4	2.9				
North: Kirchhofer Street															
Lane 1[d]	111	2.0	111	2.0	1104	0.100	100	5.6	LOS A	0.2	1.6	Full	230	0.0	0.0
Approach	111	2.0	111	2.0		0.100		5.6	LOS A	0.2	1.6				
West: Moama Anglican Grammar															
Lane 1[d]	89	2.0	89	2.0	1034	0.087	100	5.7	LOS A	0.2	1.4	Full	30	0.0	0.0
Approach	89	2.0	89	2.0		0.087		5.7	LOS A	0.2	1.4				
Intersection	648	2.0	631[N1]	2.0		0.183		6.3	LOS A	0.4	3.0				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
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.

d Dominant lane on roundabout approach
N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

ATTACHMENT B – PROPOSED DEVELOPMENT CONCEPT PLANS



Lignum Road, Moama - Outline Development Plan

Preliminary Development Plan - For discussion purposes only

scale: 0 12.5 25 37.5 50 62.5m
Scale: 1:1250 @ A1 / 1:2500 @ A3

date: NOV 2018 project no.: M6178 dwg: M6178-ODP_ACTIVE.dwg

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