NEW PRIMARY SCHOOL AT WARNERVALE – TRANSPORT AND ACCESSIBILITY ASSESSMENT

PREPARED FOR BILLARD LEECE PARTNERSHIP PTY LTD

05 August 2019

Stantec

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BILLARD LEECE PARTNERSHIP PTY LTD

New Primary School at Warnervale – Transport and Accessibility Assessment

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1. Introduction

Stantec has been engaged by Billard Leece Partnership Pty Ltd to advise on the traffic and parking matters arising from the proposed development for New Primary School at Warnervale.

The development will result in the construction of a new school on the closed school site at 75 Warnervale Road, Warnervale. By 2022, the New Primary School at Warnervale will accommodate a total enrolment of 460 students from kindergarten to Year 6, and will include on site car parking for staff and visitors, a drop-off/pick-up area, and bus facilities.

The site plans have been prepared by Billard Leece Partnership Pty Ltd as the basis for this report, and are shown in **Appendix A**.

This report has been prepared to assess the traffic and parking impacts of the proposed development of the New Primary School at Warnervale.

1.1 Previous Traffic Study

1.1.1 Traffic Modelling Study – Hyder Consulting Pty Ltd

A traffic modelling study was prepared by Hyder Consulting Pty Ltd (Hyder) for Precinct 7A development. The Precinct 7A study area consists of approximately 540 hectares and is identified within the Council's Residential Development Strategy 2002 as a medium priority for urban development. It has the potential to have substantial impact on local housing supply and demand in the region. In addition, the area is included within the draft North Wyong Shire Structure Plan (NWSSP) area for future development as identified within the Central Coast Regional Strategy (CCRS).

The proposed land use for the Precinct 7A include residential, employment generation (industrial), open space, community facilities, recreation, conservation and commercial uses.

The traffic model included the cumulative growth from planned developments for the years 2021 and 2031 at a number of individual intersections.

Figure 1-1 shows the site layout in respect to Precinct 7A Structure Plan.

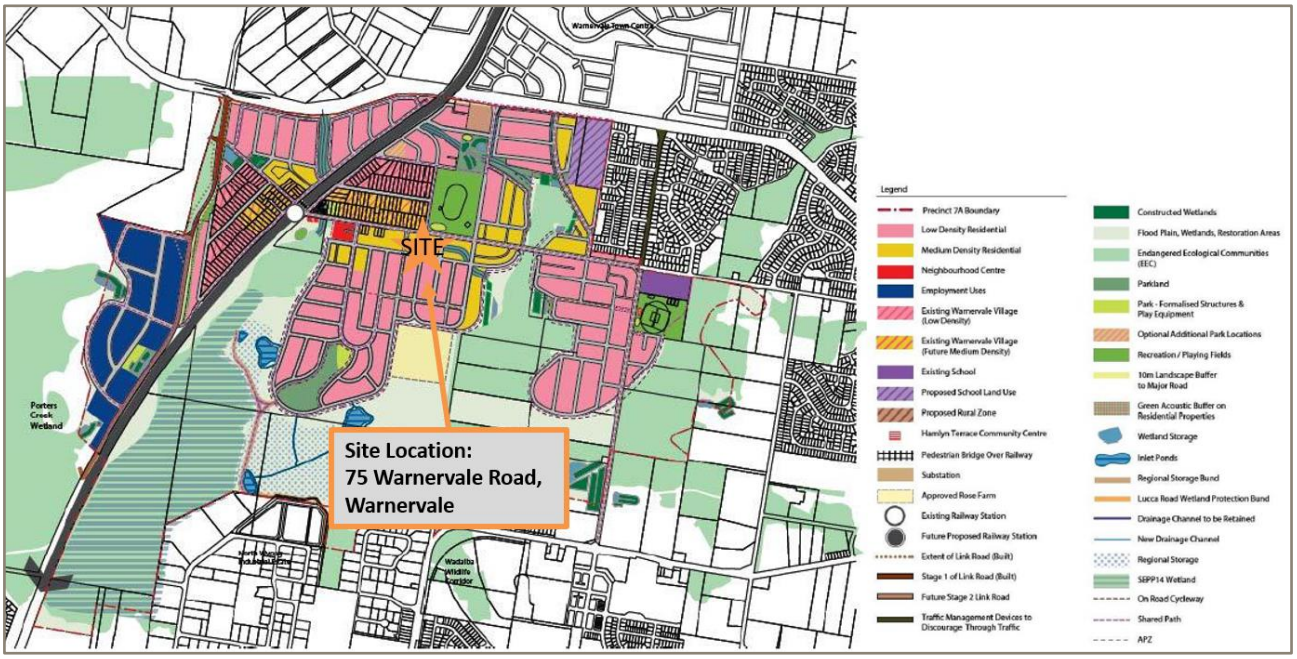


Figure 1-1: Precinct 7A Structure Plan[1]

[1] Source: Wyong Shire DCP – Chapter 6.5 – Figure 2

2. Response to Secretary's Environmental Checklist

The requirements listed within the Standard Secretary's Environmental Assessment Requirements (SEARS), are provided below along with a corresponding response.

Table 2-1: Comments on the Secretary's Environmental Checklist

Item	7. Transport and Accessibility	Comments
1	Accurate details of the current daily and peak hour vehicle, existing and future public transport networks and pedestrian and cycle movement provided on the road network located adjacent to the proposed development;	Existing public transport facilities, pedestrian and cycle network are addressed within **Section 3.3** Details of peak hour vehicles are extracted from Hyder's Traffic Modelling Study(Refer to **Section 1.1.1** and **Appendix B** of report)
2	Details of estimated total daily and peak hour trips generated by the proposal, including vehicle, public transport, pedestrian and bicycle trips based on surveys of the existing and similar schools within the local area;	The trips generated are calculated in section 7 using travel mode survey from the existing Warnervale Public School and conservative assumptions for vehicle occupancy.
3	The adequacy of existing public transport or any future public transport infrastructure within the vicinity of the site, pedestrian and bicycle networks and associated infrastructure to meet the likely future demand of the proposed development;	Existing public and active transport facilities and an assessment of their adequacy is provided in **Section 3.3**. Details of proposed share path is provided within **Section 3.3.1**.
4	Measures to integrate the development with the existing/future public transport network;	The proximity of the proposed site to public transport facilities is shown in **Figure 2-3** and **Section 3.3.1**.
5	The impact of trips generated by the development on nearby intersections (including level crossings), with consideration of the cumulative impacts from other approved developments in the vicinity, and the need/associated funding for, and details of, upgrades or road/infrastructure improvement works, if required (Traffic modelling is to be undertaken using SIDRA network modelling for currents and future years);	The effect of the proposed development and other nearby land use changes on traffic volumes at nearby intersections is analysed using SIDRA in **Section 9.3**. A proposed roundabout is flagged for future analysis in **Section 9.4**.
6	The identification of infrastructure required to ameliorate any impacts on traffic efficiency and road safety impacts associated with the proposed development, including details on improvements required to affected intersections, additional school bus routes along bus capable roads (minimum 3.5m wide travel lanes), additional bus stop or bus bays;	The future impacts of the development on the traffic efficiency are predicted in several modelling scenarios within **Section 9.3.1**. There are no significant changes to the affected intersections for the future scenarios. A roundabout is proposed, to allow for vehicles enter and exit the site in the eastbound and westbound direction. It will

Item	7. Transport and Accessibility	Comments
		reduce delay and improve the traffic flow at this intersection. At this stage, based on travel mode surveys from school nearby, there is no demand in the usage of buses to require additional bus stops or bus bay.
7	Details of travel demand management measures to minimise the impact on general traffic and bus operations, including details of a location specific sustainable travel plan (Green Travel Plan and specific Workplace travel plan) and the provision of facilities to increase the non-car mode share for travel to and from the site;	Initiatives aimed at encouraging 'green travel' are outlined in Section 4 of the Green Travel Plan. This includes actions that will be undertaken by the school alone and by the school in partnership with Council.
8	A review of road geometry between the site and the regional road network or existing bus transit network for bus access with consideration of the existing and future on-street parking environment;	Consultation has been undertaken with Council officers between Stantec and BLP. Council has noted there are future plans to upgrade Warnervale Road with the surrounding land use that will be developed. At this stage, the road geometry designs are not finalised.
9	The proposed walking and cycling access arrangements and connections to public transport services;	Access to the public and active transport networks are shown in **Section 3.3**.
10	The proposed access arrangements, including car and bus pick-up/drop-off facilities, and measures to mitigate any associated traffic impacts and impacts on public transport, pedestrian and bicycle networks, including pedestrian crossings and refuges and speed control devices and zones;	Proposed access to the development is outlined in **Section 5**.
11	Proposed bicycle parking provision, including end of trip facilities, in secure, convenient, accessible areas close to main entries incorporating lighting and passive surveillance	The provision of bicycle parking facilities is outlined in **Section 7.1**. Staff toilet with *End of Journey* (EOJ) shower facilities are provided within the admin / staff building. There are no EOJ facilities provided for students.
12	Proposed number of on-site car parking spaces for teaching staff and visitors and corresponding compliance with existing parking codes and justification for the level of car parking provided on-site;	The provision of parking for cars is outlined in **Section 6.1**.
13	An assessment of the cumulative on-street parking impacts of cars and bus pick-up/drop-off, staff parking and any other parking demands associated with the development;	The cumulative effect of on-street parking impacts can be drawn from **Sections 6** and **7.**

Item	7. Transport and Accessibility	Comments
14	An assessment of road and pedestrian safety adjacent to the proposed development and the details of required road safety measures and personal safety in line with CPTED;	The history of road safety around the proposed site is shown in **Section 4**. A Road Safety Evaluation can be undertaken to assess the detailed design of the future road network, if required.
15	Emergency vehicle access, service vehicle access, delivery and loading arrangements and estimated service vehicle movements (including vehicle type and the likely arrival and departure times);	Service vehicle access facilities are outlined in **Section 7.3** which includes a reference to AutoTurn analysis in Appendix C.
16	The preparation of a preliminary Construction Traffic and Pedestrian Management Plan (CTMP) to demonstrate the proposed management of the impact in relation to construction traffic addressing the following: 1. assessment of cumulative impacts associated with other construction activities (if any); 2. assessment of road safety at key intersections (including level crossings) and locations subject to heavy vehicle construction traffic movements and high pedestrian activity; 3. details of construction program detailing the anticipated construction duration and highlighting significant and milestone stages and events during the construction process; 4. details of anticipated peak hour and daily construction vehicle movements to and from the site; 5. details of on-site car parking and access arrangements of construction vehicles, construction workers to and from the site, emergency vehicles and service vehicles; and 6. details of temporary cycling and pedestrian access during construction	The effects of these activities are outlined in Section 4.3 of the CTMP report. 1. *Signages will be provided along Warnervale Road to aware road users, pedestrian of heavy vehicles travelling along this route. In addition, it will be proposed construction trucks will travel during the off peak times of the schools times.* 2. The staging and volume of planned construction is outlined in section 4.1. 3. The anticipated construction vehicle movements are outlined in section 4.5. 4. The on-site car parking for construction workers is outlined in section 4.13. 5. The plan to manage pedestrian and cyclist movements access around the construction site is outlined in section 4.6. Where construction works require the closure of the pedestrian footpath, an alternative pedestrian footpath will be provided. This will be managed by RMS signs prepared in a Traffic Control Plan

3. Transport Environment

3.1 Site Location

The proposed development is located at 75 Warnervale Road, Warnervale. **Figure 3-1** shows the location of the site in relation to Warnervale and the surrounding transport network.

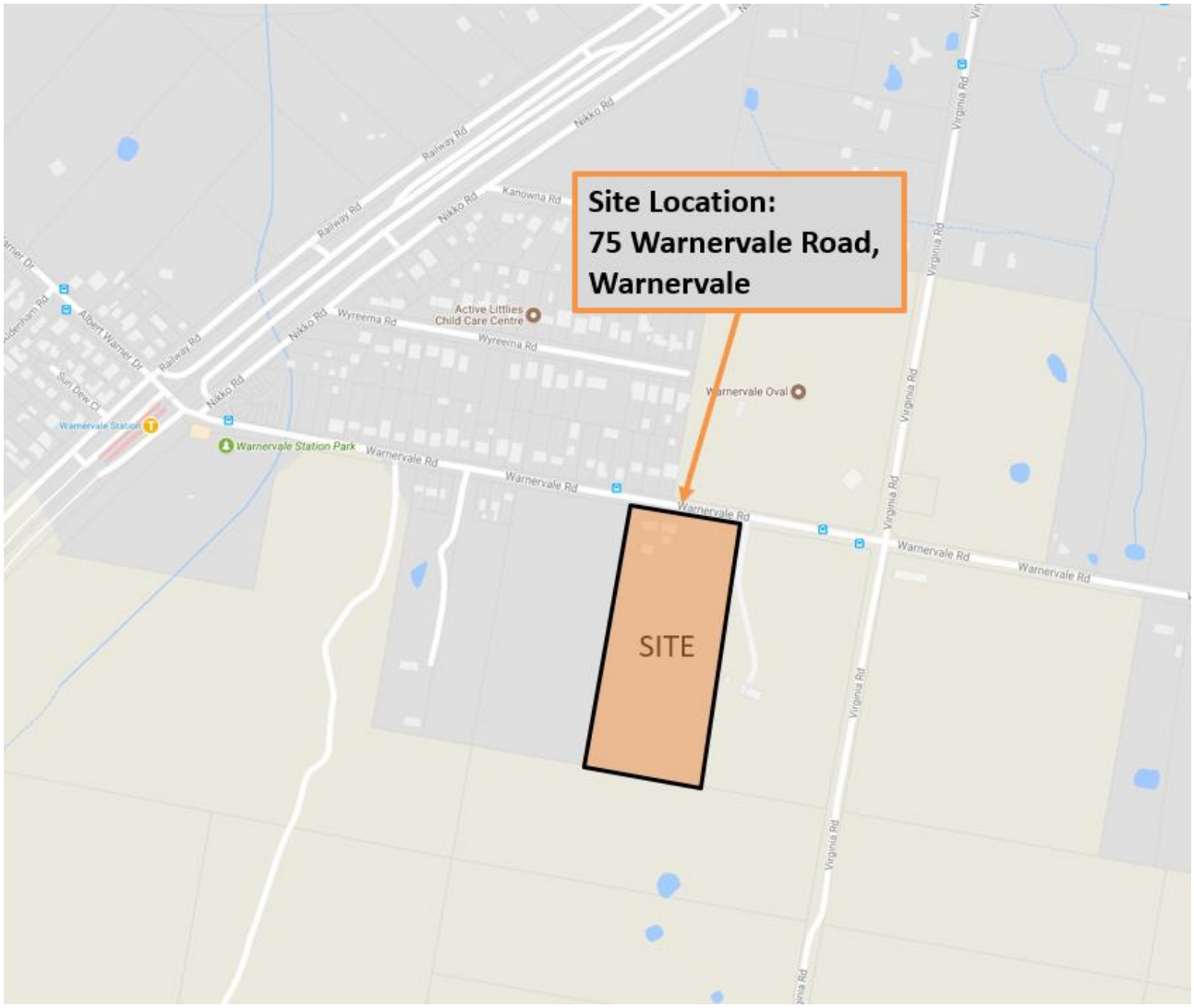


Figure 3-1: Site Location

The site is currently occupied by the decommissioned Warnervale Public School, and majority of the site is covered in vegetation. The site has a primary frontage to Warnervale Road, with access to the site provided at the northern site boundary. Warnervale Road connects to the wider road network via Albert Warner Road in the westbound direction and Virginia Road in the northbound direction.

The surrounding land uses are predominantly residential, with the following key features of the surrounds as follows:

- Warnervale Oval is located approximately 160 metres north-east of the site;
- Warnervale Train Station is located approximately 600 metres west of the site; and
- Active Littles Child Care Centre is located approximately 300 metres north-west of the site.

An aerial photo view of the site in relation to the local road network is shown in **Figure 3-2**.

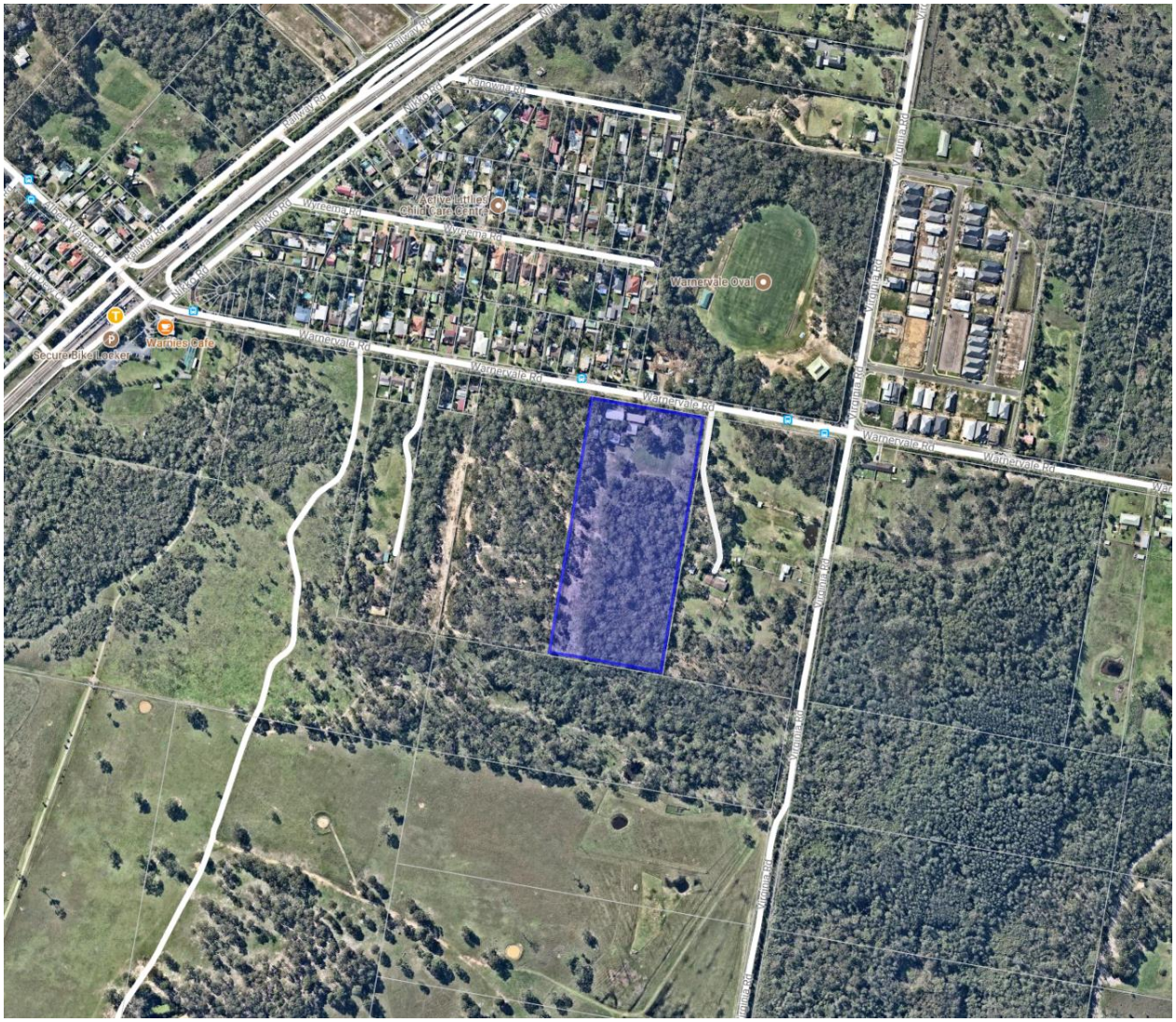


Figure 3-2: Aerial Image of the Site [3]

3.2 Road Environment

The roads in the immediate vicinity of the site are maintained and controlled by Central Coast Council. Other roads are controlled by Roads and Maritime Services as detailed below and summarised in **Table 3-1**:

- Warnervale Road is local road with a speed limit of 50km/h, extending from Warnervale Road to its termination at the Sparks Road. It runs in an east-west alignment with a sealed carriageway width ranging from 7.4 metres to 10.8 metres. It provides one lane of traffic in each direction, allowing for simultaneous two-way traffic movement.
- Virginia Road is a local road that runs in a north-south alignment. On the northern approach for the intersection of Virginia Road and Warnervale road, Virginia Road has a sealed carriageway width ranging from 6.6 metres to 10.2 metres. On the southern approach, Virginia Road has an unsealed carriageway width of 2.9 metres.
- Albert Warner Drive is a local road with a speed limit of 50km/h. It runs in a northwest-southeast alignment, extending from Warnervale Road to its intersection with Sparks Road. It has a sealed carriageway width ranging from 7.4 metres to approximately 28 metres upon approaching the intersection with Sparks Road.

[3] Source: NearMaps

- Sparks Road is an arterial road controlled by Roads and Maritime Services(RMS) with a speed limit of 70km/h. It runs in an east-west alignment with a sealed carriageway width of ranging from 9.6 metres to approximately 28 metres at the intersection at Minnesota Road. At its intersection with Virginia Road, it provides one lane of traffic in each direction.
- Minnesota Road is a local road that runs in a north-south alignment. It has a sealed carriageway of approximately 10.5 metres, allowing for simultaneous two-way traffic movement. It typically has a posted speed limit of 50km/h, which slows to 40km/h as it approaches the intersection of Minnesota Road and Warnervale Road during school times.
- Between 8:00-9:30am and 2:30-4:00pm on school days a speed limit of 40km/h applies on the surrounding streets in the vicinity of the school.
- All the immediate intersections surrounding the school are priority controlled, with 'Give Way' signage provided for vehicles exiting Virginia Road and Railway Road to Warnervale Road.
- Pedestrians footpaths are provided on the southerly side of Warnervale Road within the vicinity of the site.

Table 3-1: Road Characteristics

Road Name	Speed Limit	Lanes	Road Authority
Warnervale Road	40 / 50km/h	2 lanes	Council
Virginia Road	40 / 50km/h	2 lanes	Council
Albert Warner Road	40 / 50km/h	2 lanes	Council
Sparks Road	70km/h	2 to 4 lanes	RMS
Minnesota Road	40 / 50km/h	2 Lanes	Council

3.3 Sustainable Transport

3.3.1 Public Transport Access

Bus stops are provided on both sides of Warnervale Road, within 100 metres walking distance of the proposed site. However, there is no footpath by which to access these facilities. The locations of the bus stops are shown in **Figure 3-3.**

Figure 3-3: Location of Bus stops

The bus services at these bus stops are as follows:

- Route 11 – Lake Haven to Tuggerah via Warnervale.
- Route 78 – Lake Haven to Tuggerah via Sparks Road, Warnervale and Wadalba.

The bus services and the frequency of the services is provided within **Table 3-2**.

Table 3-2: Bus Services and frequency[4]

Bus Route No.	Direction	Bus Route	Frequency
11	Inbound	Tuggerah to Lake Haven via Warnervale via Warnervale	One services during the morning peak periods. Two services during evening peak, with a 70 minutes interval.
11	Outbound	Lake Haven to Tuggerah via Warnervale	Two services during morning peak with a 40 minutes interval. No bus services during the off-peak and evening peak periods.
78	Inbound	Tuggerah to Lake Haven via Wadalba, Warnervale and Sparks Road	Two services during the morning peak period. Every 60 minutes during the off-peak period. Three services during the evening peak periods, with a 60 to 90 minutes interval between each services
78	Outbound	Lake Haven to Tuggerah via Wadalba, Warnervale and Sparks Road	Every 60 minutes during the morning peak, and every 30 minutes during the evening peak periods. Every 90 minutes during the off peak periods.

The bus routes provide drop-offs at the Warnervale Railway Station, which links with the wider Sydney public transport network.

[4] https://www.railmaps.com.au/routedetails.php?RouteSelect=976&traveldate=2019-05-08

The services which operate within the vicinity of the site are shown within **Figure 3-4**.

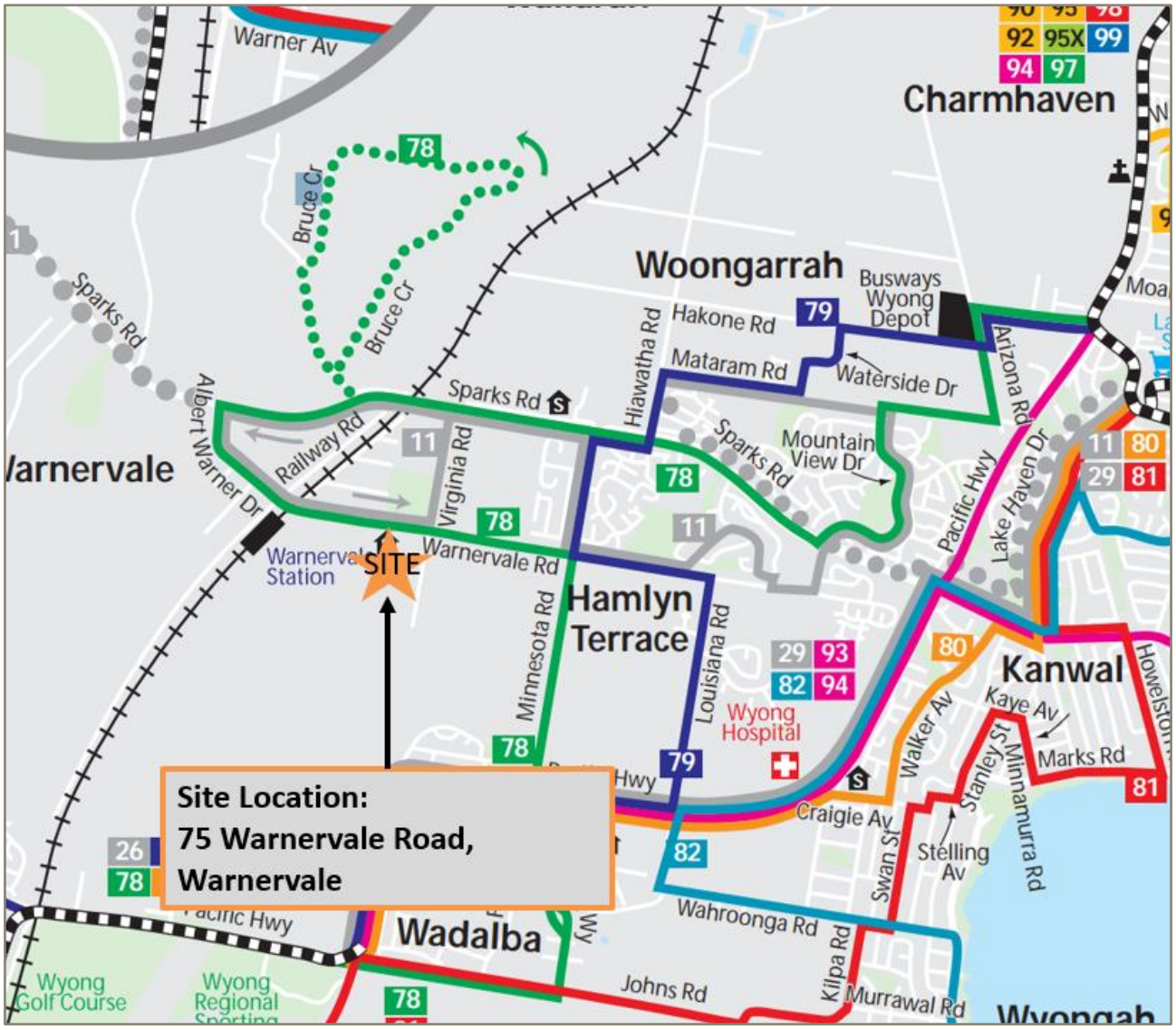


Figure 3-4: Bus Route Network Map[5]

3.3.2 Pedestrian and Cycle Network

3.3.2.1 Pedestrian Facilities

As shown in the photograph within **Figure 3-5** and **Figure 3-6**, pedestrian footpath are provided on the southerly side of Warnervale Road near the school, with wide grass berms on both sides of Warnervale Road.

It is noted that the pedestrian footpath provided is approximately 63 metres long, along the frontage of the site boundary. There are limited pedestrian facilities on the existing Warnervale Road, near the site.

[5] https://www.busways.com.au/sites/default/files/network-maps/2019-03-11/Central%20Coast%20Network%20Map.pdf

Figure 3-5: Photograph of Warnervale Road (Facing East)

Figure 3-6: Photograph of Warnervale Road (Facing West)

As shown within the plans in **Appendix A**, pedestrian walking facilities are proposed around the school, to facilitate safe pedestrian movements for staff, parents and students.

In addition, a pedestrian crossing is also proposed on the east of the site boundary in the vicinity of the school, to ensure pedestrians are able to cross in a safe environment.

3.3.2.2 Cycling

The RMS cycle finder results near the site are shown in **Figure 3-7**. At the current time, there are no dedicated cycling facilities provided within the vicinity of the site.

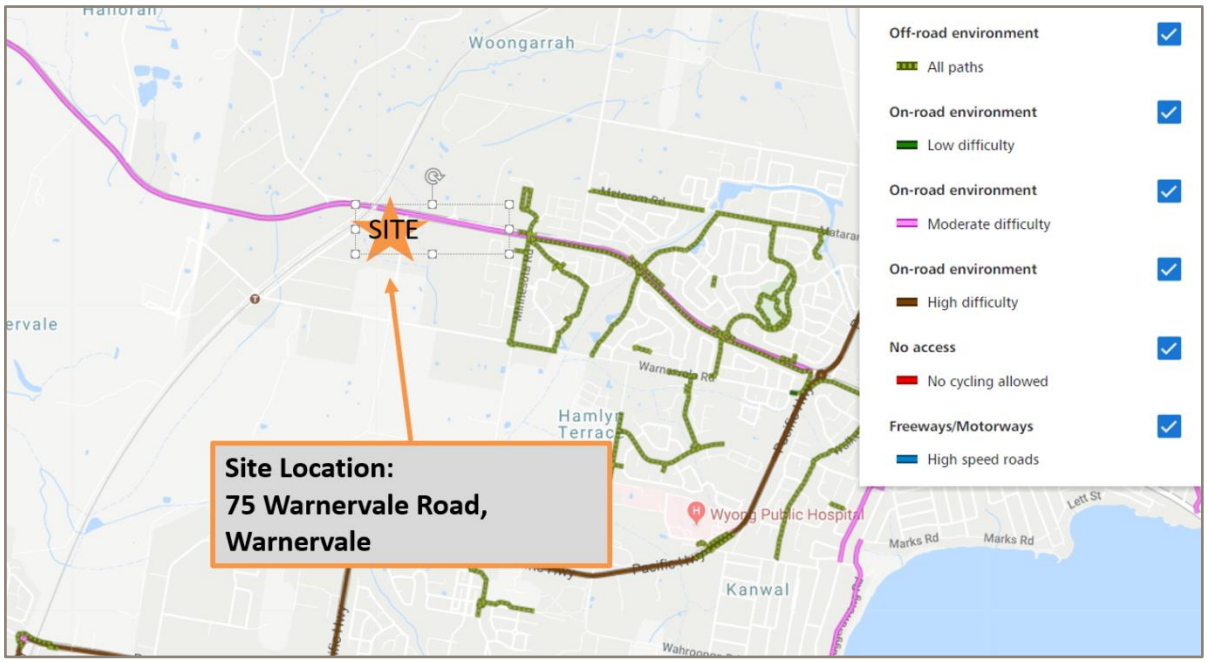


Figure 3-7: RMS Cycle Finder[6]

[6] Source: Transport Roads and Maritime Services Cycleway Finder (http://www.rms.nsw.gov.au/maps/cycleway_finder)

3.4 Future Conditions

3.4.1 Precinct 7A

Precinct 7A area consists of approximately 540 hectares and is identified within the council's residential Development strategy 2002 as a medium priory for urban development. The proposed development site is located within Precinct 7A. As such, there is currently and will continue to be significant development within the area, resulting in an increase in traffic on the surrounding road network and an increase in parking demand. It is noted that through development of the precinct Warnervale Road will be upgraded, and road widening will be required across the school frontage. The anticipated Road layout and Hierarchy from the development strategy is shown in **Figure 3-8**.

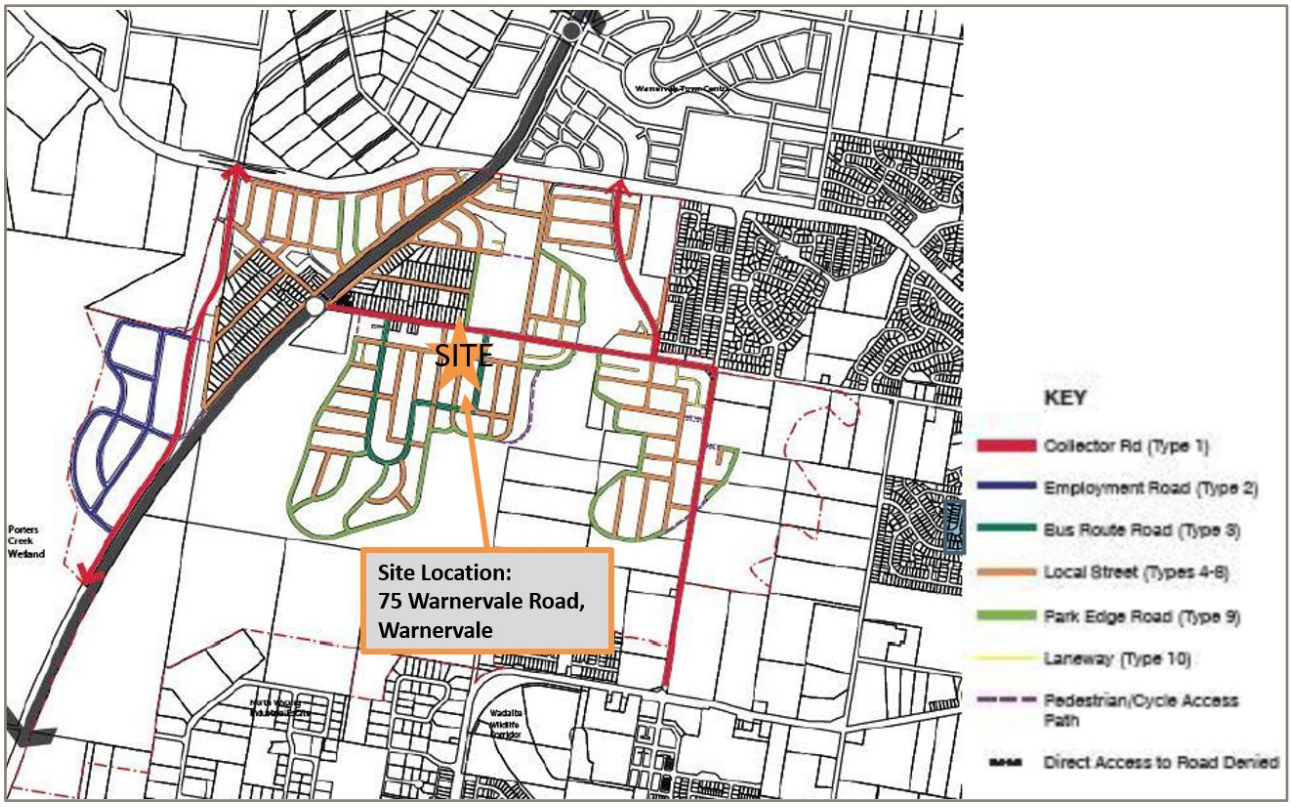


Figure 3-8:Indicative road layout and hierarchy[7]

Figure 3-8 shows a number of new roads connecting to the southerly side of Warnervale Road. The residential traffic from these new areas will result in an increase in traffic, particularly along Warnervale and at its intersection with Albert Warner Drive.

Figure 3-9 shows an indicative layout for Precinct 7A and highlights the proposed land uses within the vicinity of the site. The indicative layout shows that the predominant land use planned within the precinct is low density residential. The realisation of this development will result in an increase in the student demand in the area, which is the driving factor behind the school development.

[7] Source: Wyong Shire DCP – Chapter 6.5 – Figure 4

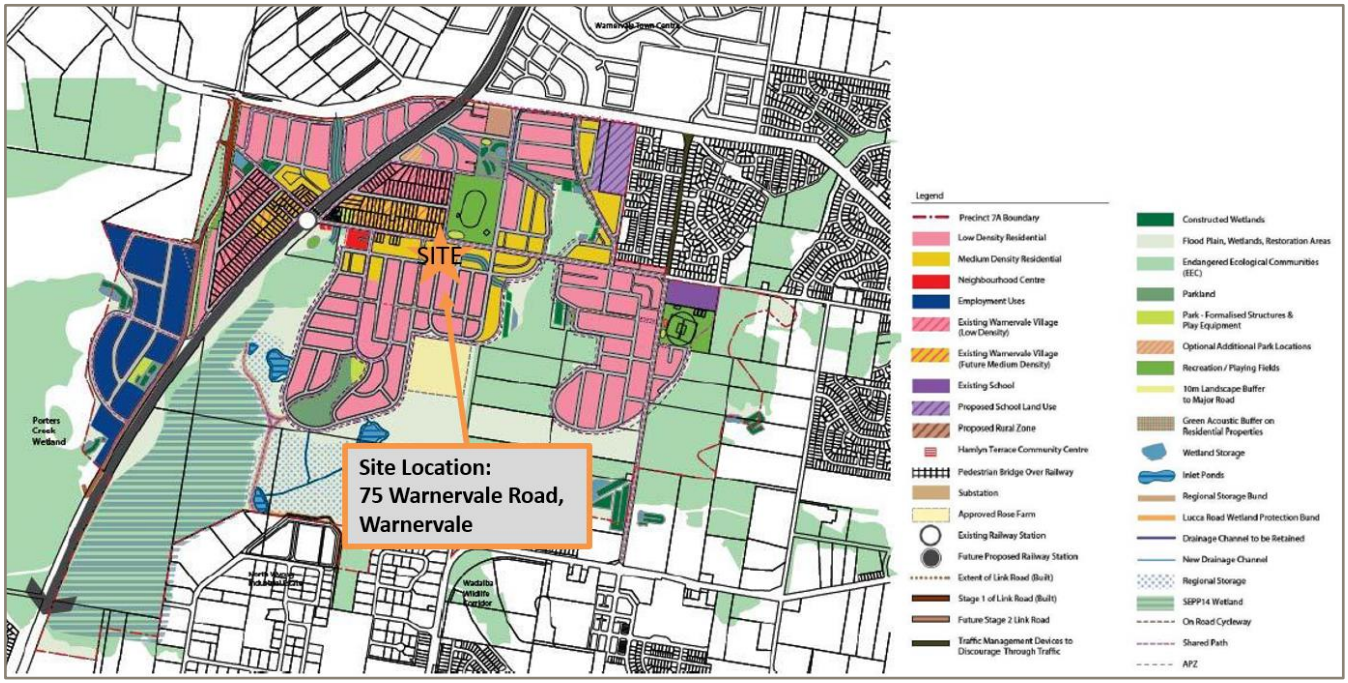


Figure 3-9: Precinct 7A Structure Plan[8]

3.4.2 Future Plans for sustainable transport

It is noted within Central Coast Bike Plan 2018, there are two proposed shared path within the vicinity of the site:

- Virginia Road, from Warnervale Road to Sparks Road. The proposed upgrade has an estimated length of approximately 880 metres.
- Warnervale Road, from Nikko Road to Minnesota Road. The proposed upgrade has an estimated length of approximately 1,715m.

Based on Central Coast's Regional Transport plan dated December 2013, the following actions are expected to occur within the short to medium future:

- Sydney's Rail Future and the creation of NSW trains will improve rail services between the central coast region, Sydney and Newcastle. These rail services will be supported by an integrated bus service;
- A new transport interchange is expected to be delivered within the short term future, to support the development of Warnervale Town Centre;

  Improved public transport services are expected to occur through network and timetable reviews. This will lead to better strategic bus corridors servicing;
- The provision of appropriate public transport services as required to support Warnervale Town Centre.

During the preparation of this Transport and Accessibility Assessment, there were no confirmation in regard to the provision of additional school bus services along Warnervale Road in the future.

However, it is noted that the public transport operator for Central Coast, Coastal Liner, will work with relevant stakeholders to deliver their 'School Services' programme. The objective for this programme is to provide accurate information on public timetables and designated school services that convey school children to schools within the Contract Region.

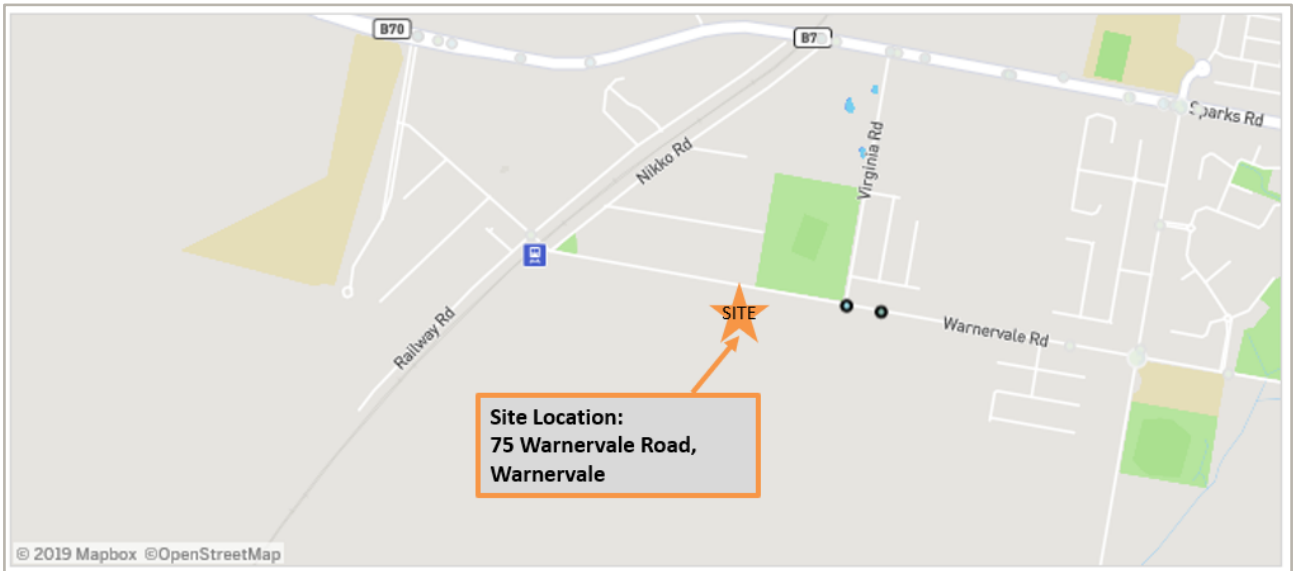
[8] Wyong Shire DCP – Chapter 6.5 – Figure 2

4. Road Safety

A search of the Road Safety Crash and Casualty Statistics Portal has been undertaken for the most recent five period 2013 to 2017 inclusive. The crash statistics are confined to crashes that conform to the national guidelines for reporting and classifying road vehicle crashes. The guidelines include crashes that meet all of these criteria:

- Were reported to the police;
- Occurred on a road open to the public;
- Involved at least one moving road vehicle; and
- Involved at least one person being killed or injured or at least one motor vehicle being towed away.

A search radius of 480 metres from the school frontages has been assessed. **Figure 4-1** shows the location of the individual crashes.



Degree of crash

Fatal | Serious Injury | Moderate Injury | Minor/Other Injury | Non-casualty (towaway)

Repo..	Crash ID	Degree of crash	RUM - code	RUM - descripti..	Type of location	Natural L..	Longitude	Lattitude	No ..	No Inju..
2016	1119699	Moderate Injury	3	Ped on carriageway	2-way undivided	Daylight	151.459493	-33.24893	-	1
2017	1132189	Minor/Other Inj..	49	Other manoeuvring	X-intersection	Dusk	151.458435	-33.248774	-	1

Figure 4-1: Crash Locations[9]

Two crashes were recorded within the crash area over the five-year period from 2013 to 2017. The crash is summarised below:

- No fatalities were recorded;
- One crash occurred on Warnervale Road to the east of the intersection of Virginia Road and Warnervale Road, resulting in moderate injury. The crash involved a pedestrian on the carriageway of Warnervale Road.
- The other crash occurred along Warnervale Road, approximately 400 metres from the site resulting in minor injury.

It is noted that there were no recorded crashes that resulted in fatalities. Overall, there is no evidence of a recurrent, persistent or adverse road crash history that would raise a particular local road safety concern.

[9] Source: Transport for NSW Centre for Road Safety Website (http://roadsafety.transport.nsw.gov.au/)

5. The Proposal

The Department of Education has proposed to build a New Primary School at Warnervale on 75 Warnervale Road, Warnervale. The proposed development will include:

- New Core 35 Hall;
- New Core 21 Administration & Staff Building;
- New Core 21 OOSH;
- New Core 21 Canteen;
- New Core 21 Library;
- New Core 21 (2x) Special Programs;
- 20 New Teaching Spaces (Includes 2 Special Education Teaching Spaces);
- New Core 21 Student Amenities;
- New Core 21 Covered Outdoor Learning area (COLA);
- Considerations for Future Expansion ;
- Staff Carpark 21 Spaces;
- Visitor 5 Spaces;
- Accessible 2 Spaces;
- Related Road Works & Drop off/pick up Zone;
- New Games Court;
- 18 informal overflow parking spaces;
- Offsite Carparking Provision:
    - 16 Short term parking
    - 1 Accessible short term parking; and
    - 8 pick up and drop off spaces.

The proposed vehicle access points for the development are as follows:

- Access Point 1: serving visitor parking, accessible parking and service area is located on Warnervale Road, approximately 175 metres from the intersection of Warnervale Road and Virginia Road;
- Access point 2: the main site access for staff parking, short term parking and drop off areas is also located on Warnervale Road, approximately 300 metres from the intersection of Warnervale Road and Virginia Road.

Plans for the site are prepared by Billard Leece Partnership Pty Ltd, and are shown within **Appendix A**.

6. Car Parking Arrangement

6.1 Development Control Plan Parking Requirements

The 'Central Coast Council (*Wyong Shire) Development Control Plan – Chapter 2.11: Parking and Access* (DCP)', outlines the parking requirement for various land uses. The parking requirement for an Educational Establishment is listed as follows:

- 1 car parking space per 1.5 staff member;
- 1 car parking space per 100 students for visitors;
- Minimum of 2 spaces for disabled students to be provided on site;
- Service requirement: 1 car parking space per 2000sqm GFA;
- Adequate 'Kiss and Ride' facility is to be provided at all education establishments;
- Provision of an easily accessible overflow carpark for special occasions on site (1 space per five students)

In year 2022, the proposal will cater for 460 students and 32 staff members on-site.

On this basis, the statutory parking requirement for the school is twenty-one parking spaces for staff and five parking spaces for visitors. The proposed provision of 28 parking spaces, including two accessible parking spaces, meets Councils parking requirements.

6.2 Parking

6.2.1 Expected Staff Parking Demand

For this assessment travel mode surveys were conducted for the staff at the existing Warnervale Public School located at Minnesota and Warnervale Road Hamlyn Terrace NSW. The travel mode surveys will determine the existing travel modes used to get to / from the school. The survey asked staff to identify their primary mode of travel (e.g. car passenger, car driver, bus, walked, cycled etc.). The survey was undertaken on Wednesday 6 June 2018, and revealed that majority of the staff members currently drive to work.

Table 6-1 presents a summary of the existing travel mode distribution for staff of the existing Warnervale Public school.

Table 6-1: Travel mode survey results for staff

Model of Travel	Number of Staff	% of Staff
Walk	0	0%
Bus	0	0%
Train	0	0%
Bicycle	1	0%
By Car – Drop off	0	3%
Passengers in a car driven by a member of staff	0	0%
Car as driver	33	97%
Other	0	0%
TOTAL	**34**	**100%**

The fact that majority of the staff currently drive to work, and park on-site is not surprising given the available car parking on-site and need for teachers to carry materials to and from work. There is an opportunity moving forward to change the mode of staff travel to encourage alternative travel modes, including; public transport, walking, cycling, and carpooling.

6.2.2 Green Travel Plan

In order to reduce the staff parking demand and drive a travel mode change, it is recommended that a Green Travel Plan be prepared for the school to ensure staff are utilising the excellent access to sustainable transport facilities in the vicinity of the site.

This plan can also be used to influence and change student travel habits which would potentially further reduce the impact of the school on the local road network.

A Green Travel Plan is a collection of initiatives and actions to encourage travel behaviour change. The plan will provide students, staff and parents with information on sustainable transport and encourages them to make alternative transport choices than the use of a private vehicle. The implementation of the Green Travel Plan will contribute to reduced traffic congestion and parking problems.

6.2.3 Other Policies and Guidelines

The Department of Education has its own set of guidelines, called the Educational Facilities Standards and Guidelines (EFSG). The EFSG are intended to assist those responsible for the management, planning, design, construction and maintenance of new and refurbished school facilities. In relation to the provision of staff parking on-site, the documents state:

> *'In order to ensure that the available site area for teaching learning and play is maximised, to enable community use and to encourage the use of sustainable means of transport to and from the school, on school site parking should be kept to a minimum.'*

In addition to the EFSG, Clause 4.8 of the Motor Vehicle Policy for NSW Government Agencies (April 2014) states:

> *'For 100% private use vehicles (whether owned, novated or 100% Departmental or Agency packaged) are not entitled to a parking space on Government leased or owned premises'*

6.2.4 Survey of Existing Travel Patterns

For this assessment travel mode surveys were conducted for students at the existing Warnervale Public School located at Minnesota and Warnervale Road Hamlyn Terrace NSW. The travel mode surveys determine the existing travel modes used to get to / from the school.

Table 6-2 presents a summary of the existing travel mode distribution for students of the existing Warnervale Public school.

Table 6-2: Travel mode survey results for Students

Model of Travel	Number of Students	% of Students
Walk	47	10%
Bus	64	14%
Train	0	0%
Bicycle	6	1%
By Car – Drop off	346	74%
Passengers in a car driven by a member of staff	3	1%
Other	2	0%
TOTAL	**468**	**100%**

Note: On the day of the survey 57 students were absent so have not been accounted for in the table.

The following characteristics are of note:

- Students are predominantly driven to school (74%). This reflects the wide catchment that the school caters for and the fact that the school caters for younger students;
- 10% of the students walk to school and another 14% of the students take the buses; and
- There is very little use of other sustainable transport modes.

6.3 Short term parking and drop off/pick up requirements

6.3.1 Number of Bays required for "Kiss and Ride" and Short-term Parking

Based on travel mode survey for existing Warnervale Public School, an assumption of 73.7% for children being driven to school is used, it is estimated that approximately 340 students would be driven to the proposed school based on an enrolment of 460 students.

Using our experience with similar education facilities, we estimate that the student occupancy for vehicles dropping-off and picking-up is approximately 1.3 students per vehicle. Applying this to the 340 students that will be driven to school, results in 262 vehicles during both the morning and afternoon peak hours, with each of the vehicles expected to generate a traffic movement arriving and departing to/from the school during each of the morning and afternoon peak hours.

Based on our experience with similar education facilities, in addition to the parking observations for Warnervale Public School, it is expected that the peak 30 minute parking demand will be approximately 50% of the total parent parking demand during each of the morning and afternoon drop-off / pick-up periods, respectively. Therefore, the expected pick-up/drop-off demand is approximately 131 vehicles during the peak period.

460 students x 73.7 % = 340 students being driven

340 / 1.3 student per vehicle = 262 vehicles

262 x 50 % (peak 30 min parking demand) = 131 vehicles during peak period

Table 6-3: Estimated Parking

Within School Carpark	
Proposed Short term Parking	**16 spaces**
Proposed accessible short-term parking	**1 Space**
Maximum time allowed for short-term parking (Austroads Guide to Traffic Management Part 11: Parking)	10 minutes
Maximum time allowed for accessible short-term parking (Austroads Guide to Traffic Management Part 11: Parking)	30 minutes
Proposed Kiss and Ride	**8 spaces**
Maximum time allowed for Kiss and Ride (TfNSW)[10]	2 minutes
Peak Period Demand (30 minutes)	131 vehicles
Estimated capacity /30 minutes (Kiss and Ride) Estimated capacity / 30 minutes (Short Term Parking) TOTAL	120 vehicles 50 vehicles 170 vehicles
Estimated Number of vehicles waiting during peak period	0 vehicles

As shown in **Table 6-3**, the number of parked vehicles allowed based on eight "Kiss and Ride" bays and 16 short-term parking, including one accessible short-term parking space will result in the capacity for at least of 170 vehicles during the peak period (30 minutes). This is under the assumption that the maximum time allowed in the respective bays be adhered to. As noted within Austroads Guide To Traffic Management Part 11, enforcement should ensure compliant turnover of parking. Given that the expected parking to be generated during the peak period is 131 vehicles, there would be ample space to facilitate the drop off and pick up of the students during peak periods.

Based on the calculations and assumptions used for the future enrolment of 460 students above, it is determined that the provision of 16 short-term parking and eight temporary pick up/drop off spaces will satisfy the expected parking demands of the school.

The provision of these temporary parking spaces will also satisfy the expected parking demands for the future expansion of 1000 students, through the implementation of the Green Travel Plan which encourages more students and parents to choose sustainable modes of transport, such as taking buses, walking and cycling.

[10] Source : https://roadsafety.transport.nsw.gov.au/stayingsafe/schools/dropoff_pickup.html

7. Other Parking / Service Facility Requirements

7.1 Bicycle Parking

7.1.1 Council Bicycle Parking Requirements

The 'Central Coast (*Wyong Shire) Development Control Plan – Chapter 2.11: Parking and access'*, outlines the bicycle parking requirement for Education facilities as '1 bicycle space per 10 car spaces'.

Based on the requirements from the development control plan (DCP), the provision of 28 on-site parking spaces plus 18 informal overflow parking spaces will lead to a requirement of five bicycle spaces for the New Primary School at Warnervale.

7.1.2 Education Facilities Standards and Guidelines (EFSG)

It is noted that the Education Facilities Standards and Guidelines (EFSG) allows up to a maximum of 36 bicycles for 720 students. This ratio will result in maximum of 23 bicycles for 460 students.

From the travel mode survey taken for Warnervale Public School, approximately six students out of 468 (1.3%) rode the bicycle to school. This relatively low percentage is most likely due to the lack of cycling facilities in the existing network, as shown in Section 3.3.2.

A provision of eight bicycle space has been proposed, therefore meeting both the requirements of Council's DCP, as well as the EFSG.

Accordingly, it is recommended that the provision of bicycle spaces be reviewed, in conjunction with the Green Travel plan, upon the full enrolment for the proposed school.

7.2 Motorcycle Parking

The motorcycle parking requirement within the development control plan is one motorcycle space per 50 car parking spaces.

The provision of a motorcycle space has been proposed along the western boundary of the western car parking area, beside short-term parking bay 16, therefore meeting the requirement of Council's DCP.

7.3 Service Facilities

A designated loading area has been provided on-site service vehicles, located east of the site boundary, adjacent to Core 21 Canteen. The area has a loading area width of 9.5 metres.

It is understood that the largest design vehicle to access the loading bay is a 9.45 metre Front loader waste truck.

In order to assess the ability for these vehicles to access the loading area, a swept path assessment has been undertaken using the software package 'AutoTurn'. The evaluation has assessed the ability for a waste truck to access the site, and is provided within Appendix C. The evaluation demonstrates that vehicles are able to enter and exit the site in a forward direction. As such, the loading area is able to accommodate the vehicles expected to use the facility.

7.4 Emergency Facilities

Emergency vehicles will access the school from the service delivery access point on Warnervale road. An emergency service route is provided around the rear perimeter of the school to the informal overflow parking area. Emergency vehicles will enter an exit the site in a forward direction.

7.5 Bus Bays

As shown within Appendix A, five bus bays have been proposed at the frontage of the site, along both sides of Warnervale Road. The provisions of additional bus bays will be determined in the future based on demand for bus usage from future enrolments.

8. Pedestrian Safety

8.1 Pedestrian Crossings

A pedestrian crossing is proposed near the eastern boundary of the site on Warnervale Road, as shown in **Figure 8-1**. The pedestrian crossing will facilitate the safe and efficient movements for students and other users, to access Warnervale Oval, which is located across the proposed site.

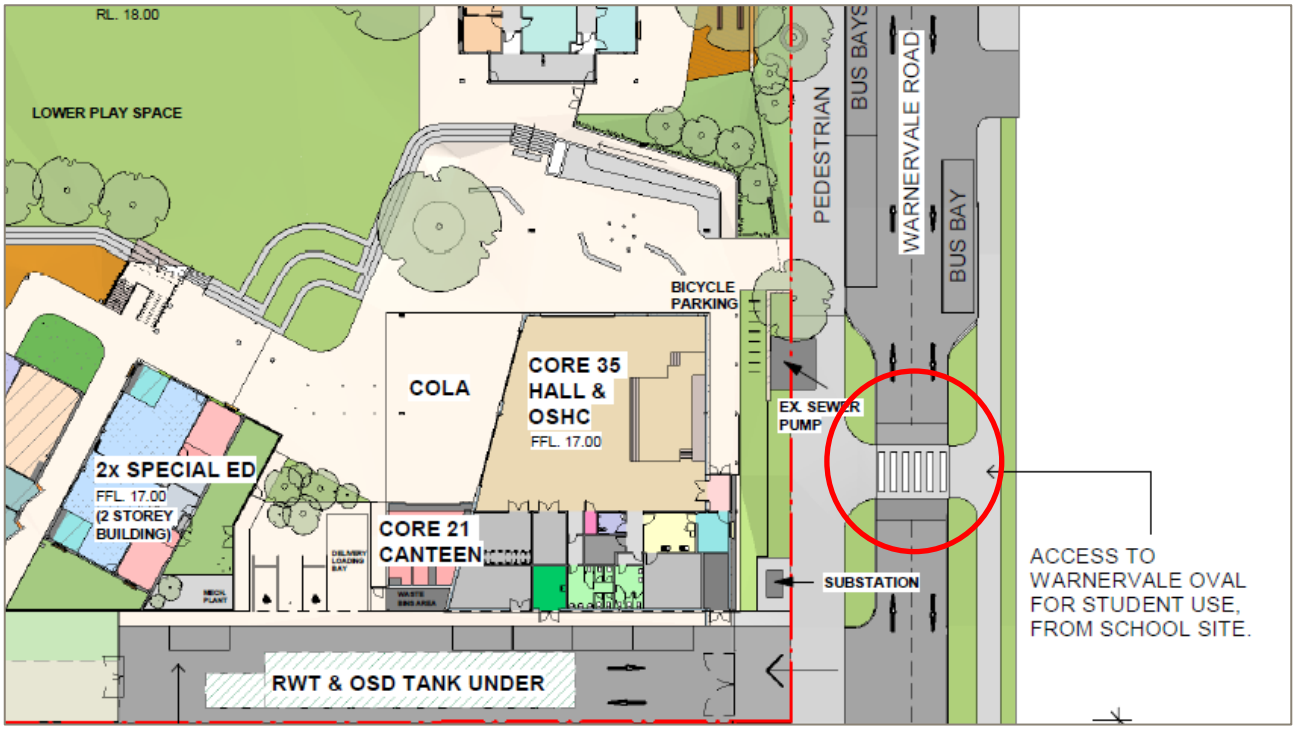


Figure 8-1: New Primary School at Warnervale - Ground Plan

8.2 Sight Distance Requirements

The following requirements are outlined in the *Austroads Guide to Road Design Part 4A: Unsignalised and Signalised Intersections (AGRD Part 4)*:

- Approaching sight distance (ASD) should be provided between approaching vehicles and the surface of the roadway at the pedestrian crossing.
- Crossing sight distance (CSD) should be provided between approaching vehicles and a pedestrian walking to cross the road. The pedestrian eye height should be taken as 1.07m which represents the lower bound of the range applicable to a person in an A80 wheelchair.

Austroads Guide to Road Design Part 4A: Unsignalised and Signalised Intersections specifies the sight distance required at pedestrian crossings between approaching drivers and pedestrians on the crossing or waiting to cross a roadway. The relevant figure from this document is shown below in **Figure 8-2**.

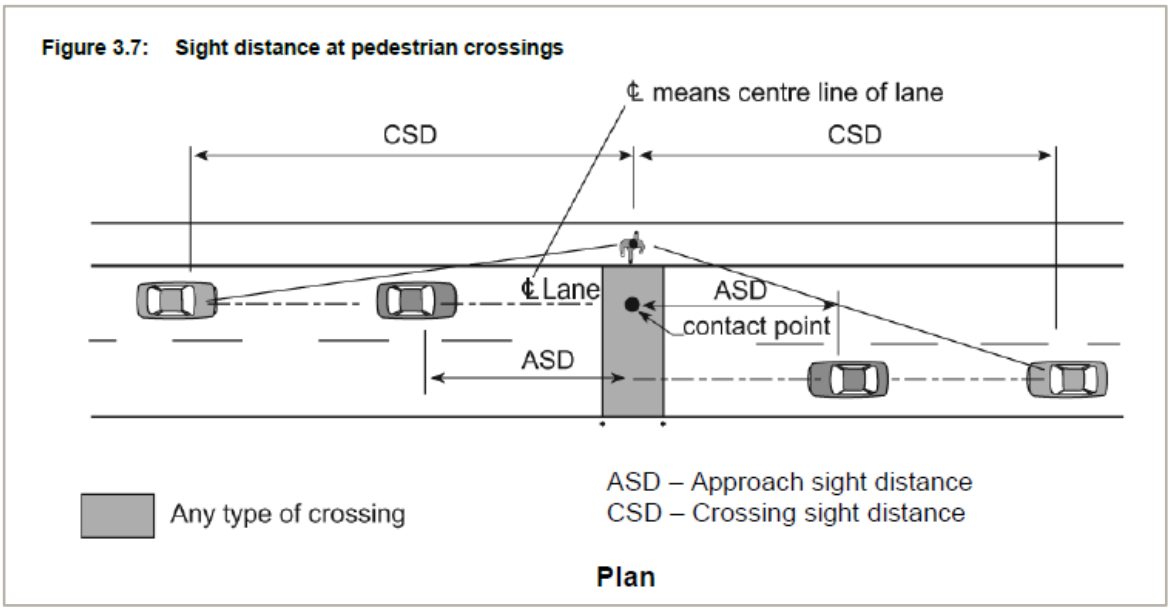


Figure 8-2: Sight Distance Parameters

$$ASD = \frac{RT \times V}{3.6} + \frac{V^2}{254\,(d+0.01 \times a)}$$

Reaction Time RT = 2 seconds

Operating Speed, V = 50 km/h

Coefficient of deceleration, d = 0.36

Longitudinal grade, a = -4 %

ASD = 58.8m

$$CSD = tc \times \frac{V}{3.6}$$

Operating Speed, V = 50 km/h

tc = 8 seconds (Crossing length / walking speed)

CSD = 111m

A level survey was prepared by Beveridge Williams development and environment consultants, and is shown in **Appendix D**. Based on the assumptions and methodology above, a road profile has been prepared within Figure 2 of **Appendix D** which highlights the ASD and CSD for the pedestrian crossing. It is recommended that the calculated ASD and CSD be accounted for during the design stage of the proposed roundabout and pedestrian crossing.

9. Traffic Impacts

9.1 Trip Generation

As described in Section 3.4 of this report, the subject site is located within Precinct 7A. Through discussion with Council, it was agreed that the most suitable approach for the traffic assessment is to utilise the existing and future traffic models from the Traffic Modelling Study for Precinct 7A, within **Appendix B**.

Given that the proposed development (new school) was not included in the Traffic Modelling Study, the traffic generated from the proposed development will be added on to the assessment.

The land use within the Traffic Modelling Study, for 75 Warnervale Road, is classified as both General Residential (R1) and Low Density Residential (R2). The trips generated by this land use profile are outlined in the Traffic Modelling Study (2012). In order to determine the impact of the proposed School, the difference in trips generated from the residential land use within Traffic Modelling Study (2012) and the New Primary School at Warnervale will be assessed.

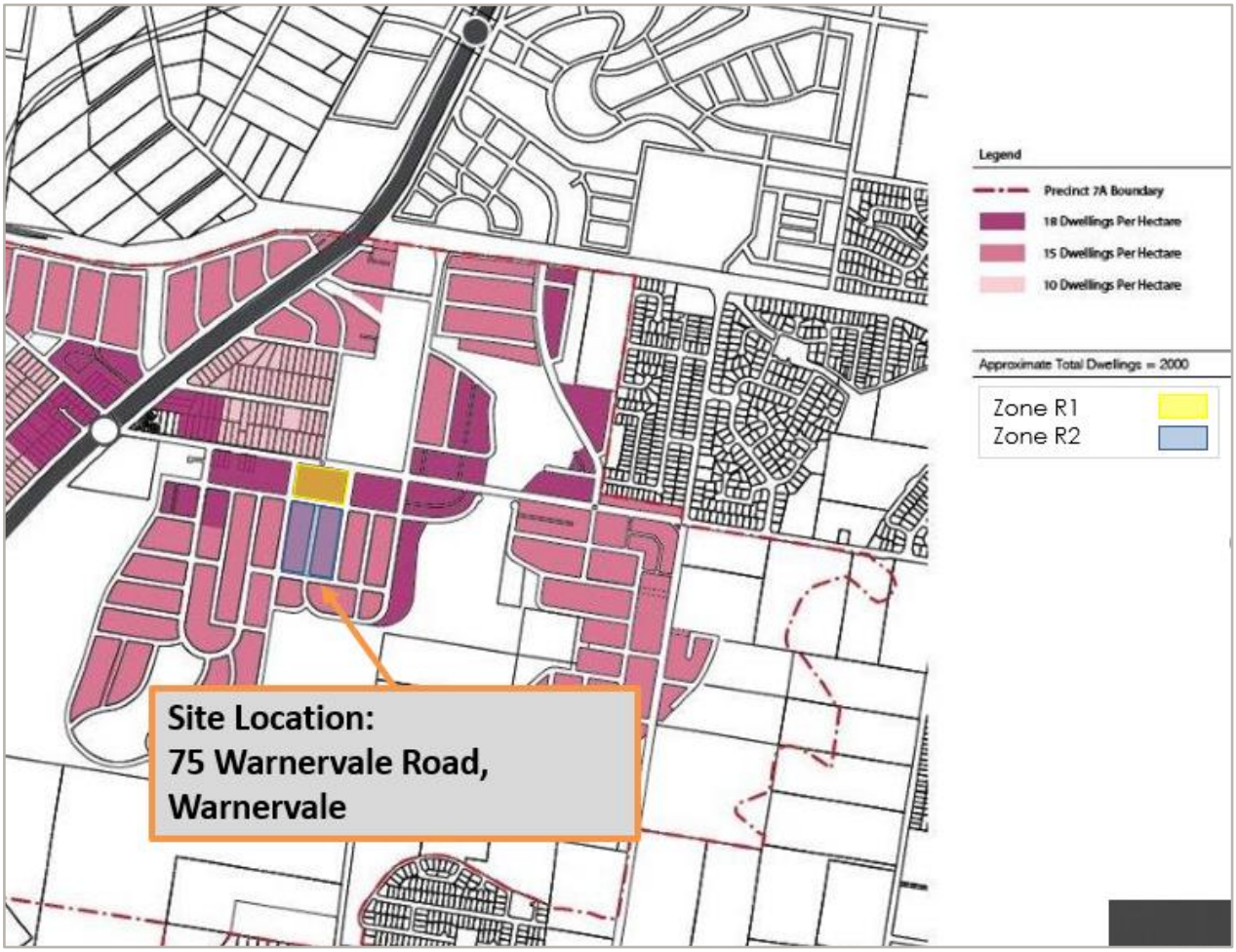


Figure 9-1: Residential density Targets (DCP - Wyong Shire)

The Roads & Maritime Services *Technical Direction 04a: Guide to Traffic Engineering Developments - Updated Traffic Surveys*, dated August 2013, provides traffic generating information for various land uses.

9.1.1 Prior Residential Trip Generation

The Traffic Modelling Study (2012) study prepared by Hyder, a trip rate of 0.85 peak hour trips per dwelling was used for residential land use. This reflects the rate outlined within the RTA (RMS) '*Guide to Traffic Generating Development (October 2002)*. Based on the Precinct 7A indicative layout applied in **Table 9-1**.

The traffic generation rates for low density residential land use within regional areas are as follows:

- Daily vehicle trips: 9.0 movements per dwelling; and

- Peak hour vehicle trips: 0.85 movements per dwelling.

All the residential lots within the subdivision have been assessed on the basis they generate traffic at the rates specified within the RMS Technical Direction.

Table 9-1: Trips Generation of Prior Residential Development of School Site

Zone	Residential Zone (R1 – General Residential)	Residential Zone (R2 – Low Density Residential)	Total
Area (ha)	1.29 ha	3.18 ha	4.47
Factor	0.85		
Number of Dwellings	20	40	60
Daily Vehicle Trip	180 vehicles	360 vehicles	540 vehicles
Peak hour vehicle trips	17 vehicles	34 vehicles	51

Application of the above rates to the 60 residential lots results in a future traffic generation of 540 vehicle movements per day, and 51 vehicle movements during the peak hour.

9.1.2 Trip Generation for New Primary School at Warnervale

The '*RTA (RMS) Guide to Traffic Generating Developments*' does not specify traffic generation rates for education establishments. The expected increase will result in the following:

- Staff vehicles are expected to generate one vehicle movement to the site during the morning peak, and one vehicle movement from the site in the afternoon peak;
- Buses are expected to generate three vehicle movements to the site during the morning peak, and three vehicle movements from the site in the afternoon peak; and
- As mentioned in section 6.3, the estimated number of vehicles driven by parents is 262 vehicles, with each of the vehicles expected to generate both a movement to and from the school during both the morning and afternoon peaks.

On this basis, the expected traffic generated by the development is provided within **Table 9-2.**

Table 9-2: Trip Generation for New Primary School at Warnervale

Movements	Morning Peak				Evening Peak			
	Parents Drop Off	Staff	Buses	Total	Parents Pick Up	Staff	Buses	Total
Inbound Trips	262	32	3	297	262	0	3	265
Outbound Trips	262	0	3	265	262	32	3	297
Total Trips				**562**				**562**

It can be seen from **Table 9-2**, it is estimated that the proposed School is expected to generate 556 vehicle trips per hour during the weekday morning and afternoon peak hour.

With the development of the New Primary School at Warnervale, there will potentially be an additional trip generation of 511 peak hour trips, over the previously anticipated residential development. However, in the context of the 3700 peak hour trips produced by Precinct 7a and 11,600 trips from development in the

wider area this is not considered significant in terms of the wider network.

9.2 Traffic Distribution

The proposed development of the New Primary School at Warnervale will effectively increase the trip generation of the site compared with the anticipated residential development by about 505 vehicle trips during the morning and afternoon, respectively. The route distribution for approaching and departing traffic is included in **Table 9-3**.

Table 9-3: Trip Distribution of Additional Traffic

Morning Peak	Arrival	Traffic Volume	Departure	Traffic Volume
	Approach Roads			
Intersection of Warnervale Road with:	-	-	-	-
Virginia Road (North Approach)	11%	34	5%	14
Virginia Road (South Approach)	1%	4	0%	2
Minnesota Road (North Approach)	3%	8	9%	23
Minnesota Road (South Approach)	25%	72	19%	49
Warnervale Road (East Approach)	10%	30	17%	43
Intersection of Sparks Road with	-	-	-	-
Albert Warner Drive (North Approach)	4%	14	2%	80
Sparks Road (West Approach)	43%	125	30%	6
Sparks Road (East Approach)	3%	10	18%	48
Total	**100%**	**297**	**100%**	**265**
Evening Peak	**Arrival**	**Traffic Volume**	**Departure**	**Traffic Volume**
	Approach Roads			
Intersection of Warnervale Road with:	-	-	-	-
Virginia Road (North Approach)	10%	26	11%	32
Virginia Road (South Approach)	1%	3	1%	4
Minnesota Road (North Approach)	5%	12	10%	31
Minnesota Road (South Approach)	38%	98	22%	65
Warnervale Road (East Approach)	11%	30	20%	57
Intersection of Sparks Road with	-	-	-	-
Albert Warner Drive (North Approach)	3%	9	1%	5
Sparks Road (West Approach)	30%	80	22%	64
Sparks Road (East Approach)	2%	7	13%	39
Total	**100%**	**265**	**100%**	**297**

9.3 Traffic Modelling

An analysis of the operation of the Sparks Road / Albert Warner Drive, Warnervale Road / Minnesota Road and Warnervale Road / Virginia Road intersections was carried out using the SIDRA computer modelling program and is discussed below.

For consistency purpose, it is noted that the Intersection Modelling carried out is based on the recommendations of future intersection layouts proposed by the Traffic Modelling Study.

The concepts of intersection capacity and level of service, as defined in the guidelines published by the RTA (RTA Guidelines for Traffic Generating Developments), are discussed in **Appendix E** together with criteria for their assessment. The assessment of the level of service of sign controlled intersections is based on the average delay (seconds per vehicle) of the critical movement.

9.3.1 Traffic Modelling Scenarios

Stantec has identified three traffic modelling scenarios for the road network and modelled for the morning and evening school peak periods:

- Scenario 1: Year 2021 (Base Case)[11] - This scenario includes Hyder's forecast traffic volumes for 2021, intersection configurations, and the proposed land use development. This analysis has been undertaken at the Sparks Road / Albert Warner Drive, Warnervale Road / Minnesota Road and Warnervale Road / Virginia Road intersections.
- Scenario 2: Year 2022 - This Scenario includes Scenario 1 plus the New Primary School at Warnervale. This analysis has been undertaken at the Sparks Road / Albert Warner Drive, Warnervale Road / Minnesota Road and Warnervale Road / Virginia Road intersections.
- Scenario 3: Year 2031 - - This scenario includes Hyder's forecast traffic volumes for 2031, intersection configurations, and the proposed land use development. This analysis has been undertaken at the Sparks Road / Albert Warner Drive, Warnervale Road / Minnesota Road and Warnervale Road / Virginia Road intersections.
- Scenario 4: Year 2031 - This scenario includes Scenario 3 plus the New Primary School at Warnervale . This analysis has been undertaken at the Sparks Road / Albert Warner Drive, Warnervale Road / Minnesota Road and Warnervale Road / Virginia Road intersections.

A summary of the SIDRA results for the various Scenarios is presented in **Table 9-4** and **Table 9-5**

[11] Traffic volumes for base (Year 2021) from Appendix E of Traffic Modelling Study prepared by Hyder.

Table 9-4: Intersection Performance for 2022 (SIDRA Results)

Intersection	Morning Peak			Evening Peak		
	Degree of Saturation (%)	Average Delay (secs)	Level of Service (LoS)	Degree of Saturation (%)	Average Delay (secs)	Level of Service (LoS)
Scenario 1						
Sparks Road and Albert Warner Drive	96.4%	34.6	C	77.3%	31.9	C
Warnervale Road and Minnesota Road	69.5%	24.5	B	67.7%	21.4	B
Warnervale Road and Virginia Road	18.0%	11.0	A	24.0%	11.0	A
Scenario 2						
Sparks Road and Albert Warner Drive	92.2%	37.9	C	89.6%	33.7	C
Warnervale Road and Minnesota Road	75.0%	25.5	B	73.0%	21.5	B
Warnervale Road and Virginia Road	21.0%	12.5	A	25.0%	15.3	B

Table 9-5: Intersection Performance for 2031 (Sidra Result)

Intersection	Morning Peak			Evening Peak		
	Degree of Saturation (%)	Average Delay (secs)	Level of Service (LoS)	Degree of Saturation (%)	Average Delay (secs)	Level of Service (LoS)
Scenario 3						
Sparks Road and Albert Warner Drive	87.0%	51.0	D	90.0%	37.0	C
Warnervale Road and Minnesota Road	75.0%	23.0	B	81.0%	24.0	B
Warnervale Road and Virginia Road	20.0%	10.0	A	20.0%	10.0	A
Scenario 4						
Sparks Road and Albert Warner Drive	92.6%	57.4	E	92.0%	36.2	C

Warnervale Road and Minnesota Road	79.7%	24.8	B	77.0%	24.4	B
Warnervale Road and Virginia Road	19.3%	10.9	A	30.7%	14.7	B

In year 2022:

- The signalised intersection of Warnervale Road / Minnesota road will continue to operate at a good level of service B during the morning and afternoon peak periods.
- The priority controlled intersection of Warnervale Road / Virginia Road would operate at an excellent level of service A and a good level of service B during the morning and afternoon peak periods respectively.
- The signalised intersection of Sparks Road / Albert Warner Drive would continue to operate at a level of service C during the morning and afternoon peak periods respectively.

In year 2031:

- The signalised intersection of Warnervale Road / Minnesota road will continue to operate at a good level of service B during the morning and afternoon peak periods.
- The priority controlled intersection of Warnervale Road / Virginia Road would operate at an excellent level of service A and a good level of service B during the morning and afternoon peak periods respectively.
- The signalised intersection of Sparks Road / Albert Warner Drive would worsen from a level of service D to E during the morning peak (with an increase in delay of six seconds) and continue to operate at a level of service C during the afternoon peak periods.

Accordingly, it is considered that the proposed school development would not have any adverse impacts on the surrounding road network

9.4 Proposed Roundabout

A roundabout has been proposed on Warnervale Road, to facilitate vehicle access and egress to/from the School, through access point 2 (refer to **Appendix A**). SIDRA intersection modelling will need to be undertaken for the proposed roundabout on Warnervale Road and the site access to identify queue length, intersection performance and vehicle delays. The geometric design of this intersection must be considered to ensure that the proposed development and adjoining lots do not compromise the provision of a safe intersection meeting standards.

A swept path assessment of the proposed roundabout has been undertaken. As shown within Appendix G, the evaluation demonstrated that a 12.5 metres Heavy Rigid Vehicle (HRV) and a 12.5 metre long bus would be able to enter and exit the roundabout from Warnervale Road.

10. Conclusion

Stantec has been asked by The Department of Education to undertake an assessment of the proposed development of the New Primary School at Warnervale, on the local traffic environment within Warnervale, NSW.

In order to determine the traffic impacts of the school, the difference in trips generated from the proposed land use (residential) within the Traffic Modelling Study and the newly proposed school development was assessed. The School development results in an increase of approximately 500 trips in the peak hour over the Precinct total of 3,700 trips.

The proposed vehicle access points for the development are as follows:

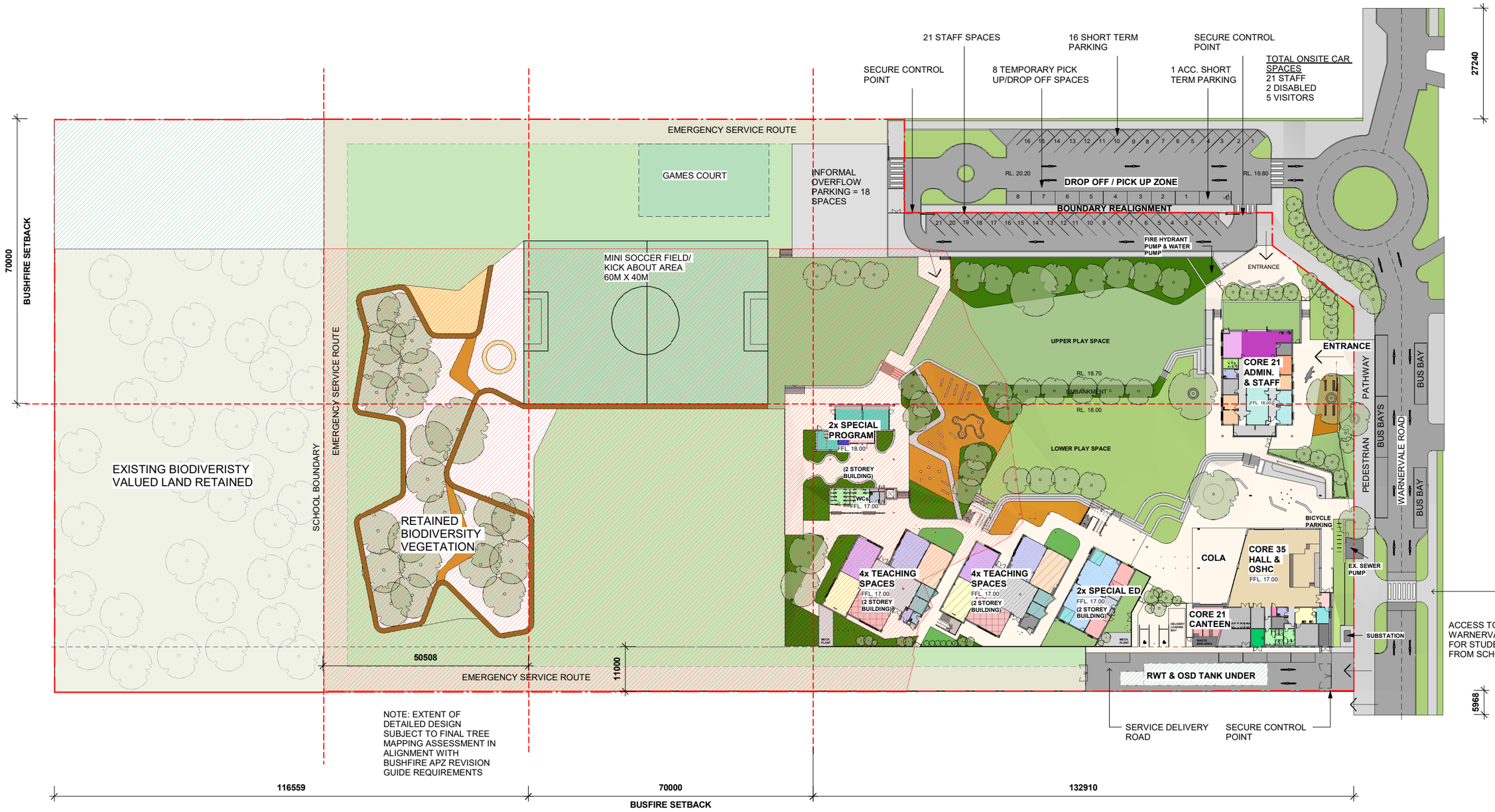
- Access Point 1: is located on Warnervale Road, approximately 175 metres from the intersection of Warnervale Road and Virginia Road;
- Access point 2: is also located on Warnervale Road, approximately 300 metres from the intersection of Warnervale Road and Virginia Road.

It is proposed for a total of 28 on site car parking spaces, including two spaces for assessible parking use. The provision of the onsite carparking spaces has met the requirements of the DCP for the enrolment of 460 students.

Based on the calculations and assumptions used within the report, it is determined that the provision of 16 short-term parking, one accessible short term parking and eight temporary pick up/drop off car parking spaces is sufficient to accommodate the expected parking demands for 460 students, and future expansion of up to 1000 students.

Appendices

Appendix A Site Plans



REV	AMENDMENTS	DATE
E	For SSDA Issue	01.08.19
D	For Information	26.07.19
C	For SSDA Issue	05.06.19
B	For Information	31.05.19
A	For Information	27.03.19

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CLIENT

CLIENT'S DETAILS

NSW Education | School Infrastructure

TSA MANAGEMENT

PROJECT NAME

The New Primary School at Warnervale

SHEET NAME

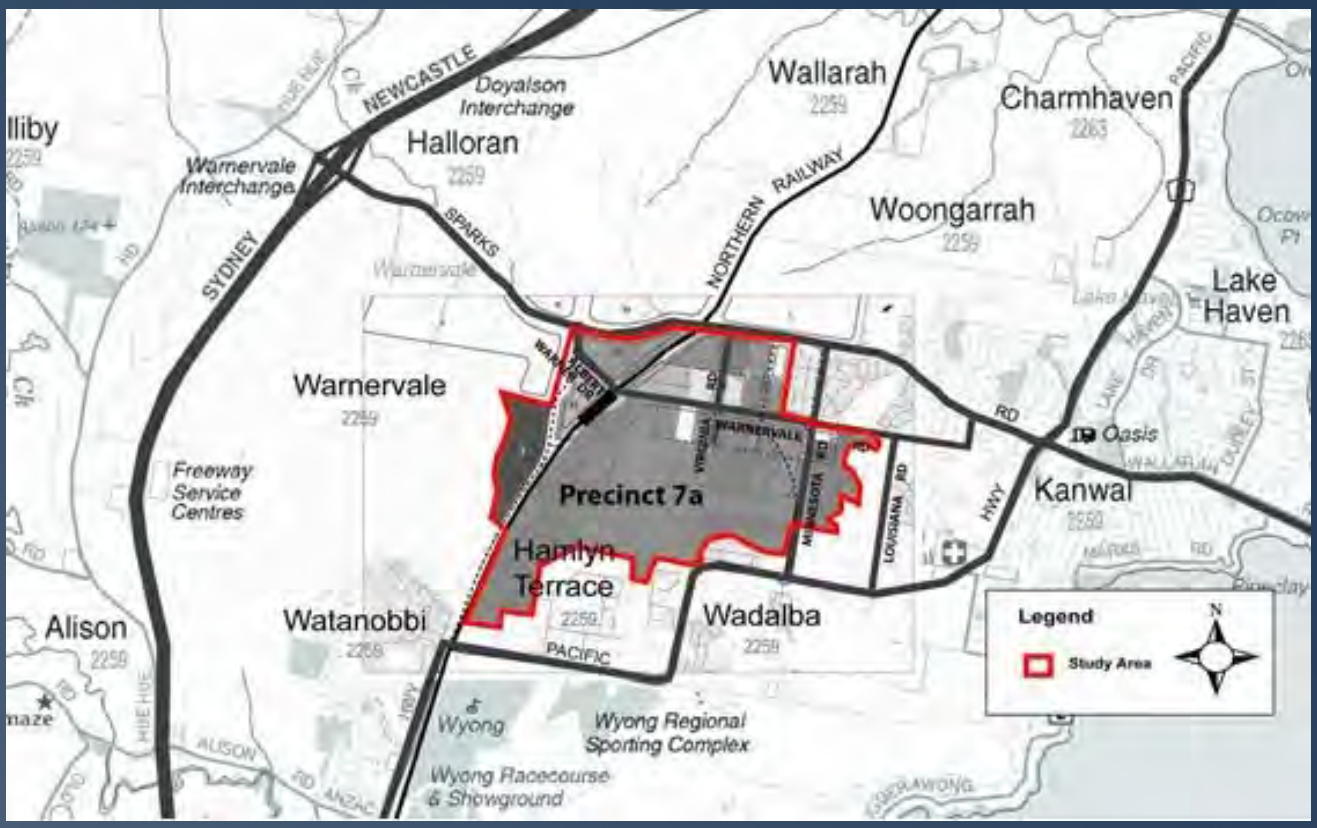
SITE CONTEXT - PROPOSED LOWER GROUND

PROJECT NO.	REVISION DATE	SCALE
17070	05.06.2019	1 : 500 @ A1

DRAWING NO	REVISION NUMBER
AA03-0001	[E]

DEVELOPMENT APPLICATION

Appendix B Traffic Modelling Study



PRECINCT 7A TRAFFIC AND TRANSPORT STUDY

Traffic Modelling Report

Prepared for

WYONG SHIRE COUNCIL

November 2012

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WYONG SHIRE COUNCIL

TRAFFIC MODELLING STUDY FOR PRECINCT 7A

Traffic Modelling

Traffic Modelling Report

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Approver Mukit Rahman

Report No

Date June 2012

This report has been prepared for Wyong Shire Council in accordance with the terms and conditions of appointment for Traffic Modelling Study for Precinct 7A dated May 2009 . Hyder Consulting Pty Ltd (ABN 76 104 485 289) cannot accept any responsibility for any use of or reliance on the contents of this report by any third party.

GLOSSARY

AADT	Average Annual Daily Traffic
BTS	Bureau of Transport Statistics (Part of Transport NSW and formerly TDC)
DCP	Development Control Plan
DoP	Department of Planning (now Department of Planning & Infrastructure)
EA	Environmental Assessment (formerly EIS)
ECRL	Epping to Chatswood Rail Link
EIS	Environmental Impact Statement
EPA	Environmental Planning & Assessment Act, 1979
F3	The F3 Sydney to Newcastle Freeway
HTS	Household Travel Survey
IA	Infrastructure Australia
JTW	Journey to Work
LGA	Local Government Area
LoS	Level of Service
RMS	Roads and Maritime Services (formally Roads and Traffic Authority, RTA)
SEPP	State Environmental Planning Policy
STM	Strategic Travel Model (mode share model operated by BTS)
TIDC	Transport Infrastructure Development Corporation (now TCA)
TOD	Transit Oriented Development
TZ	Travel Zone
VKT	Vehicle Kilometres Travelled
VPD	Vehicles per day
VPH	Vehicles per hour

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Appendix G 2031 FORECAST TURNING VOLUMES AND SIDRA RESULTS (SCENARIO 4B)

Executive Summary

Wyong Shire Council (the Council) is currently preparing a Planning Strategy for Precinct 7A development. As a part of the background information required for a Draft Local Environment Plan (LEP), Council commissioned Hyder Consulting Pty Ltd (Hyder) to undertake traffic and transport assessment of Precinct 7A development.

The purpose of Hyder's traffic study is to assess the performance of existing and future network capacity within the study area. Hyder used the RMS's Central Coast Regional Strategic Model together with its own TransCAD modelling software. For assessing individual intersection capacity, Hyder used SIDRA software. Future years modelling was undertaken for 2021 and 2031 using land use data sourced from Council.

A consultation process engaging Council constituted an important element of the traffic modelling study. Both Paramics and SIDRA models provided an assessment tool that identified key network issues and tested network impact from Precinct 7A development.

Vehicular access into Precinct 7A study area relies upon the main arterial roads, with Sparks Road and Pacific Highway being the principal routes from F3 Freeway. In general, the study area is currently ringed by Sparks Road, Minnesota Road, Porters Creek floodplain and the Link Road (Albert Warner Avenue).

The Precinct 7A study area consists of approximately 540 hectares and is identified within the Council's Residential Development Strategy (RDS) 2002 as a medium priority for urban development. It has the potential to have substantial impact on local housing supply and demand in the region. In addition the area is included within the draft North Wyong Shire Structure Plan (NWSSP) area for future development as identified within the Central Coast Regional Strategy (CCRS).

The proposed land use for the Precinct 7A include residential, employment generation (industrial), open space, community facilities, recreation, conservation and commercial uses. The traffic model included the cumulative growth from following planned developments including:

- Precinct 7A;
- Wyong Employment Zone (WEZ);
- Bruce Crescent;
- Warnervale Town Centre (WTC);
- The Lakes Anglican Grammar School;
- Precinct 14, and
- Kanwal Retirement Village.

For modelling purposes, Council provided land use data for the above mentioned developments. Council has identified the need for about 4,300 new residential dwellings. Of that about 2,000 dwellings are proposed within the Precinct 7A. It is expected that Warnervale Town Centre could accommodate about 2,200 residential dwellings when fully developed.

About 43,000 square metres gross floor area (GFA) of commercial, bulky goods, and retail developments are proposed in the Warnervale Town Centre. About 3,000 square metres GFA of commercial developments are planned within the Precinct 7A area. Industrial developments are planned in the Wyong Employment Zone (WEZ), Bruce Crescent, Precinct 14 and Precinct 7A. When fully developed, all these areas could accommodate about 12,000 new jobs. For

modelling purposes, it was assumed that all proposed developments would be fully developed and occupied by year 2031.

The Precinct 7A site is forecast to generate about 3,700 vehicle trips in one peak hour when the site is fully developed. In combining with other developments (WEZ, WTC, Bruce Crescent, Precinct 14, Retirement Village) total trip generation for the study area is forecast in order of 11,600 vehicle trips in one peak hour.

In 2031, traffic on Sparks Road is forecast in the order of 43,000 vehicles per day east of Minnesota Road and 54,000 vehicles per day west of Albert Warner Drive. The forecast traffic volumes on Sparks Road suggest that the road needs to be widened to six lanes should full developments occur by 2031.

Prior to the ultimate widening, Sparks Road will be required to be upgraded to a four lane carriageway in year 2021 to cater for traffic demand generated by initial phases of developments. For 2021, the model forecasted a traffic volume on Sparks Road in the order of 35,000 to 39,000 vehicles per day. The forecast volume on Sparks Road in 2021 is almost double than today's traffic.

Intersection modelling was undertaken using SIDRA software for eight key intersections for year 2021 and 2031.

In 2021, the analysis identified the need for intersection upgrades at the following locations:

- Sparks Road / Albert Warner Drive (Link Road) (I-1);
- Sparks Road / Virginia Road (I-2);
- Sparks Road / Minnesota Road (I-3);
- Pacific Highway / Minnesota Road (I-5);
- Warnervale Road / Virginia Road (I-6); and
- Sparks Road / Warnervale Township (I-7);

In 2031, the analysis identified the need for further intersection upgrades at the following locations:

- Sparks Road / Albert Warner Drive (Link Road) (I-1);
- Warnervale Road / Minnesota Road (I-4)
- Sparks Road / Warnervale Township (I-7);

The closure of the at grade railway crossing on Warnervale Road was assessed for the 2031 scenario. Modelling analysis indicated that potential closure would divert additional traffic to Virginia Road and the new connection between Sparks Road and Warnervale Road, located between Virginia Road and Minnesota Road. The potential closure would increase traffic on the new Sparks Road / Warnervale Township intersection. The analysis identified no additional road or further intersection upgrades are required as a result of the potential closure of the at grade railway crossing.

1 Introduction

1.1 Background

Wyong Shire Council (the Council) is currently preparing a Planning Strategy for the area known as the Precinct 7A Study Area (study area). As a part of the background information for a Draft Local Environment Plan (LEP) of subject area, Council commissioned Hyder Consulting Pty Ltd (Hyder) to undertake a traffic and transport assessment of Precinct 7A development. The scope of Hyder's study was to undertake traffic modelling support services assisting Council in the planning of the Precinct 7A development. In line with study brief, the modelling was delivered in four phases including:

- Phase 1: Preliminary assessment;
- Phase 2: Master planning and final assessment;
- Phase 3: Reviewing modelling and road and intersection requirements; and
- Phase 4: Final report.

1.2 Road Network

Vehicular access into Precinct 7A Study Area relies upon the main arterial roads, with Sparks Road and Pacific Highway being the principal routes from F3 Freeway. In general, the study area is currently ringed by Sparks Road, Minnesota Road, Porters Creek floodplain and the Link Road (Albert Warner Avenue). Figure 1-1 below shows road network within the study area.

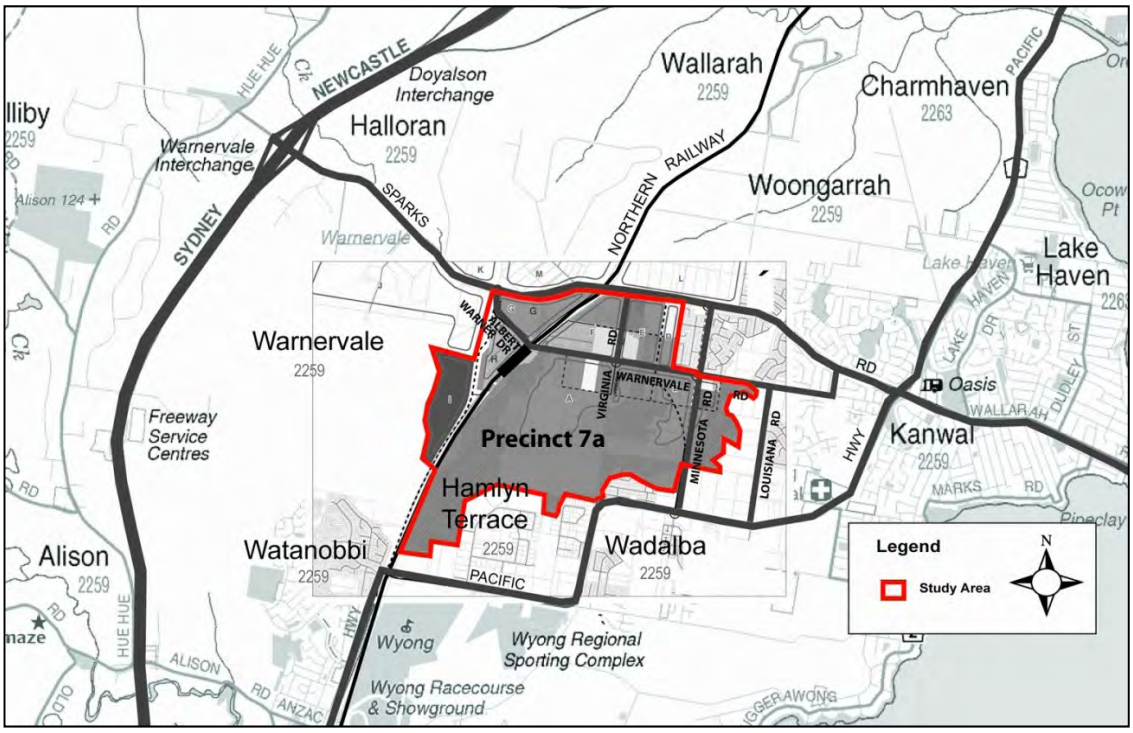


Figure 1-1 Study Area Road Network

1.3 Study Objective

The purpose of Hyder's traffic study is to assess the performance of existing and future network capacity within the study area. For Precinct 7A traffic study, Hyder used the RMS's Central

Coast Regional Strategic Model together with its own TransCAD modelling software. Hyder obtained the RMS's permission to use the traffic model for the Precinct 7A study. Hyder augmented the traffic model for the Precinct 7A Study Area. For assessing individual intersection capacity, Hyder used SIDRA software. SIDRA models were built upon and integrated with wider strategic traffic model.

Both TransCAD and SIDRA models provided an assessment tool that identified key network issues and tested network impact from Precinct 7A development. The specific purpose of this traffic modelling investigation is to assess the following elements:

- Assess current network capacity within study area network;
- Quantify the impacts of future land use development scenarios on the current road network;
- Future operational performance of key roads and intersections to determine the ultimate road and intersection footprint required to cater for the expected traffic growth as a result of future developments; and
- Assist Council in determining the optimum precinct staging strategy and optimum network upgrade strategy.

1.4 Site Context

Precinct 7A (the site) consists of approximately 554 Hectares and is identified within Council's Residential Development Strategy (RDS) 2002 as a medium priority for urban development. It has the potential to have substantial impact on local housing supply and demand in the region. In addition the area is included within the North Wyong Shire Structure Plan (NWSSP) area for future development as identified within the Central Coast Regional Strategy (CCRS).

The proposed land use types include residential, employment generation (industrial), open space, recreation, conservation and commercial.

1.5 Approach to Traffic Modelling Investigation

Hyder developed a comprehensive study approach specifically to achieve key study objectives. It involves identifying the data needs, undertake new traffic survey, development of a road based traffic model, calibration and validation of traffic model and traffic assessment.

The key aspects of Hyder's modelling approach include:

- Traffic survey and analysis. This stage consisted of reviewing the existing data resources. In March/April 2009, Council undertook new mid-block counts at eight location and intersection turning movement counts for five locations. The data was provided to Hyder and used in model development and augmentation.
- Model development/augmentation, calibration and validation. Traffic models were developed/augmented using a two-level methodology – a Central Coast Strategic Traffic Model (CCTM, using TransCAD software) and a series of intersection models (using SIDRA software). The model calibration and validation was undertaken for existing traffic condition in year 2009 traffic condition for Sparks Road and surrounding road network. This was undertaken for assessing Precinct 7A broader study area including Wyong Employment Zone and Warnervale Township. The CCTM model represent weekday AM and PM peak period traffic conditions. Future years CCTM modelling assessment was undertaken for 2021 and 2031 time steps as per Council's forecasts.
- A micro intersection model (SIDRA). Hyder built SIDRA models for five key intersections within the study area for both weekday AM and PM peak hour. For base year intersection

SIDRA modelling, Hyder used turning movement counts for year 2009. The future years (2021 and 2031) turning volumes at intersection were estimated using CCTM strategic traffic model. The SIDRA model was used to predict level of service (LoS) of key intersections. The SIDRA modelling result was also used to refinement intersection improvements. This includes identifying improvements to intersection configurations that produce the best arrangement for each option. SIDRA modelling was used to report intersection performance including:

- Level of service
- Degree of saturation
- Queue length by approach
- Optimum signs and signal times
- Geometric layout constraints

1.6 Report Structure

The Precinct 7A Traffic and Transport Report Contains the following seven chapters providing a traffic and transport assessment of Precinct 7A development.

Section 1 provides an overview of the project, background information, study objectives, an upper level approach to traffic investigation.

Section 2 provides the existing regional and location transport context for the study area.

Section 3 provides the context of existing traffic conditions of road network within which the assessment has taken place. This section provides an overview of existing traffic volumes and travel patterns in the study area.

Section 4 documents an overview of traffic models and its purposes.

Section 5 documents future land use and trip generation analysis.

Section 6 provides modelling assumptions, scenario and results documenting forecast traffic volumes and level of service of key intersections within the study area.

Section 7 summarises the key study findings.

2 Regional and Local Transport Context

2.1 Strategic & Policy Context

2.2 Road Hierarchy

Roads and Maritime Services (RMS), in co-operation with the local councils, defines the functional road hierarchy in an urban area to establish a consistent basis for traffic management. There are three key road categories and their functions are stated as below:

- State Roads: Freeways/motorways and primary arterials.
- Regional Roads: secondary or sub arterials.
- Local Roads: Collector and local access roads.

A generic road hierarchy comprises of freeways, primary arterial roads, secondary or sub arterial roads, collector roads and local access roads. The State road network (including the AusLink network) is formed by the primary network of principal traffic-carrying and linking routes for the movement of people and goods within and between major urban centres. Regional roads comprise the secondary network, which together with State roads, provide for travel between smaller towns and districts and perform a sub-arterial function within major urban centres

The road hierarchy allocated to the road network around the Precinct 7A Study Area is shown in Figure 2-2. The classification criteria are sourced from NSW Road Classification Review Panel – Final Report 2007.

National Highway

The Sydney-Newcastle Freeway (F3) is 127 km long motorway linking Sydney to the Central Coast, Newcastle and Hunter regions of New South Wales and is a part of the AusLink road corridor between Sydney and Brisbane. The freeway is one of the direct routes between Sydney and the Central Coast, and is a key part of the major road routes for road transport to the Hunter region, northern NSW and Queensland. The freeway thus carries a heavy mix of commuter traffic, road freight transport, and (periodically) holiday and recreational travellers. The F3 is a dual carriageway freeway with two lanes in each direction and provides access to the study area through a grade separated interchange at Sparks Road. The F3 speed limit is predominantly 110 km/h.

State Roads

The Pacific Highway is 1,025 km long and links Sydney to Brisbane along the coast, via Gosford, Newcastle, Taree, Port Macquarie, Kempsey, Coffs Harbour, Grafton, Ballina and the Gold Coast .The majority of traffic between Sydney and Newcastle would however use the F3. The Pacific Highway is one of the main routes serving the study area, providing access between Tuggerah and Doyalson. The Pacific Highway has a posted speed limit of 70 km/h, with lower speed limits applying in built up areas and near the intersections.

Sparks Road is a major road in the study area. Sparks Road carries traffic between the study area and the F3. It also provides a link in the study area to connect the traffic movements between Pacific Highway and the F3. Sparks Road also has a speed limit of 90 km/h.

Local Roads

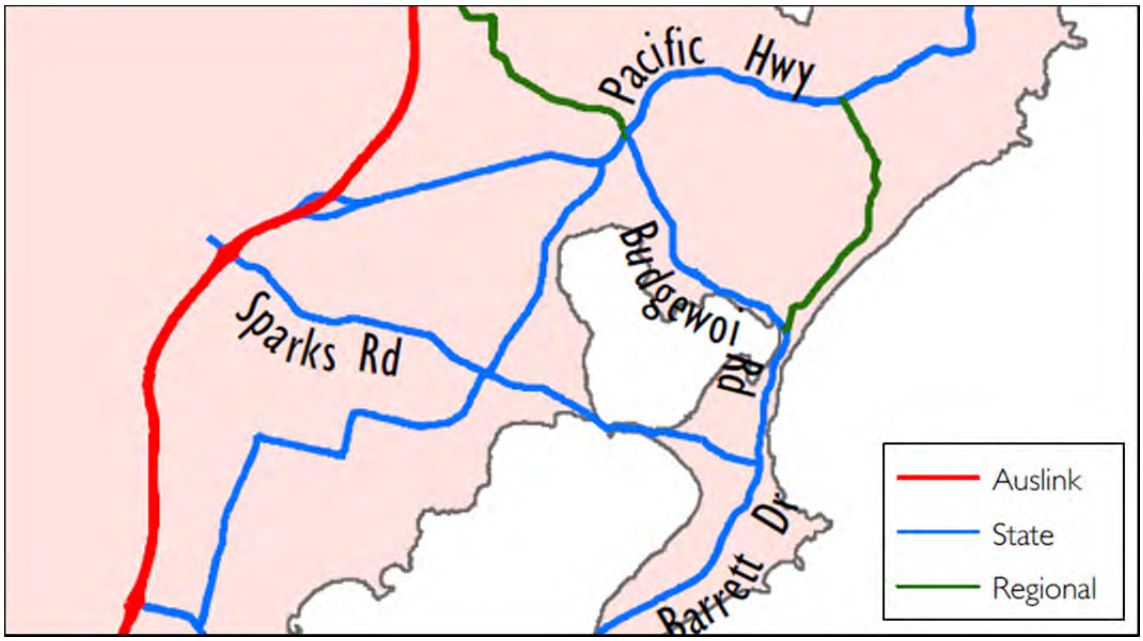
Minnesota Road is a collector road which mainly connects Pacific Highway to Warnervale Road and Sparks Roads. The speed limit posted on this street is 50km/hr.

Louisiana Road is a collector road which carries local traffic between the Pacific Highway and Warnervale Road. The posted speed limit is 50km/h.

Virginia Road is a collector road which carries local traffic between Sparks Road and Warnervale. The posted speed limit on this street is 50km/h.

Albert Warner Drive can be considered as the extension of Warnervale Road over the Railway towards the Northwest. However this street serves the residential area at its intersection with the railway and also carries local traffic from local streets to Sparks Road and Warnervale Road.

All other roads in the study area can be classified as local roads. The main characteristics of these roads are a speed limit of 50 km/hr or lower and their limited road mobility in terms of access to higher class roads.



Source: RMS Classified Road Map, 2011

Figure 2-2 Road Hierarchy in Study Area Network

2.3 Key Transport Indicators

2.3.1 Historical Traffic Growth

In general, the RMS (formally RTA) collects traffic volume data at key count locations across the NSW road network. Historical traffic data from 1995 to 2008 were obtained from the RMS. Table 2-1 shows historical traffic volume on key roads within the study area measured in average annual daily traffic (AADT). Table 2-1 also shows historical average growth rate per annum.

The information in Tables 2-1 indicates:

- Between 2001 and 2008, traffic on F3 Freeway at Alison Road overpass increased from 52,300 to 61,800 vehicles per day or up to 2.6% per annum over seven year.
- The same trend also is observed on F3 Freeway at Hue Hue Road overpass west of the study area.
- Traffic on Pacific Highway (south of study area) increase from 17,500 to 21,000 vehicles per day between 1995 and 2004. This growth is up to 2.1% per annum.
- Annual growth up to 2.9% was observed east of the study area on Wallarah Road east of Pacific Highway between 1995 and 2004.
- On average for key roads surrounding the study area, the historical traffic growth in the study area for last 13 years was found to be between 2.1% to 2.9% per annum.

Table 2-1 AADT at RMS (RTA) Count Stations (1995-2008)

RMS (RTA) Station	Road (Location)	AADT						Annual Growth Rate (between)
		1995	1998	2001	2004	2006	2008	
05.007	F3 Freeway (Alison Road overpass)	39,698	46,413	52,284	60,093	60,742	61,754	2.6% (2001-2008)
05.222	F3 Freeway (Hue Hue Road overpass)	23,680	29,463	32,702	38,494	38,178	38,877	2.7% (2001-2008)
05.028	Pacific Highway (1.3 km East of Railway Bridge)	17,476	18,672	19,213	20,978	n/a	n/a	2.1% (1995-2004)
05.165	Wallarah Road (East of Pacific Highway)	17,056	17,722	19,114	22,168	n/a	n/a	2.9% (1995-2004)

2.3.2 Seasonal Traffic Variation

Historical traffic data in the vicinity of the study area was obtained from RMS's Hunter Region Traffic Volume Data for discrete years between 1995 and 2008. Figure 2-3 shows the location of count sites in the vicinity of the study area.

Traffic volume on Doyalson Motorway Road (V05.302), south of the Pacific Highway was extracted from the RMS Traffic Volume Data for Hunter and Northern Regions 2004. This site was chosen to plot weekly traffic variation within the vicinity of the study area.

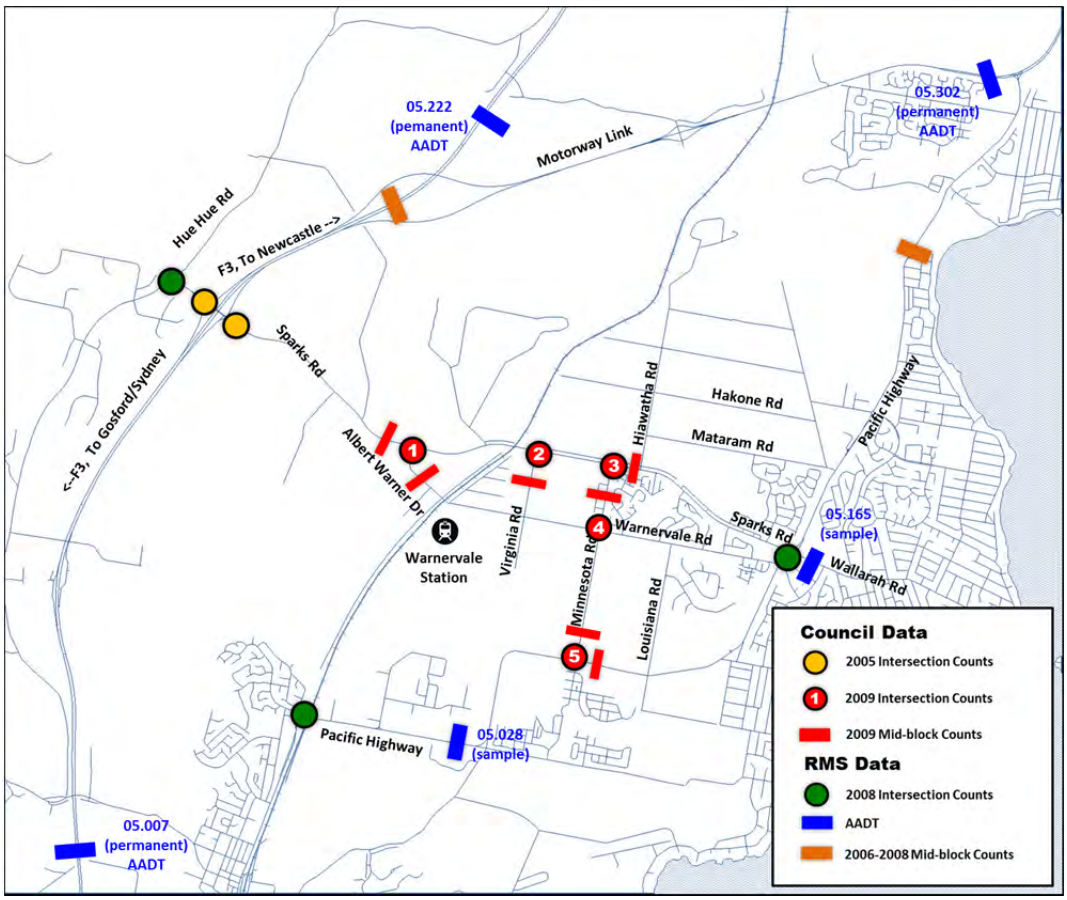


Figure 2-3 Traffic Count Locations

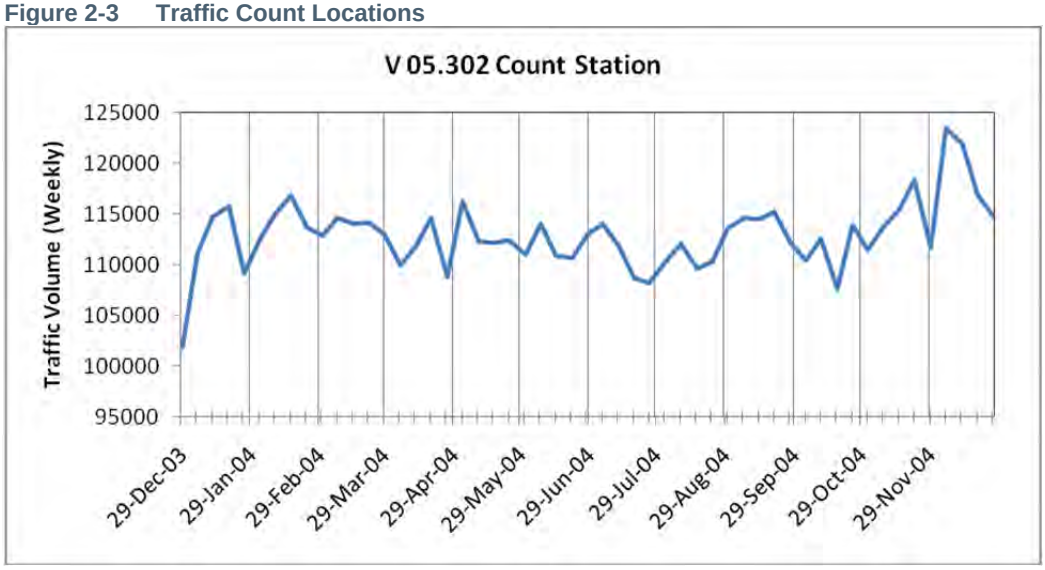


Figure 2-4 Weekly Traffic Volumes

Figure 2-4 shows the weekly variation of traffic volumes for the period of 29 December 2003 to 29 December 2004. The graph indicates that weekly traffic volumes increased from October 2004 to early December by almost 20%, and then decreased from early December to January by almost 15%. From the graph the lowest weekly traffic volume for the year occurred in early January at more than 15% below average. By mid-January the traffic volume was slightly over the average of 115,000 per week .After maintaining the same rate until late July, the graphs shows a period of lower volumes from mid-July to mid-August (almost 5% below average). Figure 2-3 also shows that weekly traffic volumes in September 2004 were slightly above average.

Figure 2-4 also indicates that lower traffic volumes occurred during April, July and October indicating that autumn (April), winter (July) and spring (October) school holiday periods reduces the traffic volumes in the study area

2.3.3 Crash Data

The analysis of crash data is based on crash reports supplied by RMS for five years from 2004 to 2008 for the roads in Precinct 7A Study Area .This report includes Pacific Highway (between Britannia Drive and Sparks Road), Sparks Road (between Albert Warner Drive and Pacific Highway), Virginia Road (between Warnervale Road and Sparks Road), and Minnesota Road (between Pacific Highway and Sparks Road).

The crash frequency on roads in the study area appears to be related to the type and volume of traffic on the different roads. As can be seen in Table 2-2, the Pacific Highway had the largest number of crashes in the study area with more than 116 crashes over the five year period. The table also indicates that the lower function roads have lower number of crashes and over 50% of crashes involved property damage only.

Figure 2-5 plots the number of crashes and casualties by street where the crash occurred. This figure indicates that the number of casualties on major roads and highways is larger than of those on collector roads. The overall trend of Crash data shows overall increase by more than 40% on Pacific Highway and Sparks Road, when casualty rate on the same road has almost had an increase of more than 100% between 2004 and 2008.

Figure 2-6 to Figure 2-87 below show distribution of crash movements observed within study area.

Rear-end crashes have been reported as the major type of crash for the whole area and for major roads (about 25 % of all crashes). However this crash type is the second largest %age by crash type on collector roads. Opposing vehicles/turning crash type have been reported for more than 25% of crashes on collector roads, but represent fewer than 10% of crashes on major roads. Off road straight on/Hit object crashes have been reported for more than 20% of crashes on collector roads while the number of this type of crashes is less than 10% of major road crashes.

Figure 2-9 summarises the location of crashes observed for the period of 2004 to 2008.

Table 2-2 Summary of Crash Data for 2004 to 2008

Location	Total number of crashes	Fatal crashes	Injury crashes	Non Injury crashes
Highways and Major Roads				
Pacific Hwy, Between Britannia Dr (Watanobbi) and Sparks Rd (Kanwal)	116	1	54	61
Sparks Rd ,Between Albert Warner Dr (Warnervale) to Pacific Hwy (Kanwal)	67	0	29	38
Collector Roads				
Virginia Rd, Warnervale Rd to Sparks Rd	4	0	2	2
Warnervale Rd, railway to Sparks Rd	13	0	6	7
Minnesota Rd, Pacific Hwy to Sparks Rd	30	0	13	17

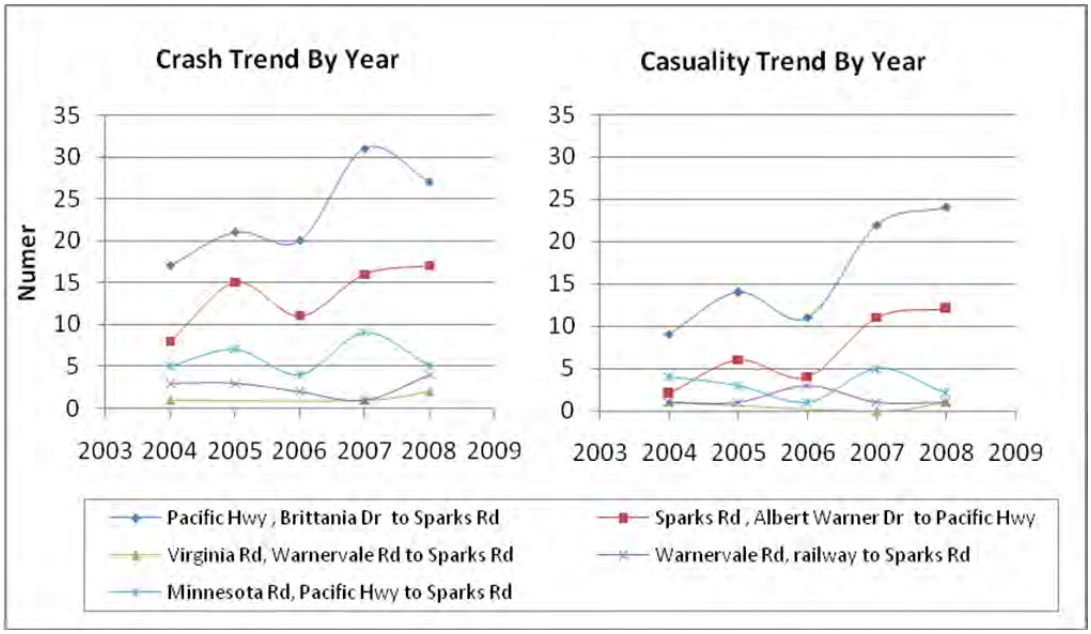


Figure 2-5 Crash and Casualty Trend between 2004 and 2008

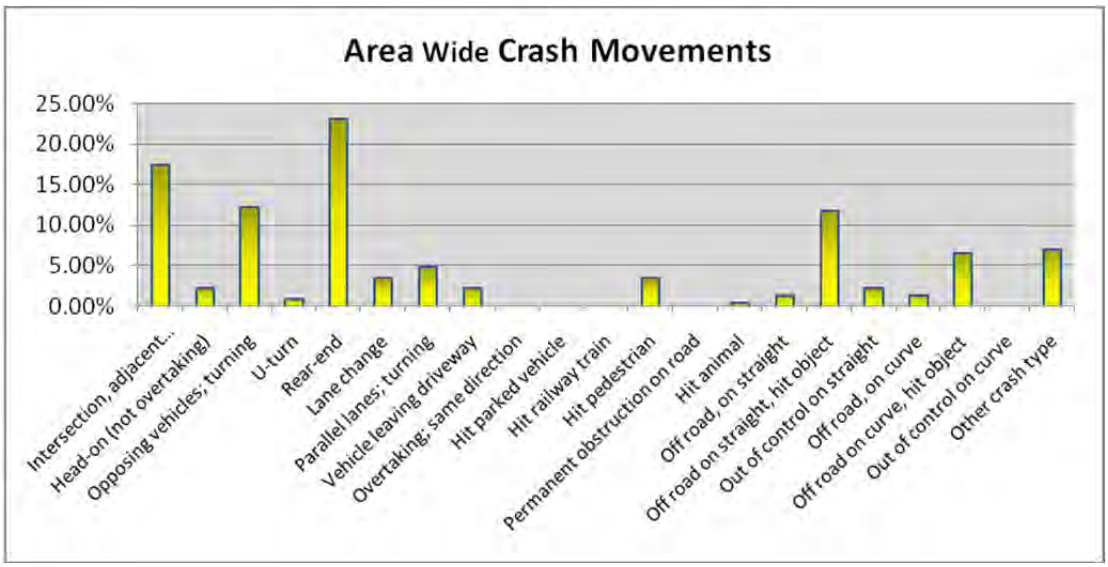


Figure 2-6 Recorded Crash Movements

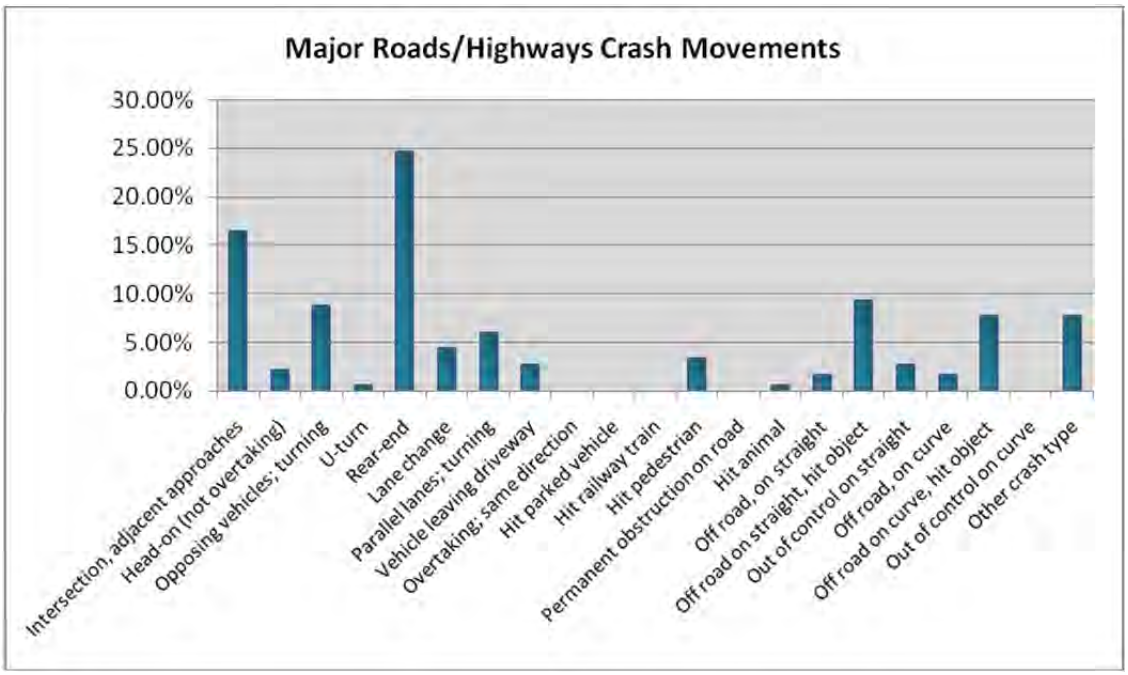


Figure 2-7 Recorded Crash Movement on Major Roads and Highways

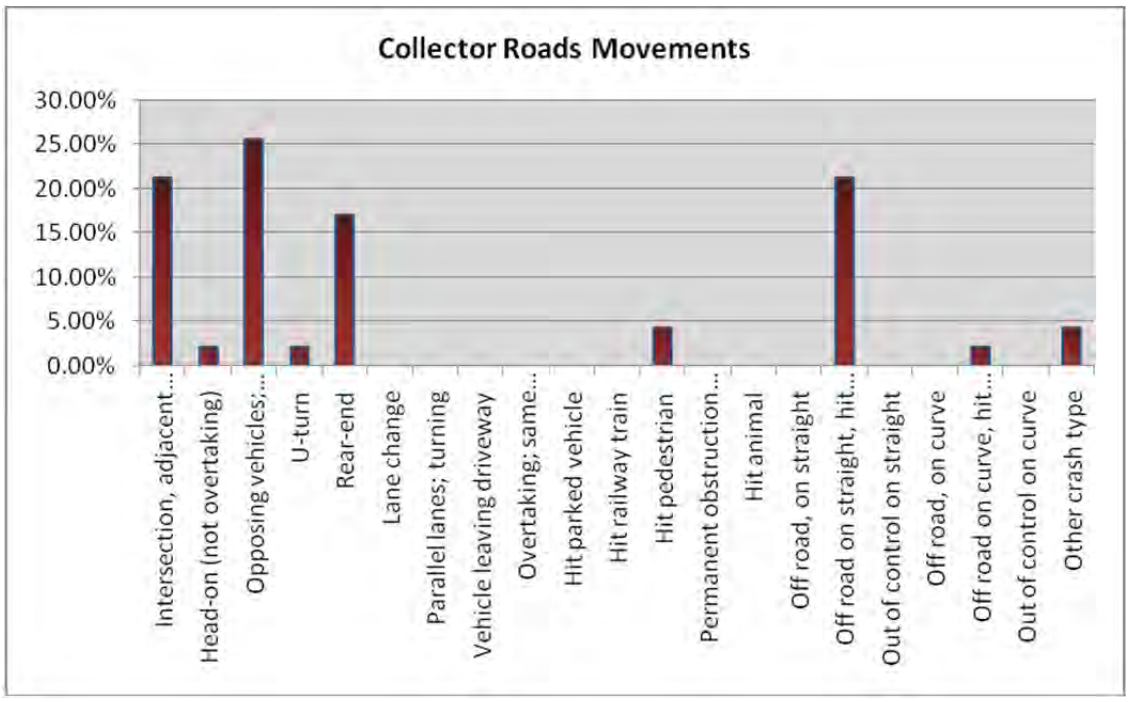


Figure 2-8 Recorded Crash Movements on Collector Roads

Figure 2-9 Crashes on Major Roads/ Highway and Collector Roads

2.3.4 Commuter Mode Share

The Bureau of Transport Statistics (BTS) provided journey to work (JTW) for the Sydney Metropolitan Area (GMA) which provided a comprehensive sample of commuter travel, collected during the 2006 Census. Work trip origin and destinations are coded to the 2006 travel zones.

Table 2-3 shows work trips by mode of travel reported for the study area. Three travel zones 3160, 3164 and 3165 represent the study area.

In 2006, about 3,000 residents travelled from the study area to work. About 19% of people did not travel to work or worked from home on census day. The Census data showed that around 66% of work trips from the study area were made by motorists in a private vehicle, with 6% of those as car passengers. Approximately 6% of workers travelled by public transport

Similarly, in 2006 about 1,300 employees travelled to study area to work. For the inbound trips statistics, it can be seen that private vehicles are still by far the dominant mode of transport to work, which was about 65%. About 2% of employees travelled by public transport.

From these statistics, it can be seen that private vehicles are by far the dominant mode of transport to work. This JTW pattern in the study area is consistent with JTW data for the entire Central Coast, with about 73% of all work trips are being made by car, either as driver or passenger

Table 2-3 JTW Trips to and from Study Area in 2006

Travel Mode	Study Area(1) as Home (Outbound trips)	%Study Area(1) as Home	Study Area(1) as Workplace (Inbound trips)	%Study Area(1) as Workplace
Car Driver	1,965	66.4%	848	65.3%
Car Passenger	194	6.6%	43	3.3%
Public Transport	190	6.4%	15	1.2%
Other (Walking, Cycle)	54	1.8%	33	2.5%
Worked at home/ Did not travel/ Not stated	557	18.8%	360	27.7%
Total	**2,960**	**100%**	**1,299**	**100%**

Note: (1) Study Area includes travel 3160, 3164 and 3165. Source: BTS JTW06

2.3.5 Work Trip Distribution

The 2006 Journey to Work (JTW) data was used to analyse work trips distribution the study area. Table 2-4 shows the work trip distribution made by car (driver and passenger) from and to the study area. The JTW data shows that work trips by study area residents tend to be long distance, while a significant proportion of inbound trips are short to medium distances.

Table 2-4 JTW Trips Distribution from and to Study Area

Catchment	Study Area[1] as Home		Study Area[1] as Workplace	
	Car Work Trips	%	Car Work Trips	%
Study Area[1]	162	8%	162	18%
Wyong LGA	808	37%	484	54%
Gosford LGA	375	17%	112	13%
Newcastle SSD	137	6%	115	13%
Sydney SSD	420	19%	14	2%
Others	257	12%	4	0%
Total	**2,159**	**100%**	**891**	**100%**

Note: (1) Study Area includes travel 3160, 3164 and 3165. Source: BTS JTW06

2.4 Public Transport

2.4.1 Rail Services

Rail travel for the study area is serviced by Warnervale and Wyong stations. Table 2-5 shows the platforms and routes serviced by Warnervale railway station

Table 2-5 Warnervale Railway Station Platforms

Platform	Line	Major Stopping Pattern
1	Newcastle & Central Coast Line	Intercity services to Gosford, Hornsby and Central (via Strathfield)
2	Newcastle & Central Coast Line	Intercity services to Newcastle via Fassifern

The intercity line calling at Warnervale Railway station operates between Newcastle and Sydney via Hamilton, Fassifern, Wyong, Tuggerah, Ourimbah, Lisarow, Niagara Park, Narara, Gosford, Woy Woy, Berowra and Hornsby.

In addition to Warnervale Railway station, the study area is served by Wyong railway station through bus services connecting the study area to the park and ride facilities provided at Wyong interchange.

Wyong railways station also services CountryLink lines and provides them with platforms. Table 2-6 shows the platforms and routes serviced by Wyong railway station.

Table 2-6 Wyong Interchange Rail Station Platforms

Platform	Line	Major Stopping Pattern
1	Newcastle & Central Coast Line	Terminating services, intercity services to Gosford and Sydney Terminal (via Strathfield)
	North Shore & Western Line	Terminating services, AM peak hour intercity services to Hornsby and Sydney Terminal (via Chatswood)
2	Newcastle & Central Coast Line	Intercity services to Gosford and Sydney Terminal (via Strathfield)
	CountryLink North Western	Country services to Sydney
	CountryLink North Western	Country services to Sydney
3	Newcastle & Central Coast Line	Intercity services to Newcastle
	CountryLink North Western	Country services to Grafton, Casino and Brisbane
	CountryLink North Western	Country services to Armidale & Moree

Source: RailCrop

A total of 29 trains travelling towards Sydney, and 30 trains travelling towards Newcastle, have a stop at Warnervale station on an average workday. Wyong station sees 56 trains travelling towards Sydney and 51 trains travelling towards Newcastle, stop at that station each day. Table 2-7 indicates lines and frequency of trains serviced by Wyong and Warnervale railway station.

Table 2-7 Train Frequency and Travel Time

Station	To Sydney (Number of Services)				To Newcastle (Number of Services)	
	Newcastle & Central Coast Intercity Line	North Shore Line	Total	Average Travel Time	Newcastle & Central Coast Intercity Line	Average Travel Time
Warnervale	29	0	36	110 min	30	55 min
Wyong	47	9	56	105 min	51	60 min

Source: RailCrop

The distribution of train arrivals by direction and time of day at both Warnervale and Wyong stations are summarised in Table 2-8.

Table 2-8 Train frequency on an average working day

Station	Stopping Time at Station							
	3:00-6:00	6:00-9:00	9:00-12:00	12:00-15:00	15:00-18:00	18:00-21:00	21:00-3:00	Total
Trains To Sydney								
Wyong	8	11	10	5	6	10	6	56
Warnervale	4	5	3	3	5	5	4	29
Trains from Sydney								
Wyong	3	8	7	6	5	13	9	51
Warnervale	2	6	4	2	5	5	6	30

Source: NSW Transport

The above stopping frequency at the existing Warnervale Station will change significantly with commencement of operations at the proposed Warnervale North railway station.

2.4.2 Bus Services

The Central Coast bus services are provided by private operators. The private bus operators in the region are Busways, Red Bus Services and Coastal Liner Coaches.

Table 2-10 summarise bus services within the study area. Additionally Figure 2-9 shows bus routes by number serving the study area.

Source: NSW Transport

Figure 2-10 Bus routes operating within the study area

Table 2-9 Bus routes operation within Precinct 7A

Bus Route	Description	Operator	Hours of operation(Monday to Friday)	Days of Operation	Monday to Friday frequency	Saturday Frequency	Sunday and Public holiday frequency
78	Lake Haven -Wnvale-Wadalba-Wyong-Tugg	Busways	07:25 to 17:47	Monday to Saturday	17	19	Nil Provided
79	Lake Haven -Wyong-Tugg - Via Hamlyn Terrace	Busways	05:35 to 22:0	Monday to Saturday	39	22	Nil Provided
80	Lake Haven -Wyong-Tugg - Via Pacific Hwy (Wyong Hospital)	Busways	05:27 to 18.30	Monday to Saturday	39	20	Nil Provided
79 N	Lake Haven -Wyong-Tugg Via Wyong Hospital	Busways	08:56 to 20:03	Sunday and Public Holidays	Nil Provided	Nil Provided	19
81	Lake Haven -Wyong-Tugg - Via Wyongah & Johns Road	Busways	04:36 to 22:34	7 Days	35	20	13
82	Lake Haven -Wyong-Tugg - Via Wyongah & Tacoma	Busways	05:58 to 19:37	7 Days	24	1	8
24	The Entrance - Wyong Hospital	Red Bus Services	04:49 to 23:00	7 Days	24	32	14
26	The Entrance - Wyong Hospital	Red Bus Services	06:55 to 1745	Monday to Friday	20	Nil Provided	Nil Provided
11	Lake Haven - Tuggerah Via Warnervale & Wyong	Coastal Liner	06:12 to 20:36	7 Days	31	17	10
10	Tuggerah - Wyong - Hue Hue Rd - Wyee	Coastal Liner	07:15 to 16.25	7 Days	4	4	4

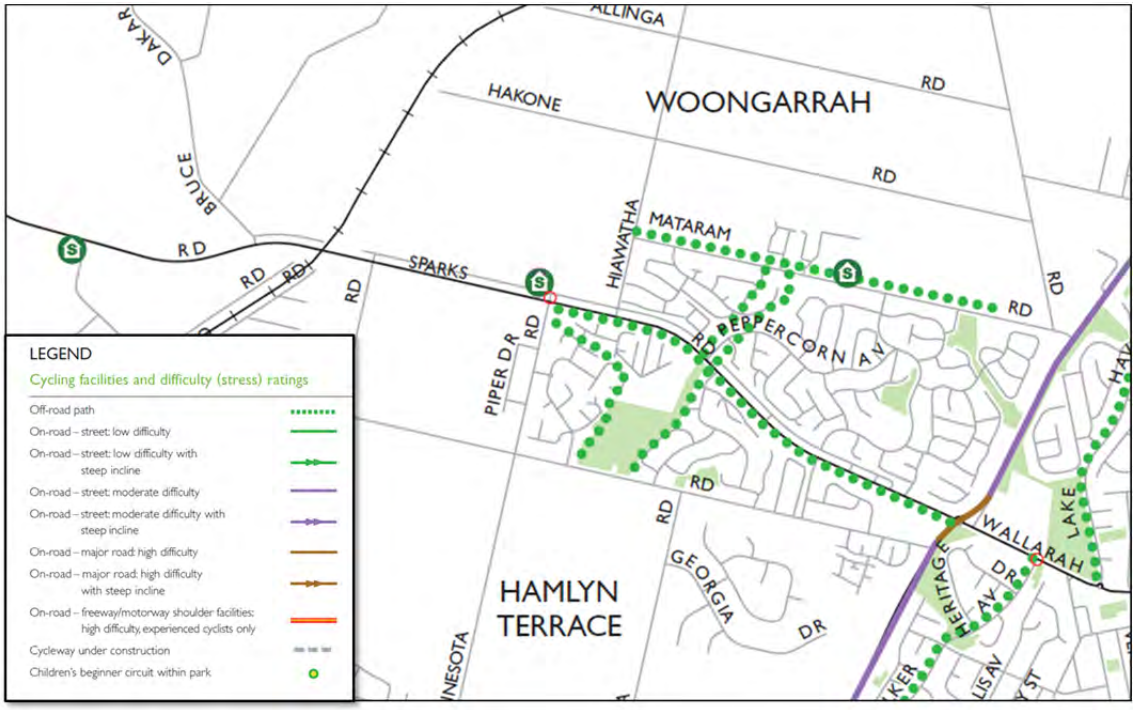
Source: NSW Transport

2.5 Pedestrian and Cycling

The study area provides several designated off street bicycle and pedestrian paths. The main areas with off-road cycling paths are:

- Sparks Road between Minnesota Road and Pacific Highway
- Mataram Road between Hiawatha Road and Arizona Road
- Warnervale Road between Minnesota Road and Louisiana Road to Sparks Road and Mataram Road through parklands and local streets

Figure 2-11 shows the locations of designated bicycle/ pedestrian routes and also the grade of difficulty for cyclists to travel along specified routes



Source: RMS

Figure 2-11 Cyclists and Pedestrians Facilities

3 Existing Network Performance

This section establishes the existing transport network performance in the Precinct 7A Study Area. An assessment of existing network capacity has been undertaken, indicating network deficiencies at key roads and intersections.

3.1 Traffic Survey

The Council provided turning movement counts at five intersections (I-1 to I-5) and mid-block traffic count at eight locations (M-1 to M8) as below:

Intersection movement counts

- I-1: Sparks Road and Albert Warner Drive
- I-2: Sparks Road and Virginia Road
- I-3: Sparks Road and Minnesota Road
- I-4: Warnervale Road and Minnesota Road
- I-5: Pacific Highway and Minnesota Road

Mid-block counts

- M-1: Sparks Road east of Minnesota Road, Hamlyn Terrace;
- M-2: Sparks Road west of Albert Warner Drive, Warnervale;
- M-3: Pacific Highway east of Minnesota Road, Hamlyn Terrace;
- M-4: Warnervale Road east of Minnesota Road, Hamlyn Terrace;
- M-5: Minnesota Road south of Sparks Road, Hamlyn Terrace;
- M-6: Virginia Road south of Sparks Road, Woongarrah;
- M-7: Minnesota Road north to Pacific Highway, Hamlyn Terrace;
- M-8: Albert Warner Drive south of Sparks Road, Warnervale.

The intersection classified turning movement counts were undertaken for two hours in the AM (7-10am) and two hours in the PM (2-6pm). Traffic survey was undertaken in March/April 2009. Traffic surveys were undertaken as an input into:

- Update and validate Central Coast Traffic Model (CCTM) for the study area and
- Analyse intersection capacity using SIDRA.

3.1.1 Daily Traffic

Table 3-10 shows daily traffic volumes on key roads within and surrounding the study area for average weekday. The heavy vehicle proportions are also shown. The following points noted from existing traffic data:

- In 2009, on an average weekday approximately 18,000 vehicles travelled on Sparks Road (east of Minnesota Road). About 8% were heavy vehicles.
- In general, the highest traffic volume was recorded on Friday (critical day) in most locations.
- Pacific Highway east of the study area carried about 19,000 vehicles per day on an average weekday.
- About 3,000 vehicles were observed on Warnervale Road, south of the study area, on an average weekday.
- Minnesota Road carried between 4,000 and 5,000 vehicles per day, on an average weekday.
- Albert Warner Drive, west of the study area, carried about 1,700 vehicles per day,on an average weekday

Table 3-10 Daily Traffic Volume

ID	Road	Location	Critical Friday	Average Weekday	
			Total	Total	% Heavy Vehicle
M-1	Sparks Road	East of Minnesota Road	18,596	17,882	9%
M-2	Sparks Road	West of Albert Warner Drive	18,383	17,593	8%
M-3	Pacific Highway	East of Minnesota Road	19,416	19,185	5%
M-4	Warnervale Road	East of Minnesota Road	2,916	2,721	4%
M-5	Minnesota Road	South of Sparks Road	4,250	4,049	6%
M-6	Virginia Road	South of Sparks Road	673	785	7%
M-7	Minnesota Road	North of Pacific Highway	5,240	5,087	4%
M-8	Albert Warner Drive	South of Sparks Road	1,700	1,675	8%

Daily traffic profiles and hourly traffic variation for the above eight locations are documented in **Appendix A**.

For modelling purpose, the following peak hours were adopted within the study area:

- AM peak between 08:00 AM and 09:00 AM; and
- PM peak between 16:00 PM and 17:00 PM.

3.1.2 Peak Hour Traffic

This section quantifies the peak hour traffic flows within the study area. Intersection turning movement data was used to identify the current capacity problems at key intersections. The traffic data also provides a basis to consider likely traffic changes that would result from the future growth and proposed improvement options. The results are based on survey data recorded from key intersections in 2009.

Table 3-11 summarises morning (AM) and afternoon (PM) peak hour traffic volumes on key roads in the study area.

Table 3-11 Peak Hour Traffic Volumes on Key Roads

ID	Road	Location	AM Peak 1 Hour			PM Peak 1 Hour		
			NB/WB	SB/EB	2way	NB/WB	SB/EB	2way
M-1	Sparks Road	East of Minnesota Road	1,038	669	1,707	586	915	1,500
M-2	Sparks Road	West of Albert Warner Drive	1,044	686	1,730	479	900	1,379
M-3	Pacific Highway	East of Minnesota Road	935	610	1,545	579	844	1,423
M-4	Warnervale Road	East of Minnesota Road	181	103	283	105	162	266
M-5	Minnesota Road	South of Sparks Road	251	165	416	169	180	349
M-6	Virginia Road	South of Sparks Road	27	50	77	30	28	57
M-7	Minnesota Road	North of Pacific Highway	193	281	474	281	186	467
M-8	Albert Warner Drive	South of Sparks Road	113	84	197	61	73	134

Note: NB-Northbound, SB-Southbound, EB-Eastbound and WB-Eastbound, Traffic data in the above table represents one hour traffic in vehicles.

Traffic volumes are presented as one hour volumes in both directions and as two-way volumes. Key Roads including Sparks Road, Warnervale, Minnesota Road, Virginia Road, Pacific Highway and Albert Warner Drive carry a significant volume of regional and local traffic. The result is Table 3-11.

- The highest two-way traffic volume in the study area was observed on Sparks Road.
- In 2009, Sparks Road carried about 1,700 to 1,500 vehicles per hour in the AM and PM peak periods respectively. The westbound traffic showed the highest peak in the morning and vice versa during evening peak.
- Approximately 1,500 vehicles per hour were recorded on Pacific Highway during both AM and PM peak periods.
- Local roads including Warnervale Road, Minnesota Road, Virginia Road, Albert Warner Drive carried traffic between 100 to 500 vehicles per hour during peak hour.
- Minnesota Road carried about 400 vehicles per hour during peak hour. The northbound traffic showed the highest peak in the morning peak and vice versa during evening peak.
- Approximately 300 vehicles per hour were observed on Warnervale Road east of Minnesota Road during peak hour.

The turning volumes for AM and PM peak hour at key intersections are shown in **Appendix A**.

3.2 Existing Network Capacity and Level of Service (LoS)

The performance of an intersection can be measured by the intersection average delay per vehicle, which in turns leads to a “Level of Service” measure for the intersection.

Assessment Criteria

At signalised intersections, the Level of Service (LoS) criteria are related to average intersection delay measured in seconds per vehicle. The RMS’s guideline (Guide to Traffic Generating Developments, Issue 2.2, RTA, October 2002) recommended that with roundabout, “Stop” and “Give Way” sign control intersections, the LoS value is determined by the critical movement with the highest delays.

In general, SIDRA predicts intersection performance for the following key parameters:

- Degree of saturation (DoS),
- Average delays to intersection, and
- Level of service (LoS) determined from LoS criteria from the Table 3-12 below.

Table 3-12 LoS Criteria for intersection capacity analysis

Level of Service	Average Delay per Vehicle (secs/veh)	Traffic Signals, Roundabout	Give Way & Stop Signs
A	<14	Good operation	Good operation
B	15 to 28	Good with acceptable delays & spare capacity	Acceptable delays & spare capacity
C	29 to 42	Satisfactory	Satisfactory, but accident study required
D	43 to 56	Operating near capacity	Near capacity & accident study required
E	57 to 70	At capacity; at signals, incidents will cause excessive delays Roundabouts require other control mode	At capacity, requires other control mode
F	>70	Unsatisfactory with excessive queuing	Unsatisfactory with excessive queuing

Source: RTA (RMS) Guide to Traffic Generating Developments.

The intersection modelling was undertaken for five key intersections for both AM and PM peak hours. Table 3-13 below summarises intersection modelling results showing overall intersection performance. Detailed SIDRA modelling results are included in **Appendix B**. From the assessment results, the following points are noted:

- Modelling results show that in 2009 five key intersections operated at satisfactory level of service (LoS D or better). However, some movements of these five intersections were expected having capacity issues.
- Minnesota Road / Sparks Road intersection is currently performing at LoS between C and D. During the AM peak, heavy right turn at east approach is observed. Model forecasts high degree of saturation (0.9) for the westbound right turn movement from Sparks Road to Mary MacKillop Drive (north) indicating that this movement has limited spare capacity available.
- Pacific Highway / Minnesota Road intersection is currently performing at LoS C. High degree of saturation was forecasted for right turn movement from Minnesota to Pacific Highway during AM peak and left turn movement from Pacific Highway to Minnesota during PM indicating that these movements have limited spare capacity available.

Table 3-13 Intersection Performance Results for Existing Condition (2009)

ID	Intersection	Control	Am Peak			PM peak		
			DoS	Avg Delay (sec)	LoS	DoS	Avg Delay (sec)	LoS
I-1	Sparks Road / Albert Warner Dr	Give-way*	0.35	17.5*	C*	0.43	20.2*	B*
I-2	Sparks Road / Virginia Road	Give-way*	0.47	17.4*	B*	0.39	18.6*	B*
I-3	Sparks Road / Minnesota Road	Signalised	0.82	43.9	D	0.86	35.1	C
I-4	Warnervale Road / Minnesota Road	Priority*	0.25	14.8*	B*	0.19	12.3*	A*
I-5	Pacific Highway / Minnesota Road	Signalised	0.89	33.3	C	0.88	31.4	D

Note: Roundabout, “Stop” and “Give Way” sign control intersections, the LoS value is determined by the critical movement with the highest delays (RMS)

4 Traffic Forecasting Model

4.1 Overview of Traffic Modelling Approach

For Precinct 7A traffic study, Hyder used the RMS's Central Coast Regional Strategic Model, together with its own TransCAD modelling software. Hyder obtained the RMS's permission to use the traffic model for the Precinct 7A study. Hyder augmented the traffic model for the Precinct 7A Study Area. The travel zone system and road network within the RMS's model was refined for calibration and validation purpose. The modelling process allows the assessment of future estimated traffic conditions and their impact on the operation of the road network. During the model development period, the Hyder team presented model calibration and validation results for Wyong Shire Council's review and comments. Through a consultation process, the calibration and validation result was signed off by the Council.

For calibration and validation purposes, the model was developed and calibrated for 2009 traffic conditions for both AM and PM peak period. Figure 4-12 shows Precinct 7A modelling study area.

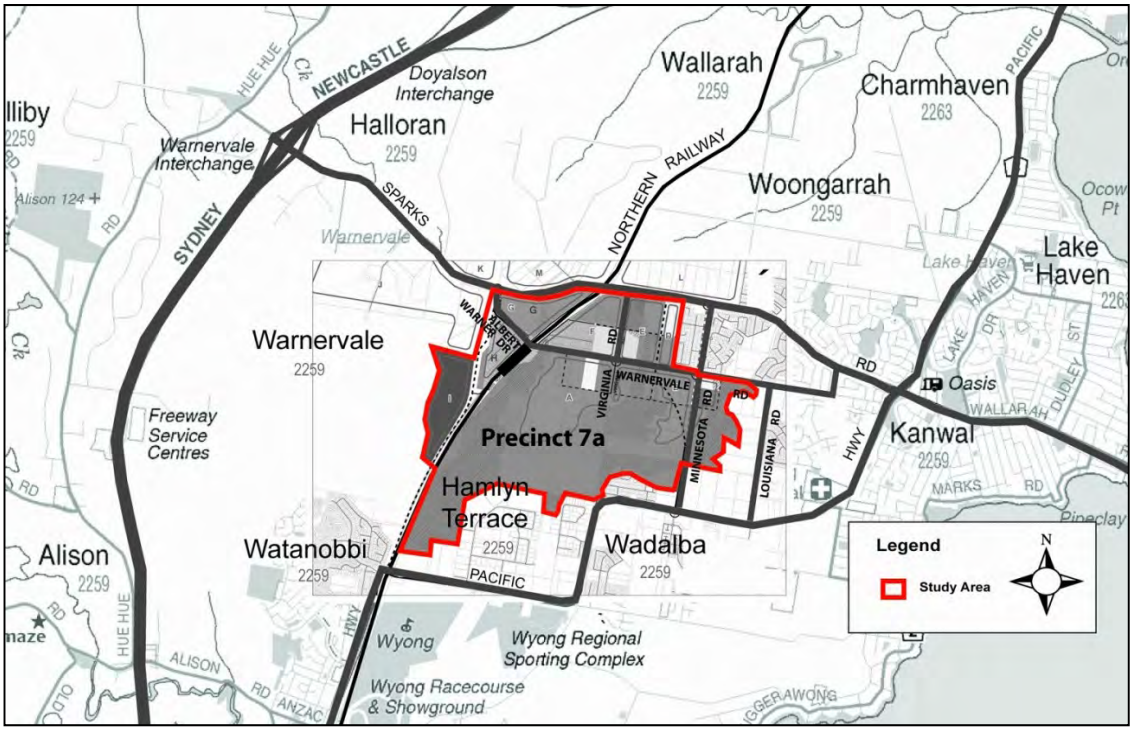


Figure 4-12 Modelling Study Area

4.2 Fit for Purpose

The RMS's Central Coast Regional Strategic Mode) was updated for the specific purpose of investigating traffic impact of Master Plan for Precinct 7A. The traffic forecasting model was developed to:

- Create a tool capable of forecasting the traffic volumes within the study area under different access and network scheme scenarios, with outputs sufficiently detailed to provide growth estimates as input into intersection models (SIDRA);
- Provide input for intersection geometry analysis, for pavement design, and to assist in the decision process quantifying network impact from proposed Master Plan; and
- Prepare a traffic report which can be used as a basis for infrastructure upgrade attributable to proposed Master Plan.

4.3 Modelling Software

RMS's Central Coast Regional Strategic Model (CCTM) was built and operated in TransCAD Transportation GIS software. Version 4.7 was used for CCTM. TransCAD fully integrates GIS with planning, modelling and logistics applications. It combines the capabilities of digital mapping, geographic database management and presentation graphics with sophisticated transport models. TransCAD provides a full complement of traffic assignment procedures that are used for modelling urban traffic. TransCAD is widely used in both the public and private sectors

4.4 Years and Time Period Modelled

Council's study brief identified that traffic analysis should include a base case model and a separate model with planned growth within the study area for 2021 and 2031.

Detailed modelling for the study area was undertaken for an average weekday, split into two time periods comprising:

- Morning peak two hours (7-9am); and
- Evening peak three hours (4-6pm).

4.5 Model Calibration and Validation

A base year highway model was calibrated and validated using year 2009 counts data for AM and PM peak period. Detailed model calibration and validation outcomes are documented in **Appendix C**. The calibration and validation results in **Appendix C** demonstrate that CCTM model has been calibrated and validated appropriately in accordance with the industry practice acceptance criteria. A robust calibration and validation was achieved for both AM and PM peak period. The strategic models therefore were fit for the study purpose

5 Future Land Use Changes

The Precinct 7A Study Area consists of approximately 540 hectares and is identified within the Council's Residential Development Strategy (RDS) 2002 as a medium priority for urban development. It has the potential to have substantial impact on local housing supply and demand in the region. In addition the area is included within the draft North Wyong Shire Structure Plan (NWSSP) area for future development as identified within the Central Coast Regional Strategy (CCRS).

The proposed land use for the Precinct 7A includes residential, employment generation (industrial), open space, community facilities, recreation, conservation and commercial uses. The traffic model included the cumulative growth from following planned developments including:

- Precinct 7A;
- Wyong Employment Zone (WEZ);
- Bruce Crescent;
- Warnervale Town Centre (WTC);
- The Lakes Anglican Grammar School;
- Precinct 14, and
- Kanwal Retirement Village.

Figure 5-13 shows locations of the proposed developments assumed in traffic model.

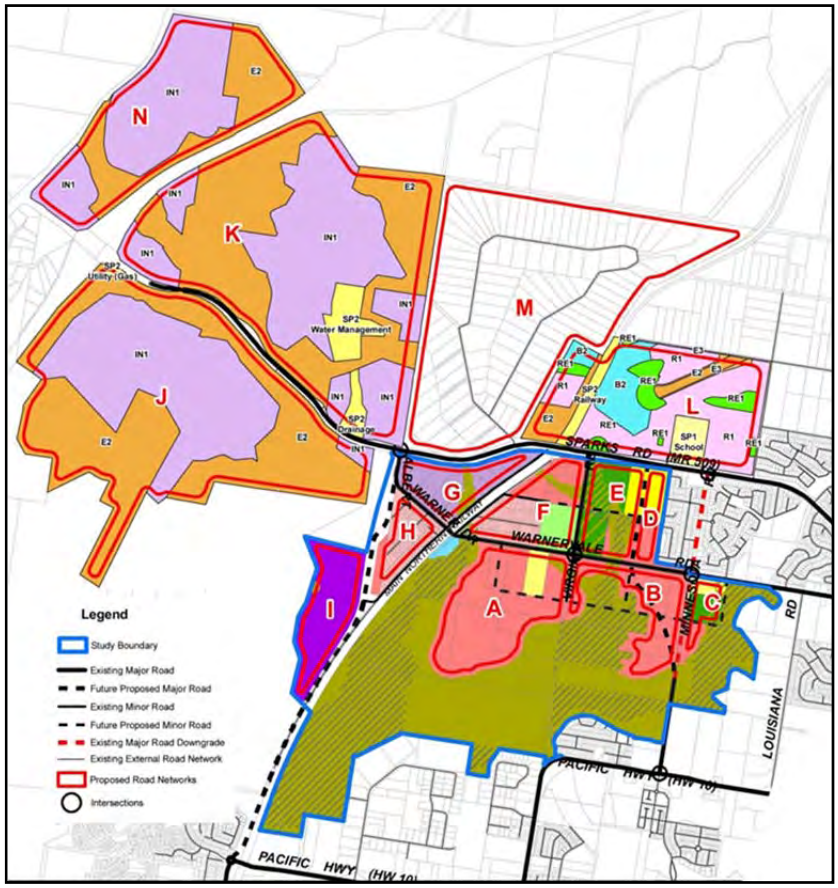
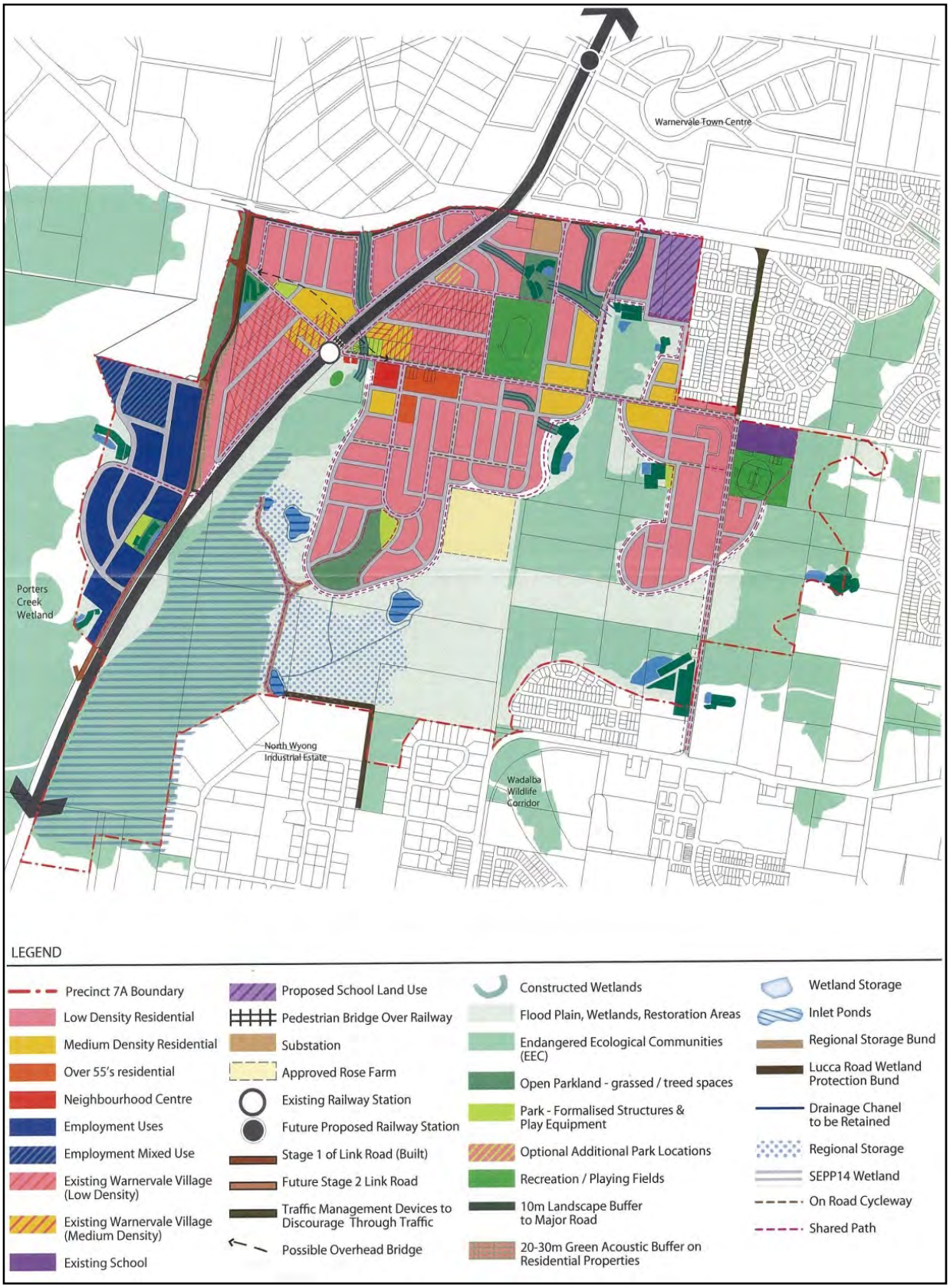


Figure 5-13 Proposed Future Land Use Assumed in Traffic Model

In March 2012, Council revised the Master Plan for Precinct 7A. Few minor changes were also made to other surrounding developments. Figure 5-14 shows the revised Structure Plan. Table 5-14 below summarises land use assumptions in the revised Master Plan (March 2012).

The following points are noted in relation to the traffic modelling assumptions:

- All proposed developments showed in Table 5-14 would be fully developed and occupied by year 2031.
- Traffic model assumed about 4,300 new residential dwellings within the wider study area. Of that about 2,000 dwellings are proposed within the Precinct 7A. It is expected that Warnervale Town Centre could accommodate about 2,200 residential dwellings when fully developed.
- About 43,000 square metres gross floor area (GFA) of commercial, bulky goods, and retail developments are proposed in the Warnervale Town Centre. About 3,000 square metres GFA of commercial developments are planned within the Precinct 7A area.
- Industrial developments are planned in the Wyong Employment Zone (WEZ), Bruce Crescent, Precinct 14 and Precinct 7A. When fully developed, all these areas could accommodate about 12,000 new jobs.



Source: Council

Figure 5-14 Revised Structure Plan for Precinct 7A, March 2012

Table 5-14 Land Use Assumptions in Revised Master Plan, March 2012

Network Zone	Area		Land Use				
	Gross Area (m²)	*NDA (m²)*	*Residential Dwellings*	*Commercial GFA (m²)*	*Employment Generating Lots*	*School (students)*	*Sports facilities/Recreation (m²)*
A (Option 2 - Develop School & Retain Existing Residential)	514,713	411,770	559	3,000	0	0	0
B (Residential)	289,960	231,968	320	0	0	0	0
C (Retain School and Develop Oval and develop residential	51,546	41,236	54	0	0	500	33,100
D (Residential)	137,494	109,995	151	0	0	1,000	0
E (Future Sporting Fields & Mingara Club + residential)	174,315	139,452	197	0	0	0	0
F (Retain Existing Residential & Sports Field	239,491	191,593	238	0	0	0	40,469
G (Option 1 - Residential & Retain Existing Residential)	254,821	203,857	280	0	0	0	0
H (Retain Existing Residential)	196,341	157,073	200	0	0	0	0
I (Employment Generation & Mixed Use)	287,000	215,000	50	0	27	0	0
J (Wyong Employment Zone)	Refer to WEZ Traffic Studies		0	0		0	0
K (Wyong Employment Zone)	Refer to WEZ Traffic Studies		0	0		0	0
M (Bruce Crescent - Employment Generation)	2,226,992	2969323	0	0	371	0	0
L (Warnervale Town Centre)	102,217	136289	2,200	40,000	0	1,300	300,000
TOTALS	4,474,890	4,807,557	4,249	43,000	398	2,800	373,569

NOTES:

* Gross Area = Total Area per Zone
* NDA = Net Developable Area. This is 80% of that area to be developed through the strategy (excluding any areas to be retained, such as schools, ovals EECs etc and
* Employment Generation for Zones I & G are suggested business parks with an average lot size of 0.8 ha (based on average lot size of Tuggerah Business Park
* GFA may be assumed between 50-60% of site area for business park areas
* Existing Residential for Zone A comprises 6 dwellings
* Existing Residential for Zone H comprises 86 dwellings
* Existing residential for Zone F comprises 90 dwellings
* Existing residential for Zone G comprises 8 dwellings

Source: Council

5.1 Traffic Generation from Site

In general, traffic generation is a key input into the traffic model and should be examined carefully prior to assessing future network impact. Hyder used trip generation rates from the RTA's Guide to Traffic Generating Developments (2002), and the Wyong Shire Council. With Council's concurrence, Hyder assumed a self-containment trip rate of about 35%. The future public transport and other non-car modes share was assumed to be up to 10%. Table 5-15 summarises trip generation rates used in traffic model.

Table 5-16 below summarises the expected trip generation from each development site. The Precinct 7A site (zones A to I) is forecast to generate about 3,700 vehicle trips in one peak hour when the site is fully developed. In combining with other developments (WEZ, WTC, Bruce Crescent, Precinct 14, Retirement Village) total trip generation for the study area is forecast in order of 11,600 vehicle trips in one peak hour.

Table 5-15 Trip generation assumptions used in traffic model

ID	Developments	Rate	Unit	Source
1	Trip generation rate per dwelling (Residential)	0.85	Peak hour trips	RTA Guide
2	Trip generation rate per 100m2 of GFA for commercial	2.0	Peak hour trips	RTA Guide
3	Trip generation rate per 100m2 of GLFA for bulky goods	2.5	Peak hour trips	RTA Guide
4	Trip generation rate per 100m2 of GLFA for retail	5.9	Peak hour trips	RTA Guide
5	Number of trips per employee (Industrial estates-business parks)	2.3	Trips per day	Wyong Shire Council
6	Trip generation rate for sport fields (per field)	60	Peak hour trips	Wyong Shire Council
7	Trip generation rate for Primary School (Zone C)	320	Peak hour trips	Wyong Shire Council
8	Trip generation rate for High School (Zone D & L)	700	Peak hour trips	Wyong Shire Council
9	Trip generation rate for Community facility (size 15,293 m2)	50	Peak hour trips	Wyong Shire Council
10	Trip generation for Kanwal Retirement Village	150	Peak hour trips	Wyong Shire Council
11	Trip generation rate for swiming pool	120	Peak hour trips	Wyong Shire Council
12	Number of dwellings per developable ha	12	for zone M (OPT1)	Wyong Shire Council
13	GLFA	60%	of the GFA	Wyong Shire Council
14	Multi-trip discount for retail trips	0.8		RTA Guide

ID	Developments	Rate	Unit	Source
15	Number of employees per developable ha (industrial estates)	20	For zones M (OPT1), J, K, N	Wyong Shire Council
16	Number of employees per developable ha (industrial estates)	40	For zone I	Wyong Shire Council
17	Peak periods proportion	15%	of the daily trips calculated for business parks	Wyong Shire Council
18	Proportion of the land for Employment Generation zone M (OPT1)	75%	of the net developable area	Wyong Shire Council
19	Proportion of the land for Residental zone M (OPT1)	25%	of the net developable area	Wyong Shire Council
20	In general, the influence of retail trips during AM peak period is lower than PM peak. For AM peak traffic model, we assumed discounted rate of 60% of critical PM peak rate for retail related trips.	0.4	Factor applied for AM Peak retail & bulky good trips	

Table 5-16 Trip generation (peak period-one hour) from the proposed developments by 2031

Developments	Network Zone	One Peak Hour Trips (2way) March 2012 Revised Master Plan
Precinct 7A	A to I	3,680
Warnervale Employment Zone (WEZ)	J	615
	K	730
Bruce Crescent	M	2,048
Warnervale Town Centre (WTC)	L	3,903
Precinct 14	N	435
Retirement Village		150
Network Zone		**11,560**

6 Traffic Forecasts and Future Network Performance

6.1 Base Network Assumptions

Future traffic conditions in and around the Precinct 7A Study Area will be influenced by a combination of background traffic growth, additional traffic generated by proposed developments and planned network changes at regional and local levels. For modelling 2031 traffic conditions, the potential upgrading works on the F3 Freeway (six lanes, 3/3) and Pacific Highway (four lanes, 2/2) was assumed in the traffic model. Council provided Hyder the future changes to local network and comprised the following:

- A left-in-left-out at
  - Sparks Road and Virginia Road intersection;
  - Sparks Road and Hiawatha Road intersection;
  - Sparks Road and Coral Gum Road intersection;
  - Sparks Road and Dundonald Road intersection;
- Access to proposed developments:
  - Residential area and sporting fields within Precinct 7A (area F, see previous Figure 5-13) will be accessed via Nikko Road;
  - Access to areas D and E would be allowed via a new link between Warnervale Road and Sparks Road. Accesses to both areas D and E would be left-in-left-out.

In addition to the above, the base network also included the following potential improvements and new links:

- Link Road extension;
- Sparks Road duplication (four lanes, 2/2);
- New Minnesota Road deviation;
- New link between Sparks Road and Warnervale Road;
- At grade crossing of railway line at Warnervale Road/Albert Warner Drive.

6.2 Modelling Scenarios

During investigation Phase (November 2010) Hyder assessed following five traffic modelling scenarios:

- Scenario 1 (S1) includes the base case network assumptions.
- Scenario 2 (S2) is similar to Scenario 1 but excludes the at grade existing rail crossing on the Warnervale Road (Warnervale road at this rail crossing point becomes a cul-de-sac).
- Scenario 3 (S3) is variation to Scenario 2 but includes a new link over the rail line south of Warnervale.
- Scenario 4A (S4A) is a variation to Scenario 2 but excludes the new Minnesota Road deviation south of Warnervale Road.
- Scenario 4B (S4B) is similar to Scenario 4A but speed control measures was assumed on the Minnesota Road between Sparks Road and Warnervale Road.

In Council's agreement Scenario 4B was carried forward for further investigation for revised Master Plan. In consultation with Council, two additional modelling scenarios were developed:

- Scenario 4B1 (S4B1) is essentially similar to Scenario 4B that includes base case network assumptions.
- Scenario 4B2 (S4B2) is a variation to Scenario 4B1 but excludes the at grade existing rail crossing on Warnervale Road (Warnervale Road at this rail crossing point becomes a cul-de-sac).

The revised traffic forecast was prepared for two horizon years, 2021 and 2031. For modelling purposes, the following was assumed for 2021:

- Sparks Road would be upgraded to a four lane (two lanes each direction) road;
- The F3 Freeway would be upgraded to six lanes (three lanes in each direction);
- The Pacific Highway between Minnesota Road and Sparks Road would remain a single lane in each direction;
- There would be no:
    - Link Road – Watanobbi to Warnervale;
    - Connector road between Warnervale Road and Sparks Road, west of Minnesota Road.

By 2031:

- Full development in the area, including the Warnervale Town Centre and Wyong Employment Zone.
- Sparks Road would be upgraded to a six lanes (three lanes each direction);
- The Pacific Highway between Minnesota Road and Sparks Road would be upgraded to four lanes (two lanes in each direction);
- The Link Road between Watanobbi Road and Sparks Road would be constructed;
- The connector road between Warnervale Road and Sparks Road, west of Minnesota Road would be constructed.

6.3 Future Traffic Forecasts

Traffic demand forecast was re-generated for years 2021 and 2031 for both scenarios S4B1 and S4B2 at key locations across the study area (see Figure 6-15). Table 6-17 below summarises daily traffic forecasts at these locations. Traffic volumes for existing year 2009 are also included for comparison.

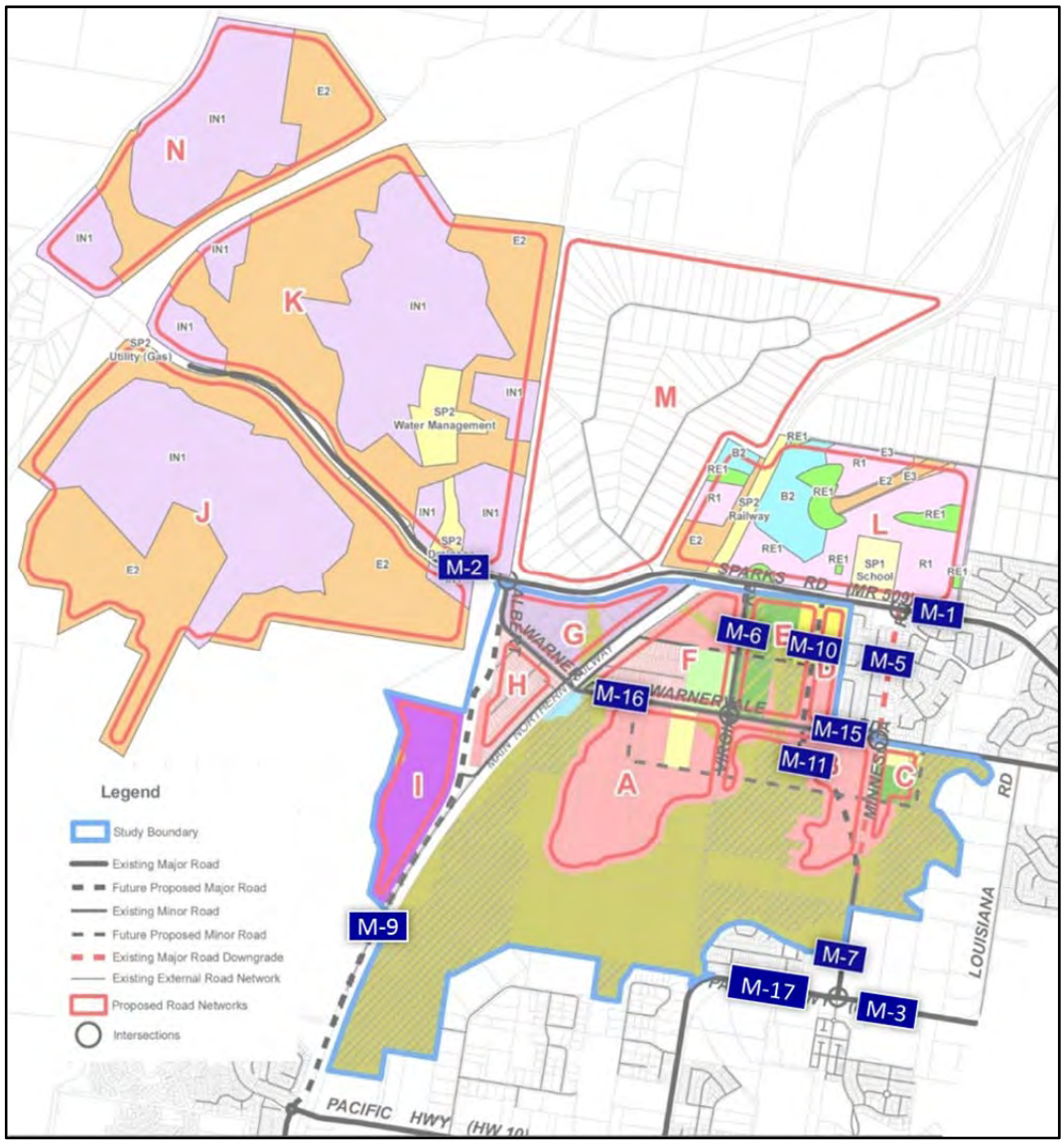


Figure 6-15 Key locations where traffic data was report

Table 6-17 Daily traffic forecast on key roads

Site ID	Road	Location	2009 Existing	Forecasts (Average Weekday Traffic, 2way in vehicles)		
				2021	2031	
					S4B1	S4B2
					With Rail Crossing	Without Rail Crossing
M-1	Sparks Road	East of Minnesota Road	18,600	34,700	41,300	42,800
M-2	Sparks Road	West of Albert Warner Drive	18,400	38,600	54,000	54,100
M-3	Pacific Highway	East of Minnesota Road	20,200	25,400	20,600	20,900
M-17	Pacific Highway	West of Minnesota Road	n/a	30,700	20,400	21,300
M-5	Minnesota Road	South of Sparks Road	4,300	8,800	6,400	6,900
M-7	Minnesota Road	North of Pacific Highway	5,200	11,500	8,000	9,100
M-6	Virginia Road	South of Sparks Road	700	2,400	2,400	5,700
M-9	The Link Road (Watanobbi to Warnervale)	Between Pacific Highway (Watanobbi) and Sparks Road (Warnervale)	n/a	n/a	23,500	22,600
M-10	Sparks Road - Warnervale Road connection	Between Sparks Road and Warnervale Road	n/a	n/a	9,800	12,700
M-15	Warnervale Road	West of Minnesota Road	2,800	7,100	12,800	11,300
M-16	Warnervale Road	East of Nikko Road (East of Railway crossing)	n/a	7,000	8,000	6,100

In 2031, traffic on the Link Road (Watanobbi to Warnervale), south of Sparks Road, is forecast in the order of 24,000 vehicles per day.

Key points to note from revised traffic forecast:

- In 2031, traffic on Sparks Road is forecast in the order of 43,000 vehicles per day east of Minnesota Road and 54,000 vehicles per day west of Albert Warner Drive. The forecast traffic volumes on Sparks Road suggest that the road needs to be widened to six lanes should full developments occur in 2031.
- Prior to the ultimate widening, Sparks Road will be required to be upgraded to a four lane carriageway in year 2021 to cater for traffic demand generated by initial phases of developments. In 2021, model forecasts traffic volume on Sparks Road in the order of 35,000 to 39,000 vehicles per day. The forecast volume on Sparks Road in 2021 is almost double than today's traffic.
- The closure of railway crossing would divert additional traffic to Virginia Road and new connector (between Sparks Road and Warnervale Road). Daily traffic is forecast to increase on Virginia Road from 2,400 vehicles (scenario S4B1) to 5,700 vehicles (scenario S4B2). Similar traffic increase is expected on the new connector road from 9,800 vehicles (scenario S4B1) to 12,700 vehicles (scenario S4B2). Virginia Road and the new connector road between Warnervale Road ad Sparks Road, west of Minnesota Road, will have ample capacity to cater for the additional traffic should the at grade rail crossing on Warnervale Road /Albert Warner Drive be closed.

- Traffic on Warnervale Road east of railway crossing is forecast in the order of 8,000 vehicles per day (scenario S4B1). The model results indicate that without the at grade railway crossing (scenario S4B2) traffic on Warnervale Road is forecast to reduce by about 25 per cent at this location.
- In 2021, traffic on Minnesota Road, south of Sparks Road, is forecast in the order of 8,800 vehicles per day. This is without the connector road between Warnervale Road and Sparks Road being constructed. With construction of the connector road in 2031, the volume on Minnesota Road is forecast to reduce to 6,400 vehicles (with the existing rail crossing) or 6,900 vehicles per day without a rail crossing. These 2031 volumes are based on speed control devices being installed between Warnervale Road and Sparks Road to discourage its use as a through route and the Link Road, Watanobbi to Warnervale, being constructed.
- The Link Road is forecast to carry in the order of 24,000 vehicles per day in 2031.
- In 2021, the Pacific Highway west of Minnesota Road is forecast to carry 30,700 vehicles per day. With construction of the Link Road, this will reduce to 20,400 vehicles per day in 2031, for Scenario S4B1 (with Warnervale rail crossing), and 21,300 vehicles per day for Scenario S4B2 (without Warnervale rail crossing).

Hyder also prepared a series of TransCAD network plots showing an indicative level of service (LoS) for two-hour AM and PM peak period traffic volumes for year 2021 and 2031 (scenarios S4B1 and S4B2). The plots indicate the level of traffic forecast across the network and provide an indication of the level of congestion on each road. This level of congestion is reported in terms of volume-to-capacity ratio (VCR). These TransCAD plots are included in **Appendix D**. The Council officer has revised and agreed with these results (dated 23rd May 2012).

6.4 Intersection Analysis

In order to cater for the predicted future traffic growth and in line with the suggested road network upgrades, detailed intersection modelling were undertaken to assess future performance and to identify intersection upgrades at key intersections within the study area.

In consultation with the Council, the eight key intersections were modelled as follows:

- Sparks Road / New Link Road connecting Sparks Road, Warnervale and Pacific Highway, Watanobbi (Link Road extension) – four way;
- Sparks Road / Virginia Road – three way;
- Sparks Road / Minnesota Road – four way;
- Warnervale Road / Minnesota Road – four way;
- Pacific Highway / Minnesota Road – four way;
- Warnervale Road / Virginia Road – four way;
- Sparks Road / New connector road between Sparks Road and Warnervale Road – four way; and
- Warnervale Road / New connector road between Sparks Road and Warnervale Road – four way.

Intersection modelling was undertaken using SIDRA software. SIDRA modelling was undertaken for year 2021 and 2031.

- **Intersection performance for 2021**. The predicted traffic growth in 2021 was assessed at key modelled intersections.

- **Intersection performance for 2031**. The predicted traffic growth in 2031 was assessed at key modelled intersections for Scenario 4B1 (S4B1) and Scenario 4B2 (S4B2).

6.5 Intersection Performance in 2021

Detailed modelling was undertaken for eight intersections including two new access roads on Sparks Road (I-7) and Warnervale Road (I-8). Improvements to intersections were investigated when the intersection LoS is E or F (operating close to or over capacity).

To cater for predicted traffic growth in 2021, the analysis identified the need for intersection upgrades at the following locations:

- Provision of four way signal control intersection upgrade with dual right turn lanes at Sparks Road / Albert Warner Drive (Link Road) (I-1);
- Provision of a left-in-left-out intersection upgrade at Sparks Road / Virginia Road (I-2);
- Provision of intersection upgrade at Sparks Road / Minnesota Road (I-3) to provide additional westbound right turn bay, an exclusive eastbound left turn bay and a short northbound exit lane;
- Provision of intersection upgrade at Pacific Highway / Minnesota Road (I-5) to provide an extension of southbound right turn bay from 40m to 200m;
- Provision of four way sign control intersection upgrade at Warnervale Road / Virginia Road (I-6);
- Provision of a new three way (T-junction) signal control at Sparks Road / Warnervale Township (I-7);

Figure 3-1 show indicative layout of required intersection upgrade (as highlighted in yellow) by year 2021.

With proposed upgrade identified (see Figure 6-16), the SIDRA analysis predicted satisfactory level of service D or better. The Sparks Road was assumed to be upgraded to a four lane by 2021.

Table 6-18 below shows the estimated level of service (LoS), degree of saturation (DoS) and average delay (in seconds) for each of the eight intersections operating under peak hour demands and improved traffic control (where needed) for year 2021. Detailed SIDRA modelling results are included in **Appendix E**.

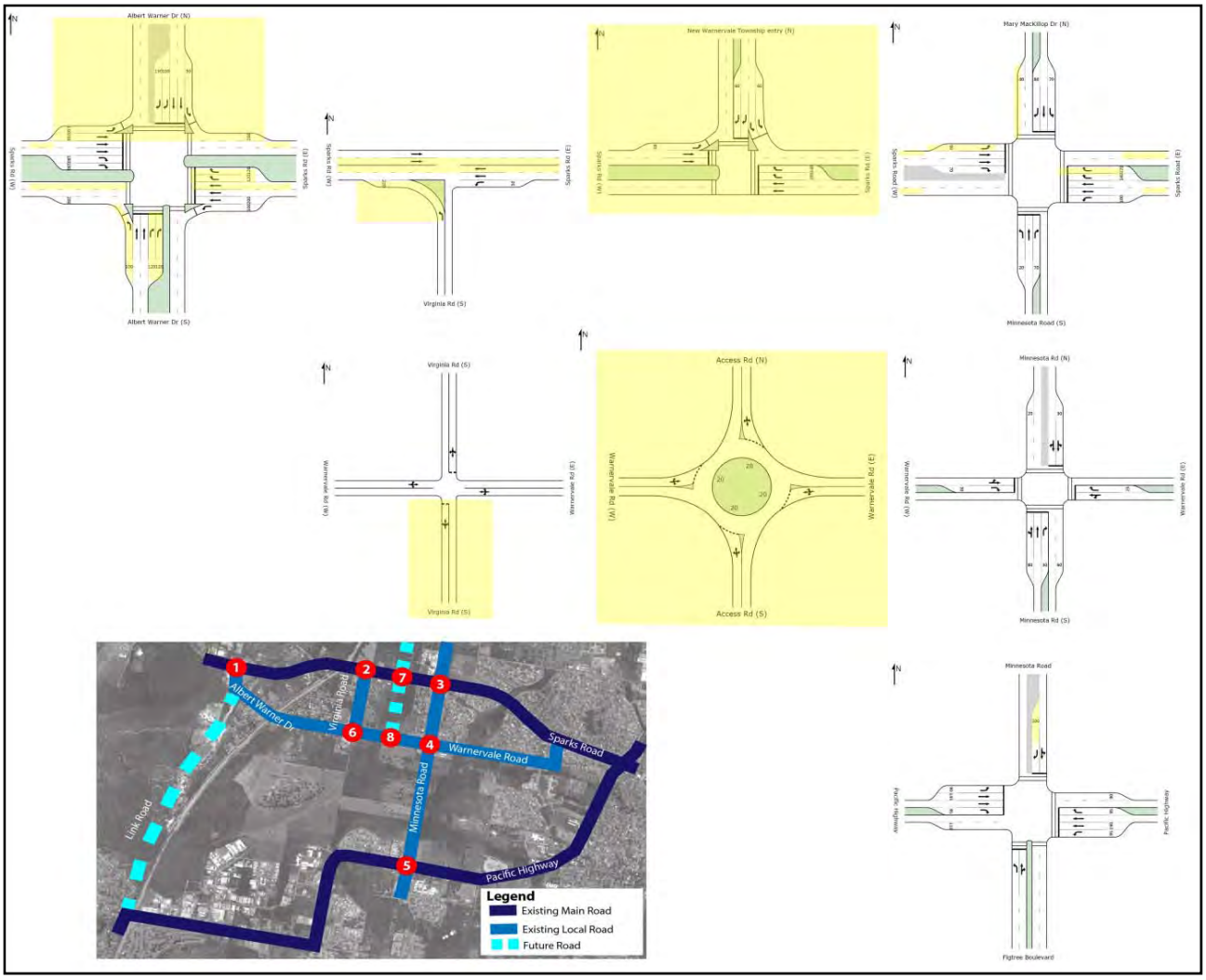


Figure 6-16 Proposed Intersection Upgrade in 2021

Table 6-18 Overall LoS Summary Results, Year 2021

Ref.	Intersection	Control Type	AM Peak			PM Peak		
			DoS	Average Delay (sec)	LoS	DoS	Average Delay (sec)	LoS
I-1	Sparks Road / Albert Warner Drive	Signals Upgrade	0.78	37	C	0.77	33	C
I-2	Sparks Road / Virginia Road	Priority Upgrade	0.44	15	B	0.21	14	A
I-3	Sparks Road / Minnesota Road	Signals Upgrade	1.0	69	E	0.91	49	D
I-4	Warnervale Road / Minnesota Road	Signals (existing)	0.82	22	B	0.62	22	B
I-5	Pacific Highway / Minnesota Road	Signals Upgrade	0.90	39	C	0.88	28	B
I-6	Warnervale Road / Virginia Road	**New** Priority	0.18	11	A	0.24	11	A
I-7	Sparks Road / Warnervale Town Centre Access	Signals Upgrade	0.86	26	B	0.77	25	B
I-8	Warnervale Road / Connector	**New** Roundabout	0.23	11	A	0.28	11	A

Note: DoS – Degree of Saturation, LoS – Level of Service

6.6 Intersection Performance in 2031

Similar to year 2021, intersection assessment was undertaken for ultimate development year 2031. Further improvements were identified when the intersection LoS is E or F. The analysis assumed Sparks Road will be upgrade to six lane (three lane each direction) road and Pacific Highway will be upgrade to four lane (two lane each direction) road.

The full development would have significant impact on key intersections. There would be increased pressure on Sparks Road and associated intersections. Additional upgrade would be required at following location when the site is fully developed:

- Upgrade of Sparks Road traffic signals with Albert Warner Drive (Link Road) (I-1) to have extension of auxiliary turning lanes.
- Upgrade of Warnervale Road traffic signals with Minnesota Road (I-4) to have an extension of eastbound right turn bay from 30m to 120m and continuous slip lane from the south approach ;
- Upgrade of Sparks Road traffic signals with New Warnervale Township entry (I-7) to a four way intersection with extension of eastbound left turn bay from 80m to 140m.

Figure 3-2 show indicative layout of required intersection upgrade (as highlighted in yellow) by year 2031.

With proposed upgrade identified (see Figure 6-17), the SIDRA analysis predicted satisfactory level of service D or better by 2031.

Table 6-19 below shows the estimated level of service (LoS), degree of saturation (DoS) and average delay (in seconds) for each of the eight intersections operating under peak hour demands and improved traffic control (where needed) for year 2031 Scenario 4B1. Detailed SIDRA modelling results are included in **Appendix F**.

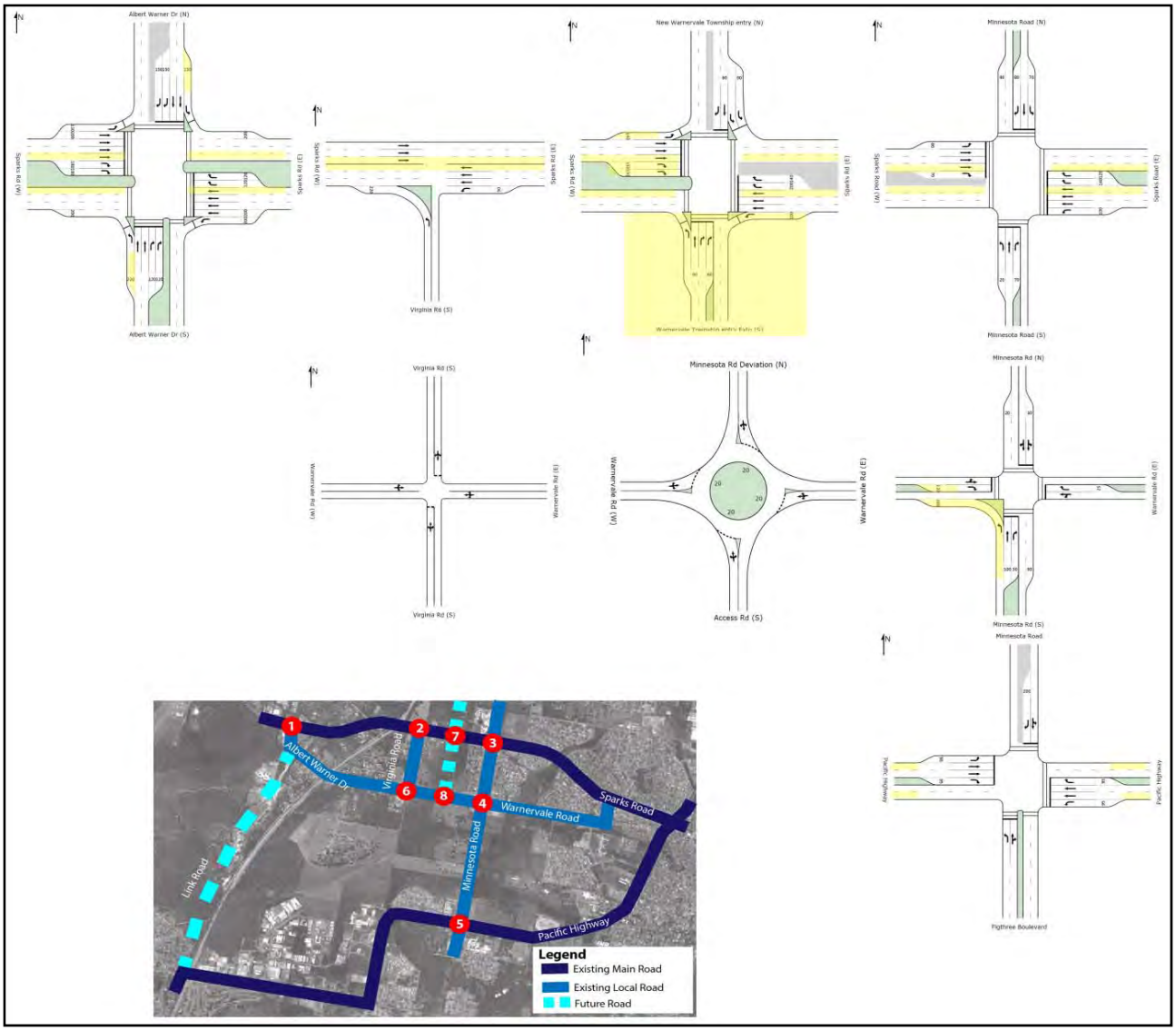


Figure 6-17 Proposed Intersection Upgrade 2031 Scenario S4B1

Table 6-19 Overall LoS Summary Results, Year 2031 Scenario 4B1

Ref.	Intersection	Control Type	AM Peak			PM Peak		
			DoS	Average Delay (sec)	LoS	DoS	Average Delay (sec)	LoS
I-1	Sparks Road / Albert Warner Drive	Signals Upgrade	0.87	51	D	0.90	37	C
I-2	Sparks Road / Virginia Road	Priority Upgrade	0.43	15	B	0.25	13	A
I-3	Sparks Road / Minnesota Road	Signals Upgrade	0.92	51	D	0.71	37	C
I-4	Warnervale Road / Minnesota Road	Signals Upgrade	0.75	23	B	0.81	24	B
I-5	Pacific Highway / Minnesota Road	Signals Upgrade	0.89	25	B	0.78	26	B
I-6	Warnervale Road / Virginia Road	Priority	0.20	10	A	0.20	10	A
I-7	Sparks Road / Warnervale Town Centre Access	Signals Upgrade	0.88	46	D	0.84	45	D
I-8	Warnervale Road / Connector	Roundabout	0.41	11	A	0.45	11	A

Note: DoS – Degree of Saturation, LoS – Level of Service

6.6.1 Impact of Rail Crossing Closure

The closure of at grade railway crossing on Warnervale Road was assessed for 2031 Scenario 4B2 as part of the sensitivity analysis. Analysis indicated that the closure would divert additional traffic to Virginia Road and to the new connection between Sparks Road and Warnervale Road, (between Virginia Road and Minnesota Road). The potential closure would increase traffic pressure on the Sparks Road / Warnervale Township intersection.

The analysis identified that no further road or intersection upgrades are required as a result of the closure of the at grade railway crossing.

Figure 6-18 below show indicative layout of required intersection as a result of the closure of at grade railway crossing which are the same as Scenario 4B1. Table 6-20 below shows the estimated level of service (LoS), degree of saturation (DoS) and average delay (in seconds) for each of the eight intersections operating under peak hour demands and improved traffic control (where needed)

Detailed SIDRA modelling results are included in **Appendix G**.

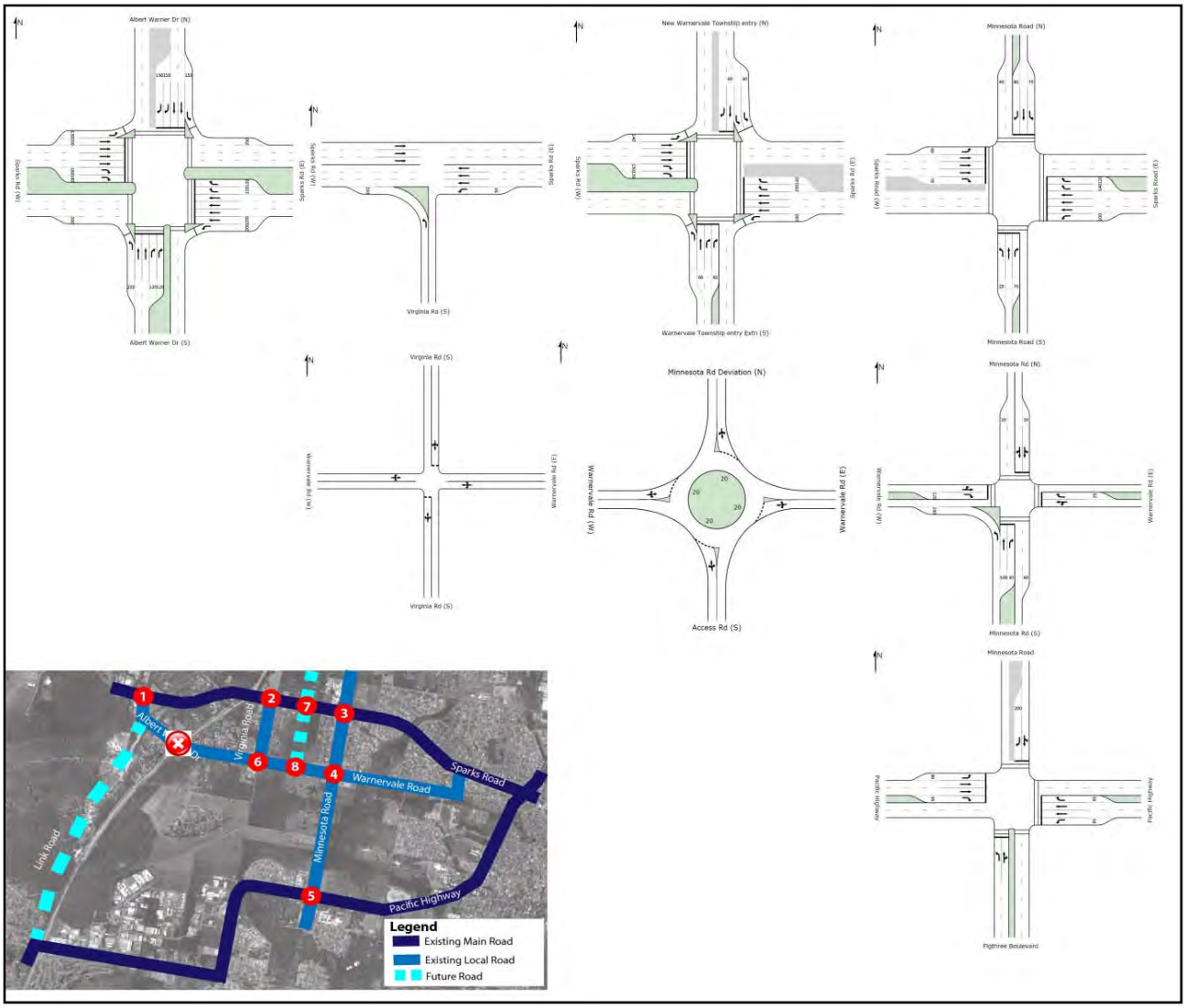


Figure 6-18 Proposed Intersection Layout 2031 Scenario S4B2

Table 6-20 Overall LoS Summary Results, Year 2031 Scenario 4B2

Ref.	Intersection	Control Type	AM Peak			PM Peak		
			DoS	Average Delay (sec)	LoS	DoS	Average Delay (sec)	LoS
I-1	Sparks Road / Albert Warner Drive	Signals Upgrade	0.90	53	D	0.94	43	D
I-2	Sparks Road / Virginia Road	Priority Upgrade	0.53	12	A	0.29	9	A
I-3	Sparks Road / Minnesota Road	Signals Upgrade	0.93	54	D	0.79	36	C
I-4	Warnervale Road / Minnesota Road	Signals Upgrade	0.75	22	B	0.65	24	B
I-5	Pacific Highway / Minnesota Road	Signals Upgrade	0.89	25	B	0.78	26	B
I-6	Warnervale Road / Virginia Road	Priority	0.27	10	A	0.22	10	A
I-7	Sparks Road / Warnervale Town Centre Access	Signals Upgrade	0.92	52	D	0.89	47	D
I-8	Warnervale Road / Connector	Roundabout	0.45	11	A	0.59	13	A

Note: DoS – Degree of Saturation, LoS – Level of Service

7 Summary of Key Findings

Precinct 7A (the site) consists of approximately 554 Hectares and is identified within Council's Residential Development Strategy (RDS) 2002 as a medium priority for urban development. It has the potential to have substantial impact on local housing supply and demand in the region. In addition the area is included within the North Wyong Shire Structure Plan (NWSSP) area for future development as identified within the Central Coast Regional Strategy (CCRS).

The purpose of Hyder's traffic study is to assess the performance of existing and future network capacity within the study area. For Precinct 7A traffic study, Hyder used the RMS's Central Coast Regional Strategic Model, together with its own TransCAD model. Hyder augmented the traffic model for the Precinct 7A study area. For assessing individual intersection capacity, Hyder used SIDRA software. The TransCAD and SIDRA model also provided an assessment tool to test the network impact from Precinct 7A development.

The specific purpose of Hyder's traffic modelling investigation was to assess the following elements:

- Assess current network capacity within study area network;
- Quantify the impacts of future land use development scenarios on the current road network;
- Future operational performance of key roads and intersections to determine the ultimate road and intersection footprint required to cater for the expected traffic growth as a result of future developments; and
- Assist Council in determining the optimum precinct staging strategy and optimum network upgrade strategy.

Hyder developed a comprehensive study approach specifically to achieve key study objectives. It involved identifying the data needs, undertake new traffic survey, development of a road based traffic model, calibration and validation of traffic model and traffic assessment.

For this study, Council provided traffic survey data which was counted in March/April 2009. In 2009, on an average weekday approximately 18,000 vehicles travelled on Sparks Road (east of Minnesota Road). About 8% were heavy vehicles. Pacific Highway east of the study area carried about 19,000 vehicles per day on an average weekday. About 3,000 vehicles were observed on Warnerval Road south of the study area on weekday. Minnesota Road carried traffic between 4,000 and 5,000 vehicles per day on an average weekday. Albert Warner Drive west of the study area carried about 1,700 vehicles per data on an average weekday.

The intersection modelling was undertaken for five key intersections for both AM and PM peak hours including:

- I-1: Sparks Road and Albert Warner Drive;
- I-2: Sparks Road and Virginia Road;
- I-3: Sparks Road and Minnesota Road;
- I-4: Warnervale Road and Minnesota Road; and
- I-5: Pacific Highway and Minnesota Road.

Modelling results show that in 2009 five key intersections operated at satisfactory level of service (LoS D or better). However, some movements of these five intersections were expected having capacity issues. Minnesota Road / Sparks Road intersection is currently performing at LoS between C and D. During the AM peak, heavy right turn at east approach is observed. Model forecasts high degree of saturation (0.9) for the westbound right turn movement from

Sparks Road to Mary MacKillop Drive (north) indicating that this movement has limited spare capacity available. Pacific Highway / Minnesota Road intersection is currently performing at LoS between C and D. High degree of saturation was forecasted for right turn movement from Minnesota to Pacific Highway during AM peak and left turn movement from Pacific Highway to Minnesota during PM indicating that these movements have limited spare capacity available.

In March 2012, Council revised the Master Plan for Precinct 7A. Traffic model assumed about 4,300 new residential dwellings within the wider study area. Of that about 2,000 dwellings are proposed within the Precinct 7A. It is expected that Warnervale Town Centre could accommodate about 2,200 residential dwellings when fully developed. About 43,000 square metres gross floor area (GFA) of commercial, bulky goods, and retail developments are proposed in the Warnervale Town Centre. About 3,000 square metres GFA of commercial developments are planned within the Precinct 7A area. Industrial developments are planned in the Wyong Employment Zone (WEZ), Bruce Crescent, Precinct 14 and Precinct 7A. When fully developed, all these areas could accommodate about 12,000 new jobs.

Future traffic conditions in and around the Precinct 7A Study Area will be influenced by a combination of background traffic growth, additional traffic generated by proposed developments and planned network changes at regional and local levels. In 2031, traffic on Sparks Road is forecast in the order of 43,000 vehicles per day east of Minnesota Road and 54,000 vehicles per day west of Albert Warner Drive. The forecast traffic volumes on Sparks Road suggest that the road needs to be widened to six lanes should full developments occur in 2031.

Prior to the ultimate widening, Sparks Road will be required to be upgraded to a four lane carriageway in year 2021 to cater for traffic demand generated by initial phases of developments. In 2021, model forecasts traffic volume on Sparks Road in the order of 35,000 to 39,000 vehicles per day. The forecast volume on Sparks Road in 2021 is almost double than today's traffic.

In order to cater for the predicted future traffic growth and in line with the suggested road network upgrades, detailed intersection modelling were undertaken to assess future performance and to identify intersection upgrades at key intersections within the study area. In consultation with the Council, the eight key intersections were modelled as follows:

- Sparks Road / New Link Road connecting Sparks Road and Pacific Highway (Link Road extension) – four way;
- Sparks Road / Virginia Road – three way;
- Sparks Road / Minnesota Road – four way;
- Warnervale Road / Minnesota Road – four way;
- Pacific Highway / Minnesota Road – four way;
- Warnervale Road / Virginia Road – four way;
- Sparks Road / New connector road between Sparks Road and Warnervale Road – four way; and
- Warnervale Road / New connector road between Sparks Road and Warnervale Road – four way.

Intersection modelling was undertaken for year 2021 and 2031.

Improvements to intersections were investigated when the intersection LoS is E or F (operating close to or over capacity). To cater for predicted traffic growth in 2021, the analysis identified the need for intersection upgrades at the following locations:

- Provision of four way signal control intersection upgrade with dual right turn lanes at Sparks Road / Albert Warner Drive (Link Road) (I-1);
- Provision of a left-in-left-out intersection upgrade at Sparks Road / Virginia Road (I-2);
- Provision of intersection upgrade at Sparks Road / Minnesota Road (I-3) to provide additional westbound right turn bay, an exclusive eastbound left turn bay and a short northbound exit lane;
- Provision of intersection upgrade at Pacific Highway / Minnesota Road (I-5) to provide an extension of southbound right turn bay from 40m to 200m;
- Provision of four way sign control intersection upgrade at Warnervale Road / Virginia Road (I-6);

Similar to year 2021, intersection assessment was undertaken for ultimate development year 2031. Further improvements were identified when the intersection LoS is E or F. The analysis assumed Sparks Road will be upgrade to six lane (three lane each direction) road and Pacific Highway will be upgrade to four lane (two lane each direction) road.

The full development would have significant impact on key intersections. There would be increased pressure on Sparks Road and associated intersections. Additional upgrade would be required at following location when the site is fully developed:

- Upgrade of Sparks Road traffic signals with Albert Warner Drive (Link Road) (I-1) to have extension of auxiliary turning lanes.
- Upgrade of Warnervale Road traffic signals with Minnesota Road (I-4) to have an extension of eastbound right turn bay from 30m to 120m and continuous slip lane from the south approach ;
- Upgrade of Sparks Road traffic signals with New Warnervale Township entry (I-7) to a four way intersection with extension of eastbound left turn bay from 80m to 140m.
- Provision of a new single lane roundabout at Warnervale Road / Connector Road (Warnervale Road to Sparks Road) location (I-8). Controls for this intersection were later changed to signals to facilitate and ensure safety for pedestrians to cross the roads.

With proposed upgrade identified, the SIDRA analysis predicted satisfactory level of service D or better by 2031.

The closure of at grade railway crossing on Warnervale Road was assessed for 2031 scenario. Modelling analysis indicated that potential closure would divert additional traffic to Virginia Road and new Minnesota Road deviation link (between Sparks Road and Warnervale Road). The potential closure would increase traffic on Sparks Road / Warnervale Township intersection. The analysis identified that the roads would adequately cater for the additional volumes and that no further intersection upgrades would be required as a result of the closure of the at grade railway crossing.

- In 2021, Minnesota Road south of Sparks Road is forecast to carry 8,800 vehicles per day. With construction of the Link Road, (Watanobbi to Warnervale), the connector road between Warnervale Road and Sparks Road (located between Virginia Road and Minnesota Road), and with the placement of speed control devices along the section of Minnesota Road between Warnervale Road and Sparks Road, the traffic volume is expected to reduce to 6,400 vehicles per day in 2031 for Scenario S4B1 (with Warnervale rail crossing), and 6,900 vehicles per day for Scenario S4B2 (without Warnervale rail crossing).
- The Link Road is forecast to carry in the order of 24,000 vehicles per day in 2031

- In 2021, the Pacific Highway west of Minnesota Road is forecast to carry 30,700 vehicles per day. With construction of the Link Road, this will reduce to 20,400 vehicles per day in 2031 for Scenario S4B1 (with Warnervale rail crossing), and 21,300 vehicles per day for Scenario S4B2 (without Warnervale rail crossing).

APPENDIX A

2009 TRAFFIC DATA

2009 Traffic Data

Traffic Survey

Automatic traffic counts (ATC) were conducted for one week from Wednesday 25 March 2009 for all following sites except M4 where the survey was conducted from Wednesday 1 April 2009 for one week.

- M-1: Sparks Road east of Minnesota Road, Hamlyn Terrace;
- M-2: Sparks Road west of Albert Warner Drive, Warnervale;
- M-3: Pacific Highway east of Minnesota Road, Hamlyn Terrace;
- M-4: Warnervale Road east of Minnesota Road, Hamlyn Terrace;
- M-5: Minnesota Road south of Sparks Road, Hamlyn Terrace;
- M-6: Virginia Road south of Sparks Road, Woongarrah;
- M-7: Minnesota Road north to Pacific Highway, Hamlyn Terrace;
- M-8: Albert Warner Drive south of Sparks Road, Warnervale.

All counted vehicles were classified using the Austroads vehicle classification of 12 classes.

In addition, detailed turning movement counts of the following key intersections were provided by the council

- I-1: Sparks Road / Albert Warner Drive
- I-2: Sparks Road / Virginia Road
- I-3: Sparks Road / Minnesota Road
- I-4: Warnervale Road / Minnesota Road
- I-5: Warnervale Road / Minnesota Road

Intersection turning movement surveys were conducted for both morning and afternoon peak periods. The morning peak survey was conducted from 7:15 am to 10 am and the afternoon peak period was from 2:15 pm to 6 pm. Figure 1 shows the count sites and type of data collection for the study area.

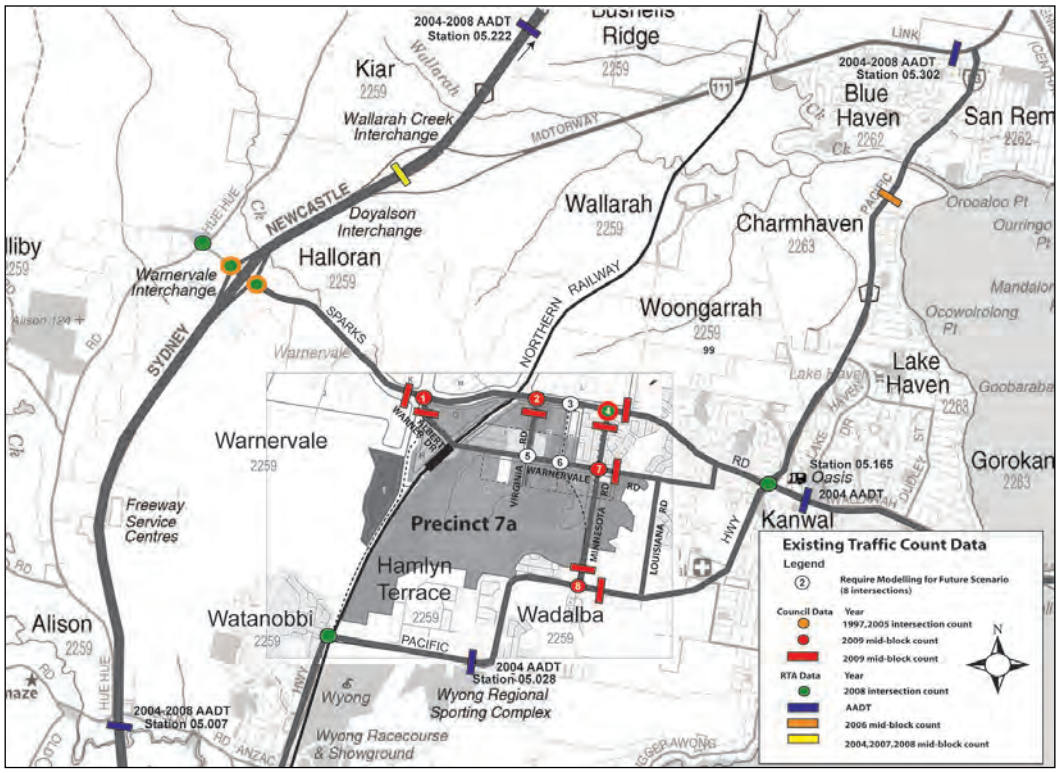


Figure 1 2009 Traffic Survey Locations

Daily Traffic Volumes

Average weekday traffic (AWT) and average weekend day traffic (AWET) were calculated based on eight mid-block 2009 counts. Table 1 shows daily traffic volumes in terms of average weekday, weekend day and critical day traffic volumes.

Table 1 Daily Traffic Volumes

ID	Road	Locations	Average Weekday	Average Weekend	Critical day	Critical vs. Weekday	Weekend vs. Weekday
M-1	Sparks Road	East of Minnesota Road	17882	12824	18596	3.80%	-28.30%
M-2	Sparks Road	West of Albert Warner Drive	17593	12468	18383	4.30%	-29.10%
M-3	Pacific Highway	East of Minnesota Road	19185	13964	20166	4.90%	-27.20%
M-4	Warnervale Road	East of Minnesota Road	2721	2147	3035	10.30%	-21.10%
M-5	Minnesota Road	South of Sparks Rd	4049	3017	4250	4.70%	-25.50%

ID	Road	Locations	Average Weekday	Average Weekend	Critical day	Critical vs. Weekday	Weekend vs. Weekday
M-6	Virginia Road	South of Sparks Road	785	465	949	17.30%	-40.80%
M-7	Minnesota Road	North of Pacific Highway	5087	3938	5614	9.40%	-22.60%
M-8	Albert Warner Drive	South of Sparks Road	1675	1081	1715	2.30%	-35.50%

Daily Traffic Profiles

This section shows the variation of the traffic profile over the survey period of one week. Figure 2 shows the daily profile of traffic volume during the survey period over one week.

Figure 2 indicates that:

- Working days have two peak periods while weekends profiles show a bell shape distribution of hourly traffic volumes throughout the day
- Traffic volumes for working days follow almost the same pattern for all working days.
- Weekend traffic volumes are lower than weekday traffic volumes
- Pacific Highway shows the highest hourly traffic volume for the weekend.
- AM peak shows shorter period than PM peak duration
- The difference between off peak period and peak period volumes on Major Roads/Highways varies by up to 25%.

Hourly Variations, AM and PM Peak Traffic

Local Roads show larger differences between peak periods and off peak periods (up to 5%) compared to Major Roads and Highways.

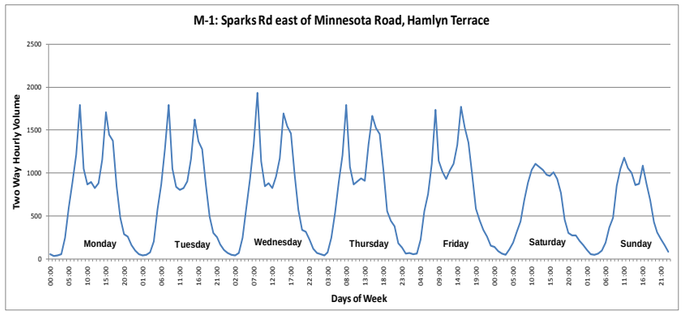
Graphs in Figure 3 plot the hourly traffic volumes on the count sites against the time of the day. These graphs also compare directional flows at survey sites and indicate the difference in volume between two traffic directions.

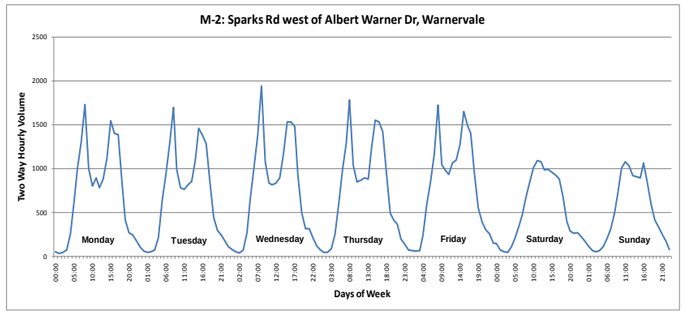
Figure 3 shows that:

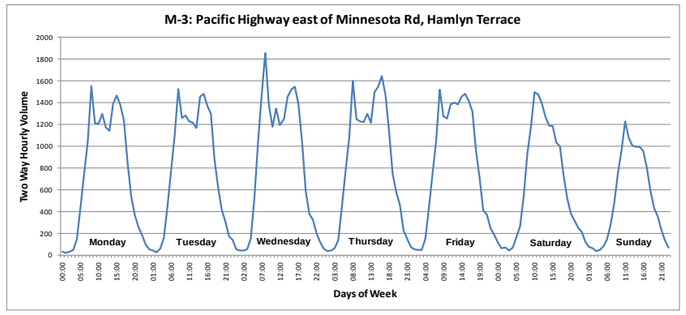
- Traffic volumes on all sites follow the pattern of two peak periods of AM peak and PM peak.
- AM peak periods begin at 7am at all surveyed mid-block locations.
- PM peak begins at 3pm at all surveyed mid-block locations.
- Except for Virginia Road (M-6), survey counts show that the direction of the higher traffic flow in one peak is reversed in the next peak.
- Virginia Road, south of Sparks Road is the only survey station where the higher traffic flow direction is the same in both peaks.

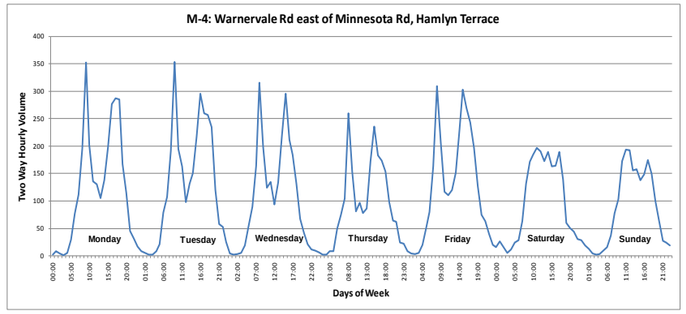
- Albert Warner Drive, Warnervale Road, and Pacific Highway show 10% higher volumes in the AM peak compared to the PM peak. The AM peak is also up to 50%greater than at other times during the day
- Virginia Road is the only site where the PM peak traffic volumes are more than the AM peak (35%) and more than twice as large as traffic flows at other times during the day.
- Minnesota Road and Sparks Road show almost the same traffic volumes for the both AM and PM peak periods.
- For all of the sites the hourly traffic volume between two peak periods shows balanced directional distribution.

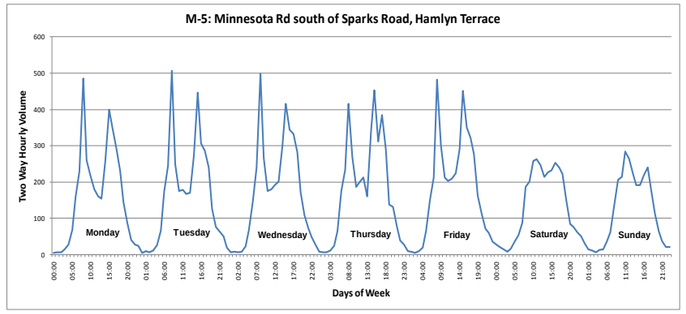
In addition, Figure 4 shows the overall hourly variation of traffic volume based on all critical days. This diagram was prepared by averaging hourly traffic distribution for all critical days and working out the percentage of hourly traffic from daily traffic volumes for critical days. The graph indicates that the overall critical peak periods for the study area occurred between 8am and 9am for the AM peak period and between 4pm and 5pm for the PM peak. This figure also indicates that the PM peak accommodates more than 9%of the daily traffic volume in critical days while the AM peak serves slightly less than 9%of daily traffic on critical days.

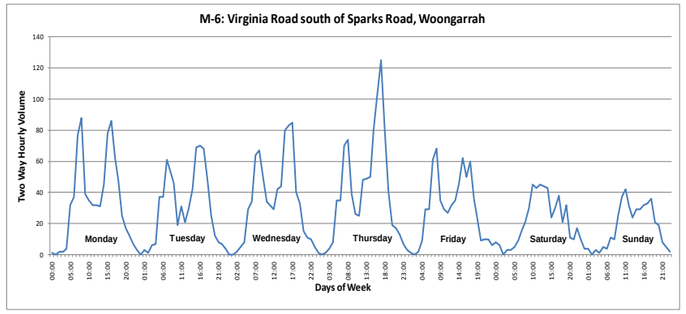


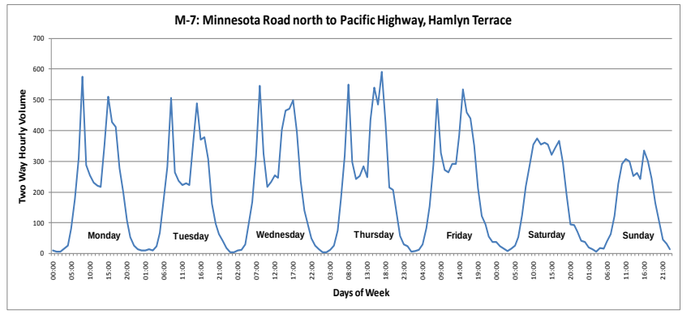












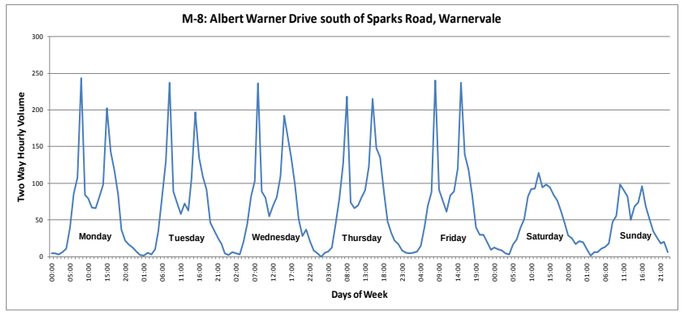
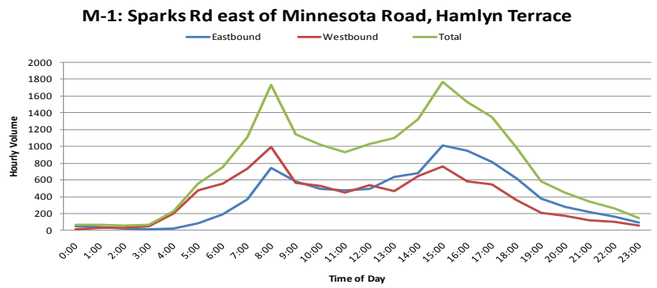
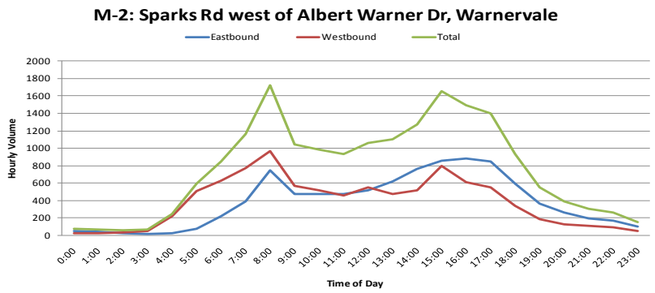
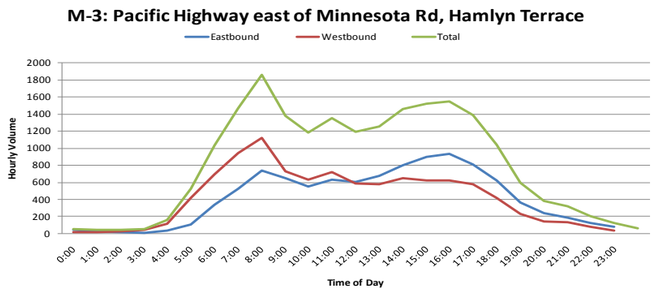
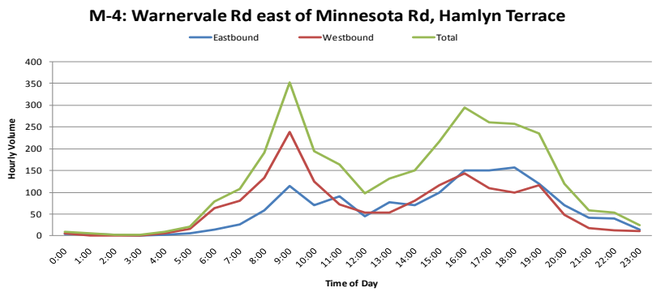


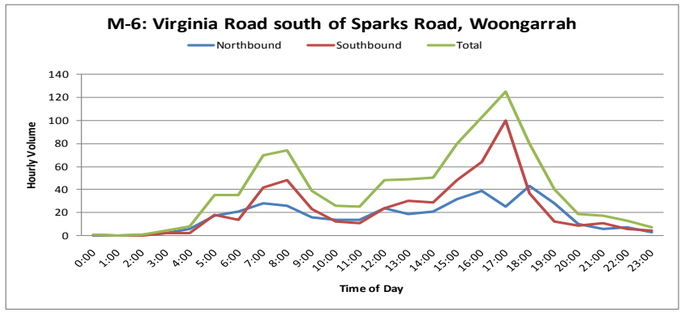
Figure 3 Daily Traffic Profile Roads Surveyed by Automatic Traffic Counters

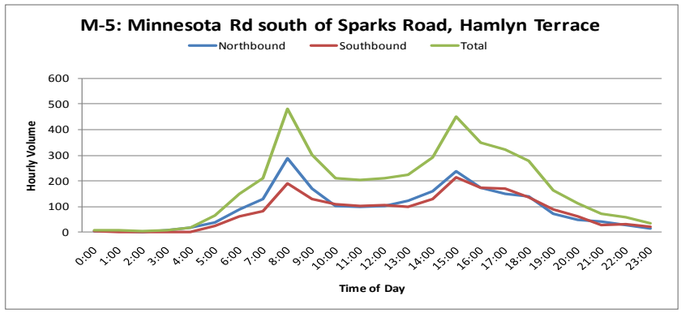


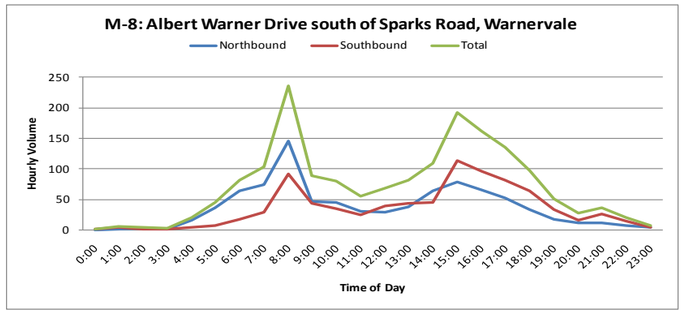












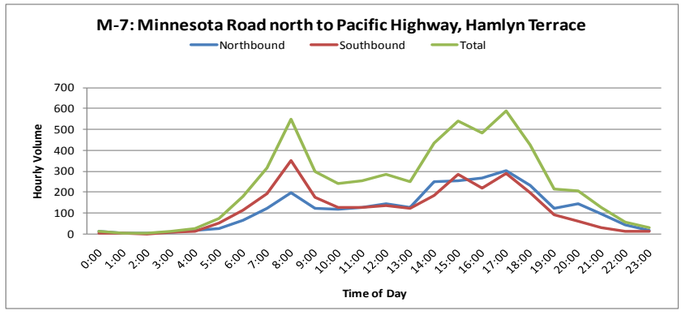


Figure 3 Hourly Variations Critical Days at Automatic Counter Sites

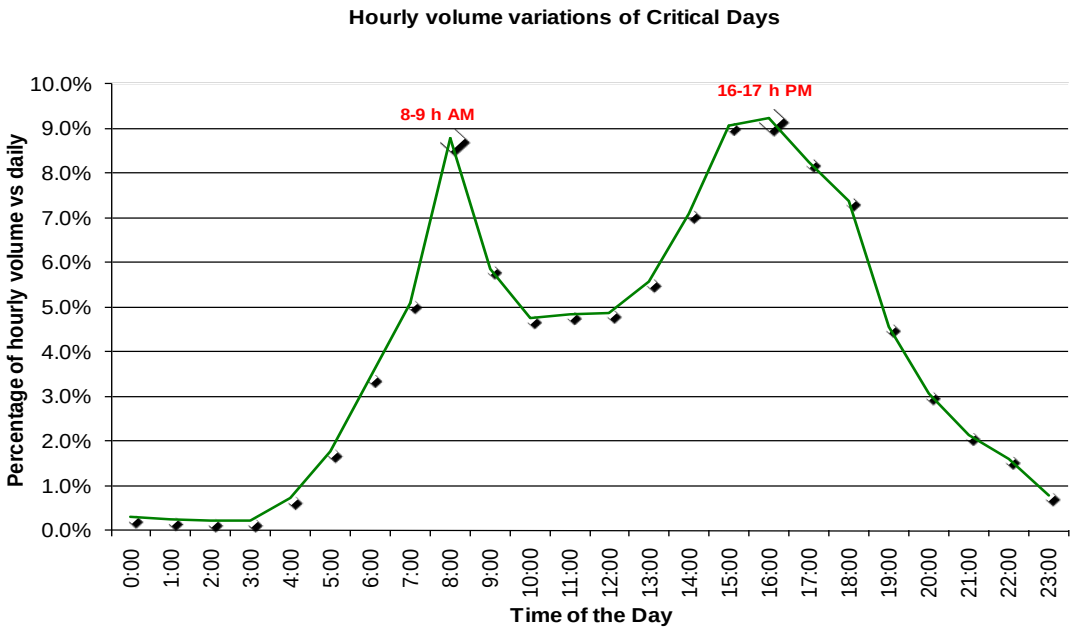


Figure 4 Hourly Volume Variation

2009 Existing SIDRA Results

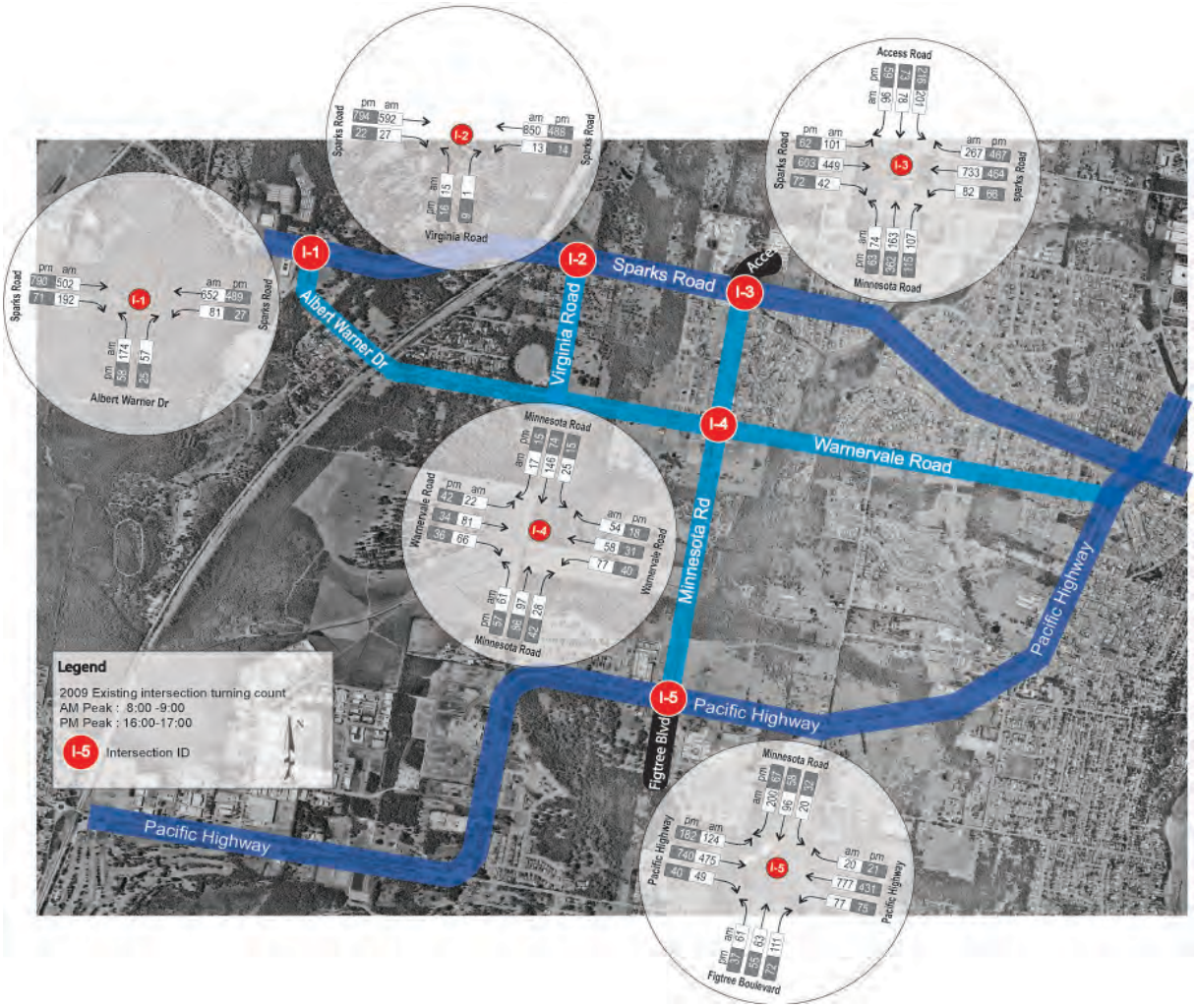


Figure 1 2009 Intersection Turn counts

I-1 Sparks Road Albert Warner Drive

AM Peak

MOVEMENT SUMMARY

Site: I-1 Sparks Road and Albert Warner Drive_AM Peak

Sparks Road and Albert Warner Drive_AM Peak
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Albert Warner Dr (RT Stage 1)											
1	L	183	3.4	0.282	12.8	LOS A	1.5	11.2	0.63	0.90	43.8
3	R	60	5.2	0.192	17.5	LOS B	0.8	5.8	0.74	0.91	40.6
Approach		243	3.9	0.282	14.0	LOS A	1.5	11.2	0.66	0.91	43.0
East: Sparks Road											
4	L	85	22.0	0.053	12.7	LOS A	0.0	0.0	0.00	0.74	60.5
5	T	686	0.0	0.352	0.0	LOS A	0.0	0.0	0.00	0.00	90.0
Approach		772	2.4	0.352	1.4	LOS A	0.0	0.0	0.00	0.08	85.8
West: Sparks Road											
11	T	528	6.7	0.283	0.0	LOS A	0.0	0.0	0.00	0.00	90.0
12	R	202	3.6	0.269	15.8	LOS B	1.5	10.8	0.63	0.92	53.9
Approach		731	5.8	0.283	4.4	LOS A	1.5	10.8	0.17	0.25	76.3
South West: Median (RT Stage 2)											
32	R	60	5.2	0.099	15.6	LOS B	0.4	2.7	0.53	0.85	46.6
Approach		60	5.2	0.099	15.6	LOS B	0.4	2.7	0.53	0.85	46.6
All Vehicles		1805	4.1	0.352	4.8	NA	1.5	11.2	0.18	0.29	70.3

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

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PM Peak

MOVEMENT SUMMARY

Site: I-1 Sparks Road and Albert Warner Driver_PM Peak

Sparks Road and Albert Warner Drive_PM Peak
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	95% Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Albert Warner Dr(RT Stage 1)											
1	L	61	1.7	0.075	10.3	LOS A	0.4	2.6	0.51	0.75	45.7
3	R	26	4.0	0.054	12.0	LOS A	0.2	1.6	0.54	0.79	44.3
Approach		87	2.4	0.075	10.9	LOS A	0.4	2.6	0.52	0.76	45.3
East: Sparks Road											
4	L	28	7.4	0.016	12.0	LOS A	0.0	0.0	0.00	0.74	60.5
5	T	515	8.5	0.279	0.0	LOS A	0.0	0.0	0.00	0.00	90.0
Approach		543	8.4	0.279	0.6	LOS A	0.0	0.0	0.00	0.04	88.0
West: Sparks Road											
11	T	832	2.2	0.432	0.0	LOS A	0.0	0.0	0.00	0.00	90.0
12	R	75	4.2	0.078	13.7	LOS A	0.4	2.8	0.51	0.78	56.8
Approach		906	2.4	0.433	1.1	LOS A	0.4	2.8	0.04	0.06	86.0
South West: Median (RT Stage 2)											
32	R	26	4.0	0.075	20.2	LOS B	0.3	1.9	0.72	0.93	40.6
Approach		26	4.0	0.075	20.2	LOS B	0.3	1.9	0.72	0.93	40.6
All Vehicles		1563	4.5	0.432	1.8	NA	0.4	2.8	0.07	0.11	81.0

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

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I-2 Sparks Road and Virginia Road

AM Peak

MOVEMENT SUMMARY

Site: I-2 Sparks Road and Virginia Road_AM Peak

Sparks Road and Virginia Road_AM Peak
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Virginia Road											
1	L	16	0.0	0.051	17.3	LOS B	0.2	1.1	0.72	0.91	40.6
3	R	1	0.0	0.051	17.5	LOS B	0.2	1.1	0.72	0.91	40.6
Approach		17	0.0	0.051	17.3	LOS B	0.2	1.1	0.72	0.91	40.6
East: Sparks Road											
4	L	14	15.3	0.008	7.5	LOS A	0.0	0.0	0.00	0.63	48.7
5	T	895	5.3	0.475	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		908	5.5	0.475	0.1	NA	0.0	0.0	0.00	0.01	59.8
West: Sparks Road											
11	T	623	9.4	0.339	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
12	R	28	7.4	0.059	13.9	LOS A	0.2	1.6	0.67	0.88	42.0
Approach		652	9.3	0.339	0.6	NA	0.2	1.6	0.03	0.04	59.0
All Vehicles		1577	7.0	0.475	0.5	NA	0.2	1.6	0.02	0.03	59.2

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

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PM Peak

MOVEMENT SUMMARY

Site: I-2 Sparks Road and Virginia Road_PM Peak

Sparks Road and Virginia Road_PM Peak
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	95% Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Virginia Road											
1	L	17	0.0	0.089	18.3	LOS B	0.3	2.0	0.67	0.82	39.8
3	R	9	11.0	0.089	18.9	LOS B	0.3	2.0	0.67	0.90	39.8
Approach		26	4.0	0.089	18.5	LOS B	0.3	2.0	0.67	0.85	39.8
East: Sparks Road											
4	L	15	0.0	0.008	7.2	LOS A	0.0	0.0	0.00	0.64	48.7
5	T	514	4.5	0.271	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		528	4.4	0.271	0.2	NA	0.0	0.0	0.00	0.02	59.6
West: Sparks Road											
11	T	749	2.5	0.390	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
12	R	22	4.5	0.026	9.9	LOS A	0.1	0.7	0.49	0.70	45.8
Approach		771	2.6	0.390	0.3	NA	0.1	0.7	0.01	0.02	59.5
All Vehicles		1326	3.3	0.390	0.6	NA	0.3	2.0	0.02	0.04	59.0

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

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I-3 Speak Road and Minnesota Road

AM Peak

MOVEMENT SUMMARY

Site: I-3 Sparks Road and Minnesota Road_AM Peak

Sparks Road and Minnesota Road_ AM Peak
Signals - Fixed Time Cycle Time = 128 seconds (User-Given Phase Times)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	95% Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Minnesota Road											
1	L	74	5.4	0.747	52.5	LOS D	3.8	28.2	0.75	0.86	24.6
2	T	163	0.6	0.488	52.3	LOS D	9.3	65.6	0.95	0.78	23.7
3	R	107	6.5	0.594	69.9	LOS E	6.7	49.2	1.00	0.79	20.6
Approach		344	3.5	0.747	57.8	LOS E	9.3	65.6	0.92	0.80	22.8
East: Sparks Road											
4	L	82	3.6	0.136	25.4	LOS B	2.6	18.6	0.54	0.74	35.4
5	T	733	4.9	0.661	32.5	LOS C	24.9	181.4	0.84	0.73	30.4
6	R	267	3.7	0.821	51.4	LOS D	12.2	88.1	1.00	0.94	24.9
Approach		1082	4.5	0.821	36.6	LOS C	24.9	181.4	0.85	0.78	29.1
North: Access Road											
7	L	201	1.4	0.349	16.7	LOS B	4.7	33.5	0.50	0.72	41.3
8	T	78	0.0	0.233	49.6	LOS D	4.2	29.6	0.90	0.70	24.5
9	R	96	13.5	0.558	70.1	LOS E	5.9	46.5	1.00	0.79	20.6
Approach		375	4.2	0.558	37.2	LOS C	5.9	46.5	0.71	0.73	29.6
West: Sparks Road											
10	L	101	4.0	0.551	69.5	LOS E	6.2	45.1	1.00	0.79	20.6
11	T	449	8.2	0.817	49.0	LOS D	27.6	206.9	0.99	0.94	24.5
12	R	42	9.5	0.182	62.5	LOS E	2.4	18.0	0.93	0.74	22.2
Approach		592	7.6	0.817	53.5	LOS D	27.6	206.9	0.99	0.90	23.6
All Vehicles		2393	5.1	0.821	43.9	LOS D	27.6	206.9	0.88	0.81	26.6

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model used.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow	Average Delay	Level of Service	Average Back of Queue Pedestrian	Average Back of Queue Distance	Prop. Queued	Effective Stop Rate
		ped/h	sec		ped	m		per ped
P1	Across S approach	50	30.3	LOS D	0.1	0.1	0.69	0.69
P3	Across E approach	50	58.1	LOS E	0.2	0.2	0.95	0.95
P5	Across N approach	50	28.2	LOS C	0.1	0.1	0.66	0.66
P7	Across W approach	50	55.3	LOS E	0.2	0.2	0.93	0.93
All Pedestrians		200	43.0	LOS E			0.81	0.81

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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PM Peak

MOVEMENT SUMMARY

Site: I-3 Sparks Road and Minnesota Road_PM Peak

Sparks Road and Minnesota Road_PM Peak
Signals - Fixed Time Cycle Time = 92 seconds (User-Given Phase Times)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Minnesota Road											
1	L	63	6.3	0.503	35.8	LOS C	2.1	15.8	0.79	0.74	30.3
2	T	68	0.6	0.403	45.2	LOS D	3.1	21.5	0.99	0.75	25.7
3	R	115	6.1	0.457	48.8	LOS D	4.9	36.3	0.96	0.79	25.7
Approach		246	4.6	0.503	44.5	LOS D	4.9	36.3	0.92	0.76	26.7
East: Sparks Road											
4	L	66	4.5	0.081	16.9	LOS B	1.2	9.1	0.45	0.72	41.0
5	T	464	6.2	0.404	22.6	LOS B	9.3	68.9	0.77	0.65	35.4
6	R	167	3.0	0.768	55.3	LOS D	8.0	57.4	1.00	0.90	23.8
Approach		697	5.3	0.768	29.9	LOS C	9.3	68.9	0.79	0.71	32.1
North: Access Road											
7	L	216	4.2	0.332	18.6	LOS B	4.9	35.8	0.60	0.74	39.9
8	T	73	5.4	0.446	45.5	LOS D	3.3	24.2	0.99	0.75	25.6
9	R	59	3.4	0.230	47.2	LOS D	2.4	17.5	0.93	0.75	26.1
Approach		348	4.3	0.446	29.1	LOS C	4.9	35.8	0.74	0.75	33.1
West: Sparks Road											
10	L	62	17.7	0.416	49.3	LOS D	4.1	32.4	0.96	0.79	26.0
11	T	630	6.5	0.861	37.5	LOS C	28.8	212.8	0.99	1.01	28.2
12	R	72	4.2	0.334	49.9	LOS D	3.1	22.4	0.96	0.76	25.3
Approach		764	7.2	0.861	39.6	LOS C	28.8	212.8	0.98	0.97	27.7
All Vehicles		2055	5.7	0.861	35.1	LOS C	28.8	212.8	0.87	0.82	29.8

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model used.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	Across S approach	53	25.1	LOS C	0.1	0.1	0.74	0.74
P5	Across N approach	53	23.0	LOS C	0.1	0.1	0.71	0.71
All Pedestrians		106	24.0	LOS C			0.72	0.72

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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I-4 Warnervale Road and Minnesota Road

AM Peak

MOVEMENT SUMMARY

Site: I-4 Warnervale Road and Minnesota Road_AM Peak

Warnervale Road and Minnesota Road_AM Peak
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Minnesota Road											
1	L	64	3.4	0.224	12.8	LOS A	0.9	6.6	0.32	0.83	45.1
2	T	102	4.1	0.224	12.4	LOS A	0.9	6.6	0.32	0.94	45.5
3	R	29	7.1	0.224	12.8	LOS A	0.9	6.6	0.32	1.03	45.3
Approach		196	4.3	0.224	12.6	LOS A	0.9	6.6	0.32	0.92	45.4
East: Warnervale Road											
4	L	81	2.6	0.112	8.6	LOS A	0.6	4.4	0.28	0.53	48.1
5	T	61	1.8	0.112	0.4	LOS A	0.6	4.4	0.28	0.00	53.5
6	R	57	7.4	0.112	9.1	LOS A	0.6	4.4	0.28	0.71	48.0
Approach		199	3.7	0.112	6.2	NA	0.6	4.4	0.28	0.42	49.6
North: Minnesota Road											
7	L	26	31.6	0.245	14.8	LOS B	1.0	7.4	0.40	0.81	45.0
8	T	154	4.1	0.245	12.8	LOS A	1.0	7.4	0.40	0.94	45.3
9	R	18	0.0	0.245	12.7	LOS A	1.0	7.4	0.40	1.01	45.2
Approach		198	7.4	0.245	13.0	LOS A	1.0	7.4	0.40	0.93	45.2
West: Warnervale Road											
10	L	23	11.1	0.102	9.1	LOS A	0.5	3.8	0.28	0.58	48.3
11	T	85	2.4	0.102	0.5	LOS A	0.5	3.8	0.28	0.00	54.0
12	R	69	1.5	0.102	9.0	LOS A	0.5	3.8	0.28	0.77	48.2
Approach		178	3.2	0.102	4.9	NA	0.5	3.8	0.28	0.37	50.8
All Vehicles		771	4.7	0.245	9.3	NA	1.0	7.4	0.32	0.67	47.6

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

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PM Peak

MOVEMENT SUMMARY

Site: I-4 Warnervale Road and Minnesota Road_PM Peak

Warnervale Road and Minnesota Road_PM
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	95% Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Minnesota Road											
1	L	60	0.0	0.191	11.6	LOS A	0.8	5.5	0.22	0.85	45.9
2	T	91	0.0	0.191	11.2	LOS A	0.8	5.5	0.22	0.92	46.2
3	R	44	0.0	0.191	11.4	LOS A	0.8	5.5	0.22	0.98	46.0
Approach		195	0.0	0.191	11.4	LOS A	0.8	5.5	0.22	0.91	46.1
East: Warnervale Road											
4	L	42	5.0	0.052	8.6	LOS A	0.3	2.0	0.24	0.58	48.3
5	T	33	0.0	0.052	0.3	LOS A	0.3	2.0	0.24	0.00	54.5
6	R	19	11.0	0.052	9.2	LOS A	0.3	2.0	0.24	0.73	48.2
Approach		94	4.5	0.052	5.8	NA	0.3	2.0	0.24	0.41	50.3
North: Minnesota Road											
7	L	16	0.0	0.114	11.7	LOS A	0.4	3.1	0.26	0.83	45.8
8	T	78	0.0	0.114	11.3	LOS A	0.4	3.1	0.26	0.90	46.2
9	R	16	13.0	0.114	12.3	LOS A	0.4	3.1	0.26	0.98	46.0
Approach		109	1.9	0.114	11.5	LOS A	0.4	3.1	0.26	0.90	46.1
West: Warnervale Road											
10	L	44	0.0	0.065	8.4	LOS A	0.3	2.4	0.21	0.58	48.3
11	T	36	3.0	0.065	0.2	LOS A	0.3	2.4	0.21	0.00	55.0
12	R	38	5.5	0.065	8.9	LOS A	0.3	2.4	0.21	0.72	48.2
Approach		118	2.7	0.065	6.1	NA	0.3	2.4	0.21	0.45	50.1
All Vehicles		516	1.8	0.191	9.2	NA	0.8	5.5	0.23	0.71	47.7

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

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I-5 Pacific Highway and Minnesota Road

AM Peak

MOVEMENT SUMMARY

Site: I-5 Pacific Highway and Minnesota Road_AM Peak

Pacific Highway and Minnesota Road_AM Peak
Signals - Fixed Time Cycle Time = 70 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	95% Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Figthree Boulevard											
1	L	64	3.3	0.130	29.3	LOS C	1.7	12.1	0.79	0.75	33.2
2	T	66	0.0	0.879	42.4	LOS C	7.4	53.0	1.00	1.02	25.7
3	R	117	4.7	0.879	50.5	LOS D	7.4	53.0	1.00	1.02	25.6
Approach		247	3.1	0.879	42.8	LOS D	7.4	53.0	0.95	0.95	27.3
East: Pacific Highway											
4	L	120	1.8	0.218	28.3	LOS B	3.1	22.2	0.79	0.77	33.7
5	T	818	4.0	0.886	31.2	LOS C	20.7	150.1	0.96	0.96	30.8
6	R	21	0.0	0.132	42.1	LOS C	0.7	5.0	0.95	0.70	27.8
Approach		959	3.6	0.886	31.1	LOS C	20.7	150.1	0.94	0.93	31.0
North: Minnesota Road											
7	L	21	0.0	0.526	40.0	LOS C	4.1	29.8	0.97	0.80	29.9
8	T	101	5.2	0.526	31.8	LOS C	4.1	29.8	0.97	0.77	30.1
9	R	211	1.5	0.891	51.4	LOS D	8.7	61.9	1.00	1.06	24.9
Approach		333	2.5	0.891	44.8	LOS D	8.7	61.9	0.99	0.96	26.6
West: Pacific Highway											
10	L	131	2.4	0.556	41.1	LOS C	4.5	31.8	0.98	0.79	28.2
11	T	500	6.9	0.588	22.2	LOS B	9.8	72.5	0.87	0.73	35.4
12	R	52	4.1	0.334	43.2	LOS D	1.8	13.0	0.98	0.74	27.5
Approach		682	5.8	0.588	27.4	LOS B	9.8	72.5	0.90	0.75	33.1
All Vehicles		2221	4.1	0.891	33.3	LOS C	20.7	150.1	0.93	0.88	30.4

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model used.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow	Average Delay	Level of Service	Average Back of Queue Pedestrian	Average Back of Queue Distance	Prop. Queued	Effective Stop Rate
		ped/h	sec		ped	m		per ped
P1	Across S approach	53	26.6	LOS C	0.1	0.1	0.87	0.87
P3	Across E approach	53	28.4	LOS C	0.1	0.1	0.90	0.90
P5	Across N approach	53	22.4	LOS C	0.1	0.1	0.80	0.80
All Pedestrians		159	25.8	LOS C			0.86	0.86

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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PM Peak

MOVEMENT SUMMARY

Site: I-5 Pacific Highway and Minnesota Road_PM Peak

Pacific Highway and Minnesota Road_PM Peak
Signals - Fixed Time Cycle Time = 69 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	95% Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Figthree Boulevard											
1	L	39	0.0	0.080	29.2	LOS C	1.0	7.0	0.79	0.73	33.3
2	T	58	0.0	0.741	37.3	LOS C	4.9	34.8	1.00	0.88	27.4
3	R	76	2.7	0.741	45.3	LOS D	4.9	34.8	1.00	0.88	27.3
Approach		173	1.2	0.741	39.0	LOS C	4.9	34.8	0.95	0.84	28.5
East: Pacific Highway											
4	L	79	1.3	0.141	27.2	LOS B	2.0	13.8	0.76	0.75	34.3
5	T	454	3.0	0.482	21.0	LOS B	7.9	56.4	0.84	0.70	36.2
6	R	22	0.0	0.137	41.5	LOS C	0.7	5.1	0.95	0.70	28.0
Approach		555	2.7	0.482	22.7	LOS B	7.9	56.4	0.84	0.71	35.5
North: Minnesota Road											
7	L	34	3.2	0.779	48.2	LOS D	3.7	26.1	1.00	0.91	26.7
8	T	61	1.7	0.779	39.9	LOS C	3.7	26.1	1.00	0.91	26.8
9	R	71	0.0	0.291	38.8	LOS C	2.3	15.8	0.94	0.76	29.1
Approach		165	1.3	0.779	41.1	LOS C	3.7	26.1	0.98	0.85	27.7
West: Pacific Highway											
10	L	192	1.1	0.797	45.0	LOS D	7.1	50.4	1.00	0.93	26.8
11	T	779	2.0	0.875	29.9	LOS C	20.2	144.1	0.95	0.95	31.3
12	R	42	5.0	0.270	42.4	LOS C	1.4	10.4	0.97	0.73	27.7
Approach		1013	2.0	0.875	33.3	LOS C	20.2	144.1	0.96	0.94	30.2
All Vehicles		1905	2.0	0.875	31.4	LOS C	20.2	144.1	0.92	0.86	31.1

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model used.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow	Average Delay	Level of Service	Average Back of Queue Pedestrian	Average Back of Queue Distance	Prop. Queued	Effective Stop Rate
		ped/h	sec		ped	m		per ped
P1	Across S approach	53	26.1	LOS C	0.1	0.1	0.87	0.87
P3	Across E approach	53	28.8	LOS C	0.1	0.1	0.91	0.91
P5	Across N approach	53	21.9	LOS C	0.1	0.1	0.80	0.80
All Pedestrians		159	25.6	LOS C			0.86	0.86

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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APPENDIX B

2009 EXISTING SIDRA RESULTS

Strategic Traffic Model Calibration and Validation

1 Model Calibration and Validation Criteria

Model calibration is the process by which the initial model inputs and parameters are adjusted in a logical and controlled manner until the model matches a set of observed values. This calibration process confirms that appropriate parameters are chosen, thus ensuring that traffic projections will be consistent with the current behavioural responses. Table 1 presents the calibration criteria based on the relevant modelling guidelines.

Table 1 Calibration Criteria

Criteria	Description	Target
1	Difference in link flow within 100 for flows <700 vph	Greater than 85%
2	Difference in link flow within 15% for flows 700-2,700 vph	Greater than 85%
3	Difference in link flow within 400 for flows >2,700 vph	Greater than 85%
4	Difference of total screen line flows	
	Small to medium network models	within 5%
	Large network models	within 10%
5	GEH Statistic less than 5 of all individual modelled flow	Greater than 85%

*Source: UK-Design Manual for Roads and Bridges (DMRB)

2 Model Calibration Results

Within the study area a total of eight screenline flows, cordon line flow and 56 individual link flows by direction were examined during the calibration process.

Table 2 summarises number of links included in the AM Peak and PM peak model calibration.

Table 2 Number of Individual Links Included In The Model Calibration

	AM	PM
Number of individual link flows (by direction)	56	56
<700 vph	*37*	*34*
<700-2,700 vph	*17*	*20*
>2,700 vph	*2*	*2*
Average link flow -one direction (vph)	482	439

Figure 2 below shows the cordon line and eight screenline locations included in the model calibration. Table 3 shows the summary of the model calibration results for the Precinct 7A Study Area.

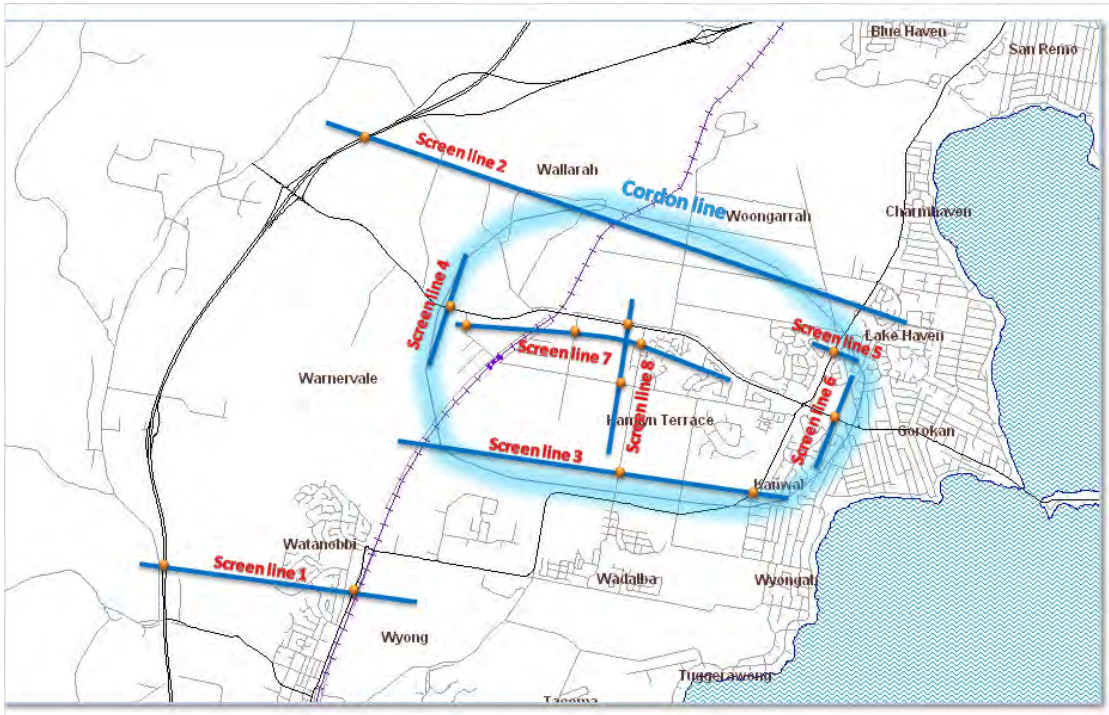

Figure 2 Cordon Line and Screenline Locations

Table 3 Model calibration achievement

Criteria	Description	Target*	Achievement		Pass/Fail
			AM	PM	
1	Difference in link flow within 100 for flows <700 vph	Greater than 85%	100%	100%	Pass
2	Difference in link flow within 15% for flows 700-2,700 vph	Greater than 85%	100%	100%	Pass
3	Difference in link flow within 400 for flows >2,700 vph	Greater than 85%	100%	100%	Pass
4	Difference of total screen line flows	within 10%			Pass
	Screen line 1		5%	3%	Pass
	Screen line 2		6%	6%	Pass
	Screen line 3		3%	6%	Pass
	Screen line 4		6%	8%	Pass
	Screen line 5		1%	4%	Pass
	Screen line 6		2%	2%	Pass
	Screen line 7		0%	7%	Pass
	Screen line 8		1%	8%	Pass
	Cordon line		2%	1%	Pass

Criteria	Description	Target*	Achievement		Pass/Fail
5	GEH Statistic less than 5 of all individual modelled flow	Greater than 85%	98%	100%	Pass

The model calibration results presented in Table 3 shows that both AM and PM peak models were calibrated for individual link and screenline flows to the required calibration standards. Figure A3 below show the plots of the observed and modelled volumes. The R^2 value was achieved more than 0.99, indicates a close match between the observed traffic and model volumes. The result confirms that traffic model was adequately calibrated for existing traffic condition and formed the basis for the modelling of future conditions.

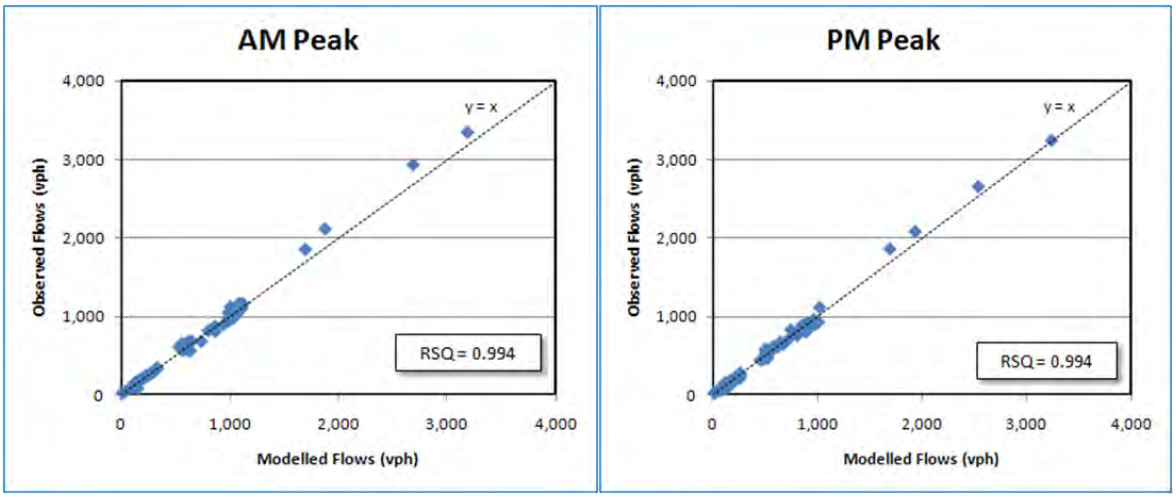

Figure 3 Scatter Plot-Modelled and Observed Flows AM And PM Peak

3 Model Validation Results

The November/December 2008 travel time survey data was used to validate the traffic model. The model validation was undertaken for two key travel routes which have immediate effect to the project. These two travel routes are part of the RMS' eight strategic travel routes which is covering the entire Central Coast road network. These two key strategic routes are

- Sparks Road between the F3 Freeway and Budgewoi Road, Noraville and
- Pacific Highway between Wyong Road, Tuggerah and Motorway Link, Doyalson.

Figure 4 shows two strategic routes relevant to the study area.

Figure 4 Key Strategic Travel Routes

Figures 5 and 6 show the model travel time validation results for AM and PM peak period respectively. The survey travel time data was shown for a range from minimum to maximum values. The results indicated that modelled travel time lie within the bands of observed travel times. This confirms that traffic model was validated to the required standard.

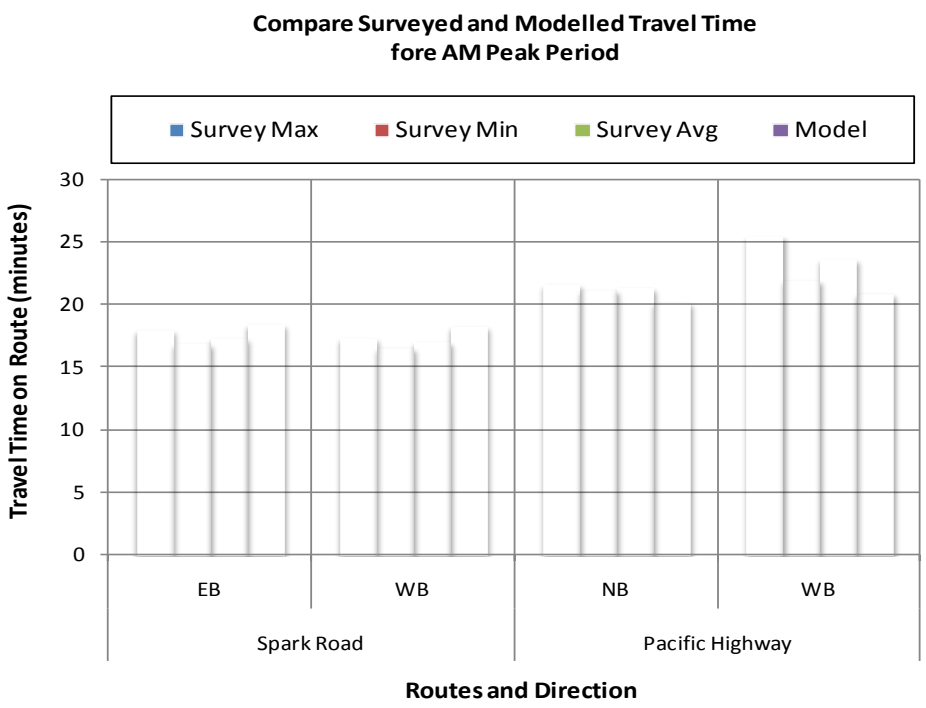

Figure 6 AM Peak Travel Time Model Validation

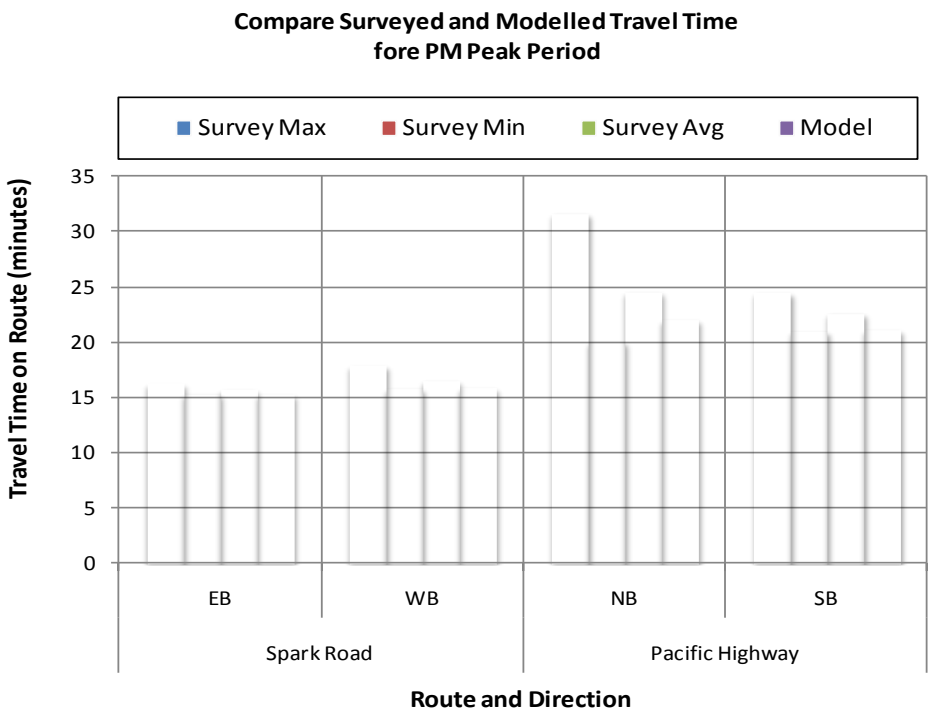

Figure 7 PM Peak Travel Time Model Validation

4 Summary of Model Calibration & Validation

The traffic model calibration & validation results documented in this report suggest that both AM and PM peak models were calibrated adequately and the models are fit for purpose.

APPENDIX C

STRATEGIC TRAFFIC MODEL CALIBRATION AND VALIDATION

APPENDIX D

TRANSCAD VCR PLOTS

TransCAD VCR Plots

An indicative level of service (LoS) was determined from TransCAD model. TransCAD network plots were prepared for two-hour AM and PM peak period traffic volumes for year 2021 and 2031. TransCAD plots indicate the level of traffic forecast across the network and provide an indication of the level of congestion on each road. This level of congestion is reported in terms of volume-to-capacity ratios (VCRs). The notional VCR and indicative LoS is presented into six bands as set out below:

Volume capacity Ratio (VCR)	Description	TransCAD plot colour code	Indicative Level of Service (LoS)
VCR<0.35	No capacity problem	Dark green	A
0.35 <VCR<=0.60	No capacity problem	Green	B
0.61 <VCR<=0.75	No capacity problem	Light green	C
0.76 <VCR<=1.0	Approaching capacity	Yellow	D
1.01 <VCR<=1.2	Over capacity	Orange	E
VCR>1.2	Over capacity	Red	F

The forecast traffic volumes and volume-to-capacity ratios (VCRs) are prepared at mid-block sections of Sparks Road for four future scenarios using TransCAD. A series of TransCAD VCR plots are included in this appendix (Figures 1 to 6).

With proposed four lanes in 2021 and six lanes upgrade in 2031 in place, model forecasts Sparks Road will operate in satisfactory level of service.

In a conclusion, traffic modelling has identified the need of Sparks Road upgrade to cater for traffic growth generated by future developments. The proposed ultimate upgrade of six lanes on Sparks Road would provide a satisfactory level of service in the long term.

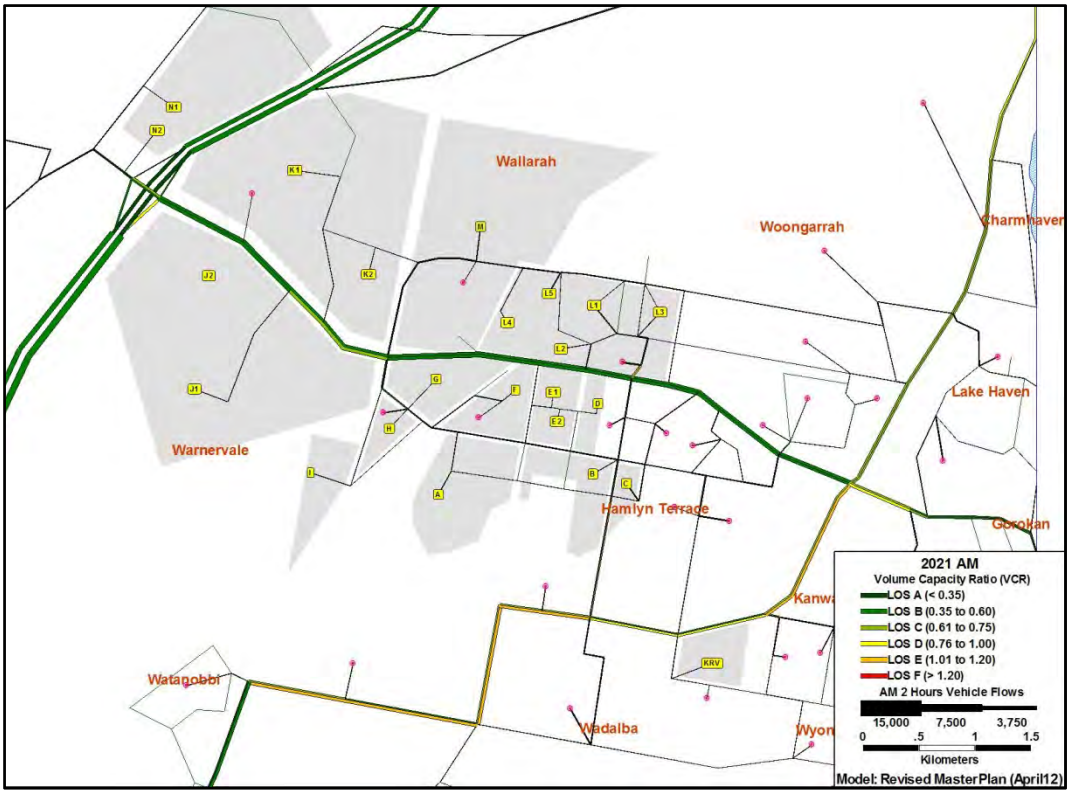

Figure 1 2021 AM

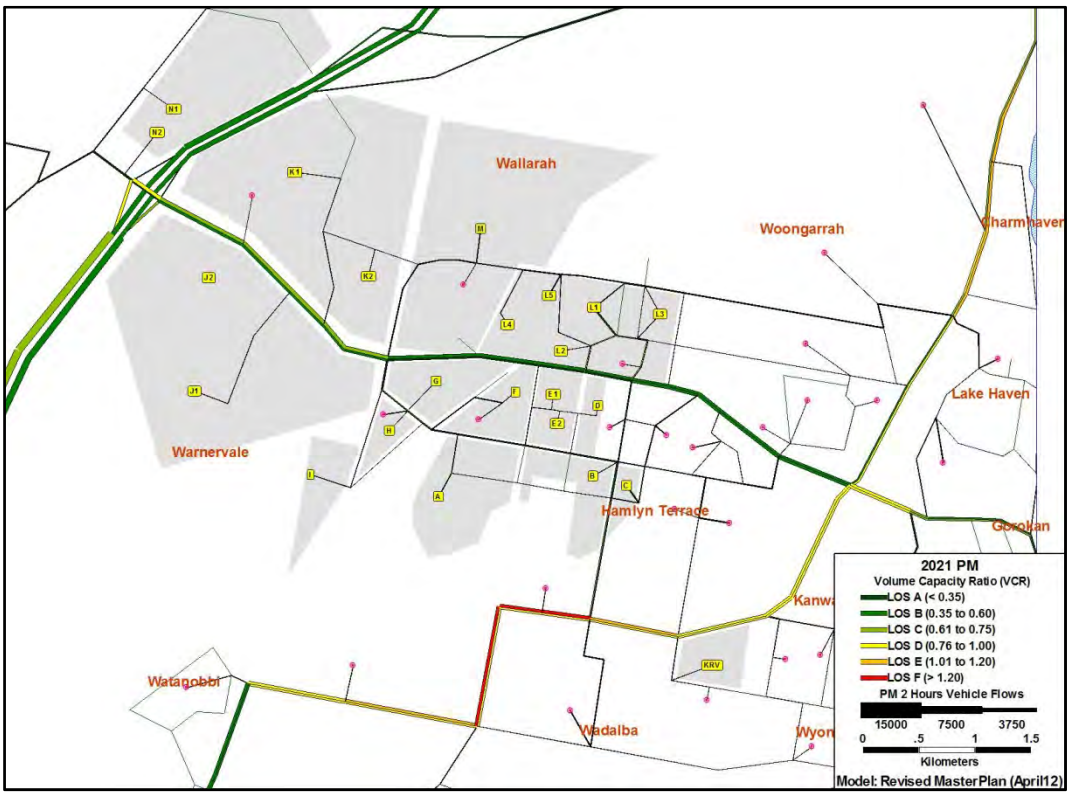

Figure 2 2021 PM

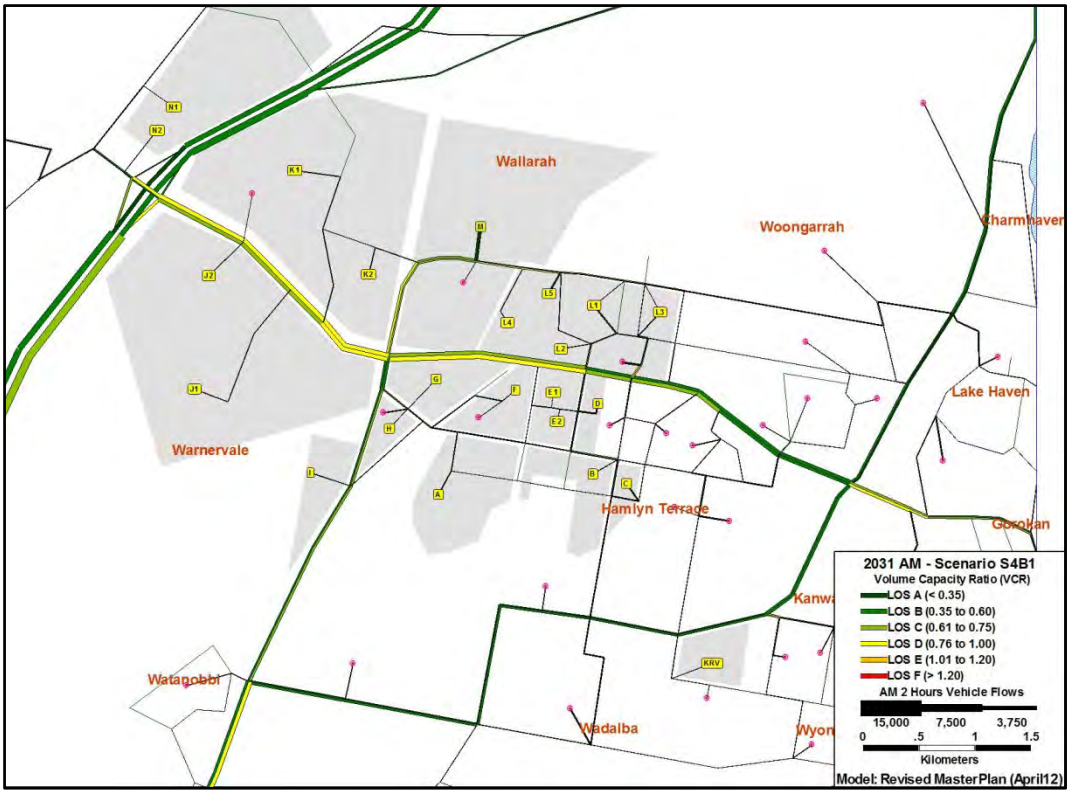

Figure 3 **2031 AM Scenario 4B1**

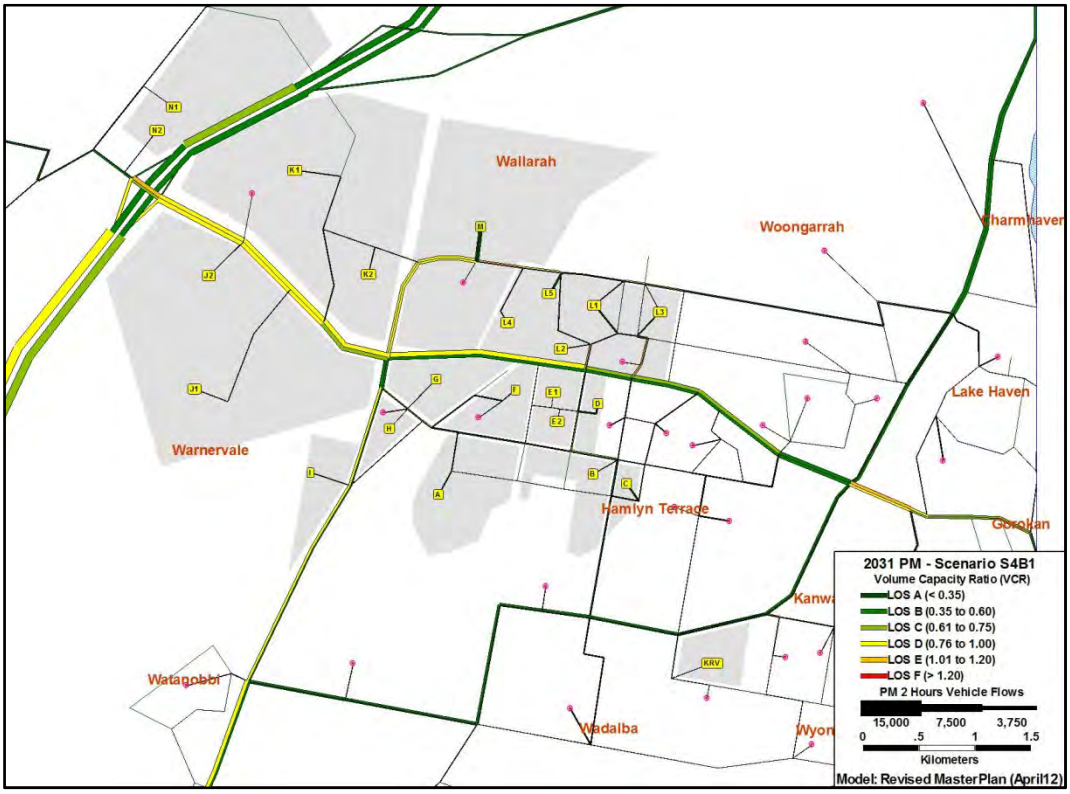

Figure 4 **2031 PM Scenario 4B1**

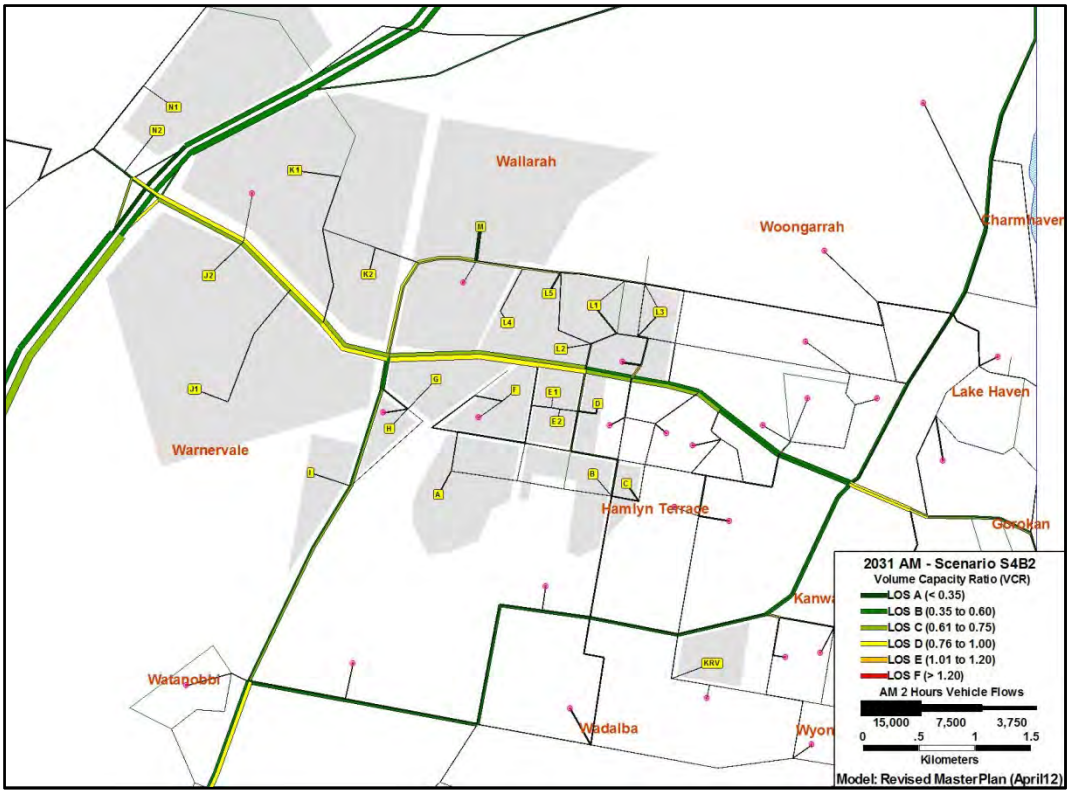

Figure 5 2031 AM Scenario 4B2

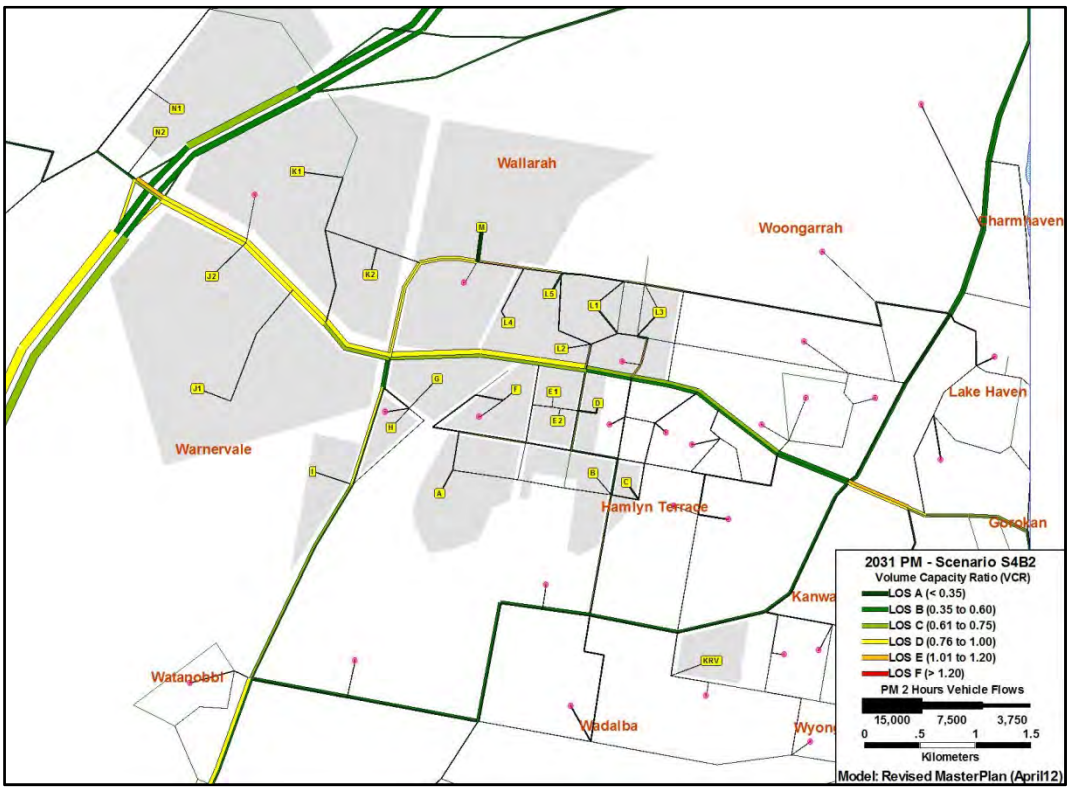

Figure 6 2031 PM Scenario 4B2

APPENDIX E

2021 FORECAST TURNING VOLUMES AND SIDRA RESULTS (SCENARIO 1)

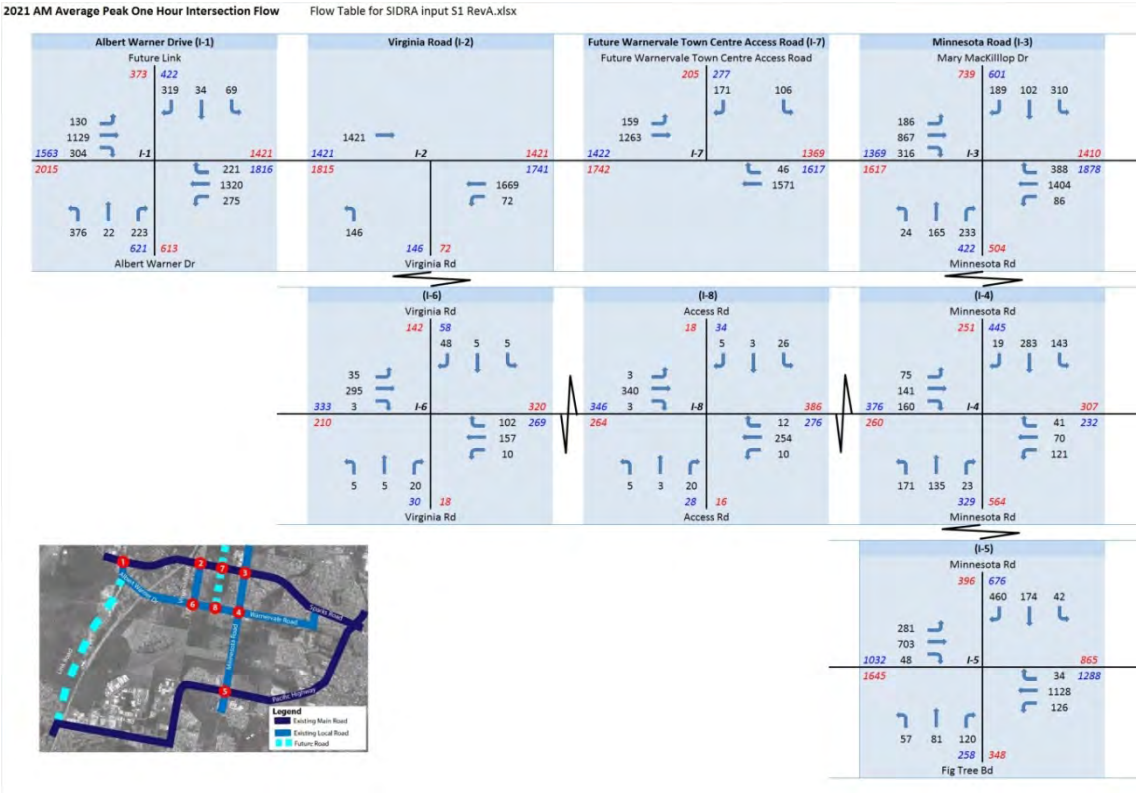

Figure 1 Forecast turning volume – 2021 AM Peak 1 hour

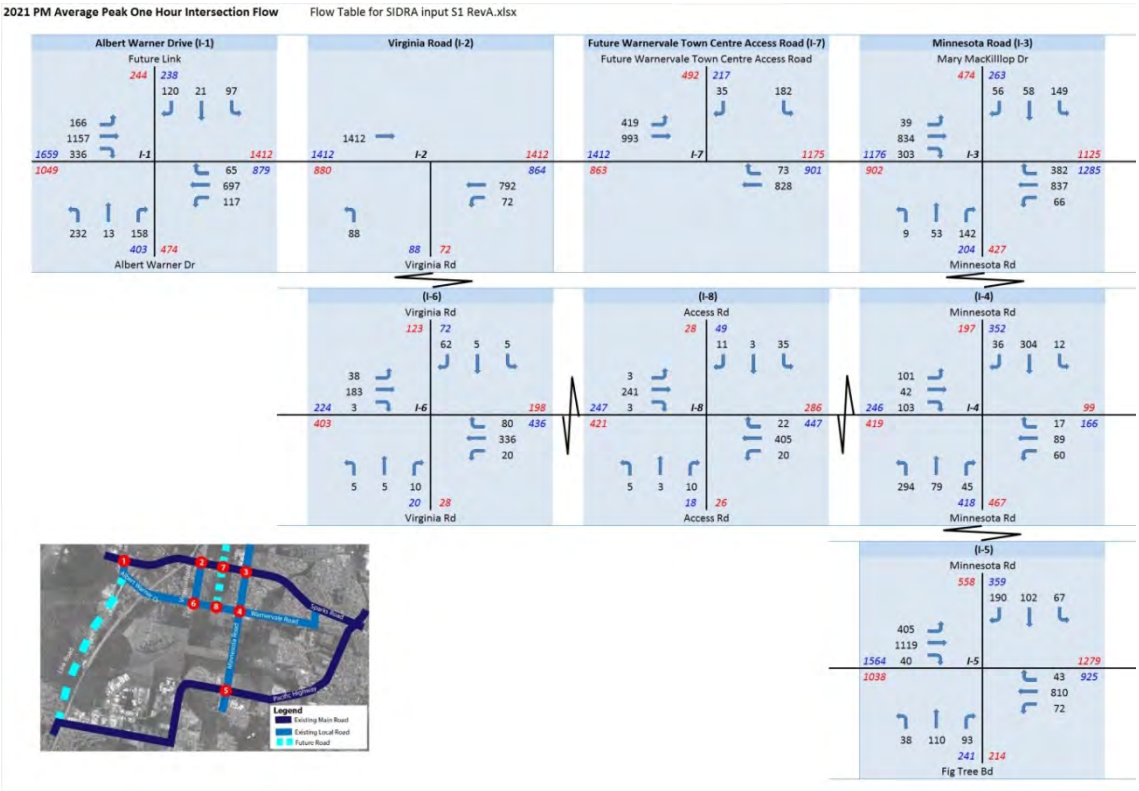

Figure 2 Forecast turning volume – 2021 PM Peak 1 hour

MOVEMENT SUMMARY

Site: AM Peak

I-1 Sparks Rd / Albert Warner Dr
Signals - Fixed Time Cycle Time = 90 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	95% Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Albert Warner Dr (S)											
1	L	376	6.4	0.680	31.7	LOS C	13.1	97.1	0.84	0.82	32.0
2	T	22	72.7	0.042	31.8	LOS C	0.4	4.5	0.83	0.58	27.3
3	R	223	22.0	0.568	50.5	LOS D	4.9	40.7	0.99	0.80	25.9
Approach		621	14.3	0.680	38.4	LOS C	13.1	97.1	0.89	0.81	29.3
East: Sparks Rd (E)											
4	L	275	18.2	0.473	25.4	LOS B	7.4	59.9	0.65	0.78	40.7
5	T	1320	4.9	0.776	33.9	LOS C	18.8	137.5	0.97	0.90	35.8
6	R	221	8.6	0.568	53.2	LOS D	4.9	36.7	0.99	0.79	26.4
Approach		1816	7.4	0.776	35.0	LOS C	18.8	137.5	0.93	0.87	35.0
North: Albert Warner Dr (N)											
7	L	69	11.6	0.217	27.3	LOS B	2.0	15.1	0.68	0.72	34.0
8	T	34	38.2	0.054	31.8	LOS C	0.6	5.7	0.84	0.60	27.3
9	R	319	8.8	0.747	53.3	LOS D	7.4	55.8	1.00	0.91	24.9
Approach		422	11.6	0.747	47.3	LOS D	7.4	55.8	0.93	0.85	26.3
West: Sparks Rd (W)											
10	L	130	13.1	0.183	23.7	LOS B	3.1	24.4	0.58	0.75	42.0
11	T	1129	11.0	0.689	30.6	LOS C	14.9	114.1	0.94	0.82	37.6
12	R	304	8.9	0.783	57.6	LOS E	7.2	54.5	1.00	0.89	25.0
Approach		1563	10.7	0.783	35.3	LOS C	14.9	114.1	0.92	0.83	34.9
All Vehicles		4422	10.0	0.783	36.7	LOS C	18.8	137.5	0.92	0.84	33.0

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model used.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow	Average Delay	Level of Service	Average Back of Queue Pedestrian	Average Back of Queue Distance	Prop. Queued	Effective Stop Rate
		ped/h	sec		ped	m		per ped
P1	Across S approach	53	28.8	LOS C	0.1	0.1	0.80	0.80
P2	Across S approach	53	24.9	LOS C	0.1	0.1	0.74	0.74
P3	Across E approach	53	39.2	LOS D	0.1	0.1	0.93	0.93
P4	Across E approach	53	34.7	LOS D	0.1	0.1	0.88	0.88
P5	Across N approach	53	28.8	LOS C	0.1	0.1	0.80	0.80
P6	Across N approach	53	24.9	LOS C	0.1	0.1	0.74	0.74
P7	Across W approach	53	39.2	LOS D	0.1	0.1	0.93	0.93
P8	Across W approach	53	34.7	LOS D	0.1	0.1	0.88	0.88
All Pedestrians		424	31.9	LOS D			0.84	0.84

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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MOVEMENT SUMMARY

Site: PM Peak

I-1 Sparks Rd / Albert Warner Dr
Signals - Fixed Time Cycle Time = 80 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	95% Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Albert Warner Dr (S)											
1	L	232	3.4	0.358	23.9	LOS B	6.0	43.1	0.70	0.77	35.5
2	T	13	76.9	0.022	26.4	LOS B	0.2	2.3	0.80	0.55	29.5
3	R	158	15.2	0.629	50.7	LOS D	3.3	26.2	1.00	0.82	25.8
Approach		403	10.4	0.629	34.5	LOS C	6.0	43.1	0.82	0.78	30.8
East: Sparks Rd (E)											
4	L	117	41.9	0.236	26.5	LOS B	2.9	27.4	0.66	0.76	40.4
5	T	697	2.3	0.440	26.2	LOS B	7.6	54.3	0.87	0.73	40.6
6	R	65	7.7	0.148	44.9	LOS D	1.2	8.8	0.92	0.73	29.4
Approach		879	8.0	0.440	27.6	LOS B	7.6	54.3	0.85	0.73	39.6
North: Albert Warner Dr (N)											
7	L	97	15.5	0.269	23.0	LOS B	2.3	18.3	0.64	0.72	36.2
8	T	21	23.8	0.028	26.2	LOS B	0.3	2.7	0.80	0.56	29.6
9	R	120	4.2	0.444	48.9	LOS D	2.4	17.6	0.99	0.75	26.1
Approach		238	10.5	0.444	36.3	LOS C	2.4	18.3	0.83	0.72	29.8
West: Sparks Rd (W)											
10	L	166	9.6	0.225	25.7	LOS B	4.1	31.3	0.67	0.77	40.3
11	T	1157	3.3	0.735	30.4	LOS C	14.5	104.2	0.97	0.87	37.7
12	R	336	8.9	0.770	51.5	LOS D	7.1	53.4	1.00	0.89	27.0
Approach		1659	5.1	0.770	34.2	LOS C	14.5	104.2	0.94	0.86	35.4
All Vehicles		3179	7.0	0.770	32.6	LOS C	14.5	104.2	0.89	0.80	35.2

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model used.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow	Average Delay	Level of Service	Average Back of Queue Pedestrian	Average Back of Queue Distance	Prop. Queued	Effective Stop Rate
		ped/h	sec		ped	m		per ped
P1	Across S approach	53	28.1	LOS C	0.1	0.1	0.84	0.84
P2	Across S approach	53	24.0	LOS C	0.1	0.1	0.78	0.78
P3	Across E approach	53	34.2	LOS D	0.1	0.1	0.93	0.93
P4	Across E approach	53	29.8	LOS C	0.1	0.1	0.86	0.86
P5	Across N approach	53	28.1	LOS C	0.1	0.1	0.84	0.84
P6	Across N approach	53	24.0	LOS C	0.1	0.1	0.78	0.78
P7	Across W approach	53	34.2	LOS D	0.1	0.1	0.93	0.93
P8	Across W approach	53	29.8	LOS C	0.1	0.1	0.86	0.86
All Pedestrians		424	29.0	LOS C			0.85	0.85

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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MOVEMENT SUMMARY

Site: AM Peak

I-2 Sparks Rd / Virginia Rd
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	95% Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Virginia Rd (S)											
1	L	146	7.5	0.083	5.7	X	X	X	X	0.53	44.1
Approach		146	7.5	0.083	5.7	NA	0.0	0.0	0.00	0.53	44.1
East: Sparks Rd (E)											
4	L	72	5.6	0.040	10.3	LOS A	0.0	0.0	0.00	0.71	57.1
5	T	1669	5.5	0.443	0.0	LOS A	0.0	0.0	0.00	0.00	80.0
Approach		1741	5.5	0.443	0.4	NA	0.0	0.0	0.00	0.03	78.9
All Vehicles		1887	5.7	0.443	0.8	NA	0.0	0.0	0.00	0.07	75.0

X: Not applicable for Continuous movement.

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

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MOVEMENT SUMMARY

Site: AM Peak Merge

Merge From Left

Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	95% Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South East: Merge Movement											
2	T	146	7.5	0.165	4.7	LOS A	0.5	3.7	0.54	0.47	45.5
Approach		146	7.5	0.165	4.7	LOS A	0.5	3.7	0.54	0.47	45.5
East: Main Road Upstream											
1	T	835	5.5	0.444	0.0	LOS A	0.0	0.0	0.00	0.00	80.0
Approach		835	5.5	0.444	0.0	NA	0.0	0.0	0.00	0.00	80.0
All Vehicles		981	5.8	0.444	0.7	NA	0.5	3.7	0.08	0.07	75.8

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

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MOVEMENT SUMMARY

Site: PM Peak

I-2 Sparks Rd / Virginia Rd
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	95% Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Virginia Rd (S)											
1	L	88	0.0	0.047	5.6	X	X	X	X	0.53	44.1
Approach		88	0.0	0.047	5.6	NA	0.0	0.0	0.00	0.53	44.1
East: Sparks Rd (E)											
4	L	72	0.0	0.039	10.1	LOS A	0.0	0.0	0.00	0.71	57.1
5	T	792	4.0	0.208	0.0	LOS A	0.0	0.0	0.00	0.00	80.0
Approach		864	3.7	0.208	0.8	NA	0.0	0.0	0.00	0.06	77.8
All Vehicles		952	3.4	0.208	1.3	NA	0.0	0.0	0.00	0.10	73.3

X: Not applicable for Continuous movement.

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

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MOVEMENT SUMMARY

Site: PM Peak Merge

Merge From Left

Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	95% Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South East: Merge Movement											
2	T	88	0.0	0.065	2.8	LOS A	0.2	1.4	0.33	0.29	48.7
Approach		88	0.0	0.065	2.8	LOS A	0.2	1.4	0.33	0.29	48.7
East: Main Road Upstream											
1	T	416	8.7	0.225	0.0	LOS A	0.0	0.0	0.00	0.00	80.0
Approach		416	8.7	0.225	0.0	NA	0.0	0.0	0.00	0.00	80.0
All Vehicles		504	7.1	0.225	0.5	NA	0.2	1.4	0.06	0.05	75.8

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

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MOVEMENT SUMMARY

Site: AM Peak final

I-3 Sparks Rd / Minnesota Rd
Signals - Fixed Time Cycle Time = 140 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	95% Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Minnesota Road (S)											
1	L	24	33.3	0.250	32.2	LOS C	0.9	7.8	0.75	0.70	30.7
2	T	165	0.6	0.661	65.5	LOS E	11.0	77.6	1.00	0.83	18.6
3	R	233	3.0	0.997	75.0	LOS F	16.4	117.6	1.00	0.83	19.4
Approach		422	3.8	0.997	68.9	LOS E	16.4	117.6	0.99	0.82	19.5
East: Sparks Road (E)											
4	L	86	5.8	0.174	27.1	LOS B	2.9	21.5	0.54	0.74	36.2
5	T	1404	5.1	0.983	100.0	LOS F	70.7	516.7	1.00	1.30	16.9
6	R	388	3.4	0.555	64.5	LOS E	12.1	87.1	0.96	0.82	21.5
Approach		1878	4.8	0.983	89.3	LOS F	70.7	516.7	0.97	1.18	18.0
North: Mary MacKillop Dr (N)											
7	L	300	0.3	1.000 [3]	54.7	LOS D	16.3	114.2	1.00	0.85	23.3
8	T	112	0.0	0.450	61.9	LOS E	7.2	50.6	0.97	0.77	19.4
9	R	189	17.5	0.890	87.2	LOS F	14.7	118.6	1.00	1.03	17.7
Approach		601	5.7	1.000	66.3	LOS E	16.3	118.6	0.99	0.89	20.5
West: Sparks Road (W)											
10	L	186	3.2	0.393	21.2	LOS B	4.4	31.7	0.62	0.77	40.2
11	T	932	15.5	0.693	39.1	LOS C	26.7	210.5	0.90	0.80	30.4
12	R	251	0.9	1.000 [3]	66.1	LOS E	16.2	114.2	0.99	0.83	21.5
Approach		1369	10.4	1.000	41.7	LOS C	26.7	210.5	0.88	0.80	29.2
All Vehicles		4270	6.6	1.000	68.8	LOS E	70.7	516.7	0.95	0.98	21.1

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model used.

3 x = 1.00 due to short lane. Refer to the Lane Summary report for information about excess flow and related conditions.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow	Average Delay	Level of Service	Average Back of Queue Pedestrian	Average Back of Queue Distance	Prop. Queued	Effective Stop Rate
		ped/h	sec		ped	m		per ped
P1	Across S approach	50	31.6	LOS D	0.1	0.1	0.67	0.67
P2	Across S approach	53	28.3	LOS C	0.1	0.1	0.64	0.64
P3	Across E approach	50	64.1	LOS F	0.2	0.2	0.96	0.96
P4	Across E approach	53	56.7	LOS E	0.2	0.2	0.90	0.90
P5	Across N approach	50	31.6	LOS D	0.1	0.1	0.67	0.67
P6	Across N approach	53	29.6	LOS C	0.1	0.1	0.65	0.65
P7	Across W approach	50	61.3	LOS F	0.2	0.2	0.94	0.94
P8	Across W approach	53	56.7	LOS E	0.2	0.2	0.90	0.90
All Pedestrians		412	44.9	LOS E			0.79	0.79

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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MOVEMENT SUMMARY

Site: PM Peak final

I-3 Sparks Rd / Minnesota Rd
Signals - Fixed Time Cycle Time = 100 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	95% Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Minnesota Road (S)											
1	L	9	22.2	0.054	23.2	LOS B	0.2	1.6	0.75	0.67	34.7
2	T	53	0.0	0.181	42.0	LOS C	2.3	16.1	0.91	0.70	23.8
3	R	142	2.1	0.517	51.0	LOS D	6.6	47.0	0.97	0.80	24.4
Approach		204	2.5	0.517	47.4	LOS D	6.6	47.0	0.94	0.77	24.6
East: Sparks Road (E)											
4	L	66	3.0	0.119	28.0	LOS B	1.9	14.0	0.64	0.74	35.6
5	T	837	3.5	0.878	49.7	LOS D	23.2	166.9	1.00	1.03	26.7
6	R	382	0.0	0.571	50.3	LOS D	8.7	61.2	0.96	0.82	25.3
Approach		1285	2.4	0.878	48.7	LOS D	23.2	166.9	0.97	0.95	26.6
North: Mary MacKillop Dr (N)											
7	L	149	0.0	0.360	30.8	LOS C	5.0	34.7	0.72	0.77	30.8
8	T	58	0.0	0.165	37.8	LOS C	2.4	17.0	0.88	0.67	25.3
9	R	56	0.0	0.168	45.3	LOS D	2.3	16.4	0.88	0.75	25.9
Approach		263	0.0	0.360	35.4	LOS C	5.0	34.7	0.79	0.74	28.3
West: Sparks Road (W)											
10	L	39	0.0	0.069	19.8	LOS B	0.7	4.8	0.66	0.72	41.3
11	T	834	5.3	0.885	50.9	LOS D	23.4	171.4	1.00	1.05	26.4
12	R	303	0.0	0.906	60.0	LOS E	16.3	114.2	1.00	0.93	23.0
Approach		1176	3.7	0.906	52.2	LOS D	23.4	171.4	0.99	1.01	25.7
All Vehicles		2928	2.7	0.906	48.8	LOS D	23.4	171.4	0.96	0.94	26.3

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model used.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow	Average Delay	Level of Service	Average Back of Queue Pedestrian	Average Back of Queue Distance	Prop. Queued	Effective Stop Rate
		ped/h	sec		ped	m		per ped
P1	Across S approach	50	33.6	LOS D	0.1	0.1	0.82	0.82
P2	Across S approach	53	29.6	LOS C	0.1	0.1	0.77	0.77
P3	Across E approach	50	44.2	LOS E	0.1	0.1	0.94	0.94
P4	Across E approach	53	37.0	LOS D	0.1	0.1	0.86	0.86
P5	Across N approach	50	33.6	LOS D	0.1	0.1	0.82	0.82
P6	Across N approach	53	31.2	LOS D	0.1	0.1	0.79	0.79
P7	Across W approach	50	44.2	LOS E	0.1	0.1	0.94	0.94
P8	Across W approach	53	39.6	LOS D	0.1	0.1	0.89	0.89
All Pedestrians		412	36.6	LOS D			0.85	0.85

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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MOVEMENT SUMMARY

Site: AM Peak - school zone

I-4 Warnervale Rd / Minnesota Rd
Signals - Fixed Time Cycle Time = 56 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	95% Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Minnesota Rd (S)											
1	L	171	2.9	0.238	14.8	LOS B	2.9	20.7	0.65	0.71	30.8
2	T	135	3.7	0.305	19.8	LOS B	3.2	22.9	0.87	0.69	27.7
3	R	23	8.7	0.135	30.9	LOS C	0.6	4.6	0.94	0.70	24.7
Approach		329	3.6	0.305	18.0	LOS B	3.2	22.9	0.76	0.70	29.0
East: Warnervale Rd (E)											
4	L	121	3.3	0.303	19.5	LOS B	3.9	28.2	0.78	0.77	28.9
5	T	70	1.4	0.303	15.0	LOS B	3.9	28.2	0.78	0.64	29.4
6	R	41	7.3	0.217	31.3	LOS C	1.1	8.2	0.95	0.72	24.5
Approach		232	3.4	0.303	20.3	LOS B	3.9	28.2	0.81	0.72	28.2
North: Minnesota Rd (N)											
7	L	143	32.2	0.497	15.4	LOS B	2.4	21.8	0.65	0.70	30.8
8	T	283	3.9	0.723	24.1	LOS B	8.4	60.7	0.98	0.92	26.0
9	R	19	0.0	0.723	28.6	LOS C	8.4	60.7	0.98	0.93	26.0
Approach		445	12.8	0.723	21.5	LOS B	8.4	60.7	0.87	0.85	27.4
West: Warnervale Rd (W)											
10	L	75	10.7	0.344	19.9	LOS B	4.5	33.1	0.79	0.79	29.0
11	T	141	2.1	0.344	15.3	LOS B	4.5	33.1	0.79	0.65	29.4
12	R	160	1.9	0.815	36.7	LOS C	5.0	35.9	1.00	1.02	23.0
Approach		376	3.7	0.815	25.3	LOS B	5.0	35.9	0.88	0.84	26.2
All Vehicles		1382	6.6	0.815	21.5	LOS B	8.4	60.7	0.84	0.79	27.5

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model used.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow	Average Delay	Level of Service	Average Back of Queue Pedestrian	Average Back of Queue Distance	Prop. Queued	Effective Stop Rate
		ped/h	sec		ped	m		per ped
P1	Across S approach	53	22.3	LOS C	0.1	0.1	0.89	0.89
P3	Across E approach	53	22.3	LOS C	0.1	0.1	0.89	0.89
P5	Across N approach	53	19.7	LOS B	0.1	0.1	0.84	0.84
P7	Across W approach	53	22.3	LOS C	0.1	0.1	0.89	0.89
All Pedestrians		212	21.7	LOS C			0.88	0.88

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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MOVEMENT SUMMARY

Site: PM Peak

I-4 Warnervale Rd / Minnesota Rd
Signals - Fixed Time Cycle Time = 60 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	95% Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Minnesota Rd (S)											
1	L	294	0.0	0.399	16.7	LOS B	5.3	37.3	0.65	0.77	35.6
2	T	79	0.0	0.143	17.6	LOS B	1.8	12.3	0.78	0.61	33.7
3	R	45	0.0	0.190	31.0	LOS C	1.2	8.4	0.90	0.74	28.6
Approach		418	0.0	0.399	18.4	LOS B	5.3	37.3	0.70	0.73	34.4
East: Warnervale Rd (E)											
4	L	60	5.0	0.250	23.3	LOS B	3.3	23.5	0.78	0.80	32.8
5	T	89	0.0	0.250	16.7	LOS B	3.3	23.5	0.78	0.63	33.6
6	R	17	11.8	0.099	35.1	LOS C	0.5	3.7	0.94	0.69	27.2
Approach		166	3.0	0.250	21.0	LOS B	3.3	23.5	0.80	0.70	32.6
North: Minnesota Rd (N)											
7	L	12	0.0	0.219	23.0	LOS B	1.3	9.4	0.76	0.78	33.1
8	T	304	0.0	0.619	20.9	LOS B	7.8	55.3	0.90	0.75	31.6
9	R	36	13.9	0.619	28.6	LOS C	7.8	55.3	0.93	0.85	30.9
Approach		352	1.4	0.619	21.8	LOS B	7.8	55.3	0.90	0.77	31.6
West: Warnervale Rd (W)											
10	L	101	0.0	0.241	23.1	LOS B	3.2	22.3	0.78	0.78	32.5
11	T	42	2.4	0.241	16.7	LOS B	3.2	22.3	0.78	0.63	33.3
12	R	103	5.8	0.578	37.1	LOS C	3.2	23.3	1.00	0.81	26.5
Approach		246	2.8	0.578	27.8	LOS B	3.2	23.3	0.87	0.76	29.8
All Vehicles		1182	1.4	0.619	21.7	LOS B	7.8	55.3	0.81	0.74	32.2

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model used.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow	Average Delay	Level of Service	Average Back of Queue Pedestrian	Average Back of Queue Distance	Prop. Queued	Effective Stop Rate
		ped/h	sec		ped	m		per ped
P1	Across S approach	53	24.3	LOS C	0.1	0.1	0.90	0.90
P3	Across E approach	53	20.8	LOS C	0.1	0.1	0.83	0.83
P5	Across N approach	53	21.7	LOS C	0.1	0.1	0.85	0.85
P7	Across W approach	53	20.8	LOS C	0.1	0.1	0.83	0.83
All Pedestrians		212	21.9	LOS C			0.85	0.85

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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MOVEMENT SUMMARY

Site: AM Peak - Extend RT bay

I-5 Pacific Hwy / Minnesota Rd
Signals - Fixed Time Cycle Time = 117 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	95% Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Figtree Boulevard											
1	L	57	3.5	0.123	43.6	LOS D	2.5	18.0	0.80	0.75	26.3
2	T	81	0.0	0.857	62.6	LOS E	12.8	92.2	1.00	1.02	19.0
3	R	120	5.0	0.857	70.1	LOS E	12.8	92.2	1.00	1.02	20.4
Approach		258	3.1	0.857	61.9	LOS E	12.8	92.2	0.96	0.96	21.0
East: Pacific Highway											
4	L	126	2.4	0.262	32.0	LOS C	4.5	32.1	0.67	0.77	33.3
5	T	1128	4.0	0.894	39.2	LOS C	43.2	312.5	0.93	0.91	30.5
6	R	34	0.0	0.357	70.5	LOS F	2.0	14.1	1.00	0.72	20.6
Approach		1288	3.7	0.894	39.3	LOS C	43.2	312.5	0.91	0.89	30.4
North: Minnesota Road											
7	L	42	0.0	0.296	33.6	LOS C	8.4	60.8	0.73	0.84	30.2
8	T	174	5.2	0.296	26.0	LOS B	8.4	60.8	0.73	0.61	29.5
9	R	460	2.0	0.897	56.5	LOS D	26.2	186.4	1.00	1.03	23.0
Approach		676	2.7	0.897	47.2	LOS D	26.2	186.4	0.91	0.91	24.6
West: Pacific Highway											
10	L	281	2.1	0.427	18.2	LOS B	6.7	47.5	0.45	0.76	42.8
11	T	703	7.0	0.643	28.0	LOS B	22.4	165.9	0.81	0.71	36.0
12	R	48	4.2	0.519	71.6	LOS F	2.9	20.9	1.00	0.75	20.4
Approach		1032	5.5	0.643	27.4	LOS B	22.4	165.9	0.72	0.73	36.2
All Vehicles		3254	4.0	0.897	38.9	LOS C	43.2	312.5	0.85	0.85	29.5

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model used.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow	Average Delay	Level of Service	Average Back of Queue Pedestrian	Average Back of Queue Distance	Prop. Queued	Effective Stop Rate
		ped/h	sec		ped	m		per ped
P1	Across S approach	53	28.0	LOS C	0.1	0.1	0.69	0.69
P3	Across E approach	53	33.1	LOS D	0.1	0.1	0.75	0.75
P5	Across N approach	53	24.7	LOS C	0.1	0.1	0.65	0.65
All Pedestrians		159	28.6	LOS C			0.70	0.70

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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MOVEMENT SUMMARY

Site: PM Peak - Extend RT bay

I-5 Pacific Hwy / Minnesota Rd
Signals - Fixed Time Cycle Time = 106 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	95% Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Figtree Boulevard											
1	L	40	0.0	0.082	39.1	LOS C	1.5	10.8	0.78	0.73	27.7
2	T	116	0.0	0.875	59.1	LOS E	12.7	89.9	1.00	1.05	19.7
3	R	98	3.2	0.875	66.6	LOS E	12.7	89.9	1.00	1.05	21.1
Approach		254	1.2	0.875	58.8	LOS E	12.7	89.9	0.97	1.00	21.3
East: Pacific Highway											
4	L	76	1.4	0.127	22.8	LOS B	2.0	13.9	0.54	0.74	39.0
5	T	853	3.0	0.555	17.9	LOS B	19.0	136.1	0.70	0.61	43.0
6	R	45	0.0	0.431	64.7	LOS E	2.4	17.0	1.00	0.74	21.8
Approach		974	2.7	0.555	20.5	LOS B	19.0	136.1	0.70	0.63	41.1
North: Minnesota Road											
7	L	71	3.0	0.343	40.4	LOS C	7.3	52.4	0.84	0.82	27.7
8	T	107	2.0	0.343	32.6	LOS C	7.3	52.4	0.84	0.69	26.6
9	R	200	0.0	0.748	52.8	LOS D	9.4	65.6	1.00	0.98	23.8
Approach		378	1.1	0.748	44.7	LOS D	9.4	65.6	0.92	0.87	25.2
West: Pacific Highway											
10	L	426	1.0	0.625	19.2	LOS B	10.7	75.2	0.53	0.78	41.9
11	T	1178	2.0	0.848	25.0	LOS B	40.1	285.7	0.85	0.80	37.7
12	R	42	5.0	0.415	64.8	LOS E	2.3	16.5	1.00	0.73	21.9
Approach		1646	1.8	0.848	24.5	LOS B	40.1	285.7	0.77	0.80	38.0
All Vehicles		3252	1.9	0.875	28.3	LOS B	40.1	285.7	0.78	0.77	34.7

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model used.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow	Average Delay	Level of Service	Average Back of Queue Pedestrian	Average Back of Queue Distance	Prop. Queued	Effective Stop Rate
		ped/h	sec		ped	m		per ped
P1	Across S approach	53	19.3	LOS B	0.1	0.1	0.60	0.60
P3	Across E approach	53	41.7	LOS E	0.1	0.1	0.89	0.89
P5	Across N approach	53	16.4	LOS B	0.1	0.1	0.56	0.56
All Pedestrians		159	25.8	LOS C			0.68	0.68

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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MOVEMENT SUMMARY

Site: AM Peak

I-6 Warnervale Rd / Virginia Rd

Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	95% Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Virginia Rd (S)											
1	L	5	0.0	0.043	9.2	LOS A	0.1	1.0	0.42	0.55	40.8
2	T	5	0.0	0.043	7.9	LOS A	0.1	1.0	0.42	0.62	41.6
3	R	20	0.0	0.043	9.6	LOS A	0.1	1.0	0.42	0.75	40.7
Approach		30	0.0	0.043	9.2	LOS A	0.1	1.0	0.42	0.70	40.9
East: Warnervale Rd (E)											
4	L	10	0.0	0.163	7.7	LOS A	1.0	6.9	0.45	0.41	42.4
5	T	157	0.0	0.163	1.3	LOS A	1.0	6.9	0.45	0.00	44.1
6	R	102	0.0	0.163	8.1	LOS A	1.0	6.9	0.45	0.78	42.4
Approach		269	0.0	0.163	4.1	NA	1.0	6.9	0.45	0.31	43.4
North: Virginia Rd (S)											
7	L	5	0.0	0.095	10.0	LOS A	0.3	2.4	0.50	0.63	40.1
8	T	5	0.0	0.095	8.7	LOS A	0.3	2.4	0.50	0.68	40.8
9	R	48	8.3	0.095	10.6	LOS A	0.3	2.4	0.50	0.81	40.0
Approach		58	6.9	0.095	10.4	LOS A	0.3	2.4	0.50	0.78	40.1
West: Warnervale Rd (W)											
10	L	35	31.4	0.177	7.9	LOS A	1.1	7.9	0.33	0.60	43.0
11	T	295	1.0	0.177	0.6	LOS A	1.1	7.9	0.33	0.00	45.9
12	R	3	0.0	0.177	7.4	LOS A	1.1	7.9	0.33	0.84	42.9
Approach		333	4.2	0.177	1.4	NA	1.1	7.9	0.33	0.07	45.6
All Vehicles		690	2.6	0.177	3.6	NA	1.1	7.9	0.39	0.25	44.0

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

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MOVEMENT SUMMARY

Site: PM Peak

I-6 Warnervale Rd / Virginia Rd

Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	95% Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Virginia Rd (S)											
1	L	5	0.0	0.029	9.4	LOS A	0.1	0.7	0.48	0.62	40.8
2	T	5	0.0	0.029	8.1	LOS A	0.1	0.7	0.48	0.64	41.5
3	R	10	0.0	0.029	9.7	LOS A	0.1	0.7	0.48	0.76	40.6
Approach		20	0.0	0.029	9.2	LOS A	0.1	0.7	0.48	0.70	40.9
East: Warnervale Rd (E)											
4	L	20	0.0	0.237	7.3	LOS A	1.6	11.2	0.40	0.49	42.8
5	T	336	0.0	0.237	0.9	LOS A	1.6	11.2	0.40	0.00	45.0
6	R	80	0.0	0.237	7.7	LOS A	1.6	11.2	0.40	0.80	42.7
Approach		436	0.0	0.237	2.5	NA	1.6	11.2	0.40	0.17	44.5
North: Virginia Rd (S)											
7	L	5	0.0	0.120	10.3	LOS A	0.4	2.8	0.51	0.58	39.9
8	T	5	0.0	0.120	9.0	LOS A	0.4	2.8	0.51	0.71	40.6
9	R	62	0.0	0.120	10.6	LOS A	0.4	2.8	0.51	0.82	39.8
Approach		72	0.0	0.120	10.5	LOS A	0.4	2.8	0.51	0.80	39.9
West: Warnervale Rd (W)											
10	L	38	0.0	0.117	7.8	LOS A	0.8	5.7	0.50	0.42	42.8
11	T	183	0.5	0.117	1.4	LOS A	0.8	5.7	0.50	0.00	44.0
12	R	3	0.0	0.117	8.1	LOS A	0.8	5.7	0.50	0.83	42.8
Approach		224	0.4	0.117	2.6	NA	0.8	5.7	0.50	0.08	43.8
All Vehicles		752	0.1	0.237	3.4	NA	1.6	11.2	0.44	0.22	43.7

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

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MOVEMENT SUMMARY

Site: AM Peak Final

I-7 Sparks Rd / New Warnervale Township Entry
Signals - Fixed Time Cycle Time = 90 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	95% Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
East: Sparks Rd (E)											
11	T	1571	6.9	0.861	28.8	LOS C	34.8	258.2	0.95	0.96	35.2
12	R	46	4.3	0.192	54.3	LOS D	1.0	7.4	0.98	0.71	24.6
Approach		1617	6.8	0.861	29.5	LOS C	34.8	258.2	0.95	0.95	34.9
North: New Warnervale Township entry (N)											
1	L	106	12.3	0.105	26.7	LOS B	1.9	14.8	0.67	0.71	33.0
3	R	171	6.4	0.226	37.0	LOS C	3.5	25.8	0.83	0.76	28.6
Approach		277	8.7	0.226	33.1	LOS C	3.5	25.8	0.77	0.74	30.2
West: Sparks Rd (W)											
4	L	159	14.5	0.308	22.3	LOS B	3.9	30.8	0.60	0.74	39.8
5	T	1263	7.0	0.692	19.1	LOS B	21.4	158.8	0.83	0.75	41.7
Approach		1422	7.8	0.692	19.5	LOS B	21.4	158.8	0.81	0.75	41.5
All Vehicles		3316	7.4	0.861	25.5	LOS B	34.8	258.2	0.88	0.85	36.9

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model used.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow	Average Delay	Level of Service	Average Back of Queue Pedestrian	Average Back of Queue Distance	Prop. Queued	Effective Stop Rate
		ped/h	sec		ped	m		per ped
P7	Across E approach	53	39.2	LOS D	0.1	0.1	0.93	0.93
P1	Across N approach	53	17.4	LOS B	0.1	0.1	0.62	0.62
P3	Across W approach	53	38.3	LOS D	0.1	0.1	0.92	0.92
All Pedestrians		159	31.6	LOS D			0.83	0.83

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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MOVEMENT SUMMARY

Site: PM Peak Final

I-7 Sparks Rd / New Warnervale Township Entry
Signals - Fixed Time Cycle Time = 70 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	95% Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
East: Sparks Rd (E)											
11	T	828	3.6	0.634	21.2	LOS B	12.1	87.3	0.90	0.77	40.0
12	R	73	11.0	0.247	43.5	LOS D	1.3	9.6	0.97	0.73	28.3
Approach		901	4.2	0.634	23.0	LOS B	12.1	87.3	0.90	0.77	38.8
North: New Warnervale Township entry (N)											
1	L	182	0.0	0.124	17.5	LOS B	2.1	14.6	0.57	0.71	37.7
3	R	35	25.7	0.040	26.2	LOS B	0.5	4.1	0.72	0.69	33.4
Approach		217	4.1	0.124	18.9	LOS B	2.1	14.6	0.59	0.70	37.0
West: Sparks Rd (W)											
4	L	419	1.7	0.750	31.9	LOS C	13.3	94.1	0.91	0.88	33.5
5	T	993	4.8	0.766	24.8	LOS B	16.4	119.5	0.95	0.89	37.5
Approach		1412	3.9	0.766	26.9	LOS B	16.4	119.5	0.94	0.89	36.3
All Vehicles		2530	4.0	0.766	24.8	LOS B	16.4	119.5	0.90	0.83	37.3

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model used.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow	Average Delay	Level of Service	Average Back of Queue Pedestrian	Average Back of Queue Distance	Prop. Queued	Effective Stop Rate
		ped/h	sec		ped	m		per ped
P7	Across E approach	53	29.3	LOS C	0.1	0.1	0.91	0.91
P1	Across N approach	53	22.4	LOS C	0.1	0.1	0.80	0.80
P3	Across W approach	53	28.4	LOS C	0.1	0.1	0.90	0.90
All Pedestrians		159	26.7	LOS C			0.87	0.87

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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MOVEMENT SUMMARY

Site: AM Peak

I-8 Warnervale Rd / Connector

Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	95% Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Access Rd (S)											
1	L	5	0.0	0.025	5.5	LOS A	0.1	0.8	0.39	0.47	43.0
2	T	3	0.0	0.025	4.6	LOS A	0.1	0.8	0.39	0.40	43.3
3	R	20	0.0	0.025	10.1	LOS A	0.1	0.8	0.39	0.65	40.5
Approach		28	0.0	0.025	8.7	LOS A	0.1	0.8	0.39	0.60	41.2
East: Warnervale Rd (E)											
4	L	10	0.0	0.173	4.4	LOS A	1.0	7.1	0.07	0.47	44.9
5	T	254	0.4	0.173	3.4	LOS A	1.0	7.1	0.07	0.34	45.8
6	R	12	41.7	0.173	9.8	LOS A	1.0	7.1	0.07	0.87	41.6
Approach		276	2.2	0.173	3.7	LOS A	1.0	7.1	0.07	0.37	45.5
North: Access Rd (N)											
7	L	26	30.8	0.041	7.3	LOS A	0.2	1.6	0.49	0.56	42.7
8	T	3	0.0	0.041	5.6	LOS A	0.2	1.6	0.49	0.47	42.9
9	R	5	0.0	0.041	11.1	LOS A	0.2	1.6	0.49	0.72	40.3
Approach		34	23.5	0.041	7.7	LOS A	0.2	1.6	0.49	0.58	42.4
West: Warnervale Rd (W)											
10	L	3	0.0	0.230	4.5	LOS A	1.3	9.5	0.16	0.47	44.5
11	T	340	0.9	0.230	3.6	LOS A	1.3	9.5	0.16	0.36	45.2
12	R	3	0.0	0.230	9.1	LOS A	1.3	9.5	0.16	0.86	41.5
Approach		346	0.9	0.230	3.6	LOS A	1.3	9.5	0.16	0.36	45.2
All Vehicles		684	2.5	0.230	4.1	LOS A	1.3	9.5	0.15	0.39	45.0

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model used.

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MOVEMENT SUMMARY

Site: PM Peak

I-8 Warnervale Rd / Connector

Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	95% Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Access Rd (S)											
1	L	5	0.0	0.018	6.3	LOS A	0.1	0.6	0.50	0.52	42.5
2	T	3	0.0	0.018	5.4	LOS A	0.1	0.6	0.50	0.46	42.7
3	R	10	0.0	0.018	10.9	LOS A	0.1	0.6	0.50	0.68	40.3
Approach		18	0.0	0.018	8.7	LOS A	0.1	0.6	0.50	0.60	41.3
East: Warnervale Rd (E)											
4	L	20	0.0	0.279	4.4	LOS A	1.8	12.6	0.11	0.46	44.8
5	T	405	0.0	0.279	3.5	LOS A	1.8	12.6	0.11	0.34	45.6
6	R	22	22.7	0.279	9.4	LOS A	1.8	12.6	0.11	0.85	41.5
Approach		447	1.1	0.279	3.8	LOS A	1.8	12.6	0.11	0.37	45.3
North: Access Rd (N)											
7	L	35	17.1	0.048	6.0	LOS A	0.2	1.8	0.40	0.50	43.1
8	T	3	0.0	0.048	4.7	LOS A	0.2	1.8	0.40	0.42	43.5
9	R	11	0.0	0.048	10.2	LOS A	0.2	1.8	0.40	0.70	40.9
Approach		49	12.2	0.048	6.9	LOS A	0.2	1.8	0.40	0.54	42.6
West: Warnervale Rd (W)											
10	L	3	0.0	0.167	4.5	LOS A	0.9	6.3	0.15	0.47	44.6
11	T	241	0.4	0.167	3.6	LOS A	0.9	6.3	0.15	0.36	45.3
12	R	3	0.0	0.167	9.1	LOS A	0.9	6.3	0.15	0.86	41.5
Approach		247	0.4	0.167	3.6	LOS A	0.9	6.3	0.15	0.36	45.3
All Vehicles		761	1.6	0.279	4.1	LOS A	1.8	12.6	0.15	0.39	45.0

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model used.

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APPENDIX F

2031 FORECAST TURNING VOLUMES AND SIDRA RESULTS (SCENARIO 4B1)

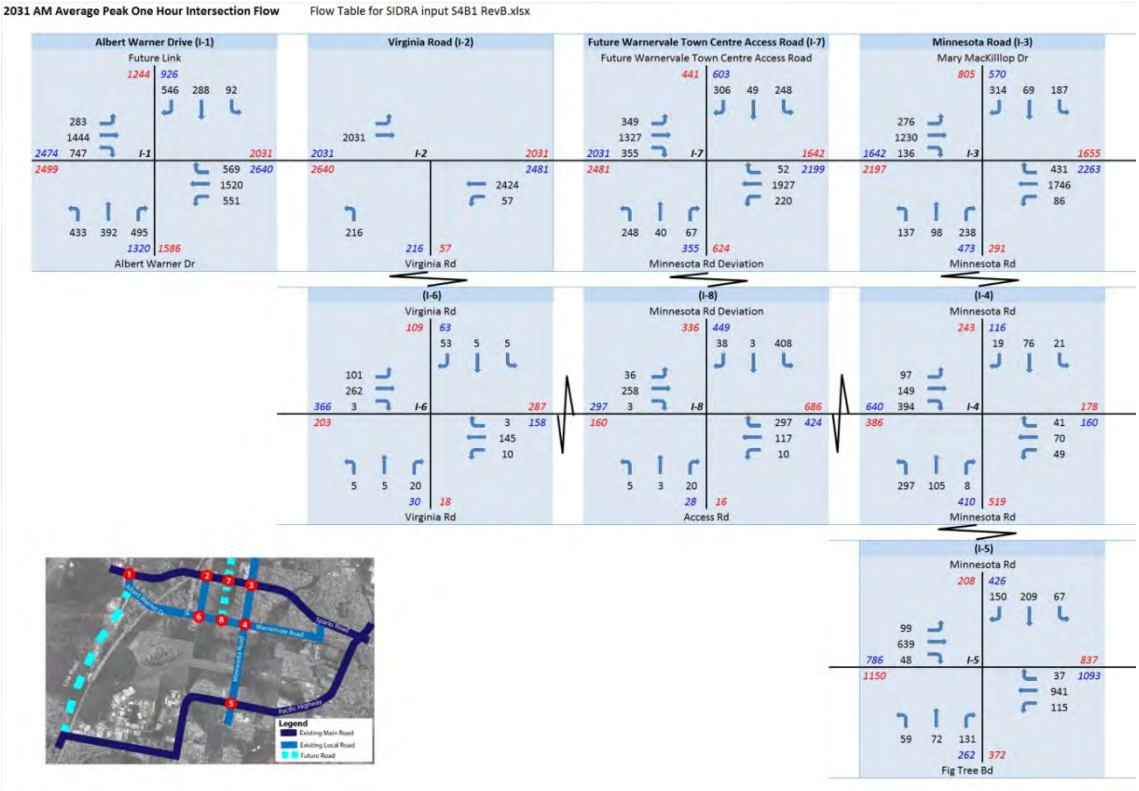

Figure 1 Forecast turning volume – 2031 Scenario 4B1 AM Peak 1 hour

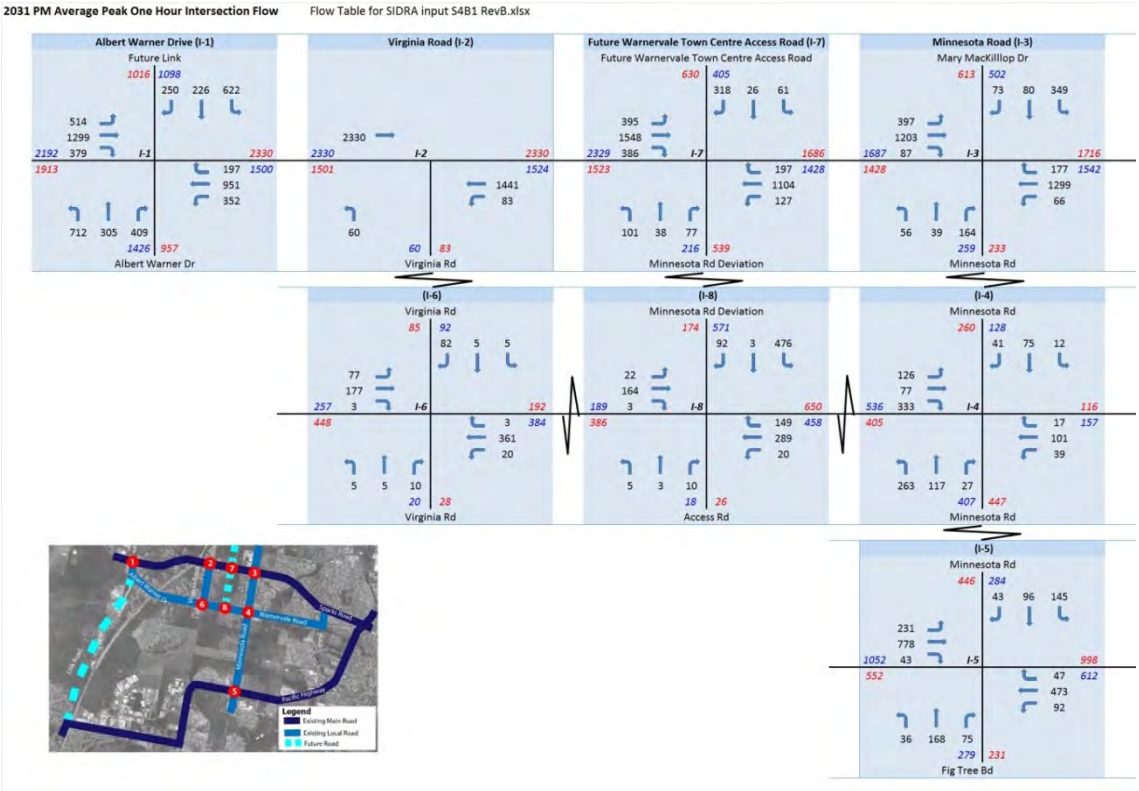

Figure 2 Forecast turning volume – 2031 Scenario 4B1 PM Peak 1 hour

MOVEMENT SUMMARY

Site: AM Peak - final

I-1 Sparks Rd / Albert Warner Dr
Signals - Fixed Time Cycle Time = 225 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	95% Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Albert Warner Dr (S)											
1	L	433	5.5	0.562	33.4	LOS C	18.7	136.9	0.81	0.83	31.3
2	T	392	4.1	0.749	60.1	LOS E	11.8	85.8	1.00	0.87	19.8
3	R	495	9.9	0.803	60.2	LOS E	15.0	113.9	1.00	0.88	23.5
Approach		1320	6.7	0.803	51.4	LOS D	18.7	136.9	0.94	0.86	24.4
East: Sparks Rd (E)											
4	L	551	9.1	0.723	35.6	LOS C	25.8	194.4	0.85	0.86	33.9
5	T	1520	4.3	0.867	52.7	LOS D	23.4	170.1	1.00	0.91	28.2
6	R	569	3.3	0.654	51.8	LOS D	14.7	105.7	0.96	0.84	26.8
Approach		2640	5.1	0.867	48.9	LOS D	25.8	194.4	0.96	0.88	28.8
North: Albert Warner Dr (N)											
7	L	92	8.7	0.144	28.2	LOS B	3.1	23.6	0.63	0.73	33.5
8	T	288	4.5	0.552	50.5	LOS D	8.0	58.3	0.98	0.79	21.8
9	R	546	5.1	0.857	65.3	LOS E	17.7	129.0	1.00	0.91	22.3
Approach		926	5.3	0.857	57.0	LOS E	17.7	129.0	0.96	0.86	22.9
West: Sparks Rd (W)											
10	L	283	6.0	0.471	30.6	LOS C	10.7	78.8	0.68	0.79	36.7
11	T	1444	8.6	0.846	50.3	LOS D	21.6	162.0	1.00	0.90	28.9
12	R	747	3.6	0.860	61.2	LOS E	22.6	163.3	1.00	0.89	24.0
Approach		2474	6.8	0.860	51.3	LOS D	22.6	163.3	0.96	0.88	28.0
All Vehicles		7360	6.0	0.867	51.2	LOS D	25.8	194.4	0.96	0.88	26.8

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model used.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow	Average Delay	Level of Service	Average Back of Queue Pedestrian	Average Back of Queue Distance	Prop. Queued	Effective Stop Rate
		ped/h	sec		ped	m		per ped
P1	Across S approach	53	97.1	LOS F	0.3	0.3	0.93	0.93
P2	Across S approach	53	92.5	LOS F	0.3	0.3	0.91	0.91
P3	Across E approach	53	106.6	LOS F	0.3	0.3	0.97	0.97
P4	Across E approach	53	100.8	LOS F	0.3	0.3	0.95	0.95
P5	Across N approach	53	97.1	LOS F	0.3	0.3	0.93	0.93
P6	Across N approach	53	92.5	LOS F	0.3	0.3	0.91	0.91
P7	Across W approach	53	106.6	LOS F	0.3	0.3	0.97	0.97
P8	Across W approach	53	100.8	LOS F	0.3	0.3	0.95	0.95
All Pedestrians		424	99.2	LOS F			0.94	0.94

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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MOVEMENT SUMMARY

Site: PM Peak - final

I-1 Sparks Rd / Albert Warner Dr
Signals - Fixed Time Cycle Time = 145 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	95% Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Albert Warner Dr (S)											
1	L	712	1.1	0.904	41.8	LOS C	31.7	223.8	1.00	0.98	28.2
2	T	305	3.3	0.414	28.9	LOS C	5.3	37.9	0.92	0.74	28.3
3	R	409	5.9	0.876	53.0	LOS D	9.1	66.6	1.00	0.98	25.2
Approach		1426	2.9	0.904	42.3	LOS C	31.7	223.8	0.98	0.93	27.2
East: Sparks Rd (E)											
4	L	352	13.9	0.512	27.7	LOS B	9.7	75.9	0.80	0.82	38.9
5	T	951	1.7	0.638	30.1	LOS C	8.1	57.8	0.97	0.80	37.8
6	R	197	2.5	0.356	41.6	LOS C	3.8	26.9	0.94	0.77	30.8
Approach		1500	4.7	0.638	31.1	LOS C	9.7	75.9	0.93	0.80	37.1
North: Albert Warner Dr (N)											
7	L	622	2.4	0.797	27.2	LOS B	19.6	139.8	0.93	0.87	33.9
8	T	226	2.2	0.304	28.2	LOS B	3.8	27.1	0.90	0.71	28.6
9	R	250	2.0	0.521	41.0	LOS C	4.4	31.2	0.98	0.79	28.5
Approach		1098	2.3	0.797	30.5	LOS C	19.6	139.8	0.94	0.82	31.5
West: Sparks Rd (W)											
10	L	514	3.1	0.695	29.2	LOS C	15.6	112.2	0.89	0.86	37.6
11	T	1299	2.9	0.879	42.4	LOS C	14.4	103.1	1.00	0.94	31.9
12	R	379	7.9	0.711	53.9	LOS D	8.1	60.3	1.00	0.87	26.2
Approach		2192	3.8	0.879	41.3	LOS C	15.6	112.2	0.97	0.91	31.8
All Vehicles		6216	3.6	0.904	37.1	LOS C	31.7	223.8	0.96	0.87	31.6

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model used.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow	Average Delay	Level of Service	Average Back of Queue Pedestrian	Average Back of Queue Distance	Prop. Queued	Effective Stop Rate
		ped/h	sec		ped	m		per ped
P1	Across S approach	53	66.6	LOS F	0.2	0.2	0.96	0.96
P2	Across S approach	53	61.9	LOS F	0.2	0.2	0.92	0.92
P3	Across E approach	53	67.6	LOS F	0.2	0.2	0.97	0.97
P4	Across E approach	53	61.9	LOS F	0.2	0.2	0.92	0.92
P5	Across N approach	53	66.6	LOS F	0.2	0.2	0.96	0.96
P6	Across N approach	53	61.9	LOS F	0.2	0.2	0.92	0.92
P7	Across W approach	53	67.6	LOS F	0.2	0.2	0.97	0.97
P8	Across W approach	53	61.9	LOS F	0.2	0.2	0.92	0.92
All Pedestrians		424	64.5	LOS F			0.94	0.94

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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MOVEMENT SUMMARY

Site: AM Peak

I-2 Sparks Rd / Virginia Rd
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	95% Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Virginia Rd (S)											
1	L	216	5.1	0.121	5.7	X	X	X	X	0.53	44.1
Approach		216	5.1	0.121	5.7	NA	0.0	0.0	0.00	0.53	44.1
East: Sparks Rd (E)											
4	L	57	7.0	0.032	10.4	LOS A	0.0	0.0	0.00	0.71	57.1
5	T	2424	3.8	0.425	0.0	LOS A	0.0	0.0	0.00	0.00	80.0
Approach		2481	3.9	0.425	0.2	NA	0.0	0.0	0.00	0.02	79.4
All Vehicles		2697	4.0	0.425	0.7	NA	0.0	0.0	0.00	0.06	75.2

X: Not applicable for Continuous movement.

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

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MOVEMENT SUMMARY

Site: AM Peak Merge

Merge From Left

Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	95% Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South East: Merge Movement											
2	T	216	5.1	0.227	4.5	LOS A	0.7	5.3	0.53	0.46	45.7
Approach		216	5.1	0.227	4.5	LOS A	0.7	5.3	0.53	0.46	45.7
East: Main Road Upstream											
1	T	808	3.8	0.425	0.0	LOS A	0.0	0.0	0.00	0.00	80.0
Approach		808	3.8	0.425	0.0	NA	0.0	0.0	0.00	0.00	80.0
All Vehicles		1024	4.1	0.425	0.9	NA	0.7	5.3	0.11	0.10	74.0

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

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MOVEMENT SUMMARY

Site: PM Peak

I-2 Sparks Rd / Virginia Rd
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	95% Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Virginia Rd (S)											
1	L	60	0.0	0.032	5.6	X	X	X	X	0.53	44.1
Approach		60	0.0	0.032	5.6	NA	0.0	0.0	0.00	0.53	44.1
East: Sparks Rd (E)											
4	L	83	0.0	0.045	10.1	LOS A	0.0	0.0	0.00	0.71	57.1
5	T	1441	2.2	0.250	0.0	LOS A	0.0	0.0	0.00	0.00	80.0
Approach		1524	2.1	0.250	0.6	NA	0.0	0.0	0.00	0.04	78.6
All Vehicles		1584	2.0	0.250	0.7	NA	0.0	0.0	0.00	0.06	76.6

X: Not applicable for Continuous movement.

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

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MOVEMENT SUMMARY

Site: PM Peak Merge

Merge From Left

Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	95% Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South East: Merge Movement											
2	T	60	0.0	0.046	2.9	LOS A	0.1	1.0	0.35	0.30	48.4
Approach		60	0.0	0.046	2.9	LOS A	0.1	1.0	0.35	0.30	48.4
East: Main Road Upstream											
1	T	481	2.3	0.250	0.0	LOS A	0.0	0.0	0.00	0.00	80.0
Approach		481	2.3	0.250	0.0	NA	0.0	0.0	0.00	0.00	80.0
All Vehicles		541	2.0	0.250	0.3	NA	0.1	1.0	0.04	0.03	77.3

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

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MOVEMENT SUMMARY

Site: AM Peak Final

I-3 Sparks Rd / Minnesota Rd
Signals - Fixed Time Cycle Time = 110 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	95% Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Minnesota Road (S)											
1	L	137	5.8	0.920	35.0	LOS C	4.4	32.6	0.91	0.82	29.2
2	T	98	1.0	0.309	45.7	LOS D	4.7	33.3	0.92	0.74	22.8
3	R	238	2.9	0.800	60.4	LOS E	13.4	96.2	1.00	0.93	22.2
Approach		473	3.4	0.920	50.0	LOS D	13.4	96.2	0.96	0.86	24.0
East: Sparks Road (E)											
4	L	86	5.8	0.139	21.0	LOS B	2.1	15.5	0.49	0.74	40.5
5	T	1746	4.1	0.911	54.5	LOS D	37.2	269.9	1.00	1.09	25.3
6	R	431	3.0	0.815	64.3	LOS E	12.4	88.8	1.00	0.91	21.5
Approach		2263	4.0	0.911	55.1	LOS D	37.2	269.9	0.98	1.04	24.9
North: Minnesota Road (N)											
7	L	187	0.5	0.498	35.0	LOS C	7.2	50.4	0.76	0.78	29.1
8	T	69	0.0	0.218	39.5	LOS C	3.1	21.6	0.87	0.67	24.8
9	R	314	10.5	0.909	71.4	LOS F	20.4	155.8	1.00	1.08	20.1
Approach		570	6.0	0.909	55.6	LOS D	20.4	155.8	0.91	0.93	22.9
West: Sparks Road (W)											
10	L	276	2.2	0.480	20.7	LOS B	5.3	37.9	0.72	0.80	40.6
11	T	1230	10.9	0.826	46.2	LOS D	22.7	173.5	1.00	0.96	27.8
12	R	136	2.2	0.909	77.5	LOS F	8.7	61.8	1.00	1.04	19.3
Approach		1642	8.7	0.909	44.5	LOS D	22.7	173.5	0.95	0.94	28.2
All Vehicles		4948	5.7	0.920	51.1	LOS D	37.2	269.9	0.96	0.98	25.6

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model used.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow	Average Delay	Level of Service	Average Back of Queue Pedestrian	Average Back of Queue Distance	Prop. Queued	Effective Stop Rate
		ped/h	sec		ped	m		per ped
P1	Across S approach	50	34.4	LOS D	0.1	0.1	0.79	0.79
P2	Across S approach	53	30.6	LOS D	0.1	0.1	0.75	0.75
P3	Across E approach	50	48.2	LOS E	0.1	0.1	0.94	0.94
P4	Across E approach	53	41.0	LOS E	0.1	0.1	0.86	0.86
P5	Across N approach	50	34.4	LOS D	0.1	0.1	0.79	0.79
P6	Across N approach	53	32.1	LOS D	0.1	0.1	0.76	0.76
P7	Across W approach	50	49.2	LOS E	0.1	0.1	0.95	0.95
P8	Across W approach	53	44.6	LOS E	0.1	0.1	0.90	0.90
All Pedestrians		412	39.2	LOS D			0.84	0.84

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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MOVEMENT SUMMARY

Site: PM Peak Final

I-3 Sparks Rd / Minnesota Rd
Signals - Fixed Time Cycle Time = 110 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	95% Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Minnesota Road (S)											
1	L	56	3.6	0.355	29.2	LOS C	1.5	10.9	0.87	0.73	31.5
2	T	39	0.0	0.122	43.9	LOS D	1.8	12.6	0.89	0.68	23.3
3	R	164	1.8	0.547	53.9	LOS D	8.3	58.9	0.97	0.81	23.7
Approach		259	1.9	0.547	47.1	LOS D	8.3	58.9	0.93	0.77	25.0
East: Sparks Road (E)											
4	L	66	3.0	0.107	21.7	LOS B	1.7	12.0	0.51	0.73	39.9
5	T	1299	2.2	0.708	35.6	LOS C	20.5	146.4	0.94	0.82	32.0
6	R	177	0.0	0.655	66.3	LOS E	5.0	34.8	1.00	0.81	21.1
Approach		1542	2.0	0.708	38.6	LOS C	20.5	146.4	0.93	0.82	30.6
North: Minnesota Road (N)											
7	L	349	0.0	0.608	42.6	LOS D	16.0	112.0	0.91	0.84	26.6
8	T	80	0.0	0.245	37.0	LOS C	3.5	24.3	0.84	0.66	25.6
9	R	73	0.0	0.202	44.3	LOS D	3.2	22.1	0.84	0.75	26.2
Approach		502	0.0	0.608	41.9	LOS C	16.0	112.0	0.89	0.80	26.4
West: Sparks Road (W)											
10	L	397	0.0	0.636	18.6	LOS B	7.5	52.7	0.68	0.80	42.4
11	T	1203	3.7	0.662	35.0	LOS C	18.6	134.6	0.92	0.80	32.3
12	R	87	0.0	0.644	66.0	LOS E	4.9	34.2	1.00	0.80	21.6
Approach		1687	2.6	0.662	32.7	LOS C	18.6	134.6	0.87	0.80	33.2
All Vehicles		3990	2.0	0.708	37.1	LOS C	20.5	146.4	0.90	0.81	30.5

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model used.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow	Average Delay	Level of Service	Average Back of Queue Pedestrian	Average Back of Queue Distance	Prop. Queued	Effective Stop Rate
		ped/h	sec		ped	m		per ped
P1	Across S approach	50	30.6	LOS D	0.1	0.1	0.75	0.75
P2	Across S approach	53	27.0	LOS C	0.1	0.1	0.70	0.70
P3	Across E approach	50	45.5	LOS E	0.1	0.1	0.91	0.91
P4	Across E approach	53	38.5	LOS D	0.1	0.1	0.84	0.84
P5	Across N approach	50	30.6	LOS D	0.1	0.1	0.75	0.75
P6	Across N approach	53	28.4	LOS C	0.1	0.1	0.72	0.72
P7	Across W approach	50	49.2	LOS E	0.1	0.1	0.95	0.95
P8	Across W approach	53	44.6	LOS E	0.1	0.1	0.90	0.90
All Pedestrians		412	36.7	LOS D			0.81	0.81

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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MOVEMENT SUMMARY

Site: AM Peak Final

I-4 Warnervale Rd / Minnesota Rd
Signals - Fixed Time Cycle Time = 70 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	95% Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Minnesota Rd (S)											
1	L	297	3.0	0.163	3.5	X	X	X	X	0.41	37.4
2	T	105	3.8	0.241	24.3	LOS B	3.0	21.7	0.86	0.68	26.1
3	R	8	12.5	0.041	29.5	LOS C	0.2	1.7	0.83	0.65	25.2
Approach		410	3.4	0.241	9.3	LOS A	3.0	21.7	0.24	0.48	33.4
East: Warnervale Rd (E)											
4	L	49	2.0	0.276	29.1	LOS C	3.4	24.4	0.86	0.77	25.6
5	T	70	1.4	0.276	24.6	LOS B	3.4	24.4	0.86	0.69	25.7
6	R	41	7.3	0.208	24.7	LOS B	1.0	7.7	0.76	0.69	26.7
Approach		160	3.1	0.276	26.0	LOS B	3.4	24.4	0.84	0.71	25.9
North: Minnesota Rd (N)											
7	L	21	33.3	0.097	11.0	LOS A	0.3	2.6	0.42	0.60	33.0
8	T	76	3.9	0.249	24.5	LOS B	2.7	19.7	0.86	0.68	25.9
9	R	19	0.0	0.249	29.0	LOS C	2.7	19.7	0.86	0.77	25.7
Approach		116	8.6	0.249	22.8	LOS B	2.7	19.7	0.78	0.68	26.9
West: Warnervale Rd (W)											
10	L	97	11.3	0.586	31.5	LOS C	7.7	56.9	0.94	0.82	24.9
11	T	149	2.0	0.586	26.8	LOS B	7.7	56.9	0.94	0.78	24.9
12	R	394	2.0	0.753	31.7	LOS C	13.3	95.0	0.97	0.91	24.4
Approach		640	3.4	0.753	30.5	LOS C	13.3	95.0	0.96	0.87	24.6
All Vehicles		1326	3.8	0.753	22.7	LOS B	13.3	95.0	0.70	0.71	27.2

X: Not applicable for Continuous movement.

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model used.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow	Average Delay	Level of Service	Average Back of Queue Pedestrian	Average Back of Queue Distance	Prop. Queued	Effective Stop Rate
		ped/h	sec		ped	m		per ped
P1	Across S approach	53	29.3	LOS C	0.1	0.1	0.91	0.91
P3	Across E approach	53	26.6	LOS C	0.1	0.1	0.87	0.87
P5	Across N approach	53	29.3	LOS C	0.1	0.1	0.91	0.91
P7	Across W approach	53	29.3	LOS C	0.1	0.1	0.91	0.91
All Pedestrians		212	28.6	LOS C			0.90	0.90

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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MOVEMENT SUMMARY

Site: PM Peak Final

I-4 Warnervale Rd / Minnesota Rd
Signals - Fixed Time Cycle Time = 65 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	95% Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Minnesota Rd (S)											
1	L	263	0.0	0.142	5.6	X	X	X	X	0.53	44.1
2	T	117	0.0	0.244	21.7	LOS B	3.0	21.3	0.84	0.67	31.5
3	R	27	0.0	0.116	28.2	LOS B	0.7	4.8	0.81	0.71	29.8
Approach		407	0.0	0.244	11.7	LOS A	3.0	21.3	0.30	0.58	38.5
East: Warnervale Rd (E)											
4	L	39	5.1	0.299	28.6	LOS C	3.7	26.3	0.86	0.80	30.5
5	T	101	0.0	0.299	22.0	LOS B	3.7	26.3	0.86	0.69	30.9
6	R	17	11.8	0.090	28.2	LOS B	0.4	3.3	0.80	0.69	29.9
Approach		157	2.5	0.299	24.3	LOS B	3.7	26.3	0.85	0.72	30.7
North: Minnesota Rd (N)											
7	L	12	0.0	0.102	25.1	LOS B	0.6	4.4	0.76	0.73	31.8
8	T	75	0.0	0.278	22.1	LOS B	2.7	20.0	0.84	0.66	30.8
9	R	41	12.2	0.278	29.7	LOS C	2.7	20.0	0.86	0.79	29.9
Approach		128	3.9	0.278	24.9	LOS B	2.7	20.0	0.84	0.71	30.6
West: Warnervale Rd (W)											
10	L	126	0.0	0.439	29.4	LOS C	5.6	39.6	0.89	0.81	29.7
11	T	77	2.6	0.439	23.0	LOS B	5.6	39.6	0.89	0.73	30.0
12	R	333	6.0	0.810	37.4	LOS C	11.5	85.0	1.00	0.97	26.4
Approach		536	4.1	0.810	33.5	LOS C	11.5	85.0	0.96	0.90	27.6
All Vehicles		1228	2.5	0.810	24.2	LOS B	11.5	85.0	0.71	0.75	31.3

X: Not applicable for Continuous movement.

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model used.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow	Average Delay	Level of Service	Average Back of Queue Pedestrian	Average Back of Queue Distance	Prop. Queued	Effective Stop Rate
		ped/h	sec		ped	m		per ped
P1	Across S approach	53	26.8	LOS C	0.1	0.1	0.91	0.91
P3	Across E approach	53	24.1	LOS C	0.1	0.1	0.86	0.86
P5	Across N approach	53	26.8	LOS C	0.1	0.1	0.91	0.91
P7	Across W approach	53	26.8	LOS C	0.1	0.1	0.91	0.91
All Pedestrians		212	26.1	LOS C			0.90	0.90

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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8000014, HYDER CONSULTING, FLOATING

MOVEMENT SUMMARY

Site: AM Peak

I-5 Pacific Hwy / Minnesota Rd
Signals - Fixed Time Cycle Time = 71 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	95% Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Figthree Boulevard											
1	L	59	3.4	0.105	26.7	LOS B	1.5	10.6	0.75	0.74	32.6
2	T	72	0.0	0.893	44.6	LOS D	8.7	62.5	1.00	1.11	22.8
3	R	131	5.3	0.893	52.1	LOS D	8.7	62.5	1.00	1.11	24.3
Approach		262	3.4	0.893	44.4	LOS D	8.7	62.5	0.94	1.03	25.3
East: Pacific Highway											
4	L	115	1.7	0.178	26.0	LOS B	2.8	19.7	0.73	0.77	36.8
5	T	941	4.0	0.703	22.3	LOS B	14.5	105.3	0.92	0.82	39.2
6	R	37	0.0	0.236	43.8	LOS D	1.3	9.0	0.97	0.73	28.0
Approach		1093	3.7	0.703	23.4	LOS B	14.5	105.3	0.90	0.81	38.5
North: Minnesota Road											
7	L	67	0.0	0.460	28.6	LOS C	7.7	55.8	0.84	0.84	32.5
8	T	209	4.8	0.460	20.9	LOS B	7.7	55.8	0.84	0.71	31.6
9	R	150	2.0	0.419	29.8	LOS C	4.3	30.4	0.92	0.78	31.3
Approach		426	3.1	0.460	25.2	LOS B	7.7	55.8	0.87	0.76	31.6
West: Pacific Highway											
10	L	99	2.0	0.133	18.0	LOS B	1.7	12.3	0.53	0.74	43.0
11	T	639	7.0	0.487	19.7	LOS B	8.8	65.2	0.83	0.71	41.3
12	R	48	4.2	0.315	44.3	LOS D	1.7	12.2	0.98	0.74	27.9
Approach		786	6.2	0.487	21.0	LOS B	8.8	65.2	0.80	0.71	40.4
All Vehicles		2567	4.3	0.893	25.1	LOS B	14.5	105.3	0.87	0.79	35.9

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model used.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow	Average Delay	Level of Service	Average Back of Queue Pedestrian	Average Back of Queue Distance	Prop. Queued	Effective Stop Rate
		ped/h	sec		ped	m		per ped
P1	Across S approach	53	23.7	LOS C	0.1	0.1	0.82	0.82
P3	Across E approach	53	29.8	LOS C	0.1	0.1	0.92	0.92
P5	Across N approach	53	19.8	LOS B	0.1	0.1	0.75	0.75
All Pedestrians		159	24.4	LOS C			0.83	0.83

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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MOVEMENT SUMMARY

Site: PM Peak

I-5 Pacific Hwy / Minnesota Rd
Signals - Fixed Time Cycle Time = 70 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	95% Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Figthree Boulevard											
1	L	38	0.0	0.055	22.8	LOS B	0.8	5.8	0.67	0.72	34.5
2	T	177	0.0	0.776	33.2	LOS C	9.3	65.8	1.00	0.96	26.3
3	R	79	2.7	0.776	40.7	LOS C	9.3	65.8	1.00	0.96	27.8
Approach		294	0.7	0.776	33.9	LOS C	9.3	65.8	0.96	0.93	27.7
East: Pacific Highway											
4	L	97	1.1	0.184	29.4	LOS C	2.5	17.9	0.79	0.77	34.8
5	T	498	3.0	0.455	22.6	LOS B	7.1	51.2	0.87	0.73	39.2
6	R	49	0.0	0.311	43.6	LOS D	1.7	12.0	0.97	0.74	28.1
Approach		644	2.5	0.455	25.2	LOS B	7.1	51.2	0.87	0.73	37.5
North: Minnesota Road											
7	L	153	2.8	0.331	22.9	LOS B	5.9	42.4	0.72	0.81	34.9
8	T	101	2.1	0.331	15.1	LOS B	5.9	42.4	0.72	0.61	34.4
9	R	45	0.0	0.123	25.1	LOS B	1.1	7.5	0.85	0.72	33.4
Approach		299	2.1	0.331	20.6	LOS B	5.9	42.4	0.74	0.73	34.5
West: Pacific Highway											
10	L	243	0.9	0.349	21.6	LOS B	5.2	36.8	0.66	0.79	39.9
11	T	819	2.1	0.745	26.9	LOS B	13.7	97.3	0.97	0.88	36.3
12	R	45	4.7	0.294	43.6	LOS D	1.6	11.4	0.97	0.74	28.1
Approach		1107	1.9	0.745	26.4	LOS B	13.7	97.3	0.90	0.85	36.6
All Vehicles		2344	1.9	0.776	26.3	LOS B	13.7	97.3	0.88	0.81	35.2

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model used.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow	Average Delay	Level of Service	Average Back of Queue Pedestrian	Average Back of Queue Distance	Prop. Queued	Effective Stop Rate
		ped/h	sec		ped	m		per ped
P1	Across S approach	53	27.5	LOS C	0.1	0.1	0.89	0.89
P3	Across E approach	53	25.7	LOS C	0.1	0.1	0.86	0.86
P5	Across N approach	53	23.2	LOS C	0.1	0.1	0.81	0.81
All Pedestrians		159	25.5	LOS C			0.85	0.85

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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MOVEMENT SUMMARY

Site: AM Peak

I-6 Warnervale Rd / Virginia Rd

Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	95% Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Virginia Rd (S)											
1	L	5	0.0	0.037	8.4	LOS A	0.1	0.9	0.37	0.55	41.5
2	T	5	0.0	0.037	7.1	LOS A	0.1	0.9	0.37	0.59	42.3
3	R	20	0.0	0.037	8.7	LOS A	0.1	0.9	0.37	0.71	41.3
Approach		30	0.0	0.037	8.4	LOS A	0.1	0.9	0.37	0.66	41.5
East: Warnervale Rd (E)											
4	L	10	0.0	0.082	7.8	LOS A	0.6	3.9	0.47	0.47	42.9
5	T	145	0.0	0.082	1.4	LOS A	0.6	3.9	0.47	0.00	44.5
6	R	3	0.0	0.082	8.1	LOS A	0.6	3.9	0.47	0.86	43.0
Approach		158	0.0	0.082	1.9	NA	0.6	3.9	0.47	0.05	44.4
North: Virginia Rd (S)											
7	L	5	0.0	0.090	9.1	LOS A	0.3	2.3	0.46	0.63	40.9
8	T	5	0.0	0.090	7.8	LOS A	0.3	2.3	0.46	0.63	41.6
9	R	53	7.5	0.090	9.7	LOS A	0.3	2.3	0.46	0.76	40.7
Approach		63	6.3	0.090	9.5	LOS A	0.3	2.3	0.46	0.74	40.8
West: Warnervale Rd (W)											
10	L	101	10.9	0.198	7.3	LOS A	1.2	8.9	0.35	0.53	42.8
11	T	262	3.1	0.198	0.6	LOS A	1.2	8.9	0.35	0.00	45.5
12	R	3	0.0	0.198	7.3	LOS A	1.2	8.9	0.35	0.77	42.7
Approach		366	5.2	0.198	2.5	NA	1.2	8.9	0.35	0.15	44.7
All Vehicles		617	3.7	0.198	3.3	NA	1.2	8.9	0.39	0.21	44.0

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

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MOVEMENT SUMMARY

Site: PM Peak

I-6 Warnervale Rd / Virginia Rd

Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	95% Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Virginia Rd (S)											
1	L	5	0.0	0.028	9.1	LOS A	0.1	0.7	0.47	0.63	41.0
2	T	5	0.0	0.028	7.8	LOS A	0.1	0.7	0.47	0.64	41.7
3	R	10	0.0	0.028	9.5	LOS A	0.1	0.7	0.47	0.75	40.8
Approach		20	0.0	0.028	9.0	LOS A	0.1	0.7	0.47	0.69	41.1
East: Warnervale Rd (E)											
4	L	20	0.0	0.198	7.4	LOS A	1.4	9.6	0.42	0.52	43.0
5	T	361	0.0	0.198	1.0	LOS A	1.4	9.6	0.42	0.00	45.0
6	R	3	0.0	0.198	7.8	LOS A	1.4	9.6	0.42	0.86	43.0
Approach		384	0.0	0.198	1.4	NA	1.4	9.6	0.42	0.03	44.9
North: Virginia Rd (S)											
7	L	5	0.0	0.148	10.1	LOS A	0.5	3.6	0.51	0.60	40.1
8	T	5	0.0	0.148	8.8	LOS A	0.5	3.6	0.51	0.71	40.7
9	R	82	0.0	0.148	10.4	LOS A	0.5	3.6	0.51	0.82	40.0
Approach		92	0.0	0.148	10.3	LOS A	0.5	3.6	0.51	0.80	40.0
West: Warnervale Rd (W)											
10	L	77	0.0	0.135	8.0	LOS A	1.0	6.8	0.56	0.35	42.5
11	T	177	1.1	0.135	1.5	LOS A	1.0	6.8	0.56	0.00	43.1
12	R	3	0.0	0.135	8.3	LOS A	1.0	6.8	0.56	0.81	42.6
Approach		257	0.8	0.135	3.5	NA	1.0	6.8	0.56	0.11	42.9
All Vehicles		753	0.3	0.198	3.4	NA	1.4	9.6	0.48	0.17	43.4

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

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MOVEMENT SUMMARY

Site: AM Peak final

I-7 Sparks Rd / New Warnervale Township Entry
Signals - Fixed Time Cycle Time = 140 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	95% Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Warnervale Township entry Extn (S)											
1	L	248	4.0	0.481	51.6	LOS D	14.0	101.3	0.88	0.82	24.3
2	T	40	5.0	0.201	59.1	LOS E	2.5	18.0	0.93	0.69	20.0
3	R	67	6.0	0.157	66.4	LOS E	2.2	16.3	0.92	0.73	21.0
Approach		355	4.5	0.481	55.3	LOS D	14.0	101.3	0.89	0.79	23.1
East: Sparks Rd (E)											
10	L	220	5.0	0.310	18.5	LOS B	4.9	35.9	0.58	0.74	42.7
11	T	1927	5.6	0.869	49.0	LOS D	44.0	323.1	0.99	0.97	26.9
12	R	52	3.8	0.126	69.4	LOS E	1.6	11.7	0.93	0.72	20.9
Approach		2199	5.5	0.869	46.5	LOS D	44.0	323.1	0.95	0.94	27.7
North: New Warnervale Township entry (N)											
1	L	248	5.2	0.281	29.8	LOS C	5.6	40.8	0.79	0.76	31.5
2	T	49	6.1	0.229	50.3	LOS D	2.8	20.4	0.87	0.65	21.9
3	R	306	3.6	0.876	77.6	LOS F	23.0	166.0	1.00	1.00	19.2
Approach		603	4.5	0.876	55.7	LOS D	23.0	166.0	0.90	0.87	23.2
West: Sparks Rd (W)											
4	L	349	6.6	0.477	20.9	LOS B	10.8	79.7	0.50	0.74	40.7
5	T	1327	6.6	0.602	36.0	LOS C	23.8	175.9	0.85	0.75	32.0
6	R	355	4.2	0.862	84.1	LOS F	13.3	96.6	1.00	0.95	18.3
Approach		2031	6.2	0.862	41.8	LOS C	23.8	175.9	0.82	0.79	29.4
All Vehicles		5188	5.6	0.876	46.3	LOS D	44.0	323.1	0.89	0.86	27.3

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model used.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow	Average Delay	Level of Service	Average Back of Queue Pedestrian	Average Back of Queue Distance	Prop. Queued	Effective Stop Rate
		ped/h	sec		ped	m		per ped
P1	Across S approach	53	30.2	LOS D	0.1	0.1	0.66	0.66
P2	Across S approach	53	28.3	LOS C	0.1	0.1	0.64	0.64
P7	Across E approach	53	55.8	LOS E	0.2	0.2	0.89	0.89
P8	Across E approach	53	51.4	LOS E	0.2	0.2	0.86	0.86
P1	Across N approach	53	28.3	LOS C	0.1	0.1	0.64	0.64
P2	Across N approach	53	28.3	LOS C	0.1	0.1	0.64	0.64
P3	Across W approach	53	64.1	LOS F	0.2	0.2	0.96	0.96
P4	Across W approach	53	59.4	LOS E	0.2	0.2	0.92	0.92
All Pedestrians		424	43.2	LOS E			0.77	0.77

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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MOVEMENT SUMMARY

Site: PM Peak final

I-7 Sparks Rd / New Warnervale Township Entry
Signals - Fixed Time Cycle Time = 125 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	95% Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Warnervale Township entry Extn (S)											
1	L	101	2.0	0.357	39.8	LOS C	4.4	31.3	0.76	0.74	27.8
2	T	38	7.9	0.142	50.9	LOS D	2.0	15.3	0.91	0.68	21.8
3	R	77	5.2	0.161	58.4	LOS E	2.2	16.4	0.91	0.73	22.7
Approach		216	4.2	0.357	48.4	LOS D	4.4	31.3	0.84	0.73	24.7
East: Sparks Rd (E)											
10	L	127	3.1	0.175	18.6	LOS B	2.6	18.6	0.60	0.73	42.5
11	T	1104	2.7	0.586	37.5	LOS C	18.6	133.3	0.89	0.77	31.3
12	R	197	4.1	0.426	64.1	LOS E	5.7	41.2	0.97	0.78	22.1
Approach		1428	2.9	0.586	39.5	LOS C	18.6	133.3	0.87	0.77	30.3
North: New Warnervale Township entry (N)											
1	L	61	0.0	0.058	23.4	LOS B	1.0	6.7	0.70	0.69	34.5
2	T	26	7.7	0.109	42.6	LOS D	1.3	9.5	0.83	0.61	23.9
3	R	318	2.8	0.840	65.5	LOS E	20.5	147.2	1.00	0.96	21.3
Approach		405	2.7	0.840	57.7	LOS E	20.5	147.2	0.94	0.90	22.8
West: Sparks Rd (W)											
4	L	395	1.8	0.521	22.7	LOS B	12.5	89.1	0.57	0.76	39.3
5	T	1548	3.1	0.823	45.5	LOS D	30.7	220.7	0.99	0.93	28.1
6	R	386	2.6	0.827	72.8	LOS F	12.6	90.4	1.00	0.92	20.3
Approach		2329	2.8	0.827	46.2	LOS D	30.7	220.7	0.92	0.90	27.7
All Vehicles		4378	2.9	0.840	45.2	LOS D	30.7	220.7	0.90	0.85	27.7

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model used.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow	Average Delay	Level of Service	Average Back of Queue Pedestrian	Average Back of Queue Distance	Prop. Queued	Effective Stop Rate
		ped/h	sec		ped	m		per ped
P1	Across S approach	53	33.1	LOS D	0.1	0.1	0.73	0.73
P2	Across S approach	53	31.0	LOS D	0.1	0.1	0.70	0.70
P7	Across E approach	53	49.3	LOS E	0.2	0.2	0.89	0.89
P8	Across E approach	53	44.9	LOS E	0.2	0.2	0.85	0.85
P1	Across N approach	53	31.0	LOS D	0.1	0.1	0.70	0.70
P2	Across N approach	53	31.0	LOS D	0.1	0.1	0.70	0.70
P3	Across W approach	53	56.6	LOS E	0.2	0.2	0.95	0.95
P4	Across W approach	53	52.0	LOS E	0.2	0.2	0.91	0.91
All Pedestrians		424	41.1	LOS E			0.80	0.80

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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MOVEMENT SUMMARY

Site: AM Peak

I-8 Warnervale Rd / Connector

Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	95% Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Access Rd (S)											
1	L	5	0.0	0.029	6.4	LOS A	0.1	1.0	0.52	0.53	42.3
2	T	3	0.0	0.029	5.5	LOS A	0.1	1.0	0.52	0.48	42.5
3	R	20	0.0	0.029	11.0	LOS A	0.1	1.0	0.52	0.68	40.2
Approach		28	0.0	0.029	9.6	LOS A	0.1	1.0	0.52	0.63	40.8
East: Warnervale Rd (E)											
4	L	10	0.0	0.283	4.6	LOS A	1.9	13.6	0.20	0.41	44.1
5	T	117	0.9	0.283	3.6	LOS A	1.9	13.6	0.20	0.32	44.7
6	R	297	3.0	0.283	9.2	LOS A	1.9	13.6	0.20	0.66	41.1
Approach		424	2.4	0.283	7.5	LOS A	1.9	13.6	0.20	0.56	42.1
North: Minnesota Rd Deviation (N)											
7	L	408	2.7	0.406	6.2	LOS A	2.8	20.2	0.57	0.61	42.4
8	T	3	0.0	0.406	5.2	LOS A	2.8	20.2	0.57	0.56	42.4
9	R	38	0.0	0.406	10.7	LOS A	2.8	20.2	0.57	0.76	40.6
Approach		449	2.4	0.406	6.6	LOS A	2.8	20.2	0.57	0.62	42.2
West: Warnervale Rd (W)											
10	L	36	0.0	0.275	6.2	LOS A	1.6	11.6	0.52	0.62	43.0
11	T	258	3.1	0.275	5.3	LOS A	1.6	11.6	0.52	0.55	43.2
12	R	3	0.0	0.275	10.7	LOS A	1.6	11.6	0.52	0.83	40.9
Approach		297	2.7	0.275	5.4	LOS A	1.6	11.6	0.52	0.56	43.2
All Vehicles		1198	2.4	0.406	6.7	LOS A	2.8	20.2	0.43	0.59	42.3

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model used.

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MOVEMENT SUMMARY

Site: PM Peak

I-8 Warnervale Rd / Connector

Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	95% Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Access Rd (S)											
1	L	5	0.0	0.020	6.9	LOS A	0.1	0.7	0.57	0.55	42.2
2	T	3	0.0	0.020	5.9	LOS A	0.1	0.7	0.57	0.50	42.3
3	R	10	0.0	0.020	11.4	LOS A	0.1	0.7	0.57	0.69	40.0
Approach		18	0.0	0.020	9.2	LOS A	0.1	0.7	0.57	0.62	40.9
East: Warnervale Rd (E)											
4	L	20	0.0	0.334	4.9	LOS A	2.3	16.1	0.32	0.47	43.7
5	T	289	0.0	0.334	3.9	LOS A	2.3	16.1	0.32	0.39	44.1
6	R	149	3.4	0.334	9.5	LOS A	2.3	16.1	0.32	0.73	41.2
Approach		458	1.1	0.334	5.8	LOS A	2.3	16.1	0.32	0.50	43.1
North: Minnesota Rd Deviation (N)											
7	L	476	4.2	0.453	5.6	LOS A	3.3	24.0	0.48	0.53	42.8
8	T	3	0.0	0.453	4.6	LOS A	3.3	24.0	0.48	0.47	43.0
9	R	92	0.0	0.453	10.1	LOS A	3.3	24.0	0.48	0.72	40.7
Approach		571	3.5	0.453	6.3	LOS A	3.3	24.0	0.48	0.56	42.4
West: Warnervale Rd (W)											
10	L	22	0.0	0.156	5.2	LOS A	0.8	5.9	0.35	0.51	43.7
11	T	164	1.2	0.156	4.2	LOS A	0.8	5.9	0.35	0.43	44.1
12	R	3	0.0	0.156	9.7	LOS A	0.8	5.9	0.35	0.81	41.4
Approach		189	1.1	0.156	4.4	LOS A	0.8	5.9	0.35	0.44	44.0
All Vehicles		1236	2.2	0.453	5.9	LOS A	3.3	24.0	0.40	0.52	42.9

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model used.

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APPENDIX G

2031 FORECAST TURNING VOLUMES AND SIDRA RESULTS (SCENARIO 4B)

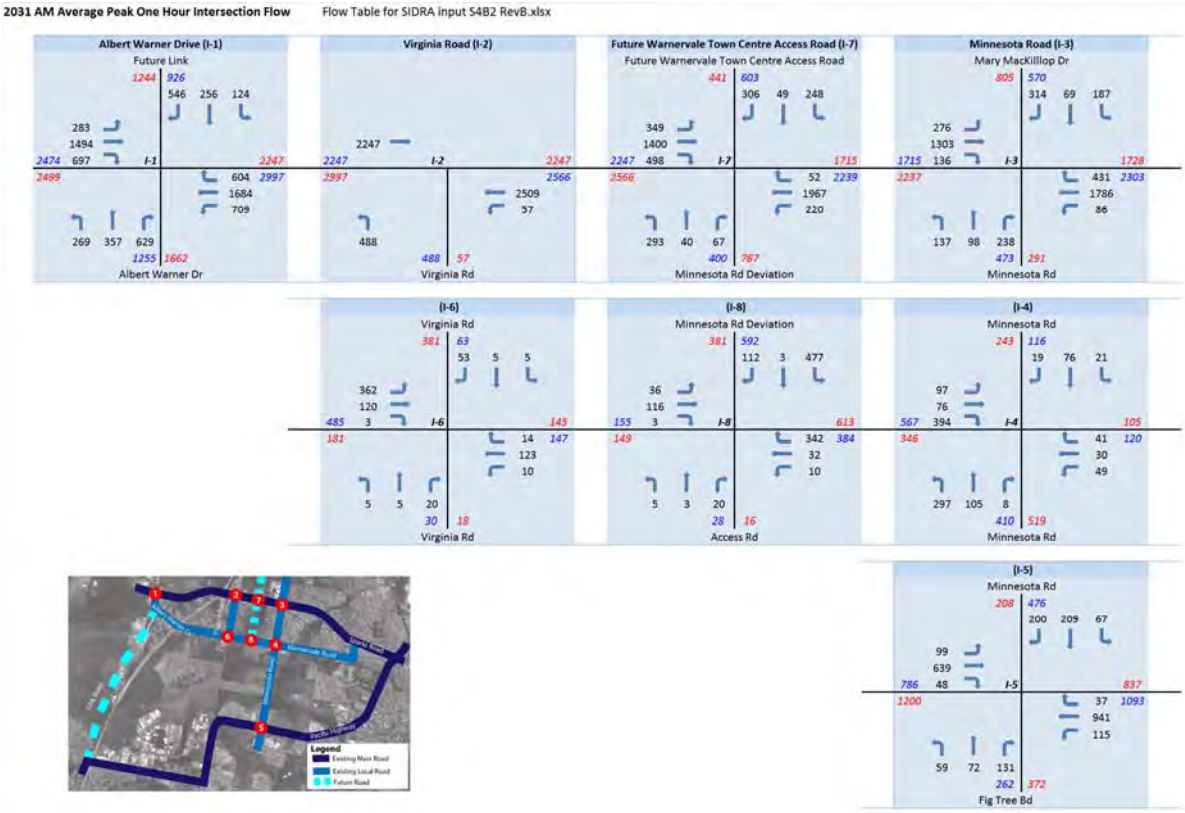

Figure 1 Forecast turning volume – 2031 Scenario 4B2 AM Peak 1 hour

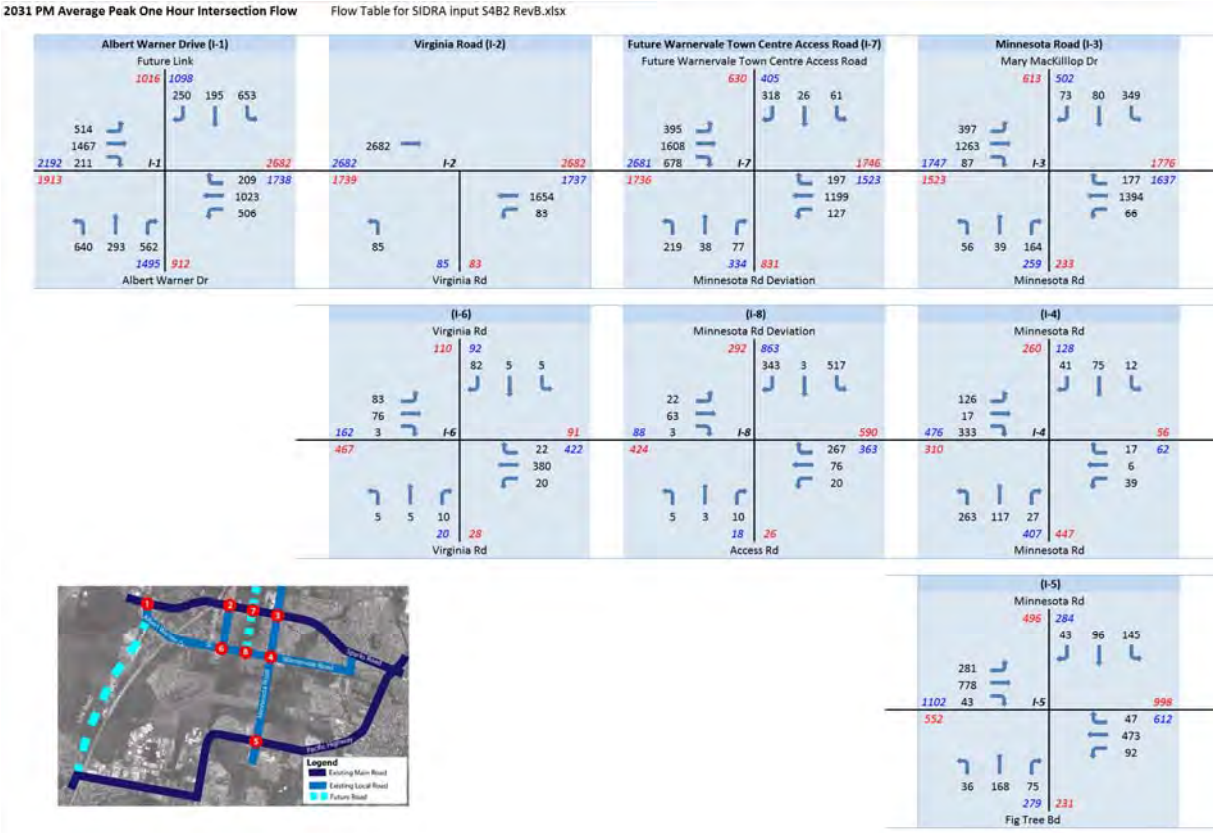

Figure 2 Forecast turning volume – 2031 Scenario 4B2 PM Peak 1 hour

MOVEMENT SUMMARY

Site: AM Peak - final

I-1 Sparks Rd / Albert Warner Dr
Signals - Fixed Time Cycle Time = 235 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	95% Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Albert Warner Dr (S)											
1	L	269	8.9	0.402	36.5	LOS C	12.6	94.8	0.78	0.80	30.1
2	T	357	4.5	0.820	90.0	LOS F	15.4	112.0	1.00	0.99	15.4
3	R	629	7.8	0.857	64.6	LOS E	21.6	161.2	1.00	0.91	22.5
Approach		1255	7.1	0.857	65.8	LOS E	21.6	161.2	0.95	0.91	21.3
East: Sparks Rd (E)											
4	L	709	7.1	0.897	38.4	LOS C	38.7	287.6	0.88	0.89	32.4
5	T	1684	3.9	0.867	51.5	LOS D	26.0	188.3	1.00	0.91	28.5
6	R	604	3.1	0.766	57.0	LOS E	16.7	119.9	1.00	0.85	25.2
Approach		2997	4.5	0.897	49.5	LOS D	38.7	287.6	0.97	0.89	28.6
North: Albert Warner Dr (N)											
7	L	124	6.5	0.202	33.7	LOS C	5.2	38.7	0.70	0.75	31.2
8	T	256	5.1	0.590	70.7	LOS F	8.5	62.3	1.00	0.85	18.0
9	R	546	5.1	0.731	55.8	LOS D	16.5	120.6	0.99	0.84	24.4
Approach		926	5.3	0.731	56.9	LOS E	16.5	120.6	0.95	0.83	23.1
West: Sparks Rd (W)											
10	L	283	6.0	0.460	27.5	LOS B	10.3	75.9	0.62	0.78	38.8
11	T	1494	8.3	0.791	44.4	LOS D	20.6	154.8	1.00	0.86	31.1
12	R	697	3.9	0.889	70.3	LOS E	23.2	167.6	1.00	0.91	21.7
Approach		2474	6.8	0.889	49.8	LOS D	23.2	167.6	0.95	0.86	28.5
All Vehicles		7652	5.8	0.897	53.2	LOS D	38.7	287.6	0.96	0.88	26.3

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model used.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow	Average Delay	Level of Service	Average Back of Queue Pedestrian	Average Back of Queue Distance	Prop. Queued	Effective Stop Rate
		ped/h	sec		ped	m		per ped
P1	Across S approach	53	101.1	LOS F	0.3	0.3	0.93	0.93
P2	Across S approach	53	96.5	LOS F	0.3	0.3	0.91	0.91
P3	Across E approach	53	111.6	LOS F	0.3	0.3	0.97	0.97
P4	Across E approach	53	105.8	LOS F	0.3	0.3	0.95	0.95
P5	Across N approach	53	101.1	LOS F	0.3	0.3	0.93	0.93
P6	Across N approach	53	96.5	LOS F	0.3	0.3	0.91	0.91
P7	Across W approach	53	111.6	LOS F	0.3	0.3	0.97	0.97
P8	Across W approach	53	105.8	LOS F	0.3	0.3	0.95	0.95
All Pedestrians		424	103.8	LOS F			0.94	0.94

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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MOVEMENT SUMMARY

Site: PM Peak - final

I-1 Sparks Rd / Albert Warner Dr
Signals - Fixed Time Cycle Time = 150 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	95% Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Albert Warner Dr (S)											
1	L	640	1.3	0.899	43.9	LOS D	29.5	209.0	1.00	0.97	27.6
2	T	293	3.4	0.360	27.9	LOS B	4.8	34.5	0.90	0.72	28.7
3	R	562	4.3	0.936	66.5	LOS E	15.9	115.4	1.00	1.10	22.1
Approach		1495	2.8	0.936	49.3	LOS D	29.5	209.0	0.98	0.97	25.3
East: Sparks Rd (E)											
4	L	506	9.7	0.643	27.3	LOS B	15.8	119.9	0.83	0.84	39.1
5	T	1023	1.6	0.641	30.4	LOS C	9.4	66.4	0.97	0.80	37.7
6	R	209	2.4	0.613	48.0	LOS D	4.3	30.4	1.00	0.78	28.2
Approach		1738	4.0	0.643	31.6	LOS C	15.8	119.9	0.93	0.81	36.7
North: Albert Warner Dr (N)											
7	L	653	2.3	0.924	52.7	LOS D	33.5	239.4	1.00	1.02	25.1
8	T	195	2.6	0.238	27.0	LOS B	3.1	22.1	0.87	0.68	29.1
9	R	250	2.0	0.410	39.0	LOS C	4.6	32.5	0.94	0.78	29.2
Approach		1098	2.3	0.924	45.0	LOS D	33.5	239.4	0.96	0.91	26.5
West: Sparks Rd (W)											
10	L	514	3.1	0.624	26.9	LOS B	15.8	113.9	0.82	0.84	39.2
11	T	1467	2.6	0.925	53.2	LOS D	19.7	141.2	1.00	1.00	28.0
12	R	211	14.2	0.670	49.5	LOS D	4.4	34.7	1.00	0.80	27.7
Approach		2192	3.8	0.925	46.7	LOS D	19.7	141.2	0.96	0.95	29.8
All Vehicles		6523	3.4	0.936	43.0	LOS D	33.5	239.4	0.96	0.91	29.4

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model used.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow	Average Delay	Level of Service	Average Back of Queue Pedestrian	Average Back of Queue Distance	Prop. Queued	Effective Stop Rate
		ped/h	sec		ped	m		per ped
P1	Across S approach	53	69.1	LOS F	0.2	0.2	0.96	0.96
P2	Across S approach	53	64.4	LOS F	0.2	0.2	0.93	0.93
P3	Across E approach	53	69.1	LOS F	0.2	0.2	0.96	0.96
P4	Across E approach	53	63.5	LOS F	0.2	0.2	0.92	0.92
P5	Across N approach	53	69.1	LOS F	0.2	0.2	0.96	0.96
P6	Across N approach	53	64.4	LOS F	0.2	0.2	0.93	0.93
P7	Across W approach	53	69.1	LOS F	0.2	0.2	0.96	0.96
P8	Across W approach	53	63.5	LOS F	0.2	0.2	0.92	0.92
All Pedestrians		424	66.5	LOS F			0.94	0.94

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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MOVEMENT SUMMARY

Site: AM Peak

I-2 Sparks Rd / Virginia Rd
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	95% Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Virginia Rd (S)											
1	L	488	2.3	0.267	5.7	X	X	X	X	0.53	44.1
Approach		488	2.3	0.267	5.7	NA	0.0	0.0	0.00	0.53	44.1
East: Sparks Rd (E)											
4	L	57	7.0	0.032	10.4	LOS A	0.0	0.0	0.00	0.71	57.1
5	T	2509	3.7	0.439	0.0	LOS A	0.0	0.0	0.00	0.00	80.0
Approach		2566	3.7	0.439	0.2	NA	0.0	0.0	0.00	0.02	79.4
All Vehicles		3054	3.5	0.439	1.1	NA	0.0	0.0	0.00	0.10	71.5

X: Not applicable for Continuous movement.

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: AM Peak Merge

Merge From Left

Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	95% Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South East: Merge Movement											
2	T	488	2.3	0.526	6.0	LOS A	2.5	18.1	0.66	0.74	43.9
Approach		488	2.3	0.526	6.0	LOS A	2.5	18.1	0.66	0.74	43.9
East: Main Road Upstream											
1	T	837	3.7	0.440	0.0	LOS A	0.0	0.0	0.00	0.00	80.0
Approach		837	3.7	0.440	0.0	NA	0.0	0.0	0.00	0.00	80.0
All Vehicles		1325	3.2	0.526	2.2	NA	2.5	18.1	0.24	0.27	68.3

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: PM Peak

I-2 Sparks Rd / Virginia Rd
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	95% Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Virginia Rd (S)											
1	L	85	0.0	0.046	5.6	X	X	X	X	0.53	44.1
Approach		85	0.0	0.046	5.6	NA	0.0	0.0	0.00	0.53	44.1
East: Sparks Rd (E)											
4	L	83	0.0	0.045	10.1	LOS A	0.0	0.0	0.00	0.71	57.1
5	T	1654	1.9	0.286	0.0	LOS A	0.0	0.0	0.00	0.00	80.0
Approach		1737	1.8	0.286	0.5	NA	0.0	0.0	0.00	0.03	78.7
All Vehicles		1822	1.8	0.286	0.7	NA	0.0	0.0	0.00	0.06	76.3

X: Not applicable for Continuous movement.

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: PM Peak Merge

Merge From Left

Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	95% Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South East: Merge Movement											
2	T	85	0.0	0.069	3.2	LOS A	0.2	1.4	0.38	0.32	47.9
Approach		85	0.0	0.069	3.2	LOS A	0.2	1.4	0.38	0.32	47.9
East: Main Road Upstream											
1	T	552	2.0	0.287	0.0	LOS A	0.0	0.0	0.00	0.00	80.0
Approach		552	2.0	0.287	0.0	NA	0.0	0.0	0.00	0.00	80.0
All Vehicles		637	1.7	0.287	0.4	NA	0.2	1.4	0.05	0.04	76.7

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: AM Peak Final

I-3 Sparks Rd / Minnesota Rd
Signals - Fixed Time Cycle Time = 110 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	95% Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Minnesota Road (S)											
1	L	137	5.8	0.920	35.0	LOS C	4.4	32.6	0.91	0.82	29.2
2	T	98	1.0	0.309	45.7	LOS D	4.7	33.3	0.92	0.74	22.8
3	R	238	2.9	0.800	60.4	LOS E	13.4	96.2	1.00	0.93	22.2
Approach		473	3.4	0.920	50.0	LOS D	13.4	96.2	0.96	0.86	24.0
East: Sparks Road (E)											
4	L	86	5.8	0.139	21.0	LOS B	2.1	15.5	0.49	0.74	40.5
5	T	1786	4.0	0.931	61.0	LOS E	40.7	294.6	1.00	1.15	23.6
6	R	431	3.0	0.869	69.4	LOS E	13.1	93.8	1.00	0.97	20.4
Approach		2303	3.9	0.931	61.1	LOS E	40.7	294.6	0.98	1.10	23.4
North: Minnesota Road (N)											
7	L	187	0.5	0.504	35.8	LOS C	7.3	51.2	0.77	0.78	28.8
8	T	69	0.0	0.218	39.5	LOS C	3.1	21.6	0.87	0.67	24.8
9	R	314	10.5	0.909	71.4	LOS F	20.4	155.8	1.00	1.08	20.1
Approach		570	6.0	0.909	55.9	LOS D	20.4	155.8	0.91	0.94	22.9
West: Sparks Road (W)											
10	L	276	2.2	0.346	20.3	LOS B	5.1	36.7	0.70	0.80	41.0
11	T	1303	10.3	0.843	47.2	LOS D	24.5	186.8	1.00	0.98	27.5
12	R	136	2.2	0.909	77.5	LOS F	8.7	61.8	1.00	1.04	19.3
Approach		1715	8.3	0.909	45.3	LOS D	24.5	186.8	0.95	0.96	27.9
All Vehicles		5061	5.6	0.931	54.1	LOS D	40.7	294.6	0.96	1.01	24.7

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model used.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow	Average Delay	Level of Service	Average Back of Queue Pedestrian	Average Back of Queue Distance	Prop. Queued	Effective Stop Rate
		ped/h	sec		ped	m		per ped
P1	Across S approach	50	33.6	LOS D	0.1	0.1	0.78	0.78
P2	Across S approach	53	29.8	LOS C	0.1	0.1	0.74	0.74
P3	Across E approach	50	48.2	LOS E	0.1	0.1	0.94	0.94
P4	Across E approach	53	41.0	LOS E	0.1	0.1	0.86	0.86
P5	Across N approach	50	33.6	LOS D	0.1	0.1	0.78	0.78
P6	Across N approach	53	31.3	LOS D	0.1	0.1	0.75	0.75
P7	Across W approach	50	49.2	LOS E	0.1	0.1	0.95	0.95
P8	Across W approach	53	44.6	LOS E	0.1	0.1	0.90	0.90
All Pedestrians		412	38.9	LOS D			0.84	0.84

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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8000014, HYDER CONSULTING, FLOATING

MOVEMENT SUMMARY

Site: PM Peak Final

I-3 Sparks Rd / Minnesota Rd
Signals - Fixed Time Cycle Time = 100 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	95% Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Minnesota Road (S)											
1	L	56	3.6	0.330	27.5	LOS B	1.4	10.1	0.87	0.73	32.2
2	T	39	0.0	0.111	38.6	LOS C	1.6	11.3	0.87	0.67	24.9
3	R	164	1.8	0.497	48.1	LOS D	7.4	52.5	0.95	0.80	25.2
Approach		259	1.9	0.497	42.2	LOS C	7.4	52.5	0.92	0.77	26.4
East: Sparks Road (E)											
4	L	66	3.0	0.099	19.9	LOS B	1.5	10.6	0.49	0.73	41.3
5	T	1394	2.1	0.779	36.4	LOS C	21.7	154.9	0.97	0.89	31.6
6	R	177	0.0	0.794	65.7	LOS E	4.8	33.5	1.00	0.88	21.2
Approach		1637	1.9	0.794	38.9	LOS C	21.7	154.9	0.96	0.89	30.4
North: Minnesota Road (N)											
7	L	349	0.0	0.671	42.4	LOS C	15.3	106.9	0.94	0.85	26.6
8	T	80	0.0	0.232	35.3	LOS C	3.2	22.7	0.86	0.67	26.1
9	R	73	0.0	0.187	42.7	LOS D	3.0	20.7	0.86	0.75	26.7
Approach		502	0.0	0.671	41.3	LOS C	15.3	106.9	0.92	0.81	26.5
West: Sparks Road (W)											
10	L	397	0.0	0.455	19.0	LOS B	7.6	53.1	0.72	0.81	42.1
11	T	1263	3.5	0.712	33.4	LOS C	18.4	132.9	0.95	0.83	33.0
12	R	87	0.0	0.781	65.1	LOS E	4.7	32.8	1.00	0.87	21.8
Approach		1747	2.5	0.781	31.7	LOS C	18.4	132.9	0.90	0.83	33.6
All Vehicles		4145	1.9	0.794	36.4	LOS C	21.7	154.9	0.92	0.84	30.8

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model used.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow	Average Delay	Level of Service	Average Back of Queue Pedestrian	Average Back of Queue Distance	Prop. Queued	Effective Stop Rate
		ped/h	sec		ped	m		per ped
P1	Across S approach	50	28.9	LOS C	0.1	0.1	0.76	0.76
P2	Across S approach	53	25.2	LOS C	0.1	0.1	0.71	0.71
P3	Across E approach	50	44.2	LOS E	0.1	0.1	0.94	0.94
P4	Across E approach	53	37.0	LOS D	0.1	0.1	0.86	0.86
P5	Across N approach	50	28.9	LOS C	0.1	0.1	0.76	0.76
P6	Across N approach	53	26.6	LOS C	0.1	0.1	0.73	0.73
P7	Across W approach	50	44.2	LOS E	0.1	0.1	0.94	0.94
P8	Across W approach	53	39.6	LOS D	0.1	0.1	0.89	0.89
All Pedestrians		412	34.3	LOS D			0.82	0.82

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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8000014, HYDER CONSULTING, FLOATING

MOVEMENT SUMMARY

Site: AM Peak Final

I-4 Warnervale Rd / Minnesota Rd
Signals - Fixed Time Cycle Time = 70 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	95% Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Minnesota Rd (S)											
1	L	297	3.0	0.163	3.5	X	X	X	X	0.41	37.4
2	T	105	3.8	0.241	24.3	LOS B	3.0	21.7	0.86	0.68	26.1
3	R	8	12.5	0.041	29.5	LOS C	0.2	1.7	0.83	0.65	25.2
Approach		410	3.4	0.241	9.3	LOS A	3.0	21.7	0.24	0.48	33.4
East: Warnervale Rd (E)											
4	L	49	2.0	0.186	28.5	LOS B	2.2	15.9	0.84	0.75	25.6
5	T	30	3.3	0.186	24.0	LOS B	2.2	15.9	0.84	0.65	25.8
6	R	41	7.3	0.208	24.7	LOS B	1.0	7.7	0.76	0.69	26.7
Approach		120	4.2	0.208	26.1	LOS B	2.2	15.9	0.81	0.70	26.1
North: Minnesota Rd (N)											
7	L	21	33.3	0.097	11.0	LOS A	0.3	2.6	0.42	0.60	33.0
8	T	76	3.9	0.249	24.5	LOS B	2.7	19.7	0.86	0.68	25.9
9	R	19	0.0	0.249	29.0	LOS C	2.7	19.7	0.86	0.77	25.7
Approach		116	8.6	0.249	22.8	LOS B	2.7	19.7	0.78	0.68	26.9
West: Warnervale Rd (W)											
10	L	97	11.3	0.422	30.3	LOS C	5.2	39.0	0.90	0.79	25.1
11	T	76	3.9	0.422	25.6	LOS B	5.2	39.0	0.90	0.73	25.2
12	R	394	2.0	0.753	31.7	LOS C	13.3	95.0	0.97	0.91	24.4
Approach		567	3.9	0.753	30.6	LOS C	13.3	95.0	0.95	0.87	24.7
All Vehicles		1213	4.2	0.753	22.2	LOS B	13.3	95.0	0.68	0.70	27.5

X: Not applicable for Continuous movement.

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model used.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow	Average Delay	Level of Service	Average Back of Queue Pedestrian	Average Back of Queue Distance	Prop. Queued	Effective Stop Rate
		ped/h	sec		ped	m		per ped
P1	Across S approach	53	29.3	LOS C	0.1	0.1	0.91	0.91
P3	Across E approach	53	26.6	LOS C	0.1	0.1	0.87	0.87
P5	Across N approach	53	29.3	LOS C	0.1	0.1	0.91	0.91
P7	Across W approach	53	29.3	LOS C	0.1	0.1	0.91	0.91
All Pedestrians		212	28.6	LOS C			0.90	0.90

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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8000014, HYDER CONSULTING, FLOATING

MOVEMENT SUMMARY

Site: PM Peak Final

I-4 Warnervale Rd / Minnesota Rd
Signals - Fixed Time Cycle Time = 70 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	95% Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Minnesota Rd (S)											
1	L	263	0.0	0.142	5.6	X	X	X	X	0.53	44.1
2	T	117	0.0	0.263	24.4	LOS B	3.4	23.5	0.86	0.68	30.2
3	R	27	0.0	0.126	30.9	LOS C	0.8	5.3	0.83	0.71	28.7
Approach		407	0.0	0.263	12.7	LOS A	3.4	23.5	0.30	0.59	37.9
East: Warnervale Rd (E)											
4	L	39	5.1	0.109	30.0	LOS C	1.2	9.0	0.82	0.73	29.2
5	T	6	0.0	0.109	23.4	LOS B	1.2	9.0	0.82	0.62	29.7
6	R	17	11.8	0.089	26.4	LOS B	0.4	3.2	0.75	0.68	30.7
Approach		62	6.5	0.109	28.4	LOS B	1.2	9.0	0.80	0.71	29.6
North: Minnesota Rd (N)											
7	L	12	0.0	0.111	27.7	LOS B	0.7	4.8	0.78	0.73	30.6
8	T	75	0.0	0.302	25.0	LOS B	3.0	22.1	0.86	0.67	29.5
9	R	41	12.2	0.302	32.6	LOS C	3.0	22.1	0.88	0.79	28.8
Approach		128	3.9	0.302	27.7	LOS B	3.0	22.1	0.86	0.71	29.3
West: Warnervale Rd (W)											
10	L	126	0.0	0.338	31.4	LOS C	4.2	29.8	0.88	0.78	28.6
11	T	17	11.8	0.338	25.0	LOS B	4.2	29.8	0.88	0.71	28.9
12	R	333	6.0	0.654	31.0	LOS C	10.4	76.3	0.93	0.84	28.7
Approach		476	4.6	0.654	30.9	LOS C	10.4	76.3	0.92	0.82	28.7
All Vehicles		1073	2.9	0.654	23.5	LOS B	10.4	76.3	0.67	0.71	31.8

X: Not applicable for Continuous movement.

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model used.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow	Average Delay	Level of Service	Average Back of Queue Pedestrian	Average Back of Queue Distance	Prop. Queued	Effective Stop Rate
		ped/h	sec		ped	m		per ped
P1	Across S approach	53	29.3	LOS C	0.1	0.1	0.91	0.91
P3	Across E approach	53	26.6	LOS C	0.1	0.1	0.87	0.87
P5	Across N approach	53	29.3	LOS C	0.1	0.1	0.91	0.91
P7	Across W approach	53	29.3	LOS C	0.1	0.1	0.91	0.91
All Pedestrians		212	28.6	LOS C			0.90	0.90

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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8000014, HYDER CONSULTING, FLOATING

MOVEMENT SUMMARY

Site: AM Peak

I-5 Pacific Hwy / Minnesota Rd
Signals - Fixed Time Cycle Time = 71 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	95% Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Figthree Boulevard											
1	L	59	3.4	0.105	26.7	LOS B	1.5	10.6	0.75	0.74	32.6
2	T	72	0.0	0.893	44.6	LOS D	8.7	62.5	1.00	1.11	22.8
3	R	131	5.3	0.893	52.1	LOS D	8.7	62.5	1.00	1.11	24.3
Approach		262	3.4	0.893	44.4	LOS D	8.7	62.5	0.94	1.03	25.3
East: Pacific Highway											
4	L	115	1.7	0.178	26.0	LOS B	2.8	19.7	0.73	0.77	36.8
5	T	941	4.0	0.703	22.3	LOS B	14.5	105.3	0.92	0.82	39.2
6	R	37	0.0	0.236	43.8	LOS D	1.3	9.0	0.97	0.73	28.0
Approach		1093	3.7	0.703	23.4	LOS B	14.5	105.3	0.90	0.81	38.5
North: Minnesota Road											
7	L	67	0.0	0.460	28.6	LOS C	7.7	55.8	0.84	0.84	32.5
8	T	209	4.8	0.460	20.9	LOS B	7.7	55.8	0.84	0.71	31.6
9	R	200	1.5	0.558	30.6	LOS C	5.9	41.8	0.95	0.80	31.0
Approach		476	2.7	0.558	26.0	LOS B	7.7	55.8	0.89	0.77	31.4
West: Pacific Highway											
10	L	99	2.0	0.133	18.0	LOS B	1.7	12.3	0.53	0.74	43.0
11	T	639	7.0	0.487	19.7	LOS B	8.8	65.2	0.83	0.71	41.3
12	R	48	4.2	0.315	44.3	LOS D	1.7	12.2	0.98	0.74	27.9
Approach		786	6.2	0.487	21.0	LOS B	8.8	65.2	0.80	0.71	40.4
All Vehicles		2617	4.2	0.893	25.2	LOS B	14.5	105.3	0.87	0.79	35.8

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model used.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow	Average Delay	Level of Service	Average Back of Queue Pedestrian	Average Back of Queue Distance	Prop. Queued	Effective Stop Rate
		ped/h	sec		ped	m		per ped
P1	Across S approach	53	23.7	LOS C	0.1	0.1	0.82	0.82
P3	Across E approach	53	29.8	LOS C	0.1	0.1	0.92	0.92
P5	Across N approach	53	19.8	LOS B	0.1	0.1	0.75	0.75
All Pedestrians		159	24.4	LOS C			0.83	0.83

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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8000014, HYDER CONSULTING, FLOATING

MOVEMENT SUMMARY

Site: PM Peak

I-5 Pacific Hwy / Minnesota Rd
Signals - Fixed Time Cycle Time = 70 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	95% Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Figthree Boulevard											
1	L	38	0.0	0.055	22.8	LOS B	0.8	5.8	0.67	0.72	34.5
2	T	177	0.0	0.776	33.2	LOS C	9.3	65.8	1.00	0.96	26.3
3	R	79	2.7	0.776	40.7	LOS C	9.3	65.8	1.00	0.96	27.8
Approach		294	0.7	0.776	33.9	LOS C	9.3	65.8	0.96	0.93	27.7
East: Pacific Highway											
4	L	97	1.1	0.184	29.4	LOS C	2.5	17.9	0.79	0.77	34.8
5	T	498	3.0	0.455	22.6	LOS B	7.1	51.2	0.87	0.73	39.2
6	R	49	0.0	0.311	43.6	LOS D	1.7	12.0	0.97	0.74	28.1
Approach		644	2.5	0.455	25.2	LOS B	7.1	51.2	0.87	0.73	37.5
North: Minnesota Road											
7	L	153	2.8	0.331	22.9	LOS B	5.9	42.4	0.72	0.81	34.9
8	T	101	2.1	0.331	15.1	LOS B	5.9	42.4	0.72	0.61	34.4
9	R	45	0.0	0.123	25.1	LOS B	1.1	7.5	0.85	0.72	33.4
Approach		299	2.1	0.331	20.6	LOS B	5.9	42.4	0.74	0.73	34.5
West: Pacific Highway											
10	L	296	0.7	0.424	22.0	LOS B	6.6	46.2	0.69	0.80	39.6
11	T	819	2.1	0.745	26.9	LOS B	13.7	97.3	0.97	0.88	36.3
12	R	45	4.7	0.294	43.6	LOS D	1.6	11.4	0.97	0.74	28.1
Approach		1160	1.8	0.745	26.3	LOS B	13.7	97.3	0.90	0.85	36.6
All Vehicles		2397	1.9	0.776	26.2	LOS B	13.7	97.3	0.88	0.81	35.2

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model used.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow	Average Delay	Level of Service	Average Back of Queue Pedestrian	Average Back of Queue Distance	Prop. Queued	Effective Stop Rate
		ped/h	sec		ped	m		per ped
P1	Across S approach	53	27.5	LOS C	0.1	0.1	0.89	0.89
P3	Across E approach	53	25.7	LOS C	0.1	0.1	0.86	0.86
P5	Across N approach	53	23.2	LOS C	0.1	0.1	0.81	0.81
All Pedestrians		159	25.5	LOS C			0.85	0.85

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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MOVEMENT SUMMARY

Site: AM Peak

I-6 Warnervale Rd / Virginia Rd

Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	95% Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Virginia Rd (S)											
1	L	5	0.0	0.034	7.9	LOS A	0.1	0.8	0.31	0.54	42.0
2	T	5	0.0	0.034	6.6	LOS A	0.1	0.8	0.31	0.58	42.8
3	R	20	0.0	0.034	8.2	LOS A	0.1	0.8	0.31	0.67	41.8
Approach		30	0.0	0.034	7.9	LOS A	0.1	0.8	0.31	0.63	42.0
East: Warnervale Rd (E)											
4	L	10	0.0	0.081	8.4	LOS A	0.6	4.0	0.53	0.40	42.7
5	T	123	0.0	0.081	2.0	LOS A	0.6	4.0	0.53	0.00	43.7
6	R	14	0.0	0.081	8.7	LOS A	0.6	4.0	0.53	0.86	42.7
Approach		147	0.0	0.081	3.1	NA	0.6	4.0	0.53	0.11	43.5
North: Virginia Rd (S)											
7	L	5	0.0	0.088	9.0	LOS A	0.3	2.2	0.45	0.62	41.0
8	T	5	0.0	0.088	7.7	LOS A	0.3	2.2	0.45	0.62	41.7
9	R	53	7.5	0.088	9.5	LOS A	0.3	2.2	0.45	0.75	40.9
Approach		63	6.3	0.088	9.3	LOS A	0.3	2.2	0.45	0.73	40.9
West: Warnervale Rd (W)											
10	L	362	3.0	0.265	7.0	LOS A	1.7	12.4	0.52	0.32	41.8
11	T	120	6.7	0.265	0.5	LOS A	1.7	12.4	0.52	0.00	42.9
12	R	3	0.0	0.265	7.3	LOS A	1.7	12.4	0.52	0.63	41.9
Approach		485	3.9	0.265	5.4	NA	1.7	12.4	0.52	0.24	42.1
All Vehicles		725	3.2	0.265	5.4	NA	1.7	12.4	0.50	0.27	42.3

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

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MOVEMENT SUMMARY

Site: PM Peak

I-6 Warnervale Rd / Virginia Rd

Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	95% Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Virginia Rd (S)											
1	L	5	0.0	0.026	8.8	LOS A	0.1	0.6	0.45	0.63	41.2
2	T	5	0.0	0.026	7.5	LOS A	0.1	0.6	0.45	0.62	42.0
3	R	10	0.0	0.026	9.1	LOS A	0.1	0.6	0.45	0.73	41.1
Approach		20	0.0	0.026	8.6	LOS A	0.1	0.6	0.45	0.68	41.3
East: Warnervale Rd (E)											
4	L	20	0.0	0.220	7.0	LOS A	1.4	10.1	0.33	0.59	43.0
5	T	380	0.0	0.220	0.6	LOS A	1.4	10.1	0.33	0.00	46.0
6	R	22	0.0	0.220	7.4	LOS A	1.4	10.1	0.33	0.84	42.9
Approach		422	0.0	0.220	1.3	NA	1.4	10.1	0.33	0.07	45.7
North: Virginia Rd (S)											
7	L	5	0.0	0.138	9.5	LOS A	0.5	3.3	0.46	0.53	40.5
8	T	5	0.0	0.138	8.3	LOS A	0.5	3.3	0.46	0.67	41.2
9	R	82	0.0	0.138	9.9	LOS A	0.5	3.3	0.46	0.79	40.4
Approach		92	0.0	0.138	9.8	LOS A	0.5	3.3	0.46	0.77	40.4
West: Warnervale Rd (W)											
10	L	83	0.0	0.086	8.0	LOS A	0.6	4.2	0.63	0.27	41.9
11	T	75	2.7	0.086	1.5	LOS A	0.6	4.2	0.63	0.00	42.0
12	R	3	0.0	0.086	8.3	LOS A	0.6	4.2	0.63	0.76	42.1
Approach		161	1.2	0.086	5.0	NA	0.6	4.2	0.63	0.15	42.0
All Vehicles		695	0.3	0.220	3.5	NA	1.4	10.1	0.42	0.20	43.9

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

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MOVEMENT SUMMARY

Site: AM Peak final

I-7 Sparks Rd / New Warnervale Township Entry
Signals - Fixed Time Cycle Time = 150 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	95% Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Warnervale Township entry Extn (S)											
1	L	293	3.4	0.516	52.3	LOS D	17.4	125.6	0.87	0.82	24.2
2	T	40	5.0	0.215	64.6	LOS E	2.7	19.4	0.94	0.70	19.0
3	R	67	6.0	0.169	71.9	LOS F	2.4	17.7	0.93	0.73	20.0
Approach		400	4.0	0.516	56.8	LOS E	17.4	125.6	0.89	0.80	22.8
East: Sparks Rd (E)											
10	L	220	5.0	0.332	19.9	LOS B	5.0	36.8	0.60	0.75	41.5
11	T	1967	5.5	0.916	64.0	LOS E	53.8	394.5	1.00	1.05	22.9
12	R	52	3.8	0.308	87.3	LOS F	1.9	14.1	1.00	0.72	17.7
Approach		2239	5.4	0.916	60.2	LOS E	53.8	394.5	0.96	1.01	23.7
North: New Warnervale Township entry (N)											
1	L	248	5.2	0.359	39.1	LOS C	6.8	50.0	0.87	0.77	28.0
2	T	49	6.1	0.245	54.7	LOS D	3.0	22.0	0.87	0.66	21.0
3	R	306	3.6	0.905	87.9	LOS F	25.6	185.1	1.00	1.04	17.7
Approach		603	4.5	0.905	65.1	LOS E	25.6	185.1	0.94	0.90	21.2
West: Sparks Rd (W)											
4	L	349	6.6	0.427	16.3	LOS B	8.9	65.6	0.38	0.72	44.7
5	T	1400	6.3	0.512	27.8	LOS B	22.9	169.1	0.74	0.66	36.3
6	R	498	3.0	0.893	89.5	LOS F	20.5	147.2	1.00	0.97	17.5
Approach		2247	5.6	0.893	39.7	LOS C	22.9	169.1	0.74	0.74	30.3
All Vehicles		5489	5.3	0.916	52.1	LOS D	53.8	394.5	0.86	0.87	25.6

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model used.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow	Average Delay	Level of Service	Average Back of Queue Pedestrian	Average Back of Queue Distance	Prop. Queued	Effective Stop Rate
		ped/h	sec		ped	m		per ped
P1	Across S approach	53	33.3	LOS D	0.2	0.2	0.67	0.67
P2	Across S approach	53	31.4	LOS D	0.1	0.1	0.65	0.65
P7	Across E approach	53	59.9	LOS E	0.2	0.2	0.89	0.89
P8	Across E approach	53	55.5	LOS E	0.2	0.2	0.86	0.86
P1	Across N approach	53	31.4	LOS D	0.1	0.1	0.65	0.65
P2	Across N approach	53	31.4	LOS D	0.1	0.1	0.65	0.65
P3	Across W approach	53	69.1	LOS F	0.2	0.2	0.96	0.96
P4	Across W approach	53	64.4	LOS F	0.2	0.2	0.93	0.93
All Pedestrians		424	47.0	LOS E			0.78	0.78

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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MOVEMENT SUMMARY

Site: PM Peak final

I-7 Sparks Rd / New Warnervale Township Entry
Signals - Fixed Time Cycle Time = 120 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	95% Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Warnervale Township entry Extn (S)											
1	L	219	0.9	0.659	32.8	LOS C	8.6	60.6	0.71	0.77	30.3
2	T	38	7.9	0.137	48.2	LOS D	2.0	14.6	0.90	0.67	22.4
3	R	77	5.2	0.154	55.7	LOS D	2.1	15.6	0.90	0.73	23.3
Approach		334	2.7	0.659	39.9	LOS C	8.6	60.6	0.78	0.75	27.4
East: Sparks Rd (E)											
10	L	127	3.1	0.187	21.2	LOS B	2.5	17.8	0.69	0.75	40.4
11	T	1199	2.5	0.862	55.6	LOS D	25.2	180.3	1.00	0.99	25.0
12	R	194	4.1	0.717	71.9	LOS F	6.0	43.5	1.00	0.84	20.4
Approach		1520	2.8	0.862	54.8	LOS D	25.2	180.3	0.97	0.95	25.1
North: New Warnervale Township entry (N)											
1	L	61	0.0	0.067	26.2	LOS B	1.0	6.8	0.77	0.70	33.1
2	T	26	7.7	0.107	41.8	LOS C	1.2	9.2	0.84	0.61	24.1
3	R	318	2.8	0.873	68.1	LOS E	20.7	148.8	1.00	1.01	20.8
Approach		405	2.7	0.873	60.1	LOS E	20.7	148.8	0.95	0.94	22.2
West: Sparks Rd (W)											
4	L	395	1.8	0.480	19.5	LOS B	10.8	77.0	0.51	0.75	41.8
5	T	1608	3.0	0.747	34.9	LOS C	27.1	194.9	0.93	0.83	32.3
6	R	678	1.5	0.885	70.4	LOS E	22.5	159.5	1.00	0.98	20.8
Approach		2681	2.4	0.885	41.6	LOS C	27.1	194.9	0.89	0.86	29.3
All Vehicles		4940	2.6	0.885	47.1	LOS D	27.1	194.9	0.91	0.89	27.1

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model used.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow	Average Delay	Level of Service	Average Back of Queue Pedestrian	Average Back of Queue Distance	Prop. Queued	Effective Stop Rate
		ped/h	sec		ped	m		per ped
P1	Across S approach	53	40.0	LOS E	0.1	0.1	0.82	0.82
P2	Across S approach	53	37.6	LOS D	0.1	0.1	0.79	0.79
P7	Across E approach	53	48.6	LOS E	0.2	0.2	0.90	0.90
P8	Across E approach	53	44.2	LOS E	0.2	0.2	0.86	0.86
P1	Across N approach	53	37.6	LOS D	0.1	0.1	0.79	0.79
P2	Across N approach	53	37.6	LOS D	0.1	0.1	0.79	0.79
P3	Across W approach	53	54.2	LOS E	0.2	0.2	0.95	0.95
P4	Across W approach	53	49.5	LOS E	0.2	0.2	0.91	0.91
All Pedestrians		424	43.7	LOS E			0.85	0.85

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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MOVEMENT SUMMARY

Site: AM Peak

I-8 Warnervale Rd / Connector

Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	95% Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Access Rd (S)											
1	L	5	0.0	0.030	6.6	LOS A	0.2	1.1	0.55	0.55	42.2
2	T	3	0.0	0.030	5.7	LOS A	0.2	1.1	0.55	0.50	42.3
3	R	20	0.0	0.030	11.2	LOS A	0.2	1.1	0.55	0.69	40.0
Approach		28	0.0	0.030	9.8	LOS A	0.2	1.1	0.55	0.64	40.6
East: Warnervale Rd (E)											
4	L	10	0.0	0.290	5.0	LOS A	1.9	13.3	0.34	0.45	43.2
5	T	32	3.1	0.290	4.1	LOS A	1.9	13.3	0.34	0.38	43.6
6	R	342	2.6	0.290	9.6	LOS A	1.9	13.3	0.34	0.64	40.6
Approach		384	2.6	0.290	9.0	LOS A	1.9	13.3	0.34	0.61	40.9
North: Minnesota Rd Deviation (N)											
7	L	477	2.3	0.451	5.3	LOS A	3.4	24.5	0.44	0.50	43.0
8	T	3	0.0	0.451	4.3	LOS A	3.4	24.5	0.44	0.44	43.2
9	R	112	0.0	0.451	9.8	LOS A	3.4	24.5	0.44	0.70	40.8
Approach		592	1.9	0.451	6.2	LOS A	3.4	24.5	0.44	0.54	42.5
West: Warnervale Rd (W)											
10	L	36	0.0	0.153	6.3	LOS A	0.8	6.2	0.52	0.61	43.0
11	T	116	6.9	0.153	5.4	LOS A	0.8	6.2	0.52	0.54	43.1
12	R	3	0.0	0.153	10.8	LOS A	0.8	6.2	0.52	0.82	40.8
Approach		155	5.2	0.153	5.7	LOS A	0.8	6.2	0.52	0.56	43.0
All Vehicles		1159	2.5	0.451	7.1	LOS A	3.4	24.5	0.42	0.57	41.9

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model used.

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MOVEMENT SUMMARY

Site: PM Peak

I-8 Warnervale Rd / Connector

Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	95% Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Access Rd (S)											
1	L	5	0.0	0.023	7.9	LOS A	0.1	0.9	0.66	0.60	41.7
2	T	3	0.0	0.023	7.0	LOS A	0.1	0.9	0.66	0.56	41.7
3	R	10	0.0	0.023	12.5	LOS A	0.1	0.9	0.66	0.71	39.2
Approach		18	0.0	0.023	10.3	LOS A	0.1	0.9	0.66	0.66	40.3
East: Warnervale Rd (E)											
4	L	20	0.0	0.349	6.5	LOS A	2.3	16.0	0.59	0.63	42.0
5	T	76	0.0	0.349	5.5	LOS A	2.3	16.0	0.59	0.58	42.0
6	R	267	1.9	0.349	11.1	LOS A	2.3	16.0	0.59	0.75	40.1
Approach		363	1.4	0.349	9.7	LOS A	2.3	16.0	0.59	0.71	40.6
North: Minnesota Rd Deviation (N)											
7	L	517	3.9	0.587	5.0	LOS A	5.7	40.4	0.38	0.44	43.2
8	T	3	0.0	0.587	4.0	LOS A	5.7	40.4	0.38	0.37	43.5
9	R	343	0.0	0.587	9.5	LOS A	5.7	40.4	0.38	0.65	40.8
Approach		863	2.3	0.587	6.8	LOS A	5.7	40.4	0.38	0.52	42.1
West: Warnervale Rd (W)											
10	L	22	0.0	0.080	5.7	LOS A	0.4	3.1	0.45	0.55	43.2
11	T	62	3.2	0.080	4.7	LOS A	0.4	3.1	0.45	0.47	43.5
12	R	3	0.0	0.080	10.2	LOS A	0.4	3.1	0.45	0.78	41.2
Approach		87	2.3	0.080	5.2	LOS A	0.4	3.1	0.45	0.50	43.3
All Vehicles		1331	2.0	0.587	7.5	LOS A	5.7	40.4	0.44	0.58	41.7

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model used.

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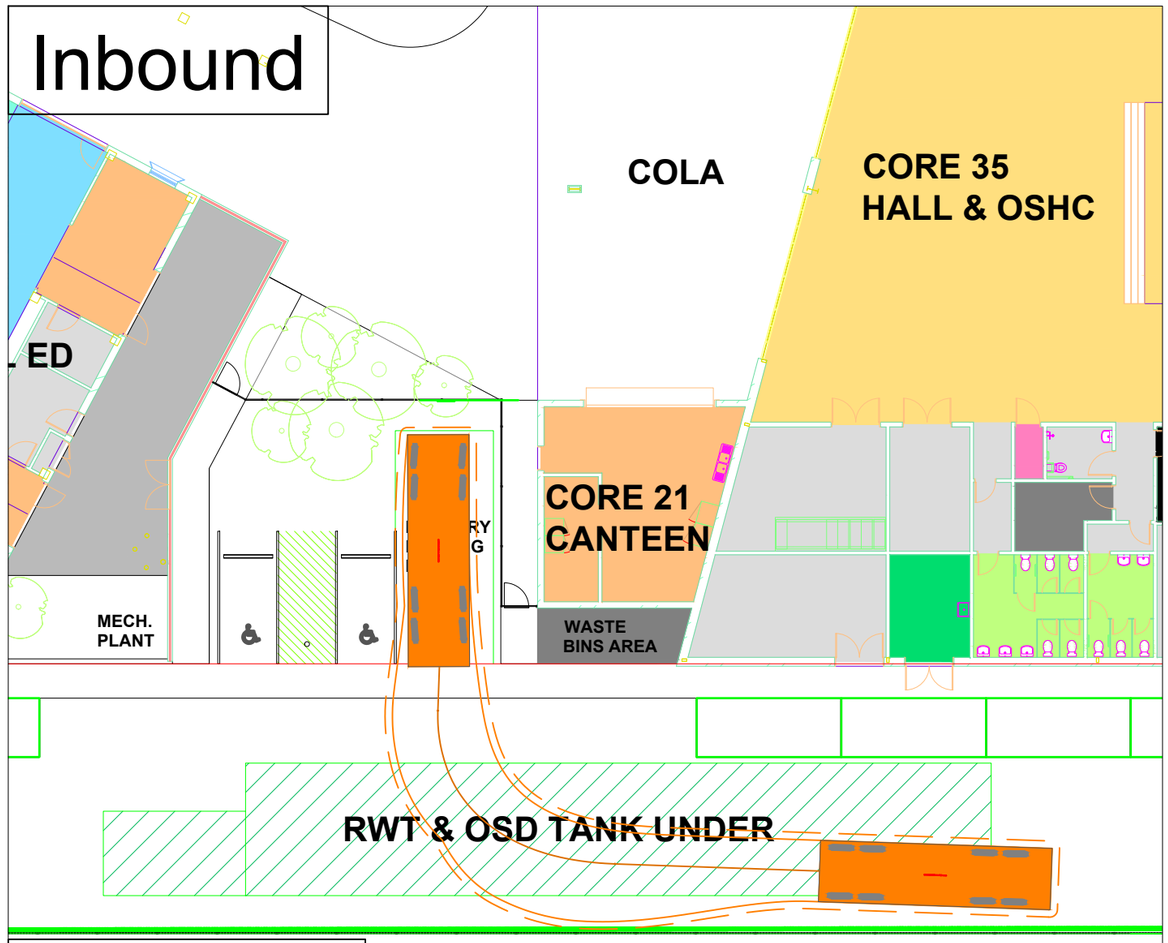
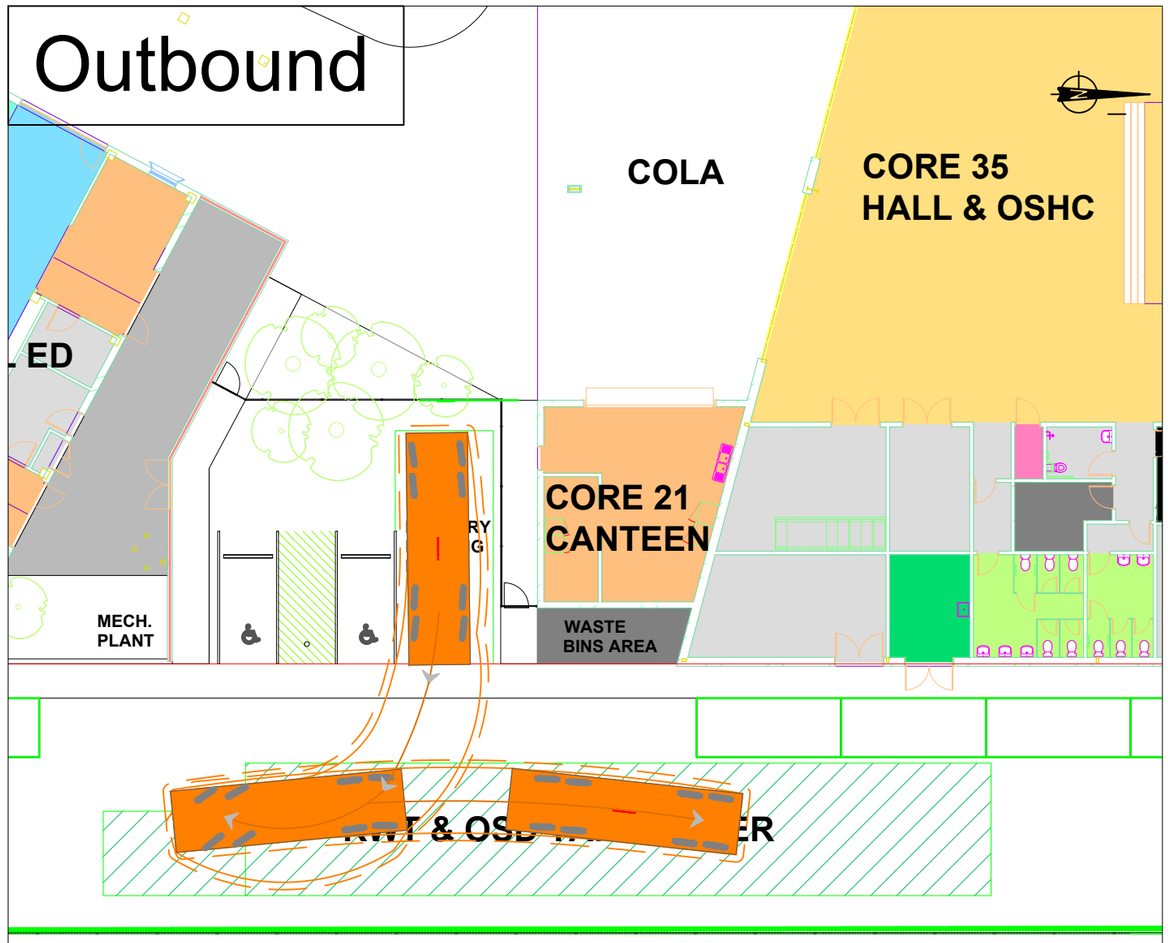
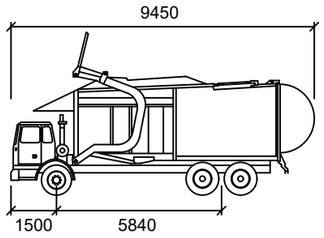
Appendix C Swept Paths of Service Vehicle / Waste Truck







9.45 Front Lifting Truck

	mm
Width	: 2500
Track	: 2220
Lock to Lock Time	: 6.0
Steering Angle	: 28.0

REV	DATE	DRN	CHK	DESCRIPTION
00	04/06/19	DA	----	----
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Warnervale Public School

Swept Path Assessment

9.45 metres Front Loader (Waste Collection Truck)

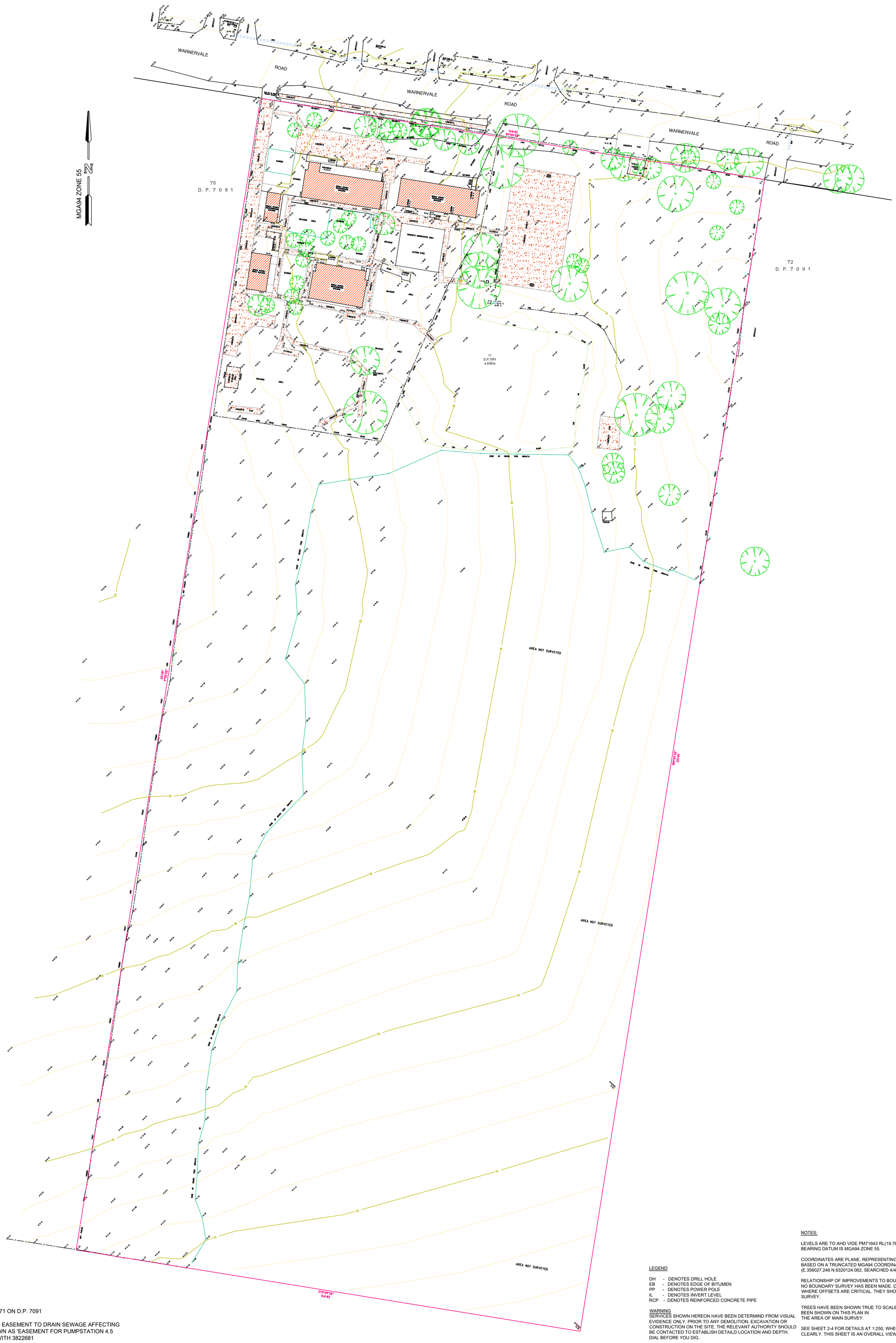
DRAWN: DA	---	---
DATE: 04-06-19	STATUS: ---	
SCALE: 1:250 @ A3		
DWG NO:15536 - 02SB - 190604		

Stantec

1

X:\brSYD\OldData\Australia Business\Australia Jobs\15500\15536 - Warnervale Public School - Traffic Assessment\DWGs\TDG\15536 - 02SB - 190604.dwg

Appendix D Approaching Sight Distance and Crossing Sight Distance for Pedestrian Crossing



TITLE DETAILS:

TITLE REF: LOT 71 ON D.P. 7091

EASEMENT: (A) - EASEMENT TO DRAIN SEWAGE AFFECTING THE PART SHOWN AS 'EASEMENT FOR PUMPSTATION 4.5 WIDE' IN PLAN WITH 3822681

LEGEND

DH - DENOTES DRILL HOLE
EB - DENOTES EDGE OF BITUMEN
PP - DENOTES POWER POLE
IL - DENOTES INVERT LEVEL
RCP - DENOTES REINFORCED CONCRETE PIPE

WARNING
SERVICES SHOWN HEREON HAVE BEEN DETERMIND FROM VISUAL EVIDENCE ONLY. PRIOR TO ANY DEMOLITION, EXCAVATION OR CONSTRUCTION ON THE SITE, THE RELEVANT AUTHORITY SHOULD BE CONTACTED TO ESTABLISH DETAILD LOCATION AND DEPTH. DIAL BEFORE YOU DIG.

NOTES:

LEVELS ARE TO AHD VIDE PM71643 RL(19.767) ON 4/4/2018.
BEARING DATUM IS MGA94 ZONE 55.

COORDINATES ARE PLANE, REPRESENTING MEASURED GROUND DISTANCES BASED ON A TRUNCATED MGA94 COORDINATE CENTRED FROM PM71643 (E.356027.246 N.6320124.062, SEARCHED 4/4/2018.)

RELATIONSHIP OF IMPROVEMENTS TO BOUNDARIES IS DIAGRAMMATIC ONLY. NO BOUNDARY SURVEY HAS BEEN MADE. DO NOT SCALE OFF THIS PLAN WHERE OFFSETS ARE CRITICAL. THEY SHOULD BE CONFIRMED BY A FURTHER SURVEY.

TREES HAVE BEEN SHOWN TRUE TO SCALE. MOST SIGNIFICANT TREES HAVE BEEN SHOWN ON THIS PLAN IN THE AREA OF MAIN SURVEY.

SEE SHEET 2-4 FOR DETAILS AT 1:250, WHERE DETAILS CAN BE VIEWED CLEARLY. THIS SHEET IS AN OVERALL VIEW ONLY.

SURVEYOR: A.S.
DRAWN: A.S.
CHECKED: J.K.

www.dialbeforeyoudig.com.au
DIAL 1100 BEFORE YOU DIG

VER	BY	AMENDMENTS	DATE
2			
3			
4			
5			

CLIENT: BILLARD LEECE PARTNERSHIP

DETAILS: FEATURE & LEVEL SURVEY

PROJECT: WARNERVALE PUBLIC SCHOOL
75 WARNERVALE ROAD,
WARNERVALE

Beveridge Williams
development & environment consultants
Miranda ph : 02 9524 4073
www.beveridgewilliams.com.au

SURVEYORS REF.
1702033
VERSION 1
DATE: 13/04/2018
SHEET 1 OF 4

ORIGINAL
SCALE 1:500
SHEET SIZE A1
0 5 10 15 20
LENGTHS ARE IN METRES

CAD REFERENCE: 1702033-180413-DET-V1

Approaching Sight Distance (ASD) of 58.8 metres

Crossing Sight Distance (CSD) of 111 metres

Notes:

The following requirements are obtained from section 3.3 of Austroads Guide to Road Design Part 4A: Unsignalised and Signalised Intersections (AGRD Part 4):

1) Approaching sight distance (ASD) should be provided between approaching vehicles (1.1m eye height) and the surface of the roadway (0 m) at the crossing.

2) Crossing sight distance(CSD) should be provided between approaching vehicles (1.1m eye height) and a pedestrian walking to cross the road. The pedestrian eye height should be taken as 1.07 m which represents the lower bound of the range applicable to a person in an A80 wheelchair.

Friday, May 31, 2019 15:23:46

REV	DATE	DRN	CHK	DESCRIPTION
00	31/05/19	DA	----	----
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Warnervale Public School
Pedestrian Crossing Assessment
Road Profile

DRAWN: DA | --- | ---
DATE: 19/02/19 | STATUS: ---
SCALE: 1:500 @ A3
DWG NO:15536 - 01SA - 190531

Stantec

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X:\brSYD\OldData\Australia Business\Australia Jobs\15500\15536 - Warnervale Public School - Traffic Assessment\DWGs\TDG\15536 - 01SA - 190531.dwg

Appendix E Concepts of Level of Service and Delay

Concepts of Carriageway Capacity and Level of Service

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

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

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

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

LEVELS OF SERVICE

A - Free flow (almost no delays)

B - Stable flow (slight delays)

C - Stable flow (acceptable delays)

D - Approaching unstable flow (tolerable delays)

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

F - Forced flow (jammed)

A service volume, as defined by Austroads, is the maximum number of vehicles that can pass over a given section of roadway in one direction during one hour while operating conditions are maintained at a specified level of service. It is suggested that ideally arterial and sub-arterial roads should not exceed service volumes at LoS 'C'. At this level, whilst most drivers are restricted in their freedom to manoeuvre, operating speeds are still reasonable and acceptable delays experienced. However, in urban situations, arterial and sub-arterial roads operating at LoS 'D' are still considered adequate. Traffic volumes along urban roads with interrupted and uninterrupted flow conditions are included in **Table C1** and **Table C2** respectively.

Table C1: Level of Service of Interrupted Flow Conditions along Urban Roads (One Way Hourly Volumes)

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

Table C2: Level of Service of Uninterrupted Flow Conditions along Urban Roads (One Way Hourly Volumes)

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

Guidelines for Evaluation of Intersection Operation

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

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

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

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

(d) Cycle length (traffic signals)

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

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

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

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

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

Table C3 sets out average delays for different levels of service. There is no consistent correlation between definitions of levels of service for road links as defined elsewhere in this section, and the ranges set out in Table C3. In assigning a level of service, the average delay to the motoring public needs to be considered, keeping in mind the location of the intersection. For example, drivers in inner urban areas of Sydney have a higher tolerance of delay than drivers in country areas. Table C3 provides a recommended baseline for assessment.

Table C3: Level of Service Criteria for Intersections

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

The figures in Table C3 are intended as a guide only. Any particular assessment should take into account site-specific factors including maximum queue lengths (and their effect on lane blocking), the influence of nearby intersections and the sensitivity of the location to delays. In many situations, a comparison of the current and future average delay provides a better appreciation of the impact of a proposal, and not simply the change in the level of service.

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

Although in some situations additional traffic does not alter the level of service, particularly where the level of service is 'E' or 'F', additional capacity may still be required. This is particularly appropriate for LoS 'F', where small increases in flow can cause disproportionately greater increases in delay. In this situation, it is advisable to consider means of control to maintain the existing level of absolute delay. Suggested criteria for the evaluation of the capacity of signalised intersections based on the DoS are summarised below in **Table C4**.

Table C4: Criteria for Evaluating Capacity of Signalised Intersections

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

Appendix F Sidra Results

MOVEMENT SUMMARY

Site: 101 [S1A-Albert Warner Road / Sparks Road-Base 2021-AM]

Albert Warner Road / Sparks Road
AM
Base 2021
Site Category: -
Signals - Fixed Time Isolated Cycle Time = 96 seconds (Site Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Albert Warner Dr												
1	L2	376	0.0	0.404	15.3	LOS B	8.8	61.5	0.61	0.74	0.61	47.5
2	T1	23	0.0	0.026	30.7	LOS C	0.4	2.9	0.80	0.56	0.80	40.1
3	R2	223	0.0	0.640	54.0	LOS D	5.4	37.7	1.00	0.82	1.08	31.9
Approach		622	0.0	0.640	29.7	LOS C	8.8	61.5	0.76	0.76	0.78	40.1
East: Sparks Road												
4	L2	275	0.0	0.194	7.1	LOS A	2.2	15.6	0.26	0.63	0.26	53.0
5	T1	1320	0.0	0.743	30.7	LOS C	20.6	144.0	0.93	0.82	0.95	40.0
6	R2	233	0.0	0.432	27.7	LOS B	3.1	22.0	0.95	0.77	0.95	41.1
Approach		1828	0.0	0.743	26.8	LOS B	20.6	144.0	0.83	0.79	0.84	41.7
North: Albert Warner Dr												
7	L2	73	0.0	0.171	37.8	LOS C	2.8	19.3	0.84	0.75	0.84	36.4
8	T1	36	0.0	0.040	30.9	LOS C	0.6	4.5	0.81	0.57	0.81	40.1
9	R2	336	0.0	0.964	77.8	LOS F	10.4	73.0	1.00	1.14	1.77	26.5
Approach		444	0.0	0.964	67.5	LOS E	10.4	73.0	0.96	1.03	1.54	28.5
West: Sparks Road												
10	L2	137	0.0	0.354	41.1	LOS C	5.6	39.0	0.90	0.78	0.90	35.2
11	T1	1129	0.0	0.635	28.7	LOS C	16.4	115.1	0.89	0.77	0.89	40.9
12	R2	304	0.0	0.873	61.9	LOS E	8.2	57.2	1.00	0.99	1.44	29.8
Approach		1570	0.0	0.873	36.3	LOS C	16.4	115.1	0.91	0.81	1.00	37.7
All Vehicles		4464	0.0	0.964	34.6	LOS C	20.6	144.0	0.86	0.82	0.96	38.3

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

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate
P1	South Full Crossing	53	42.3	LOS E	0.1	0.1	0.94	0.94
P3	North Full Crossing	53	42.3	LOS E	0.1	0.1	0.94	0.94
P4	West Full Crossing	53	42.3	LOS E	0.1	0.1	0.94	0.94
All Pedestrians		158	42.3	LOS E			0.94	0.94

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

MOVEMENT SUMMARY

Site: 101 [S1-Albert Warner Road / Sparks Road-Base 2021-PM]

Albert Warner Road / Sparks Road
AM
Base 2021
Site Category: -
Signals - Fixed Time Isolated Cycle Time = 94 seconds (Site Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Albert Warner Dr												
1	L2	232	0.0	0.201	8.1	LOS A	2.4	17.1	0.32	0.65	0.32	52.3
2	T1	14	0.0	0.015	29.5	LOS C	0.2	1.7	0.79	0.53	0.79	40.7
3	R2	158	0.0	0.666	56.6	LOS E	3.9	27.2	1.00	0.82	1.15	31.2
Approach		404	0.0	0.666	27.8	LOS B	3.9	27.2	0.60	0.71	0.66	41.0
East: Sparks Road												
4	L2	117	0.0	0.084	7.0	LOS A	0.9	6.0	0.24	0.61	0.24	53.1
5	T1	697	0.0	0.396	25.9	LOS B	9.0	63.3	0.81	0.68	0.81	42.2
6	R2	68	0.0	0.109	24.5	LOS B	0.8	5.7	0.87	0.71	0.87	42.6
Approach		882	0.0	0.396	23.3	LOS B	9.0	63.3	0.74	0.67	0.74	43.4
North: Albert Warner Dr												
7	L2	102	0.0	0.235	37.3	LOS C	3.8	26.9	0.85	0.76	0.85	36.6
8	T1	22	0.0	0.024	29.6	LOS C	0.4	2.7	0.79	0.55	0.79	40.6
9	R2	126	0.0	0.533	55.3	LOS D	3.0	21.3	1.00	0.76	1.02	31.5
Approach		251	0.0	0.533	45.7	LOS D	3.8	26.9	0.92	0.74	0.93	34.1
West: Sparks Road												
10	L2	175	0.0	0.465	41.9	LOS C	7.2	50.5	0.93	0.80	0.93	35.0
11	T1	1157	0.0	0.658	28.7	LOS C	16.7	117.1	0.90	0.78	0.90	40.9
12	R2	336	0.0	0.773	53.9	LOS D	8.2	57.5	1.00	0.90	1.20	31.8
Approach		1668	0.0	0.773	35.1	LOS C	16.7	117.1	0.92	0.80	0.96	38.1
All Vehicles		3204	0.0	0.773	31.8	LOS C	16.7	117.1	0.83	0.75	0.86	39.4

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

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate
P1	South Full Crossing	53	41.3	LOS E	0.1	0.1	0.94	0.94
P3	North Full Crossing	53	41.3	LOS E	0.1	0.1	0.94	0.94
P4	West Full Crossing	53	41.3	LOS E	0.1	0.1	0.94	0.94
All Pedestrians		158	41.3	LOS E			0.94	0.94

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

MOVEMENT SUMMARY

Site: 101 [S1-Warnervale Rd-Virginia Rd-Base -Year 2021-AM]

Warnervale Rd/ Virginia Rd
Base -Year 2021
AM Peak
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: RoadNameVirginia Road												
1	L2	5	0.0	0.044	6.0	LOS A	0.1	1.0	0.42	0.67	0.42	51.6
2	T1	5	0.0	0.044	7.2	LOS A	0.1	1.0	0.42	0.67	0.42	51.8
3	R2	20	0.0	0.044	9.0	LOS A	0.1	1.0	0.42	0.67	0.42	51.2
Approach		30	0.0	0.044	8.2	LOS A	0.1	1.0	0.42	0.67	0.42	51.3
East: Warnervale Road												
4	L2	10	0.0	0.162	6.8	LOS A	0.8	5.3	0.35	0.26	0.35	55.1
5	T1	157	0.0	0.162	0.8	LOS A	0.8	5.3	0.35	0.26	0.35	56.6
6	R2	102	0.0	0.162	6.7	LOS A	0.8	5.3	0.35	0.26	0.35	54.6
Approach		269	0.0	0.162	3.3	NA	0.8	5.3	0.35	0.26	0.35	55.7
North: Virginia Road												
7	L2	5	0.0	0.092	6.5	LOS A	0.3	2.2	0.50	0.75	0.50	51.1
8	T1	5	0.0	0.092	7.2	LOS A	0.3	2.2	0.50	0.75	0.50	51.3
9	R2	48	0.0	0.092	9.3	LOS A	0.3	2.2	0.50	0.75	0.50	50.7
Approach		58	0.0	0.092	8.9	LOS A	0.3	2.2	0.50	0.75	0.50	50.8
West: Warnervale Road												
10	L2	35	0.0	0.172	5.6	LOS A	0.0	0.2	0.01	0.07	0.01	57.7
11	T1	295	0.0	0.172	0.0	LOS A	0.0	0.2	0.01	0.07	0.01	59.3
12	R2	3	0.0	0.172	6.1	LOS A	0.0	0.2	0.01	0.07	0.01	57.1
Approach		333	0.0	0.172	0.6	NA	0.0	0.2	0.01	0.07	0.01	59.2
All Vehicles		690	0.0	0.172	2.7	NA	0.8	5.3	0.20	0.23	0.20	56.6

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

MOVEMENT SUMMARY

Site: 101 [S1-Warnervale Rd-Virginia Rd-Base-Year 2021-PM]

Warnervale Rd/ Virginia Rd
Base - Year 2021
PM Peak
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: RoadNameVirginia Road												
1	L2	5	0.0	0.030	6.6	LOS A	0.1	0.7	0.48	0.68	0.48	51.5
2	T1	5	0.0	0.030	7.6	LOS A	0.1	0.7	0.48	0.68	0.48	51.7
3	R2	10	0.0	0.030	9.5	LOS A	0.1	0.7	0.48	0.68	0.48	51.1
Approach		20	0.0	0.030	8.3	LOS A	0.1	0.7	0.48	0.68	0.48	51.3
East: Warnervale Road												
4	L2	20	0.0	0.232	6.3	LOS A	0.7	4.9	0.17	0.14	0.17	56.6
5	T1	336	0.0	0.232	0.3	LOS A	0.7	4.9	0.17	0.14	0.17	58.1
6	R2	80	0.0	0.232	6.3	LOS A	0.7	4.9	0.17	0.14	0.17	56.0
Approach		436	0.0	0.232	1.7	NA	0.7	4.9	0.17	0.14	0.17	57.6
North: Virginia Road												
7	L2	5	0.0	0.125	6.1	LOS A	0.4	2.9	0.51	0.78	0.51	50.6
8	T1	5	0.0	0.125	7.8	LOS A	0.4	2.9	0.51	0.78	0.51	50.8
9	R2	62	0.0	0.125	9.9	LOS A	0.4	2.9	0.51	0.78	0.51	50.3
Approach		72	0.0	0.125	9.5	LOS A	0.4	2.9	0.51	0.78	0.51	50.3
West: Warnervale Road												
10	L2	38	0.0	0.117	5.7	LOS A	0.0	0.3	0.02	0.11	0.02	57.3
11	T1	183	0.0	0.117	0.0	LOS A	0.0	0.3	0.02	0.11	0.02	58.9
12	R2	3	0.0	0.117	6.8	LOS A	0.0	0.3	0.02	0.11	0.02	56.7
Approach		224	0.0	0.117	1.1	NA	0.0	0.3	0.02	0.11	0.02	58.6
All Vehicles		752	0.0	0.232	2.4	NA	0.7	4.9	0.17	0.20	0.17	56.9

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

MOVEMENT SUMMARY

Site: 401 [S1-Warnervale Road- Minnesota Road-Base -Year 2021-AM]

Warnervale Road- Minnesota Road
Base -Year 2021
AM
Site Category: -
Signals - Fixed Time Isolated Cycle Time = 87 seconds (Site Optimum Cycle Time - Minimum Delay)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Minnesota road												
1	L2	171	0.0	0.205	13.7	LOS A	2.3	16.2	0.64	0.73	0.64	47.9
2	T1	135	0.0	0.301	15.9	LOS B	2.8	19.4	0.87	0.69	0.87	47.6
3	R2	23	0.0	0.307	54.9	LOS D	1.1	7.4	1.00	0.68	1.00	31.1
Approach		329	0.0	0.307	17.5	LOS B	2.8	19.4	0.76	0.71	0.76	46.0
East: Warnervale road												
4	L2	121	0.0	0.676	45.6	LOS D	8.1	56.9	1.00	0.85	1.07	34.4
5	T1	70	0.0	0.676	40.1	LOS C	8.1	56.9	1.00	0.85	1.07	35.0
6	R2	41	0.0	0.320	50.0	LOS D	1.8	12.4	0.99	0.73	0.99	32.3
Approach		232	0.0	0.676	44.7	LOS D	8.1	56.9	1.00	0.83	1.05	34.2
North: Minnesota road												
7	L2	143	0.0	0.358	37.9	LOS C	5.4	37.9	0.87	0.80	1.17	36.5
8	T1	283	0.0	0.695	19.3	LOS B	7.0	48.9	0.97	0.83	1.02	45.2
9	R2	19	0.0	0.695	24.3	LOS B	7.0	48.9	0.97	0.83	1.02	44.7
Approach		445	0.0	0.695	25.5	LOS B	7.0	48.9	0.94	0.82	1.07	42.0
West: Warnervale road												
10	L2	75	0.0	0.316	17.6	LOS B	4.3	30.3	0.77	0.68	0.77	47.7
11	T1	141	0.0	0.316	12.1	LOS A	4.3	30.3	0.77	0.68	0.77	48.8
12	R2	160	0.0	0.312	20.6	LOS B	3.5	24.5	0.83	0.77	0.83	44.0
Approach		376	0.0	0.316	16.8	LOS B	4.3	30.3	0.79	0.72	0.79	46.4
All Vehicles		1382	0.0	0.695	24.5	LOS B	8.1	56.9	0.87	0.77	0.92	42.4

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

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate
P1	South Full Crossing	53	37.8	LOS D	0.1	0.1	0.93	0.93
P2	East Full Crossing	53	37.8	LOS D	0.1	0.1	0.93	0.93
P3	North Full Crossing	53	16.4	LOS B	0.1	0.1	0.86	0.86
P4	West Full Crossing	53	37.8	LOS D	0.1	0.1	0.93	0.93

All Pedestrians	211	32.5	LOS D	0.92	0.92

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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MOVEMENT SUMMARY

Site: 401 [S1-Warnervale Road- Minnesota Road-Base-Year 2021-PM]

Warnervale Road- Minnesota Road
Base -Year 2021
AM
Site Category: -
Signals - Fixed Time Isolated Cycle Time = 85 seconds (Site Optimum Cycle Time - Minimum Delay)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Minnesota road												
1	L2	294	0.0	0.345	13.9	LOS A	4.3	29.9	0.68	0.76	0.68	47.8
2	T1	79	0.0	0.191	15.7	LOS B	1.6	10.9	0.86	0.66	0.86	47.7
3	R2	45	0.0	0.410	50.7	LOS D	2.0	13.7	1.00	0.73	1.00	32.2
Approach		418	0.0	0.410	18.2	LOS B	4.3	29.9	0.75	0.73	0.75	45.4
East: Warnervale road												
4	L2	60	0.0	0.510	42.5	LOS D	5.9	41.3	0.97	0.78	0.97	35.9
5	T1	89	0.0	0.510	37.0	LOS C	5.9	41.3	0.97	0.78	0.97	36.5
6	R2	17	0.0	0.130	47.8	LOS D	0.7	4.9	0.97	0.69	0.97	33.0
Approach		166	0.0	0.510	40.1	LOS C	5.9	41.3	0.97	0.77	0.97	35.9
North: Minnesota road												
7	L2	12	0.0	0.349	22.0	LOS B	2.7	18.9	0.89	0.71	0.89	45.9
8	T1	304	0.0	0.677	18.6	LOS B	5.1	35.5	0.95	0.78	0.98	45.5
9	R2	36	0.0	0.677	25.5	LOS B	5.1	35.5	0.98	0.83	1.04	43.7
Approach		352	0.0	0.677	19.4	LOS B	5.1	35.5	0.95	0.78	0.99	45.4
West: Warnervale road												
10	L2	101	0.0	0.208	16.4	LOS B	2.6	18.1	0.72	0.70	0.72	47.3
11	T1	42	0.0	0.208	10.8	LOS A	2.6	18.1	0.72	0.70	0.72	48.3
12	R2	103	0.0	0.196	19.7	LOS B	2.2	15.2	0.80	0.74	0.80	44.5
Approach		246	0.0	0.208	16.8	LOS B	2.6	18.1	0.75	0.71	0.75	46.2
All Vehicles		1182	0.0	0.677	21.4	LOS B	5.9	41.3	0.84	0.75	0.85	43.9

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

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate
P1	South Full Crossing	53	36.8	LOS D	0.1	0.1	0.93	0.93
P2	East Full Crossing	53	36.8	LOS D	0.1	0.1	0.93	0.93
P3	North Full Crossing	53	15.9	LOS B	0.1	0.1	0.86	0.86
P4	West Full Crossing	53	36.8	LOS D	0.1	0.1	0.93	0.93

All Pedestrians	211	31.6	LOS D	0.91	0.91

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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MOVEMENT SUMMARY

Site: 101 [S2A-Albert Warner Road / Sparks Road-Future with 460 students-Year 2022 AM]

Albert Warner Road / Sparks Road
AM
Year 2022
Site Category: -
Signals - Fixed Time Isolated Cycle Time = 102 seconds (Site Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Albert Warner Dr												
1	L2	455	0.0	0.475	16.7	LOS B	12.0	84.2	0.65	0.76	0.65	46.6
2	T1	28	0.0	0.032	33.0	LOS C	0.5	3.8	0.81	0.57	0.81	39.2
3	R2	270	0.0	0.741	58.4	LOS E	7.1	49.7	1.00	0.87	1.17	30.7
Approach		753	0.0	0.741	32.3	LOS C	12.0	84.2	0.78	0.79	0.84	39.1
East: Sparks Road												
4	L2	284	0.0	0.209	7.9	LOS A	3.0	20.8	0.30	0.64	0.30	52.5
5	T1	1320	0.0	0.789	35.7	LOS C	23.2	162.1	0.95	0.87	1.00	38.0
6	R2	233	0.0	0.357	27.3	LOS B	3.2	22.4	0.91	0.77	0.91	41.3
Approach		1837	0.0	0.789	30.3	LOS C	23.2	162.1	0.85	0.82	0.88	40.1
North: Albert Warner Dr												
7	L2	73	0.0	0.173	40.1	LOS C	2.9	20.5	0.84	0.75	0.84	35.6
8	T1	49	0.0	0.056	33.3	LOS C	1.0	6.7	0.81	0.59	0.81	39.0
9	R2	336	0.0	0.922	70.9	LOS F	10.1	70.8	1.00	1.06	1.56	27.8
Approach		458	0.0	0.922	61.9	LOS E	10.1	70.8	0.96	0.96	1.37	29.8
West: Sparks Road												
10	L2	137	0.0	0.376	44.5	LOS D	6.0	42.1	0.91	0.79	0.91	34.1
11	T1	1129	0.0	0.675	32.4	LOS C	18.0	125.9	0.91	0.79	0.91	39.3
12	R2	429	0.0	0.906	67.0	LOS E	12.7	88.7	1.00	1.04	1.46	28.6
Approach		1695	0.0	0.906	42.1	LOS C	18.0	125.9	0.93	0.85	1.05	35.5
All Vehicles		4743	0.0	0.922	37.9	LOS C	23.2	162.1	0.88	0.84	0.98	37.0

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

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate
P1	South Full Crossing	53	45.3	LOS E	0.1	0.1	0.94	0.94
P3	North Full Crossing	53	45.3	LOS E	0.1	0.1	0.94	0.94
P4	West Full Crossing	53	45.3	LOS E	0.1	0.1	0.94	0.94
All Pedestrians		158	45.3	LOS E			0.94	0.94

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

MOVEMENT SUMMARY

Site: 101 [S2A-Albert Warner Road / Sparks Road-Future with 460 students-Year 2022-PM]

Albert Warner Road / Sparks Road
AM
Future
Site Category: -
Signals - Fixed Time Isolated Cycle Time = 96 seconds (Site Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Albert Warner Dr												
1	L2	296	0.0	0.256	8.2	LOS A	3.3	23.1	0.33	0.65	0.33	52.2
2	T1	18	0.0	0.020	30.6	LOS C	0.3	2.3	0.80	0.55	0.80	40.2
3	R2	196	0.0	0.844	62.2	LOS E	5.2	36.5	1.00	0.94	1.44	29.8
Approach		510	0.0	0.844	29.7	LOS C	5.2	36.5	0.61	0.76	0.78	40.1
East: Sparks Road												
4	L2	123	0.0	0.090	7.6	LOS A	1.1	7.6	0.27	0.62	0.27	52.7
5	T1	697	0.0	0.392	26.2	LOS B	9.2	64.2	0.81	0.68	0.81	42.1
6	R2	68	0.0	0.105	24.5	LOS B	0.8	5.6	0.86	0.71	0.86	42.7
Approach		888	0.0	0.392	23.5	LOS B	9.2	64.2	0.74	0.67	0.74	43.4
North: Albert Warner Dr												
7	L2	102	0.0	0.240	38.4	LOS C	3.9	27.6	0.86	0.76	0.86	36.2
8	T1	31	0.0	0.034	30.8	LOS C	0.6	3.9	0.80	0.57	0.80	40.1
9	R2	126	0.0	0.544	56.5	LOS D	3.1	21.8	1.00	0.76	1.03	31.2
Approach		259	0.0	0.544	46.3	LOS D	3.9	27.6	0.92	0.74	0.94	33.9
West: Sparks Road												
10	L2	175	0.0	0.452	42.0	LOS C	7.3	51.1	0.92	0.80	0.92	34.9
11	T1	1157	0.0	0.651	28.9	LOS C	17.0	118.8	0.89	0.77	0.89	40.8
12	R2	416	0.0	0.896	62.7	LOS E	11.5	80.3	1.00	1.04	1.45	29.6
Approach		1748	0.0	0.896	38.3	LOS C	17.0	118.8	0.92	0.84	1.03	36.9
All Vehicles		3405	0.0	0.896	33.7	LOS C	17.0	118.8	0.83	0.77	0.91	38.6

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

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate
P1	South Full Crossing	53	42.3	LOS E	0.1	0.1	0.94	0.94
P3	North Full Crossing	53	42.3	LOS E	0.1	0.1	0.94	0.94
P4	West Full Crossing	53	42.3	LOS E	0.1	0.1	0.94	0.94
All Pedestrians		158	42.3	LOS E			0.94	0.94

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

MOVEMENT SUMMARY

Site: 101 [S2-Warnervale Rd-Virginia Rd-Future(460)-Year 2022-AM]

Warnervale Rd/ Virginia Rd
Future with 460 Students - Year 2022
AM Peak
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: RoadNameVirginia Road												
1	L2	8	0.0	0.061	6.4	LOS A	0.2	1.4	0.51	0.75	0.51	50.3
2	T1	5	0.0	0.061	9.5	LOS A	0.2	1.4	0.51	0.75	0.51	50.5
3	R2	20	0.0	0.061	11.5	LOS A	0.2	1.4	0.51	0.75	0.51	49.9
Approach		33	0.0	0.061	10.0	LOS A	0.2	1.4	0.51	0.75	0.51	50.1
East: Warnervale Road												
4	L2	20	0.0	0.234	7.6	LOS A	1.1	7.5	0.35	0.20	0.35	55.5
5	T1	267	0.0	0.234	1.0	LOS A	1.1	7.5	0.35	0.20	0.35	56.9
6	R2	102	0.0	0.234	7.7	LOS A	1.1	7.5	0.35	0.20	0.35	54.9
Approach		389	0.0	0.234	3.1	NA	1.1	7.5	0.35	0.20	0.35	56.3
North: Virginia Road												
7	L2	5	0.0	0.207	7.2	LOS A	0.7	5.0	0.66	0.86	0.68	48.9
8	T1	5	0.0	0.207	9.8	LOS A	0.7	5.0	0.66	0.86	0.68	49.1
9	R2	82	0.0	0.207	12.5	LOS A	0.7	5.0	0.66	0.86	0.68	48.6
Approach		92	0.0	0.207	12.1	LOS A	0.7	5.0	0.66	0.86	0.68	48.6
West: Warnervale Road												
10	L2	49	0.0	0.240	5.6	LOS A	0.1	0.4	0.01	0.07	0.01	57.7
11	T1	411	0.0	0.240	0.0	LOS A	0.1	0.4	0.01	0.07	0.01	59.3
12	R2	4	0.0	0.240	6.7	LOS A	0.1	0.4	0.01	0.07	0.01	57.1
Approach		464	0.0	0.240	0.7	NA	0.1	0.4	0.01	0.07	0.01	59.1
All Vehicles		978	0.0	0.240	3.0	NA	1.1	7.5	0.23	0.22	0.23	56.5

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

MOVEMENT SUMMARY

Site: 101 [S2-Warnervale Rd-Virginia Rd-Future(460)-Year 2022-PM]

Warnervale Rd/ Virginia Rd
Future with 500 Students
PM Peak
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: RoadNameVirginia Road												
1	L2	7	0.0	0.047	7.3	LOS A	0.1	1.0	0.61	0.79	0.61	49.7
2	T1	5	0.0	0.047	11.2	LOS A	0.1	1.0	0.61	0.79	0.61	49.8
3	R2	10	0.0	0.047	13.4	LOS A	0.1	1.0	0.61	0.79	0.61	49.3
Approach		22	0.0	0.047	10.9	LOS A	0.1	1.0	0.61	0.79	0.61	49.5
East: Warnervale Road												
4	L2	20	0.0	0.314	7.5	LOS A	1.0	6.8	0.21	0.11	0.21	56.7
5	T1	476	0.0	0.314	0.5	LOS A	1.0	6.8	0.21	0.11	0.21	58.2
6	R2	80	0.0	0.314	7.6	LOS A	1.0	6.8	0.21	0.11	0.21	56.1
Approach		576	0.0	0.314	1.7	NA	1.0	6.8	0.21	0.11	0.21	57.8
North: Virginia Road												
7	L2	5	0.0	0.252	7.3	LOS A	0.9	6.2	0.73	0.90	0.82	47.2
8	T1	5	0.0	0.252	12.2	LOS A	0.9	6.2	0.73	0.90	0.82	47.4
9	R2	82	0.0	0.252	15.3	LOS B	0.9	6.2	0.73	0.90	0.82	46.9
Approach		92	0.0	0.252	14.7	LOS B	0.9	6.2	0.73	0.90	0.82	47.0
West: Warnervale Road												
10	L2	70	0.0	0.216	5.8	LOS A	0.1	0.7	0.03	0.11	0.03	57.3
11	T1	337	0.0	0.216	0.1	LOS A	0.1	0.7	0.03	0.11	0.03	58.9
12	R2	6	0.0	0.216	7.9	LOS A	0.1	0.7	0.03	0.11	0.03	56.7
Approach		413	0.0	0.216	1.2	NA	0.1	0.7	0.03	0.11	0.03	58.6
All Vehicles		1103	0.0	0.314	2.8	NA	1.0	6.8	0.20	0.19	0.20	56.8

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

MOVEMENT SUMMARY

Site: 401 [S2-Warnervale Road- Minnesota Road-Future with 460 students-Year 2022-AM]

Warnervale Road- Minnesota Road
Year 2022
AM
Site Category: -
Signals - Fixed Time Isolated Cycle Time = 88 seconds (Site Optimum Cycle Time - Minimum Delay)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Minnesota road												
1	L2	243	0.0	0.281	13.7	LOS A	3.4	23.9	0.65	0.74	0.65	47.9
2	T1	135	0.0	0.290	15.6	LOS B	2.7	19.2	0.86	0.68	0.86	47.8
3	R2	23	0.0	0.224	52.5	LOS D	1.0	7.2	0.99	0.70	0.99	31.7
Approach		401	0.0	0.290	16.6	LOS B	3.4	23.9	0.74	0.72	0.74	46.5
East: Warnervale road												
4	L2	121	0.0	0.700	44.1	LOS D	9.4	65.7	0.98	0.86	1.07	35.1
5	T1	100	0.0	0.700	38.6	LOS C	9.4	65.7	0.98	0.86	1.07	35.7
6	R2	41	0.0	0.324	50.6	LOS D	1.8	12.6	0.99	0.73	0.99	32.2
Approach		262	0.0	0.700	43.0	LOS D	9.4	65.7	0.99	0.84	1.05	34.8
North: Minnesota road												
7	L2	143	0.0	0.391	40.3	LOS C	5.7	40.0	0.90	0.81	1.21	35.7
8	T1	283	0.0	0.746	21.3	LOS B	7.3	51.4	0.98	0.86	1.09	44.0
9	R2	27	0.0	0.746	26.2	LOS B	7.3	51.4	0.99	0.87	1.09	43.7
Approach		453	0.0	0.746	27.6	LOS B	7.3	51.4	0.96	0.85	1.13	41.0
West: Warnervale road												
10	L2	98	0.0	0.418	18.1	LOS B	5.7	40.2	0.80	0.71	0.80	47.4
11	T1	184	0.0	0.418	12.6	LOS A	5.7	40.2	0.80	0.71	0.80	48.5
12	R2	209	0.0	0.413	21.7	LOS B	5.0	34.7	0.86	0.78	0.86	43.5
Approach		491	0.0	0.418	17.6	LOS B	5.7	40.2	0.83	0.74	0.83	46.1
All Vehicles		1607	0.0	0.746	24.3	LOS B	9.4	65.7	0.87	0.78	0.93	42.4

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

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate
P1	South Full Crossing	53	38.3	LOS D	0.1	0.1	0.93	0.93
P2	East Full Crossing	53	38.3	LOS D	0.1	0.1	0.93	0.93
P3	North Full Crossing	53	16.5	LOS B	0.1	0.1	0.87	0.87
P4	West Full Crossing	53	38.3	LOS D	0.1	0.1	0.93	0.93

All Pedestrians	211	32.9	LOS D	0.92	0.92

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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MOVEMENT SUMMARY

Site: 401 [S2-Warnervale Road- Minnesota Road-Future with 460 students-Year 2022-PM]

Warnervale Road- Minnesota Road
Year 2022
PM
Site Category: -
Signals - Fixed Time Isolated Cycle Time = 88 seconds (Site Optimum Cycle Time - Minimum Delay)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Minnesota road												
1	L2	392	0.0	0.442	14.2	LOS A	6.1	42.6	0.70	0.77	0.70	47.6
2	T1	79	0.0	0.178	15.6	LOS B	1.6	11.1	0.84	0.65	0.84	47.8
3	R2	45	0.0	0.360	50.9	LOS D	2.0	13.9	0.99	0.74	0.99	32.2
Approach		516	0.0	0.442	17.6	LOS B	6.1	42.6	0.75	0.75	0.75	45.7
East: Warnervale road												
4	L2	60	0.0	0.589	43.8	LOS D	7.4	51.7	0.98	0.80	0.98	35.6
5	T1	119	0.0	0.589	38.3	LOS C	7.4	51.7	0.98	0.80	0.98	36.2
6	R2	17	0.0	0.115	48.1	LOS D	0.7	5.0	0.96	0.69	0.96	32.9
Approach		196	0.0	0.589	40.9	LOS C	7.4	51.7	0.98	0.79	0.98	35.7
North: Minnesota road												
7	L2	12	0.0	0.380	22.4	LOS B	3.2	22.1	0.90	0.72	0.90	45.7
8	T1	304	0.0	0.726	19.7	LOS B	5.3	37.2	0.95	0.79	1.01	44.8
9	R2	48	0.0	0.726	27.7	LOS B	5.3	37.2	1.00	0.86	1.11	42.6
Approach		364	0.0	0.726	20.9	LOS B	5.3	37.2	0.95	0.80	1.02	44.5
West: Warnervale road												
10	L2	132	0.0	0.347	17.7	LOS B	4.6	32.1	0.78	0.72	0.78	46.9
11	T1	100	0.0	0.347	12.2	LOS A	4.6	32.1	0.78	0.72	0.78	47.9
12	R2	169	0.0	0.320	21.0	LOS B	3.9	27.3	0.83	0.77	0.83	44.0
Approach		401	0.0	0.347	17.7	LOS B	4.6	32.1	0.80	0.74	0.80	45.9
All Vehicles		1477	0.0	0.726	21.5	LOS B	7.4	51.7	0.84	0.77	0.86	43.8

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

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate
P1	South Full Crossing	53	38.3	LOS D	0.1	0.1	0.93	0.93
P2	East Full Crossing	53	38.3	LOS D	0.1	0.1	0.93	0.93
P3	North Full Crossing	53	16.5	LOS B	0.1	0.1	0.87	0.87
P4	West Full Crossing	53	38.3	LOS D	0.1	0.1	0.93	0.93

All Pedestrians	211	32.9	LOS D	0.92	0.92

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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MOVEMENT SUMMARY

Site: 101 [S3-Albert Warner Road / Sparks Road-Future with 460 students-Year 2031-AM]

Albert Warner Road / Sparks Road
AM
Year 2031
Site Category: -
Signals - Fixed Time Isolated Cycle Time = 152 seconds (Site Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Albert Warner Dr												
1	L2	476	0.0	0.482	23.0	LOS B	19.1	134.0	0.64	0.77	0.64	43.2
2	T1	454	0.0	0.553	57.8	LOS E	15.0	105.3	0.95	0.79	0.95	31.2
3	R2	544	0.0	0.856	80.0	LOS F	21.4	150.1	1.00	0.94	1.18	26.1
Approach		1474	0.0	0.856	54.8	LOS D	21.4	150.1	0.87	0.84	0.94	31.7
East: Sparks Road												
4	L2	556	0.0	0.501	17.3	LOS B	18.3	128.2	0.60	0.76	0.60	46.3
5	T1	1520	0.0	0.858	64.1	LOS E	31.2	218.4	0.99	0.94	1.09	29.4
6	R2	599	0.0	0.653	46.6	LOS D	15.9	111.3	0.95	0.87	1.05	34.1
Approach		2675	0.0	0.858	50.5	LOS D	31.2	218.4	0.90	0.88	0.98	32.9
North: Albert Warner Dr												
7	L2	97	0.0	0.122	19.9	LOS B	2.4	17.1	0.63	0.72	0.63	44.3
8	T1	342	0.0	0.417	55.8	LOS D	11.0	76.8	0.91	0.75	0.91	31.7
9	R2	575	0.0	0.905	87.1	LOS F	24.0	168.2	1.00	0.99	1.27	24.9
Approach		1014	0.0	0.905	70.1	LOS E	24.0	168.2	0.94	0.88	1.09	28.1
West: Sparks Road												
10	L2	298	0.0	0.387	22.4	LOS B	7.8	54.5	0.74	0.78	0.74	43.0
11	T1	1444	0.0	0.815	60.5	LOS E	28.2	197.7	0.99	0.90	1.05	30.3
12	R2	852	0.0	0.926	75.8	LOS F	32.7	229.2	1.00	1.04	1.41	26.9
Approach		2594	0.0	0.926	61.2	LOS E	32.7	229.2	0.96	0.93	1.13	30.0
All Vehicles		7756	0.0	0.926	57.4	LOS E	32.7	229.2	0.92	0.89	1.04	31.0

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

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate
P1	South Full Crossing	53	70.3	LOS F	0.2	0.2	0.96	0.96
P3	North Full Crossing	53	70.3	LOS F	0.2	0.2	0.96	0.96
P4	West Full Crossing	53	70.3	LOS F	0.2	0.2	0.96	0.96
All Pedestrians		158	70.3	LOS F			0.96	0.96

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

MOVEMENT SUMMARY

Site: 101 [S3-Albert Warner Road / Sparks Road-Future with 460 students-Year 2031-PM]

Albert Warner Road / Sparks Road
PM
Year 2031
Site Category: -
Signals - Fixed Time Isolated Cycle Time = 120 seconds (Site Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Albert Warner Dr												
1	L2	746	0.0	0.679	12.9	LOS A	21.8	152.6	0.63	0.78	0.63	49.0
2	T1	354	0.0	0.375	41.0	LOS C	8.7	60.6	0.88	0.73	0.88	36.2
3	R2	448	0.0	0.905	75.3	LOS F	15.2	106.6	1.00	1.02	1.39	27.1
Approach		1548	0.0	0.905	37.4	LOS C	21.8	152.6	0.79	0.84	0.91	37.2
East: Sparks Road												
4	L2	355	0.0	0.279	9.0	LOS A	4.8	33.6	0.37	0.67	0.37	51.7
5	T1	951	0.0	0.461	37.8	LOS C	12.3	86.0	0.87	0.73	0.87	37.2
6	R2	207	0.0	0.311	31.2	LOS C	3.5	24.2	0.90	0.76	0.90	39.7
Approach		1513	0.0	0.461	30.2	LOS C	12.3	86.0	0.76	0.72	0.76	40.2
North: Albert Warner Dr												
7	L2	655	0.0	0.920	43.8	LOS D	31.5	220.3	1.00	0.98	1.23	34.3
8	T1	305	0.0	0.324	40.4	LOS C	7.4	51.6	0.87	0.71	0.87	36.4
9	R2	263	0.0	0.531	59.3	LOS E	7.4	51.7	0.98	0.80	0.98	30.6
Approach		1223	0.0	0.920	46.3	LOS D	31.5	220.3	0.96	0.87	1.09	33.9
West: Sparks Road												
10	L2	541	0.0	0.699	22.8	LOS B	15.7	109.9	0.88	0.85	0.90	42.8
11	T1	1157	0.0	0.561	39.1	LOS C	15.5	108.3	0.90	0.76	0.90	36.7
12	R2	446	0.0	0.652	33.2	LOS C	8.0	56.2	0.98	0.82	0.98	38.9
Approach		2144	0.0	0.699	33.8	LOS C	15.7	109.9	0.91	0.80	0.91	38.5
All Vehicles		6428	0.0	0.920	36.2	LOS C	31.5	220.3	0.86	0.80	0.91	37.6

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

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate
P1	South Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P3	North Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P4	West Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
All Pedestrians		158	54.3	LOS E			0.95	0.95

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

MOVEMENT SUMMARY

Site: 101 [S3-Warnervale Rd-Virginia Rd-Future(460)-Year 2031-AM]

Warnervale Rd/ Virginia Rd
Future with 460 Students
AM Peak
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: RoadNameVirginia Road												
1	L2	9	0.0	0.052	6.3	LOS A	0.2	1.2	0.46	0.70	0.46	51.3
2	T1	5	0.0	0.052	8.7	LOS A	0.2	1.2	0.46	0.70	0.46	51.5
3	R2	20	0.0	0.052	9.6	LOS A	0.2	1.2	0.46	0.70	0.46	50.9
Approach		34	0.0	0.052	8.6	LOS A	0.2	1.2	0.46	0.70	0.46	51.1
East: Warnervale Road												
4	L2	10	0.0	0.132	6.2	LOS A	0.0	0.3	0.02	0.03	0.02	58.0
5	T1	250	0.0	0.132	0.0	LOS A	0.0	0.3	0.02	0.03	0.02	59.6
6	R2	3	0.0	0.132	7.7	LOS A	0.0	0.3	0.02	0.03	0.02	57.4
Approach		263	0.0	0.132	0.4	NA	0.0	0.3	0.02	0.03	0.02	59.5
North: Virginia Road												
7	L2	5	0.0	0.193	6.9	LOS A	0.7	4.6	0.59	0.83	0.59	49.9
8	T1	5	0.0	0.193	8.4	LOS A	0.7	4.6	0.59	0.83	0.59	50.1
9	R2	91	0.0	0.193	10.9	LOS A	0.7	4.6	0.59	0.83	0.59	49.6
Approach		101	0.0	0.193	10.5	LOS A	0.7	4.6	0.59	0.83	0.59	49.6
West: Warnervale Road												
10	L2	137	0.0	0.259	5.6	LOS A	0.1	0.4	0.01	0.17	0.01	56.9
11	T1	356	0.0	0.259	0.0	LOS A	0.1	0.4	0.01	0.17	0.01	58.4
12	R2	4	0.0	0.259	6.6	LOS A	0.1	0.4	0.01	0.17	0.01	56.3
Approach		497	0.0	0.259	1.6	NA	0.1	0.4	0.01	0.17	0.01	58.0
All Vehicles		895	0.0	0.259	2.5	NA	0.7	4.6	0.10	0.22	0.10	57.0

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

MOVEMENT SUMMARY

Site: 101 [S3-Warnervale Rd-Virginia Rd-Future(460)-Year 2031-PM]

Warnervale Rd/ Virginia Rd
Future with 460 Students
PM Peak
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: RoadNameVirginia Road												
1	L2	7	0.0	0.042	7.4	LOS A	0.1	1.0	0.58	0.77	0.58	50.2
2	T1	5	0.0	0.042	10.6	LOS A	0.1	1.0	0.58	0.77	0.58	50.3
3	R2	10	0.0	0.042	12.0	LOS A	0.1	1.0	0.58	0.77	0.58	49.8
Approach		22	0.0	0.042	10.2	LOS A	0.1	1.0	0.58	0.77	0.58	50.0
East: Warnervale Road												
4	L2	20	0.0	0.258	5.9	LOS A	0.0	0.3	0.01	0.03	0.01	58.1
5	T1	495	0.0	0.258	0.0	LOS A	0.0	0.3	0.01	0.03	0.01	59.7
6	R2	3	0.0	0.258	7.7	LOS A	0.0	0.3	0.01	0.03	0.01	57.5
Approach		518	0.0	0.258	0.3	NA	0.0	0.3	0.01	0.03	0.01	59.6
North: Virginia Road												
7	L2	5	0.0	0.307	7.5	LOS A	1.2	8.2	0.72	0.92	0.86	47.5
8	T1	5	0.0	0.307	11.8	LOS A	1.2	8.2	0.72	0.92	0.86	47.6
9	R2	112	0.0	0.307	14.7	LOS B	1.2	8.2	0.72	0.92	0.86	47.1
Approach		122	0.0	0.307	14.3	LOS A	1.2	8.2	0.72	0.92	0.86	47.2
West: Warnervale Road												
10	L2	133	0.0	0.233	5.7	LOS A	0.1	0.6	0.03	0.18	0.03	56.7
11	T1	306	0.0	0.233	0.1	LOS A	0.1	0.6	0.03	0.18	0.03	58.2
12	R2	5	0.0	0.233	8.2	LOS A	0.1	0.6	0.03	0.18	0.03	56.1
Approach		444	0.0	0.233	1.8	NA	0.1	0.6	0.03	0.18	0.03	57.7
All Vehicles		1106	0.0	0.307	2.7	NA	1.2	8.2	0.11	0.20	0.12	57.0

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

MOVEMENT SUMMARY

Site: 401 [S3-Warnervale Road- Minnesota Road-Future with 460 students-Year 2031-AM]

Warnervale Road- Minnesota Road
Future
Year 2031
Site Category: -
Signals - Fixed Time Isolated Cycle Time = 106 seconds (Site Optimum Cycle Time - Minimum Delay)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Minnesota road												
1	L2	243	0.0	0.248	13.0	LOS A	3.7	25.6	0.58	0.73	0.58	48.3
2	T1	135	0.0	0.319	19.8	LOS B	3.4	23.7	0.88	0.70	0.88	45.3
3	R2	23	0.0	0.140	54.8	LOS D	1.1	7.9	0.95	0.71	0.95	31.1
Approach		401	0.0	0.319	17.7	LOS B	3.7	25.6	0.70	0.72	0.70	45.8
East: Warnervale road												
4	L2	49	0.0	0.476	50.3	LOS D	6.7	46.7	0.96	0.78	0.96	33.5
5	T1	89	0.0	0.476	44.7	LOS D	6.7	46.7	0.96	0.78	0.96	34.0
6	R2	41	0.0	0.180	51.6	LOS D	2.0	13.7	0.93	0.73	0.93	31.9
Approach		179	0.0	0.476	47.8	LOS D	6.7	46.7	0.95	0.77	0.95	33.4
North: Minnesota road												
7	L2	21	0.0	0.170	28.8	LOS C	1.2	8.3	0.91	0.70	0.91	41.3
8	T1	76	0.0	0.324	23.7	LOS B	2.0	13.9	0.93	0.72	0.93	42.2
9	R2	24	0.0	0.324	29.5	LOS C	2.0	13.9	0.94	0.73	0.94	41.5
Approach		121	0.0	0.324	25.7	LOS B	2.0	13.9	0.93	0.72	0.93	41.9
West: Warnervale road												
10	L2	111	0.0	0.391	19.9	LOS B	7.0	49.2	0.77	0.70	0.77	46.2
11	T1	171	0.0	0.391	14.4	LOS A	7.0	49.2	0.77	0.70	0.77	47.2
12	R2	452	0.0	0.797	26.9	LOS B	14.8	103.8	0.90	0.87	0.99	41.0
Approach		734	0.0	0.797	22.9	LOS B	14.8	103.8	0.85	0.81	0.91	43.1
All Vehicles		1435	0.0	0.797	24.8	LOS B	14.8	103.8	0.83	0.77	0.86	42.1

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

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate
P1	South Full Crossing	53	47.3	LOS E	0.1	0.1	0.95	0.95
P2	East Full Crossing	53	47.3	LOS E	0.1	0.1	0.95	0.95
P3	North Full Crossing	53	21.0	LOS C	0.1	0.1	0.89	0.89
P4	West Full Crossing	53	47.3	LOS E	0.1	0.1	0.95	0.95

All Pedestrians	211	40.7	LOS E	0.93	0.93

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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MOVEMENT SUMMARY

Site: 401 [S3-Warnervale Road- Minnesota Road-Future with 460 students-Year 2031-PM]

Warnervale Road- Minnesota Road
Future
Year 2031
Site Category: -
Signals - Fixed Time Isolated Cycle Time = 96 seconds (Site Optimum Cycle Time - Minimum Delay)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Minnesota road												
1	L2	350	0.0	0.377	13.8	LOS A	5.5	38.3	0.66	0.76	0.66	47.9
2	T1	117	0.0	0.274	17.9	LOS B	2.7	19.1	0.87	0.69	0.87	46.4
3	R2	27	0.0	0.160	49.6	LOS D	1.2	8.4	0.94	0.72	0.94	32.6
Approach		494	0.0	0.377	16.7	LOS B	5.5	38.3	0.72	0.74	0.72	46.3
East: Warnervale road												
4	L2	39	0.0	0.592	47.5	LOS D	7.8	54.5	0.98	0.80	0.98	34.6
5	T1	134	0.0	0.592	41.9	LOS C	7.8	54.5	0.98	0.80	0.98	35.2
6	R2	17	0.0	0.080	47.5	LOS D	0.7	5.1	0.92	0.69	0.92	33.1
Approach		190	0.0	0.592	43.5	LOS D	7.8	54.5	0.97	0.79	0.97	34.9
North: Minnesota road												
7	L2	12	0.0	0.221	24.5	LOS B	1.7	12.2	0.88	0.69	0.88	44.3
8	T1	75	0.0	0.422	23.0	LOS B	2.7	19.1	0.90	0.70	0.95	42.8
9	R2	55	0.0	0.422	52.1	LOS D	2.7	19.1	0.98	0.80	1.32	32.2
Approach		142	0.0	0.422	34.4	LOS C	2.7	19.1	0.93	0.74	1.09	38.1
West: Warnervale road												
10	L2	145	0.0	0.375	19.3	LOS B	5.8	40.3	0.79	0.73	0.79	46.0
11	T1	107	0.0	0.375	13.7	LOS A	5.8	40.3	0.79	0.73	0.79	47.0
12	R2	412	0.0	0.777	25.9	LOS B	12.5	87.3	0.93	0.87	1.01	41.5
Approach		664	0.0	0.777	22.5	LOS B	12.5	87.3	0.87	0.82	0.93	43.2
All Vehicles		1490	0.0	0.777	24.4	LOS B	12.5	87.3	0.84	0.78	0.88	42.3

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

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate
P1	South Full Crossing	53	42.3	LOS E	0.1	0.1	0.94	0.94
P2	East Full Crossing	53	42.3	LOS E	0.1	0.1	0.94	0.94
P3	North Full Crossing	53	18.7	LOS B	0.1	0.1	0.88	0.88
P4	West Full Crossing	53	42.3	LOS E	0.1	0.1	0.94	0.94

All Pedestrians	211	36.4	LOS D	0.92	0.92

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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MOVEMENT SUMMARY

Site: 101 [S4-Albert Warner Road / Sparks Road-Future with 460 students-Year 2031-AM]

Albert Warner Road / Sparks Road
AM
Year 2031
Site Category: -
Signals - Fixed Time Isolated Cycle Time = 152 seconds (Site Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Albert Warner Dr												
1	L2	476	0.0	0.482	23.0	LOS B	19.1	134.0	0.64	0.77	0.64	43.2
2	T1	454	0.0	0.553	57.8	LOS E	15.0	105.3	0.95	0.79	0.95	31.2
3	R2	544	0.0	0.856	80.0	LOS F	21.4	150.1	1.00	0.94	1.18	26.1
Approach		1474	0.0	0.856	54.8	LOS D	21.4	150.1	0.87	0.84	0.94	31.7
East: Sparks Road												
4	L2	556	0.0	0.501	17.3	LOS B	18.3	128.2	0.60	0.76	0.60	46.3
5	T1	1520	0.0	0.858	64.1	LOS E	31.2	218.4	0.99	0.94	1.09	29.4
6	R2	599	0.0	0.653	46.6	LOS D	15.9	111.3	0.95	0.87	1.05	34.1
Approach		2675	0.0	0.858	50.5	LOS D	31.2	218.4	0.90	0.88	0.98	32.9
North: Albert Warner Dr												
7	L2	97	0.0	0.122	19.9	LOS B	2.4	17.1	0.63	0.72	0.63	44.3
8	T1	342	0.0	0.417	55.8	LOS D	11.0	76.8	0.91	0.75	0.91	31.7
9	R2	575	0.0	0.905	87.1	LOS F	24.0	168.2	1.00	0.99	1.27	24.9
Approach		1014	0.0	0.905	70.1	LOS E	24.0	168.2	0.94	0.88	1.09	28.1
West: Sparks Road												
10	L2	298	0.0	0.387	22.4	LOS B	7.8	54.5	0.74	0.78	0.74	43.0
11	T1	1444	0.0	0.815	60.5	LOS E	28.2	197.7	0.99	0.90	1.05	30.3
12	R2	852	0.0	0.926	75.8	LOS F	32.7	229.2	1.00	1.04	1.41	26.9
Approach		2594	0.0	0.926	61.2	LOS E	32.7	229.2	0.96	0.93	1.13	30.0
All Vehicles		7756	0.0	0.926	57.4	LOS E	32.7	229.2	0.92	0.89	1.04	31.0

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

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate
P1	South Full Crossing	53	70.3	LOS F	0.2	0.2	0.96	0.96
P3	North Full Crossing	53	70.3	LOS F	0.2	0.2	0.96	0.96
P4	West Full Crossing	53	70.3	LOS F	0.2	0.2	0.96	0.96
All Pedestrians		158	70.3	LOS F			0.96	0.96

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

MOVEMENT SUMMARY

Site: 101 [S4-Albert Warner Road / Sparks Road-Future with 460 students-Year 2031-PM]

Albert Warner Road / Sparks Road
PM
Year 2031
Site Category: -
Signals - Fixed Time Isolated Cycle Time = 120 seconds (Site Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Albert Warner Dr												
1	L2	746	0.0	0.679	12.9	LOS A	21.8	152.6	0.63	0.78	0.63	49.0
2	T1	354	0.0	0.375	41.0	LOS C	8.7	60.6	0.88	0.73	0.88	36.2
3	R2	448	0.0	0.905	75.3	LOS F	15.2	106.6	1.00	1.02	1.39	27.1
Approach		1548	0.0	0.905	37.4	LOS C	21.8	152.6	0.79	0.84	0.91	37.2
East: Sparks Road												
4	L2	355	0.0	0.279	9.0	LOS A	4.8	33.6	0.37	0.67	0.37	51.7
5	T1	951	0.0	0.461	37.8	LOS C	12.3	86.0	0.87	0.73	0.87	37.2
6	R2	207	0.0	0.311	31.2	LOS C	3.5	24.2	0.90	0.76	0.90	39.7
Approach		1513	0.0	0.461	30.2	LOS C	12.3	86.0	0.76	0.72	0.76	40.2
North: Albert Warner Dr												
7	L2	655	0.0	0.920	43.8	LOS D	31.5	220.3	1.00	0.98	1.23	34.3
8	T1	305	0.0	0.324	40.4	LOS C	7.4	51.6	0.87	0.71	0.87	36.4
9	R2	263	0.0	0.531	59.3	LOS E	7.4	51.7	0.98	0.80	0.98	30.6
Approach		1223	0.0	0.920	46.3	LOS D	31.5	220.3	0.96	0.87	1.09	33.9
West: Sparks Road												
10	L2	541	0.0	0.699	22.8	LOS B	15.7	109.9	0.88	0.85	0.90	42.8
11	T1	1157	0.0	0.561	39.1	LOS C	15.5	108.3	0.90	0.76	0.90	36.7
12	R2	446	0.0	0.652	33.2	LOS C	8.0	56.2	0.98	0.82	0.98	38.9
Approach		2144	0.0	0.699	33.8	LOS C	15.7	109.9	0.91	0.80	0.91	38.5
All Vehicles		6428	0.0	0.920	36.2	LOS C	31.5	220.3	0.86	0.80	0.91	37.6

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

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate
P1	South Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P3	North Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P4	West Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
All Pedestrians		158	54.3	LOS E			0.95	0.95

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

MOVEMENT SUMMARY

Site: 101 [S4-Warnervale Rd-Virginia Rd-Future(460)-Year 2031-AM]

Warnervale Rd/ Virginia Rd
Future with 460 Students
AM Peak
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: RoadNameVirginia Road												
1	L2	9	0.0	0.052	6.3	LOS A	0.2	1.2	0.46	0.70	0.46	51.3
2	T1	5	0.0	0.052	8.7	LOS A	0.2	1.2	0.46	0.70	0.46	51.5
3	R2	20	0.0	0.052	9.6	LOS A	0.2	1.2	0.46	0.70	0.46	50.9
Approach		34	0.0	0.052	8.6	LOS A	0.2	1.2	0.46	0.70	0.46	51.1
East: Warnervale Road												
4	L2	10	0.0	0.132	6.2	LOS A	0.0	0.3	0.02	0.03	0.02	58.0
5	T1	250	0.0	0.132	0.0	LOS A	0.0	0.3	0.02	0.03	0.02	59.6
6	R2	3	0.0	0.132	7.7	LOS A	0.0	0.3	0.02	0.03	0.02	57.4
Approach		263	0.0	0.132	0.4	NA	0.0	0.3	0.02	0.03	0.02	59.5
North: Virginia Road												
7	L2	5	0.0	0.193	6.9	LOS A	0.7	4.6	0.59	0.83	0.59	49.9
8	T1	5	0.0	0.193	8.4	LOS A	0.7	4.6	0.59	0.83	0.59	50.1
9	R2	91	0.0	0.193	10.9	LOS A	0.7	4.6	0.59	0.83	0.59	49.6
Approach		101	0.0	0.193	10.5	LOS A	0.7	4.6	0.59	0.83	0.59	49.6
West: Warnervale Road												
10	L2	137	0.0	0.259	5.6	LOS A	0.1	0.4	0.01	0.17	0.01	56.9
11	T1	356	0.0	0.259	0.0	LOS A	0.1	0.4	0.01	0.17	0.01	58.4
12	R2	4	0.0	0.259	6.6	LOS A	0.1	0.4	0.01	0.17	0.01	56.3
Approach		497	0.0	0.259	1.6	NA	0.1	0.4	0.01	0.17	0.01	58.0
All Vehicles		895	0.0	0.259	2.5	NA	0.7	4.6	0.10	0.22	0.10	57.0

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

MOVEMENT SUMMARY

Site: 101 [S4-Warnervale Rd-Virginia Rd-Future(460)-Year 2031-PM]

Warnervale Rd/ Virginia Rd
Future with 460 Students
PM Peak
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: RoadNameVirginia Road												
1	L2	7	0.0	0.042	7.4	LOS A	0.1	1.0	0.58	0.77	0.58	50.2
2	T1	5	0.0	0.042	10.6	LOS A	0.1	1.0	0.58	0.77	0.58	50.3
3	R2	10	0.0	0.042	12.0	LOS A	0.1	1.0	0.58	0.77	0.58	49.8
Approach		22	0.0	0.042	10.2	LOS A	0.1	1.0	0.58	0.77	0.58	50.0
East: Warnervale Road												
4	L2	20	0.0	0.258	5.9	LOS A	0.0	0.3	0.01	0.03	0.01	58.1
5	T1	495	0.0	0.258	0.0	LOS A	0.0	0.3	0.01	0.03	0.01	59.7
6	R2	3	0.0	0.258	7.7	LOS A	0.0	0.3	0.01	0.03	0.01	57.5
Approach		518	0.0	0.258	0.3	NA	0.0	0.3	0.01	0.03	0.01	59.6
North: Virginia Road												
7	L2	5	0.0	0.307	7.5	LOS A	1.2	8.2	0.72	0.92	0.86	47.5
8	T1	5	0.0	0.307	11.8	LOS A	1.2	8.2	0.72	0.92	0.86	47.6
9	R2	112	0.0	0.307	14.7	LOS B	1.2	8.2	0.72	0.92	0.86	47.1
Approach		122	0.0	0.307	14.3	LOS A	1.2	8.2	0.72	0.92	0.86	47.2
West: Warnervale Road												
10	L2	133	0.0	0.233	5.7	LOS A	0.1	0.6	0.03	0.18	0.03	56.7
11	T1	306	0.0	0.233	0.1	LOS A	0.1	0.6	0.03	0.18	0.03	58.2
12	R2	5	0.0	0.233	8.2	LOS A	0.1	0.6	0.03	0.18	0.03	56.1
Approach		444	0.0	0.233	1.8	NA	0.1	0.6	0.03	0.18	0.03	57.7
All Vehicles		1106	0.0	0.307	2.7	NA	1.2	8.2	0.11	0.20	0.12	57.0

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

MOVEMENT SUMMARY

Site: 401 [S4-Warnervale Road- Minnesota Road-Future with 460 students-Year 2031-AM]

Warnervale Road- Minnesota Road
Future
Year 2031
Site Category: -
Signals - Fixed Time Isolated Cycle Time = 106 seconds (Site Optimum Cycle Time - Minimum Delay)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Minnesota road												
1	L2	243	0.0	0.248	13.0	LOS A	3.7	25.6	0.58	0.73	0.58	48.3
2	T1	135	0.0	0.319	19.8	LOS B	3.4	23.7	0.88	0.70	0.88	45.3
3	R2	23	0.0	0.140	54.8	LOS D	1.1	7.9	0.95	0.71	0.95	31.1
Approach		401	0.0	0.319	17.7	LOS B	3.7	25.6	0.70	0.72	0.70	45.8
East: Warnervale road												
4	L2	49	0.0	0.476	50.3	LOS D	6.7	46.7	0.96	0.78	0.96	33.5
5	T1	89	0.0	0.476	44.7	LOS D	6.7	46.7	0.96	0.78	0.96	34.0
6	R2	41	0.0	0.180	51.6	LOS D	2.0	13.7	0.93	0.73	0.93	31.9
Approach		179	0.0	0.476	47.8	LOS D	6.7	46.7	0.95	0.77	0.95	33.4
North: Minnesota road												
7	L2	21	0.0	0.170	28.8	LOS C	1.2	8.3	0.91	0.70	0.91	41.3
8	T1	76	0.0	0.324	23.7	LOS B	2.0	13.9	0.93	0.72	0.93	42.2
9	R2	24	0.0	0.324	29.5	LOS C	2.0	13.9	0.94	0.73	0.94	41.5
Approach		121	0.0	0.324	25.7	LOS B	2.0	13.9	0.93	0.72	0.93	41.9
West: Warnervale road												
10	L2	111	0.0	0.391	19.9	LOS B	7.0	49.2	0.77	0.70	0.77	46.2
11	T1	171	0.0	0.391	14.4	LOS A	7.0	49.2	0.77	0.70	0.77	47.2
12	R2	452	0.0	0.797	26.9	LOS B	14.8	103.8	0.90	0.87	0.99	41.0
Approach		734	0.0	0.797	22.9	LOS B	14.8	103.8	0.85	0.81	0.91	43.1
All Vehicles		1435	0.0	0.797	24.8	LOS B	14.8	103.8	0.83	0.77	0.86	42.1

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

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate
P1	South Full Crossing	53	47.3	LOS E	0.1	0.1	0.95	0.95
P2	East Full Crossing	53	47.3	LOS E	0.1	0.1	0.95	0.95
P3	North Full Crossing	53	21.0	LOS C	0.1	0.1	0.89	0.89
P4	West Full Crossing	53	47.3	LOS E	0.1	0.1	0.95	0.95

All Pedestrians	211	40.7	LOS E	0.93	0.93

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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MOVEMENT SUMMARY

Site: 401 [S4-Warnervale Road- Minnesota Road-Future with 460 students-Year 2031-PM]

Warnervale Road- Minnesota Road
Future
Year 2031
Site Category: -
Signals - Fixed Time Isolated Cycle Time = 96 seconds (Site Optimum Cycle Time - Minimum Delay)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Movement Performance - Vehicles

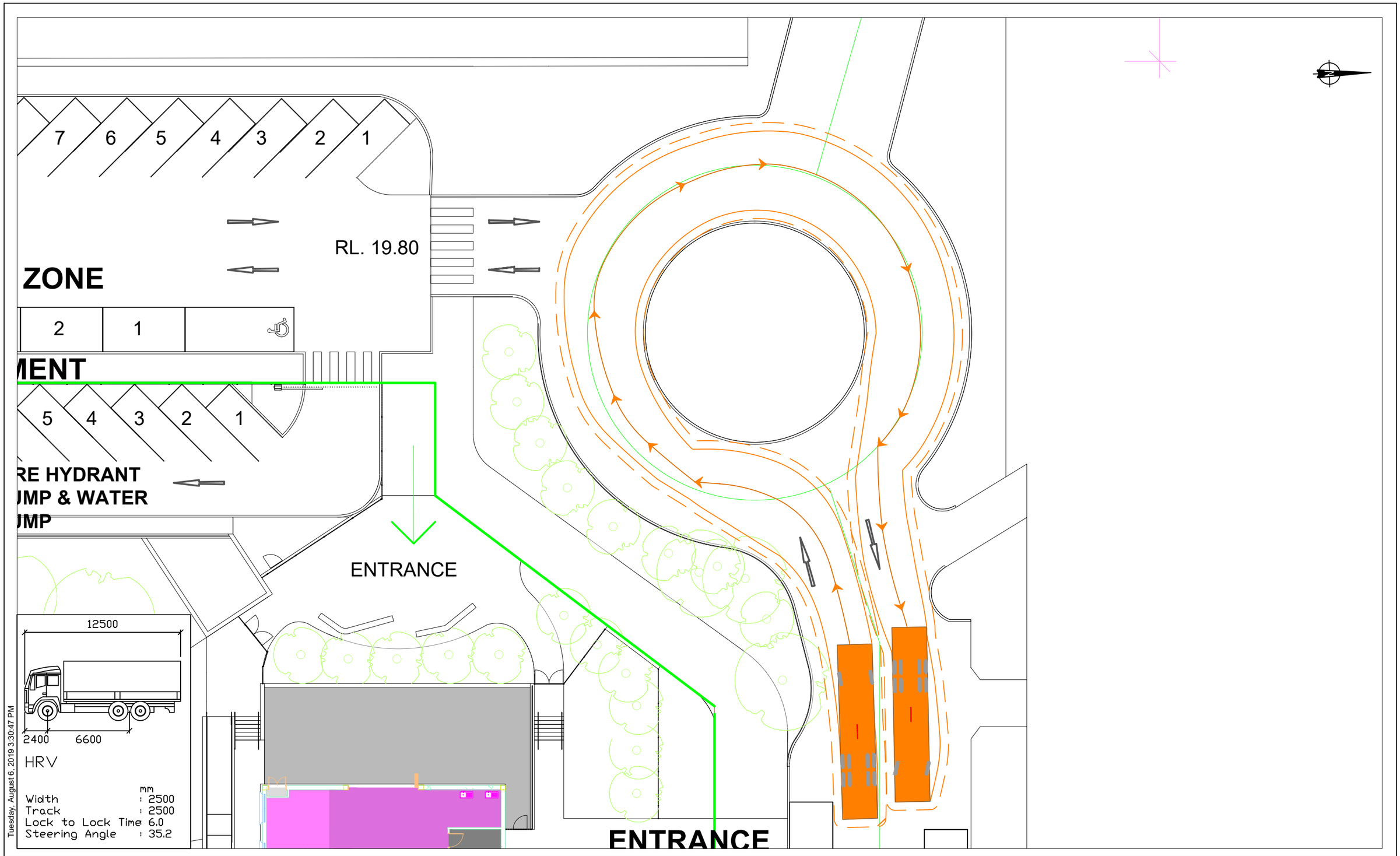
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Minnesota road												
1	L2	350	0.0	0.377	13.8	LOS A	5.5	38.3	0.66	0.76	0.66	47.9
2	T1	117	0.0	0.274	17.9	LOS B	2.7	19.1	0.87	0.69	0.87	46.4
3	R2	27	0.0	0.160	49.6	LOS D	1.2	8.4	0.94	0.72	0.94	32.6
Approach		494	0.0	0.377	16.7	LOS B	5.5	38.3	0.72	0.74	0.72	46.3
East: Warnervale road												
4	L2	39	0.0	0.592	47.5	LOS D	7.8	54.5	0.98	0.80	0.98	34.6
5	T1	134	0.0	0.592	41.9	LOS C	7.8	54.5	0.98	0.80	0.98	35.2
6	R2	17	0.0	0.080	47.5	LOS D	0.7	5.1	0.92	0.69	0.92	33.1
Approach		190	0.0	0.592	43.5	LOS D	7.8	54.5	0.97	0.79	0.97	34.9
North: Minnesota road												
7	L2	12	0.0	0.221	24.5	LOS B	1.7	12.2	0.88	0.69	0.88	44.3
8	T1	75	0.0	0.422	23.0	LOS B	2.7	19.1	0.90	0.70	0.95	42.8
9	R2	55	0.0	0.422	52.1	LOS D	2.7	19.1	0.98	0.80	1.32	32.2
Approach		142	0.0	0.422	34.4	LOS C	2.7	19.1	0.93	0.74	1.09	38.1
West: Warnervale road												
10	L2	145	0.0	0.375	19.3	LOS B	5.8	40.3	0.79	0.73	0.79	46.0
11	T1	107	0.0	0.375	13.7	LOS A	5.8	40.3	0.79	0.73	0.79	47.0
12	R2	412	0.0	0.777	25.9	LOS B	12.5	87.3	0.93	0.87	1.01	41.5
Approach		664	0.0	0.777	22.5	LOS B	12.5	87.3	0.87	0.82	0.93	43.2
All Vehicles		1490	0.0	0.777	24.4	LOS B	12.5	87.3	0.84	0.78	0.88	42.3

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

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate
P1	South Full Crossing	53	42.3	LOS E	0.1	0.1	0.94	0.94
P2	East Full Crossing	53	42.3	LOS E	0.1	0.1	0.94	0.94
P3	North Full Crossing	53	18.7	LOS B	0.1	0.1	0.88	0.88
P4	West Full Crossing	53	42.3	LOS E	0.1	0.1	0.94	0.94

Appendix G Swept Paths for Proposed Roundabout



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New Primary School at Warnervale

Swept Path Assessment

12.5 metres Heavy Rigid Vehicle (HRV)

DRAWN: DA	---	---
DATE: 06-08-19	STATUS: ---	
SCALE: 1:250 @ A3		
DWG NO:15536 - 02SE		

1

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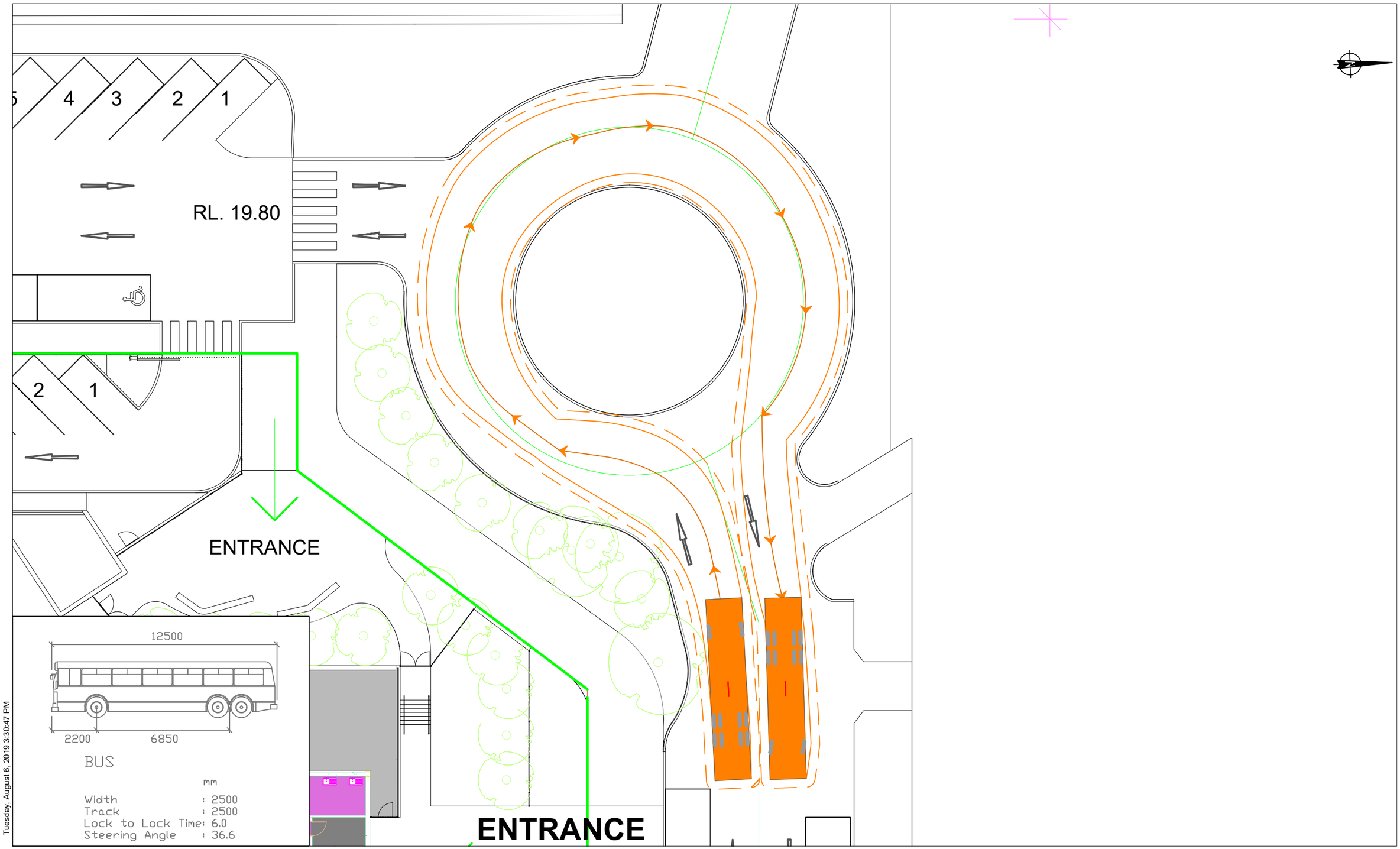

Tuesday, August 6, 2019 3:30:47 PM

REV	DATE	DRN	CHK	DESCRIPTION
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New Primary School at Warnervale

Swept Path Assessment

12.5 metres long School Bus

DRAWN: DA	---	---
DATE: 06-08-19	STATUS: ---	
SCALE: 1:250 @ A3		
DWG NO:15536 - 02SE		

2

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