Traffic Impact Assessment

Werrington Subdivision

89914069

Prepared for

Lendlease

2 October 2019

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1 Introduction

Cardno has been invited by Lendlease to prepare a Traffic Impact Assessment (TIA) to supplement a Development Application (DA) for the residential and industrial subdivision located at 16 Chapman Street, Werrington. The subject site is within the Penrith City Council and the development seeks to create 265 Residential Lots together with 14 light industrial lots. The light industrial lots have a combined Land Area of 31,000 m^2.

The development also creates several super lots which create the potential for a further 91 Residential Lots and 33 apartments.

The staging of the development is per the table below:

Table 1-1 Development Staging

Stages	RESIDENTIAL LOTS (No)		APARTMENTS (No)		LIGHT INDUSTRIAL GROSS AREA (m^2)	
	This DA	Future DA	This DA	Future DA	This DA	Future DA
Stage 1A	64	0	0	0	0	0
Stage 1B	60	16	0	0	0	0
Stage 1C and 1D	4	14	0	0	0	0
Stage 2A	44	16	0	0	0	0
Stage 2B	63	45	0	0	0	0
Stage 3	30	0	0	33	0	0
Stage 4A	0	0	0	0	10982.3 m^2	0
Stage 4B	0	0	0	0	20017.7 m^2	0
TOTAL	**265**	**91**	**0**	**33**	**31000 m^2**	**0**

This assessment has been undertaken to demonstrate the compliance of the development with relevant standards and Council controls as well as identifying the relevant traffic impacts (if any) associated with the development.

1.1 Scope of Works

The main objective of this report is to evaluate the traffic impacts that are generated by the subdivision together with its associated impact on the surrounding road network. Cardno's scope of works for this study includes the following tasks:

- Review background information and collate supplied information from previous Cardno Tech Memo;
- Review the current transport context, including pedestrian, cycling and public transport networks and the integration of these transport modes with the wider transport network;
- Assess the traffic impact associated with the development using RMS guidelines; and
- Review the access arrangements of the proposed Lots in accordance with the relevant standards and guidelines.

1.2 Reference Documents

In preparing this report, reference has been made to a number of background documents, including:

- Lendlease Werrington Subdivision Traffic Investigation (Cardno, 2019);
- South Werrington Urban Village – Traffic Impact Assessment (Traffix, 2014);
- 25 Rance Road, Werrington – Traffic Impact Assessment (Mott MacDonald, 2015);
- Guide to Traffic Generating Developments (Roads and Maritime, 2002); and
- Technical Direction (Roads and Maritime, TDT 2013/04a).

2 Strategic Context

2.1 South Werrington Urban Village (SWUV) Precinct

The South Werrington Urban Village (SWUV) consists of approximately 48 hectares of land between the Great Western Highway and Werrington Railway Station. Penrith Council has a Development Control Plan (DCP) specific to the SWUV and is applicable to the land shown in **Figure 2-1**.

Figure 2-1 SWUV Area

The SWUV structure plan provided within the DCP shows the high level land-use and road hierarchy strategy and broadly informs the future development of land within SWUV. The structure plan is depicted in **Figure 2-2**, with the DCP citing the following access measures:

- The structure plan envisages the construction of the proposed Werrington Arterial Road. A new major collector road is proposed to link the Werrington Arterial Road to the future employment development to the west. This new link road also provides a separation between the employment and residential land uses. A roundabout at the intersection of the new link road with the Werrington Arterial Road has been proposed as part of the development and can be constructed in stages if required. The location of the new link road is as shown on the Structure Plan, and is located on the residential zoned land.
- A minor north south road is proposed linking Werrington Station with the Great Western Highway and forming an edge between the employment precinct and the land that forms part of the Wollemi School.
- The arterial and collector road system are proposed to be designed to accommodate buses and articulated vehicles.
- Local streets are proposed to be generally inter-connective and to link with existing streets in South Werrington.
- A cycle system is proposed to provide movement through the area, linking with surrounding areas including the recreational areas to the east and St Marys. The system links with the proposed cycleway along the western side of the Werrington Arterial Road with the potential to extend northwards.

Figure 2-2 SWUV Structure Plan

The SWUV DCP also nominates the minimum level of residential development across the precinct. The total minimum development is shown as 414 dwellings. This is shown in **Figure 2-3**.

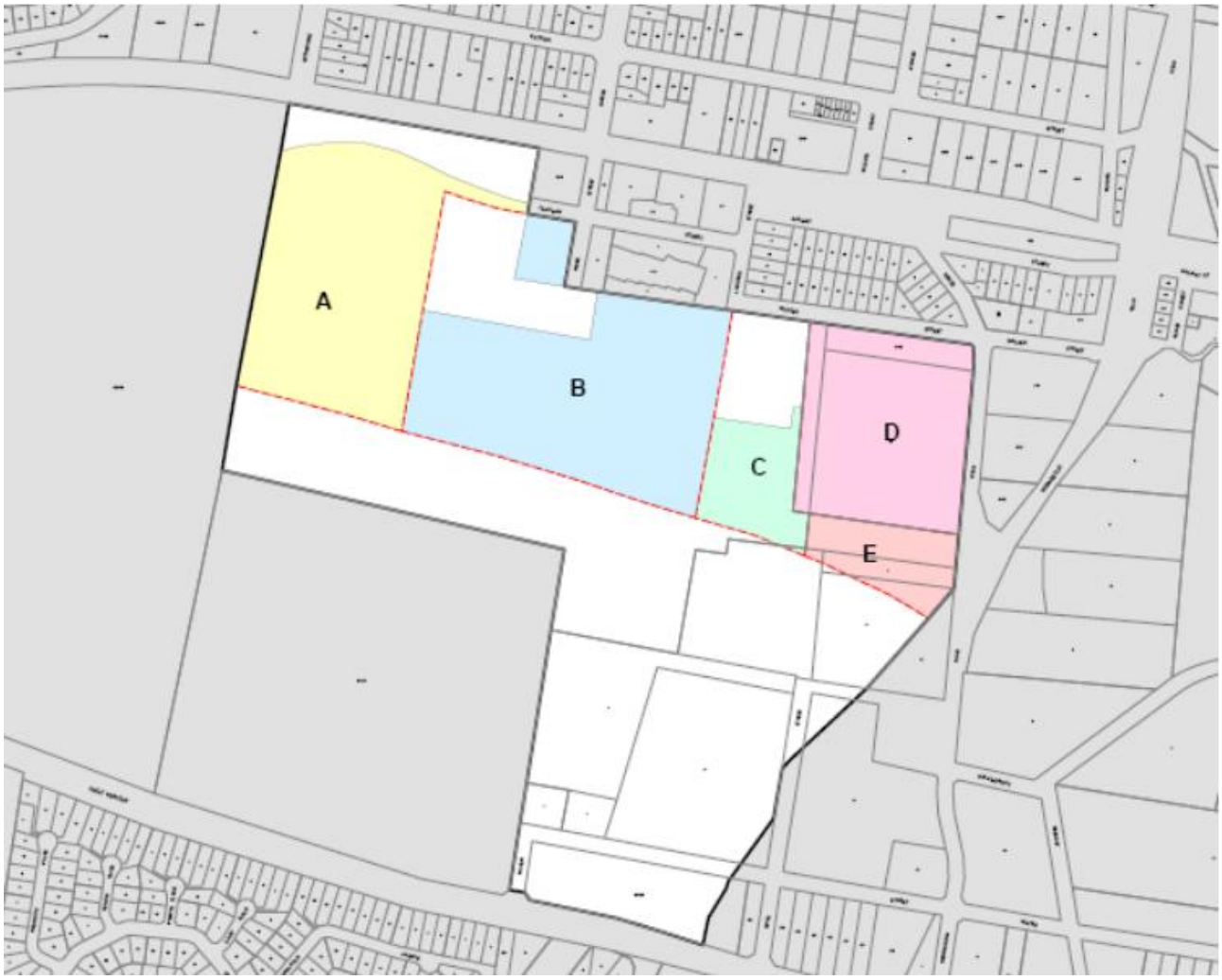


Figure 2-3 SUWV DCP Yield

Sub-Precinct	Minimum dwelling yield
A	78
B	154
C	30
D	122
E	30
Totals	**414**

Traffix has previously undertaken a traffic impact assessment for the SWUVP development. The SWUVP Concept Plan envisaged a proposed development of some 2,000 units of high and medium density with a mix of employment and industrial land as well.

Cardno's review of the document identified that with no development, the Rance Road / Werrington Road intersection performs at LoS B & F during the AM and PM peak hour respectively. The Traffix report states that provision of the new East-West link between the subject site and the future signalised intersection with Werrington Road should be considered a priority for redevelopment of the South Werrington Urban Village as a result of the poor performance identified at Rance Road. The proposed signalised intersection along Werrington Road with the proposed East-West link (at the south of Rance Road) would provide additional capacity and ensure an acceptable level of service of intersection performance to cope with future developmental traffic.

The provision of the signalised intersection is likely to be warranted when some 950 residential units are developed to achieve 200veh/hr on the minor roads, as required under the warrant criteria at the time of the assessment.

Development Status within SWUV:

Cardno has undertaken a high level review of relevant documents and studies associated with the site (or nearby developments). They are summarised as follows:

- South Werrington Urban Village TIA
  - Traffic report prepared by Traffix (6 February 2014)
  - Identified that with no development, Rance Road / Werrington Road performs at LoS B & F during the AM and PM peak hour respectively. The Traffix report states that provision of the new east-west connection between the subject site and the future signalised intersection with Werrington Road should be considered a priority for redevelopment of the South Werrington Urban Village as a result of the poor performance identified at Rance Road.
  - Provision of signalised intersection likely to be warranted when some 950 residential units are developed to achieve 200veh/hr on the minor road required under the warrant criteria at the time of the assessment.
- DA 14-0627 for 85 residential allotments and 2 residue lots
  - Consent details cross section requirements for the east-west road, being a 24m road reserve width with a 14m carriageway.
- DA 15-0207 for 83 residential allotments (known as the Statewide site)
  - Traffic report prepared by Mott McDonald (February 2015). The report identifies a reduced trip generation rate based on surveys of the existing dwellings in Werrington. A trip rate of 0.44 to 0.54 was estimated based on the survey results, with a rate of 0.40 applied to the development application.
  - This February 2015 report identified that the intersection delay of Rance Road / Werrington Road was not adversely affected and proposed an upgrade to a Seagull intersection for safety reasons.
  - Peer review undertaken by Lyle Marshall & Associates (July 2015) identified capacity issues at the Rance Road / Werrington Road intersection and recommended a roundabout upgrade.
- DA 16-1148 for 94 residential allotments and 1 superlot
- DA 16-0789 for 95 apartments (L&EC Approved)
- DA 17-0982 for 751 apartments
  - Application withdrawn
  - Traffic report prepared by Traffix (August 2017)
  - Assessment did not identify an upgrade of Rance Road / Werrington Road intersection under the future traffic loading of the site (Stages 1 to 4 and the Statewide site). LoS B/C was reported for the priority controlled intersection
  - Recommendation to upgrade the roundabout intersection of Werrington Road / The Kingsway with a short northbound lane.
- DA 17/1204 for Place of Public Worship containing 89 place Child Care Centre (refused)
  - Site access via Water Street, directly onto Great Western Highway
  - Land provision for the proposed Lander Street Extension which would travel north towards the Lendlease site (north-south collector road within the DCP Structure Plan)
  - Peak traffic generation appears to be Friday evening (6:00-7:00pm) and Sundays (9:00am – 11:30am).
  - Traffic generation in weekday morning in the order of 71 trips whilst the evening would see some 62 trips
  - Peak Friday evening traffic generation is in the order of 105 trips.
  - Peak Sunday morning traffic generation in the order of 676 coinciding with the changeover between two different services.
  - Application refusal appears to be, amongst other things, is due to concurrence with RMS not being achieved regarding access to / from Great Western Highway.

Based on the review, it is understood that there are 262 residential lots, inclusive of the Statewide site, and a further 94 residential apartments approved within the SWUV precinct.

3 Existing Conditions

3.1 Subject Site

The proposed development is located at the west of Werrington Road (approximately 400m south of Werrington Station) and is bounded to the east by Rance Road/ Werrington Road. It is located approximately 50 km west of Sydney CBD. The site is primarily vacant, with surrounding rural land and residential dwellings. The location of the proposed site is shown in **Figure 3-1.**

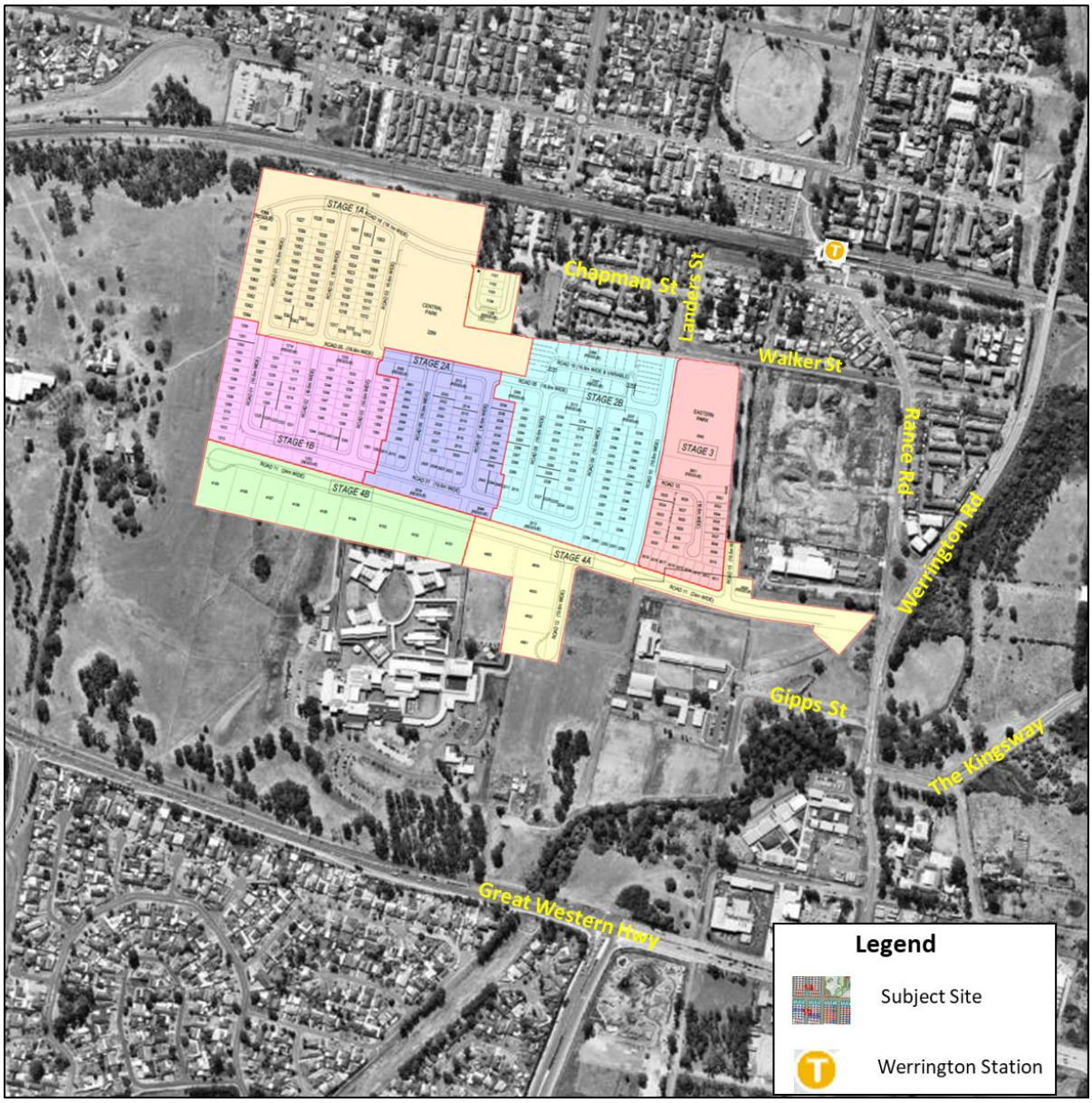


Figure 3-1 Subject Site

3.2 Existing Road Network

3.2.1 Schedule of Road Classification

Roads and Maritime Services (Roads and Maritime) in partnership with local government established an administrative framework of State, Regional and Local Road categories to help manage the extensive network of roads.

State roads are managed and financed by Roads and Maritime, and Regional / Local Roads are managed and financed by Councils. Notwithstanding, Regional Roads perform an intermediate function between the

main arterial network of State Roads and Council controlled Local Roads and therefore received financial assistance from Roads and Maritime.

The key road network surrounding the subject site consists of:

- Werrington Road;
- Rance Road;
- Chapman St/Landers St/Walker St; and
- Gipps Street.

3.2.2 Werrington Road

Werrington Road is classified as a Regional Road (Road No 7485) under the care and maintenance of the local Council. The road is typically configured with a two-lane carriageway with one lane in each direction. The posted speed limit is 70km/hr.

3.2.3 Rance Road

Rance Road is a local, unclassified road under the care and maintenance of the local Council, and runs in a north-south direction. Rance Road borders the development site to the east. The road is typically configured with a two lane carriageway with a posted speed limit of 50 km/hr.

3.2.4 Chapman Street/Landers Street/Walker Street

Chapman St, Landers St and Walker St are local, unclassified road under the care and maintenance of the local Council with a two-lane undivided carriageway. There is no posted speed limit hence a default speed of 50km/hr applies.

3.2.5 Gipp Street

Gipps St is a local, unclassified road under the care and maintenance of the local Council with a two-lane undivided carriageway. There is no posted speed limit hence a default speed of 50km/hr applies.

3.3 Traffic Control

The description of the intersection in the close proximity of the subject site and their restrictions are given below:

Intersection Layout - Werrington Road / Rance Road	Description
	Werrington Road / Rance Road intersection is a priority control intersection with a 'Give Way' sign at Rance Road to control the traffic. All vehicles approaching the intersection from Rance Road to turn left or right must give way to all vehicles approaching from Werrington Road.

3.4 Existing Traffic Volumes (2019)

An indication of the existing traffic volumes in the vicinity of the subject site is provided by peak hour traffic surveys, undertaken by Trans Traffic Survey (TTS), on Tuesday 27 August 2019 at the following locations:

- Werrington Road/ The Kingsway;
- Werrington Road/Rance Road; and
- Rance Road/Walker Street.

In addition to the classified intersection counts, Cardno commissioned TTS to undertake a vehicle delay survey for the right turn onto Werrington Road from Rance Road. A summarised version of the surveys is provided in the **Figure 3-2** to **Figure 3-4.**

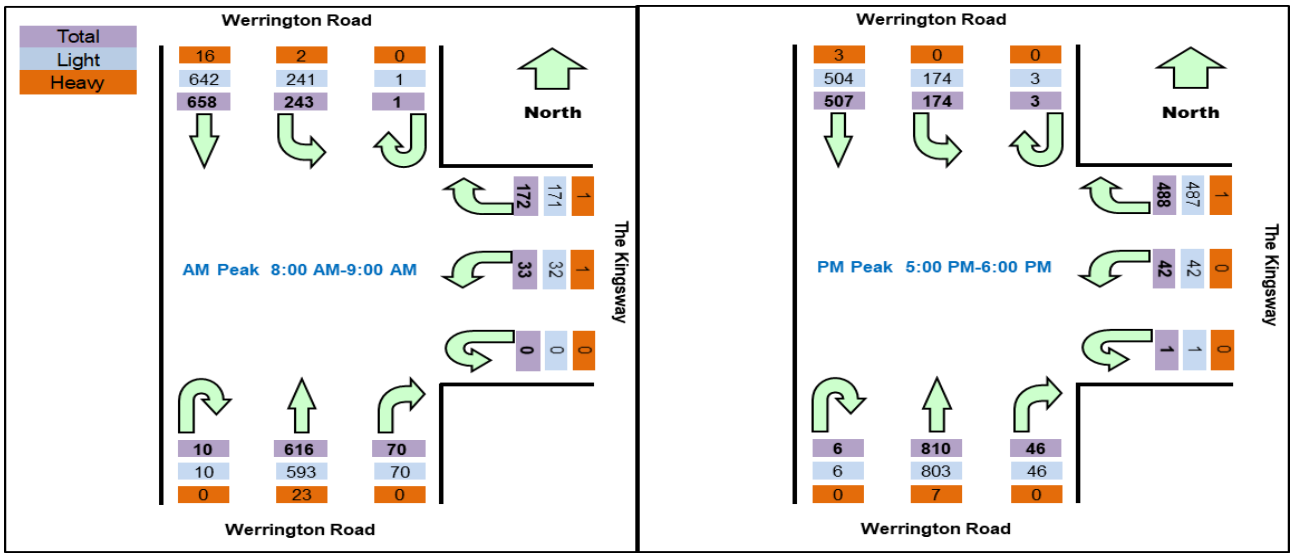


Figure 3-2 Werrington Road/ The Kingsway Intersection

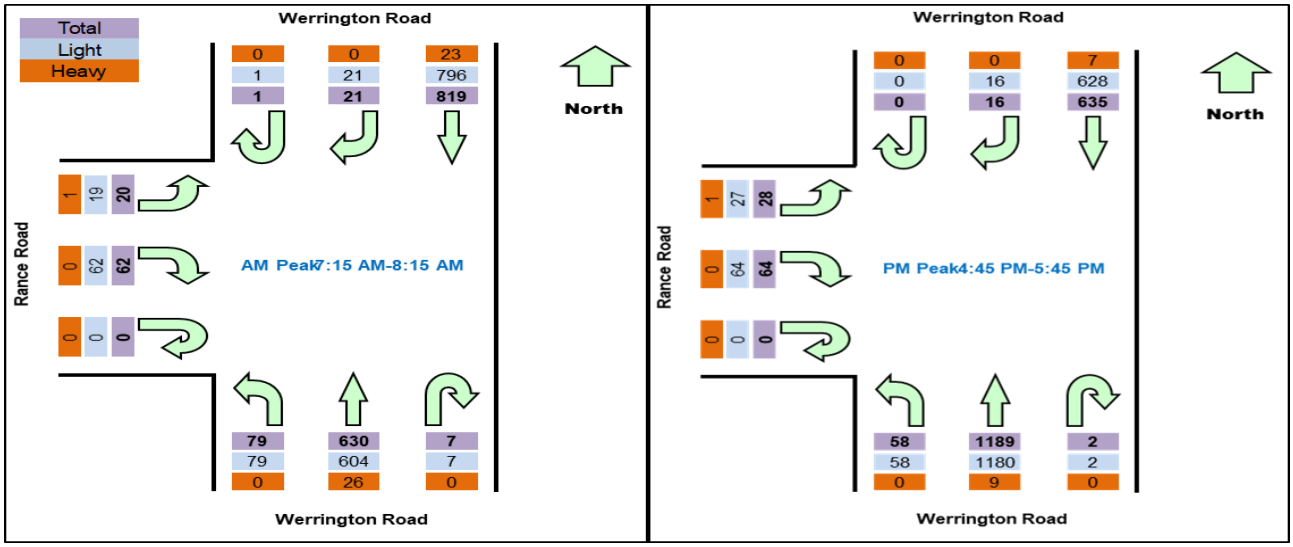


Figure 3-3 Werrington Road/ Rance Road Intersection

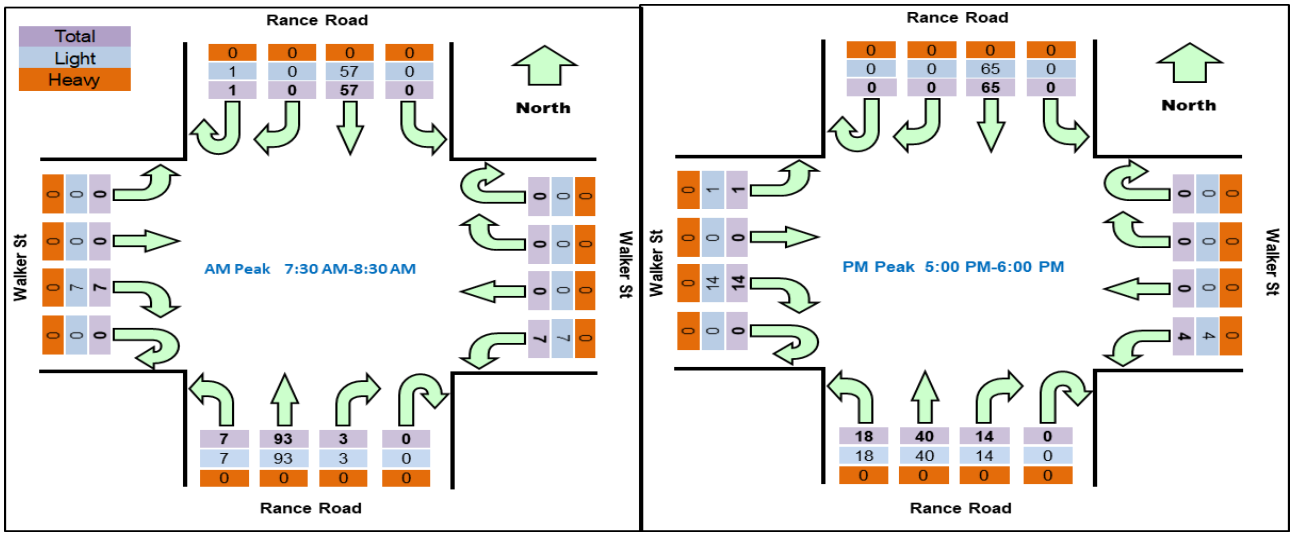


Figure 3-4 Rance Road/Walker Street Intersection

4 Existing Public Transport Services

4.1 Train

The proposed location of the subject site is currently well served by public transport services as it is located within 500 metres walk from Werrington Station, which is served by Sydney Trains T1 Western line services.

Table 4-1 provides a guide of the frequency of the existing train services.

Table 4-1 Train Service Frequency

Line	Weekday Peak Frequency	Weekend Peak Frequency
T1 (Towards Chatswood)	1 Service every 10 minutes	1 Service every 15 minutes
T1 (Towards Emu Plains)	1 Service every 15 minutes	1 Service every 15 minutes

4.2 Buses

Busways operates two routes via Werrington station: Route 782 (Penrith station to St Mary's station) and Route 785 (to Penrith station). A public transport map showcasing the bus routes and train services serving the development and nearby suburbs is shown in **Figure 4-1**.

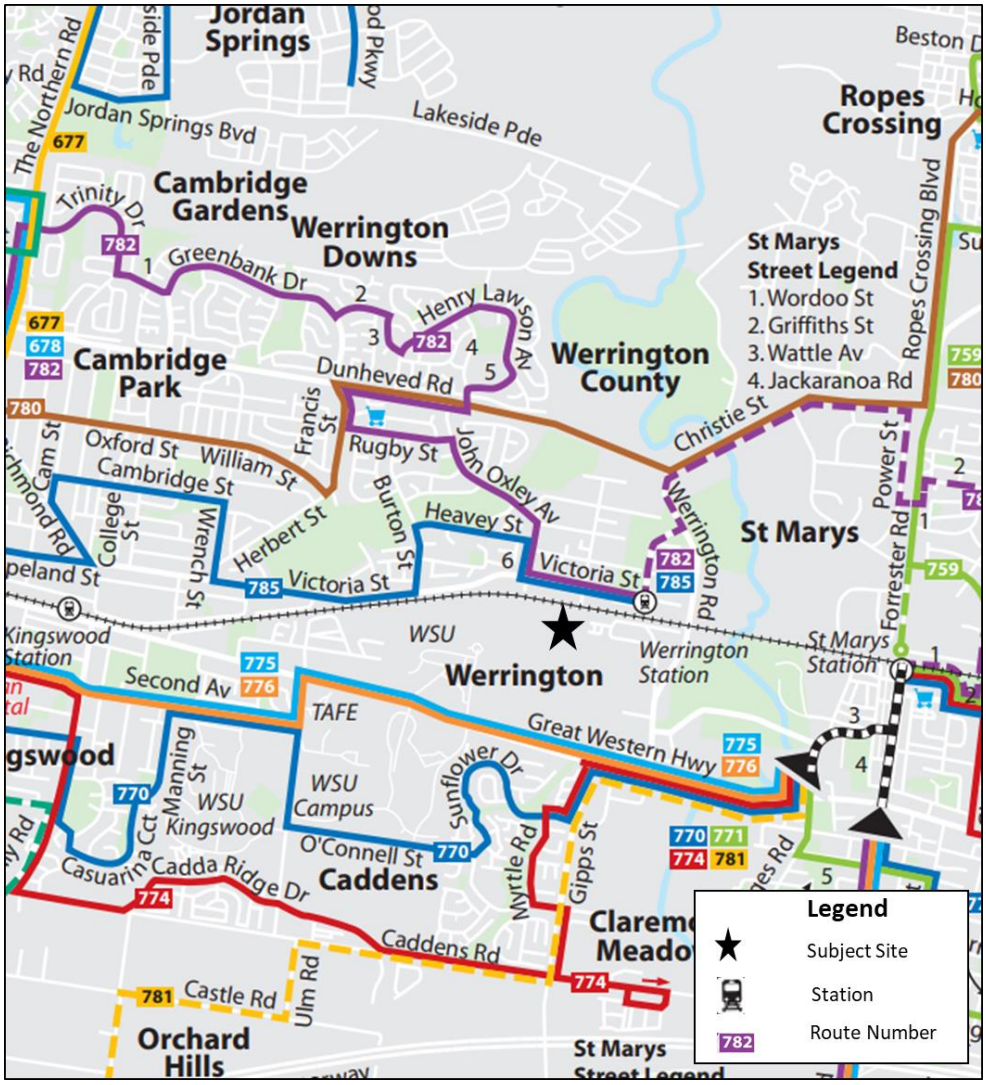


Figure 4-1 Public Transport Map

Source: Transport for NSW

Table 4-2 provides a guide of the frequency of the existing bus services.

Table 4-2 Bus Service Frequency

Route	Weekdays Peak Frequency	Weekend Frequency
782 (To St Marys)	1 Service every 30 minutes	1 service Every Hour
782 (To Penrith)	1 Service every 30 minutes	1 service Every Hour
785 (To Penrith Station)	3 Services Daily	1 service Every Hour

The proposed development site is conveniently located to take advantage of the connectivity of existing public transport services and encourage the greater use of sustainable modes of transport, therefore reducing reliance on private vehicles.

4.3 Walking and Cycling

A desktop review using NearMaps showed that the site is surrounded by footpaths. A figure showing the surrounding footpath is given below in **Figure 4-2**.

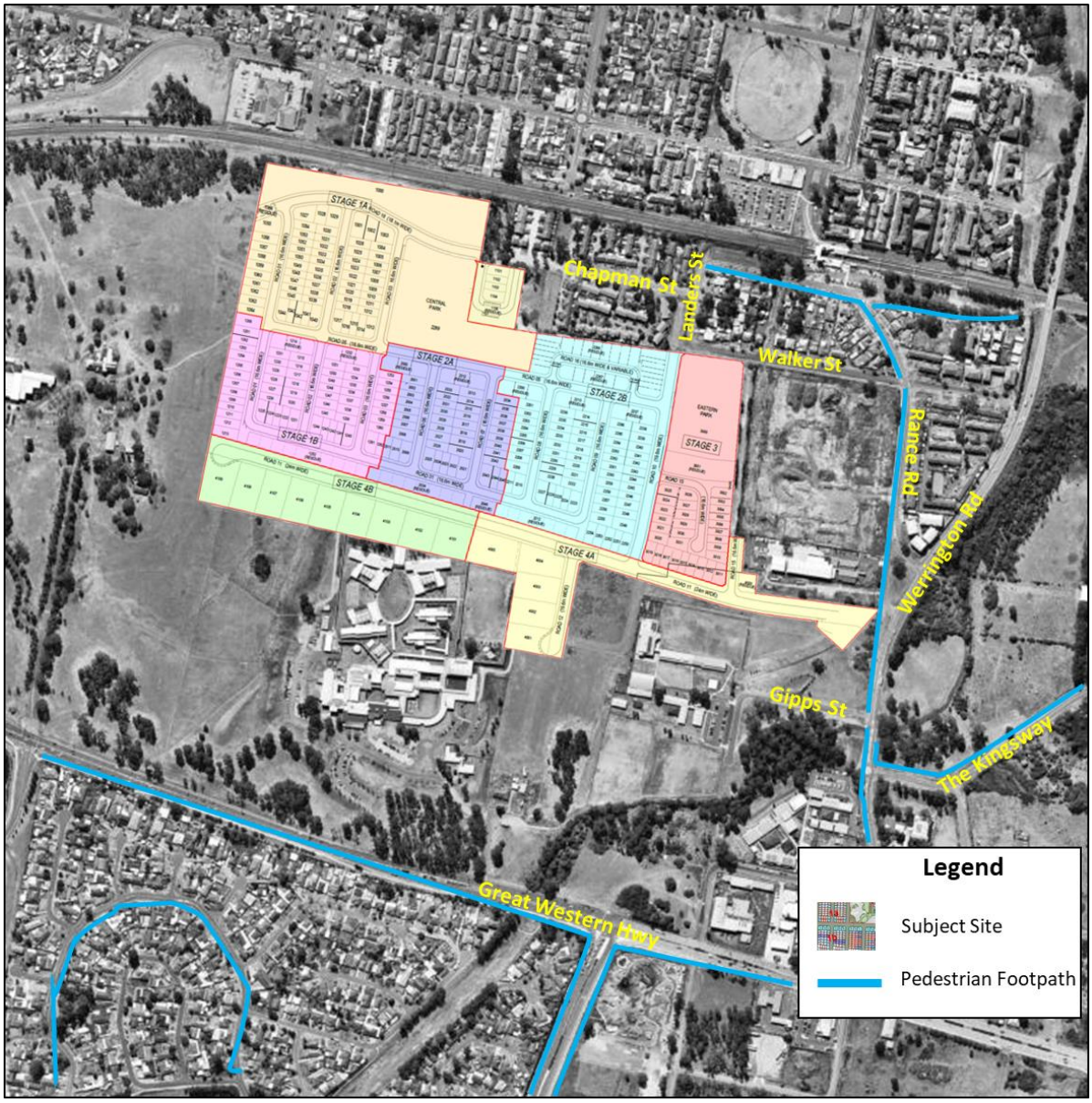


Figure 4-2 Pedestrian Footpath

On the above basis, it can be seen that on the areas surrounding the subject site footpaths are provided on the western side of Werrington Road, which links to Rance Road and ultimately connects to Werrington station. From the latest NearMap aerial image, the width of the footpath is calculated at approximately 1.2 m,

which is considered narrow as Sydney Streets Design Code (2013) recommends a minimum width of 2 m footpath to allow two pairs of people to comfortably pass each other.

In addition, RMS Cycle Way finder was accessed and reviewed and the cycleway network in the close vicinity of the subject site is shown in **Figure 4-3**.

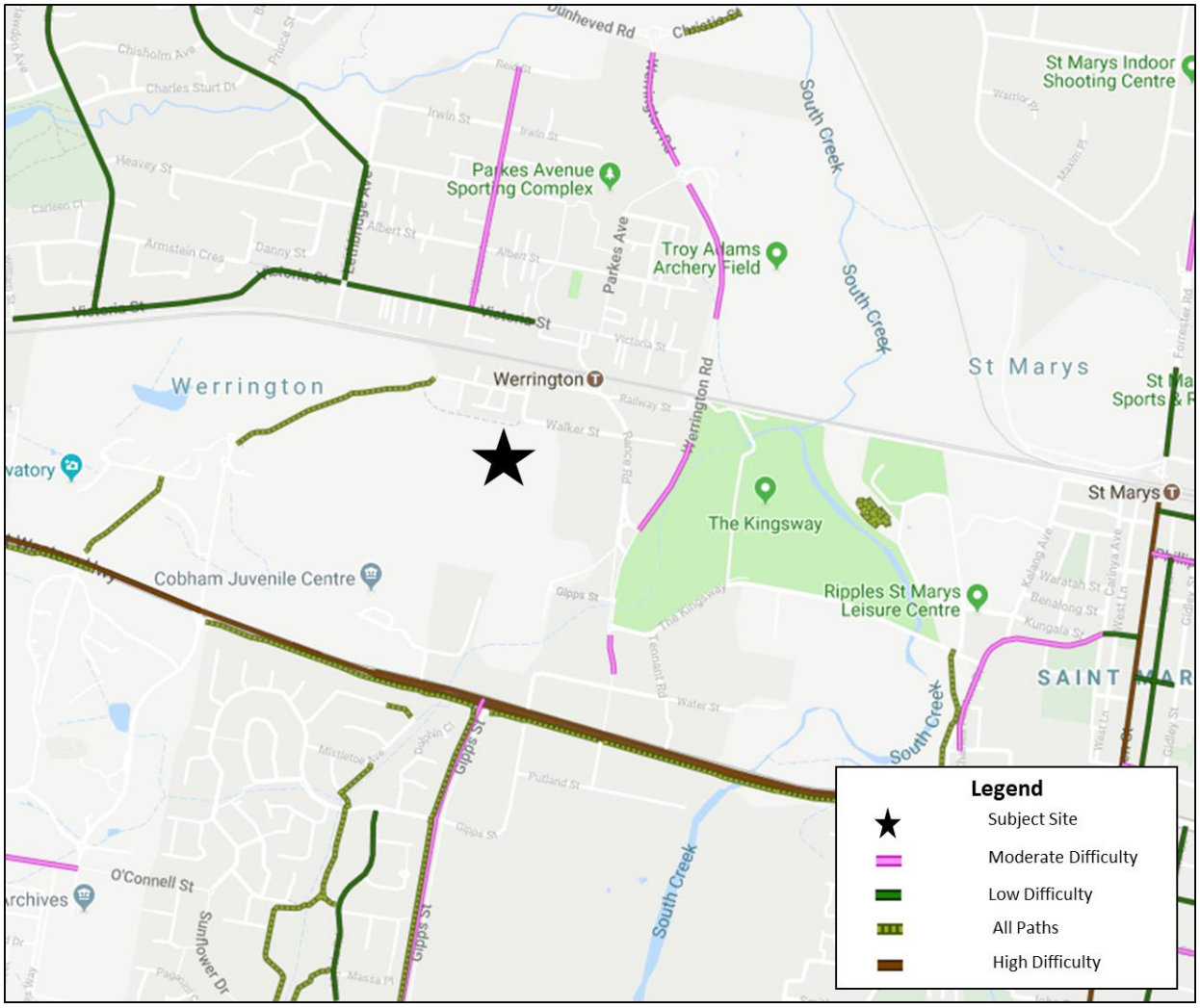


Figure 4-3 Existing Cycleway Network

Source: RMS Cycleway Finder (Accessed: 10/09/2019)

5 Proposed Development

5.1 Description

The proposed subdivision development is located at 16 Chapman Street, Werrington and the development seeks to create 265 Residential Lots together with 14 light industrial lots. The light industrial lots have a combined Land Area of 31,000 m^2. The development also creates several super lots which create the potential for a further 91 Residential Lots and 33 apartments.

The proposed development has the following components shown in **Table 5-1**.

Stage 1a and 1b has been assessed for the year 2022 to test the impact of the development. The remaining stages (2-4) which is under the ultimate scenario are expected to be delivered by the year 2029.

This overall aim of this assessment is to ensure that the development master plan Lendlease is proposing has merit and can be achieved considering the traffic assessment impacts.

Table 5-1 Development Components

Stages	RESIDENTIAL LOTS (No)		APARTMENTS (No)		LIGHT INDUSTRIAL GROSS AREA (m^2)	
	This DA	Future DA	This DA	Future DA	This DA	Future DA
Stage 1A	64	0	0	0	0	0
Stage 1B	60	16	0	0	0	0
Stage 1C and 1D	4	14	0	0	0	0
Stage 2A	44	16	0	0	0	0
Stage 2B	63	45	0	0	0	0
Stage 3	30	0	0	33	0	0
Stage 4A	0	0	0	0	10,982.3 m^2	0
Stage 4B	0	0	0	0	20,017.7 m^2	0
TOTAL	**265**	**91**	**0**	**33**	**31,000 m^2**	**0**

5.2 Proposed Site Access

Vehicular access into and out of the proposed development will be through the existing connections to the development via Walker Street/Chapman Street and a new link road (East-West link) passing through the southern side of the development, which will connect to Werrington Road.

The general arrangement of the proposed development is illustrated in **Figure 5-1**. A larger version of the layout is provided in **Appendix A**.

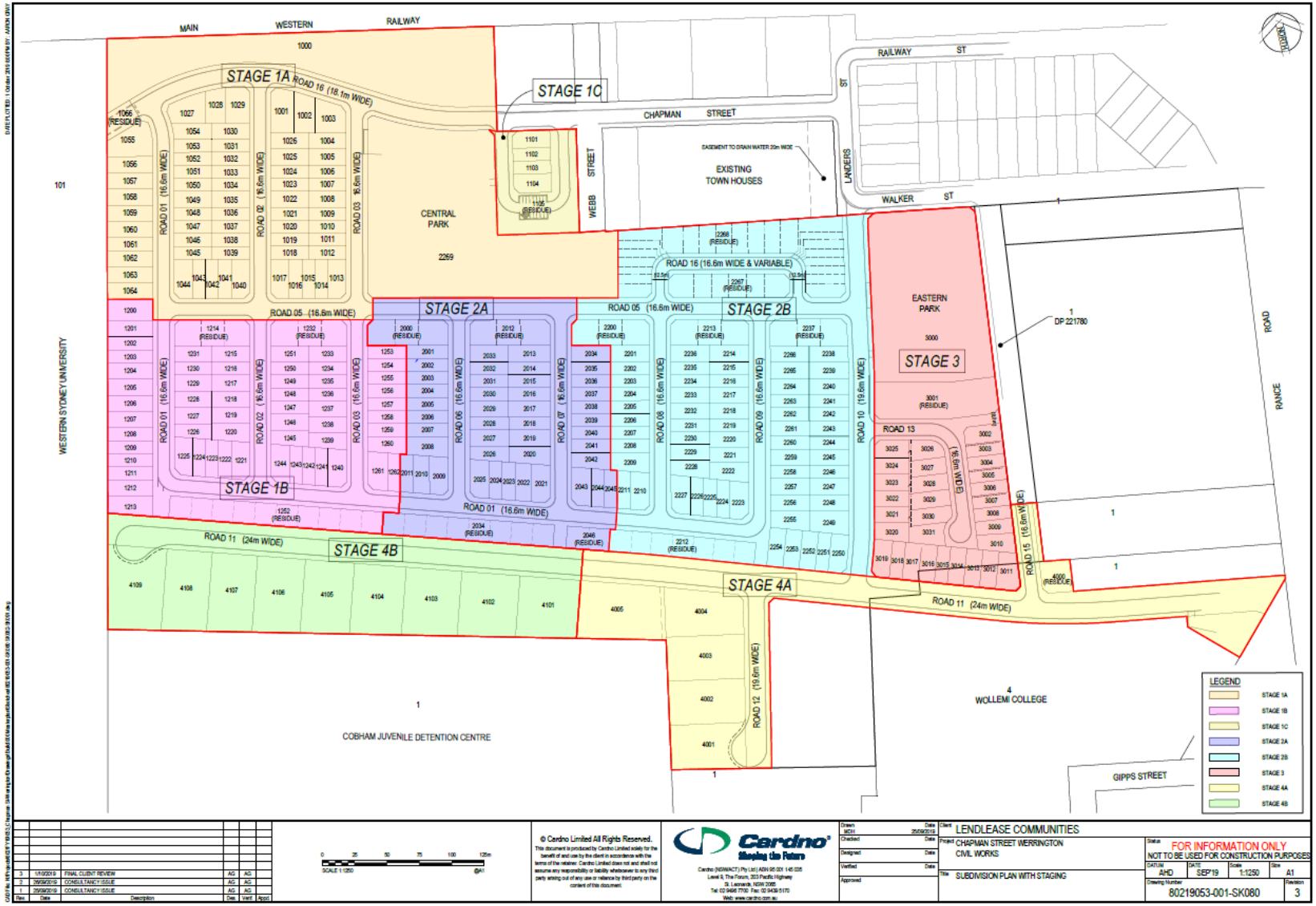


Figure 5-1 Development Layout

Source: Lendlease (dated 28 August 2019)

6 Crash Data

Crash data for the period 2014 to 2019 for the study area was accessed through TfNSW Centre for Road Safety. **Figure 6-1** shows the location of crashes within the study area.

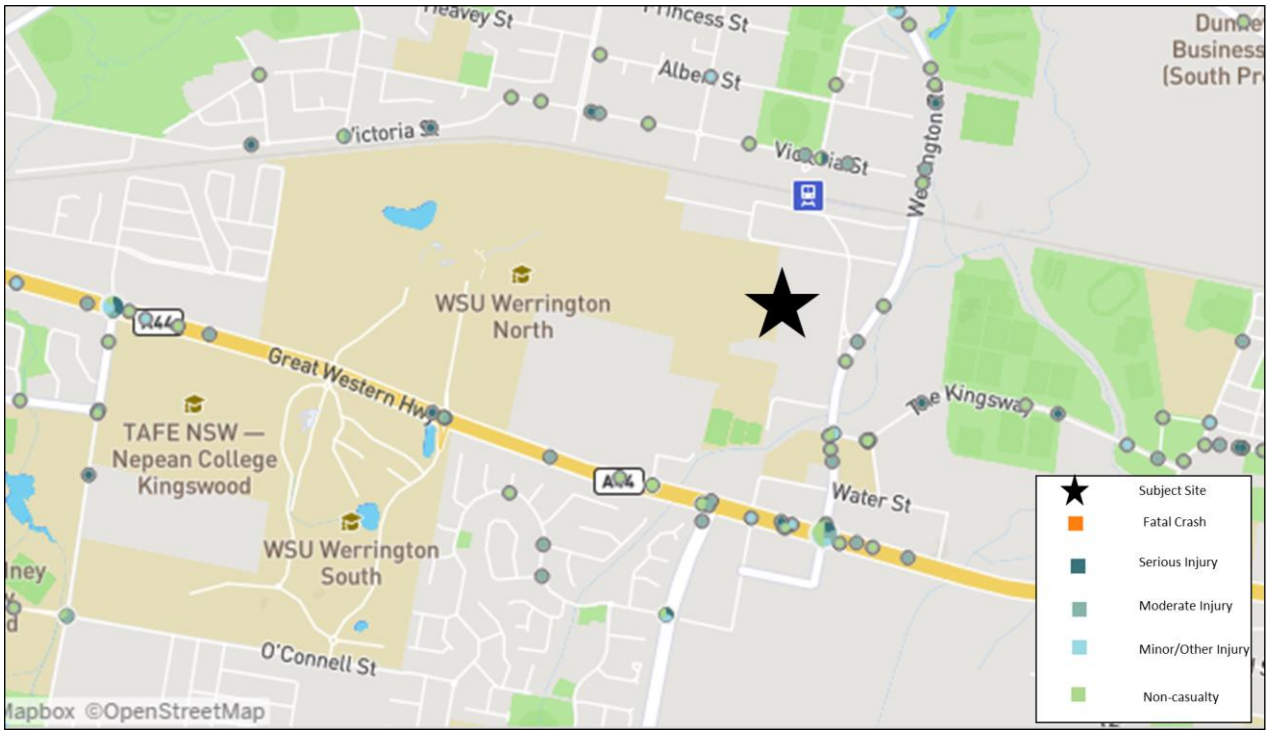


Figure 6-1 Crash locations by injury severity within study area between 2014-2018

The following key findings were identified from the analysis of the crash data:

- No fatalities were recorded in the study area.
- There was a total of two crashes at the Werrington Road / Rance Road Intersection (moderate injury and non-casual (tow-away)).
- There was a total of 20 crashes along Werrington Road which extends from Christie Street to Great Western Highway. Most of the crashes along Werrington Road were non-casual. The details of the crash types are described below:
  - Total of 4 (four) Moderate injury crashes
  - Total of 12 non casual (tow-away) type of crashes
  - 2 (two) serious injury crashes
  - 2 (two) minor injury crashes

7 Traffic Assessment

7.1 Assessment Years

As part of this study there is a need to assess intersection performance for key intersections at different design horizon years. This is done to identify capacity issues and propose mitigation measures (if any) that would ensure satisfactory performance in all design years. This assessment focuses on two design years and is in line with the proposed staging development as outlined in **Section 5.1** and **Table 5-1**.

- Assessing interim requirements at opening year of Stage 1a and 1b only (2022); and
- Assessing ultimate requirements under a ten-year horizon (2029).

7.2 Development Traffic Generation

An indication of the traffic generation potential of the proposed development is sourced from the "*25 Rance Road Werrington Traffic Assessment Report*" prepared by Mott Macdonald (February 2015). The report adopted a lower trip rate of 0.4 trips per dwelling considering the mixture of low and medium density residential dwellings and the potential for easy access to rail and bus services from the site.

RMS trip generation rates for medium density housing is between 0.4 and 0.65 trips per dwelling. Hence it was deemed reasonable to adopt a trip rate of 0.4 trips per dwelling for the mixture of low and medium density given the current public transport usage for residential commuter trips was around 30%.

Cardno have compared 2019 aerial photography to 2014 to confirm that the number of lots has remained unchanged between 2014 (Mott Macdonald Report traffic survey period) and the current year (2019). Classified intersection counts that were recently undertaken by Cardno (August 2019) were compared against previous assessments (Mott MacDonald, December 2014) relating to the Werrington Road / Rance Road Intersection and showed negligible turning volume differences (except for the northbound through approach) as seen in **Table 7-1**.

Table 7-1 Traffic Survey Comparison Werrington Rd/Rance Rd Intersection (Cardno 2019 vs Mott MacDonald 2014)

		Cardno (August 2019)		Mott MacDonald (December 2014)	
Approach	**Movement**	**AM (7:45-8:45)**	**PM (16:45-17:45)**	**AM (7:45-8:45)**	**PM (16:45-17:45)**
North	T	819	635	860	645
	R	21	16	11	10
South	L	79	58	56	66
	T	630	1,189	517	1,174
West	L	20	28	25	26
	R	62	64	51	63
Total (vehs/hr)		**1,631**	**1,990**	**1,520**	**1,984**

Therefore, a trip generation rate of 0.4 for both AM and PM peaks for low and medium density residential dwellings has been applied for this assessment.

For High-Density Residential (apartments) the trip generation rates provided by the RMS Technical Direction is 0.19 per dwelling for the AM Peak and 0.15 per dwelling for the PM Peak. As the trip generation rates provided by RMS is extreme for this location this assessment has adopted a rate of 0.29 trips per dwelling considering that the apartment users are likely to have higher car ownership and less public transport availability. Regarding the trip generation for industrial land uses this assessment has adopted the rates provided by the RMS Technical Direction

The adopted traffic generation rates for this assessment is given below:

Low and Medium Density Residential

AM Peak: 0.4 trips per lot

PM Peak: 0.4 trips per lot

High Density Residential (Apartments)

AM Peak: 0.29 trips per dwelling

PM Peak: 0.29 trips per dwelling

Industrial

AM Peak: 0.52 per 100 m^2 of GFA

PM Peak: 0.56 per 100 m^2 of GFA

The resulting traffic generation is summarised in **Table 7-1**.

Table 7-1 Traffic Generation Estimate

Stage	Lots/Dwellings/GFA	Traffic Generation (# of Trips)	
		AM Peak	PM Peak
Stage 1A	64 Lots	26	26
Stage 1B	76 Lots	30	30
Stage 1C	18 Lots	7	7
Stage 2A	60 Lots	24	24
Stage 2B	108 Lots	43	43
Stage 3	30 Lots	12	12
Stage 3	33 Apartments	10	10
Stage 4A	10982.3 m^2 GFA	57	62
Stage 4B	20017.7 m^2 GFA	104	112
Total		313	326

The proposed development is therefore expected to generate 313 vehicular trips during the 1-hour morning peak and 326 vehicular trips during the evening peak period.

In addition to the traffic generated by the new development, a background traffic growth rate of **2% per annum** was applied to the existing road network. Traffic background growth refers to the traffic volume increase experienced across corridors between different years, which are not impacted by the proposed developments within the study precinct. To calculate this traffic growth, historical traffic background data at the same locations are compared to most recent traffic surveyed data. A growth rate is then determined for the compared time period and a linear annual percentage growth is derived.

7.3 Trip Distribution

- The ratio of the inbound and outbound traffic movements for residential developments is assumed to be 20:80 in the AM peak hour and 80:20 in the PM peak hour respectively.
- The ratio of the inbound and outbound traffic movements for industrial developments is assumed to be 50:50 in the AM and PM peak hour respectively.
- Cardno adopted the shortest distance calculation approach in order to derive the number of lots that are expected to use the two site accesses (new East-West link and Rance Road):
  - It is assumed that traffic from development stages 1a and 1c will divert to Chapman Street / Railway Street / Rance Road; and
  - The remaining development stages (1b, 2a, 2b, 3, 4a and 4b) are expected to use the new East-West link upon construction completion.
- The 2019 surveyed turning count proportions were adopted to distribute the North/South trips going in/out of the development. The North/South trip assignment obtained from survey turning counts is shown in **Figure 7-1**.

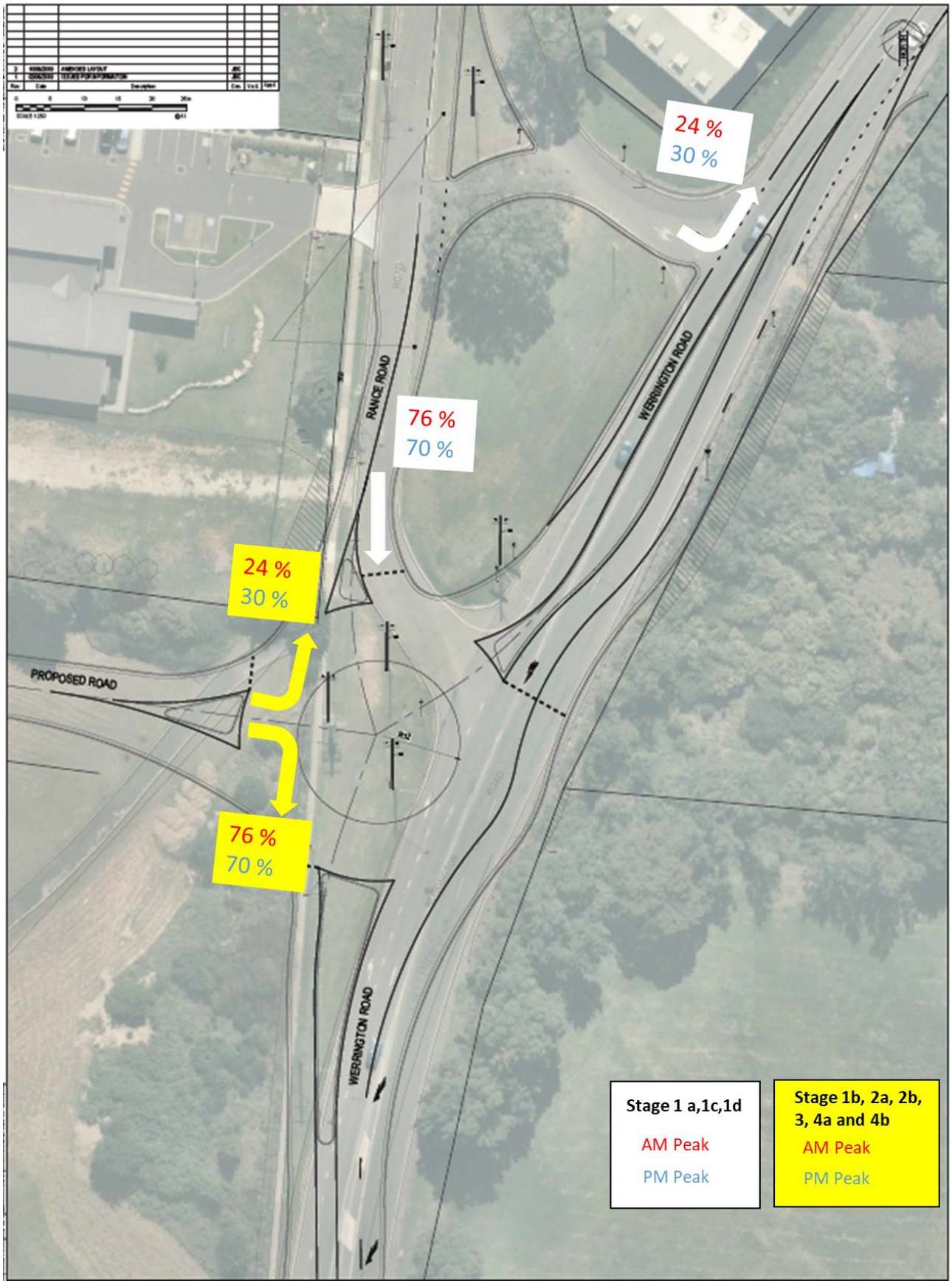


Figure 7-1 North/South Trip Assignment

7.4 Key Intersections Operations and Performance

The existing intersection operation performance was assessed using the SIDRA Intersection 8.0 software package. The key indicator of intersection performance is typically the Level of Service (LoS), where results are placed on a scale from 'A' to 'F', outlined in **Table 7-2**

Table 7-2 Level of Service Criteria for Intersections

Level of Service	Average Delay per Vehicle (sec/veh)	Traffic Signals, Roundabout	Giveway & Stop Signs
A	< 14	Good Operation	Good Operation
B	15 to 28	Good with acceptable delays and spare capacity	Acceptable delays and 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 and requires additional capacity.	Unsatisfactory and requires additional capacity.

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

The Average Vehicle Delay (AVD) provides a measure of the operational performance of an intersection and determines the LoS when applying the RMS method. It should be noted that the AVD's should be taken as a guide only as longer delays could be tolerated in some locations (i.e. inner city conditions) and on some roads (i.e. minor side street intersecting with a major arterial route). For traffic signals, the weighted average delay over all movements should be utilised. For roundabouts and priority control intersections (sign control) the critical movement for assessing LoS should be the movement with the highest average delay.

The Degree of Saturation (DoS) is another measure of the operational performance of individual intersections. For intersections controlled by traffic signals, both queue length and delay increase rapidly as DOS approaches 1.0. It is usual to attempt to keep DOS to less than 0.9. Degrees of Saturation in the order of 0.7 generally represent satisfactory intersection operation. When DOS exceed 0.9 queues can be anticipated.

7.4.1 SIDRA Model Calibration

The Rance Road / Werrington Road intersection was assessed as an initial step using SIDRA and based on the updated 2019 traffic surveys. SIDRA outputs (under default parameters) showed LoS B in the AM peak with 26.8 seconds of average delay and LoS F in the PM peak with 152.7 seconds of average vehicle delay for the worst movement (right turn onto Werrington Road).

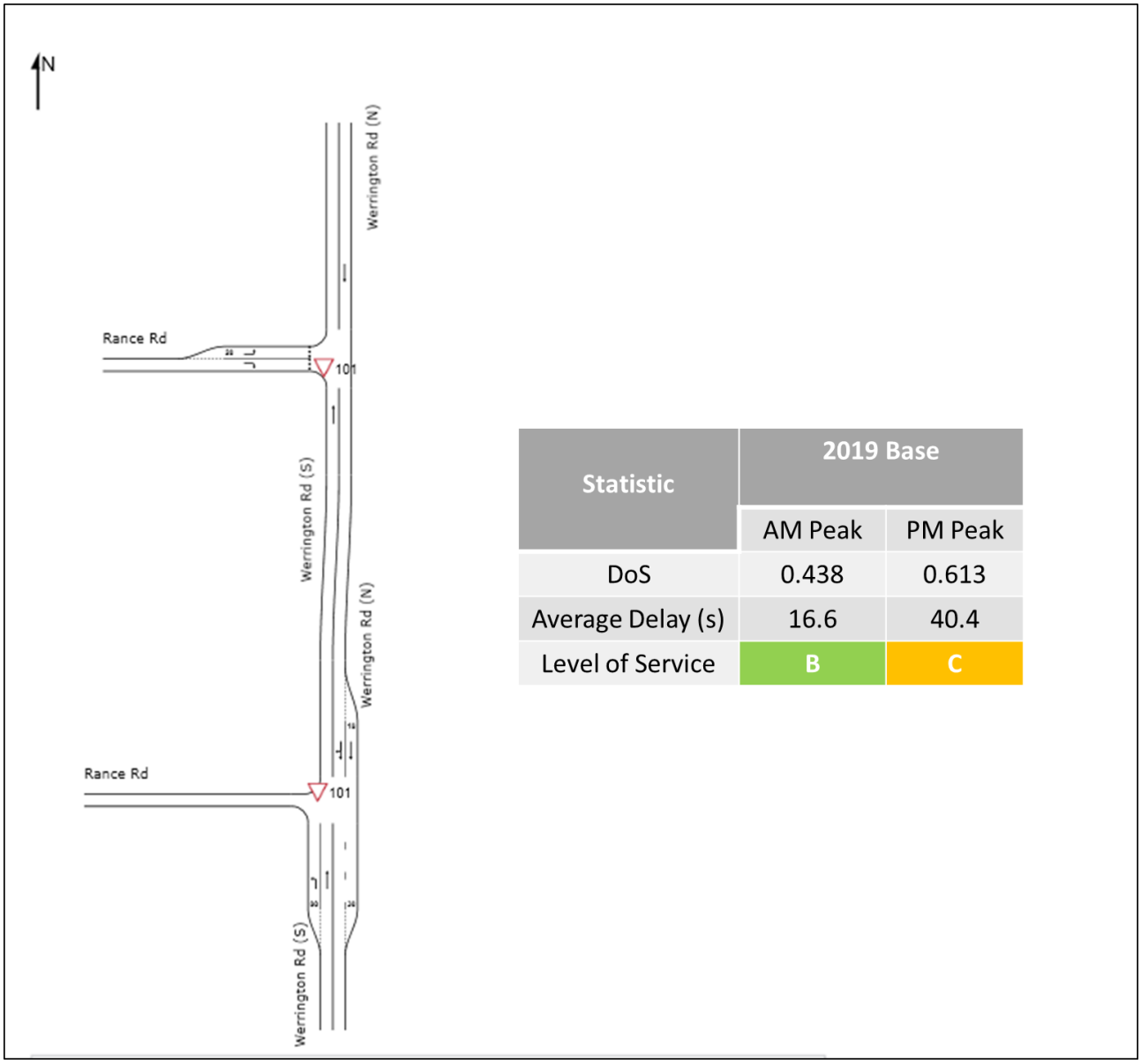
Delay surveys for the right turn from Rance Road onto Werrington Road were analysed and showed that average vehicle delay during the morning 1-hour peak was 17 seconds and for the afternoon 1-hour peak 40 seconds. This suggests a discrepancy between SIDRA outputs and surveyed vehicle delay.

The "critical gap" parameter was adjusted to calibrate the SIDRA model to the observed average vehicle delay for the right turn (for both AM and PM peaks). Critical gap for the Rance Road right turn was adjusted from the default value of 7.0 seconds to 6.35 seconds. The actual critical gap acceptance calculated by SIDRA through the Two Way Sign Control Calibration (TWSC) is actually 3.65 seconds in both the AM and PM peak which is aggressive behaviour. Updated LoS for the 2019 base AM peak remains at LoS B with average delay of 16.6 seconds and improves to LoS C with average delay of 41.7 seconds in the PM peak.

This parameter was carried forward for the future base modelling of 2022 and 2029.

7.4.2 2019 Base Year

The Rance Road / Werrington Road geometry for 2019 base is illustrated in **Figure 7-2**.The intersection assessment has been undertaken using SIDRA v8 network input parameters. This is to enable the model to see the impact of queue propagation as modelled in SIDRA.



Statistic	2019 Base	
	AM Peak	PM Peak
DoS	0.438	0.613
Average Delay (s)	16.6	40.4
Level of Service	B	C

Figure 7-2 2019 Intersection Performance Summary

The intersection of Rance Road / Werrington Road is currently operating at satisfactory LoS B during the AM and LoS C during PM peak hour. The LoS is based on the worst movement which is the right turn movement from Rance Road.

7.4.3 2022 Design Horizon Year

The 2022 design horizon year assumes that stage 1a and 1b (including the development of the super lots through subsequent development application) will have been fully constructed without the East-West link in place.

As such, the proposed 4-leg roundabout would be constructed to operate as a 3- leg roundabout until Stage 4a of the development. **Figure 7-3** illustrates the base and upgraded SIDRA networks along with the operational performance summaries.

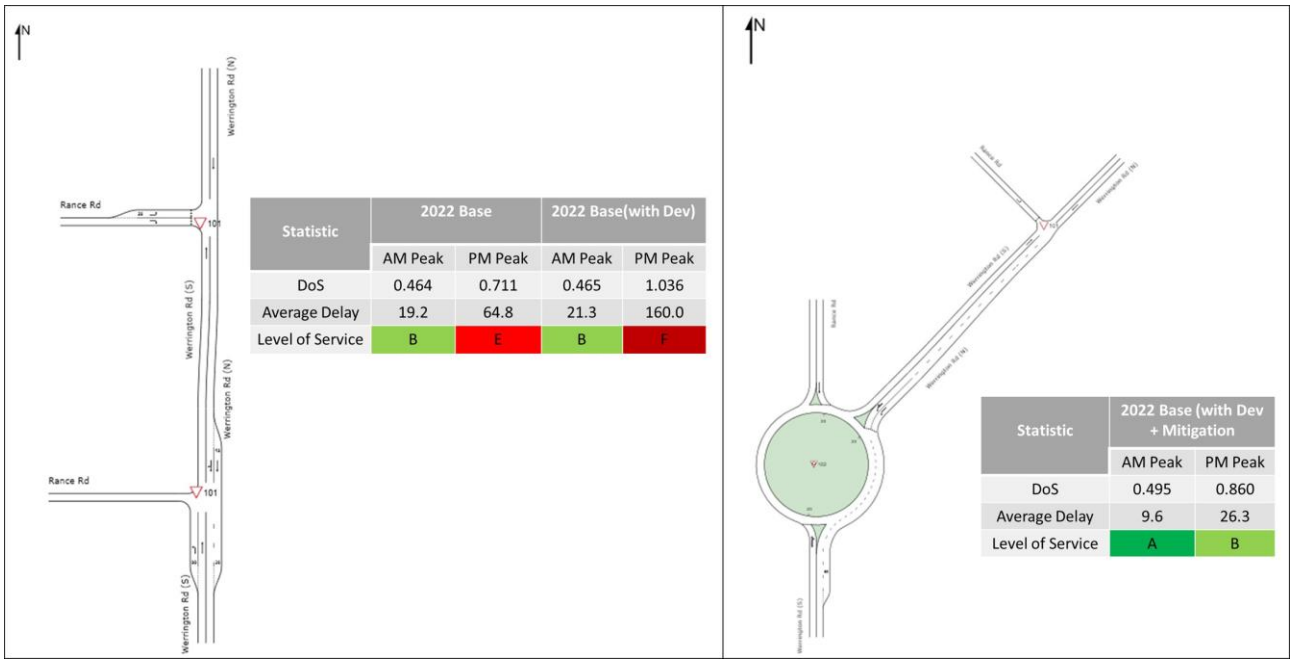


Figure 7-3 2022 Design Horizon Intersection Performance Summary

> Under the 2022 base scenario, the intersection of Rance Road / Werrington Road will operate at LoS B in the AM peak and LoS E in the PM peak. The intersection will deteriorate further to LoS F in the PM peak due to the additional developmental traffic. The worst movement was the right turn movement from Rance Road.

> With the application of the proposed 3-approach roundabout design, the intersection performance of Rance Road / Werrington Road will improve from LoS F to B in the PM peak. The roundabout design will also improve the intersection's performance in the AM peak from LoS B to A.

7.4.4 2029 Design Horizon Year

The 2029 design horizon year assumes that all stages will have been constructed and the East-West link will be in place tying in with the already proposed 3-approach roundabout to convert it into a 4-approach as seen in **Figure 7-4**.

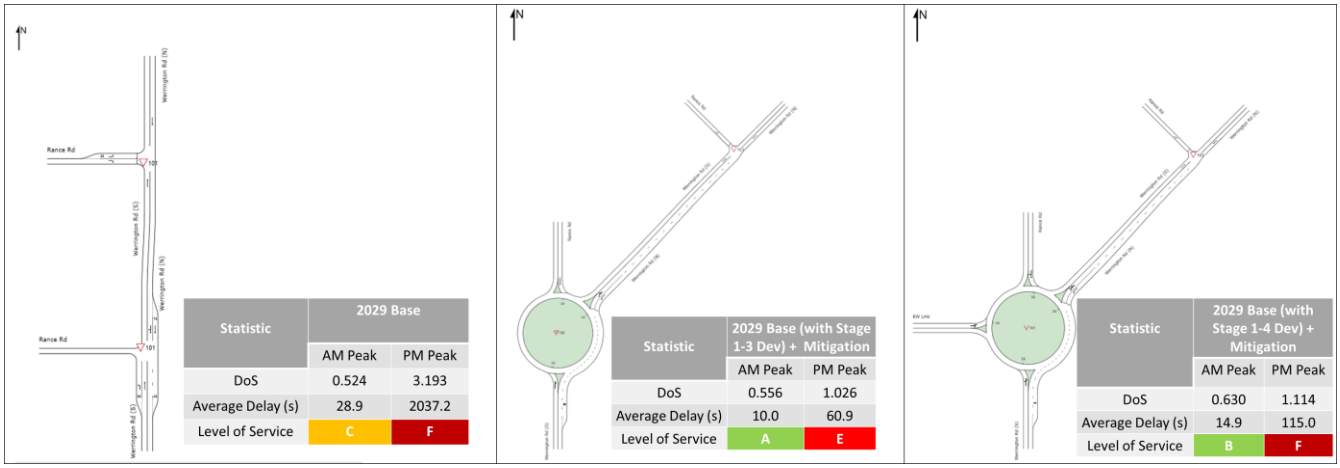


Figure 7-4 2029 Design Horizon Year Intersection Performance Summary

> Under the 2029 base case (no developmental traffic), the intersection of Rance Road / Werrington Road will operate unsatisfactorily in the PM peak with LoS F. The LoS is based on the worst movement which is the right turn movement from Rance Road.

- The scenario for three-legged roundabout has only been tested for Stages 1-3, which purely consists of residential development. The four-legged roundabout was tested for all stages 1-4, which consists of both residential and industrial land uses.
- With the application of three-legged roundabout design, the intersection will operate at capacity in the PM peak with LoS E. The LoS is based on the worst movement which is the right turn movement from Rance Road. This LoS E for Rance Road is actually an improvement when compared to the LoS F under the base scenario (>2,000 seconds).
- The introduction of the proposed East-West link as the fourth arm to the roundabout's design (west approach), will result in unsatisfactory performance during the PM peak with LoS F. The roundabout design however significantly improves the delay performance when compared to the 2029 base case. LoS in the AM peak improves from C to B when compared to the 2029 base. The afternoon peak hour is reported as LoS "F" however, again this is considerably better than the base scenario (>2,000 seconds).
- Similarly, the SWUV structure plan relies upon the delivery of the Werrington Arterial Stage 2 project. The performance of the intersection of the East West links, Werrington Road and Rance Road will ultimately improve once the capacity of Werrington road increases per the planned Werrington Arterial Road Stage 2 upgrade.

Detailed intersection performance results extracted from SIDRA are provided in **Appendix C**.

8 Public and Active Travel

8.1 Proposed Internal Road Network

The road hierarchy proposed by the SWUV structure plan provided within the DCP of Penrith Development Control Plan 2014 is shown in **Figure 8-1**.

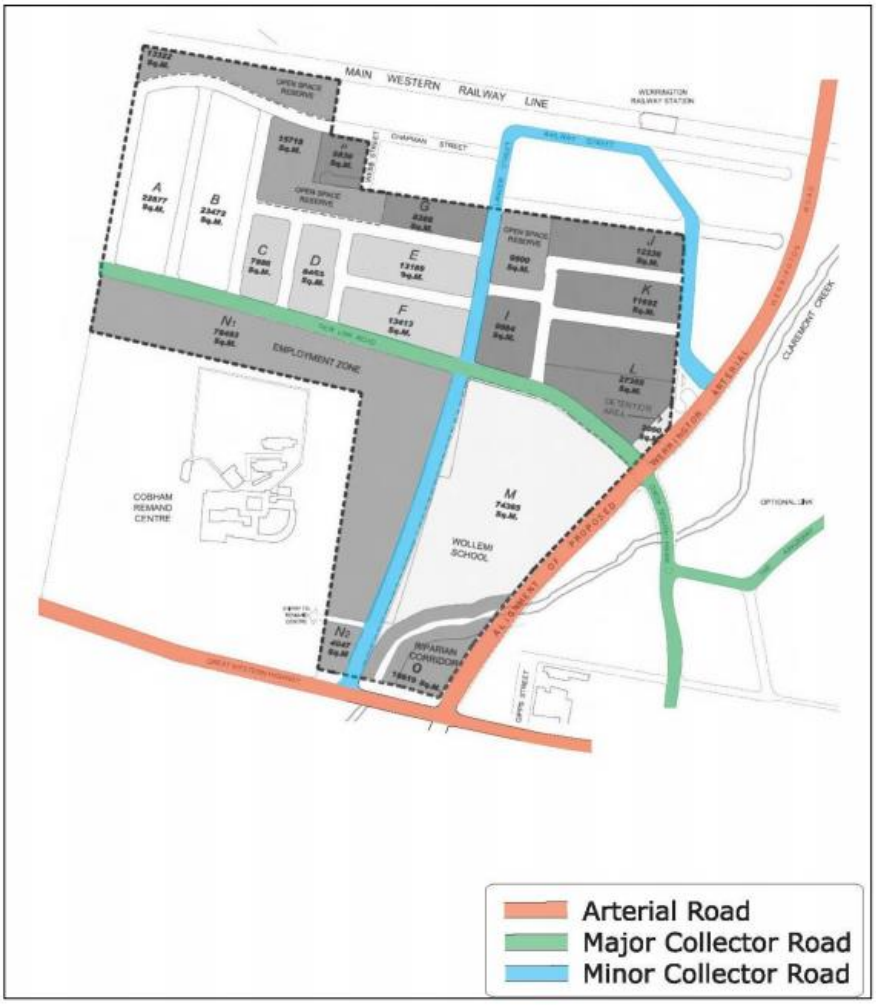


Figure 8-1 Proposed Road Hierarchy

As seen from **Figure 8-1,** the structure plan envisages a major and minor collector road (East-West New Link Road, North-South Road) to run through the subject site. The subdivision layout provided by Lendlease as seen in **Figure 5-1** shows an internal road in the east-west direction which runs in the same alignment envisioned by the structure plan. The North-South road has been segmented into two straights which are linked by the East-West New Link Road.

The indicative sections of East-West New Link Road, North-South Road and Local Road envisioned by the structure plan are illustrated in **Figure 8-2**, **Figure 8-3** and **Figure 8-4** respectively.

The structure plan envisions the width of the East-West link road for the carriageway (including pavement and kerbside lane only) to be 14 m whereas the proposed layout also shows an approximate width of 12 m for the carriageway. The overall road reserve width is unchanged and it is understood that some additional width has been provided to the footpath verges.

The North-South which runs north of the East-West Road is 19.6m wide and has a 12m wide carriageway (including pavement and kerbside lane only) in accordance with the structure plan.

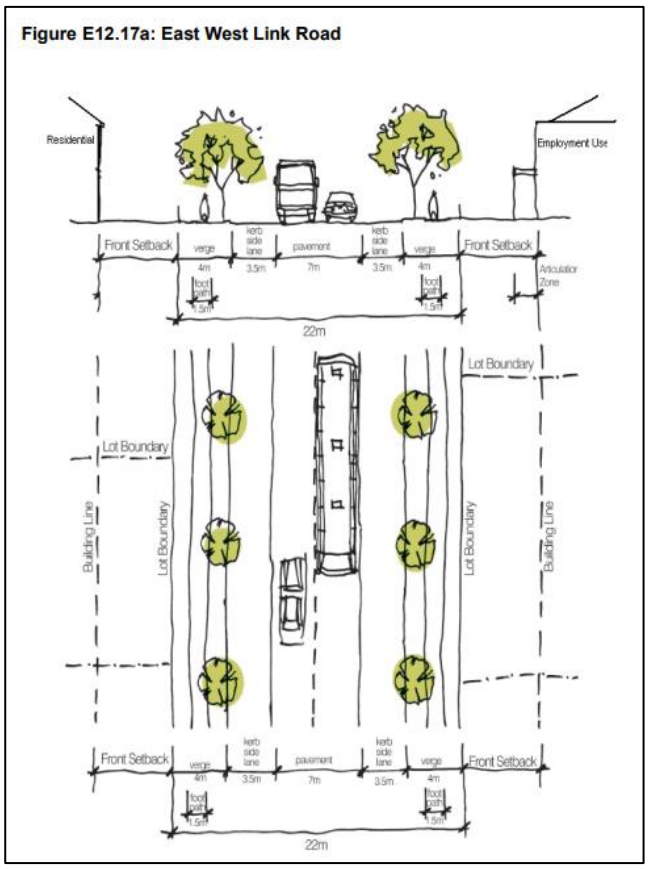


Figure 8-2 Indicative Section East-West Link Road

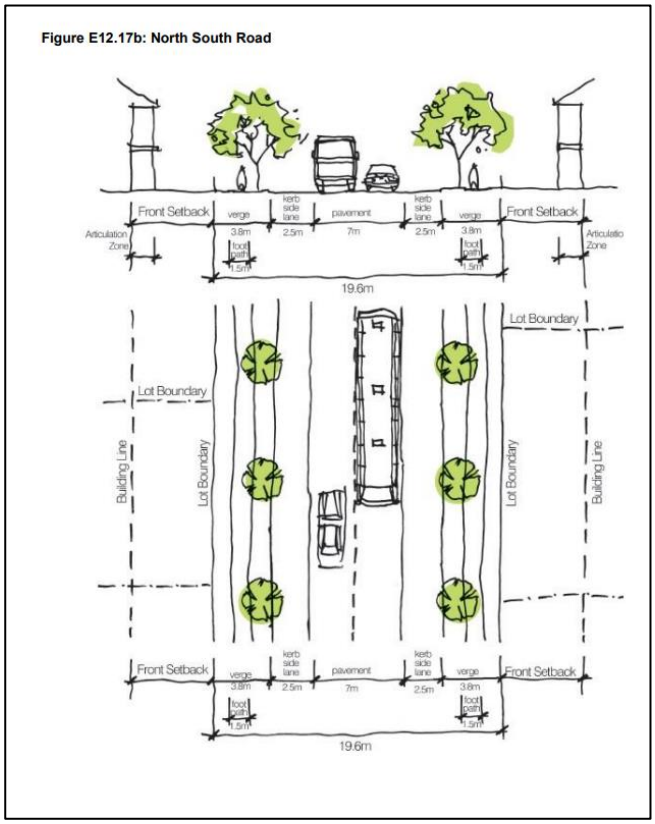


Figure 8-3 Indicative Section North-South Road

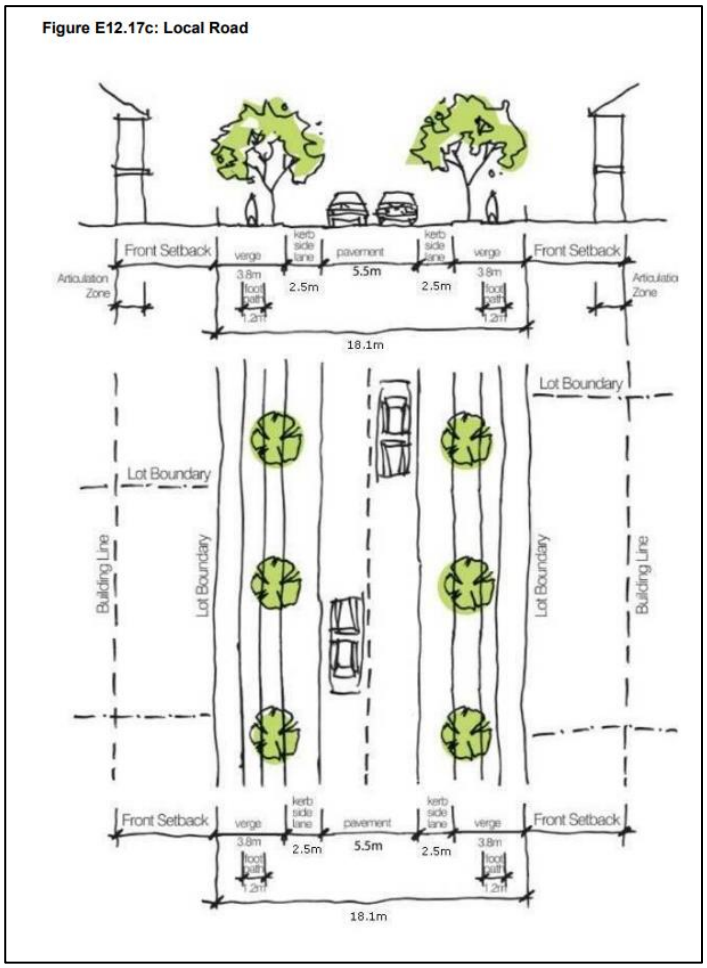


Figure 8-4 Indicative Section Local Road

Cardno recommends providing internal intersection controls where the internal roads intersect (for example New Link Road /Local Road intersections). Also, as the East West New Link Road is aligned as long straights, traffic calming measures like speed humps are recommended to control the speed. Also, pedestrian refuges are recommended to be provided to improve pedestrian permeability.

Stopping Sight Distance (SSD) for the individual lot access driveways is assessed based on the guidelines provided in relevant Australian Standard (AS 2890.1:2004). The SSD determines the minimum sight distance, which should be provided on a major road at an intersection and is dependent on several factors including the major road speed limit of frontage road and type of vehicle traveling on the road.

At the DA stage for each individual dwelling, the lot driveways need to be located and constructed so that there is adequate entering stopping sight distance (SSD), which is most likely adequately offset from corners and bends. It is understood that all corner Lots have been sized so to allow for a driveway to be placed a minimum of 6m from the tangent points of all kerb returns.

8.2 Public transport Accessibility

The public transport proposed by the SWUV structure plan provided within the DCP of Penrith Development Control Plan 2014 is shown in **Figure 8-5**.

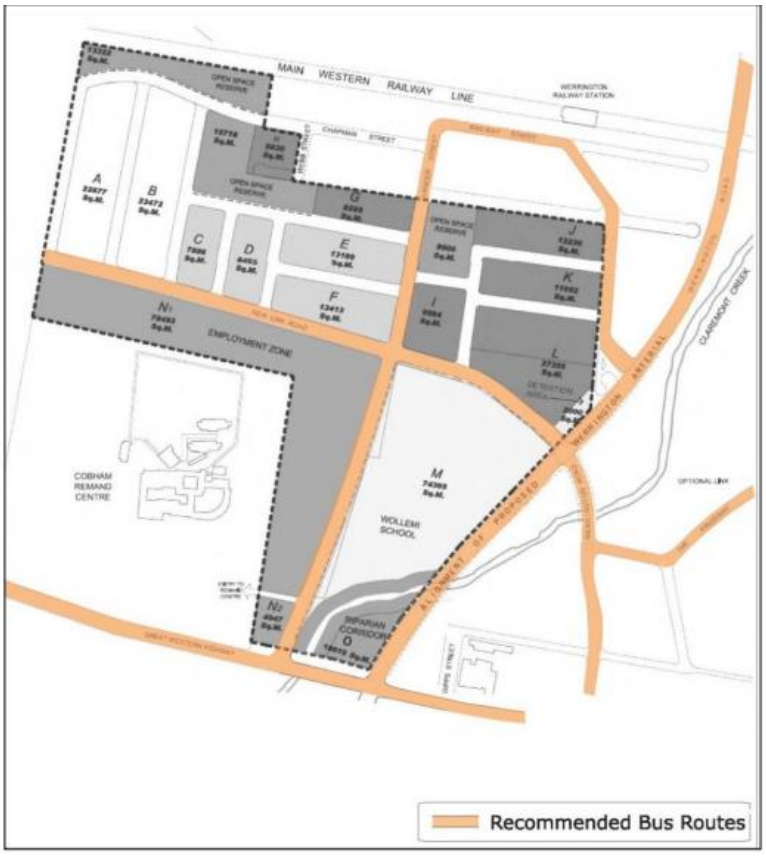


Figure 8-5 Proposed Bus Routes

As seen from **Figure 8-5,** the structure plan envisions bus routes to run along the arterial roads (Great Western Highway and Werrington Road) and to enter the site through the proposed East-West link road and North-South link Roads.

The proposed subdivision layout as seen in **Figure 5-1** shows an internal road in the east-west direction that has the potential to run the bus in the same route as envisioned by the structure plan. The location of the proposed North-South link road is slightly different to the structure plan however affords the the same connectivity through the site.

8.3 Pedestrian / Cycle Connectivity

The pedestrian/cycle connectivity proposed by the SWUV structure plan provided within the DCP of Penrith Development Control Plan 2014 is shown in **Figure 8-6**.

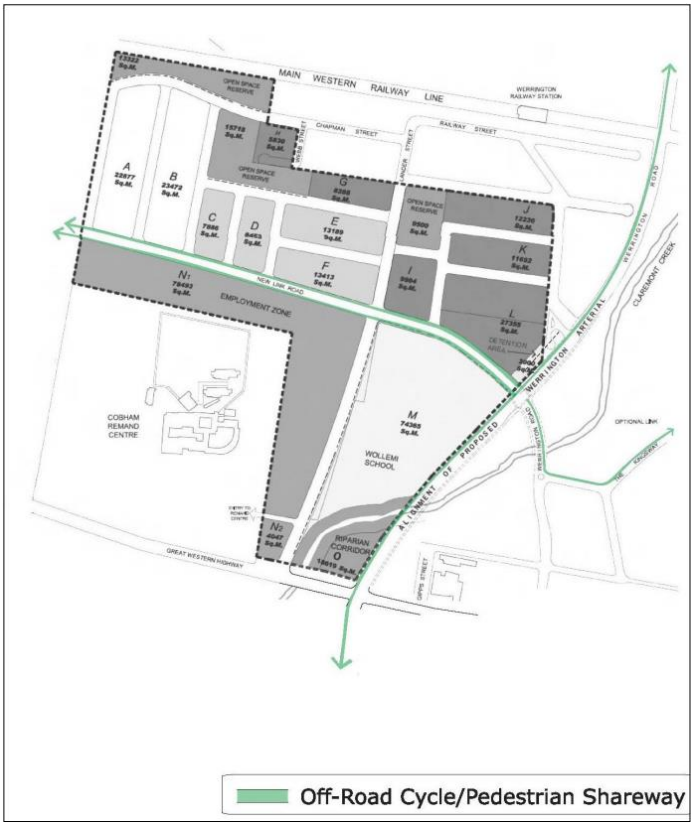


Figure 8-6 Proposed Pedestrian/Cycling Links

As seen from **Figure 8-6,** the structure plans envisions an off-road cycle/pedestrian share way to run along the East-West Road.

It should be noted that DCP requires pedestrian and cycle pathway to have a minimum width of 1.5 m which should be provided along both sides of the road. The subdivision layout at **Figure 5-1** proposes a share way width of 3.6m. This greatly improves the safety of the users of this share way.

9 Conclusion

The traffic impact assessment undertaken for the Werrington subdivision results in the following conclusions:

- Previous traffic reports have shown that:
  - Traffix has previously undertaken a traffic impact assessment for the SWUVP development. The SWUVP Concept Plan envisaged a proposed development of some 2,000 units of high and medium density with a mix of employment and industrial land as well;
  - Cardno's review of the document identified that with no development, Rance Road / Werrington Road performs at LoS B & F during the AM and PM peak hour respectively. The Traffix report states that provision of the new East-West link between the subject site and the future signalised intersection with Werrington Road should be considered a priority for redevelopment of the South Werrington Urban Village as a result of the poor performance identified at Rance Road. The proposed signalised intersection along Werrington Road with the new East-West link (at the south of Rance Road) would provide additional capacity and ensure acceptable level of service intersection performance to cope with future developmental traffic; and
  - Provision of signalised intersection likely to be warranted when some 950 residential units are developed to achieve 200veh/hr on the minor road required under the warrant criteria at the time of the assessment.
- The Lot yield plan is proposing a development which will ultimately provide for a total of 389 dwellings. This is split up into 265 Lots, 91 future Lots and 33 future apartments. The development also includes the creation of 14 industrial lots comprising 31,005 m^2 gross land area. The development scale is considerably lower when compared to the yield highlighted in Traffix's report;
- The complete development is expected to generate 317 and 330 vehicular trips per hour in the AM and PM peaks respectively;
- A 2% per annum background traffic growth has been added across Werrington Road for the purpose of this assessment to capture significant growth from the SWUV and other growth precincts nearby;
- Trip rate of 0.4 trips per dwellings was adopted for the reasons specified in this assessment as well as Mott Macdonald's report. This considers the sites locality to the Werrington railway station;
- Stage 1a and Stage 1b are planned to be completed by the end of 2022 with the remaining stages being completed by the end of year 2029;
- Vehicular access into and out of the proposed development will be through the existing connections to the development via Walker Street/Chapman Street and a new link road (East-West link), which will connect to Werrington Road;
- Cardno adopted the shortest distance calculation approach in order to derive the number of lots that are expected to use the two site accesses (new East-West link and Rance Road):
  - It is assumed that traffic from development stages 1a and 1c will divert to Chapman Street / Railway Street / Rance Road; and
  - The remaining development stages (1b, 2a, 2b, 3, 4a and 4b) are expected to use the new East-West link upon construction completion.
- The TIA assessed a roundabout design using SIDRA in both 2022 and 2029 with the following specifications:
  - 3-approach roundabout conversion at Rance Road / Werrington Road by 2022 (Stage 1a and 1b);
  - 3-approach roundabout conversion at Rance Road / Werrington Road by 2029 (Stage 1-3); and
  - 4-approach roundabout conversion tying in the East-West link to the west by 2029 (Stage 1-4).
- SIDRA results show the intersection of Rance Road / Werrington Road is currently (2019) operating at LoS B and C in the AM and PM peaks respectively;
- The 2022 and 2029 base case SIDRA models showed unsatisfactory intersection performance with LoS E and F in the PM peak at the respective years;

- The implementation of the three-legged roundabout design in 2022 will improve performance to LoS B in the PM peak when compared to the base case.
- In 2029 the three-legged and four-legged roundabout will operate at LoS E and F respectively in the PM peak. However, both scenarios show significant delay improvements when compared to the 2029 base case;
- It is important to state that the development of the Werrington site is part of the wider SWUV precinct development. Under the SWUV, it was intended that the East-West link intersection with Werrington Road would be signalised and as such providing additional capacity, making the roundabout design and corresponding LoS performance redundant.
- Similarly, the SWUV structure plan relies upon the delivery of the Werrington Arterial Stage 2 project. The performance of the intersection of the East West links, Werrington Road and Rance Road will ultimately improve once the capacity of Werrington road increases per the planned Werrington Arterial Road Stage 2 upgrade.

APPENDIX

A

DEVELOPMENT LAYOUT

DATE PLOTTED: 1 October 2019 8:00 PM BY : AARON GRAY

MAIN WESTERN RAILWAY

1000

STAGE 1A

ROAD 16 (18.1m WIDE)

1066 (RESIDUE)

1055

1056

1057

1058

1059

1060

1061

1062

1063

1064

1027 1028 1029

1054 1030

1053 1031

1052 1032

1051 1033

1050 1034

1049 1035

1048 1036

1047 1037

1046 1038

1045 1039

1044 1043 1042 1041 1040

ROAD 01 (16.6m WIDE)

ROAD 02 (16.6m WIDE)

ROAD 03 16.6m WIDE)

1001 1002 1003

1026 1004

1025 1005

1024 1006

1023 1007

1022 1008

1021 1009

1020 1010

1019 1011

1018 1012

1017 1016 1015 1014 1013

STAGE 1C

1101

1102

1103

1104

1105 (RESIDUE)

CHAPMAN STREET

WEBB STREET

EASEMENT TO DRAIN WATER 20m WIDE

EXISTING TOWN HOUSES

LANDERS ST

RAILWAY ST

WALKER ST

CENTRAL PARK

2269

2268 (RESIDUE)

ROAD 16 (16.6m WIDE & VARIABLE)

(12.5m) 2267 (RESIDUE) (12.5m)

ROAD 05 (16.6m WIDE)

STAGE 2A

STAGE 2B

EASTERN PARK

3000

STAGE 3

3001 (RESIDUE)

ROAD 13

(8.0m)

3002 3003 3004 3005 3006 3007 3008 3009 3010

3025 3026

3024 3027

3023 3028

3022 3029

3021 3030

3020 3031

3019 3018 3017 3016 3015 3014 3013 3012 3011

(16.6m WIDE)

ROAD 15 (16.6m WIDE)

4000 (RESIDUE)

1 DP 221780

ROAD

RANCE

101

WESTERN SYDNEY UNIVERSITY

1200 1201 1202 1203 1204 1205 1206 1207 1208 1209 1210 1211 1212 1213

1214 (RESIDUE)

1231 1215

1230 1216

1229 1217

1228 1218

1227 1219

1226 1220

1225 1224 1223 1222 1221

1232 (RESIDUE)

1251 1233

1250 1234

1249 1235

1248 1236

1247 1237

1246 1238

1245 1239

1244 1243 1242 1241 1240

2000 (RESIDUE)

1253 2001

1254 2002

1255 2003

1256 2004

1257 2005

1258 2006

1259 2007

1260 2008

1261 1262 2011 2010 2009

2012 (RESIDUE)

2033 2013

2032 2014

2031 2015

2030 2016

2029 2017

2028 2018

2027 2019

2026 2020

2025 2024 2023 2022 2021

2200 (RESIDUE)

2034 2201

2035 2202

2036 2203

2037 2204

2038 2205

2039 2206

2040 2207

2041 2208

2042 2209

2043 2044 2045 2211 2210

2213 (RESIDUE)

2236 2214

2235 2215

2234 2216

2233 2217

2232 2218

2231 2219

2230 2220

2229 2221

2228 2222

2227 2226 2225 2224 2223

2237 (RESIDUE)

2266 2238

2265 2239

2264 2240

2263 2241

2262 2242

2261 2243

2260 2244

2259 2245

2258 2246

2257 2247

2256 2248

2255 2249

2254 2253 2252 2251 2250

ROAD 01 (16.6m WIDE)

ROAD 02 (16.6m WIDE)

ROAD 03 (16.6m WIDE)

ROAD 06 (16.6m WIDE)

ROAD 07 (16.6m WIDE)

ROAD 08 (16.6m WIDE)

ROAD 09 (16.6m WIDE)

ROAD 10 (19.6m WIDE)

STAGE 1B

1252 (RESIDUE)

ROAD 01 (16.6m WIDE)

2034 (RESIDUE)

2046 (RESIDUE)

2212 (RESIDUE)

ROAD 11 (24m WIDE)

STAGE 4B

4109 4108 4107 4106 4105 4104 4103 4102 4101

STAGE 4A

4005 4004 4003 4002 4001

ROAD 12 (19.6m WIDE)

ROAD 11 (24m WIDE)

1

COBHAM JUVENILE DETENTION CENTRE

1

4

WOLLEMI COLLEGE

1

GIPPS STREET

LEGEND

- STAGE 1A
- STAGE 1B
- STAGE 1C
- STAGE 2A
- STAGE 2B
- STAGE 3
- STAGE 4A
- STAGE 4B

Rev.	Date	Description	Des.	Verif.	Appd.
3	1/10/2019	FINAL CLIENT REVIEW	AG	AG	
2	26/09/2019	CONSULTANCY ISSUE	AG	AG	
1	25/09/2019	CONSULTANCY ISSUE	AG	AG	

0 25 50 75 100 125m

SCALE 1:1250 @A1

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Web: www.cardno.com.au

Drawn	MDH
Date	25/09/2019
Checked	
Date	
Designed	
Date	
Verified	
Date	
Approved	

Client: LENDLEASE COMMUNITIES

Project: CHAPMAN STREET WERRINGTON
CIVIL WORKS

Title: SUBDIVISION PLAN WITH STAGING

Status: FOR INFORMATION ONLY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

DATUM	DATE	Scale	Size
AHD	SEP'19	1:1250	A1

Drawing Number: 80219053-001-SK080

Revision: 3

XREFs: XR-80219053-CI-SURVEY; XR-80219053-001-SK080 LOT LAYOUT; XR-80219053-CI-ROAD
CAD File: N:\Projects\80\2FY19\053_Chapman St-Werrington\Drawings\Bulk\000 Masterplan\Sketches\80219053-001-SK080 SK082-SK091.dwg

APPENDIX

B

RANCE ROAD/WERRINGTON ROAD INTERSECTION DESIGN

DATE PLOTTED: 10 September 2019 4:47 PM BY : AARON GRAY

Rev.	Date	Description	Des.	Verif.	Appd.
2	10/09/2019	AMENDED LAYOUT	JBC		
1	02/09/2019	ISSUED FOR INFORMATION	JBC		

0 5 10 15 20 25m

SCALE 1:250 @A1

NORTH

DP132721

EXISTING ISLANDS TO BE DEMOLISHED

EXISTING STORMWATER PIT TO BE RELOCATED

PROPOSED BOUNDARY ADJUSTMENT
APPROX. 125m²

DP527752

EXISTING ELECTRICAL OVERHEAD LINE TO BE RELOCATED

EXISTING LIGHT POLE TO BE RELOCATED

EXISTING WATER MAIN TO BE POTHOLED
TO CHECK AGAINST PROPOSED LEVELS

PROPOSED ROAD

RANCE ROAD

WERRINGTON ROAD

EXISTING SIGN POST TO BE RELOCATED

DP844168

PROPOSED BOUNDARY ADJUSTMENT
APPROX. 200m²

EXISTING SIGN TO BE RELOCATED

EXISTING GUARDRAILTO BE REALIGNED
TO SUIT PROPOSED ROUNDABOUT LAYOUT

R12

PROPOSED BOUNDARY ADJUSTMENT
APPROX. 11m²

EXISTING SIGN TO BE REMOVED

EXISTING POWER POLE TO BE RELOCATED

EXISTING LIGHT POLE TO BE RELOCATED

EXISTING CULVERT HEADWALL

DP734612

DP263098

APPROXIMATE PROPOSED BOUNDARY ADJUSTMENT

EXISTING BOUNDARY FROM SIX MAP CLIP AND SHIP

NOTE: PROPOSED CONCEPT LAYOUT AND
APPROXIMATE AREAS IS FOR DISCUSSION
PURPOSES ONLY AND IS SUBJECT TO FINAL DESIGN

XREFs: XR-80219053-CI-LOT LAYOUT; XR-80219053-CI-SURVEY; XR-80219053-CI-AERIAL; XR-80219053-CI-ROUNDABOUT
CAD File: N:\Projects\802\FY19\053_Chapman St-Werrington\Drawings\Build\000 Masterplan\Sketches\80219053-001-SK032.dwg

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Drawn YNL	Date 02.09.2019
Checked	Date
Designed JBC	Date 02.09.2019
Verified	Date
Approved	

Client: LENDLEASE COMMUNITIES

Project: CHAPMAN STREET WERRINGTON
CIVIL WORKS

Title: WERRINGTON ROAD ROUNDABOUT
SERVICES AND STREETSIGNS RELOCATION / REMOVED

Status: FOR INFORMATION ONLY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

DATUM	DATE	Scale	Size
AHD	JUL' 19	1:250	A1

Drawing Number: 80219053-001-SK032

Revision: 2

APPENDIX

C

SIDRA SUMMARY

MOVEMENT SUMMARY

Site: 101 [Site1 - Rance Rd 2019 AM (Base)-inbound]

Network: N101 [Base 2019 - AM Peak]

New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	Aver. Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: Werrington Rd (S)														
1	L2	79	0.0	79	0.0	0.043	5.5	LOS A	0.0	0.0	0.00	0.58	0.00	51.3
2	T1	630	4.1	630	4.1	0.332	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
Approach		709	3.7	709	3.7	0.332	0.6	NA	0.0	0.0	0.00	0.06	0.00	57.1
North: Werrington Rd (N)														
8	T1	881	2.6	881	2.6	0.403	0.5	LOS A	0.3	2.0	0.07	0.02	0.10	57.3
9	R2	21	0.0	21	0.0	0.403	11.6	LOS A	0.3	2.0	0.09	0.02	0.12	47.8
Approach		902	2.5	902	2.5	0.403	0.7	NA	0.3	2.0	0.07	0.02	0.10	56.8
All Vehicles		1611	3.0	1611	3.0	0.403	0.7	NA	0.3	2.0	0.04	0.04	0.05	56.9

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network 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 [Site1 - Rance Rd 2019 AM (Base)-outbound]

Network: N101 [Base 2019 - AM Peak]

New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	Aver. Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: Werrington Rd (S)														
2	T1	630	4.1	630	4.1	0.332	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
Approach		630	4.1	630	4.1	0.332	0.0	NA	0.0	0.0	0.00	0.00	0.00	59.9
North: Werrington Rd (N)														
8	T1	840	2.7	840	2.7	0.438	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
Approach		840	2.7	840	2.7	0.438	0.1	NA	0.0	0.0	0.00	0.00	0.00	59.9
West: Rance Rd														
10	L2	20	5.0	20	5.0	0.025	7.5	LOS A	0.0	0.3	0.54	0.68	0.54	47.7
12	R2	62	0.0	62	0.0	0.228	16.6	LOS B	0.3	1.8	0.83	0.95	0.91	34.4
Approach		82	1.2	82	1.2	0.228	14.4	LOS A	0.3	1.8	0.76	0.89	0.82	38.6
All Vehicles		1552	3.2	1552	3.2	0.438	0.8	NA	0.3	1.8	0.04	0.05	0.04	57.9

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network 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 [Site1 - Rance Rd 2019 PM (Base)-inbound]

Network: N101 [Base 2019 - PM Peak]

New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	Aver. Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: Werrington Rd (S)														
1	L2	58	0.0	58	0.0	0.031	5.5	LOS A	0.0	0.0	0.00	0.58	0.00	51.3
2	T1	1189	0.8	1189	0.8	0.613	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	59.7
Approach		1247	0.7	1247	0.7	0.613	0.3	NA	0.0	0.0	0.00	0.03	0.00	58.4
North: Werrington Rd (N)														
8	T1	699	1.0	699	1.0	0.360	3.3	LOS A	0.9	6.4	0.16	0.02	0.22	48.1
9	R2	16	0.0	16	0.0	0.360	31.1	LOS C	0.9	6.4	0.21	0.02	0.28	43.6
Approach		715	1.0	715	1.0	0.360	3.9	NA	0.9	6.4	0.16	0.02	0.22	47.8
All Vehicles		1962	0.8	1962	0.8	0.613	1.6	NA	0.9	6.4	0.06	0.02	0.08	53.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network 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.

Organisation: CARDNO (QLD) PTY LTD | Processed: Friday, 6 September 2019 1:57:16 PM
Project: \\cardno.corp\global\AU\NSW\DirectoryStructure\Projects\899\FY14\069_ENGINEERING FEASIBILITY LEND LEASE COMMUNITIES\015_WERRINGTON\Des-An\Traffic\Werrington - Rance Access Only v02-SS.sip8

MOVEMENT SUMMARY

Site: 101 [Site1 - Rance Rd 2019 PM (Base)-outbound]

Network: N101 [Base 2019 - PM Peak]

New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	Aver. Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: Werrington Rd (S)														
2	T1	1189	0.8	1189	0.8	0.613	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.7
Approach		1189	0.8	1189	0.8	0.613	0.0	NA	0.0	0.0	0.00	0.00	0.00	59.7
North: Werrington Rd (N)														
8	T1	651	1.1	651	1.1	0.336	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
Approach		651	1.1	651	1.1	0.336	0.0	NA	0.0	0.0	0.00	0.00	0.00	59.9
West: Rance Rd														
10	L2	28	3.6	28	3.6	0.107	17.5	LOS B	0.1	0.9	0.85	0.93	0.85	42.3
12	R2	64	0.0	64	0.0	0.532	40.4	LOS C	0.6	4.2	0.95	1.05	1.24	23.8
Approach		92	1.1	92	1.1	0.532	33.4	LOS C	0.6	4.2	0.92	1.01	1.12	29.9
All Vehicles		1932	0.9	1932	0.9	0.613	1.6	NA	0.6	4.2	0.04	0.05	0.05	56.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network 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 [Site1 - Rance Rd 2022 AM (Base)-inbound]

Network: N101 [Base 2022 - AM Peak]

New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	Aver. Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: Werrington Rd (S)														
1	L2	79	0.0	79	0.0	0.043	5.5	LOS A	0.0	0.0	0.00	0.58	0.00	51.3
2	T1	668	4.2	668	4.2	0.352	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
Approach		747	3.7	747	3.7	0.352	0.6	NA	0.0	0.0	0.00	0.06	0.00	57.2
North: Werrington Rd (N)														
8	T1	868	2.8	868	2.8	0.399	0.5	LOS A	0.3	2.2	0.08	0.02	0.10	57.0
9	R2	21	0.0	21	0.0	0.399	12.3	LOS A	0.3	2.2	0.09	0.02	0.13	47.7
Approach		889	2.7	889	2.7	0.399	0.8	NA	0.3	2.2	0.08	0.02	0.10	56.5
All Vehicles		1636	3.2	1636	3.2	0.399	0.7	NA	0.3	2.2	0.04	0.04	0.06	56.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network 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 [Site1 - Rance Rd 2022 AM (Base)-outbound]

Network: N101 [Base 2022 - AM Peak]

New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	Aver. Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: Werrington Rd (S)														
2	T1	668	4.2	668	4.2	0.352	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
Approach		668	4.2	668	4.2	0.352	0.0	NA	0.0	0.0	0.00	0.00	0.00	59.9
North: Werrington Rd (N)														
8	T1	889	2.7	889	2.7	0.464	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
Approach		889	2.7	889	2.7	0.464	0.1	NA	0.0	0.0	0.00	0.00	0.00	59.9
West: Rance Rd														
10	L2	20	5.0	20	5.0	0.027	7.9	LOS A	0.0	0.3	0.55	0.70	0.55	47.5
12	R2	62	0.0	62	0.0	0.265	19.2	LOS B	0.3	2.1	0.86	0.97	0.97	32.8
Approach		82	1.2	82	1.2	0.265	16.4	LOS B	0.3	2.1	0.78	0.91	0.87	37.3
All Vehicles		1639	3.2	1639	3.2	0.464	0.9	NA	0.3	2.1	0.04	0.05	0.04	57.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network 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 [Site1 - Rance Rd 2022 PM (Base)-inbound]

Network: N101 [Base 2022 - PM Peak]

New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	Aver. Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: Werrington Rd (S)														
1	L2	58	0.0	58	0.0	0.031	5.5	LOS A	0.0	0.0	0.00	0.58	0.00	51.3
2	T1	1261	0.8	1261	0.8	0.650	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	59.7
Approach		1319	0.8	1319	0.8	0.650	0.3	NA	0.0	0.0	0.00	0.03	0.00	58.4
North: Werrington Rd (N)														
8	T1	673	1.0	673	1.0	0.364	4.9	LOS A	1.2	8.6	0.19	0.02	0.26	44.2
9	R2	16	0.0	16	0.0	0.364	37.3	LOS C	1.2	8.6	0.25	0.02	0.34	41.5
Approach		689	1.0	689	1.0	0.364	5.6	NA	1.2	8.6	0.19	0.02	0.26	44.1
All Vehicles		2008	0.8	2008	0.8	0.650	2.1	NA	1.2	8.6	0.07	0.02	0.09	52.1

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network 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.

Organisation: CARDNO (QLD) PTY LTD | Processed: Tuesday, 24 September 2019 3:36:04 PM
Project: \\cardno.corp\global\AU\NSW\DirectoryStructure\Projects\899\FY14\069_ENGINEERING FEASIBILITY LEND LEASE COMMUNITIES\015_WERRINGTON\Des-An\Traffic\Werrington - Rance Access Only v02-SS.sip8

MOVEMENT SUMMARY

Site: 101 [Site1 - Rance Rd 2022 PM (Base)-outbound]

Network: N101 [Base 2022 - PM Peak]

New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	Aver. Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: Werrington Rd (S)														
2	T1	1261	0.8	1261	0.8	0.650	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.7
Approach		1261	0.8	1261	0.8	0.650	0.0	NA	0.0	0.0	0.00	0.00	0.00	59.7
North: Werrington Rd (N)														
8	T1	689	1.0	689	1.0	0.356	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
Approach		689	1.0	689	1.0	0.356	0.0	NA	0.0	0.0	0.00	0.00	0.00	59.9
West: Rance Rd														
10	L2	28	3.6	28	3.6	0.133	20.9	LOS B	0.2	1.1	0.88	0.95	0.88	40.7
12	R2	64	0.0	64	0.0	0.711	64.8	LOS E	0.8	5.9	0.98	1.11	1.46	18.1
Approach		92	1.1	92	1.1	0.711	51.5	LOS D	0.8	5.9	0.95	1.06	1.28	24.4
All Vehicles		2042	0.9	2042	0.9	0.711	2.3	NA	0.8	5.9	0.04	0.05	0.06	55.4

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network 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 [Site1 - Rance Rd 2022 AM (Base + Dev)-inbound]

Network: N101 [Base + Dev 2022 - AM Peak]

New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	Aver. Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: Werrington Rd (S)														
1	L2	88	0.0	88	0.0	0.047	5.5	LOS A	0.0	0.0	0.00	0.58	0.00	51.3
2	T1	668	4.2	668	4.2	0.352	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
Approach		756	3.7	756	3.7	0.352	0.7	NA	0.0	0.0	0.00	0.07	0.00	57.0
North: Werrington Rd (N)														
8	T1	868	2.8	868	2.8	0.404	0.6	LOS A	0.4	2.6	0.09	0.02	0.12	56.6
9	R2	24	0.0	24	0.0	0.404	12.5	LOS A	0.4	2.6	0.11	0.02	0.15	47.5
Approach		892	2.7	892	2.7	0.404	0.9	NA	0.4	2.6	0.09	0.02	0.12	56.0
All Vehicles		1648	3.2	1648	3.2	0.404	0.8	NA	0.4	2.6	0.05	0.04	0.07	56.4

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network 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 [Site1 - Rance Rd 2022 AM (Base + Dev)-outbound]

Network: N101 [Base + Dev 2022 - AM Peak]

New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	Aver. Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: Werrington Rd (S)														
2	T1	668	4.2	668	4.2	0.352	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
Approach		668	4.2	668	4.2	0.352	0.0	NA	0.0	0.0	0.00	0.00	0.00	59.9
North: Werrington Rd (N)														
8	T1	891	2.7	891	2.7	0.465	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
Approach		891	2.7	891	2.7	0.465	0.1	NA	0.0	0.0	0.00	0.00	0.00	59.9
West: Rance Rd														
10	L2	31	3.2	31	3.2	0.041	7.8	LOS A	0.1	0.4	0.55	0.72	0.55	47.6
12	R2	97	0.0	97	0.0	0.417	21.3	LOS B	0.5	3.5	0.89	1.02	1.12	31.7
Approach		128	0.8	128	0.8	0.417	18.0	LOS B	0.5	3.5	0.81	0.94	0.99	36.4
All Vehicles		1687	3.1	1687	3.1	0.465	1.4	NA	0.5	3.5	0.06	0.07	0.07	56.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network 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 [Site1 - Rance Rd 2022 PM (Base + Dev)-inbound]

Network: N101 [Base + Dev 2022 - PM Peak]

New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	Aver. Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: Werrington Rd (S)														
1	L2	94	0.0	94	0.0	0.051	5.5	LOS A	0.0	0.0	0.00	0.58	0.00	51.3
2	T1	1261	0.8	1261	0.8	0.650	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	59.7
Approach		1355	0.7	1355	0.7	0.650	0.4	NA	0.0	0.0	0.00	0.04	0.00	57.8
North: Werrington Rd (N)														
8	T1	673	1.0	673	1.0	0.422	8.1	LOS A	4.6	32.2	0.72	0.04	0.85	37.8
9	R2	26	0.0	26	0.0	0.422	39.5	LOS C	4.6	32.2	1.00	0.05	1.17	37.4
Approach		699	1.0	699	1.0	0.422	9.3	NA	4.6	32.2	0.73	0.04	0.86	37.8
All Vehicles		2054	0.8	2054	0.8	0.650	3.5	NA	4.6	32.2	0.25	0.04	0.29	48.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network 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 [Site1 - Rance Rd 2022 PM (Base + Dev)-outbound]

Network: N101 [Base + Dev 2022 - PM Peak]

New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	Aver. Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: Werrington Rd (S)														
2	T1	1261	0.8	1261	0.8	0.650	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.7
Approach		1261	0.8	1261	0.8	0.650	0.0	NA	0.0	0.0	0.00	0.00	0.00	59.7
North: Werrington Rd (N)														
8	T1	699	1.0	699	1.0	0.458	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	59.8
Approach		699	1.0	699	1.0	0.458	0.1	NA	0.0	0.0	0.00	0.00	0.00	59.8
West: Rance Rd														
10	L2	32	3.1	32	3.1	0.151	20.9	LOS B	0.2	1.3	0.89	0.95	0.89	40.7
12	R2	72	0.0	72	0.0	1.036	160.0	LOS F	2.2	15.1	1.00	1.62	3.54	9.3
Approach		104	1.0	104	1.0	1.036	117.2	LOS F	2.2	15.1	0.96	1.41	2.73	14.5
All Vehicles		2064	0.9	2064	0.9	1.036	5.9	NA	2.2	15.1	0.05	0.07	0.14	50.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network 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 [Site 3 - Rance Rd 2022 AM]

Network: N101 [Base + Dev 2022 - AM Peak (Mitigation)]

New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	Aver. Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
NorthEast: Werrington Rd (N)														
8	T1	938	2.7	938	2.7	0.489	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	59.8
Approach		938	2.7	938	2.7	0.489	0.1	NA	0.0	0.0	0.00	0.00	0.00	59.8
NorthWest: Rance Rd														
10	L2	33	3.2	33	3.2	0.045	8.1	LOS A	0.1	0.5	0.57	0.74	0.57	47.4
Approach		33	3.2	33	3.2	0.045	8.1	LOS A	0.1	0.5	0.57	0.74	0.57	47.4
SouthWest: Werrington Rd (S)														
2	T1	703	4.2	703	4.2	0.370	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
Approach		703	4.2	703	4.2	0.370	0.0	NA	0.0	0.0	0.00	0.00	0.00	59.9
All Vehicles		1674	3.3	1674	3.3	0.489	0.2	NA	0.1	0.5	0.01	0.01	0.01	59.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network 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: 102 [Site 2 - EW Connection 2022 AM]

Network: N101 [Base + Dev 2022 - AM Peak (Mitigation)]

Site 2 - EW Connection 2022 AM
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	Aver. Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: Werrington Rd (S)														
2	T1	93	0.0	93	0.0	0.495	4.3	LOS A	1.8	12.7	0.18	0.56	0.18	50.3
3a	R1	703	4.2	703	4.2	0.495	7.9	LOS A	1.8	12.7	0.18	0.56	0.18	48.0
Approach		796	3.7	796	3.7	0.495	7.5	LOS A	1.8	12.7	0.18	0.56	0.18	48.5
NorthEast: Werrington Rd (N)														
24a	L1	914	2.8	914	2.8	0.455	3.6	LOS A	1.6	11.4	0.37	0.44	0.37	53.3
26b	R3	25	0.0	25	0.0	0.455	9.6	LOS A	1.6	11.4	0.38	0.44	0.38	49.3
Approach		939	2.7	939	2.7	0.455	3.8	LOS A	1.6	11.4	0.37	0.44	0.37	53.2
North: Rance Rd														
8	T1	102	0.0	102	0.0	0.123	6.9	LOS A	0.3	2.0	0.69	0.66	0.69	50.1
Approach		102	0.0	102	0.0	0.123	6.9	LOS A	0.3	2.0	0.69	0.66	0.69	50.1
All Vehicles		1837	3.0	1837	3.0	0.495	5.6	LOS A	1.8	12.7	0.30	0.50	0.30	50.8

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

MOVEMENT SUMMARY

Site: 101 [Site 3 - Rance Rd 2022 PM]

Network: N101 [Base + Dev 2022 - PM Peak (Mitigation)]

New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	Aver. Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
NorthEast: Werrington Rd (N)														
8	T1	736	1.0	736	1.0	0.380	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
Approach		736	1.0	736	1.0	0.380	0.1	NA	0.0	0.0	0.00	0.00	0.00	59.9
NorthWest: Rance Rd														
10	L2	34	3.1	34	3.1	0.200	26.3	LOS B	0.2	1.7	0.91	0.97	0.96	38.4
Approach		34	3.1	34	3.1	0.200	26.3	LOS B	0.2	1.7	0.91	0.97	0.96	38.4
SouthWest: Werrington Rd (S)														
2	T1	1327	0.8	1327	0.8	0.684	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.7
Approach		1327	0.8	1327	0.8	0.684	0.0	NA	0.0	0.0	0.00	0.00	0.00	59.7
All Vehicles		2097	0.9	2097	0.9	0.684	0.5	NA	0.2	1.7	0.01	0.02	0.02	58.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network 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.

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MOVEMENT SUMMARY

Site: 102 [Site 2 - EW Connection 2022 PM]

Network: N101 [Base + Dev 2022 - PM Peak (Mitigation)]

Site 2 - EW Connection 2022 AM
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	Aver. Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: Werrington Rd (S)														
2	T1	99	0.0	99	0.0	0.860	4.7	LOS A	8.8	61.8	0.44	0.49	0.44	49.4
3a	R1	1327	0.8	1327	0.8	0.860	8.3	LOS A	8.8	61.8	0.44	0.49	0.44	46.5
Approach		1426	0.7	1426	0.7	0.860	8.0	LOS A	8.8	61.8	0.44	0.49	0.44	46.9
NorthEast: Werrington Rd (N)														
24a	L1	708	1.0	708	1.0	0.349	3.4	LOS A	1.2	8.4	0.31	0.42	0.31	53.7
26b	R3	27	0.0	27	0.0	0.349	9.4	LOS A	1.2	8.4	0.32	0.42	0.32	49.6
Approach		736	1.0	736	1.0	0.349	3.6	LOS A	1.2	8.4	0.31	0.42	0.31	53.5
North: Rance Rd														
8	T1	76	0.0	76	0.0	0.222	20.2	LOS B	0.7	4.8	1.00	0.95	1.00	42.5
Approach		76	0.0	76	0.0	0.222	20.2	LOS B	0.7	4.8	1.00	0.95	1.00	42.5
All Vehicles		2238	0.8	2238	0.8	0.860	7.0	LOS A	8.8	61.8	0.42	0.48	0.42	48.5

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

MOVEMENT SUMMARY

Site: 101 [Site1 - Rance Rd 2029 AM (Base)-inbound]

Network: N101 [Base 2029 - AM Peak]

New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	Aver. Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: Werrington Rd (S)														
1	L2	79	0.0	79	0.0	0.043	5.5	LOS A	0.0	0.0	0.00	0.58	0.00	51.3
2	T1	756	4.1	756	4.1	0.398	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
Approach		835	3.7	835	3.7	0.398	0.5	NA	0.0	0.0	0.00	0.05	0.00	57.4
North: Werrington Rd (N)														
8	T1	983	2.8	983	2.8	0.453	0.7	LOS A	0.4	2.9	0.09	0.01	0.12	56.3
9	R2	21	0.0	21	0.0	0.453	15.4	LOS B	0.4	2.9	0.11	0.02	0.15	47.4
Approach		1004	2.8	1004	2.8	0.453	1.0	NA	0.4	2.9	0.09	0.01	0.12	55.9
All Vehicles		1839	3.2	1839	3.2	0.453	0.8	NA	0.4	2.9	0.05	0.03	0.07	56.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network 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 [Site1 - Rance Rd 2029 AM (Base)-outbound]

Network: N101 [Base 2029 - AM Peak]

New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	Aver. Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: Werrington Rd (S)														
2	T1	756	4.1	756	4.1	0.398	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
Approach		756	4.1	756	4.1	0.398	0.0	NA	0.0	0.0	0.00	0.00	0.00	59.9
North: Werrington Rd (N)														
8	T1	1004	2.8	1004	2.8	0.524	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	59.8
Approach		1004	2.8	1004	2.8	0.524	0.1	NA	0.0	0.0	0.00	0.00	0.00	59.8
West: Rance Rd														
10	L2	20	5.0	20	5.0	0.031	8.7	LOS A	0.0	0.3	0.60	0.75	0.60	47.0
12	R2	62	0.0	62	0.0	0.394	28.9	LOS C	0.4	3.1	0.92	1.02	1.11	28.0
Approach		82	1.2	82	1.2	0.394	23.9	LOS B	0.4	3.1	0.84	0.95	0.99	33.3
All Vehicles		1842	3.3	1842	3.3	0.524	1.1	NA	0.4	3.1	0.04	0.04	0.04	57.4

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network 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 [Site1 - Rance Rd 2029 PM (Base)-inbound]

Network: N101 [Base 2029 - PM Peak]

New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	Aver. Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: Werrington Rd (S)														
1	L2	58	0.0	58	0.0	0.031	5.5	LOS A	0.0	0.0	0.00	0.58	0.00	51.3
2	T1	1427	0.8	1427	0.8	0.735	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	59.6
Approach		1485	0.7	1485	0.7	0.735	0.3	NA	0.0	0.0	0.00	0.02	0.00	58.4
North: Werrington Rd (N)														
8	T1	762	1.0	725	1.1	0.445	12.3	LOS A	7.1	50.0	0.73	0.02	0.85	32.4
9	R2	16	0.0	15	0.0	0.445	65.7	LOS E	7.1	50.0	1.00	0.03	1.16	33.9
Approach		778	1.0	740 N1	1.1	0.445	13.4	NA	7.1	50.0	0.74	0.02	0.85	32.4
All Vehicles		2263	0.8	2225 N1	0.9	0.735	4.7	NA	7.1	50.0	0.24	0.02	0.28	45.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network 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.

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

MOVEMENT SUMMARY

Site: 101 [Site1 - Rance Rd 2029 PM (Base)-outbound]

Network: N101 [Base 2029 - PM Peak]

New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	Aver. Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: Werrington Rd (S)														
2	T1	1427	0.8	1427	0.8	0.735	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.6
Approach		1427	0.8	1427	0.8	0.735	0.0	NA	0.0	0.0	0.00	0.00	0.00	59.6
North: Werrington Rd (N)														
8	T1	778	1.0	778	1.0	0.402	0.1	LOS A	0.3	1.9	0.00	0.00	0.00	59.9
Approach		778	1.0	778	1.0	0.402	0.1	NA	0.3	1.9	0.00	0.00	0.00	59.9
West: Rance Rd														
10	L2	28	3.6	28	3.6	0.249	38.6	LOS C	0.3	2.1	0.95	0.99	1.02	34.0
12	R2	64	0.0	64	0.0	3.193	2037.2	LOS F	12.5	87.5	1.00	3.11	10.02	0.9
Approach		92	1.1	92	1.1	3.193	1428.9	LOS F	12.5	87.5	0.98	2.47	7.28	1.6
All Vehicles		2297	0.9	2297	0.9	3.193	57.3	NA	12.5	87.5	0.04	0.10	0.29	21.4

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network 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: 102 [Site 2 - EW Connection 2029 AM (Stage 1-3)]

Network: N101 [Base + Dev (Stage 1-3) 2029 - AM Peak (Mitigation)]

Site 2 - EW Connection 2022 AM
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	Aver. Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: Werrington Rd (S)														
2	T1	108	0.0	108	0.0	0.566	4.4	LOS A	2.4	17.1	0.23	0.55	0.23	50.2
3a	R1	796	4.1	796	4.1	0.566	8.0	LOS A	2.4	17.1	0.23	0.55	0.23	47.8
Approach		904	3.6	904	3.6	0.566	7.6	LOS A	2.4	17.1	0.23	0.55	0.23	48.3
NorthEast: Werrington Rd (N)														
24a	L1	1035	2.8	1035	2.8	0.553	4.1	LOS A	2.1	15.4	0.52	0.51	0.52	52.4
26b	R3	29	0.0	29	0.0	0.553	10.0	LOS A	2.1	15.4	0.54	0.51	0.54	48.5
Approach		1064	2.8	1064	2.8	0.553	4.2	LOS A	2.1	15.4	0.52	0.51	0.52	52.3
North: Rance Rd														
8	T1	164	0.0	164	0.0	0.219	8.1	LOS A	0.6	3.9	0.77	0.76	0.77	49.3
Approach		164	0.0	164	0.0	0.219	8.1	LOS A	0.6	3.9	0.77	0.76	0.77	49.3
All Vehicles		2133	2.9	2133	2.9	0.566	5.9	LOS A	2.4	17.1	0.42	0.54	0.42	50.2

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

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MOVEMENT SUMMARY

Site: 101 [Site 3 - Rance Rd 2029 AM (Stage 1-3)]

Network: N101 [Base + Dev (Stage 1-3) 2029 - AM Peak (Mitigation)]

New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	Aver. Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
NorthEast: Werrington Rd (N)														
8	T1	1064	2.8	1064	2.8	0.556	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	59.8
Approach		1064	2.8	1064	2.8	0.556	0.1	NA	0.0	0.0	0.00	0.00	0.00	59.8
NorthWest: Rance Rd														
10	L2	53	2.0	53	2.0	0.084	9.1	LOS A	0.1	0.8	0.64	0.83	0.64	46.8
Approach		53	2.0	53	2.0	0.084	9.1	LOS A	0.1	0.8	0.64	0.83	0.64	46.8
SouthWest: Werrington Rd (S)														
2	T1	796	4.1	796	4.1	0.419	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
Approach		796	4.1	796	4.1	0.419	0.0	NA	0.0	0.0	0.00	0.00	0.00	59.9
All Vehicles		1913	3.3	1913	3.3	0.556	0.3	NA	0.1	0.8	0.02	0.02	0.02	59.0

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network 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: 102 [Site 2 - EW Connection 2029 PM (Stage 1-3)]

Network: N101 [Base + Dev (Stage 1-3) 2029 - PM Peak (Mitigation)]

Site 2 - EW Connection 2022 AM
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	Aver. Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: Werrington Rd (S)														
2	T1	157	0.0	157	0.0	1.026	33.9	LOS C	55.8	393.1	1.00	0.53	1.29	36.2
3a	R1	1502	0.8	1502	0.8	1.026	37.5	LOS C	55.8	393.1	1.00	0.53	1.29	28.0
Approach		1659	0.7	1659	0.7	1.026	37.1	LOS C	55.8	393.1	1.00	0.53	1.29	29.1
NorthEast: Werrington Rd (N)														
24a	L1	802	1.0	802	1.0	0.407	3.5	LOS A	1.5	10.4	0.35	0.44	0.35	53.3
26b	R3	43	0.0	43	0.0	0.407	9.5	LOS A	1.5	10.4	0.36	0.44	0.36	49.2
Approach		845	1.0	845	1.0	0.407	3.8	LOS A	1.5	10.4	0.35	0.44	0.35	53.1
North: Rance Rd														
8	T1	88	0.0	88	0.0	0.576	60.9	LOS E	2.1	14.7	1.00	1.17	1.41	29.0
Approach		88	0.0	88	0.0	0.576	60.9	LOS E	2.1	14.7	1.00	1.17	1.41	29.0
All Vehicles		2593	0.8	2593	0.8	1.026	27.1	LOS B	55.8	393.1	0.79	0.52	0.99	34.1

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

MOVEMENT SUMMARY

Site: 101 [Site 3 - Rance Rd 2029 PM (Stage 1-3)]

Network: N101 [Base + Dev (Stage 1-3) 2029 - PM Peak (Mitigation)]

New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	Aver. Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
NorthEast: Werrington Rd (N)														
8	T1	845	1.0	845	1.0	0.436	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
Approach		845	1.0	845	1.0	0.436	0.1	NA	0.0	0.0	0.00	0.00	0.00	59.9
NorthWest: Rance Rd														
10	L2	39	2.7	39	2.7	0.404	50.4	LOS D	0.5	3.4	0.96	1.02	1.12	30.6
Approach		39	2.7	39	2.7	0.404	50.4	LOS D	0.5	3.4	0.96	1.02	1.12	30.6
SouthWest: Werrington Rd (S)														
2	T1	1502	0.8	1465	0.8	0.755	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.5
Approach		1502	0.8	1465[N1]	0.8	0.755	0.0	NA	0.0	0.0	0.00	0.00	0.00	59.5
All Vehicles		2386	0.9	2349[N1]	0.9	0.755	0.9	NA	0.5	3.4	0.02	0.02	0.02	58.0

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network 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.

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

Organisation: CARDNO (QLD) PTY LTD | Processed: Friday, 20 September 2019 10:50:37 AM
Project: \\cardno.corp\global\AU\NSW\DirectoryStructure\Projects\899\FY14\069_ENGINEERING FEASIBILITY LEND LEASE COMMUNITIES \015_WERRINGTON\Des-An\Traffic\Werrington - Rance Access Only v02-SS.sip8

MOVEMENT SUMMARY

Site: 101 [Site 2 - EW Connection 2029 AM]

Network: N101 [Base + Dev 2029 - AM Peak (Mitigation)]

Site 2 - EW Connection 2022 AM
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	Aver. Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: Werrington Rd (S)														
1	L2	88	0.0	88	0.0	0.630	4.3	LOS A	3.0	21.3	0.34	0.53	0.34	48.8
2	T1	89	0.0	89	0.0	0.630	4.6	LOS A	3.0	21.3	0.34	0.53	0.34	50.0
3a	R1	796	4.1	796	4.1	0.630	8.2	LOS A	3.0	21.3	0.34	0.53	0.34	47.5
Approach		974	3.4	974	3.4	0.630	7.5	LOS A	3.0	21.3	0.34	0.53	0.34	48.0
NorthEast: Werrington Rd (N)														
24a	L1	1035	2.8	1035	2.8	0.589	4.5	LOS A	2.2	15.7	0.59	0.56	0.59	52.0
26a	R1	23	0.0	23	0.0	0.589	8.3	LOS A	2.2	15.7	0.62	0.57	0.62	46.4
26b	R3	23	0.0	23	0.0	0.589	10.4	LOS A	2.2	15.7	0.62	0.57	0.62	48.1
Approach		1081	2.7	1081	2.7	0.589	4.7	LOS A	2.2	15.7	0.59	0.56	0.59	51.7
North: Rance Rd														
8	T1	86	0.0	86	0.0	0.144	10.4	LOS A	0.4	2.7	0.84	0.79	0.84	47.8
9	R2	1	0.0	1	0.0	0.144	14.9	LOS B	0.4	2.7	0.84	0.79	0.84	45.2
Approach		87	0.0	87	0.0	0.144	10.4	LOS A	0.4	2.7	0.84	0.79	0.84	47.8
West: EW Link														
10	L2	1	0.0	1	0.0	0.292	9.8	LOS A	0.8	5.7	0.86	0.88	0.86	42.7
10a	L1	46	0.0	46	0.0	0.292	9.5	LOS A	0.8	5.7	0.86	0.88	0.86	37.5
12	R2	142	0.0	142	0.0	0.292	14.3	LOS A	0.8	5.7	0.86	0.88	0.86	46.3
Approach		189	0.0	189	0.0	0.292	13.1	LOS A	0.8	5.7	0.86	0.88	0.86	44.7
All Vehicles		2332	2.7	2332	2.7	0.630	6.8	LOS A	3.0	21.3	0.52	0.59	0.52	49.1

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

MOVEMENT SUMMARY

Site: 101 [Site 3 - Rance Rd 2029 AM]

Network: N101 [Base + Dev 2029 - AM Peak (Mitigation)]

New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	Aver. Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
NorthEast: Werrington Rd (N)														
8	T1	1081	2.7	1081	2.7	0.564	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	59.8
Approach		1081	2.7	1081	2.7	0.564	0.1	NA	0.0	0.0	0.00	0.00	0.00	59.8
NorthWest: Rance Rd														
10	L2	28	3.7	28	3.7	0.050	9.7	LOS A	0.1	0.5	0.66	0.83	0.66	46.5
Approach		28	3.7	28	3.7	0.050	9.7	LOS A	0.1	0.5	0.66	0.83	0.66	46.5
SouthWest: Werrington Rd (S)														
2	T1	842	3.9	842	3.9	0.443	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
Approach		842	3.9	842	3.9	0.443	0.0	NA	0.0	0.0	0.00	0.00	0.00	59.9
All Vehicles		1952	3.2	1952	3.2	0.564	0.2	NA	0.1	0.5	0.01	0.01	0.01	59.4

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network 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.

Organisation: CARDNO (QLD) PTY LTD | Processed: Thursday, 19 September 2019 4:57:58 PM
Project: \\cardno.corp\global\AU\NSW\DirectoryStructure\Projects\899\FY14\069_ENGINEERING FEASIBILITY LEND LEASE COMMUNITIES \015_WERRINGTON\Des-An\Traffic\Werrington - Rance Access Only v02-SS.sip8

MOVEMENT SUMMARY

Site: 101 [Site 2 - EW Connection 2029 PM]

Network: N101 [Base + Dev 2029 - PM Peak (Mitigation)]

Site 2 - EW Connection 2022 AM
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	Aver. Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: Werrington Rd (S)														
1	L2	153	0.0	153	0.0	1.114	111.1	LOS F	76.1	535.4	1.00	1.19	2.52	20.5
2	T1	83	0.0	83	0.0	1.114	111.4	LOS F	76.1	535.4	1.00	1.19	2.52	20.7
3a	R1	1502	0.8	1502	0.8	1.114	115.0	LOS F	76.1	535.4	1.00	1.19	2.52	13.2
Approach		1738	0.7	1738	0.7	1.114	114.5	LOS F	76.1	535.4	1.00	1.19	2.52	14.4
NorthEast: Werrington Rd (N)														
24a	L1	802	1.0	802	1.0	0.439	3.9	LOS A	1.4	9.9	0.43	0.49	0.43	52.8
26a	R1	42	0.0	42	0.0	0.439	7.7	LOS A	1.4	9.9	0.44	0.49	0.44	47.1
26b	R3	23	0.0	23	0.0	0.439	9.8	LOS A	1.4	9.9	0.44	0.49	0.44	48.8
Approach		867	1.0	867	1.0	0.439	4.2	LOS A	1.4	9.9	0.43	0.49	0.43	52.4
North: Rance Rd														
8	T1	73	0.0	73	0.0	0.453	41.8	LOS C	1.5	10.5	1.00	1.09	1.22	34.1
9	R2	1	0.0	1	0.0	0.453	46.3	LOS D	1.5	10.5	1.00	1.09	1.22	32.7
Approach		74	0.0	74	0.0	0.453	41.9	LOS C	1.5	10.5	1.00	1.09	1.22	34.1
West: EW Link														
10	L2	1	0.0	1	0.0	0.725	88.0	LOS F	3.2	22.4	1.00	1.31	1.75	22.7
10a	L1	36	0.0	36	0.0	0.725	87.7	LOS F	3.2	22.4	1.00	1.31	1.75	15.1
12	R2	82	0.0	82	0.0	0.725	92.5	LOS F	3.2	22.4	1.00	1.31	1.75	23.6
Approach		119	0.0	119	0.0	0.725	91.0	LOS F	3.2	22.4	1.00	1.31	1.75	21.4
All Vehicles		2798	0.7	2798	0.7	1.114	77.4	LOS F	76.1	535.4	0.82	0.97	1.80	19.4

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

MOVEMENT SUMMARY

Site: 101 [Site 3 - Rance Rd 2029 PM]

Network: N101 [Base + Dev 2029 - PM Peak (Mitigation)]

New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	Aver. Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
NorthEast: Werrington Rd (N)														
8	T1	867	1.0	867	1.0	0.448	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
Approach		867	1.0	867	1.0	0.448	0.1	NA	0.0	0.0	0.00	0.00	0.00	59.9
NorthWest: Rance Rd														
10	L2	32	3.3	32	3.3	0.233	32.5	LOS C	0.3	2.0	0.93	0.99	1.00	36.0
Approach		32	3.3	32	3.3	0.233	32.5	LOS C	0.3	2.0	0.93	0.99	1.00	36.0
SouthWest: Werrington Rd (S)														
2	T1	1538	0.8	1384	0.8	0.713	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.6
Approach		1538	0.8	1384[N1]	0.8	0.713	0.0	NA	0.0	0.0	0.00	0.00	0.00	59.6
All Vehicles		2437	0.9	2283[N1]	0.9	0.713	0.5	NA	0.3	2.0	0.01	0.01	0.01	58.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network 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.

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.