Tolland Estate

Transport Impact Assessment Report

Prepared for: NSW Land and Housing Corporation

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Revision

Revision	Date	Comment	Prepared By	Approved By
A	14 September 2023	Final for Submission	Chris Coath	Chris Coath

Chris Coath

For and on behalf of

Stantec Australia Pty Ltd

L25, 55 Collins Street, Melbourne VIC 3000

Acknowledgment of Country

In the spirit of reconciliation, Stantec acknowledges the Traditional Custodians of country throughout Australia and their connections to land, sea and community. We pay our respect to their Elders past and present, and extend that respect to all Aboriginal and Torres Strait Islander peoples.

Limitations

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1. Introduction

1.1 Background

Stantec have been engaged by the Tolland Renewal Project Consortium to develop a new masterplan for Tolland, an existing suburb in Wagga Wagga, NSW.

The existing suburb, originally structured on the Radburn public housing model, is characterised by low internal connectivity, poor interface with public open space and pedestrian laneways and has limited access and egress opportunities to the surrounding suburbs.

The purpose of this design report is to supplement the urban masterplan, civil masterplans, neighbourhood character assessment and landscape masterplan in order to generate improved social and urban outcomes for the Tolland Community.

1.2 Purpose of this Report

The report sets out an assessment of the anticipated traffic and transport implications of the proposed development, including consideration of the:

- Existing and future road infrastructure and operating conditions surrounding the site
- Traffic generation and distribution characteristics of the proposal
- Ability of the proposed road network to accommodate the future demands of the site
- The connection of the site with active and public transport networks

1.3 References

In preparing this report, reference has been made to the following: Remove or add references as necessary

- Wagga Wagga City Council, *Engineering Guidelines for Subdivisions and Development Standards*
- Wagga Wagga Integrated Transport Strategy and Implementation Plan 2040
- Stantec, Tolland Renewal Project, Neighbourhood Master Plan, Revision B
- Stantec, Tolland Renewal Project, Staging Master Plan, Revision B
- Stantec, Tolland Renewal Project, Road Hierarchy Master Plan, Revision B
- Stantec, Tolland Renewal Project, Typical Road Cross Sections, Revision B
- Stantec, Tolland Renewal Project Active Travel Master Plan, Revision B
- Stantec, Tolland Renewal Project Bus Routes Master Plan, Revision B
- Australian Standard / New Zealand Standard, Parking Facilities (AS 2890)
- traffic and car parking surveys undertaken by Stantec as referenced in the context of this report
- an inspection of the site and its surrounds
- other documents as nominated.

2. Site Context and Surrounds

2.1 Subject Site

The suburb of Tolland covers a total area of approximately 200ha, the subject site within the suburb is a 49ha parcel in the south western corner, boarded by Glenfield Road, Red Hill Road and Bourke Street. The subject site for these investigations has been identified in Figure 2.1.

The subject site is comprised of approximately 387 private residences, 227 social housing dwellings, 20 social housing vacant blocks, a community centre, two schools, a church and 6.9ha of existing public open space. It is noted that much of the existing public open space is collocated with existing trunk stormwater assets which control outflows from the suburb.

Figure 2.1 – Subject site

Base Image: Metromaps, 2021

The distribution of social housing stock within the suburb is concentrated in the south western corner of the subject site. It is proposed as part of the urban renewal plan that the social housing stock within the suburb be more evenly distributed to provide opportunities for additional interspersed private housing. Additional information on the existing and proposed character of the suburb, including details on the distribution metrics used to develop the masterplan can be accessed in the Neighbourhood Character Assessment.

2.2 Road Network

2.2.1 Road Hierarchy

Tolland estate is bordered by three major roads. These being Bourke St, Glenfield Rd and Red Hill Road. Bourke St and Glenfield Rd are north-south sub-arterial roads, which both intersect Red Hill Rd which is an east-west sub-arterial road to the south of Tolland.

Internal to Tolland estate, Bruce St acts as a major collector road and allows both east and west access via Glenfield Rd and Bourke St. The remaining roads within the Tolland estate are minor collector and local access roads, which feed from Bruce St. Tolland estate contains multiple cul-der-sacs and service roads throughout which limit the connectivity of movement through the suburb.

Bourke Street

Bourke Street is a classified Regional road and is aligned in a north-south direction. It is a two-way road configured with a primary 4-lane carriageway with service roads provided on both sides of the main carriageway. The carriageway is set within a 45-metre-wide road reserve (approx.).

Kerbside parking is permitted within the service roads.

Glenfield Road

Glenfield Road functions as a sub arterial road and is aligned in a north-south direction. It is a two-way road configured with a 2-lane, 7-metre-wide carriageway, set within a 100-metre-wide road reserve (approx.). The road carriageway is bordered by unsealed gravel shoulders.

Red Hill Road

Red Hill Road functions as a sub arterial and is aligned in a east-west direction. It is a two-way road configured with a 2-lane, 7-metre-wide carriageway (approx.), on-road cycle lanes on each side of the carriageway and sealed shoulders, set within a 70-metre-wide road reserve (approx.).

Bruce Street

Bruce Street functions as a collector road and is aligned in an east-west direction. It is a two-way road configured with a 2-lane, 12.5-metre-wide carriageway (approx.), set within a 23-metre-wide road reserve (approx.).

Unrestricted kerbside parking is typically permitted along the length of the road.

2.2.2 Surrounding Intersections

The following key intersections currently exist in the vicinity of the site:

- Bruce Street / Glenfield Road (unsignalized T-intersection)
- Glenfield Road / Red Hill Road (Roundabout)
- Red Hill Road / Ramus Street (unsignalized T-intersection)
- Bourke Street / Red Hill Road (Roundabout)
- Bruce Street / Bourke Street (unsignalized T-intersection)

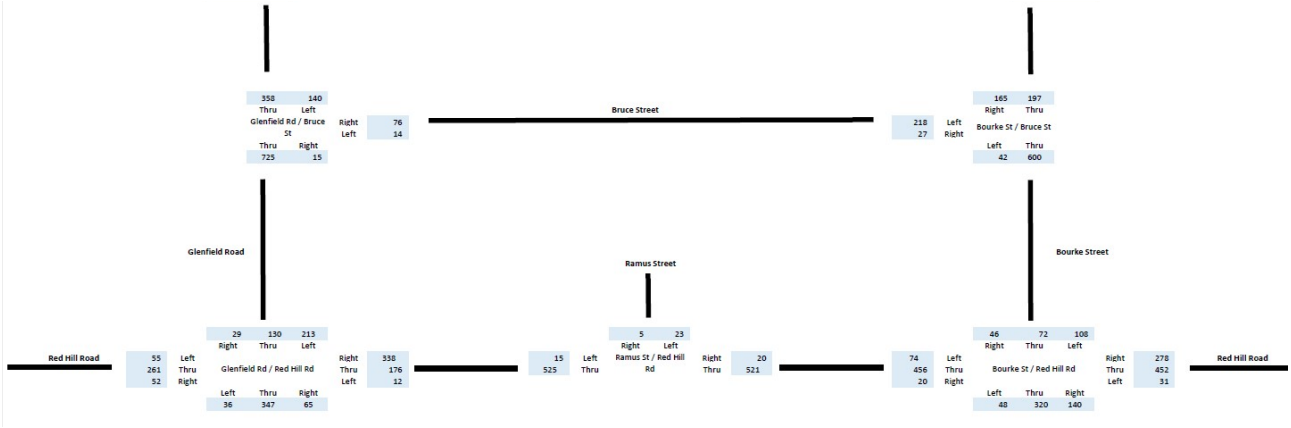
2.2.3 Traffic Volumes

Stantec commissioned traffic turning movement counts at the above key intersections in the vicinity of the site on Wednesday 16 August 2023 during the following peak periods:

- 7:00am and 10:00am
- 3:00pm and 6:00pm.

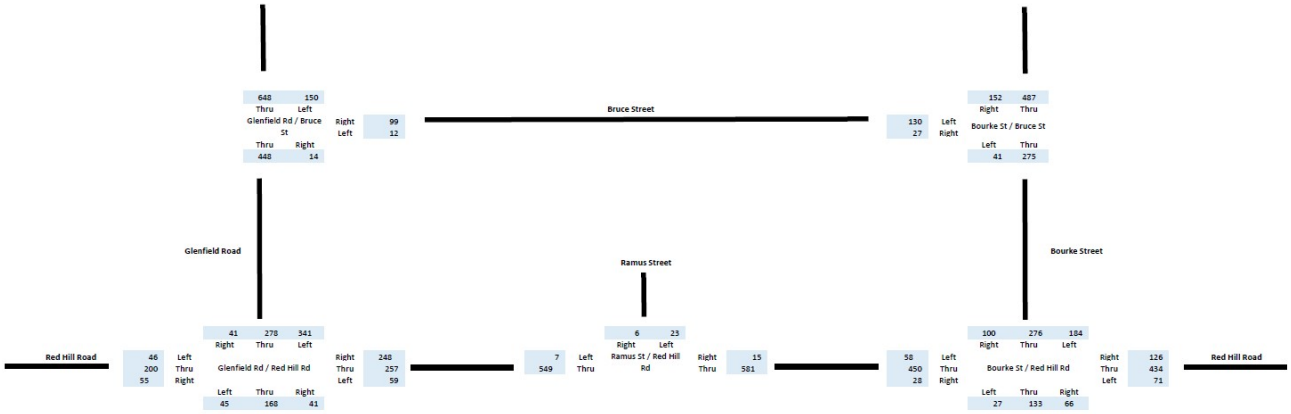
The AM and PM peak hour traffic volumes are summarised in Figure 7.4.

Figure 7.2: Existing AM Peak Hour Traffic Volumes



Source: Data collected by Trans Traffic Surveys

Figure 7.3: Existing PM Peak Hour Traffic Volumes



Source: Data collected by Trans Traffic Surveys

In addition two-way daily pneumatic tube counts were undertaken on local roads within the study area. These surveys were undertaken between Wednesday 16 August 2023 to Tuesday 22 August 2023.

A summary of these surveys is provided in Table 2.1.

Table 2.1 – Local Road Daily Traffic Volumes

Location	Average Weekday Two-Way Daily Traffic Volume	Average 7-Day Two-Way Daily Traffic Volume	Average Vehicle Speed (km/hr)	Indicative Daily Traffic Capacity (vehicles per day) [1]
Bruce Street (west of Awaba Ave)	2,798 vehicles	2,651 vehicles	43.9	5,000 – 10,000
Bruce Street (west of Martin St)	2,517 vehicles	2,373 vehicles	50.6	5,000 – 10,000
Bruce Street (East of Raye St)	3,898 vehicles	3,644 vehicles	41.0	5,000 – 10,000
Raye Street (south of Brooks Cct)	564 vehicles	523 vehicles	39.1	1,500 – 2,000
Raye Street (North of Hawkes Pl)	1,451 vehicles	1,277 vehicles	43.6	1,500 – 2,000
Ramus Street (North of Red Hill Rd)	583 vehicles	528 vehicles	38.0	1,500 – 2,000
Awaba Avenue (North of Bruce St)	347 vehicles	323 vehicles	41.5	1,500 – 2,000
Maher Street (East of Adjin St)	531 vehicles	492 vehicles	33.0	1,500 – 2,000
Maher Street (East of Raye St)	460 vehicles	428 vehicles	39.5	1,500 – 2,000
Adjin Street (North of Maher St)	639 vehicles	597 vehicles	31.6	1,500 – 2,000

Source: Data collected by Trans Traffic Surveys

[1] Wagga Wagga Integrate Transport Strategy and Implementation Plan 2040

2.3 Intersection Operation

The operation of the key intersections within the study area has been assessed using SIDRA INTERSECTION[1], a modelling software package which calculates intersection performance.

The commonly used measure of intersection performance is referred to as the *Degree of Saturation* (*DOS*). The *DOS* represents the flow-to-capacity ratio for the most critical movement on each leg of the intersection. For unsignalised intersections, a DOS of around 0.90 has been typically considered the 'ideal' limit, beyond which queues and delays increase disproportionately[2].

Vehicle delays and 95th percentile queue lengths also provide key criteria upon which the operation of the intersection can be characterised.

Table 2.2 presents a summary of the existing operation of the intersection, with full results presented in Appendix A of this report.

[1] Program used under license from Akcelik & Associates Pty Ltd.

[2] SIDRA INTERSECTION adopts the following criteria for Level of Service assessment:

Level of Service		Intersection Degree of Saturation (DOS)		
		Unsignalised Intersection	Signalised Intersection	Roundabout
A	Excellent	<=0.60	<=0.60	<=0.60
B	Very Good	0.60-0.70	0.60-0.70	0.60-0.70
C	Good	0.70-0.80	0.70-0.90	0.70-0.85
D	Acceptable	0.80-0.90	0.90-0.95	0.85-0.95
E	Poor	0.90-1.00	0.95-1.00	0.95-1.00
F	Very Poor	>=1.0	>=1.0	>=1.0

Table 2.2: Sidra Intersection – Existing Operating Conditions

Intersection	Peak	Leg	Degree of Saturation (DOS)	Average Delay (sec)	95th Percentile Queue (m)
Bruce Street / Glenfield Road	AM	South	0.41	0.4	2
		East	0.29	16.3	7
		North	0.28	1.8	0
	PM	South	0.27	0.9	3
		East	0.39	18.5	10
		North	0.44	1.3	0
Glenfield Road / Red Hill Road	AM	South	0.30	8.6	11
		East	0.29	9.6	13
		North	0.22	7.6	9
		West	0.37	10.0	16
	PM	South	0.17	8.1	6
		East	0.31	9.7	14
		North	0.32	7.2	16
		West	0.26	8.5	10
Red Hill Road/ Ramus Street	AM	East	0.28	0.6	2
		North	0.03	6.4	1
		West	0.27	0.2	0
	PM	East	0.31	0.4	2
		North	0.03	7.0	1
		West	0.28	0.2	0
Bourke Street / Red Hill Road	AM	South	0.31	7.5	11
		East	0.38	7.9	20
		North	0.15	9.8	7
		West	0.56	10.4	30
	PM	South	0.13	7.0	5
		East	0.53	9.7	32
		North	0.42	10.4	22
		West	0.44	7.3	19
Bourke Street / Bruce Street	AM	South	0.18	0.4	0
		North	0.26	4.6	8
		West	0.23	7.6	7
	PM	South	0.09	0.8	0
		North	0.21	2.0	8
		West	0.12	7.3	3

On the basis of the above assessment, it is clear that all intersections currently operate well with minimal queues and delays on all approaches.

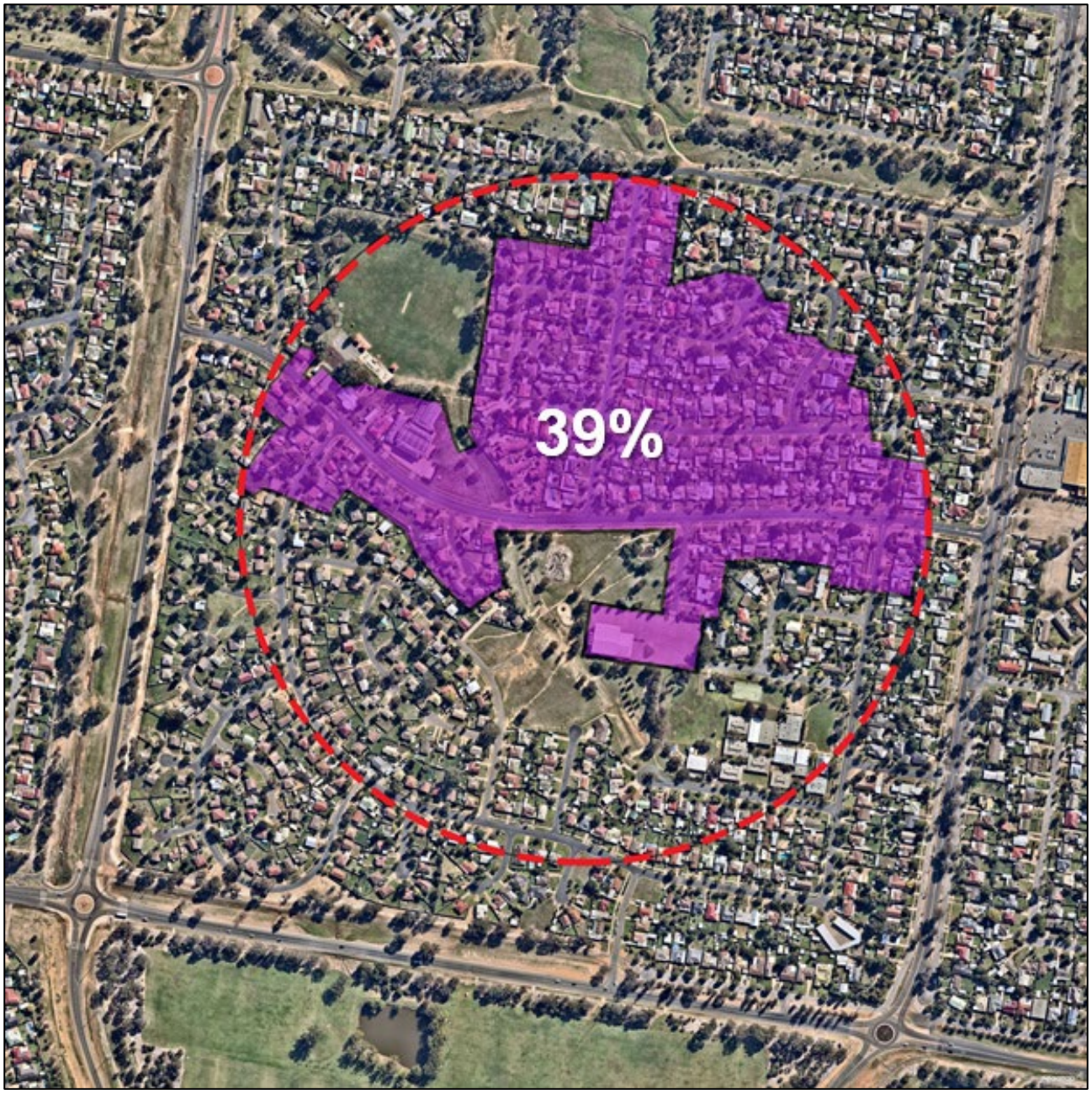
2.4 Active Transport Network

Existing pedestrian infrastructure within Tolland estate was assessed via a Pedestrian Shed assessment. This assessment identifies the percentage of the estate deemed accessible within a 5-minute walk of the suburb centre. The assessment considers factors such pedestrian safety, visual permeability, access to footpath infrastructure and destinations to generate a walkability map displayed in Figure 2.9.

The existing walkability percentage for Tolland is 39%, which is below industry benchmark of 60%. The contributing factors which affect this score include dead ends, missing links, insufficient lighting, narrow walkways, and poor path condition.

In alignment with good urban design principles, it is recommended that walkability should be a focus in the master planning of Tolland estate, with infrastructure upgrades to footpaths, street lighting and road connectivity likely to be required.

Figure 2.4 – Existing Pedestrian Shed Analysis



Base Map Source: Google Maps

Existing cycle infrastructure within Tolland is displayed in Figure 2.10.

Figure 2.5 – Cycleways Map

Source: Wagga Wagga Council Intra Maps

The surrounding cycle network consists of off-road, on-road dedicated and on-road shared shoulder lane paths.

The majority of paths within the local surroundings are off-road, with the exception of an on-road shared shoulder lane connecting the north western section of Tolland to adjacent Glenfield park and an on-road dedicated lane linking the southern section of Tolland to neighbouring south eastern suburbs.

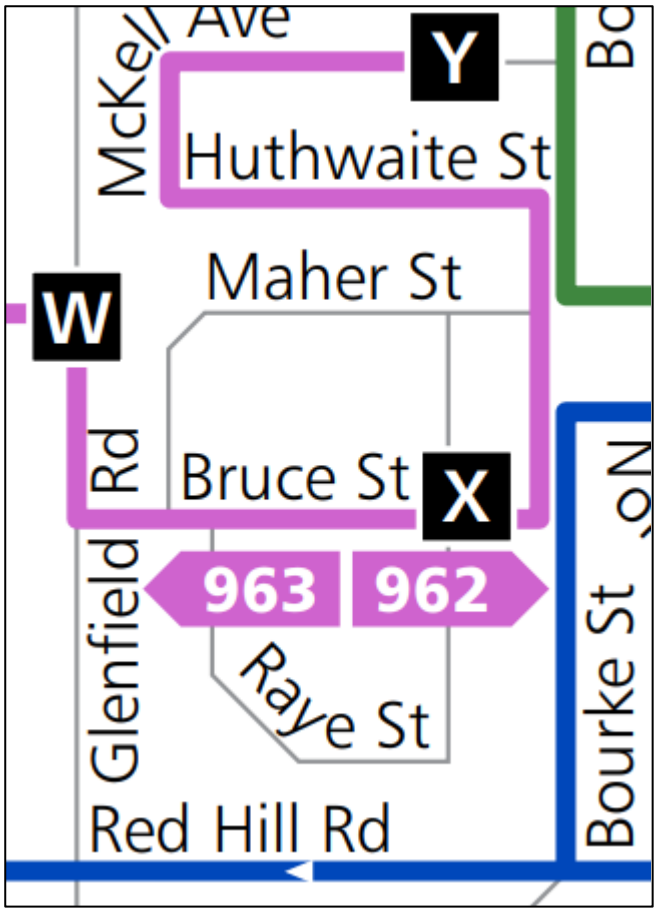
Internal cycle connections within the estate are limited, with two off road paths within Chambers and Emblen Park. It is assumed that cyclists utilise the footpath network within the estate, which may be a cause for safety concerns for both pedestrians and motorist accessing their property.

2.5 Public Transport Network

The local bus service is provided by Busabout Wagga Wagga. Tolland is serviced by the 962 and 963 routes, which connect to the Bayliss St interchange. The frequency of service varies during weekdays and weekends, with the 962-route operating approximately every 30 minutes during weekdays and every hour during weekends and public holidays. The 963-route operates less frequently, at approximately 40 minutes during the weekdays and every hour during weekends and public holidays.

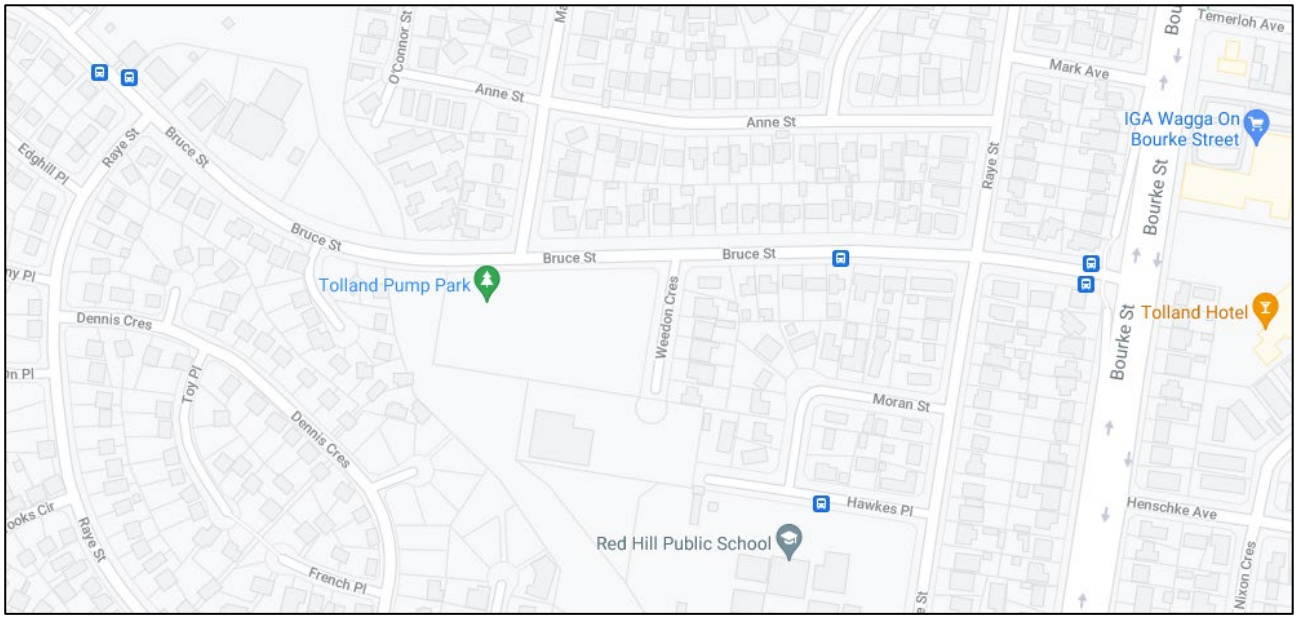
Figure 2.9 and Figure 2.10 detail the route direction and stop locations for the above services.

Figure 2.6 – Bus Route Map



Source: Busabout Wagga Wagga Network Map

Figure 2.7 – Tolland Bus Stop Locations



Source: Google Maps

Busabout Wagga Wagga also provides a school bus service to the Red Hill Public school, with three services during the morning and afternoon. These service local suburbs including Tolland, Glenfield, Bourkelands, Lloyd and Ashmont.

3. Development Proposal

3.1 Land Use

The proposed masterplan achieves a redistribution of the existing social housing properties through generating private property uplift.

A total of 679 dwellings are proposed to be provided comprising in the order of 30% social housing and 70% private dwellings.

The development will result in an uplift of 292 private dwellings throughout study area, to those dwellings currently provided. These additional dwellings will include a mix of low and medium density dwellings.

3.2 Access and Connections

At a fundamental level the proposed access to the Tolland Estate will remain the same as currently provided with access to the external road network provided through the following intersections:

- Bruce Street and Glenfield Road
- Bruce Street and Bourke Street
- Ramus Street and Red Hill Road.

The internal road network, provides largely a similar function however creates connections between previous cul-der-sac roads to improve the permeability of the site from a walking cycling and vehicle perspective.

The proposed Master Plan layout is should in Figure 3.1

Figure 3.1 – Proposed Subdivision Layout

Source: Stantec

4. Site Layout and Access

4.1 Road Network

4.1.1 Access and hierarchy

The proposed road layout reflects a continuance of the existing road hierarchy within the suburb. The proposed Road Hierarchy is shown in Figure 4.1 with the following commentary provided:

- Bruce Street continues its role as a Collector Road throughout the suburb connecting Glenfield Road and Bourke Street
- Raye Street, Awaba Avenue, Maher Street and Martin Street continue their existing role supporting local access, and
- A series of Local Access Roads and Access Streets are created through the connection of existing cul-der-sacs.

The designation of these road type within the network are appropriate and consistent with the function of the road.

Figure 4.1 – Proposed Road Hierarchy

Source: Stantec

4.1.2 Cross Sections

The proposed road hierarchy include the designation of four road cross sections:

- Collector Road
- Local Access Road
- Access Street
- Lane Way.

The internal road network that supports active travel modes whilst accommodating the needs of public transport and private motor vehicles. In preparing the cross sections, reference was made to the Wagga Wagga City Council, *Engineering Guidelines for Subdivisions and Development Standards*, which provide guidance on the road widths for new subdivisions.

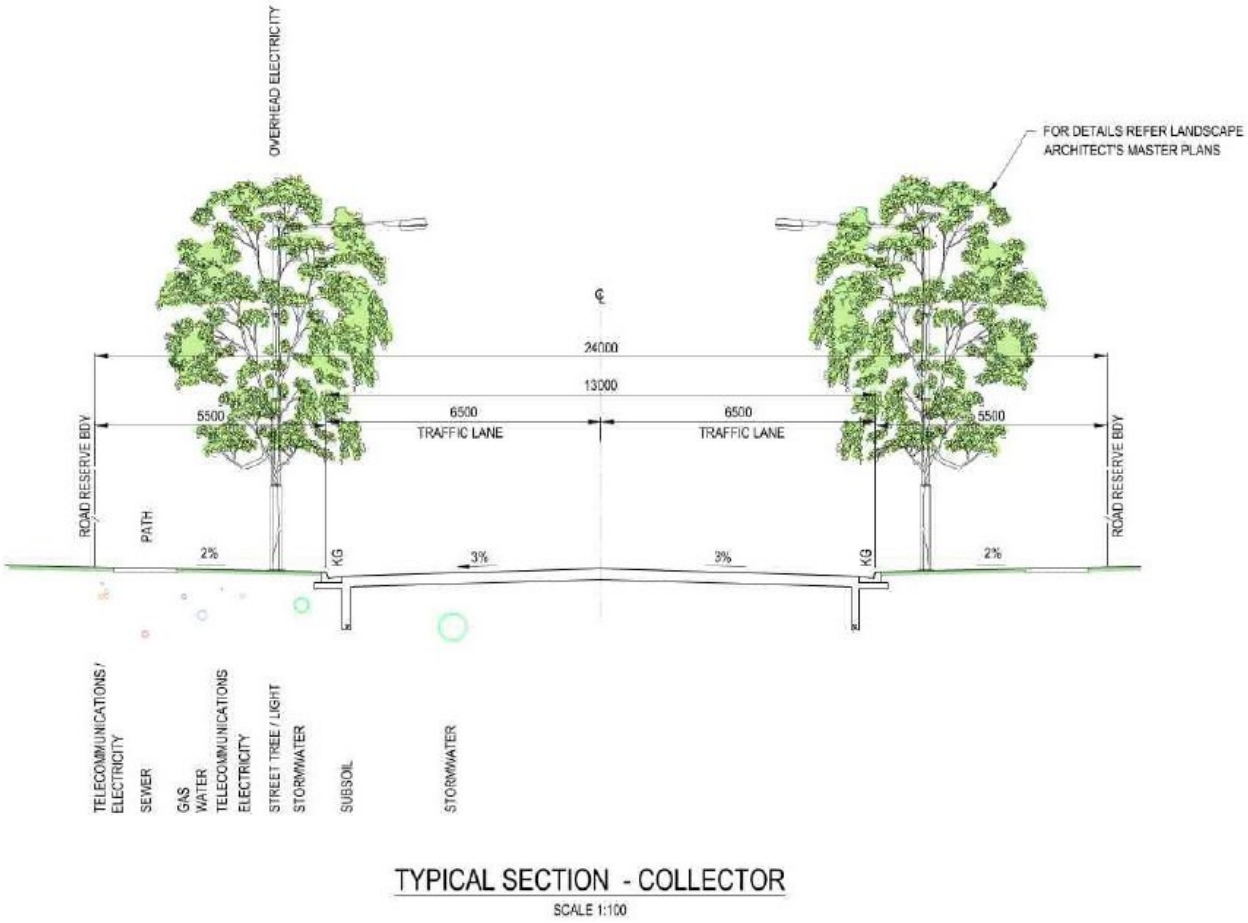
The cross section layouts for different road types are presented below.

Collector Road

The Collector Road cross section shown in Figure 4.2 provides the following features:

- Two-way vehicle travel with traffic lanes provided at widths (a 13m carriageway) consistent with the *Engineering Guidelines for Subdivisions and Development Standards*
- Opportunity for vehicle parking, bus stop provisions within the vehicle carriageway. This is consistent with the existing bus route that runs along Bruce Street.
- Pedestrian footpaths on both sides of the road exceeding the *Engineering Guidelines for Subdivisions and Development Standards* which requires foot path provisions on only one side of the road.
- The Bruce Street cross retains the existing cross section provisions.

Figure 4.2 – Collector Road Cross Section



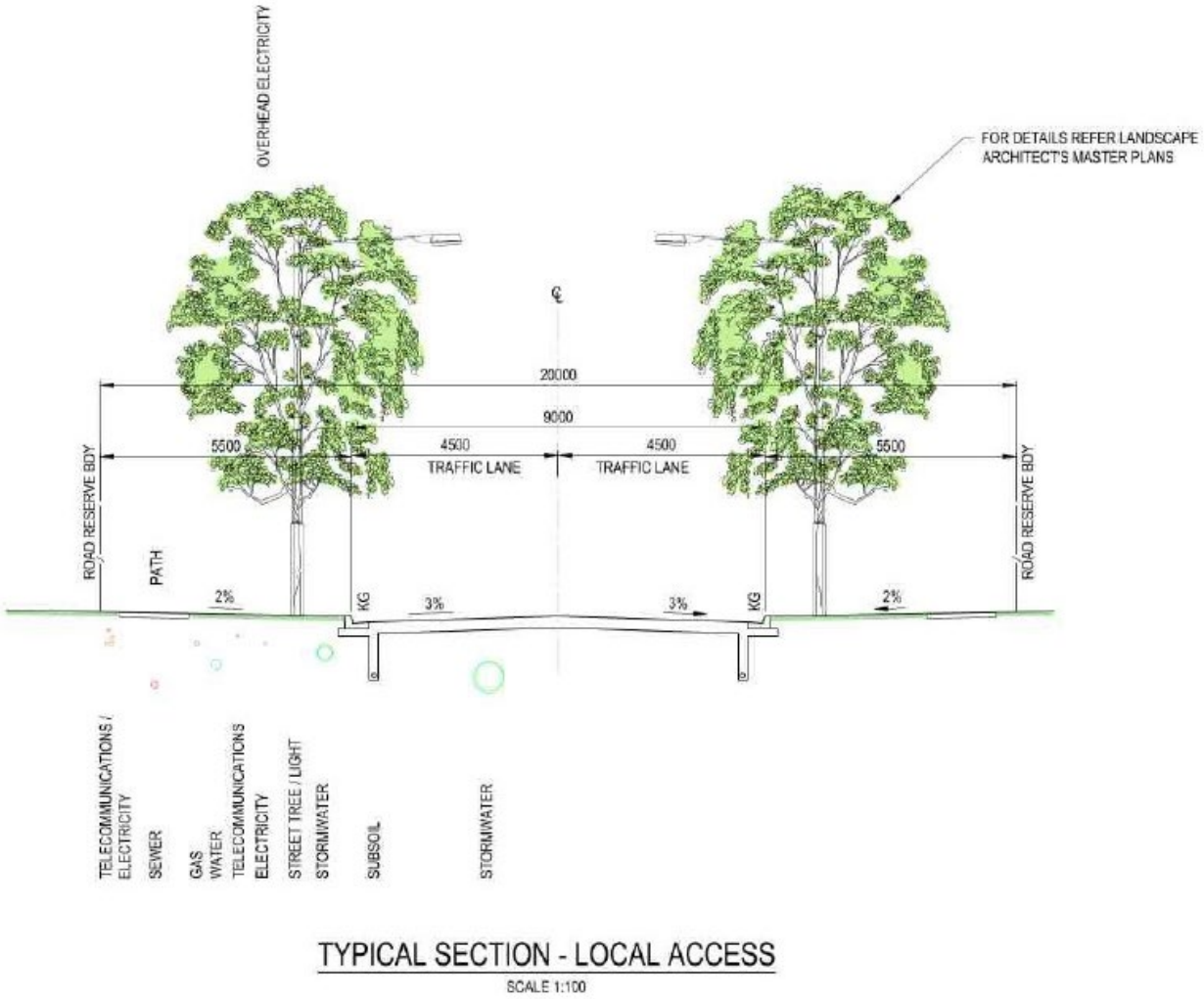
Source: Stantec

Local Access Road

The Local Access Road cross section shown in Figure 4.3 provides the following features:

- Two-way vehicle travel with traffic lanes provided at widths (a 9m carriageway) consistent with the *Engineering Guidelines for Subdivisions and Development Standards*
- Opportunity for vehicle parking within the vehicle carriageway.
- Pedestrian footpaths on both sides of the road exceeding the *Engineering Guidelines for Subdivisions and Development Standards* which requires foot path provisions on only one side of the road.
- Cyclists are to share the vehicle carriageway as expected by the *Engineering Guidelines for Subdivisions and Development Standards*

Figure 4.3 – Local Access Road Cross Section



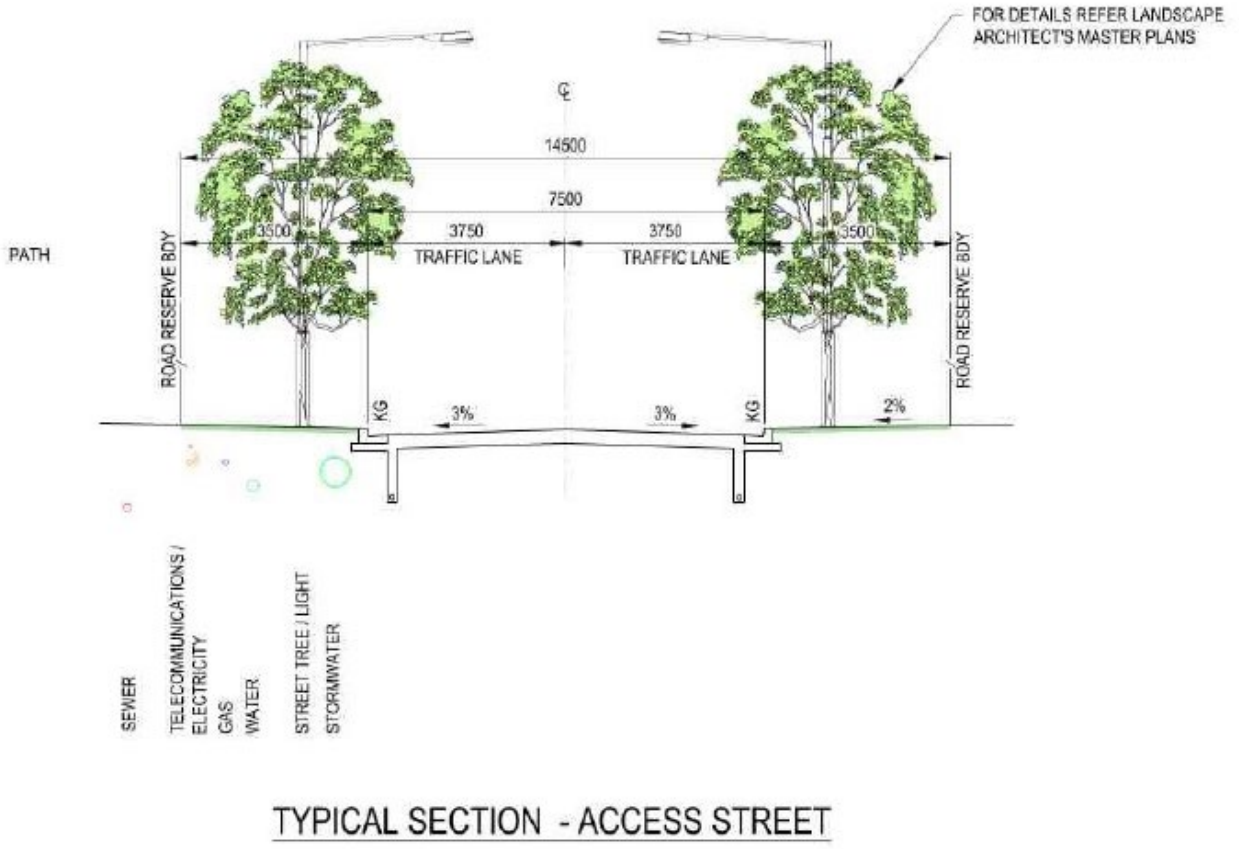
Source: Stantec

Access Street

The Access Street cross section shown in Figure 4.4 provides the following features:

- Two-way vehicle travel with traffic lanes provided at widths (a 7.5m carriageway) consistent with the *Engineering Guidelines for Subdivisions and Development Standards*
- Opportunity for vehicle parking within the vehicle carriageway.
- Pedestrian footpaths are not required which is consistent with the *Engineering Guidelines for Subdivisions and Development Standards*.
- Cyclists are to share the vehicle carriageway as expected by the *Engineering Guidelines for Subdivisions and Development Standards*

Figure 4.4 – Access Street Cross Section



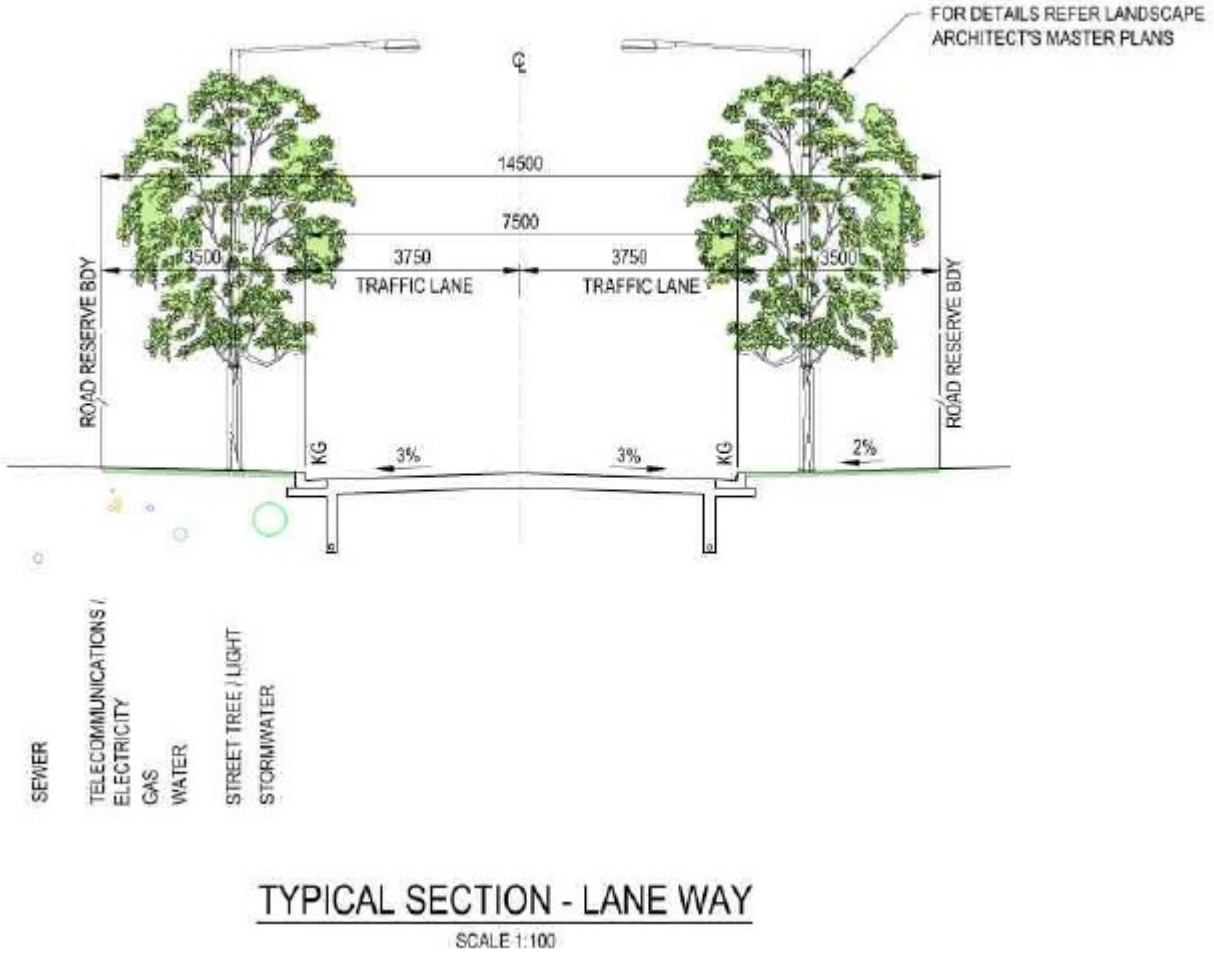
Source: Stantec

Lane Way

The Lane Way cross section shown in Figure 4.5 provides the following features:

- Two-way vehicle travel with traffic lanes provided at widths (a 7.5m carriageway) consistent with the *Engineering Guidelines for Subdivisions and Development Standards*
- Opportunity for vehicle parking within the vehicle carriageway.
- Pedestrian footpaths are not required which is consistent with the *Engineering Guidelines for Subdivisions and Development Standards*.
- Cyclists are to share the vehicle carriageway as expected by the *Engineering Guidelines for Subdivisions and Development Standards*

Figure 4.5 – Lane Way Cross Section



Source: Stantec

4.2 Active Travel Network

A key focus within the proposed masterplan is to improve and revitalise the public open space within the estate. This is achieved through increasing the connectivity, safety and accessibility of footpath network.

The masterplan includes new active travel infrastructure which focuses on improving safety and connectivity by linking to the existing network. The active travel upgrades are shown in Figure 4.6.

Figure 4.6 – Proposed Active Travel Network

Source: Stantec

The proposed path infrastructure upgrades include:

- 2.5m wide shared paths through the estate along with 'Wombat' road crossings linking the southern section of the estate to the north through Chambers Park, and the west to the east along Bruce St
- 2.5m wide shared paths along Red Hill Road and Glenfield Road
- Multiple 1.5m paths are proposed throughout the estate. These upgrades focus on linking existing paths to the trunk paths, improving the overall connectivity and permeability.
- These provisions are in addition to the expected pedestrian and cyclist facilities as identified within the road cross section requirements of the *Engineering Guidelines for Subdivisions and Development Standards.*
- The geometric path provisions are consistent with those identified in Section 2.24.4 of the *Engineering Guidelines for Subdivisions and Development Standards.*

4.3 Public Transport

Existing bus services currently travel along Bruce Street. These services will continue to operate in the future and the route and bus stops are not impacted by the proposed Master Plan. The existing bus routes are shown in Figure 4.7.

Figure 4.7 – Bus Routes

Source: Stantec

4.4 Waste Collection and Servicing

The proposed road cross sections and intersections, designed in accordance with the *Engineering Guidelines for Subdivisions and Development Standards*, are suitable to accommodate vehicle movements of waste collection and emergency services vehicles.

Further the improvements to road network permeability and circulation through the removal cul-der-sacs improves access for waste collection and emergency services vehicles and reduces the potential need for these vehicles to undertake reversing movements.

5. Traffic Impact

5.1 Traffic Generation

Traffic generating characteristics of the proposed additional residential development can be considered from a number of sources as discussed in the following. These discussions also consider the nature of development proposed and the varying traffic generating characteristics of differing residential densities.

Low Density Residential Development

- The RTA (RMS) NSW Guide to Traffic Generating Development, 2002 identifies a traffic generation of 9 vehicle trips per dwelling per day (and 0.85 vehicle trips per dwelling in the peak hour) for low density residential developments. This source however also notes that not all of these trips would represents external trips to the arterial road network with some trips being contained within the subdivision.
- The ACT Territory Plan (Estate Development Code) identifies a traffic generation rate of 8 vehicle trips per dwelling per day for low density residential development.
- The RMS NSW Guide to Traffic Generating Developments Updated traffic surveys, 2013 identifies a traffic generation of 7.4 vehicle trips per dwelling per day (0.71 and 0.78 vehicle trips per dwelling in the AM and PM peak hours respectively) for low density residential developments in regional areas. This source is reflective of trips made to the arterial road network. As such some additional trips may be contained within the subdivision area.

Medium Density Residential Development

- The RTA (RMS) NSW Guide to Traffic Generating Development, 2002 identifies a traffic generation of 5.0 – 6.5 vehicle trips per dwelling per day (and 0.5 – 0.65 vehicle trips per dwelling in the peak hour) for larger units and townhouses (3 or more bedrooms).
- The ACT Territory Plan (Estate Development Code) identifies a traffic generation rate of 6 vehicle trips per dwelling per day for medium density residential dwellings.
- The ACT Territory Plan (Estate Development Code) also identifies a traffic generation rate of 7 vehicle trips per dwelling per day for detached dwellings on small lots.

Having regard to all of the above data sources and recognition that the proposed additional residential development will include a mix of low and medium density dwellings, the following traffic generation rates are proposed to be adopted and applied to the proposed uplift in residential dwellings in the Tolland estate.

- Daily: 8 vehicle trips per dwelling per day
- Peak Hour: 0.8 vehicle trips per dwelling per hour

On balance the adoption of the above traffic generation rates could be considered reasonable yet erring on the conservative (on the high side).

Applying the above traffic generation rates to the proposed residential uplift of 292 dwellings equates to an additional traffic generation of 2,336 vehicle trips per day and 234 vehicle trip in the AM and PM peak hours.

5.2 Traffic Distribution

The directional distribution and assignment of traffic generated by the proposed development will be influenced by a number of factors, including the:

- configuration of the arterial road network in the immediate vicinity of the site
- existing operation of intersections providing access between the local and arterial road network
- distribution of households in the vicinity of the site
- surrounding employment centres, retail centres and schools in relation to the site
- configuration of access points to the site.

Therefore to inform the preparation of a distribution model for traffic accessing the subject site, reference has been made to the following:

- The general location of local shopping facilities that are likely to serve the Tolland suburb
- The location of educational facilities in the proximity of Tolland
- ABS Journey to Work data collected as part of the 2016 and 2021 census.

These are further discussed in the following.

Retail Services

The South City Shopping Centre is likely to be where a majority of people in Tolland would go to undertake their regular, day to day shopping. The centre contains a Coles and an Aldi which is more than any other nearby options.

The Tolland Shopping Centre provides an IGA and a some small cafes and other shops, so while some people from the western area of Tolland will utilise these shops, it wouldn't be expected to be attractive as South City. Also, accessing the Tolland Shopping Centre, is likely to be more complicated and less desirable for drivers from the subject site, requiring right turn movements across Bourke Street. These key retail attractors are shown in Figure 5.1.

Otherwise a majority of retail and commercial facilities are located to the north of the site in central Wagga Wagga. Kooringal Shopping Centre may represent some attraction for shoppers seeking to use Woolworths rather than Coles however this would not be expected to be extensive. This may draw some users along Red Hill Road.

Figure 5.1 – Retail Attractors

Base Map Source: Google Maps

Education

There are three schools located in close proximity of the subject site which could represent the most attractive educational facilities, one of which is located within the Tolland suburb itself and would not require drivers to access the external road network. The location of these educational destinations are shown in Figure 5.1.

Figure 5.2 – Education Attractors

Base Map Source: Google Maps

Journey to Work Data

ABS Journey to work data for the suburb of Tolland identifies the characteristics as shown in Table 5.1.

Table 5.1 – Journey to Work Destinations from Residences in the Suburb of Tolland

Employment Location	2016 Work Destination	2021 Work Destination
Wagga Wagga – East	20%	20%
Wagga Wagga – North	10%	10%
Wagga Wagga – South	17%	19%
Wagga Wagga – West	48%	45%
Wagga Wagga – Surrounds	5%	5%
Other	1%	1%
Total	**100%**	**100%**

Source: Australian Beurau of Statistics, Census Data

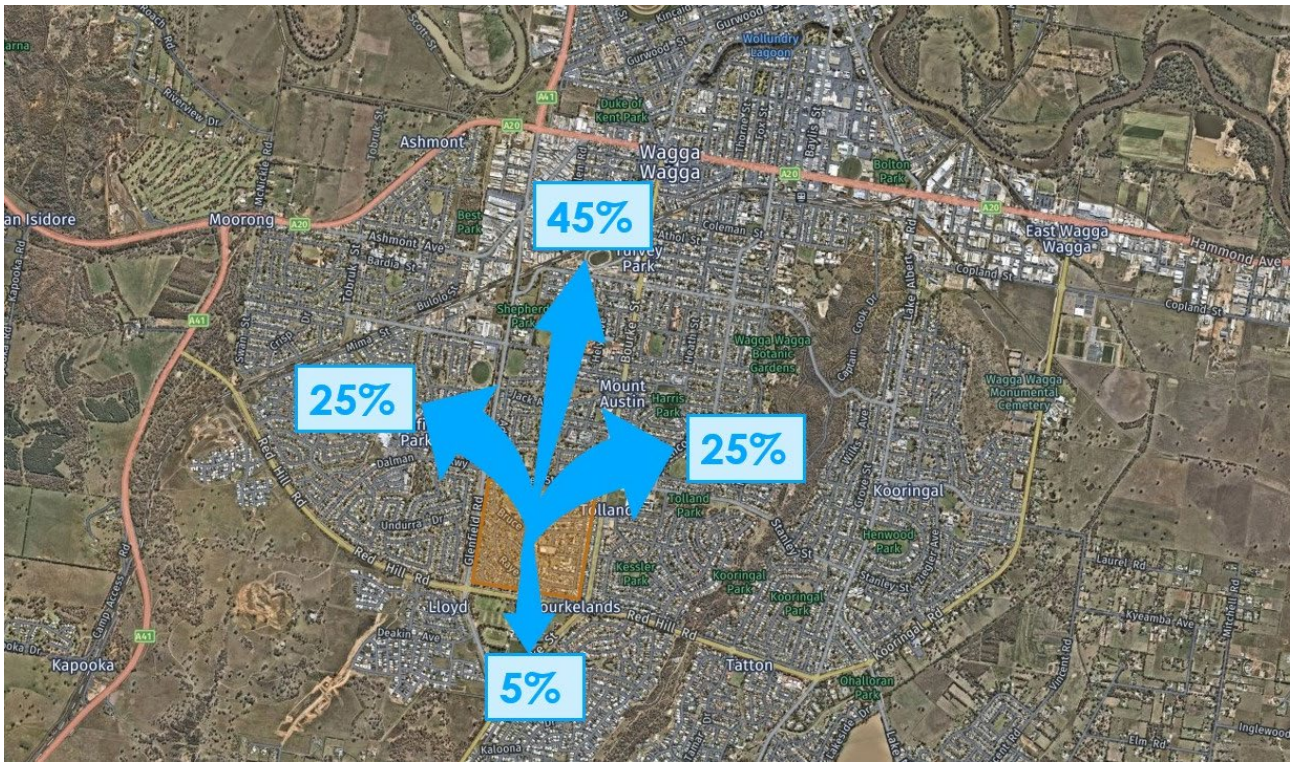
This data identifies that while employment destinations spread between north, east, south and west Wagga Wagga (with a skew to Wagga Wagga West) all of these destinations are located to the north of Tolland. As such it would be reasonably expected that a significant distribution of work-related trips will arrive and depart Tolland to and from the north. No significant changes are observed to have occurred between 2016 and 2021.

Recommended Traffic Distributions

Tolland is generally surrounded by primarily residential suburbs with the majority of employment and commercial activity being located to the north. Local retail services are available to the east and west of the study area to satisfy day to day retail needs. Educational facilities are located both within the study area and to the north and north-east of the study area. This is likely to result in some trip containment occurring within the study area and therefore not relying on the arterial road network for all trips generated. There will also be some other smaller attractors to the south, east and west, however this is not expected to be a dominant movement.

Having regard to the typical make up of residential trips between work, retail and education purposes and the attractors for each of these different trip types in the AM and PM peak hours the following general assumptions as shown in Figure 5.2 have been made in respect of the distribution of traffic to and from the subject site.

Figure 5.3 – Proposed General Traffic Distributions

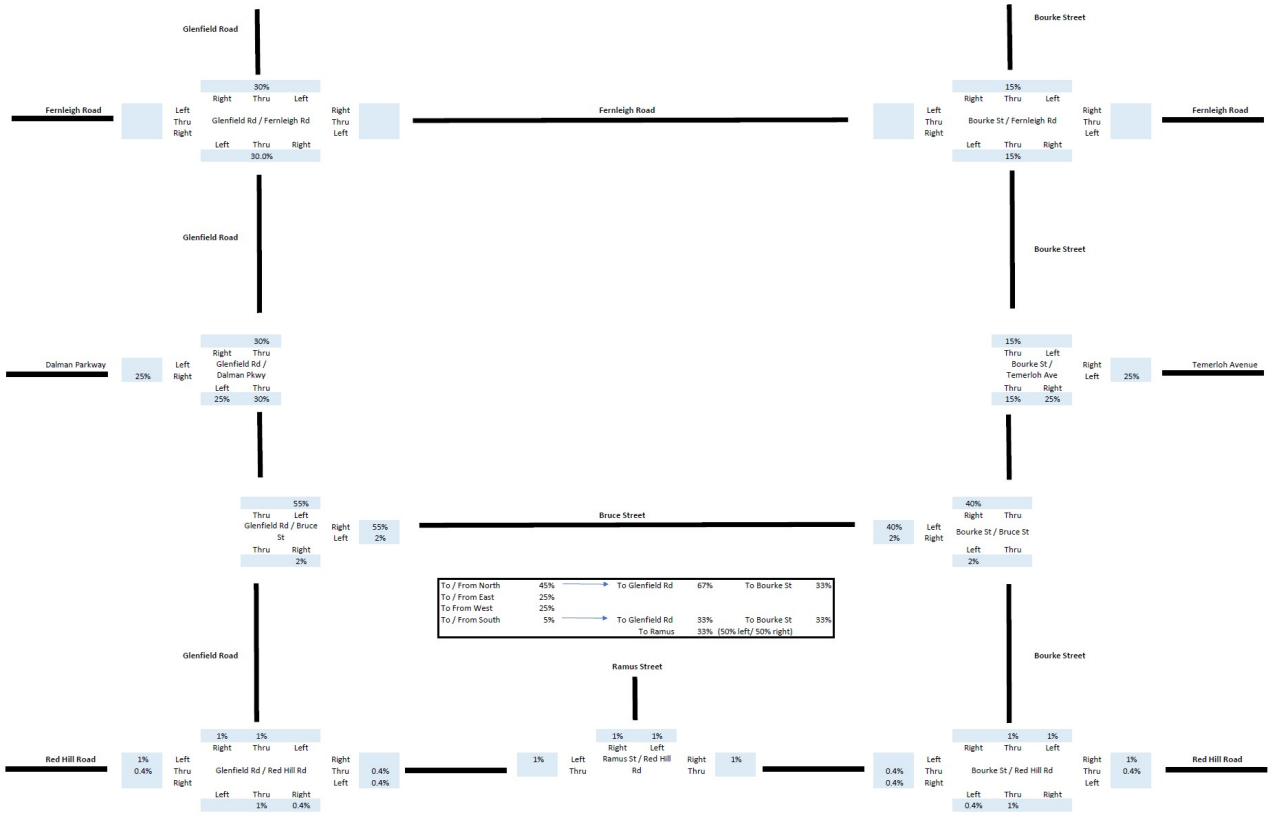


Base Map Source: Google Maps

Further to the above, Figure 5.4 provides a more detailed application of the above distribution assumptions to specific road network intersections and turning movements. This distribution includes the following additional assumptions:

- Due to the greater proximity of new residential dwellings to Glenfield Road as compared with Bourke Street, it is assumed that two thirds of north bound traffic will utilise Glenfield Road with one third utilising Bourke Street.
- Traffic travelling to the south will be distributed evenly between Glenfield Road, Bourke Street and Ramus Street.

Figure 5.4 – Proposed Traffic Network Distributions



It is noted that the existing turning movements at the Bruce Street intersections with Glenfield Road and Bourke Street indicate a slightly higher distribution of traffic to and from the south than that assumed above. These turning distributions are however likely to be influenced by residents from south travelling to and from the school within the Tolland Estate.

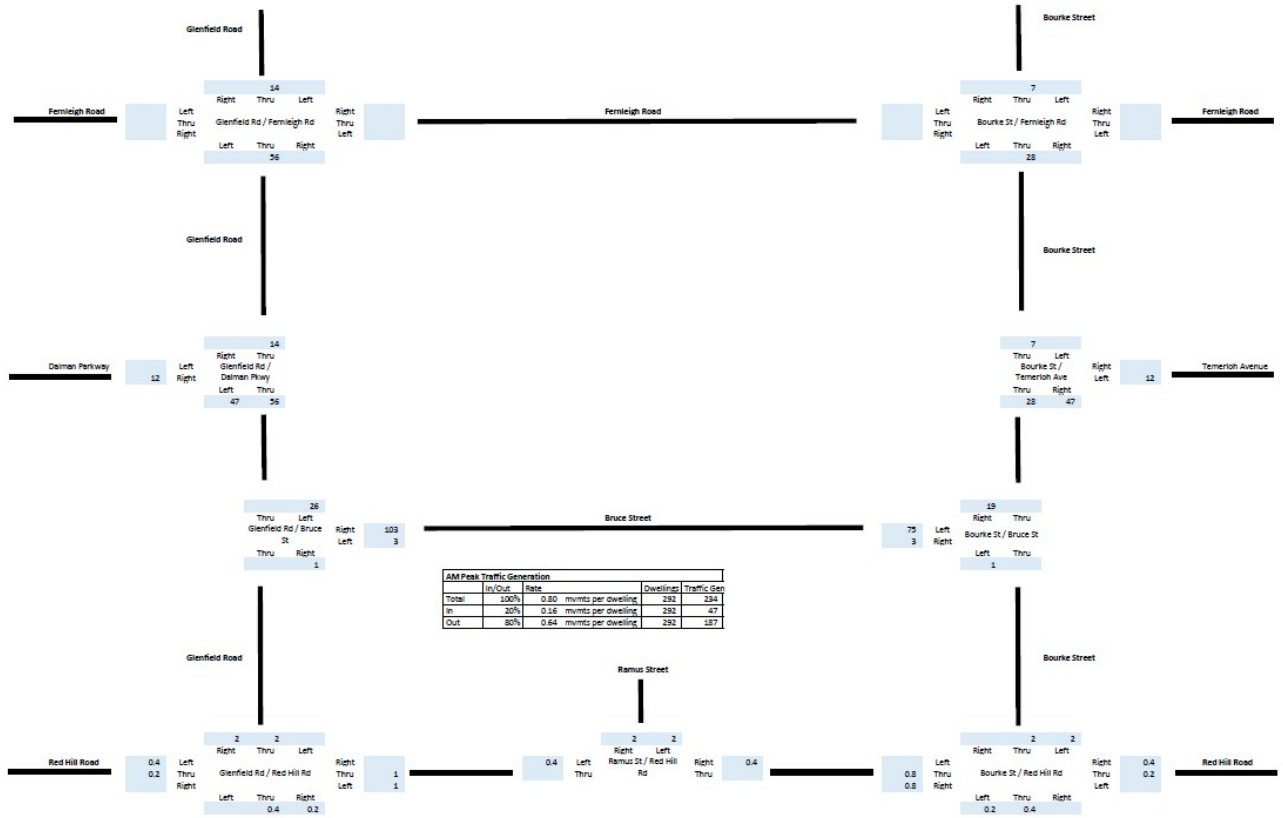
As such the above proposed distributions are considered to be 'fit for purpose'. Further given the diminishing nature of traffic generations as these are distributed across the network a more refined or precise definition of traffic distributions would not be expected to provide any real value in the analysis process.

In addition to the above the following entering and departure characteristics of residential development during the AM and PM peak hours are assumed:

- AM Peak Hour
  - Arrival – 20%
  - Departure – 80%
- PM Peak Hour
  - Arrival – 60%
  - Departure – 40%

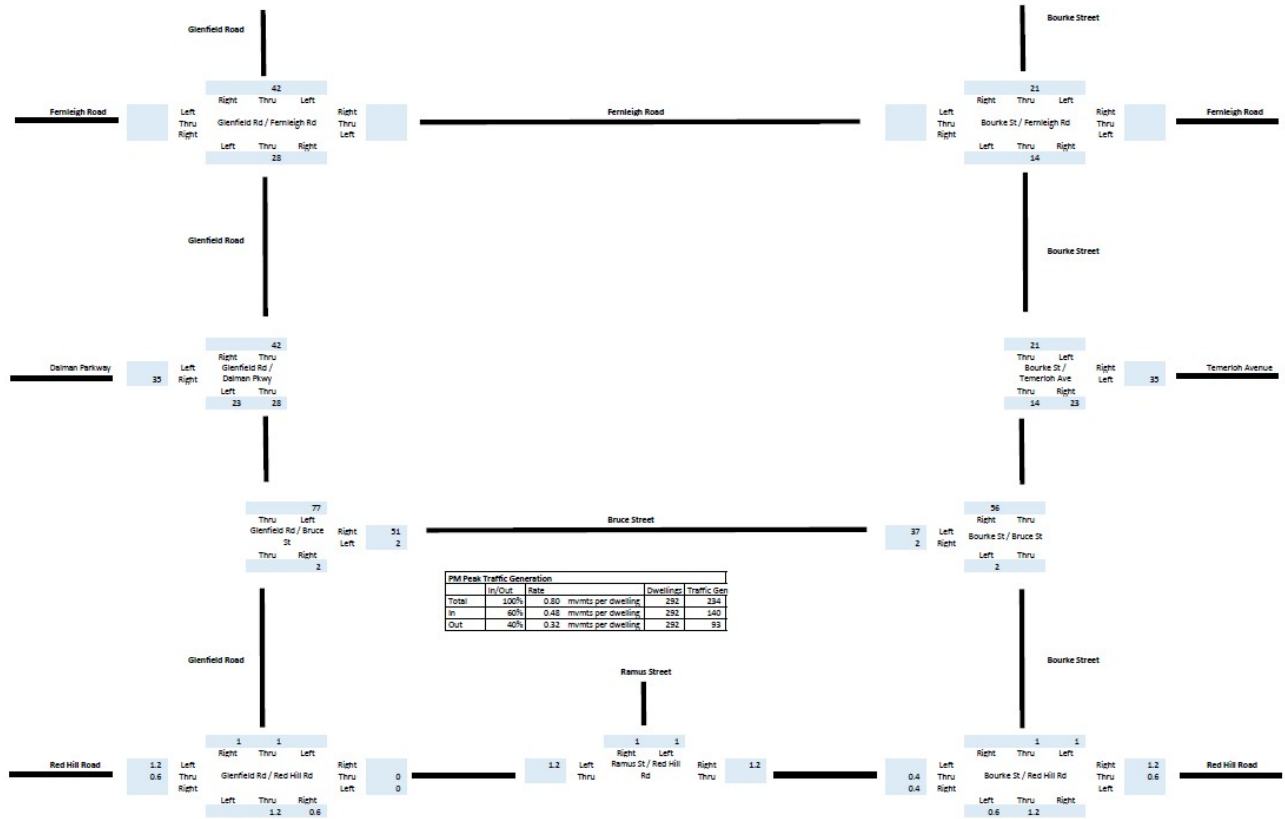
Based on the above, Figure 5.5 and Figure 5.5 have been prepared to show the additional traffic generations distributed as turning movements across the road network in the AM and PM peak hours respectively.

Figure 5.5 – Development Traffic Generation – AM Peak Hour



AM Peak Traffic Generation					
	In/Out	Rate		Dwellings	Traffic Gen
Total	100%	0.80	mvmts per dwelling	292	234
In	20%	0.16	mvmts per dwelling	292	47
Out	80%	0.64	mvmts per dwelling	292	187

Figure 5.6 – Development Traffic Generation – PM Peak Hour



PM Peak Traffic Generation					
	In/Out	Rate		Dwellings	Traffic Gen
Total	100%	0.80	mvmts per dwelling	292	234
In	60%	0.48	mvmts per dwelling	292	140
Out	40%	0.32	mvmts per dwelling	292	93

5.3 Future Traffic Volumes

To assess the impact of this development following the full site redevelopment it is appropriate to have consideration to a relevant 'Base Case' against which to test the development impact. In this instance a 'Base Case' has been developed to align with the expectations of Transport for NSW reflecting a +10 year scenario.

Advice provided by TfNSW has indicated a typical network annual linear growth factor of 2 – 3% per year could be applied to the existing conditions traffic volumes in order represent 2033 conditions.

Population growth for the Wagga Wagga Local Government Area between 2016 – 2021[3] however only identifies a current growth level in the order of 1%.

On this basis a 2% growth factor has been adopted for the purposes of this analysis.

This growth factor would be applied to traffic volumes on Bourke Street, Glenfield Road and Red Hill Road. This growth factor has however not been applied to turning movements into and out of Bruce Street and Ramus Street as growth to these movements is appropriately captured by the additional development traffic generations.

These traffic volume scenarios are presented in Figure 5.7 and Figure 5.7.

Figure 5.7 – Base Traffic Volumes – AM Peak

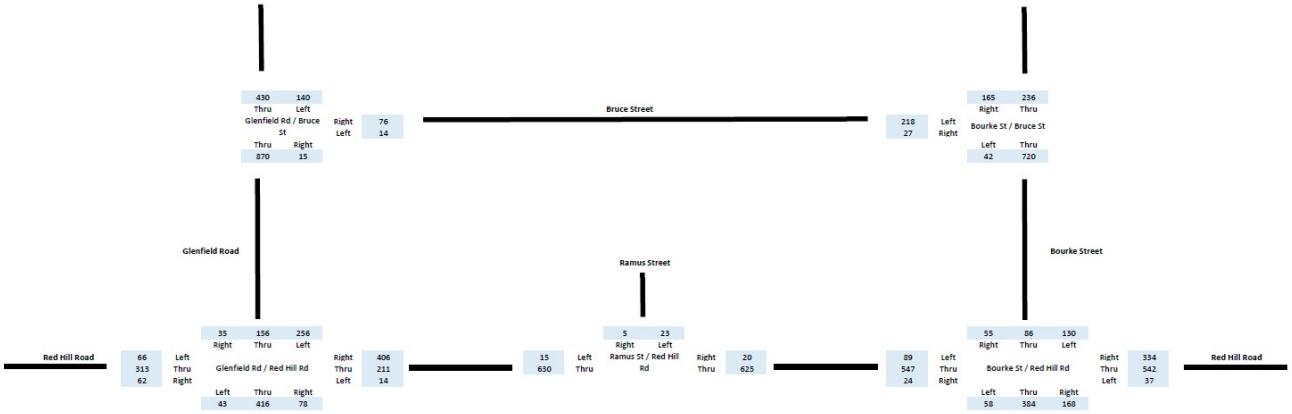
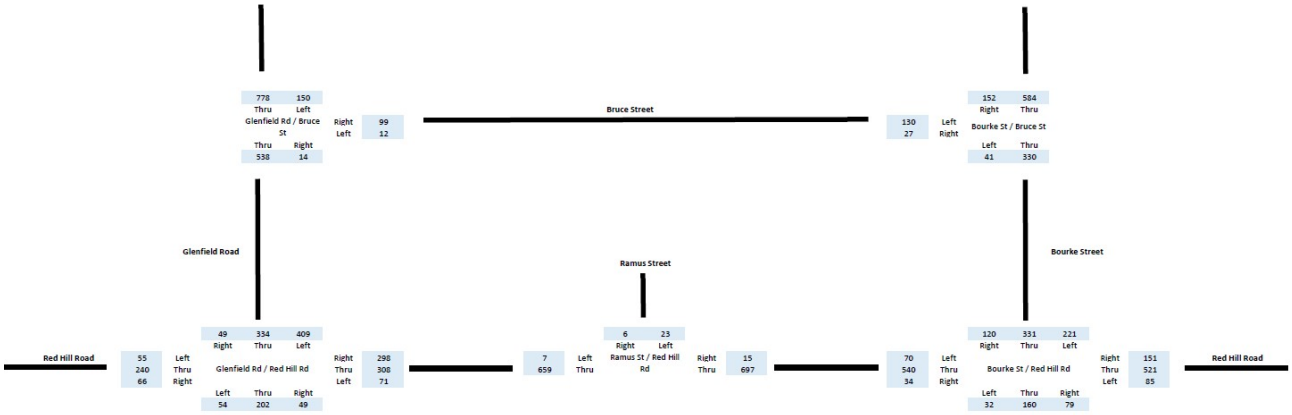


Figure 5.8 – Base Traffic Volumes – PM Peak



The development traffic volumes have been added to the base volumes to present the analysis traffic flows. These are shown in Figure 5.7 and Figure 5.7.

3 Source: Profile ID

Figure 5.9 – Future Traffic Volumes (Base + Development) – AM Peak

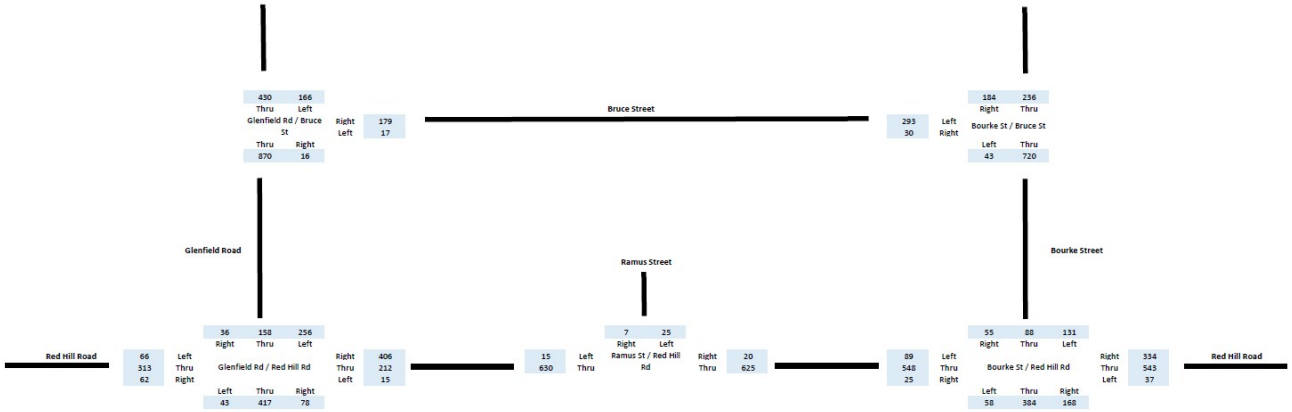
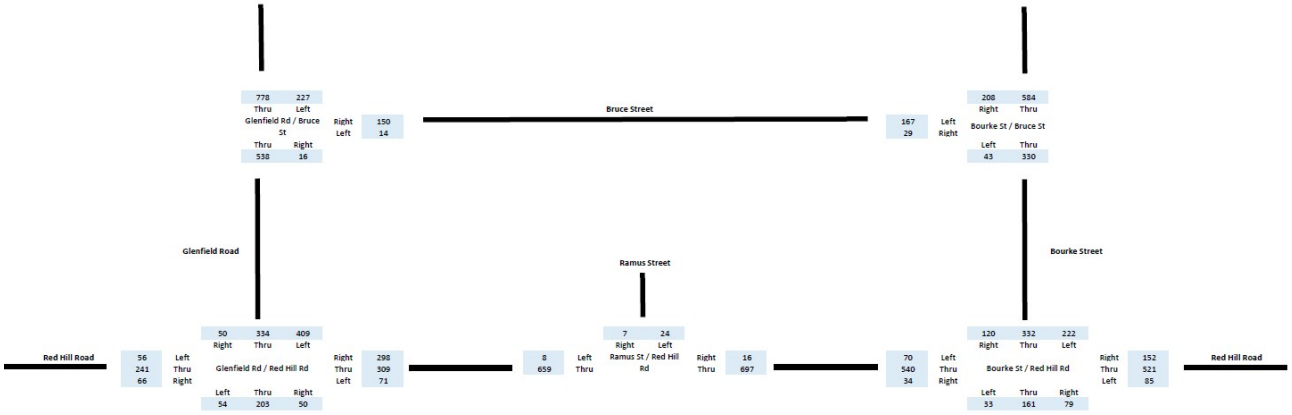


Figure 5.10 – Future Traffic Volumes (Base + Development) – PM Peak



5.4 Intersection Operation

The impact of the development traffic upon intersections in the vicinity of the site has been assessed using SIDRA INTERSECTION.

On the basis of the turning movement estimates presented above, Table 5.2 shows a summary of the anticipated future operation of the nominated intersections following the development of the site (+ 10 years). Detailed results of this analysis are provided in Appendix B of this report.

Table 5.2: Sidra Intersection – Post Development (+10 years) Conditions

Intersection	Peak	Leg	Degree of Saturation (DOS)	Average Delay (sec)	95th Percentile Queue (m)
Bruce Street / Glenfield Road	AM	South	0.49	0.5	3
		East	1.14	169.1	144
		North	0.33	1.8	0
	PM	South	0.34	1.9	7
		East	1.04	118.6	81
		North	0.56	1.6	0
Glenfield Road / Red Hill Road	AM	South	0.39	9.3	16
		East	0.36	10.0	17
		North	0.28	8.2	13
		West	0.50	12.3	26
	PM	South	0.28	8.5	8
		East	0.40	10.4	20
		North	0.42	7.8	20
		West	0.33	9.2	14
Red Hill Road/ Ramus Street	AM	East	0.34	0.7	3
		North	0.03	8.3	1
		West	0.32	0.2	0
	PM	East	0.37	0.6	3
		North	0.04	9.2	1
		West	0.34	0.2	0
Bourke Street / Red Hill Road	AM	South	0.41	2.4	17
		East	0.47	8.2	28
		North	0.23	11.3	11
		West	0.75	14.3	54
	PM	South	0.57	7.5	7
		East	0.55	13.2	63
		North	0.19	13.2	40
		West	0.71	8.3	29
Bourke Street / Bruce Street	AM	South	0.21	0.4	0
		North	0.34	5.4	11
		West	0.34	8.8	11
	PM	South	0.10	0.7	0
		North	0.28	2.3	11
		West	0.19	8.6	4

The analysis indicates that all intersections, with the exception of the Bruce Street / Glenfield Road intersection, will operate well with limited queues and delays on all approaches under post development (+10 yrs) conditions. Degree of Saturation values remain within acceptable limits.

The one exception is the operation of the right turn movement at the intersection of Bruce Street and Glenfield Road (turning right from Bruce Street east into Glenfield Road north) during the AM and PM peak hours. This movement operates with a Degree of Saturation of 1.14 and 1.04 during the AM and PM peaks respectively. Delays and queuing are also extended for this movement. Further discussion regarding this intersection movement is provided in the following section.

5.5 Traffic Mitigation Works

To increase the capacity of the right turn movement at the intersection of Bruce Street and Glenfield Road (turning right from Bruce Street east into Glenfield Road north) would require significant infrastructure works with treatment options including:

- Convert the intersection from an unsignalised T-intersection to a roundabout controlled intersection
- Convert the intersection from an unsignalised T-intersection to a traffic signal controlled intersection, or
- Undertake localised road widening on Glenfield Road to create a centre median of a minimum 6.0m width to enable right turn movements from Bruce Street to be undertaken as a staged movement when turning into Glenfield Road.

While the most basic review of this analysis could suggest the need to undertake mitigating works as suggested above to increase the capacity of this intersection[4], the following must also be reasonably considered before investing in infrastructure outcomes that may not be necessary.

Static Distribution Model

The static distribution model used in this instance to distribute traffic to the road network has primarily taken into consideration the likely origin and destinations of drivers. As identified earlier in Section 5.2 a number of factors will influence the directional distribution of drivers. One particular factor is the capacity of the surrounding road network and the ability to safety access the external road network. As such while capacity constraints may exist in the future limiting the ability for drivers to turn right out of Bruce Street, alternate routes exist that are similarly convenient for drivers travelling to the north of Tolland. This includes the option for drivers to travel along Bruce Street to the east and undertake a left turn movement from Bruce Street into Bourke Street. The SIDRA analysis presented in Table 5.2 shows a Degree of Saturation of 0.34 and 0.19 for the Bruce Street approach indicating more and sufficient capacity to accommodate additional left turn movements travel north.

Other alternate options are available which include using Maher Street to access Bruce Street.

Glenfield Road Upgrade

Glenfield Road currently operates as a Council controlled sub-arterial road. The Wagga Wagga City Council is however advocating to transfer the status of a Regional Road from Bourke Street to Glenfield Road. This is to *"…improve the operation and efficiency of Bourke Street for local traffic, cyclists and pedestrians. Further, the change of road classification of Glenfield Road supports the project for duplication of the Glenfield Road corridor."*[5]

It is unclear whether such change in road classification would be acceptable to Transport for NSW, the timing of any such change and how such road improvements would alter the configuration of the Bruce Street intersection with Glenfield Road.

As such it would be premature to undertake significant mitigation works to increase the capacity of the right turn movement from Bruce Street in Glenfield Road given the uncertainty of the future configuration of Glenfield Road, particularly when alternate opportunities exist for drivers to exit the precinct to travel north.

Uncertainty of Growth Assumption

The above analysis has been based upon an assumption of a level of growth that will occur on the surrounding road network. This has assumed a 2% growth factor as discussed earlier in this report despite demographic data showing a lesser level of population growth over recent year.

Analysis undertaken of the intersection of Bruce Street and Glenfield Road assuming no network traffic growth is presented in Table 5.3.

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4 Or reduce the scale of land use growth.

5 https://wagga.nsw.gov.au/the-council/planning-and-reporting/community-planning/current-community-plans/advocacy-plan/glenfield-road-corridor

Table 5.3: Sidra Intersection – Post Development (No Network Growth) Conditions

Intersection	Peak	Leg	Degree of Saturation (DOS)	Average Delay (sec)	95th Percentile Queue (m)
Bruce Street / Glenfield Road	AM	South	0.41	0.4	3
		East	0.71	25.6	24
		North	0.29	2.1	0
	PM	South	0.28	1.3	4
		East	0.64	25.4	19
		North	0.49	1.7	0

The analysis indicates that the Bruce Street east approach (right and left turn movements) would operate well with Degree of Saturation values remaining within acceptable limits. Queuing and delays are also limited.

As such it may again be premature to undertake significant mitigation works to increase the capacity of the right turn movement from Bruce Street in Glenfield Road given the uncertainty in the level of traffic growth that will occur along Glenfield Road.

Recommendation

On the basis of the above, given the uncertainty around level of network traffic growth that will occur, the uncertainty of the future configuration of Glenfield Road and importantly the available capacity for drivers to be able to suitably egress the precinct as a whole to travel north, it is recommended that no immediate mitigating works be required to improve the operation of the right turn movement from Bruce Street into Glenfield Road.

It is rather recommended that traffic volumes be monitored (both network traffic volumes and the distribution of traffic flows within the Tolland Estate) over time with traffic analysis revisited in the future to confirm if intersection upgrades are actually necessary.

This would also allow for any future infrastructure investment to be aligned with any future designs for the improvement of Glenfield Road rather than potentially being constructed now and representing abortive works.

The opportunity for such review exists due to the planned staged delivery of additional development within the Tolland Precinct. It could reasonably be required as part of the overall Development Approval process that traffic surveys and a further impact assessment be undertaken prior to the occupation of Stage 3 of the development (approximate mid-point of development). Required mitigation outcomes would be required to be provided to the satisfaction of the responsible authority.

This recommendation is considered to represent a balanced infrastructure investment approach.

5.6 Road Network Function and Hierarchy

The Wagga Wagga Integrated Transport Strategy and Implementation Plan identifies the following indicative road network daily traffic capacities:

- Collector Road: 5,000 – 10,000 vehicles per day
- Local Road: 1,500 – 2,000 vehicles per day.

Having regard to the existing daily traffic volumes presented earlier within Table 2.1 the existing road network within the Tolland Estate can be seen to operate well within these capacities currently.

As identified in Section 5.1 the proposed development could be anticipated to generate in the order of 2,336 additional vehicle movements per day throughout the Tolland Estate. These volumes will be dispersed across the estate and therefore not impact one singular road specifically.

Having regard to such dispersion of traffic volumes and the level of capacity that exists within the existing road hierarchy it would not be expected that the indicative network capacity thresholds would be exceeded.

On this basis the proposed development would not be expected to compromise the hierarchy classifications, function or safety of the road network.

6. Conclusions

The following conclusions are made based on the analysis and discussions presented within this report:

- The proposed development will result in an uplift of 292 private dwellings throughout study area
- Access to the Tolland Estate will remain the same as currently provided with access to the external road network provided through the following intersections:
  - Bruce Street and Glenfield Road
  - Bruce Street and Bourke Street
  - Ramus Street and Red Hill Road.
- The internal road network, provides a similar function to current however creates connections between previous cul-der-sac roads to improve the permeability of the site from a walking cycling and vehicle perspective.
- The proposed internal road layout reflects a continuance of the existing road hierarchy within the suburb.
- The internal road network supports active travel modes whilst accommodating the needs of public transport and private motor vehicles.
- Road cross sections, have been designed consistent with the requirements of the Wagga Wagga City Council, *Engineering Guidelines for Subdivisions and Development Standards*.
- The masterplan includes new active travel infrastructure which focuses on improving safety and connectivity by linking to the existing network.
- Existing bus services will continue to operate throughout the estate in the future with the routes and bus stops not impacted by the proposed Master Plan.
- The proposed road cross sections and intersections, are suitable to accommodate vehicle movements of waste collection and emergency services vehicles.
- The proposed residential uplift of 292 dwellings could be expected to generate an additional 2,336 vehicle trips per day and 234 vehicle trips in the AM and PM peak hours.
- Traffic analysis indicates that all intersections, with the exception of the Bruce Street / Glenfield Road intersection, will operate well with limited queues and delays on all approaches under post development (+10 yrs) conditions. Degree of Saturation values remain within acceptable limits.
- The one exception is the right turn movement at the intersection of Bruce Street and Glenfield Road (turning right from Bruce Street east into Glenfield Road north) during the AM and PM peak hours which operates with a Degree of Saturation of 1.14 and 1.04 during the AM and PM peaks respectively.
- While this movement is identified to operate above capacity, given the uncertainty around level of network traffic growth that will occur, the uncertainty of the future configuration of Glenfield Road and importantly the available capacity for drivers to be able to suitably egress the precinct as a whole to travel north, it is recommended that no immediate mitigating works be required to improve the operation of the right turn movement from Bruce Street into Glenfield Road. Rather, it is recommended that traffic volumes be monitored (both network traffic volumes and the distribution of traffic flows within the Tolland Estate) over time with traffic analysis revisited prior to the occupation of Stage 3 of the development to confirm if intersection upgrades are necessary.
- The local road network currently operates within its indicative daily traffic capacities and would be expected to continue to operate within these capacities following the development of the estate. On this basis the proposed development would not be expected to compromise the hierarchy classifications, function or safety of the road network.

Appendix A. Existing Conditions SIDRA Analysis

LANE SUMMARY

Site: 2 [Glenfield Road / Bruce Street - AM Existing (Site Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Glenfield Road													
Lane 1	779	2.0	1899	0.410	100	0.4	LOS A	0.3	2.3	Full	650	0.0	0.0
Approach	779	2.0		0.410		0.4	NA	0.3	2.3				
East: Bruce Street													
Lane 1	15	2.0	1130	0.013	100	5.9	LOS A	0.0	0.3	Short	90	0.0	NA
Lane 2	80	2.0	273	0.293	100	18.2	LOS B	1.0	6.9	Full	500	0.0	0.0
Approach	95	2.0		0.293		16.3	LOS B	1.0	6.9				
North: Glenfield Road													
Lane 1	524	2.0	1898	0.276	100	1.8	LOS A	0.0	0.0	Full	270	0.0	0.0
Approach	524	2.0		0.276		1.8	NA	0.0	0.0				
Intersection	1398	2.0		0.410		2.0	NA	1.0	6.9				

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

Approach Lane Flows (veh/h)

South: Glenfield Road

Mov. From S To Exit:	T1 N	R2 E	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	763	16	779	2.0	1899	0.410	100	NA	NA
Approach	763	16	779	2.0		0.410			

East: Bruce Street

Mov. From E To Exit:	L2 S	R2 N	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	15	-	15	2.0	1130	0.013	100	0.0	2
Lane 2	-	80	80	2.0	273	0.293	100	NA	NA
Approach	15	80	95	2.0		0.293			

North: Glenfield Road

Mov. From N To Exit:	L2 E	T1 S	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	147	377	524	2.0	1898	0.276	100	NA	NA
Approach	147	377	524	2.0		0.276			

	Total	%HV	Deg.Satn (v/c)
Intersection	1398	2.0	0.410

Lane flow rates given in this report are based on the arrival flow rates subject to upstream capacity constraint where applicable.

Merge Analysis

	Exit Lane Number	Short Lane Length m	Percent Opng in Lane %	Opposing Flow Rate veh/h	Opposing Flow Rate pcu/h	Critical Gap sec	Follow-up Headway sec	Lane Flow Rate veh/h	Capacity veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec
South Exit: Glenfield Road Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										
East Exit: Bruce Street Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										
North Exit: Glenfield Road Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										

LANE SUMMARY

Site: 2 [Glenfield Road / Bruce Street - PM Existing (Site Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Glenfield Road													
Lane 1	486	2.0	1818	0.268	100	0.9	LOS A	0.4	2.8	Full	650	0.0	0.0
Approach	486	2.0		0.268		0.9	NA	0.4	2.8				
East: Bruce Street													
Lane 1	13	2.0	760	0.017	100	7.7	LOS A	0.1	0.4	Short	90	0.0	NA
Lane 2	104	2.0	268	0.389	100	19.8	LOS B	1.4	9.7	Full	500	0.0	0.0
Approach	117	2.0		0.389		18.5	LOS B	1.4	9.7				
North: Glenfield Road													
Lane 1	840	2.0	1907	0.441	100	1.3	LOS A	0.0	0.0	Full	270	0.0	0.0
Approach	840	2.0		0.441		1.3	NA	0.0	0.0				
Intersection	1443	2.0		0.441		2.5	NA	1.4	9.7				

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

Approach Lane Flows (veh/h)

South: Glenfield Road

Mov. From S To Exit:	T1 N	R2 E	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	472	15	486	2.0	1818	0.268	100	NA	NA
Approach	472	15	486	2.0		0.268			

East: Bruce Street

Mov. From E To Exit:	L2 S	R2 N	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	13	-	13	2.0	760	0.017	100	0.0	2
Lane 2	-	104	104	2.0	268	0.389	100	NA	NA
Approach	13	104	117	2.0		0.389			

North: Glenfield Road

Mov. From N To Exit:	L2 E	T1 S	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	158	682	840	2.0	1907	0.441	100	NA	NA
Approach	158	682	840	2.0		0.441			

	Total	%HV	Deg.Satn (v/c)
Intersection	1443	2.0	0.441

Lane flow rates given in this report are based on the arrival flow rates subject to upstream capacity constraint where applicable.

Merge Analysis

	Exit Lane Number	Short Lane Length m	Percent Opng in Lane %	Opposing Flow Rate veh/h	Opposing Flow Rate pcu/h	Critical Gap sec	Follow-up Headway sec	Lane Flow Rate veh/h	Capacity veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec
South Exit: Glenfield Road Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										
East Exit: Bruce Street Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										
North Exit: Glenfield Road Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										

LANE SUMMARY

Site: 3 [Red Hill Road / Glenfield Road / Holbrook Road - AM Existing (Site Folder: General)]

New Site
Site Category: (None)
Roundabout

Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Holbrook Road													
Lane 1	165	2.0	811	0.204	68[6]	8.9	LOS A	0.9	6.7	Short	120	0.0	NA
Lane 2[d]	306	2.0	1023	0.300	100	8.4	LOS A	1.5	11.0	Full	370	0.0	0.0
Approach	472	2.0		0.300		8.6	LOS A	1.5	11.0				
East: Red Hill Road													
Lane 1	198	2.0	1012	0.196	100	6.6	LOS A	1.1	7.5	Short	100	0.0	NA
Lane 2[d]	356	2.0	1233	0.288	100	11.3	LOS A	1.8	12.5	Full	590	0.0	0.0
Approach	554	2.0		0.288		9.6	LOS A	1.8	12.5				
North: Glenfield Road													
Lane 1[d]	224	2.0	1044	0.215	100	7.0	LOS A	1.3	9.4	Short	80	0.0	NA
Lane 2	167	2.0	908	0.184	86[5]	8.4	LOS A	1.1	7.6	Full	650	0.0	0.0
Approach	392	2.0		0.215		7.6	LOS A	1.3	9.4				
West: Red Hill Road													
Lane 1	58	2.0	517	0.112	100	11.6	LOS A	0.5	3.6	Short	90	0.0	NA
Lane 2[d]	329	2.0	882	0.374	100	9.7	LOS A	2.2	15.6	Full	350	0.0	0.0
Approach	387	2.0		0.374		10.0	LOS A	2.2	15.6				
Intersection	1804	2.0		0.374		9.0	LOS A	2.2	15.6				

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

5 Lane under-utilisation found by the program
6 Lane under-utilisation due to downstream effects
d Dominant lane on roundabout approach

Approach Lane Flows (veh/h)

South: Holbrook Road

Mov. From S To Exit:	L2 W	T1 N	R2 E	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	38	127	-	165	2.0	811	0.204	68[6]	0.0	2
Lane 2	-	238	68	306	2.0	1023	0.300	100	NA	NA
Approach	38	365	68	472	2.0		0.300			

East: Red Hill Road

Mov. From E To Exit:	L2 S	T1 W	R2 N	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.

Lane 1	13	185	-	198	2.0	1012	0.196	100	0.0	2
Lane 2	-	-	356	356	2.0	1233	0.288	100	NA	NA
Approach	13	185	356	554	2.0		0.288			

North: Glenfield Road

Mov. From N To Exit:	L2 E	T1 S	R2 W	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	224	-	-	224	2.0	1044	0.215	100	0.0	2
Lane 2	-	137	31	167	2.0	908	0.184	86[5]	NA	NA
Approach	224	137	31	392	2.0		0.215			

West: Red Hill Road

Mov. From W To Exit:	L2 N	T1 E	R2 S	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	58	-	-	58	2.0	517	0.112	100	0.0	2
Lane 2	-	275	55	329	2.0	882	0.374	100	NA	NA
Approach	58	275	55	387	2.0		0.374			

	Total	%HV	Deg.Satn (v/c)
Intersection	1804	2.0	0.374

Lane flow rates given in this report are based on the arrival flow rates subject to upstream capacity constraint where applicable.

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

Merge Analysis

	Exit Lane Number	Short Lane Length m	Percent Opng in Lane %	Opposing Flow Rate veh/h	Opposing Flow Rate pcu/h	Critical Gap sec	Follow-up Headway sec	Lane Flow Rate veh/h	Capacity veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec
South Exit: Holbrook Road Merge Type: **Priority**												
Exit Short Lane	1	120	0.0	192	193	3.00	2.00	13	1604	0.008	0.3	0.3
Merge Lane	2	-	100.0	Merge Lane is not Opposed				192	1800	0.106	0.0	0.0
East Exit: Red Hill Road Merge Type: **Priority**												
Exit Short Lane	1	100	0.0	68	69	3.00	2.00	499	1731	0.288	0.1	0.2
Merge Lane	2	-	100.0	Merge Lane is not Opposed				68	1800	0.038	0.0	0.0
North Exit: Glenfield Road Merge Type: **Priority**												
Exit Short Lane	1	100	0.0	594	600	3.00	2.00	185	1181	0.157	1.1	1.4
Merge Lane	2	-	100.0	Merge Lane is not Opposed				594	1800	0.330	0.0	0.0
West Exit: Red Hill Road Merge Type: **Priority**												
Exit Short Lane	1	100	0.0	31	31	3.00	2.00	223	1769	0.126	0.0	0.1
Merge Lane	2	-	100.0	Merge Lane is not Opposed				31	1800	0.017	0.0	0.0

LANE SUMMARY

Site: 3 [Red Hill Road / Glenfield Road / Holbrook Road - PM Existing (Site Folder: General)]

New Site
Site Category: (None)
Roundabout

Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Holbrook Road													
Lane 1	93	2.0	799	0.117	68[6]	7.8	LOS A	0.5	3.6	Short	120	0.0	NA
Lane 2[d]	174	2.0	1011	0.172	100	8.2	LOS A	0.8	5.8	Full	370	0.0	0.0
Approach	267	2.0		0.172		8.1	LOS A	0.8	5.8				
East: Red Hill Road													
Lane 1[d]	333	2.0	1068	0.311	100	7.4	LOS A	2.0	14.0	Short	100	0.0	NA
Lane 2	261	2.0	940	0.278	100	12.6	LOS A	1.7	11.8	Full	590	0.0	0.0
Approach	594	2.0		0.311		9.7	LOS A	2.0	14.0				
North: Glenfield Road													
Lane 1[d]	359	2.0	1129	0.318	98[5]	6.6	LOS A	2.0	14.5	Short	80	0.0	NA
Lane 2	336	2.0	1036	0.324	100	7.7	LOS A	2.0	14.6	Full	650	0.0	0.0
Approach	695	2.0		0.324		7.2	LOS A	2.0	14.6				
West: Red Hill Road													
Lane 1	48	2.0	622	0.078	100	9.1	LOS A	0.3	2.4	Short	90	0.0	NA
Lane 2[d]	268	2.0	1046	0.257	100	8.4	LOS A	1.4	10.0	Full	350	0.0	0.0
Approach	317	2.0		0.257		8.5	LOS A	1.4	10.0				
Intersection	1873	2.0		0.324		8.3	LOS A	2.0	14.6				

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

5 Lane under-utilisation found by the program
6 Lane under-utilisation due to downstream effects
d Dominant lane on roundabout approach

Approach Lane Flows (veh/h)

South: Holbrook Road

Mov. From S To Exit:	L2 W	T1 N	R2 E	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	47	46	-	93	2.0	799	0.117	68[6]	0.0	2
Lane 2	-	131	43	174	2.0	1011	0.172	100	NA	NA
Approach	47	177	43	267	2.0		0.172			

East: Red Hill Road

Mov. From E To Exit:	L2 S	T1 W	R2 N	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.

Lane 1	62	271	-	333	2.0	1068	0.311	100	0.0	2
Lane 2	-	-	261	261	2.0	940	0.278	100	NA	NA
Approach	62	271	261	594	2.0		0.311			

North: Glenfield Road

Mov. From N To Exit:	L2 E	T1 S	R2 W	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	359	-	-	359	2.0	1129	0.318	98[5]	0.0	2
Lane 2	-	293	43	336	2.0	1036	0.324	100	NA	NA
Approach	359	293	43	695	2.0		0.324			

West: Red Hill Road

Mov. From W To Exit:	L2 N	T1 E	R2 S	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	48	-	-	48	2.0	622	0.078	100	0.0	2
Lane 2	-	211	58	268	2.0	1046	0.257	100	NA	NA
Approach	48	211	58	317	2.0		0.257			

	Total	%HV	Deg.Satn (v/c)
Intersection	1873	2.0	0.324

Lane flow rates given in this report are based on the arrival flow rates subject to upstream capacity constraint where applicable.

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

Merge Analysis

	Exit Lane Number	Short Lane Length m	Percent Opng in Lane %	Opposing Flow Rate veh/h	Opposing Flow Rate pcu/h	Critical Gap sec	Follow-up Headway sec	Lane Flow Rate veh/h	Capacity veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec
South Exit: Holbrook Road Merge Type: **Priority**												
Exit Short Lane	1	120	0.0	351	354	3.00	2.00	62	1439	0.043	0.5	0.6
Merge Lane	2	-	100.0	Merge Lane is not Opposed				351	1800	0.195	0.0	0.0
East Exit: Red Hill Road Merge Type: **Priority**												
Exit Short Lane	1	100	0.0	43	44	3.00	2.00	569	1756	0.324	0.1	0.1
Merge Lane	2	-	100.0	Merge Lane is not Opposed				43	1800	0.024	0.0	0.0
North Exit: Glenfield Road Merge Type: **Priority**												
Exit Short Lane	1	100	0.0	392	396	3.00	2.00	94	1396	0.068	0.6	0.8
Merge Lane	2	-	100.0	Merge Lane is not Opposed				392	1800	0.218	0.0	0.0
West Exit: Red Hill Road Merge Type: **Priority**												
Exit Short Lane	1	100	0.0	43	44	3.00	2.00	318	1756	0.181	0.1	0.1
Merge Lane	2	-	100.0	Merge Lane is not Opposed				43	1800	0.024	0.0	0.0

LANE SUMMARY

Site: 101 [Red Hill Road / Ramus Street - AM Existing (Site Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
East: Red Hill Road													
Lane 1	569	2.0	2005	0.284	100	0.6	LOS A	0.3	2.4	Full	300	0.0	0.0
Approach	569	2.0		0.284		0.6	NA	0.3	2.4				
North: Ramus Street													
Lane 1	24	2.0	913	0.027	100	5.3	LOS A	0.1	0.7	Short	28	0.0	NA
Lane 2	5	2.0	349	0.015	100	11.2	LOS A	0.0	0.3	Full	30	0.0	0.0
Approach	29	2.0		0.027		6.4	LOS A	0.1	0.7				
West: Red Hill Road													
Lane 1	568	2.0	2092	0.272	100	0.2	LOS A	0.0	0.0	Full	590	0.0	0.0
Approach	568	2.0		0.272		0.2	NA	0.0	0.0				
Intersection	1167	2.0		0.284		0.6	NA	0.3	2.4				

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

Approach Lane Flows (veh/h)

East: Red Hill Road

Mov. From E To Exit:	T1 W	R2 N	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	548	21	569	2.0	2005	0.284	100	NA	NA
Approach	548	21	569	2.0		0.284			

North: Ramus Street

Mov. From N To Exit:	L2 E	R2 W	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	24	-	24	2.0	913	0.027	100	0.0	2
Lane 2	-	5	5	2.0	349	0.015	100	NA	NA
Approach	24	5	29	2.0		0.027			

West: Red Hill Road

Mov. From W To Exit:	L2 N	T1 E	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	16	553	568	2.0	2092	0.272	100	NA	NA
Approach	16	553	568	2.0		0.272			

	Total	%HV	Deg.Satn (v/c)
Intersection	1167	2.0	0.284

Lane flow rates given in this report are based on the arrival flow rates subject to upstream capacity constraint where applicable.

Merge Analysis

	Exit Lane Number	Short Lane Length m	Percent Opng in Lane %	Opposing Flow Rate veh/h	Opposing Flow Rate pcu/h	Critical Gap sec	Follow-up Headway sec	Lane Flow Rate veh/h	Capacity veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec
East Exit: Red Hill Road Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										
North Exit: Ramus Street Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										
West Exit: Red Hill Road Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										

LANE SUMMARY

Site: 101 [Red Hill Road / Ramus Street - PM Existing (Site Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
East: Red Hill Road													
Lane 1	627	2.0	2030	0.309	100	0.4	LOS A	0.3	2.0	Full	300	0.0	0.0
Approach	627	2.0		0.309		0.4	NA	0.3	2.0				
North: Ramus Street													
Lane 1	24	2.0	882	0.027	100	5.5	LOS A	0.1	0.7	Short	28	0.0	NA
Lane 2	6	2.0	305	0.021	100	12.8	LOS A	0.1	0.4	Full	30	0.0	0.0
Approach	31	2.0		0.027		7.0	LOS A	0.1	0.7				
West: Red Hill Road													
Lane 1	585	2.0	2094	0.280	100	0.2	LOS A	0.0	0.0	Full	590	0.0	0.0
Approach	585	2.0		0.280		0.2	NA	0.0	0.0				
Intersection	1243	2.0		0.309		0.5	NA	0.3	2.0				

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

Approach Lane Flows (veh/h)

East: Red Hill Road

Mov. From E To Exit:	T1 W	R2 N	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	612	16	627	2.0	2030	0.309	100	NA	NA
Approach	612	16	627	2.0		0.309			

North: Ramus Street

Mov. From N To Exit:	L2 E	R2 W	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	24	-	24	2.0	882	0.027	100	0.0	2
Lane 2	-	6	6	2.0	305	0.021	100	NA	NA
Approach	24	6	31	2.0		0.027			

West: Red Hill Road

Mov. From W To Exit:	L2 N	T1 E	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	7	578	585	2.0	2094	0.280	100	NA	NA
Approach	7	578	585	2.0		0.280			

	Total	%HV	Deg.Satn (v/c)
Intersection	1243	2.0	0.309

Lane flow rates given in this report are based on the arrival flow rates subject to upstream capacity constraint where applicable.

Merge Analysis

	Exit Lane Number	Short Lane Length m	Percent Opng in Lane %	Opposing Flow Rate veh/h	Opposing Flow Rate pcu/h	Critical Gap sec	Follow-up Headway sec	Lane Flow Rate veh/h	Capacity veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec
East Exit: Red Hill Road Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										
North Exit: Ramus Street Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										
West Exit: Red Hill Road Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										

LANE SUMMARY

Site: 3 [Bourke St / Red Hill Road - AM Existing (Site Folder: General)]

New Site
Site Category: (None)
Roundabout

Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
East: Red Hill Road													
Lane 1[d]	508	2.0	1338	0.380	100	5.9	LOS A	2.8	19.9	Full	1200	0.0	0.0
Lane 2	293	2.0	1101	0.266	100	11.3	LOS A	1.7	11.9	Short	120	0.0	NA
Approach	801	2.0		0.380		7.9	LOS A	2.8	19.9				
North: Bourke Street													
Lane 1	114	2.0	736	0.154	100	7.8	LOS A	1.0	6.9	Full	570	0.0	0.0
Lane 2[d]	124	2.0	864	0.144	100	11.7	LOS A	0.9	6.8	Full	570	0.0	0.0
Approach	238	2.0		0.154		9.8	LOS A	1.0	6.9				
West: Red Hill Road													
Lane 1	78	2.0	519	0.150	100	9.8	LOS A	0.7	4.7	Short	120	0.0	NA
Lane 2[d]	501	2.0	893	0.561	100	10.5	LOS A	4.2	29.9	Full	300	0.0	0.0
Approach	579	2.0		0.561		10.4	LOS A	4.2	29.9				
SouthWest: Bourke Street													
Lane 1[d]	294	2.0	964	0.305	100	6.0	LOS A	1.6	11.1	Short	80	0.0	NA
Lane 2	240	2.0	787	0.305	100	9.4	LOS A	1.5	10.6	Full	930	0.0	0.0
Approach	535	2.0		0.305		7.5	LOS A	1.6	11.1				
Intersection	2153	2.0		0.561		8.7	LOS A	4.2	29.9				

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

d Dominant lane on roundabout approach

Approach Lane Flows (veh/h)

East: Red Hill Road

Mov. From E To Exit:	L1 SW	T1 W	R2 N	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	33	476	-	508	2.0	1338	0.380	100	NA	NA
Lane 2	-	-	293	293	2.0	1101	0.266	100	0.0	1
Approach	33	476	293	801	2.0		0.380			

North: Bourke Street

Mov. From N To Exit:	L2 E	R1 SW	R2 W	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	114	-	-	114	2.0	736	0.154	100	NA	NA
Lane 2	-	76	48	124	2.0	864	0.144	100	NA	NA

Approach	114	76	48	238	2.0		0.154			
West: Red Hill Road										
Mov. From W To Exit:	L2 N	T1 E	R3 SW	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	78	-	-	78	2.0	519	0.150	100	0.0	2
Lane 2	-	480	21	501	2.0	893	0.561	100	NA	NA
Approach	78	480	21	579	2.0		0.561			
SouthWest: Bourke Street										
Mov. From SW To Exit:	L3 W	L1 N	R1 E	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	51	244	-	294	2.0	964	0.305	100	0.0	2
Lane 2	-	93	147	240	2.0	787	0.305	100	NA	NA
Approach	51	337	147	535	2.0		0.305			
	Total	%HV	Deg.Satn (v/c)							
Intersection	2153	2.0	0.561							

Lane flow rates given in this report are based on the arrival flow rates subject to upstream capacity constraint where applicable.

Merge Analysis

	Exit Lane Number	Short Lane Length m	Percent Opng in Lane %	Opposing Flow Rate veh/h	Opposing Flow Rate pcu/h	Critical Gap sec	Follow-up Headway sec	Lane Flow Rate veh/h	Capacity veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec
East Exit: Red Hill Road Merge Type: **Priority**												
Exit Short Lane	1	130	0.0	147	149	3.00	2.00	594	1650	0.360	0.2	0.4
Merge Lane	2	-	100.0	Merge Lane is not Opposed				147	1800	0.082	0.0	0.0
North Exit: Bourke Street Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										
Full Length Lane	2	Merge Analysis not applied.										
West Exit: Red Hill Road Merge Type: **Priority**												
Exit Short Lane	1	110	0.0	48	49	3.00	2.00	526	1751	0.301	0.1	0.1
Merge Lane	2	-	100.0	Merge Lane is not Opposed				48	1800	0.027	0.0	0.0
SouthWest Exit: Bourke Street Merge Type: **Priority**												
Exit Short Lane	1	90	0.0	97	98	3.00	2.00	33	1702	0.019	0.1	0.1
Merge Lane	2	-	100.0	Merge Lane is not Opposed				97	1800	0.054	0.0	0.0

LANE SUMMARY

Site: 3 [Bourke St / Red Hill Road - PM Existing (Site Folder: General)]

New Site
Site Category: (None)
Roundabout

Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
East: Red Hill Road													
Lane 1[d]	532	2.0	1002	0.530	100	8.5	LOS A	4.5	32.4	Full	1200	0.0	0.0
Lane 2	133	2.0	598	0.222	100	14.5	LOS A	1.2	8.8	Short	120	0.0	NA
Approach	664	2.0		0.530		9.7	LOS A	4.5	32.4				
North: Bourke Street													
Lane 1	194	2.0	723	0.268	100	7.8	LOS A	1.6	11.6	Full	570	0.0	0.0
Lane 2[d]	396	2.0	947	0.418	100	11.7	LOS A	3.1	21.8	Full	570	0.0	0.0
Approach	589	2.0		0.418		10.4	LOS A	3.1	21.8				
West: Red Hill Road													
Lane 1	61	2.0	687	0.089	100	7.4	LOS A	0.4	2.7	Short	120	0.0	NA
Lane 2[d]	503	2.0	1150	0.438	100	7.3	LOS A	2.7	19.3	Full	300	0.0	0.0
Approach	564	2.0		0.438		7.3	LOS A	2.7	19.3				
SouthWest: Bourke Street													
Lane 1[d]	130	2.0	965	0.134	100	5.5	LOS A	0.7	4.8	Short	80	0.0	NA
Lane 2	108	2.0	807	0.134	100	8.8	LOS A	0.6	4.6	Full	930	0.0	0.0
Approach	238	2.0		0.134		7.0	LOS A	0.7	4.8				
Intersection	2056	2.0		0.530		8.9	LOS A	4.5	32.4				

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

d Dominant lane on roundabout approach

Approach Lane Flows (veh/h)

East: Red Hill Road

Mov. From E To Exit:	L1 SW	T1 W	R2 N	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	75	457	-	532	2.0	1002	0.530	100	NA	NA
Lane 2	-	-	133	133	2.0	598	0.222	100	0.0	1
Approach	75	457	133	664	2.0		0.530			

North: Bourke Street

Mov. From N To Exit:	L2 E	R1 SW	R2 W	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	194	-	-	194	2.0	723	0.268	100	NA	NA
Lane 2	-	291	105	396	2.0	947	0.418	100	NA	NA

Approach	194	291	105	589	2.0		0.418			
West: Red Hill Road										
Mov. From W To Exit:	L2 N	T1 E	R3 SW	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	61	-	-	61	2.0	687	0.089	100	0.0	2
Lane 2	-	474	29	503	2.0	1150	0.438	100	NA	NA
Approach	61	474	29	564	2.0		0.438			
SouthWest: Bourke Street										
Mov. From SW To Exit:	L3 W	L1 N	R1 E	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	28	101	-	130	2.0	965	0.134	100	0.0	2
Lane 2	-	39	69	108	2.0	807	0.134	100	NA	NA
Approach	28	140	69	238	2.0		0.134			
	Total	%HV	Deg.Satn (v/c)							
Intersection	2056	2.0	0.530							

Lane flow rates given in this report are based on the arrival flow rates subject to upstream capacity constraint where applicable.

Merge Analysis

	Exit Lane Number	Short Lane Length m	Percent Opng in Lane %	Opposing Flow Rate veh/h	Opposing Flow Rate pcu/h	Critical Gap sec	Follow-up Headway sec	Lane Flow Rate veh/h	Capacity veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec
East Exit: Red Hill Road Merge Type: **Priority**												
Exit Short Lane	1	130	0.0	69	70	3.00	2.00	667	1730	0.386	0.1	0.2
Merge Lane	2	-	100.0	Merge Lane is not Opposed				69	1800	0.039	0.0	0.0
North Exit: Bourke Street Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										
Full Length Lane	2	Merge Analysis not applied.										
West Exit: Red Hill Road Merge Type: **Priority**												
Exit Short Lane	1	110	0.0	105	106	3.00	2.00	485	1693	0.287	0.1	0.2
Merge Lane	2	-	100.0	Merge Lane is not Opposed				105	1800	0.058	0.0	0.0
SouthWest Exit: Bourke Street Merge Type: **Priority**												
Exit Short Lane	1	90	0.0	320	323	3.00	2.00	75	1471	0.051	0.5	0.6
Merge Lane	2	-	100.0	Merge Lane is not Opposed				320	1800	0.178	0.0	0.0

LANE SUMMARY

Site: 101 [Bourke Street / Bruce Street - AM Existing (Site Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Bourke Street													
Lane 1	337	2.0	1882	0.179	100	0.8	LOS A	0.0	0.0	Full	570	0.0	0.0
Lane 2	339	2.0	1895	0.179	100	0.1	LOS A	0.0	0.0	Full	570	0.0	0.0
Approach	676	2.0		0.179		0.4	NA	0.0	0.0				
North: Bourke Street													
Lane 1	207	2.0	1895	0.109	43[5]	0.0	LOS A	0.0	0.0	Full	200	0.0	0.0
Lane 2	174	2.0	682	0.255	100	10.0	LOS A	1.1	7.7	Full	200	0.0	0.0
Approach	381	2.0		0.255		4.6	NA	1.1	7.7				
West: Bruce Street													
Lane 1	229	2.0	984	0.233	100	6.1	LOS A	0.9	6.7	Short (P)	25	0.0	NA
Lane 2	28	2.0	235	0.121	100	19.2	LOS B	0.4	2.9	Full	100	0.0	0.0
Approach	258	2.0		0.233		7.6	LOS A	0.9	6.7				
Intersection	1315	2.0		0.255		3.0	NA	1.1	7.7				

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

5 Lane under-utilisation found by the program

Approach Lane Flows (veh/h)

South: Bourke Street

Mov. From S To Exit:	L2 W	T1 N	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	44	293	337	2.0	1882	0.179	100	NA	NA
Lane 2	-	339	339	2.0	1895	0.179	100	NA	NA
Approach	44	632	676	2.0		0.179			

North: Bourke Street

Mov. From N To Exit:	T1 S	R2 W	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	207	-	207	2.0	1895	0.109	43[5]	NA	NA
Lane 2	-	174	174	2.0	682	0.255	100	NA	NA
Approach	207	174	381	2.0		0.255			

West: Bruce Street

Mov.	L2	R2	Total	%HV		Deg.	Lane	Prob.	Ov.

From W To Exit:	N	S			Cap. veh/h	Satn v/c	Util. %	SL Ov. %	Lane No.
Lane 1	229	-	229	2.0	984	0.233	100	0.0	2
Lane 2	-	28	28	2.0	235	0.121	100	NA	NA
Approach	229	28	258	2.0		0.233			
	Total	%HV	Deg.Satn (v/c)						
Intersection	1315	2.0	0.255						

Lane flow rates given in this report are based on the arrival flow rates subject to upstream capacity constraint where applicable.

5 Lane under-utilisation found by the program

Merge Analysis

	Exit Lane Number	Short Lane Length m	Percent Opng in Lane %	Opposing Flow Rate veh/h	Opposing Flow Rate pcu/h	Critical Gap sec	Follow-up Headway sec	Lane Flow Rate veh/h	Capacity veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec
South Exit: Bourke Street Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										
Full Length Lane	2	Merge Analysis not applied.										
North Exit: Bourke Street Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										
Full Length Lane	2	Merge Analysis not applied.										
West Exit: Bruce Street Merge Type: **Priority**												
Exit Short Lane	1	25	0.0	174	175	3.00	2.00	44	1623	0.027	0.2	0.3
Merge Lane	2	-	100.0	Merge Lane is not Opposed				174	1800	0.096	0.0	0.0

LANE SUMMARY

Site: 101 [Bourke Street / Bruce Street - PM Existing (Site Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Bourke Street													
Lane 1	165	2.0	1870	0.088	100	1.5	LOS A	0.0	0.0	Full	570	0.0	0.0
Lane 2	167	2.0	1895	0.088	100	0.0	LOS A	0.0	0.0	Full	570	0.0	0.0
Approach	333	2.0		0.088		0.8	NA	0.0	0.0				
North: Bourke Street													
Lane 1	402	2.0	1895	0.212	100	0.0	LOS A	0.0	0.0	Full	200	0.0	0.0
Lane 2	270	2.0	1273	0.212	100	4.9	LOS A	1.1	8.0	Full	200	0.0	0.0
Approach	673	2.0		0.212		2.0	NA	1.1	8.0				
West: Bruce Street													
Lane 1	137	2.0	1178	0.116	100	5.1	LOS A	0.4	3.2	Short (P)	25	0.0	NA
Lane 2	28	2.0	251	0.113	100	18.2	LOS B	0.4	2.7	Full	100	0.0	0.0
Approach	165	2.0		0.116		7.3	LOS A	0.4	3.2				
Intersection	1171	2.0		0.212		2.4	NA	1.1	8.0				

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

Approach Lane Flows (veh/h)

South: Bourke Street

Mov. From S To Exit:	L2 W	T1 N	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	43	122	165	2.0	1870	0.088	100	NA	NA
Lane 2	-	167	167	2.0	1895	0.088	100	NA	NA
Approach	43	289	333	2.0		0.088			

North: Bourke Street

Mov. From N To Exit:	T1 S	R2 W	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	402	-	402	2.0	1895	0.212	100	NA	NA
Lane 2	110	160	270	2.0	1273	0.212	100	NA	NA
Approach	513	160	673	2.0		0.212			

West: Bruce Street

Mov. From W To Exit:	L2 N	R2 S	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.

Lane 1	137	-	137	2.0	1178	0.116	100	0.0	2
Lane 2	-	28	28	2.0	251	0.113	100	NA	NA
Approach	137	28	165	2.0		0.116			

	Total	%HV	Deg.Satn (v/c)
Intersection	1171	2.0	0.212

Lane flow rates given in this report are based on the arrival flow rates subject to upstream capacity constraint where applicable.

Merge Analysis

	Exit Lane Number	Short Lane Length m	Percent Opng in Lane %	Opposing Flow Rate veh/h	Opposing Flow Rate pcu/h	Critical Gap sec	Follow-up Headway sec	Lane Flow Rate veh/h	Capacity veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec
South Exit: Bourke Street Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										
Full Length Lane	2	Merge Analysis not applied.										
North Exit: Bourke Street Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										
Full Length Lane	2	Merge Analysis not applied.										
West Exit: Bruce Street Merge Type: **Priority**												
Exit Short Lane	1	25	0.0	160	162	3.00	2.00	43	1637	0.026	0.2	0.3
Merge Lane	2	-	100.0	Merge Lane is not Opposed				160	1800	0.089	0.0	0.0

Appendix B. Post Development SIDRA Analysis

LANE SUMMARY

Site: 2 [Glenfield Road / Bruce Street - AM Post Dev 10 Yrs (Site Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Glenfield Road													
Lane 1	933	2.0	1893	0.493	100	0.5	LOS A	0.5	3.4	Full	650	0.0	0.0
Approach	933	2.0		0.493		0.5	NA	0.5	3.4				
East: Bruce Street													
Lane 1	18	2.0	1035	0.017	100	6.2	LOS A	0.1	0.5	Short	90	0.0	NA
Lane 2	188	2.0	166	1.136	100	184.5	LOS F	20.2	143.9	Full	500	0.0	0.0
Approach	206	2.0		1.136		169.1	LOS F	20.2	143.9				
North: Glenfield Road													
Lane 1	627	2.0	1898	0.331	100	1.8	LOS A	0.0	0.0	Full	270	0.0	0.0
Approach	627	2.0		0.331		1.8	NA	0.0	0.0				
Intersection	1766	2.0		1.136		20.6	NA	20.2	143.9				

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

Approach Lane Flows (veh/h)

South: Glenfield Road

Mov. From S To Exit:	T1 N	R2 E	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	916	17	933	2.0	1893	0.493	100	NA	NA
Approach	916	17	933	2.0		0.493			

East: Bruce Street

Mov. From E To Exit:	L2 S	R2 N	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	18	-	18	2.0	1035	0.017	100	0.0	2
Lane 2	-	188	188	2.0	166	1.136	100	NA	NA
Approach	18	188	206	2.0		1.136			

North: Glenfield Road

Mov. From N To Exit:	L2 E	T1 S	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	175	453	627	2.0	1898	0.331	100	NA	NA
Approach	175	453	627	2.0		0.331			

	Total	%HV	Deg.Satn (v/c)
Intersection	1766	2.0	1.136

Lane flow rates given in this report are based on the arrival flow rates subject to upstream capacity constraint where applicable.

Merge Analysis

	Exit Lane Number	Short Lane Length m	Percent Opng in Lane %	Opposing Flow Rate veh/h	Opposing Flow Rate pcu/h	Critical Gap sec	Follow-up Headway sec	Lane Flow Rate veh/h	Capacity veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec
South Exit: Glenfield Road Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										
East Exit: Bruce Street Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										
North Exit: Glenfield Road Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										

LANE SUMMARY

Site: 2 [Glenfield Road / Bruce Street - PM Post Dev 10 Yrs (Site Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Glenfield Road													
Lane 1	583	2.0	1737	0.336	100	1.9	LOS A	0.9	6.6	Full	650	0.0	0.0
Approach	583	2.0		0.336		1.9	NA	0.9	6.6				
East: Bruce Street													
Lane 1	15	2.0	608	0.024	100	9.1	LOS A	0.1	0.6	Short	90	0.0	NA
Lane 2	158	2.0	151	1.043	100	128.8	LOS F	11.3	80.5	Full	500	0.0	0.0
Approach	173	2.0		1.043		118.6	LOS F	11.3	80.5				
North: Glenfield Road													
Lane 1	1058	2.0	1903	0.556	100	1.6	LOS A	0.0	0.0	Full	270	0.0	0.0
Approach	1058	2.0		0.556		1.6	NA	0.0	0.0				
Intersection	1814	2.0		1.043		12.8	NA	11.3	80.5				

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

Approach Lane Flows (veh/h)

South: Glenfield Road

Mov. From S To Exit:	T1 N	R2 E	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	566	17	583	2.0	1737	0.336	100	NA	NA
Approach	566	17	583	2.0		0.336			

East: Bruce Street

Mov. From E To Exit:	L2 S	R2 N	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	15	-	15	2.0	608	0.024	100	0.0	2
Lane 2	-	158	158	2.0	151	1.043	100	NA	NA
Approach	15	158	173	2.0		1.043			

North: Glenfield Road

Mov. From N To Exit:	L2 E	T1 S	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	239	819	1058	2.0	1903	0.556	100	NA	NA
Approach	239	819	1058	2.0		0.556			

	Total	%HV	Deg.Satn (v/c)
Intersection	1814	2.0	1.043

Lane flow rates given in this report are based on the arrival flow rates subject to upstream capacity constraint where applicable.

Merge Analysis

	Exit Lane Number	Short Lane Length m	Percent Opng in Lane %	Opposing Flow Rate veh/h	Opposing Flow Rate pcu/h	Critical Gap sec	Follow-up Headway sec	Lane Flow Rate veh/h	Capacity veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec
South Exit: Glenfield Road Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										
East Exit: Bruce Street Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										
North Exit: Glenfield Road Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										

LANE SUMMARY

Site: 3 [Red Hill Road / Glenfield Road / Holbrook Road - AM Post Dev 10 Yrs (Site Folder: General)]

New Site
Site Category: (None)
Roundabout

Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Holbrook Road													
Lane 1	196	2.0	740	0.265	68[6]	9.9	LOS A	1.3	9.1	Short	120	0.0	NA
Lane 2[d]	370	2.0	951	0.389	100	9.0	LOS A	2.2	15.5	Full	370	0.0	0.0
Approach	566	2.0		0.389		9.3	LOS A	2.2	15.5				
East: Red Hill Road													
Lane 1	247	2.0	977	0.253	100	7.0	LOS A	1.5	10.4	Short	100	0.0	NA
Lane 2[d]	427	2.0	1185	0.361	100	11.7	LOS A	2.4	17.0	Full	590	0.0	0.0
Approach	675	2.0		0.361		10.0	LOS A	2.4	17.0				
North: Glenfield Road													
Lane 1[d]	269	2.0	967	0.279	100	7.6	LOS A	1.9	13.2	Short	80	0.0	NA
Lane 2	204	2.0	835	0.245	88[5]	9.0	LOS A	1.5	10.8	Full	650	0.0	0.0
Approach	474	2.0		0.279		8.2	LOS A	1.9	13.2				
West: Red Hill Road													
Lane 1	69	2.0	467	0.149	100	13.3	LOS A	0.7	4.9	Short	90	0.0	NA
Lane 2[d]	395	2.0	790	0.499	100	12.2	LOS A	3.7	26.2	Full	350	0.0	0.0
Approach	464	2.0		0.499		12.3	LOS A	3.7	26.2				
Intersection	2179	2.0		0.499		9.9	LOS A	3.7	26.2				

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

5 Lane under-utilisation found by the program
6 Lane under-utilisation due to downstream effects
d Dominant lane on roundabout approach

Approach Lane Flows (veh/h)

South: Holbrook Road

Mov. From S To Exit:	L2 W	T1 N	R2 E	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	45	151	-	196	2.0	740	0.265	68[6]	0.0	2
Lane 2	-	288	82	370	2.0	951	0.389	100	NA	NA
Approach	45	439	82	566	2.0		0.389			

East: Red Hill Road

Mov. From E To Exit:	L2 S	T1 W	R2 N	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.

Lane 1	16	232	-	247	2.0	977	0.253	100	0.0	2
Lane 2	-	-	427	427	2.0	1185	0.361	100	NA	NA
Approach	16	232	427	675	2.0		0.361			

North: Glenfield Road

Mov. From N To Exit:	L2 E	T1 S	R2 W	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	269	-	-	269	2.0	967	0.279	100	0.0	2
Lane 2	-	166	38	204	2.0	835	0.245	88[5]	NA	NA
Approach	269	166	38	474	2.0		0.279			

West: Red Hill Road

Mov. From W To Exit:	L2 N	T1 E	R2 S	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	69	-	-	69	2.0	467	0.149	100	0.0	2
Lane 2	-	329	65	395	2.0	790	0.499	100	NA	NA
Approach	69	329	65	464	2.0		0.499			

	Total	%HV	Deg.Satn (v/c)
Intersection	2179	2.0	0.499

Lane flow rates given in this report are based on the arrival flow rates subject to upstream capacity constraint where applicable.

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

Merge Analysis

	Exit Lane Number	Short Lane Length m	Percent Opng in Lane %	Opposing Flow Rate veh/h	Opposing Flow Rate pcu/h	Critical Gap sec	Follow-up Headway sec	Lane Flow Rate veh/h	Capacity veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec
South Exit: Holbrook Road Merge Type: **Priority**												
Exit Short Lane	1	120	0.0	232	234	3.00	2.00	16	1563	0.010	0.3	0.4
Merge Lane	2	-	100.0	Merge Lane is not Opposed				232	1800	0.129	0.0	0.0
East Exit: Red Hill Road Merge Type: **Priority**												
Exit Short Lane	1	100	0.0	82	83	3.00	2.00	599	1717	0.349	0.1	0.2
Merge Lane	2	-	100.0	Merge Lane is not Opposed				82	1800	0.046	0.0	0.0
North Exit: Glenfield Road Merge Type: **Priority**												
Exit Short Lane	1	100	0.0	716	723	3.00	2.00	220	1050	0.210	1.4	2.0
Merge Lane	2	-	100.0	Merge Lane is not Opposed				716	1800	0.398	0.0	0.0
West Exit: Red Hill Road Merge Type: **Priority**												
Exit Short Lane	1	100	0.0	38	38	3.00	2.00	277	1762	0.157	0.0	0.1
Merge Lane	2	-	100.0	Merge Lane is not Opposed				38	1800	0.021	0.0	0.0

LANE SUMMARY

Site: 3 [Red Hill Road / Glenfield Road / Holbrook Road - PM Post Dev 10 Yrs (Site Folder: General)]

New Site
Site Category: (None)
Roundabout

Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Holbrook Road													
Lane 1	111	2.0	723	0.154	68[6]	8.4	LOS A	0.7	4.9	Short	120	0.0	NA
Lane 2[d]	212	2.0	935	0.227	100	8.6	LOS A	1.1	8.0	Full	370	0.0	0.0
Approach	323	2.0		0.227		8.5	LOS A	1.1	8.0				
East: Red Hill Road													
Lane 1[d]	400	2.0	990	0.404	100	8.1	LOS A	2.8	20.0	Short	100	0.0	NA
Lane 2	314	2.0	862	0.364	100	13.3	LOS A	2.3	16.7	Full	590	0.0	0.0
Approach	714	2.0		0.404		10.4	LOS A	2.8	20.0				
North: Glenfield Road													
Lane 1[d]	431	2.0	1065	0.404	97[5]	7.2	LOS A	2.8	20.1	Short	80	0.0	NA
Lane 2	404	2.0	970	0.417	100	8.4	LOS A	2.9	20.4	Full	650	0.0	0.0
Approach	835	2.0		0.417		7.8	LOS A	2.9	20.4				
West: Red Hill Road													
Lane 1	59	2.0	576	0.102	100	10.0	LOS A	0.5	3.3	Short	90	0.0	NA
Lane 2[d]	323	2.0	976	0.331	100	9.0	LOS A	1.9	13.8	Full	350	0.0	0.0
Approach	382	2.0		0.331		9.2	LOS A	1.9	13.8				
Intersection	2254	2.0		0.417		8.9	LOS A	2.9	20.4				

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

5 Lane under-utilisation found by the program
6 Lane under-utilisation due to downstream effects
d Dominant lane on roundabout approach

Approach Lane Flows (veh/h)

South: Holbrook Road

Mov. From S To Exit:	L2 W	T1 N	R2 E	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	57	54	-	111	2.0	723	0.154	68[6]	0.0	2
Lane 2	-	159	53	212	2.0	935	0.227	100	NA	NA
Approach	57	214	53	323	2.0		0.227			

East: Red Hill Road

Mov. From E To Exit:	L2 S	T1 W	R2 N	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.

Lane 1	75	325	-	400	2.0	990	0.404	100	0.0	2
Lane 2	-	-	314	314	2.0	862	0.364	100	NA	NA
Approach	75	325	314	714	2.0		0.404			

North: Glenfield Road

Mov. From N To Exit:	L2 E	T1 S	R2 W	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	431	-	-	431	2.0	1065	0.404	97[5]	0.0	2
Lane 2	-	352	53	404	2.0	970	0.417	100	NA	NA
Approach	431	352	53	835	2.0		0.417			

West: Red Hill Road

Mov. From W To Exit:	L2 N	T1 E	R2 S	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	59	-	-	59	2.0	576	0.102	100	0.0	2
Lane 2	-	254	69	323	2.0	976	0.331	100	NA	NA
Approach	59	254	69	382	2.0		0.331			

	Total	%HV	Deg.Satn (v/c)
Intersection	2254	2.0	0.417

Lane flow rates given in this report are based on the arrival flow rates subject to upstream capacity constraint where applicable.

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

Merge Analysis

	Exit Lane Number	Short Lane Length m	Percent Opng in Lane %	Opposing Flow Rate veh/h	Opposing Flow Rate pcu/h	Critical Gap sec	Follow-up Headway sec	Lane Flow Rate veh/h	Capacity veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec
South Exit: Holbrook Road Merge Type: **Priority**												
Exit Short Lane	1	120	0.0	421	425	3.00	2.00	75	1365	0.055	0.7	0.8
Merge Lane	2	-	100.0	Merge Lane is not Opposed				421	1800	0.234	0.0	0.0
East Exit: Red Hill Road Merge Type: **Priority**												
Exit Short Lane	1	100	0.0	53	53	3.00	2.00	684	1747	0.392	0.1	0.1
Merge Lane	2	-	100.0	Merge Lane is not Opposed				53	1800	0.029	0.0	0.0
North Exit: Glenfield Road Merge Type: **Priority**												
Exit Short Lane	1	100	0.0	473	478	3.00	2.00	113	1310	0.087	0.8	1.0
Merge Lane	2	-	100.0	Merge Lane is not Opposed				473	1800	0.263	0.0	0.0
West Exit: Red Hill Road Merge Type: **Priority**												
Exit Short Lane	1	100	0.0	53	53	3.00	2.00	382	1747	0.219	0.1	0.1
Merge Lane	2	-	100.0	Merge Lane is not Opposed				53	1800	0.029	0.0	0.0

LANE SUMMARY

Site: 101 [Red Hill Road / Ramus Street - AM Post Dev 10 Yrs (Site Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
East: Red Hill Road													
Lane 1	679	2.0	1996	0.340	100	0.7	LOS A	0.5	3.4	Full	300	0.0	0.0
Approach	679	2.0		0.340		0.7	NA	0.5	3.4				
North: Ramus Street													
Lane 1	26	2.0	782	0.034	100	6.2	LOS A	0.1	0.9	Short	28	0.0	NA
Lane 2	7	2.0	242	0.030	100	15.8	LOS B	0.1	0.6	Full	30	0.0	0.0
Approach	34	2.0		0.034		8.3	LOS A	0.1	0.9				
West: Red Hill Road													
Lane 1	679	2.0	2093	0.324	100	0.2	LOS A	0.0	0.0	Full	590	0.0	0.0
Approach	679	2.0		0.324		0.2	NA	0.0	0.0				
Intersection	1392	2.0		0.340		0.7	NA	0.5	3.4				

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

Approach Lane Flows (veh/h)

East: Red Hill Road

Mov. From E To Exit:	T1 W	R2 N	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	658	21	679	2.0	1996	0.340	100	NA	NA
Approach	658	21	679	2.0		0.340			

North: Ramus Street

Mov. From N To Exit:	L2 E	R2 W	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	26	-	26	2.0	782	0.034	100	0.0	2
Lane 2	-	7	7	2.0	242	0.030	100	NA	NA
Approach	26	7	34	2.0		0.034			

West: Red Hill Road

Mov. From W To Exit:	L2 N	T1 E	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	16	663	679	2.0	2093	0.324	100	NA	NA
Approach	16	663	679	2.0		0.324			

	Total	%HV	Deg.Satn (v/c)
Intersection	1392	2.0	0.340

Lane flow rates given in this report are based on the arrival flow rates subject to upstream capacity constraint where applicable.

Merge Analysis

	Exit Lane Number	Short Lane Length m	Percent Opng in Lane %	Opposing Flow Rate veh/h	Opposing Flow Rate pcu/h	Critical Gap sec	Follow-up Headway sec	Lane Flow Rate veh/h	Capacity veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec
East Exit: Red Hill Road Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										
North Exit: Ramus Street Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										
West Exit: Red Hill Road Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										

LANE SUMMARY

Site: 101 [Red Hill Road / Ramus Street - PM Post Dev 10 Yrs (Site Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
East: Red Hill Road													
Lane 1	751	2.0	2019	0.372	100	0.6	LOS A	0.4	3.1	Full	300	0.0	0.0
Approach	751	2.0		0.372		0.6	NA	0.4	3.1				
North: Ramus Street													
Lane 1	25	2.0	747	0.034	100	6.4	LOS A	0.1	0.8	Short	28	0.0	NA
Lane 2	7	2.0	198	0.037	100	18.9	LOS B	0.1	0.7	Full	30	0.0	0.0
Approach	33	2.0		0.037		9.2	LOS A	0.1	0.8				
West: Red Hill Road													
Lane 1	702	2.0	2094	0.335	100	0.2	LOS A	0.0	0.0	Full	590	0.0	0.0
Approach	702	2.0		0.335		0.2	NA	0.0	0.0				
Intersection	1485	2.0		0.372		0.6	NA	0.4	3.1				

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

Approach Lane Flows (veh/h)

East: Red Hill Road

Mov. From E To Exit:	T1 W	R2 N	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	734	17	751	2.0	2019	0.372	100	NA	NA
Approach	734	17	751	2.0		0.372			

North: Ramus Street

Mov. From N To Exit:	L2 E	R2 W	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	25	-	25	2.0	747	0.034	100	0.0	2
Lane 2	-	7	7	2.0	198	0.037	100	NA	NA
Approach	25	7	33	2.0		0.037			

West: Red Hill Road

Mov. From W To Exit:	L2 N	T1 E	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	8	694	702	2.0	2094	0.335	100	NA	NA
Approach	8	694	702	2.0		0.335			

	Total	%HV	Deg.Satn (v/c)
Intersection	1485	2.0	0.372

Lane flow rates given in this report are based on the arrival flow rates subject to upstream capacity constraint where applicable.

Merge Analysis

	Exit Lane Number	Short Lane Length m	Percent Opng in Lane %	Opposing Flow Rate veh/h	Opposing Flow Rate pcu/h	Critical Gap sec	Follow-up Headway sec	Lane Flow Rate veh/h	Capacity veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec
East Exit: Red Hill Road Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										
North Exit: Ramus Street Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										
West Exit: Red Hill Road Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										

LANE SUMMARY

Site: 3 [Bourke St / Red Hill Road - AM Post Dev 10 Yrs (Site Folder: General)]

New Site
Site Category: (None)
Roundabout

Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
East: Red Hill Road													
Lane 1[d]	611	2.0	1295	0.472	100	6.3	LOS A	3.9	27.6	Full	1200	0.0	0.0
Lane 2	352	2.0	1060	0.332	100	11.6	LOS A	2.2	16.0	Short	120	0.0	NA
Approach	962	2.0		0.472		8.2	LOS A	3.9	27.6				
North: Bourke Street													
Lane 1	138	2.0	604	0.228	100	9.4	LOS A	1.5	11.0	Full	570	0.0	0.0
Lane 2[d]	151	2.0	723	0.208	100	12.9	LOS A	1.5	10.7	Full	570	0.0	0.0
Approach	288	2.0		0.228		11.3	LOS A	1.5	11.0				
West: Red Hill Road													
Lane 1	94	2.0	470	0.199	100	10.7	LOS A	0.9	6.4	Short	120	0.0	NA
Lane 2[d]	603	2.0	805	0.750	100	14.9	LOS B	7.6	54.3	Full	300	0.0	0.0
Approach	697	2.0		0.750		14.3	LOS A	7.6	54.3				
SouthWest: Bourke Street													
Lane 1[d]	359	2.0	875	0.410	100	6.9	LOS A	2.4	17.0	Short	80	0.0	NA
Lane 2	283	2.0	691	0.410	100	10.9	LOS A	2.3	16.1	Full	930	0.0	0.0
Approach	642	2.0		0.410		8.7	LOS A	2.4	17.0				
Intersection	2589	2.0		0.750		10.3	LOS A	7.6	54.3				

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

d Dominant lane on roundabout approach

Approach Lane Flows (veh/h)

East: Red Hill Road

Mov. From E To Exit:	L1 SW	T1 W	R2 N	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	39	572	-	611	2.0	1295	0.472	100	NA	NA
Lane 2	-	-	352	352	2.0	1060	0.332	100	0.0	1
Approach	39	572	352	962	2.0		0.472			

North: Bourke Street

Mov. From N To Exit:	L2 E	R1 SW	R2 W	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	138	-	-	138	2.0	604	0.228	100	NA	NA
Lane 2	-	93	58	151	2.0	723	0.208	100	NA	NA

Approach	138	93	58	288	2.0		0.228				
West: Red Hill Road											
Mov. From W To Exit:	L2 N	T1 E	R3 SW	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.	
Lane 1	94	-	-	94	2.0	470	0.199	100	0.0	2	
Lane 2	-	577	26	603	2.0	805	0.750	100	NA	NA	
Approach	94	577	26	697	2.0		0.750				
SouthWest: Bourke Street											
Mov. From SW To Exit:	L3 W	L1 N	R1 E	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.	
Lane 1	61	298	-	359	2.0	875	0.410	100	0.0	2	
Lane 2	-	107	177	283	2.0	691	0.410	100	NA	NA	
Approach	61	404	177	642	2.0		0.410				
	Total	%HV	Deg.Satn (v/c)								
Intersection	2589	2.0	0.750								

Lane flow rates given in this report are based on the arrival flow rates subject to upstream capacity constraint where applicable.

Merge Analysis

	Exit Lane Number	Short Lane Length m	Percent Opng in Lane %	Opposing Flow Rate veh/h	Opposing Flow Rate pcu/h	Critical Gap sec	Follow-up Headway sec	Lane Flow Rate veh/h	Capacity veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec
East Exit: Red Hill Road Merge Type: **Priority**												
Exit Short Lane	1	130	0.0	177	179	3.00	2.00	715	1620	0.441	0.2	0.5
Merge Lane	2	-	100.0	Merge Lane is not Opposed				177	1800	0.098	0.0	0.0
North Exit: Bourke Street Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										
Full Length Lane	2	Merge Analysis not applied.										
West Exit: Red Hill Road Merge Type: **Priority**												
Exit Short Lane	1	110	0.0	58	58	3.00	2.00	633	1741	0.363	0.1	0.1
Merge Lane	2	-	100.0	Merge Lane is not Opposed				58	1800	0.032	0.0	0.0
SouthWest Exit: Bourke Street Merge Type: **Priority**												
Exit Short Lane	1	90	0.0	119	120	3.00	2.00	39	1679	0.023	0.2	0.2
Merge Lane	2	-	100.0	Merge Lane is not Opposed				119	1800	0.066	0.0	0.0

LANE SUMMARY

Site: 3 [Bourke St / Red Hill Road - PM Post Dev 10 Yrs (Site Folder: General)]

New Site
Site Category: (None)
Roundabout

Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
East: Red Hill Road													
Lane 1[d]	638	2.0	903	0.706	100	12.6	LOS A	8.8	63.0	Full	1200	0.0	0.0
Lane 2	160	2.0	536	0.299	100	15.5	LOS B	1.8	12.5	Short	120	0.0	NA
Approach	798	2.0		0.706		13.2	LOS A	8.8	63.0				
North: Bourke Street													
Lane 1	234	2.0	627	0.372	100	9.3	LOS A	2.5	17.6	Full	570	0.0	0.0
Lane 2[d]	476	2.0	830	0.573	100	15.1	LOS B	5.7	40.4	Full	570	0.0	0.0
Approach	709	2.0		0.573		13.2	LOS A	5.7	40.4				
West: Red Hill Road													
Lane 1	74	2.0	647	0.114	100	7.9	LOS A	0.5	3.6	Short	120	0.0	NA
Lane 2[d]	604	2.0	1095	0.552	100	8.3	LOS A	4.1	29.2	Full	300	0.0	0.0
Approach	678	2.0		0.552		8.3	LOS A	4.1	29.2				
SouthWest: Bourke Street													
Lane 1[d]	158	2.0	858	0.185	100	5.9	LOS A	1.0	7.1	Short	80	0.0	NA
Lane 2	129	2.0	698	0.185	100	9.5	LOS A	0.9	6.7	Full	930	0.0	0.0
Approach	287	2.0		0.185		7.5	LOS A	1.0	7.1				
Intersection	2473	2.0		0.706		11.2	LOS A	8.8	63.0				

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

d Dominant lane on roundabout approach

Approach Lane Flows (veh/h)

East: Red Hill Road

Mov. From E To Exit:	L1 SW	T1 W	R2 N	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	89	548	-	638	2.0	903	0.706	100	NA	NA
Lane 2	-	-	160	160	2.0	536	0.299	100	0.0	1
Approach	89	548	160	798	2.0		0.706			

North: Bourke Street

Mov. From N To Exit:	L2 E	R1 SW	R2 W	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	234	-	-	234	2.0	627	0.372	100	NA	NA
Lane 2	-	349	126	476	2.0	830	0.573	100	NA	NA

Approach	234	349	126	709	2.0		0.573			
West: Red Hill Road										
Mov. From W To Exit:	L2 N	T1 E	R3 SW	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	74	-	-	74	2.0	647	0.114	100	0.0	2
Lane 2	-	568	36	604	2.0	1095	0.552	100	NA	NA
Approach	74	568	36	678	2.0		0.552			
SouthWest: Bourke Street										
Mov. From SW To Exit:	L3 W	L1 N	R1 E	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	35	124	-	158	2.0	858	0.185	100	0.0	2
Lane 2	-	46	83	129	2.0	698	0.185	100	NA	NA
Approach	35	169	83	287	2.0		0.185			

	Total	%HV	Deg.Satn (v/c)
Intersection	2473	2.0	0.706

Lane flow rates given in this report are based on the arrival flow rates subject to upstream capacity constraint where applicable.

Merge Analysis

	Exit Lane Number	Short Lane Length m	Percent Opng in Lane %	Opposing Flow Rate veh/h	Opposing Flow Rate pcu/h	Critical Gap sec	Follow-up Headway sec	Lane Flow Rate veh/h	Capacity veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec
East Exit: Red Hill Road Merge Type: **Priority**												
Exit Short Lane	1	130	0.0	83	84	3.00	2.00	802	1716	0.468	0.1	0.2
Merge Lane	2	-	100.0	Merge Lane is not Opposed				83	1800	0.046	0.0	0.0
North Exit: Bourke Street Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										
Full Length Lane	2	Merge Analysis not applied.										
West Exit: Red Hill Road Merge Type: **Priority**												
Exit Short Lane	1	110	0.0	126	128	3.00	2.00	583	1672	0.349	0.2	0.3
Merge Lane	2	-	100.0	Merge Lane is not Opposed				126	1800	0.070	0.0	0.0
SouthWest Exit: Bourke Street Merge Type: **Priority**												
Exit Short Lane	1	90	0.0	385	389	3.00	2.00	89	1403	0.064	0.6	0.7
Merge Lane	2	-	100.0	Merge Lane is not Opposed				385	1800	0.214	0.0	0.0

LANE SUMMARY

Site: 101 [Bourke Street / Bruce Street - AM Post Dev 10 Yrs (Site Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Bourke Street													
Lane 1	400	2.0	1884	0.213	100	0.7	LOS A	0.0	0.0	Full	570	0.0	0.0
Lane 2	403	2.0	1895	0.213	100	0.1	LOS A	0.0	0.0	Full	570	0.0	0.0
Approach	803	2.0		0.213		0.4	NA	0.0	0.0				
North: Bourke Street													
Lane 1	248	2.0	1895	0.131	39[5]	0.0	LOS A	0.0	0.0	Full	200	0.0	0.0
Lane 2	194	2.0	576	0.336	100	12.2	LOS A	1.6	11.2	Full	200	0.0	0.0
Approach	442	2.0		0.336		5.4	NA	1.6	11.2				
West: Bruce Street													
Lane 1	308	2.0	915	0.337	100	6.9	LOS A	1.6	11.4	Short (P)	25	0.0	NA
Lane 2	32	2.0	166	0.191	100	27.1	LOS B	0.6	4.4	Full	100	0.0	0.0
Approach	340	2.0		0.337		8.8	LOS A	1.6	11.4				
Intersection	1585	2.0		0.337		3.6	NA	1.6	11.4				

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

5 Lane under-utilisation found by the program

Approach Lane Flows (veh/h)

South: Bourke Street

Mov. From S To Exit:	L2 W	T1 N	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	45	355	400	2.0	1884	0.213	100	NA	NA
Lane 2	-	403	403	2.0	1895	0.213	100	NA	NA
Approach	45	758	803	2.0		0.213			

North: Bourke Street

Mov. From N To Exit:	T1 S	R2 W	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	248	-	248	2.0	1895	0.131	39[5]	NA	NA
Lane 2	-	194	194	2.0	576	0.336	100	NA	NA
Approach	248	194	442	2.0		0.336			

West: Bruce Street

Mov.	L2	R2	Total	%HV		Deg.	Lane	Prob.	Ov.

From W To Exit:	N	S			Cap. veh/h	Satn v/c	Util. %	SL Ov. %	Lane No.
Lane 1	308	-	308	2.0	915	0.337	100	0.0	2
Lane 2	-	32	32	2.0	166	0.191	100	NA	NA
Approach	308	32	340	2.0		0.337			
	Total	%HV	Deg.Satn (v/c)						
Intersection	1585	2.0	0.337						

Lane flow rates given in this report are based on the arrival flow rates subject to upstream capacity constraint where applicable.

5 Lane under-utilisation found by the program

Merge Analysis

	Exit Lane Number	Short Lane Length m	Percent Opng in Lane %	Opposing Flow Rate veh/h	Opposing Flow Rate pcu/h	Critical Gap sec	Follow-up Headway sec	Lane Flow Rate veh/h	Capacity veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec
South Exit: Bourke Street Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										
Full Length Lane	2	Merge Analysis not applied.										
North Exit: Bourke Street Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										
Full Length Lane	2	Merge Analysis not applied.										
West Exit: Bruce Street Merge Type: **Priority**												
Exit Short Lane	1	25	0.0	194	196	3.00	2.00	45	1602	0.028	0.3	0.3
Merge Lane	2	-	100.0	Merge Lane is not Opposed				194	1800	0.108	0.0	0.0

LANE SUMMARY

Site: 101 [Bourke Street / Bruce Street - PM Post Dev 10 Yrs (Site Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Bourke Street													
Lane 1	195	2.0	1873	0.104	100	1.4	LOS A	0.0	0.0	Full	570	0.0	0.0
Lane 2	197	2.0	1895	0.104	100	0.0	LOS A	0.0	0.0	Full	570	0.0	0.0
Approach	393	2.0		0.104		0.7	NA	0.0	0.0				
North: Bourke Street													
Lane 1	521	2.0	1895	0.275	100	0.0	LOS A	0.0	0.0	Full	200	0.0	0.0
Lane 2	313	2.0	1138	0.275	100	6.1	LOS A	1.5	10.5	Full	200	0.0	0.0
Approach	834	2.0		0.275		2.3	NA	1.5	10.5				
West: Bruce Street													
Lane 1	176	2.0	1146	0.153	100	5.3	LOS A	0.6	4.3	Short (P)	25	0.0	NA
Lane 2	31	2.0	162	0.189	100	27.9	LOS B	0.6	4.4	Full	100	0.0	0.0
Approach	206	2.0		0.189		8.6	LOS A	0.6	4.4				
Intersection	1433	2.0		0.275		2.8	NA	1.5	10.5				

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

Approach Lane Flows (veh/h)

South: Bourke Street

Mov. From S To Exit:	L2 W	T1 N	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	45	150	195	2.0	1873	0.104	100	NA	NA
Lane 2	-	197	197	2.0	1895	0.104	100	NA	NA
Approach	45	347	393	2.0		0.104			

North: Bourke Street

Mov. From N To Exit:	T1 S	R2 W	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	521	-	521	2.0	1895	0.275	100	NA	NA
Lane 2	94	219	313	2.0	1138	0.275	100	NA	NA
Approach	615	219	834	2.0		0.275			

West: Bruce Street

Mov. From W To Exit:	L2 N	R2 S	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.

Lane 1	176	-	176	2.0	1146	0.153	100	0.0	2
Lane 2	-	31	31	2.0	162	0.189	100	NA	NA
Approach	176	31	206	2.0		0.189			

	Total	%HV	Deg.Satn (v/c)
Intersection	1433	2.0	0.275

Lane flow rates given in this report are based on the arrival flow rates subject to upstream capacity constraint where applicable.

Merge Analysis

	Exit Lane Number	Short Lane Length m	Percent Opng in Lane %	Opposing Flow Rate veh/h	Opposing Flow Rate pcu/h	Critical Gap sec	Follow-up Headway sec	Lane Flow Rate veh/h	Capacity veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec
South Exit: Bourke Street Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										
Full Length Lane	2	Merge Analysis not applied.										
North Exit: Bourke Street Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										
Full Length Lane	2	Merge Analysis not applied.										
West Exit: Bruce Street Merge Type: **Priority**												
Exit Short Lane	1	25	0.0	219	221	3.00	2.00	45	1576	0.029	0.3	0.4
Merge Lane	2	-	100.0	Merge Lane is not Opposed				219	1800	0.122	0.0	0.0

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