

Traffic Impact Assessment

3-7 East Street and 2 Railway Street, Lidcombe NSW 2141

August 2016



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1. Introduction

APEX Engineers were engaged by Automation Feeding Devices Pty Ltd to provide a traffic impact assessment to support the currently proposed rezoning application ('subject proposal') for the land on 3-7 East Street and 2 Railway Street in Lidcombe NSW 2141 ('subject site').

This report will address the potential traffic impacts, within the immediate surroundings of the subject site, resulting from the above-mentioned rezoning proposal.

This report has been structured into the following sections:

- Section 2 Provides the details of the subject proposal (including a review of the key transport features within the site vicinity) along with a background on the previous assessments undertaken in relation to the overall rezoning scheme;
- **Section 3** Provides a detailed overview of the methodology adopted in this assessment;
- **Section 4** Provides the details pertaining to traffic generation implications arising from the current rezoning proposal, in light of the traffic generation figures determined through previous assessments;
- **Section 5** Provides the revised traffic levels at key intersections (without any development within the subject site)
- Section 6 and Section 7 Establishes the net additional traffic levels anticipated to be experienced by the key intersections due to the current rezoning proposal and provides the SIDRA intersection assessment results for key intersections for each access option considered;
- Section 8 Provides the summary of the intersection assessment results obtained; and
- **Section 9** Addresses various other related matters.



2. Project Background

The subject proposal relates to rezoning the land on 3-7 East Street and 2 Railway Street in Lidcombe, which is currently zoned as IN2 (light industrial) to B4 (mixed use).

A comprehensive traffic and transport assessment has already been undertaken by Hyder Consultants (titled 'Marsden Street Precinct – Traffic Transport and Accessibility Study', dated: 24th April 2015) for the entirety of Marsden Street precinct. However, in this assessment, the subject land (3-7 East Street and 2 Railway Street) has been assumed to be light industrial (IN2). As such, this reports presents a revised traffic assessment, which considers the proposed change of land use zoning of the subject land (updated traffic generation figures have been derived, later on in this report, based on the change in zoning from IN2 to B4 of the subject land).

This assessment will utilise information from the following documents, which have already been submitted to Council, in relation to the Marsden Street Precinct;

- Marsden Street Precinct Traffic Transport and Accessibility Study. By Hyder Consultants (April 2015). This document will herein be referred to as the 'Hyder report'.
- Marsden Street Precinct, Lidcombe Yield Study. By AECOM (February 2015). This document will herein be referred to as the 'AECOM Yield Study'.

In this study, two distinct access options have been investigated for the subject site as follows;

1. Access option 1: includes access for all vehicles off Raphael Street in left in/left out configuration.



2. Access option 2: includes access for heavy vehicles off Raphael Street in left in/left out configuration and access for passenger vehicles off East Street in left in/left out configuration.

2.1 Subject Site within the Marsden Street Precinct

The overall Marsden Street Precinct site is located in Lidcombe, adjacent to the Lidcombe town centre, railway line and Rockwood Necropolis cemetery. It has frontages of around 220 metres on all sides and is bound by the following roads:

- Railway Street (northern boundary);
- East Street (eastern boundary);
- James Street (southern boundary); and
- Mark Street (western boundary).

The Marsden Street Precinct site's current zoning includes 'R4' high-density residential, 'IN2' light industrial and 'RE1' public recreation, land uses. Properties currently occupying the Marsden Street Precinct site include single-dwelling residential houses, apartment buildings, light industrial / workshops, small offices, training facilities, community facilities and a petrol station.

The Marsden Street Precinct rezoning came into force in September 2015. The precinct is now zoned 'B4' mixed uses and 'RE1' public recreation.

The following figure illustrates the location of the subject site (3-7 East Street and 2 Railway Street) within the overall Marsden Street Precinct.





Figure 1: Location of the Subject Site within the Marsden Street Precinct

The specific location of the subject site with the surrounding road network is illustrated in **Figure 2** below.





Figure 2: Location of the Subject Site

As can be seen from the figure above, the subject site is bound by Railway Street to the north, Davey Street to the south, Raphael Street to the west and East Street to the east.



2.2 Public Transport Service Accessibility

The local area within the subject site was assessed for available public transport services that were both easily accessible from the subject site, and provide viable alternative options to private trips for future residents. This assessment identified that the site lies within comfortable walking distance to a number of bus routes, as listed below.

Along East Street, at the site frontage, the following service operate:

- Bus route 925 East Hills to Lidcombe via Panania, Condell Park, Bankstown and Botanica Estate. Service operates daily.
- Bus route M92 Sutherland to Parramatta (Metrobus) via Bangor, Menai, Padstow, Bankstown, Lidcombe, Auburn and Rosehill. Service operates daily.

On either side of Lidcombe railway station, the following services operate:

- Bus route 915 Lidcombe to University of Sydney.
- Bus route 401 Monday to Saturday daytime service between Sydney Olympic Park (Olympic Park Station) and Lidcombe via Mons Street.
- N50 Nightrider service operating between Town Hall and Liverpool.
- N60 Nightrider service operating between Town Hall and Fairfield.
- N61 Nightrider service operating between Town Hall and Carlingford.

In addition to the above, the subject site lies proximate to Lidcombe train station (250m distance, approx. 2 minute walk). This station services T1 (Western and North Shore Line), T2 (Inner West Line), T3 (Bankstown Line) and T7 (Olympic Park Line).

The following figure outlines the location of each of the above mentioned bus and train services with respect to the location of the subject site.





Figure 3: Public Transport Services Operating within the Site Vicinity

As can be seen above, all the above mentioned bus and train services operate within close vicinity of the subject site (<10 minute walking time) and provide excellent connections to various significant destinations within both the local area and the wider Sydney metropolitan area (including Parramatta, Blacktown, Penrith, Liverpool, Bankstown, Campbelltown, Auburn, Sydney Olympic Park).



2.3 Existing Road Network Characteristics

The two key roads which bound the site, Railway Street and East Street, include the following characteristics at the site frontage;

- Railway Street a local road which runs in the east-west alignment with a speed limit of 50 km/hr.
- East Street a secondary arterial road which runs in the north-south alignment with a speed limit of 60 km/hr.

The internal roads which bound the site, Davey Street and Raphael Street, include the following characteristics;

- Davey Street a local access road which runs in the east-west alignment with no signed speed limit (therefore a 50 km/hr speed limit has been assumed).
- Raphael Street a local access road which runs in the north-south alignment with no signed speed limit (therefore a 50 km/hr speed limit has been assumed). This street is one-way (southbound) to the south of Davey Street.

2.4 Key Intersections

It is noted that two access options for the subject site has been investigated as a part of this assessment (one off East Street and another off Railway Street). Accordingly, the key intersections within the site vicinity has been considered in this assessment (in line with the Hyder report). The following figure illustrates the location of these intersections (total of 7).

- 1) James St/Mark St (roundabout)
- 2) East St/James St (roundabout)
- 3) Railway St/East St (roundabout)
- 4) Railway St/Bridge (priority)
- 5) Church St/Bridge (priority)
- 6) Railway St/Mark St (priority)



7) Mark St/Marsden St/Taylor St (priority)



Figure 4: Key Intersections in the Site Vicinity

The Hyder report included turning-movement traffic counts at the above identified 7 key intersections around the subject site during the following peak periods:

• Thursday 19 February 2015 – 7am to 9am



• Thursday 19 February 2015 – 4pm to 6pm

The results from the turning movement count surveys had subsequently been analysed to identify peak one-hour periods for the AM and PM peak periods – identified as 7:45am to 8:45am and 4:45pm to 5:45pm, respectively.

Appendix A of this document illustrates the traffic volumes obtained during AM and PM peak hour periods, for the 7 key intersection (extracted from the Hyder report) considered in the assessment.

Further to the above identified existing AM and PM peak hour traffic at each key intersection, **Appendix B** illustrates the expected future year background traffic levels (without development) at each intersection considered. Note that these figures are extracted from the Hyder report and the following assumptions are relevant;

- For the future background traffic scenario, a ten-year timeframe (i.e. 2025) has been assumed as the design year.
- In order to account for growth in background traffic, Hyder has assumed a growth factor of 0.5% per annum (which has been adopted for previous traffic studies of Auburn LGA) and this was applied to existing traffic volumes around the site.

Finally, **Appendix C** includes the AM and PM peak hour traffic volumes at key intersections for the post development scenario (with background traffic).



2.5 **Performance of Key Intersections**

The Hyder report has presented the SIDRA assessment results for the 7 key intersections considered. The assessment results have been undertaken for the following two scenarios;

- 1) Existing (2015) baseline conditions AM and PM peak periods.
- 2) Future (2025) conditions with development and background traffic growth AM and PM peak periods.

The main criteria of average delay and respective levels of service (LoS) used for SIDRA intersection assessment are based on the Guide to Traffic Generating Developments (RTA, 2002). The following table illustrates the relationship between the average delay and the level of service for priority controlled intersections such as give way/stop sign controlled intersections and roundabouts.

Level of Service (LoS)	Average Delay (sec)	Give way and Stop Intersections
A	<14	Good Operation
В	15 to 28	Acceptable delays and spare capacity
С	29 to 42	Satisfactory operations
D	43 to 56	Operating near capacity
E	57 to 70	Operating at capacity
F	>70	Operating over capacity, extra capacity required

Table 1: Performance Criteria for Priority Intersections



The following table illustrates a summary of the existing and future development scenario performance results for the 7 key intersections considered (extracted from the Hyder report). The detailed SIDRA assessment results, for each case (existing scenario and future with development scenario), are presented in Appendix A of the Hyder report.

Table	2:	Existing	and	Future	Development	Scenario	Performance	Levels	for	the	Key
Inters	ect	ions (AM	Peak	()							

ID	Intersection	Existing (baseline as	Operations per 2015)	Future Operation (with developr background traffic	s in 2025 nent and growth)
		Avg Delay	LoS	Avg Delay	LoS
1	James St/Mark St	9.8 sec	А	9.9 sec	А
2	East St/James St	27.2 sec	В	42.8 sec	D
3	Railway St/East St	24.2 sec	В	35.7 sec	С
4	Railway St/Bridge	20.7 sec	В	29.8 sec	С
5	Church St/Bridge	36.0 sec	С	52.4 sec	D
6	Railway St/Mark St	10.2 sec	A	11.5 sec	A
7	Mark St- Marsden/Taylor St	6.7 sec	A	7.8 sec	A



 Table 3: Existing and Future Development Scenario Performance Levels for the Key

 Intersections (PM Peak)

ID	Intersection	Existing (baseline as po	Operations er 2015)	Future Operations in development and traffic growth)	n 2025 (with background
		Avg Delay	LoS	Avg Delay	LoS
1	James St/Mark St	11.5 sec	А	12.4 sec	А
2	East St/James St	11.7 sec	A	14.4 sec	А
3	Railway St/East St	20.2 sec	В	45.8 sec	D
4	Railway St/Bridge	22.9 sec	В	65.3 sec	E
5	Church St/Bridge	24.8 sec	В	48.4 sec	D
6	Railway St/Mark St	9.7 sec	A	10.4 sec	A
7	Mark St- Marsden/Taylor St	7.3 sec	A	8.2 sec	A



3. Detailed Assessment Methodology

It is noted that the subject assessment builds on the information and findings presented in Hyder report (April, 2015). Accordingly, the key steps of the methodology adopted for this study is as follows;

<u>Step 1</u>

Obtain the relevant information on all 7 key intersections (such as baseline traffic volumes, future with development scenario traffic volumes) – see **Section 2.**

<u>Step 2</u>

Identify the traffic generation level of the subject site based on the current proposal – see **Section 4**.

<u>Step 3</u>

Identify the traffic generation level of the subject site based on the previous land use assumption (IN2). Subtract these traffic volumes from all the intersections in the 'future with development' scenario - see **Section 5**.

<u>Step 4</u>

Add the traffic generated from the current proposal on to the relevant movements at each intersection, depending on the access option considered (the traffic distribution assumptions will also need to be corrected on the basis of the considered access configuration)- see **Section 6 and 7**.

<u>Step 5</u>

Compare the intersection performance results for each scenario considered - see **Section 8**.



4. Traffic Generating Potential of the Subject Site

4.1 Traffic Generation Calculation from Hyder Report

It is acknowledged that the traffic generating potential of the subject site has been determined in the Hyder report on the basis of IN2 (light industrial) land use. The following figure illustrates the land use of the subject site assumed in the Hyder report with respect to the other lots within the overall Marsden Street Precinct.



Figure 5: Land Use of the Subject Site with respect to the Overall Marsden Street Precinct



As can be seen form the above figure, the subject site is referred to as land parcel F in the Hyder report. Accordingly, the development yield for the subject site (land parcel F) has been assumed to include 2,430 square metres of gross floor area (GFA) for industrial land use (refer to Table 3-1 in the Hyder report).

Subsequently, the traffic generation rates for the industrial land-use has been sourced from the Roads and Maritime Technical Direction note TDT 2013/04a Guide to Traffic Generating Developments – Updated traffic surveys dated August 2013.

The following table summarises the trip rates, traffic generation levels and peak hour trip distribution characteristics for the subject site as per the Hyder report.

	AM Peak	PM Peak			
Trip rates as per RMS TDT 2013/04a					
Industrial Land Use – Business parks and industrial estates	0.52 veh/100 sqm GFA	0.56 veh/100 sqm GFA			
Assumptions for traffic generation in/out split ratios					
Industrial Land Use	90% in / 10% out	10% in / 90% out			
Traffic generation based on the assumed development quantum					
Industrial land use with 2,430	12 veh	13 veh			
sqm GFA	(11 trips in / 1 trip out)	(1 trip in / 12 trips out)			

Table 4: Trip Generation	Characteristics f	or the Subject Site	– as per	Hyder Report



4.2 Traffic Generation for the Proposed Rezoning of the Subject Land

This section outlines the revised traffic generation calculation for the proposed rezoning of the subject site. Accordingly, the traffic generation figures have been derived based on the change in land zoning from IN2 to B4 of the subject land.

The land use characteristics of the currently proposed rezoning application is as follows;

- 1) Total area of 3,860 square meters for commercial/retail land-use. *A split of 50%/50% has been assumed for the retail/office land uses within the overall total area outlined above (in line with the proposed rezoning scheme). As such, this land use split has been assumed in trip generation procedure (i.e. the overall 3,860 square meter area has been split into 1,930 square meters of retail and 1,930 square meters of office land uses).*
- 2) Total of 144 residential units (64 x 1 bedroom units + 48 x 2 bedroom units + 32 x 3 bedroom units)

The following table summarises the trip rates, traffic generation levels and peak hour trip distribution characteristics for the subject site, based on the land use characteristics discussed above.

The trip rates and traffic distribution assumptions presented in the table below are in line with those outlined in the Hyder report. It should be noted that, in this assessment, all the relevant assumptions have been maintained consistently with those outlined in the Hyder report (Section 4.1.2).



Table 5. Tri	n Generation	Characteristics	of the	Current Rezoning	Prono	sal for Sub	iect Site
	y Generation	Characteristics	or the	Current Rezonnig	Γιυμυ	sai iui Sun	Ject Sile

	AM Peak	PM Peak
Trip rates as per RMS TDT 2013	/04a	
Retail Land Use: Shopping centre (0- 10,000 sqm GLFA)	1.8 veh/100 sqm GLFA ¹	3.7 veh/100 sqm GLFA ¹
Commercial Land Use – Office blocks	1.6 veh/100 sqm GFA	1.2 veh/100 sqm GFA
Residential Land Use – High- density residential flat dwellings	0.19 veh/unit	0.15 veh/unit
Assumptions for traffic generat	ion in/out split ratios	
Retail Land Use	60% in / 40% out	50% in / 50% out
Commercial Land Use	90% in / 10% out	10% in / 90% out
Residential Land Use	10% in / 90% out	90% in / 10% out
Traffic generation based on the	proposed rezoning develop	ment quantum
Retail land use (50% of 3,860 sqm GFA = 1,930 sqm GFA) = 1,448 sqm GLFA ²		
Also accounting for the 25% trip reduction (for linked and mulit- purpose trips), the effective GLFA = 1,086 sqm GLFA ³	20 veh (12 trips in / 8 trips out)	40 veh (20 trips in / 20 trips out)
Commercial land use with 50% of 3,860 sqm GFA = 1,930 sqm GFA	31 veh (28 trips in / 3 trips out)	23 veh (2 trips in / 21 trips out)
Residential yield of 144 units	27 veh (3 trips in / 24 trips out)	22 veh (20 trips in / 2 trips out)
Total traffic generation		
Overall rezoning proposal (mixed use comprising residential, retail and commercial uses) of the subject site	78 veh (43 trips in / 35 trips out)	85 veh (42 trips in / 43 trips out)



¹The AM and PM peak hour trip rate for retail land uses have been obtained by averaging the trip rates presented in the detailed surveys in Appendix F3 of RMS TDT 2013/04a.

² Retail GFA was converted into GLFA at a ratio of 1:0.75 (consistent with the Hyder report).

³ A trip reduction factor of 25% has been applied to the retail trips in accordance with the Hyder analysis.

4.3 Comparison of Traffic Generation Levels

From the above section, it is evident that the proposed mixed use (B4) rezoning of the subject land is likely to generate higher levels of traffic compared to when the use of the subject land is treated as light industrial (IN2).

The following table provides a comparison of the traffic generation figures established for each case.

	AM Peak	PM Peak
As per Hyder report		
Based on industrial land use (IN2)	12 veh	13 veh
with 2,430 sqm GFA	(11 trips in / 1 trip out)	(1 trip in / 12 trips out)
As per the current rezoning proposal		
Based on mixed land use (B4) comprising		
residential (144 units) and commercial	78 veh	85 veh
of the subject site	(43 trips in / 35 trips out)	(42 trips in / 43 trips out)

Table 6: Comparison of Trip Generation Levels

The following section presents the details of the methodology adopted in revising the traffic volume figures.



5. Revised Traffic Levels at Key Intersections

Based on the findings established in the previous section, the traffic volumes generated by the subject site under the previously assumed IN2 land use has been removed from the development generated traffic at all intersections.

The land parcels traffic distribution assumptions presented in Appendix B of the Hyder report has been adopted in this assessment as illustrated in the following subsections.

5.1 AM Peak Traffic Distribution

The following figure illustrates traffic distribution assumptions adopted in the Hyder report for in and out trips during the AM peak hour period (for land parcel group 4 – which includes the subject site area).



Figure 6: AM Peak Hour Traffic Distribution of In Trips





Figure 7: AM Peak Hour Traffic Distribution of Out Trips

The above identified in and out trip percentages of the in and out trip volumes calculated for the subject site based on the previously assumed IN2 land use, has subsequently been removed from all intersections in order to establish the post development traffic (without any development within the subject site).

Table 7: AM Peak Traffic Volumes Removed from Intersections

	AM Peak
As per Hyder report	
Based on industrial land use (IN2)	12 veh
with 2,430 sqm GFA	(11 trips in / 1 trip out)



The following figure illustrates the corrected traffic volumes for AM peak hour period – which represents only the post development traffic volumes, *without any development within the subject site.*



Figure 8: Corrections to the Development Only Traffic for AM Peak

Note – In trips (11 trips) are shown in Green while Out trips (1 trip) are shown in Red, in the above figure.

Appendix D of this report illustrates the respective movements where traffic volumes for AM peak hour period has been corrected – for the post development traffic (with background traffic growth up till 2025) scenario. This scenario therefore represents the future scenario *without any development within the subject site.*



The following figure presents the post development (2025 with background traffic) scenario (**without any development within the subject site**) traffic volumes during AM peak at key intersections.



Figure 9: Future Scenario AM Peak Traffic Volumes (without any development within subject site)



5.2 PM Peak Traffic Distribution

The following figures illustrate traffic distribution assumptions adopted in the Hyder report for in and out trips during the PM peak hour period (for land parcel group 4 – which includes the subject site area).



Figure 10: PM Peak Hour Traffic Distribution of In Trips





Figure 11: PM Peak Hour Traffic Distribution of Out Trips

The above identified in and out trip percentages of the in and out trip volumes calculated for the subject site based on the previously assumed IN2 land use, has subsequently been removed from all intersections in order to establish the post development traffic (without any development within the subject site).

 Table 8: PM Peak Traffic Volumes Removed from Intersections

	PM Peak
As per Hyder report	
Based on industrial land use (IN2)	13 veh
with 2,430 sqm GFA	(1 trip in / 12 trips out)



The following figure illustrates the corrected traffic volumes for PM peak hour period – which represents only the post development traffic volumes, *without any development within the subject site.*



Figure 12: Corrections to the Development Only Traffic for PM Peak

Note – In trips (1 trip) are shown in Green while Out trips (12 trips) are shown in Red, in the above figure.

Appendix D of this report illustrates the respective movements where traffic volumes for PM peak hour period has been corrected – for the post development traffic (with background traffic growth up till 2025) scenario. This scenario therefore represents the future scenario *without any development within the subject site.*



The following figure presents the post development (2025 with background traffic) scenario (**without any development within the subject site**) traffic volumes during PM peak at key intersections.



Figure 13: Future Scenario PM Peak Traffic Volumes (without any development within subject site)



6. Traffic Impact Assessment (Access Option 1)

This section presents the traffic assessment methodology for the proposed access option 1, which includes access for all vehicles off Raphael Street in left in/left out configuration.

6.1 AM Peak Period

The following table illustrates the number of AM peak hour trips (in and out) determined earlier in this report, on the basis of the subject site being B4 land use.

Table 9: AM Peak Traffic Volumes Added to Intersections

	AM Peak
As per the current rezoning proposal	
Based on mixed land use (B4) comprising residential (144 units) and commercial (50%)/retail (50%) (3,860 sqm GFA) use of the subject site	78 veh (43 trips in / 35 trips out)

The above identified AM peak hour traffic volumes were then added to the respective movements at the key intersections. Note that the traffic distribution at each key intersection presented in the Hyder report (for land group 4 - which includes the subject site) has been adopted in this assessment. The screenline assessment for traffic distributions presented in the Hyder report is extracted and presented in **Appendix E** of this report.

However, corrections to these traffic distributions have been made in consideration of left in/left out access off Railway Street into and out of Raphael Street (since the Hyder report has assumed access off East Street). **Appendix F** of this document includes the corrections adopted at respective movements in relation to traffic distributions in consideration of access off Raphael Street in left in/left out fashion.



The following figure illustrates the AM peak period trips (in and out) generated solely by the proposed development at the subject site (without background traffic or traffic from other developments).





Note – In trips (43 trips) are shown in Yellow while Out trips (35 trips) are shown in Green, in the above figure.

Finally, the above identified development traffic was added onto the traffic scenario presented in **Figure 9** (the future AM peak scenario without any development within the subject site). The following figure illustrates the ultimate traffic volumes once all developments are in place (including the development at the subject site with access off Raphael Street in left in/left out fashion).





Figure 15: Ultimate Development Scenario – AM Peak (Access Option 1)

6.2 PM Peak Period

The following table illustrates the number of PM peak hour trips (in and out) determined earlier in this report, on the basis of the subject site being B4 land use.

 Table 10: PM Peak Traffic Volumes Added to Intersections

	PM Peak
As per the current rezoning proposal	
Based on mixed land use (B4) comprising residential (144 units) and commercial (50%)/retail (50%) (3,860 sqm GFA) use of the subject site	85 veh (42 trips in / 43 trips out)



The above identified PM peak hour traffic volumes were then added to the respective movements at the key intersections. Note that the traffic distribution at each key intersection presented in the Hyder report (for land group 4 - which includes the subject site) has been adopted in this assessment. The screenline assessment for traffic distributions presented in the Hyder report is extracted and presented in **Appendix E** of this report.

However, corrections to these traffic distributions have been made in consideration of left in/left out access off Railway Street into and out of Raphael Street (since the Hyder report has assumed access off East Street). **Appendix F** of this document includes the corrections adopted at respective movements in relation to traffic distributions in consideration of access off Raphael Street in left in/left out fashion.

The following figure illustrates the PM peak period trips (in and out) generated solely by the proposed development at the subject site (without background traffic or traffic from other developments).





Figure 16: Trips Generated by the Subject Development Only - PM Peak (Access Option 1)

Note – In trips (42 trips) are shown in Yellow while Out trips (43 trips) are shown in Green, in the above figure.

Finally, the above identified development traffic was added onto the traffic scenario presented in **Figure 13** (the future PM peak scenario without any development within the subject site). The following figure illustrates the ultimate traffic volumes once all developments are in place (including the development at the subject site with access off Raphael Street in left in/left out fashion).





Figure 17: Ultimate Development Scenario Traffic Volumes – PM Peak (Access Option 1)


7. Traffic Impact Assessment (Access Option 2)

This section presents the traffic assessment methodology for the proposed access option 2, which includes access for heavy vehicles off Raphael Street in left in/left out configuration and access for passenger vehicles off East Street in left in/left out configuration.

7.1 Heavy Vehicle Estimation

The following table summarises the total traffic generation levels during each peak hour period, arising from each land use component of the proposed development at the subject site.

	AM Peak	PM Peak						
Traffic generation based on the proposed rezoning development quantum								
Retail land use	20 veh (12 trips in / 8 trips out)	40 veh (20 trips in / 20 trips out)						
Commercial land use	31 veh (28 trips in / 3 trips out) 27 veh	23 veh (2 trips in / 21 trips out) 22 veh						
Residential land use	(3 trips in / 24 trips out)	(20 trips in / 2 trips out)						
Total traffic generation								
Overall rezoning proposal (mixed use comprising residential, retail and commercial uses) of the subject site	78 veh (43 trips in / 35 trips out)	85 veh (42 trips in / 43 trips out)						

Table 11: Summary of Total Traffic Generation Levels based on Land Use



In order to determine the estimated number of heavy vehicles, the following assumptions have been adopted;

- The retail land uses will generate 20% heavy vehicle traffic out of the overall traffic generated during each peak hour period.
- The commercial land uses will generate 10% heavy vehicle traffic out of the overall traffic generated during each peak hour period.
- The residential land uses will generate 0% heavy vehicle traffic out of the overall traffic generated during each peak hour period.

The following table provides a summary of anticipated heavy vehicles generated by each land use type within the subject site.

		AM	Peak		PM Peak				
Land use	In		Out		In		Out		
	Passenger vehicles	Heavy vehicles	Passenger vehicles	Heavy vehicles	Passenger vehicles	Heavy vehicles	Passenger vehicles	Heavy vehicles	
Retail	10	2	6	2	16	4	16	4	
Commercial	25	3	3	0	2	0	19	2	
Residential	3	0	24	0	20	0	2	0	
Total	38	5	33	2	38	4	37	6	
	43	}	35		42		43		

Table 12: Summary of Heavy Vehicle Trips during each Peak Period based on Land Use

Since the heavy vehicles will access the site off Raphael Street in left in/left out configuration, the traffic distribution during each peak hour period has been determined based on the percentage splits identified in the previous section (see **Appendix F** for the corrected traffic distribution splits adopted).

The following figures illustrate heavy vehicle (only) traffic generated from the subject development during AM and PM peak periods.





Figure 18: Heavy Vehicle Trips Generated by the Subject Development Only - AM Peak (Access Option 2)

Note – In trips (5 trips) are shown in Yellow while Out trips (2 trips) are shown in Green, in the above figure.





Figure 19: Heavy Vehicle Trips Generated by the Subject Development Only - PM Peak (Access Option 2)

Note – In trips (4 trips) are shown in Yellow while Out trips (6 trips) are shown in Green, in the above figure.



7.2 AM Peak – Passenger Vehicles

Since this access option involves passenger vehicles utilising East Street access in left in/left out configuration, corrections have been made to the traffic distribution splits adopted in the Hyder report (since the Hyder report has assumed access off East Street which includes all movements). **Appendix G** of this document includes the corrections adopted at respective movements in relation to traffic distributions in consideration of access off East Street in left in/left out fashion.

The following figure illustrates the AM peak period passenger vehicle trips (in and out) generated solely by the proposed development at the subject site (without background traffic or traffic from other developments).



Figure 20: Trips Generated by the Subject Development Only - AM Peak Hour (Access Option 2)



Note – In trips (38 trips) are shown in Yellow while Out trips (33 trips) are shown in Green, in the above figure.

Finally, the ultimate scenario traffic volumes at each intersection, for the AM peak, has been established by adding the heavy vehicle traffic (as indicated in **Figure 18**) and passenger vehicle traffic (as indicated in **Figure 20**), on to the traffic scenario presented in **Figure 9** (the future AM peak scenario without any development within the subject site). The following figure illustrates the ultimate traffic volumes once all developments are in place (including the development at the subject site with access to heavy vehicles off Raphael Street in left in/left out fashion and access to passenger vehicles off East Street in left in/left out fashion).



Figure 21: Ultimate Development Scenario Traffic Volumes – AM Peak (Access Option 2)



7.3 PM Peak – Passenger Vehicles

Similar to the AM peak scenario in the above section, corrections have been made to the traffic distribution splits adopted in the Hyder report (since the Hyder report has assumed access off East Street which includes all movements). **Appendix G** of this document includes the corrections adopted at respective movements in relation to traffic distributions in consideration of access off East Street in left in/left out fashion.

The following figure illustrates the PM peak period passenger vehicle trips (in and out) generated solely by the proposed development at the subject site (without background traffic or traffic from other developments).



Figure 22: Trips Generated by the Subject Development Only - PM Peak Hour (Access Option 2)



Note – In trips (38 trips) are shown in Yellow while Out trips (37 trips) are shown in Green, in the above figure.

Finally, the ultimate scenario traffic volumes at each intersection, for the PM peak, has been established by adding the heavy vehicle traffic (as indicated in **Figure 19**) and passenger vehicle traffic (as indicated in **Figure 22**), on to the traffic scenario presented in **Figure 13** (the future PM peak scenario without any development within the subject site). The following figure illustrates the ultimate traffic volumes once all developments are in place (including the development at the subject site with access to heavy vehicles off Raphael Street in left in/left out fashion and access to passenger vehicles off East Street in left in/left out fashion).



Figure 23: Ultimate Development Scenario Traffic Volumes – PM Peak (Access Option 2)



8. Comparison of Intersection Performance Results

The following table summarises the SIDRA intersection assessment results for key intersections operating under the two access options considered (comparison is drawn with the existing baseline operations and future operations as per the previous rezoning proposal).

8.1 AM Peak

The following table summarises the SIDRA assessment results for existing and future operations (with the previous rezoning proposal) of key intersections during AM peak, as reported in the Hyder report.

ID	Intersection	Existing (baseline as	Operations per 2015)	Future Operations in 2025 (with development and background traffic growth)		
		Avg Delay	LoS	Avg Delay	LoS	
1	James St/Mark St	9.8 sec	А	9.9 sec	А	
2	East St/James St	27.2 sec	В	42.8 sec	D	
3	Railway St/East St	24.2 sec	В	35.7 sec	С	
4	Railway St/Bridge	20.7 sec	В	29.8 sec	С	
5	Church St/Bridge	36.0 sec	С	52.4 sec	D	
6	Railway St/Mark St	10.2 sec	A	11.5 sec	A	
7	Mark St- Marsden/Taylor St	6.7 sec	A	7.8 sec	A	

Table 13: Existing and Future Operations of Key Intersections (as per Hyder Report)

It is understood that the intersection models used in the Hyder report have been calibrated based on various parameters (such as gap acceptance) established on site observations (such as queuing). Indeed the level of service and delay outputs are extremely sensitive to these paramteres (especially the gap accesptance parameter, which has a large impact on the intersection level of service). However, the Hyder models were not available in electronic format for use in this report. Accordingly, the



traffic volumes presented in the Hyder report, for each intersection, has been utilised in uncalibrated SIDRA intersection models, in order to establish a more meaningful baseline scenario for comparison purposes.

The following table illustrates the SIDRA modelling outputs foreach intersection, during the AM peak period, as obtained from the uncalibrated SIDRA models (refer to **Appendix H** for detailed SIDRA model outputs).

 Table 14: Future Operations of Key Intersections (based on uncalibrated SIDRA models)

ID	Intersection	Future Operations in 2025 (with development and background traffic growth) – SIDRA models used without any calibration				
		Avg Delay	LoS			
1	James St/Mark St	10.9 sec	A			
2	East St/James St	63.3 sec	E			
3	Railway St/East St	55.7 sec	D			
4	Railway St/Bridge	>70 sec	F			
5	Church St/Bridge	>70 sec	F			
6	Railway St/Mark St	15.1 sec	В			
7	Mark St-Marsden/Taylor St	11.1 sec	A			

Finally, the future operations traffic volumes for each access option considered have been utilised using the same uncalibrated SIDRA models as above. The following table summarises the SIDRA assessment results for future operations (with the current rezoning proposal) of key intersections during AM peak, for each access option considered. Refer to **Appendix I** for detailed SIDRA model outputs.



ID	Intersection	Access Optio background growth)	n 1 (2025 with traffic	Access Option 2 (2025 with background traffic growth)		
		Avg Delay	LoS	Avg Delay	LoS	
1	James St/Mark St	10.9 sec	А	11.0 sec	А	
2	East St/James St	>70 sec	F	>70 sec	F	
3	Railway St/East St	>70 sec	F	>70 sec	F	
4	Railway St/Bridge	>70 sec	F	>70 sec	F	
5	Church St/Bridge	>70 sec	F	>70 sec	F	
6	Railway St/Mark St	15.5 sec	В	15.2 sec	В	
7	Mark St- Marsden/Taylor St	11.5 sec	A	11.4 sec	A	

Table 15: Future Intersection Operations for each Access Option

As can be seen, with the current rezoning proposal, under both access options, intersections 2 and 3 will drop to level of service F, from level of service E and D in the future baseline scenario, respectively. This is due to the heavy reliance on these two intersections by the u-turning traffic into and out of the subject site (resulting form the proposed left in and left out only access arrangement).



8.2 PM Peak

The following table summarises the SIDRA assessment results for existing and future operations (with the previous rezoning proposal) of key intersections during PM peak, as reported in the Hyder report.

ID	Intersection	Existing (baseline as pe	Operations er 2015)	Future Operations in development and traffic growth)	n 2025 (with background
		Avg Delay	LoS	Avg Delay	LoS
1	James St/Mark St	11.5 sec	А	12.4 sec	А
2	East St/James St	11.7 sec	А	14.4 sec	А
3	Railway St/East St	20.2 sec	В	45.8 sec	D
4	Railway St/Bridge	22.9 sec	В	65.3 sec	E
5	Church St/Bridge	24.8 sec	В	48.4 sec	D
6	Railway St/Mark St	9.7 sec	А	10.4 sec	А
7	Mark St- Marsden/Taylor St	7.3 sec	A	8.2 sec	A

Table 16: Existing and Future C	perations of Key	v Intersections (as per Hy	vder Report)
	perations of Re-	y Inconscious		

It is understood that the intersection models used in the Hyder report have been calibrated based on various parameters (such as gap acceptance) established on site observations (such as queuing). Indeed the level of service and delay outputs are extremely sensitive to these paramteres (especially the gap accesptance parameter, which has a large impact on the intersection level of service). However, the Hyder models were not available in electronic format for use in this report. Accordingly, the traffic volumes presented in the Hyder report, for each intersection, has been utilised in uncalibrated SIDRA intersection models, in order to establish a more meaningful baseline scenario for comparison purposes.

The following table illustrates the SIDRA modelling outputs foreach intersection, during the PM peak period, as obtained from the uncalibrated SIDRA models (refer to **Appendix J** for detailed SIDRA model outputs).



ID	Intersection	Future Operations in 2025 (with development and background traffic growth) – SIDRA models used without any calibration				
		Avg Delay	LoS			
1	James St/Mark St	13.7 sec	А			
2	East St/James St	23.1 sec	В			
3	Railway St/East St	>70 sec	F			
4	Railway St/Bridge	>70 sec	F			
5	Church St/Bridge	>70 sec	F			
6	Railway St/Mark St	10.2 sec	A			
7	Mark St-Marsden/Taylor St	13.1 sec	А			

Table 17: Future Operations of Key Intersections (based on uncalibrated SIDRA models)

Finally, the future operations traffic volumes for each access option considered have been utilised using the same uncalibrated SIDRA models as above. The following table summarises the SIDRA assessment results for future operations (with the current rezoning proposal) of key intersections during PM peak, for each access option considered. Refer to **Appendix K** for detailed SIDRA model outputs.

ID	Intersection	Access Option 1 (2025 with background traffic growth)		Access Option 2 (2025 with background traffic growth)			
		Avg Delay	LoS	Avg Delay	LoS		
1	James St/Mark St	13.8 sec	А	13.8 sec	А		
2	East St/James St	51.5 sec	D	>70 sec	F		
3	Railway St/East St	>70 sec	F	>70 sec	F		
4	Railway St/Bridge	>70 sec	F	>70 sec	F		
5	Church St/Bridge	>70 sec	F	>70 sec	F		
6	Railway St/Mark St	10.6 sec	А	10.3 sec	A		
7	Mark St- Marsden/Taylor St	13.5 sec	A	13.2 sec	A		

Table 18: Future Intersection Operations for each Access Option



As can be seen, with the current rezoning proposal, the East Street/James Street intersection will operate at level of service D and F, under access option 1 and 2 respectively (compared against the level of service B of this intersection in the future baseline scenario). Again, this is a result of high reliance on this roundabout intersection by u-turning traffic generated due to the proposed left in and left out only access arrangement.



9. Other Matters

9.1 Intersection Modelling Issues

As a result of relying on the information presented in the Hyder report for the future baseline scenario, a number of modelling issues have been encountered during this study as follows;

1) In the Hyder study, the traffic generation potential of the existing land uses within the Marsden Precinct has not been considered. Although this approach is deemed to provide conservative results, it is likely that the final results would over-estimate the actual traffic impacts (the level of service and delays) at each intersection, since the existing land uses will essentially be replaced by the proposed land uses under the subject rezoning proposal. Therefore, it would be more realistic to remove, at least, the existing major traffic generators within the Marsden Precinct, in order to establish a more accurate picture of the future performance of the key intersections.

2) In the Hyder study, access to and from the land parcels of Marsden Precinct fronting Railway Street and East Street, have been assumed to include all movements. However, based on the Council comments on the current rezoning proposal, it is understood that only left in and left out movements will be permitted off Railway and East Streets, into the subject site. Accordingly, the traffic distribution assumptions of the Hyder study will need to be revised and corrected.

3) The SIDRA intersection models used in the Hyder study was not available at the time the subject study was conducted by APEX Engineers. Therefore, APEX Engineers have utilised uncalibrated SIDRA models to establish a meaningful future baseline scenario for comparison purposes. However, it is understood that some level of calibration has been done on the SIDRA models in the Hyder study, based on site observations. Therefore, this calibration information is absent from the SIDRA models used in the subject study, by APEX Engineers.



Based on the above, it is prudent that a revised traffic assessment be undertaken by Council in order to establish a more accurate future scenario for intersection operations. Once such information is available, an updated analysis of the actual traffic impact arising from both the rezoning of the Marsden Street Precinct in 2015 and the subject rezoning proposal could be established. This would better inform Council's future traffic planning of the town centre.

9.2 Setback Requirements

The Council DCP requires future development on neighbouring sites to the west of Raphael Street and to the north of Davey Street to be set back 4 to 6m from those streets to accommodate future road widening. Accordingly, a 4-6m setback has been provided from Raphael Street on the subject site (as indicated in the concept design).

Furthermore, it is understood that the Council is planning for an upgrade of the cycleway along East Street at the subject site frontage. Accordingly, a 2m setback has been provided from East Street to the subject site within the concept design.

9.3 Pedestrian Crossing across East Street

It is noted that with the proposed rezoning development at the subject site and also within the overall Marsden Precinct, the number of pedestrian movements are likely to increase in the area- particularly along the footpaths along East Street and across East Street to the upgraded Rookwood Cemetery parklands. Currently, the section of East Street between Railway Street and James Street does not include a pedestrian crossing opportunity. Therefore, subject to the relevant warrants being satisfied, it is recommended that a pedestrian crossing to be installed across East Street in order to facilitate the pedestrian movements (particularly for the pedestrians wishing to access the bus stop located on the east side of East Street and the Rookwood Cemetery parklands).



LIST OF APPNEDICES

- **Appendix A:** Existing Scenario Traffic Volumes at Key Intersections (Extracted from Hyder Report)
- **Appendix B:** Future Baseline (2025, without development) Scenario Traffic Volumes at Key Intersections (Extracted from Hyder Report)
- Appendix C: Post Development (2025, with future background traffic) Scenario Traffic Volumes at Key Intersections – as per Previous Rezoning Proposal (Extracted from Hyder Report)
- **Appendix D:** Revised Traffic Volumes at Key Intersections for the Future Post Development Scenario (without any development in land parcel F)
- Appendix E: Traffic Distribution of Generated Traffic Screenlines
- **Appendix F:** Corrections to the Traffic Distributions to Account for Access from Raphael Street in Left In/Left Out Configuration (Access Option 1)
- **Appendix G:** Corrections to the Traffic Distributions to Account for Access from East Street in Left In/Left Out Configuration (Access Option 2)
- Appendix H: Detailed SIDRA Modelling Outputs for Key Intersections AM Peak of Future Operations (as per previous rezoning proposal) of Key Intersections (based on uncalibrated SIDRA models, using Hyder Future Scenario traffic volume figures)
- Appendix I: Detailed SIDRA Modelling Outputs for Key Intersections AM Peak of Future Operations (as per Subject Proposal) of Key Intersections (based on uncalibrated SIDRA models) for each Access Option Considered
- Appendix J: Detailed SIDRA Modelling Outputs for Key Intersections PM Peak of Future Operations (as per previous rezoning proposal) of Key Intersections (based on uncalibrated SIDRA models, using Hyder Future Scenario traffic volume figures)
- Appendix K: Detailed SIDRA Modelling Outputs for Key Intersections PM Peak of Future Operations (as per Subject Proposal) of Key Intersections (based on uncalibrated SIDRA models) for each Access Option Considered

Appendix A: Existing Scenario Traffic Volumes at Key Intersections (Extracted from Hyder Report)



Figure A1: Existing Scenario AM Peak Hour Traffic Volumes at Key Intersections



Figure A2: Existing Scenario PM Peak Hour Traffic Volumes at Key Intersections

Appendix B: Future Baseline (2025, without development) Scenario Traffic Volumes at Key Intersections (Extracted from Hyder Report)



Figure B1: Future Baseline (without development) Scenario AM Peak Hour Traffic Volumes at Key Intersections



Figure B2: Future Baseline (without development) Scenario PM Peak Hour Traffic Volumes at Key Intersections

Appendix C: Post Development (2025, with future background traffic) Scenario Traffic Volumes at Key Intersections – as per Previous Rezoning Proposal (Extracted from Hyder Report)



Figure C1: Post Development Scenario (as per previous rezoning proposal) AM Peak Hour Traffic Volumes at Key Intersections



Figure C2: Post Development Scenario (as per previous rezoning proposal) PM Peak Hour Traffic Volumes at Key Intersections

Appendix D: Revised Traffic Volumes at Key Intersections for the Future Post Development Scenario (without any development in land parcel F)



Figure D1: Post Development Scenario (as per previous rezoning proposal) without any Development at the Subject Site, AM Peak Hour Traffic Volumes at Key Intersections



Figure D2: Post Development Scenario (as per previous rezoning proposal) without any Development at the Subject Site, PM Peak Hour Traffic Volumes at Key Intersections



Appendix E: Traffic Distribution of Generated Traffic - Screenlines

Figure E1: Traffic Distribution Screenlines for AM Peak



Figure E2: Traffic Distribution Screenlines for PM Peak

Appendix F: Corrections to the Traffic Distributions to Account for Access from Raphael Street in Left In/Left Out Configuration (Access Option 1)



Figure F1: Corrections to Distribution of IN trips – AM Peak (Access Option 1)



Figure F2: Corrections to Distribution of OUT trips – AM Peak (Access Option 1)



Figure F3: Corrections to Distribution of IN trips – PM Peak (Access Option 1)



Figure F4: Corrections to Distribution of OUT trips – PM Peak (Access Option 1)

Appendix G: Corrections to the Traffic Distributions to Account for Access from East Street in Left In/Left Out Configuration (Access Option 2)



Figure G1: Corrections to Distribution of IN trips – AM Peak (Access Option 2)



Figure G2: Corrections to Distribution of OUT trips – AM Peak (Access Option 2)



Figure G3: Corrections to Distribution of IN trips – PM Peak (Access Option 2)



Figure G4: Corrections to Distribution of OUT trips – PM Peak (Access Option 2)

Appendix H: Detailed SIDRA Modelling Outputs for Key Intersections – AM Peak of Future Operations (as per previous rezoning proposal) of Key Intersections (based on uncalibrated SIDRA models, using Hyder Future Scenario traffic volume figures)

MOVEMENT SUMMARY

Site: 1.0 James St/Mark St AM

James St/Mark St Roundabout

Movem	ovement Performance - Vehicles										
Mov ID	Turn	Demand Flow	HV [Deg. Satn	Average Delay	Level of Service	95% Back Vehicles	of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
East: Ja	mes St										
5	Т	207	5.8	0.270	7.0	LOS A	1.6	11.8	0.49	0.60	42.2
6	R	50	2.0	0.270	10.6	LOS A	1.6	11.8	0.49	0.78	40.4
Approac	:h	257	5.1	0.270	7.7	LOS A	1.6	11.8	0.49	0.64	41.8
North: M	lark St										
7	L	31	0.0	0.260	8.0	LOS A	1.5	10.8	0.50	0.65	41.6
9	R	211	5.2	0.260	10.9	LOS A	1.5	10.8	0.50	0.73	39.9
Approac	:h	242	4.5	0.260	10.5	LOS A	1.5	10.8	0.50	0.72	40.1
West: Ja	ames St										
10	L	448	1.8	0.509	6.6	LOS A	4.5	32.0	0.30	0.56	42.5
11	Т	251	2.8	0.509	5.7	LOS A	4.5	32.0	0.30	0.47	43.0
12	R	1	0.0	0.509	10.7	LOS A	4.5	32.0	0.30	0.73	40.0
Approac	:h	700	2.2	0.509	6.3	LOS A	4.5	32.0	0.30	0.53	42.7
All Vehic	cles	1199	3.3	0.509	7.5	LOS A	4.5	32.0	0.38	0.59	41.9

Level of Service (LOS) Method: Delay (RTA NSW).

Vehicle movement LOS values are based on average delay per movement

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: 2.0 James St/East St AM

James St/East St Roundabout

Moven	Movement Performance - Vehicles										
Mov ID	Turn	Demand Flow	HV D	eg. Satn	Average Delay	Level of Service	95% Back Vehicles	of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: E	East St										
1	L	79	3.8	0.921	16.7	LOS B	25.6	183.8	1.00	0.89	36.2
2	Т	958	2.8	0.921	15.7	LOS B	25.6	183.8	1.00	0.88	36.2
3	R	11	0.0	0.921	20.6	LOS B	25.6	183.8	1.00	0.88	34.4
Approad	ch	1048	2.8	0.921	15.8	LOS B	25.6	183.8	1.00	0.88	36.2
North: E	ast St										
8	Т	450	6.0	0.494	5.9	LOS A	4.5	32.9	0.37	0.49	42.7
9	R	172	5.3	0.494	9.7	LOS A	4.5	32.9	0.37	0.71	40.8
Approac	ch	622	5.8	0.494	7.0	LOS A	4.5	32.9	0.37	0.55	42.1
West: Ja	ames St	t									
10	L	230	3.0	0.884	60.6	LOS E	13.4	95.8	1.00	1.58	20.2
12	R	58	0.0	0.884	63.3	LOS E	13.4	95.8	1.00	1.59	20.1
Approac	ch	288	2.4	0.884	61.2	LOS E	13.4	95.8	1.00	1.58	20.2
All Vehi	cles	1958	3.7	0.921	19.7	LOS B	25.6	183.8	0.80	0.88	33.8

Level of Service (LOS) Method: Delay (RTA NSW).

Vehicle movement LOS values are based on average delay per movement Intersection and Approach LOS values are based on average delay for all vehicle movements. Roundabout Capacity Model: SIDRA Standard. SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: 3.0 Railway St/East St AM

Railway St/East St Roundabout

Movement Performance - Vehicles											
Turn	Demand Flow	HV C	Deg. Satn	Average Delay	Level of Service	95% Back Vehicles	of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed	
	veh/h	%	v/c	sec		veh	m		per veh	km/h	
East St											
L	259	4.2	1.007	53.4	LOS D	69.1	495.6	1.00	1.34	21.7	
R	896	2.6	1.007	55.7	LOS D	69.1	495.6	1.00	1.34	21.5	
ch	1155	2.9	1.007	55.2	LOS D	69.1	495.6	1.00	1.34	21.6	
ailway S	St										
L	472	3.8	0.497	7.0	LOS A	3.3	24.0	0.50	0.63	42.0	
Т	169	1.2	0.196	6.9	LOS A	1.2	8.3	0.47	0.59	42.3	
R	1	0.0	0.196	11.7	LOS A	1.2	8.3	0.47	0.81	39.7	
ch	642	3.1	0.497	7.0	LOS A	3.3	24.0	0.49	0.62	42.1	
ailway S	St										
Т	152	2.0	0.690	26.0	LOS B	8.3	61.5	1.00	1.22	30.4	
R	158	11.4	0.690	29.8	LOS C	8.3	61.5	1.00	1.23	29.7	
ch	310	6.8	0.690	27.9	LOS B	8.3	61.5	1.00	1.23	30.0	
cles	2107	3.6	1.007	36.5	LOS C	69.1	495.6	0.85	1.10	26.6	
	East St L R ch ailway S L T R ch ailway S L T R ch ch S C R C C C S S C C C S C C C C C C C C	L 259 R 896 ch 1155 aailway St 1 L 472 T 169 R 1 ch 642 ailway St 1 T 152 R 158 ch 310 cles 2107	L 259 4.2 R 896 2.6 ch 1155 2.9 ailway St 1 12 R 1155 2.9 ailway St 1 1.2 R 1.69 1.2 R 1.69 1.2 R 1.00 1.1 ailway St 1 0.0 ch 642 3.1 ailway St 1 1.0 Ch 642 3.1 ailway St 1 1.2 R 1.58 1.1.4 ch 310 6.8 cles 2107 3.6	L 259 4.2 1.007 R 896 2.6 1.007 R 896 2.6 1.007 ch 1155 2.9 1.007 ailway St	hent Performance - Vehicles Turn Demand Flow HV Deg. Satn Veh/h Average Delay veh/h % v/c sec East St 1.007 53.4 R 896 2.6 1.007 55.7 ch 1155 2.9 1.007 55.2 ailway St 1 2 0.196 6.9 R 169 1.2 0.196 6.9 R 1 0.0 0.196 11.7 ch 642 3.1 0.497 7.0 ailway St 1 0.0 0.196 11.7 ch 642 3.1 0.497 7.0 ailway St 1 0.0 2.0196 6.9 R 1 0.0 0.196 11.7 ch 642 3.1 0.497 7.0 ailway St 1 1.4 0.690 28.0 Ch 310 6.8 0.690 27.9 <	nent Performance - Vehicles Turn Demand Flow HV Deg. Satn % Average Delay Level of Service ast St % v/c sec sec ast St 1.007 53.4 LOS D LOS D R 896 2.6 1.007 55.7 LOS D ch 1155 2.9 1.007 55.2 LOS D ailway St 472 3.8 0.497 7.0 LOS A T 169 1.2 0.196 6.9 LOS A R 1 0.0 0.196 11.7 LOS A ch 642 3.1 0.497 7.0 LOS A ailway St 1.007 56.0 LOS A T 152 2.0 0.690 26.0 LOS A ailway St 1.4 0.690 29.8 LOS C T 152 2.0 0.690 26.0 LOS B	hent Performance - Vehicles Turn Demand Flow HV Deg. Satn Average Delay Level of Service 95% Back Vehicles tast St % v/c sec veh ast St 1.007 53.4 LOS D 69.1 R 896 2.6 1.007 55.7 LOS D 69.1 sh 1155 2.9 1.007 55.2 LOS D 69.1 ch 1155 2.9 1.007 55.2 LOS D 69.1 sh 1155 2.9 1.007 55.2 LOS D 69.1 sh 1155 2.9 1.007 55.2 LOS D 69.1 sh 1152 2.9 1.007 55.2 LOS A 3.3 T 169 1.2 0.196 11.7 LOS A 1.2 R 1 0.0 0.196 11.7 LOS A 3.3 ailway St T 152 2.0 0.690 26.0	Performance - Vehicles Turn Demand Flow HV Deg. Satn Average Delay Level of Service 95% Back of Queue veh/h % v/c sec Vehicles Distance veh/h % v/c sec veh m East St 1.007 53.4 LOS D 69.1 495.6 R 896 2.6 1.007 55.7 LOS D 69.1 495.6 ch 1155 2.9 1.007 55.2 LOS D 69.1 495.6 ch 1155 2.9 1.007 55.2 LOS D 69.1 495.6 ailway St 1 1.007 55.2 LOS A 3.3 24.0 T 169 1.2 0.196 11.7 LOS A 3.3 24.0 T 169 1.2 0.196 11.7 LOS A 3.3 24.0 ailway St T 152 2.0 0.690 26.0 LOS B	nent Performance - Vehicles Turn Demand Flow HV Deg. Satn Veh/h Average belay Level of Service 95% Back of Queue Vehicles Prop. Distance veh/h % v/c sec veh m Queued ast St 1 259 4.2 1.007 53.4 LOS D 69.1 495.6 1.00 R 896 2.6 1.007 55.7 LOS D 69.1 495.6 1.00 ch 1155 2.9 1.007 55.2 LOS D 69.1 495.6 1.00 ailway St 1 1.007 55.2 LOS D 69.1 495.6 1.00 T 169 1.2 0.196 6.9 LOS A 3.3 24.0 0.50 T 169 1.2 0.196 11.7 LOS A 3.3 24.0 0.49 ailway St 1 0.0 0.196 11.7 LOS A 3.3 24.0 0.49 ath <	Lent Performance - Vehicles HV Deg. Satn Average Delay Level of Service 95% Back of Queue Prop. Queued Effective Stop Rate per veh veh/h % v/c sec veh m Prop. Per veh Stop Rate per veh East St 1.007 53.4 LOS D 69.1 495.6 1.00 1.34 R 896 2.6 1.007 55.7 LOS D 69.1 495.6 1.00 1.34 ch 1155 2.9 1.007 55.2 LOS D 69.1 495.6 1.00 1.34 sh 1155 2.9 1.007 55.2 LOS D 69.1 495.6 1.00 1.34 shway St 1.00 1.34 1.00 1.34 ch 472 3.8 0.497 7.0 LOS A 3.3 24.0 0.50 0.63 T 169 1.2 0.196 11.7 LOS A 3.3 24.0 0.49	

Level of Service (LOS) Method: Delay (RTA NSW).

Vehicle movement LOS values are based on average delay per movement

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: 4.0 Railway St/Bridge AM

Railway St/Bridge Giveway / Yield (Two-Way)

Movem	ent Po	erformance	e - Veh	icles							
Mov ID	Turn	Demand Flow	ΗV	Deg. Satn	Average Delay	Level of Service	95% Back Vehicles	of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
East: Ra	ailway S	St									
6	R	349	3.4	1.604	1124.3	LOS F	171.2	1233.2	1.00	10.75	1.8
Approac	:h	349	3.4	1.604	1124.3	LOS F	171.2	1233.2	1.00	10.75	1.8
North: B	ridge										
7	L	223	4.5	0.250	6.5	LOS A	0.0	0.0	0.00	0.59	43.3
9	R	229	3.5	0.250	6.9	LOS A	0.0	0.0	0.00	0.67	43.0
Approac	h	452	4.0	0.250	6.7	NA	0.0	0.0	0.00	0.63	43.1
West: R	ailway S	St									
10	L	659	2.6	0.361	6.5	LOS A	0.0	0.0	0.00	0.61	43.3
Approac	h	659	2.6	0.361	6.5	NA	0.0	0.0	0.00	0.61	43.3
All Vehic	cles	1460	3.2	1.604	273.8	NA	171.2	1233.2	0.24	3.04	6.6

Level of Service (LOS) Method: Delay (RTA NSW).

Vehicle movement LOS values are based on average delay per movement

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Church St/Bridge Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID Turn		Demand Flow	HV [Deg. Satn	Average Delay	Level of Service	95% Back Vehicles	95% Back of Queue Vehicles Distance		Effective Stop Rate	Average Speed	
		veh/h	%	v/c	sec		veh	m		per veh	km/h	
South: B	Bridge											
1	L	316	4.7	0.553	6.5	LOS A	0.0	0.0	0.00	0.59	43.3	
3	R	691	1.9	0.553	6.8	LOS A	0.0	0.0	0.00	0.66	43.0	
Approach		1007	2.8	0.553	6.7	NA	0.0	0.0	0.00	0.64	43.1	
East: Ch	nurch S	t										
4	L	280	3.2	0.154	6.5	LOS A	0.0	0.0	0.00	0.61	43.3	
Approac	h	280	3.2	0.154	6.5	NA	0.0	0.0	0.00	0.61	43.3	
West: Cl	hurch S	St										
12	R	172	5.2	1.082	239.9	LOS F	24.7	180.7	1.00	3.23	7.3	
Approac	h	172	5.2	1.082	239.9	LOS F	24.7	180.7	1.00	3.23	7.3	
All Vehic	cles	1459	3.1	1.082	34.2	NA	24.7	180.7	0.12	0.94	27.4	

Level of Service (LOS) Method: Delay (RTA NSW).

Vehicle movement LOS values are based on average delay per movement

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: 6.0 Railway St/Mark St AM

Railway St/Mark St Giveway / Yield (Two-Way)

Moven	nent P	erformance	- Vehio	cles							
Mov ID	Turn	Demand Flow	HV Deg. Sat		n Average Delay	Level of Service	95% Back of Queue Vehicles Distance		Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: N	/lark St	t									
3	R	545	1.9	0.375	6.4	LOS A	2.2	15.6	0.41	0.58	42.5
Approach 545		545	1.9	0.375	6.4	NA	2.2	15.6	0.41	0.58	42.5
East: Ra	ailway S	St									
4	L	72	2.8	0.040	6.5	LOS A	0.0	0.0	0.00	0.61	43.3
Approac	h	72	2.8	0.040	6.5	LOS A	0.0	0.0	0.00	0.61	43.3
North Ea	ast: Ra	ilway St									
24	L	202	5.5	0.113	6.0	LOS A	0.0	0.0	0.00	0.58	43.8
Approac	h	202	5.5	0.113	6.0	NA	0.0	0.0	0.00	0.58	43.8
North W	est: Ra	ailway St									
27	L	168	3.8	0.223	10.1	LOS A	1.6	11.9	0.38	0.34	40.2
29	R	68	10.0	0.223	15.1	LOS B	1.6	11.9	0.73	0.92	36.9
Approac	h	236	5.6	0.223	11.6	LOS A	1.6	11.9	0.48	0.51	39.2
All Vehi	cles	1055	3.5	0.375	7.5	NA	2.2	15.6	0.32	0.57	42.0

Level of Service (LOS) Method: Delay (RTA NSW).

Vehicle movement LOS values are based on average delay per movement

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Mark St/Marsden-Taylor St Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flow	HV Deg. Satn		Average Delay	Level of Service	95% Back Vehicles	95% Back of Queue Vehicles Distance		Effective Stop Rate	Average Speed	
		veh/h	%	v/c	sec		veh	m		per veh	km/h	
South: N	/lark St											
1	L	9	0.0	0.278	6.4	LOS A	0.0	0.0	0.00	0.91	43.3	
2	Т	526	1.7	0.278	0.0	LOS A	0.0	0.0	0.00	0.00	50.0	
Approad	h	535	1.7	0.278	0.1	NA	0.0	0.0	0.00	0.02	49.9	
North: N	lark St											
8	Т	219	5.0	0.199	3.1	LOS A	1.5	11.0	0.60	0.00	42.7	
9	R	78	5.1	0.199	10.5	LOS A	1.5	11.0	0.60	0.94	41.3	
Approad	h	297	5.0	0.199	5.1	NA	1.5	11.0	0.60	0.25	42.3	
All Vehi	cles	832	2.9	0.278	1.9	NA	1.5	11.0	0.21	0.10	46.9	

Level of Service (LOS) Method: Delay (RTA NSW).

Vehicle movement LOS values are based on average delay per movement

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: 7.0B Mark St/Taylor St AM

Mark St/Marsden-Taylor St Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back Vehicles	of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed	
		veh/h	%	v/c	sec		veh	m		per veh	km/h	
South: N	lark St											
2	Т	535	1.7	0.281	1.0	LOS A	2.1	14.8	0.42	0.00	45.0	
3	R	5	0.0	0.281	7.8	LOS A	2.1	14.8	0.42	0.87	43.1	
Approach		540	1.7	0.281	1.1	NA	2.1	14.8	0.42	0.01	45.0	
East: Ma	arsden S	St										
4	L	5	0.0	0.021	10.7	LOS A	0.1	0.5	0.44	0.59	39.6	
6	R	6	0.0	0.021	11.1	LOS A	0.1	0.5	0.44	0.78	39.5	
Approac	h	11	0.0	0.021	10.9	LOS A	0.1	0.5	0.44	0.69	39.6	
North: N	lark St											
7	L	5	0.0	0.116	6.4	LOS A	0.0	0.0	0.00	0.91	43.3	
8	Т	214	5.1	0.116	0.0	LOS A	0.0	0.0	0.00	0.00	50.0	
Approac	h	219	5.0	0.116	0.1	NA	0.0	0.0	0.00	0.02	49.8	
All Vehic	les	770	2.6	0.281	1.0	NA	2.1	14.8	0.30	0.02	46.2	

Level of Service (LOS) Method: Delay (RTA NSW).

Vehicle movement LOS values are based on average delay per movement

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

SIDRA Standard Delay Model used.

Appendix I: Detailed SIDRA Modelling Outputs for Key Intersections – AM Peak of Future Operations (as per Subject Proposal) of Key Intersections (based on uncalibrated SIDRA models) for each Access Option Considered

Access Option 1

MOVEMENT SUMMARY

Site: 1.0 James St/Mark St AM

James St/Mark St Roundabout

Movem	nent Pe	rformance	- Vehi	cles							
Mov ID	Turn	Demand Flow	HV I	Deg. Satn	Average Delay	Level of Service	95% Back Vehicles	of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
East: Ja	mes St										
5	Т	207	5.8	0.269	7.0	LOS A	1.6	11.8	0.48	0.60	42.2
6	R	50	2.0	0.269	10.5	LOS A	1.6	11.8	0.48	0.77	40.5
Approac	:h	257	5.1	0.269	7.7	LOS A	1.6	11.8	0.48	0.63	41.9
North: N	lark St										
7	L	27	0.0	0.253	8.1	LOS A	1.4	10.4	0.50	0.65	41.6
9	R	207	5.2	0.253	10.9	LOS A	1.4	10.4	0.50	0.73	39.8
Approac	:h	234	4.6	0.253	10.6	LOS A	1.4	10.4	0.50	0.72	40.0
West: Ja	ames St										
10	L	448	1.8	0.514	6.6	LOS A	4.6	32.5	0.30	0.56	42.5
11	Т	258	2.8	0.514	5.7	LOS A	4.6	32.5	0.30	0.47	42.9
12	R	1	0.0	0.514	10.7	LOS A	4.6	32.5	0.30	0.73	40.0
Approach		707	2.2	0.514	6.3	LOS A	4.6	32.5	0.30	0.53	42.7
All Vehic	cles	1198	3.3	0.514	7.4	LOS A	4.6	32.5	0.38	0.59	41.9

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

MOVEMENT SUMMARY

Site: 2.0 James St/East St AM

James St/East St Roundabout

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flow	HV [Deg. Satn	Average Delay	Level of Service	95% Back Vehicles	of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed	
		veh/h	%	v/c	sec		veh	m		per veh	km/h	
South: E	ast St											
1	L	79	3.8	0.931	17.9	LOS B	27.9	199.9	1.00	0.91	35.4	
2	Т	969	2.8	0.931	16.9	LOS B	27.9	199.9	1.00	0.91	35.5	
3	R	11	0.0	0.931	21.8	LOS B	27.9	199.9	1.00	0.90	33.8	
Approac	h	1059	2.8	0.931	17.0	LOS B	27.9	199.9	1.00	0.91	35.5	
North: E	ast St											
8	Т	450	6.0	0.500	6.0	LOS A	4.6	33.5	0.39	0.50	42.6	
9	R	172	5.3	0.500	9.7	LOS A	4.6	33.5	0.39	0.70	40.8	
Approac	h	622	5.8	0.500	7.0	LOS A	4.6	33.5	0.39	0.55	42.0	
West: Ja	ames St	t										
10	L	237	3.0	0.943	87.5	LOS F	18.6	133.1	1.00	1.89	16.0	
12	R	64	0.0	0.943	90.1	LOS F	18.6	133.1	1.00	1.90	16.0	
Approac	h	301	2.4	0.943	88.1	LOS F	18.6	133.1	1.00	1.89	16.0	
All Vehic	cles	1982	3.7	0.943	24.7	LOS B	27.9	199.9	0.81	0.95	31.2	
Level of Service (LOS) Method: Delay (RTA NSW). Vehicle movement LOS values are based on average delay per movement Intersection and Approach LOS values are based on average delay for all vehicle movements. Roundabout Capacity Model: SIDRA Standard. SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: 3.0 Railway St/East St AM

Railway St/East St Roundabout

Movem	ovement Performance - Vehicles													
Mov ID	Turn	Demand Flow	HV [Deg. Satn	Average Delay	Level of Service	95% Back Vehicles	of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed			
		veh/h	%	v/c	sec		veh	m		per veh	km/h			
South: E	ast St													
1	L	285	4.2	1.054	121.5	LOS F	117.1	840.4	1.00	2.30	12.7			
3	R	895	2.6	1.054	123.8	LOS F	117.1	840.4	1.00	2.30	12.7			
Approach		1180	3.0	1.054	123.2	LOS F	117.1	840.4	1.00	2.30	12.7			
East: Railway St		St												
4	L	469	3.8	0.493	7.0	LOS A	3.3	23.7	0.50	0.63	42.0			
5	Т	178	1.2	0.204	7.0	LOS A	1.2	8.7	0.48	0.60	42.2			
6	R	1	0.0	0.204	11.7	LOS A	1.2	8.7	0.48	0.81	39.7			
Approac	h	648	3.1	0.493	7.0	LOS A	3.3	23.7	0.49	0.62	42.1			
West: R	ailway	St												
11	Т	152	2.0	0.653	22.0	LOS B	7.5	55.9	1.00	1.16	32.3			
12	R	165	12.0	0.653	25.8	LOS B	7.5	55.9	1.00	1.19	31.4			
Approac	h	317	7.2	0.653	24.0	LOS B	7.5	55.9	1.00	1.18	31.9			
All Vehic	cles	2145	3.6	1.054	73.4	LOS F	117.1	840.4	0.85	1.63	18.1			

Level of Service (LOS) Method: Delay (RTA NSW). Vehicle movement LOS values are based on average delay per movement

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: 4.0 Railway St/Bridge AM

Railway St/Bridge Giveway / Yield (Two-Way)

Movem	lovement Performance - Vehicles													
Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back Vehicles	of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed			
		veh/h	%	v/c	sec		veh	m		per veh	km/h			
East: Ra	ailway S	St												
6	R	372	3.4	1.720	1332.5	LOS F	201.7	1453.0	1.00	11.74	1.5			
Approac	ch	372	3.4	1.720	1332.5	LOS F	201.7	1453.0	1.00	11.74	1.5			
North: B	Bridge													
7	L	229	4.5	0.254	6.5	LOS A	0.0	0.0	0.00	0.59	43.3			
9	R	229	3.5	0.254	6.9	LOS A	0.0	0.0	0.00	0.67	43.0			
Approac	ch	458	4.0	0.254	6.7	NA	0.0	0.0	0.00	0.63	43.1			
West: R	ailway	St												
10	L	659	2.6	0.361	6.5	LOS A	0.0	0.0	0.00	0.61	43.3			
Approac	ch	659	2.6	0.361	6.5	NA	0.0	0.0	0.00	0.61	43.3			
All Vehic	cles	1489	3.2	1.720	337.8	NA	201.7	1453.0	0.25	3.40	5.5			

Level of Service (LOS) Method: Delay (RTA NSW).

Vehicle movement LOS values are based on average delay per movement

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements. SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: 5.0 Church St/Bridge AM

Church St/Bridge Giveway / Yield (Two-Way)

Movem	ient P	erformance	e - Veh	icles							
Mov ID	Turn	Demand Flow	ΗV	Deg. Satn	Average Delay	Level of Service	95% Back Vehicles	of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: E	Bridge										
1	L	320	4.7	0.566	6.5	LOS A	0.0	0.0	0.00	0.59	43.3
3	R	711	1.9	0.566	6.8	LOS A	0.0	0.0	0.00	0.66	43.0
Approach		1031	2.8	0.566	6.7	NA	0.0	0.0	0.00	0.64	43.1
East: Ch	urch S	t									
4	L	285	3.2	0.157	6.5	LOS A	0.0	0.0	0.00	0.61	43.3
Approac	h	285	3.2	0.157	6.5	NA	0.0	0.0	0.00	0.61	43.3
West: C	hurch S	St									
12	R	177	5.2	1.183	401.5	LOS F	40.8	298.2	1.00	4.33	4.7
Approac	h	177	5.2	1.183	401.5	LOS F	40.8	298.2	1.00	4.33	4.7
All Vehic	cles	1493	3.1	1.183	53.5	NA	40.8	298.2	0.12	1.07	21.8

Level of Service (LOS) Method: Delay (RTA NSW).

Vehicle movement LOS values are based on average delay per movement

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: 6.0 Railway St/Mark St AM

Railway St/Mark St Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand	HV I	Deg. Satn	Average	Level of	95% Back	of Queue	Prop.	Effective	Average
		Flow			Delay	Service	Vehicles	Distance	Queued	Stop Rate	Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: N	Aark St										
3	R	545	1.9	0.375	6.4	LOS A	2.2	15.6	0.41	0.58	42.5
Approad	ch	545	1.9	0.375	6.4	NA	2.2	15.6	0.41	0.58	42.5
East: Ra	ailway S	t									
4	L	84	2.8	0.046	6.5	LOS A	0.0	0.0	0.00	0.61	43.3
Approad	ch	84	2.8	0.046	6.5	LOS A	0.0	0.0	0.00	0.61	43.3
North E	ast: Rail	way St									
24	L	202	5.5	0.113	6.0	LOS A	0.0	0.0	0.00	0.58	43.8
Approad	ch	202	5.5	0.113	6.0	NA	0.0	0.0	0.00	0.58	43.8
North W	est: Rai	ilway St									
27	L	168	3.8	0.228	10.2	LOS A	1.6	12.2	0.38	0.34	40.1
29	R	69	10.0	0.228	15.5	LOS B	1.6	12.2	0.74	0.93	36.7
Approad	ch	237	5.6	0.228	11.7	LOS A	1.6	12.2	0.48	0.51	39.0
All Vehi	cles	1068	3.5	0.375	7.5	NA	2.2	15.6	0.32	0.57	42.0

Level of Service (LOS) Method: Delay (RTA NSW).

Vehicle movement LOS values are based on average delay per movement

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

Site: 7.0A Mark St/Taylor St AM

Mark St/Marsden-Taylor St Giveway / Yield (Two-Way)

Movem	Novement Performance - Vehicles														
Mov ID	Turn	Demand Flow	HV C	eg. Satn	Average Delay	Level of Service	95% Back Vehicles	of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed				
		veh/h	%	v/c	sec		veh	m		per veh	km/h				
South: N	/lark St														
1	L	9	0.0	0.278	6.4	LOS A	0.0	0.0	0.00	0.91	43.3				
2	Т	526	1.7	0.278	0.0	LOS A	0.0	0.0	0.00	0.00	50.0				
Approac	h	535	1.7	0.278	0.1	NA	0.0	0.0	0.00	0.02	49.9				
North: N	lark St														
8	Т	230	5.0	0.206	3.2	LOS A	1.6	11.5	0.60	0.00	42.7				
9	R	79	5.1	0.206	10.5	LOS A	1.6	11.5	0.60	0.94	41.3				
Approac	:h	309	5.0	0.206	5.0	NA	1.6	11.5	0.60	0.24	42.3				
All Vehic	cles	844	2.9	0.278	1.9	NA	1.6	11.5	0.22	0.10	46.8				

Level of Service (LOS) Method: Delay (RTA NSW).

Vehicle movement LOS values are based on average delay per movement

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: 7.0B Mark St/Taylor St

AM

Mark St/Marsden-Taylor St Giveway / Yield (Two-Way)

Moverr	nent Pe	erformance	e - Vehic	les							
Mov ID	Turn	Demand	HV D	Deg. Satn	Average	Level of	95% Back	of Queue	Prop.	Effective	Average
		Flow			Delay	Service	Vehicles	Distance	Queued	Stop Rate	Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: N	Aark St										
2	Т	535	1.7	0.281	1.1	LOS A	2.1	14.9	0.44	0.00	44.9
3	R	5	0.0	0.281	7.8	LOS A	2.1	14.9	0.44	0.87	43.1
Approac	ch	540	1.7	0.281	1.1	NA	2.1	14.9	0.44	0.01	44.9
East: Ma	arsden	St									
4	L	5	0.0	0.024	11.1	LOS A	0.1	0.5	0.46	0.59	39.3
6	R	7	0.0	0.024	11.5	LOS A	0.1	0.5	0.46	0.79	39.2
Approac	ch	12	0.0	0.024	11.3	LOS A	0.1	0.5	0.46	0.71	39.3
North: N	/lark St										
7	L	5	0.0	0.122	6.4	LOS A	0.0	0.0	0.00	0.91	43.3
8	Т	225	5.1	0.122	0.0	LOS A	0.0	0.0	0.00	0.00	50.0
Approac	ch	230	5.0	0.122	0.1	NA	0.0	0.0	0.00	0.02	49.8
All Vehi	cles	782	2.6	0.281	1.0	NA	2.1	14.9	0.31	0.02	46.1

Level of Service (LOS) Method: Delay (RTA NSW).

Vehicle movement LOS values are based on average delay per movement

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

Access Option 2

MOVEMENT SUMMARY

Site: 1.0 James St/Mark St AM

James St/Mark St Roundabout

Mover	Average Lovel of 95% Rock of Queue Prop. Effective Average													
Mov ID	Turn	Demand	HV [Deg. Satn	Average	Level of	95% Back	of Queue	Prop.	Effective	Average			
		Flow			Delay	Service	Vehicles	Distance	Queued	Stop Rate	Speed			
		veh/h	%	v/c	sec		veh	m		per veh	km/h			
East: Ja	mes St													
5	Т	212	5.7	0.275	7.0	LOS A	1.7	12.1	0.49	0.60	42.2			
6	R	50	2.0	0.275	10.6	LOS A	1.7	12.1	0.49	0.78	40.4			
Approac	Approach		5.0	0.275	7.7	LOS A	1.7	12.1	0.49	0.64	41.8			
North: Mark St														
7	L	31	0.0	0.262	8.1	LOS A	1.5	10.9	0.51	0.65	41.6			
9	R	211	5.2	0.262	11.0	LOS A	1.5	10.9	0.51	0.73	39.8			
Approac	ch	242	4.5	0.262	10.6	LOS A	1.5	10.9	0.51	0.72	40.0			
West: Ja	ames St													
10	L	448	1.8	0.515	6.6	LOS A	4.6	32.7	0.30	0.56	42.5			
11	Т	258	3.1	0.515	5.7	LOS A	4.6	32.7	0.30	0.47	42.9			
12	R	1	0.0	0.515	10.7	LOS A	4.6	32.7	0.30	0.73	40.0			
Approac	h	707	2.3	0.515	6.3	LOS A	4.6	32.7	0.30	0.53	42.7			
All Vehi	cles	1211	3.3	0.515	7.5	LOS A	4.6	32.7	0.38	0.59	41.9			

Level of Service (LOS) Method: Delay (RTA NSW).

Vehicle movement LOS values are based on average delay per movement

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: 2.0 James St/East St AM

James St/East St Roundabout

Moven	nent Pe	erformance	- Vehi	cles							
Mov ID	Turn	Demand Flow	HV I	Deg. Satn	Average Delay	Level of Service	95% Back Vehicles	of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: E	East St										
1	L	79	3.8	0.957	24.8	LOS B	36.3	260.8	1.00	1.12	31.6
2	Т	970	3.0	0.957	23.8	LOS B	36.3	260.8	1.00	1.12	31.7
3	R	11	0.0	0.957	28.8	LOS C	36.3	260.8	1.00	1.11	30.5
Approach		1060	3.0	0.957	24.0	LOS B	36.3	260.8	1.00	1.12	31.7
North: E	ast St										
8	Т	456	5.9	0.512	6.0	LOS A	4.8	35.0	0.38	0.49	42.6
9	R	192	4.7	0.512	9.8	LOS A	4.8	35.0	0.38	0.70	40.7
Approa	ch	648	5.6	0.512	7.1	LOS A	4.8	35.0	0.38	0.55	42.0
West: J	ames St	t									
10	L	237	3.4	0.951	95.1	LOS F	19.5	139.6	1.00	1.95	15.1
12	R	58	0.0	0.951	97.7	LOS F	19.5	139.6	1.00	1.96	15.1
Approa	ch	295	2.7	0.951	95.6	LOS F	19.5	139.6	1.00	1.96	15.1
All Vehi	cles	2003	3.8	0.957	29.0	LOS C	36.3	260.8	0.80	1.06	29.3

Level of Service (LOS) Method: Delay (RTA NSW).

Vehicle movement LOS values are based on average delay per movement

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

Site: 3.0 Railway St/East St AM

Railway St/East St Roundabout

Moven	Movement Performance - Vehicles Mov ID Turn Demand HV Deg Sata Average Level of 95% Back of Oueue Prop Effective Average													
Mov ID	Turn	Demand Flow	HV D	eg. Satn	Average Delay	Level of Service	95% Back Vehicles	of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed			
		veh/h	%	v/c	sec		veh	m		per veh	km/h			
South: E	East St													
1	L	274	5.5	1.045	106.3	LOS F	108.5	780.4	1.00	2.02	14.0			
3	R	916	2.5	1.045	108.6	LOS F	108.5	780.4	1.00	2.01	14.0			
Approad	ch	1190	3.2	1.045	108.1	LOS F	108.5	780.4	1.00	2.01	14.0			
East: Ra	ailway S	t												
4	L	477	3.8	0.510	7.2	LOS A	3.4	24.7	0.53	0.65	41.9			
5	Т	170	1.8	0.203	7.1	LOS A	1.2	8.5	0.48	0.61	42.2			
6	R	1	0.0	0.203	11.8	LOS A	1.2	8.5	0.48	0.82	39.6			
Approad	ch	648	3.2	0.510	7.1	LOS A	3.4	24.7	0.52	0.64	42.0			
West: R	ailway S	St												
11	Т	152	2.0	0.688	25.1	LOS B	8.3	61.4	1.00	1.22	30.8			
12	R	165	11.5	0.688	28.9	LOS C	8.3	61.4	1.00	1.23	30.0			
Approad	ch	317	6.9	0.688	27.1	LOS B	8.3	61.4	1.00	1.22	30.4			
All Vehi	cles	2155	3.8	1.045	65.8	LOS E	108.5	780.4	0.85	1.48	19.4			

Level of Service (LOS) Method: Delay (RTA NSW).

Vehicle movement LOS values are based on average delay per movement

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: 4.0 Railway St/Bridge AM

Railway St/Bridge Giveway / Yield (Two-Way)

ovement Performance - Vehicles													
Turn	Demand Flow	HV D	eg. Satn	Average Delay	Level of Service	95% Back Vehicles	of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed			
	veh/h	%	v/c	sec		veh	m		per veh	km/h			
ilway S	St												
R	361	3.6	1.679	1259.2	LOS F	189.5	1367.3	1.00	11.35	1.6			
h	361	3.6	1.679	1259.2	LOS F	189.5	1367.3	1.00	11.35	1.6			
ridge													
L	229	4.8	0.254	6.5	LOS A	0.0	0.0	0.00	0.59	43.3			
R	229	3.5	0.254	6.9	LOS A	0.0	0.0	0.00	0.67	43.0			
h	458	4.2	0.254	6.7	NA	0.0	0.0	0.00	0.63	43.1			
ailway 🛛	St												
L	659	2.6	0.361	6.5	LOS A	0.0	0.0	0.00	0.61	43.3			
h	659	2.6	0.361	6.5	NA	0.0	0.0	0.00	0.61	43.3			
les	1478	3.3	1.679	312.5	NA	189.5	1367.3	0.24	3.24	5.8			
	ilway S R h ridge L R h ailway S L h k	ent Performance Turn Demand Flow veh/h ilway St R 361 h 361 h 361 cl C 229 R 229 h 458 ailway St L 659 h 659 h 659 cles 1478	Appendix Performance - Vehic Turn Demand Flow HV D veh/h % % % % illway St	Performance - Vehicles Turn Demand Flow HV Deg. Satn veh/h % v/c ilway St % v/c R 361 3.6 1.679 h 361 3.6 1.679 h 361 3.6 1.679 ridge 229 4.8 0.254 R 229 3.5 0.254 h 458 4.2 0.254 ailway St 0.361 L 659 2.6 0.361 h 659 2.6 0.361 ailway St 0.361 L 659 2.6 0.361 h 659 3.3 1.679	ent Performance - Vehicles Turn Demand Flow HV Deg. Satn Veh/h Average Delay veh/h % v/c sec ilway St sec R 361 3.6 1.679 1259.2 h 361 3.6 1.679 1259.2 h 361 3.6 1.679 1259.2 ridge 229 4.8 0.254 6.5 R 229 3.5 0.254 6.9 6.7 ailway St L 659 2.6 0.361 6.5 6.5 6.5 <td>ent Performance - Vehicles Turn Demand Flow HV Deg. Satn Veh/h Average Delay Level of Service veh/h % v/c sec ilway St sec sec R 361 3.6 1.679 1259.2 LOS F h 361 3.6 1.679 1259.2 LOS F ridge 229 4.8 0.254 6.5 LOS A R 229 3.5 0.254 6.9 LOS A h 458 4.2 0.254 6.7 NA ailway St L LOS A L 659 2.6 0.361 6.5 LOS A h 659 2.6 0.361 6.5 NA cles 1478 3.3 1.679 312.5 NA</td> <td>ent Performance - Vehicles Turn Demand Flow HV Deg. Satn Average Delay Level of Service 95% Back Vehicles veh/h % v/c sec veh ilway St </td> <td>ent Performance - Vehicles Turn Demand Flow HV Deg. Satn Average Delay Level of Service 95% Back of Queue veh/h % v/c sec veh m ilway St </td> <td>ent Performance - Vehicles Turn Demand Flow HV Deg. Satn Veh/h Average Delay Level of Service 95% Back of Queue Vehicles Prop. Distance veh/h % v/c sec veh m illway St R 361 3.6 1.679 1259.2 LOS F 189.5 1367.3 1.00 h 361 3.6 1.679 1259.2 LOS F 189.5 1367.3 1.00 h 361 3.6 1.679 1259.2 LOS F 189.5 1367.3 1.00 ridge </td> <td>Rent Performance - Vehicles Turn Demand Flow HV Deg. Satn Veh/h Average Delay Level of Service 95% Back of Queue Vehicles Prop. Distance Effective Stop Rate veh/h % v/c sec veh m per veh illway St sec veh m per veh R 361 3.6 1.679 1259.2 LOS F 189.5 1367.3 1.00 11.35 h 361 3.6 1.679 1259.2 LOS F 189.5 1367.3 1.00 11.35 ridge 229 4.8 0.254 6.5 LOS A 0.0 0.00 0.60 R 229 3.5 0.254 6.7 NA 0.0 0.00 0.63 ailway St 458 4.2 0.254 6.7 NA 0.0 0.00 0.663 ailway St 125. LOS A 0.0 0.00</td>	ent Performance - Vehicles Turn Demand Flow HV Deg. Satn Veh/h Average Delay Level of Service veh/h % v/c sec ilway St sec sec R 361 3.6 1.679 1259.2 LOS F h 361 3.6 1.679 1259.2 LOS F ridge 229 4.8 0.254 6.5 LOS A R 229 3.5 0.254 6.9 LOS A h 458 4.2 0.254 6.7 NA ailway St L LOS A L 659 2.6 0.361 6.5 LOS A h 659 2.6 0.361 6.5 NA cles 1478 3.3 1.679 312.5 NA	ent Performance - Vehicles Turn Demand Flow HV Deg. Satn Average Delay Level of Service 95% Back Vehicles veh/h % v/c sec veh ilway St	ent Performance - Vehicles Turn Demand Flow HV Deg. Satn Average Delay Level of Service 95% Back of Queue veh/h % v/c sec veh m ilway St	ent Performance - Vehicles Turn Demand Flow HV Deg. Satn Veh/h Average Delay Level of Service 95% Back of Queue Vehicles Prop. Distance veh/h % v/c sec veh m illway St R 361 3.6 1.679 1259.2 LOS F 189.5 1367.3 1.00 h 361 3.6 1.679 1259.2 LOS F 189.5 1367.3 1.00 h 361 3.6 1.679 1259.2 LOS F 189.5 1367.3 1.00 ridge	Rent Performance - Vehicles Turn Demand Flow HV Deg. Satn Veh/h Average Delay Level of Service 95% Back of Queue Vehicles Prop. Distance Effective Stop Rate veh/h % v/c sec veh m per veh illway St sec veh m per veh R 361 3.6 1.679 1259.2 LOS F 189.5 1367.3 1.00 11.35 h 361 3.6 1.679 1259.2 LOS F 189.5 1367.3 1.00 11.35 ridge 229 4.8 0.254 6.5 LOS A 0.0 0.00 0.60 R 229 3.5 0.254 6.7 NA 0.0 0.00 0.63 ailway St 458 4.2 0.254 6.7 NA 0.0 0.00 0.663 ailway St 125. LOS A 0.0 0.00			

Level of Service (LOS) Method: Delay (RTA NSW).

Vehicle movement LOS values are based on average delay per movement

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

Church St/Bridge Giveway / Yield (Two-Way)

Movem	ovement Performance - Vehicles													
Mov ID	Turn	Demand Flow	ΗV	Deg. Satn	Average Delay	Level of Service	95% Back Vehicles	of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed			
		veh/h	%	v/c	sec		veh	m		per veh	km/h			
South: E	Bridge													
1	L	319	4.7	0.560	6.5	LOS A	0.0	0.0	0.00	0.59	43.3			
3	R	700	2.0	0.560	6.8	LOS A	0.0	0.0	0.00	0.66	43.0			
Approach		1019	2.8	0.560	6.7	NA	0.0	0.0	0.00	0.64	43.1			
East: Ch	nurch S	t												
4	L	284	3.5	0.157	6.5	LOS A	0.0	0.0	0.00	0.61	43.3			
Approac	:h	284	3.5	0.157	6.5	NA	0.0	0.0	0.00	0.61	43.3			
West: C	hurch S	St												
12	R	176	5.1	1.144	336.0	LOS F	34.7	253.4	1.00	3.93	5.5			
Approac	h	176	5.1	1.144	336.0	LOS F	34.7	253.4	1.00	3.93	5.5			
All Vehic	cles	1479	3.2	1.144	45.9	NA	34.7	253.4	0.12	1.03	23.7			

Level of Service (LOS) Method: Delay (RTA NSW).

Vehicle movement LOS values are based on average delay per movement

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: 6.0 Railway St/Mark St AM

Railway St/Mark St Giveway / Yield (Two-Way)

Movem	ent Pe	erformance	- Vehic	cles							
Mov ID	Turn	Demand Flow	HV [Deg. Satn	Average Delay	Level of Service	95% Back Vehicles	of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: N	lark St										
3	R	545	1.9	0.375	6.4	LOS A	2.2	15.6	0.41	0.58	42.5
Approac	h	545	1.9	0.375	6.4	NA	2.2	15.6	0.41	0.58	42.5
East: Ra	ilway S	t									
4	L	74	4.1	0.041	6.5	LOS A	0.0	0.0	0.00	0.61	43.3
Approac	h	74	4.1	0.041	6.5	LOS A	0.0	0.0	0.00	0.61	43.3
North Ea	ist: Rai	lway St									
24	L	202	5.5	0.113	6.0	LOS A	0.0	0.0	0.00	0.58	43.8
Approac	h	202	5.5	0.113	6.0	NA	0.0	0.0	0.00	0.58	43.8
North We	est: Ra	ilway St									
27	L	168	3.8	0.225	10.1	LOS A	1.6	12.0	0.38	0.34	40.2
29	R	69	9.9	0.225	15.2	LOS B	1.6	12.0	0.73	0.93	36.9
Approac	h	237	5.6	0.225	11.6	LOS A	1.6	12.0	0.48	0.51	39.2
All Vehic	les	1058	3.5	0.375	7.5	NA	2.2	15.6	0.32	0.57	42.0

Level of Service (LOS) Method: Delay (RTA NSW).

Vehicle movement LOS values are based on average delay per movement

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

Site: 7.0A Mark St/Taylor St AM

Mark St/Marsden-Taylor St Giveway / Yield (Two-Way)

Movem	ovement Performance - Vehicles														
Mov ID	Turn	Demand Flow	HV C	eg. Satn	Average Delay	Level of Service	95% Back Vehicles	of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed				
		veh/h	%	v/c	sec		veh	m		per veh	km/h				
South: N	/lark St														
1	L	9	0.0	0.278	6.4	LOS A	0.0	0.0	0.00	0.91	43.3				
2	Т	526	1.7	0.278	0.0	LOS A	0.0	0.0	0.00	0.00	50.0				
Approac	h	535	1.7	0.278	0.1	NA	0.0	0.0	0.00	0.02	49.9				
North: N	lark St														
8	Т	220	5.5	0.200	3.1	LOS A	1.5	11.1	0.60	0.00	42.7				
9	R	78	5.1	0.200	10.5	LOS A	1.5	11.1	0.60	0.94	41.3				
Approac	:h	298	5.4	0.200	5.1	NA	1.5	11.1	0.60	0.25	42.3				
All Vehic	cles	833	3.0	0.278	1.9	NA	1.5	11.1	0.21	0.10	46.9				

Level of Service (LOS) Method: Delay (RTA NSW).

Vehicle movement LOS values are based on average delay per movement

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: 7.0B Mark St/Taylor St AM

Mark St/Marsden-Taylor St Giveway / Yield (Two-Way)

Movem	ient Pe	erformance	- Veh	icles							
Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back Vehicles	of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: N	lark St										
2	Т	535	1.7	0.281	1.0	LOS A	2.1	14.8	0.43	0.00	45.0
3	R	5	0.0	0.281	7.8	LOS A	2.1	14.8	0.43	0.87	43.1
Approac	:h	540	1.7	0.281	1.1	NA	2.1	14.8	0.43	0.01	45.0
East: Ma	arsden S	St									
4	L	5	0.0	0.024	11.0	LOS A	0.1	0.5	0.45	0.59	39.4
6	R	7	0.0	0.024	11.4	LOS A	0.1	0.5	0.45	0.79	39.3
Approac	h	12	0.0	0.024	11.2	LOS A	0.1	0.5	0.45	0.71	39.3
North: N	lark St										
7	L	5	0.0	0.117	6.4	LOS A	0.0	0.0	0.00	0.91	43.3
8	Т	215	5.6	0.117	0.0	LOS A	0.0	0.0	0.00	0.00	50.0
Approac	h	220	5.5	0.117	0.1	NA	0.0	0.0	0.00	0.02	49.8
All Vehic	les	772	2.7	0.281	1.0	NA	2.1	14.8	0.30	0.02	46.2

Level of Service (LOS) Method: Delay (RTA NSW).

Vehicle movement LOS values are based on average delay per movement

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

Appendix J: Detailed SIDRA Modelling Outputs for Key Intersections – PM Peak of Future Operations (as per previous rezoning proposal) of Key Intersections (based on uncalibrated SIDRA models, using Hyder Future Scenario traffic volume figures)

MOVEMENT SUMMARY

Site: 1.0 James St/Mark St PM

James St/Mark St Roundabout

Movem	ent Pe	rformance	- Vehi	icles							
Mov ID	Turn	Demand Flow	ΗV	Deg. Satn	Average Delay	Level of Service	95% Back Vehicles	of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
East: Ja	mes St										
5	Т	297	3.0	0.473	9.9	LOS A	3.5	25.0	0.77	0.84	40.3
6	R	59	1.7	0.473	13.7	LOS A	3.5	25.0	0.77	0.92	38.4
Approac	h	356	2.8	0.473	10.5	LOS A	3.5	25.0	0.77	0.86	39.9
North: M	lark St										
7	L	53	0.0	0.510	8.2	LOS A	3.8	26.6	0.60	0.67	41.2
9	R	476	0.9	0.510	11.0	LOS A	3.8	26.6	0.60	0.73	39.7
Approac	h	529	0.8	0.510	10.7	LOS A	3.8	26.6	0.60	0.73	39.9
West: Ja	mes St										
10	L	221	1.4	0.349	6.6	LOS A	2.6	18.0	0.29	0.58	42.6
11	Т	231	0.4	0.349	5.6	LOS A	2.6	18.0	0.29	0.48	43.0
12	R	3	0.0	0.349	10.7	LOS A	2.6	18.0	0.29	0.76	40.1
Approac	h	455	0.9	0.349	6.2	LOS A	2.6	18.0	0.29	0.53	42.8
All Vehic	les	1340	1.4	0.510	9.1	LOS A	3.8	26.6	0.54	0.70	40.8

Level of Service (LOS) Method: Delay (RTA NSW).

Vehicle movement LOS values are based on average delay per movement

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: 2.0 James St/East St PM

James St/East St Roundabout

Moven	nent Pe	erformance	- Vehic	les							
Mov ID	Turn	Demand Flow	HV D	eg. Satn	Average Delay	Level of Service	95% Back Vehicles	of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: E	East St										
1	L	69	4.3	0.620	9.8	LOS A	6.2	44.2	0.78	0.80	41.0
2	Т	507	2.4	0.620	8.8	LOS A	6.2	44.2	0.78	0.76	41.1
3	R	2	0.0	0.620	13.8	LOS A	6.2	44.2	0.78	0.85	38.5
Approac	ch	578	2.6	0.620	8.9	LOS A	6.2	44.2	0.78	0.77	41.0
North: E	ast St										
8	Т	1061	2.7	0.997	19.5	LOS B	62.5	447.6	1.00	0.65	33.9
9	R	268	2.6	0.997	23.1	LOS B	62.5	447.6	1.00	0.65	32.9
Approad	ch	1329	2.7	0.997	20.2	LOS B	62.5	447.6	1.00	0.65	33.7
West: Ja	ames St										
10	L	200	0.5	0.387	10.1	LOS A	2.6	18.4	0.77	0.83	40.1
12	R	81	0.0	0.387	12.9	LOS A	2.6	18.4	0.77	0.87	38.5
Approac	h	281	0.4	0.387	10.9	LOS A	2.6	18.4	0.77	0.84	39.6
All Vehi	cles	2188	2.4	0.997	16.0	LOS B	62.5	447.6	0.91	0.71	36.1

Level of Service (LOS) Method: Delay (RTA NSW).

Vehicle movement LOS values are based on average delay per movement Intersection and Approach LOS values are based on average delay for all vehicle movements. Roundabout Capacity Model: SIDRA Standard. SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: 3.0 Railway St/East St PM

Railway St/East St Roundabout

Moverr	lovement Performance - Vehicles													
Mov ID	Turn	Demand Flow	HV C	Deg. Satn	Average Delay	Level of Service	95% Back Vehicles	of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed			
		veh/h	%	v/c	sec		veh	m		per veh	km/h			
South: E	East St													
1	L	201	4.5	0.885	22.9	LOS B	18.8	133.6	1.00	1.21	32.1			
3	R	534	0.9	0.885	25.2	LOS B	18.8	133.6	1.00	1.20	31.3			
Approac	ch	735	1.9	0.885	24.5	LOS B	18.8	133.6	1.00	1.21	31.5			
East: Ra	ailway S	t												
4	L	774	3.1	1.228	432.6	LOS F	197.4	1418.7	1.00	8.85	4.4			
5	Т	384	1.8	0.587	12.6	LOS A	5.4	38.4	0.89	0.99	38.4			
6	R	2	0.0	0.587	17.3	LOS B	5.4	38.4	0.89	1.03	36.3			
Approac	ch	1160	2.7	1.228	292.8	LOS F	197.4	1418.7	0.96	6.24	6.2			
West: R	ailway S	St												
11	Т	174	1.1	1.026	104.9	LOS F	58.8	417.7	1.00	3.00	14.0			
12	R	519	2.1	1.026	108.4	LOS F	58.8	417.7	1.00	3.00	14.0			
Approac	ch	693	1.8	1.026	107.6	LOS F	58.8	417.7	1.00	3.00	14.0			
All Vehi	cles	2588	2.2	1.228	167.0	LOS F	197.4	1418.7	0.98	3.94	10.0			

Level of Service (LOS) Method: Delay (RTA NSW).

Vehicle movement LOS values are based on average delay per movement

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: 4.0 Railway St/Bridge PM

Railway St/Bridge Giveway / Yield (Two-Way)

Movem	nent Po	erformance	e - Veh	icles							
Mov ID	Turn	Demand Flow	ΗV	Deg. Satn	Average Delay	Level of Service	95% Back Vehicles	of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
East: Ra	ailway S	St									
6	R	367	2.7	1.890	1639.9	LOS F	223.0	1597.2	1.00	12.03	1.2
Approac	;h	367	2.7	1.890	1639.9	LOS F	223.0	1597.2	1.00	12.03	1.2
North: B	ridge										
7	L	540	1.9	0.539	6.5	LOS A	0.0	0.0	0.00	0.60	43.3
9	R	450	0.9	0.539	6.8	LOS A	0.0	0.0	0.00	0.67	43.0
Approac	:h	990	1.4	0.539	6.6	NA	0.0	0.0	0.00	0.63	43.1
West: R	ailway S	St									
10	L	360	1.9	0.196	6.5	LOS A	0.0	0.0	0.00	0.61	43.3
Approac	:h	360	1.9	0.196	6.5	NA	0.0	0.0	0.00	0.61	43.3
All Vehic	cles	1717	1.8	1.890	355.7	NA	223.0	1597.2	0.21	3.06	5.2

Level of Service (LOS) Method: Delay (RTA NSW).

Vehicle movement LOS values are based on average delay per movement

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

Site: 5.0 Church St/Bridge PM

Church St/Bridge Giveway / Yield (Two-Way)

Movem	ent P	erformance	- Vehi	icles							
Mov ID	Turn	Demand Flow	ΗV	Deg. Satn	Average Delay	Level of Service	95% Back Vehicles	of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: E	Bridge										
1	L	420	2.4	0.398	6.5	LOS A	0.0	0.0	0.00	0.60	43.3
3	R	307	2.3	0.398	6.8	LOS A	0.0	0.0	0.00	0.67	43.0
Approach		727	2.4	0.398	6.6	NA	0.0	0.0	0.00	0.63	43.2
East: Ch	nurch S	t									
4	L	747	0.9	0.405	6.4	LOS A	0.0	0.0	0.00	0.61	43.3
Approac	:h	747	0.9	0.405	6.4	NA	0.0	0.0	0.00	0.61	43.3
West: C	hurch S	St									
12	R	246	2.8	1.200	413.8	LOS F	58.7	420.9	1.00	5.50	4.5
Approac	h	246	2.8	1.200	413.8	LOS F	58.7	420.9	1.00	5.50	4.5
All Vehic	cles	1720	1.8	1.200	64.8	NA	58.7	420.9	0.14	1.32	19.5

Level of Service (LOS) Method: Delay (RTA NSW).

Vehicle movement LOS values are based on average delay per movement

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: 6.0 Railway St/Mark St PM

Railway St/Mark St Giveway / Yield (Two-Way)

Moven	nent P	erformance	- Vehic	cles							
Mov ID	Turn	Demand	HV C	Deg. Satn	Average	Level of	95% Back	of Queue	Prop.	Effective	Average
		Flow			Delay	Service	Vehicles	Distance	Queued	Stop Rate	Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: N	Aark St										
3	R	245	1.7	0.218	7.5	LOS A	1.0	7.2	0.52	0.70	42.0
Approac	h	245	1.7	0.218	7.5	NA	1.0	7.2	0.52	0.70	42.0
East: Ra	ailway S	St									
4	L	127	0.8	0.069	6.4	LOS A	0.0	0.0	0.00	0.61	43.3
Approad	h	127	0.8	0.069	6.4	LOS A	0.0	0.0	0.00	0.61	43.3
North Ea	ast: Ra	ilway St									
24	L	448	0.4	0.242	5.8	LOS A	0.0	0.0	0.00	0.58	43.8
Approad	ch	448	0.4	0.242	5.8	NA	0.0	0.0	0.00	0.58	43.8
North W	est: Ra	ailway St									
27	L	150	2.0	0.162	7.8	LOS A	1.0	7.5	0.31	0.37	42.0
29	R	65	10.0	0.162	10.2	LOS A	1.0	7.5	0.51	0.78	40.4
Approac	h	215	4.4	0.162	8.5	LOS A	1.0	7.5	0.37	0.50	41.5
All Vehi	cles	1035	1.6	0.242	6.9	NA	1.0	7.5	0.20	0.59	42.8

Level of Service (LOS) Method: Delay (RTA NSW).

Vehicle movement LOS values are based on average delay per movement

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

Site: 7.0A Mark St/Taylor St PM

Mark St/Marsden-Taylor St Giveway / Yield (Two-Way)

Movem	ovement Performance - Vehicles														
Mov ID	Turn	Demand Flow	HV D	eg. Satn	Average Delay	Level of Service	95% Back Vehicles	of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed				
		veh/h	%	v/c	sec		veh	m		per veh	km/h				
South: N	/lark St														
1	L	23	0.0	0.138	6.4	LOS A	0.0	0.0	0.00	0.88	43.3				
2	Т	241	3.1	0.138	0.0	LOS A	0.0	0.0	0.00	0.00	50.0				
Approac	h	264	2.8	0.138	0.6	NA	0.0	0.0	0.00	0.08	49.3				
North: M	lark St														
8	Т	535	3.1	0.371	1.4	LOS A	2.9	21.1	0.50	0.00	43.8				
9	R	127	0.0	0.371	8.6	LOS A	2.9	21.1	0.50	0.86	42.6				
Approac	:h	662	2.5	0.371	2.8	NA	2.9	21.1	0.50	0.17	43.6				
All Vehic	cles	926	2.6	0.371	2.2	NA	2.9	21.1	0.36	0.14	45.1				

Level of Service (LOS) Method: Delay (RTA NSW).

Vehicle movement LOS values are based on average delay per movement

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: 7.0B Mark St/Taylor St

ΡM

Mark St/Marsden-Taylor St Giveway / Yield (Two-Way)

Moverr	nent Pe	erformance	e - Vehic	cles							
Mov ID	Turn	Demand	HV C	Deg. Satn	Average	Level of	95% Back	of Queue	Prop.	Effective	Average
		Flow			Delay	Service	Vehicles	Distance	Queued	Stop Rate	Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: N	Aark St										
2	Т	264	3.2	0.145	2.7	LOS A	1.2	8.8	0.59	0.00	43.3
3	R	7	0.0	0.145	9.5	LOS A	1.2	8.8	0.59	0.94	42.5
Approac	ch	271	3.1	0.145	2.9	NA	1.2	8.8	0.59	0.02	43.3
East: Ma	arsden \$	St									
4	L	2	0.0	0.015	12.8	LOS A	0.0	0.3	0.62	0.72	38.1
6	R	4	0.0	0.015	13.1	LOS A	0.0	0.3	0.62	0.82	38.0
Approac	ch	6	0.0	0.015	13.0	LOS A	0.0	0.3	0.62	0.78	38.0
North: N	lark St										
7	L	7	0.0	0.284	6.4	LOS A	0.0	0.0	0.00	0.92	43.3
8	Т	535	3.2	0.284	0.0	LOS A	0.0	0.0	0.00	0.00	50.0
Approac	ch	542	3.2	0.284	0.1	NA	0.0	0.0	0.00	0.01	49.9
All Vehi	cles	819	3.1	0.284	1.1	NA	1.2	8.8	0.20	0.02	47.4

Level of Service (LOS) Method: Delay (RTA NSW).

Vehicle movement LOS values are based on average delay per movement

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

Appendix K: Detailed SIDRA Modelling Outputs for Key Intersections – PM Peak of Future Operations (as per Subject Proposal) of Key Intersections (based on uncalibrated SIDRA models) for each Access Option Considered

Access Option 1

MOVEMENT SUMMARY

Site: 1.0 James St/Mark St PM

James St/Mark St Roundabout

Movem	ient Pe	rformance	- Vehi	cles							
Mov ID	Turn	Demand Flow	ΗV	Deg. Satn	Average Delay	Level of Service	95% Back Vehicles	of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
East: Ja	mes St										
5	Т	294	3.0	0.475	10.0	LOS A	3.5	25.3	0.78	0.85	40.2
6	R	59	1.7	0.475	13.8	LOS A	3.5	25.3	0.78	0.93	38.3
Approac	h	353	2.8	0.475	10.7	LOS A	3.5	25.3	0.78	0.86	39.8
North: N	lark St										
7	L	67	0.0	0.534	8.3	LOS A	4.1	28.6	0.62	0.68	41.2
9	R	485	0.9	0.534	11.1	LOS A	4.1	28.6	0.62	0.74	39.6
Approac	h	552	0.8	0.534	10.8	LOS A	4.1	28.6	0.62	0.73	39.8
West: Ja	ames St										
10	L	221	1.4	0.353	6.6	LOS A	2.6	18.3	0.29	0.58	42.6
11	Т	237	0.4	0.353	5.6	LOS A	2.6	18.3	0.29	0.48	43.0
12	R	3	0.0	0.353	10.7	LOS A	2.6	18.3	0.29	0.76	40.1
Approac	h	461	0.9	0.353	6.2	LOS A	2.6	18.3	0.29	0.53	42.8
All Vehic	cles	1366	1.3	0.534	9.2	LOS A	4.1	28.6	0.55	0.70	40.8

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

MOVEMENT SUMMARY

Site: 2.0 James St/East St PM

James St/East St Roundabout

Movem	ent Pe	erformance	- Vehi	cles							
Mov ID	Turn	Demand Flow	ΗV	Deg. Satn	Average Delay	Level of Service	95% Back Vehicles	of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: E	ast St										
1	L	69	4.3	0.622	9.7	LOS A	6.2	44.4	0.78	0.79	41.1
2	Т	515	2.4	0.622	8.7	LOS A	6.2	44.4	0.78	0.76	41.1
3	R	2	0.0	0.622	13.6	LOS A	6.2	44.4	0.78	0.85	38.6
Approac	h	586	2.6	0.622	8.8	LOS A	6.2	44.4	0.78	0.76	41.1
North: Ea	ast St										
8	Т	1057	2.7	1.018	47.8	LOS D	82.2	588.4	1.00	1.01	23.1
9	R	265	2.6	1.018	51.5	LOS D	82.2	588.4	1.00	1.01	22.8
Approac	h	1322	2.7	1.018	48.6	LOS D	82.2	588.4	1.00	1.01	23.1
West: Ja	mes St	t									
10	L	206	0.5	0.418	10.4	LOS A	2.9	20.4	0.79	0.85	39.9
12	R	95	0.0	0.418	13.1	LOS A	2.9	20.4	0.79	0.88	38.3
Approac	h	301	0.3	0.418	11.2	LOS A	2.9	20.4	0.79	0.86	39.4
All Vehic	les	2209	2.3	1.018	32.9	LOS C	82.2	588.4	0.91	0.93	27.9

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

MOVEMENT SUMMARY

Site: 3.0 Railway St/East St PM

Railway St/East St Roundabout

Moven	vement Performance - Vehicles													
Mov ID	Turn	Demand Flow	HV [Deg. Satn	Average Delay	Level of Service	95% Back Vehicles	of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed			
		veh/h	%	v/c	sec		veh	m		per veh	km/h			
South: E	ast St													
1	L	212	4.5	0.926	30.7	LOS C	24.5	174.3	1.00	1.41	28.6			
3	R	531	0.9	0.926	33.0	LOS C	24.5	174.3	1.00	1.40	28.1			
Approac	h	743	1.9	0.926	32.3	LOS C	24.5	174.3	1.00	1.41	28.2			
East: Railway St		St												
4	L	773	3.1	1.214	407.1	LOS F	188.2	1352.6	1.00	8.51	4.6			
5	Т	399	1.8	0.608	13.0	LOS A	5.8	41.1	0.91	1.01	38.1			
6	R	2	0.0	0.608	17.7	LOS B	5.8	41.1	0.91	1.05	36.0			
Approac	h	1174	2.7	1.214	272.5	LOS F	188.2	1352.6	0.97	5.95	6.6			
West: R	ailway \$	St												
11	Т	174	1.1	1.041	124.0	LOS F	68.1	484.4	1.00	3.34	12.4			
12	R	533	2.0	1.041	127.5	LOS F	68.1	484.4	1.00	3.34	12.4			
Approac	h	707	1.8	1.041	126.7	LOS F	68.1	484.4	1.00	3.34	12.4			
All Vehi	cles	2624	2.2	1.214	165.2	LOS F	188.2	1352.6	0.99	3.96	10.1			

Level of Service (LOS) Method: Delay (RTA NSW).

Vehicle movement LOS values are based on average delay per movement

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: 4.0 Railway St/Bridge PM

Railway St/Bridge Giveway / Yield (Two-Way)

Moven	ovement Performance - Vehicles														
Mov ID	Turn	Demand Flow	HV I	Deg. Satn	Average Delay	Level of Service	95% Back Vehicles	of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed				
		veh/h	%	v/c	sec		veh	m		per veh	km/h				
East: Ra	ailway S	St													
6	R	383	2.7	1.999	1836.1	LOS F	246.4	1764.8	1.00	12.56	1.1				
Approach		383	2.7	1.999	1836.1	LOS F	246.4	1764.8	1.00	12.56	1.1				
North: Bridge															
7	L	553	1.9	0.546	6.5	LOS A	0.0	0.0	0.00	0.60	43.3				
9	R	450	0.9	0.546	6.8	LOS A	0.0	0.0	0.00	0.67	43.0				
Approac	ch	1003	1.5	0.546	6.6	NA	0.0	0.0	0.00	0.63	43.2				
West: R	ailway	St													
10	L	360	1.9	0.196	6.5	LOS A	0.0	0.0	0.00	0.61	43.3				
Approac	ch	360	1.9	0.196	6.5	NA	0.0	0.0	0.00	0.61	43.3				
All Vehi	cles	1746	1.8	1.999	407.9	NA	246.4	1764.8	0.22	3.24	4.6				

Level of Service (LOS) Method: Delay (RTA NSW).

Vehicle movement LOS values are based on average delay per movement

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements. SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: 5.0 Church St/Bridge PM

Church St/Bridge Giveway / Yield (Two-Way)

Movem	ent P	erformance	e - Veh	icles							
Mov ID	Turn	Demand Flow	ΗV	Deg. Satn	Average Delay	Level of Service	95% Back Vehicles	of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: E	Bridge										
1	L	424	2.4	0.406	6.5	LOS A	0.0	0.0	0.00	0.60	43.3
3	R	318	2.3	0.406	6.8	LOS A	0.0	0.0	0.00	0.67	43.0
Approach		742	2.4	0.406	6.6	NA	0.0	0.0	0.00	0.63	43.2
East: Ch	nurch S	st									
4	L	760	0.9	0.412	6.4	LOS A	0.0	0.0	0.00	0.61	43.3
Approac	h	760	0.9	0.412	6.4	NA	0.0	0.0	0.00	0.61	43.3
West: C	hurch S	St									
12	R	252	2.8	1.291	573.1	LOS F	77.8	557.7	1.00	6.58	3.4
Approac	h	252	2.8	1.291	573.1	LOS F	77.8	557.7	1.00	6.58	3.4
All Vehic	cles	1754	1.8	1.291	87.9	NA	77.8	557.7	0.14	1.48	16.0

Level of Service (LOS) Method: Delay (RTA NSW).

Vehicle movement LOS values are based on average delay per movement

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: 6.0 Railway St/Mark St PM

Railway St/Mark St Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand	HV [Deg. Satn	Average	Level of	95% Back	of Queue	Prop.	Effective	Average
		Flow			Delay	Service	Vehicles	Distance	Queued	Stop Rate	Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: N	Aark St										
3	R	245	1.7	0.218	7.5	LOS A	1.0	7.2	0.52	0.70	42.0
Approad	ch	245	1.7	0.218	7.5	NA	1.0	7.2	0.52	0.70	42.0
East: Ra	ailway S	t									
4	L	152	0.8	0.082	6.4	LOS A	0.0	0.0	0.00	0.61	43.3
Approad	ch	152	0.8	0.082	6.4	LOS A	0.0	0.0	0.00	0.61	43.3
North Ea	ast: Rail	way St									
24	L	448	0.4	0.242	5.8	LOS A	0.0	0.0	0.00	0.58	43.8
Approad	ch	448	0.4	0.242	5.8	NA	0.0	0.0	0.00	0.58	43.8
North W	est: Rai	ilway St									
27	L	150	2.0	0.167	8.0	LOS A	1.1	7.7	0.31	0.37	41.9
29	R	66	10.0	0.167	10.6	LOS A	1.1	7.7	0.53	0.79	40.2
Approad	ch	216	4.4	0.167	8.8	LOS A	1.1	7.7	0.38	0.50	41.3
All Vehi	cles	1061	1.6	0.242	6.9	NA	1.1	7.7	0.20	0.59	42.8

Level of Service (LOS) Method: Delay (RTA NSW).

Vehicle movement LOS values are based on average delay per movement

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

Site: 7.0A Mark St/Taylor St PM

Mark St/Marsden-Taylor St Giveway / Yield (Two-Way)

Movem	Novement Performance - Vehicles														
Mov ID	Turn	Demand Flow	HV D	eg. Satn	Average Delay	Level of Service	95% Back Vehicles	of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed				
		veh/h	%	v/c	sec		veh	m		per veh	km/h				
South: N	Aark St														
1	L	23	0.0	0.138	6.4	LOS A	0.0	0.0	0.00	0.88	43.3				
2	Т	241	3.1	0.138	0.0	LOS A	0.0	0.0	0.00	0.00	50.0				
Approac	ch	264	2.8	0.138	0.6	NA	0.0	0.0	0.00	0.08	49.3				
North: N	lark St														
8	Т	566	3.1	0.388	1.5	LOS A	3.2	22.7	0.52	0.00	43.7				
9	R	129	0.0	0.388	8.7	LOS A	3.2	22.7	0.52	0.86	42.6				
Approac	ch	695	2.5	0.388	2.8	NA	3.2	22.7	0.52	0.16	43.5				
All Vehi	cles	959	2.6	0.388	2.2	NA	3.2	22.7	0.37	0.14	45.0				

Level of Service (LOS) Method: Delay (RTA NSW).

Vehicle movement LOS values are based on average delay per movement

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: 7.0B Mark St/Taylor St

PM

Mark St/Marsden-Taylor St Giveway / Yield (Two-Way)

Moverr	nent Pe	erformance	e - Vehic	cles							
Mov ID	Turn	Demand	HV C	Deg. Satn	Average	Level of	95% Back	of Queue	Prop.	Effective	Average
		Flow			Delay	Service	Vehicles	Distance	Queued	Stop Rate	Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: N	Aark St										
2	Т	264	3.2	0.145	2.9	LOS A	1.3	9.0	0.61	0.00	43.2
3	R	7	0.0	0.145	9.7	LOS A	1.3	9.0	0.61	0.95	42.3
Approac	ch	271	3.1	0.145	3.1	NA	1.3	9.0	0.61	0.02	43.1
East: Ma	arsden \$	St									
4	L	2	0.0	0.016	13.2	LOS A	0.0	0.3	0.63	0.73	37.8
6	R	4	0.0	0.016	13.5	LOS A	0.0	0.3	0.63	0.83	37.7
Approac	ch	6	0.0	0.016	13.4	LOS A	0.0	0.3	0.63	0.80	37.8
North: N	lark St										
7	L	7	0.0	0.296	6.4	LOS A	0.0	0.0	0.00	0.92	43.3
8	Т	559	3.2	0.296	0.0	LOS A	0.0	0.0	0.00	0.00	50.0
Approac	ch	566	3.2	0.296	0.1	NA	0.0	0.0	0.00	0.01	49.9
All Vehi	cles	843	3.1	0.296	1.1	NA	1.3	9.0	0.20	0.02	47.4

Level of Service (LOS) Method: Delay (RTA NSW).

Vehicle movement LOS values are based on average delay per movement

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

Access Option 2

MOVEMENT SUMMARY

Site: 1.0 James St/Mark St PM

James St/Mark St Roundabout

Moven	ovement Performance - Vehicles													
Mov ID	Turn	Demand Flow	HV D	eg. Satn	Average Delay	Level of Service	95% Back Vehicles	of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed			
		veh/h	%	v/c	sec		veh	m		per veh	km/h			
East: Ja	ames St													
5	Т	302	3.0	0.481	10.0	LOS A	3.6	25.8	0.78	0.85	40.2			
6	R	59	1.7	0.481	13.8	LOS A	3.6	25.8	0.78	0.93	38.3			
Approa	ch	361	2.8	0.481	10.6	LOS A	3.6	25.8	0.78	0.86	39.8			
North: Mark St														
7	L	55	3.6	0.520	8.5	LOS A	3.9	27.5	0.61	0.69	41.2			
9	R	477	1.0	0.520	11.1	LOS A	3.9	27.5	0.61	0.74	39.6			
Approa	ch	532	1.3	0.520	10.8	LOS A	3.9	27.5	0.61	0.73	39.8			
West: J	ames St													
10	L	221	1.4	0.354	6.6	LOS A	2.6	18.4	0.29	0.58	42.6			
11	Т	237	0.8	0.354	5.7	LOS A	2.6	18.4	0.29	0.48	43.0			
12	R	3	0.0	0.354	10.7	LOS A	2.6	18.4	0.29	0.76	40.1			
Approa	ch	461	1.1	0.354	6.2	LOS A	2.6	18.4	0.29	0.53	42.8			
All Vehi	cles	1354	1.6	0.520	9.2	LOS A	3.9	27.5	0.55	0.70	40.8			

Level of Service (LOS) Method: Delay (RTA NSW).

Vehicle movement LOS values are based on average delay per movement

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: 2.0 James St/East St PM

James St/East St Roundabout

Movement Performance - Vehicles													
Mov ID	Turn	Demand	HV D	eg. Satn	Average	Level of	95% Back	of Queue	Prop.	Effective	Average		
		Flow			Delay	Service	Vehicles	Distance	Queued	Stop Rate	Speed		
		veh/h	%	v/c	sec		veh	m		per veh	km/h		
South: E	East St												
1	L	69	4.3	0.647	10.6	LOS A	6.9	49.2	0.82	0.84	40.4		
2	Т	515	2.5	0.647	9.6	LOS A	6.9	49.2	0.82	0.81	40.6		
3	R	2	0.0	0.647	14.5	LOS B	6.9	49.2	0.82	0.89	38.0		
Approach		586	2.7	0.647	9.7	LOS A	6.9	49.2	0.82	0.82	40.5		
North: East St													
8	Т	1069	2.7	1.032	71.2	LOS F	109.2	781.1	1.00	1.18	18.3		
9	R	299	2.3	1.032	75.0	LOS F	109.2	781.1	1.00	1.18	18.2		
Approad	ch	1368	2.6	1.032	72.1	LOS F	109.2	781.1	1.00	1.18	18.3		
West: Ja	ames St												
10	L	206	1.0	0.420	10.8	LOS A	2.9	20.9	0.80	0.87	39.6		
12	R	83	2.4	0.420	13.6	LOS A	2.9	20.9	0.80	0.90	38.0		
Approad	ch	289	1.4	0.420	11.6	LOS A	2.9	20.9	0.80	0.88	39.1		
All Vehi	cles	2243	2.5	1.032	48.0	LOS D	109.2	781.1	0.93	1.05	23.2		

Level of Service (LOS) Method: Delay (RTA NSW).

Vehicle movement LOS values are based on average delay per movement

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

Site: 3.0 Railway St/East St PM

Railway St/East St Roundabout

Moven	ovement Performance - Vehicles													
Mov ID	Turn	Demand Flow	HV D	eg. Satn	Average Delay	Level of Service	95% Back Vehicles	of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed			
		veh/h	%	v/c	sec		veh	m		per veh	km/h			
South: E	East St													
1	L	209	4.8	0.926	29.4	LOS C	24.7	176.0	1.00	1.37	29.2			
3	R	558	0.9	0.926	31.7	LOS C	24.7	176.0	1.00	1.35	28.6			
Approad	ch	767	1.9	0.926	31.0	LOS C	24.7	176.0	1.00	1.36	28.7			
East: Railway St		St												
4	L	787	3.0	1.250	471.5	LOS F	214.2	1538.5	1.00	9.44	4.0			
5	Т	385	2.1	0.595	12.9	LOS A	5.5	39.3	0.89	1.01	38.1			
6	R	2	0.0	0.595	17.6	LOS B	5.5	39.3	0.89	1.04	36.1			
Approad	ch	1174	2.7	1.250	320.4	LOS F	214.2	1538.5	0.97	6.66	5.7			
West: R	ailway S	St												
11	Т	174	1.1	1.082	187.4	LOS F	93.8	667.9	1.00	4.41	9.0			
12	R	533	2.2	1.082	190.9	LOS F	93.8	667.9	1.00	4.41	9.0			
Approad	ch	707	1.9	1.082	190.0	LOS F	93.8	667.9	1.00	4.41	9.0			
All Vehi	cles	2648	2.3	1.250	201.8	LOS F	214.2	1538.5	0.98	4.52	8.6			

Level of Service (LOS) Method: Delay (RTA NSW).

Vehicle movement LOS values are based on average delay per movement

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: 4.0 Railway St/Bridge PM

Railway St/Bridge Giveway / Yield (Two-Way)

Movem	lovement Performance - Vehicles /ov ID Turn Demand HV Deg Sath Average Level of 95% Back of Queue Prop Effective Average														
Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back Vehicles	of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed				
		veh/h	%	v/c	sec		veh	m		per veh	km/h				
East: Ra	ailway S	St													
6	R	375	3.2	1.986	1811.6	LOS F	239.7	1724.3	1.00	12.36	1.1				
Approac	:h	375	3.2	1.986	1811.6	LOS F	239.7	1724.3	1.00	12.36	1.1				
North: B	ridge														
7	L	553	2.0	0.546	6.5	LOS A	0.0	0.0	0.00	0.60	43.3				
9	R	450	0.9	0.546	6.8	LOS A	0.0	0.0	0.00	0.67	43.0				
Approac	:h	1003	1.5	0.546	6.6	NA	0.0	0.0	0.00	0.63	43.2				
West: R	ailway	St													
10	L	360	1.9	0.196	6.5	LOS A	0.0	0.0	0.00	0.61	43.3				
Approac	:h	360	1.9	0.196	6.5	NA	0.0	0.0	0.00	0.61	43.3				
All Vehic	cles	1738	1.9	1.986	396.0	NA	239.7	1724.3	0.22	3.16	4.7				

Level of Service (LOS) Method: Delay (RTA NSW).

Vehicle movement LOS values are based on average delay per movement

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

Site: 5.0 Church St/Bridge PM

Church St/Bridge Giveway / Yield (Two-Way)

Movem	lovement Performance - Vehicles														
Mov ID	Turn	Demand Flow	ΗV	Deg. Satn	Average Delay	Level of Service	95% Back Vehicles	of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed				
		veh/h	%	v/c	sec		veh	m		per veh	km/h				
South: E	Bridge														
1	L	424	2.6	0.403	6.5	LOS A	0.0	0.0	0.00	0.60	43.3				
3	R	311	2.9	0.403	6.8	LOS A	0.0	0.0	0.00	0.67	43.0				
Approach		735	2.7	0.403	6.6	NA	0.0	0.0	0.00	0.63	43.2				
East: Ch	nurch S	t													
4	L	760	1.1	0.412	6.4	LOS A	0.0	0.0	0.00	0.61	43.3				
Approac	:h	760	1.1	0.412	6.4	NA	0.0	0.0	0.00	0.61	43.3				
West: C	hurch S	St													
12	R	252	2.7	1.278	549.8	LOS F	75.4	540.0	1.00	6.45	3.5				
Approac	h	252	2.7	1.278	549.8	LOS F	75.4	540.0	1.00	6.45	3.5				
All Vehic	cles	1747	2.0	1.278	84.9	NA	75.4	540.0	0.14	1.46	16.4				

Level of Service (LOS) Method: Delay (RTA NSW).

Vehicle movement LOS values are based on average delay per movement

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: 6.0 Railway St/Mark St PM

Railway St/Mark St Giveway / Yield (Two-Way)

Mover	nent P	erformance	- Veh	icles							
Mov ID	Turn	Demand Flow	ΗV	Deg. Satn	Average Delay	Level of Service	95% Back Vehicles	of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: N	/lark St										
3	R	245	1.7	0.218	7.5	LOS A	1.0	7.2	0.52	0.70	42.0
Approac	:h	245	1.7	0.218	7.5	NA	1.0	7.2	0.52	0.70	42.0
East: Ra	ailway S	St									
4	L	132	3.8	0.073	6.5	LOS A	0.0	0.0	0.00	0.61	43.3
Approac	h	132	3.8	0.073	6.5	LOS A	0.0	0.0	0.00	0.61	43.3
North Ea	ast: Ra	ilway St									
24	L	448	0.4	0.242	5.8	LOS A	0.0	0.0	0.00	0.58	43.8
Approac	h	448	0.4	0.242	5.8	NA	0.0	0.0	0.00	0.58	43.8
North W	est: Ra	ailway St									
27	L	150	2.0	0.165	7.9	LOS A	1.0	7.6	0.31	0.37	42.0
29	R	66	9.8	0.165	10.3	LOS A	1.0	7.6	0.52	0.78	40.4
Approac	h	216	4.4	0.165	8.6	LOS A	1.0	7.6	0.37	0.50	41.5
All Vehi	cles	1041	2.0	0.242	6.9	NA	1.0	7.6	0.20	0.59	42.8

Level of Service (LOS) Method: Delay (RTA NSW).

Vehicle movement LOS values are based on average delay per movement

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

Site: 7.0A Mark St/Taylor St PM

Mark St/Marsden-Taylor St Giveway / Yield (Two-Way)

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow	HV Deg. Satn		Average Delay	Level of Service	95% Back of Queue Vehicles Distance		Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: N	Aark St										
1	L	23	0.0	0.138	6.4	LOS A	0.0	0.0	0.00	0.88	43.3
2	Т	241	3.1	0.138	0.0	LOS A	0.0	0.0	0.00	0.00	50.0
Approach		264	2.8	0.138	0.6	NA	0.0	0.0	0.00	0.08	49.3
North: N	lark St										
8	Т	545	3.7	0.378	1.5	LOS A	3.0	21.7	0.51	0.00	43.8
9	R	128	0.0	0.378	8.7	LOS A	3.0	21.7	0.51	0.86	42.6
Approach		673	3.0	0.378	2.8	NA	3.0	21.7	0.51	0.16	43.6
All Vehicles		937	2.9	0.378	2.2	NA	3.0	21.7	0.36	0.14	45.0

Level of Service (LOS) Method: Delay (RTA NSW).

Vehicle movement LOS values are based on average delay per movement

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: 7.0B Mark St/Taylor St

PM

Mark St/Marsden-Taylor St Giveway / Yield (Two-Way)

Movement Performance - Vehicles											
Mov ID	Turn	Demand	HV Deg. Satn		Average	Level of	95% Back of Queue		Prop.	Effective	Average
		Flow			Delay	Service	Vehicles	Distance	Queued	Stop Rate	Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: N	Mark St										
2	Т	264	3.2	0.145	2.8	LOS A	1.2	8.9	0.60	0.00	43.3
3	R	7	0.0	0.145	9.5	LOS A	1.2	8.9	0.60	0.94	42.4
Approach		271	3.1	0.145	2.9	NA	1.2	8.9	0.60	0.02	43.2
East: Ma	arsden \$	St									
4	L	2	0.0	0.015	12.9	LOS A	0.0	0.3	0.62	0.72	38.0
6	R	4	0.0	0.015	13.2	LOS A	0.0	0.3	0.62	0.82	37.9
Approach		6	0.0	0.015	13.1	LOS A	0.0	0.3	0.62	0.79	38.0
North: N	/lark St										
7	L	7	0.0	0.286	6.4	LOS A	0.0	0.0	0.00	0.92	43.3
8	Т	538	3.7	0.286	0.0	LOS A	0.0	0.0	0.00	0.00	50.0
Approach		545	3.7	0.286	0.1	NA	0.0	0.0	0.00	0.01	49.9
All Vehicles		822	3.5	0.286	1.1	NA	1.2	8.9	0.20	0.02	47.4

Level of Service (LOS) Method: Delay (RTA NSW).

Vehicle movement LOS values are based on average delay per movement

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.