



draft

Goonoo Goonoo Road
(New England Highway)
Tamworth
Transport Impact Assessment

Goonoo Goonoo Road (New England Highway), Tamworth

Transport Impact Assessment

Client: Tamworth Regional Council

Reference: JS11200

GTA Consultants Office: Brisbane

Quality Record

Issue	Date	Description	Prepared By	Checked By	Approved By
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Table of Contents

1. Introduction	1
1.1 Background	1
1.2 Purpose of this Report	1
1.3 References	1
2. Existing Conditions	2
2.1 Subject Site	2
2.2 Road Network	2
2.3 Traffic Volumes	3
2.4 Intersection Operation	3
2.5 Public Transport	4
2.6 Pedestrian Infrastructure	5
3. Rezoning Proposal	6
3.1 Land Use	6
3.2 Vehicle Access	6
4. Traffic Impact Assessment	7
4.1 Assessment Scenarios and Years	7
4.2 Traffic Generation	7
4.3 Traffic Growth Rate	8
4.4 Distribution and Assignment	8
4.5 Traffic Impact	9
5. Conclusion	13

Appendices

- A: Survey Results
- B: SIDRA INTERSECTION Results

Figures

Figure 2.1: Subject Site and Its Environs	2
Figure 2.2: Observed AM and PM Peak Hour Traffic Turning Volumes (15 Dec 2010)	3
Figure 4.1: AM and PM Peak Hour Site Generated Traffic Volumes – Stage 1	9
Figure 4.2: AM and PM Peak Hour Site Generated Traffic Volumes – Stages 1 and 2 Combined	9
Figure 4.3: Four-Leg Priority Controlled Intersection Layout (2016)	10

Figure 4.4: Proposed Dual Lane Roundabout Controlled Intersection Layout (2016 onwards)	11
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Tables

Table 2.1: SIDRA Intersection Level of Service Criteria	4
Table 2.2: Existing Operating Conditions	4
Table 2.3: Public Transport Provision	4
Table 4.1: Trip Generation Rates and Distribution	8
Table 4.2: Traffic Generation Estimates	8
Table 4.3: SIDRA Analysis Summary – Proposed Four-Leg Priority Controlled Intersection	10
Table 4.4: SIDRA Analysis Summary – Proposed Roundabout Controlled Intersection	12

1. Introduction

1.1 Background

It is understood that Tamworth Regional Council (TRC) is currently looking at a potential rezoning of approximately 29.87ha of land from Rural Small Holdings (RU₄ zone) to Business Park (B₇ zone) and Commercial Core (B₃ zone) on Goonoo Goonoo Road (also known as New England Highway) in Tamworth.

GTA Consultants (GTA) was commissioned by TRC in January 2011 to undertake a Transport Impact Assessment (TIA) for the proposed rezoning.

Specifically TRC has engaged GTA to undertake an investigation and provide recommendations on the type and form of intersection treatment required to provide access to the site.

1.2 Purpose of this Report

This report sets out an assessment of the anticipated transport implications of the proposed rezoning, including consideration of the following:

- i existing traffic conditions surrounding the site
- ii potential traffic generating characteristics of the proposed rezoning
- iii suitability of the proposed access arrangements for the site
- iv the transport impact of the development proposal on the surrounding road network.

The outcome of this investigation will be used by TRC in further discussion for developer funded works as part of the rezoning process.

1.3 References

In preparing this report, reference has been made to the following:

- Department of Transport & Regional Services, Bureau of Transport and Regional Economics (BTRE) – Demand Projections for AusLink Non-Urban Corridors: Methodology and Projections, Working Paper 66 (February 2006).
- 'A Guide to Traffic Generating Developments', Roads and Traffic Authority of New South Wales, October 2002.
- 'Road Planning and Design Manual' Department of Transport and Main Roads of Queensland, August 2004.
- AUSTROADS – Guide to Road Design, Part 4a: Unsignalised and Signalised Intersections, August 2009.
- other documents and data as referenced in this report.

2. Existing Conditions

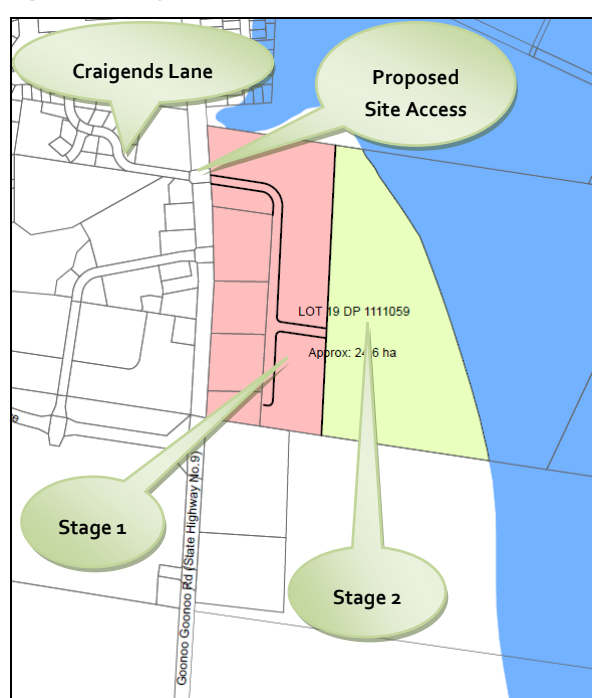
2.1 Subject Site

The subject site is located on Goonoo Goonoo Road in the suburb of Hillvue. Based on TRC's Local Environmental Plan (LEP) the site currently has a land use classification as Rural Small Holdings (RU4) and is occupied by three buildings, including Prime TV, a church and retail users.

The surrounding properties include a mix of residential, retail and rural uses.

The location of the subject site and its surrounding environs is shown in Figure 2.1.

Figure 2.1: Subject Site and Its Environs



2.2 Road Network

2.2.1 Goonoo Goonoo Road (New England Highway)

Goonoo Goonoo Road (New England Highway) is a Roads and Traffic Authority (RTA) controlled road and is generally aligned in a north-south direction. In the vicinity of the site it is a two-way undivided road configured with one lane in each direction. Goonoo Goonoo Road carries approximately 8,000 vehicles per day¹.

2.2.2 Craigends Lane

Craigends Lane is a TRC controlled road and is generally aligned in an east-west direction. It is a two-way undivided road which carries approximately 1,250 vehicles per day².

¹ Based on the peak hour traffic counts undertaken by Skyhigh on 15 December 2010 and assuming a peak-to-daily ratio of 8% for arterial roads.

² Based on the peak hour traffic counts undertaken by Skyhigh on 15 December 2010 and assuming a peak-to-daily ratio of 10% for local roads.

2.2.3 Surrounding Intersections

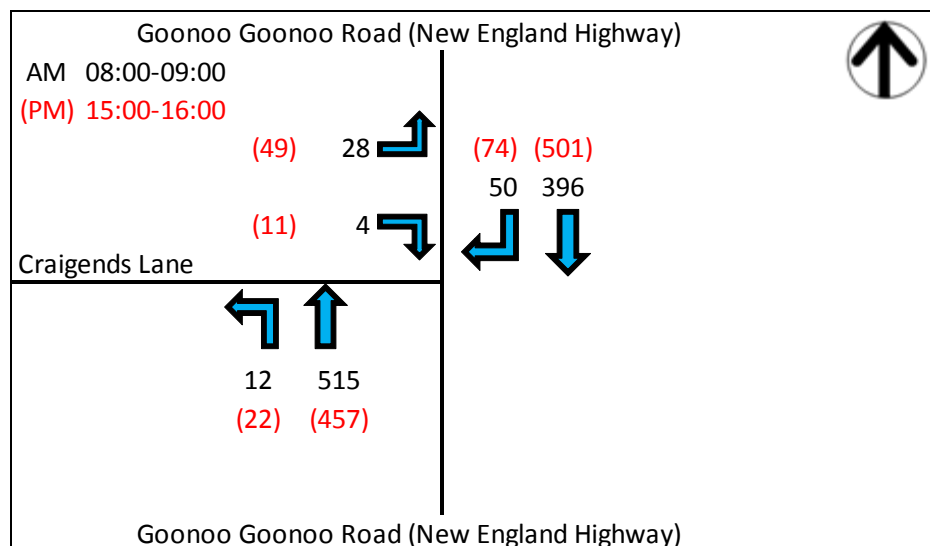
The following intersections exist in the vicinity of the subject site:

- Goonoo Goonoo Road / Craigends Lane (priority controlled type channelised right turn (CHR))
- Goonoo Goonoo Road / The Ringers Road (priority controlled type CHR)
- Goonoo Goonoo Road / Calala Lane (roundabout controlled)
- Goonoo Goonoo Road / Greg Norman Drive (priority controlled).

2.3 Traffic Volumes

Traffic turning movement counts were undertaken by Skyhigh at the Goonoo Goonoo Road / Craigends Lane intersection on Wednesday 15 December 2010 during the AM (8:00-9:00) and PM (15:00-16:00) peak hour periods. The surveyed AM and PM peak hour traffic turning volumes are shown in Figure 2.2.

Figure 2.2: Observed AM and PM Peak Hour Traffic Turning Volumes (15 Dec 2010)



Full traffic survey results are provided at Appendix A to this report.

2.4 Intersection Operation

It is envisaged that a new approach will be constructed to the east of existing Goonoo Goonoo Road / Craigends Lane intersection to provide access to the subject site.

The operation of the Goonoo Goonoo Road / Craigends Lane intersection has been assessed to determine the current operation of the intersection, prior to the rezoning proposal, for the purposes of comparison. This has been undertaken using SIDRA Intersection³, a computer based modelling package which calculates intersection performance.

The commonly used measure of intersection performance, as defined by the RTA, is vehicle delay. SIDRA Intersection determines the average delay that vehicles encounter and provides a measure of the Level of Service (LOS).

³ Program used under license from Akcelik & Associates Pty Ltd.

Table 2.1 shows the criteria that SIDRA Intersection adopts in assessing the LOS.

Table 2.1: SIDRA Intersection Level of Service Criteria

Level of Service (LOS)	Average Delay per vehicle (secs/veh)	Traffic Signals, Roundabout	Give Way & Stop Sign
A	Less than 14	Good operation	Good operation
B	15 to 28	Good with acceptable delays and spare capacity	Acceptable delays and spare capacity
C	29 to 42	Satisfactory	Satisfactory, but accident study required
D	43 to 56	Near capacity	Near capacity, accident study required
E	57 to 70	At capacity, at signals incidents will cause excessive delays	At capacity, requires other control mode
F	Greater than 70	Extra capacity required	Extreme delay, major treatment required

Table 2.2 presents a summary of the existing operation of the intersection based on the observed traffic volumes above, with full results presented in Appendix B of this report.

Table 2.2: Existing Operating Conditions

Assessment Scenario	Leg	Degree of Saturation (DOS)	Average Delay (sec)	95th Percentile Queue (m)	Level of Service (LOS)
2011 AM Peak	Goonoo Goonoo Road (South)	0.28#	0sec	0m	A
	Goonoo Goonoo Road (North)	0.22	1sec	2m	B
	Craigends Lane (West)	0.06	13sec	2m	B
2011 PM Peak	Goonoo Goonoo Road (South)	0.26	0sec	0m	A
	Goonoo Goonoo Road (North)	0.26#	2sec	3m	B
	Craigends Lane (West)	0.10	13sec	3m	B

DOS – Degree of Saturation, # - Intersection DOS

On the basis of the above assessment, the intersection of Goonoo Goonoo Road / Craigends Lane currently operates well with minimal queues and delays on all approaches.

2.5 Public Transport

A review of the public transport available in the vicinity of the subject site is summarised in Table 2.3.

Table 2.3: Public Transport Provision

Service	Route #	Route Description	Location of Stop	Distance to Nearest Stop	Frequency On/Off peak
Bus	435	South 1 via Goonoo Goonoo Road, Calala & Edward Street	Stop 21 – Golden Guitar Hotel	200m	30minutes peak / hourly off peak
Bus	435	South 1 via Goonoo Goonoo Road, Calala & Edward Street	Stop 20 – Goonoo Goonoo Road / Calala Lane intersection	600m	30minutes peak / hourly off peak

2.6 Pedestrian Infrastructure

Limited pedestrian paths are provided in the vicinity of the site, with existing facilities located as follows:

- Goonoo Goonoo Road (western side) – 1.2m wide path, providing access to Forty Winks, McDonald's, Golden Guitar Hotel etc.
- Craigends Lane (northern side) – adjacent to the Forty Winks development.

3. Rezoning Proposal

3.1 Land Use

The land rezoning is envisaged to be implemented in two stages:

- Stage 1 (Bulky Goods): The land situated east of Goonoo Goonoo Road (opposite Craigends Lane) is currently the priority site, including other existing sites (church, Prime TV and retail) being redeveloped over time. Stage 1 will require a rezoning proposal for Commercial Core (B3) to be submitted to the Department of Planning in early 2011.
- Stage 2 (Light Industrial / Commercial): The land will involve a Business Park (B7) type development at the rear of Stage 1. A rezoning proposal is envisaged to be prepared for this area between 2016 and 2021.

For assessment purposes it has been assumed 50% of site area will be developable as Gross Floor Area (GFA), assuming there are minimal site constraints and no substantial constraints such as rivers, steep land etc.

3.2 Vehicle Access

A newly constructed access will form a forth leg of the Goonoo Goonoo Road / Craigends Lane intersection. Further discussion on its layout and operation are set out in Section 4.

4. Traffic Impact Assessment

4.1 Assessment Scenarios and Years

To assess the impact of this proposal, it is appropriate to have consideration to a relevant 'Base Case' against which to test the proposal impact. A 'Base Case' examines the performance of the road network without the proposed rezoning at the key points in time. The standard key points in time are typically five and ten year design horizons.

The following assessment scenarios have been undertaken:

- year 2016 base case plus Stage 1.
- year 2021 base case plus Stages 1 and 2.

4.2 Traffic Generation

4.2.1 Design Rates

Traffic generation of a development is based on a number of factors, including the type of use, developed area, size of building, number of staff etc. As this information is currently unknown, traffic generation rates based on gross hectare (applying 50% site coverage) area have been assumed. Due to the overall size of the area, it is expected that the variation in terms of generation of specific sites will strike a balance, in terms of those with a higher than average and lower than average generation.

The following documents were reviewed in selecting appropriate traffic generation rates:

- 'A Guide to Traffic Generating Developments', Roads and Traffic Authority of New South Wales (RTANSW), October 2002.
- 'Trip Generation and Parking Generation Surveys – Bulky Goods / Hardware Stores', Hyder Consulting for RTANSW, May 2009.

The following sets out the areas and land uses adopted for the assessment, in agreement with the TRC, for the purposes of the intersection analysis.

- Stage 1 Bulky Goods: 15.32ha (51.3%)
- Stage 2 Light Industrial / Commercial: 14.55ha (48.7%).

The adopted traffic generation rates and directional split of traffic (i.e. the ratio between the inbound and outbound traffic movements) generated by the proposed development has been applied, as presented in Table 4.1.

Table 4.1: Trip Generation Rates and Distribution

Stage	Trip Generation			Traffic Distribution			
	AM	PM	DAILY	AM		PM	
				IN	OUT	IN	OUT
Stage 1 (Bulky Goods) ⁴	12 trips/ha ⁵	60 trips/ha	750 trips/ha	80%	20%	50%	50%
Stage 2 (Light Industrial / Commercial) ⁶	25 trips/ha	25 trips/ha	200 trips/ha	80%	20%	20%	80%

Estimates of peak hour and daily traffic volumes resulting from the proposal are set out in Table 4.2.

Table 4.2: Traffic Generation Estimates

Staging	Size	Vehicle Trips (movements)								
		AM			PM			DAILY		
		In	Out	Total	In	Out	Total	In	Out	Total
Stage 1	15.32ha	147	37	184	460	460	920	5,745	5,745	11,490
Stage 2	14.55ha	291	73	364	73	291	364	1,455	1,455	2,910
Total	29.87ha	438	110	548	533	751	1,284	7,200	7,200	14,400

Table 4.2 indicates that Stage 1 could potentially generate 180-190 vehicle movements in the AM peak hour and 920 vehicle movements in the PM peak hour with up to 11,490 vehicle movements over the entire day.

Furthermore, Stages 1 and 2 combined could potentially generate 550 vehicle movements in the AM peak hour and 1,250-1,300 vehicle movements in the PM peak hour with 14,400 vehicle movements over the entire day.

4.3 Traffic Growth Rate

Traffic growth trends have been estimated based on the Department of Transport & Regional Services, Bureau of Transport and Regional Economics (BTRE) – Demand Projections for Auslink Non-Urban Corridors: Methodology and Projections, Working Paper 66 (February 2006). Hence, a 1.58% per annum compound growth rate was applied to the 2011 observed traffic counts data to forecast the 2016 and 2021 background traffic flows.

4.4 Distribution and Assignment

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

- configuration of the arterial road network in the immediate vicinity of the site
- existing operation of intersections providing access between the local and arterial road network
- distribution of households in the vicinity of the site
- likely distribution of employee's residences in relation to the site
- configuration of access points to the site.

Having consideration to the above and guided by the current and future anticipated development patterns in the broader Tamworth area, for the purposes of estimating vehicle movements, the following directional distributions have been assumed:

⁴ Based on 'Trip Generation and Parking Generation Surveys – Bulky Goods / Hardware Stores' rate for a non-metropolitan bulky goods site of some 6,000sq.m and assuming 50% site cover.

⁵ Assuming 20% of PM Peak Hour traffic.

⁶ Based on 'A Guide to Traffic Generating Developments' rate for warehouse and assuming a 50% site cover.

- Goonoo Goonoo Road (south) 45%.
- Goonoo Goonoo Road (north) 50%.
- Craighends Lane (west) 5%.

Based on the above, Figure 4.1 and 4.2 have been prepared to show the estimated marginal increase in turning movements in the vicinity of the subject site following full development of Stage 1 and Stages 1 and 2 respectively.

Figure 4.1: AM and PM Peak Hour Site Generated Traffic Volumes – Stage 1

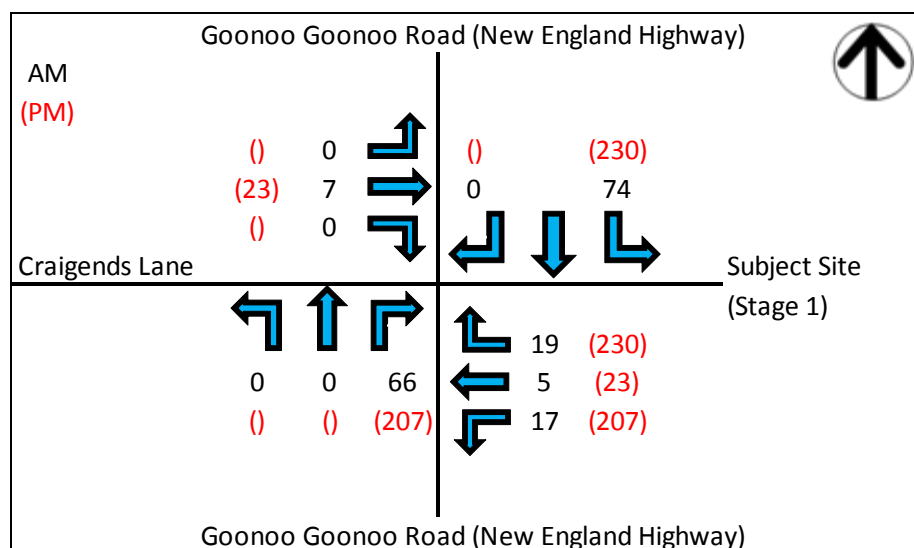
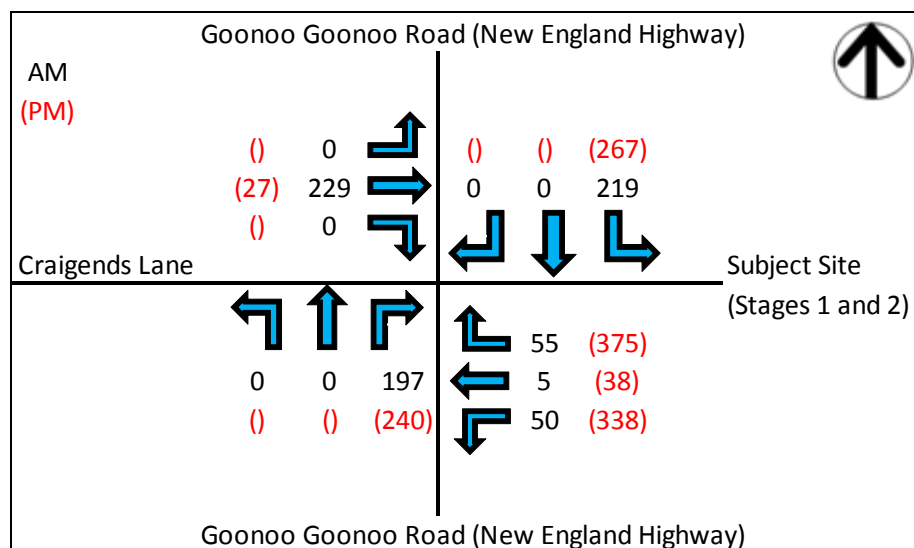


Figure 4.2: AM and PM Peak Hour Site Generated Traffic Volumes – Stages 1 and 2 Combined



4.5 Traffic Impact

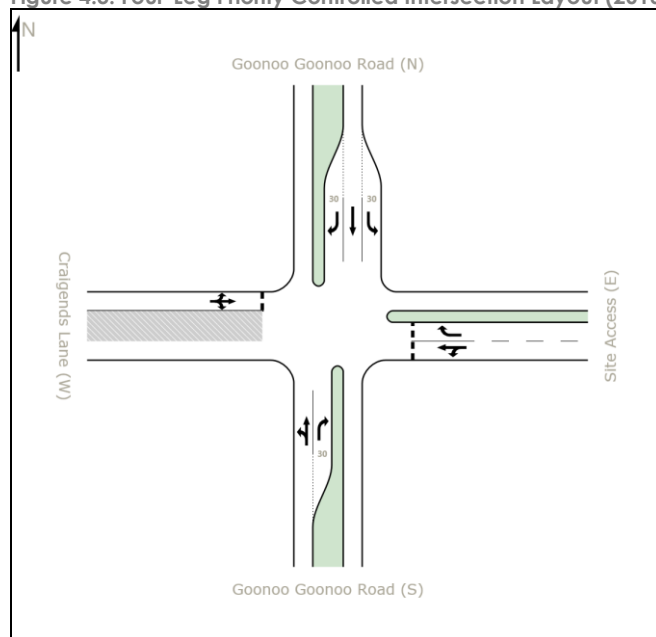
4.5.1 Preamble

Warrants for the right turn from the southbound approach along Goonoo Goonoo Road (based on conflicting traffic volumes) has been checked in accordance with AUSTROADS – Guide to Road Design, Part 4a: Unsignalised and Signalised Intersection, August 2009. The intersection will require for both south-to-east and north-to-west and an auxiliary left turn (AUL) treatment north-to east along Goonoo Goonoo Road.

The proposed access to the site has been assessed for the following two layouts in 2016 and 2021:

- Priority controlled intersection at the Goonoo Goonoo Road / Craigends Lane intersection consisting of a CHR treatment (this has been assessed for 2016 in accordance with AUSTROADS – Guide to Road Design, Part 4a: Unsignalised and Signalised Intersection, August 2009) for both south-to-east and north-to-west and an AUL treatment north-to east along Goonoo Goonoo Road as shown in Figure 4.3.
- Roundabout controlled intersection consisting of a dual lane as shown in Figure 4.4.

Figure 4.3: Four-Leg Priority Controlled Intersection Layout (2016)



4.5.2 Priority Controlled Intersection Assessment

Table 4.3 presents a summary of the anticipated future operation of a four-leg priority controlled intersection in 2016. Detailed results of this analysis are provided at Appendix B.

Table 4.3: SIDRA Analysis Summary – Proposed Four-Leg Priority Controlled Intersection

Assessment Scenario	Leg	Degree of Saturation (DOS)	Average Delay (sec)	95th Percentile Queue (m)	Level of Service (LOS)
2016 AM Peak Stage 1	Goonoo Goonoo Road (South)	0.31 #	1sec	2m	B
	Site Access (East)	0.08	17sec	2m	C
	Goonoo Goonoo Road (North)	0.23	2sec	2m	B
	Craigends Lane (West)	0.10	15sec	3m	C
2016 PM Peak Stage 1	Goonoo Goonoo Road (South)	0.28	4sec	10m	B
	Site Access (East)	>1 #	620sec	905m	F
	Goonoo Goonoo Road (North)	0.29	3sec	3m	B
	Craigends Lane (West)	0.39	28sec	14m	D

DOS – Degree of Saturation, # - Intersection DOS

The analysis shows that the proposed priority controlled intersection is not capable of accommodating the additional traffic volumes generated in Stage 1, in particular from the site access.

4.5.3 Intersection Analysis – Roundabout Controlled

A potential treatment for the site access intersection is a roundabout. This is in keeping with the Goonoo Goonoo Road / Calala Lane Intersection to the north of the site. The operation of a single lane roundabout configuration has been assessed and the layout is shown in Figure 4.4.

Figure 4.4: Proposed Dual Lane Roundabout Controlled Intersection Layout (2016 onwards)

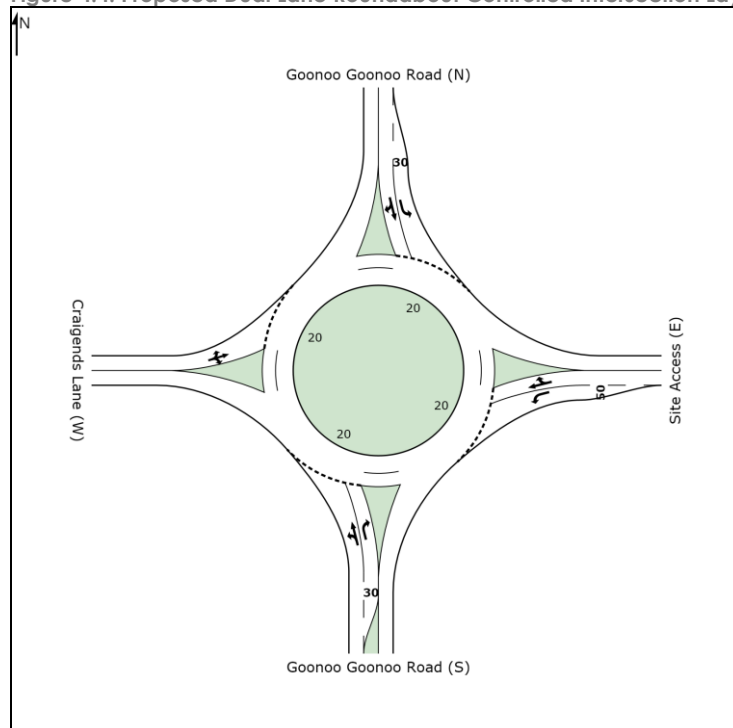


Table 4.4 presents a summary of the anticipated future operation of the intersection in 2016 and 2021. Detailed results of this analysis are provided at Appendix B.

Table 4.4: SIDRA Analysis Summary – Proposed Roundabout Controlled Intersection

Assessment Scenario	Leg	Degree of Saturation (DOS)	Average Delay (sec)	95th Percentile Queue (m)	Level of Service (LOS)
2016 AM Peak Stage 1	Goonoo Goonoo Road (South)	0.40#	7sec	24m	B
	Site Access (East)	0.03	11sec	1m	B
	Goonoo Goonoo Road (North)	0.34	7sec	20m	A
	Craigends Lane (West)	0.06	10sec	2m	A
2016 PM Peak Stage 1	Goonoo Goonoo Road (South)	0.49	10sec	33m	B
	Site Access (East)	0.36	13sec	21m	B
	Goonoo Goonoo Road (North)	0.53#	8sec	39m	A
	Craigends Lane (West)	0.16	12sec	7m	B
2021 AM Peak Stage 1 and Stage 2	Goonoo Goonoo Road (South)	0.45	8sec	30m	B
	Site Access (East)	0.07	12sec	4m	B
	Goonoo Goonoo Road (North)	0.54#	10sec	40m	A
	Craigends Lane (West)	0.42	12sec	21m	B
2021 PM Peak Stage 1 and Stage 2	Goonoo Goonoo Road (South)	0.64#	13sec	60m	B
	Site Access (East)	0.59	18sec	53m	B
	Goonoo Goonoo Road (North)	0.60	9sec	49m	A
	Craigends Lane (West)	0.22	14sec	11m	B

DOS – Degree of Saturation, # - Intersection DOS

On the basis of the above, the roundabout intersection is forecast to operate with acceptable levels of DOS and queue lengths up to 2021 and beyond.

5. Conclusion

Based on the analysis and discussions presented in this report, the following conclusions are made:

- i Assumptions have been made in relation to site cover, to that end, this assessment has been based on 50% of the total available are being developed as building area. This has been applied to a broad hectare area of:
 - 15.32ha at Stage 1
 - 14.55ha at Stage 2.
- ii Stage 1 could be expected to generate 180-190 movements in the AM peak and 920 movements in the PM peak by 2016.
- iii The combined development once complete (Stage 1 and Stage 2) could be expected to generate 550 movements in the AM peak and 1,250-1,300 movements in the PM peak by 2021.
- iv Access to the site is proposed to be provided as a fourth (eastern) approach to the Goonoo Goonoo Road / Craigends Lane intersection.
- v A dual lane roundabout controlled intersection will accommodate the anticipated volumes in 2021.

Appendix A

Survey Results

Job No.

N473

Client

: GTA

Suburb

: Tamworth

Location

: Craigends Lane / New England Hwy

Day/Date

: 15th Dec 2010

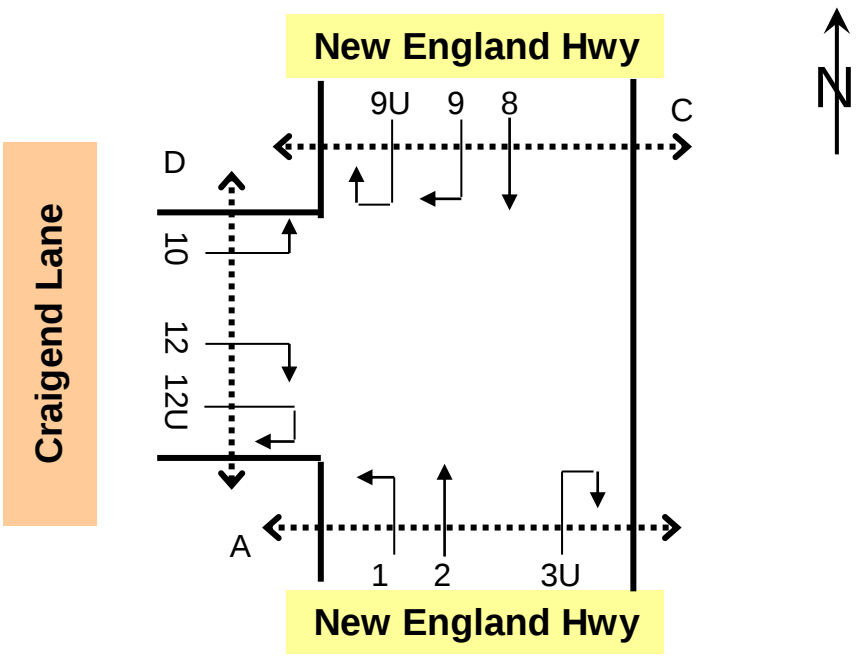
Weather

: Fine

Description

: Classified Intersection Count

: 15 mins Data



Approach	New England Hwy																							
Direction	Direction 1 (Left Turn)				Direction 2 (Through)				Direction 3U (U Turn)															
Time Period	Cars	Trucks	Buses	Total	Cars	Trucks	Buses	Total	Cars	Trucks	Buses	Total												
8:00 to 8:15	0	0	0	0	108	3	5	116	0	0	0	0												
8:15 to 8:30	6	0	0	6	138	6	1	145	0	0	0	0												
8:30 to 8:45	3	0	0	3	122	10	1	133	1	0	0	1												
8:45 to 9:00	3	0	0	3	111	6	4	121	0	0	0	0												
AM Totals	12	0	0	12	479	25	11	515	1	0	0	1												
15:00 to 15:15	4	1	0	5	114	5	3	122	0	0	0	0												
15:15 to 15:30	3	0	0	3	107	8	1	116	0	0	0	0												
15:30 to 15:45	3	1	0	4	107	4	0	111	0	0	0	0												
15:45 to 16:00	10	0	0	10	103	5	0	108	0	0	0	0												
PM Totals	20	2	0	22	431	22	4	457	0	0	0	0												

Approach	New England Hwy												Craigend Lane											
Direction					Direction 8 (Through)				Direction 9 (Right Turn)				Direction 9U (U Turn)				Direction 10 (Left Turn)							
Time Period					Cars	Trucks	Buses	Total	Cars	Trucks	Buses	Total	Cars	Trucks	Buses	Total	Cars	Trucks	Buses	Total				
8:00 to 8:15					81	10	1	92	7	0	0	7	0	0	0	0	5	1	0	6	1	0	0	0
8:15 to 8:30					84	3	0	87	12	0	0	12	0	0	0	0	10	0	0	10	1	0	0	0
8:30 to 8:45					96	9	4	109	11	0	0	11	0	0	0	0	6	0	0	6	0	1	0	0
8:45 to 9:00					99	7	2	108	19	1	0	20	0	0	0	0	6	0	0	6	1	0	0	0
AM Totals					360	29	7	396	49	1	0	50	0	0	0	0	27	1	0	28	3	1	0	0
15:00 to 15:15					108	5	0	113	17	0	0	17	0	0	0	0	13	1	0	14	2	0	0	0
15:15 to 15:30					142	5	1	148	17	0	1	18	0	0	0	0	13	0	1	14	3	0	0	0
15:30 to 15:45					125	5	0	130	22	2	0	24	0	0	0	0	13	0	0	13	3	0	0	0
15:45 to 16:00					106	3	1	110	15	0	0	15	1	0	0	1	8	0	0	8	3	0	0	0
PM Totals					481	18	2	501	71	2	1	74	1	0	0	1	47	1	1	49	11	0	0	0

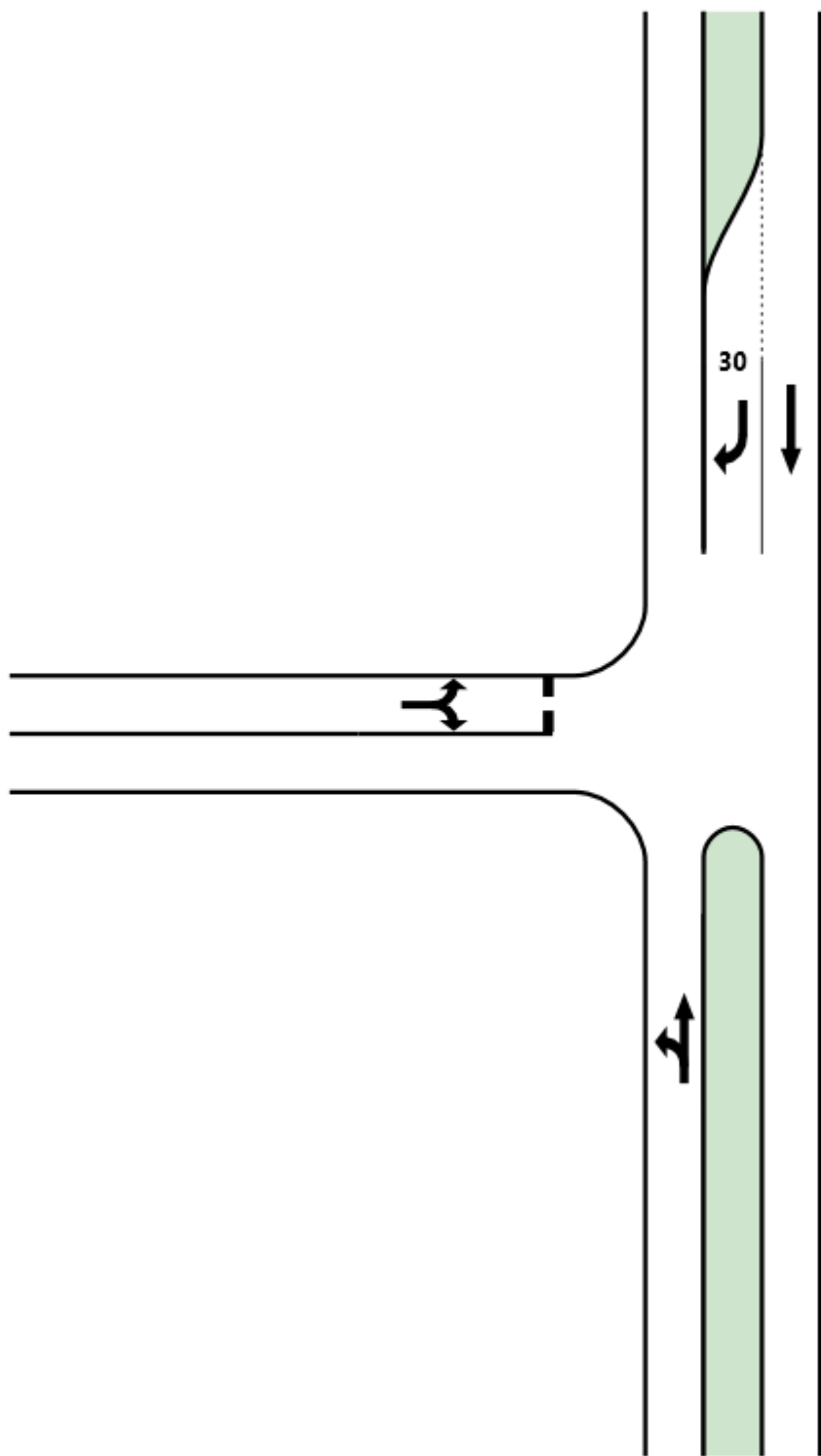
Appendix B

SIDRA Intersection Results



Goonoo Goonoo Road (N)

Craigends Lane (W)



Goonoo Goonoo Road (S)

LANE SUMMARY

Site: 2011 AM three-way Back-ground

Goonoo Goonoo Road (New England Highway) / Craigends Lane
2011 AM Background (Three-way)
Giveway / Yield (Two-Way)

Lane Use and Performance																
	Demand Flows															
	L	T	R	Total	HV	Cap.	Deg.	Lane	Average	Level of	95% Back	Queue	Lane	SL	Cap.	Prob.
	veh/h	veh/h	veh/h	veh/h	%	veh/h	Satn	Util.	Delay	Service	Vehicles	Distance	Length	Type	Adj.	Block.
							v/c	%	sec		veh	m	m		%	%
South: Goonoo Goonoo Road (S)																
Lane 1	12	515	0	527	6.8	1865	0.283	100	0.2	LOS A	0.0	0.0	500	–	0.0	0.0
Approach	12	515	0	527	6.8		0.283		0.2	LOS A	0.0	0.0				
North: Goonoo Goonoo Road (N)																
Lane 1	0	396	0	396	9.0	1842	0.215	100	0.0	LOS A	0.0	0.0	500	–	0.0	0.0
Lane 2	0	0	50	50	2.0	1031	0.048	100	10.7	LOS B	0.2	1.8	30 Turn Bay		0.0	0.0
Approach	0	396	50	446	8.2		0.215		1.2	LOS B	0.2	1.8				
West: Craigends Lane (W)																
Lane 1	28	0	4	32	6.6	518	0.062	100	13.2	LOS B	0.3	1.9	500	–	0.0	0.0
Approach	28	0	4	32	6.6		0.062		13.2	LOS B	0.3	1.9				
Intersection				1005	7.4		0.283		1.0	NA	0.3	1.9				

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

Level of Service (Worst Lane): LOS B. LOS Method for individual lanes: Delay (HCM).

Approach LOS values are based on the worst delay for any lane.

Processed: Friday, 4 March 2011 11:22:00 AM

SIDRA INTERSECTION 5.0.5.1510

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LANE SUMMARY

Site: 2011 PM three-way Back-ground

Goonoo Goonoo Road (New England Highway) / Craigends Lane
2011 PM Background (Three-way)
Giveway / Yield (Two-Way)

Lane Use and Performance																
	Demand Flows															
	L	T	R	Total	HV	Cap.	Deg.	Lane	Average	Level of	95% Back	Queue	Lane	SL	Cap.	Prob.
	veh/h	veh/h	veh/h	veh/h	%	veh/h	Satn	Util.	Delay	Service	Vehicles	Distance	Length	Type	Adj.	Block.
							v/c	%	sec		veh	m	m		%	%
South: Goonoo Goonoo Road (S)																
Lane 1	22	457	0	479	6.1	1870	0.256	100	0.4	LOS A	0.0	0.0	500	–	0.0	0.0
Approach	22	457	0	479	6.1		0.256		0.4	LOS A	0.0	0.0				
North: Goonoo Goonoo Road (N)																
Lane 1	0	501	0	501	4.0	1901	0.264	100	0.0	LOS A	0.0	0.0	500	–	0.0	0.0
Lane 2	0	0	74	74	4.0	1100	0.067	100	10.5	LOS B	0.4	2.6	30 Turn Bay		0.0	0.0
Approach	0	501	74	575	4.0		0.264		1.3	LOS B	0.4	2.6				
West: Craigends Lane (W)																
Lane 1	49	0	11	60	3.3	575	0.104	100	12.6	LOS B	0.5	3.2	500	–	0.0	0.0
Approach	49	0	11	60	3.3		0.104		12.6	LOS B	0.5	3.2				
Intersection				1114	4.9		0.264		1.5	NA	0.5	3.2				

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

Level of Service (Worst Lane): LOS B. LOS Method for individual lanes: Delay (HCM).

Approach LOS values are based on the worst delay for any lane.

Processed: Friday, 4 March 2011 11:22:00 AM

SIDRA INTERSECTION 5.0.5.1510

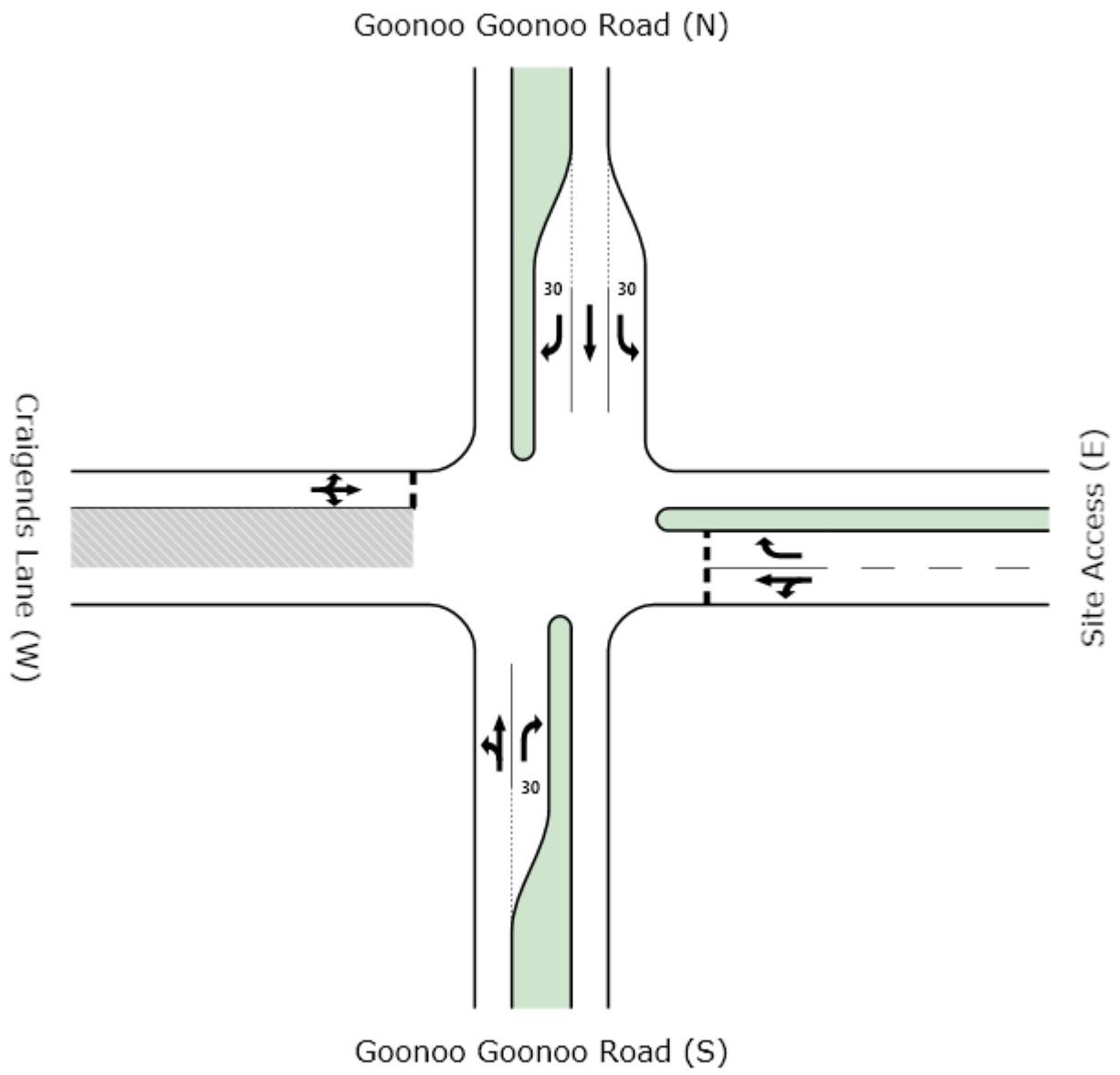
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LANE SUMMARY

Site: 2016 AM four-way Back-ground plus Stage1 CHR

Goonoo Goonoo Road (New England Highway) / Craigends Lane
2016 AM Background plus Stage1 (Four-way Unsignalised)
Giveaway / Yield (Two-Way)

Lane Use and Performance																
	Demand Flows			Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Vehicles veh	Queue Distance m	Lane Length m	SL Type	Cap. Adj. %	Prob. Block. %
	L veh/h	T veh/h	R veh/h													
South: Goonoo Goonoo Road (S)																
Lane 1	13	557	0	570	6.8	1865	0.306	100	0.2	LOS A	0.0	0.0	500	–	0.0	0.0
Lane 2	0	0	66	66	0.0	1108	0.060	100	10.0	LOS B	0.3	2.3	30 Turn Bay		0.0	0.0
Approach	13	557	66	636	6.1		0.306		1.2	LOS B	0.3	2.3				
East: Site Access (E)																
Lane 1	17	5	0	22	10.0	479	0.046	100	13.5	LOS B	0.2	1.5	500	–	0.0	0.0
Lane 2	0	0	19	19	10.0	242	0.078	100	21.9	LOS C	0.3	2.4	500	–	0.0	0.0
Approach	17	5	19	41	10.0		0.078		17.4	LOS C	0.3	2.4				
North: Goonoo Goonoo Road (N)																
Lane 1	74	0	0	74	0.0	1857	0.040	100	8.2	LOS A	0.0	0.0	30 Turn Bay		0.0	0.0
Lane 2	0	428	0	428	9.0	1842	0.232	100	0.0	LOS A	0.0	0.0	500	–	0.0	0.0
Lane 3	0	0	54	54	2.0	973	0.056	100	10.8	LOS B	0.3	2.0	30 Turn Bay		0.0	0.0
Approach	74	428	54	556	7.1		0.232		2.1	LOS B	0.3	2.0				
West: Craigends Lane (W)																
Lane 1	30	7	4	41	5.4	411	0.100	100	15.2	LOS C	0.4	3.0	500	–	0.0	0.0
Approach	30	7	4	41	5.4		0.100		15.2	LOS C	0.4	3.0				
Intersection				1274	6.7		0.306		2.6	NA	0.4	3.0				

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

Level of Service (Worst Lane): LOS C. LOS Method for individual lanes: Delay (HCM).

Approach LOS values are based on the worst delay for any lane.

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LANE SUMMARY

Site: 2016 PM four-way Back-ground plus Stage1 CHR

Goonoo Goonoo Road (New England Highway) / Craigends Lane
2016 PM Background plus Stage1 (Four-way Unsignalised)
Giveaway / Yield (Two-Way)

Lane Use and Performance																
	Demand Flows															
	L	T	R	Total	HV	Cap.	Deg.	Lane	Average	Level of	95% Back of	Queue	Lane	SL	Cap.	Prob.
	veh/h	veh/h	veh/h	veh/h	%	veh/h	Satn	Util.	Delay	Service	Vehicles	Distance	Length	Type	Adj.	Block.
							v/c	%	sec		veh	m	m		%	%
South: Goonoo Goonoo Road (S)																
Lane 1	24	494	0	518	6.7	1865	0.278	100	0.4	LOS A	0.0	0.0	500	–	0.0	0.0
Lane 2	0	0	207	207	0.0	819	0.253	100	12.2	LOS B	1.4	10.1	30 Turn Bay		0.0	0.0
Approach	24	494	207	725	4.8		0.278		3.8	LOS B	1.4	10.1				
East: Site Access (E)																
Lane 1	207	23	0	230	10.0	406	0.567	100	21.1	LOS C	3.9	29.4	500	–	0.0	0.0
Lane 2	0	0	230	230	10.0	140	1.646	100	1218.7	LOS F	119.1	904.9	500	–	0.0	26.9
Approach	207	23	230	460	10.0		1.646		619.9	LOS F	119.1	904.9				
North: Goonoo Goonoo Road (N)																
Lane 1	230	0	0	230	0.0	1857	0.124	100	8.2	LOS A	0.0	0.0	30 Turn Bay		0.0	0.0
Lane 2	0	542	0	542	9.0	1842	0.294	100	0.0	LOS A	0.0	0.0	500	–	0.0	0.0
Lane 3	0	0	80	80	2.0	1045	0.077	100	10.6	LOS B	0.4	2.8	30 Turn Bay		0.0	0.0
Approach	230	542	80	852	5.9		0.294		3.2	LOS B	0.4	2.8				
West: Craigends Lane (W)																
Lane 1	53	23	12	88	5.8	224	0.392	100	27.7	LOS D	1.8	13.5	500	–	0.0	0.0
Approach	53	23	12	88	5.8		0.392		27.7	LOS D	1.8	13.5				
Intersection				2125	6.4		1.646		137.9	NA	119.1	904.9				

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

Level of Service (Worst Lane): LOS F. LOS Method for individual lanes: Delay (HCM).

Approach LOS values are based on the worst delay for any lane.

Processed: Friday, 4 March 2011 11:22:03 AM

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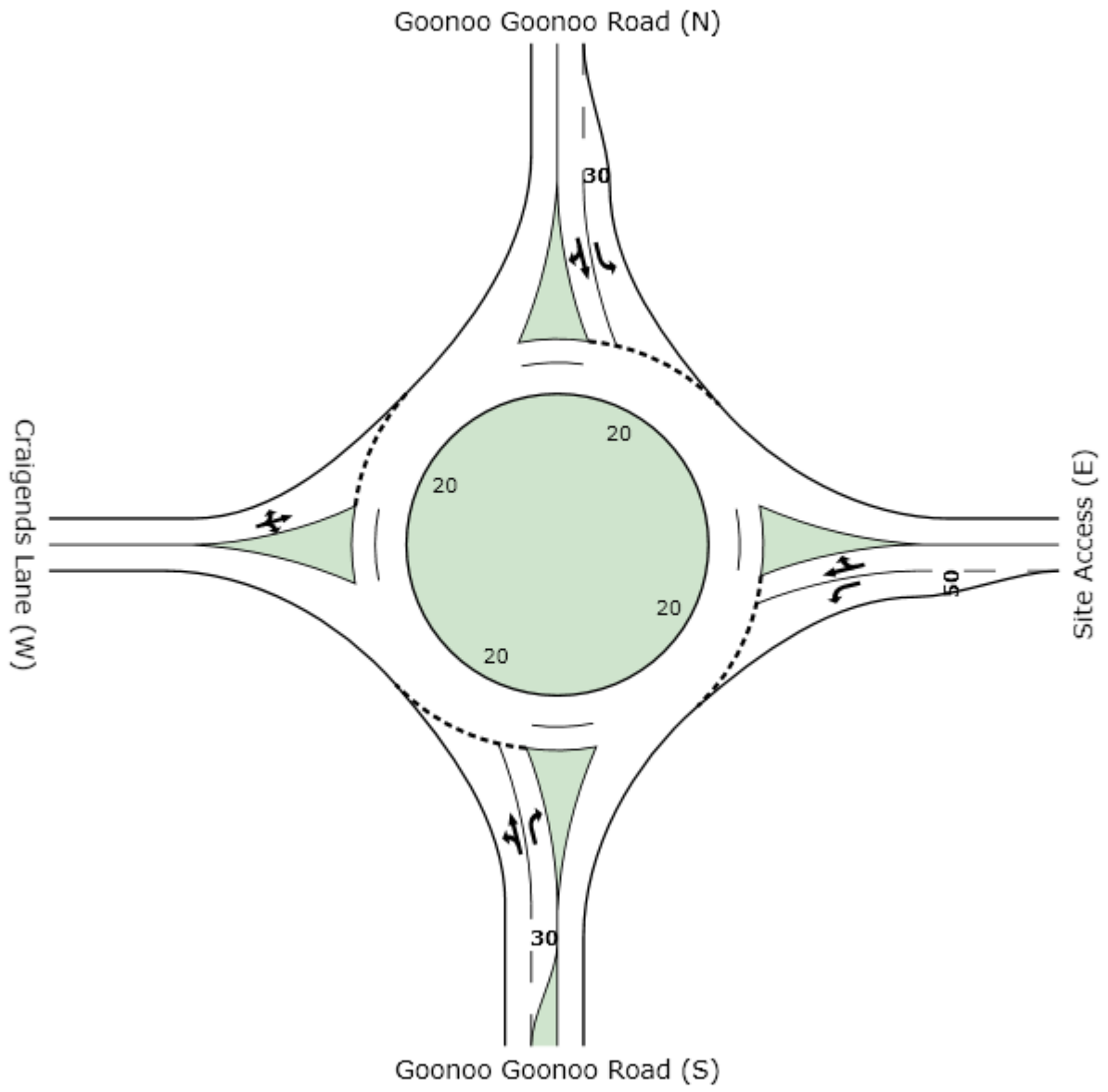
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LANE SUMMARY

Site: 2016 AM four-way Back-ground plus Stage1 Conversion

Goonoo Goonoo Road (New England Highway) / Craigends Lane
2016 AM Background plus Stage1 Roundabout
Roundabout

Lane Use and Performance																
	Demand Flows															
	L	T	R	Total	HV	Cap.	Deg.	Lane	Average	Level of	95% Back of	Queue	Lane	SL	Cap.	Prob.
	veh/h	veh/h	veh/h	veh/h	%	veh/h	Satn	Util.	Delay	Service	Vehicles	Distance	Length	Type	Adj.	Block.
							v/c	%	sec		veh	m	m		%	%
South: Goonoo Goonoo Road (S)																
Lane 1	13	557	0	570	6.8	1445	0.395	100	6.0	LOS A	3.3	24.2	500	–	0.0	0.0
Lane 2	0	0	66	66	0.0	665 ¹	0.099	100	11.8	LOS B	0.4	3.1	30 Turn Bay		0.0	0.0
Approach	13	557	66	636	6.1		0.395		6.6	LOS B	3.3	24.2				
East: Site Access (E)																
Lane 1	17	0	0	17	10.0	787	0.022	100	9.4	LOS A	0.1	1.0	50 Turn Bay		0.0	0.0
Lane 2	0	5	19	24	10.0	920	0.026	100	12.5	LOS B	0.2	1.3	500	–	0.0	0.0
Approach	17	5	19	41	10.0		0.026		11.2	LOS B	0.2	1.3				
North: Goonoo Goonoo Road (N)																
Lane 1	74	0	0	74	0.0	664 ¹	0.111	100	7.1	LOS A	0.5	3.6	30 Turn Bay		0.0	0.0
Lane 2	0	428	54	482	8.2	1412	0.341	100	6.6	LOS A	2.7	20.1	500	–	0.0	0.0
Approach	74	428	54	556	7.1		0.341		6.7	LOS A	2.7	20.1				
West: Craigends Lane (W)																
Lane 1	30	7	4	41	5.4	722	0.057	100	9.9	LOS A	0.3	2.4	500	–	0.0	0.0
Approach	30	7	4	41	5.4		0.057		9.9	LOS A	0.3	2.4				
Intersection				1274	6.7		0.395		6.9	LOS A	3.3	24.2				

Level of Service (Aver. Int. Delay): LOS A. Based on average delay for all lanes. LOS Method: Delay (HCM).

Level of Service (Worst Lane): LOS B. LOS Method for individual lanes: Delay (HCM).

Approach LOS values are based on the worst delay for any lane.

Roundabout LOS Method: Same as Signalised Intersections.

Roundabout Capacity Model: SIDRA Standard.

¹ Reduced capacity due to a short lane effect

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SIDRA INTERSECTION 5.0.5.1510

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LANE SUMMARY

Site: 2016 PM four-way Back-ground plus Stage1 Conversion

Goonoo Goonoo Road (New England Highway) / Craigends Lane
2016 PM Background plus Stage1 Roundabout
Roundabout

Lane Use and Performance																
	Demand Flows															
	L	T	R	Total	HV	Cap.	Deg.	Lane	Average	Level of	95% Back of	Queue	Lane	SL	Cap.	Prob.
	veh/h	veh/h	veh/h	veh/h	%	veh/h	Satn	Util.	Delay	Service	Vehicles	Distance	Length	Type	Adj.	Block.
							v/c	%	sec		veh	m	m		%	%
South: Goonoo Goonoo Road (S)																
Lane 1	24	494	0	518	6.7	1057	0.490	100	7.9	LOS A	4.5	33.3	500	–	0.0	0.0
Lane 2	0	0	207	207	0.0	713 ¹	0.290	100	13.8	LOS B	1.9	13.2	30 Turn Bay		0.0	0.0
Approach	24	494	207	725	4.8		0.490		9.5	LOS B	4.5	33.3				
East: Site Access (E)																
Lane 1	207	0	0	207	10.0	654	0.317	100	11.4	LOS B	2.5	18.9	50 Turn Bay		0.0	0.0
Lane 2	0	23	230	253	10.0	755	0.335	100	15.1	LOS B	2.8	21.2	500	–	0.0	0.0
Approach	207	23	230	460	10.0		0.335		13.4	LOS B	2.8	21.2				
North: Goonoo Goonoo Road (N)																
Lane 1	230	0	0	230	0.0	727 ¹	0.316	100	8.3	LOS A	1.9	13.5	30 Turn Bay		0.0	0.0
Lane 2	0	542	80	622	8.1	1167	0.533	100	8.0	LOS A	5.1	38.5	500	–	0.0	0.0
Approach	230	542	80	852	5.9		0.533		8.1	LOS A	5.1	38.5				
West: Craigends Lane (W)																
Lane 1	53	23	12	88	5.8	550	0.160	100	12.0	LOS B	1.0	7.4	500	–	0.0	0.0
Approach	53	23	12	88	5.8		0.160		12.0	LOS B	1.0	7.4				
Intersection				2125	6.4		0.533		9.9	LOS A	5.1	38.5				

Level of Service (Aver. Int. Delay): LOS A. Based on average delay for all lanes. LOS Method: Delay (HCM).

Level of Service (Worst Lane): LOS B. LOS Method for individual lanes: Delay (HCM).

Approach LOS values are based on the worst delay for any lane.

Roundabout LOS Method: Same as Signalised Intersections.

Roundabout Capacity Model: SIDRA Standard.

¹ Reduced capacity due to a short lane effect

Processed: Friday, 4 March 2011 1:22:13 PM

SIDRA INTERSECTION 5.0.5.1510

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LANE SUMMARY

Site: 2021 AM four-way Back-ground plus Stage1 and Stage 2 Conversion

Goonoo Goonoo Road (New England Highway) / Craigends Lane
2021 AM Background plus Stage1 and Stage 2 Roundabout
Roundabout

Lane Use and Performance																
	Demand Flows															
	L	T	R	Total	HV	Cap.	Deg.	Lane	Average	Level of	95% Back of	Queue	Lane	SL	Cap.	Prob.
	veh/h	veh/h	veh/h	veh/h	%	veh/h	Satn	Util.	Delay	Service	Vehicles	Distance	Length	Type	Adj.	Block.
							v/c	%	sec		veh	m	m		%	%
South: Goonoo Goonoo Road (S)																
Lane 1	14	602	0	616	6.8	1366	0.451	100	6.3	LOS A	4.1	30.3	500	–	0.0	0.0
Lane 2	0	0	197	197	0.0	733 ¹	0.269	100	12.1	LOS B	1.4	10.0	30 Turn Bay		0.0	0.0
Approach	14	602	197	813	5.2		0.451		7.7	LOS B	4.1	30.3				
East: Site Access (E)																
Lane 1	50	0	0	50	10.0	728	0.069	100	9.7	LOS A	0.5	3.7	50 Turn Bay		0.0	0.0
Lane 2	0	5	55	60	10.0	825	0.073	100	13.6	LOS B	0.5	4.1	500	–	0.0	0.0
Approach	50	5	55	110	10.0		0.073		11.8	LOS B	0.5	4.1				
North: Goonoo Goonoo Road (N)																
Lane 1	219	0	0	219	0.0	756	0.290	100	9.7	LOS A	2.1	14.4	30 Turn Bay		0.0	0.0
Lane 2	0	463	58	521	8.2	974	0.535	100	9.8	LOS A	5.3	39.5	500	–	0.0	0.0
Approach	219	463	58	740	5.8		0.535		9.8	LOS A	5.3	39.5				
West: Craigends Lane (W)																
Lane 1	33	229	5	267	1.0	643	0.415	100	11.5	LOS B	3.0	21.3	500	–	0.0	0.0
Approach	33	229	5	267	1.0		0.415		11.5	LOS B	3.0	21.3				
Intersection				1930	5.1		0.535		9.3	LOS A	5.3	39.5				

Level of Service (Aver. Int. Delay): LOS A. Based on average delay for all lanes. LOS Method: Delay (HCM).

Level of Service (Worst Lane): LOS B. LOS Method for individual lanes: Delay (HCM).

Approach LOS values are based on the worst delay for any lane.

Roundabout LOS Method: Same as Signalised Intersections.

Roundabout Capacity Model: SIDRA Standard.

¹ Reduced capacity due to a short lane effect

Processed: Friday, 4 March 2011 1:21:22 PM

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LANE SUMMARY

Site: 2021 PM four-way Back-ground plus Stage1 and Stage 2 Conversion

Goonoo Goonoo Road (New England Highway) / Craigends Lane
2021 PM Background plus Stage1 and Stage 2 Roundabout
Roundabout

Lane Use and Performance																
	Demand Flows															
	L	T	R	Total	HV	Cap.	Deg.	Lane	Average	Level of	95% Back of	Queue	Lane	SL	Cap.	Prob.
	veh/h	veh/h	veh/h	veh/h	%	veh/h	Satn	Util.	Delay	Service	Vehicles	Distance	Length	Type	Adj.	Block.
							v/c	%	sec		veh	m	m		%	%
South: Goonoo Goonoo Road (S)																
Lane 1	26	535	0	561	6.7	874	0.642	100	11.7	LOS B	8.2	60.4	500	–	0.0	0.0
Lane 2	0	0	240	240	0.0	664	0.361	100	15.3	LOS B	2.8	19.9	30 Turn Bay		0.0	0.0
Approach	26	535	240	801	4.7		0.642		12.8	LOS B	8.2	60.4				
East: Site Access (E)																
Lane 1	338	0	0	338	10.0	598	0.566	100	15.6	LOS B	6.0	45.6	50 Turn Bay		0.0	3.0
Lane 2	0	38	375	413	10.0	696	0.594	100	19.2	LOS B	6.9	52.7	500	–	0.0	0.0
Approach	338	38	375	751	10.0		0.594		17.6	LOS B	6.9	52.7				
North: Goonoo Goonoo Road (N)																
Lane 1	267	0	0	267	0.0	727 ¹	0.367	100	8.6	LOS A	2.4	16.9	30 Turn Bay		0.0	0.0
Lane 2	0	586	87	673	8.1	1121	0.600	100	8.6	LOS A	6.5	48.8	500	–	0.0	0.0
Approach	267	586	87	940	5.8		0.600		8.6	LOS A	6.5	48.8				
West: Craigends Lane (W)																
Lane 1	57	23	13	93	5.9	431	0.216	100	14.3	LOS B	1.5	10.7	500	–	0.0	0.0
Approach	57	23	13	93	5.9		0.216		14.3	LOS B	1.5	10.7				
Intersection				2585	6.7		0.642		12.7	LOS B	8.2	60.4				

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all lanes. LOS Method: Delay (HCM).

Level of Service (Worst Lane): LOS B. LOS Method for individual lanes: Delay (HCM).

Approach LOS values are based on the worst delay for any lane.

Roundabout LOS Method: Same as Signalised Intersections.

Roundabout Capacity Model: SIDRA Standard.

¹ Reduced capacity due to a short lane effect

Processed: Friday, 4 March 2011 1:33:05 PM

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