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TDG Ref: 13561-5
13 November 2017

Issued via email: binglis@thehills.nsw.gov.au

Dear Bronwyn,

**Old Northern Road / Francis Street Intersection Upgrade
Amended Concept Design**

TDG has prepared this letter on behalf of Merc Capital, in response to the email sent by Bronwyn Inglis to Tony Merhi and Andrew Wilson at Merc Capital on 25 October 2017, regarding the Old Northern Road / Francis Street intersection upgrade.

1. Background

TDG has recently provided traffic and transport engineering advice to Merc Capital in regard to a proposed residential development at 97-103 Cecil Avenue and 9-10 Roger Avenue, Castle Hill (the Cecil Avenue development).

The Parking and Traffic Study (PTS) dated June 2017 indicated that traffic signals were required at the intersection of Old Northern Road / Francis Street in Castle Hill in its current state, in order to alleviate the large delays that the intersection currently experiences during peak traffic periods.

Further analysis has indicated that the intersection will continue to operate at a poor level of service upon completion of the Cecil Avenue development. The installation of traffic signals, in addition to the provision of an exclusive right turn lane in the northbound direction, would considerably improve traffic conditions at the intersection and the surrounding road network.

A TDG memorandum to Merc Capital dated 6 July 2017, detailed the proposed concept layout of the intersection based on the traffic demands expected to be generated by the Cecil Avenue development. The intersection was identified as requiring a northbound right turn storage length of about 40 metres in order to accommodate the 95th percentile queue length during the morning peak hour.

Subsequently and separately, TDG was engaged by The Hills Shire Council (Council) to undertake a traffic study for the Castle Hill South area (Castle Hill South Report), which assessed the traffic effects that the redevelopment of the Castle Hill South area would have on the local road network. The area of the study included the Cecil Avenue development, and as such the traffic generation for this development was included in the traffic study.

Analysis of the Old Northern Road / Francis Street intersection in the Castle Hill South Report revealed that with an upgraded and signalised intersection, the 95th percentile queue for the northbound right turning vehicles was approximately 130 metres.



Council has therefore requested that the initial concept intersection design be modified to accommodate the additional Castle Hill South development traffic. Specifically, in the email from Bronwyn Inglis to Tony Merhi and Andrew Wilson at Merc Capital on 25 October 2017, Council requested the following:

- *An assessment of the overall capital cost of the proposed road works (the revised intersection concept);*
- *Amend the concept intersection layout to show:*
 - *A longer right turn lane that will accommodate the anticipated 'Castle Hill South' traffic generation;*
 - *Footpath widths of 3.5 metres on both sides of the road;*
 - *The extent of all land (if any) to be acquired in order to accommodate all road works / signalisation / medians etc. As discussed in our recent meeting, please note that there is a State-listed heritage item located on the corner of Old Northern Road and Francis Street. There are also a number of other heritage items in the vicinity of this intersection that should be considered in any proposed road widening.*

2. Concept Road Design for Intersection

A concept plan for the upgrade of Old Northern Road and the Old Northern Road / Francis Street intersection has been prepared by TDG to address the specified requirements, adhering to the dimensions specified in *Austroads Guide to Road Design – Part 4A* (Austroads Guide) for urban channelised right-turn treatments (short deceleration length).

Drawings detailing the plan are shown in **Appendix A**.

The following design process has been undertaken, and assumptions made in creating this concept design:

- The eastern road / site boundary has been shifted east approximately two metres at the Old Northern Road / Francis Street intersection, in line with the Alan Drew Funerals building on the south-east corner of the intersection. This does not have any direct physical impact on the existing buildings that are on the heritage properties.
- No properties on the western side of Old Northern Road that are designated as heritage properties are affected.
- The road has been widened between Francis Street and Church Street to accommodate a carriageway width of 15.8 metres, comprising of four 3.2 metre wide through lanes and one 3.0 metre wide right turn lane.
- Old Northern Road tapers back to its current alignment between Kerrs Road and Church Street, which is approximately 60 metres in length, the lateral movement length required in the Austroads Guide.
- The western road boundary is determined by a line offset 3.5m from the edge of the western kerb line.
- The Old Northern Road / Parsonage Road intersection will be required to be converted into a left-in/left-out intersection, and an indicative layout can be seen in **Figure 5**.
- Pedestrian crossings have been provided on the eastern and northern legs of the Old Northern Road / Francis Street intersection. Currently the closest pedestrian crossings to Francis Street are located approximately 200 metres to the south (at the Old Northern Road / Kerrs Road intersection) and 300 metres to the north (at the Old Northern Road / Cecil Avenue intersection).



A second concept design has also been prepared with a total verge width of 2.5m on both sides of Old Northern Road. This is considered as a potentially viable alternative option. It has the effect of reducing the amount of land required to be acquired. This concept design is detailed in **Appendix B**.

3. Required Land Acquisition

By widening the road boundary as described, approximately 400 m² of property would need to be acquired in total, with some of this land falling on either side of Old Northern Road, as shown in **Figure 3** within **Appendix A**.

In the alternative option with 2.5m wide verges, approximately 200m² of property would need to be acquired on the eastern side only of Old Northern Road, as shown in **Figure 7** within **Appendix B**.

4. Estimated Costing

A provisional cost estimate has been prepared for the concept design works as shown Appendix A and outlined above. This is a preliminary estimate based on the concept design. It is subject to a range of broad based assumptions and exclusions as have been indicated.

On these bases, it is estimated that the total cost of the upgrade of Old Northern Road and the Old Northern Road / Francis Street intersection (as shown in Appendix A) could be in the order of \$3,000,000 and \$3,500,000, excluding GST. An indicative cost breakdown of this estimate is included within **Appendix C**.

Similarly, a costing estimate for the alternative design concept (as shown in Appendix B) is expected to cost between \$2,800,000 and \$3,300,000, excluding GST.

5. Heritage Item Consideration

An extract from Council's Local Environment Plan (LEP) 2012 Heritage Map is shown in **Figure 1** below, and shows four heritage items in the vicinity of the intersection of Old Northern Road and Francis Street. The four heritage items are the former St. Paul's Anglican Church at 221–225 Old Northern Road (I59) (also listed on the State Heritage Register); Castle Hill House at 6–10 Francis Street (I50); Wansbrough House at 230 Old Northern Road (I60); and The Parsonage at 210 Old Northern Road (I58).



Figure 1: The Hills Shire Local Environment Plan 2012 Heritage Map (figure supplied by Merc Capital)



The intersection design concepts indicate a potential need for the acquisition of a narrow strip of the Old Northern Road frontage of two of the heritage properties, being the former St. Paul's Anglican Church at 221-225 Old Northern Road (I59), to a depth of approximately 2.0m. It also shows widening over the Castle Hill House property at 6-10 Francis Street (I50), to a depth of approximately 1.0m to 1.5m. Neither the intersection performance improvements nor the acquisition of land is expected to impact the main historic building structures on these properties.

Further, the intersection design concepts are not expected to impact either of the two heritage listed properties being the Wansbrough House at 230 Old Northern Road (I60) or the Old Parsonage at 210 Old Northern Road (I58).

6. Conclusion

As mentioned in the Parking and Traffic Study that TDG have previously prepared for the Cecil Avenue Development, the intersection of Old Northern Road / Francis Street was identified to be currently operating at very poor level of service conditions. The Cecil Avenue development is expected to only have a minor impact on the operation of the intersection, increasing the critical delay slightly.

The Castle Hill South traffic study revealed that in order to support the planned developments within the Castle Hill South area, the intersection is required to be upgraded to a signalised intersection, and an exclusive northbound right-turn lane on Old Northern Road is also required.

In this regard, the cost of the intersection upgrade is assessed as reasonable to apportion between developments planned across the Castle Hill South area as well as existing traffic, with a proportion of the cost being attributed to development in the Cecil Avenue Planning Proposal.

As such, it is concluded that sufficient information has been provided to Council and Roads and Maritime Services in order for the Planning Proposal for the Cecil Avenue development to progress without further delay from this matter.

Yours sincerely
Traffic Design Group Ltd

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Attached: **Appendix A (Intersection Concept Design (3.5m wide verges))**
Appendix B (Alternative Intersection Concept Design (2.5m wide verges))
Appendix C (Cost Estimation Summary)

Appendix A

Intersection Concept Design
3.5m Wide Verge

[illegible]

DRAWN: TJG	---	---
DATE: 08/11/17	STATUS: ---	
SCALE: 1:800 @ A3		
DWG NO:13561-5S1A		

Wednesday, November 01, 2017 14:34:52



LEGEND

- LAND REQUIRED TO BE ACQUIRED (400m²)
- REQUIRED ROAD WIDENING (932m²)

REV	DATE	DRN	CHK	DESCRIPTION

OLD NORTHERN ROAD / FRANCIS STREET INTERSECTION UPGRADE
CONCEPT DESIGN - REQUIRED WIDENING
AS PER COUNCIL COMMENTS - 3.5M FOOTPATHS

DRAWN: TJG	---	---
DATE: 08/11/17	STATUS: ---	
SCALE: 1:800 @ A3		
DWG NO:13561-5S1A		





Wednesday, November 01, 2017 14:34:52

REV	DATE	DRN	CHK	DESCRIPTION

OLD NORTHERN ROAD / FRANCIS STREET INTERSECTION UPGRADE
CONCEPT DESIGN - OLD NORTHERN ROAD / FRANCIS STREET INTERSECTION
AS PER COUNCIL COMMENTS - 3.5M FOOTPATHS

DRAWN: TJG	---	---
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SCALE: 1:400 @ A3		
DWG NO:13561-5S1A		





Wednesday, November 01, 2017 14:34:52

REV	DATE	DRN	CHK	DESCRIPTION

OLD NORTHERN ROAD / FRANCIS STREET INTERSECTION UPGRADE
CONCEPT DESIGN - ONR / PARSONAGE ROAD AND CHURCH STREET INTERSECTIONS
AS PER COUNCIL COMMENTS - 3.5M FOOTPATHS

DRAWN: TJG	---	---
DATE: 08/11/17	STATUS: ---	
SCALE: 1:400 @ A3		
DWG NO:13561-5S1A		



Appendix B

Alternative Intersection Concept Design
2.5m Wide Verge



Wednesday, November 01, 2017 14:34:52

REV	DATE	DRN	CHK	DESCRIPTION

OLD NORTHERN ROAD / FRANCIS STREET INTERSECTION UPGRADE
 CONCEPT DESIGN
 AS PER COUNCIL COMMENTS - 2.5M FOOTPATHS

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DWG NO:13561-5S1A		



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Wednesday, November 01, 2017 14:34:52

REV	DATE	DRN	CHK	DESCRIPTION

OLD NORTHERN ROAD / FRANCIS STREET INTERSECTION UPGRADE
CONCEPT DESIGN - OLD NORTHERN ROAD / FRANCIS STREET INTERSECTION
AS PER COUNCIL COMMENTS - 2.5M FOOTPATHS

DRAWN: TJG	---	---
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SCALE: 1:400 @ A3		
DWG NO:13561-5S1A		





Wednesday, November 01, 2017 14:34:52

REV	DATE	DRN	CHK	DESCRIPTION

OLD NORTHERN ROAD / FRANCIS STREET INTERSECTION UPGRADE
CONCEPT DESIGN - ONR / PARSONAGE ROAD AND CHURCH STREET INTERSECTIONS
AS PER COUNCIL COMMENTS - 2.5M FOOTPATHS

DRAWN: TJG	---	---
DATE: 08/11/17	STATUS: ---	
SCALE: 1:400 @ A3		
DWG NO:13561-5S1A		



Appendix C

Cost Estimation Summary

SCHEDULE OF PRICES - ESTIMATE SUMMARY SHEET		
Project Number :	13561-5	
Project Description:	Merc - Francis Street - Old Northern Road Signals - Concept Only	
Drawing Reference Number :	13561-5S1A	
Date Prepared :	9 November 2017	
ITEM	DESCRIPTION	TOTAL
1	PRELIMINARY AND GENERAL WORKS, INCLUDING STORMWATER	\$ 160,000.00
2	PAVEMENT AND BERM WORKS	\$ 420,000.00
3	GENERAL UTILITIES EXCLUDING STORMWATER (PROVISIONAL LUMP SUM ESTIMATE)	\$ 760,000.00
4	STREET LIGHTING, FURNITURE AND ASSETS	\$ 70,000.00
5	LAND ACQUISITION	\$ 1,000,000.00
6	TRAFFIC SIGNALS	\$ 150,000.00
SUB TOTAL \$ (EXCL GST)		\$ 2,560,000.00
10	CONTINGENCY	\$ 640,000.00
11	PROFESSIONAL FEES	\$ 180,000.00
TOTAL \$ (EXCL GST)		\$ 3,380,000.00
DESCRIPTION OF COSTING APPROACH		
	General item includes: Establishment/Disestablishment, Traffic Management Plan, On Site Traffic Control, Survey Control and Setting Out, and As-builts	
	Earthworks item based on cut to waste	
	Stormwater Construction item based on installation of a new sump	
	Pavement Works based on M4 basecourse	
	Kerbing Construction based on mountable kerb and channel and mountable concrete nib	
	First Coat Sealing based on 40mm asphalt	
	Footpath Construction based on 75mm thick concrete	
	Berm Construction based on 75mm thick topsoil and grassing	
	Fencing works based on residential fencing replacement	
	Road Marking based on new centreline, edgelines, stop limit lines as shown on the plans	
	Signs works based on 9 new signs	
	All other underground and overhead utility services including but not limited to the following (power, phone, gas, communications, water, sewer, etc), not otherwise shown has only been provided for as a provisional lump sum estimate	
	All services to be marked on site before excavation	
	A contingency has been allowed for.	
	Topographical survey costs have not been allowed for.	
	Pavement sampling and testing costs have not been allowed for.	
	Land acquisition included as provisionally shown	



The Hills Shire

Castle Hill South Traffic Study

Traffic Assessment Report

December 2017

The Hills Shire

Castle Hill South Traffic Study

Traffic Assessment Report

Quality Assurance Statement

Prepared by:

Fred Gennaoui



Principal Consultant

Reviewed by:

Michael Willson



Senior Associate / NSW Branch
Manager

Approved for Issue by:

Fred Gennaoui



Principal Consultant

Status: Final report

Date: 11 December 2017



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Table of Contents

1.	Introduction	1
1.1	Background	1
1.2	Site Location and Study Area	1
1.3	Project Objectives	2
1.4	Project Scope and Methodology	2
1.5	Scope of Report	2
2.	Existing Conditions	3
2.1	Road Network	3
2.2	Operation of Existing Road System	3
3.	Traffic Impact Assessment	10
3.1	Potential Development in Castle Hill South	10
3.2	Peak Hourly Trip Generation and Distribution	11
3.3	Traffic Impact of Proposed Development	16
4.	Summary and Recommendations	20
4.1	Summary	20
4.2	Recommendations	20
5.	References	22

Appendix A

1 *Concept of Carriageway Capacity and Level of Service*

1

Appendix B

2 *Guidelines for Evaluation of Intersection Capacity*

2

Appendix C

3 *Potential Floor Areas for Castle Hill South*

3

Appendix D

4

Origin-Destination of Potential Trips

4

Figure 1 Study Area

Figure 2 Existing AM Peak Volumes

Figure 3 Existing PM Peak Volumes

Figure 4 Designated Development Zones

Figure 5 Future AM Peak Volumes

Figure 6 Future PM Peak Volumes

1.

1.1 Background

The construction of the Sydney Metro Northwest line between Chatswood and Rouse Hill includes a major bus-rail interchange at Castle Hill. These major public transport facilities have provided the Hills Shire Council (**Council**) with the opportunity to plan for increased residential density within an 800m radius from the proposed Castle Hill Station.

Council has engaged TDG in association with Gennaoui Consulting to undertake a traffic study to assess the implications of potential developments within the Castle Hill South area, with particular emphasis on accessibility, roadway capacity and intersection operations.

1.2 Site Location and Study Area

The study area shown in **Figure 1** is generally bounded by Old Northern Road to the west, Old Northern Road and Brisbane Road to the north, Francis Street to the south, and Cecil Avenue to the east.

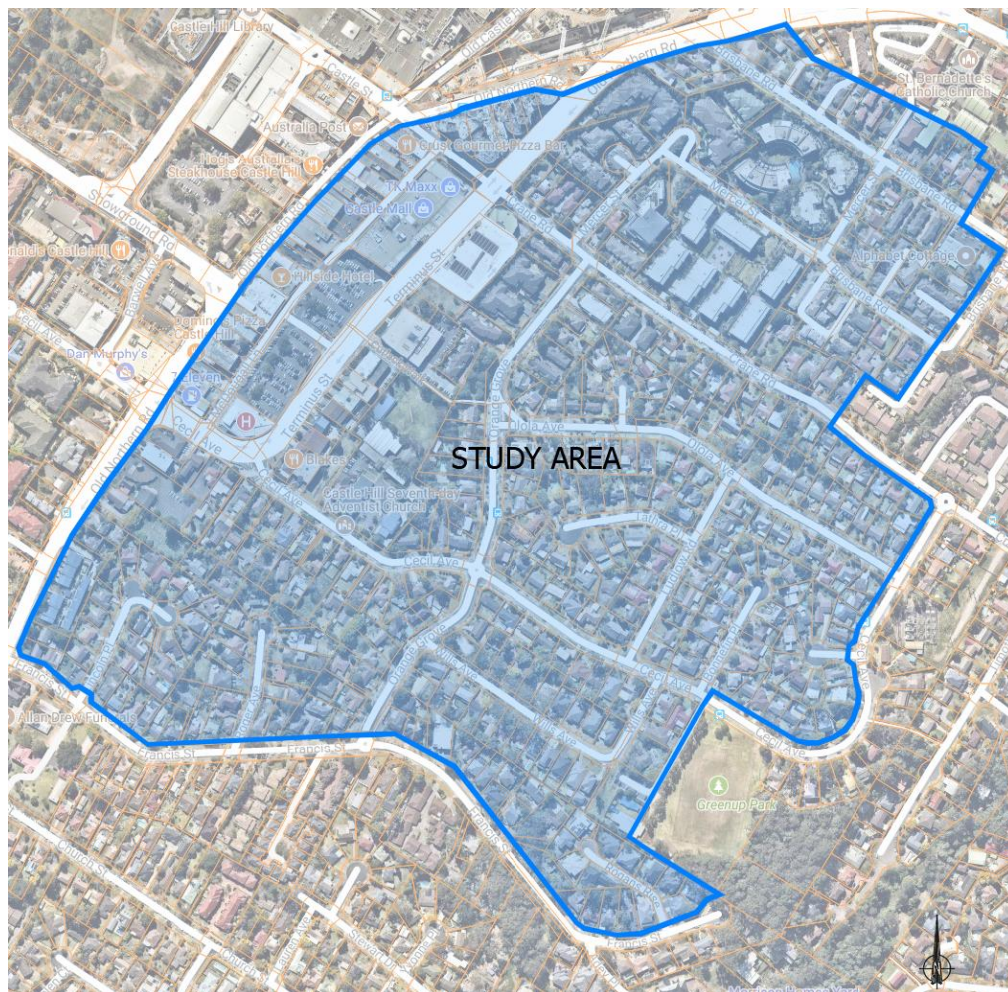


Figure 1: Study Area

1.3 Project Objectives

- Improve safety and efficiency of access to side streets; and
- Improve local and through access by controlling or limiting access points.

1.4 Project Scope and Methodology

The project identifies possible road widening options, intersection improvements such as turn lanes, and appropriate traffic controls for all roads and critical intersections within the study area illustrated in Figure 1. Intersection configuration options include traffic signals or roundabouts. The study was carried out in the following three stages:

1.4.1 Stage 1 Data Collection

- Recording data and collation of data;
- Review of all available relevant reports;
- Carry out traffic volume counts at a number of critical intersections to supplement existing information;
- Obtain the potential land uses within the study area including the potential number of additional residential units

1.4.2 Stage 2 Future Traffic Conditions

- Determine trip generation of all potential developments;
- Assign traffic generation to the existing road network to establish future traffic volumes along the main arterial, sub-arterial and collector roads within the study area, and of critical intersections;
- Assessment of roadway capacity and SIDRA analysis of all critical intersections to establish intersection capacity, degree of saturation and layout requirements.

1.4.3 Stage 3 Strategic Recommendations

- Formulation of strategic solutions to cater for additional traffic and minimise potential traffic impacts on the existing road network.

1.5 Scope of Report

This report summarises the findings, conclusions and recommendations with respect to the traffic impacts of the potential developments on the surrounding road network.

2.

2.1 Road Network

2.1.1 Major Approach Roads

The major access route to the study area is provided by the by-pass route along Terminus Street and Cecil Avenue which connects to Old Northern Road and Showground Road. The direct access to and from the area will be via Cecil Avenue; Orange Street and Crane Road would also be used. The road network has the following key features:

- The route along Terminus Street and the section of Cecil Avenue, between Terminus Street and Old Northern Road, has a four-lane divided carriageway with turning lanes at all signalised intersections along this route.
- Cecil Avenue, east of Terminus Street, has a 10.0m wide carriageway, with parking permitted on both sides of the road.
- East of Terminus Street, Crane Road has a 10.0m wide carriageway.
- Orange Grove has a narrower 9.0m carriageway.
- Traffic to and from Cecil Avenue, east of Terminus Street is restricted by a median along the by-pass route to left turning in and out only.
- Traffic to and from the south may use Roger Avenue and Francis Street to access Old Northern Road. Francis Street has a 10m carriageway with parking permitted on both sides. Roger Avenue has a narrower carriageway, between 6 and 7 m in width. Francis Street is controlled by a Stop Sign. A pedestrian refuge assists pedestrians crossing Francis Street.
- Traffic signals control the intersection of the Cecil Avenue with Old Northern Road, and the intersection with Crane Street.
- A one lane circulating roundabout is provided at the intersection of Cecil Avenue with Orange Grove.

2.2 Operation of Existing Road System

2.2.1 Traffic Counts

The existing traffic volumes in the study area were obtained from counts carried out between December 2016 and August 2017 at the following intersections (existing intersection control in brackets):

- Old Northern Road with Castle Street and Crane Road (traffic signals);
- Old Northern Road with Cecil Avenue (traffic signals);
- Terminus Street with Crane Road (traffic signals);
- Orange Grove with Francis Street (roundabout);
- Orange Grove with Cecil Avenue (roundabout);

- Cecil Avenue with Terminus Street (unsignalised);
- Francis Street with Roger Avenue (unsignalised);
- Old Northern Road with Brisbane Road (unsignalised);
- Old Northern Road with Church Street (unsignalised);
- Old Northern Road with Francis Street (unsignalised); and
- Orange Grove with Crane Street (unsignalised).

These counts were carried out during the weekday morning (7:00 to 9:00 am) and afternoon (between 4:00 and 6:00 pm) peak periods. Over the entire study area, the collective peak hours were found to occur between 8:00 and 9:00 am during the morning period, and from 4:30 to 5:30 pm during the afternoon period.

These counts were supplemented by earlier counts at the following signalised intersections:

- Old Northern Road with McMullen Avenue (Gennaoui, 2010);
- Old Northern Road with Showground Road (Brown, 2014); and
- Terminus Street with Car Park Access (Gennaoui, 2012).

The peak hour volumes at these intersections are presented in **Figure 2** and **Figure 3** for both the morning and afternoon peak hours respectively.

2.2.2 Operation of Major Approach Roads

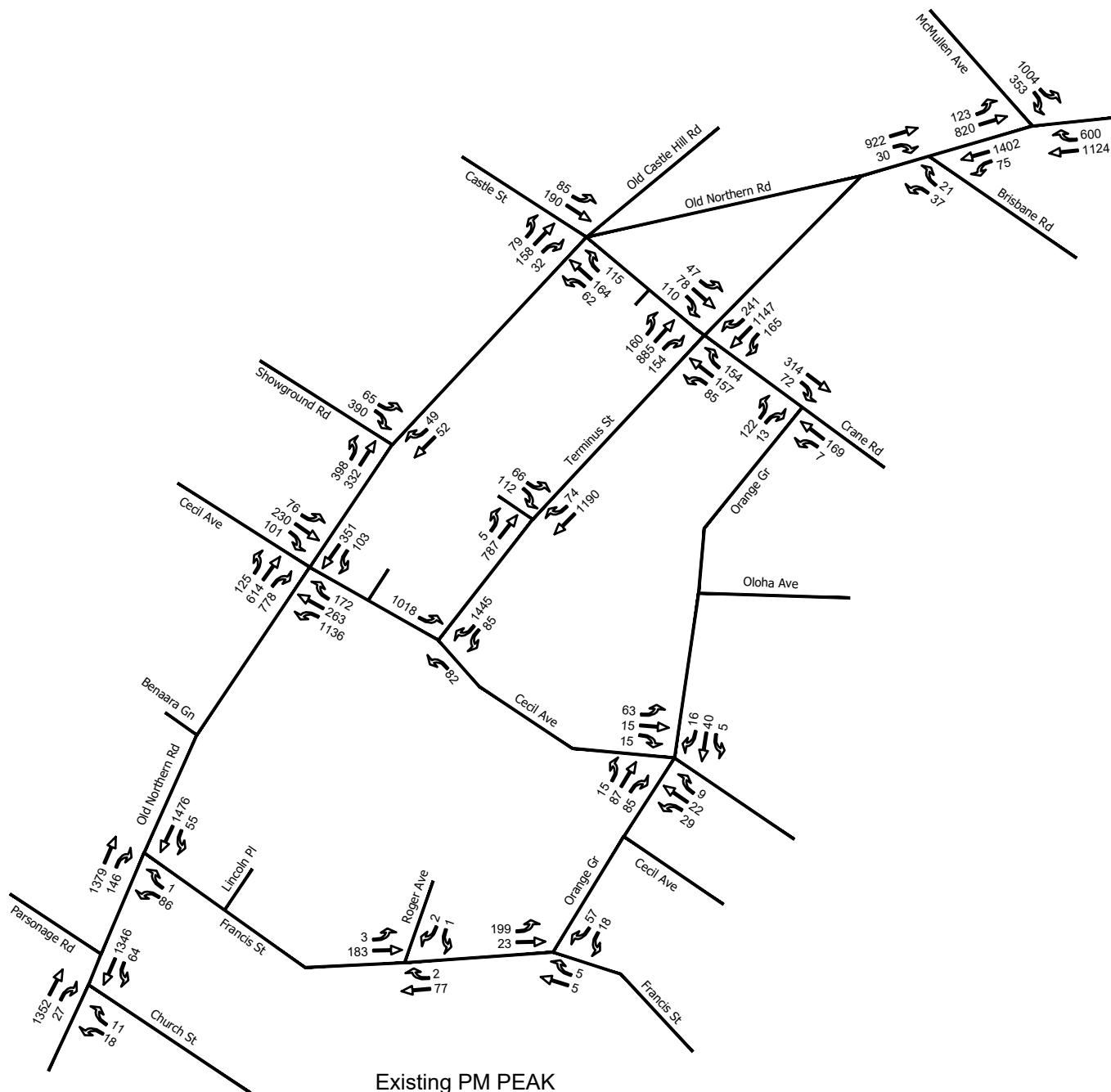
The concepts of carriageway capacity and Level of Service (LoS) are discussed in **Appendix A** together with criteria for their assessment.

The absence of major traffic movements entering/crossing from major developments along Terminus Street, Old Northern Road, south of Cecil Avenue and east of Terminus Street, and Crane Street between Terminus Street and Old Northern Road, means that the service one-way hourly volumes for uninterrupted traffic included in Table A2 of **Appendix A** could be used; all other streets were assessed based on the service one-way hourly volumes for interrupted traffic included in Table A1 of **Appendix A**.

2.2.3 Existing Operation of Major Approach Roads

The existing traffic volumes along Terminus Street, Cecil Avenue, Old Northern Road and Crane Road are summarised below in **Table 1**, together with their appropriate level of service. Existing volumes along a number of other streets are also included.

Thursday, 28 September 2010 20mm



Existing PM PEAK
4:00 - 5:00pm

Castle Hill South - Traffic Study

Existing PM Peak Hour Traffic Volumes



3

SCALE: NTS

LOCATION	LANES	AM PEAK			PM PEAK		
		East/North	South/West	LoS	East/North	South/West	LoS
Interrupted Flow Conditions - (Table A1 of Appendix A)							
Brisbane Road							
South of Old Northern	4U	144	180	A	58	105	A
Castle Street							
West of Old Northern	2U/1U	218	261	A	275	243	A
Crane Road							
East of Terminus	1U/2U	214	585	A	397	396	A
East of Orange Grove	4UP	151	372	A	327	176	A
Cecil Avenue							
East of Orange Grove	4UP	53	147	A	105	60	A
East of Terminus	4UP	43	141	A	95	82	A
West of Old Northern	4U	384	359	A	407	388	A
Church Street							
East of Old Northern	2U	65	52	A	91	29	A
Francis Street							
East of Old Northern	4UP	160	197	A	201	87	A
East of Roger Avenue	4UP	158	203	A	184	79	A
Old Northern Road							
North of Cecil Avenue	4U	817	389	A	862	454	A
South of Castle Street	2U	291	86	A	269	62	A
Orange Grove							
South of Crane Street	4UP	161	149	A	135	79	A
North of Cecil Ave	4UP	144	128	A	162	64	A
South of Cecil Ave	4UP	162	129	A	187	84	A
Roger Avenue							
North of Francis Street	2U	1	3	A	5	3	A
Uninterrupted Flow Conditions - Table A2 of Appendix A							
Cecil Avenue							
East of Old Northern	4DC	969	1,317	A	1,111	1,571	A
Crane Road							
West of Terminus	4UC	175	589	A	235	558	A
Old Northern Road							
South of Francis Street	4UC	1462	1,643	B	1,525	1,562	B

LOCATION	LANES	AM PEAK			PM PEAK		
		East/North	South/West	LoS	East/North	South/West	LoS
South of Cecil Avenue	4UC	1479	1,424	A	1,517	1,588	B
West of Brisbane	4DC	998	1552	A	952	1439	A
Terminus Street							
North of Cecil Avenue	4DC	814	1,237	A	1,018	1,540	A
South of Crane Street	4DC	880	1,271	A	1,199	1,342	A
North of Crane Street	4DC	946	1,380	A	1,086	1,553	A

Table 1: Existing Carriageway Level of Service

4DC 4 lanes divided carriageway with clearway (Uninterrupted flow conditions of Appendix A)
 4UC 4 lanes undivided carriageway with clearway
 4U 4 lanes undivided carriageway with some parking
 2U 2 lanes undivided carriageway

2.2.4 Operation of Existing Critical Intersection

The concepts of intersection capacity and level of service, as defined in the Guidelines published by the RTA (Road and Traffic Authority Guidelines of New South Wales, now Roads and Maritime Services (RMS) (2002), are discussed in **Appendix B** together with criteria for their assessment. The assessment of the level of service of traffic signals is based on the evaluation of the average delay (seconds per vehicle) of vehicles on all approaches. The assessment of the level of service of roundabouts and signed controlled intersections is based on the average delay (seconds per vehicle) of the critical movement.

An analysis of the operation of all critical intersections within the study area was carried out using the SIDRA computer modelling program. The results of this analysis are summarised in Table 2.

during both the morning and the afternoon peak hours.

The roundabouts controlling the intersection of Orange Grove with both Cecil Avenue and Francis Street operate at a very good level of service peak periods.

The right turning movements from Old Northern Road into Francis Street experience very high delays whilst waiting for a gap in the large volume of southbound traffic along Old Northern Road, of the right turning movement onto Francis Street from Old Northern Road is not possible, as it is the only direct access to a very large residential area east of Old Northern Road.

The right turning movement from Francis Street onto Old Northern Road is very difficult due to the considerable volume of southbound traffic. The installation of traffic signals would resolve this existing problem and should seriously be considered by Council.

INTERSECTION	AM		PM	
	Delay sec/v	LoS	Delay sec/v	Los
Traffic Signals				
Old Northern Road with Castle Street / Crane Road	23.7	B	23.5	B
Old Northern Road with Cecil Avenue	29.3	C	39.6	C
Old Northern Road with McMullan Avenue	22.2	B	24.7	B
Old Northern Road with Showground Road	20.8	B	17.9	B
Terminus Street with Crane Street	42.3	C/D	37.1	C
Terminus Street with Access to Car Park	15.3	B	13.2	A
Roundabout				
Orange Grove with Cecil Avenue	8.9	A	9.10	A
Orange Grove with Francis Street	8.2	A	7.7	A
T-Junctions				
Cecil Avenue with Terminus Street	11.6	A	12.5	A
Francis Street with Roger Avenue	6.2	A	5.6	A
Old Northern Road with Brisbane Road	>70	F	>70	F
Old Northern Road with Church Street	>70	F	>70	F
Orange Grove with Crane Road	9.0	A	8.4	A
Old Northern Road with Francis Street	>70	F	>70	F

Table 2: Existing Operation of Intersections

The right turning movement from Church Street onto Old Northern Road is also very On-site observations suggest that there are a number of courtesy gaps that become available, especially due to the presence of the Old Northern Road / Kerrs Road signalised intersection approximately 70m to the south. This is not reflected within the SIDRA model, however it remains evident that there are still very large delays for right turning vehicles from Church Street onto Old Northern Road.

The right turning movement from Brisbane Road onto Old Northern Road is also very a small number of vehicles make this movement taking advantage of the gaps in traffic generated by the signals at McMullen Avenue Old Northern Road.

The remaining intersections operate at a very good level of

3.

3.1 Potential Development in Castle Hill South

Council Planning Section have provided the potential floor area for each major property within the study area. The study area has been divided into 13 zones by TDG for the purposes of traffic distribution, as shown in **Figure 4**.

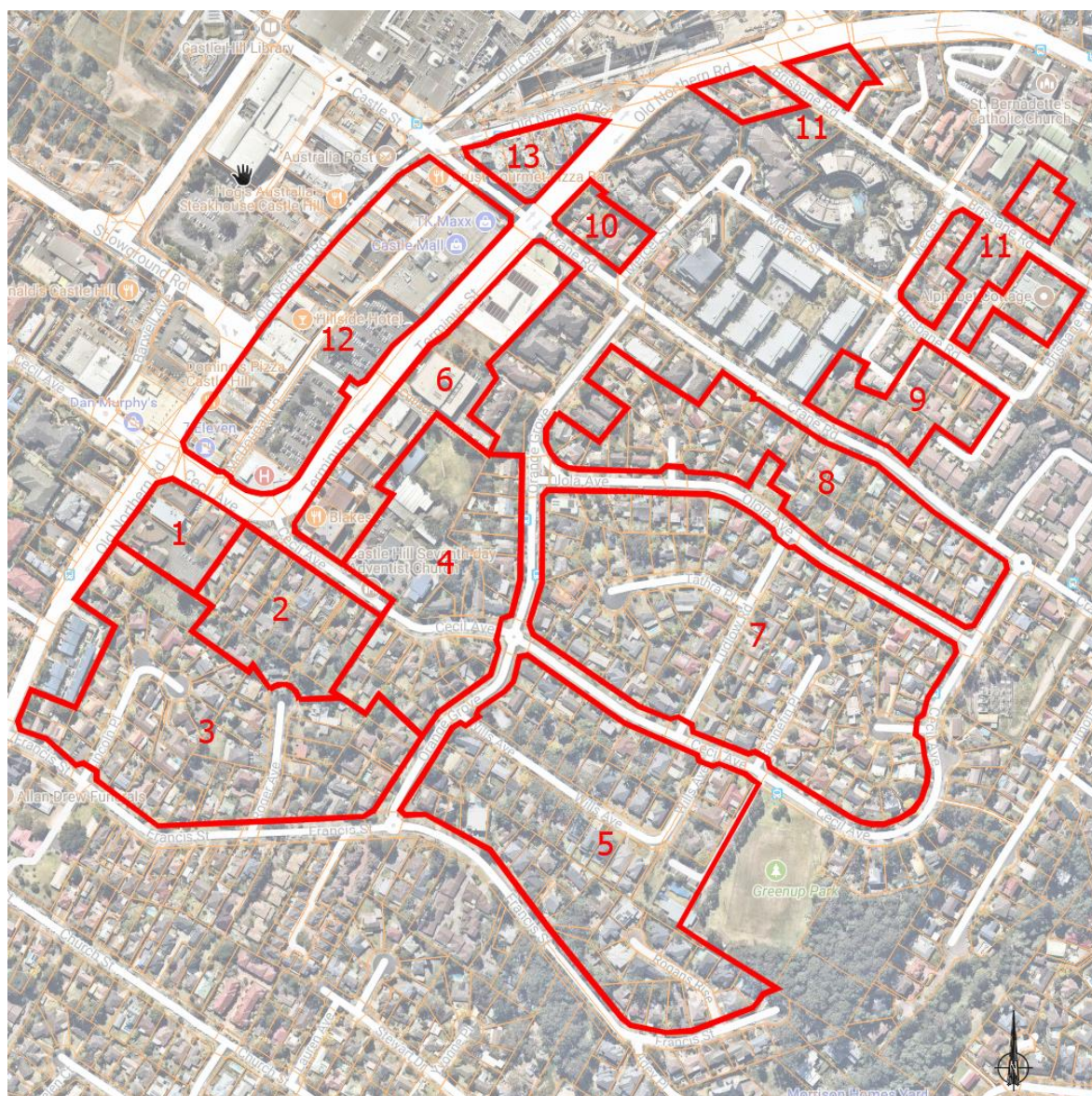


Figure 4: Designated Development Zones

Potential growth for retail, office and residential land uses are detailed in **Appendix C** and summarised in **Table 3**. The largest proportion of developments in the study area is high density residential buildings, comprising approximately 3,400 apartments.

Approximately 37,240 m² GFA of offices could be provided within the study area, mostly in Zones 2, 6 and 12, either side of Terminus Street. Approximately 21,850 m² GFA of retail is also anticipated.

Zone No	Block No	Retail m ² GFA	Office m ² GFA	Additional Dwellings
1	1	0	3,706	109
2	2 **	810	8,000	442
3	3 & 5	0	0	379
4	4 & 9	0	0	414
5	7 & 8	0	0	220
6	6	15,536	15,536	0
7	10 & 11	0	0	377
8	12, 13 & 14	0	0	382
9	15	0	0	84
10	16	0	0	74
11	17, 18,19, 20 & 21	0	0	152
12	22 *	5,500	10,000	351
13	Crane Rd Target Site			378
		21,846	37,241	3,363

Table 3: Potential Development in Castle Hill South

*source: Gennaoui, 2012

**source: Gennaoui, 2017

3.2 Peak Hourly Trip Generation and Distribution

3.2.1 Trip Generation of Proposed Developments

The trip generations of the potential development within the study area were estimated as follows:

- **Residential:** The RMS Technical Directive 04a (2013) indicates that the average trip generation rates for high density residential buildings near railway stations is an average of 0.19 trips/unit, based on a range of 0.07 to 0.32 trips/unit (from eight high density buildings) during the morning peak hour. During the afternoon peak hour, the average trip generation rate is 0.15 vehicle trips/unit, based on a range of 0.06 to 0.41 trips/unit.

The 85% rates of 0.28 trips/unit and 0.18 trips/unit have been adopted to estimate the trip generation during the morning and afternoon peak hours of the proposed high density residential buildings, respectively.

- **Office:** The latest trip generation rates published by the RMS (TD) for office developments are 1.6 and 1.2 trips per 100 m² GFA for the morning and afternoon peak hours respectively. These rates were used to estimate the trip generation of the office component of the potential development.
- **Retail:** The trip generation rates determined in the Norwest Business Park Master Plan Study (Gennaoui, 2003) for retail developments of 9.0 trips per 100 m² GFA for the afternoon peak hour were used to estimate the trip generation of this land use. A trip generation rate equivalent to 50 percent (4.5 trips per 100m² GFA) of the afternoon peak was adopted for the morning peak hour.

The study area is expected to generate about 2,520 and 3,020 vehicle trips during the morning and afternoon peak hours respectively, as noted in **Table 4** below:

Zone No	AM PEAK				PM PEAK			
	Residential	Retail	Office	Total	Residential	Retail	Office	Total
	Two Way	Two Way	Two Way	Two Way	Two Way	Two Way	Two Way	Two Way
1	31	0	59	90	20	0	44	64
2	124	36	128	288	80	73	96	248
3	106	0	0	106	68	0	0	68
4	116	0	0	116	75	0	0	75
5	62	0	0	62	40	0	0	40
6	0	699	249	948	0	1398	186	1585
7	105	0	0	105	68	0	0	68
8	107	0	0	107	69	0	0	69
9	23	0	0	23	15	0	0	15
10	21	0	0	21	13	0	0	13
11	43	0	0	43	27	0	0	27
12	98	248	160	506	63	495	120	678
13	106	0	0	106	68	0	0	68
Total	942	983	596	2,520	605	1,966	477	3,018

Table 4: Estimated Trip Generation of Potential Developments in Castle Hill South

3.2.2 Trip Distribution and Assignment

The route distribution for approaching and departing traffic, included in **Table 5** was adopted to assign the traffic generated by the potential developments within the study area to the road network.

ORIGIN	ROUTE	PERCENTAGES			
		AM Peak		PM Peak	
		Arriving	Departing	Arriving	Departing
East	Old Northern Road / Brisbane Road	35.0%	35.0%	35.0%	35.0%
West	Cecil Avenue / Old Northern Road	15.0%	15.0%	15.0%	15.0%
	Showground Road / Old Northern Road	15.0%	15.0%	15.0%	15.0%
	Castle Street / Old Northern Road	10.0%	5.0%	10.0%	5.0%
North	Old Castle Hill Road / Castle Street	0.0%	5.0%	0.0%	5.0%
South	Old Northern Road / Francis Street	25.0%	25.0%	25.0%	25.0%
Total		100.0%	100.0%	100.0%	100.0%

Table 5: Peak Trip Distribution for Castle Hill South Potential Developments

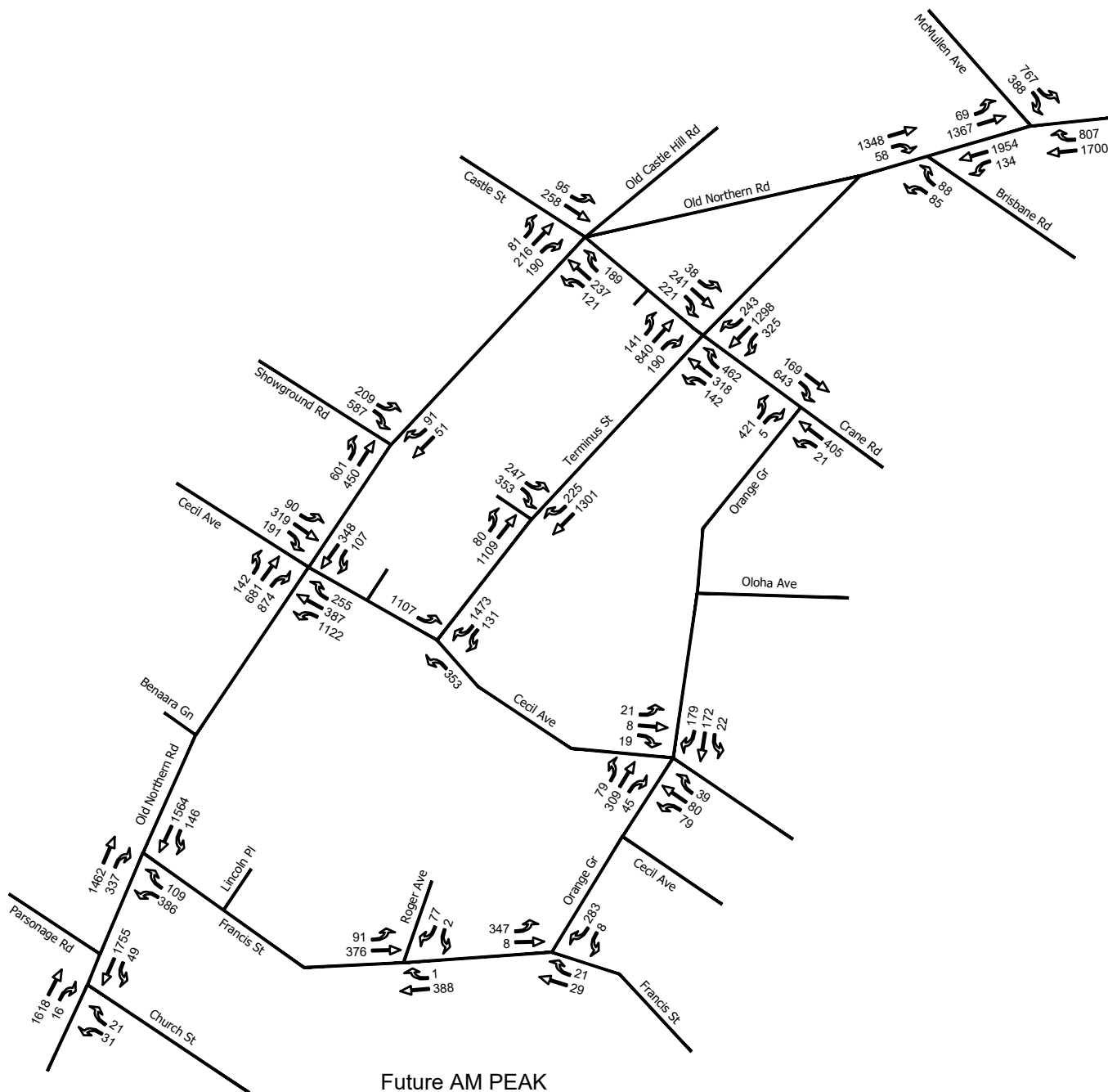
The distribution in Table 5Error! Reference source not found. was then applied to the trips generated by each zone of the study area to derive the origin and distribution of trips presented in **Table 6** and detailed in **Appendix D**.

ORIGIN	ROUTE	PERCENTAGES			
		AM Peak		PM Peak	
		Arriving	Departing	Arriving	Departing
East	ONR east Brisbane	472	410	502	554
West	Cecil west of ONR	202	176	215	237
	Showground west ONR	202	176	215	237
	Castle west ONR	135	59	144	79
North	Old Castle Hill	0	59	0	79
South	ONR / Francis	337	293	359	396
Total		1,349	1,171	1,436	1,583

Table 6: Directional Peak Trip Distribution for Castle Hill South Potential Developments

The trips were then assigned to the overall road network. The resultant volumes at all relevant intersections within the Study Area are presented in **Figure 5** and **Figure 6** for the morning and afternoon peak hour respectively.

Thursday, 28 September 2010 20mm



Castle Hill South - Traffic Study

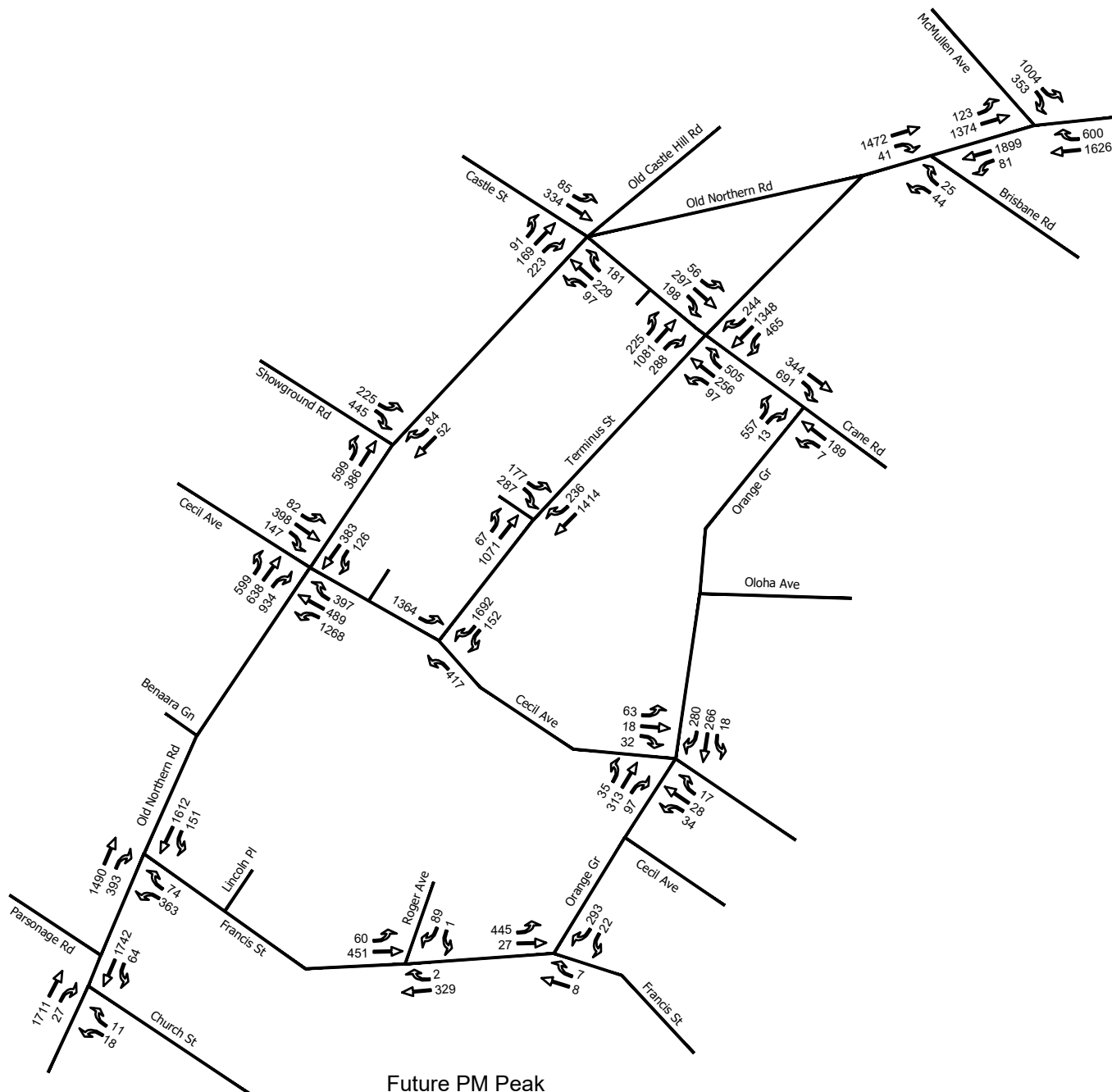
Future AM Peak Hour Traffic Volumes



5

SCALE: NTS

Thursday, 28 September 2010 20mm



Future PM Peak
4:00 - 5:00pm

3.3 Traffic Impact of Proposed Development

3.3.1 Impact on Major Approach Roads

The carriageway traffic volumes along all approach roads and most roads within the study area at full development are summarised in **Table 7**, together with their appropriate level of service.

LOCATION	LANES	AM PEAK			PM PEAK		
		East/North	South/West	LoS	East/North	South/West	LoS
Interrupted Flow Conditions							
Brisbane Road							
South of Old Northern	4U	173	192	A	69	122	A
Castle Street							
West of Old Northern	2U/1U	373	318	A	419	320	A
Crane Road							
East of Terminus Street	1U/2U	756	922	F	1050	858	F
East of Orange Grove	4UP	174	426	A	357	196	A
Cecil Avenue							
East of Orange Grove	4UP	75	198	A	133	79	A
East of Terminus Street	4UP	131	353	A	152	417	A
West of Old Northern	4U	600	529	A	627	619	A
Church Street							
East of Old Northern	2U	65	52	A	91	29	A
Francis Street							
East of Old Northern	4UP	483	495	A	544	437	A
East of Roger Avenue	4UP	378	389	A	452	331	A
Old Northern Road							
North of Cecil Avenue	4UC	1026	455	A	1117	509	B
South of Castle Street	2U	487	121	A	483	97	A
Orange Grove							
South of Crane Street	4UP	426	664	C	570	698	C
North of Cecil Avenue	4UP	372	376	A	396	567	B
South of Cecil Avenue	4UP	433	270	A	445	332	A
Roger Avenue							
North of Francis Street	2U	92	79	A	62	90	A

LOCATION	LANES	AM PEAK			PM PEAK		
		East/North	South/West	LoS	East/North	South/West	LoS
Uninterrupted Flow Conditions							
Cecil Avenue							
East of Old Northern Road	4DC	1300	1,764	B	1,458	2,154	D
Crane Road							
West of Terminus Street	4UC	500	702	A	551	725	A
Old Northern Road							
South of Francis Street	4UC	1799	1,950	C	1,883	1,975	C
South of Cecil Avenue	4UC	1697	1,661	B	1,702	1,798	C
West of Brisbane Street	4DC	1406	2039	C	1513	1943	C
Terminus Street							
North of Cecil Avenue	4DC	1107	1,473	A	1,364	1,844	B
South of Crane Street	4DC	1171	1,661	B	1,594	1,643	B
North of Crane Street	4DC	1340	1,866	C	1,642	2,057	C

Table 7: Carriageway Level of Service at Ultimate Development

4DC	4 lanes divided carriageway with clearway
4UC	4 lanes undivided carriageway with clearway
4UP	4 lanes undivided carriageway with parking
2U	2 lanes undivided carriageway

At full potential development, the majority of approach roads within the study area would
C following:

- Crane Road between Terminus Street and Orange Grove which would operate a poor
F and afternoon peaks; this could be addressed by prohibiting on-street parking during both the morning and afternoon peak periods and the widening of Crane Road to provide four traffic lanes.
- The section of Cecil Avenue between Old Northern Road and Terminus Street which

3.3.2 Impact on Critical Intersections

An analysis of the operation of all relevant intersections likely to be affected by the potential developments in Castle Hill South was carried out using the SIDRA intersection modelling program. The results of this analysis are summarised in **Table 8**.

INTERSECTION	AM		PM	
	Delay sec/v	LoS	Delay sec/v	Los
Traffic Signals				
Old Northern Road with Castle Street / Crane Road	33.0	C	34.9	C
Old Northern Road with Cecil Avenue	>70	F	>70	F
Old Northern Road with McMullen Avenue	26.3	B	22.3	B
Old Northern Road with McMullen Avenue / Brisbane Road	77.8	F	44.4	D
Old Northern Road with Showground Road	19.7	B	16.9	B
Terminus Street with Crane Road	>70	F	>70	F
Terminus Street with access to Car Park	19.9	B	17.8	B
Old Northern Road with Francis Street	21.7	B	25.3	B
Roundabout				
Orange Grove with Cecil Avenue	10.5	A	11.7	A
Orange Grove with Francis Street	9.0	A	9.0	A
T-Junctions				
Cecil Avenue with Terminus Street	16.2	B	23.6	B
Francis Street with Roger Avenue	9.4	A	9.6	A
Old Northern Road with Brisbane Road	>70	F	>70	F
Old Northern Road with Church Street	>70	F	>70	F
Orange Grove with Crane Road	22.7	B	28.0	B/C
Old Northern Road with Francis Street	>70	F	>70	F

Table 8: Future Operation of Intersections

This assessment of the impact of the potential growth in Castle Hill South has highlighted the following issues:

- The intersection of Old Northern Road with Cecil Avenue would operate at a very poor F Additional capacity would be required;
- The traffic signals at the intersection of Terminus Street with Crane Road would operate at a very poor F peak hours. Additional capacity would be required;
- The right turning movement from Brisbane Street to Old Northern Road would increase the conflicts with through traffic resulting in an unsafe situation. To resolve this problem, serious consideration ought to be given to the realignment of Brisbane Street with McMullen Avenue as suggested in a previous report (Gennaoui, 2010);
- The intersection of Orange Grove with Crane Road may require the provision of a roundabout due to the large volume of vehicles turning right onto Orange Grove from Crane Road;

- The provision of traffic signals incorporating an exclusive right turn bay at the intersection of Old Northern Road with Francis Street would operate at satisfactory level of service "B". However, the length of the right turning bay would be past Parsonage Street, which may in turn be restricted to left turning in and out only movements.

The roundabouts controlling the intersections of Orange Grove with Cecil Avenue and with Francis Street would continue to operate at a very good level of service "A" during the morning and afternoon peak periods.

4.

4.1 Summary

Approximately 52,800 m² GFA of offices could be provided within the Study Area mostly in Zones 2, 6 and 12 either side of Terminus Street. Approximately 21,850 m² GFA of retail is also anticipated.

The Castle Hill South study area is expected to generate about 2,770 and 3,200 vehicle trips during the morning and afternoon peak hours respectively.

At full potential developments, the majority of roads within the study area would operate at **C**

- Crane Road between Terminus Street and Orange Grove, which would operate at a **C** level, addressed by the widening of Crane Road to provide four traffic lanes;
- The section of Cecil Avenue between Old Northern Road and Terminus Street which would operate at **C** level during peak.

This assessment has highlighted the following issues:

- The intersections of Old Northern Road with Cecil Avenue and the intersection of Terminus Street with Crane Road would operate at very poor levels during the morning peak and the afternoon peak hours. Additional capacity would be required;
- The right turning movement from Brisbane Street to Old Northern Road will be exacerbated resulting in an unsafe situation. To resolve this problem, serious consideration ought to be given to the realignment of Brisbane Street with McMullen Avenue as suggested in a previous report (Gennaoui, 2010);
- The intersection of Orange Grove with Crane Road may require the provision of a roundabout;
- The provision of traffic signals at the intersection of Old Northern Road with Francis Street would necessitate an exclusive right turn bay which would extend beyond Parsonage Road.

4.2 Recommendations

In order to address the traffic issues identified above, the following improvements are recommended for serious consideration:

- Widening of Crane Road between Terminus Street and Orange Grove to achieve a four lane carriageway;
- Provision of additional capacity at the intersections of Old Northern Road with Cecil Avenue and the intersection of Terminus Street with Crane Road; if not possible, then consideration to reduce the potential trip generation by reducing the retail floor area being the land use with highest trip generation rates;

- Installation of traffic signals at the junction of Old Northern Road with Francis Street together with restriction of traffic movement in Parsonage Road to left turn in and out only at Old Northern Road;
- Provision of a roundabout at the intersection of Crane Road with Orange Grove;
- Serious consideration should be given to the realignment of Brisbane Street with McMullen Avenue.

5.

Review of Residential Development in Castle Hill North Precinct. Traffic & Accessibility Study Report

Capacity of Proposed Intersection of Old Northern Road with McMullen Ave & Brisbane Rd

Terminus Street Car Park Traffic Impact Study
Shire. May

Mixed Residential Development at Cecil Avenue, Castle Hill
Pty Ltd. June.

Appendix A

Concept of Carriageway Capacity and Level of Service

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

Level of service is defined by Austroads as a "qualitative measure of the effects of a number of features, which include speed and travel time, traffic interruptions, freedom to manoeuvre, safety, driving comfort and convenience, and operating costs. Levels of service are designated from A to F from best (free flow conditions) to worst (forced flow with stop start operation, long queues and delays) as follows:

***LEVELS OF SERVICE**

- A - Free flow (almost no delays)
- B - Stable flow (slight delays)
- C - Stable flow (acceptable delays)
- D - Approaching unstable flow (tolerable delays)
- E - Unstable flow (congestion; intolerable delays), and
- F - Forced flow (jammed)

A service volume, as defined by Austroads, is the maximum number of vehicles that can pass over a given section of roadway in one direction during one hour while operating conditions are maintained at a specified level of service. It is suggested that ideally arterial and sub-arterial roads should not exceed service volumes at level of service C. At this level, whilst most drivers are restricted in their freedom to manoeuvre, operating speeds are still reasonable and acceptable delays experienced. However, in urban situations, arterial and sub-arterial roads operating at Level of Service D are still considered adequate. Traffic Volumes along urban roads with interrupted and uninterrupted flow conditions are included in **Table A1** and **A2** respectively.

	DESCRIPTION	LEVEL OF SERVICE					
		A	B	C	D	E	F
2U	2 Lane Undivided	540	630	720	810	900	F
4UP	4 Lane Undivided with Two Parking Lanes	540	630	720	810	900	F
4U	4 Lane Undivided with Some Parking	900	1050	1200	1350	1500	O
4UC	4 Lane Undivided with Clearways	1080	1260	1440	1620	1800	R
4D	4 Lane Divided with Clearways	1140	1330	1520	1710	1900	C
6U	6 Lane Undivided	1440	1680	1920	2160	2400	E
6D	6 Lane Divided with Clearway	1740	2030	2320	2610	2900	D

Table A1: Level of Service Interrupted Flow Conditions along Urban Roads (One Way Hourly Volumes)

	DESCRIPTION	LEVEL OF SERVICE					
		A	B	C	D	E	F
2U	2 Lane Undivided	760	880	1000	1130	1260	F
4U	4 Lane Undivided with Some Parking	1260	1470	1680	1890	2100	O
4UC	4 Lane Undivided with Clearways	1510	1760	2010	2270	2520	R
4DC	4 Lane Divided with Clearways	1600	1860	2130	2400	2660	C
4DCL	6 Lane Undivided with Clearways	2250	2620	3000	3380	3740	E
6DC	6 Lane Divided with Clearway	2440	2840	3250	3660	4060	D

* 40% higher than base volumes in Table F1

Table A2: Level of Service Uninterrupted Flow Conditions along Urban Roads (One Way Hourly Volumes)

Appendix B

Guidelines for Evaluation of Intersection Operation

The RTA has included in the "Guide to Traffic Generating Developments" (Dec 1993, Issue 2) a section on the assessment of intersections. The assessment of the level of service of an intersection is based on the evaluation of the following Measures of Effectiveness:

- (a) Average delay (seconds/veh) (all forms of control)
- (b) Delay to critical movement (seconds/veh) (all forms of control)
- (c) Degree of saturation (traffic signals and roundabouts)
- (d) Cycle length (traffic signals)

INTANAL was used to calculate the relevant intersection parameters. INTANAL is a software which allows comparisons between different forms of intersection control and different forms of intersection configurations to be readily evaluated. That is at each intersection the priority control, roundabout and signal control options will be examined to determine the most efficient form of control.

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

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

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

Table B1 sets out average delays for different levels of service. There is no consistent correlation between definitions of levels of service for road links as defined elsewhere in this section, and the ranges set out in Table G1. In assigning a level of service, the average delay to the motoring public needs to be considered, keeping in mind the location of the intersection. For example, drivers in inner-urban areas of Sydney have a higher tolerance of delay than drivers in country areas. Table B1 provides a recommended baseline for assessment.

Level of Service	Average Delay per Vehicle (seconds/veh)	Traffic Signals, Roundabout	Give Way and Stop Signs
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 - 42	Satisfactory	Satisfactory, but accident study required
D	43 to 56	Operating near capacity	Near capacity and accident study required
E	57 to 70	At capacity; at signals, incidents will cause excessive delays Roundabouts require other control mode	At capacity, required other control mode

Table B1: Level of Service Criteria for Intersections

The figures in Table B1 are intended as a guide only. Any particular assessment should take into account site-specific factors including maximum queue lengths (and their effect on lane blocking), the influence of nearby intersections and the sensitivity of the location to delays. In many situations, a comparison of the current and future average delay provides a better appreciation of the impact of a proposal, and not simply the change in the level of service.

The intersection degree of saturation (DS) can also be used to measure the performance of isolated intersections. At intersections controlled by traffic signals, both queue length and delays increase rapidly as DS approaches 1.0. An upper limit of 0.9 is appropriate. When DS exceeds 0.8 - 0.85, overflow queues start to become a problem. Satisfactory intersection operation is generally achieved with a DS of about 0.7 - 0.8. (Note that these figures are based on isolated signalised intersections with cycle lengths of 120 seconds. In co-ordinated signal systems DS might be actively maximised at key intersections). Although in some situations additional traffic does not alter the level of service, particularly where the level of service is E or F, additional capacity may still be required. This is particularly appropriate for service level F, where small increases in flow can cause disproportionately greater increases in delay. In this situation, it is advisable to consider means of control to maintain the existing level of absolute delay. Suggested criteria for the evaluation of the capacity of signalised intersections based on the Degree of Saturation are summarised in Table B2.

Level Of Service	Optimum Cycle Length (Seconds) (Co)	Volume/Saturation Y	Intersection Degree Of Saturation X
A/B - Very good operation	< 90	< 0.70	< 0.80
C - Satisfactory	90-120	0.70-0.80	0.80-0.85
D - Poor but manageable	120-140	0.80-0.85	0.85-0.90
E/F - Bad, extra capacity required	>140	>0.85	> 0.90

Table B2: Criteria for Evaluating Capacity Of Signalised Intersections*

* Source: Roads & Traffic Authority (2002)

Appendix C

Potential Floor Areas for Castle Hill South

Castle Hill (Dwelling Potential) - Excluding Growth on Castle Towers)					
			*Assume 10,000 m ² existing		
		GFA			Dwellings
Zone No.	Block No.	Retail	Office		Additional
1	1		3,705.5		109
2	2	810.0	8,000.0		442
3	3	0.0	0.0		113
4	4		0.0		81
3	5		0.0		266
6	6	15,535.5	15,535.5		0
5	7		0.0		59
5	8		0.0		161
4	9		0.0		333
7	10		0.0		286
7	11		0.0		91
8	12		0.0		109
8	13		0.0		108
8	14		0.0		164
9	15		0.0		84
10	16		0.0		74
11	17		0.0		54
11	18		0.0		9
11	19		0.0		15
11	20		0.0		6
11	21		0.0		67
	Sub-Total	16,346	27,241		2,633
12	22	5,500.0	10,000.0		351
	Sub-Total				351
13	Street Trag	Approved DA			378
	Pennant Street Tar	Approved DA			0
	Sub-Total				378
TOTAL		21,845.5	37,241.0		3,363

Appendix D

Origin-Destination of Potential Trips

ORIGIN DESTINATION OF TRIPS

AM PEAK																														
APPROACH ROUTES			Zone 1		Zone 2		Zone 3		Zone 4		Zone 5		Zone 6		Zone 7		Zone 8		Zone 9		Zone 10		Zone 11		Zone 12		Zone 13		TOTAL	
Arr	Dep		Arr	Dep	Arr	Dep	Arr	Dep	Arr	Dep	Arr	Dep	Arr	Dep	Arr	Dep	Arr	Dep	Arr	Dep	Arr	Dep	Arr	Dep	Arr	Dep	Arr	Dep	Arr	Dep

Old Northern Road

S of Francis	25%	25%	14	8	40	32	8	19	9	20	5	11	155	82	8	18	8	19	2	4	2	4	3	7	76	50	8	19	329	274	
e of Brisbane St	35%	35%	20	12	56	44	11	26	12	28	6	15	216	115	11	26	11	26	2	6	2	5	4	10	107	70	11	26	461	384	
Cecil Avenue		0			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
W of Old Northern Rd	15%	15%	8	5	24	19	5	11	5	12	3	6	93	49	5	11	5	11	1	2	1	2	2	4	46	30	5	11	198	165	
Showground Road		0			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
West of Old Northern Rd	15%	15%	8	5	24	19	5	11	5	12	3	6	93	49	5	11	5	11	1	2	1	2	2	4	46	30	5	11	198	165	
Crane Street		0			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
W of Old Northern Rd	10%	5%	6	2	16	6	3	4	3	4	2	2	62	16	3	4	3	4	1	1	1	1	1	1	31	10	3	4	132	55	
Old Castle Hill Road		0			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
n of Crane St	0%	5%	0	2	0	6	0	4	0	4	0	2	0	16	0	4	0	4	0	1	0	1	0	1	0	10	0	4	0	55	
Total		100%	100%	57	33	161	127	32	74	35	81	19	43	618	329	32	74	32	75	7	16	6	15	13	30	306	200	32	74	1317	1097

ORIGIN DESTINATION OF TRIPS

PM PEAK																																	
APPROACH ROUTES				Zone 1		Zone 2		Zone 3		Zone 4		Zone 5		Zone 6		Zone 7		Zone 8		Zone 9		Zone 10		Zone 11		Zone 12		Zone 13		TOTAL			
Arr	Dep	Arr	Dep	Arr	Dep	Arr	Dep	Arr	Dep	Arr	Dep	Arr	Dep	Arr	Dep	Arr	Dep	Arr	Dep	Arr	Dep	Arr	Dep	Arr	Dep	Arr	Dep	Arr	Dep	Arr	Dep		
Old Northern Road																																	
S of Francis	25%	5	11	26	36	10	7	11	7	6	4	184	212	10	7	10	7	2	2	2	2	1	4	3	77	92	10	7	349	389			
	35%	7	15	36	51	14	10	16	10	8	6	258	297	14	9	14	10	3	2	3	2	6	4	108	129	14	10	488	544				
Cecil Avenue				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
W of Old Northern Rd		15%	3	7	16	22	6	4	7	4	4	2	110	127	6	4	6	4	1	1	1	1	2	2	46	55	6	4	209	233			
Showground Road				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
West of Old Northern Rd		15%	3	7	16	22	6	4	7	4	4	2	110	127	6	4	6	4	1	1	1	1	2	2	46	55	6	4	209	233			
Crane Street				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
W of Old Northern Rd		10%	2	4	10	15	4	3	4	3	2	2	74	85	4	3	4	3	1	1	1	1	2	1	31	37	4	3	139	156			
Old Castle Hill Road					0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
n of Crane St		0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Total		100%	21	43	103	145	41	27	45	30	24	16	736	848	41	27	41	27	9	6	8	5	16	11	309	369	41	27	1395	1555			

From: Andrew Wilson [andrew@merccapital.com.au]

Sent: Wednesday, 27 September 2017 4:45:58 PM

To: Stewart Seale; Bronwyn Inglis

CC: Tony Merhi; fred.gennaoui@tdg.co.nz

Subject: RE: Public Authority comments for planning proposal 93-107 Cecil Avenue and 9-10 Roger Avenue, Castle Hill (12/2016/PLP)

Stewart / Bronwyn,

Thank you for referring the submissions from RMS and Endeavour Energy.

We would like to meet with you both and Andrew King or Stephen Barnes to discuss submissions received by Council during the exhibition and notification period including the RMS submission. Can you please let me know some times that you are all available for a meeting over the next 2 weeks prior to our traffic engineer going on leave from 13 October. Thank you.

The recommendation from RMS to defer the Planning Proposal in our view is made without a complete knowledge of the circumstances of the case and is unnecessary. In particular, there is no need to defer the Planning Proposal given the following circumstances:

- The cumulative traffic and transport assessment for Castle Hill south raised by RMS will be completed within a week or two as far as we understand. Further, the timeframe needed to finalise and implement it is far short of the lead times needed for finalisation and gazettal of the LEP amendment (min. 3 months) followed by preparation, assessment and determination of a Development Application (min. 9 months) followed by detailed design and construction of development envisaged in the Planning Proposal (2 years).
- The Draft DCP and Draft VPA provisions are purposefully drafted in a way that anticipate a cumulative traffic study across Castle Hill south with potential options for road upgrades to cater for increased densities as discussed in the past. In particular, the Draft VPA has a generous contribution that is for road and traffic management works as well as public domain works.
- The existing road network has capacity to accommodate the Planning Proposal without any road upgrades as demonstrated in the attached advice prepared by TDG and previously provided to Council.

Our traffic engineer TDG has provided the following initial response to each of the 5 points in

Attachment A of the RMS response follows:

1. Public transport share is embodied in the adopted trip generation rates for the analysis at the high end of the RMS published figures in TDG 13/4a. The 85% rates of 0.28 trips per unit and 0.18 trip/unit have been adopted to estimate the trip generation during the morning and afternoon peak hour respectively of the proposed high density residential buildings. These rates take into account proximity to railway stations. (Castle Hill station is scheduled to be operating in the first half of 2019 before the development envisaged in the PP would be completed and occupied.)
2. No comment. A matter for Council.
3. The traffic counts were carried in late February 2017.
4. Noted and should be addressed in the Castle Hill South study.

5. The 907 spaces include 355 for retail (35) and commercial (320). High requirements for office and retail is required by Council. The trip generation used for these land use take into account proximity to new railway station.

Given the above, the deferral of the Planning Proposal as recommended by RMS in our view is unnecessary, and the plan should proceed to be finalised in accordance with the timeframe in the Gateway Determination.

We look forward to discussing the submissions with you at a meeting in the near future before our traffic engineer goes on leave on 12 October. Thank you.

Regards,

ANDREW WILSON
DEVELOPMENT MANAGER
Of **Merc Capital** and Affiliated Companies



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From: Bronwyn Inglis [<mailto:binglis@thehills.nsw.gov.au>]
Sent: Friday, 22 September 2017 5:41 PM
To: Tony Merhi <tony.merhi@merccapital.com.au>; Andrew Wilson <andrew@merccapital.com.au>
Subject: Public Authority comments for planning proposal 93-107 Cecil Avenue and 9-10 Roger Avenue, Castle Hill (12/2016/PLP)

Dear Tony and Andrew,

Please find attached a copy of the comments provided by the Roads and Maritime Services and Endeavour Energy in relation to the Planning Proposal for 93-107 Cecil Avenue and 9-10 Roger Avenue, Castle Hill (12/2016/PLP), for your information.

The advice from Endeavour Energy included a number of guidelines / fact sheets which are also attached for your information.

Please note that I have not yet received comments from Transport for NSW or Sydney Water. I will forward them to you when I receive them.

I have received comments from the Office of Environment and Heritage who have raised no issues.

Please contact me on 9843 0531 if you need to discuss.

Yours sincerely,
Bronwyn Inglis



Bronwyn Inglis | Senior Town Planner
THE HILLS SHIRE COUNCIL

Administration Centre, 3 Columbia Court BAULKHAM
HILLS NSW 2153

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Memorandum

To: Merc Capital and Affiliated Companies

From: Fred Gennaoui

Date: 12 July 2017

Job N°: 13561.003

Subject: Cecil Ave Planning Proposal – Traffic Assessment with No Signals at Intersection of Old Northern Road with Francis Street

Background

In our Parking and Traffic Study (PTS) dated June 2017, we (TDG) have indicated that traffic signals are currently required at the intersection of Old Northern Road with Francis Street in Caste Hill.

Further analysis indicates that the intersection will continue to operate at a poor level of service upon the completion of the proposed development. The installation of traffic signals with the provision of an additional exclusive right turn lane in the northbound direction would considerably improve conditions at this location.

It is understood that Council is concerned about whether the installation of signals at the intersection of Francis Street and Old Northern Road will be supported in consultation with NSW Roads and Maritime Services.

We have assessed the impact of not providing signals at the intersection of Francis Street with Old Northern Road on the overall road network but more particularly critical intersections.

Options Tested

The following two options were tested:

Option 1 – All northbound development traffic anticipated to turn into Francis Street would redirect to Parsonage Street, Hume Avenue, Cecil Avenue before right turning onto Old Northern Road to access Francis Street from the north.

Option 2 – All northbound development traffic anticipated to turn right into Francis Street would remain along Old Northern Road before turning right into Cecil Avenue, travel northbound along Terminus Street before right turning into Crane Road then use Orange Grove to access the development from either Cecil Avenue or Francis Street.

Analysis of Option 1

An analysis of the operation of all critical intersections in the vicinity of the site for Option 1 was carried out using the SIDRA computer modelling program. The results of this analysis are summarised in **Table 1**.



Intersections	With Signals at Francis*				Without Signals at Francis Option 1			
	AM Peak		PM Peak		AM Peak		PM Peak	
	D sec/v	LoS	D sec/v	LoS	D sec/v	LoS	D sec/v	LoS
Traffic Signals								
Old Northern Road with Cecil Avenue	32.0	C	39.7	C	33.0	C	40.8	C
Terminus Street with Crane Street	54.4	D	46.3	D	54.4	D	46.3	D
Old Northern Road with Francis Street	10.9	A	13.3	A				
Roundabout								
Cecil Avenue with Orange Grove	8.9	A	8.6	A	8.9	A	8.6	A
T-Junction Rule								
Francis Street with Roger Avenue	6.2	A	5.6	A	6.2	A	5.6	A
Old Northern Road with Francis Street					>70	F	>70	F

Table 1: Option 1 Operation of Intersections with Proposed Development

*SOURCE: TDG (2017)

The redirection of the northbound traffic destined to the proposed development to Hume Street and Cecil Avenue west would marginally impact the traffic signals at its intersection with Old Northern Road which will continue to operate at a satisfactory level of service “C” during the morning peak and the afternoon peak hours. All other intersections would not be impacted upon.

The intersection of Francis Street with Old Northern Road would continue to operate at a very poor level of service “F” as is currently the case.

The Option 1 traffic route is within the traffic carrying and environmental capacities of Parsonage Street and Hume Street.

Analysis of Option 2

An analysis of the operation of all critical intersections in the vicinity of the site for Option 2 was carried out using the SIDRA computer modelling program. The results of this analysis are summarised in **Table 2**.

The redirection of traffic destined to the proposed development from the south Terminus Street would have a marginal impact on the traffic signals controlling the intersection of Cecil Avenue with Old Northern Road and the intersection of Terminus Street with Crane Road which will continue to operate at a satisfactory level of service “C” and “D” respectively.

The roundabout controlling the intersection of Cecil Avenue with Orange Grove would continue to operate at a very good level of service “A” during the morning and afternoon peak periods.

Intersections	With Signals at Francis*				Without Signals at Francis Option 2			
	AM Peak		PM Peak		AM Peak		PM Peak	
	D sec/v	LoS	D sec/v	LoS	D sec/v	LoS	D sec/v	LoS
Traffic Signals								
Old Northern Road with Cecil Avenue	32.0	C	39.7	C	32.5	C	40.4	C
Terminus Street with Crane Street	54.4	D	46.3	D	54.7	D	46.5	D
Old Northern Road with Francis Street	10.9	A	13.3	A				
Roundabout								
Cecil Avenue with Orange Grove	8.9	A	8.6	A	9.1	A	9.1	A
T-Junction Rule								
Francis Street with Roger Avenue	6.2	A	5.6	A	6.1	A	5.6	A
Old Northern Road with Francis Street					>70	F	>70	F

Table 2: Option 2 Operation of Intersections with Proposed Development

*SOURCE: TDG (2017)

The intersection of Francis Street with Old Northern Road would continue to operate at a very poor level of service “F” as is currently the case. The Option 2 traffic route is mostly along Old Northern Road and Terminus Street, both arterial roads. The additional traffic along Crane Road and Orange Grove would not affect within the traffic carrying and environmental capacities of these streets.

Conclusions

Our assessment indicates that without the installation of traffic signals at the intersection of Francis Street with Old Northern Road, the road network would not be significantly impacted by the Planning Proposal with all nearby intersections continuing to operate at the same level of service as if traffic signals were in place at Francis Street. The Planning Proposal can easily be accommodated by the existing road network including the nearby intersections as shown in Tables 1 and 2 above.

Yours sincerely

Traffic Design Group Ltd



Fred Gennaoui
Principal Consultant

fred.gennaoui@tdgaustralia.com.au

Memorandum

To: Andrew Wilson

From: Fred Gennaoui

Date: 6 July 2017

Job N°: 13561.002

Subject: Old Northern Road / Francis Street Intersection Upgrade

Dear Andrew,

Background

In our Parking and Traffic Study (PTS) dated June 2017, we (TDG) have indicated that traffic signals are currently required at the intersection of Old Northern Road with Francis Street in Caste Hill.

Further analysis indicates that the intersection will continue to operate a poor level of service upon the completion of the proposed development. The installation of traffic signals with the provision of an additional exclusive right turn lane in the northbound direction would considerably improve conditions at this location.

It is understood that Council has requested a Concept Plan for the signals be prepared before the Planning Proposal goes on Exhibition. The details of the intersection are discussed below.

Development of Concept Plan

Storage Length

Based on the anticipated traffic volumes at the intersection a signalised intersection comprising (among other elements) a right turn lane in the northbound direction was modelled in the SIDRA modelling package. The purpose of this exercise was to establish the required storage length for the northbound right turn lane.

The combined traffic volumes returned a 95th percentile storage length of 39.5 metres, which occurred during the AM peak hour. As such, it can be established that a minimum storage length of 40 metres is required for the northbound right turn lane.

The Sidra signalised intersection layout is shown in Figure 1 below, and comprises two pedestrian crossings, one at the eastern leg on Francis Street, and one along the northern approach of Old Northern Road.

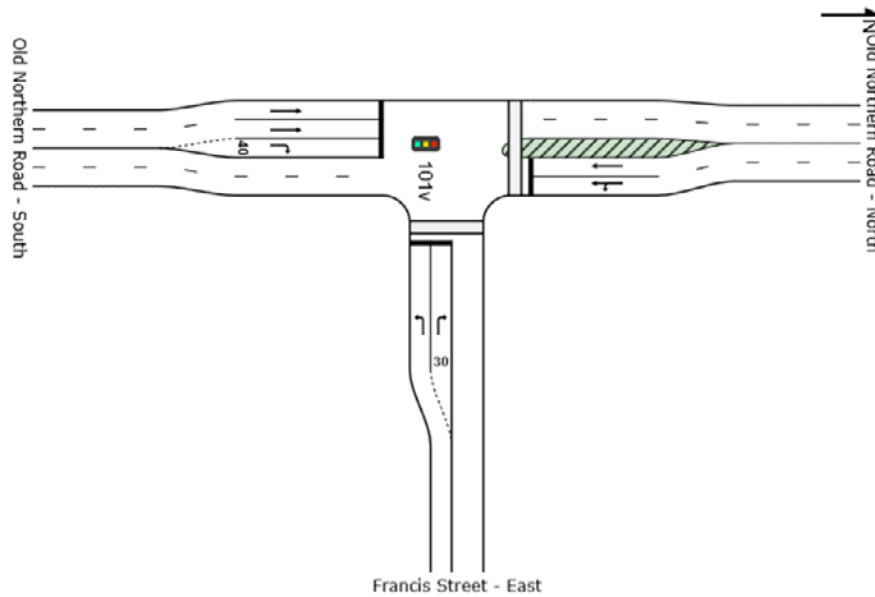


Figure 1: Concept Intersection Layout

Deceleration and Taper Length

As per Table 5.2 (Deceleration distances required for cars on a level grade) of Austroads' Guide to Road Design Part 4A (2017 edition), for a design speed of 60 km/h a deceleration (including taper) length of 55 metres is required under 'comfortable' (2.5m/s^2) rates of deceleration. Using 'maximum' (3.5m/s^2) rates of deceleration, a deceleration and taper length of 40 metres is required.

Available Length between Parsonage Road and Francis Street

Due to the proximity of the Old Northern Road / Parsonage Road intersection to the Old Northern Road / Francis Street intersection (approximately 95 metres centreline to centreline distance), the available length for a right turn lane is limited. After applying a 10 metre setback to the stop line for the southern approach to the Old Northern Road / Francis Street intersection, approximately 80 metres are available for a right turn lane without intruding on the Old Northern Road / Parsonage Road intersection.

As such, a storage length of 40 metres and a deceleration and taper length of 40 metres (for a total of 80 metres) is considered the minimum required design for the proposed intersection. This concept layout is shown in Figure 2.

It needs to be reiterated that this is a concept layout design, and various elements such as painted medians and additional land requirements etc. may have an impact the final design.

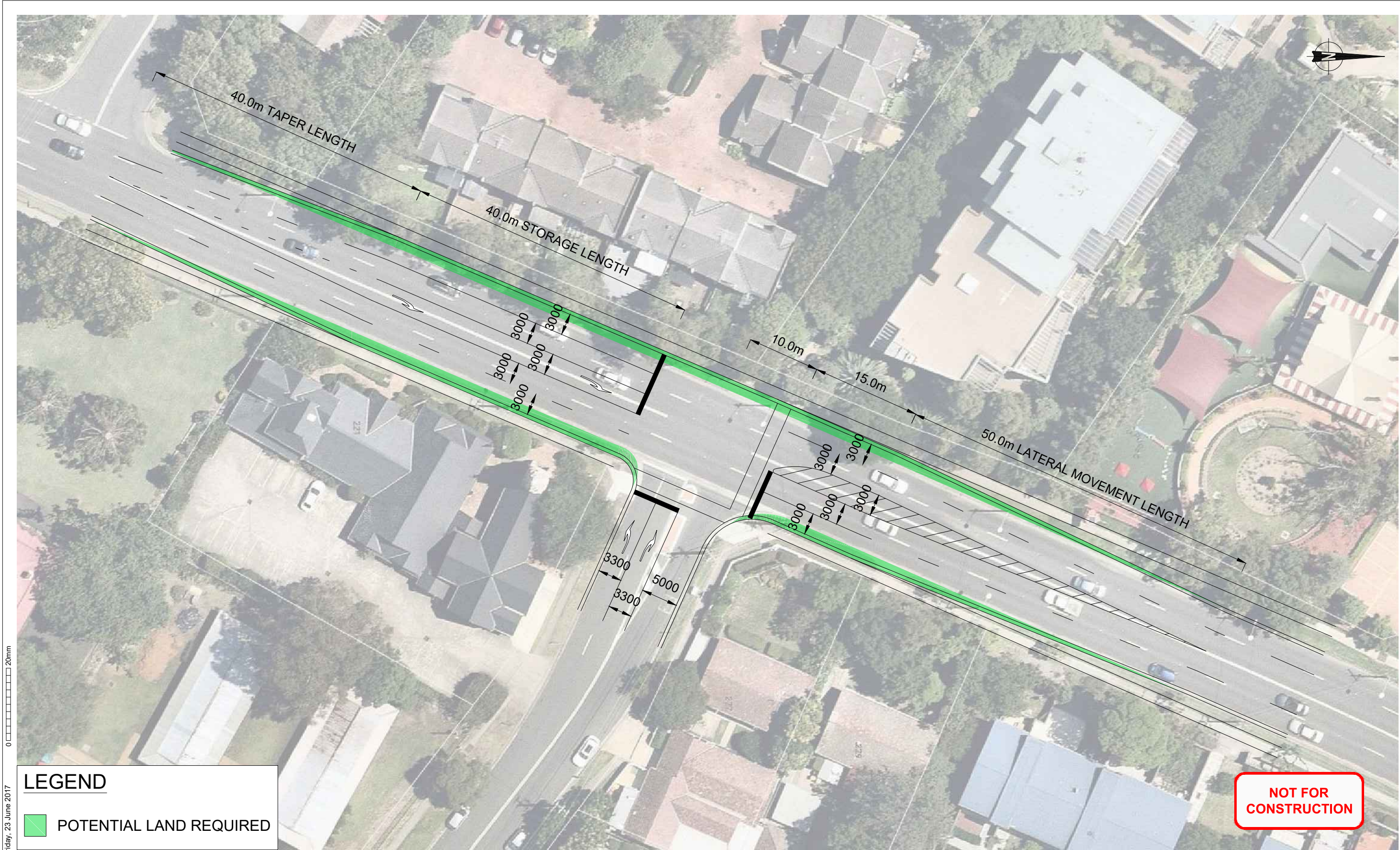
Yours sincerely

Traffic Design Group Ltd



Fred Gennaoui
Principal Consultant

Gennaoui1@bigpond.com.com.au



Friday, 23 June 2017

LEGEND

POTENTIAL LAND REQUIRED

REVISION	DATE	DESCRIPTION

Old Northern Road / Francis Street

Concept Intersection Layout

DRAWN: TJG
 DATE: 23/06/2017
 SCALE: 1:500 @ A3
 DWG NO:13561-2S1A





Merc Property Pty Ltd

Mixed Residential Development at
Cecil Avenue, Castle Hill

Planning Proposal

Parking and Traffic Study

July 2017

Merc Property Pty Ltd

Mixed Residential Development at Cecil Avenue, Castle Hill

Parking and Traffic Study

Quality Assurance Statement

Prepared by:

Fred Gennaoui

Principal Consultant



Reviewed by:

Mark Apeldoorn

Director



Approved for Issue by:

Mark Apeldoorn

Director



Status: Final report

Date: 26 July 2017

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Table of Contents

1.	Introduction	1
1.1	Background	1
1.2	Scope of Report	1
2.	Parking and Access Evaluation.....	2
2.1	The Proposal	2
2.2	Parking Requirement	2
2.3	Evaluation of Parking Layout	3
2.4	Vehicular Access to the Site.....	3
3.	Assessment of Traffic Conditions.....	4
3.1	Approach Roads.....	4
3.2	Existing Traffic Conditions	4
3.3	Traffic Impact of Proposed Development	7
4.	Summary and Conclusions	11

Appendix A

Concept of Carriageway Capacity and Level of Service

Appendix B

Guidelines for Evaluation of Intersection Operation

Figures

- Figure 1: Study Area
Figure 2: Existing Traffic Volumes

1. Introduction

1.1 Background

Merc Property Pty Ltd is submitting a Planning Proposal for a mixed-residential development to be situated between Cecil Avenue and Roger Avenue, Castle Hill as shown in **Figure 1**.



Figure 1: Aerial Image of Proposed Site

The proposed complex will consist of four (4) buildings providing:

- 52,860 m² GFA (460 apartments)
- 8,810 m² of commercial & retail.

A planning proposal was lodged with the Hills Shire Council. Council has requested that a traffic study be provided which addresses the peak hour directional splits, potential impacts on the nearby intersections, measures to address capacity issues in Cecil Avenue and Roger Avenue.

TDG in association with *Gennaoui Consulting Pty Ltd* has been commissioned to investigate and report on the parking requirements and traffic impact of the proposed development.

1.2 Scope of Report

The report includes the findings and conclusions in respect to the parking requirements and traffic impact of the proposed development on the surrounding road network and nearby intersections.

2. Parking and Access Evaluation

2.1 The Proposal

The Planning Proposal is for the construction of four (4) buildings ranging from 3 to 18 storeys comprising 52,860 m² of residential (460 units) as well as about 8,800 m² of commercial development as noted in **Table 1**.

Land Use		MAYORAL MINUTE	
		Rate	Space
Residential			
Tenants	460	1.0	460
Visitors		0.2	92
Total Residential Spaces			552
Commercial m² GFA	8,000	1 per 25m² GFA	320
Retail m² GFA	810*	1 per 18.5m² GLFA	35
Total Commercial	8,810		355
TOTAL			907

Table 1: Proposed Mixed Development

* 80% of GFA = 648 m² GLFA

2.2 Parking Requirement

The proposed parking requirement for the proposed development will be based on the latest Council's requirement which stipulates the following parking provisions for residential apartments and commercial developments.

■ Residential Apartments:

The proposed development will be located about 650 m from the under-construction railway station at Castle Hill. Consideration should therefore be given to reduce this number of parking spaces by adopting the Mayoral Minutes No 9/ 2016 adopted by Council on at its meeting held on 25 October 2016. The Minute concerns housing mix and diversity within the Sydney Metro Norwest Corridor which included an "incentivised" car parking policy rate for developments meeting Council's requirements. This planning proposal meets these requirements for mix and size and therefore car parking has been calculated accordingly as follows:

- Residential
 - 1 space per apartment:
 - 1 visitor spaces per 5 units
- Commercial (office) component
 - 1 space per 25 m² GFA
- Retail component
 - 1 space per 18.5m² GLFA

Based on these rates, some 552 spaces would be required for the residential component of the development as noted in **Table 1**; in addition the commercial areas would require some 355 spaces. Thus a minimum of 907 spaces would be required.

2.3 Evaluation of Parking Layout

All parking spaces will be designed to comply with Council's DCP and the Australian Standards *AS 2890.1-2004 Parking Facilities Part 1 Off Street car parking*". Spaces for cars with a mobility impaired permit should comply with the *AS/NZS 2890.6 - 2009, Parking Facilities Part 6: Off-Street parking for people with disabilities*".

A loading area to cater for the proposed commercial component of the development and residential (removals trucks) will also be provided. It will be designed to comply with the Australian Standards *AS 2890.2-2002 Parking facilities - Off-street commercial vehicle facilities*.

Parking will be provided over several levels with all basement levels inter-connected. A detailed assessment of the parking layout and circulation will be provided in conjunction with the Development Application.

To minimise the impact along Cecil Avenue and provide adequate sight distance for vehicles entering and exiting the development, on-street parking adjacent to the development may need to be restricted.

2.4 Vehicular Access to the Site

The main access to the proposed development will be provided from Cecil Avenue; it will be situated near the eastern corner of the site about 125m from Terminus Street. This access will be used by all vehicles associated with the commercial part of the development as well as all visitors to the residential units. It could also be used by tenants accessing residential parking levels.

A secondary access will be provided onto Roger Avenue. This access will be restricted to residents only of the development; it would mostly be used by residents with an origin or destination to the south.

The driveways will be designed to comply with the Australian Standards *AS 2890.1-2004 Parking Facilities Part 1 Off Street car parking*.

3. Assessment of Traffic Conditions

3.1 Approach Roads

Major access route to the proposed development is provided by the by-pass route along Terminus Street and Cecil Avenue which connects to Old Northern Road and Showground Road. The direct access to and from the proposed development will be via Cecil Avenue; Orange Street and Crane Street would also be used.

Cecil Avenue has 10.0m wide carriageways with parking permitted on both sides. East of Terminus Street, Crane Street also has a 10m wide carriageway. Orange Grove has a narrower 9m carriageway.

The route along Terminus Street and the section of Cecil Avenue, between Terminus Street and Old Northern Road have a four-lane divided carriageway with turning lanes at all signalised intersections along this route.

Traffic to and from Cecil Avenue, east of Terminus Street is restricted by a median along the by-pass route to left turning in and out only.

Traffic to and from the south may use Roger Avenue and Francis Street to access Old Northern Road. Francis Street has a 10m carriageway with parking permitted on both sides. Roger Avenue has a narrower carriageway, between 6 and 7 m in width. Francis Street is controlled by a Stop Sign. A pedestrian refuge assists pedestrians crossing Francis Street.

Traffic signals control the intersection of the Cecil Avenue with Old Northern Road, and the intersections of Terminus Street with the access to Council's car park and with Crane Street.

A one lane circulating roundabout is provided at the intersection of Cecil Avenue with Orange Grove.

3.2 Existing Traffic Conditions

3.2.1 Traffic Counts

In order to gauge the traffic conditions in the vicinity to the site, traffic movements were counted at the following intersections:

- Old Northern Road with Cecil Street;
- Terminus Street with Crane Street and Castle Street;
- Cecil Avenue with Orange Grove;
- Cecil Avenue with Terminus Street;
- Francis Street with Roger Avenue; and
- Old Northern Road with Francis Street.

These counts were carried out during the morning (7.00 to 9.00am) and afternoon (between 4:00 and 6:00 pm) peak periods on 8 December 2016 and 2 February 2017.

Overall, traffic volumes peaked between 8.00 and 9.00 am and from 4.30 to 5.30pm during the morning and afternoon respectively. The peak hour volumes at these surveyed intersections are shown in **Figure 2**.

3.2.2 Existing Operation of Major Approach Roads

The existing traffic volumes along Terminus Street, Cecil Avenue, Old Northern Road and Crane Street are summarised in **Table 2** together with their appropriate level of service.

LOCATION	LANES	AM PEAK			PM PEAK		
		East/North	South/West	LoS	East/North	South/West	LoS
Crane St							
East of Terminus St	4U	214	585	A	397	396	A
West of Terminus St	4UC	175	589	A	235	558	A
Cecil Avenue							
East of Orange Grove	4UP	53	147	A	105	60	A
East of Terminus St	4UP	43	141	A	95	82	A
East of Old Northern Rd	4DC	969	1,317	A	1,111	1,571	A
West of Old Northern Rd	4U	384	359	A	407	388	A
Francis Street							
East of Old Northern	4UP	160	197	A	201	87	A
East of Roger Ave	4UP	158	203	A	184	79	A
Old Northern Road							
South of Cecil Ave	4UC	1479	1,424	A	1,517	1,588	B
North of Cecil Ave	4U	817	389	A	862	454	A
South of Francis St	4UC	1462	1,643	B	1,525	1,562	B
Orange Grove							
North of Cecil Ave	4UP	144	128	A	162	64	A
South of Cecil Ave	4UP	162	129	A	187	84	A
Roger Avenue							
North of Francis St	2U	1	3	A	5	3	A
Terminus Street							
North of Cecil Ave	4DC	814	1,237	A	1,018	1,540	A
South of Crane St	4DC	880	1,271	A	1,199	1,342	A
North of Crane St	4DC	946	1,380	A	1,086	1,553	A

Table 2: Existing Carriageway Level of Service

Interrupted Flow Conditions - Table A1 of Appendix A
Uninterrupted Flow Conditions - Table A2 of Appendix A
4DC 4 lanes divided carriageway with clearway (Uninterrupted flow conditions of Appendix C)
4UC 4 lanes undivided carriageway with clearway
4U 4 lanes undivided carriageway with some parking
2U 2 lanes

The concepts of carriageway capacity and Level of Service (LoS) are discussed in **Appendix A** together with criteria for their assessment. The absence of major traffic movements entering/crossing from major developments along Terminus Street, Old Northern Road, south of Cecil Avenue, and Castle Street between Terminus Street and Old Northern Road, means that the service one-way hourly volumes for uninterrupted traffic included in Table A2 of **Appendix A** could be used; all other streets were assessed based on the service one-way hourly volumes for interrupted traffic included in Table A1 of **Appendix A**.

Currently Old Northern Road operates at a good level of service “B” or better. All other roads operate at a very good Level of Service “A”.

3.2.3 Operation of Existing Critical Intersection

The concepts of intersection capacity and level of service, as defined in the Guidelines published by the RTA (2002), are discussed in Appendix B together with criteria for their assessment. The assessment of the level of service of traffic signals is based on the evaluation of the average delay (seconds/vehicle) of vehicles on all approaches. The assessment of the level of service of roundabouts and signed controlled intersections is based on the average delay (seconds/vehicle) of the critical movement.

An analysis of the operation of all four critical intersections in the vicinity of the site was carried out using the SIDRA computer modelling program. The results of this analysis are summarised in **Table 3**.

INTERSECTION	AM		PM	
	Delay sec/v	LoS	Delay sec/v	LoS
Traffic Signals				
Old Northern Road with Cecil Avenue	30.8	C	34.3	C
Terminus Street with Crane Street	44.2	D	40.9	C
Roundabout				
Cecil Avenue with Orange Grove	8.8	A	9.0	A
T-Junctions				
Old Northern Road with Francis Street	>70	F	>70	F
Francis Street with Roger Avenue	5.9	A	5.5	A
Cecil Avenue with Terminus Street	11.2	A	12.2	A

Table 3: Existing Operation of Intersections

The intersection of Old Northern Road with Cecil Avenue currently operates at a satisfactory level of service “C” during the morning peak and the afternoon peak hours.

The traffic signals at the intersection of Terminus Street with Crane Street currently operates at an acceptable level of service “D” during the morning peak hour, improving to a satisfactory level of service “C” during the afternoon peak.

The roundabout controlling the intersection of Cecil Avenue with Orange Grove operates at a very good level of service "A" during the morning and afternoon peak periods.

The right turning movements from Old Northern Road into Francis Street experience very high delays whilst waiting for a gap in the large volume of southbound traffic resulting in a very poor level of service "F". The banning of the right turning movement into Francis Street is not suggested as it is the only direct access to a very large residential area east of Old Northern Road.

To resolve this existing problem, traffic signals should be installed.

3.3 Traffic Impact of Proposed Development

3.3.1 Trip Generation and Distribution

The following peak hourly trip generations stipulated in the RTA *Guide to Traffic Generating Developments Issue 2.2. October 2002* were adopted to estimate the likely trip generation of the proposed development.

■ Residential Component

The RMS Technical Directive 04a (2013) indicates that the average trip generation rates for high density residential buildings near railway stations is an average 0.19 trips/units based on a range of 0.07 to 0.32 trips/units (from 8 high density buildings) during the morning peak hour. During the afternoon peak hour, is 0.15 vehicle trips/units based on a range of 0.06 to 0.41 trips/units.

The 85% rates of 0.28 trips per unit and 0.18 trip/unit have been adopted to estimate the trip generation during the morning and afternoon peak hour respectively of the proposed high density residential buildings.

■ Office Component

The following rates published in the RMS Technical Direction TDT 2013/04a were adopted

- AM Peak: 1.6 trips/100 m² GFA
- PM Peak: 1.2 trips /100m² GFA

■ Retail Component

The proposed retail will be part of a large residential and office development within 650 m of a railway station. It was therefore considered reasonable to adopt similar generation rates than those estimated for Norwest Marketown at Norwest

- AM Peak: 4.5 trips/100 m² GLFA
- PM Peak: 9.0 trips /100m² GLFA

The proposed development is likely to generate about 285 vph and 240 vph during the morning and afternoon peak hours respectively as noted in **Table 4**.

The main access to the proposed development will be provided from Cecil Avenue; it will be used by all vehicles associated with the commercial part of the development as well as all

visitors to the residential units. The second access onto Roger Avenue will be restricted to residents only. The likely number of trips using each driveway is also included in **Table 4**.

	No. Units	AM Peak		PM PEAK	
		Arr	Dep	Arr	Dep
Residential	460	39	90	54	29
Office	8,000 m ² GFA	115	13	24	72
Retail	810 m ² GFA*	23	6	23	35
Total		177	109	101	136

Table 4: Trip Generation of Proposed Development

* GLFA = 80% GFA

3.3.2 Trip Distribution

The distribution for approaching and departing traffic included in **Table 5** was derived from the existing traffic counts in the vicinity of the subject site.

APPROACH ROUTES			AM PEAK		PM PEAK	
	Arr	Dep	Arr	Dep	Arr	Dep
Old Northern Road						
S of Francis	24%	17%	42	19	24	23
N of Cecil St	14%	27%	25	29	14	37
Terminus St						
N of Crane St	40%	31%	71	34	40	42
Cecil Avenue						
W of Old Northern Rd	13%	12%	23	13	13	16
W of Orange Grove	3%	3%	5	3	3	4
Crane Street						
W of Terminus	6%	11%	11	12	6	15
Total	100%	100%	177	110	101	137

Table 5: Approach Routes Trips Distribution

3.3.3 Impact on Major Approach Roads

The future traffic volumes along Terminus Street and all major approach roads are summarised in **Table 6**, together with their appropriate level of service. The proposed potential developments would only marginally affect the level of service of most major approach roads to the site which would operate at a Level of Service "B" or better.

Traffic volumes along Roger Avenue would increase during the morning and afternoon peak hours to less than 50 cars. These volumes are well within the environmental (~300 vph) and physical capacity of the road.

LOCATION	LANES	AM PEAK			PM PEAK		
		East/North	South/West	LoS	East/North	South/West	LoS
Crane St							
East of Terminus St	4U	218	622	A	403	435	A
West of Terminus St	4UC	222	593	A	260	558	A
Cecil Avenue							
East of Orange Grove	4UP	56	152	A	109	64	A
East of Terminus St	4UP	150	195	A	151	148	A
East of Old Northern Rd	4DC	969	1371	A	1111	1647	B
West of Old Northern Rd	4U	388	371	A	413	402	A
Francis Street							
East of Old Northern	4UP	204	210	A	230	91	A
East of Roger Ave	4UP	167	207	A	187	87	A
Old Northern Road							
South of Cecil Ave	4UC	1479	1434	A	1517	1611	B
North of Cecil Ave	4U	854	389	A	908	454	A
South of Francis St	4UC	1502	1661	B	1548	1583	B
Orange Grove							
North of Cecil Ave	4UP	181	132	A	201	70	A
South of Cecil Ave	4UP	202	133	A	202	92	A
Roger Avenue							
North of Francis St	2U	18	25	A	30	10	A
Terminus Street							
North of Cecil Ave	4DC	814	1344	A	1018	1596	B
South of Crane St	4DC	880	1378	A	1199	1398	A
North of Crane St	4DC	979	1462	A	1125	1591	B

Table 6: Carriageway Level of Service with Proposed Development

Interrupted Flow Conditions -Table C1 of Appendix C

Uninterrupted flow conditions -Table C2 of Appendix C

4DC 4 lanes divided carriageway with clearway (Uninterrupted flow conditions of Appendix C)

4UC 4 lanes undivided carriageway with clearway

4U 4 lanes undivided carriageway with some parking

2U 2 lanes

3.3.4 Impact on Critical Intersections

An analysis of the operation of the surveyed critical intersections with the development in place was also carried out using the SIDRA computer intersection modelling program. The results of this analysis are summarised in **Table 7**.

INTERSECTION	AM		PM	
	Delay sec/v	LoS	Delay sec/v	LoS
Traffic Signals				
Old Northern Road with Cecil Avenue	32.0	C	39.7	C
Terminus Street with Crane Street	54.4	D	46.3	D
Roundabout				
Cecil Avenue with Orange Grove	8.9	A	8.6	A
T-Junctions				
Old Northern Road with Francis Street	70	F	>70	F
Francis Street with Roger Avenue	6.2	A	5.6	A
Cecil Avenue with Terminus Street	11.2	A	12.2	A

Table 7: Operation of Intersections with Proposed Development

The intersection of Old Northern Road with Cecil Avenue would continue to operate at a satisfactory level of service “C” during the morning peak and the afternoon peak hours.

The traffic signals at the intersection of Terminus Street with Crane Street would operate at an acceptable level of service “D” during the morning peak and the afternoon peak hours.

The roundabout controlling the intersection of Cecil Avenue with Orange Grove Street would continue to operate at a very good level of service “A” during the morning and afternoon peak periods.

The right turning movement from Old Northern Road into Francis Street would experience slightly higher delays exacerbating an already very poor level of service “F”.

As mentioned before, to resolve this existing problem, traffic signals incorporating an exclusive right turn bay should be installed.

4. Summary and Conclusions

Merc Property Pty Ltd is submitting a Planning Proposal for a mixed-residential development to be situated between Cecil Avenue and Roger Avenue, Castle Hill, comprising four (4) buildings including a total of 52,860 m² of residential (460 units) and 8,810 m² of commercial development

The proposed development will comply with Council's parking requirements. To minimise the impact along Cecil Avenue on-street parking adjacent to the development may need to be restricted. A detailed assessment of the traffic implication of the proposed development will be carried out in conjunction with the preparation of the development application.

Currently Old Northern Road operates at a good level of service "B" or better. All other roads operate at a very good Level of Service "A". The proposed potential developments would only marginally affect the level of service of most major approach roads to the site which would operate at a Level of Service "B" or better.

The signalised intersection of Old Northern Road with Cecil Avenue and the intersection of Terminus Street with Crane Street currently operates at levels of service "C" and "D" respectively. These levels of service will not be unduly affected by the proposed development.

Thus the surrounding road network would easily accommodate the traffic generated by the proposed development, more particularly the intersection of Francis Street with Old northern Road where traffic signals would be required including the provision of an exclusive right turn lane from Old Northern Road.

Preliminary investigation indicates that the intersection upgrade and its cost is a feasible proposition within the scale of development growth envisaged for the town centre and in the Cecil Avenue proposal and taking into account the existing traffic conditions.

It is anticipated that the design and implementation of the intersection upgrade would be made in consultation with RMS and Council at subsequent stages as a normal part of the planning and development process.

TDG

References

Roads and Traffic Authority of NSW (2002) *"Guide to Traffic Generating Developments"*.
Issue 2.2. October.

Standards Australia (2004). *"AS 2890.1-2004 Parking Facilities Part 1 Off Street car parking."*

Appendix A

Concept of Carriageway Capacity and Level of Service

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

Level of service is defined by Austroads as a "qualitative measure of the effects of a number of features, which include speed and travel time, traffic interruptions, freedom to manoeuvre, safety, driving comfort and convenience, and operating costs. Levels of service are designated from A to F from best (free flow conditions) to worst (forced flow with stop start operation, long queues and delays) as follows:

***LEVELS OF SERVICE**

- A - Free flow (almost no delays)
- B - Stable flow (slight delays)
- C - Stable flow (acceptable delays)
- D - Approaching unstable flow (tolerable delays)
- E - Unstable flow (congestion; intolerable delays), and
- F - Forced flow (jammed)

A service volume, as defined by Austroads, is the maximum number of vehicles that can pass over a given section of roadway in one direction during one hour while operating conditions are maintained at a specified level of service. It is suggested that ideally arterial and sub-arterial roads should not exceed service volumes at level of service C. At this level, whilst most drivers are restricted in their freedom to manoeuvre, operating speeds are still reasonable and acceptable delays experienced. However, in urban situations, arterial and sub-arterial roads operating at Level of Service D are still considered adequate. Traffic Volumes along urban roads with interrupted and uninterrupted flow conditions are included in **Table A1** and **A2** respectively.

	DESCRIPTION	LEVEL OF SERVICE					
		A	B	C	D	E	F
2U	2 Lane Undivided	540	630	720	810	900	F
4UP	4 Lane Undivided with Two Parking Lanes	540	630	720	810	900	F
4U	4 Lane Undivided with Some Parking	900	1050	1200	1350	1500	O
4UC	4 Lane Undivided with Clearways	1080	1260	1440	1620	1800	R
4D	4 Lane Divided with Clearways	1140	1330	1520	1710	1900	C
6U	6 Lane Undivided	1440	1680	1920	2160	2400	E
6D	6 Lane Divided with Clearway	1740	2030	2320	2610	2900	D

Table A1: Level of Service Interrupted Flow Conditions along Urban Roads (One Way Hourly Volumes)

	DESCRIPTION	LEVEL OF SERVICE					
		A	B	C	D	E	F
2U	2 Lane Undivided	760	880	1000	1130	1260	F
4U	4 Lane Undivided with Some Parking	1260	1470	1680	1890	2100	O
4UC	4 Lane Undivided with Clearways	1510	1760	2010	2270	2520	R
4DC	4 Lane Divided with Clearways	1600	1860	2130	2400	2660	C
4DCL	6 Lane Undivided with Clearways	2250	2620	3000	3380	3740	E
6DC	6 Lane Divided with Clearway	2440	2840	3250	3660	4060	D

* 40% higher than base volumes in Table F1

Table A2: Level of Service Uninterrupted Flow Conditions along Urban Roads (One Way Hourly Volumes)

Appendix B

Guidelines for Evaluation of Intersection Operation

The RTA has included in the "Guide to Traffic Generating Developments" (Dec 1993, Issue 2) a section on the assessment of intersections. The assessment of the level of service of an intersection is based on the evaluation of the following Measures of Effectiveness:

- (a) Average delay (seconds/veh) (all forms of control)
- (b) Delay to critical movement (seconds/veh) (all forms of control)
- (c) Degree of saturation (traffic signals and roundabouts)
- (d) Cycle length (traffic signals)

INTANAL was used to calculate the relevant intersection parameters. INTANAL is a software which allows comparisons between different forms of intersection control and different forms of intersection configurations to be readily evaluated. That is at each intersection the priority control, roundabout and signal control options will be examined to determine the most efficient form of control.

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

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

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

Table B1 sets out average delays for different levels of service. There is no consistent correlation between definitions of levels of service for road links as defined elsewhere in this section, and the ranges set out in Table G1. In assigning a level of service, the average delay to the motoring public needs to be considered, keeping in mind the location of the intersection. For example, drivers in inner-urban areas of Sydney have a higher tolerance of delay than drivers in country areas. Table B1 provides a recommended baseline for assessment.

Level of Service	Average Delay per Vehicle (seconds/veh)	Traffic Signals, Roundabout	Give Way and Stop Signs
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 - 42	Satisfactory	Satisfactory, but accident study required
D	43 to 56	Operating near capacity	Near capacity and accident study required
E	57 to 70	At capacity; at signals, incidents will cause excessive delays Roundabouts require other control mode	At capacity, required other control mode

Table B1: Level of Service Criteria for Intersections

The figures in Table B1 are intended as a guide only. Any particular assessment should take into account site-specific factors including maximum queue lengths (and their effect on lane blocking), the influence of nearby intersections and the sensitivity of the location to delays. In many situations, a comparison of the current and future average delay provides a better appreciation of the impact of a proposal, and not simply the change in the level of service.

The intersection degree of saturation (DS) can also be used to measure the performance of isolated intersections. At intersections controlled by traffic signals, both queue length and delays increase rapidly as DS approaches 1.0. An upper limit of 0.9 is appropriate. When DS exceeds 0.8 - 0.85, overflow queues start to become a problem. Satisfactory intersection operation is generally achieved with a DS of about 0.7 - 0.8. (Note that these figures are based on isolated signalised intersections with cycle lengths of 120 seconds. In co-ordinated signal systems DS might be actively maximised at key intersections). Although in some situations additional traffic does not alter the level of service, particularly where the level of service is E or F, additional capacity may still be required. This is particularly appropriate for service level F, where small increases in flow can cause disproportionately greater increases in delay. In this situation, it is advisable to consider means of control to maintain the existing level of absolute delay. Suggested criteria for the evaluation of the capacity of signalised intersections based on the Degree of Saturation are summarised in Table B2.

Level Of Service	Optimum Cycle Length (Seconds) (Co)	Volume/Saturation γ	Intersection Degree Of Saturation X
A/B - Very good operation	< 90	< 0.70	< 0.80
C - Satisfactory	90-120	0.70-0.80	0.80-0.85
D - Poor but manageable	120-140	0.80-0.85	0.85-0.90
E/F - Bad, extra capacity required	>140	>0.85	> 0.90

Table B2: Criteria for Evaluating Capacity Of Signalised Intersections*

* Source: Roads & Traffic Authority (2002)

MOVEMENT SUMMARY



Site: 101 [Old Northern Road-Cecil Avenue - Future AM - Option 1]

Future AM Peak Option 1

Existing plus Development

Signals - Fixed Time Isolated Cycle Time = 85 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back Vehicles veh	of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Old Northern Road											
1	L2	136	0.0	0.438	21.0	LOS C	11.0	76.9	0.70	0.67	45.8
2	T1	671	0.0	0.438	15.9	LOS B	11.1	77.6	0.71	0.64	47.2
3	R2	751	0.0	0.859	47.8	LOS D	17.5	122.2	1.00	0.98	33.4
Approach		1557	0.0	0.859	31.7	LOS C	17.5	122.2	0.85	0.81	39.3
East: Cecil Avenue											
4	L2	1051	0.0	0.636	22.7	LOS C	17.7	123.7	0.78	0.82	42.8
5	T1	257	0.0	0.867	45.5	LOS D	12.0	83.7	1.00	1.02	34.5
6	R2	144	0.0	0.440	40.3	LOS D	5.5	38.6	0.94	0.79	35.5
Approach		1452	0.0	0.867	28.5	LOS C	17.7	123.7	0.83	0.85	40.3
North: Old Northern Road											
7	L2	88	0.0	0.615	35.3	LOS D	7.1	49.9	0.97	0.84	38.7
8	T1	321	0.0	0.615	34.2	LOS C	7.9	55.4	0.98	0.82	38.2
Approach		409	0.0	0.615	34.4	LOS C	7.9	55.4	0.98	0.82	38.3
West: Cecil Avenue											
10	L2	89	0.0	0.855	52.2	LOS D	10.8	75.8	1.00	1.00	32.9
11	T1	181	0.0	0.855	46.7	LOS D	10.8	75.8	1.00	1.00	33.2
12	R2	186	0.0	0.855	52.4	LOS D	10.6	74.3	1.00	1.00	32.3
Approach		457	0.0	0.855	50.1	LOS D	10.8	75.8	1.00	1.00	32.8
All Vehicles		3875	0.0	0.867	33.0	LOS C	17.7	123.7	0.87	0.85	38.6

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

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

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians									
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back Pedestrian ped	of Queue Distance m	Prop. Queued	Effective Stop Rate per ped	
P1	South Full Crossing	53	36.8	LOS D	0.1	0.1	0.93	0.93	
P2	East Full Crossing	53	36.8	LOS D	0.1	0.1	0.93	0.93	
P3	North Full Crossing	53	36.8	LOS D	0.1	0.1	0.93	0.93	
P4	West Full Crossing	53	19.2	LOS B	0.1	0.1	0.67	0.67	
All Pedestrians		211	32.4	LOS D			0.87	0.87	

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

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 101 [Old Northern Road-Cecil Avenue - Future PM - Option 1]

Future PM Peak Option 1

Existing plus Development

Signals - Fixed Time Isolated Cycle Time = 100 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Old Northern Road											
1	L2	132	0.0	0.433	24.4	LOS C	12.6	87.9	0.71	0.68	43.9
2	T1	646	0.0	0.433	19.2	LOS B	12.7	88.7	0.72	0.65	45.3
3	R2	819	0.0	0.919	62.9	LOS E	24.5	171.2	1.00	1.03	29.4
Approach		1597	0.0	0.919	42.0	LOS D	24.5	171.2	0.86	0.85	35.4
East: Cecil Avenue											
4	L2	1216	0.0	0.691	23.3	LOS C	24.5	171.3	0.76	0.82	42.6
5	T1	294	0.0	0.909	55.5	LOS E	16.6	115.9	0.96	1.06	31.5
6	R2	236	0.0	0.746	45.4	LOS D	10.9	76.0	0.93	0.86	33.8
Approach		1745	0.0	0.909	31.7	LOS C	24.5	171.3	0.82	0.87	38.9
North: Old Northern Road											
7	L2	108	0.0	0.740	44.6	LOS D	10.8	75.4	1.00	0.91	35.2
8	T1	369	0.0	0.740	43.5	LOS D	11.4	80.0	1.00	0.90	34.8
Approach		478	0.0	0.740	43.8	LOS D	11.4	80.0	1.00	0.90	34.9
West: Cecil Avenue											
10	L2	80	0.0	0.935	71.0	LOS E	14.2	99.3	1.00	1.11	28.2
11	T1	242	0.0	0.935	65.5	LOS E	14.2	99.3	1.00	1.11	28.4
12	R2	141	0.0	0.935	71.2	LOS E	14.0	98.2	1.00	1.11	28.0
Approach		463	0.0	0.935	68.2	LOS E	14.2	99.3	1.00	1.11	28.3
All Vehicles		4283	0.0	0.935	40.8	LOS D	24.5	171.3	0.87	0.89	35.6

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

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

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians									
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped	
P1	South Full Crossing	53	44.3	LOS E	0.1	0.1	0.94	0.94	
P2	East Full Crossing	53	44.3	LOS E	0.1	0.1	0.94	0.94	
P3	North Full Crossing	53	44.3	LOS E	0.1	0.1	0.94	0.94	
P4	West Full Crossing	53	21.8	LOS C	0.1	0.1	0.66	0.66	
All Pedestrians		211	38.7	LOS D			0.87	0.87	

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

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

 **Site: 101 [Terminus Street-Crane Road - Future AM - Option 1]**

Future AM Peak

Existing plus Development

Signals - Fixed Time Isolated Cycle Time = 120 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Crane Road											
1	L2	115	0.0	0.934	75.8	LOS E	23.3	163.2	1.00	1.12	27.2
2	T1	264	0.0	0.934	70.3	LOS E	23.3	163.2	1.00	1.11	27.4
3	R2	281	0.0	0.934	76.2	LOS E	23.1	161.8	1.00	1.05	26.6
Approach		660	0.0	0.934	73.8	LOS E	23.3	163.2	1.00	1.09	27.0
NorthEast: Terminus Street											
4	L2	80	0.0	0.917	61.5	LOS E	47.0	328.7	1.00	1.08	30.7
5	T1	1201	0.0	0.917	54.6	LOS D	47.0	328.7	0.97	1.06	31.6
6	R2	248	0.0	0.967	84.1	LOS F	15.5	108.8	1.00	1.16	24.9
Approach		1529	0.0	0.967	59.7	LOS E	47.0	328.7	0.97	1.07	30.2
NorthWest: Crane Road											
7	L2	23	0.0	0.353	57.6	LOS E	4.9	34.5	0.95	0.75	31.5
8	T1	67	0.0	0.353	52.1	LOS D	4.9	34.5	0.95	0.75	32.0
9	R2	151	0.0	0.608	59.9	LOS E	8.6	59.9	0.99	0.81	29.9
Approach		241	0.0	0.608	57.5	LOS E	8.6	59.9	0.98	0.79	30.6
SouthWest: Terminus Street											
10	L2	112	0.0	0.587	35.7	LOS D	20.5	143.2	0.84	0.76	38.8
11	T1	732	0.0	0.587	29.9	LOS C	20.5	143.2	0.83	0.73	40.0
12	R2	83	0.0	0.502	35.8	LOS D	2.8	19.7	0.98	0.77	37.1
Approach		926	0.0	0.587	31.1	LOS C	20.5	143.2	0.84	0.74	39.6
All Vehicles		3357	0.0	0.967	54.4	LOS D	47.0	328.7	0.94	0.96	31.6

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

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

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians									
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped	
P1	SouthEast Full Crossing	53	30.2	LOS D	0.1	0.1	0.71	0.71	
P2	NorthEast Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95	
P3	NorthWest Full Crossing	53	30.2	LOS D	0.1	0.1	0.71	0.71	
P4	SouthWest Full Crossing	53	48.7	LOS E	0.2	0.2	0.90	0.90	
All Pedestrians		211	40.8	LOS E			0.82	0.82	

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

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY



Site: 101 [Terminus Street-Crane Road - Future PM - Option 1]

Future PM Peak

Existing plus Development

Signals - Fixed Time Isolated Cycle Time = 135 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Crane Road											
1	L2	89	0.0	0.827	72.2	LOS E	16.3	113.9	1.00	0.94	27.9
2	T1	165	0.0	0.827	66.6	LOS E	16.3	113.9	1.00	0.94	28.2
3	R2	208	0.0	0.827	72.4	LOS E	15.9	111.3	1.00	0.92	27.3
Approach		463	0.0	0.827	70.3	LOS E	16.3	113.9	1.00	0.93	27.7
NorthEast: Terminus Street											
4	L2	174	0.0	0.821	37.9	LOS D	43.3	302.8	0.92	0.88	38.0
5	T1	1253	0.0	0.821	30.9	LOS C	43.3	302.8	0.86	0.82	39.5
6	R2	254	0.0	1.047	128.0	LOS F	21.8	152.9	1.00	1.21	16.7
Approach		1680	0.0	1.047	46.3	LOS D	43.3	302.8	0.89	0.88	32.6
NorthWest: Crane Road											
7	L2	49	0.0	0.516	66.3	LOS E	7.8	54.8	0.98	0.79	29.2
8	T1	75	0.0	0.516	60.7	LOS E	7.8	54.8	0.98	0.79	29.6
9	R2	138	0.0	0.590	67.1	LOS E	8.8	61.6	0.99	0.80	28.3
Approach		262	0.0	0.590	65.1	LOS E	8.8	61.6	0.99	0.80	28.8
SouthWest: Terminus Street											
10	L2	168	0.0	0.631	31.4	LOS C	28.7	201.2	0.79	0.74	40.6
11	T1	932	0.0	0.631	25.0	LOS C	28.7	201.2	0.75	0.69	42.2
12	R2	162	0.0	0.899	60.0	LOS E	8.7	60.6	1.00	1.00	29.8
Approach		1262	0.0	0.899	30.3	LOS C	28.7	201.2	0.79	0.74	39.9
All Vehicles		3667	0.0	1.047	45.2	LOS D	43.3	302.8	0.88	0.83	33.7

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

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

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians									
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped	
P1	SouthEast Full Crossing	53	23.8	LOS C	0.1	0.1	0.59	0.59	
P2	NorthEast Full Crossing	53	61.8	LOS F	0.2	0.2	0.96	0.96	
P3	NorthWest Full Crossing	53	23.8	LOS C	0.1	0.1	0.59	0.59	
P4	SouthWest Full Crossing	53	61.8	LOS F	0.2	0.2	0.96	0.96	
All Pedestrians		211	42.8	LOS E			0.78	0.78	

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

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY



Site: 101 [Old Northern Road-Francis Street - Future AM - Option 1]

Future AM Peak Option 1
Existing plus Development
Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back Vehicles veh	of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Old Northern Road											
2	T1	1420	0.0	0.728	0.2	LOS A	0.0	0.0	0.00	0.00	59.6
3	R2	119	0.0	0.860	78.6	LOS F	4.6	31.9	0.99	1.30	25.0
Approach		1539	0.0	0.860	6.3	NA	4.6	31.9	0.08	0.10	53.8
East: Francis Street											
4	L2	220	0.0	0.474	16.9	LOS C	2.3	16.4	0.75	1.12	43.5
6	R2	3	0.0	1.000	1607.2	LOS F	2.3	15.8	1.00	1.04	2.2
Approach		223	0.0	1.000	39.4	LOS E	2.3	16.4	0.75	1.12	34.3
North: Old Northern Road											
7	L2	102	0.0	0.420	5.6	LOS A	0.0	0.0	0.00	0.07	57.6
8	T1	1532	0.0	0.420	0.1	LOS A	0.0	0.0	0.00	0.03	59.6
Approach		1634	0.0	0.420	0.4	NA	0.0	0.0	0.00	0.04	59.4
All Vehicles		3396	0.0	1.000	5.6	NA	4.6	31.9	0.08	0.14	54.2

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

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

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

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY



Site: 101 [Old Northern Road-Francis Street - Future PM - Option 1]

Future PM Peak Option 1
Existing plus Development
Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back Vehicles veh	of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Old Northern Road											
2	T1	1452	0.0	0.744	0.2	LOS A	0.0	0.0	0.00	0.00	59.5
3	R2	154	0.0	1.195	254.4	LOS F	21.5	150.3	1.00	2.41	11.2
Approach		1605	0.0	1.195	24.6	NA	21.5	150.3	0.10	0.23	42.1
East: Francis Street											
4	L2	96	0.0	0.217	14.6	LOS B	0.8	5.4	0.69	1.01	44.6
6	R2	1	0.0	1.000	4066.4	LOS F	2.1	14.6	1.00	1.02	0.9
Approach		97	0.0	1.000	58.6	LOS F	2.1	14.6	0.69	1.01	29.0
North: Old Northern Road											
7	L2	93	0.0	0.428	5.5	LOS A	0.0	0.0	0.00	0.07	56.8
8	T1	1574	0.0	0.428	0.1	LOS A	0.0	0.0	0.00	0.03	59.3
Approach		1666	0.0	0.428	0.4	NA	0.0	0.0	0.00	0.03	59.2
All Vehicles		3368	0.0	1.195	13.6	NA	21.5	150.3	0.07	0.16	48.4

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

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

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

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

 **Site: 101 [Orange Grove-Cecil Avenue - Future AM - Option 1]**

Future AM Peak
Existing plus Development
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back Vehicles veh	of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Orange Grove											
1	L2	74	0.0	0.199	5.1	LOS A	1.1	7.6	0.36	0.54	45.6
2	T1	108	0.0	0.199	4.8	LOS A	1.1	7.6	0.36	0.54	46.2
3	R2	37	0.0	0.199	7.5	LOS A	1.1	7.6	0.36	0.54	45.9
3u	U	1	0.0	0.199	8.9	LOS A	1.1	7.6	0.36	0.54	46.3
Approach		220	0.0	0.199	5.4	LOS A	1.1	7.6	0.36	0.54	45.9
East: Cecil Avenue											
4	L2	69	0.0	0.144	5.0	LOS A	0.7	5.2	0.32	0.52	45.7
5	T1	73	0.0	0.144	4.6	LOS A	0.7	5.2	0.32	0.52	46.3
6	R2	18	0.0	0.144	7.4	LOS A	0.7	5.2	0.32	0.52	46.1
6u	U	1	0.0	0.144	8.7	LOS A	0.7	5.2	0.32	0.52	46.5
Approach		161	0.0	0.144	5.1	LOS A	0.7	5.2	0.32	0.52	46.0
North: Orange Grove											
7	L2	13	0.0	0.111	4.5	LOS A	0.6	4.0	0.19	0.53	45.6
8	T1	66	0.0	0.111	4.1	LOS A	0.6	4.0	0.19	0.53	46.2
9	R2	58	0.0	0.111	6.9	LOS A	0.6	4.0	0.19	0.53	46.0
9u	U	3	0.0	0.111	8.2	LOS A	0.6	4.0	0.19	0.53	46.4
Approach		140	0.0	0.111	5.4	LOS A	0.6	4.0	0.19	0.53	46.1
West: Cecil Avenue											
10	L2	66	0.0	0.078	5.1	LOS A	0.4	2.7	0.35	0.54	45.6
11	T1	9	0.0	0.078	4.7	LOS A	0.4	2.7	0.35	0.54	46.3
12	R2	5	0.0	0.078	7.5	LOS A	0.4	2.7	0.35	0.54	46.0
12u	U	2	0.0	0.078	8.9	LOS A	0.4	2.7	0.35	0.54	46.4
Approach		83	0.0	0.078	5.3	LOS A	0.4	2.7	0.35	0.54	45.8
All Vehicles		604	0.0	0.199	5.3	LOS A	1.1	7.6	0.31	0.53	46.0

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Roundabout LOS Method: SIDRA Roundabout LOS.

Vehicle movement LOS values are based on average delay per movement.

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

Roundabout Capacity Model: SIDRA Standard.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

 **Site: 101 [Orange Grove-Cecil Avenue - Future PM - Option 1]**

Future PM Peak
Existing plus Development
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Orange Grove											
1	L2	34	0.0	0.169	4.5	LOS A	0.9	6.3	0.21	0.53	45.6
2	T1	92	0.0	0.169	4.2	LOS A	0.9	6.3	0.21	0.53	46.2
3	R2	89	0.0	0.169	6.9	LOS A	0.9	6.3	0.21	0.53	46.0
3u	U	1	0.0	0.169	8.3	LOS A	0.9	6.3	0.21	0.53	46.3
Approach		216	0.0	0.169	5.4	LOS A	0.9	6.3	0.21	0.53	46.0
East: Cecil Avenue											
4	L2	33	0.0	0.064	4.6	LOS A	0.3	2.2	0.25	0.50	45.8
5	T1	31	0.0	0.064	4.3	LOS A	0.3	2.2	0.25	0.50	46.5
6	R2	9	0.0	0.064	7.1	LOS A	0.3	2.2	0.25	0.50	46.2
6u	U	1	0.0	0.064	8.4	LOS A	0.3	2.2	0.25	0.50	46.6
Approach		74	0.0	0.064	4.9	LOS A	0.3	2.2	0.25	0.50	46.2
North: Orange Grove											
7	L2	5	0.0	0.067	4.9	LOS A	0.3	2.3	0.29	0.52	45.6
8	T1	49	0.0	0.067	4.5	LOS A	0.3	2.3	0.29	0.52	46.2
9	R2	17	0.0	0.067	7.3	LOS A	0.3	2.3	0.29	0.52	46.0
9u	U	3	0.0	0.067	8.6	LOS A	0.3	2.3	0.29	0.52	46.3
Approach		75	0.0	0.067	5.3	LOS A	0.3	2.3	0.29	0.52	46.1
West: Cecil Avenue											
10	L2	113	0.0	0.144	5.3	LOS A	0.7	5.2	0.39	0.57	45.5
11	T1	20	0.0	0.144	5.0	LOS A	0.7	5.2	0.39	0.57	46.1
12	R2	16	0.0	0.144	7.7	LOS A	0.7	5.2	0.39	0.57	45.9
12u	U	3	0.0	0.144	9.1	LOS A	0.7	5.2	0.39	0.57	46.3
Approach		152	0.0	0.144	5.6	LOS A	0.7	5.2	0.39	0.57	45.7
All Vehicles		516	0.0	0.169	5.4	LOS A	0.9	6.3	0.28	0.54	45.9

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Roundabout LOS Method: SIDRA Roundabout LOS.

Vehicle movement LOS values are based on average delay per movement.

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

Roundabout Capacity Model: SIDRA Standard.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

▽ Site: 101 [Francis Street-Roger Avenue - Future AM - Option 1]

Future AM Peak
Existing plus Development
Giveaway / Yield (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back Vehicles veh	of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Francis Street											
5	T1	213	0.0	0.113	0.0	LOS A	0.0	0.3	0.02	0.02	49.8
6	R2	6	0.0	0.113	5.3	LOS A	0.0	0.3	0.02	0.02	48.9
Approach		219	0.0	0.113	0.2	NA	0.0	0.3	0.02	0.02	49.8
North: Roger Avenue											
7	L2	13	0.0	0.029	5.2	LOS A	0.1	0.7	0.32	0.57	45.9
9	R2	17	0.0	0.029	6.2	LOS A	0.1	0.7	0.32	0.57	45.5
Approach		29	0.0	0.029	5.8	LOS A	0.1	0.7	0.32	0.57	45.6
West: Francis Street											
10	L2	17	0.0	0.113	4.6	LOS A	0.0	0.0	0.00	0.04	49.3
11	T1	202	0.0	0.113	0.0	LOS A	0.0	0.0	0.00	0.04	49.7
Approach		219	0.0	0.113	0.4	NA	0.0	0.0	0.00	0.04	49.7
All Vehicles		467	0.0	0.113	0.6	NA	0.1	0.7	0.03	0.06	49.5

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

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

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

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

▽ Site: 101 [Francis Street-Roger Avenue - Future PM - Option 1]

Future PM Peak
Existing plus Development
Giveaway / Yield (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back Vehicles veh	of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Francis Street											
5	T1	81	0.0	0.043	0.0	LOS A	0.0	0.1	0.02	0.01	49.9
6	R2	2	0.0	0.043	5.3	LOS A	0.0	0.1	0.02	0.01	48.9
Approach		83	0.0	0.043	0.2	NA	0.0	0.1	0.02	0.01	49.8
North: Roger Avenue											
7	L2	1	0.0	0.003	5.1	LOS A	0.0	0.1	0.30	0.53	46.0
9	R2	2	0.0	0.003	5.6	LOS A	0.0	0.1	0.30	0.53	45.5
Approach		3	0.0	0.003	5.4	LOS A	0.0	0.1	0.30	0.53	45.7
West: Francis Street											
10	L2	23	0.0	0.119	4.6	LOS A	0.0	0.0	0.00	0.05	49.2
11	T1	207	0.0	0.119	0.0	LOS A	0.0	0.0	0.00	0.05	49.7
Approach		231	0.0	0.119	0.5	NA	0.0	0.0	0.00	0.05	49.6
All Vehicles		317	0.0	0.119	0.4	NA	0.0	0.1	0.01	0.05	49.6

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

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

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

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY



Site: 101 [Old Northern Road-Cecil Avenue - Future AM - Option 2]

Future AM Peak Option 2

Existing plus Development

Signals - Fixed Time Isolated Cycle Time = 85 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back Vehicles veh	of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Old Northern Road											
1	L2	136	0.0	0.427	20.3	LOS C	10.7	75.0	0.69	0.66	46.2
2	T1	671	0.0	0.427	15.1	LOS B	10.8	75.8	0.69	0.63	47.7
3	R2	798	0.0	0.870	48.4	LOS D	18.8	131.9	1.00	0.99	33.2
Approach		1604	0.0	0.870	32.1	LOS C	18.8	131.9	0.85	0.81	39.1
East: Cecil Avenue											
4	L2	1051	0.0	0.572	21.9	LOS C	15.4	107.5	0.76	0.81	43.3
5	T1	257	0.0	0.867	45.5	LOS D	12.0	83.7	1.00	1.02	34.5
6	R2	144	0.0	0.440	40.3	LOS D	5.5	38.6	0.94	0.79	35.5
Approach		1452	0.0	0.867	27.9	LOS C	15.4	107.5	0.82	0.85	40.5
North: Old Northern Road											
7	L2	88	0.0	0.615	35.1	LOS D	7.1	49.9	0.97	0.83	38.8
8	T1	321	0.0	0.615	34.1	LOS C	7.9	55.4	0.98	0.82	38.2
Approach		409	0.0	0.615	34.3	LOS C	7.9	55.4	0.98	0.82	38.3
West: Cecil Avenue											
10	L2	89	0.0	0.834	51.4	LOS D	9.5	66.5	1.00	0.97	33.0
11	T1	181	0.0	0.834	45.9	LOS D	9.5	66.5	1.00	0.97	33.4
12	R2	139	0.0	0.834	51.6	LOS D	9.4	65.7	1.00	0.97	32.8
Approach		409	0.0	0.834	49.0	LOS D	9.5	66.5	1.00	0.97	33.1
All Vehicles		3875	0.0	0.870	32.5	LOS C	18.8	131.9	0.87	0.84	38.8

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

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

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians									
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back Pedestrian ped	of Queue Distance m	Prop. Queued	Effective Stop Rate per ped	
P1	South Full Crossing	53	36.8	LOS D	0.1	0.1	0.93	0.93	
P2	East Full Crossing	53	36.8	LOS D	0.1	0.1	0.93	0.93	
P3	North Full Crossing	53	36.8	LOS D	0.1	0.1	0.93	0.93	
P4	West Full Crossing	53	18.5	LOS B	0.1	0.1	0.66	0.66	
All Pedestrians		211	32.2	LOS D			0.86	0.86	

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

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY



Site: 101 [Old Northern Road-Cecil Avenue - Future PM - Option 2]

Future PM Peak Option 2

Existing plus Development

Signals - Fixed Time Isolated Cycle Time = 100 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Old Northern Road											
1	L2	132	0.0	0.424	23.7	LOS C	12.3	86.1	0.70	0.67	44.3
2	T1	646	0.0	0.424	18.5	LOS B	12.4	87.0	0.70	0.64	45.7
3	R2	846	0.0	0.911	60.8	LOS E	24.9	174.1	1.00	1.02	29.9
Approach		1624	0.0	0.911	41.0	LOS D	24.9	174.1	0.86	0.84	35.7
East: Cecil Avenue											
4	L2	1216	0.0	0.696	23.3	LOS C	24.7	173.1	0.76	0.82	42.6
5	T1	294	0.0	0.955	68.7	LOS E	18.5	129.7	0.97	1.16	28.3
6	R2	236	0.0	0.787	48.3	LOS D	11.3	79.2	0.95	0.89	33.0
Approach		1745	0.0	0.955	34.3	LOS C	24.7	173.1	0.82	0.89	37.8
North: Old Northern Road											
7	L2	108	0.0	0.740	44.6	LOS D	10.8	75.4	1.00	0.91	35.2
8	T1	369	0.0	0.740	43.5	LOS D	11.4	80.0	1.00	0.90	34.8
Approach		478	0.0	0.740	43.8	LOS D	11.4	80.0	1.00	0.90	34.9
West: Cecil Avenue											
10	L2	80	0.0	0.879	62.1	LOS E	12.2	85.4	1.00	1.02	30.2
11	T1	242	0.0	0.879	56.6	LOS E	12.2	85.4	1.00	1.02	30.6
12	R2	114	0.0	0.879	62.2	LOS E	12.1	84.8	1.00	1.02	30.2
Approach		436	0.0	0.879	59.0	LOS E	12.2	85.4	1.00	1.02	30.4
All Vehicles		4283	0.0	0.955	40.4	LOS D	24.9	174.1	0.87	0.88	35.8

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

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

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians									
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped	
P1	South Full Crossing	53	44.3	LOS E	0.1	0.1	0.94	0.94	
P2	East Full Crossing	53	44.3	LOS E	0.1	0.1	0.94	0.94	
P3	North Full Crossing	53	44.3	LOS E	0.1	0.1	0.94	0.94	
P4	West Full Crossing	53	21.2	LOS C	0.1	0.1	0.65	0.65	
All Pedestrians		211	38.5	LOS D			0.87	0.87	

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

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 101 [Terminus Street-Crane Road - Future AM - Option 2]

Future AM Peak Option 2

Existing plus Development

Signals - Fixed Time Isolated Cycle Time = 120 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Crane Road											
1	L2	115	0.0	0.934	75.8	LOS E	23.3	163.2	1.00	1.12	27.2
2	T1	264	0.0	0.934	70.3	LOS E	23.3	163.2	1.00	1.11	27.4
3	R2	281	0.0	0.934	76.2	LOS E	23.1	161.8	1.00	1.05	26.6
Approach		660	0.0	0.934	73.8	LOS E	23.3	163.2	1.00	1.09	27.0
NorthEast: Terminus Street											
4	L2	80	0.0	0.917	61.5	LOS E	47.0	328.7	1.00	1.08	30.7
5	T1	1201	0.0	0.917	54.6	LOS D	47.0	328.7	0.97	1.06	31.6
6	R2	248	0.0	0.976	88.7	LOS F	16.1	112.7	1.00	1.18	24.2
Approach		1529	0.0	0.976	60.5	LOS E	47.0	328.7	0.97	1.08	30.0
NorthWest: Crane Road											
7	L2	23	0.0	0.353	57.6	LOS E	4.9	34.5	0.95	0.75	31.5
8	T1	67	0.0	0.353	52.1	LOS D	4.9	34.5	0.95	0.75	32.0
9	R2	151	0.0	0.608	59.9	LOS E	8.6	59.9	0.99	0.81	29.9
Approach		241	0.0	0.608	57.5	LOS E	8.6	59.9	0.98	0.79	30.6
SouthWest: Terminus Street											
10	L2	112	0.0	0.597	35.9	LOS D	20.9	146.4	0.85	0.77	38.8
11	T1	732	0.0	0.597	29.9	LOS C	20.9	146.4	0.83	0.73	40.0
12	R2	109	0.0	0.661	37.3	LOS D	3.9	27.0	1.00	0.81	36.6
Approach		953	0.0	0.661	31.5	LOS C	20.9	146.4	0.85	0.75	39.4
All Vehicles		3383	0.0	0.976	54.7	LOS D	47.0	328.7	0.94	0.97	31.5

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

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

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians									
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped	
P1	SouthEast Full Crossing	53	30.2	LOS D	0.1	0.1	0.71	0.71	
P2	NorthEast Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95	
P3	NorthWest Full Crossing	53	30.2	LOS D	0.1	0.1	0.71	0.71	
P4	SouthWest Full Crossing	53	48.7	LOS E	0.2	0.2	0.90	0.90	
All Pedestrians		211	40.8	LOS E			0.82	0.82	

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

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 101 [Terminus Street-Crane Road - Future PM - Option 2]

Future PM Peak Option 2

Existing plus Development

Signals - Fixed Time Isolated Cycle Time = 145 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Crane Road											
1	L2	89	0.0	0.854	78.2	LOS E	17.7	124.0	1.00	0.97	26.6
2	T1	165	0.0	0.854	72.7	LOS E	17.7	124.0	1.00	0.96	26.9
3	R2	208	0.0	0.854	78.4	LOS E	17.2	120.1	1.00	0.93	26.1
Approach		463	0.0	0.854	76.3	LOS E	17.7	124.0	1.00	0.95	26.5
NorthEast: Terminus Street											
4	L2	174	0.0	0.870	48.4	LOS D	52.3	366.3	0.97	0.95	34.3
5	T1	1253	0.0	0.870	41.7	LOS D	52.3	366.3	0.91	0.89	35.4
6	R2	254	0.0	0.869	51.2	LOS D	12.9	90.6	1.00	0.97	32.1
Approach		1680	0.0	0.870	43.8	LOS D	52.3	366.3	0.93	0.91	34.8
NorthWest: Crane Road											
7	L2	49	0.0	0.523	70.9	LOS E	8.4	58.8	0.98	0.79	28.1
8	T1	75	0.0	0.523	65.3	LOS E	8.4	58.8	0.98	0.79	28.5
9	R2	138	0.0	0.598	71.7	LOS E	9.4	66.1	1.00	0.80	27.3
Approach		262	0.0	0.598	69.7	LOS E	9.4	66.1	0.99	0.80	27.8
SouthWest: Terminus Street											
10	L2	168	0.0	0.679	36.7	LOS D	33.3	233.4	0.84	0.78	38.4
11	T1	932	0.0	0.679	29.9	LOS C	33.3	233.4	0.80	0.72	39.9
12	R2	189	0.0	0.798	55.2	LOS E	9.2	64.6	1.00	0.94	31.0
Approach		1289	0.0	0.798	34.5	LOS C	33.3	233.4	0.83	0.76	38.1
All Vehicles		3695	0.0	0.870	46.5	LOS D	52.3	366.3	0.91	0.86	33.9

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

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

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians									
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped	
P1	SouthEast Full Crossing	53	27.4	LOS C	0.1	0.1	0.62	0.62	
P2	NorthEast Full Crossing	53	66.8	LOS F	0.2	0.2	0.96	0.96	
P3	NorthWest Full Crossing	53	27.4	LOS C	0.1	0.1	0.62	0.62	
P4	SouthWest Full Crossing	53	65.8	LOS F	0.2	0.2	0.95	0.95	
All Pedestrians		211	46.8	LOS E			0.79	0.79	

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

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

 **Site: 101 [Old Northern Road-Francis Street - Future AM - Option 2]**

Future AM Peak Option 2
Existing plus Development
Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back Vehicles veh	of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Old Northern Road											
2	T1	1467	0.0	0.737	1.2	LOS A	4.5	31.4	0.02	0.02	58.7
3	R2	119	0.0	0.737	52.9	LOS F	4.5	31.4	0.99	0.95	30.6
Approach		1586	0.0	0.737	5.1	NA	4.5	31.4	0.09	0.09	54.9
East: Francis Street											
4	L2	220	0.0	0.497	17.7	LOS C	2.5	17.3	0.77	1.13	43.1
6	R2	3	0.0	1.000	1597.8	LOS F	2.2	15.7	1.00	1.04	2.2
Approach		223	0.0	1.000	40.1	LOS E	2.5	17.3	0.78	1.13	34.1
North: Old Northern Road											
7	L2	55	0.0	0.407	5.6	LOS A	0.0	0.0	0.00	0.04	57.9
8	T1	1532	0.0	0.407	0.1	LOS A	0.0	0.0	0.00	0.02	59.7
Approach		1586	0.0	0.407	0.2	NA	0.0	0.0	0.00	0.02	59.6
All Vehicles		3396	0.0	1.000	5.1	NA	4.5	31.4	0.09	0.13	54.7

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

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

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

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY



Site: 101 [Old Northern Road-Francis Street - Future PM - Option 2]

Future PM Peak Option 2
Existing plus Development
Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back Vehicles veh	of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Old Northern Road											
2	T1	1479	0.0	0.758	0.3	LOS A	0.0	0.0	0.00	0.00	59.5
3	R2	154	0.0	1.123	198.7	LOS F	16.9	118.3	1.00	2.17	13.6
Approach		1633	0.0	1.123	18.9	NA	16.9	118.3	0.09	0.20	45.1
East: Francis Street											
4	L2	96	0.0	0.223	14.9	LOS B	0.8	5.6	0.70	1.02	44.4
6	R2	1	0.0	1.000	4048.2	LOS F	2.1	14.5	1.00	1.02	0.9
Approach		97	0.0	1.000	58.7	LOS F	2.1	14.5	0.70	1.02	29.0
North: Old Northern Road											
7	L2	65	0.0	0.421	5.5	LOS A	0.0	0.0	0.00	0.05	57.2
8	T1	1574	0.0	0.421	0.1	LOS A	0.0	0.0	0.00	0.02	59.5
Approach		1639	0.0	0.421	0.3	NA	0.0	0.0	0.00	0.02	59.4
All Vehicles		3368	0.0	1.123	11.0	NA	16.9	118.3	0.07	0.14	50.2

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

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

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

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

 **Site: 101 [Orange Grove-Cecil Avenue - Future AM - Option 2]**

Future AM Peak Option 2
Existing plus Development
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back Vehicles veh	of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Orange Grove											
1	L2	36	0.0	0.172	5.3	LOS A	0.9	6.4	0.39	0.56	45.4
2	T1	108	0.0	0.172	5.0	LOS A	0.9	6.4	0.39	0.56	46.1
3	R2	37	0.0	0.172	7.8	LOS A	0.9	6.4	0.39	0.56	45.8
3u	U	1	0.0	0.172	9.1	LOS A	0.9	6.4	0.39	0.56	46.2
Approach		182	0.0	0.172	5.6	LOS A	0.9	6.4	0.39	0.56	45.9
East: Cecil Avenue											
4	L2	69	0.0	0.150	5.2	LOS A	0.8	5.5	0.37	0.54	45.6
5	T1	73	0.0	0.150	4.8	LOS A	0.8	5.5	0.37	0.54	46.2
6	R2	18	0.0	0.150	7.6	LOS A	0.8	5.5	0.37	0.54	46.0
6u	U	1	0.0	0.150	9.0	LOS A	0.8	5.5	0.37	0.54	46.4
Approach		161	0.0	0.150	5.3	LOS A	0.8	5.5	0.37	0.54	45.9
North: Orange Grove											
7	L2	22	0.0	0.146	4.5	LOS A	0.8	5.5	0.20	0.55	45.5
8	T1	66	0.0	0.146	4.1	LOS A	0.8	5.5	0.20	0.55	46.1
9	R2	96	0.0	0.146	6.9	LOS A	0.8	5.5	0.20	0.55	45.8
9u	U	3	0.0	0.146	8.2	LOS A	0.8	5.5	0.20	0.55	46.2
Approach		187	0.0	0.146	5.6	LOS A	0.8	5.5	0.20	0.55	45.9
West: Cecil Avenue											
10	L2	66	0.0	0.078	5.1	LOS A	0.4	2.8	0.35	0.54	45.6
11	T1	9	0.0	0.078	4.7	LOS A	0.4	2.8	0.35	0.54	46.3
12	R2	5	0.0	0.078	7.5	LOS A	0.4	2.8	0.35	0.54	46.0
12u	U	2	0.0	0.078	8.9	LOS A	0.4	2.8	0.35	0.54	46.4
Approach		83	0.0	0.078	5.3	LOS A	0.4	2.8	0.35	0.54	45.7
All Vehicles		614	0.0	0.172	5.5	LOS A	0.9	6.4	0.32	0.55	45.9

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Roundabout LOS Method: SIDRA Roundabout LOS.

Vehicle movement LOS values are based on average delay per movement.

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

Roundabout Capacity Model: SIDRA Standard.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

 **Site: 101 [Orange Grove-Cecil Avenue - Future PM - Option 2]**

Future PM Peak Option 2
Existing plus Development
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Orange Grove											
1	L2	19	0.0	0.163	4.6	LOS A	0.9	6.0	0.24	0.54	45.5
2	T1	92	0.0	0.163	4.3	LOS A	0.9	6.0	0.24	0.54	46.1
3	R2	89	0.0	0.163	7.0	LOS A	0.9	6.0	0.24	0.54	45.9
3u	U	1	0.0	0.163	8.4	LOS A	0.9	6.0	0.24	0.54	46.2
Approach		201	0.0	0.163	5.5	LOS A	0.9	6.0	0.24	0.54	45.9
East: Cecil Avenue											
4	L2	33	0.0	0.064	4.7	LOS A	0.3	2.2	0.27	0.50	45.8
5	T1	31	0.0	0.064	4.4	LOS A	0.3	2.2	0.27	0.50	46.4
6	R2	9	0.0	0.064	7.1	LOS A	0.3	2.2	0.27	0.50	46.2
6u	U	1	0.0	0.064	8.5	LOS A	0.3	2.2	0.27	0.50	46.6
Approach		74	0.0	0.064	4.9	LOS A	0.3	2.2	0.27	0.50	46.1
North: Orange Grove											
7	L2	18	0.0	0.091	4.9	LOS A	0.5	3.2	0.30	0.54	45.5
8	T1	49	0.0	0.091	4.5	LOS A	0.5	3.2	0.30	0.54	46.1
9	R2	32	0.0	0.091	7.3	LOS A	0.5	3.2	0.30	0.54	45.8
9u	U	3	0.0	0.091	8.7	LOS A	0.5	3.2	0.30	0.54	46.2
Approach		102	0.0	0.091	5.6	LOS A	0.5	3.2	0.30	0.54	45.9
West: Cecil Avenue											
10	L2	113	0.0	0.144	5.3	LOS A	0.8	5.3	0.39	0.57	45.5
11	T1	20	0.0	0.144	5.0	LOS A	0.8	5.3	0.39	0.57	46.1
12	R2	16	0.0	0.144	7.7	LOS A	0.8	5.3	0.39	0.57	45.9
12u	U	3	0.0	0.144	9.1	LOS A	0.8	5.3	0.39	0.57	46.3
Approach		152	0.0	0.144	5.6	LOS A	0.8	5.3	0.39	0.57	45.6
All Vehicles		528	0.0	0.163	5.5	LOS A	0.9	6.0	0.30	0.54	45.9

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Roundabout LOS Method: SIDRA Roundabout LOS.

Vehicle movement LOS values are based on average delay per movement.

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

Roundabout Capacity Model: SIDRA Standard.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

▼ Site: 101 [Francis Street-Roger Avenue - Future AM - Option 2]

Future AM Peak Option 2
Existing plus Development
Giveway / Yield (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back Vehicles veh	of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Francis Street											
5	T1	213	0.0	0.120	0.1	LOS A	0.1	0.8	0.05	0.04	49.6
6	R2	16	0.0	0.120	5.1	LOS A	0.1	0.8	0.05	0.04	48.7
Approach		228	0.0	0.120	0.4	NA	0.1	0.8	0.05	0.04	49.6
North: Roger Avenue											
7	L2	13	0.0	0.028	5.0	LOS A	0.1	0.7	0.29	0.56	46.0
9	R2	17	0.0	0.028	6.1	LOS A	0.1	0.7	0.29	0.56	45.5
Approach		29	0.0	0.028	5.6	LOS A	0.1	0.7	0.29	0.56	45.7
West: Francis Street											
10	L2	7	0.0	0.088	4.6	LOS A	0.0	0.0	0.00	0.02	49.4
11	T1	164	0.0	0.088	0.0	LOS A	0.0	0.0	0.00	0.02	49.9
Approach		172	0.0	0.088	0.2	NA	0.0	0.0	0.00	0.02	49.8
All Vehicles		429	0.0	0.120	0.7	NA	0.1	0.8	0.05	0.07	49.4

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

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

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

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

▼ Site: 101 [Francis Street-Roger Avenue - Future PM - Option 2]

Future PM Peak Option 2
Existing plus Development
Giveway / Yield (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back Vehicles veh	of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Francis Street											
5	T1	81	0.0	0.052	0.1	LOS A	0.1	0.7	0.11	0.09	49.2
6	R2	15	0.0	0.052	5.2	LOS A	0.1	0.7	0.11	0.09	48.3
Approach		96	0.0	0.052	0.9	NA	0.1	0.7	0.11	0.09	49.1
North: Roger Avenue											
7	L2	1	0.0	0.003	5.1	LOS A	0.0	0.1	0.29	0.52	46.0
9	R2	2	0.0	0.003	5.6	LOS A	0.0	0.1	0.29	0.52	45.6
Approach		3	0.0	0.003	5.4	LOS A	0.0	0.1	0.29	0.52	45.7
West: Francis Street											
10	L2	11	0.0	0.104	4.6	LOS A	0.0	0.0	0.00	0.03	49.3
11	T1	193	0.0	0.104	0.0	LOS A	0.0	0.0	0.00	0.03	49.8
Approach		203	0.0	0.104	0.2	NA	0.0	0.0	0.00	0.03	49.8
All Vehicles		302	0.0	0.104	0.5	NA	0.1	0.7	0.04	0.05	49.5

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

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

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

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

 **Site: 501 [ONR - Castle - Crane - Future AM]**

Old Northern Road - Castle Street - Crane Road

Future AM Peak

Signals - Fixed Time Isolated Cycle Time = 60 seconds (Practical Cycle Time)

Variable Sequence Analysis applied. The results are given for the selected output sequence.

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		Total veh/h	HV %	v/c	sec		veh	m		per veh	km/h
South: Old Northern Road											
1	L2	81	2.0	0.156	23.3	LOS B	1.8	12.9	0.78	0.74	38.3
2	T1	216	2.0	0.832	27.8	LOS B	13.0	92.7	0.97	1.00	35.6
3	R2	190	2.0	0.832	33.4	LOS C	13.0	92.7	0.97	1.00	22.3
Approach		487	2.0	0.832	29.2	LOS C	13.0	92.7	0.94	0.96	31.8
East: Crane Road											
4	L2	121	2.0	0.597	24.7	LOS B	9.1	64.7	0.90	0.78	27.5
5	T1	237	2.0	0.597	19.1	LOS B	9.1	64.7	0.90	0.78	38.0
6	R2	189	2.0	0.885	43.4	LOS D	6.8	48.2	1.00	1.04	26.5
Approach		547	2.0	0.885	28.7	LOS C	9.1	64.7	0.93	0.87	31.2
NorthEast: Old Northern ROad											
24b	L3	10	100.0	0.177	36.5	LOS C	0.6	7.7	0.95	0.71	18.0
24a	L1	10	100.0	0.177	34.5	LOS C	0.6	7.7	0.95	0.71	25.0
Approach		20	100.0	0.177	35.5	LOS C	0.6	7.7	0.95	0.71	21.5
West: Castle Street											
10	L2	95	2.0	0.930	48.9	LOS D	6.7	47.7	1.00	1.13	33.5
11	T1	258	2.0	0.930	43.2	LOS D	6.9	48.9	1.00	1.13	27.0
Approach		353	2.0	0.930	44.8	LOS D	6.9	48.9	1.00	1.13	29.2
All Vehicles		1407	3.4	0.930	33.0	LOS C	13.0	92.7	0.95	0.96	30.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

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

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians									
Mov ID	Description	Demand Flow	Average Delay	Level of Service	Average Back of Queue	Back of Queue Distance	Prop. Queued	Effective Stop Rate	
		ped/h	sec		ped	m		per ped	
P1	South Full Crossing	30	24.3	LOS C	0.0	0.0	0.90	0.90	
P2	East Full Crossing	30	23.4	LOS C	0.0	0.0	0.88	0.88	
P6	NorthEast Full Crossing	30	3.7	LOS A	0.0	0.0	0.35	0.35	
P3	North Full Crossing	30	24.3	LOS C	0.0	0.0	0.90	0.90	
P4	West Full Crossing	30	24.3	LOS C	0.0	0.0	0.90	0.90	
All Pedestrians		150	20.0	LOS C			0.79	0.79	

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

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 501 [ONR - Castle - Crane - Future PM]

Old Northern Road - Castle Street - Crane Road

Future PM Peak

Signals - Fixed Time Isolated Cycle Time = 60 seconds (Practical Cycle Time)

Variable Sequence Analysis applied. The results are given for the selected output sequence.

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		Total veh/h	HV %	v/c	sec		veh	m		per veh	km/h
South: Old Northern Road											
1	L2	91	2.0	0.186	24.3	LOS B	2.1	15.0	0.81	0.74	37.7
2	T1	169	2.0	0.867	31.5	LOS C	13.4	95.6	0.99	1.06	33.6
3	R2	223	2.0	0.867	37.1	LOS C	13.4	95.6	0.99	1.06	20.6
Approach		483	2.0	0.867	32.7	LOS C	13.4	95.6	0.95	1.00	29.3
East: Crane Road											
4	L2	97	2.0	0.516	23.3	LOS B	7.9	56.1	0.86	0.75	28.6
5	T1	229	2.0	0.516	17.8	LOS B	7.9	56.1	0.86	0.75	39.1
6	R2	181	2.0	0.847	40.8	LOS C	6.2	44.3	1.00	0.99	27.3
Approach		507	2.0	0.847	27.0	LOS B	7.9	56.1	0.91	0.84	32.3
NorthEast: Old Northern ROad											
24b	L3	10	100.0	0.177	36.5	LOS C	0.6	7.7	0.95	0.71	18.0
24a	L1	10	100.0	0.177	34.5	LOS C	0.6	7.7	0.95	0.71	25.0
Approach		20	100.0	0.177	35.5	LOS C	0.6	7.7	0.95	0.71	21.5
West: Castle Street											
10	L2	85	2.0	0.943	51.3	LOS D	8.3	59.0	1.00	1.17	33.0
11	T1	334	2.0	0.943	45.6	LOS D	8.4	60.1	1.00	1.17	26.3
Approach		419	2.0	0.943	46.7	LOS D	8.4	60.1	1.00	1.17	28.0
All Vehicles		1429	3.4	0.943	34.9	LOS C	13.4	95.6	0.95	0.99	29.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

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

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians									
Mov ID	Description	Demand Flow	Average Delay	Level of Service	Average Back of Queue	Back of Queue Distance	Prop. Queued	Effective Stop Rate	
		ped/h	sec		Pedestrian ped	m		per ped	
P1	South Full Crossing	30	24.3	LOS C	0.0	0.0	0.90	0.90	
P2	East Full Crossing	30	24.3	LOS C	0.0	0.0	0.90	0.90	
P6	NorthEast Full Crossing	30	3.7	LOS A	0.0	0.0	0.35	0.35	
P3	North Full Crossing	30	24.3	LOS C	0.0	0.0	0.90	0.90	
P4	West Full Crossing	30	24.3	LOS C	0.0	0.0	0.90	0.90	
All Pedestrians		150	20.2	LOS C			0.79	0.79	

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

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

 **Site: 301 [ONR - Cecil - Future AM]**

Old Northern Road - Cecil Avenue

Future AM Peak

Signals - Fixed Time Isolated Cycle Time = 105 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Old Northern Road											
1	L2	142	2.0	0.573	32.6	LOS C	16.6	118.2	0.84	0.77	20.7
2	T1	681	2.0	0.573	27.8	LOS B	16.8	119.3	0.85	0.75	28.2
3	R2	874	2.0	1.139	193.5	LOS F	50.0	356.2	1.00	1.51	6.6
Approach		1697	2.0	1.139	113.5	LOS F	50.0	356.2	0.93	1.15	10.4
East: Cecil Avenue											
4	L2	1122	2.0	0.607	25.5	LOS B	20.4	145.0	0.77	0.82	28.9
5	T1	387	2.0	1.173	217.9	LOS F	48.4	344.6	1.00	1.85	2.6
6	R2	255	2.0	0.942	73.2	LOS F	16.2	115.3	0.94	1.05	9.8
Approach		1764	2.0	1.173	74.6	LOS F	48.4	344.6	0.84	1.08	12.4
North: Old Northern Road											
7	L2	107	2.0	1.067	119.5	LOS F	17.6	125.4	1.00	1.26	5.7
8	T1	348	2.0	1.067	125.5	LOS F	19.6	139.7	1.00	1.34	9.3
Approach		455	2.0	1.067	124.1	LOS F	19.6	139.7	1.00	1.32	8.4
West: Cecil Avenue											
10	L2	90	2.0	1.181	229.4	LOS F	38.3	272.9	1.00	1.78	2.6
11	T1	319	2.0	1.181	226.1	LOS F	38.3	272.9	1.00	1.78	2.4
12	R2	191	2.0	1.181	229.6	LOS F	38.0	270.6	1.00	1.78	4.7
Approach		600	2.0	1.181	227.7	LOS F	38.3	272.9	1.00	1.78	3.2
All Vehicles		4516	2.0	1.181	114.5	LOS F	50.0	356.2	0.91	1.22	9.0

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

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

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians									
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped	
P1	South Full Crossing	30	44.9	LOS E	0.1	0.1	0.92	0.92	
P2	East Full Crossing	30	46.7	LOS E	0.1	0.1	0.94	0.94	
P2S	East Slip/Bypass Lane Crossing	30	22.7	LOS C	0.1	0.1	0.66	0.66	
P3	North Full Crossing	30	43.9	LOS E	0.1	0.1	0.92	0.92	
P4	West Full Crossing	30	29.0	LOS C	0.1	0.1	0.74	0.74	
All Pedestrians		150	37.4	LOS D			0.84	0.84	

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

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

 **Site: 301 [ONR - Cecil - Future PM]**

Old Northern Road - Cecil Avenue

Future PM Peak

Signals - Fixed Time Isolated Cycle Time = 115 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		Total veh/h	HV %	v/c	sec		veh	m		per veh	km/h
South: Old Northern Road											
1	L2	130	2.0	0.572	37.0	LOS C	17.3	123.2	0.86	0.78	19.3
2	T1	638	2.0	0.572	32.2	LOS C	17.4	124.1	0.87	0.76	26.1
3	R2	934	2.0	1.333	361.1	LOS F	78.3	557.2	1.00	1.86	3.7
Approach		1702	2.0	1.333	213.0	LOS F	78.3	557.2	0.94	1.37	6.0
East: Cecil Avenue											
4	L2	1268	2.0	0.766	26.7	LOS B	33.0	234.9	0.79	0.83	28.3
5	T1	489	2.0	1.330	354.8	LOS F	82.9	590.2	1.00	2.31	1.6
6	R2	397	2.0	1.239	284.7	LOS F	59.3	422.1	1.00	1.61	2.9
Approach		2154	2.0	1.330	148.7	LOS F	82.9	590.2	0.87	1.31	6.8
North: Old Northern Road											
7	L2	126	2.0	1.198	229.4	LOS F	30.9	220.1	1.00	1.51	3.3
8	T1	383	2.0	1.198	234.8	LOS F	32.1	228.4	1.00	1.61	5.5
Approach		509	2.0	1.198	233.5	LOS F	32.1	228.4	1.00	1.59	4.9
West: Cecil Avenue											
10	L2	82	2.0	1.346	372.9	LOS F	53.8	383.1	1.00	2.09	1.6
11	T1	398	2.0	1.346	369.6	LOS F	53.8	383.1	1.00	2.09	1.5
12	R2	147	2.0	1.346	373.1	LOS F	53.5	381.1	1.00	2.09	3.0
Approach		627	2.0	1.346	370.8	LOS F	53.8	383.1	1.00	2.09	1.9
All Vehicles		4992	2.0	1.346	207.2	LOS F	82.9	590.2	0.92	1.45	5.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

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

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians									
Mov ID	Description	Demand Flow	Average Delay	Level of Service	Average Back of Queue Pedestrian	Back of Queue Distance	Prop. Queued	Effective Stop Rate	
		ped/h	sec		ped	m		per ped	
P1	South Full Crossing	30	41.8	LOS E	0.1	0.1	0.85	0.85	
P2	East Full Crossing	30	51.7	LOS E	0.1	0.1	0.95	0.95	
P2S	East Slip/Bypass Lane Crossing	30	26.5	LOS C	0.1	0.1	0.68	0.68	
P3	North Full Crossing	30	48.9	LOS E	0.1	0.1	0.92	0.92	
P4	West Full Crossing	30	32.9	LOS D	0.1	0.1	0.76	0.76	
All Pedestrians		150	40.4	LOS E			0.83	0.83	

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

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

 **Site: 601 [ONR - McMullen - Future AM]**

Old Northern Road - McMullen Road

Future AM Peak

Signals - Fixed Time Isolated Cycle Time = 80 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		Total veh/h	HV %	v/c	sec		veh	m		per veh	km/h
NorthEast: Old Northern Road											
25	T1	1700	2.0	0.609	5.8	LOS A	16.2	115.2	0.53	0.49	51.2
26	R2	807	2.0	0.881	47.8	LOS D	18.5	131.8	1.00	1.01	27.1
Approach		2507	2.0	0.881	19.3	LOS B	18.5	131.8	0.68	0.66	38.7
NorthWest: McMullen Avenue											
27	L2	767	2.0	0.465	22.1	LOS B	10.4	74.4	0.74	0.79	37.5
29	R2	388	2.0	0.848	50.4	LOS D	8.6	61.3	1.00	0.98	11.5
Approach		1155	2.0	0.848	31.6	LOS C	10.4	74.4	0.83	0.85	28.7
SouthWest: Old Northern Road											
30	L2	69	2.0	0.057	7.6	LOS A	0.8	6.0	0.38	0.61	35.8
31	T1	1367	2.0	0.888	35.5	LOS C	30.8	219.2	1.00	1.08	29.3
Approach		1436	2.0	0.888	34.1	LOS C	30.8	219.2	0.97	1.06	29.4
All Vehicles		5098	2.0	0.888	26.3	LOS B	30.8	219.2	0.80	0.82	33.4

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

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

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians									
Mov ID	Description	Demand Flow	Average Delay	Level of Service	Average Back of Queue Pedestrian	Back of Queue Distance	Prop. Queued	Effective Stop Rate	
		ped/h	sec		ped	m		per ped	
P6	NorthEast Full Crossing	30	34.3	LOS D	0.1	0.1	0.93	0.93	
P7	NorthWest Full Crossing	30	28.1	LOS C	0.1	0.1	0.84	0.84	
All Pedestrians		60	31.2	LOS D			0.88	0.88	

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

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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MOVEMENT SUMMARY

 **Site: 601 [ONR - McMullen - Future PM]**

Old Northern Road - McMullen Road

Future PM Peak

Signals - Fixed Time Isolated Cycle Time = 60 seconds (Practical Cycle Time)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		Total veh/h	HV %	v/c	sec		veh	m		per veh	km/h
NorthEast: Old Northern Road											
25	T1	1626	2.0	0.618	5.6	LOS A	13.1	93.1	0.59	0.54	51.4
26	R2	600	2.0	0.894	42.8	LOS D	11.0	78.3	1.00	1.09	28.7
Approach		2226	2.0	0.894	15.6	LOS B	13.1	93.1	0.70	0.69	41.4
NorthWest: McMullen Avenue											
27	L2	1004	2.0	0.685	22.3	LOS B	12.6	89.8	0.88	0.85	37.4
29	R2	353	2.0	0.826	39.9	LOS C	6.0	42.4	1.00	0.97	13.8
Approach		1357	2.0	0.826	26.9	LOS B	12.6	89.8	0.91	0.88	32.0
SouthWest: Old Northern Road											
30	L2	123	2.0	0.098	6.3	LOS A	1.0	7.4	0.38	0.62	38.1
31	T1	1374	2.0	0.892	30.1	LOS C	24.9	177.3	1.00	1.13	31.7
Approach		1497	2.0	0.892	28.2	LOS B	24.9	177.3	0.95	1.08	31.9
All Vehicles		5080	2.0	0.894	22.3	LOS B	24.9	177.3	0.83	0.86	35.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

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

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians									
Mov ID	Description	Demand Flow	Average Delay	Level of Service	Average Back of Queue Pedestrian	Back of Queue Distance	Prop. Queued	Effective Stop Rate	
		ped/h	sec		ped	m		per ped	
P6	NorthEast Full Crossing	30	24.3	LOS C	0.0	0.0	0.90	0.90	
P7	NorthWest Full Crossing	30	24.3	LOS C	0.0	0.0	0.90	0.90	
All Pedestrians		60	24.3	LOS C			0.90	0.90	

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

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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MOVEMENT SUMMARY

 **Site: 601 [ONR - McMullen - Brisbane - Future AM]**

Old Northern Road - McMullen Road - Brisbane Road

Future AM Peak

Signals - Fixed Time Isolated Cycle Time = 130 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		Total veh/h	HV %	v/c	sec		veh	m		per veh	km/h
SouthEast: Brisbane Road											
21	L2	89	2.0	0.338	55.7	LOS D	6.2	43.9	0.91	0.77	25.7
22	T1	21	2.0	0.338	50.2	LOS D	6.2	43.9	0.91	0.77	25.4
23	R2	72	2.0	0.382	52.6	LOS D	3.8	27.3	0.98	0.76	32.1
Approach		182	2.0	0.382	53.8	LOS D	6.2	43.9	0.94	0.77	28.4
NorthEast: Old Northern Road											
24	L2	141	2.0	1.113	185.6	LOS F	16.5	117.3	1.00	1.29	14.3
25	T1	1566	2.0	1.075	142.0	LOS F	89.3	635.9	1.00	1.54	13.7
26	R2	807	2.0	0.886	62.0	LOS E	23.8	169.3	1.00	1.07	23.5
Approach		2514	2.0	1.113	118.8	LOS F	89.3	635.9	1.00	1.38	15.8
NorthWest: McMullen Avenue											
27	L2	767	2.0	0.594	41.4	LOS C	20.1	143.4	0.86	0.83	28.8
28	T1	32	2.0	0.142	56.6	LOS E	1.8	13.0	0.93	0.68	25.1
29	R2	358	2.0	0.764	60.3	LOS E	10.5	75.1	1.00	0.92	15.6
Approach		1157	2.0	0.764	47.7	LOS D	20.1	143.4	0.91	0.86	24.6
SouthWest: Old Northern Road											
30	L2	69	2.0	0.074	11.0	LOS A	0.9	6.7	0.42	0.65	38.8
31	T1	1279	2.0	0.793	34.0	LOS C	35.8	254.7	0.92	0.83	33.5
32	R2	61	2.0	0.143	29.4	LOS C	2.0	14.1	0.83	0.72	34.6
Approach		1409	2.0	0.793	32.7	LOS C	35.8	254.7	0.89	0.82	33.7
All Vehicles		5262	2.0	1.113	77.8	LOS F	89.3	635.9	0.95	1.09	20.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

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

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians									
Mov ID	Description	Demand Flow	Average Delay	Level of Service	Average Back of Queue Pedestrian	Back of Queue Distance	Prop. Queued	Effective Stop Rate	
		ped/h	sec		ped	m		per ped	
P5	SouthEast Full Crossing	30	25.9	LOS C	0.1	0.1	0.63	0.63	
P6	NorthEast Full Crossing	30	59.2	LOS E	0.1	0.1	0.96	0.96	
P7	NorthWest Full Crossing	30	32.6	LOS D	0.1	0.1	0.71	0.71	
All Pedestrians		90	39.2	LOS D			0.77	0.77	

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

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

 **Site: 601 [ONR - McMullen - Brisbane - Future PM]**

Old Northern Road - McMullen Road - Brisbane Road

Future PM Peak

Signals - Fixed Time Isolated Cycle Time = 130 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		Total veh/h	HV %	v/c	sec		veh	m		per veh	km/h
SouthEast: Brisbane Road											
21	L2	46	2.0	0.174	53.9	LOS D	3.1	21.8	0.88	0.73	26.2
22	T1	11	2.0	0.174	48.3	LOS D	3.1	21.8	0.88	0.73	25.9
23	R2	16	2.0	0.099	52.8	LOS D	0.8	5.9	0.96	0.68	32.0
Approach		73	2.0	0.174	52.9	LOS D	3.1	21.8	0.90	0.72	27.6
NorthEast: Old Northern Road											
24	L2	85	2.0	0.865	82.1	LOS F	6.1	43.3	1.00	0.93	25.3
25	T1	1545	2.0	0.896	40.6	LOS C	49.3	351.2	0.91	0.92	30.9
26	R2	600	2.0	0.804	48.9	LOS D	13.5	96.3	1.00	1.00	26.9
Approach		2230	2.0	0.896	44.4	LOS D	49.3	351.2	0.93	0.94	29.4
NorthWest: McMullen Avenue											
27	L2	1004	2.0	0.906	67.0	LOS E	36.7	261.6	1.00	0.98	22.0
28	T1	32	2.0	0.142	56.6	LOS E	1.8	13.0	0.93	0.68	25.1
29	R2	323	2.0	0.662	60.4	LOS E	9.4	66.8	0.99	0.90	15.6
Approach		1359	2.0	0.906	65.2	LOS E	36.7	261.6	1.00	0.95	20.9
SouthWest: Old Northern Road											
30	L2	123	2.0	0.133	12.2	LOS A	2.2	15.8	0.45	0.67	37.4
31	T1	1349	2.0	0.715	26.6	LOS B	33.5	238.7	0.83	0.75	37.1
32	R2	43	2.0	0.124	25.4	LOS B	1.3	9.2	0.78	0.73	36.6
Approach		1515	2.0	0.715	25.4	LOS B	33.5	238.7	0.80	0.75	37.1
All Vehicles		5177	2.0	0.906	44.4	LOS D	49.3	351.2	0.91	0.89	28.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

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

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians									
Mov ID	Description	Demand Flow	Average Delay	Level of Service	Average Back of Queue Pedestrian	Back of Queue Distance	Prop. Queued	Effective Stop Rate	
		ped/h	sec		ped	m		per ped	
P5	SouthEast Full Crossing	30	20.5	LOS C	0.1	0.1	0.56	0.56	
P6	NorthEast Full Crossing	30	59.2	LOS E	0.1	0.1	0.96	0.96	
P7	NorthWest Full Crossing	30	26.5	LOS C	0.1	0.1	0.64	0.64	
All Pedestrians		90	35.4	LOS D			0.72	0.72	

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

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 401 [ONR - Showground - Future AM]

Old Northern Road - Showground Road

Future AM Peak

Signals - Fixed Time Isolated Cycle Time = 60 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		Total veh/h	HV %	v/c	sec		veh	m		per veh	km/h
South: Old Northern Road											
1	L2	601	2.0	0.330	5.8	LOS A	1.7	12.4	0.11	0.55	51.7
2	T1	450	2.0	0.733	21.6	LOS B	12.6	89.7	0.94	0.87	29.9
Approach		1051	2.0	0.733	12.6	LOS A	12.6	89.7	0.47	0.68	42.6
North: Old Northern Road											
8	T1	51	2.0	0.051	7.7	LOS A	0.7	5.2	0.52	0.40	44.2
9	R2	91	2.0	0.497	35.5	LOS C	2.7	19.5	0.99	0.77	32.5
Approach		142	2.0	0.497	25.5	LOS B	2.7	19.5	0.82	0.63	34.5
West: Showground Road											
10	L2	209	2.0	0.726	27.3	LOS B	11.8	84.0	0.95	0.88	36.1
12	R2	587	2.0	0.726	28.3	LOS B	11.8	84.0	0.95	0.88	33.7
Approach		796	2.0	0.726	28.0	LOS B	11.8	84.0	0.95	0.88	34.4
All Vehicles		1989	2.0	0.733	19.7	LOS B	12.6	89.7	0.69	0.76	37.9

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

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

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians									
Mov ID	Description	Demand Flow	Average Delay	Level of Service	Average Back of Queue Pedestrian	Back of Queue Distance	Prop. Queued	Effective Stop Rate	
		ped/h	sec		ped	m		per ped	
P3	North Full Crossing	30	23.4	LOS C	0.0	0.0	0.88	0.88	
P4	West Full Crossing	30	24.3	LOS C	0.0	0.0	0.90	0.90	
All Pedestrians		60	23.9	LOS C			0.89	0.89	

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

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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MOVEMENT SUMMARY

Site: 401 [ONR - Showground - Future PM]

Old Northern Road - Showground Road

Future PM Peak

Signals - Fixed Time Isolated Cycle Time = 50 seconds (Practical Cycle Time)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back Vehicles veh	of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Old Northern Road											
1	L2	621	2.0	0.339	5.6	LOS A	0.0	0.0	0.00	0.53	52.2
2	T1	386	2.0	0.716	19.6	LOS B	9.3	66.3	0.96	0.87	31.4
Approach		1007	2.0	0.716	11.0	LOS A	9.3	66.3	0.37	0.66	44.7
North: Old Northern Road											
8	T1	52	2.0	0.052	6.4	LOS A	0.6	4.4	0.52	0.39	46.3
9	R2	84	2.0	0.382	29.3	LOS C	2.1	14.6	0.96	0.76	35.2
Approach		136	2.0	0.382	20.5	LOS B	2.1	14.6	0.79	0.62	37.3
West: Showground Road											
10	L2	231	2.0	0.684	23.8	LOS B	8.7	62.1	0.94	0.87	37.9
12	R2	445	2.0	0.684	25.4	LOS B	8.7	62.1	0.95	0.87	35.2
Approach		676	2.0	0.684	24.9	LOS B	8.7	62.1	0.95	0.87	36.2
All Vehicles		1819	2.0	0.716	16.9	LOS B	9.3	66.3	0.61	0.73	40.1

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

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

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians									
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back Pedestrian ped	of Queue Distance m	Prop. Queued	Effective Stop Rate per ped	
P3	North Full Crossing	30	19.4	LOS B	0.0	0.0	0.88	0.88	
P4	West Full Crossing	30	19.4	LOS B	0.0	0.0	0.88	0.88	
All Pedestrians		60	19.4	LOS B			0.88	0.88	

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

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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MOVEMENT SUMMARY

 **Site: 502 [Terminus - Crane - Future AM]**

Terminus Street - Crane Street

Future AM Peak

Signals - Fixed Time Isolated Cycle Time = 135 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Terminus Street											
1	L2	141	2.0	0.972	71.4	LOS F	34.2	243.5	1.00	1.13	10.9
2	T1	840	2.0	0.972	66.0	LOS E	34.2	243.5	1.00	1.13	18.0
3	R2	190	2.0	1.167	231.3	LOS F	25.7	183.0	1.00	1.38	4.5
Approach		1171	2.0	1.167	93.5	LOS F	34.2	243.5	1.00	1.17	12.6
East: Crane Road											
4	L2	142	2.0	0.576	37.2	LOS C	22.9	162.8	0.82	0.76	21.5
5	T1	318	2.0	0.576	31.7	LOS C	22.9	162.8	0.82	0.76	16.4
6	R2	462	2.0	1.274	322.1	LOS F	78.6	559.8	1.00	1.62	3.7
Approach		922	2.0	1.274	178.0	LOS F	78.6	559.8	0.91	1.19	5.4
North: Terminus Street											
7	L2	325	2.0	1.269	310.1	LOS F	144.8	1030.8	1.00	1.97	3.7
8	T1	1298	2.0	1.269	305.6	LOS F	144.8	1030.8	1.00	2.10	5.0
9	R2	243	2.0	0.995	111.9	LOS F	21.9	156.2	1.00	1.09	9.4
Approach		1866	2.0	1.269	281.1	LOS F	144.8	1030.8	1.00	1.94	5.0
West: Crane Road											
10	L2	38	2.0	0.350	37.5	LOS C	12.1	86.1	0.73	0.67	23.0
11	T1	241	2.0	0.350	32.0	LOS C	12.1	86.1	0.73	0.67	16.6
12	R2	221	2.0	0.943	95.2	LOS F	19.3	137.2	1.00	1.07	9.9
Approach		500	2.0	0.943	60.3	LOS E	19.3	137.2	0.85	0.85	12.5
All Vehicles		4459	2.0	1.274	185.8	LOS F	144.8	1030.8	0.96	1.46	6.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

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

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians									
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped	
P1	South Full Crossing	30	32.1	LOS D	0.1	0.1	0.69	0.69	
P2	East Full Crossing	30	58.9	LOS E	0.1	0.1	0.93	0.93	
P4	West Full Crossing	30	61.7	LOS F	0.1	0.1	0.96	0.96	
All Pedestrians		90	50.9	LOS E			0.86	0.86	

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

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

 **Site: 502 [Terminus - Crane - Future PM]**

Terminus Street - Crane Street

Future PM Peak

Signals - Fixed Time Isolated Cycle Time = 145 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Terminus Street											
1	L2	225	2.0	1.048	134.6	LOS F	83.3	593.2	1.00	1.33	6.7
2	T1	1081	2.0	1.048	132.0	LOS F	83.3	593.2	1.00	1.37	10.5
3	R2	288	2.0	1.364	400.1	LOS F	54.3	386.5	1.00	1.63	2.7
Approach		1594	2.0	1.364	180.8	LOS F	83.3	593.2	1.00	1.41	7.2
East: Crane Road											
4	L2	97	2.0	0.899	79.4	LOS F	27.9	198.5	1.00	1.02	12.2
5	T1	256	2.0	0.899	73.9	LOS F	27.9	198.5	1.00	1.02	8.5
6	R2	505	2.0	1.333	372.3	LOS F	92.6	659.5	1.00	1.62	3.2
Approach		858	2.0	1.333	250.2	LOS F	92.6	659.5	1.00	1.38	4.1
North: Terminus Street											
7	L2	465	2.0	1.362	379.8	LOS F	173.2	1233.4	1.00	1.86	3.0
8	T1	1348	2.0	1.362	383.3	LOS F	173.2	1233.4	1.00	2.16	4.0
9	R2	244	2.0	0.907	71.3	LOS F	15.8	112.6	1.00	1.01	13.4
Approach		2057	2.0	1.362	345.5	LOS F	173.2	1233.4	1.00	1.96	4.0
West: Crane Road											
10	L2	56	2.0	1.340	379.1	LOS F	64.8	461.2	1.00	1.98	3.1
11	T1	297	2.0	1.340	373.6	LOS F	64.8	461.2	1.00	1.98	1.9
12	R2	198	2.0	0.784	75.3	LOS F	14.4	102.3	1.00	0.88	11.9
Approach		551	2.0	1.340	266.9	LOS F	64.8	461.2	1.00	1.58	3.2
All Vehicles		5060	2.0	1.364	268.9	LOS F	173.2	1233.4	1.00	1.65	4.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

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

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians									
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped	
P1	South Full Crossing	30	57.5	LOS E	0.1	0.1	0.89	0.89	
P2	East Full Crossing	30	64.8	LOS F	0.1	0.1	0.95	0.95	
P4	West Full Crossing	30	35.2	LOS D	0.1	0.1	0.70	0.70	
All Pedestrians		90	52.5	LOS E			0.84	0.84	

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

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

 **Site: 402 [Terminus - SC - Future AM]**

Terminus Road - Shopping Centre

Future AM Peak

Signals - Fixed Time Isolated Cycle Time = 60 seconds (Practical Cycle Time)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back Vehicles veh	of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Terminus Road											
1	L2	80	2.0	0.062	8.6	LOS A	0.7	5.2	0.33	0.65	47.1
2	T1	1109	2.0	0.810	23.0	LOS B	17.4	123.9	0.95	0.95	28.3
Approach		1189	2.0	0.810	22.1	LOS B	17.4	123.9	0.91	0.93	29.6
North: Terminus Road											
8	T1	1301	2.0	0.596	9.2	LOS A	12.6	89.4	0.70	0.63	41.4
9	R2	225	2.0	0.614	36.4	LOS C	3.5	24.8	1.00	0.82	32.0
Approach		1526	2.0	0.614	13.2	LOS A	12.6	89.4	0.75	0.66	38.3
West: Shopping Centre Access											
10	L2	247	2.0	0.578	28.4	LOS B	6.7	47.6	0.94	0.81	35.3
12	R2	353	2.0	0.826	35.3	LOS C	11.6	82.5	1.00	0.97	30.5
Approach		600	2.0	0.826	32.5	LOS C	11.6	82.5	0.97	0.91	32.5
All Vehicles		3315	2.0	0.826	19.9	LOS B	17.4	123.9	0.85	0.80	33.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

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

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians									
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped	
P3	North Full Crossing	30	24.3	LOS C	0.0	0.0	0.90	0.90	
P4	West Full Crossing	30	24.3	LOS C	0.0	0.0	0.90	0.90	
All Pedestrians		60	24.3	LOS C			0.90	0.90	

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

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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MOVEMENT SUMMARY

 **Site: 402 [Terminus - SC - Future PM]**

Terminus Road - Shopping Centre

Future PM Peak

Signals - Fixed Time Isolated Cycle Time = 50 seconds (Practical Cycle Time)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back Vehicles veh	of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Terminus Road											
1	L2	67	2.0	0.057	9.2	LOS A	0.6	4.3	0.39	0.66	46.5
2	T1	1076	2.0	0.838	22.8	LOS B	15.2	108.1	0.98	1.02	28.4
Approach		1143	2.0	0.838	22.0	LOS B	15.2	108.1	0.94	1.00	29.6
North: Terminus Road											
8	T1	1414	2.0	0.633	7.6	LOS A	11.6	82.7	0.71	0.64	43.8
9	R2	236	2.0	0.537	30.0	LOS C	3.0	21.1	0.98	0.79	34.7
Approach		1650	2.0	0.633	10.8	LOS A	11.6	82.7	0.75	0.66	40.9
West: Shopping Centre Access											
10	L2	177	2.0	0.537	26.9	LOS B	4.2	29.8	0.95	0.80	36.1
12	R2	287	2.0	0.871	35.7	LOS C	8.6	61.3	1.00	1.06	30.3
Approach		464	2.0	0.871	32.3	LOS C	8.6	61.3	0.98	0.96	32.5
All Vehicles		3257	2.0	0.871	17.8	LOS B	15.2	108.1	0.85	0.82	34.9

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

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

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians									
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped	
P3	North Full Crossing	30	19.4	LOS B	0.0	0.0	0.88	0.88	
P4	West Full Crossing	30	19.4	LOS B	0.0	0.0	0.88	0.88	
All Pedestrians		60	19.4	LOS B			0.88	0.88	

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

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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MOVEMENT SUMMARY

 **Site: 201v [ONR - Francis - Future AM]**

Old Northern Road - Francis Street
Future AM Peak

Signals - Fixed Time Isolated Cycle Time = 90 seconds (Practical Cycle Time)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Old Northern Road											
2	T1	1462	2.0	0.481	3.4	LOS A	10.7	76.5	0.37	0.34	52.7
3	R2	337	2.0	0.696	39.2	LOS C	12.5	89.0	0.96	1.00	21.3
Approach		1799	2.0	0.696	10.1	LOS A	12.5	89.0	0.48	0.46	41.6
East: Francis Street											
4	L2	386	2.0	0.709	31.0	LOS C	14.2	101.3	0.87	0.83	23.8
6	R2	109	2.0	0.765	54.0	LOS D	5.2	37.3	1.00	0.90	21.4
Approach		495	2.0	0.765	36.1	LOS C	14.2	101.3	0.90	0.85	23.1
North: Old Northern Road											
7	L2	146	2.0	0.873	34.8	LOS C	38.7	275.6	0.95	0.98	29.6
8	T1	1564	2.0	0.873	29.2	LOS C	39.0	277.5	0.96	0.98	27.3
Approach		1710	2.0	0.873	29.7	LOS C	39.0	277.5	0.96	0.98	27.6
All Vehicles		4004	2.0	0.873	21.7	LOS B	39.0	277.5	0.73	0.73	31.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

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

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians									
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped	
P2	East Full Crossing	30	14.5	LOS B	0.0	0.0	0.57	0.57	
P3	North Full Crossing	30	39.2	LOS D	0.1	0.1	0.93	0.93	
All Pedestrians		60	26.9	LOS C			0.75	0.75	

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

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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MOVEMENT SUMMARY

 **Site: 201v [ONR - Francis - Future PM]**

Old Northern Road - Francis Street
Future PM Peak

Signals - Fixed Time Isolated Cycle Time = 110 seconds (Practical Cycle Time)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Old Northern Road											
2	T1	1490	2.0	0.642	3.9	LOS A	20.9	148.9	0.38	0.35	51.9
3	R2	393	2.0	0.766	49.4	LOS D	18.1	128.7	0.98	1.06	18.5
Approach		1883	2.0	0.766	13.4	LOS A	20.9	148.9	0.51	0.50	38.0
East: Francis Street											
4	L2	363	2.0	0.615	33.6	LOS C	15.2	108.3	0.84	0.81	22.8
6	R2	74	2.0	0.494	59.5	LOS E	4.0	28.5	1.00	0.76	20.3
Approach		437	2.0	0.615	38.0	LOS C	15.2	108.3	0.86	0.80	22.2
North: Old Northern Road											
7	L2	151	2.0	0.888	40.2	LOS C	48.3	344.1	0.97	0.98	27.4
8	T1	1612	2.0	0.888	34.5	LOS C	48.7	346.4	0.97	0.98	24.9
Approach		1763	2.0	0.888	35.0	LOS C	48.7	346.4	0.97	0.98	25.2
All Vehicles		4083	2.0	0.888	25.3	LOS B	48.7	346.4	0.74	0.74	29.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

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

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians								
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P2	East Full Crossing	30	16.4	LOS B	0.1	0.1	0.55	0.55
P3	North Full Crossing	30	49.2	LOS E	0.1	0.1	0.95	0.95
All Pedestrians		60	32.8	LOS D			0.75	0.75

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

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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MOVEMENT SUMMARY

 **Site: 303 [Orange - Cecil Future AM]**

Orange Grove - Cecil Avenue
Future AM Peak
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Orange Grove											
1	L2	79	2.0	0.454	6.7	LOS A	3.1	21.8	0.61	0.68	40.4
2	T1	309	2.0	0.454	6.4	LOS A	3.1	21.8	0.61	0.68	42.5
3	R2	45	2.0	0.454	9.1	LOS A	3.1	21.8	0.61	0.68	43.6
3u	U	1	2.0	0.454	10.5	LOS A	3.1	21.8	0.61	0.68	40.6
Approach		434	2.0	0.454	6.7	LOS A	3.1	21.8	0.61	0.68	42.3
East: Cecil Avenue											
4	L2	79	2.0	0.225	6.7	LOS A	1.3	9.0	0.56	0.67	43.0
5	T1	80	2.0	0.225	6.3	LOS A	1.3	9.0	0.56	0.67	44.3
6	R2	39	2.0	0.225	9.1	LOS A	1.3	9.0	0.56	0.67	44.5
6u	U	1	2.0	0.225	10.5	LOS A	1.3	9.0	0.56	0.67	45.6
Approach		199	2.0	0.225	7.0	LOS A	1.3	9.0	0.56	0.67	43.8
North: Orange Grove											
7	L2	22	2.0	0.295	4.7	LOS A	1.9	13.6	0.28	0.54	44.6
8	T1	172	2.0	0.295	4.3	LOS A	1.9	13.6	0.28	0.54	43.2
9	R2	179	2.0	0.295	7.1	LOS A	1.9	13.6	0.28	0.54	43.4
9u	U	3	2.0	0.295	8.4	LOS A	1.9	13.6	0.28	0.54	44.6
Approach		376	2.0	0.295	5.7	LOS A	1.9	13.6	0.28	0.54	43.4
West: Cecil Avenue											
10	L2	21	2.0	0.059	6.4	LOS A	0.3	2.2	0.55	0.65	41.9
11	T1	8	2.0	0.059	6.1	LOS A	0.3	2.2	0.55	0.65	44.0
12	R2	19	2.0	0.059	8.9	LOS A	0.3	2.2	0.55	0.65	40.5
12u	U	2	2.0	0.059	10.2	LOS A	0.3	2.2	0.55	0.65	42.0
Approach		50	2.0	0.059	7.5	LOS A	0.3	2.2	0.55	0.65	41.9
All Vehicles		1059	2.0	0.454	6.4	LOS A	3.1	21.8	0.48	0.63	43.0

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

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

Roundabout Capacity Model: SIDRA Standard.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

 **Site: 303 [Orange - Cecil Future PM]**

Orange Grove - Cecil Avenue
Future PM Peak
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Orange Grove											
1	L2	35	2.0	0.488	7.0	LOS A	3.5	24.8	0.68	0.72	39.9
2	T1	313	2.0	0.488	6.7	LOS A	3.5	24.8	0.68	0.72	42.0
3	R2	97	2.0	0.488	9.4	LOS A	3.5	24.8	0.68	0.72	43.2
3u	U	1	2.0	0.488	10.8	LOS A	3.5	24.8	0.68	0.72	40.0
Approach		446	2.0	0.488	7.3	LOS A	3.5	24.8	0.68	0.72	42.2
East: Cecil Avenue											
4	L2	34	2.0	0.112	7.9	LOS A	0.6	4.5	0.67	0.72	42.1
5	T1	28	2.0	0.112	7.6	LOS A	0.6	4.5	0.67	0.72	43.4
6	R2	17	2.0	0.112	10.4	LOS A	0.6	4.5	0.67	0.72	43.7
6u	U	1	2.0	0.112	11.7	LOS A	0.6	4.5	0.67	0.72	44.9
Approach		80	2.0	0.112	8.4	LOS A	0.6	4.5	0.67	0.72	42.9
North: Orange Grove											
7	L2	18	2.0	0.490	5.4	LOS A	3.9	27.5	0.50	0.60	44.1
8	T1	266	2.0	0.490	5.1	LOS A	3.9	27.5	0.50	0.60	42.4
9	R2	280	2.0	0.490	7.9	LOS A	3.9	27.5	0.50	0.60	42.7
9u	U	3	2.0	0.490	9.2	LOS A	3.9	27.5	0.50	0.60	44.0
Approach		567	2.0	0.490	6.5	LOS A	3.9	27.5	0.50	0.60	42.7
West: Cecil Avenue											
10	L2	63	2.0	0.144	6.9	LOS A	0.8	5.9	0.61	0.69	41.8
11	T1	18	2.0	0.144	6.5	LOS A	0.8	5.9	0.61	0.69	43.9
12	R2	32	2.0	0.144	9.3	LOS A	0.8	5.9	0.61	0.69	40.4
12u	U	3	2.0	0.144	10.7	LOS A	0.8	5.9	0.61	0.69	41.9
Approach		116	2.0	0.144	7.6	LOS A	0.8	5.9	0.61	0.69	41.9
All Vehicles		1209	2.0	0.490	7.0	LOS A	3.9	27.5	0.59	0.66	42.4

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

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

Roundabout Capacity Model: SIDRA Standard.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

 **Site: 203 [Francis - Orange - Future AM]**

Francis Street - Orange Grove
Future AM Peak
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Average Speed
		Total veh/h	HV %	v/c	sec		veh	m		per veh	km/h
East: Francis Street											
5	T1	29	2.0	0.053	6.5	LOS A	0.2	1.8	0.43	0.63	48.2
6	R2	21	2.0	0.053	9.0	LOS A	0.2	1.8	0.43	0.63	48.7
Approach		50	2.0	0.053	7.6	LOS A	0.2	1.8	0.43	0.63	48.4
North: Orange Grove											
7	L2	8	2.0	0.190	5.7	LOS A	1.0	7.5	0.06	0.66	48.5
9	R2	283	2.0	0.190	7.4	LOS A	1.0	7.5	0.06	0.66	40.8
Approach		291	2.0	0.190	7.4	LOS A	1.0	7.5	0.06	0.66	41.2
West: Francis Street											
10	L2	347	2.0	0.247	5.8	LOS A	1.6	11.3	0.13	0.58	41.7
11	T1	8	2.0	0.247	5.0	LOS A	1.6	11.3	0.13	0.58	49.8
Approach		355	2.0	0.247	5.7	LOS A	1.6	11.3	0.13	0.58	41.9
All Vehicles		696	2.0	0.247	6.6	LOS A	1.6	11.3	0.12	0.61	42.4

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

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

Roundabout Capacity Model: SIDRA Standard.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

 **Site: 203 [Francis - Orange - Future PM]**

Francis Street - Orange Grove
Future PM Peak
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Average Speed
		Total veh/h	HV %	v/c	sec		veh	m		per veh	km/h
East: Francis Street											
5	T1	8	2.0	0.016	6.5	LOS A	0.1	0.5	0.43	0.60	48.1
6	R2	7	2.0	0.016	9.0	LOS A	0.1	0.5	0.43	0.60	48.6
Approach		15	2.0	0.016	7.7	LOS A	0.1	0.5	0.43	0.60	48.4
North: Orange Grove											
7	L2	22	2.0	0.225	5.8	LOS A	1.3	8.9	0.13	0.64	48.4
9	R2	293	2.0	0.225	7.6	LOS A	1.3	8.9	0.13	0.64	40.6
Approach		315	2.0	0.225	7.4	LOS A	1.3	8.9	0.13	0.64	41.5
West: Francis Street											
10	L2	445	2.0	0.300	5.7	LOS A	2.1	14.8	0.07	0.59	42.0
11	T1	27	2.0	0.300	4.9	LOS A	2.1	14.8	0.07	0.59	50.0
Approach		472	2.0	0.300	5.6	LOS A	2.1	14.8	0.07	0.59	42.7
All Vehicles		802	2.0	0.300	6.4	LOS A	2.1	14.8	0.10	0.61	42.4

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

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

Roundabout Capacity Model: SIDRA Standard.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY



Site: 302 [Terminus - Cecil - Future AM]

Terminus Street - Cecil Avenue
Future AM Peak
Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back Vehicles veh	of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Cecil Avenue											
21	L2	353	2.0	0.559	16.2	LOS B	3.6	25.6	0.74	1.16	35.4
Approach		353	2.0	0.559	16.2	LOS B	3.6	25.6	0.74	1.16	35.4
NorthEast: Terminus Street											
24	L2	131	2.0	0.418	5.6	LOS A	0.0	0.0	0.00	0.10	53.3
25	T1	1473	2.0	0.418	0.0	LOS A	0.0	0.0	0.00	0.04	58.2
Approach		1604	2.0	0.418	0.5	NA	0.0	0.0	0.00	0.05	57.5
All Vehicles		1957	2.0	0.559	3.3	NA	3.6	25.6	0.13	0.25	49.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

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

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

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY



Site: 302 [Terminus - Cecil - Future PM]

Terminus Street - Cecil Avenue
Future PM Peak
Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back Vehicles veh	of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Cecil Avenue											
21	L2	417	2.0	0.781	23.6	LOS B	6.9	48.9	0.88	1.40	30.0
Approach		417	2.0	0.781	23.6	LOS B	6.9	48.9	0.88	1.40	30.0
NorthEast: Terminus Street											
24	L2	152	2.0	0.481	5.6	LOS A	0.0	0.0	0.00	0.10	53.3
25	T1	1692	2.0	0.481	0.0	LOS A	0.0	0.0	0.00	0.04	58.2
Approach		1844	2.0	0.481	0.5	NA	0.0	0.0	0.00	0.05	57.5
All Vehicles		2261	2.0	0.781	4.7	NA	6.9	48.9	0.16	0.30	46.4

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

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

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

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

Site: 202 [Francis - Roger - Future AM]

Francis Street - Roger Avenue
Future AM Peak
Giveway / Yield (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back Vehicles veh	of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Francis Street											
5	T1	388	2.0	0.202	0.0	LOS A	0.0	0.1	0.00	0.00	50.0
6	R2	1	2.0	0.202	6.9	LOS A	0.0	0.1	0.00	0.00	46.0
Approach		389	2.0	0.202	0.0	NA	0.0	0.1	0.00	0.00	49.9
North: Roger Avenue											
7	L2	2	2.0	0.142	6.0	LOS A	0.5	3.3	0.60	0.82	32.4
9	R2	77	2.0	0.142	9.4	LOS A	0.5	3.3	0.60	0.82	36.3
Approach		79	2.0	0.142	9.3	LOS A	0.5	3.3	0.60	0.82	36.2
West: Francis Street											
10	L2	91	2.0	0.245	4.6	LOS A	0.0	0.0	0.00	0.11	47.1
11	T1	376	2.0	0.245	0.0	LOS A	0.0	0.0	0.00	0.11	48.5
Approach		467	2.0	0.245	0.9	NA	0.0	0.0	0.00	0.11	48.2
All Vehicles		935	2.0	0.245	1.3	NA	0.5	3.3	0.05	0.12	47.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

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

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

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

Site: 202 [Francis - Roger - Future PM]

Francis Street - Roger Avenue
Future PM Peak
Giveway / Yield (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back Vehicles veh	of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Francis Street											
5	T1	329	2.0	0.173	0.0	LOS A	0.0	0.2	0.01	0.00	49.9
6	R2	2	2.0	0.173	7.1	LOS A	0.0	0.2	0.01	0.00	45.9
Approach		331	2.0	0.173	0.1	NA	0.0	0.2	0.01	0.00	49.9
North: Roger Avenue											
7	L2	1	2.0	0.166	6.4	LOS A	0.5	3.8	0.62	0.83	32.2
9	R2	89	2.0	0.166	9.6	LOS A	0.5	3.8	0.62	0.83	36.0
Approach		90	2.0	0.166	9.6	LOS A	0.5	3.8	0.62	0.83	36.0
West: Francis Street											
10	L2	60	2.0	0.267	4.6	LOS A	0.0	0.0	0.00	0.06	47.6
11	T1	451	2.0	0.267	0.0	LOS A	0.0	0.0	0.00	0.06	49.0
Approach		511	2.0	0.267	0.6	NA	0.0	0.0	0.00	0.06	48.9
All Vehicles		932	2.0	0.267	1.3	NA	0.5	3.8	0.06	0.12	47.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

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

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

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

Site: 602 [ONR - Brisbane - Future AM]

Old Northern Road - Brisbane Road
Future AM Peak
Giveway / Yield (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back Vehicles veh	of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Brisbane Road											
21	L2	85	2.0	0.220	14.3	LOS A	0.8	5.4	0.76	0.91	44.3
23	R2	88	2.0	14.667	12418.1	LOS F	78.6	559.3	1.00	1.42	0.2
Approach		173	2.0	14.667	6323.8	LOS F	78.6	559.3	0.88	1.17	0.4
NorthEast: Old Northern Road											
24	L2	134	2.0	0.544	3.5	LOS A	0.0	0.0	0.00	0.07	56.0
25	T1	1954	2.0	0.544	0.0	LOS A	0.0	0.0	0.00	0.03	59.1
Approach		2088	2.0	0.544	0.2	NA	0.0	0.0	0.00	0.04	58.8
SouthWest: Old Northern Road											
31	T1	1348	2.0	0.344	1.7	LOS A	1.7	12.4	0.02	0.00	55.0
32	R2	58	2.0	1.526	630.6	LOS F	17.0	121.0	1.00	1.86	3.9
Approach		1406	2.0	1.526	27.6	NA	17.0	121.0	0.06	0.08	24.1
All Vehicles		3667	2.0	14.667	309.1	NA	78.6	559.3	0.06	0.11	3.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

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

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

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

▽ Site: 602 [ONR - Brisbane - Future PM]

Old Northern Road - Brisbane Road
Future PM Peak
Giveway / Yield (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back Vehicles veh	of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Brisbane Road											
21	L2	44	2.0	0.114	13.6	LOS A	0.4	2.6	0.73	0.89	44.8
23	R2	25	2.0	4.167	3110.6	LOS F	19.6	139.7	1.00	1.35	0.6
Approach		69	2.0	4.167	1135.7	LOS F	19.6	139.7	0.83	1.05	1.9
NorthEast: Old Northern Road											
24	L2	81	2.0	0.515	3.5	LOS A	0.0	0.0	0.00	0.05	56.3
25	T1	1899	2.0	0.515	0.0	LOS A	0.0	0.0	0.00	0.02	59.4
Approach		1980	2.0	0.515	0.2	NA	0.0	0.0	0.00	0.02	59.2
SouthWest: Old Northern Road											
31	T1	1472	2.0	0.255	0.0	LOS A	0.0	0.0	0.00	0.00	59.9
32	R2	41	2.0	0.777	150.0	LOS F	2.7	19.0	0.99	1.11	14.0
Approach		1513	2.0	0.777	4.1	NA	2.7	19.0	0.03	0.03	49.3
All Vehicles		3562	2.0	4.167	23.8	NA	19.6	139.7	0.03	0.05	25.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

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

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

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY



Site: 101 [ONR - Church - Future AM]

Old Northern Road - Church Street
Future AM Peak

Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back Vehicles veh	of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Old Northern Road											
2	T1	1618	2.0	0.502	5.7	LOS A	18.6	132.3	0.40	0.01	51.6
3	R2	16	2.0	0.502	67.8	LOS E	18.6	132.3	1.00	0.02	42.5
Approach		1634	2.0	0.502	6.3	NA	18.6	132.3	0.41	0.01	51.4
East: Church Street											
4	L2	31	2.0	0.087	16.2	LOS B	0.3	2.0	0.72	1.00	42.1
6	R2	21	2.0	1.000	341.9	LOS F	3.0	21.6	1.00	1.18	3.8
Approach		52	2.0	1.000	147.7	LOS F	3.0	21.6	0.83	1.08	11.9
North: Old Northern Road											
7	L2	49	2.0	0.469	5.6	LOS A	0.0	0.0	0.00	0.03	54.5
8	T1	1755	2.0	0.469	0.0	LOS A	0.0	0.0	0.00	0.02	59.6
Approach		1804	2.0	0.469	0.2	NA	0.0	0.0	0.00	0.02	59.5
All Vehicles		3490	2.0	1.000	5.2	NA	18.6	132.3	0.20	0.03	52.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

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

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

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY



Site: 101 [ONR - Church - Future PM]

Old Northern Road - Church Street
Future PM Peak

Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Old Northern Road											
2	T1	1711	2.0	0.582	8.2	LOS A	18.4	130.7	0.34	0.02	48.7
3	R2	27	2.0	0.582	67.4	LOS E	18.4	130.7	1.00	0.05	36.8
Approach		1738	2.0	0.582	9.1	NA	18.4	130.7	0.35	0.02	48.4
East: Church Street											
4	L2	18	2.0	0.049	15.7	LOS B	0.2	1.1	0.70	1.00	42.4
6	R2	11	2.0	1.000	568.9	LOS F	2.6	18.7	1.00	1.11	2.4
Approach		29	2.0	1.000	225.5	LOS F	2.6	18.7	0.82	1.04	8.5
North: Old Northern Road											
7	L2	64	2.0	0.470	5.6	LOS A	0.0	0.0	0.00	0.04	54.4
8	T1	1742	2.0	0.470	0.0	LOS A	0.0	0.0	0.00	0.02	59.6
Approach		1806	2.0	0.470	0.2	NA	0.0	0.0	0.00	0.02	59.4
All Vehicles		3573	2.0	1.000	6.4	NA	18.4	130.7	0.18	0.03	51.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

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

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

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

Site: 503 [Crane - Orange - Future AM]

Crane Road - Orange Grove
Future AM Peak
Giveway / Yield (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back Vehicles veh	of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Orange Grove											
1	L2	421	2.0	0.403	8.1	LOS A	2.4	16.8	0.54	0.79	32.8
3	R2	5	2.0	0.403	22.7	LOS B	2.4	16.8	0.54	0.79	50.0
Approach		426	2.0	0.403	8.3	LOS A	2.4	16.8	0.54	0.79	33.0
East: Crane Road											
4	L2	21	2.0	0.208	5.6	LOS A	0.0	0.0	0.00	0.03	57.6
5	T1	405	2.0	0.208	0.0	LOS A	0.0	0.0	0.00	0.03	59.5
Approach		426	2.0	0.208	0.3	NA	0.0	0.0	0.00	0.03	59.4
West: Crane Road											
11	T1	169	2.0	0.640	4.8	LOS A	7.9	56.2	0.72	0.80	48.0
12	R2	643	2.0	0.640	10.3	LOS A	7.9	56.2	0.72	0.80	42.7
Approach		812	2.0	0.640	9.2	NA	7.9	56.2	0.72	0.80	44.0
All Vehicles		1664	2.0	0.640	6.7	NA	7.9	56.2	0.49	0.60	44.1

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

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

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

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

Site: 503 [Crane - Orange - Future PM]

Crane Road - Orange Grove
Future PM Peak
Giveway / Yield (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back Vehicles veh	of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Orange Grove											
1	L2	557	2.0	0.461	6.7	LOS A	2.9	20.7	0.40	0.62	33.5
3	R2	13	2.0	0.461	28.0	LOS B	2.9	20.7	0.40	0.62	50.9
Approach		570	2.0	0.461	7.2	LOS A	2.9	20.7	0.40	0.62	33.9
East: Crane Road											
4	L2	7	2.0	0.096	5.6	LOS A	0.0	0.0	0.00	0.02	57.7
5	T1	189	2.0	0.096	0.0	LOS A	0.0	0.0	0.00	0.02	59.7
Approach		196	2.0	0.096	0.2	NA	0.0	0.0	0.00	0.02	59.6
West: Crane Road											
11	T1	344	2.0	0.637	2.2	LOS A	8.8	62.8	0.54	0.47	51.5
12	R2	691	2.0	0.637	7.9	LOS A	8.8	62.8	0.54	0.47	46.4
Approach		1035	2.0	0.637	6.0	NA	8.8	62.8	0.54	0.47	48.3
All Vehicles		1801	2.0	0.637	5.8	NA	8.8	62.8	0.43	0.47	44.0

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

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

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

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY



Site: 201 [ONR - Francis - Future AM]

Old Northern Road - Francis Street
Future AM Peak

Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back Vehicles veh	of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Old Northern Road											
2	T1	1462	2.0	0.759	0.1	LOS A	0.0	0.0	0.00	0.00	59.5
3	R2	337	2.0	2.631	1496.7	LOS F	138.4	985.3	1.00	5.39	0.9
Approach		1799	2.0	2.631	280.4	NA	138.4	985.3	0.19	1.01	4.8
East: Francis Street											
4	L2	386	2.0	0.811	25.7	LOS B	7.7	55.0	0.89	1.52	27.0
6	R2	109	2.0	1.000	79.8	LOS F	4.5	31.7	1.00	1.53	17.1
Approach		495	2.0	1.000	37.6	LOS C	7.7	55.0	0.91	1.52	23.2
North: Old Northern Road											
7	L2	146	2.0	0.446	5.6	LOS A	0.0	0.0	0.00	0.10	55.0
8	T1	1564	2.0	0.446	0.0	LOS A	0.0	0.0	0.00	0.05	58.9
Approach		1710	2.0	0.446	0.5	NA	0.0	0.0	0.00	0.05	58.4
All Vehicles		4004	2.0	2.631	130.9	NA	138.4	985.3	0.20	0.66	9.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

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

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

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY



Site: 201 [ONR - Francis - Future PM]

Old Northern Road - Francis Street
Future PM Peak

Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back Vehicles veh	of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Old Northern Road											
2	T1	1490	2.0	0.774	0.1	LOS A	0.0	0.0	0.00	0.00	59.4
3	R2	393	2.0	3.457	2237.0	LOS F	184.2	1311.7	1.00	5.51	0.6
Approach		1883	2.0	3.457	466.9	NA	184.2	1311.7	0.21	1.15	3.0
East: Francis Street											
4	L2	363	2.0	0.792	25.4	LOS B	7.0	49.5	0.88	1.47	27.2
6	R2	74	2.0	1.000	111.4	LOS F	3.9	28.0	1.00	1.42	13.4
Approach		437	2.0	1.000	39.9	LOS C	7.0	49.5	0.90	1.46	22.2
North: Old Northern Road											
7	L2	151	2.0	0.460	5.6	LOS A	0.0	0.0	0.00	0.10	55.0
8	T1	1612	2.0	0.460	0.0	LOS A	0.0	0.0	0.00	0.05	58.8
Approach		1763	2.0	0.460	0.5	NA	0.0	0.0	0.00	0.05	58.4
All Vehicles		4083	2.0	3.457	219.8	NA	184.2	1311.7	0.19	0.71	6.1

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

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

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

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

Site: 501 [ONR - Castle - Crane - Existing AM]

Old Northern Road - Castle Street - Crane Road

Existing AM Peak

Signals - Fixed Time Isolated Cycle Time = 50 seconds (Practical Cycle Time)

Variable Sequence Analysis applied. The results are given for the selected output sequence.

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		Total veh/h	HV %	v/c	sec		veh	m		per veh	km/h
South: Old Northern Road											
1	L2	61	2.0	0.208	26.4	LOS B	1.4	9.8	0.90	0.74	36.6
2	T1	200	2.0	0.752	25.2	LOS B	6.1	43.5	1.00	0.92	37.9
3	R2	30	2.0	0.752	30.7	LOS C	6.1	43.5	1.00	0.92	24.4
Approach		291	2.0	0.752	26.0	LOS B	6.1	43.5	0.98	0.88	36.6
East: Crane Road											
4	L2	86	2.0	0.419	18.9	LOS B	5.4	38.5	0.80	0.71	32.0
5	T1	200	2.0	0.419	13.4	LOS A	5.4	38.5	0.80	0.71	42.4
6	R2	148	2.0	0.674	31.2	LOS C	3.9	27.7	1.00	0.86	31.1
Approach		434	2.0	0.674	20.5	LOS B	5.4	38.5	0.87	0.76	36.1
NorthEast: Old Northern ROad											
24b	L3	10	100.0	0.147	30.5	LOS C	0.5	6.3	0.93	0.71	19.9
24a	L1	10	100.0	0.147	28.4	LOS B	0.5	6.3	0.93	0.71	27.7
Approach		20	100.0	0.147	29.5	LOS C	0.5	6.3	0.93	0.71	23.8
West: Castle Street											
10	L2	95	2.0	0.482	29.6	LOS C	2.6	18.8	0.98	0.77	39.8
11	T1	123	2.0	0.482	24.0	LOS B	2.8	19.6	0.98	0.76	35.8
Approach		218	2.0	0.482	26.5	LOS B	2.8	19.6	0.98	0.76	38.0
All Vehicles		963	4.0	0.752	23.7	LOS B	6.1	43.5	0.93	0.80	36.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

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

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians									
Mov ID	Description	Demand Flow	Average Delay	Level of Service	Average Back of Queue	Back of Queue Distance	Prop. Queued	Effective Stop Rate	
		ped/h	sec		Pedestrian ped	m		per ped	
P1	South Full Crossing	50	19.4	LOS B	0.1	0.1	0.88	0.88	
P2	East Full Crossing	50	19.4	LOS B	0.1	0.1	0.88	0.88	
P6	NorthEast Full Crossing	50	4.4	LOS A	0.0	0.0	0.42	0.42	
P3	North Full Crossing	50	19.4	LOS B	0.1	0.1	0.88	0.88	
P4	West Full Crossing	50	19.4	LOS B	0.1	0.1	0.88	0.88	
All Pedestrians		250	16.4	LOS B			0.79	0.79	

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

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 501 [ONR - Castle - Crane - Existing PM]

Old Northern Road - Castle Street - Crane Road

Existing PM Peak

Signals - Fixed Time Isolated Cycle Time = 50 seconds (Practical Cycle Time)

Variable Sequence Analysis applied. The results are given for the selected output sequence.

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		Total veh/h	HV %	v/c	sec		veh	m		per veh	km/h
South: Old Northern Road											
1	L2	79	2.0	0.270	26.7	LOS B	1.8	12.8	0.92	0.75	36.5
2	T1	158	2.0	0.622	23.1	LOS B	4.7	33.6	0.98	0.83	38.9
3	R2	32	2.0	0.622	28.6	LOS C	4.7	33.6	0.98	0.83	25.4
Approach		269	2.0	0.622	24.8	LOS B	4.7	33.6	0.96	0.80	37.0
East: Crane Road											
4	L2	62	2.0	0.331	18.4	LOS B	4.1	29.3	0.77	0.67	32.6
5	T1	164	2.0	0.331	12.8	LOS A	4.1	29.3	0.77	0.67	43.0
6	R2	115	2.0	0.523	29.8	LOS C	2.9	20.5	0.98	0.78	31.8
Approach		341	2.0	0.523	19.6	LOS B	4.1	29.3	0.84	0.71	36.9
NorthEast: Old Northern ROad											
24b	L3	10	100.0	0.147	30.5	LOS C	0.5	6.3	0.93	0.71	19.9
24a	L1	10	100.0	0.147	28.4	LOS B	0.5	6.3	0.93	0.71	27.7
Approach		20	100.0	0.147	29.5	LOS C	0.5	6.3	0.93	0.71	23.8
West: Castle Street											
10	L2	85	2.0	0.605	30.5	LOS C	3.5	24.7	0.99	0.82	40.1
11	T1	190	2.0	0.605	24.9	LOS B	3.6	25.4	0.99	0.82	35.1
Approach		275	2.0	0.605	26.6	LOS B	3.6	25.4	0.99	0.82	37.1
All Vehicles		905	4.2	0.622	23.5	LOS B	4.7	33.6	0.92	0.77	36.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

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

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians									
Mov ID	Description	Demand Flow	Average Delay	Level of Service	Average Back of Queue	Back of Queue Distance	Prop. Queued	Effective Stop Rate	
		ped/h	sec		Pedestrian ped	m		per ped	
P1	South Full Crossing	50	19.4	LOS B	0.1	0.1	0.88	0.88	
P2	East Full Crossing	50	19.4	LOS B	0.1	0.1	0.88	0.88	
P6	NorthEast Full Crossing	50	4.4	LOS A	0.0	0.0	0.42	0.42	
P3	North Full Crossing	50	19.4	LOS B	0.1	0.1	0.88	0.88	
P4	West Full Crossing	50	19.4	LOS B	0.1	0.1	0.88	0.88	
All Pedestrians		250	16.4	LOS B			0.79	0.79	

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

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

 **Site: 301 [ONR - Cecil - Existing AM]**

Old Northern Road - Cecil Avenue

Existing AM Peak

Signals - Fixed Time Isolated Cycle Time = 70 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Old Northern Road											
1	L2	129	2.0	0.461	20.4	LOS B	9.3	66.2	0.75	0.70	26.2
2	T1	637	2.0	0.461	15.2	LOS B	9.3	66.4	0.75	0.67	36.8
3	R2	713	2.0	0.852	41.5	LOS C	13.9	98.9	1.00	0.99	22.0
Approach		1479	2.0	0.852	28.3	LOS B	13.9	98.9	0.87	0.83	27.2
East: Cecil Avenue											
4	L2	992	2.0	0.558	19.4	LOS B	12.0	85.7	0.76	0.80	32.8
5	T1	230	2.0	0.697	31.9	LOS C	8.0	56.7	0.99	0.87	14.4
6	R2	95	2.0	0.303	33.9	LOS C	3.0	21.0	0.91	0.76	17.5
Approach		1317	2.0	0.697	22.6	LOS B	12.0	85.7	0.81	0.81	28.6
North: Old Northern Road											
7	L2	84	2.0	0.827	38.0	LOS C	6.8	48.4	1.00	0.98	17.5
8	T1	305	2.0	0.827	36.4	LOS C	7.0	50.0	1.00	0.97	24.2
Approach		389	2.0	0.827	36.8	LOS C	7.0	50.0	1.00	0.97	23.0
West: Cecil Avenue											
10	L2	85	2.0	0.885	45.5	LOS D	7.8	55.5	1.00	1.05	11.3
11	T1	172	2.0	0.885	42.2	LOS C	7.8	55.5	1.00	1.05	11.1
12	R2	127	2.0	0.885	45.7	LOS D	7.8	55.3	1.00	1.05	18.3
Approach		384	2.0	0.885	44.1	LOS D	7.8	55.5	1.00	1.05	13.8
All Vehicles		3569	2.0	0.885	28.8	LOS C	13.9	98.9	0.88	0.86	25.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

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

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians									
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped	
P1	South Full Crossing	50	29.3	LOS C	0.1	0.1	0.92	0.92	
P2	East Full Crossing	50	29.3	LOS C	0.1	0.1	0.92	0.92	
P2S	East Slip/Bypass Lane Crossing	50	17.9	LOS B	0.1	0.1	0.72	0.72	
P3	North Full Crossing	50	29.3	LOS C	0.1	0.1	0.92	0.92	
P4	West Full Crossing	50	19.4	LOS B	0.1	0.1	0.74	0.74	
All Pedestrians		250	25.0	LOS C			0.84	0.84	

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

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

 **Site: 301 [ONR - Cecil - Existing PM]**

Old Northern Road - Cecil Avenue

Existing PM Peak

Signals - Fixed Time Isolated Cycle Time = 80 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		Total veh/h	HV %	v/c	sec		veh	m		per veh	km/h
South: Old Northern Road											
1	L2	125	2.0	0.437	21.8	LOS B	9.9	70.8	0.73	0.69	25.4
2	T1	614	2.0	0.437	16.6	LOS B	10.0	71.2	0.74	0.66	35.6
3	R2	778	2.0	0.895	50.2	LOS D	18.3	130.4	1.00	1.03	19.5
Approach		1517	2.0	0.895	34.3	LOS C	18.3	130.4	0.87	0.85	24.5
East: Cecil Avenue											
4	L2	1136	2.0	0.698	22.2	LOS B	19.0	135.0	0.80	0.82	30.9
5	T1	263	2.0	0.924	51.8	LOS D	12.9	91.7	1.00	1.13	9.8
6	R2	172	2.0	0.537	39.2	LOS C	6.4	45.2	0.96	0.80	15.9
Approach		1571	2.0	0.924	29.0	LOS C	19.0	135.0	0.85	0.87	24.9
North: Old Northern Road											
7	L2	103	2.0	0.890	48.0	LOS D	9.9	70.5	1.00	1.06	14.6
8	T1	351	2.0	0.890	45.9	LOS D	9.9	70.8	1.00	1.05	21.0
Approach		454	2.0	0.890	46.4	LOS D	9.9	70.8	1.00	1.06	19.7
West: Cecil Avenue											
10	L2	76	2.0	0.910	53.3	LOS D	9.6	68.5	0.99	1.09	9.9
11	T1	230	2.0	0.910	50.0	LOS D	9.6	68.5	0.99	1.09	9.7
12	R2	101	2.0	0.910	53.5	LOS D	9.6	68.3	0.99	1.09	16.5
Approach		407	2.0	0.910	51.5	LOS D	9.6	68.5	0.99	1.09	11.7
All Vehicles		3949	2.0	0.924	35.3	LOS C	19.0	135.0	0.89	0.91	22.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

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

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians									
Mov ID	Description	Demand Flow	Average Delay	Level of Service	Average Back of Queue	Back of Queue Distance	Prop. Queued	Effective Stop Rate	
		ped/h	sec		Pedestrian ped	m		per ped	
P1	South Full Crossing	50	34.3	LOS D	0.1	0.1	0.93	0.93	
P2	East Full Crossing	50	34.3	LOS D	0.1	0.1	0.93	0.93	
P2S	East Slip/Bypass Lane Crossing	50	18.9	LOS B	0.1	0.1	0.69	0.69	
P3	North Full Crossing	50	34.3	LOS D	0.1	0.1	0.93	0.93	
P4	West Full Crossing	50	20.3	LOS C	0.1	0.1	0.71	0.71	
All Pedestrians		250	28.4	LOS C			0.84	0.84	

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

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

 **Site: 601 [ONR - McMullen - Existing AM]**

Old Northern Road - McMullen Road

Existing AM Peak

Signals - Fixed Time Isolated Cycle Time = 65 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		Total veh/h	HV %	v/c	sec		veh	m		per veh	km/h
NorthEast: Old Northern Road											
25	T1	1228	2.0	0.494	6.4	LOS A	10.1	72.0	0.56	0.50	50.4
26	R2	807	2.0	0.843	37.3	LOS C	14.5	102.9	1.00	0.99	30.7
Approach		2035	2.0	0.843	18.7	LOS B	14.5	102.9	0.73	0.69	39.3
NorthWest: McMullen Avenue											
27	L2	767	2.0	0.400	15.7	LOS B	7.4	52.5	0.64	0.76	41.7
29	R2	388	2.0	0.626	34.5	LOS C	6.1	43.5	0.98	0.83	15.3
Approach		1155	2.0	0.626	22.0	LOS B	7.4	52.5	0.76	0.79	33.8
SouthWest: Old Northern Road											
30	L2	69	2.0	0.060	7.4	LOS A	0.7	5.1	0.41	0.62	36.3
31	T1	957	2.0	0.850	30.8	LOS C	17.1	122.0	1.00	1.03	31.4
Approach		1026	2.0	0.850	29.2	LOS C	17.1	122.0	0.96	1.01	31.5
All Vehicles		4216	2.0	0.850	22.2	LOS B	17.1	122.0	0.80	0.80	35.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

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

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians									
Mov ID	Description	Demand Flow	Average Delay	Level of Service	Average Back of Queue Pedestrian	Back of Queue Distance	Prop. Queued	Effective Stop Rate	
		ped/h	sec		ped	m		per ped	
P6	NorthEast Full Crossing	50	26.8	LOS C	0.1	0.1	0.91	0.91	
P7	NorthWest Full Crossing	50	26.8	LOS C	0.1	0.1	0.91	0.91	
All Pedestrians		100	26.8	LOS C			0.91	0.91	

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

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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MOVEMENT SUMMARY

Site: 601 [ONR - McMullen - Existing PM]

Old Northern Road - McMullen Road

Existing PM Peak

Signals - Fixed Time Isolated Cycle Time = 65 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		Total veh/h	HV %	v/c	sec		veh	m		per veh	km/h
NorthEast: Old Northern Road											
25	T1	514	2.0	0.207	5.0	LOS A	3.3	23.5	0.43	0.37	52.2
26	R2	963	2.0	0.855	36.6	LOS C	17.4	124.2	1.00	1.00	31.0
Approach		1477	2.0	0.855	25.6	LOS B	17.4	124.2	0.80	0.78	35.4
NorthWest: McMullen Avenue											
27	L2	1093	2.0	0.524	14.9	LOS B	10.7	76.2	0.66	0.78	42.3
29	R2	384	2.0	0.620	34.4	LOS C	6.0	42.9	0.98	0.83	15.3
Approach		1477	2.0	0.620	19.9	LOS B	10.7	76.2	0.74	0.79	36.1
SouthWest: Old Northern Road											
30	L2	123	2.0	0.114	8.6	LOS A	1.5	10.9	0.48	0.64	34.2
31	T1	820	2.0	0.865	34.0	LOS C	15.2	108.1	1.00	1.05	29.9
Approach		943	2.0	0.865	30.7	LOS C	15.2	108.1	0.93	1.00	30.1
All Vehicles		3897	2.0	0.865	24.7	LOS B	17.4	124.2	0.81	0.84	34.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

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

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians									
Mov ID	Description	Demand Flow	Average Delay	Level of Service	Average Back of Queue	Back of Queue Distance	Prop. Queued	Effective Stop Rate	
		ped/h	sec		Pedestrian ped	m		per ped	
P6	NorthEast Full Crossing	50	26.8	LOS C	0.1	0.1	0.91	0.91	
P7	NorthWest Full Crossing	50	26.8	LOS C	0.1	0.1	0.91	0.91	
All Pedestrians		100	26.8	LOS C			0.91	0.91	

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

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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MOVEMENT SUMMARY

 **Site: 401 [ONR - Showground - Existing AM]**

Old Northern Road - Showground Road

Existing AM Peak

Signals - Fixed Time Isolated Cycle Time = 40 seconds (Practical Cycle Time)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		Total veh/h	HV %	v/c	sec		veh	m		per veh	km/h
South: Old Northern Road											
1	L2	451	2.0	0.742	18.5	LOS B	10.5	74.5	0.90	0.91	41.3
2	T1	390	2.0	0.742	17.5	LOS B	10.5	74.5	0.97	0.92	32.2
Approach		841	2.0	0.742	18.1	LOS B	10.5	74.5	0.93	0.91	37.8
North: Old Northern Road											
8	T1	51	2.0	0.053	5.6	LOS A	0.5	3.7	0.54	0.41	47.7
9	R2	56	2.0	0.204	22.9	LOS B	1.0	7.4	0.91	0.73	38.5
Approach		107	2.0	0.204	14.6	LOS B	1.0	7.4	0.73	0.58	40.9
West: Showground Road											
10	L2	72	2.0	0.780	25.4	LOS B	6.7	47.9	0.99	0.97	37.1
12	R2	521	2.0	0.780	25.7	LOS B	6.7	47.9	1.00	0.97	35.1
Approach		593	2.0	0.780	25.7	LOS B	6.7	47.9	1.00	0.97	35.3
All Vehicles		1541	2.0	0.780	20.8	LOS B	10.5	74.5	0.94	0.91	36.9

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

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

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians									
Mov ID	Description	Demand Flow	Average Delay	Level of Service	Average Back of Queue Pedestrian	Back of Queue Distance	Prop. Queued	Effective Stop Rate	
		ped/h	sec		ped	m		per ped	
P3	North Full Crossing	50	14.5	LOS B	0.0	0.0	0.85	0.85	
P4	West Full Crossing	50	14.5	LOS B	0.0	0.0	0.85	0.85	
All Pedestrians		100	14.5	LOS B			0.85	0.85	

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

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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MOVEMENT SUMMARY

 **Site: 401 [ONR - Showground - Existing PM]**

Old Northern Road - Showground Road

Existing PM Peak

Signals - Fixed Time Isolated Cycle Time = 40 seconds (Practical Cycle Time)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back Vehicles veh	of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Old Northern Road											
1	L2	398	2.0	0.634	16.0	LOS B	7.9	56.0	0.84	0.81	43.2
2	T1	332	2.0	0.634	15.6	LOS B	7.9	56.0	0.93	0.82	33.8
Approach		730	2.0	0.634	15.8	LOS B	7.9	56.0	0.88	0.82	39.7
North: Old Northern Road											
8	T1	52	2.0	0.054	5.6	LOS A	0.5	3.7	0.54	0.41	47.7
9	R2	49	2.0	0.178	22.8	LOS B	0.9	6.4	0.91	0.73	38.5
Approach		101	2.0	0.178	13.9	LOS A	0.9	6.4	0.72	0.56	41.2
West: Showground Road											
10	L2	65	2.0	0.594	21.9	LOS B	4.5	32.1	0.94	0.83	39.0
12	R2	390	2.0	0.594	22.4	LOS B	4.5	32.1	0.95	0.83	37.0
Approach		455	2.0	0.594	22.3	LOS B	4.5	32.1	0.95	0.83	37.3
All Vehicles		1286	2.0	0.634	17.9	LOS B	7.9	56.0	0.89	0.80	38.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

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

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians									
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back Pedestrian ped	of Queue Distance m	Prop. Queued	Effective Stop Rate per ped	
P3	North Full Crossing	50	14.5	LOS B	0.0	0.0	0.85	0.85	
P4	West Full Crossing	50	14.5	LOS B	0.0	0.0	0.85	0.85	
All Pedestrians		100	14.5	LOS B			0.85	0.85	

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

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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MOVEMENT SUMMARY

 **Site: 502 [Terminus - Crane - Existing AM]**

Terminus Street - Crane Street

Existing AM Peak

Signals - Fixed Time Isolated Cycle Time = 105 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Terminus Street											
1	L2	106	2.0	0.538	32.1	LOS C	15.8	112.2	0.83	0.75	17.6
2	T1	695	2.0	0.538	26.5	LOS B	15.8	112.5	0.82	0.73	30.8
3	R2	79	2.0	0.453	56.3	LOS D	4.0	28.6	0.99	0.77	15.0
Approach		880	2.0	0.538	29.8	LOS C	15.8	112.5	0.84	0.74	27.2
East: Crane Road											
4	L2	109	2.0	0.881	61.2	LOS E	18.5	131.5	1.00	1.03	14.9
5	T1	251	2.0	0.881	55.7	LOS D	18.5	131.5	1.00	1.03	10.6
6	R2	267	2.0	0.881	61.4	LOS E	18.1	128.5	1.00	0.99	15.7
Approach		627	2.0	0.881	59.1	LOS E	18.5	131.5	1.00	1.01	13.7
North: Terminus Street											
7	L2	76	2.0	0.880	49.1	LOS D	36.4	259.2	1.00	1.04	16.2
8	T1	1141	2.0	0.880	42.4	LOS C	36.4	259.2	0.96	1.01	24.0
9	R2	236	2.0	0.667	25.0	LOS B	6.9	49.0	0.90	0.82	26.1
Approach		1453	2.0	0.880	40.0	LOS C	36.4	259.2	0.95	0.98	23.8
West: Crane Road											
10	L2	22	2.0	0.475	56.3	LOS D	4.4	31.1	0.99	0.77	17.1
11	T1	64	2.0	0.475	50.8	LOS D	4.4	31.1	0.99	0.77	11.6
12	R2	143	2.0	0.820	62.9	LOS E	8.0	57.2	1.00	0.92	13.7
Approach		229	2.0	0.820	58.9	LOS E	8.0	57.2	1.00	0.86	13.5
All Vehicles		3189	2.0	0.881	42.3	LOS C	36.4	259.2	0.93	0.91	21.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

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

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians									
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped	
P1	South Full Crossing	50	46.8	LOS E	0.1	0.1	0.94	0.94	
P2	East Full Crossing	50	46.8	LOS E	0.1	0.1	0.94	0.94	
P4	West Full Crossing	50	26.1	LOS C	0.1	0.1	0.71	0.71	
All Pedestrians		150	39.9	LOS D			0.87	0.87	

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

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

 **Site: 502 [Terminus - Crane - Existing PM]**

Terminus Street - Crane Street

Existing PM Peak

Signals - Fixed Time Isolated Cycle Time = 100 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Terminus Street											
1	L2	160	2.0	0.676	29.5	LOS C	21.9	156.0	0.86	0.79	18.3
2	T1	885	2.0	0.676	23.1	LOS B	21.9	156.0	0.83	0.74	32.7
3	R2	154	2.0	0.841	61.3	LOS E	8.4	59.6	1.00	0.94	14.1
Approach		1199	2.0	0.841	28.9	LOS C	21.9	156.0	0.85	0.77	27.2
East: Crane Road											
4	L2	85	2.0	0.757	54.1	LOS D	10.1	72.0	1.00	0.90	16.3
5	T1	157	2.0	0.757	48.6	LOS D	10.1	72.0	1.00	0.90	11.7
6	R2	154	2.0	0.757	54.2	LOS D	10.0	70.9	1.00	0.89	17.2
Approach		396	2.0	0.757	52.0	LOS D	10.1	72.0	1.00	0.90	15.0
North: Terminus Street											
7	L2	165	2.0	0.843	38.2	LOS C	33.6	239.6	0.96	0.96	18.5
8	T1	1147	2.0	0.843	31.9	LOS C	33.6	239.6	0.91	0.92	28.1
9	R2	241	2.0	0.736	26.8	LOS B	6.4	45.5	0.96	0.88	25.2
Approach		1553	2.0	0.843	31.8	LOS C	33.6	239.6	0.93	0.92	26.5
West: Crane Road											
10	L2	47	2.0	0.827	61.8	LOS E	6.8	48.2	1.00	0.93	15.8
11	T1	78	2.0	0.827	56.3	LOS D	6.8	48.2	1.00	0.93	10.6
12	R2	110	2.0	0.751	59.4	LOS E	5.8	41.1	1.00	0.87	14.3
Approach		235	2.0	0.827	58.8	LOS E	6.8	48.2	1.00	0.90	13.5
All Vehicles		3383	2.0	0.843	35.0	LOS C	33.6	239.6	0.91	0.86	24.1

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

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

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians									
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped	
P1	South Full Crossing	50	44.3	LOS E	0.1	0.1	0.94	0.94	
P2	East Full Crossing	50	44.3	LOS E	0.1	0.1	0.94	0.94	
P4	West Full Crossing	50	21.8	LOS C	0.1	0.1	0.66	0.66	
All Pedestrians		150	36.8	LOS D			0.85	0.85	

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

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

 **Site: 402 [Terminus - SC - Existing AM]**

Terminus Road - Shopping Centre

Existing AM Peak

Signals - Fixed Time Isolated Cycle Time = 50 seconds (Practical Cycle Time)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		Total veh/h	HV %	v/c	sec		veh	m		per veh	km/h
South: Terminus Road											
1	L2	19	2.0	0.016	9.0	LOS A	0.2	1.2	0.38	0.63	46.6
2	T1	878	2.0	0.714	18.0	LOS B	10.3	73.4	0.94	0.86	31.9
Approach		897	2.0	0.714	17.8	LOS B	10.3	73.4	0.93	0.85	32.3
North: Terminus Road											
8	T1	1040	2.0	0.482	7.2	LOS A	7.7	55.2	0.65	0.57	44.3
9	R2	64	2.0	0.146	28.3	LOS B	0.7	5.3	0.93	0.71	35.5
Approach		1104	2.0	0.482	8.5	LOS A	7.7	55.2	0.66	0.58	43.1
West: Shopping Centre Access											
10	L2	187	2.0	0.511	25.9	LOS B	4.3	30.7	0.94	0.80	36.6
12	R2	258	2.0	0.705	28.2	LOS B	6.5	46.4	0.98	0.89	33.7
Approach		445	2.0	0.705	27.3	LOS B	6.5	46.4	0.96	0.85	34.9
All Vehicles		2446	2.0	0.714	15.3	LOS B	10.3	73.4	0.81	0.73	36.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

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

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians									
Mov ID	Description	Demand Flow	Average Delay	Level of Service	Average Back of Queue Pedestrian	Back of Queue Distance	Prop. Queued	Effective Stop Rate	
		ped/h	sec		ped	m		per ped	
P3	North Full Crossing	50	19.4	LOS B	0.1	0.1	0.88	0.88	
P4	West Full Crossing	50	19.4	LOS B	0.1	0.1	0.88	0.88	
All Pedestrians		100	19.4	LOS B			0.88	0.88	

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

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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MOVEMENT SUMMARY

 **Site: 402 [Terminus - SC - Existing PM]**

Terminus Road - Shopping Centre

Existing PM Peak

Signals - Fixed Time Isolated Cycle Time = 40 seconds (Practical Cycle Time)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Back of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		Total veh/h	HV %	v/c	sec		veh	m		per veh	km/h
South: Terminus Road											
1	L2	5	2.0	0.005	9.9	LOS A	0.0	0.3	0.46	0.62	45.8
2	T1	787	2.0	0.818	20.3	LOS B	8.9	63.1	1.00	1.02	30.1
Approach		792	2.0	0.818	20.2	LOS B	8.9	63.1	1.00	1.01	30.2
North: Terminus Road											
8	T1	1190	2.0	0.562	6.5	LOS A	7.8	55.2	0.70	0.61	45.6
9	R2	74	2.0	0.135	22.6	LOS B	0.7	4.8	0.90	0.71	38.4
Approach		1264	2.0	0.562	7.4	LOS A	7.8	55.2	0.71	0.62	44.6
West: Shopping Centre Access											
10	L2	66	2.0	0.240	23.0	LOS B	1.2	8.7	0.92	0.74	38.1
12	R2	112	2.0	0.408	23.7	LOS B	2.2	15.4	0.95	0.77	36.1
Approach		178	2.0	0.408	23.4	LOS B	2.2	15.4	0.94	0.76	36.9
All Vehicles		2234	2.0	0.818	13.2	LOS A	8.9	63.1	0.83	0.77	37.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

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

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians									
Mov ID	Description	Demand Flow	Average Delay	Level of Service	Average Back of Queue Pedestrian	Back of Queue Distance	Prop. Queued	Effective Stop Rate	
		ped/h	sec		ped	m		per ped	
P3	North Full Crossing	50	14.5	LOS B	0.0	0.0	0.85	0.85	
P4	West Full Crossing	50	14.5	LOS B	0.0	0.0	0.85	0.85	
All Pedestrians		100	14.5	LOS B			0.85	0.85	

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

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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MOVEMENT SUMMARY

 **Site: 303 [Orange - Cecil Existing AM]**

Orange Grove - Cecil Avenue
Existing AM Peak
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Orange Grove											
1	L2	24	2.0	0.149	5.0	LOS A	0.8	5.5	0.33	0.53	41.4
2	T1	103	2.0	0.149	4.7	LOS A	0.8	5.5	0.33	0.53	43.5
3	R2	35	2.0	0.149	7.5	LOS A	0.8	5.5	0.33	0.53	44.4
3u	U	1	2.0	0.149	8.8	LOS A	0.8	5.5	0.33	0.53	41.8
Approach		163	2.0	0.149	5.4	LOS A	0.8	5.5	0.33	0.53	43.5
East: Cecil Avenue											
4	L2	66	2.0	0.132	4.9	LOS A	0.7	4.8	0.31	0.52	44.1
5	T1	63	2.0	0.132	4.6	LOS A	0.7	4.8	0.31	0.52	45.3
6	R2	17	2.0	0.132	7.3	LOS A	0.7	4.8	0.31	0.52	45.5
6u	U	1	2.0	0.132	8.7	LOS A	0.7	4.8	0.31	0.52	46.5
Approach		147	2.0	0.132	5.1	LOS A	0.7	4.8	0.31	0.52	44.8
North: Orange Grove											
7	L2	12	2.0	0.102	4.4	LOS A	0.5	3.7	0.18	0.53	44.9
8	T1	58	2.0	0.102	4.1	LOS A	0.5	3.7	0.18	0.53	43.6
9	R2	55	2.0	0.102	6.9	LOS A	0.5	3.7	0.18	0.53	43.8
9u	U	3	2.0	0.102	8.2	LOS A	0.5	3.7	0.18	0.53	44.9
Approach		128	2.0	0.102	5.4	LOS A	0.5	3.7	0.18	0.53	43.9
West: Cecil Avenue											
10	L2	21	2.0	0.032	5.0	LOS A	0.2	1.1	0.33	0.53	43.1
11	T1	6	2.0	0.032	4.7	LOS A	0.2	1.1	0.33	0.53	45.1
12	R2	5	2.0	0.032	7.4	LOS A	0.2	1.1	0.33	0.53	42.0
12u	U	2	2.0	0.032	8.8	LOS A	0.2	1.1	0.33	0.53	43.4
Approach		34	2.0	0.032	5.5	LOS A	0.2	1.1	0.33	0.53	43.4
All Vehicles		472	2.0	0.149	5.3	LOS A	0.8	5.5	0.28	0.53	44.1

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

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

Roundabout Capacity Model: SIDRA Standard.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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14875 SIDRA - Existing Intersections.sip7

MOVEMENT SUMMARY

 **Site: 303 [Orange - Cecil Existing PM]**

Orange Grove - Cecil Avenue
Existing PM Peak
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Orange Grove											
1	L2	15	2.0	0.147	4.5	LOS A	0.8	5.5	0.19	0.53	41.5
2	T1	87	2.0	0.147	4.1	LOS A	0.8	5.5	0.19	0.53	43.6
3	R2	85	2.0	0.147	6.9	LOS A	0.8	5.5	0.19	0.53	44.4
3u	U	1	2.0	0.147	8.3	LOS A	0.8	5.5	0.19	0.53	41.9
Approach		188	2.0	0.147	5.4	LOS A	0.8	5.5	0.19	0.53	43.9
East: Cecil Avenue											
4	L2	29	2.0	0.053	4.6	LOS A	0.3	1.8	0.23	0.50	44.3
5	T1	22	2.0	0.053	4.3	LOS A	0.3	1.8	0.23	0.50	45.5
6	R2	9	2.0	0.053	7.0	LOS A	0.3	1.8	0.23	0.50	45.6
6u	U	1	2.0	0.053	8.4	LOS A	0.3	1.8	0.23	0.50	46.6
Approach		61	2.0	0.053	4.9	LOS A	0.3	1.8	0.23	0.50	45.0
North: Orange Grove											
7	L2	5	2.0	0.057	4.8	LOS A	0.3	1.9	0.28	0.52	44.9
8	T1	40	2.0	0.057	4.5	LOS A	0.3	1.9	0.28	0.52	43.5
9	R2	16	2.0	0.057	7.3	LOS A	0.3	1.9	0.28	0.52	43.7
9u	U	3	2.0	0.057	8.6	LOS A	0.3	1.9	0.28	0.52	44.9
Approach		64	2.0	0.057	5.4	LOS A	0.3	1.9	0.28	0.52	43.8
West: Cecil Avenue											
10	L2	63	2.0	0.092	5.2	LOS A	0.5	3.2	0.36	0.56	43.1
11	T1	15	2.0	0.092	4.9	LOS A	0.5	3.2	0.36	0.56	45.0
12	R2	15	2.0	0.092	7.7	LOS A	0.5	3.2	0.36	0.56	41.9
12u	U	3	2.0	0.092	9.0	LOS A	0.5	3.2	0.36	0.56	43.4
Approach		96	2.0	0.092	5.7	LOS A	0.5	3.2	0.36	0.56	43.3
All Vehicles		409	2.0	0.147	5.4	LOS A	0.8	5.5	0.25	0.53	43.9

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

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

Roundabout Capacity Model: SIDRA Standard.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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14875 SIDRA - Existing Intersections.sip7

MOVEMENT SUMMARY

 **Site: 203 [Francis - Orange - Existing AM]**

Francis Street - Orange Grove
Existing AM Peak
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Average Speed
		Total veh/h	HV %	v/c	sec		veh	m		per veh	km/h
East: Francis Street											
5	T1	20	2.0	0.034	5.7	LOS A	0.2	1.1	0.30	0.58	48.8
6	R2	16	2.0	0.034	8.2	LOS A	0.2	1.1	0.30	0.58	49.3
Approach		36	2.0	0.034	6.8	LOS A	0.2	1.1	0.30	0.58	49.0
North: Orange Grove											
7	L2	5	2.0	0.097	5.7	LOS A	0.5	3.4	0.04	0.67	48.6
9	R2	142	2.0	0.097	7.4	LOS A	0.5	3.4	0.04	0.67	40.9
Approach		147	2.0	0.097	7.4	LOS A	0.5	3.4	0.04	0.67	41.4
West: Francis Street											
10	L2	145	2.0	0.108	5.7	LOS A	0.6	4.1	0.09	0.58	41.8
11	T1	5	2.0	0.108	5.0	LOS A	0.6	4.1	0.09	0.58	49.9
Approach		150	2.0	0.108	5.7	LOS A	0.6	4.1	0.09	0.58	42.3
All Vehicles		333	2.0	0.108	6.6	LOS A	0.6	4.1	0.09	0.62	43.0

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

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

Roundabout Capacity Model: SIDRA Standard.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

 **Site: 203 [Francis - Orange - Existing PM]**

Francis Street - Orange Grove
Existing PM Peak
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		Total veh/h	HV %	v/c	sec		veh	m		per veh	km/h
East: Francis Street											
5	T1	5	2.0	0.009	5.2	LOS A	0.0	0.3	0.18	0.57	49.1
6	R2	5	2.0	0.009	7.7	LOS A	0.0	0.3	0.18	0.57	49.6
Approach		10	2.0	0.009	6.5	LOS A	0.0	0.3	0.18	0.57	49.3
North: Orange Grove											
7	L2	18	2.0	0.058	5.8	LOS A	0.3	1.9	0.11	0.63	48.7
9	R2	57	2.0	0.058	7.5	LOS A	0.3	1.9	0.11	0.63	41.0
Approach		75	2.0	0.058	7.1	LOS A	0.3	1.9	0.11	0.63	43.8
West: Francis Street											
10	L2	199	2.0	0.143	5.7	LOS A	0.8	5.5	0.04	0.60	42.2
11	T1	23	2.0	0.143	4.9	LOS A	0.8	5.5	0.04	0.60	50.2
Approach		222	2.0	0.143	5.6	LOS A	0.8	5.5	0.04	0.60	43.4
All Vehicles		307	2.0	0.143	6.0	LOS A	0.8	5.5	0.06	0.60	43.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

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

Roundabout Capacity Model: SIDRA Standard.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY



Site: 302 [Terminus - Cecil - Existing AM]

Terminus Street - Cecil Avenue
Existing AM Peak
Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back Vehicles veh	of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Cecil Avenue											
21	L2	141	2.0	0.200	12.0	LOS A	0.8	5.6	0.58	1.00	39.2
Approach		141	2.0	0.200	12.0	LOS A	0.8	5.6	0.58	1.00	39.2
NorthEast: Terminus Street											
24	L2	43	2.0	0.333	5.6	LOS A	0.0	0.0	0.00	0.04	54.4
25	T1	1237	2.0	0.333	0.0	LOS A	0.0	0.0	0.00	0.02	59.2
Approach		1280	2.0	0.333	0.2	NA	0.0	0.0	0.00	0.02	58.9
All Vehicles		1421	2.0	0.333	1.4	NA	0.8	5.6	0.06	0.12	54.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

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

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

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY



Site: 302 [Terminus - Cecil - Existing PM]

Terminus Street - Cecil Avenue
Existing PM Peak
Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back Vehicles veh	of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Cecil Avenue											
21	L2	82	2.0	0.132	12.6	LOS A	0.5	3.5	0.60	1.00	38.5
Approach		82	2.0	0.132	12.6	LOS A	0.5	3.5	0.60	1.00	38.5
NorthEast: Terminus Street											
24	L2	85	2.0	0.399	5.6	LOS A	0.0	0.0	0.00	0.07	53.9
25	T1	1445	2.0	0.399	0.0	LOS A	0.0	0.0	0.00	0.03	58.7
Approach		1530	2.0	0.399	0.3	NA	0.0	0.0	0.00	0.03	58.2
All Vehicles		1612	2.0	0.399	0.9	NA	0.5	3.5	0.03	0.08	56.0

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

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

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

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

▼ Site: 202 [Francis - Roger - Existing AM]

Francis Street - Roger Avenue
Existing AM Peak
Giveway / Yield (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back Vehicles veh	of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Francis Street											
5	T1	202	2.0	0.106	0.0	LOS A	0.0	0.1	0.00	0.00	49.9
6	R2	1	2.0	0.106	5.1	LOS A	0.0	0.1	0.00	0.00	46.0
Approach		203	2.0	0.106	0.0	NA	0.0	0.1	0.00	0.00	49.9
North: Roger Avenue											
7	L2	2	2.0	0.003	5.0	LOS A	0.0	0.1	0.25	0.51	37.4
9	R2	1	2.0	0.003	5.9	LOS A	0.0	0.1	0.25	0.51	40.1
Approach		3	2.0	0.003	5.3	LOS A	0.0	0.1	0.25	0.51	38.5
West: Francis Street											
10	L2	2	2.0	0.082	4.6	LOS A	0.0	0.0	0.00	0.01	48.4
11	T1	156	2.0	0.082	0.0	LOS A	0.0	0.0	0.00	0.01	49.9
Approach		158	2.0	0.082	0.1	NA	0.0	0.0	0.00	0.01	49.9
All Vehicles		364	2.0	0.106	0.1	NA	0.0	0.1	0.00	0.01	49.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

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

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

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

▼ Site: 202 [Francis - Roger - Existing PM]

Francis Street - Roger Avenue
Existing PM Peak
Giveway / Yield (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back Vehicles veh	of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Francis Street											
5	T1	77	2.0	0.041	0.0	LOS A	0.0	0.1	0.02	0.01	49.7
6	R2	2	2.0	0.041	5.2	LOS A	0.0	0.1	0.02	0.01	45.6
Approach		79	2.0	0.041	0.2	NA	0.0	0.1	0.02	0.01	49.6
North: Roger Avenue											
7	L2	1	2.0	0.003	5.1	LOS A	0.0	0.1	0.28	0.52	37.2
9	R2	2	2.0	0.003	5.5	LOS A	0.0	0.1	0.28	0.52	40.0
Approach		3	2.0	0.003	5.4	LOS A	0.0	0.1	0.28	0.52	39.3
West: Francis Street											
10	L2	3	2.0	0.097	4.6	LOS A	0.0	0.0	0.00	0.01	48.4
11	T1	183	2.0	0.097	0.0	LOS A	0.0	0.0	0.00	0.01	49.9
Approach		186	2.0	0.097	0.1	NA	0.0	0.0	0.00	0.01	49.8
All Vehicles		268	2.0	0.097	0.2	NA	0.0	0.1	0.01	0.02	49.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

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

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

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

▽ Site: 602 [ONR - Brisbane - Existing AM]

Old Northern Road - Brisbane Road
Existing AM Peak
Giveaway / Yield (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back Vehicles veh	of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Brisbane Road											
21	L2	66	2.0	0.112	10.0	LOS A	0.4	2.7	0.58	0.82	47.6
23	R2	78	2.0	13.000	10956.2	LOS F	72.0	512.7	1.00	1.39	0.2
Approach		144	2.0	13.000	5939.2	LOS F	72.0	512.7	0.81	1.13	0.4
NorthEast: Old Northern Road											
24	L2	130	2.0	0.421	3.5	LOS A	0.0	0.0	0.00	0.09	55.9
25	T1	1486	2.0	0.421	0.0	LOS A	0.0	0.0	0.00	0.04	59.1
Approach		1616	2.0	0.421	0.3	NA	0.0	0.0	0.00	0.05	58.6
SouthWest: Old Northern Road											
31	T1	948	2.0	0.164	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
32	R2	50	2.0	0.374	39.6	LOS C	1.2	8.8	0.94	1.01	31.7
Approach		998	2.0	0.374	2.0	NA	1.2	8.8	0.05	0.05	54.3
All Vehicles		2758	2.0	13.000	311.0	NA	72.0	512.7	0.06	0.10	3.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

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

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

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

▽ Site: 602 [ONR - Brisbane - Existing PM]

Old Northern Road - Brisbane Road
Existing PM Peak
Giveway / Yield (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back Vehicles veh	of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Brisbane Road											
21	L2	37	2.0	0.062	9.7	LOS A	0.2	1.5	0.56	0.78	47.8
23	R2	21	2.0	3.500	2635.4	LOS F	17.0	121.0	1.00	1.30	0.7
Approach		58	2.0	3.500	960.4	LOS F	17.0	121.0	0.72	0.97	2.2
NorthEast: Old Northern Road											
24	L2	75	2.0	0.385	3.5	LOS A	0.0	0.0	0.00	0.06	56.3
25	T1	1402	2.0	0.385	0.0	LOS A	0.0	0.0	0.00	0.03	59.4
Approach		1477	2.0	0.385	0.2	NA	0.0	0.0	0.00	0.03	59.1
SouthWest: Old Northern Road											
31	T1	922	2.0	0.160	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
32	R2	30	2.0	0.166	25.8	LOS B	0.5	3.7	0.89	0.96	37.6
Approach		952	2.0	0.166	0.8	NA	0.5	3.7	0.03	0.03	57.4
All Vehicles		2487	2.0	3.500	22.8	NA	17.0	121.0	0.03	0.05	25.9

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

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

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

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY



Site: 101 [ONR - Church - Existing AM]

Old Northern Road - Church Street
Existing AM Peak

Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back Vehicles veh	of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Old Northern Road											
2	T1	1281	2.0	0.376	2.1	LOS A	2.3	16.5	0.10	0.01	56.3
3	R2	16	2.0	0.376	35.4	LOS C	2.3	16.5	0.22	0.02	49.8
Approach		1297	2.0	0.376	2.5	NA	2.3	16.5	0.10	0.01	56.2
East: Church Street											
4	L2	31	2.0	0.066	13.4	LOS A	0.2	1.6	0.62	0.99	43.9
6	R2	21	2.0	1.000	381.4	LOS F	3.4	24.1	1.00	1.19	3.5
Approach		52	2.0	1.000	162.0	LOS F	3.4	24.1	0.77	1.07	11.0
North: Old Northern Road											
7	L2	49	2.0	0.393	5.6	LOS A	0.0	0.0	0.00	0.04	54.4
8	T1	1462	2.0	0.393	0.0	LOS A	0.0	0.0	0.00	0.02	59.6
Approach		1511	2.0	0.393	0.2	NA	0.0	0.0	0.00	0.02	59.5
All Vehicles		2860	2.0	1.000	4.2	NA	3.4	24.1	0.06	0.03	53.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

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

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

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY



Site: 101 [ONR - Church - Existing PM]

Old Northern Road - Church Street
Existing PM Peak

Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back Vehicles veh	of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Old Northern Road											
2	T1	1352	2.0	0.411	2.3	LOS A	2.9	20.8	0.13	0.01	55.9
3	R2	27	2.0	0.411	30.4	LOS C	2.9	20.8	0.30	0.03	48.8
Approach		1379	2.0	0.411	2.9	NA	2.9	20.8	0.13	0.01	55.7
East: Church Street											
4	L2	18	2.0	0.034	12.3	LOS A	0.1	0.8	0.57	0.94	44.5
6	R2	11	2.0	1.000	649.3	LOS F	3.0	21.3	1.00	1.12	2.1
Approach		29	2.0	1.000	253.9	LOS F	3.0	21.3	0.73	1.01	7.7
North: Old Northern Road											
7	L2	64	2.0	0.367	5.6	LOS A	0.0	0.0	0.00	0.05	54.2
8	T1	1346	2.0	0.367	0.0	LOS A	0.0	0.0	0.00	0.03	59.5
Approach		1410	2.0	0.367	0.3	NA	0.0	0.0	0.00	0.03	59.4
All Vehicles		2818	2.0	1.000	4.2	NA	3.0	21.3	0.07	0.03	53.9

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

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

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

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

▽ Site: 503 [Crane - Orange - Existing AM]

Crane Road - Orange Grove
Existing AM Peak
Giveway / Yield (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back Vehicles veh	of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Orange Grove											
1	L2	156	2.0	0.142	6.9	LOS A	0.6	4.1	0.42	0.65	33.4
3	R2	5	2.0	0.142	9.0	LOS A	0.6	4.1	0.42	0.65	50.9
Approach		161	2.0	0.142	7.0	LOS A	0.6	4.1	0.42	0.65	34.1
East: Crane Road											
4	L2	21	2.0	0.182	5.6	LOS A	0.0	0.0	0.00	0.03	57.6
5	T1	351	2.0	0.182	0.0	LOS A	0.0	0.0	0.00	0.03	59.5
Approach		372	2.0	0.182	0.3	NA	0.0	0.0	0.00	0.03	59.3
West: Crane Road											
11	T1	146	2.0	0.176	1.2	LOS A	0.9	6.5	0.41	0.31	53.7
12	R2	128	2.0	0.176	7.1	LOS A	0.9	6.5	0.41	0.31	48.8
Approach		274	2.0	0.176	3.9	NA	0.9	6.5	0.41	0.31	51.6
All Vehicles		807	2.0	0.182	2.9	NA	0.9	6.5	0.22	0.25	50.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

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

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

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

Site: 503 [Crane - Orange - Existing PM]

Crane Road - Orange Grove
Existing PM Peak
Giveway / Yield (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back Vehicles veh	of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Orange Grove											
1	L2	122	2.0	0.105	6.1	LOS A	0.4	3.0	0.27	0.58	33.8
3	R2	13	2.0	0.105	8.4	LOS A	0.4	3.0	0.27	0.58	51.4
Approach		135	2.0	0.105	6.3	LOS A	0.4	3.0	0.27	0.58	35.9
East: Crane Road											
4	L2	7	2.0	0.086	5.6	LOS A	0.0	0.0	0.00	0.02	57.7
5	T1	169	2.0	0.086	0.0	LOS A	0.0	0.0	0.00	0.02	59.6
Approach		176	2.0	0.086	0.2	NA	0.0	0.0	0.00	0.02	59.5
West: Crane Road											
11	T1	314	2.0	0.202	0.2	LOS A	0.6	4.0	0.14	0.11	57.4
12	R2	72	2.0	0.202	6.2	LOS A	0.6	4.0	0.14	0.11	52.9
Approach		386	2.0	0.202	1.3	NA	0.6	4.0	0.14	0.11	56.7
All Vehicles		697	2.0	0.202	2.0	NA	0.6	4.0	0.13	0.18	52.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

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

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

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY



Site: 201 [ONR - Francis - Existing AM]

Old Northern Road - Francis Street
Existing AM Peak

Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back Vehicles veh	of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Old Northern Road											
2	T1	1349	2.0	0.626	3.1	LOS A	5.5	39.5	0.11	0.05	52.8
3	R2	113	2.0	0.626	35.3	LOS C	5.5	39.5	1.00	0.51	24.1
Approach		1462	2.0	0.626	5.5	NA	5.5	39.5	0.18	0.09	48.5
East: Francis Street											
4	L2	194	2.0	0.404	15.9	LOS B	1.9	13.7	0.71	1.09	33.0
6	R2	3	2.0	1.000	1808.4	LOS F	2.4	17.2	1.00	1.04	1.1
Approach		197	2.0	1.000	43.2	LOS D	2.4	17.2	0.72	1.09	20.3
North: Old Northern Road											
7	L2	47	2.0	0.389	5.6	LOS A	0.0	0.0	0.00	0.04	55.9
8	T1	1449	2.0	0.389	0.0	LOS A	0.0	0.0	0.00	0.02	59.5
Approach		1496	2.0	0.389	0.2	NA	0.0	0.0	0.00	0.02	59.3
All Vehicles		3155	2.0	1.000	5.4	NA	5.5	39.5	0.13	0.12	48.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

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

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

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY



Site: 201 [ONR - Francis - Existing PM]

Old Northern Road - Francis Street
Existing PM Peak

Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back Vehicles veh	of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Old Northern Road											
2	T1	1379	2.0	0.716	0.1	LOS A	0.0	0.0	0.00	0.00	59.6
3	R2	146	2.0	0.783	48.7	LOS D	3.7	26.5	0.97	1.22	18.7
Approach		1525	2.0	0.783	4.7	NA	3.7	26.5	0.09	0.12	49.6
East: Francis Street											
4	L2	86	2.0	0.182	13.8	LOS A	0.6	4.6	0.65	1.00	34.5
6	R2	1	2.0	1.000	4530.8	LOS F	2.2	15.8	1.00	1.02	0.4
Approach		87	2.0	1.000	65.7	LOS E	2.2	15.8	0.65	1.00	15.3
North: Old Northern Road											
7	L2	55	2.0	0.398	5.6	LOS A	0.0	0.0	0.00	0.04	55.9
8	T1	1476	2.0	0.398	0.0	LOS A	0.0	0.0	0.00	0.02	59.4
Approach		1531	2.0	0.398	0.2	NA	0.0	0.0	0.00	0.02	59.3
All Vehicles		3143	2.0	1.000	4.2	NA	3.7	26.5	0.06	0.09	50.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

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

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

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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Andrew Wilson
Development Manager
Merc Capital
Suite 306, 25 Solent Circuit
Baulkham Hills
NSW 2153

TDG Ref: 13561.3
4 September 2017

Issued via email: andrew@merccapital.com.au

Dear Andrew,

**Old Northern Road / Francis Street Intersection
Traffic Signals Warrant Assessment**

Thank you for engaging TDG to provide a traffic signals warrant assessment relating to the layout and operation of the existing T-intersection at Old Northern Road and Francis Street in Castle Hill.

1. Background

A Parking and Traffic Study (PTS) was prepared by TDG in July 2017, which indicated that traffic signals are currently required at the existing intersection of Old Northern Road and Francis Street in Castle Hill. The assessment concluded that upgrading from an unsignalised intersection to a signalised intersection and the provision of a northbound right turn lane on Old Northern Road would considerably improve the overall operation of the intersection in both existing and future conditions.

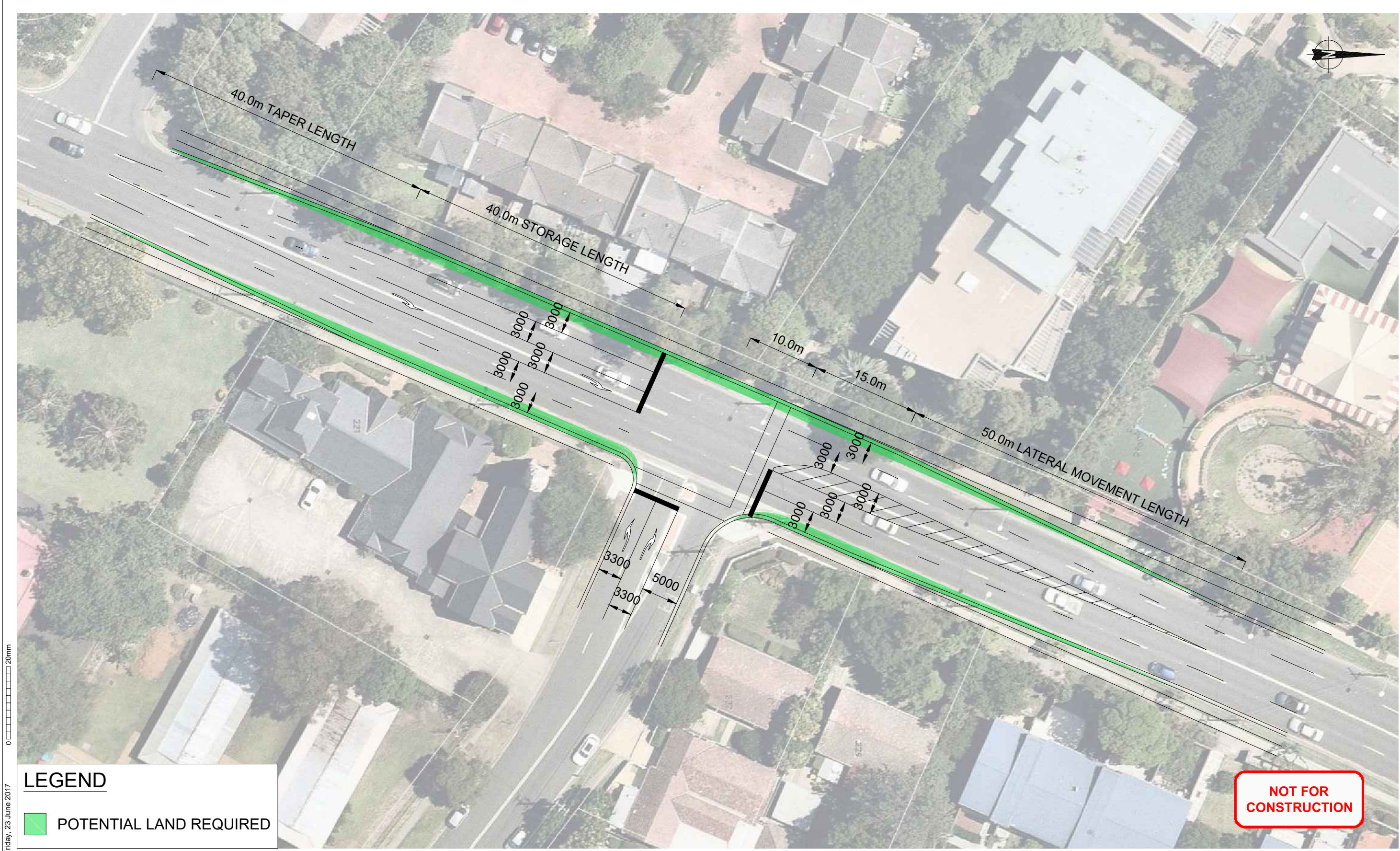
A concept intersection layout plan was prepared for Roads and Maritime Services (RMS) in July 2017, which shows a widened Old Northern Road, to cater for the provision of a northbound right turn lane, and signalisation of the intersection.

The PTS was prepared to support a mixed use development on the southern side of Cecil Avenue, with access to Roger Avenue. The PTS identified that the intersection currently operates with a level of service "F" during both morning and afternoon peak periods, and would continue to do so with the proposed development traffic added. It also demonstrated that with signalisation of the intersection, the average delays would reduce significantly and the intersection would operate at level of service "A" for both peak periods.

This Signals Warrant Assessment has been prepared to assess the intersection against the RMS warrants as requested, whilst also considering other aspects of road safety and efficiency.

2. Concept Design

Figure 1 shows the concept layout design of the intersection, including the approximate area of land required to facilitate the design.



Friday, 23 June 2017

LEGEND

POTENTIAL LAND REQUIRED

REVISION	DATE	DESCRIPTION

Old Northern Road / Francis Street

Concept Intersection Layout

DRAWN: TJG

DATE: 23/06/2017

SCALE: 1:500 @ A3

DWG NO:13561-2S1A





3. Traffic Volumes

A turning movement count survey was undertaken at the intersection in February 2017.

The weekday morning peak hour was found to occur from 8:00am to 9:00am, and the afternoon peak hour was found to occur from 4:30pm to 5:30pm.

A summary of the turning movement counts are displayed below in **Table 1**:

Time Period	Old Northern Road South			Old Northern Road North			Francis Street		
	Through	Right	Total	Through	Left	Total	Left	Right	Total
AM Peak	1,349	113	1,462	1,449	97	1,546	194	3	197
PM Peak	1,379	146	1,525	1,476	55	1,531	86	1	87

Table 1: Peak Hour Turning Volumes at the Old Northern Road / Francis Street Intersection

The proposed development discussed in the PTS is expected to generate traffic that will flow through the Old Northern Road / Francis Street intersection, and the resulting turning volumes are shown below in **Table 2**:

Time Period	Old Northern Road South			Old Northern Road North			Francis Street		
	Through	Right	Total	Through	Left	Total	Left	Right	Total
AM Peak	1,349	158	1,507	1,455	52	1,507	209	100	309
PM Peak	1,379	172	1,551	1,495	62	1,557	91	100	191

Table 2: Expected Future Traffic Volumes at the Old Northern Road / Francis Street Intersection

As the proposed development is expected to generate additional traffic through the intersection, the expected future volumes have been used for the purposes of this assessment.



4. Signal Warrants

The intersection has been assessed against the warrants included in the Roads and Traffic Authority of New South Wales' (now Roads and Maritime Services) "*Traffic Signal Design – Section 2 - Warrants*" (**RTA Warrant Guide**).

The warrants for the installation of traffic signals are included in the RTA Warrant Guide, and are reproduced in **Table 4** below.

The RTA Warrant Guide states that as a guide, a signalised intersection may be considered if one of the five following warrants is met. It was anticipated that the subject site would meet warrant (a) or (b) regarding traffic demands and these have been assessed.

The warrants require that volume limits be met during four hours of the day. As described in Section 3 of this assessment, only two peak hours were assessed during the weekday period, and as such there are no future traffic volumes for a four hour period. However, shoulder peak hours adjacent to the peaks are typically only marginally lower than the peak hour, particularly in larger urban areas where peak spreading occurs and the network is often operating at close to its capacity. For this assessment, the adjacent peak hour periods for both the morning and afternoon peaks have been conservatively assessed to be 15 percent lower than the peak hour volumes discussed in Section 3.

The four hourly volumes are displayed below in **Table 3**, and were used in the assessment against warrants (a) and (b).

Time Period	Old Northern Road South			Old Northern Road North			Francis Street		
	Through	Right	Total	Through	Left	Total	Left	Right	Total
AM Peak	1,349	158	1,507	1,455	52	1,507	209	100	309
PM Peak	1,379	172	1,551	1,495	62	1,557	91	100	191
AM Adjacent Peak	1,147	134	1,281	1,237	44	1,281	178	85	263
PM Adjacent Peak	1,172	146	1,318	1,271	53	1,324	77	85	162

Table 3: Peak Hourly and Estimated Adjacent Peak Hourly Volumes at Intersection



Warrants		Actual Situation	Meets Warrants
a) Traffic Demand	For each of four one-hour periods of an average day:		NO.
	i) The major road flow exceeds 600 vehicles per hour (vph) in each direction; and	YES. Major road volumes exceed 600 vph in one direction for all four peak hours.	
	ii) The minor road flow exceeds 200 vph in one direction.	NO. The minor road volume exceeds 200 vph in the eastbound direction for the AM peak and AM peak adjacent hours, but not more than 200 vph for either PM hour.	
b) Continuous Traffic	For each of four one-hour periods of an average day:		YES.
	i) The major road flow exceeds 900 vph in each direction; and	YES. Major road volumes exceed 900 vph in one direction for all four peak hours.	
	ii) The minor road flow exceeds 100 vph in one direction; and	YES. Minor road volumes exceed 100 vph in one direction for all four peak hours.	
	iii) The speed of traffic on the major road or limited sight distance from the minor road causes undue delay or hazard to the minor road vehicles; and	YES. Considerable delay and hazard expected.	
	iv) There is no other nearby traffic signal site easily accessible to the minor road vehicles.	YES.	
c) Pedestrian Safety	For each of four one-hour periods of an average day:		Not Assessed.
	i) The pedestrian flow crossing the major road exceeds 150 persons per hour (pph); and	Not recorded as part of the traffic volume counts.	
	ii) The major road flow exceeds 600 vph in each direction or, where there is a central median of at least 1.2m wide, 1,000 vph in each direction.	YES. Major road volumes exceed 600 vph in one direction for all four peak hours.	
d) Pedestrian Safety – High Speed Road	For each of four one-hour periods of an average day:		Not Assessed.
	i) The pedestrian flow crossing the major road exceeds 150 pph; and	Not recorded as part of the traffic volume counts.	
	ii) The major flow exceeds 450 vph in each direction or, where there is a central median of at least 1.2m wide, 750 vph in each direction; and	YES. Major road volumes exceed 600 vph in one direction for all four peak hours.	
	iii) The 85 th percentile speed on the major road exceeds 75 km/h.	Not assessed. However the posted speed limit is 60 km/h so	

		this warrant is unlikely.	
e) Crashes	For each of four one-hour periods of an average day:		Not Assessed.
	i) The intersection has been the site of an average of three or more reported tow-away or casualty traffic accidents per year over a three year period, where the traffic accidents could have been prevented by traffic signals; and	Not assessed.	
	ii) The traffic flows are at least 80% of the appropriate flow warrants.	YES.	

Table 4: RTA Signal Warrants

The assessment against the warrants indicates that warrant (b), Continuous Traffic, is met but warrant (a), Traffic Demand, is not.

The warrants based on pedestrian safety have not been formally assessed due to the uncertainty regarding pedestrian volumes; however it is evident that the higher risk traffic volumes and speeds targeted by the warrants will be present.

5. Operating Efficiency

The intersection has been modelled using the SIDRA intersection analysis software, for both the existing and future concept scenarios. Both layouts are shown below in **Figure 2** and **Figure 3**.

The signalised intersection was modelled using a standard t-intersection A-B-C phasing, with northbound right filter turns permitted during the A phase. To be conservative, both pedestrian movements were modelled as operating every cycle.

The results of the analyses for both the existing and future concept scenarios are summarised in **Table 5**, with SIDRA output summaries included in **Appendix A**.

The concepts of intersection capacity and level of service (LoS), as defined in the guidelines published by the RTA (2002), are discussed in **Appendix B** together with criteria for their assessment. The assessment of the LoS of traffic signals is based on the evaluation of the average delay (seconds per vehicle) of vehicles on all approaches. The assessment of LoS of roundabouts and unsignalised intersections is based on the average delay of the critical movements, i.e. the movement with the highest delay.

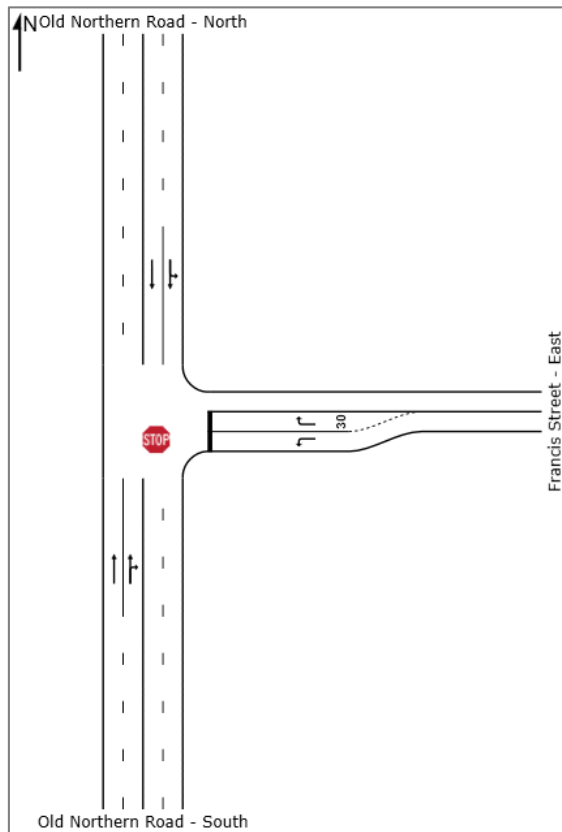


Figure 2: Modelled Existing Layout (Unsignalised)

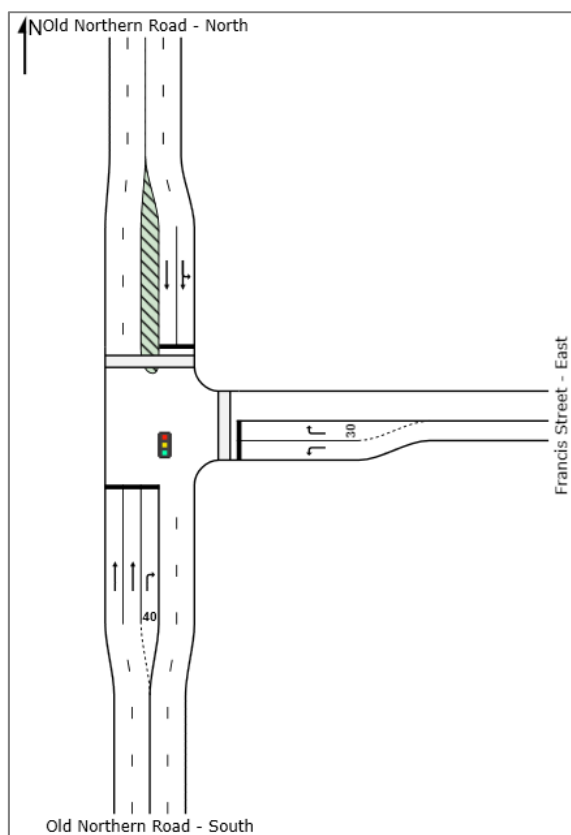


Figure 3: Modelled Future Concept Layout (Signalised)

Intersection Scenario	AM Peak		PM Peak	
	Average Delay (sec/veh)	Level of Service (LoS)	Average Delay (sec/veh)	Level of Service (LoS)
Existing – Unsignalised Intersection (Critical movement - Francis Street right turn)	>70.5	F	>70.5	F
Future – Signalised Intersection (All movements)	10.9	A	13.3	A

Table 5: Existing and Future Concept SIDRA Analysis Results

Under priority control, the intersection is modelled as running at a very poor level of service “F” during both the morning and afternoon peak hours. This can be attributed to the large volumes of through traffic on Old Northern Road restricting the traffic exiting from Francis Street. For the existing intersection, the largest delays (of well over 70.5 seconds per vehicle) are for the right turning vehicles on Francis Street, of which there were 3 vph recorded in the morning peak and 1 vph recorded in the afternoon peak. The next highest critical movement is the northbound right turn movement from Old Northern Road onto Francis Street, with average delays of 75.1 sec / veh in the morning peak and 152.7 sec / veh in the afternoon peak.

The large delay and small volumes undertaking the right turn from Francis Street effectively show from a practical point of view that this movement is no longer possible during peak traffic periods.

The provision of traffic signals would considerably improve the operation of the intersection, improving the intersection operation to a level of service “A” as shown in Table 5, including after the additional development traffic is taken into account.

6. Conclusion

Based on the above assessment, the intersection of Old Northern Road and Francis Street in Castle Hill has been determined to warrant an upgrade to a signalised intersection under the RMS warrants.

This is also supported by the SIDRA modelling which shows an overall significant improvement to the intersection’s operating LoS.

Yours sincerely
Traffic Design Group Ltd



Tom Guernier
Senior Traffic Engineer

tom.guernier@gmail.com



Duncan Wilson
Principal Traffic Engineer

duncan.wilson@tdg.co.nz

Attached:
Appendix A – SIDRA Movement Summaries
Appendix B – Guidelines for the Evaluation of Intersection Operation



Appendix A

SIDRA Movement Summaries

MOVEMENT SUMMARY



Site: 101 [Old Northern Road / Francis Street - Existing AM]

AM Peak - Existing
Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Old Northern Road - South											
2	T1	1420	0.0	0.728	0.2	LOS A	0.0	0.0	0.00	0.00	59.6
3	R2	119	0.0	0.848	75.1	LOS F	4.4	30.7	0.98	1.28	25.6
Approach		1539	0.0	0.848	6.0	NA	4.4	30.7	0.08	0.10	54.0
East: Francis Street - East											
4	L2	204	0.0	0.438	16.3	LOS C	2.1	14.5	0.74	1.10	43.7
6	R2	3	0.0	1.000	1608.3	LOS F	2.3	15.8	1.00	1.04	2.2
Approach		207	0.0	1.000	40.6	LOS E	2.3	15.8	0.74	1.10	33.9
North: Old Northern Road - North											
7	L2	102	0.0	0.419	5.6	LOS A	0.0	0.0	0.00	0.08	57.6
8	T1	1525	0.0	0.419	0.1	LOS A	0.0	0.0	0.00	0.03	59.6
Approach		1627	0.0	0.419	0.4	NA	0.0	0.0	0.00	0.04	59.4
All Vehicles		3374	0.0	1.000	5.4	NA	4.4	30.7	0.08	0.13	54.4

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

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

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

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY



Site: 101 [Old Northern Road / Francis Street - Existing PM]

PM Peak - Existing
Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Old Northern Road - South											
2	T1	1452	0.0	0.744	0.2	LOS A	0.0	0.0	0.00	0.00	59.5
3	R2	154	0.0	1.057	152.7	LOS F	12.7	89.0	1.00	1.93	16.5
Approach		1605	0.0	1.057	14.8	NA	12.7	89.0	0.10	0.18	47.6
East: Francis Street - East											
4	L2	91	0.0	0.208	14.6	LOS B	0.7	5.1	0.69	1.01	44.6
6	R2	1	0.0	1.000	4082.5	LOS F	2.1	14.7	1.00	1.02	0.9
Approach		92	0.0	1.000	61.4	LOS F	2.1	14.7	0.69	1.01	28.4
North: Old Northern Road - North											
7	L2	58	0.0	0.414	5.5	LOS A	0.0	0.0	0.00	0.04	57.3
8	T1	1554	0.0	0.414	0.1	LOS A	0.0	0.0	0.00	0.02	59.5
Approach		1612	0.0	0.414	0.3	NA	0.0	0.0	0.00	0.02	59.4
All Vehicles		3308	0.0	1.057	9.0	NA	12.7	89.0	0.07	0.13	51.6

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

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

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

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

 **Site: 101v [Old Northern Road / Francis Street - Future AM]**

AM Peak - Existing Plus Development

Signals - Fixed Time Isolated Cycle Time = 70 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Old Northern Road - South											
2	T1	1349	0.0	0.473	3.8	LOS A	9.1	63.5	0.43	0.39	56.5
3	R2	158	0.0	0.503	22.7	LOS C	4.6	31.9	0.90	0.82	40.5
Approach		1507	0.0	0.503	5.8	LOS A	9.1	63.5	0.48	0.43	54.2
East: Francis Street - East											
4	L2	209	0.0	0.438	28.6	LOS C	6.1	43.0	0.88	0.79	37.5
6	R2	100	0.0	0.628	41.3	LOS D	3.6	25.4	1.00	0.82	33.2
Approach		309	0.0	0.628	32.7	LOS C	6.1	43.0	0.92	0.80	36.0
North: Old Northern Road - North											
7	L2	52	0.0	0.688	17.0	LOS B	18.2	127.3	0.76	0.70	46.0
8	T1	1455	0.0	0.688	11.4	LOS B	18.3	127.8	0.76	0.69	50.4
Approach		1507	0.0	0.688	11.6	LOS B	18.3	127.8	0.76	0.69	50.2
All Vehicles		3323	0.0	0.688	10.9	LOS B	18.3	127.8	0.65	0.59	50.1

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

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

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians									
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped	
P2	East Full Crossing	15	10.9	LOS B	0.0	0.0	0.56	0.56	
P3	North Full Crossing	15	29.3	LOS C	0.0	0.0	0.91	0.91	
All Pedestrians		30	20.1	LOS C			0.74	0.74	

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

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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MOVEMENT SUMMARY



Site: 101v [Old Northern Road / Francis Street - Future PM]

PM Peak - Existing Plus Development

Signals - Fixed Time Isolated Cycle Time = 60 seconds (Practical Cycle Time)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Old Northern Road - South											
2	T1	1379	0.0	0.513	4.5	LOS A	9.4	66.1	0.50	0.45	55.8
3	R2	172	0.0	0.518	24.0	LOS C	4.5	31.2	0.94	0.81	39.9
Approach		1551	0.0	0.518	6.7	LOS A	9.4	66.1	0.55	0.49	53.5
East: Francis Street - East											
4	L2	91	0.0	0.163	21.5	LOS C	2.0	14.0	0.77	0.73	40.5
6	R2	100	0.0	0.538	34.7	LOS C	3.0	21.3	0.99	0.78	35.3
Approach		191	0.0	0.538	28.4	LOS C	3.0	21.3	0.89	0.76	37.6
North: Old Northern Road - North											
7	L2	62	0.0	0.813	23.3	LOS C	22.1	154.6	0.91	0.91	44.9
8	T1	1495	0.0	0.813	17.9	LOS B	22.2	155.1	0.91	0.91	46.2
Approach		1557	0.0	0.813	18.1	LOS B	22.2	155.1	0.91	0.91	46.1
All Vehicles		3299	0.0	0.813	13.3	LOS B	22.2	155.1	0.74	0.71	48.6

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

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

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians									
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped	
P2	East Full Crossing	15	12.7	LOS B	0.0	0.0	0.65	0.65	
P3	North Full Crossing	15	24.3	LOS C	0.0	0.0	0.90	0.90	
All Pedestrians		30	18.5	LOS B			0.78	0.78	

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

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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Organisation: TRAFFIC DESIGN GROUP LTD (TDG) | Processed: Tuesday, 15 August 2017 3:21:29 PM

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Appendix B

Guidelines for the Evaluation of Intersection Operation

The RTA has included in the "Guide to Traffic Generating Developments" (Dec 1993, Issue 2) a section on the assessment of intersections. The assessment of the level of service of an intersection is based on the evaluation of the following Measures of Effectiveness:

- (a) Average delay (seconds/veh) (all forms of control)
- (b) Delay to critical movement (seconds/veh) (all forms of control)
- (c) Degree of saturation (traffic signals and roundabouts)
- (d) Cycle length (traffic signals)

INTANAL was used to calculate the relevant intersection parameters. INTANAL is a software which allows comparisons between different forms of intersection control and different forms of intersection configurations to be readily evaluated. That is at each intersection the priority control, roundabout and signal control options will be examined to determine the most efficient form of control.

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

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

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

Table B1 sets out average delays for different levels of service. There is no consistent correlation between definitions of levels of service for road links as defined elsewhere in this section, and the ranges set out in Table G1. In assigning a level of service, the average delay to the motoring public needs to be considered, keeping in mind the location of the intersection. For example, drivers in inner-urban areas of Sydney have a higher tolerance of delay than drivers in country areas. Table B1 provides a recommended baseline for assessment.

Level of Service	Average Delay per Vehicle (seconds/veh)	Traffic Signals, Roundabout	Give Way and Stop Signs
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 - 42	Satisfactory	Satisfactory, but accident study required
D	43 to 56	Operating near capacity	Near capacity and accident study required
E	57 to 70	At capacity; at signals, incidents will cause excessive delays Roundabouts require other control mode	At capacity, required other control mode

Table B1: Level of Service Criteria for Intersections

The figures in Table B1 are intended as a guide only. Any particular assessment should take into account site-specific factors including maximum queue lengths (and their effect on lane blocking), the influence of nearby intersections and the sensitivity of the location to delays. In many situations, a comparison of the current and future average delay provides a better appreciation of the impact of a proposal, and not simply the change in the level of service.

The intersection degree of saturation (DS) can also be used to measure the performance of isolated intersections. At intersections controlled by traffic signals, both queue length and delays increase rapidly as DS approaches 1.0. An upper limit of 0.9 is appropriate. When DS exceeds 0.8 - 0.85, overflow queues start to become a problem. Satisfactory intersection operation is generally achieved with a DS of about 0.7 - 0.8. (Note that these figures are based on isolated signalised intersections with cycle lengths of 120 seconds. In co-ordinated signal systems DS might be actively maximised at key intersections). Although in some situations additional traffic does not alter the level of service, particularly where the level of service is E or F, additional capacity may still be required. This is particularly appropriate for service level F, where small increases in flow can cause disproportionately greater increases in delay. In this situation, it is advisable to consider means of control to maintain the existing level of absolute delay. Suggested criteria for the evaluation of the capacity of signalised intersections based on the Degree of Saturation are summarised in Table B2.

Level Of Service	Optimum Cycle Length (Seconds) (Co)	Volume/Saturation γ	Intersection Degree Of Saturation X
A/B - Very good operation	< 90	< 0.70	< 0.80
C - Satisfactory	90-120	0.70-0.80	0.80-0.85
D - Poor but manageable	120-140	0.80-0.85	0.85-0.90
E/F - Bad, extra capacity required	>140	>0.85	> 0.90

Table B2: Criteria for Evaluating Capacity Of Signalised Intersections*

* Source: Roads & Traffic Authority (2002)