Delbest Pty Ltd

"Life City Wollongong"

Traffic and Transport Assessment

24 October 2013

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1. Introduction

1.1 Overview

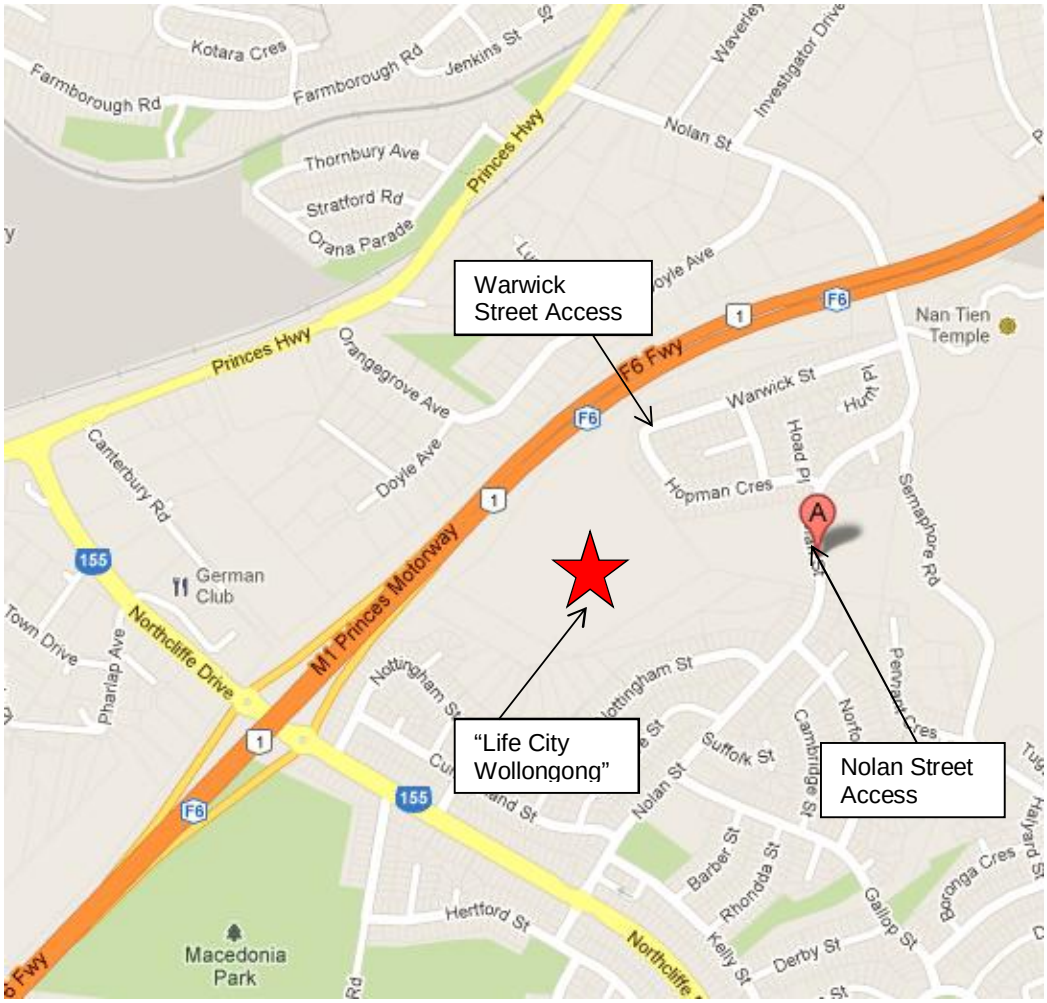
This report has been prepared by GHD Pty Ltd (GHD) on behalf of Delbest Pty Ltd to accompany a Part 3A concept application for the development of the Hi Tech Holistic Cancer and Medical Facility "Life City Wollongong".

Life City Wollongong (Life City) is to be situated on Nolan Street, Berkeley, NSW. (refer to Figure 1).

The report discusses the following:

- Existing Conditions – a review of existing road features, adjacent developments, traffic volumes, pedestrian facilities, sight distances and crash data;
- Proposed Development– a review of additional traffic generated from the proposed facility, proposed access/egress arrangements and parking facilities; and
- Development Impact– assessment of sightline distances and the performance of the existing intersections (queues, delays, level of service, safety).

Figure 1 – Site Location



Source: Google Maps, 2012

1.2 Study Scope

This report has been prepared by GHD for TCG Planning and Delbest Pty Ltd and may only be used and relied on by TCG Planning and Delbest Pty Ltd for the purpose agreed as set out in Section 1.1 of this report.

GHD otherwise disclaims responsibility to any person other than TCG Planning and Delbest Pty Ltd arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in Section 1.3 of this report. GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by TCG Planning and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

1.3 Assumptions

This report has been based on the following assumptions:

- Data collection has been limited to traffic volumes surveys at key intersections; trip generation surveys of similar developments have not been undertaken.
- Some of the land uses proposed in the development are not addressed in the RMS Guide; for these, the traffic generation and assumptions used are those provided in the Traffic Impact Assessment undertaken by Bruce Conneeley of Traffic Impact Service Pty Ltd for the Preliminary Environmental Assessment.
- Traffic growth assumptions have been provided by Wollongong City Council in the form of model outputs from the Wollongong Shoalhaven (WOLSH) Strategic Traffic Model.
- Staging and configurations of each stage are based on those provided by TCG Planning and the plans provided by Boss Design dated September 2013, received by GHD on 9 October 2013.

2. Existing Conditions

This section outlines the existing conditions around the Life City site including traffic conditions on Nolan Street, Warwick Street, Northcliffe Drive and the Princes Highway. This includes the profile of the development, the existing transport and accessibility conditions and the existing road network performance.

2.1 Existing Road Network Characteristics

The classification of roads on the existing road network can be used as an indication of the functional role each road plays with respect to the volume of traffic they should appropriately carry. The Roads and Maritime Services (RMS) have developed a set of road hierarchy classifications detailed in Table 1 indicating typical nominal volumes expressed in terms of average annual daily traffic (AADT) serviced by various classes of roads.

Table 1 Functional Classification of Roads

Type of Road	Traffic Volume (vpd*)	Peak Hour Volume (vph**)
Arterial Road	>20,000	>2,000
Sub-Arterial Road	10,000 – 20,000	1,000 – 2,000
Collector Road	2,000 – 10,000	200 – 1,000
Local Road	<2,000	0 – 200

Note: * vpd – vehicles per day

** vph – vehicles per hour

2.1.1 Nolan Street

Nolan Street performs the function of a collector road in Berkeley and has the following key features:

- The posted speed limit is 50 km/h, there is a 40 km/h school zone located on the southern end of Nolan Street; and
- The carriageway is sealed, with one lane marked in each direction.

Photo 1 - Nolan Street north of Warwick Street.

2.1.2 Warwick Street

Warwick Street performs the function of a local road in Berkeley and has the following key features:

- The posted speed limit is 50 km/h; and
- The carriageway is sealed approximately 10 metres wide with no road marking.

Photo 2 - Warwick Street looking west with the proposed development to be accessed at the western end of Warwick Street.

2.1.3 Northcliffe Drive

Northcliffe Drive performs the function of a sub-arterial road in Berkeley and has the following key features:

- The posted speed limit is 70 km/h; and
- The carriageway is sealed, median divided with two lanes in each direction.

Photo 3 - Northcliffe Drive looking east to the east of the Southern Freeway south bound on and off ramps.

2.1.4 Princes Highway

Princes Highway performs the function of a sub-arterial road in Berkeley and has the following key features:

- The posted speed limit is 70 km/h in the vicinity of Nolan Street; and
- The carriageway is sealed, with two marked lanes in each direction.

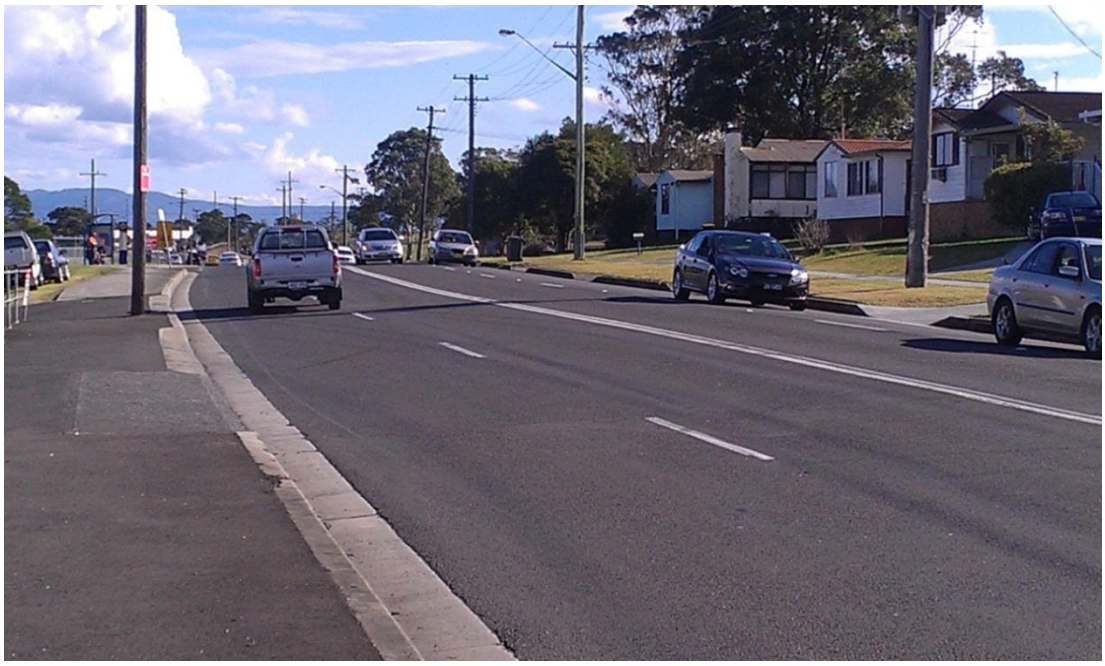


Photo 4 - The Princes Highway looking south to the south of Nolan Street

2.2 Existing Traffic Volumes

This section provides an understanding of current traffic volumes.

2.2.1 Existing Daily and Peak Hour Traffic

Intersection turning movement surveys were undertaken during the peak AM and PM at the following intersections on Tuesday the 9th October 2012 between 7–9 am and 4–6 pm:

- Warwick Street / Nolan Street (stop sign);
- Nolan Street / Northcliffe Drive (roundabout);
- Northcliffe Drive / Southern Freeway, Southbound on and off ramps (roundabout);
- Northcliffe Drive / Southern Freeway, Northbound on and off ramps (roundabout);
- Northcliffe Drive / Princes Highway (signalised); and
- Nolan Street / Princess Highway (signalised).

A copy of the traffic count data is provided in the Appendix A.

A network peak hour of 8 am to 9 am and 4 pm to 5 pm was selected based on analysis of peak period volumes across the study area. Peak hour and estimated daily traffic volumes are summarised in Table 2.

Table 2 Existing Traffic Volumes – October 2012

Location	AM Peak Hour (vph)	PM Peak Hour (vph)	Daily* (vpd)
Warwick Street west of Nolan Street	54	65	595
Nolan Street north of Warwick Street	426	500	4,630
Nolan Street South of Warwick Street	436	481	917
Nolan Street east of Princes Highway	377	438	4,075
Northcliffe Drive north of Nolan Street	888	1,201	10,445
Princes Highway west of Nolan Street	1,248	1,140	11,940

Note: *daily traffic volumes have been estimates based on the assumption that the average peak hour traffic flow is approximately 10% of the daily traffic volume.

Based on the existing traffic volumes shown in Table 2 these roads all are within the expected functional classification as outlined in Table 1.

2.2.2 Heavy and Light Vehicle Ratio

From the traffic volume surveys undertaken in September 2012 the heavy vehicle percentage is shown in Table 3.

Table 3 Heavy Vehicles – October 2012

Location	Vehicles per hour (vph)	HCV* (vph)	HCV* %
Nolan Street (south of Warwick St)	481	27	6%
Warwick Street	65	0	0%
Northcliffe Drive (west of Nolan St)	1,201	47	4%
Princes Highway (south of Nolan St)	1248	77	6%

Note: * HCV – heavy commercial vehicles

2.3 Existing Intersection Performance

The performance of the existing road network is largely dependent on the operating performance of key intersections, which are critical capacity control points on the road network. SIDRA intersection modelling software was used to assess the proposed peak hour operating performance of intersections on the surrounding road network. The criteria for evaluating the operational performance of intersections is provided by the RTA *Guide to Traffic Generating Developments* and reproduced in Table 4. The criteria for evaluating the operational performance of intersections is based on a qualitative measure (i.e. Level of Service), which is applied to each band of average vehicle delay.

Table 4 Performance Criteria at Intersections

Level of Service	Average Delay Per Vehicle (secs/vehicle)	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 to 42	Satisfactory	Satisfactory but accident study required
D	43 to 56	Operating near capacity	Near capacity and other accident study required
E	57 to 70	At capacity; at signals incidents will cause excessive delays	At capacity and requires other control mode
F	Greater than 70	Roundabouts require other control mode	

Notes:

a) The average delay for priority-controlled intersections is selected from the movement on the approach with the highest average delay.
b) The level of service for priority-controlled intersections is based on the highest average delay per vehicle for the most critical movement.
c) The degree of saturation is defined as the ratio of the arrival flow (demand) to the capacity of each approach.

Existing traffic flows were analysed using SIDRA to obtain the operation of key intersections in the study area.

Table 5 Intersection Performance AM and PM Peak Hour –Traffic Conditions 2012 (without development)

Intersection	Morning Peak			Evening Peak		
	Av Delay (s)	LoS	DoS	Av Delay (s)	LoS	DoS
Nolan St/Northcliffe Dr	13	A	0.20	13	A	0.24
Nolan St/Warwick St	14	A	0.07	14	A	0.05
Nolan St/Princes Hwy	18	B	0.67	18	B	0.60
Northcliffe Dr/Southern Fwy Southbound on/off ramps	16	B	0.25	15	B	0.29
Northcliffe Dr/Southern Fwy Northbound on/off ramps	15	B	0.15	15	B	0.12
Princes Hwy/Northcliffe Drive	22	B	0.71	19	B	0.78

Table 5 indicates that the existing intersections surrounding Life City currently operate satisfactorily in both the AM and PM peaks in 2012. Detailed performance of these intersections is in Appendix B.

2.4 Crash Statistics

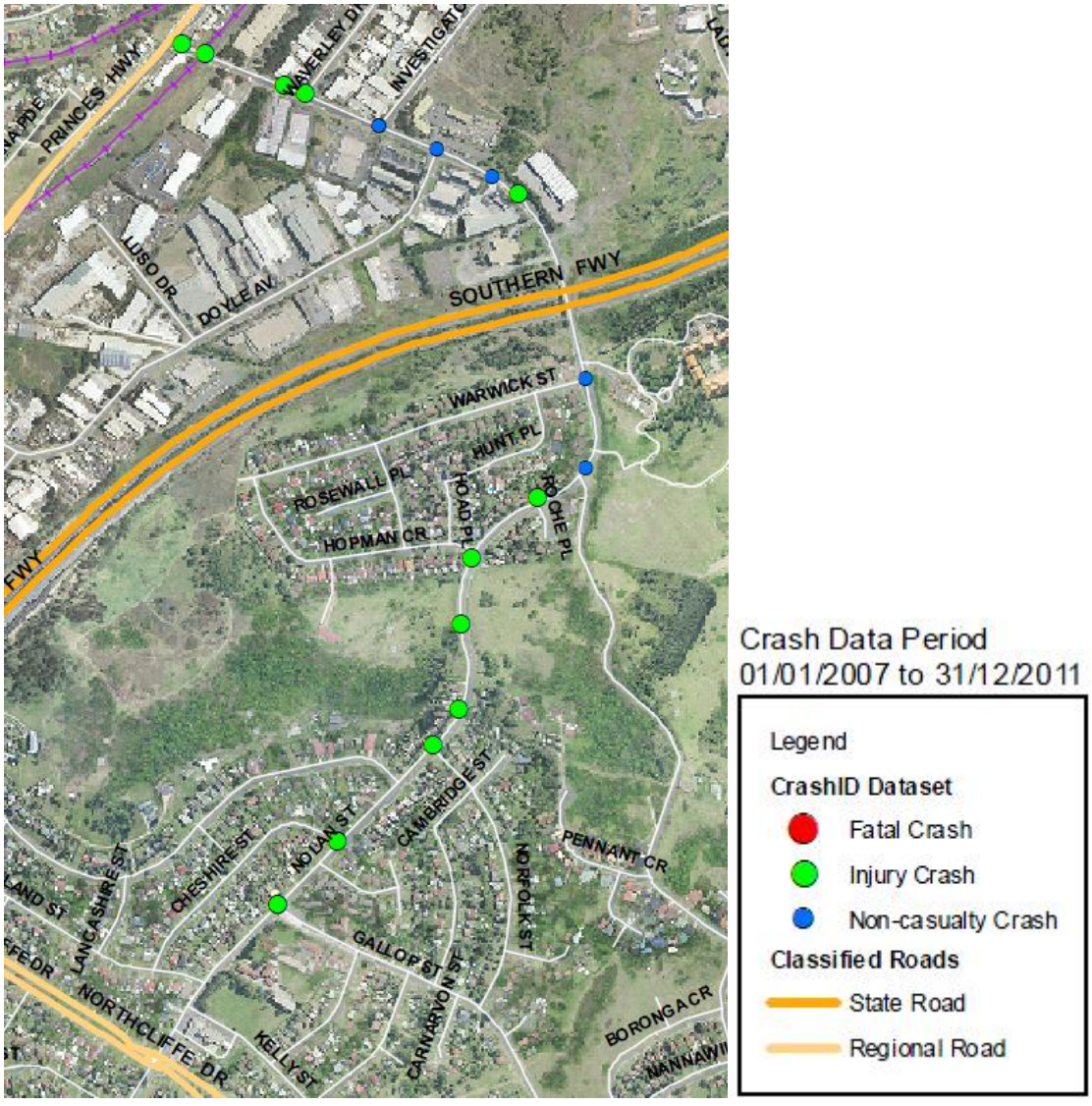
The Roads and Maritime Services (RMS) Crash Analysis Department supplied GHD with crash statistics for a five-year period from 2007 to 2011 for the length of Nolan Street covering the proposed access location to the development, and are summarised below:

In total, 22 crashes occurred over this 5 year period. Of these recorded crashes:

- 13 crashes resulted in injury;
- 16 of these crashes occurred in dry/daylight conditions;
- 16 were multi vehicle crashes;
- 14 crashes occurred at an intersection; and
- Speed was a contributing factor in 5 of the crashes.

Figure 2 shows the location of the crashes on Nolan Street. These crashes were spread along the route and not concentrated in one particular area. The crash statistics along Nolan Street do not indicate any pattern of crashes that would signify a specific safety issue along the route. Detailed crash reports are in Appendix D.

Figure 2 – Nolan Street Crash Map



2.5 Pedestrian and Bicycle Environment

Nolan Street has a pedestrian footpath approximately 1.5 m wide on both sides of the road between Northcliffe Drive and pedestrian crossing to the school. The footpath then continues on the eastern side only from the school to Hopman Crescent, where it changes to the western side to the Princes Highway.

There are currently no on or off road bicycle facilities along Nolan Street.

2.6 Public Transport

The Warrawong to Wollongong Bus Route 34 travels via Nolan Street. Figure 3 shows the route for this service and Table 6 shows the bus stop locations along Nolan Street.

Figure 3 – Bus Network Map

Source: http://www.premierillawarra.com.au/networkmap.html

Route 34 from Warrawong to Wollongong travels through Nolan Street every 20 – 30 mins from 6 am to 8:30 pm Monday to Friday. Services also operate on weekends and public holidays. Route 34 also provides a connection to Unanderra Railway Station.

As the bus route 34 from Warrawong to Wollongong already travels through Nolan Street, there could be an opportunity extend the bus route to include a loop through the Life City Development to encourage public transport usage to the site.

Table 6 Bus Stop Locations on Nolan Street (including Warwick St Loop)

Northbound (Along Nolan Street)	Southbound (Along Nolan Street)
Between Northcliffe to Cumberland Street	Near Investigator Drive
Between Cumberland Street to Gallop Street	On Warwick Street near Hunt Place
Nottingham Street to Norfolk Street	On Hopman Cres – near Newcombe Street
On Hopman Cres – near Warwick Street	Between Gallop Street and Suffolk Street
On Warwick St – near Newcombe Street	Between Kelly Street and Gallop Street
On Warwick between Hunt and Newcombe St	
Warwick Street to Nolan Bridge	
Near Investigator Drive	
Near the Rail Crossing	

3. Proposed Life City Development Impact

This section outlines the proposed development on the Life City development and summarises the traffic impact analysis of the development as well as any additional works that may be required to accommodate additional traffic generated by the development.

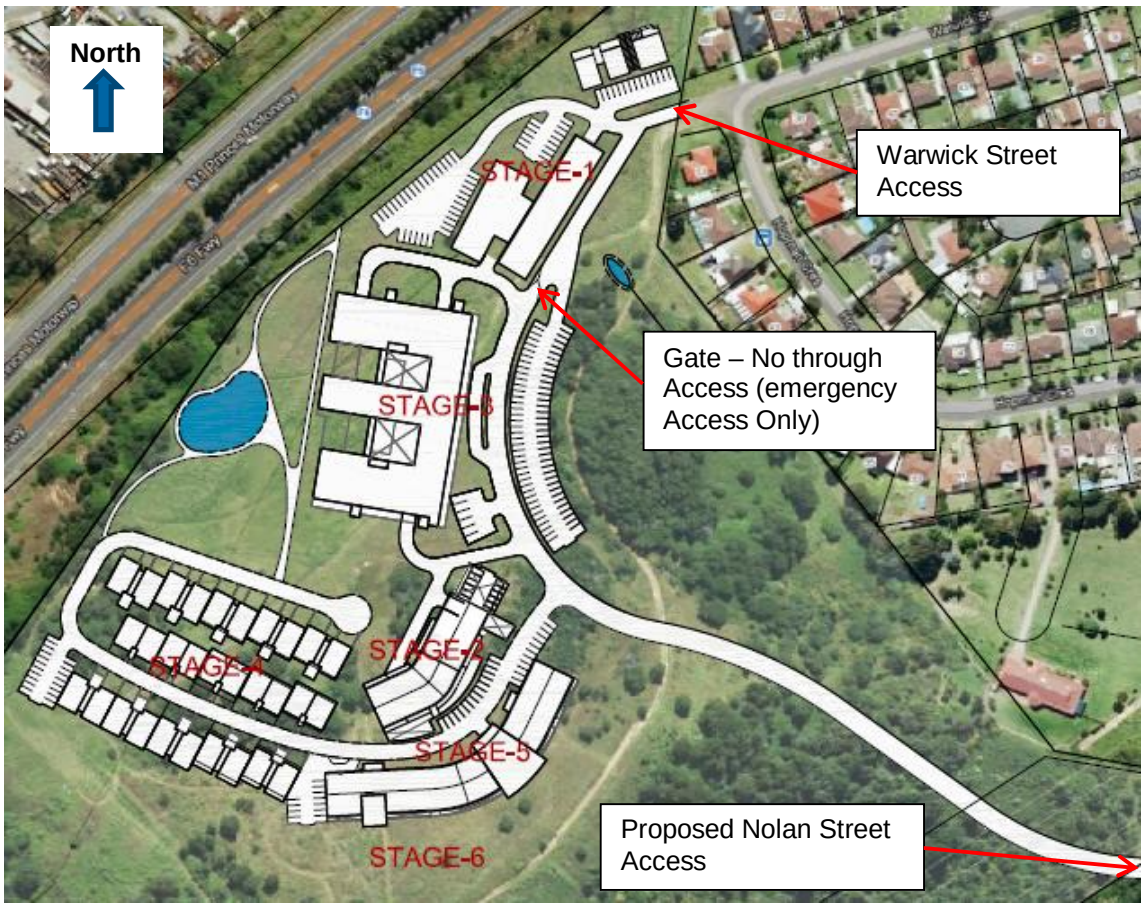
3.1 Overview – Proposed 'Life City' Development

The proposed development is a 'Hi Tech Holistic Cancer and Medical Hospital Facility' which consists of the following land uses:

- Stage 1 Medical Centre, Day Surgery, Child Care Centre and Respite Care Centre;
- Stage 2 Medi Hostel and Medi Serviced Apartments;
- Stage 3 Hi-Tech Holistic Cancer and Medical Hospital;
- Stage 4 Self-care Seniors Housing;
- Stage 5 Residential Care Facility and Hostel; and
- Stage 6 Holistic Healthcare Course.

A plan of the proposed development and the layout of these land uses are shown below in Figure 4. Access to the development would initially be at the western end of Warwick Street for Stages 1 with a new intersection at Nolan Street located between Hopman Crescent and Norfolk Street being provided prior to the opening of Stage 2.

Figure 4 – Proposed Development



Source: Boss Design Overall Concept Plan September 2013

3.2 Projected Traffic Generation

An indication of the potential traffic generation from the 'Life City' development has been obtained from the RTA *Guide to Traffic Generating Developments (2002)*. Some of the land uses are not covered in the RTA Guide, for these, the traffic generation and assumptions used are those provided in the *Traffic Impact Assessment* undertaken by Bruce Conneeley for the Preliminary Environmental Assessment.

Table 7 below outlines the traffic generation and assumptions used for each land use.

Table 7 Potential Traffic Generation

Stage	Component	Beds/Rooms/Persons	Peak Hour Traffic Generation Rate	Peak Hour Trips
1	Medical Centre, Day surgery and Respite Care Centre	26 consulting rooms (18 Specialists)	4 trips per specialist	72
		10 Beds	10 x 1 = 10	10
	Childcare Centre	70 Children	0.7 trips per child	49
2	Medi Hostel and Medi Serviced Apartments	12 x 2 bedroom 6 x 3 bedroom 24 hostel rooms	0.4-0.5/dwelling (RMS Medium density)	26
3	Hi-Tech Holistic Cancer and Medical Hospital	320 beds	*Assumption from Prelim assessment: 0.97 per bed reduced by 35 as staff accommodation on site	275
4	Self-care seniors housing	60 units 10 x 1 bedroom 40 x 2 bedroom 10 x 3 bedroom	0.4-0.5/dwelling (RMS Medium density)	25
5	Residential Care Facility and Hostel	130 beds	0.1/dwelling (RMS)	13
6	Holistic Health Care Course	On site use only	No traffic generation as for on-site use only	-
			Total	470

Notes:

*Assumptions are from the report titled *Traffic Impact Assessment* by Bruce Conneeley (August 2010) for the Preliminary Environmental Assessment.

**vtph = vehicle trips per hour

Stage 6 the proposed Holistic Health Care Course will not generate additional traffic to/from the site as the course will only be available for use by staff and patients of the facility. It should also be noted that Stage 2 the Medi Hostel and Medi Serviced Apartments would only be available for use by staff, patients and visitors.

Based on the above trip rates, the estimated peak hour traffic generation for the proposed development at each stage is provided in Table 8.

Table 8 Peak Hour Traffic Generation Potential

Stage	Morning Peak (vtph) IN	Morning Peak (vtph) OUT	Evening Peak (vtph) IN	Evening Peak (vtph) IN	Expected Year of Completion
1	66	66	66	66	2014-2015
2	13	13	13	13	2014-2015
3	137	137	137	137	2015-2016
4	13	13	13	13	2016-2017
5	6	6	6	6	2017-2018
6	-	-	-	-	2018-2019
Total	**235**	**235**	**235**	**235**	

The above table indicates that the peak movement to or from the proposed development would be in the order 470 vtph (one way) in the AM and PM peak period, which equates to 235 vph (two way).

3.3 Development Access

Warwick Street would initially be used to access Stages 1. The proposed Nolan Street access would be implemented prior to the operation of Stage 2. From then onwards the Warwick Street access would only service Stage 1 (Medical Centre, Day surgery and Respite Care Centre). There would be no through access from Warwick Street to the rest of the development (except for emergency access).

Vehicular access to the site would be provided by direct access to Nolan Street. The proposed access on Nolan Street would be the main visual entrance to the development, and the most direct access from the freeway, via Northcliffe Drive. The majority of vehicles including service vehicles would access the site through the Nolan Street access.

3.3.1 Sight Distance

In assessing this proposed development it is appropriate to assess the traffic safety of the proposed entry/exit locations to/from the site, by determining whether there is adequate longitudinal sight distance at the proposed access to allow drivers approaching the driveway sufficient sight distance to avoid potential conflicts. The specific sight distance criteria used in the report has been derived from the Austroads Publication “Guide to Traffic Engineering Practice, Part 5: Intersections at Grade” (2005) which specifies the following:

Approach Sight Distance (ASD)

This is the minimum requirement to provide the driver of a vehicle adequate distance to observe the road layout, including pavement markings, kerbs, islands, etc, in sufficient time to react and stop if necessary before entering the conflict area. Approach Sight Distance is measured from driver eye height (1.15m to 0.0m, i.e. the road surface).

Safe Intersection Sight Distance (SISD)

It provides sufficient sight distance for a driver of a vehicle on the major road to observe a vehicle from the minor road approach moving into a collision situation (e.g. in the worst case stalling across the traffic lanes), and to decelerate to stop before reaching the collision point. Safe Intersection Sight Distance is measured from the driver eye height (1.05m) to (1.05m).

A comparison of the required and available ASD and SISD for vehicles approaching and departing the proposed access road is set out in Table 4 for the vehicle speed of 50 km/h.

Table 9 Sight Distance Requirements

Driveway (Entry/Exit)	ASD (Minimum Requirement		SISD (Desirable Requirement)	
	Required	Measured	Required	Measured
Nolan Street 50 km/h	50 m	160 m (north) 90 m (south)	90 m	160 m (north) 90 m (south)

From the above assessment, it can be concluded that the proposed access arrangement meets a satisfactory level of traffic safety because it satisfies the sight distance requirements for both (ASD) and (SISD) measured in accordance with the definition set out in the Austroads publication.

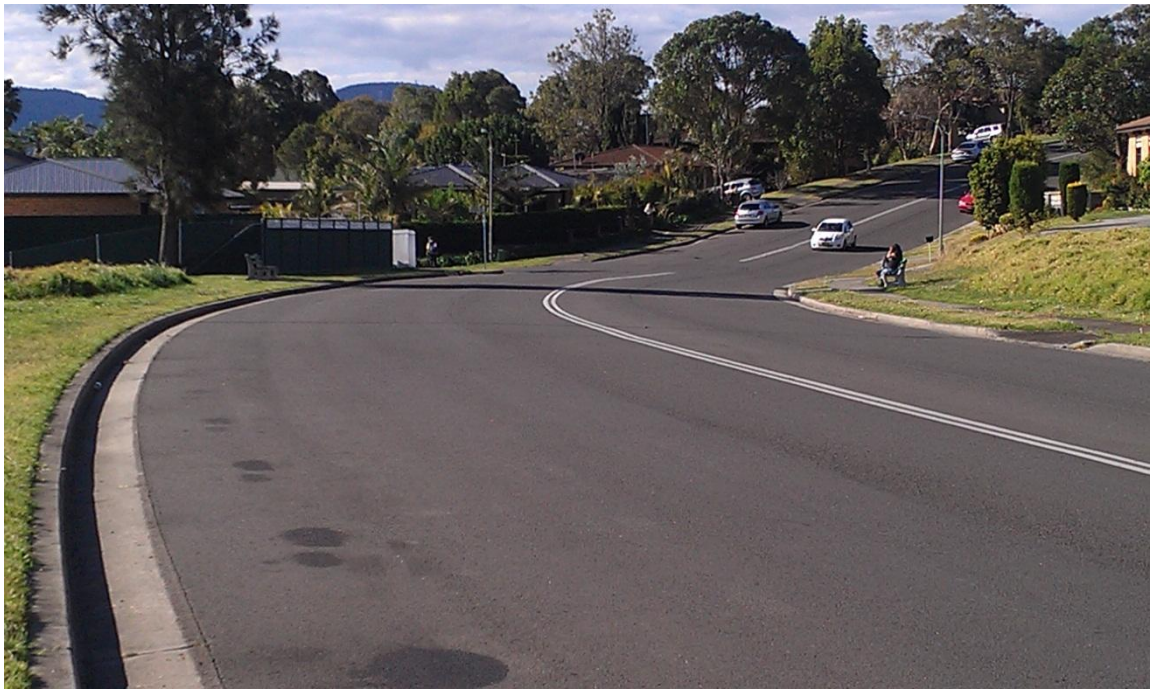


Photo 5 - Nolan Street looking northeast with the proposed development site on the left.

3.4 Parking Requirements

3.4.1 Parking Provision

Wollongong Development Control Plan 2009 Chapter E3: Carparking, Access, Servicing/loading Facilities and Traffic Management provides car parking requirements, based on a minimum parking provision, for various land uses. Where requirements could not be obtained in the DCP, the RTA *Guide to Traffic Generating Developments 2002* has been used as an alternative reference.

Table 10 Parking Requirements – Life City Wollongong

Stage	Component	Beds/Rooms/ Persons/GFA	Parking Requirements	No. Spaces (WCC DCP)	No. Spaces Provided
1	Medical Centre and day surgery Childcare Centre	3,664 m^2 GFA 70 Children	4 spaces per consulting room and 1 space per 3 employees 1 per 6 children 1 per staff present 1 accessible 2 large spaces	135 20	162
2	Medi Hostel and Medi Service Apartments	12 x 2 bedroom 6 x 3 bedroom 24 hostel rooms	housing attached dwelling (1 space per (<70 m2) hostel rooms) (1.5 per (70 - 110m2) 2 bedroom)(2 per >110m2) plus 0.2 per dwelling for visitors	56	56
3	Hi Tech Holistic Cancer and Medical Hospital	320 beds	1 space per 2 beds plus 1 space per practitioner and 1 per 2 employees	260	260 + 6 ambulance
4	Self-care seniors housing	10 x 1 bedroom 40 x 2 bedroom 10 x 3 bedroom	Seniors Housing 0.5 per bedroom	60	60
5	Residential Care Facility and Hostel	139 beds	1 space per 10 beds plus 1 per 2 employees	27	23
6	Holistic Health Care Course		on site use only no additional parking requirement	-	19
Total				558	580
Surplus Parking Spaces					**+22**

Notes: *Where no guidance from the DCP is provided an assumption has been made.

A total of 580 parking spaces in total would be provided within this development, which exceeds the required 558 parking spaces required under Wollongong City Councils DCP. At each stage of the development sufficient parking spaces would be provided on site as required under the DCP.

State Environmental Planning Policies – Housing for Seniors & People with a Disability (SEPP 5) does not include parking space measurement standards. Therefore, in accordance with the *Australian Standards AS 2890.1:2004 Parking Facilities, Part 1: Off-street Car Parking*, the parking space measurements will be as follows:

- 2.4 m wide;
- 4.8 m long (car parking is controlled by a kerb which allows overhang); and
- Aisle width of 5.8 m.

Accessible parking spaces are to be provided in accordance with AS 2890.6 (2009) as outlined in Schedule 2 of the DCP's chapter E3, 1 space is required for every 100 car parking spaces. Therefore a total of 6 accessible parking spaces will be provided in this development.

Accessible parking measurements will be in accordance with AS 2890.6 (2009) Section 2.2.1, which states a dedicated parking space of 2.4 m wide, 5.4 m long and must include a shared area on one side of the space that is also 2.4 m wide and 5.4 m long.

3.4.2 Service and Delivery Vehicles

A private contractor would be engaged to undertake refuse collection. A bin bay and service delivery area is located within each stage. Service areas and refuse collection would be accessed through the internal road network. Turning movements have been assessed in Auto Turn for the internal road network which has confirmed that an 8.8 m refuse vehicle and rigid truck movements can be accommodated on site and that the trucks would be able to exit the site in a forward direction.

Auto Turn was also used to assess turning movement requirements for an ambulance accessing the front of the hospital this can be accommodated (swept turning paths are attached in Appendix E).

3.4.3 Bicycle / Motorcycle Parking

Bicycle parking is to be included within this development and designed in accordance with AS 2890.3 and provided as per Schedule 1 of the DCP's Chapter E3. Spaces provided for each stage of the development are shown in Table 11.

Table 11 Bicycle / Motorcycle Parking

Stage	Component	No. of Bicycle Parking Spaces	No. of Motorcycle Parking Spaces
1	Medical centre and day surgery and childcare centre	9	-
2	Medi Hostel and Medi Serviced Apartments	4	-
3	Hi Tech Holistic Cancer and medical Hospital	52	10
4	Self-care seniors living	-	-
5	Residential Care Facility and hostel	-	-
6	Holistic Health Care Course	-	-
	Total	**65**	**10**

3.5 Intersection Performance

3.5.1 Background Traffic Growth

Background traffic growth has been obtained from the Wollongong Shoalhaven (WOLSH) strategic traffic model. Background traffic growth has been obtained for 2021 (the year of full development) and also the 10 year horizon year, 2031. Background traffic growth has been added to observed 2012 volumes and traffic generated by the development added to the forecast future year volumes.

A summary of peak hour traffic growth from the WOLSH model on each the key roads in the study area by 2031 is shown in Table 12.

Table 12 WOLSH Model Forecast Traffic Flows

Street	AM Peak Hour (vph)	PM Peak Hour (vph)
Warwick Street west of Nolan Street	0	0
Nolan Street north of Warwick Street	+71	+109
Nolan Street South of Warwick Street	+71	+109
Nolan Street east of Princes Highway	+66	+117
Northcliffe Drive north of Nolan Street	+477	+547
Princes Highway west of Nolan Street	+397	+483

3.5.2 Proposed Traffic Distribution

Vehicles can access the development site via Nolan Street and Warwick Street, either from the south, Southern Freeway via Northcliffe Drive or the north from Princes Highway.

The Nolan Street access would be developed as the main access to the site, all visitors, deliveries, service vehicles would be expected to use this access. The Warwick Street access would provide access to Stage 7 – the residential care facility and to the northern section of Stage 1 – the medical centre. There would be no through access (except for emergency access) from Warwick Street to the rest of the development once the Nolan Street access is operational, and this would be controlled by a gate. Based on this, it has been assumed that:

- 72% of the development traffic would enter and exit via the Nolan Street access; and
- 28% of the development traffic would enter and exit via the Warwick Street access.

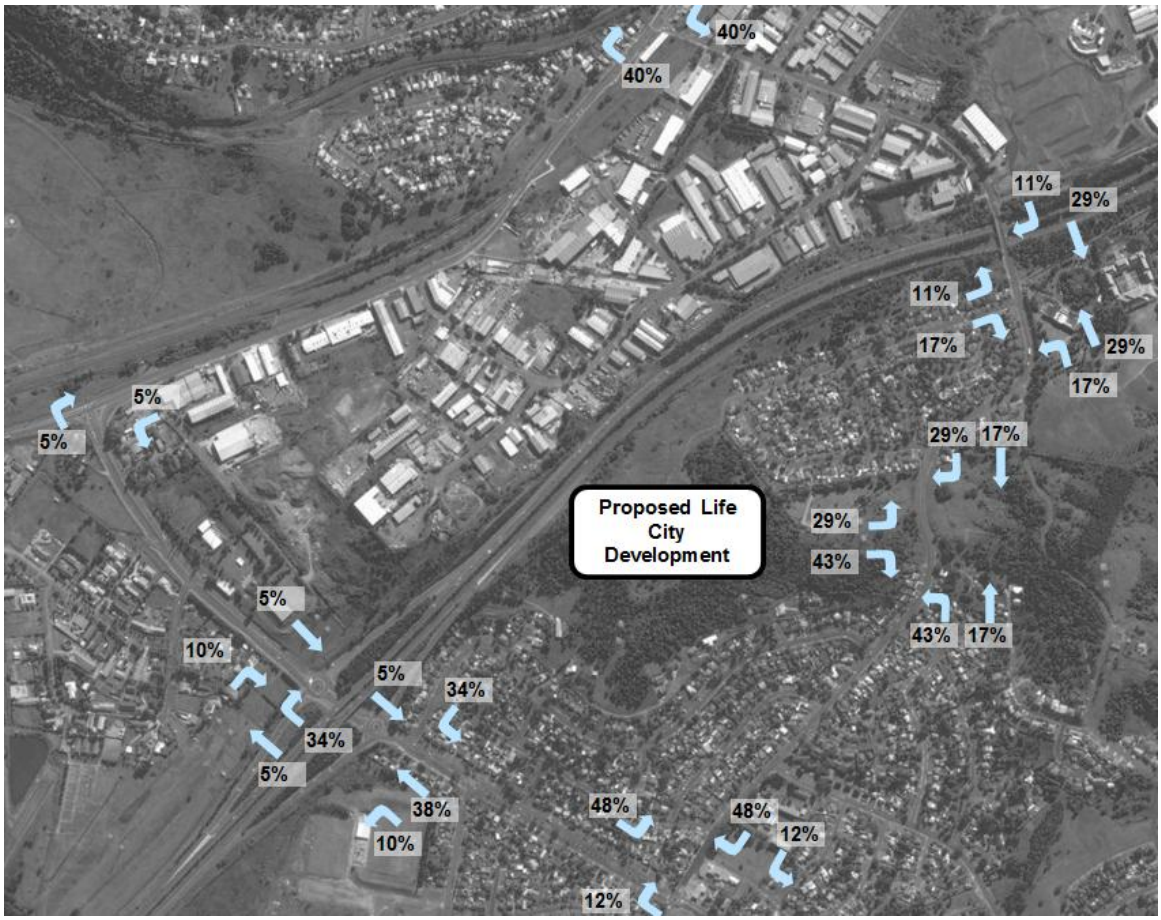
The existing AM and PM peak traffic distributions on Nolan Street have been reviewed to determine the expected distribution for the development traffic, taking into consideration the surrounding road network and accessibility to the M1 Motorway it has been assumed that:

- 60% of development traffic would be to/from Northcliffe Drive (Southern Freeway); and
- 40% of development traffic would be to/from the Princes Highway.

Figure 5 shows how the proposed development traffic has been assigned on the surrounding road network.

Detailed traffic assignment for the 2021 and 2031 forecast years are provided in Appendix F.

Figure 5 –Proposed Traffic Distribution



3.5.3 2021 Intersection Operating Performance

The future traffic volumes have been calculated by adding the traffic growth from the WOLSH model to the 2012 surveyed traffic flows presented in Table 2 and then adding the development traffic flows. Estimated future 2021 traffic flows were analysed using SIDRA to obtain the operation of key intersections in the study area. A summary of the 2021 intersection performance is shown in Table 13.

Table 13 Intersection Performance AM and PM Peak Hour –Traffic Conditions 2021 (with development)

Intersection	Morning Peak			Evening Peak		
	Av Delay (s)	LoS	DoS	Av Delay (s)	LoS	DoS
Nolan St/Life City Access	26	B	0.5	26	B	0.5
Nolan St/Northcliffe Dr	15	B	0.5	15	B	0.6
Nolan St/Warwick St	20	B	0.3	21	B	0.3
Nolan St/Princes Hwy	23	B	0.9	23	B	0.8
Northcliffe Dr/Southern Fwy Southbound on/off ramps	16	B	0.5	17	B	0.7
Northcliffe Dr/Southern Fwy Northbound on/off ramps	15	B	0.5	15	B	0.5
Princes Hwy/Northcliffe Drive	26	B	0.9	22	B	0.8

3.5.4 2031 Intersection Operating Performance

Estimated future 2031 traffic flows were analysed using SIDRA to obtain the operation of key intersections in the study area. A summary of the 2031 intersection performance is shown in Table 14.

Table 14 Intersection Performance AM and PM Peak Hour –Traffic Conditions 2031 (with development)

Intersection	Morning Peak			Evening Peak		
	Av Delay (s)	LoS	DoS	Av Delay (s)	LoS	DoS
Nolan St/Life City Access	28	B	0.6	29	C	0.6
Nolan St/Northcliffe Dr	16	B	0.5	17	B	0.7
Nolan St/Warwick St	21	B	0.3	23	B	0.3
Nolan St/Princes Hwy	26	B	0.9	26	B	0.8
Northcliffe Dr/Southern Fwy Southbound on/off ramps	16	B	0.6	27	B	0.9
Northcliffe Dr/Southern Fwy Northbound on/off ramps	23	B	0.7	20	B	0.7
Princes Hwy/Northcliffe Drive	37	C	0.9	31	C	0.9

In the previous traffic assessment (GHD May 2013) the Nolan Street/Life City Access results showed that the proposed new intersection would operate near to capacity by 2031 and therefore a proposed roundabout arrangement was assessed. Due to a proposed reduction in development at this site and hence a reduction in traffic generation analysis now shows that the intersection would continue to operate satisfactorily in their existing configurations up to 2031 in both the AM and PM peaks

Based on the intersection analysis undertaken in this study, it can be concluded that traffic generated by the 'Life City' development under the 2021 and 2031 horizon years can be accommodated on the existing network.

3.5.5 2031 Midblock Operating Performance

A summary of the midblock flows at key points on key roads in the study area is shown in Table 15.

Table 15 2031 Forecast Midblock Traffic Volumes

Location	AM Peak Hour (vph)	PM Peak Hour (vph)	Daily* (vpd)
Warwick Street west of Nolan Street	186	198	1,920
Nolan Street north of Warwick Street	685	798	7,415
Nolan Street South of Warwick Street	724	808	7,660
Nolan Street east of Princes Highway	725	840	7,825
Northcliffe Drive north of Nolan Street	1,591	1,976	17,835
Princes Highway west of Nolan Street	1,645	1,623	16,340

Note: *daily traffic volumes have been estimates based on the assumption that the average peak hour traffic flow is approximately 10% of the daily traffic volume.

Analysis of the 2031 forecast midblock traffic flows that the forecast traffic flows on key streets in the study area remain within acceptable environmental flow limits for their function within the road hierarchy.

3.6 Sensitivity Testing

In GHD's previous traffic assessment dated May 2013 the intersection assessment undertaken in section 3.5 was based on mode share assumptions previously identified in proposed land uses of the development which generally reflected an increased proportion of trips using public transport. Therefore in the previous assessment a sensitivity test was undertaken to determine whether the intersection requirements would change if these mode share assumptions were not realised and mode share to public transport stayed the same as is currently observed in the area. However, due to changes in the land uses in this proposed development there are no longer any land uses within the development that are assuming a proportion of public transport. Section 3.5 now identifies the worst case scenario for traffic generation assuming no public transport usage.

3.6.1 Future Public and Active Transport Opportunities

Life City aims to enhance opportunities for walking, cycling and public transport. To achieve this, the development will include:

- Pedestrian paths throughout the Life City development connecting into the existing pedestrian network on Nolan Street;
- Bicycle parking areas to encourage cycling; and
- Bus stops throughout Life City development so that existing bus services can be extended to include Life City.

In order to support public transport usage there is an opportunity for Life City to implement workplace travel plans. It is recommended that the following elements of workplace travel plans be integrated into the development of Life City:

- Providing a shuttle bus service to and from Unanderra and/or Kembla Grange railway station;
- Setting up a car sharing scheme;
- Developing public transport information programs and promotions;
- Providing and encouraging the use of the local pedestrian environment;
- Providing and encouraging the use of cycle facilities;
- Negotiating service requirements with transport agencies; and
- Developing attractive flexible working practises.

4. Conclusions

The following conclusions are made based on the above investigations:

4.1 Access Arrangements

- Vehicular access to the site would be provided by direct access to Nolan Street as well as a secondary access from Warwick Street. The proposed access on Nolan Street would be the main visual entrance to the development, and the most direct access from the freeway, via Northcliffe Drive. The majority of vehicles including servicing vehicles would access the site through the Nolan Street access. The Warwick Street access would only service the Medical Centre (Stage 1). There would be no through access from Warwick Street to the rest of the development, except for emergency access.
- The proposed Life City Access with Nolan Street provides a satisfactory level of traffic safety under the current speed environment, as it satisfies the minimum sight distance requirement (ASD) and the desirable sight distance (SISD) measured in accordance with the definition set out in the Austroads publication.
- An assessment of crash data in the vicinity of the site showed that there were 22 crashes recorded over a 5 year period on Nolan Street. These crashes appear to be spread over the route and not concentrated in one particular area and are not indicative of any traffic safety issues on the study area.
- Auto Turn assessments show that an ambulance can access the hospital and that an 8.8 m refuse truck/rigid vehicle can access the site along the proposed internal access roads.

4.2 Parking Arrangements

- A total of 580 parking spaces in total would be provided within this development, which exceeds the parking spaces required under Wollongong City Councils DCP. Ambulances spaces are provided directly in front of the hospital.
- The proposed car parking spaces and vehicular access arrangements will be designed in accordance with AS 2890.1:2004 Parking Facilities, Part 1: Off-street Car Parking.

4.3 Traffic Impact

- The peak movement to or from the proposed development would be in the order 470 vtph (one way) in the AM and PM peak period, which equates to 235 vph (two way).
- In the previous traffic assessment (GHD May 2013) the Nolan Street/Life City Access results showed that the proposed new intersection would operate near to capacity by 2031 and therefore a proposed roundabout arrangement was assessed. Due to a proposed reduction in development at this site and hence a reduction in traffic generation analysis now indicates that the intersection will continue to operate satisfactorily in 2031 in both the AM and PM peaks.
- Warwick Street would only provide access to the Medical Centre (Stage 1). No access through to the rest of the development (except emergency access) would ensure that the amenity of Warwick Street would not adversely be impacted.
- The performance outputs from SIDRA intersection analysis indicate that the road network surrounding the Life City development would operate satisfactorily under forecast 2021 and 2031 traffic flows, including background traffic growth and traffic generated by the development during both AM and PM peak periods.

- Analysis of the 2031 forecast midblock traffic flows that the forecast traffic flows on key streets in the study area remain within acceptable environmental flow limits for their function within the road hierarchy.
- The intersection analysis has been undertaken assuming no public transport usage to or from the development, which provides a worst case scenario. Life City aims to enhance opportunities for walking, cycling and public transport through connections from the development to the existing road network.

4.4 Public Transport

- As the bus route 34 from Warrawong to Wollongong already travels through Nolan Street, there could be the opportunity extend the bus route to include a loop through the Life City Development to encourage public transport usage to the site.
- Life City could provide a shuttle bus service to and from Unanderra and/or Kembla grange railway stations in order to encourage additional public transport usage.
- There is an opportunity for Life City to implement workplace travel plans in order to support higher public transport usage.

Therefore, it is concluded that the existing road network in the study area has sufficient capacity to accommodate the proposed Life City Wollongong Development and would continue to operate satisfactorily under the forecast 2021 and 2031 AM and PM peak.

Appendices

Appendix A - Traffic Volumes

TCS Instruments

TCS Instruments - People and Vehicle Counting

SURVEY DETAILS

DAY /DATE	FINE			
WEATHER	11/10/2012			
survey period	7	To	9	
	16	To	18	
		To		
Intersection	PRINCESS HWY			
	NOLAN STREET			
Client reference				
Description:	Traffic Counts (15mins & 1hour Data)			

Prepared for

GHD

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Level 15 133 Castlereagh Street Sydney NSW 2000 Australia

Screenshot of intersection

North Bound

VARIABLE HOURLY VEHICLE SUMMARY

Hour Starting: 8:00 | All vehicles

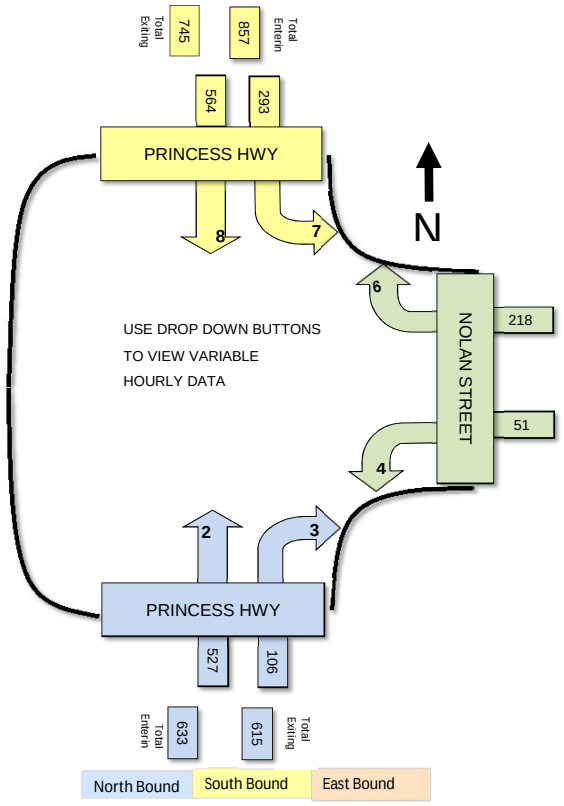
VEHICLE PEAKS

AM Peak	**7:45**	**to**	**8:45**	**2144**
PM Peak	**16:00**	**to**	**17:00**	**2052**

DAILY TOTAL	AM	PM
Cars	**2665**	**3001**
Trucks	**158**	**55**
Buses	**75**	**43**
Articulated	**0**	**0**
Moterbikes	**0**	**0**

TOTALS	**2898**	3099
Total Vehicles through intersection all day		**5997**

	AM	PM
PEDESTRIANS		
Total Pedestrians through intersection all day		0



Total Exiting 399

Total Entering 269

North Bound | South Bound | East Bound

TCS Instruments

TCS Instruments - People and Vehicle Counting

SURVEY DETAILS

DAY /DATE	FINE			
WEATHER	11/10/2012			
survey period	7	To	9	
	16	To	18	
		To		
Intersection	PRINCESS HWY			
	NOLAN STREET			
Client reference				
Description:	Traffic Counts (15mins & 1hour Data)			

Prepared for

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Level 15 133 Castlereagh Street Sydney NSW 2000 Australia

Screenshot of intersection

North Bound

VARIABLE HOURLY VEHICLE SUMMARY

Hour Starting: 16:00 | All vehicles

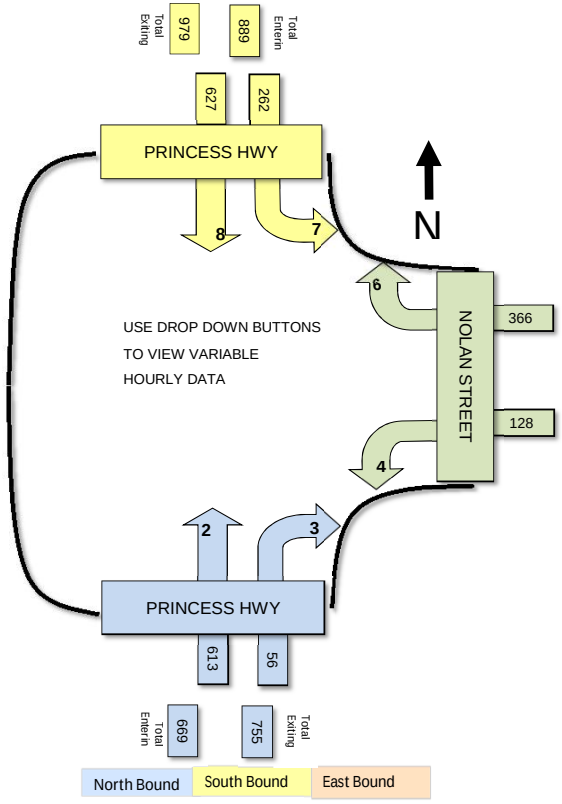
VEHICLE PEAKS

AM Peak	7:45	to	8:45	2144
PM Peak	16:00	to	17:00	2052

DAILY TOTAL	AM	PM
Cars	2665	3001
Trucks	158	55
Buses	75	43
Articulated	0	0
Moterbikes	0	0

TOTALS	2898	3099
Total Vehicles through intersection all day		5997

	AM	PM
PEDESTRIANS		
Total Pedestrians through intersection all day		0



Total Exiting 318

Total Entering 494

North Bound | South Bound | East Bound

TCS Instruments

TCS Instruments - People and Vehicle Counting

SURVEY DETAILS

DAY /DATE	FINE			
WEATHER	11/10/2012			
survey period	7	To	9	
	16	To	18	
		To		
Intersection	NOLAN ST			
	ENTER STREET			
Client reference				
Description:	Traffic Counts (15mins & 1hour Data)			

Prepared for

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North Bound Leg

Screenshot of intersection

VARIABLE HOURLY VEHICLE SUMMARY

Hour Starting: 8:00 | All vehicles

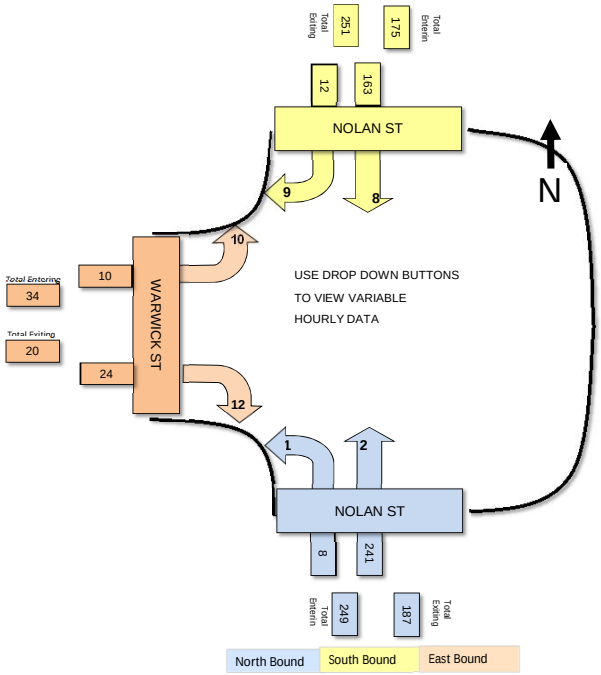
VEHICLE PEAKS

AM Peak	7:45	to	8:45	573
PM Peak	16:00	to	17:00	657

DAILY TOTAL	AM	PM
Cars	774	944
Trucks	26	19
Buses	35	18
Articulated	0	0
Moterbikes	0	0

TOTALS	835	981
Total Vehicles through intersection all day		1816

	AM	PM
PEDESTRIANS		
Total Pedestrians through intersection all day		0



TCS Instruments

TCS Instruments - People and Vehicle Counting

SURVEY DETAILS

DAY /DATE	FINE			
WEATHER	11/10/2012			
survey period	7	To	9	
	16	To	18	
		To		
Intersection	NOLAN ST			
	ENTER STREET			
Client reference				
Description:	Traffic Counts (15mins & 1hour Data)			

Prepared for

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Level 15 133 Castlereagh Street Sydney NSW 2000 Australia

North Bound Leg

Screenshot of intersection

VARIABLE HOURLY VEHICLE SUMMARY

Hour Starting: 16:00 | All vehicles

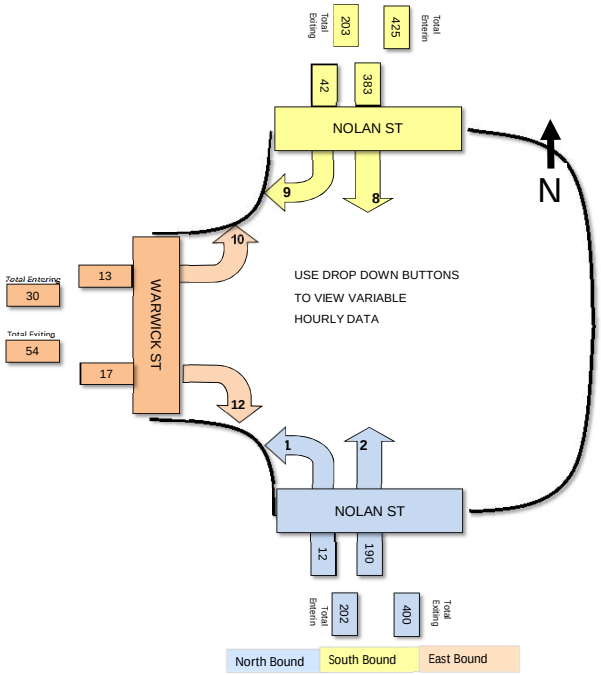
VEHICLE PEAKS

AM Peak	7:45	to	8:45	573
PM Peak	16:00	to	17:00	657

DAILY TOTAL	AM		PM
Cars	774		944
Trucks	26		19
Buses	35		18
Articulated	0		0
Moterbikes	0		0

TOTALS	835		981
Total Vehicles through intersection all day			1816

	AM		PM
PEDESTRIANS			
Total Pedestrians through intersection all day			0



TCS Instruments

TCS Instruments - People and Vehicle Counting

SURVEY DETAILS

DAY /DATE	FINE			
WEATHER	11/10/2012			
survey period	7	To	9	
	16	To	18	
		To		
Intersection	BEDFORD STREET			
	NORTHCLIFFE DRIVE			
Client reference				
Description:	Pedestrians & Traffic Counts (15mins & 1hour Data)			

Prepared for

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Screenshot of intersection

North Bound Leg

VARIABLE HOURLY VEHICLE SUMMARY

Hour Starting: 8:00 | All vehicles

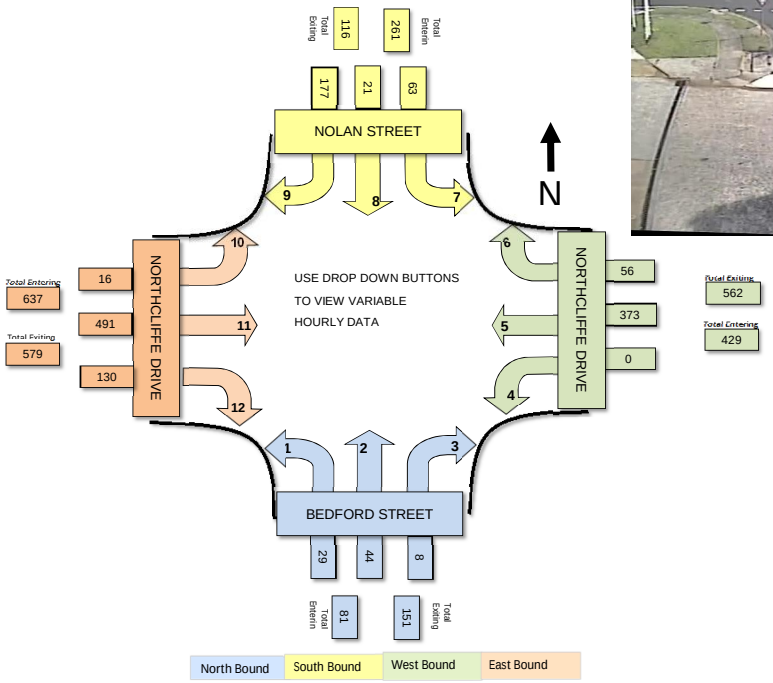
VEHICLE PEAKS

AM Peak	7:45	to	8:45	1729
PM Peak	16:00	to	17:00	2043

DAILY TOTAL	AM	PM
Cars	2226	3001
Trucks	110	35
Buses	47	24
Articulated	0	0
Moterbikes	0	0

TOTALS	**2383**	3060
Total Vehicles through intersection all day		**5443**

	AM	PM
PEDESTRIANS		
Total Pedestrians through intersection all day		0



North Bound | South Bound | West Bound | East Bound

TCS Instruments

TCS Instruments - People and Vehicle Counting

SURVEY DETAILS

DAY /DATE	FINE			
WEATHER	11/10/2012			
survey period	7	To	9	
	16	To	18	
		To		
Intersection	BEDFORD STREET			
	NORTHCLIFFE DRIVE			
Client reference				
Description:	Pedestrians & Traffic Counts (15mins & 1hour Data)			

Prepared for

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Level 15 133 Castlereagh Street Sydney NSW 2000 Australia

Screenshot of intersection

North Bound Leg

VARIABLE HOURLY VEHICLE SUMMARY

Hour Starting: 16:00 | All vehicles

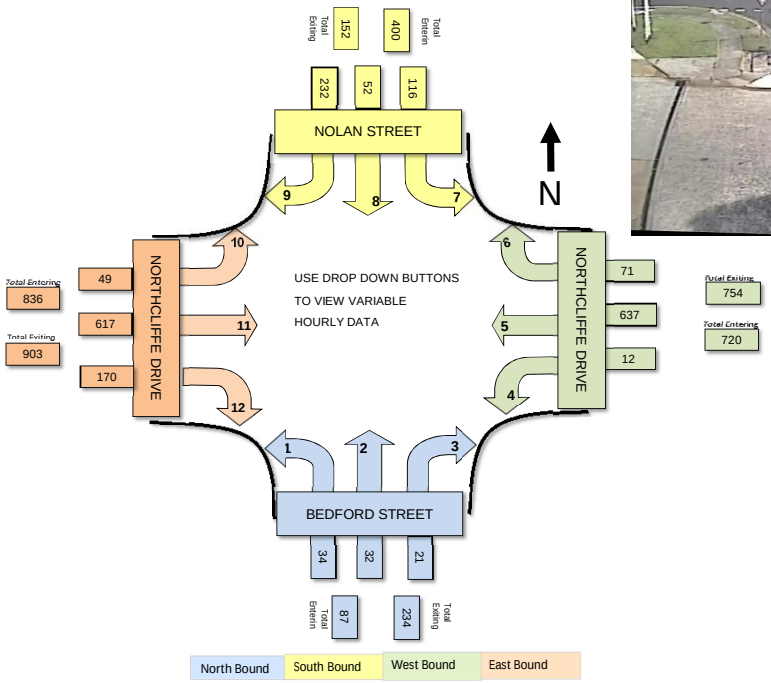
VEHICLE PEAKS

AM Peak	7:45	to	8:45	1729
PM Peak	16:00	to	17:00	2043

DAILY TOTAL	AM	PM
Cars	2226	3001
Trucks	110	35
Buses	47	24
Articulated	0	0
Moterbikes	0	0

TOTALS	**2383**	3060
Total Vehicles through intersection all day		**5443**

PEDESTRIANS	AM	PM
Total Pedestrians through intersection all day		0



TCS Instruments

TCS Instruments - People and Vehicle Counting

SURVEY DETAILS

DAY /DATE	FINE			
WEATHER	11/10/2012			
survey period	7	To	9	
	16	To	18	
		To		
Intersection	SOUTHERN FREEWAY SB ENTRY			
	NORTHCLIFFE DRIVE			
Client reference				
Description:	Traffic Counts (15mins & 1hour Data)			

Prepared for

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Level 15 133 Castlereagh Street Sydney NSW 2000 Australia

Screenshot of intersection

North Bound Leg

VARIABLE HOURLY VEHICLE SUMMARY

Hour Starting: 8:00 | All vehicles

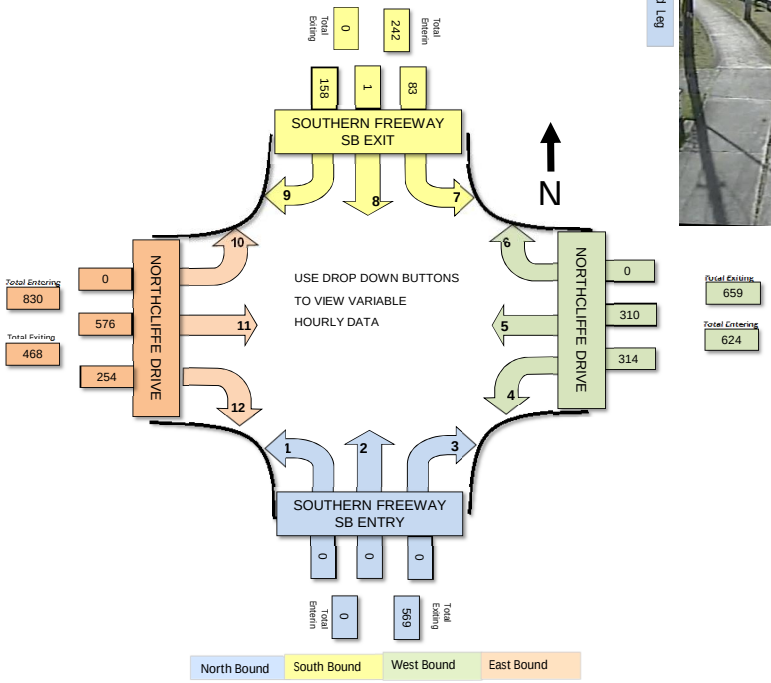
VEHICLE PEAKS

AM Peak	**7:45**	**to**	**8:45**	**2108**
PM Peak	**16:00**	**to**	**17:00**	**2530**

DAILY TOTAL	AM	PM
Cars	**2686**	**3748**
Trucks	**191**	**67**
Buses	**47**	**11**
Articulated	**0**	**0**
Moterbikes	**0**	**0**

TOTALS	**2924**	3826
Total Vehicles through intersection all day		**6750**

	AM	PM
PEDESTRIANS		
Total Pedestrians through intersection all day		0



TCS Instruments

TCS Instruments - People and Vehicle Counting

SURVEY DETAILS

DAY /DATE	FINE			
WEATHER	11/10/2012			
survey period	7	To	9	
	16	To	18	
		To		
Intersection	SOUTHERN FREEWAY SB ENTRY			
	NORTHCLIFFE DRIVE			
Client reference				
Description:	Traffic Counts (15mins & 1hour Data)			

Prepared for

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Level 15 133 Castlereagh Street Sydney NSW 2000 Australia

Screenshot of intersection

North Bound Leg

VARIABLE HOURLY VEHICLE SUMMARY

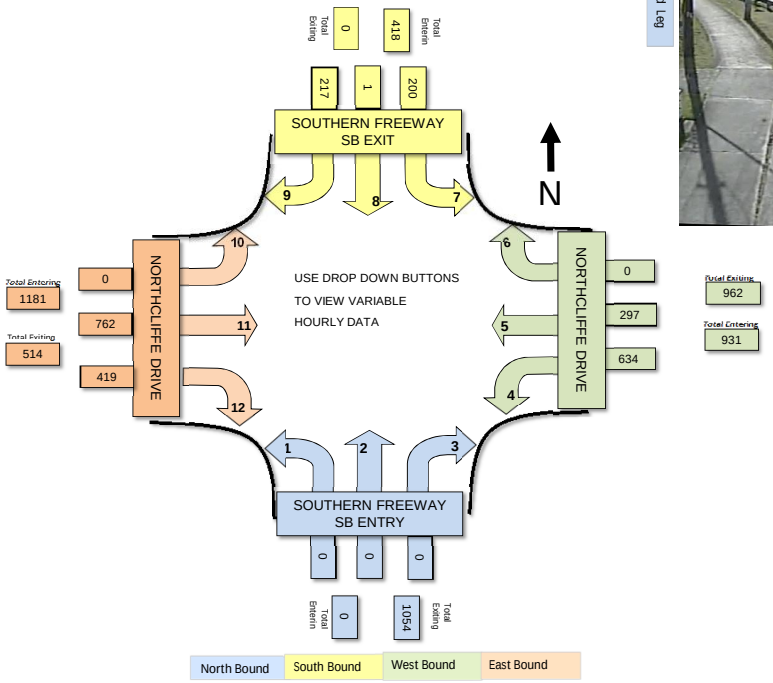
Hour Starting: 16:00 | All vehicles

VEHICLE PEAKS

AM Peak	**7:45**	**to**	**8:45**	**2108**
PM Peak	**16:00**	**to**	**17:00**	**2530**

DAILY TOTAL	AM		PM
Cars	**2686**		**3748**
Trucks	**191**		**67**
Buses	**47**		**11**
Articulated	**0**		**0**
Moterbikes	**0**		**0**
TOTALS	**2924**		3826
Total Vehicles through intersection all day			**6750**

	AM		PM
PEDESTRIANS			
Total Pedestrians through intersection all day			0



TCS Instruments

TCS Instruments - People and Vehicle Counting

SURVEY DETAILS

DAY /DATE	FINE			
WEATHER	11/10/2012			
survey period	7	To	9	
	16	To	18	
		To		
Intersection	SOUTHERN FREEWAY NB EXIT			
	NORTHCLIFFE DRIVE			
Client reference				
Description:	Pedestrians & Traffic Counts (15mins & 1hour Data)			

Prepared for

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Level 15 133 Castlereagh Street Sydney NSW 2000 Australia

Screenshot of intersection

North Bound Leg

VARIABLE HOURLY VEHICLE SUMMARY

Hour Starting: 8:00 | All vehicles

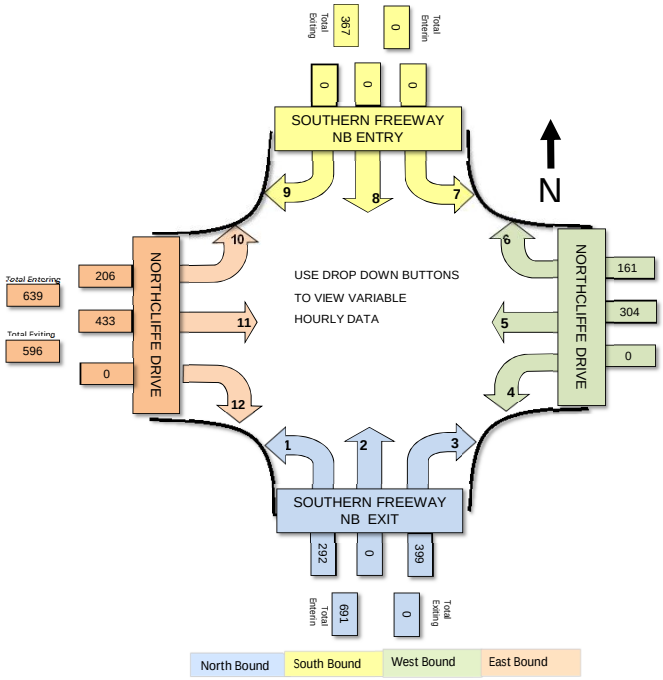
VEHICLE PEAKS

AM Peak	7:45	to	8:45	2225
PM Peak	16:00	to	17:00	2173

DAILY TOTAL	AM	PM
Cars	2900	3137
Trucks	245	84
Buses	32	14
Articulated	0	0
Moterbikes	0	0

TOTALS	3177	3235
Total Vehicles through intersection all day		6412

PEDESTRIANS	AM	PM
Total Pedestrians through intersection all day		0



North Bound | South Bound | West Bound | East Bound

TCS Instruments

TCS Instruments - People and Vehicle Counting

SURVEY DETAILS

DAY /DATE	FINE			
WEATHER	11/10/2012			
survey period	7	To	9	
	16	To	18	
		To		
Intersection	SOUTHERN FREEWAY NB EXIT			
	NORTHCLIFFE DRIVE			
Client reference				
Description:	Pedestrians & Traffic Counts (15mins & 1hour Data)			

Prepared for

GHD

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Screenshot of intersection

North Bound Leg

VARIABLE HOURLY VEHICLE SUMMARY

Hour Starting: 16:00 | All vehicles

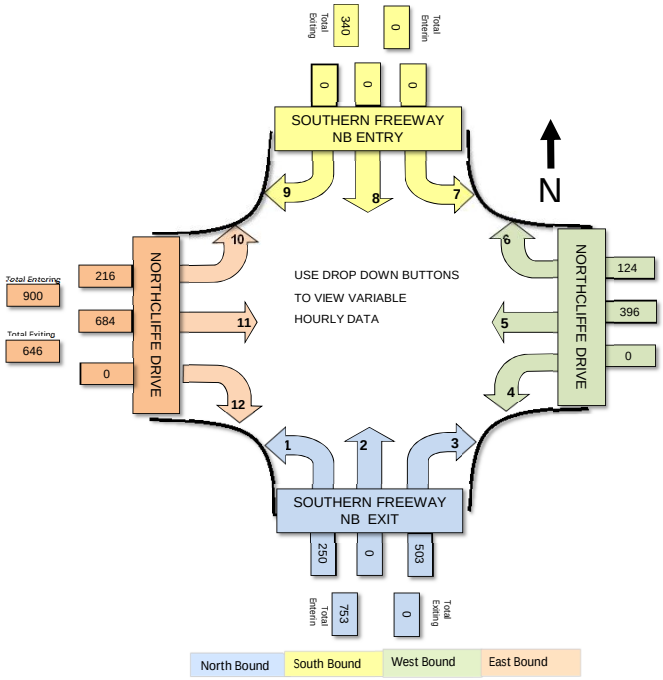
VEHICLE PEAKS

AM Peak	7:45	to	8:45	2225
PM Peak	16:00	to	17:00	2173

DAILY TOTAL	AM		PM
Cars	2900		3137
Trucks	245		84
Buses	32		14
Articulated	0		0
Moterbikes	0		0

TOTALS	**3177**		3235
Total Vehicles through intersection all day			**6412**

	AM		PM
PEDESTRIANS			
Total Pedestrians through intersection all day			0



North Bound | South Bound | West Bound | East Bound

TCS Instruments

TCS Instruments - People and Vehicle Counting

SURVEY DETAILS

DAY /DATE	FINE			
WEATHER	11/10/2012			
survey period	7	To	9	
	16	To	18	
		To		
Intersection	PRINCES HIGHWAY			
	NORTHCLIFFE DRIVE			
Client reference				
Description:	Traffic Counts (15mins & 1hour Data)			

Prepared for

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Level 15 133 Castlereagh Street Sydney NSW 2000 Australia

Screenshot of intersection

North Bound

VARIABLE HOURLY VEHICLE SUMMARY

Hour Starting: 8:00 | All vehicles

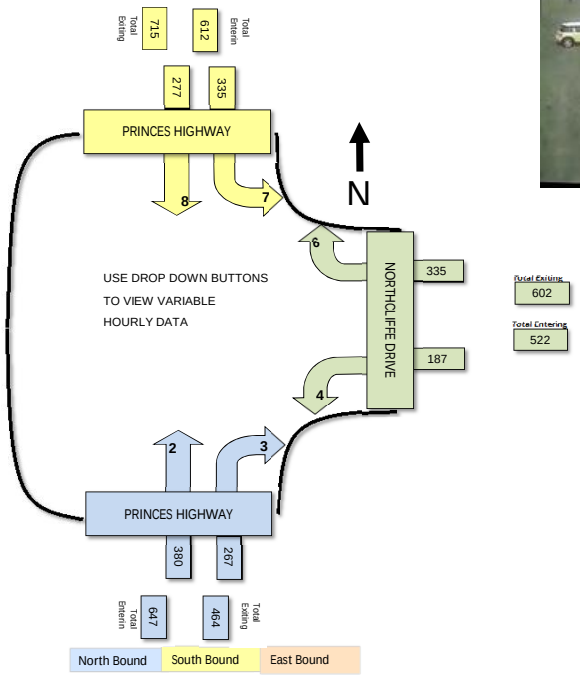
VEHICLE PEAKS

AM Peak	7:45	to	8:45	2270
PM Peak	16:00	to	17:00	2405

DAILY TOTAL	AM		PM
Cars	2949		3437
Trucks	257		101
Buses	58		36
Articulated	0		0
Moterbikes	0		0

TOTALS	3264		3574
Total Vehicles through intersection all day			6838

	AM		PM
PEDESTRIANS			
Total Pedestrians through intersection all day			0



Total Exiting
602

Total Entering
522

TCS Instruments

TCS Instruments - People and Vehicle Counting

SURVEY DETAILS

DAY /DATE	FINE			
WEATHER	11/10/2012			
survey period	7	To	9	
	16	To	18	
		To		
Intersection	PRINCES HIGHWAY			
	NORTHCLIFFE DRIVE			
Client reference				
Description:	Traffic Counts (15mins & 1hour Data)			

Prepared for

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Screenshot of intersection

North Bound

VARIABLE HOURLY VEHICLE SUMMARY

Hour Starting: 16:00 | All vehicles

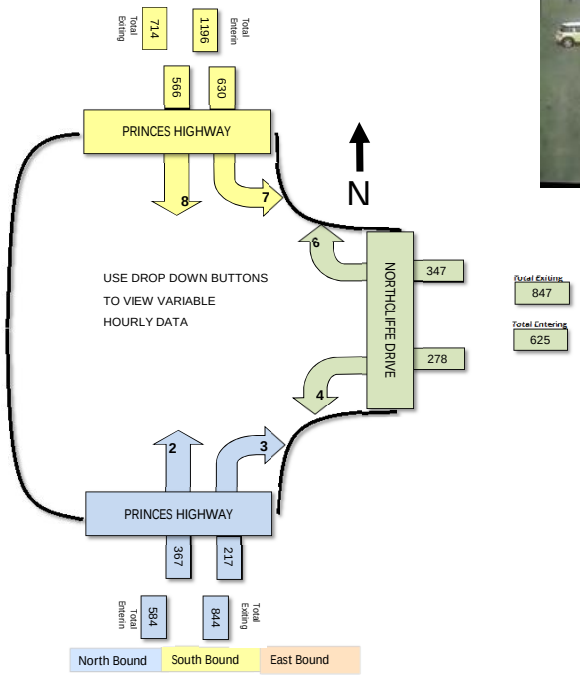
VEHICLE PEAKS

AM Peak	7:45	to	8:45	2270
PM Peak	16:00	to	17:00	2405

DAILY TOTAL	AM	PM
Cars	2949	3437
Trucks	257	101
Buses	58	36
Articulated	0	0
Moterbikes	0	0

TOTALS	3264	3574
Total Vehicles through intersection all day		6838

	AM	PM
PEDESTRIANS		
Total Pedestrians through intersection all day		0



Total Exiting
847

Total Entering
625

Appendix B – SIDRA Outputs

MOVEMENT SUMMARY

Site: Life City Access/Nolan Street
2021 + Growth + Dev AM

Life City Access/Nolan Drive
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Nolan Street South											
1	L	106	0.0	0.057	8.2	LOS A	0.0	0.0	0.00	0.67	49.0
2	T	327	6.0	0.174	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		434	4.5	0.174	2.0	NA	0.0	0.0	0.00	0.16	56.9
North: Nolan Street North											
8	T	336	5.0	0.178	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
9	R	72	0.0	0.077	10.4	LOS A	0.3	2.1	0.46	0.73	46.5
Approach		407	4.1	0.178	1.8	NA	0.3	2.1	0.08	0.13	57.1
West: Life City Access											
10	L	72	0.0	0.520	25.8	LOS B	2.9	20.2	0.73	1.13	35.9
12	R	106	0.0	0.520	25.7	LOS B	2.9	20.2	0.73	1.13	36.0
Approach		178	0.0	0.520	25.7	LOS B	2.9	20.2	0.73	1.13	35.9
All Vehicles		1019	3.6	0.520	6.1	NA	2.9	20.2	0.16	0.32	51.7

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: Life City Access/Nolan Street
2021 + Growth + Dev PM

Life City Access/Nolan Drive
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Nolan Street South											
1	L	107	0.0	0.058	8.2	LOS A	0.0	0.0	0.00	0.67	49.0
2	T	243	12.0	0.134	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		351	8.3	0.134	2.5	NA	0.0	0.0	0.00	0.20	56.1
North: Nolan Street North											
8	T	419	2.0	0.218	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
9	R	73	0.0	0.081	10.0	LOS A	0.3	2.0	0.42	0.71	46.9
Approach		492	1.7	0.218	1.5	NA	0.3	2.0	0.06	0.10	57.7
West: Life City Access											
10	L	73	0.0	0.520	25.6	LOS B	2.9	20.5	0.70	1.09	36.0
12	R	107	0.0	0.520	25.5	LOS B	2.9	20.5	0.70	1.12	36.0
Approach		180	0.0	0.520	25.6	LOS B	2.9	20.5	0.70	1.11	36.0
All Vehicles		1022	3.7	0.520	6.1	NA	2.9	20.5	0.15	0.32	51.7

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: Life City Access/Nolan Street
2031 + Growth + Dev AM

Life City Access/Nolan Drive
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Nolan Street South											
1	L	106	0.0	0.057	8.2	LOS A	0.0	0.0	0.00	0.67	49.0
2	T	352	6.0	0.187	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		458	4.6	0.187	1.9	NA	0.0	0.0	0.00	0.15	57.0
North: Nolan Street North											
8	T	346	5.0	0.183	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
9	R	72	0.0	0.079	10.6	LOS A	0.3	2.2	0.47	0.74	46.4
Approach		418	4.1	0.183	1.8	NA	0.3	2.2	0.08	0.13	57.1
West: Life City Access											
10	L	72	0.0	0.553	27.7	LOS B	3.1	21.8	0.76	1.18	34.8
12	R	106	0.0	0.553	27.6	LOS B	3.1	21.8	0.76	1.14	34.9
Approach		178	0.0	0.553	27.6	LOS B	3.1	21.8	0.76	1.16	34.9
All Vehicles		1054	3.6	0.553	6.2	NA	3.1	21.8	0.16	0.31	51.6

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: Life City Access/Nolan Street
2031 + Growth + Dev PM

Life City Access/Nolan Drive
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Nolan Street South											
1	L	107	0.0	0.058	8.2	LOS A	0.0	0.0	0.00	0.67	49.0
2	T	266	12.0	0.147	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		374	8.6	0.147	2.4	NA	0.0	0.0	0.00	0.19	56.4
North: Nolan Street North											
8	T	448	2.0	0.233	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
9	R	73	0.0	0.082	10.2	LOS A	0.3	2.0	0.43	0.72	46.8
Approach		521	1.7	0.233	1.4	NA	0.3	2.0	0.06	0.10	57.7
West: Life City Access											
10	L	73	0.0	0.569	28.6	LOS C	3.3	23.1	0.74	1.15	34.3
12	R	107	0.0	0.569	28.5	LOS C	3.3	23.1	0.74	1.15	34.3
Approach		180	0.0	0.569	28.6	LOS C	3.3	23.1	0.74	1.15	34.3
All Vehicles		1075	3.8	0.569	6.3	NA	3.3	23.1	0.15	0.31	51.4

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: Nolan / Northcliffe 2021
Existing + Growth + Dev AM

Nolan St / Northcliffe Drive
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South East: Northcliffe Drive											
21	L	1	0.0	0.271	8.7	LOS A	1.9	14.1	0.67	0.71	52.4
22	T	462	8.0	0.271	9.2	LOS A	1.9	14.1	0.67	0.69	52.7
23	R	99	13.0	0.271	14.8	LOS B	1.7	12.9	0.68	0.86	47.5
Approach		562	8.9	0.271	10.2	LOS A	1.9	14.1	0.68	0.72	51.7
North East: Nolan Street											
24	L	101	11.0	0.474	7.6	LOS A	2.7	19.4	0.61	0.70	43.7
25	T	23	0.0	0.474	5.0	LOS A	2.7	19.4	0.61	0.58	42.2
26	R	318	3.0	0.474	13.8	LOS A	2.7	19.4	0.61	0.88	41.5
Approach		442	4.7	0.474	11.9	LOS A	2.7	19.4	0.61	0.82	42.0
North West: Northcliffe Drive											
27	L	144	0.0	0.219	6.8	LOS A	1.4	9.9	0.35	0.54	54.1
28	T	261	9.0	0.219	7.1	LOS A	1.4	9.9	0.35	0.49	55.2
29	R	208	11.0	0.219	12.2	LOS A	1.3	9.9	0.37	0.69	48.5
Approach		614	7.6	0.219	8.8	LOS A	1.4	9.9	0.36	0.57	52.5
South West: Bedford Street											
30	L	31	3.0	0.117	8.0	LOS A	0.5	3.9	0.64	0.74	44.2
31	T	46	2.0	0.117	5.5	LOS A	0.5	3.9	0.64	0.62	42.8
32	R	8	0.0	0.117	14.3	LOS A	0.5	3.9	0.64	0.91	41.7
Approach		85	2.2	0.117	7.3	LOS A	0.5	3.9	0.64	0.69	43.2
All Vehicles		1703	7.0	0.474	10.0	LOS A	2.7	19.4	0.54	0.69	48.5

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

MOVEMENT SUMMARY

Site: Nolan / Northcliffe 2021
Existing + Growth + Dev PM

Nolan St / Northcliffe Drive
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South East: Northcliffe Drive											
21	L	13	0.0	0.351	9.0	LOS A	2.7	19.0	0.74	0.75	52.0
22	T	611	1.0	0.351	9.4	LOS A	2.7	19.0	0.75	0.73	52.1
23	R	95	11.0	0.351	15.1	LOS B	2.4	17.4	0.75	0.89	47.4
Approach		718	2.3	0.351	10.2	LOS A	2.7	19.0	0.75	0.75	51.5
North East: Nolan Street											
24	L	141	4.0	0.604	9.3	LOS A	4.2	29.6	0.72	0.91	43.0
25	T	45	3.0	0.604	6.8	LOS A	4.2	29.6	0.72	0.83	41.5
26	R	340	1.0	0.604	15.6	LOS B	4.2	29.6	0.72	1.01	40.3
Approach		526	2.0	0.604	13.1	LOS A	4.2	29.6	0.72	0.97	41.1
North West: Northcliffe Drive											
27	L	182	0.0	0.284	6.7	LOS A	1.9	13.5	0.35	0.54	54.1
28	T	438	2.0	0.284	6.9	LOS A	1.9	13.5	0.36	0.49	55.2
29	R	219	7.0	0.284	12.0	LOS A	1.8	13.4	0.37	0.72	48.9
Approach		839	2.9	0.284	8.2	LOS A	1.9	13.5	0.36	0.56	53.2
South West: Bedford Street											
30	L	24	0.0	0.106	8.5	LOS A	0.5	3.6	0.69	0.78	43.8
31	T	27	0.0	0.106	6.0	LOS A	0.5	3.6	0.69	0.68	42.3
32	R	17	6.0	0.106	15.0	LOS B	0.5	3.6	0.69	0.91	41.2
Approach		68	1.5	0.106	9.1	LOS A	0.5	3.6	0.69	0.77	42.5
All Vehicles		2152	2.4	0.604	10.1	LOS A	4.2	29.6	0.59	0.73	48.6

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

MOVEMENT SUMMARY

Site: Nolan / Northcliffe 2031
Existing + Growth + Dev AM

Nolan St / Northcliffe Drive
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South East: Northcliffe Drive											
21	L	1	0.0	0.339	9.3	LOS A	2.5	18.9	0.75	0.75	52.0
22	T	545	8.0	0.339	9.9	LOS A	2.5	18.9	0.75	0.74	52.1
23	R	112	13.0	0.339	15.6	LOS B	2.2	17.0	0.75	0.89	46.8
Approach		658	8.8	0.339	10.9	LOS A	2.5	18.9	0.75	0.77	51.1
North East: Nolan Street											
24	L	103	11.0	0.528	8.7	LOS A	3.2	23.2	0.68	0.83	43.3
25	T	24	0.0	0.528	6.0	LOS A	3.2	23.2	0.68	0.72	41.7
26	R	325	3.0	0.528	14.9	LOS B	3.2	23.2	0.68	0.97	40.8
Approach		453	4.7	0.528	13.0	LOS A	3.2	23.2	0.68	0.92	41.3
North West: Northcliffe Drive											
27	L	153	0.0	0.279	6.9	LOS A	1.9	13.6	0.39	0.56	53.9
28	T	345	9.0	0.279	7.2	LOS A	1.9	13.6	0.39	0.50	54.9
29	R	276	11.0	0.279	12.3	LOS A	1.8	13.6	0.42	0.68	48.3
Approach		774	7.9	0.279	9.0	LOS A	1.9	13.6	0.40	0.58	52.2
South West: Bedford Street											
30	L	31	3.0	0.128	8.4	LOS A	0.6	4.4	0.69	0.78	44.0
31	T	46	2.0	0.128	5.9	LOS A	0.6	4.4	0.69	0.66	42.6
32	R	8	0.0	0.128	14.7	LOS B	0.6	4.4	0.69	0.93	41.4
Approach		85	2.2	0.128	7.7	LOS A	0.6	4.4	0.69	0.73	42.9
All Vehicles		1969	7.2	0.528	10.5	LOS A	3.2	23.2	0.59	0.73	48.4

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

MOVEMENT SUMMARY

Site: Nolan / Northcliffe 2031
Existing + Growth + Dev PM

Nolan St / Northcliffe Drive
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South East: Northcliffe Drive											
21	L	14	0.0	0.427	9.7	LOS A	3.5	24.9	0.83	0.79	51.5
22	T	697	1.0	0.427	10.2	LOS A	3.5	24.9	0.83	0.78	51.5
23	R	104	11.0	0.427	16.2	LOS B	3.2	22.9	0.82	0.93	46.5
Approach		815	2.3	0.427	11.0	LOS A	3.5	24.9	0.83	0.80	50.8
North East: Nolan Street											
24	L	149	4.0	0.687	11.0	LOS A	5.3	37.7	0.80	1.01	41.7
25	T	48	3.0	0.687	8.5	LOS A	5.3	37.7	0.80	0.97	40.3
26	R	358	1.0	0.687	17.3	LOS B	5.3	37.7	0.80	1.08	39.3
Approach		556	2.0	0.687	14.8	LOS B	5.3	37.7	0.80	1.05	39.9
North West: Northcliffe Drive											
27	L	196	0.0	0.342	6.8	LOS A	2.5	17.5	0.39	0.55	53.9
28	T	537	2.0	0.342	7.0	LOS A	2.5	17.5	0.40	0.50	54.9
29	R	268	7.0	0.342	12.1	LOS A	2.4	17.4	0.42	0.71	48.8
Approach		1001	2.9	0.342	8.3	LOS A	2.5	17.5	0.40	0.57	52.9
South West: Bedford Street											
30	L	24	0.0	0.117	9.0	LOS A	0.6	4.1	0.74	0.82	43.5
31	T	27	0.0	0.117	6.6	LOS A	0.6	4.1	0.74	0.74	42.0
32	R	17	6.0	0.117	15.5	LOS B	0.6	4.1	0.74	0.93	40.8
Approach		68	1.5	0.117	9.6	LOS A	0.6	4.1	0.74	0.81	42.2
All Vehicles		2440	2.5	0.687	10.7	LOS A	5.3	37.7	0.64	0.76	48.2

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

MOVEMENT SUMMARY

Site: Northcliffe/Northbd on/off ramps 2021 Existing + Growth + Dev AM

Northcliffe Dr / Southern Fwy on/off ramps Northbound
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South East: Northcliffe Drive											
22	T	395	11.0	0.203	6.6	LOS A	0.0	0.0	0.00	0.48	58.9
23	R	292	6.0	0.203	15.4	LOS B	0.0	0.0	0.00	0.77	55.4
Approach		686	8.9	0.203	10.3	LOS A	0.0	0.0	0.00	0.60	57.2
North West: Northcliffe Drive											
27	L	215	13.0	0.473	16.0	LOS B	3.6	27.9	0.84	0.96	53.6
28	T	463	9.0	0.473	13.7	LOS A	3.6	27.9	0.84	0.95	49.6
Approach		678	10.3	0.473	14.4	LOS A	3.6	27.9	0.84	0.96	51.0
South West: Northbound OFF Ramp											
30	L	400	8.0	0.448	10.0	LOS A	2.2	16.6	0.60	0.83	48.8
31	T	1	0.0	0.448	9.9	LOS A	2.2	16.6	0.60	0.77	52.9
32	R	571	4.0	0.498	15.2	LOS B	2.7	19.9	0.59	0.90	45.0
Approach		972	5.6	0.498	13.1	LOS A	2.7	19.9	0.60	0.87	46.4
All Vehicles		2336	7.9	0.498	12.7	LOS A	3.6	27.9	0.49	0.82	50.6

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

MOVEMENT SUMMARY

Site: Northcliffe/Northbd on/off ramps 2021 Existing + Growth + Dev PM

Northcliffe Dr / Southern Fwy on/off ramps Northbound
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South East: Northcliffe Drive											
22	T	403	5.0	0.170	6.4	LOS A	0.0	0.0	0.00	0.47	58.9
23	R	194	1.0	0.170	15.2	LOS B	0.0	0.0	0.00	0.82	55.4
Approach		597	3.7	0.170	9.3	LOS A	0.0	0.0	0.00	0.58	57.5
North West: Northcliffe Drive											
27	L	184	4.0	0.501	14.6	LOS B	4.0	29.1	0.82	0.93	54.9
28	T	637	3.0	0.501	12.4	LOS A	4.0	29.1	0.82	0.93	50.9
Approach		821	3.2	0.501	12.9	LOS A	4.0	29.1	0.82	0.93	51.9
South West: Northbound OFF Ramp											
30	L	295	7.0	0.335	9.1	LOS A	1.4	10.3	0.53	0.73	49.2
31	T	1	0.0	0.335	9.0	LOS A	1.4	10.3	0.53	0.68	53.5
32	R	596	3.0	0.504	14.9	LOS B	2.8	20.1	0.57	0.86	45.1
Approach		892	4.3	0.504	13.0	LOS A	2.8	20.1	0.56	0.82	46.3
All Vehicles		2309	3.8	0.504	12.0	LOS A	4.0	29.1	0.51	0.80	50.9

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

MOVEMENT SUMMARY

Site: Northcliffe/Northbd on/off ramps 2031 Existing + Growth + Dev AM

Northcliffe Dr / Southern Fwy on/off ramps Northbound
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South East: Northcliffe Drive											
22	T	565	11.0	0.278	6.6	LOS A	0.0	0.0	0.00	0.47	58.9
23	R	376	6.0	0.278	15.4	LOS B	0.0	0.0	0.00	0.78	55.4
Approach		941	9.0	0.278	10.1	LOS A	0.0	0.0	0.00	0.60	57.2
North West: Northcliffe Drive											
27	L	299	13.0	0.729	25.1	LOS B	9.1	70.2	0.99	1.23	45.6
28	T	641	9.0	0.729	23.3	LOS B	9.1	70.2	0.98	1.22	41.2
Approach		940	10.3	0.729	23.9	LOS B	9.1	70.2	0.98	1.22	42.7
South West: Northbound OFF Ramp											
30	L	408	8.0	0.506	11.5	LOS A	2.7	20.3	0.67	0.90	47.3
31	T	1	0.0	0.506	11.5	LOS A	2.7	20.3	0.67	0.89	51.9
32	R	581	4.0	0.540	16.4	LOS B	3.2	23.3	0.66	0.96	44.2
Approach		991	5.6	0.540	14.4	LOS A	3.2	23.3	0.67	0.94	45.4
All Vehicles		2872	8.3	0.729	16.1	LOS B	9.1	70.2	0.55	0.92	47.8

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

MOVEMENT SUMMARY

Site: Northcliffe/Northbd on/off ramps 2031 Existing + Growth + Dev PM

Northcliffe Dr / Southern Fwy on/off ramps Northbound
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South East: Northcliffe Drive											
22	T	617	5.0	0.248	6.4	LOS A	0.0	0.0	0.00	0.47	58.9
23	R	253	1.0	0.248	15.2	LOS B	0.0	0.0	0.00	0.83	55.4
Approach		869	3.8	0.248	9.0	LOS A	0.0	0.0	0.00	0.58	57.7
North West: Northcliffe Drive											
27	L	224	4.0	0.673	19.6	LOS B	7.7	55.2	0.95	1.12	49.9
28	T	773	3.0	0.673	17.8	LOS B	7.7	55.2	0.94	1.12	45.6
Approach		997	3.2	0.673	18.2	LOS B	7.7	55.2	0.94	1.12	46.6
South West: Northbound OFF Ramp											
30	L	312	7.0	0.390	10.4	LOS A	1.7	13.0	0.61	0.84	48.5
31	T	1	0.0	0.390	10.3	LOS A	1.7	13.0	0.61	0.80	52.9
32	R	628	3.0	0.570	16.2	LOS B	3.6	25.6	0.66	0.97	44.3
Approach		941	4.3	0.570	14.3	LOS A	3.6	25.6	0.64	0.92	45.5
All Vehicles		2807	3.8	0.673	14.0	LOS A	7.7	55.2	0.55	0.89	49.2

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

MOVEMENT SUMMARY

Site: Northcliffe/Princes Hwy 2021
Existing + Growth + Dev AM

Northcliffe Dr / Princes Hwy
Signals - Fixed Time Cycle Time = 50 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Northcliffe Drive											
1	L	271	19.0	0.239	12.6	LOS A	1.6	13.2	0.40	0.74	53.0
3	R	496	7.0	0.876	37.4	LOS C	15.1	112.2	1.00	1.03	32.8
Approach		766	11.2	0.876	28.6	LOS C	15.1	112.2	0.79	0.93	38.2
East: Princes Hwy East											
4	L	435	8.0	0.247	9.6	X	X	X	X	0.65	54.6
5	T	349	8.0	0.786	27.8	LOS B	4.8	36.2	1.00	0.93	36.5
Approach		784	8.0	0.786	17.7	LOS B	4.8	36.2	0.45	0.77	44.4
West: Princes Hwy West											
12	R	301	10.0	0.868	40.5	LOS C	9.1	68.9	1.00	1.02	33.0
Approach		301	10.0	0.868	40.5	LOS C	9.1	68.9	1.00	1.02	33.0
All Vehicles		1852	9.7	0.876	25.9	LOS B	15.1	112.2	0.68	0.88	39.6

X: Not applicable for Continuous movement.

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

MOVEMENT SUMMARY

Site: Northcliffe/Princes Hwy 2021
Existing + Growth + Dev PM

Northcliffe Dr / Princes Hwy
Signals - Fixed Time Cycle Time = 50 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Northcliffe Drive											
1	L	294	4.0	0.254	13.0	LOS A	2.3	16.4	0.48	0.75	52.1
3	R	402	6.0	0.806	33.1	LOS C	10.8	79.8	0.99	0.96	35.0
Approach		696	5.2	0.806	24.6	LOS B	10.8	79.8	0.77	0.87	40.9
East: Princes Hwy East											
4	L	605	3.0	0.333	9.5	X	X	X	X	0.65	54.6
5	T	560	3.0	0.813	26.5	LOS B	7.8	55.7	1.00	0.97	37.2
Approach		1165	3.0	0.813	17.7	LOS B	7.8	55.7	0.48	0.80	44.3
West: Princes Hwy West											
12	R	233	6.0	0.726	34.6	LOS C	6.0	44.5	0.99	0.89	36.0
Approach		233	6.0	0.726	34.6	LOS C	6.0	44.5	0.99	0.89	36.0
All Vehicles		2094	4.0	0.813	21.9	LOS B	10.8	79.8	0.63	0.83	42.1

X: Not applicable for Continuous movement.

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

MOVEMENT SUMMARY

Site: Northcliffe/Princes Hwy 2031
Existing + Growth + Dev AM

Northcliffe Dr / Princes Hwy
Signals - Fixed Time Cycle Time = 90 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Northcliffe Drive											
1	L	298	19.0	0.235	12.7	LOS A	2.7	21.7	0.30	0.72	53.1
3	R	545	7.0	0.867	48.7	LOS D	26.4	196.2	1.00	0.97	28.3
Approach		843	11.2	0.867	36.0	LOS C	26.4	196.2	0.75	0.88	34.2
East: Princes Hwy East											
4	L	478	8.0	0.272	9.6	X	X	X	X	0.65	54.6
5	T	385	8.0	0.850	49.9	LOS D	9.5	71.3	1.00	0.97	27.6
Approach		863	8.0	0.850	27.6	LOS B	9.5	71.3	0.45	0.79	37.5
West: Princes Hwy West											
12	R	497	10.0	0.890	55.0	LOS D	25.6	194.3	1.00	0.98	27.3
Approach		497	10.0	0.890	55.0	LOS D	25.6	194.3	1.00	0.98	27.3
All Vehicles		2203	9.7	0.890	37.0	LOS C	26.4	196.2	0.69	0.87	33.5

X: Not applicable for Continuous movement.

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

MOVEMENT SUMMARY

Site: Northcliffe/Princes Hwy 2031
Existing + Growth + Dev PM

Northcliffe Dr / Princes Hwy
Signals - Fixed Time Cycle Time = 70 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Northcliffe Drive											
1	L	376	4.0	0.304	13.5	LOS A	4.0	28.8	0.44	0.75	51.6
3	R	511	6.0	0.873	44.0	LOS D	20.4	150.3	1.00	0.99	30.0
Approach		886	5.2	0.873	31.1	LOS C	20.4	150.3	0.76	0.89	36.8
East: Princes Hwy East											
4	L	672	3.0	0.369	9.5	X	X	X	X	0.65	54.6
5	T	623	3.0	0.877	39.7	LOS C	12.6	90.6	1.00	1.03	31.1
Approach		1295	3.0	0.877	24.0	LOS B	12.6	90.6	0.48	0.84	39.6
West: Princes Hwy West											
12	R	367	6.0	0.903	52.7	LOS D	15.8	116.0	1.00	1.02	28.0
Approach		367	6.0	0.903	52.7	LOS D	15.8	116.0	1.00	1.02	28.0
All Vehicles		2548	4.2	0.903	30.6	LOS C	20.4	150.3	0.65	0.88	36.6

X: Not applicable for Continuous movement.

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

MOVEMENT SUMMARY

Site: Northcliffe Dr / Southern FWY Southbd on/off ramps 2021 Existing + Growth + Dev AM

Northcliffe Drive / Southern Freeway SOUTHBOUND on/off ramps
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South East: Northcliffe Drive											
21	L	429	6.0	0.468	12.3	LOS A	3.2	23.3	0.68	0.80	56.1
22	T	495	6.0	0.468	10.1	LOS A	3.2	23.3	0.69	0.79	52.7
Approach		924	6.0	0.468	11.1	LOS A	3.2	23.3	0.69	0.79	54.4
North East: Southbound OFF Ramp											
24	L	196	10.0	0.248	10.1	LOS A	1.0	7.3	0.59	0.80	48.8
25	T	1	100.0	0.232	12.5	LOS A	0.9	7.2	0.57	0.61	55.4
26	R	215	14.0	0.232	15.6	LOS B	0.9	7.2	0.57	0.88	45.0
Approach		412	12.3	0.248	13.0	LOS A	1.0	7.3	0.58	0.84	46.7
North West: Northcliffe Drive											
28	T	721	5.0	0.299	6.4	LOS A	0.0	0.0	0.00	0.47	58.9
29	R	313	10.0	0.299	15.6	LOS B	0.0	0.0	0.00	0.82	55.4
Approach		1034	6.5	0.299	9.2	LOS A	0.0	0.0	0.00	0.58	57.6
All Vehicles		2369	7.3	0.468	10.6	LOS A	3.2	23.3	0.37	0.71	54.2

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

MOVEMENT SUMMARY

Site: Northcliffe Dr / Southern FWY Southbd on/off ramps 2021 Existing + Growth + Dev PM

Northcliffe Drive / Southern Freeway SOUTHBOUND on/off ramps
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South East: Northcliffe Drive											
21	L	683	2.0	0.667	15.6	LOS B	7.0	49.9	0.83	0.98	53.2
22	T	387	4.0	0.476	11.3	LOS A	3.2	23.3	0.73	0.86	52.4
Approach		1071	2.7	0.667	14.0	LOS A	7.0	49.9	0.79	0.94	53.0
North East: Southbound OFF Ramp											
24	L	287	2.0	0.283	9.4	LOS A	1.2	8.6	0.61	0.76	48.8
25	T	1	0.0	0.283	9.5	LOS A	1.2	8.6	0.61	0.71	52.9
26	R	231	5.0	0.295	16.5	LOS B	1.2	8.7	0.63	0.89	44.1
Approach		519	3.3	0.295	12.5	LOS A	1.2	8.7	0.62	0.82	46.5
North West: Northcliffe Drive											
28	T	803	3.0	0.348	6.4	LOS A	0.0	0.0	0.00	0.48	58.9
29	R	419	3.0	0.348	15.3	LOS B	0.0	0.0	0.00	0.81	55.4
Approach		1222	3.0	0.348	9.4	LOS A	0.0	0.0	0.00	0.59	57.5
All Vehicles		2812	3.0	0.667	11.8	LOS A	7.0	49.9	0.42	0.76	53.5

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

MOVEMENT SUMMARY

Site: Northcliffe Dr / Southern FWY Southbd on/off ramps 2031 Existing + Growth + Dev AM

Northcliffe Drive / Southern Freeway SOUTHBOUND on/off ramps
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South East: Northcliffe Drive											
21	L	529	6.0	0.628	15.6	LOS B	6.1	44.8	0.83	0.98	53.5
22	T	594	6.0	0.628	13.7	LOS A	6.1	44.8	0.83	0.99	49.7
Approach		1123	6.0	0.628	14.6	LOS B	6.1	44.8	0.83	0.99	51.6
North East: Southbound OFF Ramp											
24	L	238	10.0	0.328	11.1	LOS A	1.4	10.4	0.64	0.84	47.8
25	T	2	100.0	0.328	14.1	LOS A	1.4	10.4	0.64	0.70	55.6
26	R	295	14.0	0.328	16.2	LOS B	1.4	11.0	0.63	0.90	44.5
Approach		535	12.6	0.328	13.9	LOS A	1.4	11.0	0.63	0.87	45.9
North West: Northcliffe Drive											
28	T	818	5.0	0.340	6.4	LOS A	0.0	0.0	0.00	0.47	58.9
29	R	356	10.0	0.340	15.6	LOS B	0.0	0.0	0.00	0.82	55.4
Approach		1174	6.5	0.340	9.2	LOS A	0.0	0.0	0.00	0.58	57.6
All Vehicles		2832	7.5	0.628	12.2	LOS A	6.1	44.8	0.45	0.80	52.7

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

MOVEMENT SUMMARY

Site: Northcliffe Dr / Southern FWY Southbd on/off ramps 2031 Existing + Growth + Dev PM

Northcliffe Drive / Southern Freeway SOUTHBOUND on/off ramps
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South East: Northcliffe Drive											
21	L	801	2.0	0.866	26.7	LOS B	16.7	119.2	1.00	1.37	43.8
22	T	440	4.0	0.609	15.2	LOS B	5.4	38.9	0.85	1.03	48.2
Approach		1241	2.7	0.866	22.6	LOS B	16.7	119.2	0.95	1.25	45.1
North East: Southbound OFF Ramp											
24	L	358	2.0	0.362	10.1	LOS A	1.7	12.2	0.66	0.84	48.5
25	T	1	0.0	0.362	10.2	LOS A	1.7	12.2	0.66	0.78	52.5
26	R	311	5.0	0.416	18.0	LOS B	2.0	14.7	0.69	0.96	43.0
Approach		669	3.4	0.416	13.7	LOS A	2.0	14.7	0.67	0.89	45.7
North West: Northcliffe Drive											
28	T	884	3.0	0.383	6.4	LOS A	0.0	0.0	0.00	0.48	58.9
29	R	462	3.0	0.383	15.3	LOS B	0.0	0.0	0.00	0.81	55.4
Approach		1346	3.0	0.383	9.4	LOS A	0.0	0.0	0.00	0.59	57.5
All Vehicles		3257	3.0	0.866	15.4	LOS B	16.7	119.2	0.50	0.90	49.6

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

MOVEMENT SUMMARY

Nolan Street / Princes Hwy
Signals - Fixed Time Cycle Time = 60 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Princes Hwy South											
2	T	692	5.0	0.606	11.7	LOS A	12.5	90.9	0.77	0.67	47.9
3	R	139	15.0	0.606	29.8	LOS C	6.0	45.7	0.96	0.84	35.9
Approach		831	6.7	0.606	14.7	LOS B	12.5	90.9	0.80	0.70	45.6
East: Nolan Street											
4	L	57	14.0	0.205	17.6	LOS B	0.9	7.2	0.58	0.71	37.6
6	R	340	8.0	0.726	32.1	LOS C	9.9	74.2	0.97	0.89	30.3
Approach		397	8.9	0.726	30.0	LOS C	9.9	74.2	0.91	0.87	31.2
North: Princes Hwy North											
7	L	462	7.0	0.837	28.6	LOS C	15.6	115.1	0.96	1.02	36.2
8	T	698	5.0	0.837	24.8	LOS B	17.1	124.5	0.98	0.99	36.9
Approach		1160	5.8	0.837	26.3	LOS B	17.1	124.5	0.97	1.00	36.6
All Vehicles		2387	6.6	0.837	22.9	LOS B	17.1	124.5	0.90	0.88	38.1

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

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	Across S approach	53	24.3	LOS C	0.1	0.1	0.90	0.90
P3	Across E approach	53	18.4	LOS B	0.1	0.1	0.78	0.78
All Pedestrians		106	21.4	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: Nolan St / Princes Hwy 2021
Existing + Growth + Dev PM

Nolan Street / Princes Hwy
Signals - Fixed Time Cycle Time = 60 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Princes Hwy South											
2	T	651	3.0	0.465	12.2	LOS A	8.6	61.4	0.74	0.63	47.5
3	R	64	23.0	0.465	24.9	LOS B	6.2	46.0	0.83	0.90	40.9
Approach		715	4.8	0.465	13.3	LOS A	8.6	61.4	0.75	0.65	46.9
East: Nolan Street											
4	L	129	4.0	0.409	16.5	LOS B	2.0	14.8	0.57	0.73	38.2
6	R	459	2.0	0.836	35.6	LOS C	15.0	107.0	1.00	0.98	28.9
Approach		588	2.4	0.836	31.4	LOS C	15.0	107.0	0.90	0.93	30.5
North: Princes Hwy North											
7	L	376	6.0	0.804	27.3	LOS B	12.7	92.6	0.96	0.98	37.2
8	T	634	2.0	0.804	23.6	LOS B	14.4	102.4	0.98	0.95	37.6
Approach		1009	3.5	0.804	25.0	LOS B	14.4	102.4	0.97	0.96	37.5
All Vehicles		2313	3.6	0.836	23.0	LOS B	15.0	107.0	0.88	0.86	37.6

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

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	Across S approach	53	22.5	LOS C	0.1	0.1	0.87	0.87
P3	Across E approach	53	20.0	LOS C	0.1	0.1	0.82	0.82
All Pedestrians		106	21.3	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

Nolan Street / Princes Hwy
Signals - Fixed Time Cycle Time = 60 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Princes Hwy South											
2	T	781	5.0	0.693	12.6	LOS A	15.3	111.6	0.82	0.73	46.9
3	R	157	15.0	0.693	32.4	LOS C	6.6	51.1	0.98	0.89	34.3
Approach		938	6.7	0.693	15.9	LOS B	15.3	111.6	0.84	0.76	44.4
East: Nolan Street											
4	L	57	14.0	0.205	17.6	LOS B	0.9	7.2	0.58	0.71	37.6
6	R	340	8.0	0.726	32.1	LOS C	9.9	74.2	0.97	0.89	30.3
Approach		397	8.9	0.726	30.0	LOS C	9.9	74.2	0.91	0.87	31.2
North: Princes Hwy North											
7	L	482	7.0	0.881	34.2	LOS C	19.2	142.0	0.99	1.08	33.0
8	T	737	5.0	0.881	29.5	LOS C	19.7	144.0	1.00	1.07	34.3
Approach		1219	5.8	0.881	31.4	LOS C	19.7	144.0	0.99	1.08	33.8
All Vehicles		2554	6.6	0.881	25.5	LOS B	19.7	144.0	0.92	0.93	36.6

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

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	Across S approach	53	24.3	LOS C	0.1	0.1	0.90	0.90
P3	Across E approach	53	18.4	LOS B	0.1	0.1	0.78	0.78
All Pedestrians		106	21.4	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: Nolan St / Princes Hwy 2031
Existing + Growth + Dev PM

Nolan Street / Princes Hwy
Signals - Fixed Time Cycle Time = 70 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Princes Hwy South											
2	T	777	3.0	0.585	15.6	LOS B	13.6	97.5	0.80	0.69	44.2
3	R	76	23.0	0.585	30.6	LOS C	8.6	64.3	0.90	0.87	36.9
Approach		853	4.8	0.585	16.9	LOS B	13.6	97.5	0.81	0.71	43.5
East: Nolan Street											
4	L	140	4.0	0.501	18.0	LOS B	2.6	18.7	0.57	0.74	37.2
6	R	489	2.0	0.814	36.2	LOS C	17.5	124.6	0.98	0.95	28.7
Approach		629	2.4	0.814	32.1	LOS C	17.5	124.6	0.89	0.90	30.2
North: Princes Hwy North											
7	L	412	6.0	0.838	32.0	LOS C	18.0	131.1	0.97	1.00	34.3
8	T	716	2.0	0.838	28.2	LOS B	19.6	139.6	0.99	0.99	35.0
Approach		1127	3.5	0.838	29.6	LOS C	19.6	139.6	0.98	0.99	34.8
All Vehicles		2609	3.6	0.838	26.0	LOS B	19.6	139.6	0.90	0.88	35.8

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

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	Across S approach	53	23.2	LOS C	0.1	0.1	0.81	0.81
P3	Across E approach	53	20.8	LOS C	0.1	0.1	0.77	0.77
All Pedestrians		106	22.0	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: Warwick / Nolan 2021
Existing + Growth + Dev AM

Warrick St / Nolan St
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Nolan Street South											
1	L	51	0.0	0.211	6.4	LOS A	0.0	0.0	0.00	0.86	43.3
2	T	347	5.0	0.211	0.0	LOS A	0.0	0.0	0.00	0.00	50.0
Approach		398	4.4	0.211	0.8	NA	0.0	0.0	0.00	0.11	49.0
North: Nolan Street North											
8	T	272	9.0	0.190	2.3	LOS A	1.5	10.9	0.54	0.00	43.6
9	R	40	0.0	0.190	9.1	LOS A	1.5	10.9	0.54	0.90	42.4
Approach		312	7.8	0.190	3.2	NA	1.5	10.9	0.54	0.12	43.5
West: Warrick Street											
10	L	38	10.0	0.297	20.0	LOS B	1.2	8.9	0.67	0.99	34.7
12	R	67	0.0	0.297	19.4	LOS B	1.2	8.9	0.67	1.05	34.8
Approach		105	3.6	0.297	19.6	LOS B	1.2	8.9	0.67	1.03	34.7
All Vehicles		815	5.6	0.297	4.2	NA	1.5	10.9	0.29	0.23	44.5

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: Warwick / Nolan 2021
Existing + Growth + Dev PM

Warrick St / Nolan St
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Nolan Street South											
1	L	52	0.0	0.173	6.4	LOS A	0.0	0.0	0.00	0.85	43.3
2	T	262	12.0	0.173	0.0	LOS A	0.0	0.0	0.00	0.00	50.0
Approach		314	10.0	0.173	1.1	NA	0.0	0.0	0.00	0.14	48.8
North: Nolan Street North											
8	T	438	2.0	0.287	2.1	LOS A	2.4	17.2	0.55	0.00	43.5
9	R	61	0.0	0.287	8.9	LOS A	2.4	17.2	0.55	0.88	42.7
Approach		499	1.8	0.287	2.9	NA	2.4	17.2	0.55	0.11	43.4
West: Warrick Street											
10	L	38	0.0	0.298	21.2	LOS B	1.2	8.4	0.67	0.94	33.7
12	R	57	0.0	0.298	21.0	LOS B	1.2	8.4	0.67	1.05	33.8
Approach		95	0.0	0.298	21.1	LOS B	1.2	8.4	0.67	1.00	33.8
All Vehicles		907	4.4	0.298	4.2	NA	2.4	17.2	0.37	0.21	43.8

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: Warwick / Nolan 2031
Existing + Growth + Dev AM

Warrick St / Nolan St
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Nolan Street South											
1	L	51	0.0	0.224	6.4	LOS A	0.0	0.0	0.00	0.87	43.3
2	T	372	5.0	0.224	0.0	LOS A	0.0	0.0	0.00	0.00	50.0
Approach		422	4.4	0.224	0.8	NA	0.0	0.0	0.00	0.10	49.1
North: Nolan Street North											
8	T	273	9.0	0.192	2.5	LOS A	1.5	11.2	0.56	0.00	43.4
9	R	40	0.0	0.192	9.3	LOS A	1.5	11.2	0.56	0.91	42.3
Approach		313	7.8	0.192	3.4	NA	1.5	11.2	0.56	0.12	43.3
West: Warrick Street											
10	L	38	10.0	0.312	20.9	LOS B	1.3	9.4	0.69	1.02	34.2
12	R	67	0.0	0.312	20.3	LOS B	1.3	9.4	0.69	1.05	34.3
Approach		105	3.6	0.312	20.5	LOS B	1.3	9.4	0.69	1.04	34.2
All Vehicles		840	5.6	0.312	4.2	NA	1.5	11.2	0.29	0.23	44.5

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: Warwick / Nolan 2031
Existing + Growth + Dev PM

Warrick St / Nolan St
Stop (Two-Way)

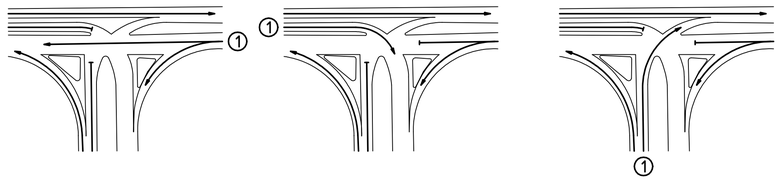
Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Nolan Street South											
1	L	52	0.0	0.185	6.4	LOS A	0.0	0.0	0.00	0.85	43.3
2	T	284	12.0	0.185	0.0	LOS A	0.0	0.0	0.00	0.00	50.0
Approach		336	10.2	0.185	1.0	NA	0.0	0.0	0.00	0.13	48.8
North: Nolan Street North											
8	T	457	2.0	0.299	2.3	LOS A	2.6	18.6	0.58	0.00	43.2
9	R	61	0.0	0.299	9.1	LOS A	2.6	18.6	0.58	0.90	42.6
Approach		518	1.8	0.299	3.1	NA	2.6	18.6	0.58	0.11	43.1
West: Warrick Street											
10	L	38	0.0	0.324	23.0	LOS B	1.3	9.3	0.70	0.97	32.8
12	R	57	0.0	0.324	22.8	LOS B	1.3	9.3	0.70	1.06	32.9
Approach		95	0.0	0.324	22.9	LOS B	1.3	9.3	0.70	1.02	32.9
All Vehicles		948	4.6	0.324	4.3	NA	2.6	18.6	0.39	0.21	43.6

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

Appendix C – RMS Signal Plans

Date in Service: 23/06/75
Reconstructed: 19/05/87
1st Reconstruction: 19/08/88
2nd Reconstruction:



A PHASE B PHASE C PHASE

MOVEMENT DIAGRAMS

SPECIAL SIGNAL GROUP DISPLAY SEQUENCE

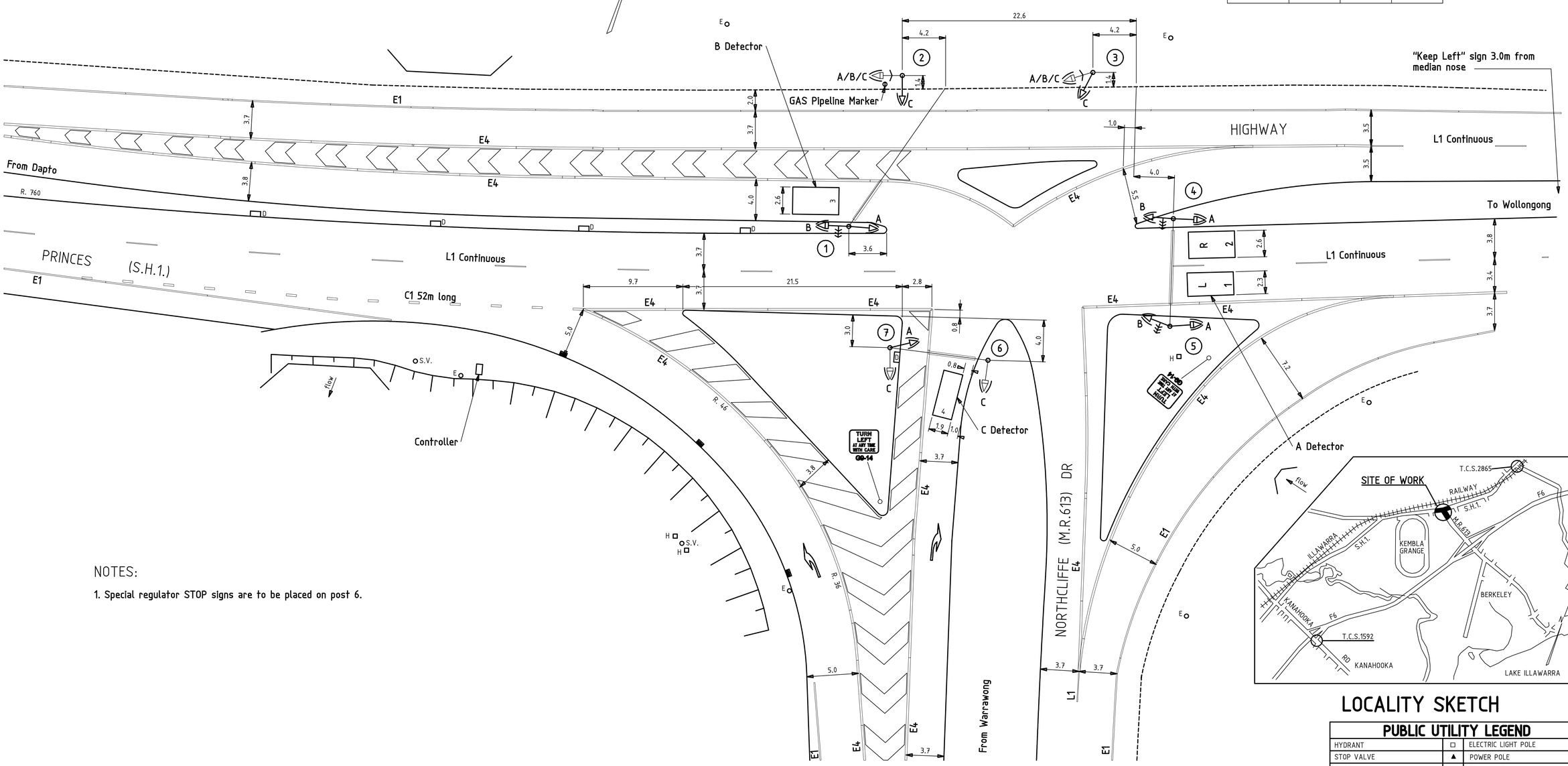
SIGNAL GROUP	TABLE TYPE	REMARKS
A/B/C	3	Continuous Green Arrow

POST CHART

POST	TYPE	HEIGHT	KERB OFFSET
1	2	4.1	–
2	2	4.1	–
3	2	4.1	–
4	2	4.1	–
5	2	4.1	1.0
6	2	4.1	1.0
7	2	4.1	1.0

CONTROLLER SCHEDULE

DETECTOR	SPECIFICATION		
A	FN	A(L)	A(E1)
	SG	$\overline{A}$	A
	DS	–	–
B	FN	B(L)	B(E1)
	SG	$\overline{B}$	B
	DS	–	–
C	FN	C(L)	C(E1)
	SG	$\overline{C}$	C
	DS	–	–



NOTES:

1. Special regulator STOP signs are to be placed on post 6.

LOCALITY SKETCH

PUBLIC UTILITY LEGEND

HYDRANT	□	ELECTRIC LIGHT POLE	⌀		
STOP VALVE	▲	POWER POLE	○		
GAS VALVE	#	STAY POLE	⚲		
SEWER MANHOLE	⊕	TELEPHONE BOX	▥		
TELECOM PIT	▰	TELECOM PILLAR	◔		
FILE NAME :	tcs/kembla_grange/sh1_northcliffe_dr/vv0130_11a.dgn				
SURVEY FILE :					

DESIGN LAYOUT

A ORIGINAL ISSUE
ISSUE A JJ ILL 1388 10/08/99
Special regulatory Stop Sign on post 6.
W.A.E. 15/03/99
S.E. 06/01/03

REFERENCE PLANS	
Symbols & Abb.	VD003-6
Standard Posit.	VD001-5
Det. Sched. Exp.	VD018-10
Pres. Detectors	VC005-17
SSG Dis. Seq.	VD018-8
Type 2 Posts	VM202-1
Type 5 Mast Arm	VM211-6

U.B.D.REF. MAP 40 D6
I.S.G. E
CO-ORDS N
K.P. 01/87
G.B. 01/87
DESIGNED
G.B. 01/87
J.K. 01/87
CHECKED
F.M. 01/87
PASSED

THESE DRAWINGS HAVE BEEN EXAMINED AND ARE RECOMMENDED FOR APPROVAL
SIGNATURE... SEE ISSUE B SHEET 8
NAME... SEE ISSUE B SHEET 8
POSITION... ENGINEER (TRAFFIC)
DATE... 20/02/87

APPROVED
SIGNATURE... SEE ISSUE B SHEET 8
NAME... SEE ISSUE B SHEET 8
POSITION... DIVISONAL ENGINEER
DATE... 20/02/87

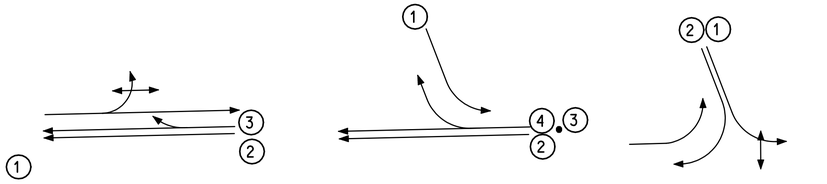
Quality Endorsed Company QEC 9443

Roads and Traffic Authority of NSW
CITY OF WOLLONGONG
PRINCES HWY & NORTHCLIFFE DR
KEMBLA GRANGE

REGION : SOUTHERN REGIONAL OFFICE
SCALE 5 0 5 10
FILE 497.TS.130
SUPERSEDES SHEET 8
REGN. 0001.497.VV.0130

SHEET 11
ISSUE A

Date in Service ..22.4.92....



A PHASE
(Also acts as Train Phase)

B PHASE

C PHASE
(Also acts as Queue - Clearing Phase)

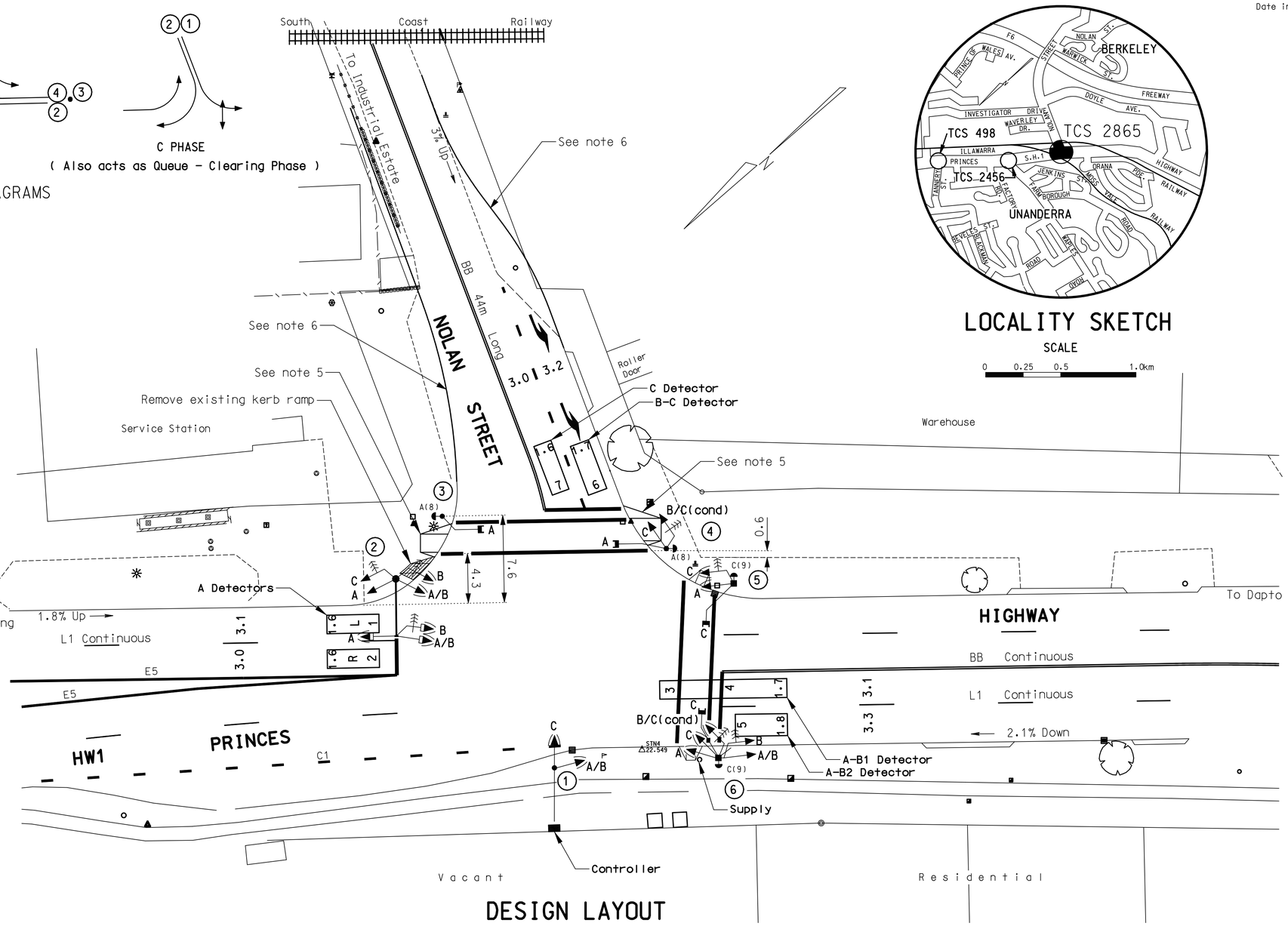
MOVEMENT DIAGRAMS

POSTS

POST	TYPE	LENGTH	OFFSET	REMARKS
1	2	4.1	1.0	EXISTING
2	5L	–	1.0	EXISTING
3	2	3.2	1.0	NEW
4	2	4.1	1.0	EXISTING
5	6	–	1.0	EXISTING
6	6	–	1.0	EXISTING

LOCALITY SKETCH

SCALE
0 0.25 0.5 1.0km



DESIGN LAYOUT

DETECTOR SPECIFICATION

Detector		Specifications			
A	FN	A(L)	A(E1)		
	SG/PS	$\overline{A}$	A		
	DS	–	–		
A–B1 Depart. + Approach	FN	B(PR)	B(E4)		
	SG/PS	A	B		
	DS	–	A(NEXT)		
A–B1 Approach	FN	A(L).B(L)	A(E3)		B(E3)
	SG/PS	$\overline{A/B}$	A		B
	DS	–	$\overline{A–B1(PR).B(NEXT)}$		$\overline{A(NEXT)}$
A–B2	FN	A(L)	A(E2)	B(E2)	
	SG/PS	$\overline{A/B}$	A	B	
	DS	–	$\overline{B(NEXT)}$	$\overline{A(NEXT)}$	
B–C	FN	B(PR)	B(E1)	C(E1)	
	SG/PS	$\overline{B.C}$	B	C	
	DS	$\overline{C}$	$\overline{C(NEXT)}$	$\overline{B(NEXT)}$	
C	FN	C(L)	C(E2)		
	SG/PS	$\overline{C}$	C		
	DS	–	–		
A P.B.	FN	A(PB)	C(L)		
	SG/PS	$\overline{A(WALK)}$	$A.\overline{A(WALK)}$		
	DS	–	$\overline{B.C}$		
C P.B.	FN	C(PB)	A(L)		
	SG/PS	$\overline{C(WALK)}$	$C.\overline{C(WALK)}$		
	DS	–	A.B.		

SPECIAL SIGNAL GROUP DISPLAY SEQUENCE

SIGNAL GROUP	TABLE TYPE	REMARKS
A	1	—
A/B	3	—
B(RT)	39	Timed R.A. protection for 'A' pedestrians. *
B/C COND (LT)	14	Timed R.A. protection for 'C' pedestrians. #
C	1	—
C (LT)	21	Timed R.A. protection for 'A' pedestrians. *

* Push button on post 4 extends R.A. protection subject to timer.
\# Push button on post 6 extends R.A. protection subject to timer.

NOTES

1. Regulatory special stop sign placed on post 4.
2. Arterial on A phase. (Isolated)
3. This site forms part of the WOLSCATS system.
4. All push buttons are audio tactile.
5. Kerb ramps to be constructed at all pedestrian crossings in accordance with Model Drawing MD.R173.B01.A.1.
6. Proposed kerb designed by Wollongong City Council as part of the Improvements to the South Coast Railway Level Crossing.

PUBLIC UTILITY LEGEND

HYDRANT	□	ELECTRIC POLE	○
STOP VALVE	▼	LIGHT POLE	☼
GAS VALVE	#	SEWER MANHOLE	⊕
H.P. GAS LINE MARKER	⊥	TELEPHONE BOX	⊡
GAS TEST POINT	⚠	TELECOM PIT	◪

DOGS DRAWING FILE : user/tcs/unanderra/sh1_nolan/vv2865_1i.dgn
ARCHIVE FILE:

A ORIGINAL ISSUE

B Issue J.I. ILL. 854 28.11.91
(M.A.E. 22.4.92)
Train facility not connected.
N.B.

C Issue J.I. ILL. 987 10.8.93
WAE-21.10.92 Train facility connected.
WAE-10.11.93 Telecom lines connected.
D.L.H.

D Issue. J/ ILL.1167 6.11.95
Pedestrian Phase added to SH1
D.M. Dec/'95.

E Issue. J/ ILL.1167 6.11.95
Pedestrian Phase removed from Nolan Street.
Special operation for Train Phase Revised.
R.T.A.T. July/'96

F Issue. J/ ILL.1171
M.A.E. 25.8.96
R.E.J. Sept/'95.

G Issue J/ ILL 1255 7.11.97
Change approach numbers in A & B phase.
MFB Nov 96

H Issue J/ ILL 1426 11.1.00
M.A.E. 17.2.00
New PROM to change site conditions when extended train demands during truck work.
S.H.

I Issue J/ ILL 1884 7/11/06
Added ped crossing on eastern approach and post detectors. Added SCOS. notes and detector spec.
N. Cooke 28/11/06

REFERENCE PLANS	
Symbols & Abb.	VD003-6
Standard Posit.	VD001-5
Det. Sched. Exp.	VD018-10
Pres. Detectors	VC005-7
SSG Dis. Seq.	VD018-8
Type 5 Mast Arm	VM211-6
Channelisation	SH. 4
Operation Design	SH. 5

U.B.D.REF. 9 G9
I.S.G. ..E285056..206.....
CO-ORDS N..1185133..688...

G. BIRCH
DESIGNED
N.F. BURKE 10/91
CHECKED
N.F. BURKE 10/91
PASSED

THESE DRAWINGS HAVE BEEN EXAMINED AND ARE RECOMMENDED FOR APPROVAL

SIGNATURE Refer to Issue A
NAME G. BRISBANE
POSITION TF & RSM
DATE 11.10.91

APPROVED

SIGNATURE Refer to Issue A
NAME N. C. LAMB
POSITION DIVISIONAL ENGINEER
DATE 14.10.91

ROADS AND TRAFFIC AUTHORITY OF NSW

CITY OF WOLLONGONG
INTERSECTION OF HW1 PRINCES HIGHWAY AND NOLAN STREET
UNANDERRA

REGION : SOUTHERN REGION
DIVISION : ILLAWARRA DIVISION
SCALE 5 0 5 10
FILE 497.TS.467
SUPERSEDES SHEET
REGN. 0001.497.VV.2865

SHEET 1
ISSUE A B C D E F G H I

Appendix D - Crash Data

Detailed Crash Report

Transport Centre for Road Safety — NSW GOVERNMENT

Crash No.	Date	Day of Week	Time	Distance		ID Feature	Loc Type	Alignment	Weather	Surface Condition	Speed Limit	No. of Tus	Tu Type/Obj	Age/Sex	Street Travelling	Speed Travelling	Manoeuvre	Degree of Crash	Killed	Injured	Factors
																					A S F
Southern Region																					
Wollongong City LGA																					
Berkeley																					
Cheshire St																					
557266	20/01/2007	Sat	09:43		at	NOLAN ST	TJN	STR	Fine	Dry	50	1	UTE	M31	N in NOLAN ST	70 Proceeding in lane		I	0	1	S
E29443004							RUM:	73	Off rd rght => obj				Tree/bush								
Gallop St																					
715411	25/06/2010	Fri	10:15		at	NOLAN ST	TJN	STR	Fine	Dry	50	2	CAR	F78	N in NOLAN ST	20 Turning right		I	0	1	
E42292416							RUM:	21	Right through				BUS	M74	S in NOLAN ST	40 Proceeding in lane					
719335	23/07/2010	Fri	09:20		at	NOLAN ST	TJN	STR	Fine	Dry	50	2	CAR	F47	W in GALLOP ST	5 Turning right		I	0	1	
E41898971							RUM:	13	Right near				WAG	M51	S in NOLAN ST	40 Proceeding in lane					
Hopman Cres																					
763906	15/08/2011	Mon	18:30		at	NOLAN ST	TJN	STR	Fine	Dry	50	2	CAR	M19	S in NOLAN ST	20 Proceeding in lane		I	0	1	
E45319347							RUM:	32	Right rear				CAR	M63	S in NOLAN ST	0 Wait turn right					
Nolan St																					
561738	16/03/2007	Fri	19:10	5 m	N	CHESHIRE ST	TJN	CRV	Raining	Wet	50	2	CAR	M36	S in NOLAN ST	50 Proceeding in lane		N	0	0	
E29818479							RUM:	32	Right rear				CAR	M49	S in NOLAN ST	15 Turning right					
759875	29/04/2011	Fri	19:30	245 m	N	HOPMAN CRES	2WY	CRV	Raining	Wet	50	1	CAR	F24	N in NOLAN ST	20 Proceeding in lane		N	0	0	S
E44280154							RUM:	87	Off lft/lft bnd=>obj				Building								
607693	04/02/2008	Mon	17:00		at	NORFOLK ST	TJN	STR	Raining	Wet	50	2	4WD	F17	W in NORFOLK ST	5 Proceeding in lane		I	0	2	
E33010558							RUM:	10	Cross traffic				CAR	F35	S in NOLAN ST	40 Proceeding in lane					
607319	08/12/2007	Sat	00:20	75 m	N	NORFOLK ST	2WY	CRV	Fine	Dry	50	2	TRK	M26	W in NOLAN ST	5 Forward from drive		I	0	1	A
E32110776							RUM:	47	Emerging from drive				M/C	M20	N in NOLAN ST	Unk Along footpath					
666514	07/05/2009	Thu	22:15	300 m	N	NOTTINGHAM ST	2WY	CRV	Fine	Dry	60	2	CAR	F19	S in NOLAN ST	60 Proceeding in lane		I	0	3	S
E37505703							RUM:	87	Off lft/lft bnd=>obj				TRK		S in NOLAN ST	0 Parked					
621933	25/04/2008	Fri	07:30		at	ROCHE PL	TJN	STR	Fine	Dry	50	2	CAR	M20	N in NOLAN ST	30 Incorrect side		I	0	1	F
E33340475							RUM:	20	Head on				4WD	M42	S in NOLAN ST	15 Proceeding in lane					
763461	30/07/2011	Sat	14:00		at	WARWICK ST	TJN	STR	Fine	Dry	60	2	CAR	M24	E in WARWICK ST	5 Turning right		N	0	0	
E47750088							RUM:	11	Right far				CAR	F31	S in NOLAN ST	60 Proceeding in lane					
Unanderra																					
Doyle Ave																					

Detailed Crash Report

Transport Centre for Road Safety — NSW GOVERNMENT

Crash No.	Date	Day of Week	Time	Distance		ID Feature	Loc Type	Alignment	Weather	Surface Condition	Speed Limit	No. of Tus	Tu Type/Obj	Age/Sex	Street Travelling	Speed Travelling	Manoeuvre	Degree of Crash	Killed	Injured	Factors
																					A S F
779836	21/11/2011	Mon	10:30		at	NOLAN ST	TJN	STR	Overcast	Dry	50	2	CAR	M21	E in DOYLE AVE	30	Proceeding in lane	N	0	0	
E48158085							RUM:	32	Right rear				UTE	M66	E in DOYLE AVE	0	Wait turn right				
Investigator Dr																					
628015	20/06/2008	Fri	11:29		at	NOLAN ST	TJN	STR	Fine	Dry	60	2	4WD	M55	S in INVESTIGATOR DR	10	Turning right	N	0	0	
E34170506							RUM:	13	Right near				CAR	F62	E in NOLAN ST	60	Proceeding in lane				
755772	07/06/2011	Tue	10:15		at	NOLAN ST	TJN	STR	Fine	Dry	50	2	TRK	M68	S in INVESTIGATOR DR	30	Proceeding in lane	N	0	0	
E46588980							RUM:	10	Cross traffic				CAR	F54	W in NOLAN ST	50	Proceeding in lane				
Nolan St																					
748469	09/04/2011	Sat	21:30	100 m	E	DOYLE AVE	2WY	CRV	Fine	Dry	60	1	CAR	M18	E in NOLAN ST	Unk	Proceeding in lane	N	0	0	A S F
E44345340							RUM:	81	Off left/rt bnd=>obj				Fence								
688268	03/11/2009	Tue	17:50	20 m	E	PRINCES HWY	2WY	STR	Fine	Dry	50	2	CAR	M84	W in NOLAN ST	40	Proceeding in lane	I	0	1	A
E39597642							RUM:	30	Rear end				CAR	F43	W in NOLAN ST	0	Stationary				
602449	10/11/2007	Sat	07:00	60 m	E	PRINCES HWY	2WY	STR	Raining	Wet	60	1	P/C	F U	NOLAN ST		Proceeding in lane	I	0	1	
E32542158							RUM:	74	On road-out of cont.												
671162	15/06/2009	Mon	09:55	200 m	E	PRINCES HWY	2WY	STR	Fine	Dry	60	2	CAR	M24	E in NOLAN ST	40	Turning right	I	0	1	
E38169067							RUM:	21	Right through				CAR	F53	W in NOLAN ST	40	Proceeding in lane				
767815	17/09/2011	Sat	09:20	175 m	N	SOUTHERN EXPRE OP	2WY	CRV	Fine	Dry	60	1	CAR	M U	N in NOLAN ST	Unk	Proceeding in lane	I	0	1	S F
E47868084							RUM:	85	Off rt/lft bnd=>obj				Fence								
667678	24/02/2009	Tue	17:00		at	WAVERLEY DR	TJN	STR	Fine	Dry	50	1	M/C	M44	W in NOLAN ST	20	Proceeding in lane	I	0	1	
E37801177							RUM:	74	On road-out of cont.												
685358	08/10/2009	Thu	08:50		at	WAVERLEY DR	TJN	STR	Fine	Dry	50	2	TRK	M47	S in WAVERLEY DR	20	Turning right	N	0	0	
E39176674							RUM:	13	Right near				CAR	F48	E in NOLAN ST	40	Proceeding in lane				
759420	08/07/2011	Fri	14:10		at	WAVERLEY DR	TJN	STR	Fine	Dry	50	2	LOR	M42	W in NOLAN ST	20	Turning right	N	0	0	
E44915006							RUM:	39	Other same direction				TRK	M38	W in NOLAN ST	5	Proceeding in lane				

Report Totals: Total Crashes: 22 Fatal Crashes: 0 Injury Crashes: 13 Killed: 0 Injured: 16

Crashid dataset Nolan St - Berkeley - Jan 2007 to Dec 2011

Summary Crash Report

Transport Centre for Road Safety

# Crash Type		
Car Crash	18	81.8%
Light Truck Crash	5	22.7%
Rigid Truck Crash	1	4.5%
Articulated Truck Crash	0	0.0%
'Heavy Truck Crash	(1)	(4.5%)
Bus Crash	1	4.5%
"Heavy Vehicle Crash	(2)	(9.1%)
Emergency Vehicle Crash	0	0.0%
Motorcycle Crash	2	9.1%
Pedal Cycle Crash	1	4.5%
Pedestrian Crash	0	0.0%

' Rigid or Artic. Truck " Heavy Truck or Heavy Bus
These categories are NOT mutually exclusive

Location Type		
*Intersection	14	63.6%
Non intersection	8	36.4%

* Up to 10 metres from an intersection

~ 07:30-09:30 or 14:30-17:00 on school days

Collision Type		
Single Vehicle	6	27.3%
Multi Vehicle	16	72.7%

Road Classification		
Freeway/Motorway	0	0.0%
State Highway	0	0.0%
Other Classified Road	0	0.0%
Unclassified Road	22	100.0%

Contributing Factors		
Speeding	5	22.7%
Fatigue	3	13.6%
Alcohol	3	13.6%

Weather		
Fine	17	77.3%
Rain	4	18.2%
Overcast	1	4.5%
Fog or mist	0	0.0%
Other	0	0.0%

Road Surface Condition		
Wet	4	18.2%
Dry	18	81.8%
Snow or ice	0	0.0%

Natural Lighting		
Dawn	0	0.0%
Daylight	16	72.7%
Dusk	0	0.0%
Darkness	6	27.3%

Crash Movement		
Intersection, adjacent approaches	6	27.3%
Head-on (not overtaking)	1	4.5%
Opposing vehicles; turning	2	9.1%
U-turn	0	0.0%
Rear-end	4	18.2%
Lane change	0	0.0%
Parallel lanes; turning	0	0.0%
Vehicle leaving driveway	1	4.5%
Overtaking; same direction	0	0.0%
Hit parked vehicle	0	0.0%
Hit railway train	0	0.0%
Hit pedestrian	0	0.0%
Permanent obstruction on road	0	0.0%
Hit animal	0	0.0%
Off road, on straight	0	0.0%
Off road on straight, hit object	1	4.5%
Out of control on straight	2	9.1%
Off road, on curve	0	0.0%
Off road on curve, hit object	4	18.2%
Out of control on curve	0	0.0%
Other crash type	1	4.5%

Speed Limit				
40 km/h or less	0	0.0%	80 km/h zone	0	0.0%
50 km/h zone	15	68.2%	90 km/h zone	0	0.0%
60 km/h zone	7	31.8%	100 km/h zone	0	0.0%
70 km/h zone	0	0.0%	110 km/h zone	0	0.0%
~ 40km/h or less	0	0.0%			

CRASHES	22	
Fatal crash	0	0.0%
Injury crash	13	59.1%
Non-casualty crash	9	40.9%

Time Group		% of Day	
00:01 - 02:59	1	4.5%	12.5%
03:00 - 04:59	0	0.0%	8.3%
05:00 - 05:59	0	0.0%	4.2%
06:00 - 06:59	0	0.0%	4.2%
07:00 - 07:59	2	9.1%	4.2%
08:00 - 08:59	1	4.5%	4.2%
09:00 - 09:59	4	18.2%	4.2%
10:00 - 10:59	3	13.6%	4.2%
11:00 - 11:59	1	4.5%	4.2%
12:00 - 12:59	0	0.0%	4.2%
13:00 - 13:59	0	0.0%	4.2%
14:00 - 14:59	2	9.1%	4.2%
15:00 - 15:59	0	0.0%	4.2%
16:00 - 16:59	0	0.0%	4.2%
17:00 - 17:59	3	13.6%	4.2%
18:00 - 18:59	1	4.5%	4.2%
19:00 - 19:59	2	9.1%	4.2%
20:00 - 21:59	1	4.5%	8.3%
22:00 - 24:00	1	4.5%	8.3%

Street Lighting Off/Nil			% of Dark
0	of	6 in Dark	0.0%

CASUALTIES	16	
Killed	0	0.0%
Injured	16	100.0%
^ Unrestrained	0	0.0%

^ Belt fitted but not worn, No restraint fitted to position OR No helmet worn

Crashes		Casualties
8	2011	2
2	2010	2
5	2009	6
3	2008	3
4	2007	3

~ School Travel Time		
Involvement	3	13.6%

McLean Periods			% Week
A	2	9.1%	17.9%
B	1	4.5%	7.1%
C	7	31.8%	17.9%
D	3	13.6%	3.5%
E	0	0.0%	3.6%
F	4	18.2%	10.7%
G	2	9.1%	7.1%
H	0	0.0%	7.1%
I	0	0.0%	12.5%
J	3	13.6%	10.7%

Day of the Week						# Holiday Periods		
Monday	4	18.2%	Thursday	2	9.1%	Sunday	0	0.0%
Tuesday	3	13.6%	Friday	7	31.8%	WEEKDAY	16	72.7%
Wednesday	0	0.0%	Saturday	6	27.3%	WEEKEND	6	27.3%

New Year	0	0.0%	Queen's BD	0	0.0%	Easter SH	2	9.1%
Aust. Day	0	0.0%	Labour Day	0	0.0%	June/July SH	1	4.5%
Easter	0	0.0%	Christmas	0	0.0%	Sept./Oct. SH	1	4.5%
Anzac Day	1	4.5%	January SH	1	4.5%	December SH	0	0.0%

Crashid dataset Nolan St - Berkeley - Jan 2007 to Dec 2011

Percentages are percentages of all crashes. Unknown values for each category are not shown on this report.

Appendix E – Auto Turn Plans

F6 SOUTHERN FREEWAY

25m WIDE BUFFER

IPA 3-5 YEARS OLD A= 113 m2

IPA 3-5 YEARS OLD A=120 m2

IPA 3-5 YEARS OLD A=57 m2

SERVICE VEHICLE AUSTROADS 300t (AU)

RD T FE CR ST CHL DT OT KS CA SR LB OF K G L

+15.00

RL 53.50 RL 53.85 RL 54.20 RL 54.55 RL 54.90 RL 55.25 RL 55.30 RL 55.60 RL 55.95 RL 56.30 RL 56.65 RL 57.00 RL 58.00 RL 60.00 RL 61.00 RL 82.00

B B1 B2 P L/D LB

HB G ST L KS CM D K AD E AK LO AK TV MR T DR

1 11 12 15 1A 6A 19 36 40 41 42 44 45 46 52 54 72

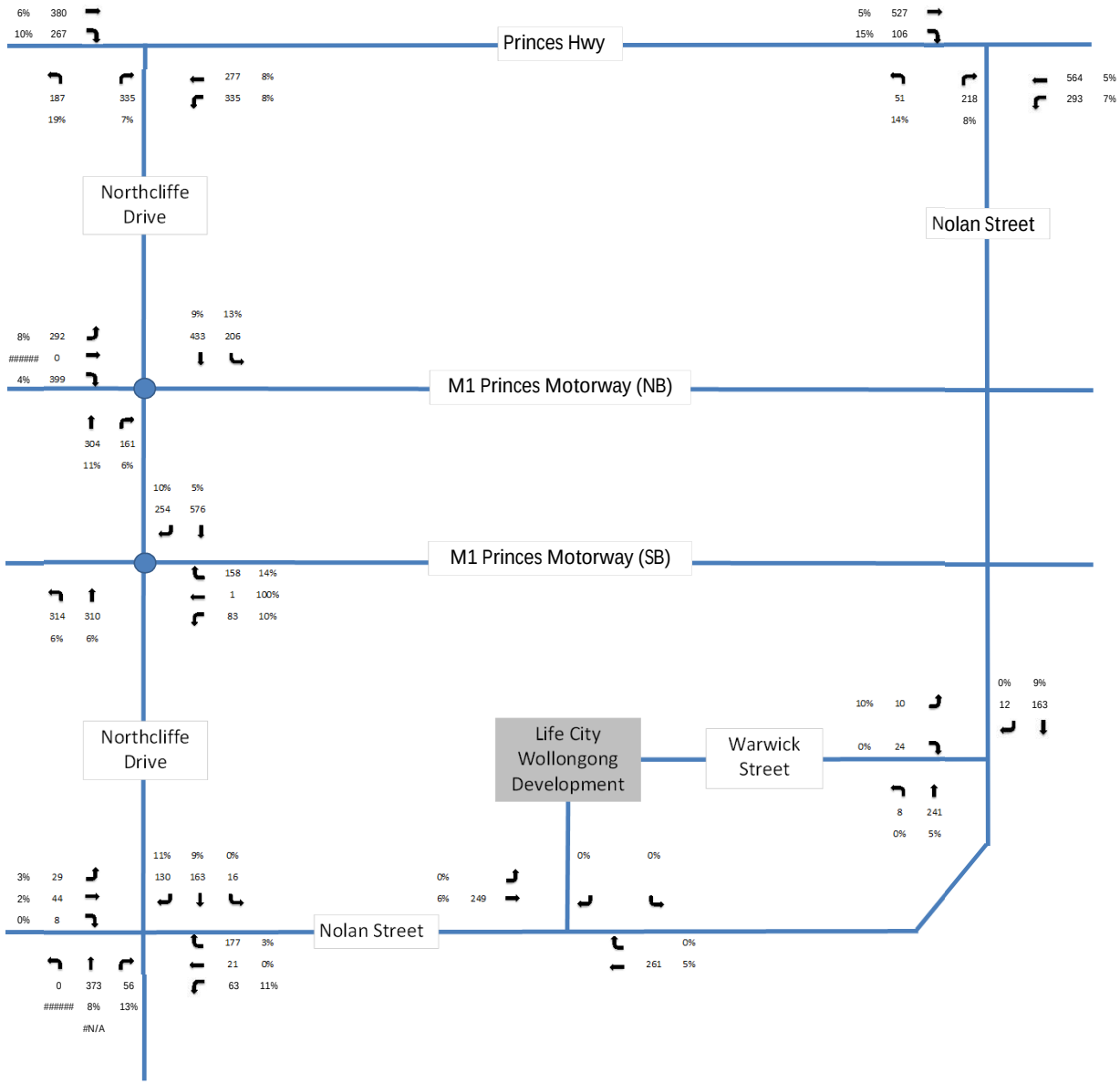
19


72
6A
41
41
12
15
L/D

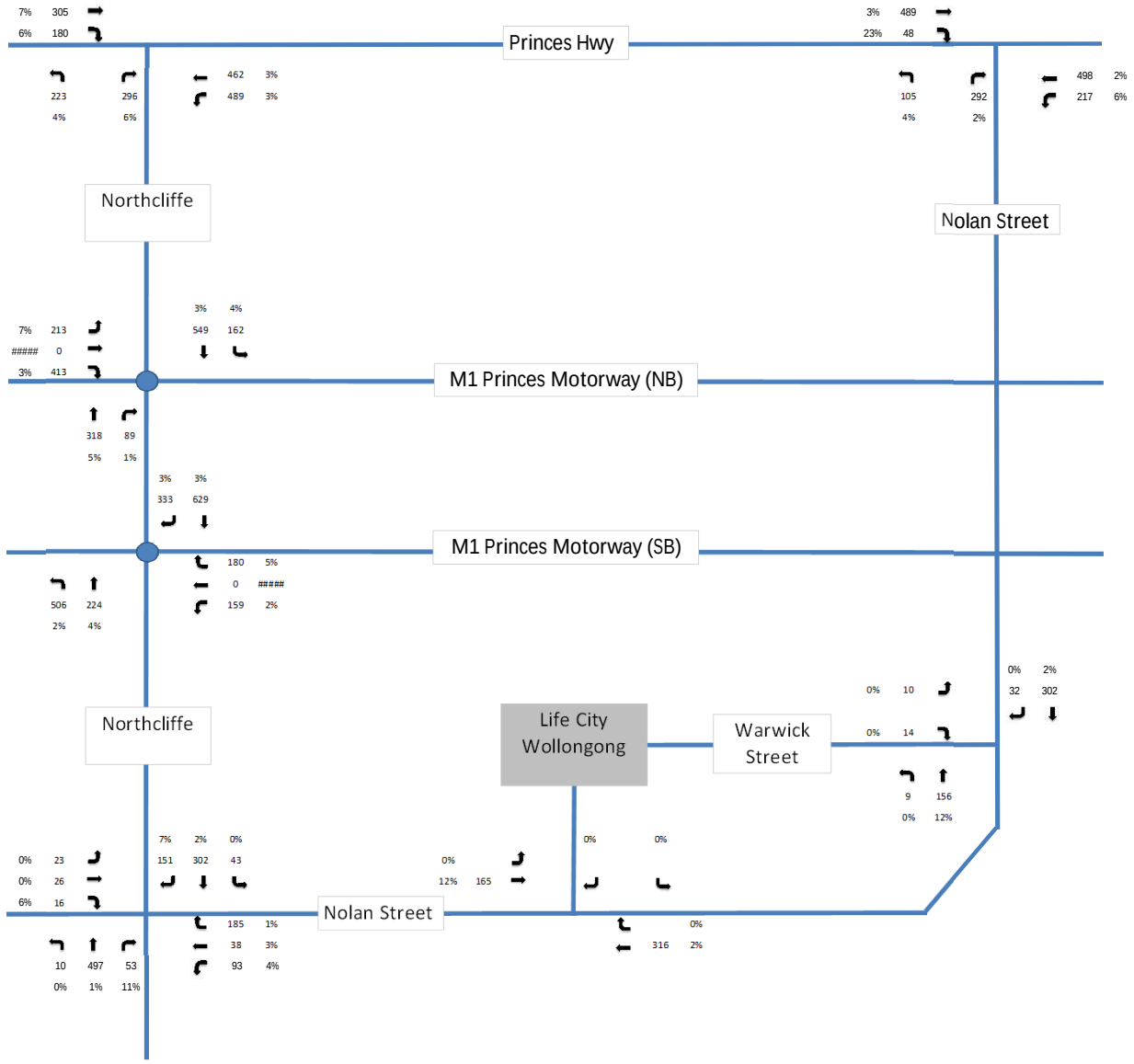

FREEWAY
36
15
25m WIDE BUFFE

Appendix F – Detailed Traffic Distribution

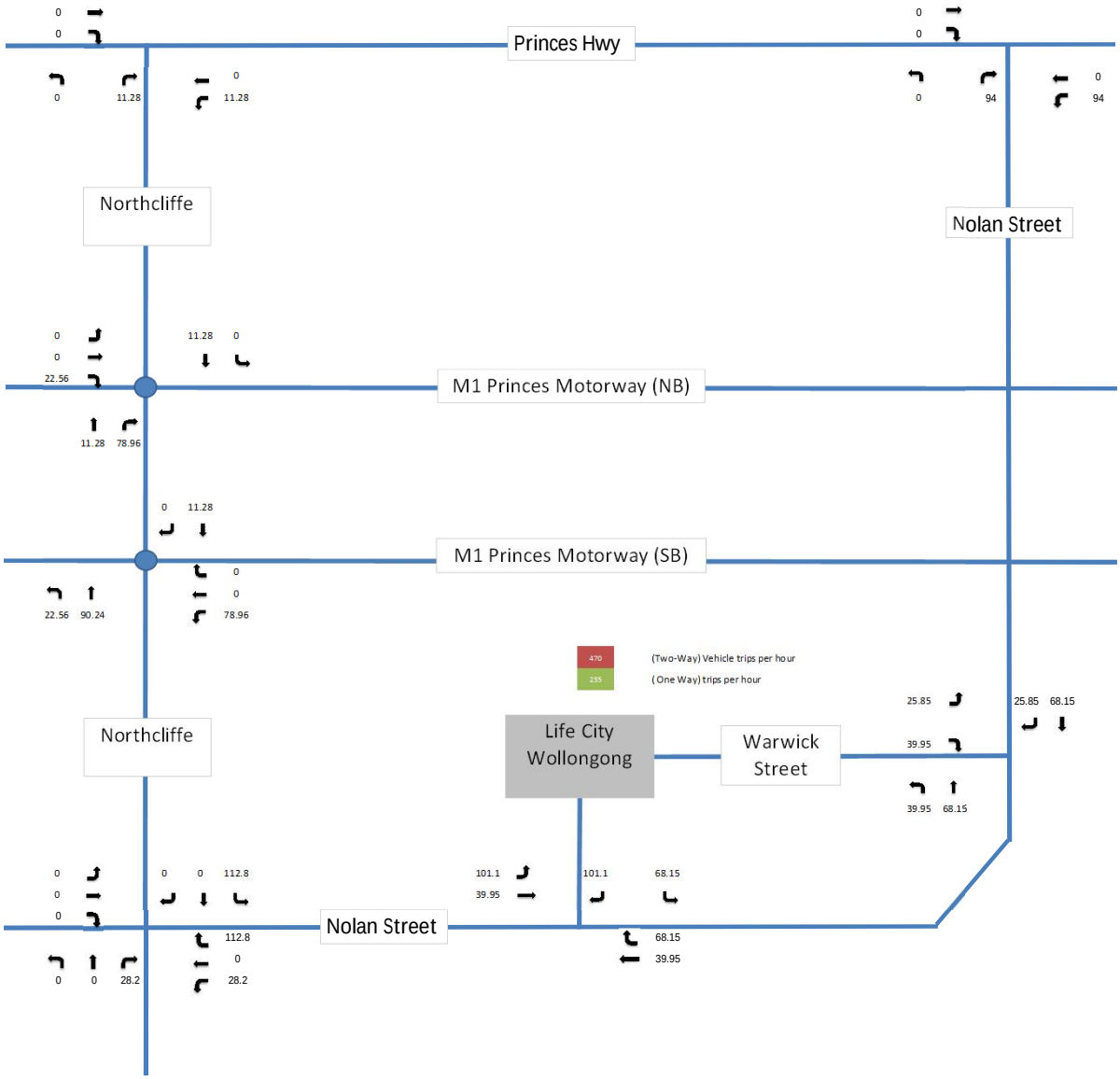
2013 AM Peak Hour Traffic Flows



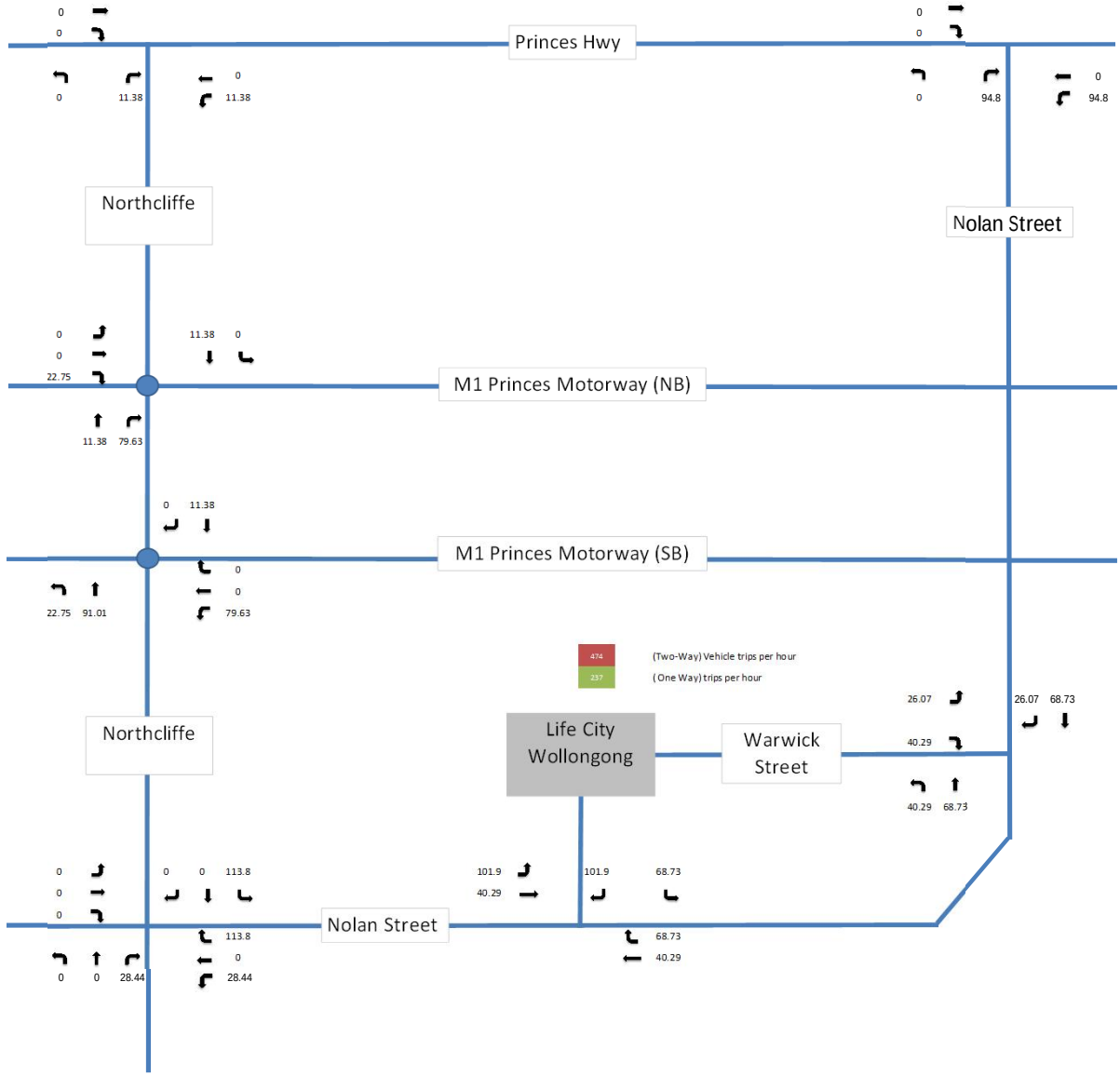
2013 PM Peak Hour Traffic Flows



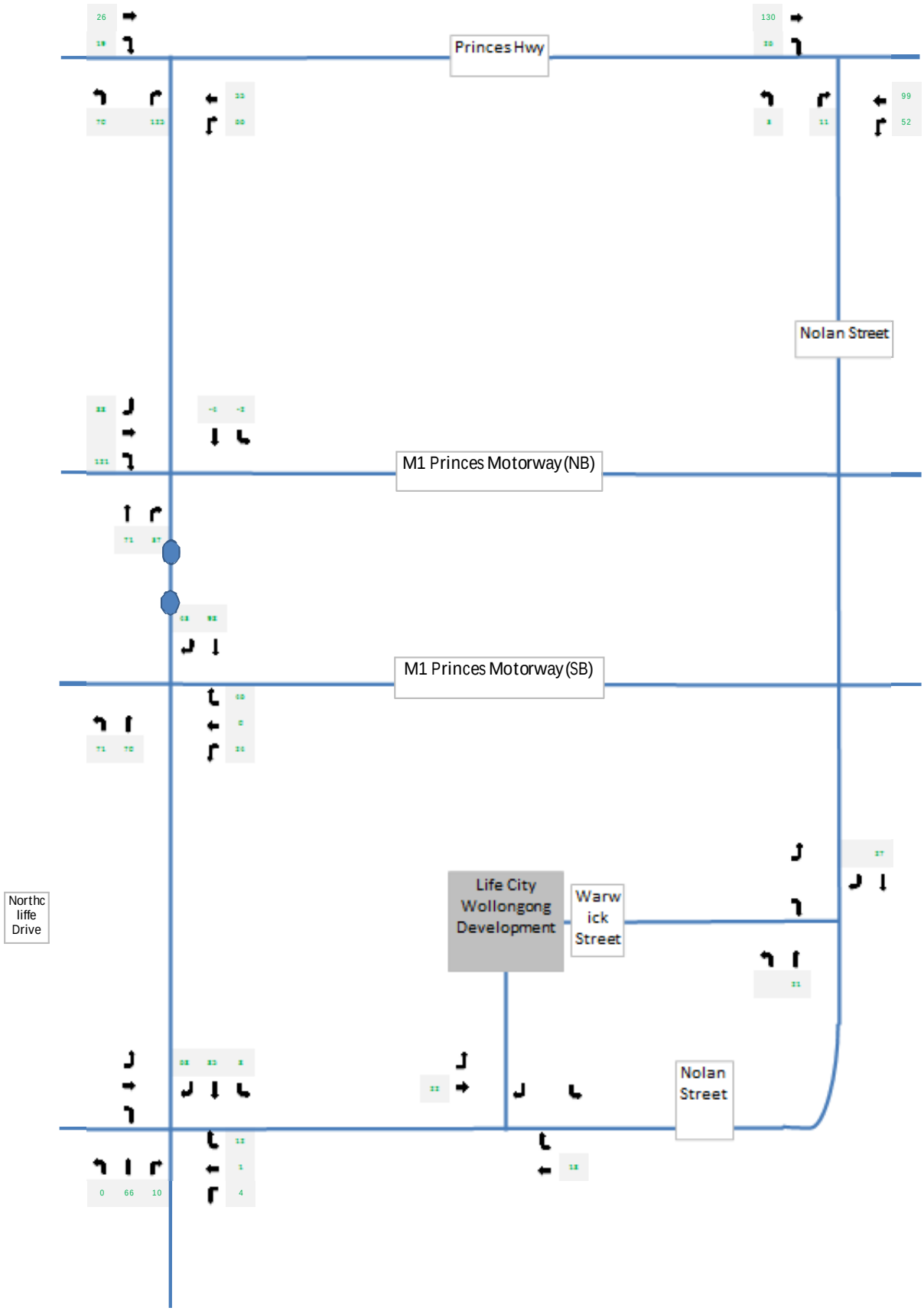
AM Peak Hour Development Traffic Flows



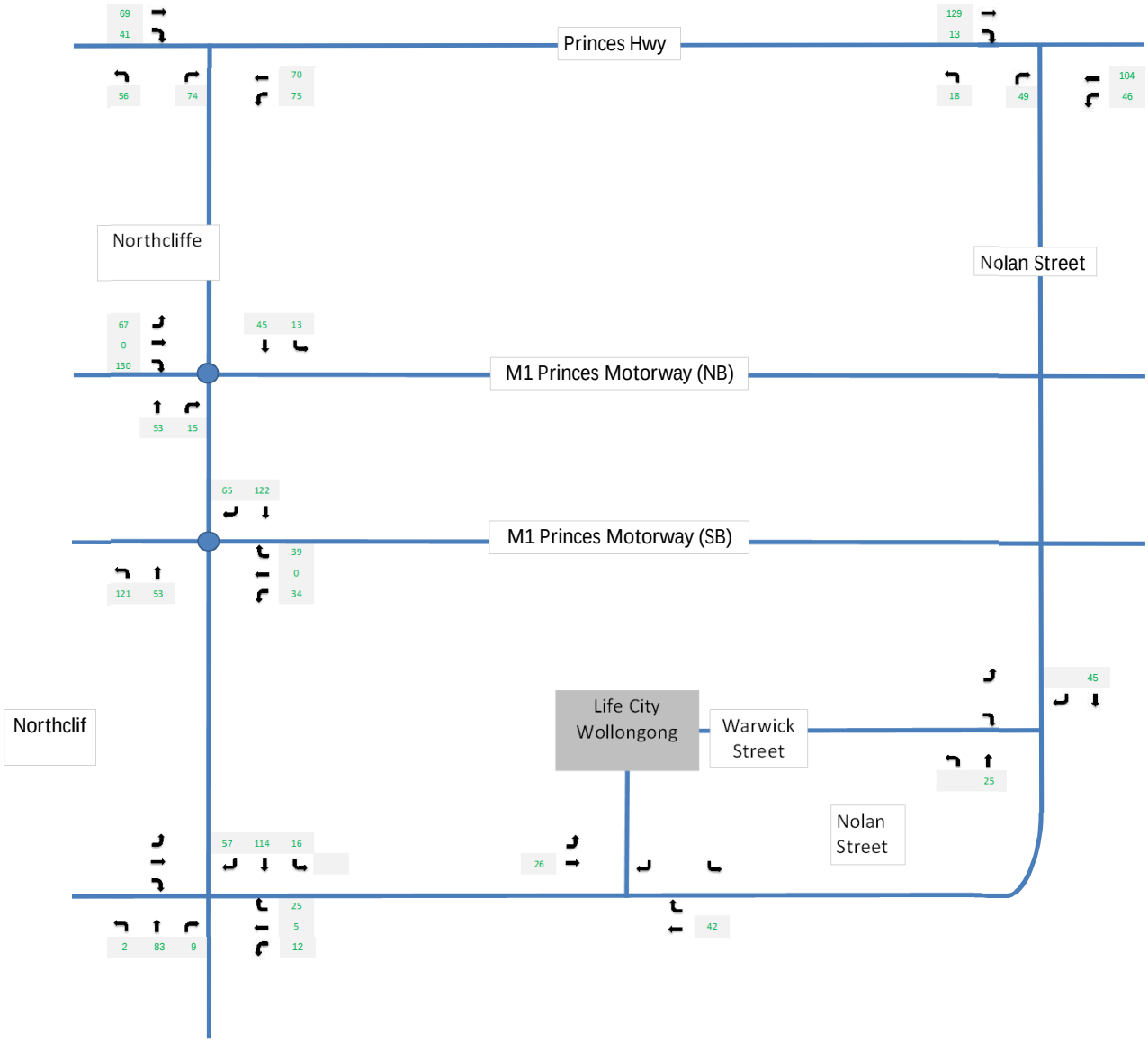
PM Peak Hour Development Traffic Flows



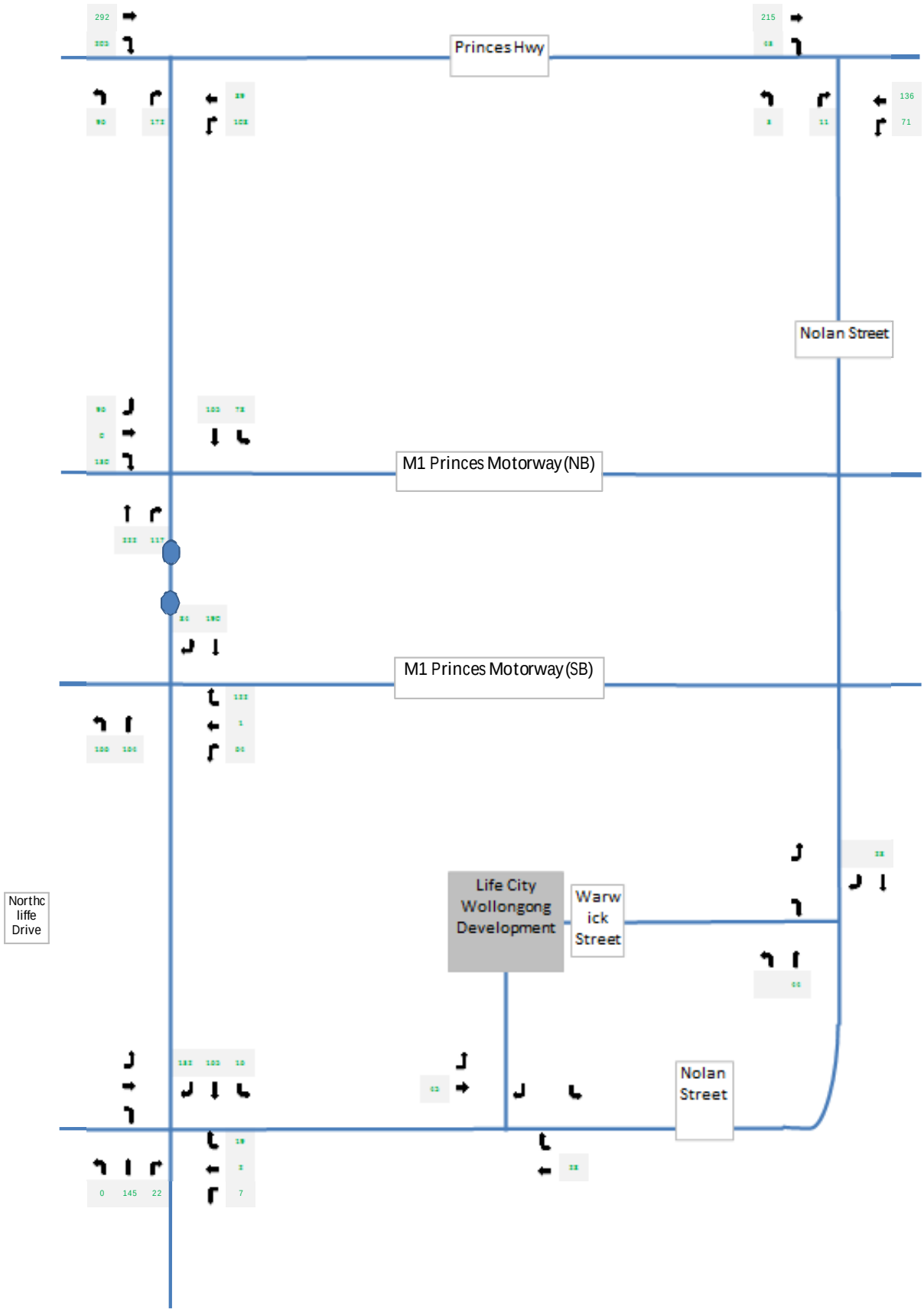
2021 AM Peak Hour Background Traffic Growth



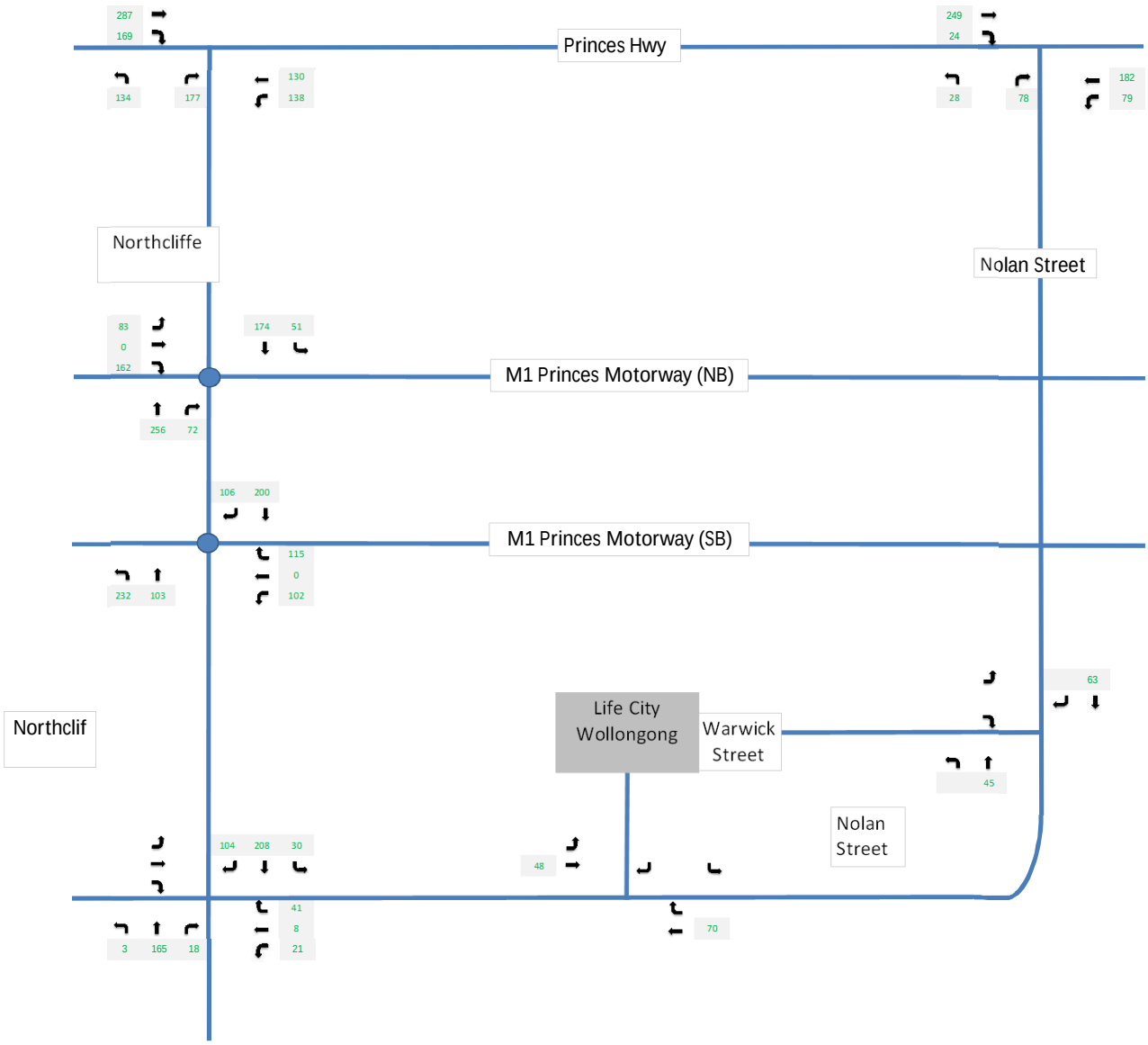
2021 PM Peak Hour Background Traffic Growth



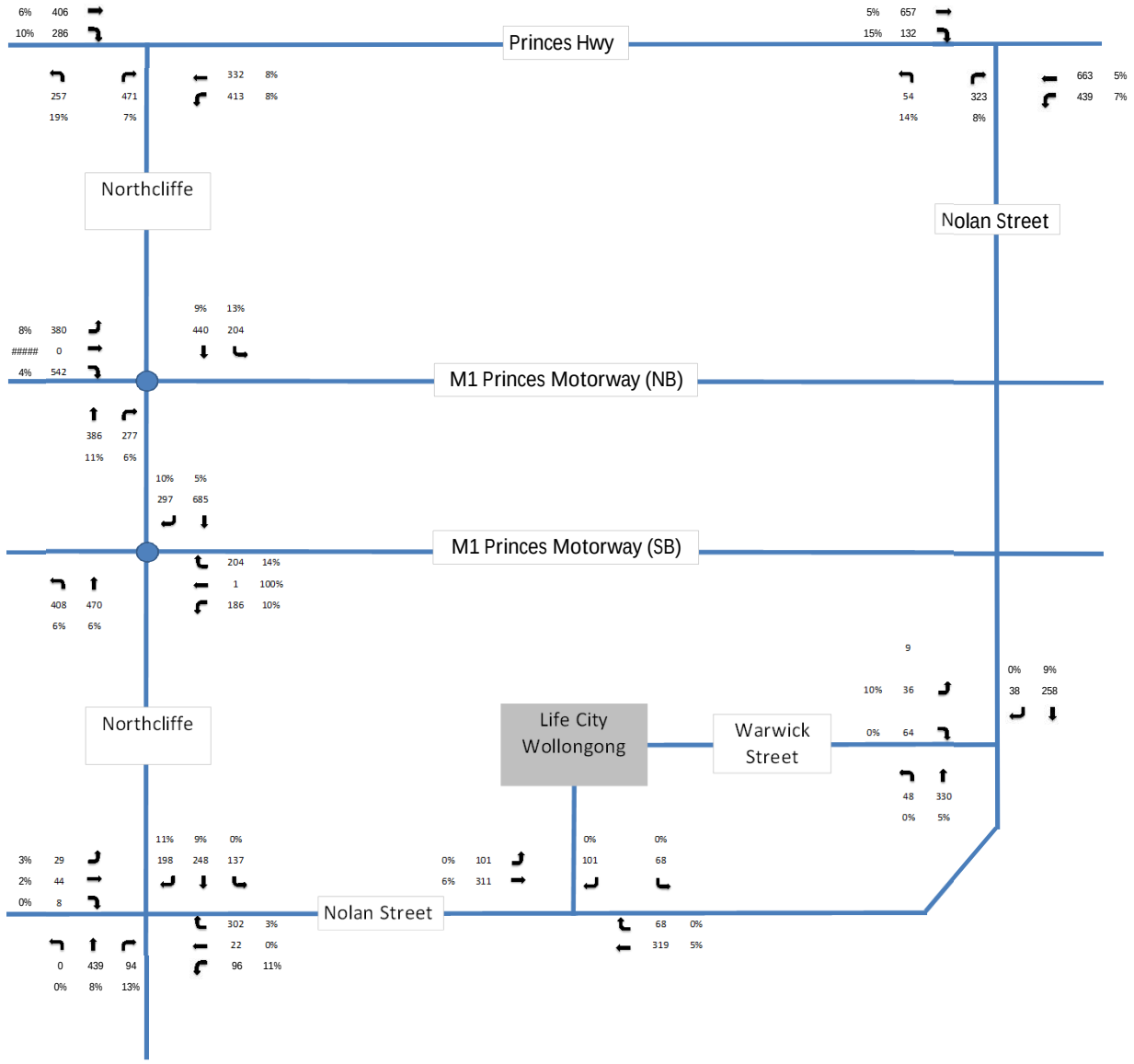
2031 AM Peak Hour Background Traffic Growth



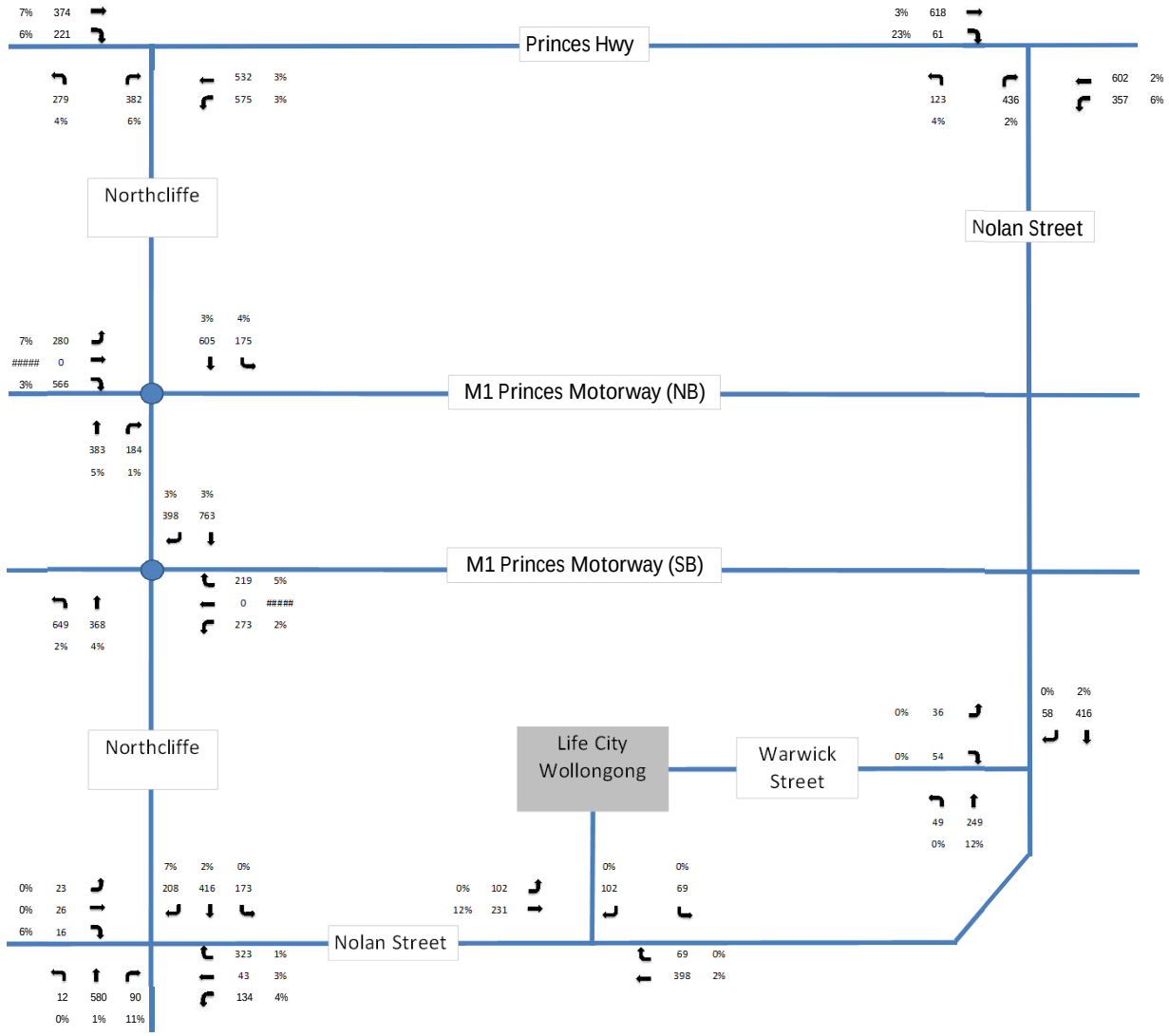
2031 AM Peak Hour Background Traffic Growth



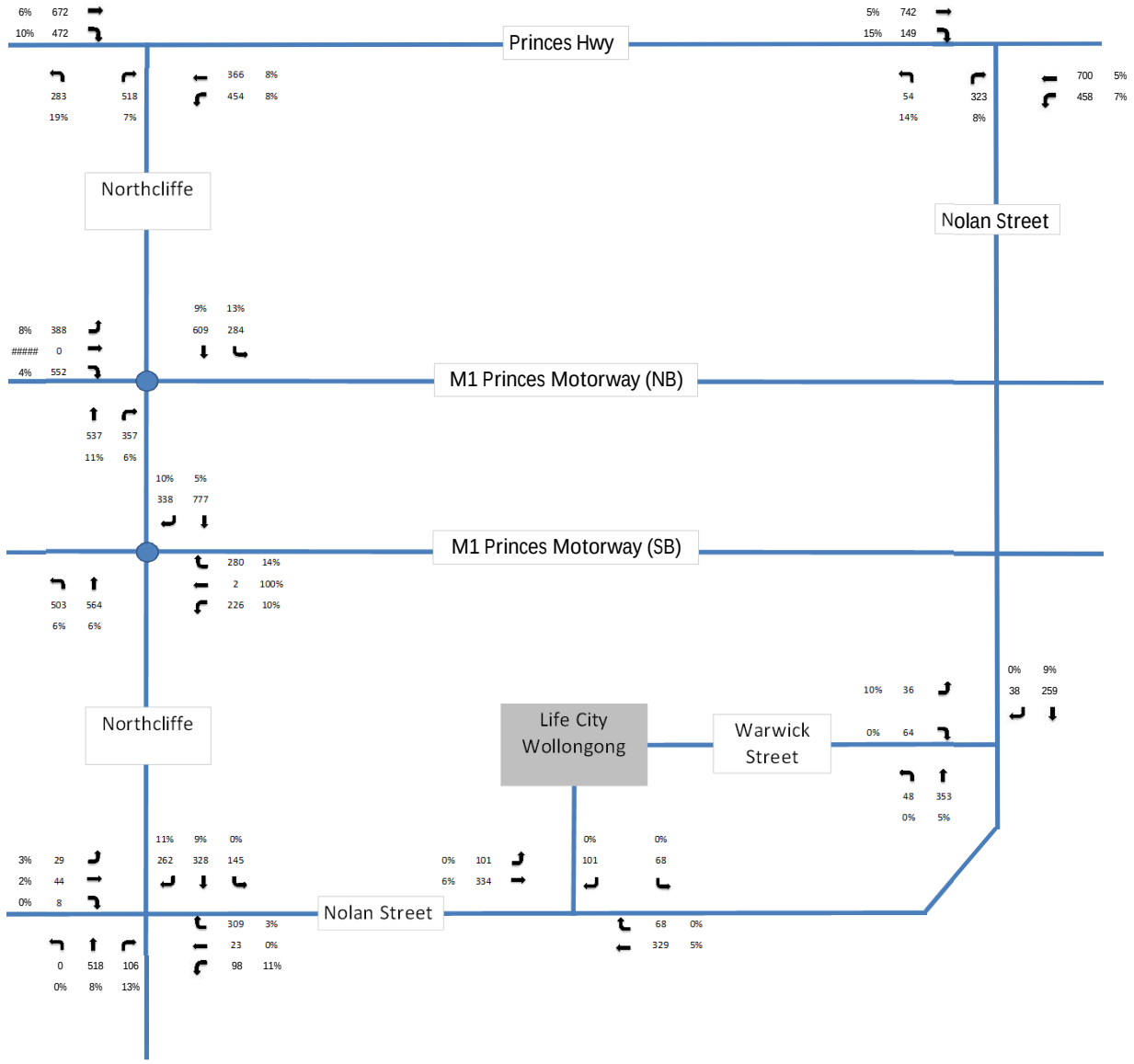
2021 AM Peak Hour Forecast Traffic Flows



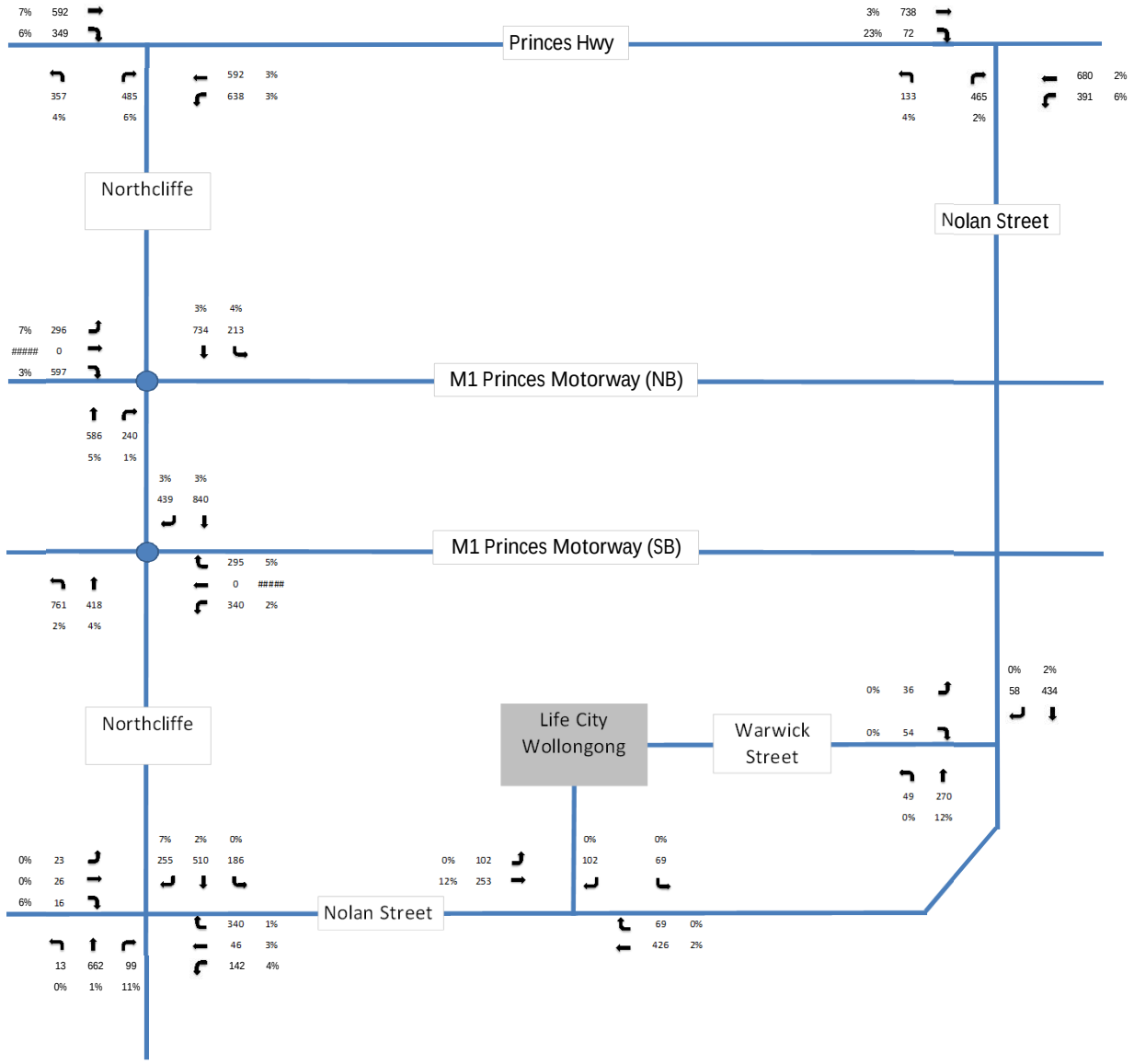
2021 PM Peak Hour Forecast Traffic Flows



2031 AM Peak Hour Forecast Traffic Flows



2031 PM Peak Hour Forecast Traffic Flows



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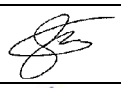
Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
2	K McNatty	I Smith		S Konstas		23/11/12
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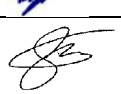
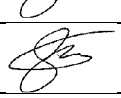
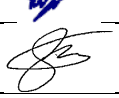
4	K McNatty	I Smith		S Konstas		23/05/13
5	K McNatty	I Smith		I Smith		22/10/13

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