Statement of Environmental Effects,
Proposed Wollongong Hospital
Carpark

APPENDIX C

TRAFFIC IMPACE ASSESSMENT (CARDNO)

Cardno
Shaping the Future

Wollongong Hospital Car Park

Traffic Impact Assessment

NA80813070/012

Prepared for
NSW Health Infrastructure

June 2013

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Shaping the Future

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Prepared for:
NSW Health Infrastructure

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1 Introduction

1.1 Background

Cardno has been engaged by NSW Health Infrastructure c/o TSA Management to undertake a Traffic Impact Assessment (TIA) for the proposed 754 space expansion of the existing multi-storey car park at Wollongong Hospital located on New Dapto Road in Wollongong. The proposed expansion of the multi-story car park is intended to support the already approved Wollongong Hospital redevelopment. The hospital currently has approximately 2,368 employees, 474 beds and 1,565 outpatients per day.

The approved redevelopment of Wollongong Hospital will result in an overall increase to approximately 2,779 employees, 554 beds and 1,696 outpatients per day. The Master Plan for the site shows the provision of a new multi-storey car park as a future stage of works, located adjacent to the current multi-storey car park to the west of New Dapto Road. The Hospital expansion approval requires the provision of 296 car parking spaces to support the new Hospital.

As part of the already approved Wollongong Hospital redevelopment planning application, Taylor Thomson Whitting (TTW) undertook the following traffic studies which assess pedestrian and traffic access, parking capacity increase and the effect of the redevelopment on the surrounding road system:

> Traffic and Parking Demand Report – Wollongong Hospital Redevelopment – June 2011;

> Traffic and Transport Accessibility Report – Wollongong Hospital Redevelopment – July 2011;

> Proposed New Car Park at Wollongong Hospital – Review of Parking Supply and Demand – March 2012.

This assessment should be read in conjunction with the reports produced by TTW. It is noted that the proposed development does not seek to specifically address any parking issues as a result of the extant planning permission for the Wollongong Hospital with any surplus provision in parking spaces contributing to alleviating existing deficiencies in parking supply.

1.2 Scope of Works

This report provides a traffic engineering assessment of the proposed expansion of the multi-storey car park, specifically in relation to the potential impact on car parking demand and the surrounding road network. It is noted that, as agreed with Council, the basis of this report will be largely based on assumptions and data collected for the TTW reports including the traffic and parking surveys. This assessment extends upon the work that has previously been undertaken by TTW in support of the overall redevelopment of Wollongong Hospital.

The following scope of works was agreed with Council's Traffic Section and undertaken as part of this study:

> Site location, description and mapping;

> Description of proposals and associated layout plans;

> A review of previous studies / assessments to obtain relevant information with regards to background traffic conditions and future demands;

> Development of a spreadsheet model which accounts for traffic generation, distribution and assignment of development traffic on the surrounding road network, increase in background traffic as well as committed development traffic. The spreadsheet model is based on refinement/sensitivity tests in relation public transport and private vehicle usage based on initial TTW assumptions and the latest Census Data. Allowance shall be made for the free shuttle loop service that operates around Wollongong CBD.

> The following scenarios for the AM and PM peak periods are assessed:

  - 2011 Base – Refinement of TTW's base SIDRA models and application 2011 traffic survey data to form the 2011 baseline conditions. The baseline conditions will focus on existing land use, surrounding land uses, car parking and site access;

- 2016 Base – This is design year baseline for the opening of the new car park. The 2016 base will include background traffic growth and new developments (within site vicinity) that are completed between 2011 and 2016 (as agreed with Council);
- 2016 Base plus Development – Additional traffic generated from the car park will be added onto the opening year base to assess the impacts on the surrounding road network;
- 2026 Base – 10 year future horizon assessment after opening year which will include background traffic growth and approved developments (as agreed with Council); and
- 2026 Base plus Development – Additional traffic generated from the car park will be added onto the future 10 year base to assess the impacts on the surrounding road network.

> Undertake intersection analysis for the above scenarios of the following intersections:
  - New Dapto Street/Loftus Street/New Dapto Road/Mercury Street (roundabout controlled);
  - Darling Street/Loftus Street (priority controlled);
  - Crown Street/Darling Street/Princess Highway/Osborne Street (signal controlled); and
  - Princess Highway/New Dapto Street (signal controlled).
> Identifying the performance of the existing road network and network demands;
> Assessment of the traffic and parking impacts of the proposed redevelopment;
> Review car park layout including accesses from New Dapto Road and Dudley Street;
> Considering the potential for sustainable travel options to the hospital; and
> Recommendations and mitigation measures for traffic and parking improvements.

1.3 Reference Documents

The following documents have been reviewed and referenced in this report:

> Traffic and Parking Demand Report – Wollongong Hospital Redevelopment – June 2011;
> Traffic and Transport Accessibility Report – Wollongong Hospital Redevelopment – July 2011;
> Proposed New Car Park at Wollongong Hospital – Review of Parking Supply and Demand – March 2012.
> RTA – Guide to Traffic Generating Developments (2002);
> QED Pty Ltd – Draft City Centre West Parking Management Plan;
> Wollongong Bus and Traffic Plan;
> Australian Standards 2890.1 Parking Facilities: Off Street Car Parking;
> Austroads Guide to Traffic Management: Part 12 Traffic Impacts of Developments;
> Austroads Guide to Road Design: Part 4A Unsignalised and Signalised Intersections; and
> Development application traffic reports for the following projects:
  - West Kiera (MP2006/335);
  - Rawson Street mixed use development (DA-2011/770);
  - Gladstone Avenue mixed us development (DA-2010/1415);
  - 10 Regent Street (DA2009/750);
  - 9 Crown Lane (DA2009/1113);
  - 21-27 Denison Street (DA2007/603); and
  - Wollongong Private Hospital at 360-364 Crown Street.

1.4 Background Review

1.4.1 Wollongong Hospital Traffic and Parking Report – TTW July 2011

As part of the proposed Wollongong Hospital redevelopment, TTW were engaged by Health Infrastructure to advise on traffic aspects of the project. The scope of works included:

> Undertaking parking occupancy surveys for both surrounding on street parking and hospital car parks;

> Intersection counts at critical intersections surrounding Wollongong Hospital;

> Assessment of the future parking requirements;

> Assessment of traffic impacts for the surrounding roads taking into consideration of the following approved new developments:

- Medical Centre at 46-48 Loftus Road; and
- Private Hospital at 360 Crown Street.

> Evaluation of active and public transport facilities.

Key assumptions made by TTW in their reporting include:

> 20% of on-street parking within the vicinity of the hospital was assigned to residents; and

> 75% of staff using private transport.

The report concluded that the existing road system and access arrangement will continue to operate at similar level of service when the redevelopment of the Hospital is completed. Pedestrian desire lines have been identified and are included as part of the proposed plan for the campus which will form the basis for pedestrian links and facilities. The car parking supply for the Hospital use is within the Wollongong Council's DCP requirements.

1.4.2 Wollongong Central Retail Redevelopment TIA – AECOM July 2007

This report assesses the traffic impact from the proposed expansion of the Wollongong Central Shopping Centre. The proposed development involves the construction of a new multi-level retail centre to the west of Keira Street and north of Crown Lane in the Wollongong CBD, on top of which a residential and a commercial tower are to be built at a later stage.

The 2016 Thursday PM Peak Base Paramics Model supplied by Wollongong City Council includes the assessment of the increase in trips on the network to account for planned growth in the city centre. Intersection traffic volumes have been presented were used for this study to establish the turning splits at the Crown Street/Gladstone Avenue/Denison Street intersection. The splits have been utilised in this study for distribution when taking consideration the future traffic generated from the surrounding committed developments.

1.4.3 Draft City Centre West Parking Management Plan – QED Pty Ltd

Wollongong City Council is committed to the revitalisation of the Wollongong's City Centre, including the City Centre West Precinct. Wollongong Hospital is the centre of the precinct and also the centre of the region's health industry. Over the last few years, the precinct has seen a rapid growth in health-related jobs and is expected to continue. The growth of new jobs in the precinct and the increasing number of people living in the area has created pressures on space for parking and has also increase the traffic on the local streets.

The parking management plan seeks to address issues raised by local residents in regards to increasing vehicle use, occupation of parking spaces and higher vehicle traffic movement in and around the precinct. The plan has also investigated options to relieve the pressure on parking for residents, visitors and employees as well as encourage a street environment that is safe and attractive and promotes the amenity of the area.

Recommendations made in the management plan include providing more off-street parking spaces by utilising the existing owned land on New Dapto Road. Other measures include adopting a green transport plan, improving the public transport facilities, line mark parking spaces, reduce amount of kerb space taken up by driveways and make distant car parking spaces more accessible by walking.

2 Site Location

As indicated on **Figure 2.1**, Wollongong Hospital is highlighted in yellow and is located approximately 500m west of the Wollongong CBD. The subject site is located directly opposite the Hospital and is bound by the existing Hospital car park to the north, Dudley Street to the west, Urunga Parade to the south and New Dapto Road to the east. The existing hospital multi-storey car park is situated on the western side of New Dapto Road between Urunga Parade and Mercury Street. It currently provides for 574 car park spaces for hospital staff and visitors. The TTW report indicates 591 spaces in the existing multi-storey car-park. The difference may be due to some level of informal parking taking place. Ingress and egress to the car park is via New Dapto Road and Dudley Street. There is a pedestrian overbridge on level 2 to provide connection between the car park and hospital.

The application site is currently occupied by medical facilities with car parking provision of approximately 48 spaces.

The new multi-storey car park will be located immediately south of the existing car park as highlighted in yellow in **Figure 2.1**, providing for approximately754 car parking spaces (including 12 accessible spaces) with ingress movements only from New Dapto Road with Dudley Street providing for both ingress and egress movements.

Figure 2.1 Site Location

3 Existing Transport Situation

3.1 Hospital Traffic Generators

Hospital traffic is pre-dominantly generated by employees, outpatients and visitors to the hospital. Based on information received from the Hospital, the following indicates the current numbers for Wollongong Hospital:

> Total employees – 2368 (434 medical practitioners and 1934 general employees);

> No. of beds – 474 (this will determine the number of visitors to the hospital); and

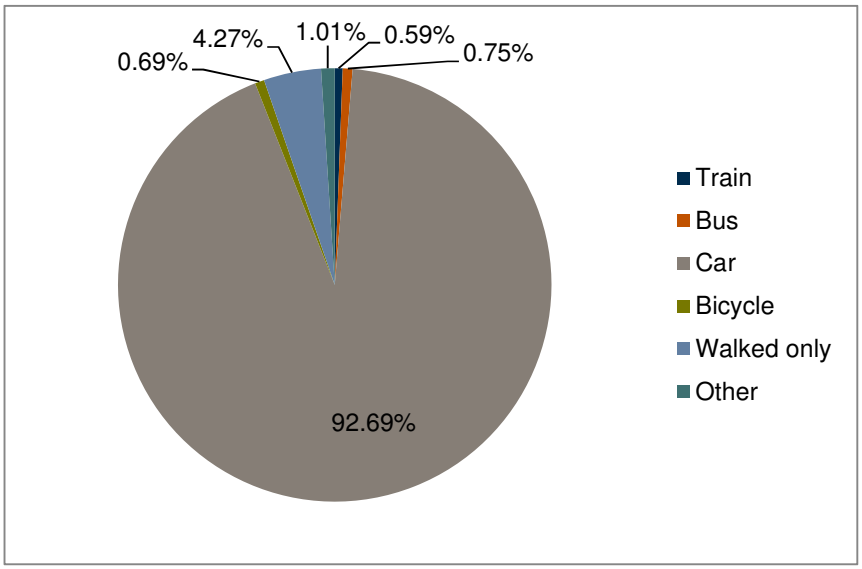
> Outpatients – 1565 average per day.

3.2 Travel Patterns

3.2.1 Medical Staff Professions

Journey to Work (JTW) data from the 2011 Census was used to form a basis for trends in transport use for employees commuting to the hospital. At the time of reporting, JTW data was only available for workplaces distinguished by Local Government Areas (LGA). A preliminary review was undertaken of the Wollongong LGA, with the data refined to incorporate only workers in the medical and nursing professions. The results of this assessment, presented in **Figure 3.1**, indicate that the predominant mode of travel is by car, with over 90%. It is useful to note that the next highest proportion of travel mode is by walking with approximately 5% of medical employees walking to work.

Figure 3.1 Journey to Work (Wollongong LGA – Medical Professions)



In summary, workers in the medical profession are very likely to drive to work (with approximately 90% of workers using a car). It is also important to note that there are also a high proportion of medical professionals who walk to work.

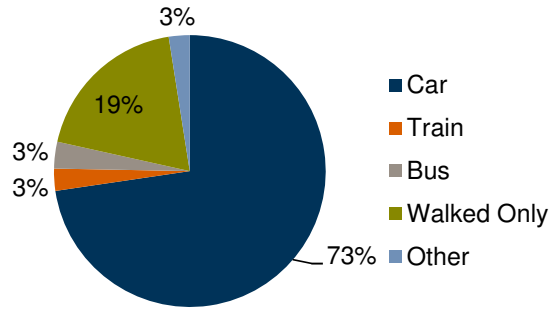
3.2.2 General Public

Figure 3.2 below presents the 2007 Household Travel Survey and 2011 Journey to Work data for the type of mode use for general public commuters. The Household Travel Survey (HTS) involves participants completing a diary of all trips they undertake, including details of origin, destination, travel mode/s and reasons for the journey

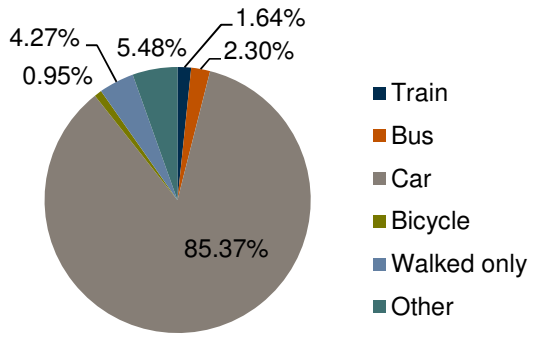
The results of the HTS review are similar to the Census data indicating that the preferred mode of travel to work in Wollongong LGA is by private cars followed by the next highest mode which is walking to and from their destinations.

Figure 3.2 Household Travel Survey (Wollongong LGA)

2007 Household Travel Survey (Wollongong LGA)



2011 Journey to Work Census Data (Wollongong LGA – General Public)



3.3 Parking Demand and Supply

3.3.1 Parking Supply

The existing parking supply was documented by TTW as part of their study supporting the Wollongong Hospital redevelopment and is summarised in **Table 3.1**. It indicates that there are 591 spaces provided in the multi-storey car park with approximately 155 car parking spaces available within the hospital compound resulting in a total car parking provision of 746 spaces. It is noted that the 591 spaces consists of both formal and informal parking spaces. Our findings indicate that there are approximately 574 formal spaces currently contained within the multi-storey car-park.

Table 3.1 Existing Parking Supply (Source: TTW 2011)

Parking Location	Number of Parking Spaces
Multi-Storey Car Park	591*
Outside Area Adjacent to Multi-Storey Parking	70
Renal Centre	14
Renal Centre (10 minute parking)	4
Loftus Street Entrance	9
Cancer Care (adjacent to Loftus Road)	14
Adjacent to Loading Dock	8
Engineering	8
Hospital Road	16
Mental Health	2
TOTAL	**746**

Note: Consists of both informal and formal parking spaces (formal spaces recorded as approximately 574)

In addition to the hospital car parking spaces, TTW's report (June 2011) has also identified approximately 236 on-street car parking spaces within the hospital vicinity with a peak demand of 220 spaces (93% occupancy) experienced at 12pm. These findings exclude the extended on-street areas surrounding the hospital.

3.3.2 Hospital Car Parking Usage

Based on the parking occupancy surveys undertaken by TTW in 2010 and summarised in **Table 3.2**, the existing multi-storey car park experiences a parking occupancy of more than 90% between 8.30am to 3.30pm. The results of the parking surveys also indicate a high usage of on-street parking within the immediate vicinity of the hospital with an occupancy rate of 80-90% between 10am to 3pm.

Table 3.2 Parking Surveys for Multilevel Car Park – Number of Empty Spaces

Parking Type	8.30AM	9.30AM	10.30AM	11.30AM	12.30PM	1.30PM	2.30PM	3.30PM	4.30PM	5.30PM
Normal	46	18	7	0	15	9	8	39	123	247
2 Hour Visitor	20	11	5	5	0	0	0	0	0	3
Disability	5	5	5	5	8	8	7	4	4	5
TOTAL	**71**	**34**	**17**	**10**	**23**	**17**	**15**	**43**	**127**	**255**
Parking Occupancy	90%	95%	98%	99%	97%	98%	98%	94%	83%	66%

3.4 Existing Traffic Conditions

3.4.1 Traffic Surveys

Traffic surveys were originally undertaken by TTW on 30 March 2011 during the AM and PM peak periods across the following intersections:

> Crown Street/Darling Street/Osborne Street;

> Crown Street/New Dapto Road;

> New Dapto Road/Loftus Street/Mercury Street; and

> Loftus Street/Darling Street.

From the survey data, it was found that the network traffic peak period for the AM is from 08:00 – 09:00 and for the PM is 16:30 – 17.30. These traffic counts were undertaken as part of the TTW report and are illustrated in **Appendix A**.

3.4.2 Intersection Performance

The existing operation of the subject intersections was assessed using the SIDRA Intersection 5.1 software package in order to determine the degree of saturation (DoS), average delay (AVD) in seconds and level of service (LoS) at each intersection; the generally accepted measures of the operational performance of an intersection.

The key indicator of intersection performance is LoS, where results are placed on a continuum from 'A' to 'F', as summarised in **Table 3.3.**

Table 3.3 Intersection Level of Service Description

LoS	Traffic Signal / Roundabout	Give Way / Stop Sign / T-Junction control
A	Good operation	Good operation
B	Good with acceptable delays and spare capacity	Acceptable delays and spare capacity
C	Satisfactory	Satisfactory
D	Operating near capacity	Near capacity
E	At capacity, at signals incidents will cause excessive delays	At capacity, requires other control mode
F	Unsatisfactory and requires additional capacity, Roundabouts require other control mode	Unsatisfactory and requires additional capacity

The AVD provides a measure of the operational performance of an intersection as indicated below, which relates AVD to LOS. The AVD's should be taken as a guide only as longer delays could be tolerated in some locations (i.e. inner city conditions) and on some roads (i.e. minor side street intersecting with a major arterial route).

For traffic signals, the average delay over all movements should be taken. For roundabouts and priority control intersections (sign control) the critical movement for LoS assessment should be the movement with the highest AVD. **Table 3.4** summarises the AVD ranges for each LoS criteria.

Table 3.4 Intersection Average Delay (AVD)

LoS	AVD per Vehicles (seconds/vehicle)
A	Less than 14
B	15 to 28
C	29 to 42
D	43 to 56
E	57 to 70
F	>70

The DoS is another measure of the operational performance of individual intersections. For intersections controlled by traffic signals both queue length and delay increase rapidly as DoS approaches 1.0. It is common practice to ensure DoS is less than 0.9. DoS up to 0.8 generally represents satisfactory intersection operation; when DoS exceeds 0.9 the junction is considered to be approaching capacity, queues usually occur and mitigation maybe required.

The intersection layouts used in the SIDRA analysis are presented in **Appendix B.**

3.4.3 Intersection Performance based on 2011 Traffic Surveys

Intersection counts undertaken by TTW in 2011 were analysed using the modelling software SIDRA 5.1. **Table 3.5** presents the performances of the subject intersections with 2011 traffic volumes. Full SIDRA outputs are contained in **Appendix C.**

These results indicate that the performance of all intersections is generally satisfactory in the AM and PM peak periods. It is important to note that the Crown Street/New Dapto Road intersection is operating at LoS B in the PM peak period with a degree of saturation of 0.901.

Table 3.5 SIDRA Output Summary – 2011 Traffic Counts

Intersection	Intersection Control	AM Peak				PM Peak			
		Degree of Saturation	Delay (s)	Level of Service	95t% Q (m)	Degree of Saturation	Delay (s)	Level of Service	95t% Q (m)
Crown Street/ Darling Street/ Osborne Street	Signalised	0.326	6.9	A	24.3	0.6	8.4	A	47.6
Crown Street/ New Dapto Road	Signalised	0.678	12.5	A	66.3	0.901	23.3	B	195.8
New Dapto Road/ Loftus Street/ Mercury Street	Roundabout	0.125	13.8	A	5.1	0.257	14.4	A	11.5
Loftus Street/ Darling Street	Priority Control (Stop)	0.115	11.8	A	3.1	0.165	11.9	A	4.7

3.4.3.1 Validation of SIDRA Models

Observed queues at the intersection were recorded on Tuesday 9th April 2013 in the AM and PM peak hours, with the average standing queue for each approach recorded based on at least 5 signal cycles. The average observed queues were compared with modelled queues for model validation purposes and to ensure that the model is robust for use in the assessment of future conditions.

For the queue length comparisons, the GEH statistic, which is a modified chi-squared statistic that incorporates both relative and absolute differences, was used. **Table 3.6** summarises the comparison between modelled versus observed queue lengths and its associated GEH values.

GEH statistic is represented by the equation below:

$$GEH = \sqrt{\frac{(M-O)^2}{0{\cdot}5*(M+O)}}$$

Where

M: Modelled queue lengths

O: Observed queue lengths

Various GEH values give an indication of goodness of fit as outlined below:

GEH<5 – Results considered as good fit.

5<GEH<10 – Results may require further investigation.

10<GEH – Results cannot be considered to be good fit.

GEH values presented in **Table 3.6** indicate that the simulated values are a good fit to the observed queue lengths with all approaches modelled returning a GEH value of less than 5 at both intersections in both peak periods.

Table 3.6 Average Queue Length Comparison for Crown St / Darling St / Osborne St Intersection

Approach Leg	Lane	AM Peak			PM Peak		
		Actual (no. of vehicles)	Modelled (no. of vehicles)	GEH	Actual (no. of vehicles)	Modelled (no. of vehicles)	GEH
Crown Street (East)	Kerbside Lane	2	1	0.82	3	1	1.41
	Centre Lane	3	2	0.63	4	4	0.00
Osborne Street	N/A	2	2	0.00	2	3	0.63
Crown Street (West)	Kerbside Lane	3	3	0.00	3	1	1.41
	Centre Lane	4	3	0.53	4	1	1.90
Darling Street	N/A	1	4	1.90	4	7	1.28

Table 3.7 Average Queue Length Comparison for Crown St / New Dapto St Intersection

Approach Leg	Lane	AM Peak			PM Peak		
		Actual (no. of vehicles)	Modelled (no. of vehicles)	GEH	Actual (no. of vehicles)	Modelled (no. of vehicles)	GEH
Crown Street (East)	Kerbside Lane	2	1	0.82	9	9	0.00
	Centre Lane	4	2	1.15	5	5	0.00
New Dapto Road	Kerbside Lane	4	7	1.28	10	10	0.00
	Centre Lane	7	10	1.03	30	28	0.37
Crown Street (West)	Kerbside Lane	6	2	2.00	3	1	1.41
	Centre Lane	6	6	0.00	6	8	0.76

3.5 Public Transport Provisions

3.5.1 Passenger Rail

Wollongong Railway Station is located approximately 700m from Wollongong Hospital. The station is located on the South Coast Line, which extends to Central Station (Sydney) to the north, and branches out to Port Kembla and Nowra to the south. CityRail coach services also operate to Bundanoon via Robertson and Mittagong. This is indicated on **Figure 3.3.**

Services to Thirroul depart approximately every 15minutes, and services to Sydney depart every 30-60minutes.

Figure 3.3 CityRail Network – Wollongong Station

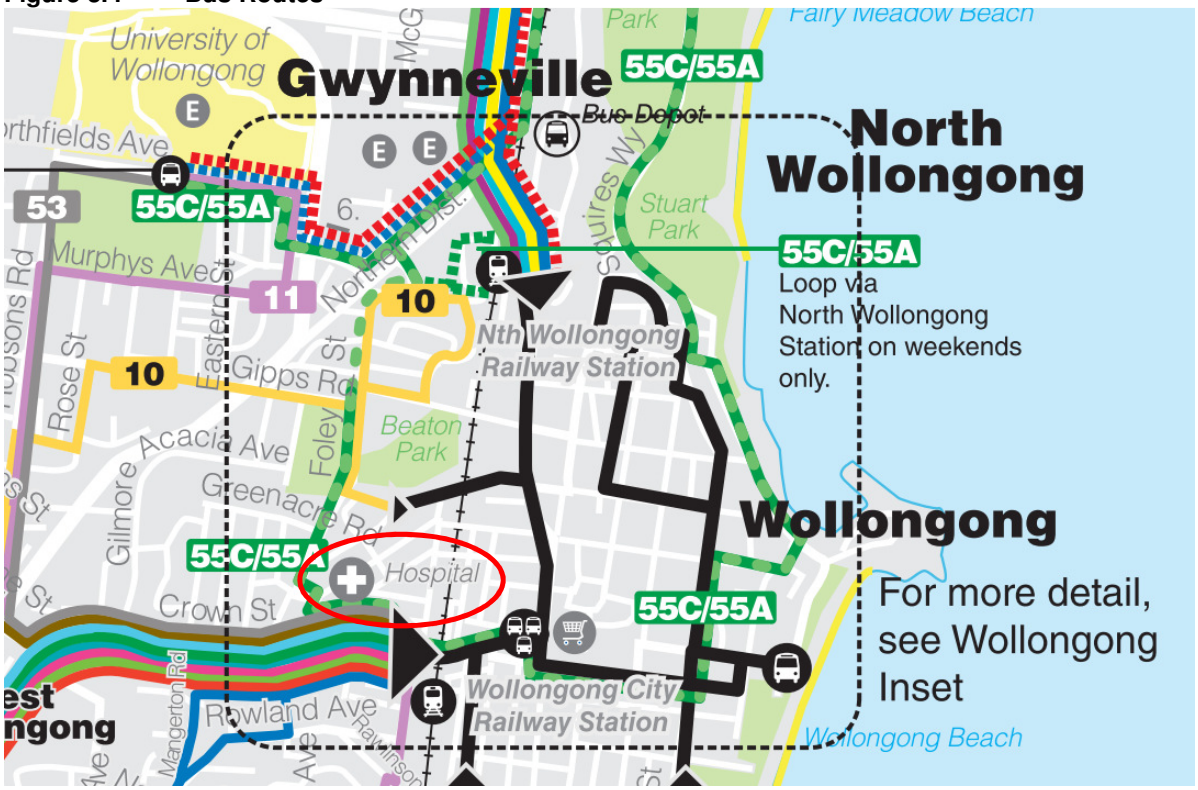
3.5.2 Bus

Wollongong's local bus network is primarily operated by Premier Illawarra bus lines, including a free shuttle bus (Route 55) around Wollongong which also passes Wollongong Hospital. There are a large number of bus routes which operate past Wollongong Hospital as shown in **Figure 3.4**. However there is generally poor service frequency (typically every 60 minutes for each route).These bus services are summarised in **Table 3.8.**

Table 3.8 Bus Routes around Wollongong Hospital

Bus Route Number	Origin	Destination	Peak Frequency
55	Wollongong Shuttle Loop		10 minutes
24	Wollongong	Fig Tree	30 minutes
33	Wollongong	Dapto	30-60 minutes
34	Wollongong	Warrawong	30 minutes
35	Wollongong	Unanderra	60 minutes
36	Wollongong	Kembla heights	120 minutes
37	Wollongong Loop		60 minutes
39	Wollongong	Fig Tree	30-60 minutes
51	Wollongong	Shellharbour	60 minutes
53	Wollongong	Shellharbour	60 minutes
57	Wollongong Loop		60 minutes

Figure 3.4 Bus Routes



Source: http://www.premierillawarra.com.au/pdf/guides/networkmap.pdf

4 Proposed Development

The proposed multi-storey car park will be constructed immediately south of the existing car park to cater for the additional parking demands from the redevelopment of Wollongong Hospital. The key features of the proposed car park are:

> Provision of 754 car park spaces (including 12 accessible spaces);

> Ingress points at both New Dapto Road and Dudley Street;

> Egress point at Dudley Street; and

> Connections on various levels to provide a linkage between the old and new car park.

4.1 Forecast Staff, Outpatients and No. of Beds

On the basis of information provided by the Illawarra Shoalhaven Local Health District and Health Infrastructure, the existing and future employees, number of beds and outpatients have been determined as shown in **Table 4.1**. The table indicates that the hospital redevelopment will yield an additional 411 employees, 80 beds and 131 outpatients per day.

Table 4.1 Forecast Staff, Patient and No. of Beds

User Type	Existing	Future	Growth
Medical Practitioners (per day)	434	478	+ 44
General Employees (per day)	1934	2301	+ 367
No. of Beds	474	554	+ 80
Outpatients (per day)	1565	1696	+ 131

5 Traffic Impacts

5.1 Traffic Generation

The RMS Guide to Traffic Generating Development (2002) was initially used to assess the traffic impact from the proposed development. It is noted that the rates given in the RMS Guide are for private hospitals and only takes into consideration the number of beds (B) and average staff per weekday day shift (ASDS). The traffic generation equations given in the RMS Guide are:

Peak Vehicle Trips = -14.69 + 0.69 B + 0.31 ASDS

Morning Commuter Peak Hour Trips = -10.21 + 0.47 B + 0.06 ASDS

Evening Commuter Peak Hour Trips = -2.84 + 0.25 B + 0.40 ASDS

The application of the above equations with the proposed development quantum for Wollongong Hospital results in 168 peak vehicle trips, 53 morning commuter peak trips and 182 evening commuter peak trips.

The resultant generated traffic based on the RMS Guide under-estimates the traffic generated at the site. It is also important to note that the models did not take into consideration outpatients trips to the hospital.

To undertake a robust traffic impact assessment, the traffic generation from the hospital is based on a first principles approach. **Table 5.1** outlines the methodology used to identify the traffic generation rates and assumptions associated with each step during this process.

Table 5.1 Trip Generation Assumptions

User Type	Trip Generation Rate	Assumptions for Trip Generation
Medical Practitioners (MP)	1 trip per MP	– 1 trip per MP based on JTW data; – 85% of MPs are present on an average day (15% will be away on holiday, sabbatical leave or conferences); – 95% of MPs works in the morning shift arrives in the AM peak and departs in the PM Peak.
General Employees (GE)	0.9 trips per GE	– 85% of GEs are present on an average day (15% will be away on holiday, sabbatical leaves); – 90% of GEs drives to hospital with the remaining 10% using the shuttle bus service, public transport and walking; – 95% of GEs works in the morning shift arrives in the AM peak and departs in the PM Peak.
Outpatients	120 trips per hour	– 85% of outpatients drives to hospital based on HTS and Census data with a 5% mode shift to use the shuttle bus service, public transport and walking; – Average number of operation hours is 10 hours; – Average number of outpatients (drivers) per hour is 136 (total daily outpatients x 80% drivers /average operation hours); and – Average time in hospital for each outpatient (drivers) is 90 minutes;
Visitors	1 car trip per 2 beds	– Based on parking requirement rates of 1 space per 2 beds as specified in Wollongong DCP; – No visitor trips during the AM peak hour as it is outside visiting hours; – 50% of visitors to arrive and leave within the peak period.

Note: AM peak hour is from 8am to 9am and the PM peak hour is from 4.30pm to 5.30pm as identified in the TTW report.

Based on the first principles approach undertaken, the additional quantum associated with the Hospital redevelopment is anticipated to be 344 trips in the AM peak and 406 trips in the PM Peak. The spreadsheet detailing the traffic generation methodology is contained in **Appendix D**.

The TTW report indicated that currently there is a DCP requirement of 1,215 car parking spaces for the Wollongong Hospital. However, the existing multi storey car park and hospital campus can only accommodate 719 vehicles (formal spaces), indicating a deficit of 496 parking spaces. As a result, a large portion of the demand spills over to the on-street parking in the vicinity of Wollongong Hospital. However, it is expected that the proposed multi storey car park will be able to alleviate this demand for on-street car parking spaces as well as to fully accommodate the additional car parking space requirements generated by the proposed hospital redevelopment. It must be noted that the vehicles currently using on-street car parking are not considered as additional traffic in the modelling process as these vehicles are already present within the network. The only additional traffic is that which is generated by the proposed hospital redevelopment.

5.2 Traffic Distribution

Based on 2011 mid-block volumes from traffic survey data, the proportion of vehicles entering the car park via each route was calculated. The proportion of vehicles entering via Mercury Street, New Dapto Road (north), Crown Street (east) and Crown Street (west) were calculated to be in the order of 10%, 10%, 35% and 45% respectively.

Table 5.2 outlines the traffic distribution assumptions for the new additional vehicles using the proposed car park facility.

Table 5.2 Ingress and Egress Traffic Distribution Assumptions

Street	Ingress	Egress
New Dapto Street	It is assumed that 75% of new car park traffic will enter from New Dapto Road. The car park access predominantly serves vehicles from main arterial road of Crown Street.	No egress permitted from new car park to New Dapto Road
Dudley Street	The remaining 25% of new car park traffic will use the Dudley Street entry. These trips will consist of vehicles coming from the north (Mercury Street), east (Loftus Road) and the west.	All exiting vehicles use Dudley Street with 10% travelling north to reach Mercury Street and 90% travelling south to reach Urunga Parade and then turning left on to New Dapto Road. It was assumed that 10% of the vehicles will travel north towards New Dapto Road from the New Dapto Road/ Loftus Street/ Mercury Street roundabout and the rest will make a U-turn in order to travel south on New Dapto Road towards the Crown Street/ New Dapto Road intersection. However, during the PM peak it was assumed that half of the vehicles travelling towards Crown Street East and 10% of the vehicles travelling towards Crown Street West will turn right on to Loftus Street (from Street/ Mercury Street roundabout) and travel to Crown Street via Darling Street. This assumption is justified on the observation of large queues that back up on the New Dapto Street from Crown Street/New Dapto Road intersection during the PM peak; therefore many drivers, especially the familiar drivers such as the hospital staff, would consider an alternate route.

5.3 Cumulative Impacts from Committed Developments

Information on committed developments was received by Wollongong City Council, and the traffic reports on each of these developments were reviewed. The traffic generated from these developments were added onto the network and taken into account as part of the forecast assessment. The following table summarises the committed developments, their respective traffic generations and splits.

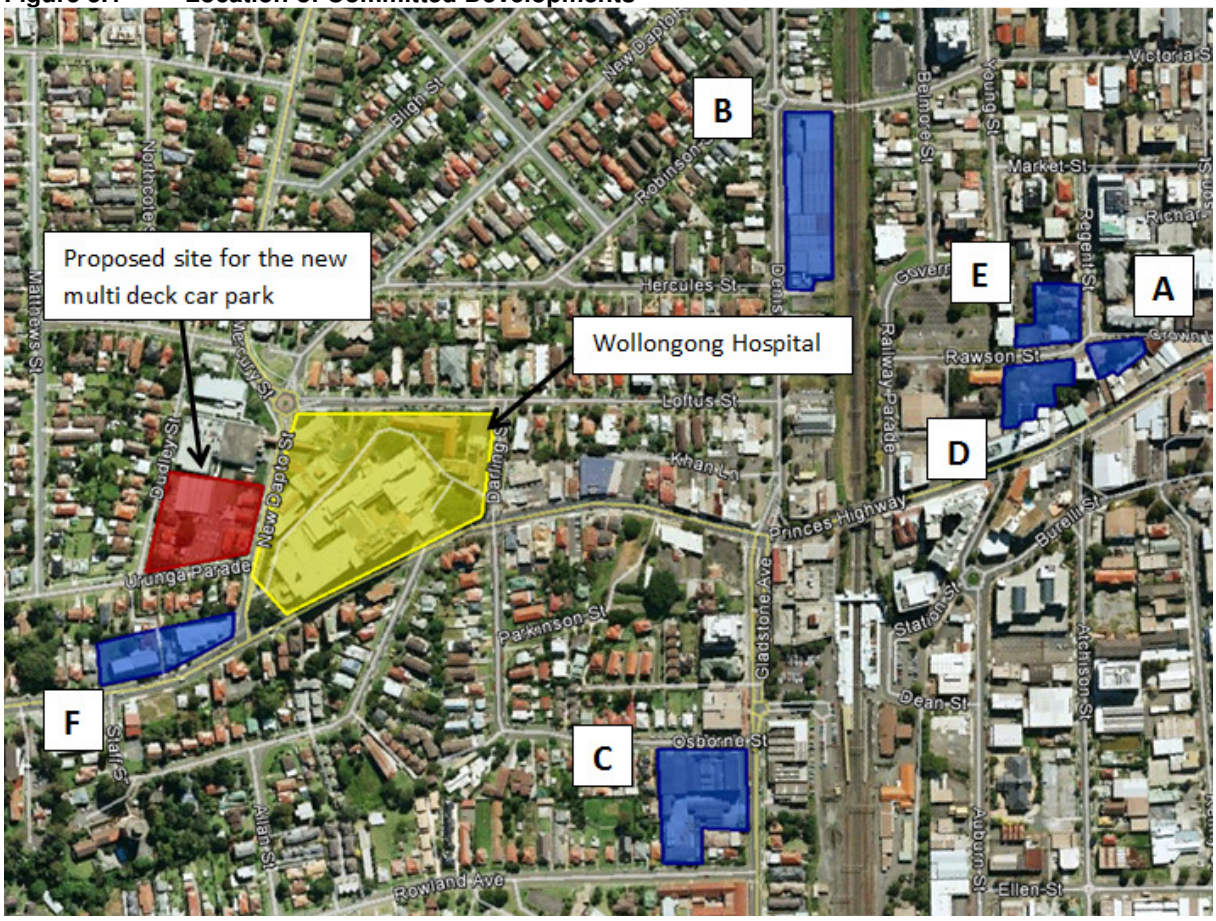
Table 5.3 Committed Developments and Traffic Generations

Map Reference (See Figure 5.1)	Development Location	Type of Development	AM Peak Hour		PM Peak Hour	
			In	Out	In	Out
A	9 Crown Lane	Commercial and residential development	23*	17*	17*	23*
B	21 – 27 Denison Street	Commercial development	75	15	20	55
C	Gladstone Avenue, Osborne Street and Rowland Avenue	Retail and residential development	10	21	21	10
D	3 Rawson Street	Mixed use development	35	26	26	35
E	Regent and Rawson Streets	Mixed use development	33	20	20	33
F	360-364 Crown Street	Private Hospital	144	36	155	233

*Assumption made on the distribution splits as traffic assessment has no specification

Figure 5.1 indicates the locations of committed developments in the vicinity of Wollongong Hospital and the hospital car park (shaded in yellow and red, respectively). The additional traffic from developments A, B, D and E using the intersection of Crown Street/Darling Street/Osborne Street intersection were distributed according to the splits assumed in the AECOM report as detailed in **Section 1.4.2**.

Figure 5.1 Location of Committed Developments



5.4 Background Traffic Growth

A spreadsheet traffic model for the surrounding road network was developed by interrogating 2011 traffic survey data to form the 2011 baseline conditions. This model accounts for traffic generation, distribution and assignment of development traffic on the surrounding road network, increase in background traffic as well as committed development traffic.

As referenced from TTW's previous assessment, a rate of 1% growth per annum in background growth has been assumed for the through traffic trips travelling on Crown Street, New Dapto Road and Mercury Street in order to calculate the future year baseline traffic levels. The growth rate was applied to the network in order to obtain forecast volumes for 2016 and 2026 scenarios.

5.5 Intersection Performance – 2016 Opening Year

5.5.1 2016 Baseline

The proposed multi-storey car park has been assumed to be opened in 2016. The 2016 base includes background traffic growth and committed developments (within site vicinity) that are completed between 2011 and 2016 (without car park development). The SIDRA analysis results are summarised in the table below. These results indicate that all the intersections perform satisfactorily in 2016 at a LoS B. Full SIDRA outputs are contained in **Appendix E.**

Table 5.4 2016 Baseline Scenario Intersection Assessment Results

Intersection	Intersection Control	AM Peak				PM Peak			
		Degree of Saturation	Delay (s)	Level of Service	95t% Q (m)	Degree of Saturation	Delay (s)	Level of Service	95t% Q (m)
Crown Street/ Darling Street/ Osborne Street	Signalised	0.401	6.3	A	24.3	0.739	7.5	A	51.4
Crown Street/ New Dapto Road	Signalised	0.776	12.5	A	72	0.96	25.8	B	249.2
New Dapto Road/ Loftus Street/ Mercury Street	Roundabout	0.136	13.8	A	5.7	0.282	14.5	A	12.9
Loftus Street/ Darling Street	Priority Control (Stop)	0.115	11.8	A	3.1	0.165	11..9	A	4.7

5.5.2 2016 Baseline plus Development Traffic

This scenario considers the traffic movements forecast from the proposed car park facility. This traffic is added onto the opening year base (2016 Base) to assess the impacts on the surrounding road network. The SIDRA intersection analysis results are presented in **Table 5.5** below. It is important to note that the intersection of Crown Street/New Dapto Street will operate satisfactorily at a LoS C in the PM peak with the new car park in operation. Full SIDRA outputs are contained in **Appendix F.**

Table 5.5 2016 Baseline plus Development Scenario Intersection Assessment Results

Intersection	Intersection Control	AM Peak				PM Peak			
		Degree of Saturation	Delay (s)	Level of Service	95t% Q (m)	Degree of Saturation	Delay (s)	Level of Service	95t% Q (m)
Crown Street/ Darling Street/ Osborne Street	Signalised	0.476	6.1	A	24.7	0.786	9.9	A	78.7
Crown Street/ New Dapto Road	Signalised	0.776	13.7	A	75.1	0.892	34.4	C	276.1
New Dapto Road/ Loftus Street/ Mercury Street	Roundabout	0.178	14.2	A	7.6	0.371	17.1	B	17.9
Loftus Street/ Darling Street	Priority Control (Stop)	0.115	11.8	A	3.1	0.175	12.3	A	4.9

5.6 Intersection Performance – 2026

5.6.1 2026 Baseline

This scenario considers the 10 year future horizon assessment after the opening year and includes background traffic growth and committed developments (with car park development). The following table outlines the SIDRA intersection assessment results for this scenario. It is noted that the Crown Street/New Dapto Road intersection will operate at LoS E during the PM peak hour. Full SIDRA outputs are contained in **Appendix G.**

Table 5.6 2026 Baseline Scenario Intersection Assessment Results

Intersection	Intersection Control	AM Peak				PM Peak			
		Degree of Saturation	Delay (s)	Level of Service	95t% Q (m)	Degree of Saturation	Delay (s)	Level of Service	95t% Q (m)
Crown Street/ Darling Street/ Osborne Street	Signalised	0.448	6	A	24.8	0.821	7.6	A	83.6
Crown Street/ New Dapto Road	Signalised	0.869	15.4	B	117.8	1.106	60.3	E	547.1
New Dapto Road/ Loftus Street/ Mercury Street	Roundabout	0.199	13.9	A	8.7	0.361	14.7	B	17.6
Loftus Street/ Darling Street	Priority Control (Stop)	0.115	11.8	A	3.1	0.165	11.9	A	4.7

5.6.2 2026 Baseline plus Development Traffic

This scenario considers traffic movements forecast from the proposed car park which is added onto the future 10 year base to assess the impacts on the surrounding road network. The following table summarises the results of the SIDRA intersection assessment. It is evident that the performance of Crown Street/New Dapto Road intersection has deteriorated from a LoS E during 2026 baseline conditions to LoS F during the 2026 baseline plus development scenario for the PM peak hour period. Full SIDRA outputs are contained in **Appendix H.**

Additional analyses were undertaken by optimising the signal timings at Crown Street/New Dapto Road. The improved results indicate that the intersection will perform satisfactorily at a LoS D in 2026 with the operation of the car park. It is also anticipated that the RMS's SCATS system will further optimise the performance at the intersection by coordinating the traffic signals to achieve a green-wave progression whereby motorists travelling along Crown Street receives successive green signals to minimise overall delay and number of stops.

Table 5.7 2026 Baseline plus Development Scenario Intersection Assessment Results

Intersection	Intersection Control	AM Peak				PM Peak			
		Degree of Saturation	Delay (s)	Level of Service	95t% Q (m)	Degree of Saturation	Delay (s)	Level of Service	95t% Q (m)
Crown Street/ Darling Street/ Osborne Street	Signalised	0.523	5.8	A	28.3	0.86	11.5	A	127.8
Crown Street/ New Dapto Road	Signalised	0.869	17.4	B	117.8	1.52	238.7	F	1680.8
Crown Street/ New Dapto Road: *Optimised*	Signalised	0.869	17.4	B	117.8	0.999	51	D	360.0
New Dapto Road/ Loftus Street/ Mercury Street	Roundabout	0.244	14.3	A	11	0.473	18.3	B	26.4
Loftus Street/ Darling Street	Priority Control (Stop)	0.115	11.8	A	3.1	0.175	12.3	A	4.9

It is noted that the right turn movement from New Dapto Street to Crown Street does not perform well particularly during the PM peak period for the existing and forecast scenarios. However, when comparing against the respective baseline conditions the queue length only increases slightly. For the right turn movement from New Dapto Street to Crown Street, during the PM peak, the following is highlighted:

- 2016 Baseline: LoS F and 249m queue distance.
- 2016 Baseline + Development: LoS E and 276m queue distance.
- 2026 Baseline: LoS F and 547m queue distance.
- 2026 Baseline + Development: LoS F and 315m queue distance.

When comparing the forecast 2016 Baseline to the 2016 Baseline plus Development scenarios it can be seen that there is only a minimal increase of approximately 4 additional vehicles for the right turn movement from New Dapto Street to Crown Street.

When comparing the forecast 2026 Baseline to the 2026 Baseline plus Development scenarios it is noted that conditions to worsen. However, with optimisation of the traffic signals and with consideration given to linkage with nearby signals (including the new signals at the intersection of Crown Street and Staff Street) the anticipated queue length can be improved significantly from the Baseline scenario.

6 Parking Impacts

6.1 Parking Requirements

6.1.1 Car Parking Requirements for Outpatients

The forecast increase in the number of outpatients at the hospital will have an impact on the number of car parking spaces required for the hospital. As there are no provisions of car parking requirements for the number of outpatients in the Council's DCP, this assessment has considered the number of car parking spaces required based on a first principles approach and the assumptions listed in **Table 6.1.**

Table 6.1 Assumptions for Car Parking Requirements for Additional Outpatients

No. of Additional Outpatients	131
% of Outpatients travels by Car	80%
Operation Hours	10 (8am – 6pm)
Average number of outpatients (drivers) per hour	10
Arrival Rate	6 vehicles every 30 minutes
Average stay rate	1.5 hours

Based on the above assumptions and a first principle approach, **Table 6.2** below indicates the forecast profile of the arrival and departure patterns for outpatients driving to the hospital. The table indicates that there is a minimum requirement of **18** car spaces to accommodate the increase in outpatient numbers in the future.

Table 6.2 Determine Additional Car Park Spaces for Outpatients

	Between		In	Out	Accu. In	Accu. Out	No. of Spaces Required
First Car In	7:30	8:00	6	-	6	0	6
First Appointment	8:00	8:30	6	-	12	0	12
	8:30	9:00	6	-	18	0	**18**
First Car Out (1.5hrs Occupancy)	9:00	9:30	6	6	24	6	**18**
	9:30	10:00	6	6	30	12	**18**
	10:00	10:30	6	6	36	18	**18**
	10:30	11:00	6	6	42	24	**18**
	11:00	11:30	6	6	48	30	**18**
	11:30	12:00	6	6	54	36	**18**
	12:00	12:30	6	6	60	42	**18**
	12:30	13:00	6	6	66	48	**18**
	13:00	13:30	6	6	72	54	**18**
	13:30	14:00	6	6	78	60	**18**
	14:00	14:30	6	6	84	66	**18**
	14:30	15:00	6	6	90	72	**18**
	15:00	15:30	6	6	96	78	**18**
	15:30	16:00	6	6	102	84	**18**
	16:00	16:30	6	6	108	90	**18**
	16:30	17:00	6	6	114	96	**18**
	17:00	17:30	6	6	120	102	**18**
Last Appointment	17:30	18:00	6	6	126	108	**18**
Last Car Out	18:00	18:30		6	126	114	12

6.1.2 Car Parking Requirements for Hospital Staff and Visitors

Wollongong Council's DCP Chapter E3 Schedule 1 has the following car parking requirements for a hospital development:

> 1 car parking space per medical practitioner, plus

> 1 car parking space per 2 employees, plus

> 1 car parking space per 2 beds.

The application of the above standards to the already approved hospital redevelopment will result in a requirement for an additional 44 spaces for medical practitioners, 184 spaces for general employees and 40 spaces based on the number of additional beds.

Table 6.3 presents the requirements for the number of car park spaces to accommodate the additional quantum from the hospital redevelopment. Based on a first principles approach and the standards from the Wollongong Council's DCP, the hospital will require an additional 286 spaces to accommodate the increase in staff, visitors and outpatients.

Table 6.3 Parking Requirements for Hospital Redevelopment

Category	Additional Quantum	Parking Rate	No. of Car Spaces required
Medical Practitioners	44	1 per medical practitioner	44
General Employees	367	1 per 2 employees	184
No. of Beds	80	1 per 2 beds	40
Outpatients	131	Based on first principle approach	18
Total			**286**

6.1.3 Parking Supply

The development of the multi-storey car park will provide for 754 spaces (including 12 accessible spaces). The number of existing spaces lost as a result of the development is approximately 85 (this consists of existing spaces located within the site footprint, existing multi-storey car-park and others located within hospital grounds). Therefore, the net additional spaces as a result of the proposed car-park facility are 669 spaces. With the hospital redevelopment, the total additional number of spaces required is **286** spaces to cater for the forecast increase in employees, visitors and outpatients.

The TTW report (June 2011) identified approximately 236 on-street car parking spaces within the hospital vicinity with a peak demand of 220 spaces (93% occupancy) experienced at 12pm. These findings exclude the extended on-street areas surrounding the hospital. The new car park adequately provides for the demand with an excess of approximately 383 spaces which is expected to help alleviate the current high demand of on-street car parking in the surrounding streets.

7 Car Park Review

7.1 Car Park Layout Review

7.1.1 Design of Parking Modules

According to the Australian Standards (AS) 2890.1-2004, a hospital car park is classified as User Class 3 which specifies that 90 degree angle bays are required to be at least 2.6m wide and 5.4m long with a parking aisle width of 5.8m.

The review of the proposed parking modules of the Wollongong Hospital Car Park indicates compliance with the Australian Standards as shown in **Table 7.1**.

Table 7.1 Car Park Design Requirements

Item	AS 2890.1 Requirements	Comply with AS2890.1
Parking Module	2.6m wide x 5.4m long	Yes
Parking Aisle Width	5.8m wide	Yes

7.1.2 Queuing Storage at Entrance Control Points

Based on the assumption that the main entry point is off New Dapto Road, it is established that the proportion of the users entering the car park via New Dapto Road and Dudley Street are in the order of 75% and 25% respectively.

The entry points off both New Dapto Road and Dudley Street are expected to serve more than 100 cars per peak hour. As per the AS/NZS 2890.1-2004 **Table 3.3**, the entry points should provide 6% of the parking spaces served by the individual entrances for queuing storage lengths.

Table 7.2 Queuing Storage Requirements

Total Capacity for Hospital Car Park	Entrance	Car Park Entry Distribution	Number of Entry Movements	AS2890.1 Queuing Storage Capacity Required	Proposed Design Storage Capacity	Comply with AS2890.1
754	New Dapto Road	75%	566	33	33	Yes
	Dudley Street	25%	188	11	11	Yes

As per **Table 7.2** above, the proposed storage capacity at both entrances complies with AS2890.1 and is considered as satisfactory.

7.2 Car Park Access Review

7.2.1 Car Park entry via New Dapto Road

The following facilities on New Dapto Road are noted:

- There is an existing deceleration/turning lane on New Dapto Road within the current road reserve which serves the existing multi-storey car park.
- There is currently a bus zone located along the site frontage to New Dapto Road. Wollongong Council has confirmed that this bus zone is no longer in use and is planned to be converted to a 'No Stopping' zone.

It is proposed that the existing deceleration/turning lane be extended towards Urunga Street in order to serve the new car park facility and to ensure that vehicles slowing down to turn into the new facility would not impact upon the operational efficiency and safety for through traffic on New Dapto Road. **Figure 7.1** below provides an indicative location for the extension of the deceleration/turning lane on New Dapto Road.

Figure 7.1 Proposed extension of deceleration/turning lane on New Dapto Road (indicative)

There is sufficient space to provide a deceleration lane length that complies with Austroads design standards. It is noted that there is currently sufficient carriageway width to accommodate a deceleration/turning lane, similar to the existing car park entrance.

The nearside lane which is currently hatched/designated as a bus zone can be easily converted to a deceleration lane with minimal works (i.e. line marking, hatching).

The proposed access crossover off New Dapto Road has been designed to minimise the length that pedestrians would be required to cross and thereby reducing potential conflict. The access is perpendicular to New Dapto Road to help reduce vehicle speed and improve pedestrian safety.

7.2.2 Segregation of Old and New Car Parks

The proposed development results in a total provision of 1,320 formal spaces.

The total future parking demands are anticipated to be as follows:

- Medical Practitioners 23% (478 spaces)
- General Employees 54% (1151 spaces)
- Visitors & Outpatients 23% (478 spaces)

The existing car park shall potentially be segregated from the new car park in terms of staff usage predominantly in the current facility and public parking in the new facility. From the numbers presented above, it is clear that the existing car park does not have adequate capacity to house all staff traffic.

Therefore, there shall be some degree of linkage between the two facilities. It is envisaged that staff shall gain access via the existing car park entrance and that visitors shall use the new car park entrance. It is proposed that further detail in relation to the methodology and systems required to segregate/control the car park be provide through a Car Parking Management Plan (CTMP).

7.2.3 Non-Consolidation of Car Park Access Points

The proposed multi-storey car park will be constructed immediately south of the existing car park with following access arrangements:

> Separate ingress points at both New Dapto Road and Dudley Street.

> Separate egress point at Dudley Street.

> Controlled connections on various levels to provide a linkage between the old and new car park.

It is considered that the separation of access points, as opposed to consolidation, would provide a better design in terms of operational efficiency and overall project objectives as listed below:

- The consolidation of access points would almost double the storage length required for vehicles to queue before entering the car park. The lack of storage length would result in vehicles queuing back from the car park onto New Dapto Road. This would potentially impact on through traffic movement and the operation of the signalised intersection of Crown Street and New Dapto Street. Pedestrian safety would also be impacted as vehicles queue across the footpath.

- If only one access point were to be provided on New Dapto Road this would potentially divert additional traffic through residential streets potentially resulting in the environmental capacity as set out in the RMS Guide being exceeded.

- One of the objectives of the proposed new car park facility is for it to be able to function as a standalone facility if need be therefore separate access points are required.

Appropriate signage/control measures shall be proposed as part of the Car Parking Management Study to reduce confusion for drivers. As per demand numbers discussed above, the car park will be used largely by hospital staff that will be familiar with the car parking arrangements and traffic operation within the site vicinity, reducing the likelihood of conflicts.

7.2.4 Pedestrian Linkage

The main pedestrian linkage between the car park facility and the main Hospital campus would be via the existing pedestrian footbridge over New Dapto Road. In addition to this, there is sufficient footway provision on New Dapto Road and Crown Street as well as controlled crossing points at the signalised intersection of New Dapto Road and Crown Street to help facilitate safe pedestrian linkage to and from the proposed car park facility.

In relation to the access points off Dudley Street, should it be required, pedestrians would have storage space between access points which would minimise effective crossing distance and allow crossing to occur in stages thereby minimising any potential conflict. However, it is envisaged that pedestrian movement along the Dudley Street frontage would be minimal.

8 Conclusions

Cardno has been engaged to undertake a traffic impact assessment of the proposed expansion of the multi-storey car park for Wollongong Hospital, specifically in relation to the potential impact on car parking demand and the surrounding road network. It was agreed with Council that the basis of this report will be largely based on assumptions and data collected previously for the TTW reports including the traffic and parking surveys. This assessment extends upon the work that has previously been undertaken by TTW in support of the overall redevelopment of Wollongong Hospital and should be read in conjunction the TTW reports. It is noted that this report does not seek to specifically address any parking issues as a result of the extant planning permission for the Wollongong Hospital. Any surplus provision in parking spaces as a result of the proposed development would contribute to alleviating existing deficiencies in parking supply. The following presents the summary of findings:

> The subject site is located next to the Hospital campus, approximately 500m west of the Wollongong CBD. It is bounded by the existing car park to the north, Dudley Street to the west, Urunga Parade to the south and New Dapto Road to the east.

> Review of JTW and HTS data indicate that a majority of Wollongong residents use private car as their primary mode of transportation, followed by walking to and from their destinations;

> Assessment of JTW data reveal that the medical professionals in Wollongong prefer to drive to work (~93%) compared to the rest of general public (~85%);

> Wollongong Hospital is generally well accessible by public transport. Wollongong Railway Station is located approximately 700m from the Wollongong hospital. Also, there are a large number of bus routes which operate past Wollongong Hospital including a free shuttle bus service (Route 55). However there is generally poor service frequency (typically every 60 minutes for each route);

> According to the information provided by the Illawarra Shoalhaven Local Health District and Health Infrastructure, the Wollongong hospital redevelopment will yield an additional 44 medical practitioners, 367 general employees, 80 beds and 131 outpatients per day.

> The TTW study has previously identified that there are 591 spaces (both formal and informal) provided in the multi-storey car park with approximately 155 car parking spaces available within the hospital compound, totalling to 746 parking spaces provided by the hospital. In addition to the above parking spaces, TTW's report has also identified 404 on-street car parking spaces within the hospital vicinity;

> Based on the parking occupancy surveys undertaken by TTW in 2010, the multi-storey car park experiences a parking occupancy of more than 90% between 8.30am to 3.30pm. The results of the parking surveys also indicate a high usage of on street parking within the immediate vicinity of the hospital with an occupancy rate of 80-90% between 10am to 3pm;

> Intersection counts undertaken by TTW in 2011 were analysed using the modelling software SIDRA 5.1 and these results indicate that the performance of all intersections is generally satisfactory in the AM and PM peak periods. It is important to note that all the intersections except Crown Street/New Dapto Road intersection operate at LoS A during both the AM and PM peak hours. Crown Street/New Dapto Road intersection operate at LoS A and LoS B during the AM and PM peaks respectively;

> The traffic volumes derived using the "RTA Guide to Traffic Generating Development (2002)" under-estimates the traffic generated at the site as the guide only considers the total number of beds and the total number of staff to determine the traffic generated. This approach leaves out other critical aspects to the traffic generation at the hospital such as the number of outpatients. Therefore, in order to undertake a robust traffic impact assessment, the traffic generation from the hospital is based on first principles;

> A spreadsheet traffic model was developed by refining TTW's base SIDRA models and applying 2011 traffic survey data to form the 2011 baseline conditions. This model accounts for traffic generation, distribution and assignment of development traffic on the surrounding road network, increase in background traffic as well as committed development traffic;

- In line with TTW's previous assessment, a 1% growth rate per annum for background growth has been assumed for the through traffic trips travelling on Crown Street, New Dapto Road and Mercury Street in order to calculate the future year traffic levels, this increase is in addition to the committed development already considered;
- The intersection of Crown Street/New Dapto Road operates at a LoS B under 2016 baseline conditions. With the opening of the car park, the intersection will continue to operate satisfactorily at a LoS C;
- Assessing the 10 year future horizon, with and without the development, it is evident that the performance of Crown Street/New Dapto Road intersection will deteriorate from LoS E for baseline PM peak conditions to LoS F for baseline plus development PM peak conditions;
- An additional analysis was undertaken by optimising the signal timings at Crown Street/New Dapto Road. The improved results indicate that the intersection will perform satisfactorily at a LoS D in the 2026 baseline plus development scenario. It is also anticipated that the RMS's SCATS system will further optimise the performance at the intersection by coordinating the traffic signals to achieve a green-wave progression whereby a motorists travelling along Crown Street receives successive green signals to minimise overall delay and number of stops;
- Based on Wollongong Council's DCP and a first principles approach (for outpatient parking requirements), the increase in hospital quantum due to the redevelopment will require an additional 286 spaces to accommodate staff, visitors and outpatients;
- The development of the multi-storey car park will provide for 754 spaces (including 12 accessible spaces). The number of existing spaces lost as a result of the development is approximately 85 (this consists of existing spaces located within the site footprint, existing multi-storey car-park and others located within hospital grounds). Therefore, the net additional spaces as a result of the proposed car-park facility s 669 spaces. With the hospital redevelopment, the total additional number of spaces required is **286** spaces to cater for the forecast increase in employees, visitors and outpatients.
- The TTW report (June 2011) identified approximately 236 on-street car parking spaces within the hospital vicinity with a peak demand of 220 spaces (93% occupancy) experienced at 12pm. These findings exclude the extended on-street areas surrounding the hospital. The new car park adequately provides for the demand with an excess of approximately 383 spaces which is expected to help alleviate the current high demand of on-street car parking in the surrounding streets.
- Queuing storage capacity at both entrances to the car park adequately provides for the requirements set out in the AS2890.1. Dimensions for the parking modules adhere to AS 2890.1 requirements and are considered satisfactory.
- The existing deceleration/turning lane can be extended towards Urunga Street, with minimal works, in order to serve the new car park facility and to ensure that vehicles slowing down to turn into the new facility would not impact upon the operational efficiency and safety for through traffic on New Dapto Road.
- The existing car park shall potentially be segregated from the new car park in terms of staff usage predominantly in the current facility and public parking in the new facility with some degree of linkage between the two facilities. It is envisaged that staff shall gain access via the existing car park entrance and that visitors shall use the new car park entrance. It is proposed that further detail in relation to the methodology and systems required to segregate/control the car park be provide through a Car Parking Management Plan (CTMP).

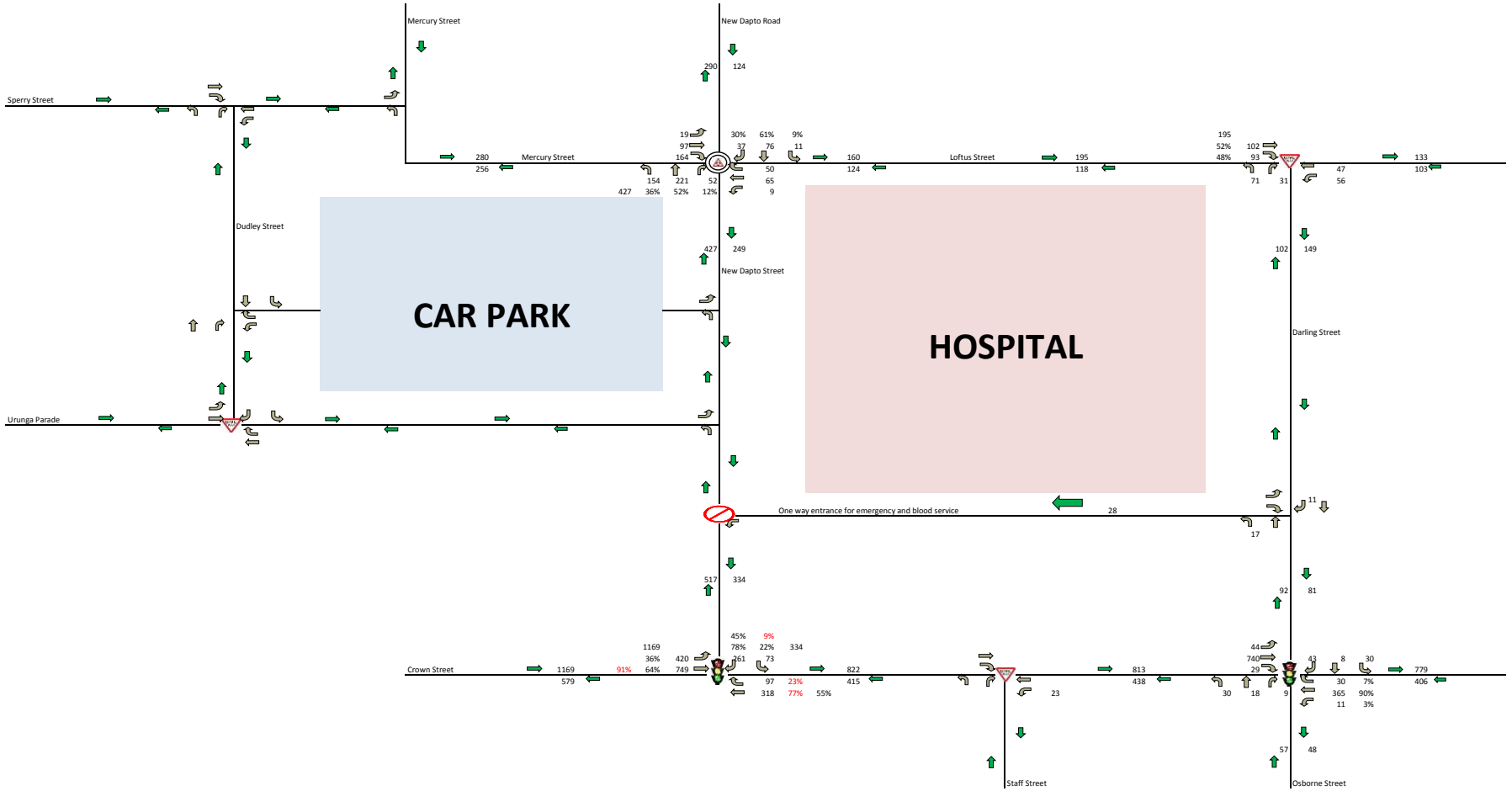
In conclusion, the traffic impact assessment has indicated that the proposed new car park will have no adverse impacts on the traffic operation on the surrounding road network which is in line with previous studies undertaken. The surplus car park spaces provided by the multi-storey car park will contribute to alleviating existing deficiencies in the parking supply for the City West precinct and help improve the local amenity.

APPENDIX A

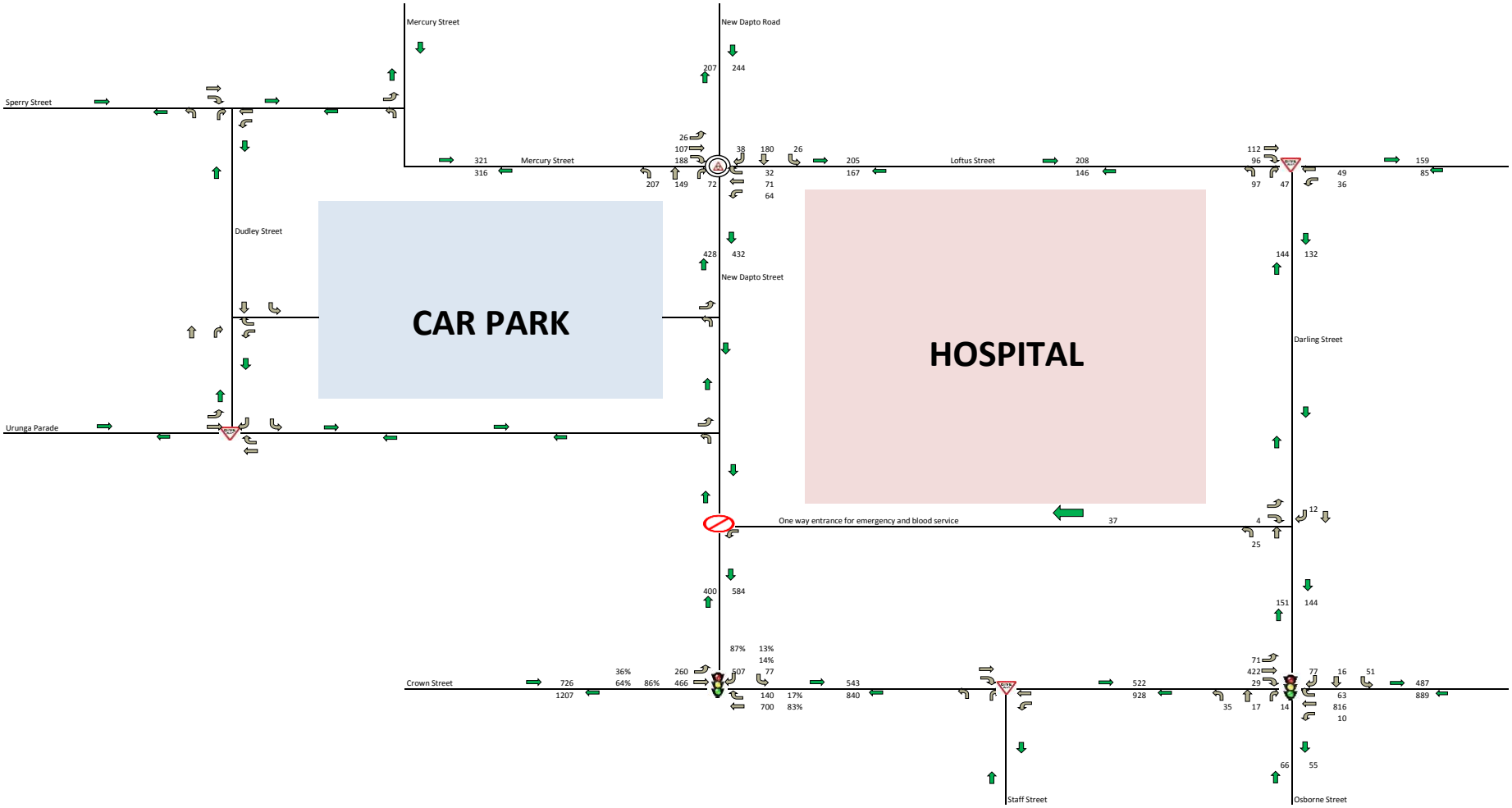
EXISTING TRAFFIC VOLUMES

Cardno
Shaping the Future

2011 Existing Counts from TTW Traffic Survey Data AM Peak



2011 Existing Counts from TTW Traffic Survey Data PM Peak



APPENDIX B

INTERSECTION LAYOUTS

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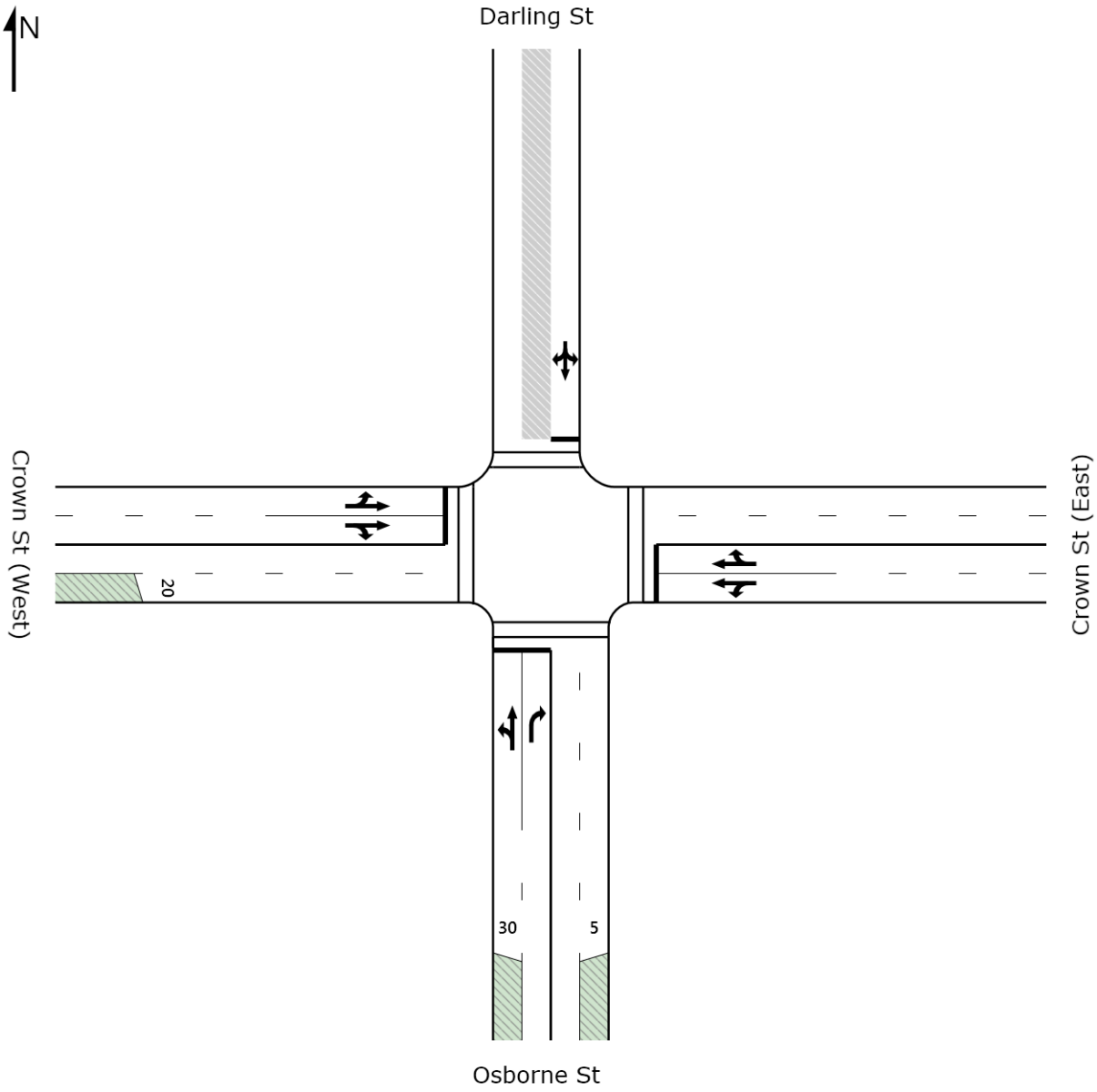
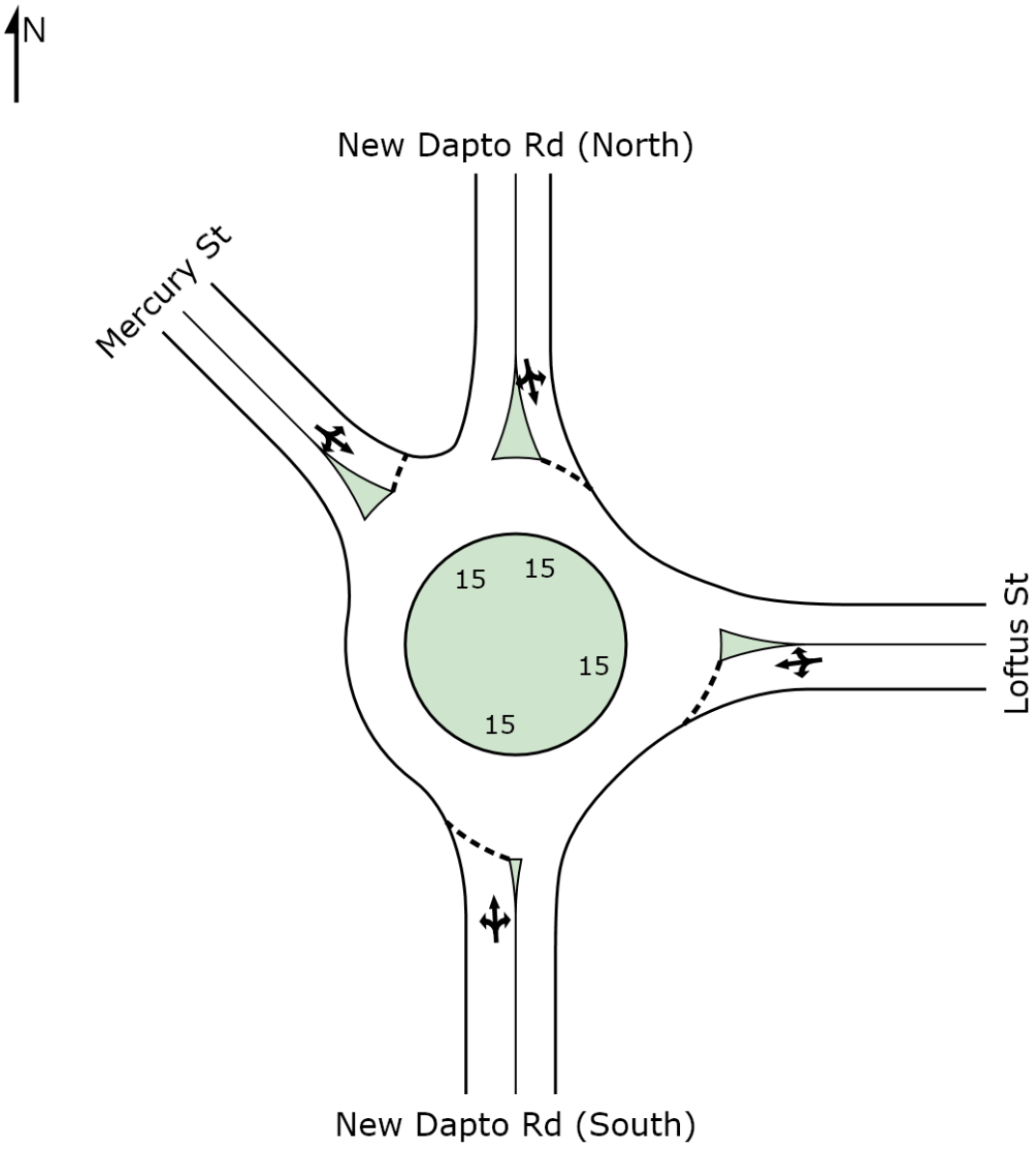
Intersection Layouts

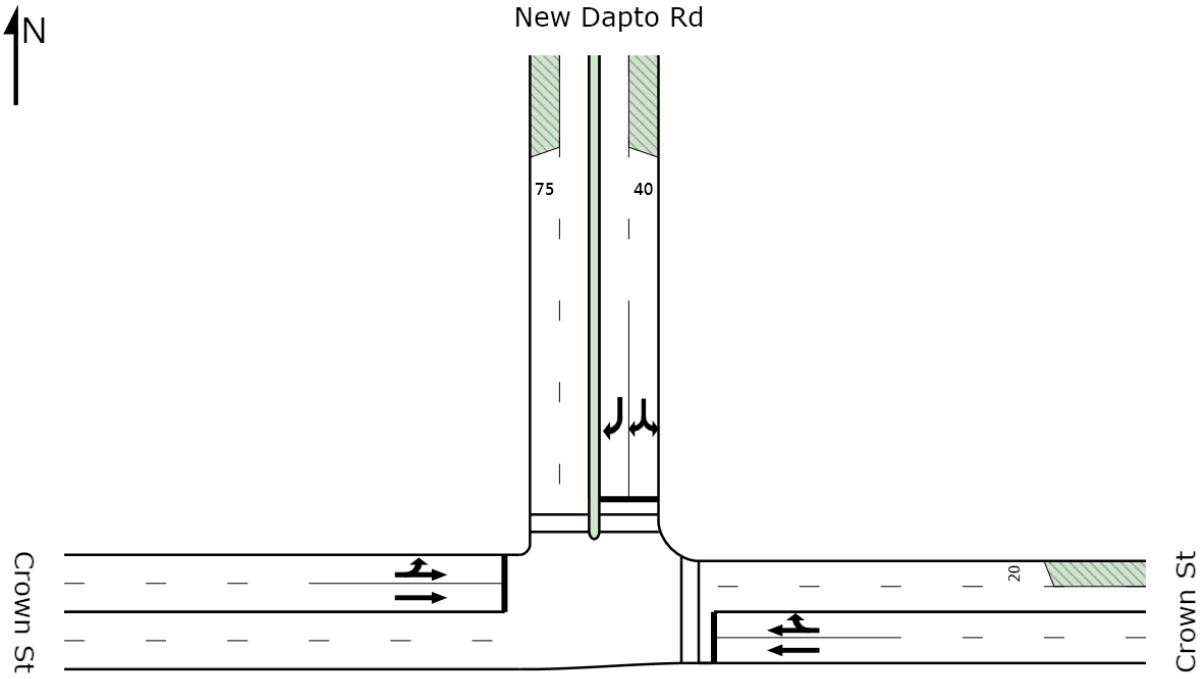
Crown St - Darling St - Osborne St



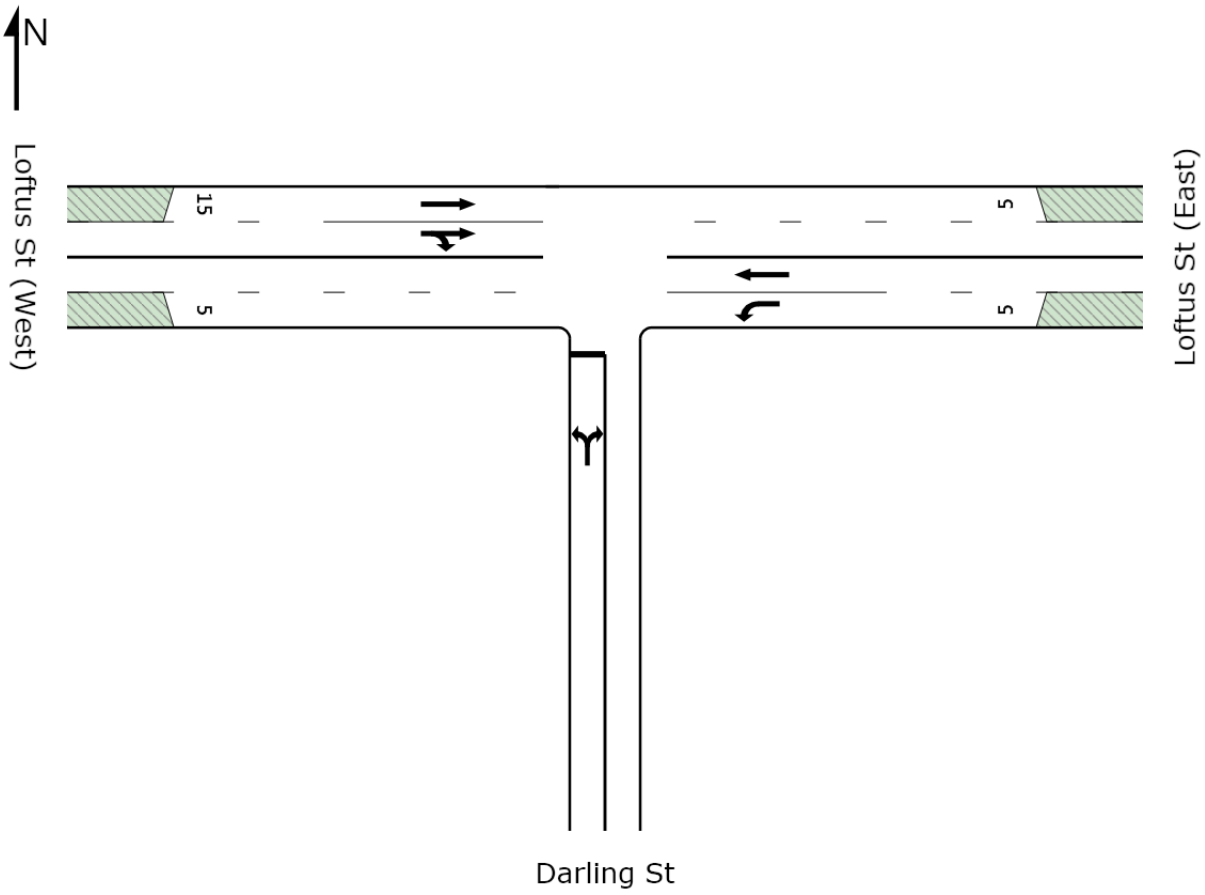
Loftus St - New Dapto Rd - Mercury St



Crown St - New Dapto Rd



Loftus St - Darling St



Traffic Impact Assessment

APPENDIX C

EXISTING TRAFFIC VOLUMES – SIDRA ANALYSIS

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2011 Traffic Volumes

Crown St - Darling St - Osborne St

AM Peak

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
							Vehicles	Distance			
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Osborne St											
1	L	30	0.0	0.299	44.8	LOS D	2.0	13.8	0.87	0.75	27.3
2	T	18	0.0	0.299	36.6	LOS C	2.0	13.8	0.87	0.64	27.8
3	R	9	0.0	0.034	45.9	LOS D	0.4	2.6	0.86	0.68	26.5
Approach		57	0.0	0.299	42.4	LOS C	2.0	13.8	0.87	0.71	27.3
East: Crown St (East)											
4	L	11	0.0	0.069	9.8	LOS A	0.4	2.6	0.09	0.99	47.6
5	T	365	5.0	0.317	1.9	LOS A	1.7	12.6	0.11	0.10	56.4
6	R	30	0.0	0.317	10.3	LOS A	1.7	12.6	0.12	1.04	47.3
Approach		406	4.5	0.317	2.7	LOS A	1.7	12.6	0.11	0.19	55.3
North: Darling St											
7	L	30	0.0	0.277	46.4	LOS D	3.5	24.3	0.90	0.78	26.4
8	T	8	0.0	0.277	38.3	LOS C	3.5	24.3	0.90	0.70	26.8
9	R	43	0.0	0.277	46.6	LOS D	3.5	24.3	0.90	0.78	26.4
Approach		81	0.0	0.277	45.7	LOS D	3.5	24.3	0.90	0.77	26.4
West: Crown St (West)											
10	L	44	0.0	0.326	10.1	LOS A	2.3	16.9	0.12	1.00	47.4
11	T	740	5.0	0.326	2.0	LOS A	2.3	16.9	0.12	0.11	56.2
12	R	29	0.0	0.326	10.1	LOS A	2.1	15.6	0.12	1.02	47.4
Approach		813	4.6	0.326	2.7	LOS A	2.3	16.9	0.12	0.19	55.3
All Vehicles		1357	4.1	0.326	6.9	LOS A	3.5	24.3	0.20	0.25	49.9

PM Peak

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
							Vehicles	Distance			
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Osborne St											
1	L	35	0.0	0.338	48.0	LOS D	2.2	15.6	0.90	0.75	26.2
2	T	17	0.0	0.338	39.8	LOS C	2.2	15.6	0.90	0.67	26.6
3	R	14	0.0	0.072	51.4	LOS D	0.6	4.4	0.92	0.70	24.8
Approach		66	0.0	0.338	46.6	LOS D	2.2	15.6	0.90	0.72	26.0
East: Crown St (East)											
4	L	10	0.0	0.129	9.1	LOS A	0.5	3.5	0.06	1.04	48.2
5	T	816	5.0	0.600	1.4	LOS A	4.0	29.1	0.11	0.10	57.1
6	R	63	0.0	0.600	9.8	LOS A	4.0	29.1	0.13	1.05	47.7
Approach		889	4.6	0.600	2.1	LOS A	4.0	29.1	0.11	0.18	56.2
North: Darling St											
7	L	51	0.0	0.593	52.0	LOS D	6.8	47.6	0.98	0.81	24.8
8	T	16	0.0	0.593	43.8	LOS D	6.8	47.6	0.98	0.80	24.9
9	R	77	0.0	0.593	52.1	LOS D	6.8	47.6	0.98	0.81	24.7
Approach		144	0.0	0.593	51.1	LOS D	6.8	47.6	0.98	0.81	24.8
West: Crown St (West)											
10	L	71	0.0	0.229	9.2	LOS A	0.9	6.9	0.07	0.94	48.1
11	T	422	5.0	0.229	1.0	LOS A	0.9	6.9	0.07	0.06	57.9
12	R	29	0.0	0.229	9.2	LOS A	0.7	4.7	0.07	0.99	48.1
Approach		522	4.0	0.229	2.6	LOS A	0.9	6.9	0.07	0.23	55.7
All Vehicles		1621	3.8	0.600	8.4	LOS A	6.8	47.6	0.21	0.27	48.4

Loftus St - New Dapto Rd - Mercury St

AM Peak

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
							Vehicles	Distance			
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: New Dapto Rd (South)											
1	L	154	0.0	0.333	6.6	LOS A	1.7	12.2	0.32	0.54	49.4
2	T	221	0.0	0.333	6.6	LOS A	1.7	12.2	0.32	0.54	49.4
3	R	52	0.0	0.333	11.6	LOS A	1.7	12.2	0.32	0.80	46.1
Approach		427	0.0	0.333	7.2	LOS A	1.7	12.2	0.32	0.57	48.9
East: Loftus St											
4	L	9	0.0	0.113	8.1	LOS A	0.5	3.8	0.41	0.59	47.9
5	T	65	0.0	0.113	11.2	LOS A	0.5	3.8	0.41	0.69	45.7
6	R	50	0.0	0.113	12.2	LOS A	0.5	3.8	0.41	0.70	45.0
Approach		124	0.0	0.113	11.4	LOS A	0.5	3.8	0.41	0.69	45.5
North: New Dapto Rd (North)											
7	L	11	0.0	0.125	8.7	LOS A	0.7	5.1	0.52	0.64	47.8
8	T	76	0.0	0.125	7.9	LOS A	0.7	5.1	0.52	0.59	47.9
9	R	37	0.0	0.125	13.8	LOS A	0.7	5.1	0.52	0.78	44.6
Approach		124	0.0	0.125	9.7	LOS A	0.7	5.1	0.52	0.65	46.8
North West: Mercury St											
27	L	19	0.0	0.272	9.3	LOS A	1.6	11.3	0.53	0.69	47.4
28	T	97	0.0	0.272	7.9	LOS A	1.6	11.3	0.53	0.62	47.6
29	R	164	0.0	0.272	12.0	LOS A	1.6	11.3	0.53	0.76	45.7
Approach		280	0.0	0.272	10.4	LOS A	1.6	11.3	0.53	0.70	46.4
All Vehicles		955	0.0	0.333	9.0	LOS A	1.7	12.2	0.42	0.63	47.4

PM Peak

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
							Vehicles	Distance			
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: New Dapto Rd (South)											
1	L	207	0.0	0.331	6.6	LOS A	1.8	12.3	0.31	0.53	49.4
2	T	149	0.0	0.331	6.6	LOS A	1.8	12.3	0.31	0.53	49.4
3	R	72	0.0	0.331	11.6	LOS A	1.8	12.3	0.31	0.79	46.1
Approach		428	0.0	0.331	7.4	LOS A	1.8	12.3	0.31	0.57	48.8
East: Loftus St											
4	L	64	0.0	0.168	8.8	LOS A	0.9	6.1	0.51	0.66	47.4
5	T	71	0.0	0.168	11.9	LOS A	0.9	6.1	0.51	0.75	45.5
6	R	32	0.0	0.168	12.9	LOS A	0.9	6.1	0.51	0.76	44.9
Approach		167	0.0	0.168	10.9	LOS A	0.9	6.1	0.51	0.72	46.1
North: New Dapto Rd (North)											
7	L	26	0.0	0.257	9.3	LOS A	1.6	11.5	0.61	0.70	47.5
8	T	180	0.0	0.257	8.5	LOS A	1.6	11.5	0.61	0.66	47.5
9	R	38	0.0	0.257	14.4	LOS A	1.6	11.5	0.61	0.83	44.2
Approach		244	0.0	0.257	9.5	LOS A	1.6	11.5	0.61	0.69	47.0
North West: Mercury St											
27	L	26	0.0	0.294	8.9	LOS A	1.8	12.4	0.48	0.67	47.6
28	T	107	0.0	0.294	7.5	LOS A	1.8	12.4	0.48	0.58	47.9
29	R	188	0.0	0.294	11.6	LOS A	1.8	12.4	0.48	0.73	45.8
Approach		321	0.0	0.294	10.0	LOS A	1.8	12.4	0.48	0.68	46.6
All Vehicles		1160	0.0	0.331	9.1	LOS A	1.8	12.4	0.45	0.65	47.4

Crown St - New Dapto Rd

AM Peak

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
							Vehicles	Distance			
		veh/h	%	v/c	sec		veh	m		per veh	km/h
East: Crown St											
5	T	318	5.0	0.244	1.0	LOS A	1.0	7.2	0.07	0.06	58.0
6	R	97	0.0	0.411	14.5	LOS B	1.6	11.2	0.36	0.75	42.8
Approach		415	3.8	0.411	4.2	LOS A	1.6	11.2	0.14	0.22	53.6
North: New Dapto Rd											
7	L	73	0.0	0.675	49.0	LOS D	6.2	43.6	0.93	0.83	25.5
9	R	261	0.0	0.675	52.0	LOS D	9.5	66.3	0.98	0.84	24.6
Approach		334	0.0	0.675	51.4	LOS D	9.5	66.3	0.97	0.84	24.8
West: Crown St											
10	L	420	0.0	0.283	8.9	LOS A	1.4	9.6	0.07	0.68	48.2
11	T	749	5.0	0.678	1.8	LOS A	5.1	37.2	0.15	0.14	56.4
Approach		1169	3.2	0.678	4.3	LOS A	5.1	37.2	0.12	0.33	53.1
All Vehicles		1918	2.8	0.678	12.5	LOS A	9.5	66.3	0.27	0.40	44.4

PM Peak

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
							Vehicles	Distance			
		veh/h	%	v/c	sec		veh	m		per veh	km/h
East: Crown St											
5	T	700	5.0	0.508	5.4	LOS A	8.2	59.9	0.28	0.25	50.8
6	R	140	0.0	0.508	15.6	LOS B	4.1	29.4	0.41	0.82	42.5
Approach		840	4.2	0.508	7.1	LOS A	8.2	59.9	0.30	0.35	49.2
North: New Dapto Rd											
7	L	77	0.0	0.901	56.5	LOS E	9.3	65.3	0.87	0.87	23.4
9	R	507	0.0	0.901	67.9	LOS E	28.0	195.8	0.98	0.97	20.9
Approach		584	0.0	0.901	66.4	LOS E	28.0	195.8	0.96	0.95	21.2
West: Crown St											
10	L	260	0.0	0.178	9.0	LOS A	0.9	6.2	0.06	0.68	48.1
11	T	466	5.0	0.498	6.4	LOS A	7.1	51.9	0.28	0.25	49.8
Approach		726	3.2	0.498	7.3	LOS A	7.1	51.9	0.21	0.41	49.2
All Vehicles		2150	2.7	0.901	23.3	LOS B	28.0	195.8	0.45	0.53	36.2

Loftus St - Darling St

AM Peak

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
							Vehicles	Distance			
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Darling St											
1	L	71	0.0	0.115	11.8	LOS A	0.4	3.1	0.21	0.88	45.7
3	R	31	0.0	0.115	11.7	LOS A	0.4	3.1	0.21	0.97	45.7
Approach		102	0.0	0.115	11.8	LOS A	0.4	3.1	0.21	0.90	45.7
East: Loftus St (East)											
4	L	56	0.0	0.030	8.2	LOS A	0.0	0.0	0.00	0.67	49.0
5	T	47	0.0	0.024	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		103	0.0	0.030	4.4	NA	0.0	0.0	0.00	0.36	53.5
West: Loftus St (West)											
11	T	102	0.0	0.103	0.2	LOS A	0.5	3.5	0.13	0.00	56.9
12	R	93	0.0	0.103	8.7	LOS A	0.5	3.5	0.22	0.73	48.3
Approach		195	0.0	0.103	4.3	NA	0.5	3.5	0.17	0.35	52.5
All Vehicles		400	0.0	0.115	6.2	NA	0.5	3.5	0.14	0.49	50.8

PM Peak

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
							Vehicles	Distance			
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Darling St											
1	L	97	0.0	0.165	11.9	LOS A	0.7	4.7	0.21	0.88	45.5
3	R	47	0.0	0.165	11.9	LOS A	0.7	4.7	0.21	0.97	45.6
Approach		144	0.0	0.165	11.9	LOS A	0.7	4.7	0.21	0.91	45.6
East: Loftus St (East)											
4	L	36	0.0	0.019	8.2	LOS A	0.0	0.0	0.00	0.67	49.0
5	T	49	0.0	0.025	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		85	0.0	0.025	3.5	NA	0.0	0.0	0.00	0.28	54.8
West: Loftus St (West)											
11	T	112	0.0	0.108	0.2	LOS A	0.5	3.7	0.12	0.00	57.1
12	R	96	0.0	0.108	8.6	LOS A	0.5	3.7	0.20	0.74	48.4
Approach		208	0.0	0.108	4.1	NA	0.5	3.7	0.16	0.34	52.7
All Vehicles		437	0.0	0.165	6.6	NA	0.7	4.7	0.14	0.52	50.5

Traffic Impact Assessment

APPENDIX D

SPREADSHEET MODEL

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Shaping the Future

TRIP GENERATION FOR FUTURE DEVELOPMENT AM PEAK (8:00-9:00 AM)

No. of Additional Medical Practitioners (MP) Employed	**44**	*Reference from "Quantum" worksheet*
% of MP in Hospital on Avg Day	85%	
No. of MP in Hospital on Avg Day	38	
% MP Arrivals in AM Peak	95%	*Assumption: average of 5% MP on late night shift per day, leaving during the morning peak hour*
No. of MP Arriving in AM Peak	37	
%. of (MP) Arrivals by Car	100%	*Assumption: All MPs travel by car*
No. of (MP) Arrivals by Car	**37**	
% (MP) Departures in AM Peak	5%	
No. of (MP) Departures in AM Peak	2	
%. of (MP) Departures by Car	100%	
No. of (MP) Departures by Car	**2**	
No. of Additional General Employees	**367**	*Reference from "Quantum" worksheet*
% of GE in Hospital on Avg Day	85%	
No. of GE in Hospital on Avg Day	312	
% GE Arrivals in AM Peak	95%	*Assumption: average of 5% GE on late night shift per day, leaving during the morning peak hour*
No. of GE Arriving in AM Peak	297	
%. of (GE) Arrivals by Car	90%	*Assumption: 10% of GE takes shuttle buses*
% of Mode Shift to Shuttle Bus Assumption	10%	
No. of (GE) Arrivals by Car	**268**	
% (GE) Departures in AM Peak	5%	
No. of (GE) Departures in AM Peak	16	
%. of (GE) Departures by Car	90%	
% of Mode Shift to Shuttle Bus Assumption	10%	
No. of (GE) Departures by Shuttle Bus	**2**	
No. of Additional Outpatients	**131** per day	
(Based on Parking Generation)		
Between 8 - 9 am Arrival Trips	12	as per parking demands spreadsheet
%. of (Outpatient) Arrivals by Car	100%	
% of Mode Shift to Shuttle Bus Assumption	0%	
No. of (Outpatient) Arrivals by Car	**12**	
Between 8 - 9 am Departure Trips	**0**	
%. of (Outpatient) Departures by Car	0%	
% of Mode Shift to Shuttle Bus Assumption	0%	
% Resultant Departures By Car	0%	
No. of (Outpatient) Departures by Car	**0**	
No. of Additional Beds	**80**	
AM peak hour trips only applies to "Same Day" Beds	29	(visiting hours starts from 11am for majority)
Visitors per bed	0.5	*Assumption: 1 visitor for 2 beds*
Number of visitors	15	
% Visitors during the AM peak hour	100%	
Number of visitors during the AM peak hour	15	
%. of Visitor Arrivals	100%	
No of Visitors Arrivals	15	
% Visitors Car trips	100%	
% using shuttle bus	10%	
No. of Visitor Arrivals by Car	**15**	
% Visitor Departures in AM Peak	50%	*Assumption: 50% of the visitors leave the hospital within an hr*
No. of Visitor Departures in AM Peak	8	
% Visitors Car trips	100%	
% using shuttle bus	0.00%	
No. of Visitor Departures by Car	**8**	

DURING AM PEAK

Total Traffic Arriving to Car Park

332

Total Traffic Departing from Car Park

12

TRIP GENERATION FOR FUTURE DEVELOPMENT PM PEAK (4:30-5:30 PM)

No. of Additional Medical Practitioners (MP) Employed	**44**	*Reference from "Quantum" worksheet*
% of MP in Hospital on Avg Day	85%	
No. of MP in Hospital on Avg Day	38	
% MP Arrivals in PM Peak	5%	*Assumption: average of 5% MP on late night shift per day, leaving during the morning peak hour*
No. of MP Arriving in PM Peak	2	
%. of (MP) Arrivals by Car	100%	*Assumption: All MPs travel by car*
No. of (MP) Arrivals by Car	**2**	
% (MP) Departures in PM Peak	95%	
No. of (MP) Departures in PM Peak	37	
%. of (MP) Departures by Car	100%	
No. of (MP) Departures by Car	**37**	
No. of Additional General Employees	**367**	*Reference from "Quantum" worksheet*
% of GE in Hospital on Avg Day	85%	
No. of GE in Hospital on Avg Day	312	
% GE Arrivals in PM Peak	5%	*Assumption: average of 5% GE on late night shift per day, leaving during the morning peak hour*
No. of GE Arriving in PM Peak	16	
%. of (GE) Arrivals by Car	90%	*Assumption: 10% of GE takes shuttle buses*
% of Mode Shift to Shuttle Bus Assumption	10%	
No. of (GE) Arrivals by Car	**15**	
% (GE) Departures in PM Peak	95%	
No. of (GE) Departures in PM Peak	297	
%. of (GE) Departures by Car	90%	
% of Mode Shift to Shuttle Bus Assumption	10%	
No. of (GE) Departures by Car	**268**	
No. of Additional Outpatients	**131** per day	
(Based on Parking Generation)		
Between4.30 - 5.30 PM Arrival Trips	12	
%. of (Outpatient) Arrivals by Car	100%	
% of Mode Shift to Shuttle Bus Assumption	0%	
No. of (Outpatient) Arrivals by Car	**12**	
Between 4.30-5.30 PM Departure Trips	**12**	
%. of (Outpatient) Departures by Car	100%	
% of Mode Shift to Shuttle Bus Assumption	0%	
No. of (Outpatient) Departures by Car	**12**	
No. of Additional Beds	**80**	
PM peak hour trips only applies to "Same Day" Beds	29	(visiting hours starts from 11PM for majority)
Visitors per bed	0.5	*Assumption: 1 visitor for 2 beds*
Number of visitors	40	
% Visitors during the PM peak hour	100%	
Number of visitors during the PM peak hour	40	
%. of Visitor Arrivals	100%	
No of Visitors Arrivals	40	
% Visitors Car trips	100%	
% using shuttle bus	0.00%	
No. of Visitor Arrivals by Car	**40**	
% Visitor Departures in PM Peak	50%	*Assumption: 50% of the visitors leave the hospital within an hr*
No. of Visitor Departures in PM Peak	20	
% Visitors Car trips	100%	
% using shuttle bus	0.00%	
No. of Visitor Departures by Car	**20**	

DURING PM PEAK

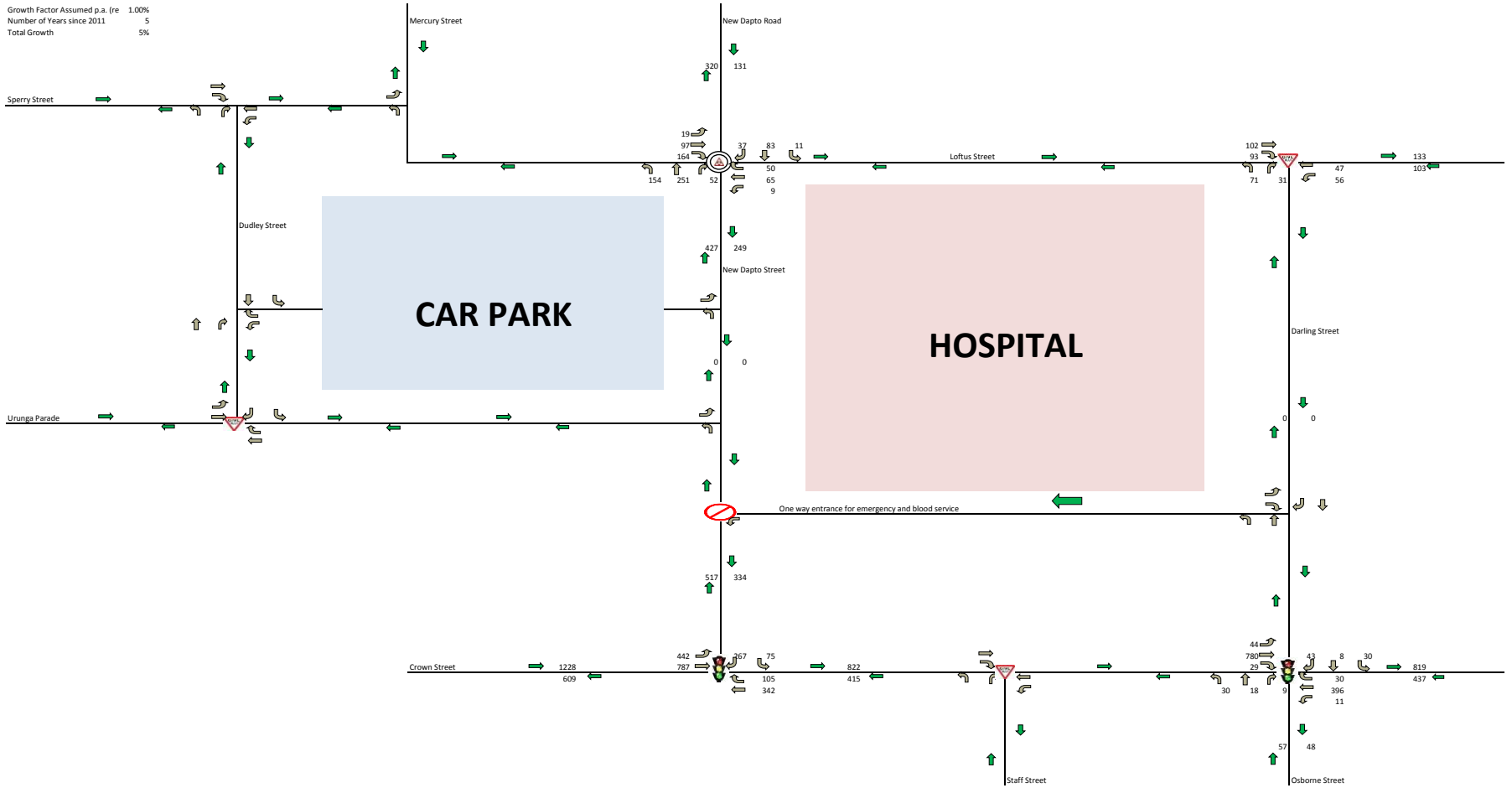
Total Traffic Arriving to Car Park

69

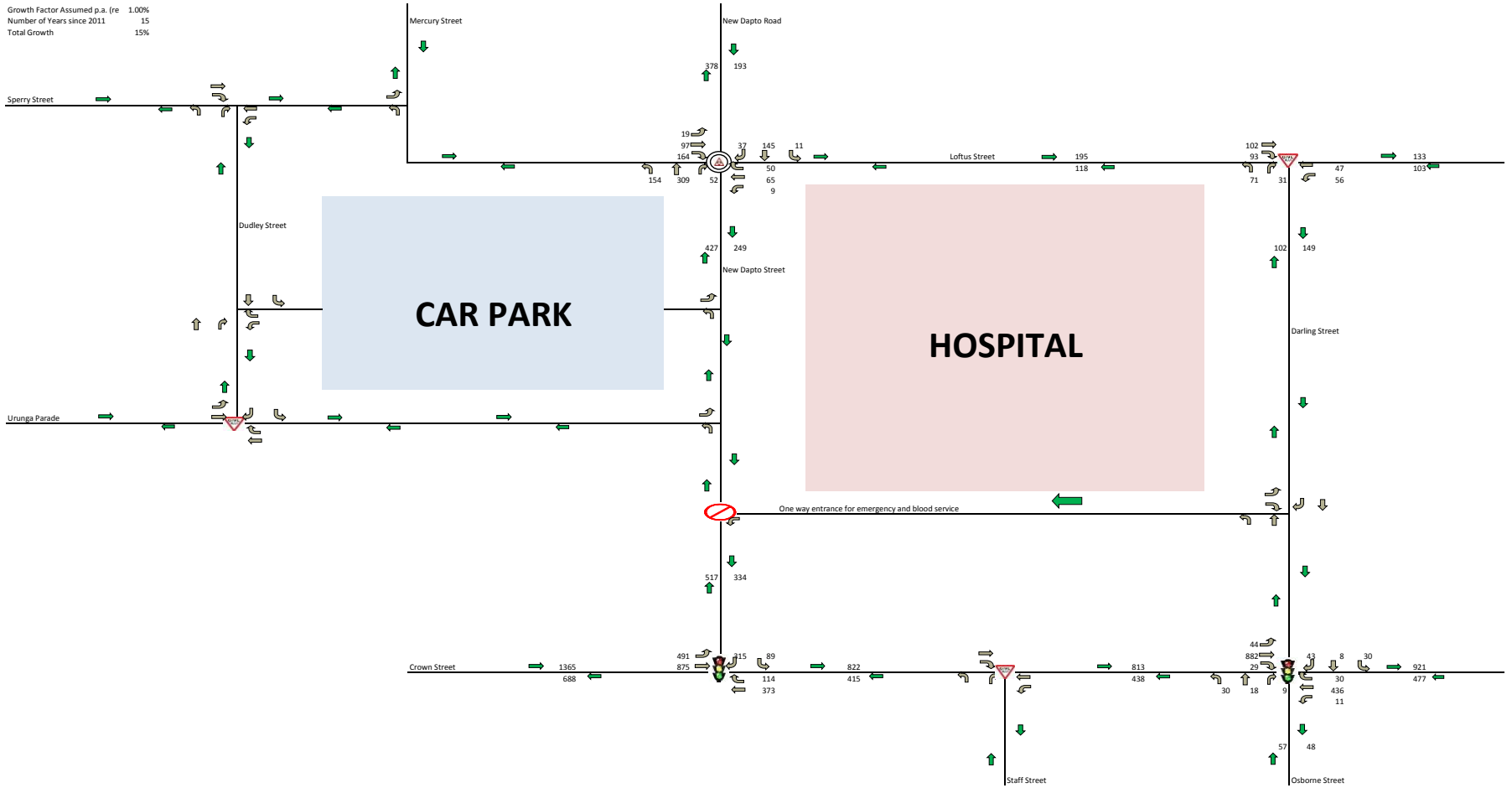
Total Traffic Departing from Car Park

337

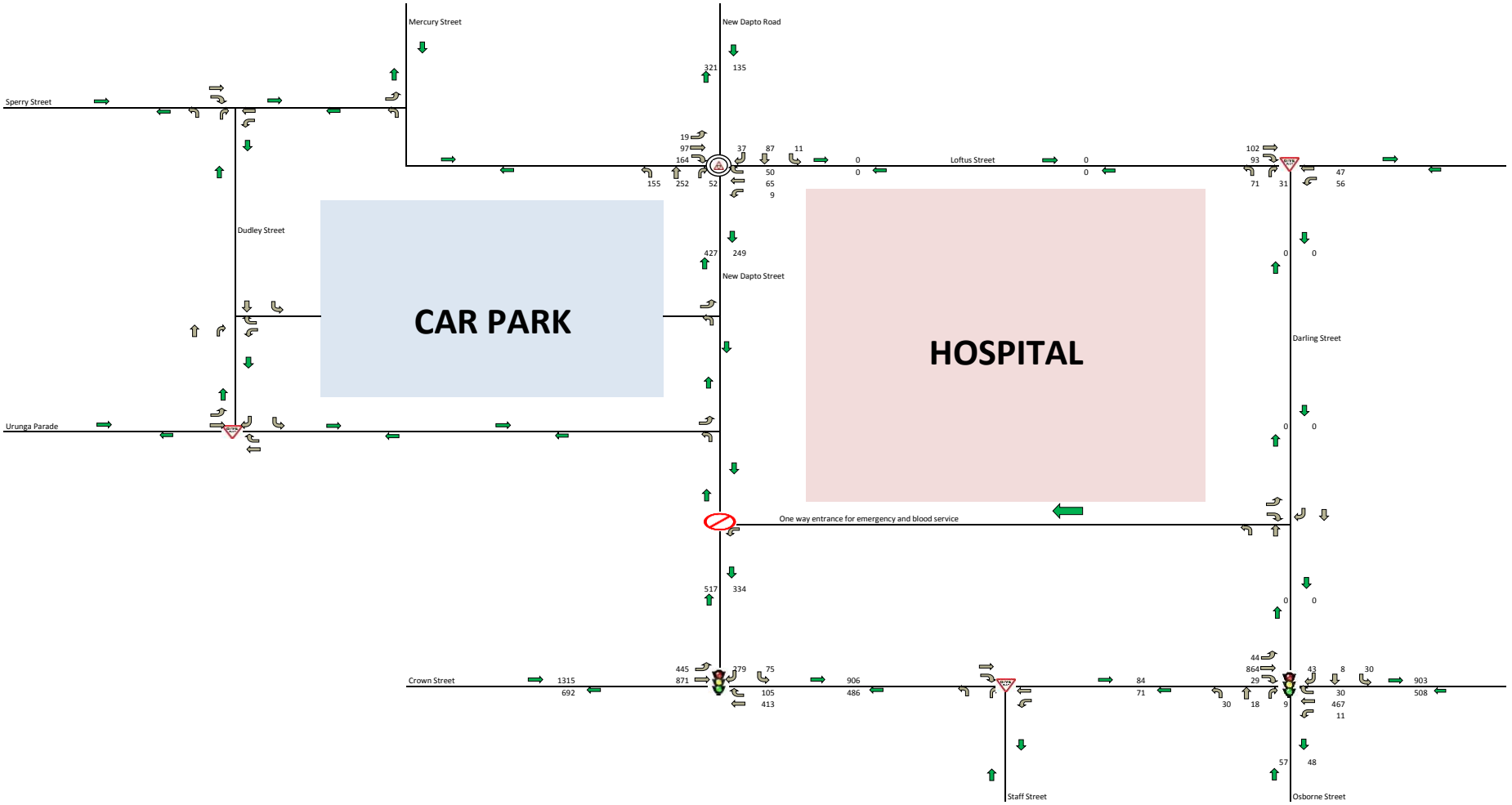
Background 2016 AM Peak



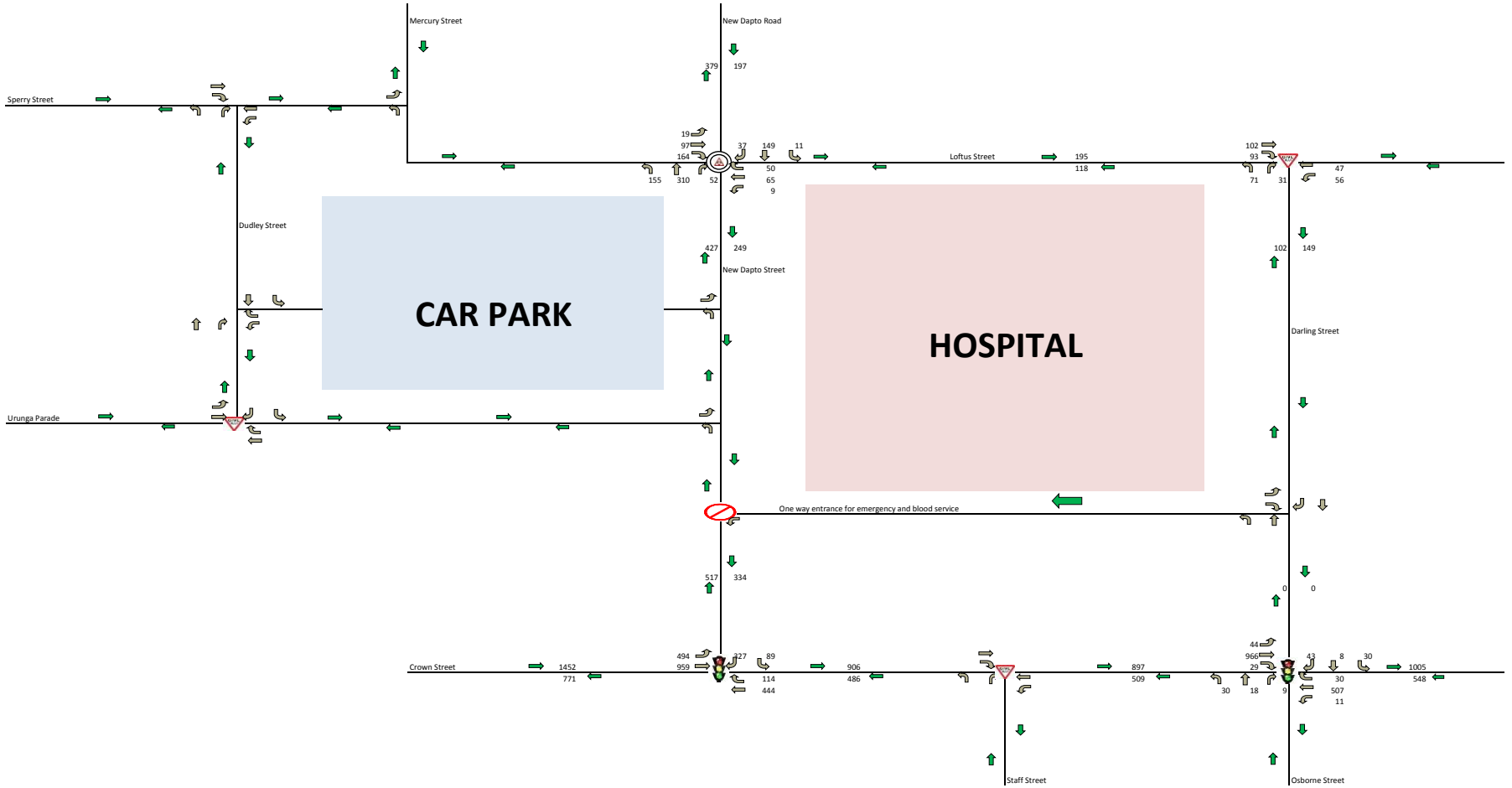
Background 2026 AM Peak



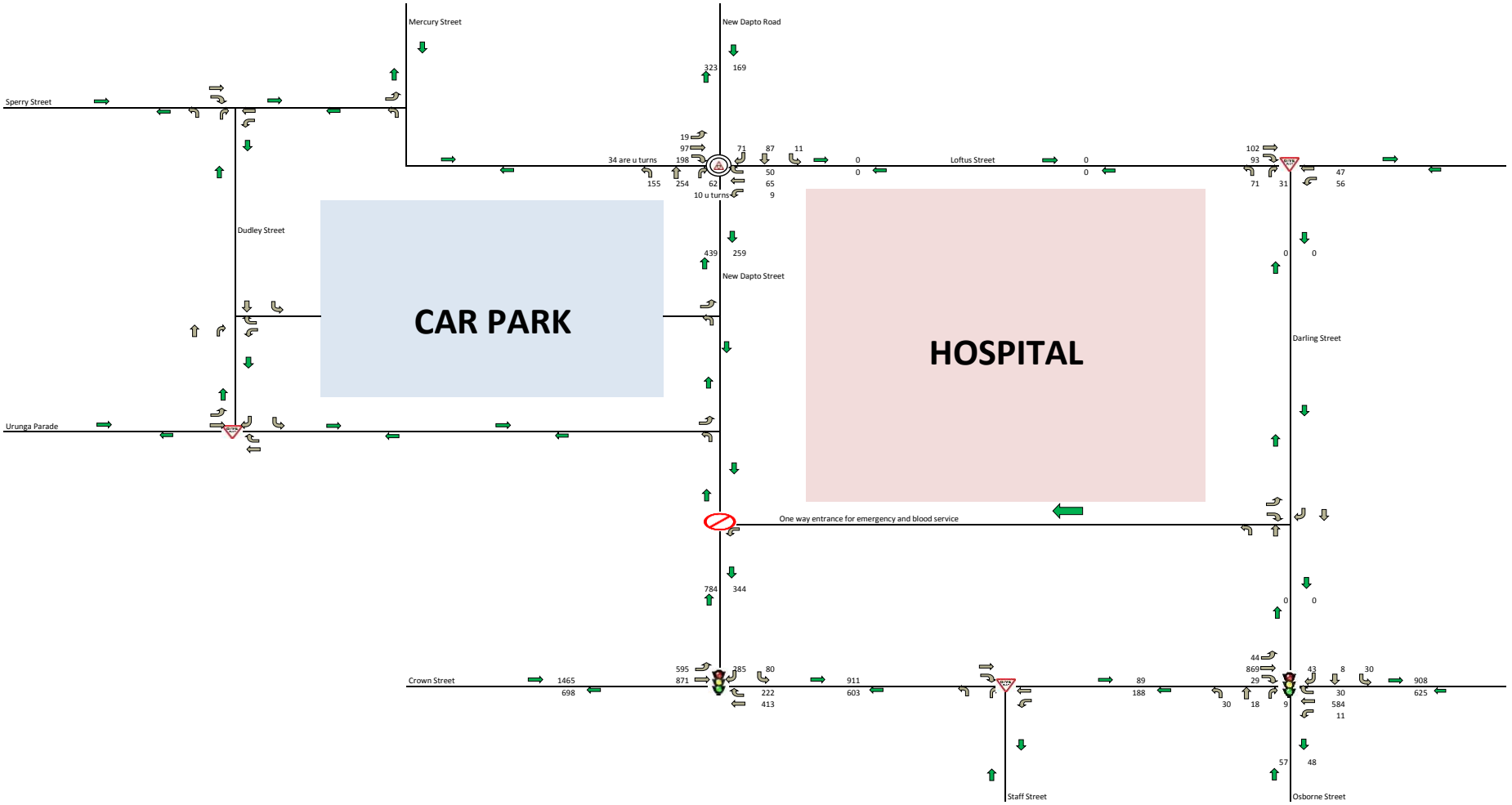
2016 AM Peak Background + Development Traffic



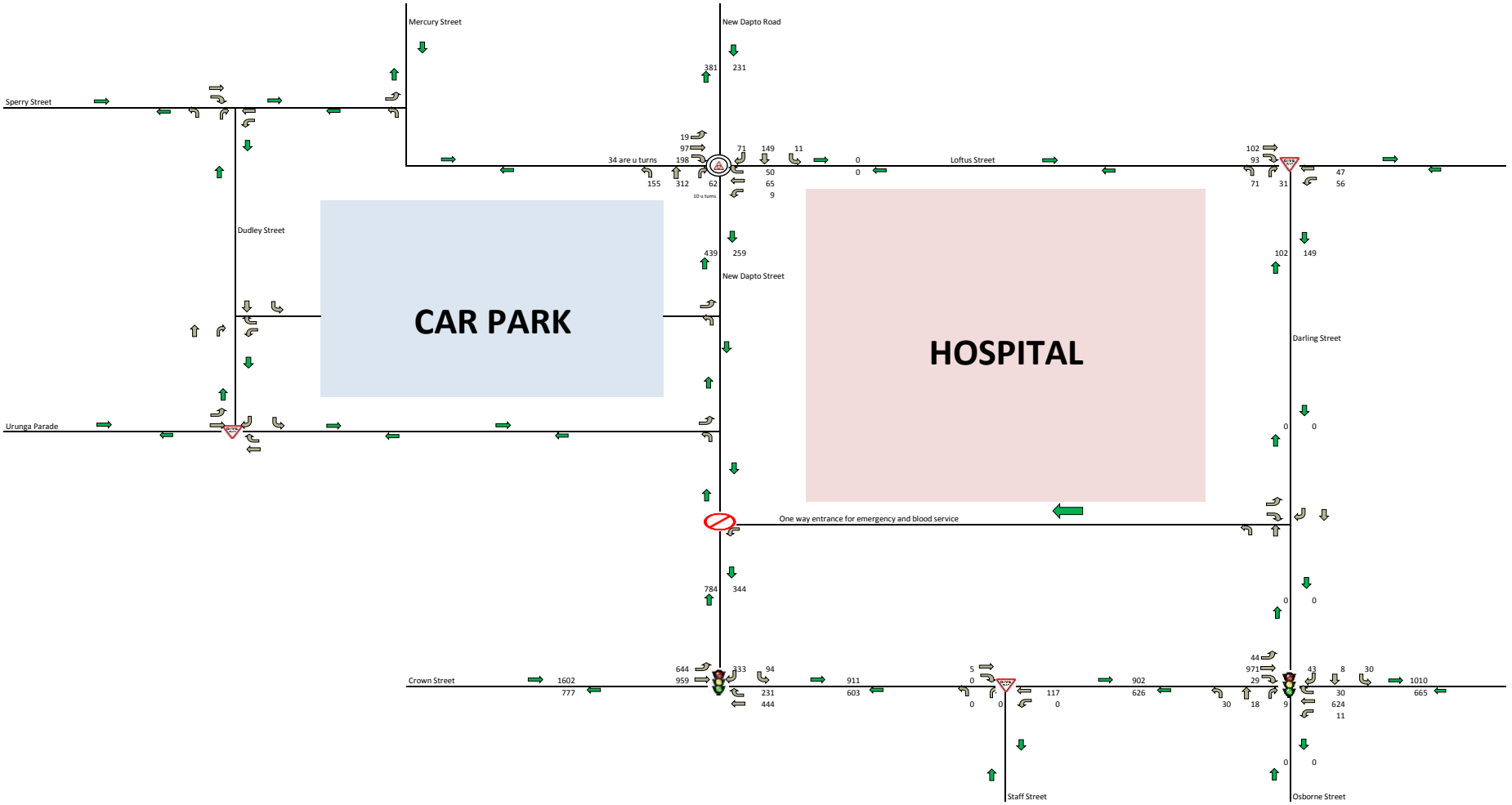
2026 AM Peak Background + Development Traffic



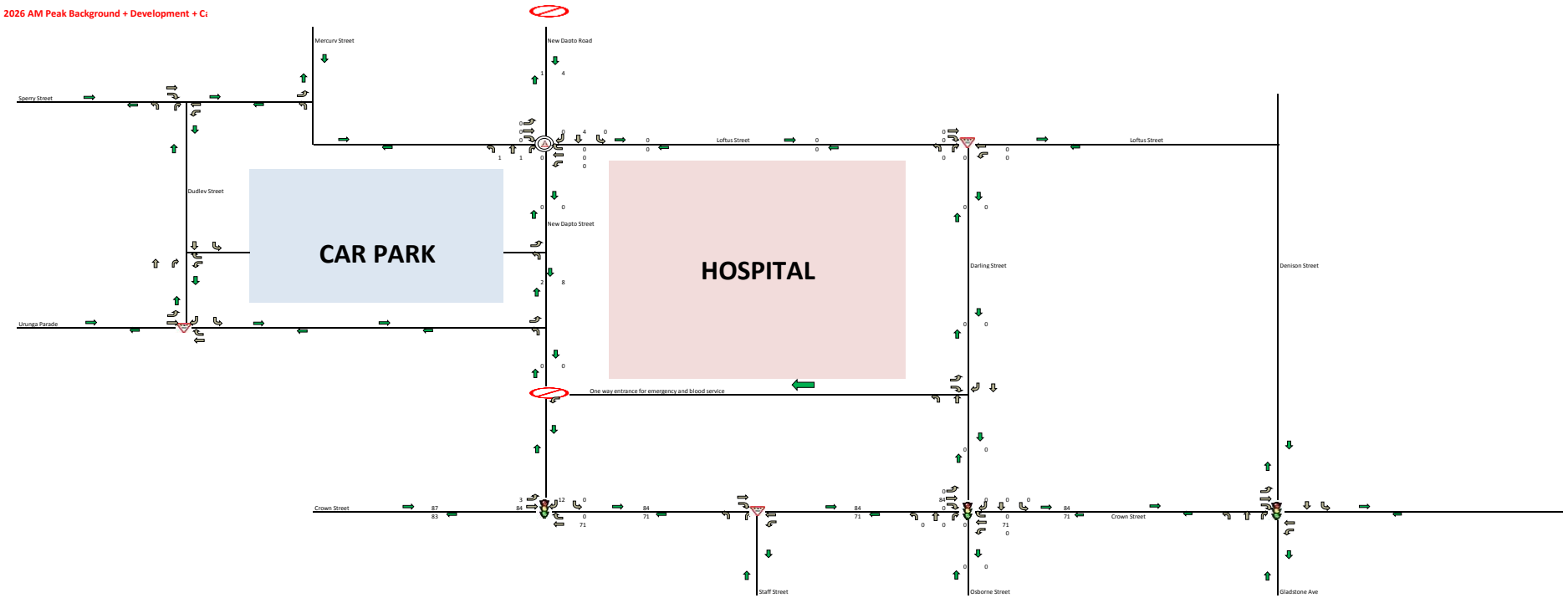
2016 AM Peak Background + Development + Car Park Traffic



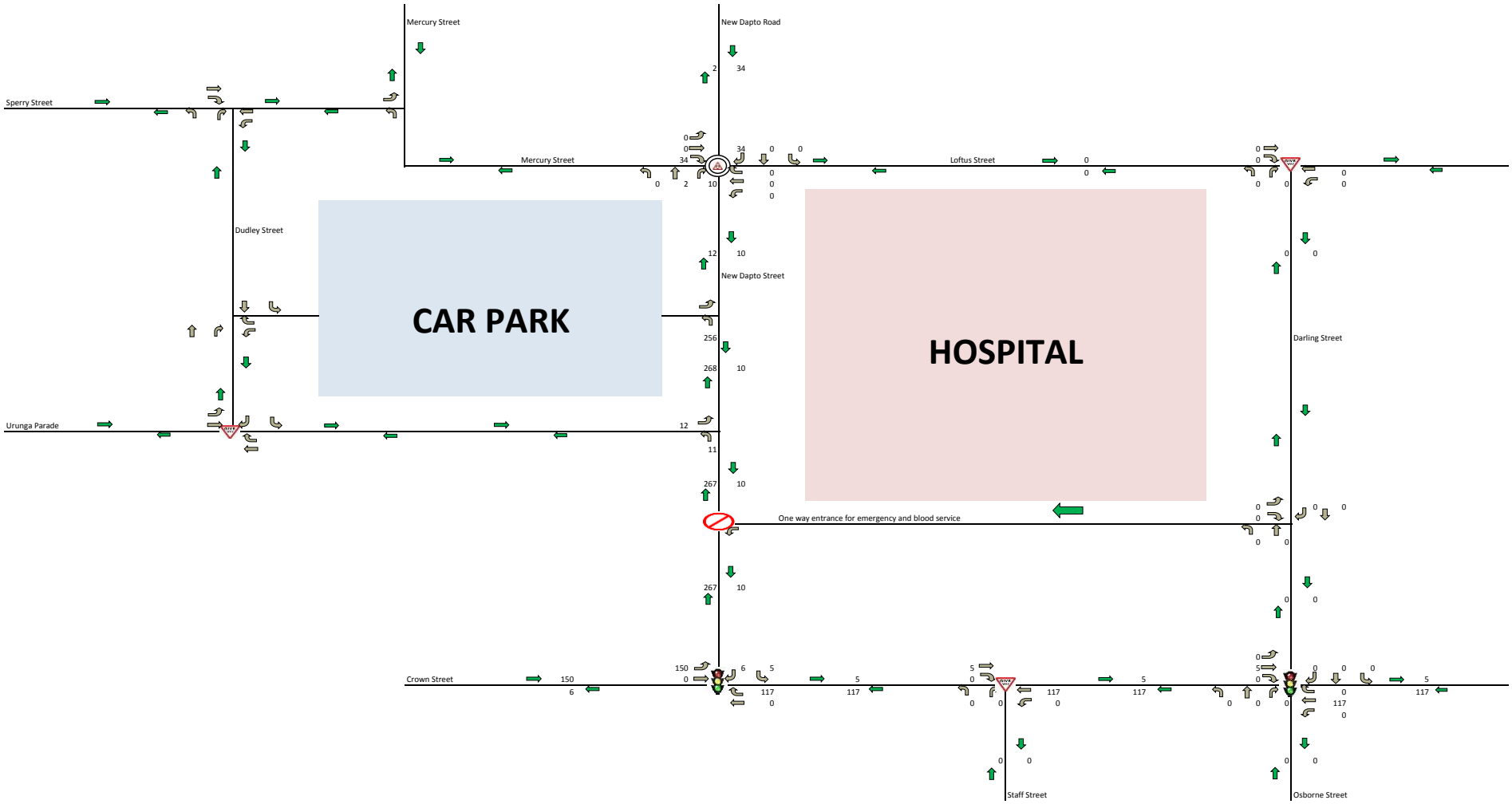
2026 AM Peak Background + Development + Car Park Traffic



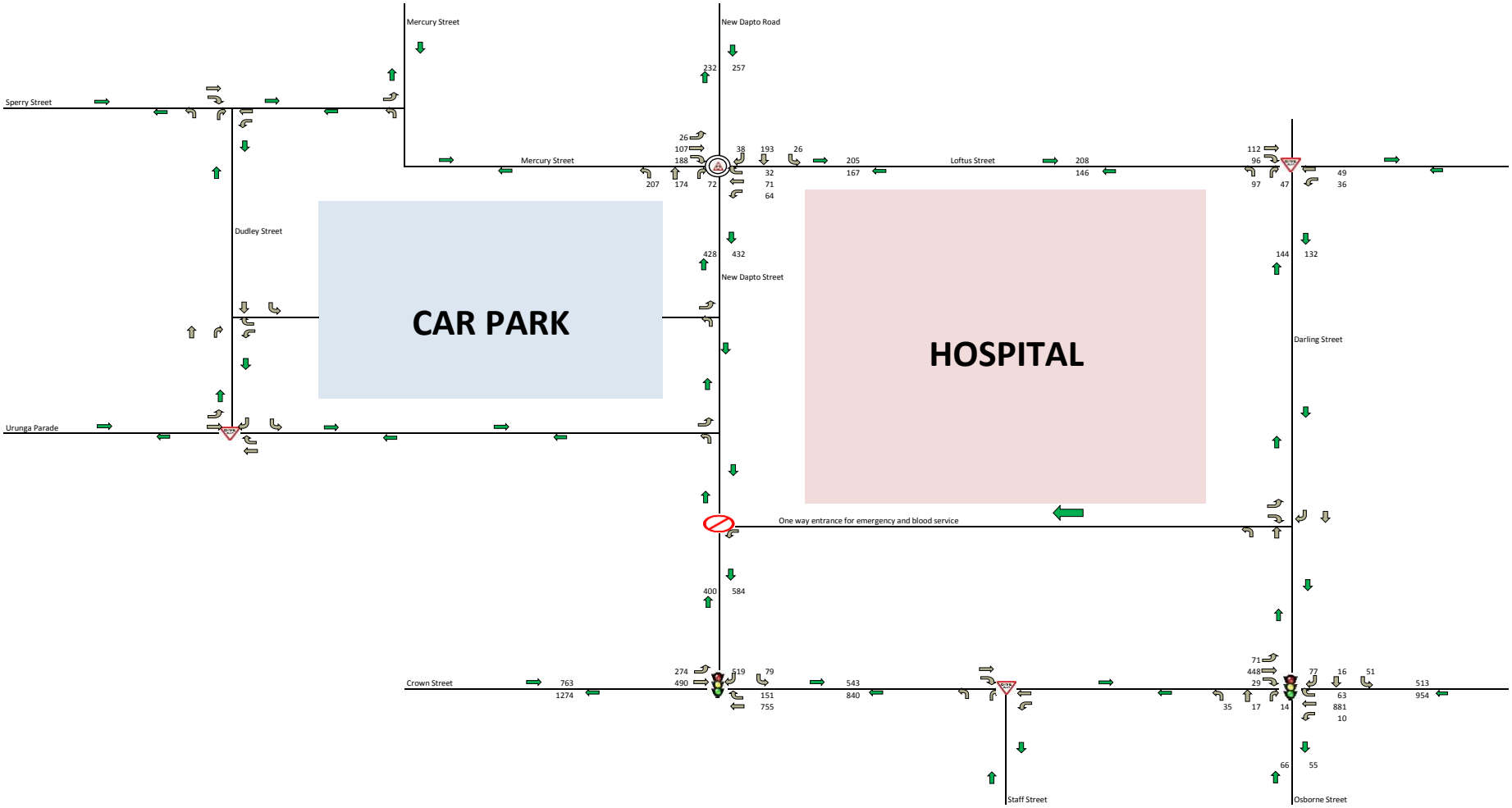
2026 AM Peak Background + Development + Ca



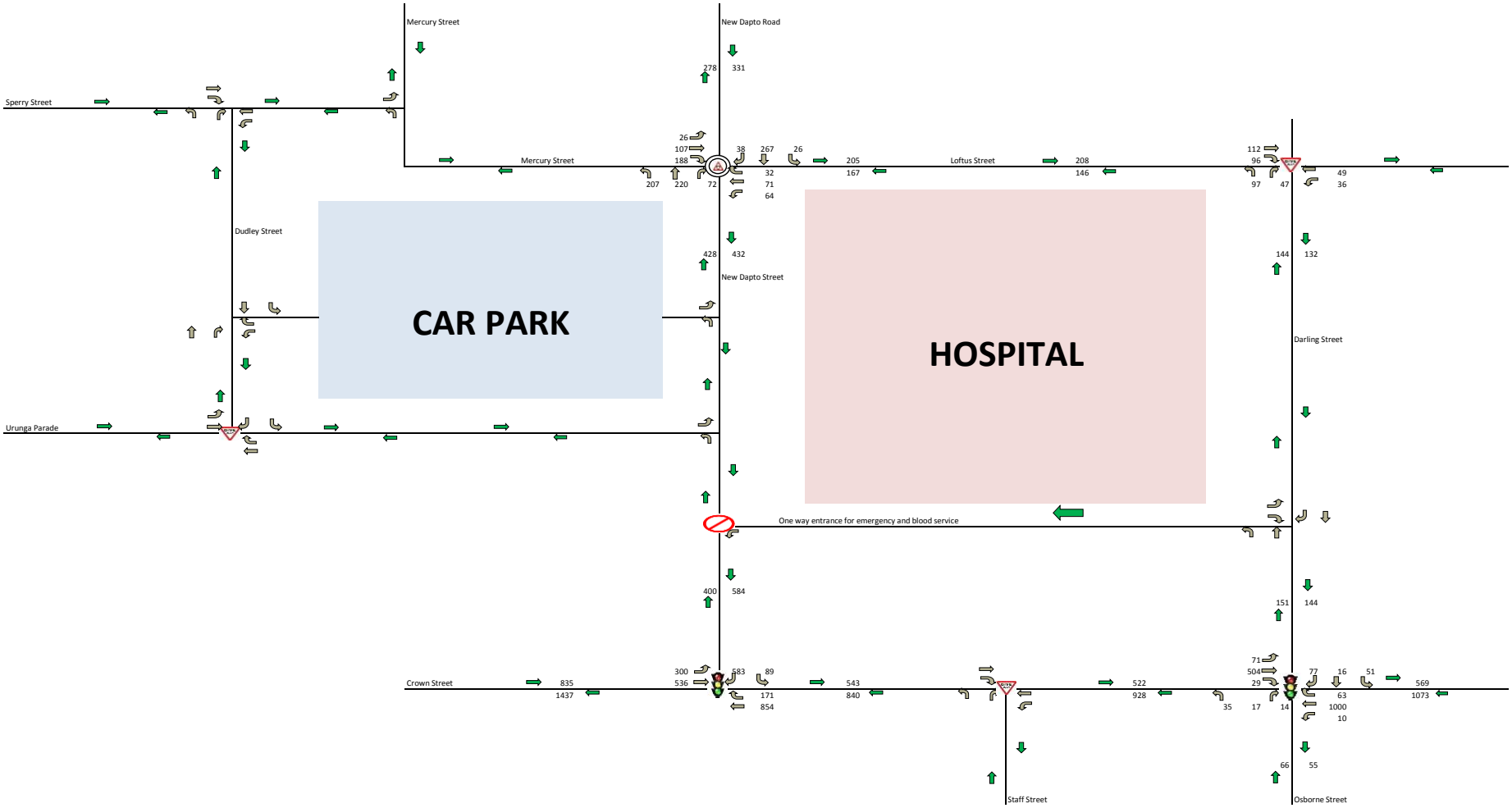
Car Park Traffic AM



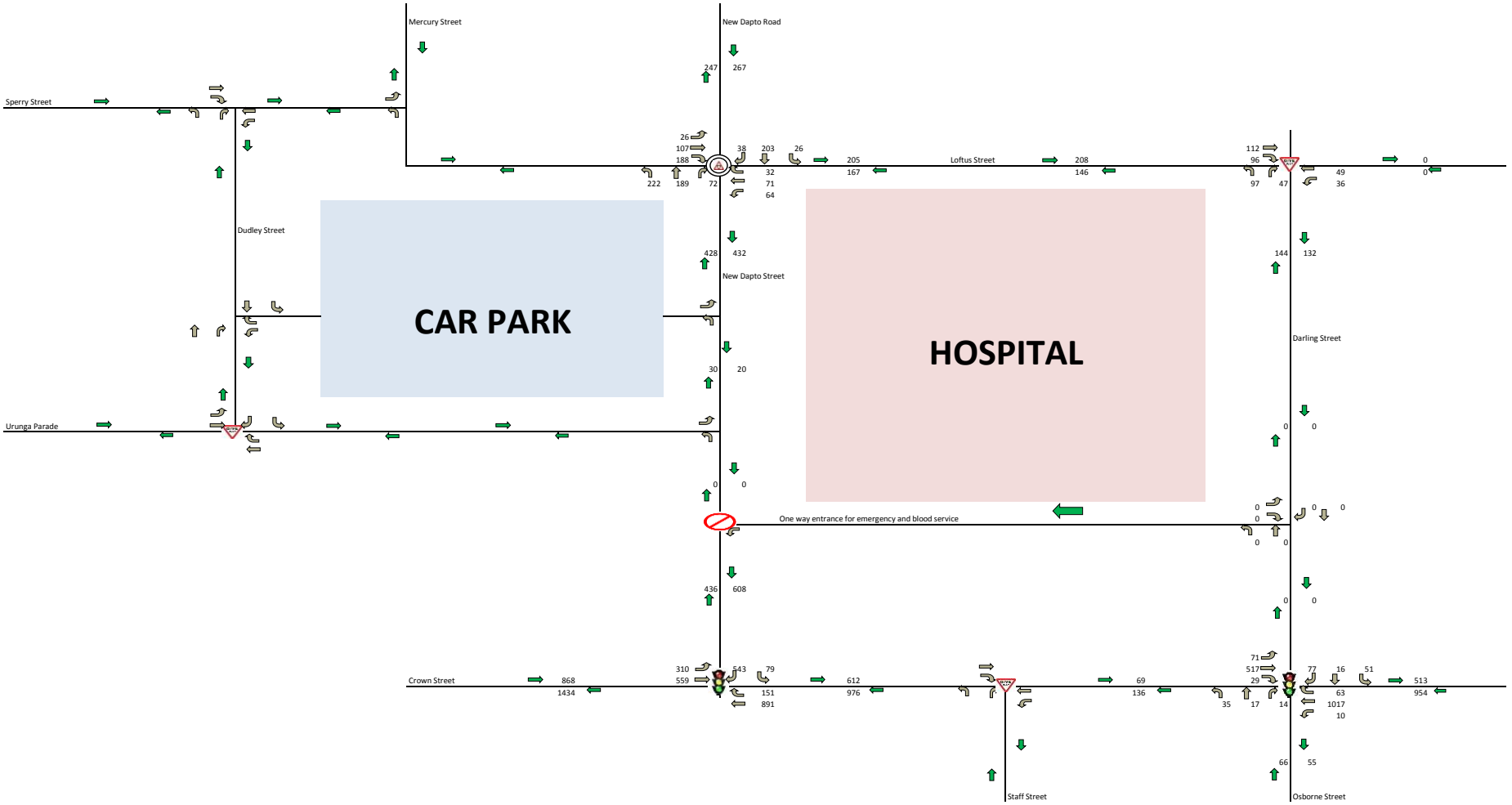
Background 2016 PM Peak



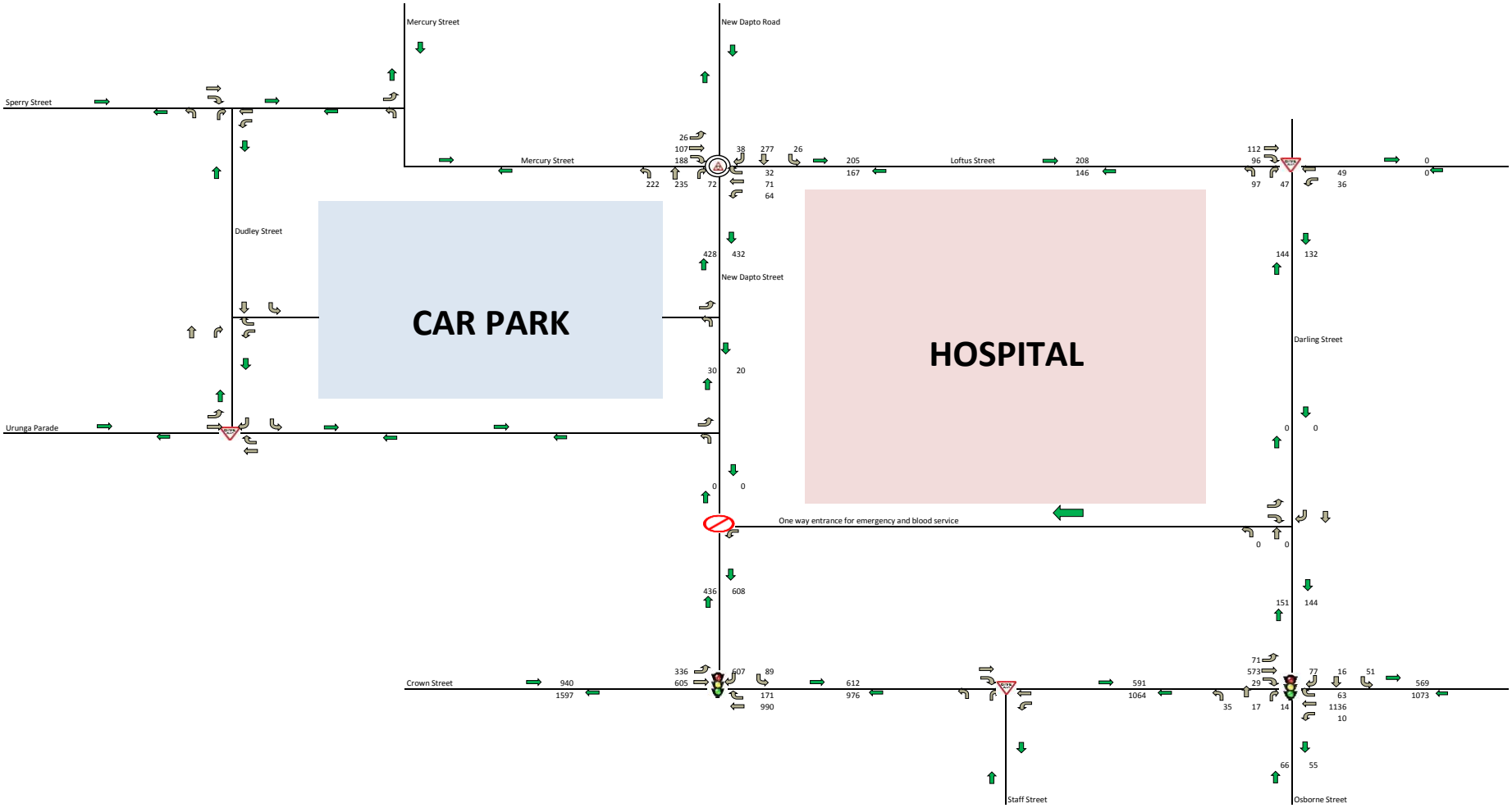
Background 2026 PM Peak



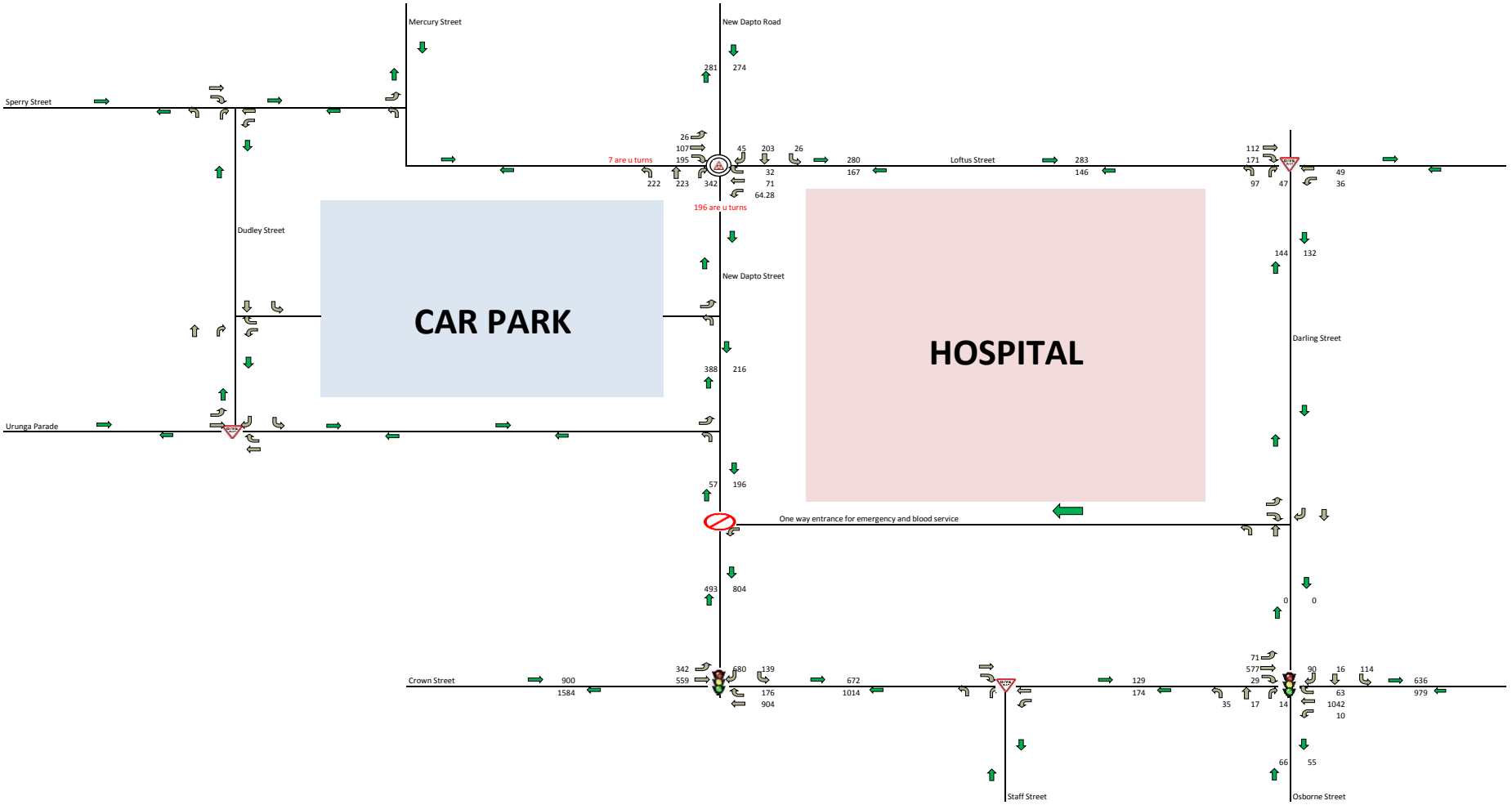
2016 PM Peak Background + Development Traffic



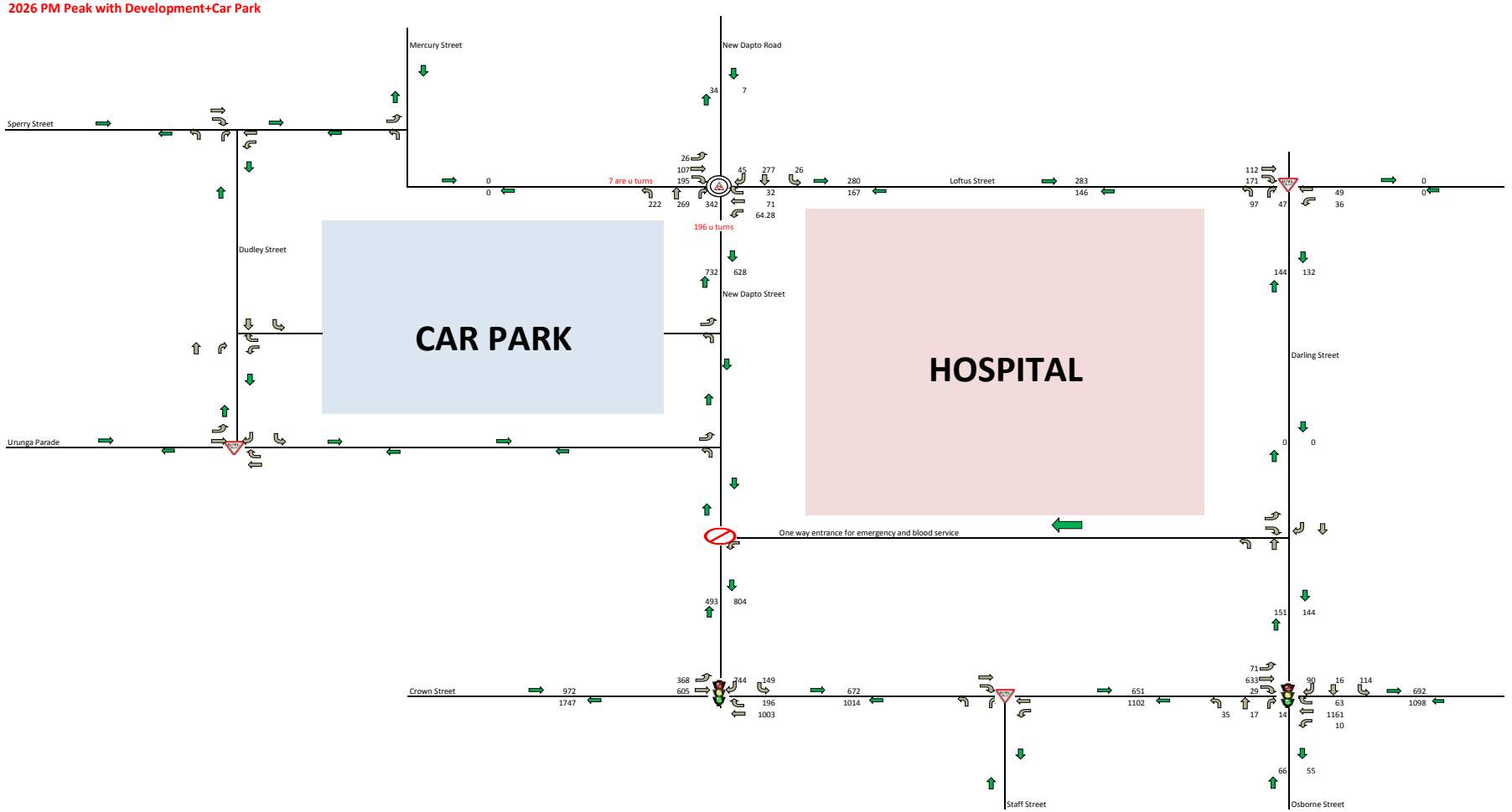
2026 PM Peak Background + Development Traffic

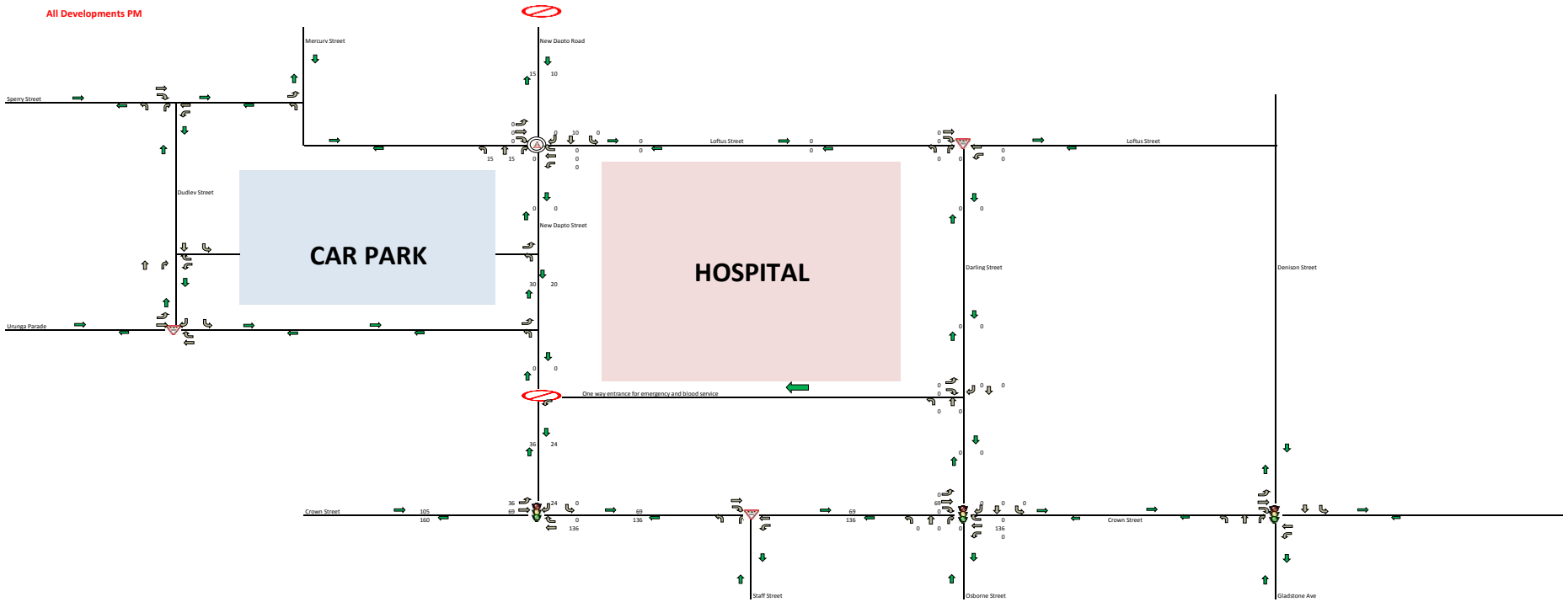


2016 PM Peak with Development+Car Park

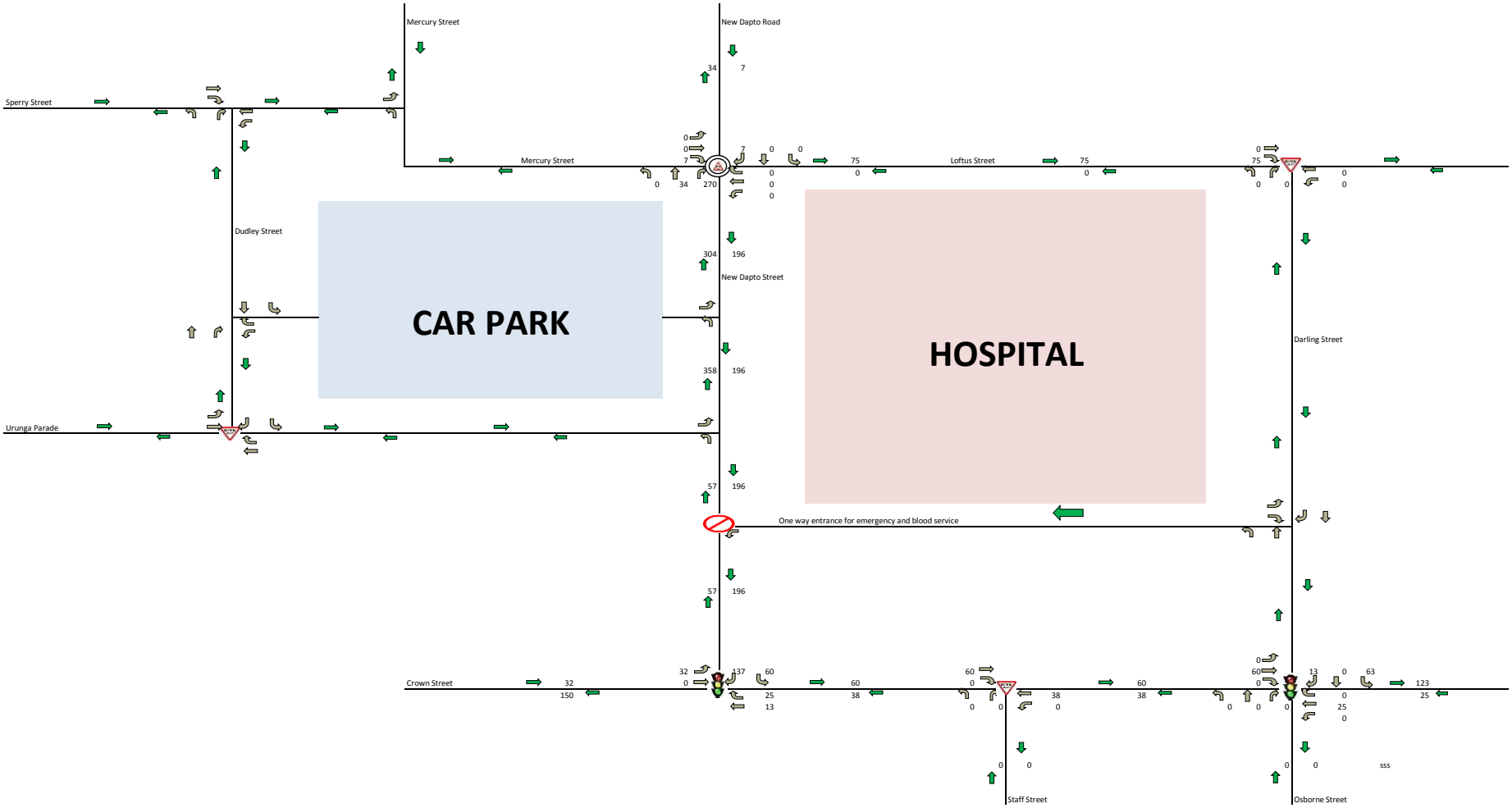


2026 PM Peak with Development+Car Park




All Developments PM
Mercury Street
New Dapto Road
Sperry Street
Loftus Street
Loftus Street
Dudley Street
CAR PARK
HOSPITAL
New Dapto Street
Darling Street
Denison Street
Urunga Parade
One way entrance for emergency and blood service
Crown Street
Crown Street
Staff Street
Osborne Street
Gladstone Ave

Car Park Traffic PM



Wollongong Council DCP **PARKING DEMANDS FOR ONLY THE ADDITIONAL INCREASE**

Hospitals	*City wide:* 1 car parking space per medical practitioner plus 1 car parking space plus 2 employee plus 1 car parking space per 2 beds.	1 bicycle space per 5 car spaces	1 motor cycle space per 25 car spaces	Large Rigid Vehicle

Parking Required for Additional Growth

Assumptions:
No. of beds take into consideration of the no. of visitors

Additional Development Quantum		DCP Rate	Design Guidelines for Hospital Rate	Parking Requirments
Total Employees	411			
Medical Practitioners	44	1		44
General Employees	367	0.5		184
No. of Beds (Vistors Spaces)	80	0.5		40
Outpatients	131			18

Total Required
286

ONLY FOR OUTPATIENTS

No. of outpatients drivers	0.8	*about 85% as per CEnsus and 5% taken off to account for shuttle service*						
Average no. of operation hours	10	(8am-6pm)						
Average no. of outpatients per hour	11							
Even Arrival Rate	6	every half an hour						
Occupancy	between 1.5 to 2 hours							
	Between		In	Out	Accu. IN	Accu. Out	No. of Spaces Required	
First Car In	7:30	8:00	6		6	0	6	
First Appointment	8:00	8:30	6		12	0	12	
	8:30	9:00	6		18	0	18	
First Car Out (1.5hrs Occupancy)	9:00	9:30	6	6	24	6	18	Maximum Number
	9:30	10:00	6	6	30	12	18	
	10:00	10:30	6	6	36	18	18	
	10:30	11:00	6	6	42	24	18	
	11:00	11:30	6	6	48	30	18	
	11:30	12:00	6	6	54	36	18	
	12:00	12:30	6	6	60	42	18	
	12:30	13:00	6	6	66	48	18	
	13:00	13:30	6	6	72	54	18	
	13:30	14:00	6	6	78	60	18	
	14:00	14:30	6	6	84	66	18	
	14:30	15:00	6	6	90	72	18	
	15:00	15:30	6	6	96	78	18	
	15:30	16:00	6	6	102	84	18	
	16:00	16:30	6	6	108	90	18	
	16:30	17:00	6	6	114	96	18	
	17:00	17:30	6	6	120	102	18	
Last Appointment	17:30	18:00	6	6	126	108	18	
Last Car Out	18:00	18:30		6	126	114	12	

Peak Hourly In-Flow 15%

Traffic Impact Assessment

APPENDIX E

2016 BASELINE – SIDRA ANALYSIS

Cardno
Shaping the Future

2016 Background+Committed Development

Crown St - Darling St - Osborne St

AM Peak

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
							Vehicles	Distance			
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Osborne St											
1	L	30	0.0	0.299	44.8	LOS D	2.0	13.8	0.87	0.75	27.3
2	T	18	0.0	0.299	36.6	LOS C	2.0	13.8	0.87	0.64	27.8
3	R	9	0.0	0.034	45.9	LOS D	0.4	2.6	0.86	0.68	26.5
Approach		57	0.0	0.299	42.4	LOS C	2.0	13.8	0.87	0.71	27.3
East: Crown St (East)											
4	L	11	0.0	0.087	9.8	LOS A	0.5	3.4	0.09	1.00	47.6
5	T	467	5.0	0.401	2.0	LOS A	2.4	17.7	0.13	0.11	56.1
6	R	30	0.0	0.401	10.4	LOS A	2.4	17.7	0.14	1.05	47.2
Approach		508	4.6	0.401	2.7	LOS A	2.4	17.7	0.13	0.19	55.3
North: Darling St											
7	L	30	0.0	0.277	46.4	LOS D	3.5	24.3	0.90	0.78	26.4
8	T	8	0.0	0.277	38.3	LOS C	3.5	24.3	0.90	0.70	26.8
9	R	43	0.0	0.277	46.6	LOS D	3.5	24.3	0.90	0.78	26.4
Approach		81	0.0	0.277	45.7	LOS D	3.5	24.3	0.90	0.77	26.4
West: Crown St (West)											
10	L	44	0.0	0.377	10.2	LOS A	2.9	21.0	0.13	1.01	47.3
11	T	864	5.0	0.377	2.0	LOS A	2.9	21.0	0.13	0.12	56.0
12	R	29	0.0	0.377	10.2	LOS A	2.6	19.2	0.13	1.03	47.3
Approach		937	4.6	0.377	2.7	LOS A	2.9	21.0	0.13	0.19	55.3
All Vehicles		1583	4.2	0.401	6.3	LOS A	3.5	24.3	0.20	0.24	50.6

PM Peak

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
							Vehicles	Distance			
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Osborne St											
1	L	35	0.0	0.338	48.0	LOS D	2.2	15.6	0.90	0.75	26.2
2	T	17	0.0	0.338	39.8	LOS C	2.2	15.6	0.90	0.67	26.6
3	R	14	0.0	0.072	51.4	LOS D	0.6	4.4	0.92	0.70	24.8
Approach		66	0.0	0.338	46.6	LOS D	2.2	15.6	0.90	0.72	26.0
East: Crown St (East)											
4	L	10	0.0	0.159	9.1	LOS A	0.6	4.4	0.06	1.05	48.2
5	T	1017	5.0	0.739	1.7	LOS A	7.1	51.4	0.16	0.15	56.5
6	R	63	0.0	0.739	10.1	LOS A	7.1	51.4	0.18	1.06	47.7
Approach		1090	4.7	0.739	2.2	LOS A	7.1	51.4	0.16	0.21	55.8
North: Darling St											
7	L	51	0.0	0.593	52.0	LOS D	6.8	47.6	0.98	0.81	24.8
8	T	16	0.0	0.593	43.8	LOS D	6.8	47.6	0.98	0.80	24.9
9	R	77	0.0	0.593	52.1	LOS D	6.8	47.6	0.98	0.81	24.7
Approach		144	0.0	0.593	51.1	LOS D	6.8	47.6	0.98	0.81	24.8
West: Crown St (West)											
10	L	71	0.0	0.284	9.3	LOS A	1.3	9.2	0.07	0.96	48.1
11	T	517	5.0	0.284	1.1	LOS A	1.3	9.2	0.08	0.07	57.7
12	R	29	0.0	0.284	9.4	LOS A	0.8	6.0	0.08	1.00	48.0
Approach		617	4.2	0.284	2.4	LOS A	1.3	9.2	0.08	0.21	55.9
All Vehicles		1917	4.0	0.739	7.5	LOS A	7.1	51.4	0.22	0.27	49.3

Loftus St - New Dapto Rd - Mercury St

AM Peak

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
							Vehicles	Distance			
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: New Dapto Rd (South)											
1	L	155	0.0	0.356	6.6	LOS A	1.9	13.5	0.33	0.54	49.3
2	T	252	0.0	0.356	6.6	LOS A	1.9	13.5	0.33	0.54	49.3
3	R	52	0.0	0.356	11.6	LOS A	1.9	13.5	0.33	0.80	46.1
Approach		459	0.0	0.356	7.2	LOS A	1.9	13.5	0.33	0.57	48.9
East: Loftus St											
4	L	9	0.0	0.114	8.1	LOS A	0.6	3.9	0.42	0.60	47.8
5	T	65	0.0	0.114	11.3	LOS A	0.6	3.9	0.42	0.69	45.7
6	R	50	0.0	0.114	12.2	LOS A	0.6	3.9	0.42	0.70	45.0
Approach		124	0.0	0.114	11.4	LOS A	0.6	3.9	0.42	0.69	45.5
North: New Dapto Rd (North)											
7	L	11	0.0	0.136	8.7	LOS A	0.8	5.7	0.53	0.64	47.8
8	T	87	0.0	0.136	7.9	LOS A	0.8	5.7	0.53	0.60	47.9
9	R	37	0.0	0.136	13.8	LOS A	0.8	5.7	0.53	0.79	44.6
Approach		135	0.0	0.136	9.6	LOS A	0.8	5.7	0.53	0.65	46.9
North West: Mercury St											
27	L	19	0.0	0.279	9.5	LOS A	1.7	11.6	0.56	0.71	47.3
28	T	97	0.0	0.279	8.1	LOS A	1.7	11.6	0.56	0.64	47.4
29	R	164	0.0	0.279	12.2	LOS A	1.7	11.6	0.56	0.77	45.5
Approach		280	0.0	0.279	10.6	LOS A	1.7	11.6	0.56	0.72	46.2
All Vehicles		998	0.0	0.356	9.0	LOS A	1.9	13.5	0.43	0.64	47.4

PM Peak

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
							Vehicles	Distance			
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: New Dapto Rd (South)											
1	L	222	0.0	0.371	6.6	LOS A	2.1	14.6	0.33	0.53	49.3
2	T	189	0.0	0.371	6.6	LOS A	2.1	14.6	0.33	0.53	49.3
3	R	72	0.0	0.371	11.6	LOS A	2.1	14.6	0.33	0.79	46.1
Approach		483	0.0	0.371	7.3	LOS A	2.1	14.6	0.33	0.57	48.8
East: Loftus St											
4	L	64	0.0	0.171	8.9	LOS A	0.9	6.3	0.53	0.67	47.3
5	T	71	0.0	0.171	12.1	LOS A	0.9	6.3	0.53	0.76	45.4
6	R	32	0.0	0.171	13.0	LOS A	0.9	6.3	0.53	0.77	44.7
Approach		167	0.0	0.171	11.1	LOS A	0.9	6.3	0.53	0.73	46.0
North: New Dapto Rd (North)											
7	L	26	0.0	0.282	9.4	LOS A	1.8	12.9	0.62	0.71	47.5
8	T	203	0.0	0.282	8.5	LOS A	1.8	12.9	0.62	0.67	47.5
9	R	38	0.0	0.282	14.5	LOS A	1.8	12.9	0.62	0.83	44.2
Approach		267	0.0	0.282	9.5	LOS A	1.8	12.9	0.62	0.70	46.9
North West: Mercury St											
27	L	26	0.0	0.305	9.2	LOS A	1.9	13.0	0.52	0.69	47.4
28	T	107	0.0	0.305	7.8	LOS A	1.9	13.0	0.52	0.61	47.6
29	R	188	0.0	0.305	11.9	LOS A	1.9	13.0	0.52	0.75	45.7
Approach		321	0.0	0.305	10.3	LOS A	1.9	13.0	0.52	0.70	46.5
All Vehicles		1238	0.0	0.371	9.1	LOS A	2.1	14.6	0.47	0.65	47.4

Crown St - New Dapto Rd

AM Peak

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
							Vehicles	Distance			
		veh/h	%	v/c	sec		veh	m		per veh	km/h
East: Crown St											
5	T	413	5.0	0.312	1.1	LOS A	1.4	10.3	0.08	0.07	57.9
6	R	105	0.0	0.442	16.7	LOS B	2.1	15.0	0.44	0.76	41.1
Approach		518	4.0	0.442	4.2	LOS A	2.1	15.0	0.15	0.21	53.5
North: New Dapto Rd											
7	L	75	0.0	0.750	53.1	LOS D	7.2	50.2	0.95	0.87	24.3
9	R	279	0.0	0.750	55.2	LOS D	10.3	72.0	0.99	0.87	23.8
Approach		354	0.0	0.750	54.7	LOS D	10.3	72.0	0.98	0.87	23.9
West: Crown St											
10	L	445	0.0	0.300	8.9	LOS A	1.5	10.4	0.08	0.68	48.2
11	T	871	5.0	0.776	2.0	LOS A	8.0	58.5	0.21	0.19	55.8
Approach		1316	3.3	0.776	4.3	LOS A	8.0	58.5	0.16	0.36	53.0
All Vehicles		2188	2.9	0.776	12.5	LOS A	10.3	72.0	0.29	0.41	44.4

PM Peak

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
							Vehicles	Distance			
		veh/h	%	v/c	sec		veh	m		per veh	km/h
East: Crown St											
5	T	891	5.0	0.656	6.3	LOS A	13.8	100.6	0.36	0.33	49.4
6	R	151	0.0	0.656	17.0	LOS B	5.3	37.6	0.54	0.84	41.6
Approach		1042	4.3	0.656	7.9	LOS A	13.8	100.6	0.39	0.40	48.1
North: New Dapto Rd											
7	L	79	0.0	0.960	54.1	LOS D	9.3	65.3	0.94	0.83	24.0
9	R	543	0.0	0.960	85.3	LOS F	35.6	249.2	0.99	1.04	17.9
Approach		622	0.0	0.960	81.4	LOS F	35.6	249.2	0.98	1.02	18.5
West: Crown St											
10	L	310	0.0	0.212	9.0	LOS A	1.1	7.7	0.07	0.68	48.0
11	T	559	5.0	0.598	6.9	LOS A	10.0	73.0	0.33	0.30	49.1
Approach		869	3.2	0.598	7.6	LOS A	10.0	73.0	0.24	0.44	48.7
All Vehicles		2533	2.9	0.960	25.8	LOS B	35.6	249.2	0.48	0.57	34.6

Loftus St - Darling St

AM Peak

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
							Vehicles	Distance			
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Darling St											
1	L	71	0.0	0.115	11.8	LOS A	0.4	3.1	0.21	0.88	45.7
3	R	31	0.0	0.115	11.7	LOS A	0.4	3.1	0.21	0.97	45.7
Approach		102	0.0	0.115	11.8	LOS A	0.4	3.1	0.21	0.90	45.7
East: Loftus St (East)											
4	L	56	0.0	0.030	8.2	LOS A	0.0	0.0	0.00	0.67	49.0
5	T	47	0.0	0.024	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		103	0.0	0.030	4.4	NA	0.0	0.0	0.00	0.36	53.5
West: Loftus St (West)											
11	T	102	0.0	0.103	0.2	LOS A	0.5	3.5	0.13	0.00	56.9
12	R	93	0.0	0.103	8.7	LOS A	0.5	3.5	0.22	0.73	48.3
Approach		195	0.0	0.103	4.3	NA	0.5	3.5	0.17	0.35	52.5
All Vehicles		400	0.0	0.115	6.2	NA	0.5	3.5	0.14	0.49	50.8

PM Peak

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
							Vehicles	Distance			
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Darling St											
1	L	97	0.0	0.165	11.9	LOS A	0.7	4.7	0.21	0.88	45.5
3	R	47	0.0	0.165	11.9	LOS A	0.7	4.7	0.21	0.97	45.6
Approach		144	0.0	0.165	11.9	LOS A	0.7	4.7	0.21	0.91	45.6
East: Loftus St (East)											
4	L	36	0.0	0.019	8.2	LOS A	0.0	0.0	0.00	0.67	49.0
5	T	49	0.0	0.025	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		85	0.0	0.025	3.5	NA	0.0	0.0	0.00	0.28	54.8
West: Loftus St (West)											
11	T	112	0.0	0.108	0.2	LOS A	0.5	3.7	0.12	0.00	57.1
12	R	96	0.0	0.108	8.6	LOS A	0.5	3.7	0.20	0.74	48.4
Approach		208	0.0	0.108	4.1	NA	0.5	3.7	0.16	0.34	52.7
All Vehicles		437	0.0	0.165	6.6	NA	0.7	4.7	0.14	0.52	50.5

Traffic Impact Assessment

APPENDIX F

2016 BASELINE PLUS DEVELOPMENT – SIDRA ANALYSIS

Cardno
Shaping the Future

2016 Background+Committed Development+Car Park Traffic

Crown St - Darling St - Osborne St

AM Peak

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
							Vehicles	Distance			
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Osborne St											
1	L	30	0.0	0.299	44.8	LOS D	2.0	13.8	0.87	0.75	27.3
2	T	18	0.0	0.299	36.6	LOS C	2.0	13.8	0.87	0.64	27.8
3	R	9	0.0	0.034	45.9	LOS D	0.4	2.6	0.86	0.68	26.5
Approach		57	0.0	0.299	42.4	LOS C	2.0	13.8	0.87	0.71	27.3
East: Crown St (East)											
4	L	11	0.0	0.103	9.8	LOS A	0.6	4.1	0.09	1.01	47.6
5	T	584	5.0	0.476	2.1	LOS A	3.4	24.7	0.14	0.13	55.9
6	R	30	0.0	0.476	10.6	LOS A	3.4	24.7	0.15	1.06	47.1
Approach		625	4.7	0.476	2.7	LOS A	3.4	24.7	0.14	0.19	55.2
North: Darling St											
7	L	30	0.0	0.277	46.4	LOS D	3.5	24.3	0.90	0.78	26.4
8	T	8	0.0	0.277	38.3	LOS C	3.5	24.3	0.90	0.70	26.8
9	R	43	0.0	0.277	46.6	LOS D	3.5	24.3	0.90	0.78	26.4
Approach		81	0.0	0.277	45.7	LOS D	3.5	24.3	0.90	0.77	26.4
West: Crown St (West)											
10	L	44	0.0	0.385	10.2	LOS A	3.0	21.7	0.13	1.01	47.3
11	T	869	5.0	0.385	2.1	LOS A	3.0	21.7	0.13	0.12	56.0
12	R	29	0.0	0.385	10.3	LOS A	2.6	19.2	0.13	1.03	47.3
Approach		942	4.6	0.385	2.7	LOS A	3.0	21.7	0.13	0.19	55.2
All Vehicles		1705	4.3	0.476	6.1	LOS A	3.5	24.7	0.20	0.23	50.9

PM Peak

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
							Vehicles	Distance			
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Osborne St											
1	L	35	0.0	0.329	45.9	LOS D	2.2	15.2	0.88	0.75	26.9
2	T	17	0.0	0.329	37.7	LOS C	2.2	15.2	0.88	0.66	27.3
3	R	14	0.0	0.084	52.8	LOS D	0.6	4.5	0.93	0.70	24.4
Approach		66	0.0	0.329	45.3	LOS D	2.2	15.2	0.89	0.71	26.4
East: Crown St (East)											
4	L	10	0.0	0.170	9.6	LOS A	0.9	6.2	0.08	1.04	47.8
5	T	1042	5.0	0.786	2.5	LOS A	10.8	78.7	0.23	0.22	54.9
6	R	63	0.0	0.786	11.0	LOS A	10.8	78.7	0.27	1.04	47.1
Approach		1115	4.7	0.786	3.0	LOS A	10.8	78.7	0.24	0.27	54.3
North: Darling St											
7	L	114	0.0	0.777	55.4	LOS D	11.2	78.7	1.00	0.91	23.8
8	T	16	0.0	0.777	47.2	LOS D	11.2	78.7	1.00	0.91	23.9
9	R	90	0.0	0.777	55.5	LOS D	11.2	78.7	1.00	0.91	23.8
Approach		220	0.0	0.777	54.8	LOS D	11.2	78.7	1.00	0.91	23.8
West: Crown St (West)											
10	L	71	0.0	0.318	9.8	LOS A	1.9	13.8	0.10	0.97	47.7
11	T	577	5.0	0.318	2.0	LOS A	1.9	13.8	0.13	0.11	56.0
12	R	29	0.0	0.318	11.0	LOS A	1.9	13.6	0.16	0.99	46.7
Approach		677	4.3	0.318	3.2	LOS A	1.9	13.8	0.12	0.24	54.6
All Vehicles		2078	3.9	0.786	9.9	LOS A	11.2	78.7	0.30	0.34	46.5

Loftus St - New Dapto Rd - Mercury St

AM Peak

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
							Vehicles	Distance			
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: New Dapto Rd (South)											
1	L	155	0.0	0.389	7.0	LOS A	2.1	14.9	0.41	0.58	48.8
2	T	254	0.0	0.389	7.0	LOS A	2.1	14.9	0.41	0.58	48.8
3	R	62	0.0	0.389	12.3	LOS A	2.1	14.9	0.41	0.82	45.8
Approach		471	0.0	0.389	7.7	LOS A	2.1	14.9	0.41	0.61	48.4
East: Loftus St											
4	L	9	0.0	0.121	8.5	LOS A	0.6	4.2	0.47	0.63	47.5
5	T	65	0.0	0.121	11.7	LOS A	0.6	4.2	0.47	0.71	45.4
6	R	50	0.0	0.121	12.6	LOS A	0.6	4.2	0.47	0.72	44.8
Approach		124	0.0	0.121	11.8	LOS A	0.6	4.2	0.47	0.71	45.3
North: New Dapto Rd (North)											
7	L	11	0.0	0.178	9.1	LOS A	1.1	7.6	0.58	0.67	47.4
8	T	87	0.0	0.178	8.2	LOS A	1.1	7.6	0.58	0.63	47.5
9	R	71	0.0	0.178	14.2	LOS A	1.1	7.6	0.58	0.79	44.2
Approach		169	0.0	0.178	10.8	LOS A	1.1	7.6	0.58	0.70	46.0
North West: Mercury St											
27	L	19	0.0	0.318	9.7	LOS A	2.0	13.8	0.59	0.72	47.1
28	T	97	0.0	0.318	8.3	LOS A	2.0	13.8	0.59	0.65	47.2
29	R	198	0.0	0.318	12.8	LOS A	2.0	13.8	0.59	0.78	45.0
Approach		314	0.0	0.318	11.2	LOS A	2.0	13.8	0.59	0.74	45.7
All Vehicles		1078	0.0	0.389	9.7	LOS A	2.1	14.9	0.49	0.67	46.8

PM Peak

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
							Vehicles	Distance			
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: New Dapto Rd (South)											
1	L	222	0.0	0.598	6.9	LOS A	4.6	32.3	0.46	0.55	48.2
2	T	223	0.0	0.598	6.9	LOS A	4.6	32.3	0.46	0.55	48.2
3	R	342	0.0	0.598	13.0	LOS A	4.6	32.3	0.46	0.76	44.9
Approach		787	0.0	0.598	9.6	LOS A	4.6	32.3	0.46	0.64	46.7
East: Loftus St											
4	L	64	0.0	0.201	10.3	LOS A	1.1	7.9	0.66	0.76	46.3
5	T	71	0.0	0.201	13.5	LOS A	1.1	7.9	0.66	0.82	44.2
6	R	32	0.0	0.201	14.4	LOS A	1.1	7.9	0.66	0.82	43.6
Approach		167	0.0	0.201	12.5	LOS A	1.1	7.9	0.66	0.79	44.8
North: New Dapto Rd (North)											
7	L	26	0.0	0.371	12.0	LOS A	2.6	17.9	0.80	0.85	45.4
8	T	203	0.0	0.371	11.1	LOS A	2.6	17.9	0.80	0.83	45.7
9	R	45	0.0	0.371	17.1	LOS B	2.6	17.9	0.80	0.91	42.3
Approach		274	0.0	0.371	12.2	LOS A	2.6	17.9	0.80	0.85	45.0
North West: Mercury St											
27	L	26	0.0	0.410	11.6	LOS A	2.8	19.5	0.77	0.84	45.6
28	T	107	0.0	0.410	10.2	LOS A	2.8	19.5	0.77	0.81	46.0
29	R	195	0.0	0.410	14.4	LOS A	2.8	19.5	0.77	0.88	43.7
Approach		328	0.0	0.410	12.8	LOS A	2.8	19.5	0.77	0.85	44.5
All Vehicles		1556	0.0	0.598	11.0	LOS A	4.6	32.3	0.61	0.74	45.7

Crown St - New Dapto Rd

AM Peak

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
							Vehicles	Distance			
		veh/h	%	v/c	sec		veh	m		per veh	km/h
East: Crown St											
5	T	413	5.0	0.312	1.1	LOS A	1.4	10.3	0.08	0.07	57.9
6	R	222	0.0	0.753	26.8	LOS B	8.6	60.5	0.74	0.90	34.4
Approach		635	3.3	0.753	10.1	LOS A	8.6	60.5	0.31	0.36	46.8
North: New Dapto Rd											
7	L	80	0.0	0.771	53.5	LOS D	7.5	52.6	0.95	0.89	24.2
9	R	285	0.0	0.771	55.9	LOS D	10.7	75.1	0.99	0.89	23.6
Approach		365	0.0	0.771	55.4	LOS D	10.7	75.1	0.98	0.89	23.7
West: Crown St											
10	L	595	0.0	0.401	9.0	LOS A	2.3	16.1	0.09	0.69	48.1
11	T	871	5.0	0.776	2.0	LOS A	8.0	58.5	0.21	0.19	55.8
Approach		1466	3.0	0.776	4.8	LOS A	8.0	58.5	0.16	0.39	52.4
All Vehicles		2466	2.6	0.776	13.7	LOS A	10.7	75.1	0.32	0.46	43.3

PM Peak

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
							Vehicles	Distance			
		veh/h	%	v/c	sec		veh	m		per veh	km/h
East: Crown St											
5	T	904	5.0	0.838	23.1	LOS B	35.1	255.9	0.81	0.77	34.8
6	R	176	0.0	0.838	47.6	LOS D	12.7	90.0	1.00	0.96	26.4
Approach		1080	4.2	0.838	27.1	LOS B	35.1	255.9	0.84	0.80	33.1
North: New Dapto Rd											
7	L	139	0.0	0.892	47.5	LOS D	9.3	65.3	0.88	0.86	26.0
9	R	680	0.0	0.892	57.6	LOS E	39.4	276.1	0.99	0.96	23.2
Approach		819	0.0	0.892	55.9	LOS D	39.4	276.1	0.97	0.94	23.6
West: Crown St											
10	L	342	0.0	0.247	9.2	LOS A	1.3	8.9	0.07	0.68	47.8
11	T	559	5.0	0.889	32.6	LOS C	31.4	229.0	0.94	0.92	30.2
Approach		901	3.1	0.889	23.7	LOS B	31.4	229.0	0.61	0.83	35.1
All Vehicles		2800	2.6	0.892	34.4	LOS C	39.4	276.1	0.80	0.85	30.1

Loftus St - Darling St

AM Peak

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
							Vehicles	Distance			
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Darling St											
1	L	71	0.0	0.115	11.8	LOS A	0.4	3.1	0.21	0.88	45.7
3	R	31	0.0	0.115	11.7	LOS A	0.4	3.1	0.21	0.97	45.7
Approach		102	0.0	0.115	11.8	LOS A	0.4	3.1	0.21	0.90	45.7
East: Loftus St (East)											
4	L	56	0.0	0.030	8.2	LOS A	0.0	0.0	0.00	0.67	49.0
5	T	47	0.0	0.024	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		103	0.0	0.030	4.4	NA	0.0	0.0	0.00	0.36	53.5
West: Loftus St (West)											
11	T	102	0.0	0.103	0.2	LOS A	0.5	3.5	0.13	0.00	56.9
12	R	93	0.0	0.103	8.7	LOS A	0.5	3.5	0.22	0.73	48.3
Approach		195	0.0	0.103	4.3	NA	0.5	3.5	0.17	0.35	52.5
All Vehicles		400	0.0	0.115	6.2	NA	0.5	3.5	0.14	0.49	50.8

PM Peak

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
							Vehicles	Distance			
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Darling St											
1	L	97	0.0	0.175	12.3	LOS A	0.7	4.9	0.21	0.88	45.2
3	R	47	0.0	0.175	12.2	LOS A	0.7	4.9	0.21	0.99	45.2
Approach		144	0.0	0.175	12.3	LOS A	0.7	4.9	0.21	0.91	45.2
East: Loftus St (East)											
4	L	36	0.0	0.019	8.2	LOS A	0.0	0.0	0.00	0.67	49.0
5	T	49	0.0	0.025	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		85	0.0	0.025	3.5	NA	0.0	0.0	0.00	0.28	54.8
West: Loftus St (West)											
11	T	112	0.0	0.155	0.2	LOS A	0.7	5.2	0.09	0.00	57.7
12	R	171	0.0	0.155	8.7	LOS A	0.7	5.2	0.20	0.69	48.2
Approach		283	0.0	0.155	5.3	NA	0.7	5.2	0.16	0.41	51.5
All Vehicles		512	0.0	0.175	7.0	NA	0.7	5.2	0.15	0.53	50.1

Traffic Impact Assessment

APPENDIX G

2026 BASELINE – SIDRA ANALYSIS

Cardno
Shaping the Future

2026 Background+Committed Development

Crown St - Darling St - Osborne St

AM Peak

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
							Vehicles	Distance			
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Osborne St											
1	L	30	0.0	0.299	44.8	LOS D	2.0	13.8	0.87	0.75	27.3
2	T	18	0.0	0.299	36.6	LOS C	2.0	13.8	0.87	0.64	27.8
3	R	9	0.0	0.034	45.9	LOS D	0.4	2.6	0.86	0.68	26.5
Approach		57	0.0	0.299	42.4	LOS C	2.0	13.8	0.87	0.71	27.3
East: Crown St (East)											
4	L	11	0.0	0.097	9.8	LOS A	0.5	3.8	0.09	1.01	47.6
5	T	507	5.0	0.448	2.1	LOS A	2.8	20.3	0.13	0.12	56.0
6	R	30	0.0	0.448	10.5	LOS A	2.8	20.3	0.15	1.06	47.1
Approach		548	4.6	0.448	2.7	LOS A	2.8	20.3	0.13	0.19	55.2
North: Darling St											
7	L	30	0.0	0.277	46.4	LOS D	3.5	24.3	0.90	0.78	26.4
8	T	8	0.0	0.277	38.3	LOS C	3.5	24.3	0.90	0.70	26.8
9	R	43	0.0	0.277	46.6	LOS D	3.5	24.3	0.90	0.78	26.4
Approach		81	0.0	0.277	45.7	LOS D	3.5	24.3	0.90	0.77	26.4
West: Crown St (West)											
10	L	44	0.0	0.418	10.3	LOS A	3.4	24.8	0.14	1.02	47.3
11	T	966	5.0	0.418	2.1	LOS A	3.4	24.8	0.14	0.13	55.9
12	R	29	0.0	0.418	10.3	LOS A	3.1	22.6	0.14	1.03	47.3
Approach		1039	4.6	0.418	2.7	LOS A	3.4	24.8	0.14	0.19	55.2
All Vehicles		1725	4.3	0.448	6.0	LOS A	3.5	24.8	0.20	0.23	50.9

PM Peak

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
							Vehicles	Distance			
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Osborne St											
1	L	35	0.0	0.338	48.0	LOS D	2.2	15.6	0.90	0.75	26.2
2	T	17	0.0	0.338	39.8	LOS C	2.2	15.6	0.90	0.67	26.6
3	R	14	0.0	0.072	51.4	LOS D	0.6	4.4	0.92	0.70	24.8
Approach		66	0.0	0.338	46.6	LOS D	2.2	15.6	0.90	0.72	26.0
East: Crown St (East)											
4	L	10	0.0	0.177	9.2	LOS A	0.7	5.0	0.06	1.05	48.2
5	T	1136	5.0	0.821	2.6	LOS A	11.5	83.6	0.21	0.20	54.8
6	R	63	0.0	0.821	11.4	LOS A	11.5	83.6	0.25	1.06	46.7
Approach		1209	4.7	0.821	3.1	LOS A	11.5	83.6	0.21	0.25	54.3
North: Darling St											
7	L	51	0.0	0.593	52.0	LOS D	6.8	47.6	0.98	0.81	24.8
8	T	16	0.0	0.593	43.8	LOS D	6.8	47.6	0.98	0.80	24.9
9	R	77	0.0	0.593	52.1	LOS D	6.8	47.6	0.98	0.81	24.7
Approach		144	0.0	0.593	51.1	LOS D	6.8	47.6	0.98	0.81	24.8
West: Crown St (West)											
10	L	71	0.0	0.321	9.3	LOS A	1.5	10.8	0.08	0.98	48.1
11	T	573	5.0	0.321	1.4	LOS A	1.5	10.8	0.09	0.08	57.1
12	R	29	0.0	0.321	10.2	LOS A	1.3	9.6	0.12	0.99	47.3
Approach		673	4.3	0.321	2.6	LOS A	1.5	10.8	0.09	0.22	55.5
All Vehicles		2092	4.1	0.821	7.6	LOS A	11.5	83.6	0.25	0.29	48.9

Loftus St - New Dapto Rd - Mercury St

AM Peak

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
							Vehicles	Distance			
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: New Dapto Rd (South)											
1	L	155	0.0	0.399	6.7	LOS A	2.3	16.0	0.35	0.54	49.2
2	T	310	0.0	0.399	6.7	LOS A	2.3	16.0	0.35	0.54	49.2
3	R	52	0.0	0.399	11.7	LOS A	2.3	16.0	0.35	0.80	46.1
Approach		517	0.0	0.399	7.2	LOS A	2.3	16.0	0.35	0.57	48.9
East: Loftus St											
4	L	9	0.0	0.119	8.4	LOS A	0.6	4.1	0.46	0.62	47.6
5	T	65	0.0	0.119	11.6	LOS A	0.6	4.1	0.46	0.71	45.5
6	R	50	0.0	0.119	12.5	LOS A	0.6	4.1	0.46	0.72	44.8
Approach		124	0.0	0.119	11.7	LOS A	0.6	4.1	0.46	0.71	45.3
North: New Dapto Rd (North)											
7	L	11	0.0	0.199	8.8	LOS A	1.2	8.7	0.55	0.66	47.7
8	T	149	0.0	0.199	8.0	LOS A	1.2	8.7	0.55	0.62	47.8
9	R	37	0.0	0.199	13.9	LOS A	1.2	8.7	0.55	0.81	44.6
Approach		197	0.0	0.199	9.2	LOS A	1.2	8.7	0.55	0.66	47.2
North West: Mercury St											
27	L	19	0.0	0.293	9.9	LOS A	1.8	12.4	0.60	0.74	47.1
28	T	97	0.0	0.293	8.5	LOS A	1.8	12.4	0.60	0.67	47.1
29	R	164	0.0	0.293	12.6	LOS A	1.8	12.4	0.60	0.79	45.1
Approach		280	0.0	0.293	11.0	LOS A	1.8	12.4	0.60	0.74	45.9
All Vehicles		1118	0.0	0.399	9.0	LOS A	2.3	16.0	0.46	0.64	47.4

PM Peak

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
							Vehicles	Distance			
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: New Dapto Rd (South)											
1	L	222	0.0	0.405	6.6	LOS A	2.4	16.7	0.34	0.53	49.2
2	T	235	0.0	0.405	6.6	LOS A	2.4	16.7	0.34	0.53	49.2
3	R	72	0.0	0.405	11.6	LOS A	2.4	16.7	0.34	0.79	46.1
Approach		529	0.0	0.405	7.3	LOS A	2.4	16.7	0.34	0.57	48.8
East: Loftus St											
4	L	64	0.0	0.183	9.4	LOS A	1.0	7.0	0.59	0.70	47.0
5	T	71	0.0	0.183	12.5	LOS A	1.0	7.0	0.59	0.78	45.0
6	R	32	0.0	0.183	13.5	LOS A	1.0	7.0	0.59	0.79	44.4
Approach		167	0.0	0.183	11.5	LOS A	1.0	7.0	0.59	0.75	45.6
North: New Dapto Rd (North)											
7	L	26	0.0	0.361	9.6	LOS A	2.5	17.6	0.66	0.73	47.3
8	T	277	0.0	0.361	8.7	LOS A	2.5	17.6	0.66	0.70	47.3
9	R	38	0.0	0.361	14.7	LOS B	2.5	17.6	0.66	0.84	44.1
Approach		341	0.0	0.361	9.5	LOS A	2.5	17.6	0.66	0.71	46.9
North West: Mercury St											
27	L	26	0.0	0.317	9.5	LOS A	2.0	13.7	0.56	0.71	47.2
28	T	107	0.0	0.317	8.1	LOS A	2.0	13.7	0.56	0.64	47.3
29	R	188	0.0	0.317	12.2	LOS A	2.0	13.7	0.56	0.77	45.5
Approach		321	0.0	0.317	10.6	LOS A	2.0	13.7	0.56	0.72	46.2
All Vehicles		1358	0.0	0.405	9.1	LOS A	2.5	17.6	0.51	0.66	47.3

Crown St - New Dapto Rd

AM Peak

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
							Vehicles	Distance			
		veh/h	%	v/c	sec		veh	m		per veh	km/h
East: Crown St											
5	T	444	5.0	0.341	1.1	LOS A	1.6	11.5	0.08	0.07	57.8
6	R	114	0.0	0.487	21.6	LOS B	3.2	22.3	0.60	0.79	37.5
Approach		558	4.0	0.487	5.3	LOS A	3.2	22.3	0.19	0.22	52.1
North: New Dapto Rd											
7	L	89	0.0	0.842	58.1	LOS E	8.8	61.9	0.95	0.96	23.0
9	R	327	0.0	0.842	59.6	LOS E	13.2	92.2	0.99	0.95	22.7
Approach		416	0.0	0.842	59.3	LOS E	13.2	92.2	0.98	0.95	22.8
West: Crown St											
10	L	494	0.0	0.333	8.9	LOS A	1.7	12.1	0.08	0.69	48.1
11	T	959	5.0	0.869	5.7	LOS A	16.1	117.8	0.31	0.32	50.6
Approach		1453	3.3	0.869	6.8	LOS A	16.1	117.8	0.23	0.45	49.7
All Vehicles		2427	2.9	0.869	15.4	LOS B	16.1	117.8	0.35	0.48	41.7

PM Peak

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
							Vehicles	Distance			
		veh/h	%	v/c	sec		veh	m		per veh	km/h
East: Crown St											
5	T	990	5.0	0.755	7.5	LOS A	19.8	144.3	0.45	0.41	47.8
6	R	171	0.0	0.755	22.5	LOS B	6.8	48.1	0.69	0.88	37.7
Approach		1161	4.3	0.755	9.7	LOS A	19.8	144.3	0.48	0.48	46.0
North: New Dapto Rd											
7	L	89	0.0	1.000[3]	52.2	LOS D	9.3	65.3	0.98	0.81	24.6
9	R	607	0.0	1.106	239.9	LOS F	78.2	547.1	1.00	1.48	7.9
Approach		696	0.0	1.106	215.9	LOS F	78.2	547.1	0.99	1.39	8.6
West: Crown St											
10	L	336	0.0	0.230	9.0	LOS A	1.2	8.6	0.07	0.68	48.0
11	T	605	5.0	0.647	7.1	LOS A	11.8	86.3	0.36	0.33	48.7
Approach		941	3.2	0.647	7.8	LOS A	11.8	86.3	0.26	0.45	48.5
All Vehicles		2798	2.9	1.106	60.3	LOS E	78.2	547.1	0.53	0.70	22.3

Loftus St - Darling St

AM Peak

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
							Vehicles	Distance			
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Darling St											
1	L	71	0.0	0.115	11.8	LOS A	0.4	3.1	0.21	0.88	45.7
3	R	31	0.0	0.115	11.7	LOS A	0.4	3.1	0.21	0.97	45.7
Approach		102	0.0	0.115	11.8	LOS A	0.4	3.1	0.21	0.90	45.7
East: Loftus St (East)											
4	L	56	0.0	0.030	8.2	LOS A	0.0	0.0	0.00	0.67	49.0
5	T	47	0.0	0.024	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		103	0.0	0.030	4.4	NA	0.0	0.0	0.00	0.36	53.5
West: Loftus St (West)											
11	T	102	0.0	0.103	0.2	LOS A	0.5	3.5	0.13	0.00	56.9
12	R	93	0.0	0.103	8.7	LOS A	0.5	3.5	0.22	0.73	48.3
Approach		195	0.0	0.103	4.3	NA	0.5	3.5	0.17	0.35	52.5
All Vehicles		400	0.0	0.115	6.2	NA	0.5	3.5	0.14	0.49	50.8

PM Peak

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
							Vehicles	Distance			
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Darling St											
1	L	97	0.0	0.165	11.9	LOS A	0.7	4.7	0.21	0.88	45.5
3	R	47	0.0	0.165	11.9	LOS A	0.7	4.7	0.21	0.97	45.6
Approach		144	0.0	0.165	11.9	LOS A	0.7	4.7	0.21	0.91	45.6
East: Loftus St (East)											
4	L	36	0.0	0.019	8.2	LOS A	0.0	0.0	0.00	0.67	49.0
5	T	49	0.0	0.025	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		85	0.0	0.025	3.5	NA	0.0	0.0	0.00	0.28	54.8
West: Loftus St (West)											
11	T	112	0.0	0.108	0.2	LOS A	0.5	3.7	0.12	0.00	57.1
12	R	96	0.0	0.108	8.6	LOS A	0.5	3.7	0.20	0.74	48.4
Approach		208	0.0	0.108	4.1	NA	0.5	3.7	0.16	0.34	52.7
All Vehicles		437	0.0	0.165	6.6	NA	0.7	4.7	0.14	0.52	50.5

Traffic Impact Assessment

APPENDIX H

2026 BASELINE PLUS DEVELOPMENT – SIDRA ANALYSIS

Cardno
Shaping the Future

Loftus St - Darling St

AM Peak

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
							Vehicles	Distance			
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Darling St											
1	L	71	0.0	0.115	11.8	LOS A	0.4	3.1	0.21	0.88	45.7
3	R	31	0.0	0.115	11.7	LOS A	0.4	3.1	0.21	0.97	45.7
Approach		102	0.0	0.115	11.8	LOS A	0.4	3.1	0.21	0.90	45.7
East: Loftus St (East)											
4	L	56	0.0	0.030	8.2	LOS A	0.0	0.0	0.00	0.67	49.0
5	T	47	0.0	0.024	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		103	0.0	0.030	4.4	NA	0.0	0.0	0.00	0.36	53.5
West: Loftus St (West)											
11	T	102	0.0	0.103	0.2	LOS A	0.5	3.5	0.13	0.00	56.9
12	R	93	0.0	0.103	8.7	LOS A	0.5	3.5	0.22	0.73	48.3
Approach		195	0.0	0.103	4.3	NA	0.5	3.5	0.17	0.35	52.5
All Vehicles		400	0.0	0.115	6.2	NA	0.5	3.5	0.14	0.49	50.8

PM Peak

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
							Vehicles	Distance			
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Darling St											
1	L	97	0.0	0.165	11.9	LOS A	0.7	4.7	0.21	0.88	45.5
3	R	47	0.0	0.165	11.9	LOS A	0.7	4.7	0.21	0.97	45.6
Approach		144	0.0	0.165	11.9	LOS A	0.7	4.7	0.21	0.91	45.6
East: Loftus St (East)											
4	L	36	0.0	0.019	8.2	LOS A	0.0	0.0	0.00	0.67	49.0
5	T	49	0.0	0.025	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		85	0.0	0.025	3.5	NA	0.0	0.0	0.00	0.28	54.8
West: Loftus St (West)											
11	T	112	0.0	0.108	0.2	LOS A	0.5	3.7	0.12	0.00	57.1
12	R	96	0.0	0.108	8.6	LOS A	0.5	3.7	0.20	0.74	48.4
Approach		208	0.0	0.108	4.1	NA	0.5	3.7	0.16	0.34	52.7
All Vehicles		437	0.0	0.165	6.6	NA	0.7	4.7	0.14	0.52	50.5

2026 Background+Committed Development+Car Park Traffic

Crown St - Darling St - Osborne St

AM Peak

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
							Vehicles	Distance			
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Osborne St											
1	L	30	0.0	0.299	44.8	LOS D	2.0	13.8	0.87	0.75	27.3
2	T	18	0.0	0.299	36.6	LOS C	2.0	13.8	0.87	0.64	27.8
3	R	9	0.0	0.034	45.9	LOS D	0.4	2.6	0.86	0.68	26.5
Approach		57	0.0	0.299	42.4	LOS C	2.0	13.8	0.87	0.71	27.3
East: Crown St (East)											
4	L	11	0.0	0.113	9.8	LOS A	0.6	4.6	0.09	1.02	47.6
5	T	624	5.0	0.523	2.2	LOS A	3.9	28.3	0.15	0.14	55.7
6	R	30	0.0	0.523	10.7	LOS A	3.9	28.3	0.17	1.06	47.0
Approach		665	4.7	0.523	2.7	LOS A	3.9	28.3	0.15	0.19	55.1
North: Darling St											
7	L	30	0.0	0.277	46.4	LOS D	3.5	24.3	0.90	0.78	26.4
8	T	8	0.0	0.277	38.3	LOS C	3.5	24.3	0.90	0.70	26.8
9	R	43	0.0	0.277	46.6	LOS D	3.5	24.3	0.90	0.78	26.4
Approach		81	0.0	0.277	45.7	LOS D	3.5	24.3	0.90	0.77	26.4
West: Crown St (West)											
10	L	44	0.0	0.427	10.3	LOS A	3.5	25.6	0.14	1.02	47.3
11	T	971	5.0	0.427	2.1	LOS A	3.5	25.6	0.14	0.13	55.8
12	R	29	0.0	0.427	10.3	LOS A	3.1	22.6	0.14	1.03	47.3
Approach		1044	4.7	0.427	2.7	LOS A	3.5	25.6	0.14	0.19	55.2
All Vehicles		1847	4.3	0.523	5.8	LOS A	3.9	28.3	0.20	0.23	51.1

PM Peak

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
							Vehicles	Distance			
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Osborne St											
1	L	35	0.0	0.333	46.9	LOS D	2.2	15.4	0.89	0.75	26.5
2	T	17	0.0	0.333	38.7	LOS C	2.2	15.4	0.89	0.66	26.9
3	R	14	0.0	0.092	54.0	LOS D	0.6	4.5	0.94	0.70	24.1
Approach		66	0.0	0.333	46.3	LOS D	2.2	15.4	0.90	0.72	26.1
East: Crown St (East)											
4	L	10	0.0	0.186	9.3	LOS A	0.8	5.6	0.07	1.05	48.1
5	T	1161	5.0	0.860	5.7	LOS A	17.6	127.8	0.26	0.28	50.6
6	R	63	0.0	0.860	15.2	LOS B	17.6	127.8	0.31	1.08	43.4
Approach		1234	4.7	0.860	6.2	LOS A	17.6	127.8	0.26	0.32	50.2
North: Darling St											
7	L	114	0.0	0.824	59.0	LOS E	11.7	82.2	1.00	0.95	22.9
8	T	16	0.0	0.824	50.8	LOS D	11.7	82.2	1.00	0.95	23.0
9	R	90	0.0	0.824	59.1	LOS E	11.7	82.2	1.00	0.95	22.9
Approach		220	0.0	0.824	58.4	LOS E	11.7	82.2	1.00	0.95	22.9
West: Crown St (West)											
10	L	71	0.0	0.350	9.4	LOS A	1.8	13.0	0.09	0.98	47.9
11	T	633	5.0	0.350	2.0	LOS A	2.2	16.3	0.12	0.11	56.1
12	R	29	0.0	0.350	11.5	LOS A	2.2	16.3	0.19	0.99	46.3
Approach		733	4.3	0.350	3.1	LOS A	2.2	16.3	0.12	0.23	54.7
All Vehicles		2253	4.0	0.860	11.5	LOS A	17.6	127.8	0.31	0.36	45.0

Loftus St - New Dapto Rd - Mercury St

AM Peak

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
							Vehicles	Distance			
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: New Dapto Rd (South)											
1	L	155	0.0	0.434	7.1	LOS A	2.5	17.7	0.43	0.59	48.7
2	T	312	0.0	0.434	7.1	LOS A	2.5	17.7	0.43	0.59	48.7
3	R	62	0.0	0.434	12.4	LOS A	2.5	17.7	0.43	0.82	45.8
Approach		529	0.0	0.434	7.7	LOS A	2.5	17.7	0.43	0.61	48.3
East: Loftus St											
4	L	9	0.0	0.127	8.8	LOS A	0.6	4.5	0.51	0.65	47.3
5	T	65	0.0	0.127	12.0	LOS A	0.6	4.5	0.51	0.73	45.3
6	R	50	0.0	0.127	12.9	LOS A	0.6	4.5	0.51	0.74	44.6
Approach		124	0.0	0.127	12.1	LOS A	0.6	4.5	0.51	0.73	45.2
North: New Dapto Rd (North)											
7	L	11	0.0	0.244	9.2	LOS A	1.6	11.0	0.61	0.69	47.4
8	T	149	0.0	0.244	8.4	LOS A	1.6	11.0	0.61	0.65	47.4
9	R	71	0.0	0.244	14.3	LOS A	1.6	11.0	0.61	0.81	44.2
Approach		231	0.0	0.244	10.2	LOS A	1.6	11.0	0.61	0.70	46.3
North West: Mercury St											
27	L	19	0.0	0.334	10.1	LOS A	2.1	14.8	0.64	0.75	46.9
28	T	97	0.0	0.334	8.7	LOS A	2.1	14.8	0.64	0.69	46.8
29	R	198	0.0	0.334	13.2	LOS A	2.1	14.8	0.64	0.80	44.6
Approach		314	0.0	0.334	11.7	LOS A	2.1	14.8	0.64	0.77	45.4
All Vehicles		1198	0.0	0.434	9.7	LOS A	2.5	17.7	0.53	0.68	46.8

PM Peak

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
							Vehicles	Distance			
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: New Dapto Rd (South)											
1	L	222	0.0	0.632	7.0	LOS A	5.2	36.4	0.49	0.56	48.0
2	T	269	0.0	0.632	7.0	LOS A	5.2	36.4	0.49	0.56	48.0
3	R	342	0.0	0.632	13.0	LOS A	5.2	36.4	0.49	0.75	44.9
Approach		833	0.0	0.632	9.5	LOS A	5.2	36.4	0.49	0.64	46.7
East: Loftus St											
4	L	64	0.0	0.218	11.0	LOS A	1.3	9.1	0.71	0.79	45.7
5	T	71	0.0	0.218	14.1	LOS A	1.3	9.1	0.71	0.84	43.7
6	R	32	0.0	0.218	15.1	LOS B	1.3	9.1	0.71	0.85	43.0
Approach		167	0.0	0.218	13.1	LOS A	1.3	9.1	0.71	0.82	44.3
North: New Dapto Rd (North)											
7	L	26	0.0	0.473	13.2	LOS A	3.8	26.4	0.85	0.92	44.3
8	T	277	0.0	0.473	12.4	LOS A	3.8	26.4	0.85	0.91	44.5
9	R	45	0.0	0.473	18.3	LOS B	3.8	26.4	0.85	0.97	41.4
Approach		348	0.0	0.473	13.2	LOS A	3.8	26.4	0.85	0.92	44.1
North West: Mercury St											
27	L	26	0.0	0.431	12.4	LOS A	3.1	21.7	0.81	0.88	44.8
28	T	107	0.0	0.431	11.0	LOS A	3.1	21.7	0.81	0.85	45.2
29	R	195	0.0	0.431	15.1	LOS B	3.1	21.7	0.81	0.91	43.0
Approach		328	0.0	0.431	13.6	LOS A	3.1	21.7	0.81	0.89	43.9
All Vehicles		1676	0.0	0.632	11.4	LOS A	5.2	36.4	0.65	0.76	45.3

Crown St - New Dapto Rd

AM Peak

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
							Vehicles	Distance			
		veh/h	%	v/c	sec		veh	m		per veh	km/h
East: Crown St											
5	T	444	5.0	0.341	1.1	LOS A	1.6	11.5	0.08	0.07	57.8
6	R	231	0.0	0.816	39.0	LOS C	11.1	78.0	0.88	0.99	28.9
Approach		675	3.3	0.816	14.1	LOS A	11.1	78.0	0.35	0.38	43.1
North: New Dapto Rd											
7	L	94	0.0	0.864	60.4	LOS E	9.3	65.3	0.95	0.98	22.5
9	R	333	0.0	0.864	61.7	LOS E	13.9	97.1	0.99	0.97	22.2
Approach		427	0.0	0.864	61.5	LOS E	13.9	97.1	0.98	0.97	22.2
West: Crown St											
10	L	644	0.0	0.434	9.0	LOS A	2.6	18.4	0.09	0.69	48.0
11	T	959	5.0	0.869	5.7	LOS A	16.1	117.8	0.31	0.32	50.6
Approach		1603	3.0	0.869	7.0	LOS A	16.1	117.8	0.22	0.47	49.5
All Vehicles		2705	2.6	0.869	17.4	LOS B	16.1	117.8	0.37	0.53	40.2

PM Peak

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
							Vehicles	Distance			
		veh/h	%	v/c	sec		veh	m		per veh	km/h
East: Crown St											
5	T	1003	5.0	0.791	7.8	LOS A	22.8	166.5	0.48	0.45	47.3
6	R	196	0.0	0.791	26.5	LOS B	7.9	55.6	0.77	0.90	35.1
Approach		1199	4.2	0.791	10.9	LOS A	22.8	166.5	0.53	0.53	44.8
North: New Dapto Rd											
7	L	149	0.0	1.000[3]	50.2	LOS D	9.3	65.3	0.99	0.82	25.2
9	R	744	0.0	1.520	945.4	LOS F	240.1	1680.8	1.00	2.84	2.2
Approach		893	0.0	1.520	796.0	LOS F	240.1	1680.8	1.00	2.50	2.6
West: Crown St											
10	L	368	0.0	0.252	9.1	LOS A	1.4	9.7	0.07	0.68	48.0
11	T	605	5.0	0.647	7.1	LOS A	11.8	86.3	0.36	0.33	48.7
Approach		973	3.1	0.647	7.9	LOS A	11.8	86.3	0.25	0.46	48.4
All Vehicles		3065	2.6	1.520	238.7	LOS F	240.1	1680.8	0.58	1.08	7.9

PM Peak - Optimised

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
							Vehicles	Distance			
		veh/h	%	v/c	sec		veh	m		per veh	km/h
East: Crown St											
5	T	1003	5.0	0.955	42.5	LOS D	49.3	360.0	0.98	1.23	26.4
6	R	196	0.0	0.955	55.1	LOS D	12.2	86.6	1.00	1.16	24.1
Approach		1199	4.2	0.955	44.6	LOS D	49.3	360.0	0.98	1.22	26.0
North: New Dapto Rd											
7	L	149	0.0	1.000[3]	34.2	LOS C	9.3	65.3	0.98	0.84	30.8
9	R	744	0.0	1.000[3]	89.5	LOS F	45.0	315.1	1.00	1.23	17.3
Approach		893	0.0	0.999	80.3	LOS F	45.0	315.1	0.99	1.16	18.6
West: Crown St											
10	L	368	0.0	0.276	9.0	LOS A	1.0	6.7	0.07	0.68	48.1
11	T	605	5.0	0.974	46.3	LOS D	33.5	244.3	1.00	1.26	25.3
Approach		973	3.1	0.974	32.2	LOS C	33.5	244.3	0.65	1.04	30.8
All Vehicles		3065	2.6	0.999	51.0	LOS D	49.3	360.0	0.88	1.14	24.4

Loftus St - Darling St

AM Peak

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
							Vehicles	Distance			
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Darling St											
1	L	71	0.0	0.115	11.8	LOS A	0.4	3.1	0.21	0.88	45.7
3	R	31	0.0	0.115	11.7	LOS A	0.4	3.1	0.21	0.97	45.7
Approach		102	0.0	0.115	11.8	LOS A	0.4	3.1	0.21	0.90	45.7
East: Loftus St (East)											
4	L	56	0.0	0.030	8.2	LOS A	0.0	0.0	0.00	0.67	49.0
5	T	47	0.0	0.024	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		103	0.0	0.030	4.4	NA	0.0	0.0	0.00	0.36	53.5
West: Loftus St (West)											
11	T	102	0.0	0.103	0.2	LOS A	0.5	3.5	0.13	0.00	56.9
12	R	93	0.0	0.103	8.7	LOS A	0.5	3.5	0.22	0.73	48.3
Approach		195	0.0	0.103	4.3	NA	0.5	3.5	0.17	0.35	52.5
All Vehicles		400	0.0	0.115	6.2	NA	0.5	3.5	0.14	0.49	50.8

PM Peak

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
							Vehicles	Distance			
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Darling St											
1	L	97	0.0	0.175	12.3	LOS A	0.7	4.9	0.21	0.88	45.2
3	R	47	0.0	0.175	12.2	LOS A	0.7	4.9	0.21	0.99	45.2
Approach		144	0.0	0.175	12.3	LOS A	0.7	4.9	0.21	0.91	45.2
East: Loftus St (East)											
4	L	36	0.0	0.019	8.2	LOS A	0.0	0.0	0.00	0.67	49.0
5	T	49	0.0	0.025	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		85	0.0	0.025	3.5	NA	0.0	0.0	0.00	0.28	54.8
West: Loftus St (West)											
11	T	112	0.0	0.155	0.2	LOS A	0.7	5.2	0.09	0.00	57.7
12	R	171	0.0	0.155	8.7	LOS A	0.7	5.2	0.20	0.69	48.2
Approach		283	0.0	0.155	5.3	NA	0.7	5.2	0.16	0.41	51.5
All Vehicles		512	0.0	0.175	7.0	NA	0.7	5.2	0.15	0.53	50.1