APPENDIX D

Traffic & Accessibility Impact Assessment

Rice Daubney

The Chris O'Brien Lifehouse at RPA

Transport and Accessibility Impacts Report

June 2010

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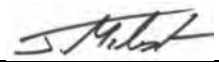
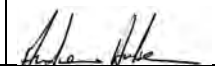
		Signature			
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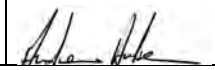
		Signature			
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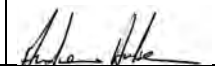
		Signature			
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Executive Summary

This following report discusses the transport and accessibility impacts relating to the proposed operation of The Chris O'Brien Lifehouse at RPA. The proposed development involves the construction of a new cancer treatment and research facility, located in the Royal Prince Alfred Hospital – Sydney University precinct at Camperdown, Sydney.

Lifehouse at RPA is well served by a number of major arterial roads, providing good access for staff and patients arriving via private vehicle. The site is well located for patrons arriving via public transport. Newtown train station is situated approximately 1km away from the proposed development, and is an easy 10 to 15 minute walk. Additionally, a significant number of public bus services operate near Lifehouse at RPA. Both King Street and Parramatta Road are a prominent part of the inner-west bus network.

The site is well situated to cater for people arriving by either walking or cycling. Strong walking connections are provided through the Sydney University Campus and also the RPAH precinct. Current Journey to Work data for the RPAH precinct indicates approximately 13.1% of full time workers arrive either via walking or cycling. As a comparison, across the entire Sydney region this figure is only 4.8%.

As the proposed development is well connected to existing public transport infrastructure networks, limited on-site parking of 100 spaces is to be provided. The majority of staff in the first stage of the project already work within the RPA precinct and will continue to park in the existing staff car parks in and around the RPAH precinct. The car park will service both senior staff/visitor parking, as well as loading vehicles, and be controlled via swipe card access to prevent unauthorised entries. The low amount of on-site parking will serve to increase the attractiveness of public transport to the site and reduce the traffic impact on the local road network.

An analysis of forecast additional traffic generated by the proposed development indicates that peak traffic generation does not coincide with the commuter peak hours, reducing the overall impact on the surrounding road network. The intersection of Salisbury Road with Missenden Road, which provides the site access, will continue to operate at an acceptable Level of Service B during both the morning and evening peak hours. As the forecast peak traffic generation does not coincide with the commuter peak hours, the overall impact on the surrounding road network is considered to be minimal.

Implementation of a green travel plan and shuttle bus service will reduce the reliance on private vehicle for Lifehouse staff and patients. It is envisioned that the current 80% mode split generally applicable for RPA staff would decrease significantly as a direct result of these measures. Research staff are already at a significantly lower car mode share.

The City of Sydney is currently constructing a high quality, separated two-way cycleway along Missenden Road and Lyons Road. Running adjacent to Lifehouse at RPA, this will dramatically increase the attractiveness of this mode of transport for people accessing the site.

A detailed construction traffic management plan would be prepared at the construction stage of the project, which would detail a series of measures to mitigate potential impacts for pedestrians and cyclists during the construction stage of the project.

1 Introduction

1.1 Project Background

Rice Daubney has commissioned Arup to undertake a traffic and transport assessment for operation of The Chris O'Brien Lifehouse at RPA. Located on the corner of Missenden Road and Susan Street, Camperdown, the proposed centre involves the establishment of new facilities, linking to the existing radiotherapy bunkers for the treatment of cancer patients, a treatment area for patients undergoing chemotherapy and ambulatory care clinic facilities.

This study provides an assessment of the transport and accessibility impacts as a result of the proposed development.

1.2 Scope of Study

This study has been prepared in accordance with relevant authorities guidelines such as Council and RTA Guidelines for Traffic Generating Developments. The following chapters include:

- Existing Conditions
- Proposed Development
- Transport and Accessibility Impacts
- Conclusions

The study considered within its terms of reference the Director General's Requirements for the Environmental Assessment of the proposed development. The latest DG's Requirements regarding the study areas for the traffic and transport impact of the project are outlined in Section 1.3 of this report.

1.3 Project DGRs

The NSW Government's Department of Planning issued a list of DGRs for the Chris O'Brien Cancer Centre Project (Application Number MP 10_0036) on 8 April 2010. Section 5 of the document has addressed the Transport, Access and Parking impacts as follows:

A Transport & Accessibility Impact Assessment prepared in accordance with the *RTA's Guide to Traffic Generating Developments* and making reference to the *Metropolitan Transport Plan - Connecting the City of Cities*, *NSW Planning Guidelines for Walking and Cycling* and the *Integrating Land Use and Transport policy package*, considering the issues outlined in Table 1.

Table 1 DGR Requirements

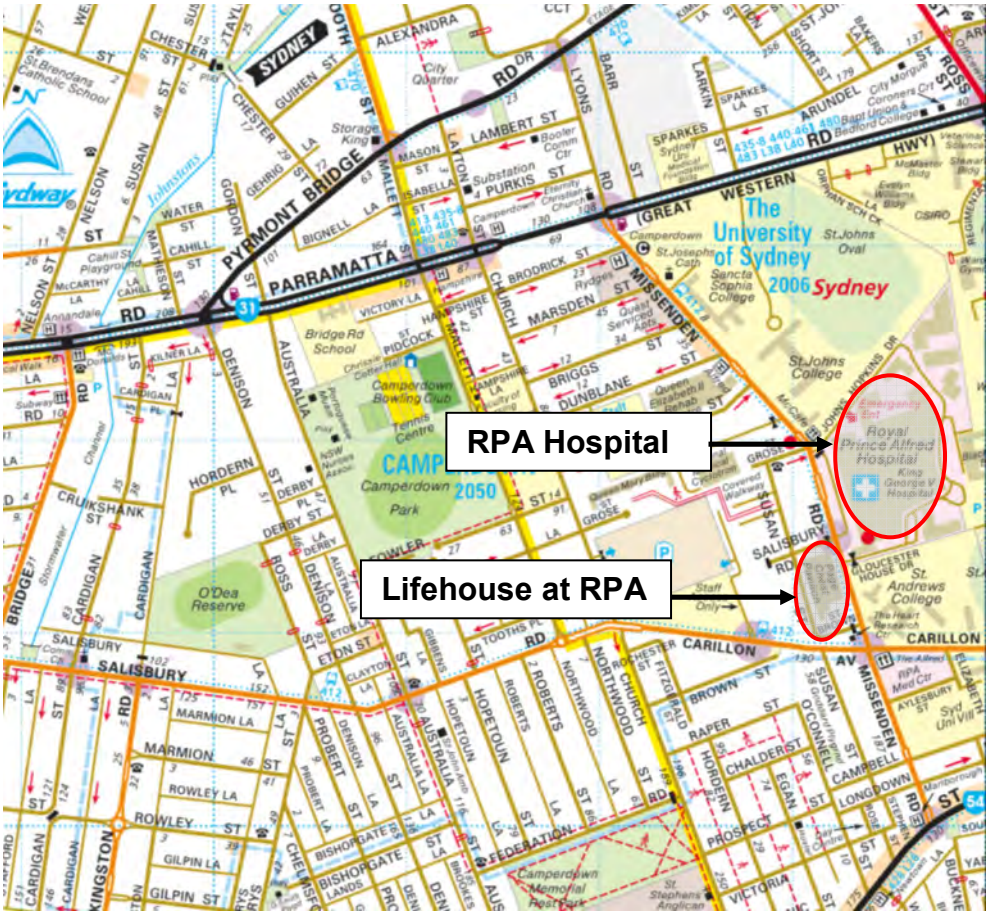
DGR No.	Description	Relevant Section of Report
DGR 5.1	an estimate of the trips generated by the proposed development, including a breakdown of vehicle types	Section 4.1
DGR 5.2	Traffic generation including: • Daily and peak traffic movements likely to be generated by the project • The impact on the safety and capacity of the surrounding road network and nearby intersections, including cumulative impacts (accounting for other recently approved developments in the area) and with consideration of any future plans available for Missenden Road such as Council's proposed cycle route • The need and provision of upgrade, road improvement works, or funding (if required)	Section 4.1, Section 4.2
DGR 5.3	parking, access and loading dock arrangements, in accordance with relevant Australian Standards and including appropriate levels of onsite car parking having regard to the local planning controls, RTA guidelines and high public transport accessibility of the site	Section 4.3
DGR 5.4	measures to promote sustainable means of transport including public transport usage and pedestrian and bicycle linkages in addition to addressing the potential for implementing a location specific sustainable travel plan	Section 4.4
DGR 5.5	demonstrate how users of the development will be able to make travel choices that support the achievement of relevant State Plan targets	
DGR 5.6	detail the existing pedestrian and cycle movements within the vicinity of the site (including the links to other RPA buildings) and determine the adequacy of the proposal to meet the likely future demand for increased public transport and pedestrian and cycle access	Section 4.4.2
DGR 5.7	identify measures to mitigate potential impacts for pedestrians and cyclists during the construction stage of the project	Section 4.5
DGR 5.8	provide an assessment of the implications of the proposed development for non-car travel modes (including public transport, walking and cycling)	Section 4.4

2 Existing Conditions

2.1 Site Description

The Chris O'Brien Lifehouse at RPA is to be located on Missenden Road, adjacent to the existing Royal Prince Alfred Hospital (RPAH). It is bordered by Salisbury Road, Susan Street and Brown Street, and is approximately 500m south of Parramatta Road. The site location is indicated in Figure 1.

Figure 1 Lifehouse Centre Location



2.2 Road Network

2.2.1 Major Roads

Lifehouse at RPA is well served by a number of major arterial roads, providing good access for staff and patients arriving access via private vehicle. Carillon Avenue and Missenden Road are the main approach routes to the RPAH campus, carrying 15,000 and 13,000 cars per day respectively. Key roads serving the site include:

- King Street to the south
- Parramatta Road to the north
- Missenden Road to the east
- Church Street to the west

2.2.2 Major Intersections

Some key intersections surrounding the site include:

- **Missenden Road / King Street:** This T-Junction is controlled by traffic signals, with pedestrian crossing facilities on all approaches. A filtered right turn facility is provided for vehicles turning into Missenden Road from the eastern approach of King Street
- **Missenden Road / Carillon Avenue:** This intersection is signalised with pedestrian crossing facilities on all approaches. Right turn bays are provided on the southern leg of Missenden Road and eastern leg of Carillon Avenue
- **Missenden Road / Salisbury Road:** Adjacent to the proposed development, this intersection is in the form of a T-Junction, and is currently controlled by traffic signals. Pedestrian crossing facilities are provided on all approaches
- **Missenden Road / John Hopkins Drive / Grose Street:** This priority intersection provides direct access to RPA Hospital via John Hopkins Drive. Pedestrian crossings are provided on both John Hopkins Drive and Missenden Road (northern leg)
- **Missenden Road / Parramatta Road / Lyons Road:** Controlled by traffic signals, this intersection provides pedestrian crossing facilities on all approaches. A right turn bay is provided on the western leg of Parramatta Road for vehicles turning into Missenden Road. Bus lanes are present on both sides of Parramatta Road

Selected photos of these intersections are shown below:

Photograph 1 – Missenden Rd / King St

Photograph 2 – Missenden Rd / Carillion Ave

Photograph 3 – Missenden Rd / Salisbury St

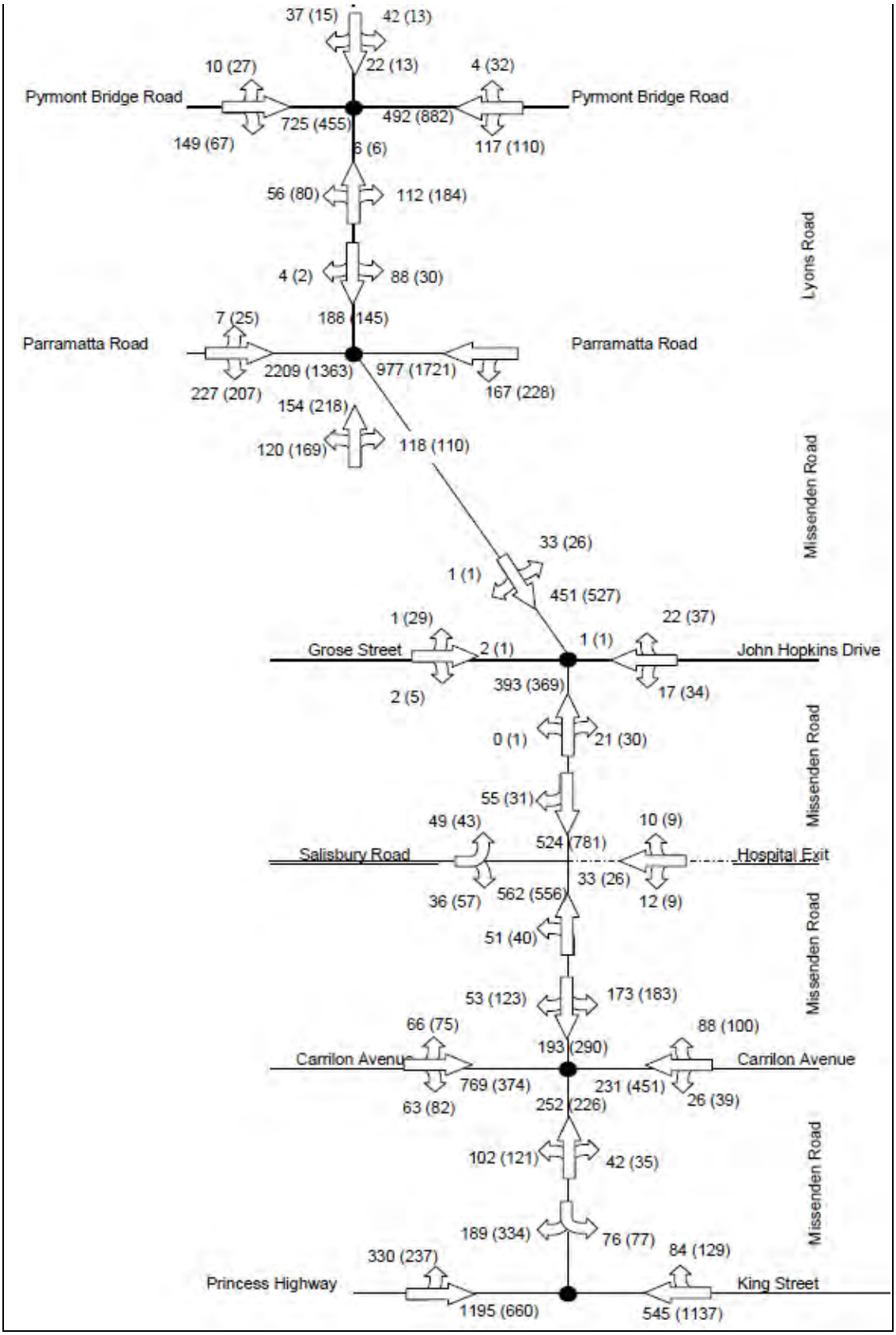
Photograph 4 – John Hopkins Dr / Grose St

2.2.3 Traffic Volumes

The most recent comprehensive traffic surveys within the study area were undertaken as part of the Missenden Road Cycleway Study by GTA Consultants in August 2009. The traffic counts were undertaken along Missenden Road between King Street and Pyrmont

Bridge Road in both the AM (8am – 9am) and PM (4.30pm – 5.30pm) commuter peak periods. Results of this survey (with the PM volumes indicated in brackets) are illustrated in Figure 2 below.

Figure 2 Existing Traffic Volumes



Source: Missenden Road Intersection Operations Final Report (GTA, February 2010)

2.3 Missenden Road Cycleway

The City of Sydney is currently planning a major separated two-way cycleway along Missenden Road and Lyons Road, running between King Street and Pyrmont Bridge Road. As a result of this cycling facility, major operational changes to the local road network are to be implemented. An overview of the key changes at the major intersections along Missenden Road are summarised in Table 2 below.

Table 2 Road Network Changes Resulting From Missenden Road Cycleway

Intersection	Proposed Operational Changes
Pyrmont Bridge Rd / Access Rd / Lyons Rd	• The addition of bicycle lamps on all approaches of the intersection including kerb extensions on the south approach
Parramatta Rd / Lyons Rd / Missenden Rd	• The introduction of a separate bicycle phase, including line marking and median adjustment on south approach.
Missenden Rd / Grose St / John Hopkins Drive	• Signalisation of the intersection. • Introduction of a separate bicycle phase. • Grose Street converted into a two way road. • Removal of an existing pedestrian refuge on Missenden Road providing a right-turn bay of 20m on the north approach and a right-turn bay of 25m on the south approach.
Missenden Rd / Salisbury Rd	• Introduction of a separate bicycle phase. • Driveway modified with road pavement and kerb ramp used as the hospital car park exit. • Introduction of a new bus stop location on the northern approach and a new taxi rank location on southern approach. • Kerb side lane on north approach converts to bus only lane (30m). • Single exit lane on south approach converts to two exit lanes with 25 m merge distance on kerb side lane. • Kerb extensions applied on the west side of Missenden Road near the intersection.
Missenden Rd / Carillion Ave	• Introduction of a separate bicycle phase. • Convert the existing left-through short lane, through lane and 25m right turn bay into a single left through • Continuous lane and a 30m right bay on south approach. • Single exit lane on north, west and south approaches.

Source: Missenden Road Intersection Operations Final Report (GTA, February 2010)

Council commissioned GTA Consultants in 2009 to conduct a study which assessed the likely future impacts of these changes. The impacts of the proposed changes at each of the intersections was modelled using the Sidra and Scates software packages. The results of this analysis for the immediate study area surrounding Lifehouse at RPA is detailed below:

- **Missenden Road / Carillon Avenue:** Analysis indicated that this intersection is currently operating at Level of Service (LOS) E and D in the AM and PM peaks respectively. This is forecast to decline to LOS F in both peaks following the introduction of the separated cycleway
- **Missenden Road / Salisbury Road:** Analysis showed that the introduction of the cycleway was unlikely to have any significant impacts on the operation of the intersection in both the AM and PM peaks
- **Missenden Road / John Hopkins Drive / Grose Street:** Modelling indicated the intersection will operate satisfactorily in both peak periods, with the cycleway forecast to have only a minor impact in the overall LOS

This analysis has formed the basis for the assessment undertaken on the local road network as a result of the proposed development as outlined in Section 4.2.

2.4 Parking

A number of parking locations exist within the vicinity of RPAH. The major multi-storey staff car park in the precinct is accessed via New Hospital Road, shown in Photograph 5. All day visitor parking is available via the car park located on Salisbury Road (see Photograph 6). There are other various smaller car parks located within the RPAH campus which are reserved for staff members. There is ample on-street parking spaces available in the area, which are controlled by various time restrictions.

Photograph 5 Multi-Storey Staff Car Park

Photograph 6 Visitor Car Park

Approval has been granted to RPA to construct a new multi-storey car park with capacity for approximately 1,000 vehicles, to be located on the site of the existing visitor car park. Primary access is to be via both New Hospital Road, with secondary access via Salisbury Road. A Salisbury Road access will be maintained to the new multi-storey car park for visitor access, with the principal staff access via New Hospital Road. It is expected that Salisbury Road will have similar levels of traffic movement to the current situation following the construction of the new car park.

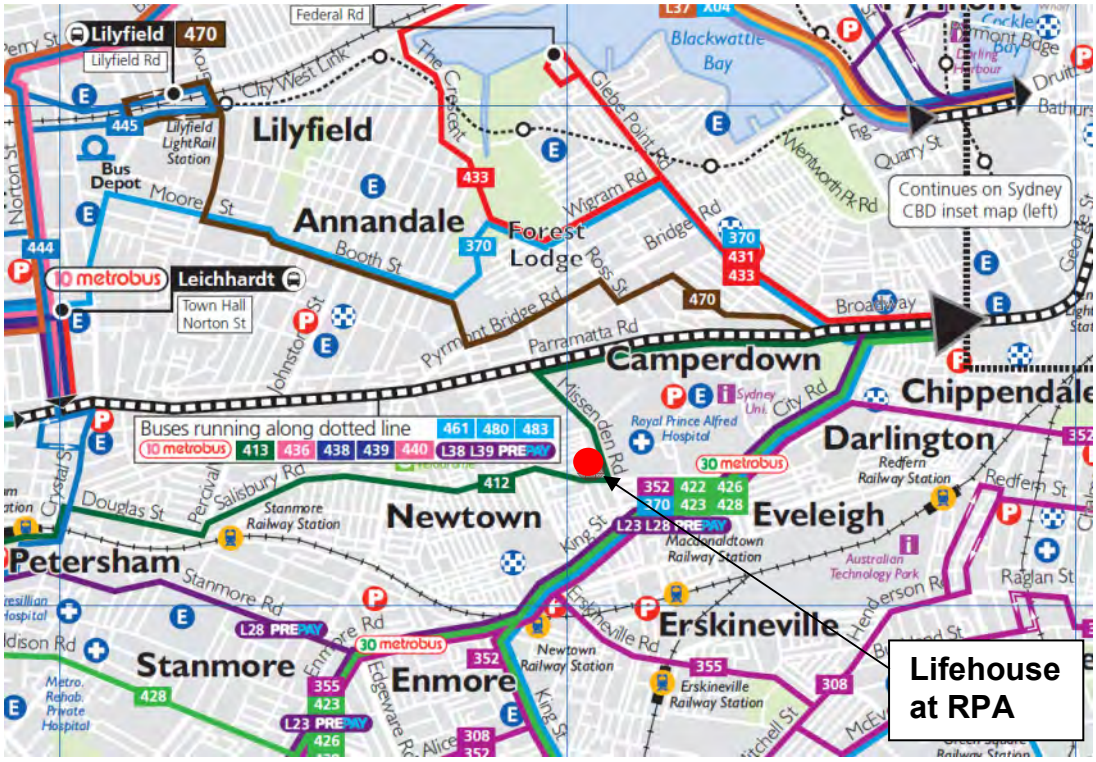
2.5 Rail Network

Newtown train station is situated approximately 1km away from the proposed development, and is an easy 10 to 15 minute walk. Train services operate frequently to and from Newtown Station on both weekday and weekends, with frequencies of between 5 and 8 minutes during weekday commuter peak hours.

2.6 Bus Network

A significant number of public bus services operate near Lifehouse at RPA. Both King Street and Parramatta Road are a prominent part of the inner-west bus network. The various bus routes that travel in the vicinity of Lifehouse at RPA is presented in Figure 3.

Figure 3 Bus Network Surrounding Lifehouse at RPA



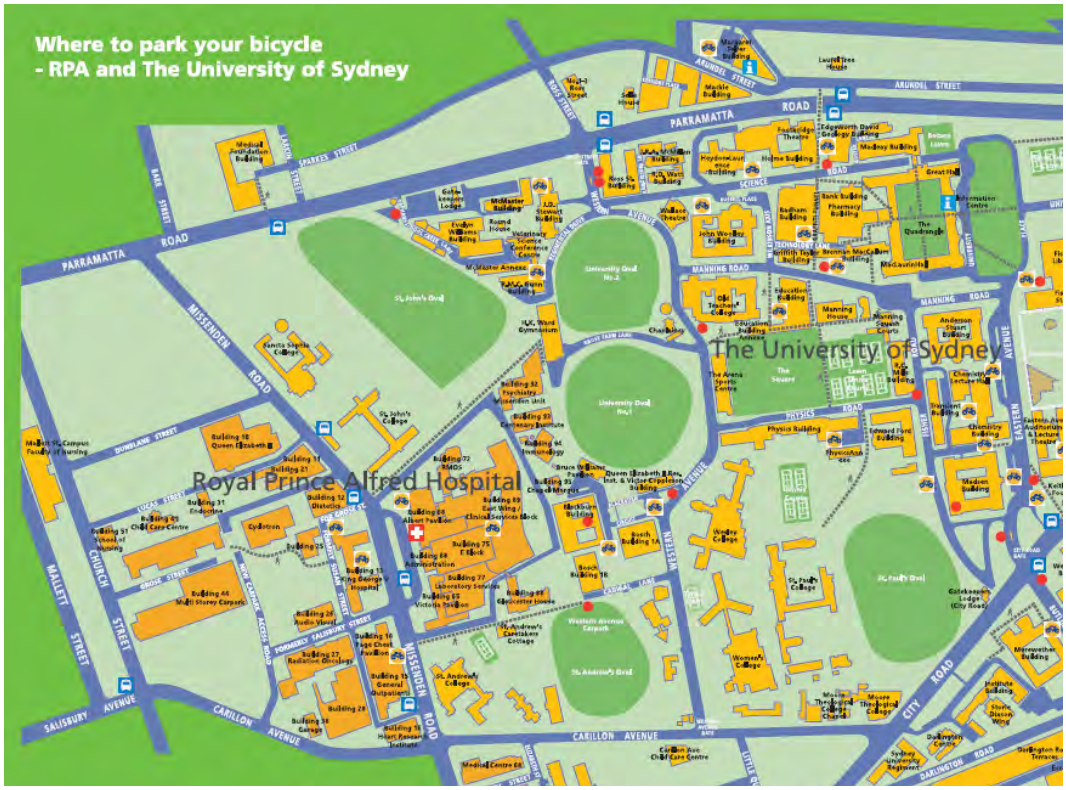
Source: Sydney Buses (2010)

2.7 Cycling and Walking Routes

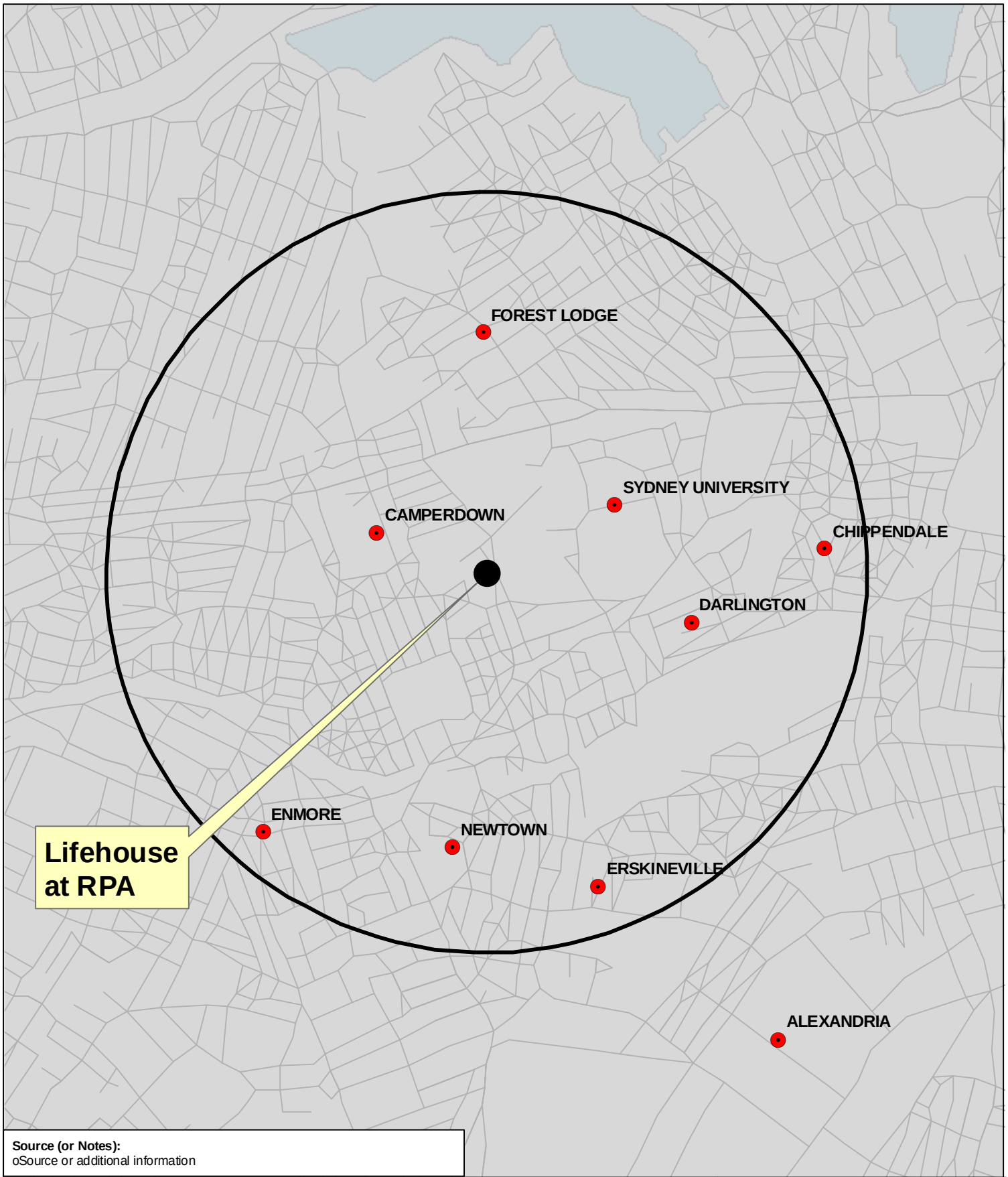
The current cycle network around Lifehouse at RPA is characterised by on-road vehicle environments. Wilson Street to the south is a popular low to medium traffic cycling route for riders travelling between the city and the inner west. To the north, Pyrmont Bridge Road is another popular route for cyclists, however this is on a road with high vehicle volumes.

There are a number of existing bicycle parking facilities in the Royal Prince Alfred Hospital precinct. End of trip facilities such as lockers and showers at Lifehouse at RPA will complement these parking bays to provide a high quality experience for all those arriving via bicycle. A map indicating cycling facilities in the RPAH and Sydney University precinct is presented in Figure 4.

Figure 4 RPA Cycling Map



A spatial analysis was undertaken indicating the areas within both a 1500m (acceptable walking distance) and 10km (acceptable commuter cycling distance) radius from the Lifehouse at RPA. This analysis is presented in Figure 5 and Figure 6.



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- Lifehouse at RPA
- 1500m Site Radius

Client
Rice Daubney

Job Title
Lifehouse at RPA

Drawing Title
1500m Site Radius

Issue	Date	By	Chkd	Appd
P1	11-06-2010	JDM	MAC	AMH

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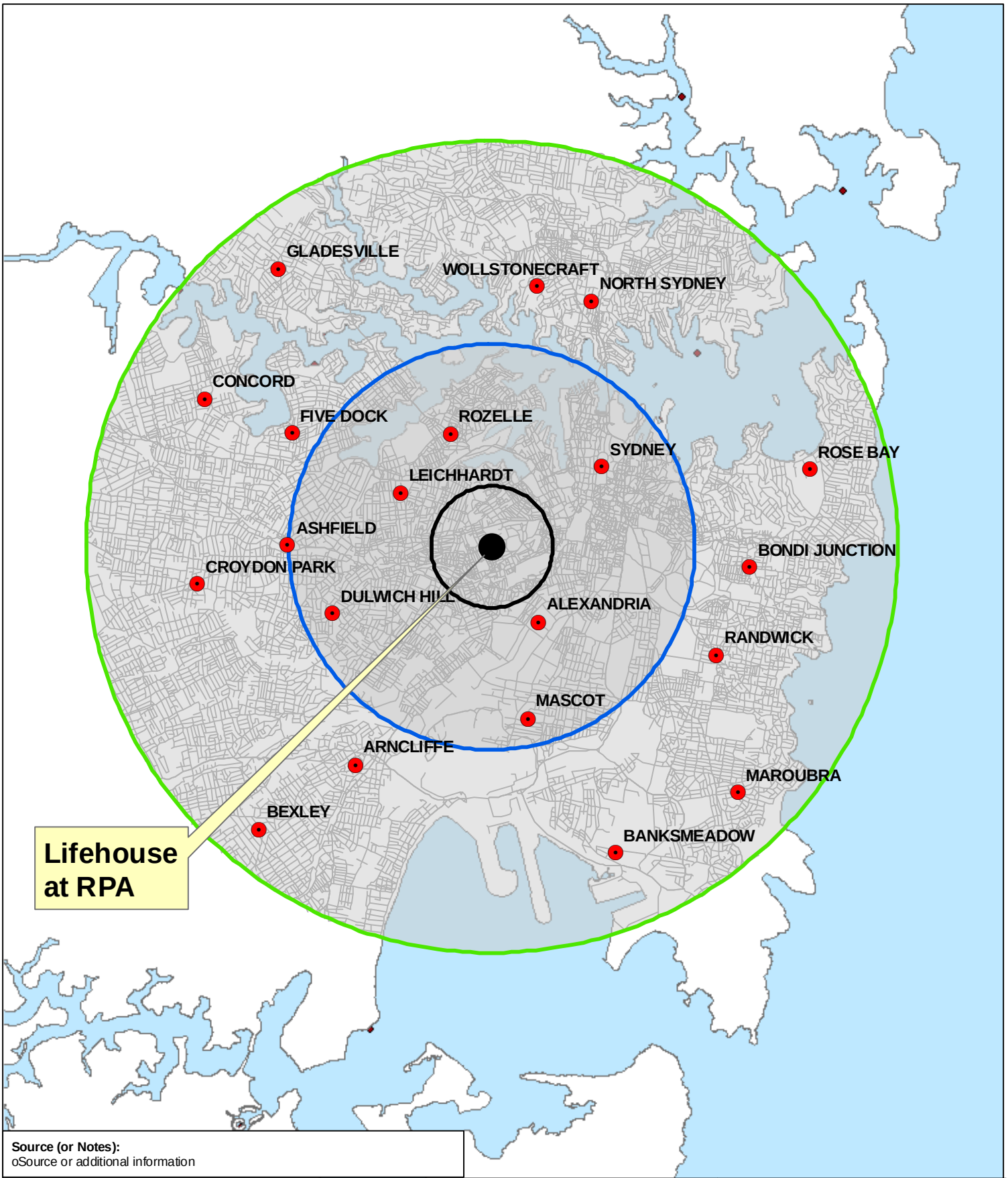

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oSource or additional information

Legend

- Lifehouse at RPA
- 5km Site Radius
- 10km Site Radius

Client
Rice Daubney

Job Title
Lifehouse at RPA

Drawing Title
10km Site Radius

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220147-00

Coordinate System
GDA 1994, Zone 56

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2.8 Travel Patterns

2.8.1 Mode Split

The existing 2006 Journey to Work data for the travel zone which takes in the Royal Prince Alfred Hospital site has been analysed, with the mode split indicated in Table 3.

Table 3 Journey to Work Existing Mode Split

Mode	Total Trips	Proportion of Total Trips
Car as driver/passenger	2636	62.4%
Train	511	12.1%
Walked only	494	11.7%
Bus	473	11.2%
Bicycle	59	1.4%
Motorbike	18	0.4%
Taxi	11	0.3%
Other mode	9	0.2%
Ferry	6	0.1%
Truck	6	0.1%
TOTAL	**4223**	**100%**

The analysis indicates that while the majority of people drive to the area, a significant number utilised existing public transport services (>20%). Additionally, walking to the area was another popular mode of transport, accounting for more than one in ten workers arriving to the area.

2.8.2 Arrival Location

The origin location of all workers arriving to the travel zone incorporating Royal Prince Alfred Hospital is presented in Table 4.

Table 4 Origin Location of Workers

Origin SLA	Total Trips	Proportion of Total Trips
Marrickville	622	13.4%
Leichhardt	311	6.7%
Sydney - West	298	6.4%
Canterbury	281	6.1%
Sydney - South	272	5.9%
Ashfield	206	4.4%
Randwick	182	3.9%
Rockdale	160	3.4%
Ryde	134	2.9%
Canada Bay - Drummoyne	128	2.8%
North Sydney	102	2.2%
Ku-ring-gai	98	2.1%
Hurstville	96	2.1%
Other	1,333	31.6%
TOTAL	**4,223**	**100%**

The analysis indicates that a significant number of workers travelling to the RPAH area live within either feasible walking (2km) or cycling (10km) distance. The areas indicated in the above table are prevalent in the spatial analysis presented in Figure 5 and Figure 6. There are therefore opportunities to increase this mode of transport through enhanced facilities such as improved walking/cycling routes and appropriate end of trip facilities.

The utilisation of local public transport is another key result that can be drawn from this analysis. The well connected nature of the site to local train and bus hubs further provides to reduce the reliance on private vehicle access to the site, thus reducing the demand for car parking spaces.

2.9 Mode Split

Current travel patterns to RPAH indicates that approximately 80% of all staff and patients arrive via private vehicle (either as drivers or passengers). This study has assumed an identical mode split for full time staff and visitors arriving to the Lifehouse at RPA.

A survey of existing research staff (who will eventually move over to the Lifehouse at RPA) indicate that only 25% utilise private vehicle. The remainder either arrive via local public transport or cycling/walking. This mode split for existing research staff transferring to the Lifehouse at RPA has been used in this study to assess the impact on the local road network as a result of the proposed development.

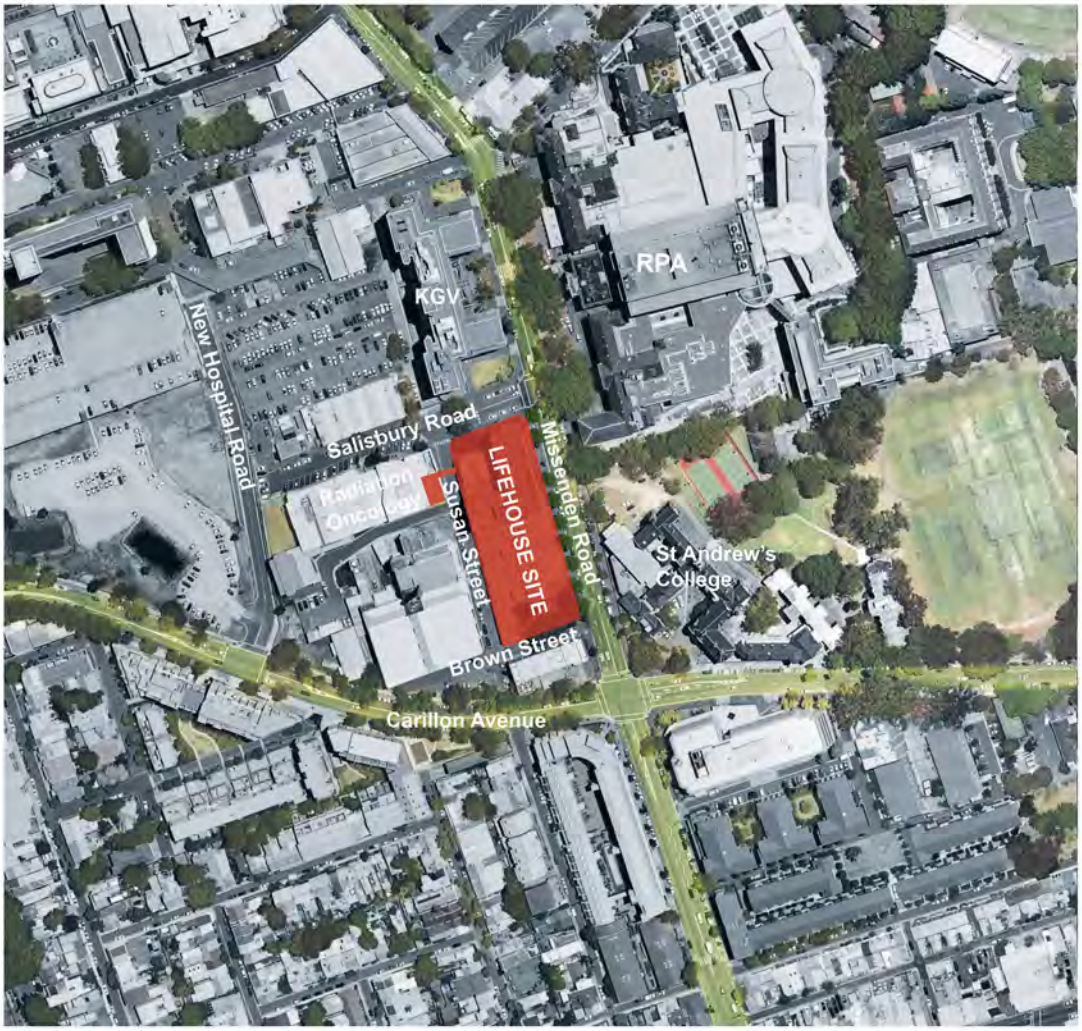
3 Proposed Development

3.1 Description of Development

The proposed development involves the construction of a new cancer treatment and research facility, located in the Royal Prince Alfred Hospital – Sydney University precinct at Camperdown, Sydney. It involves the establishment of new facilities, linking to the existing radiotherapy bunkers for the treatment of cancer patients, a treatment area for patients undergoing chemotherapy and clinic facilities. In addition, staff offices and support facilities will be established as part of the new centre. A pedestrian link to the existing radiation oncology building is to be incorporated with the site. The centre is scheduled to open in April 2013, with its location illustrated in Figure 7.

The second stage of the development (Stage B1) will involve the fitout of floors, including two ward floors, which will allow inpatient activity to occur within Lifehouse at RPA. It is proposed that there will be a total of 96 beds within the new inpatient wards, as well as 18 new critical care beds. It will also include additional theatres and support services

Figure 7 Lifehouse at RPA Site



Source: Rice Daubney

3.2 On-Site Parking

A 100 space car park is proposed to be constructed as a component of the development. This car park would be utilised largely by Lifehouse patients and visitors, as well as selected staff members. The split of patient/visitor and staff parking in this particular car park would be as follows:

- Patients/Visitors – Approximately 60 spaces
- Staff – Approximately 40 spaces

Access to the car park is to be provided via a connection off Susan Street. Entry to the car park will be controlled via swipe card access and electronic boom gate to prevent unauthorised entries.

3.3 Forecast Patient Numbers

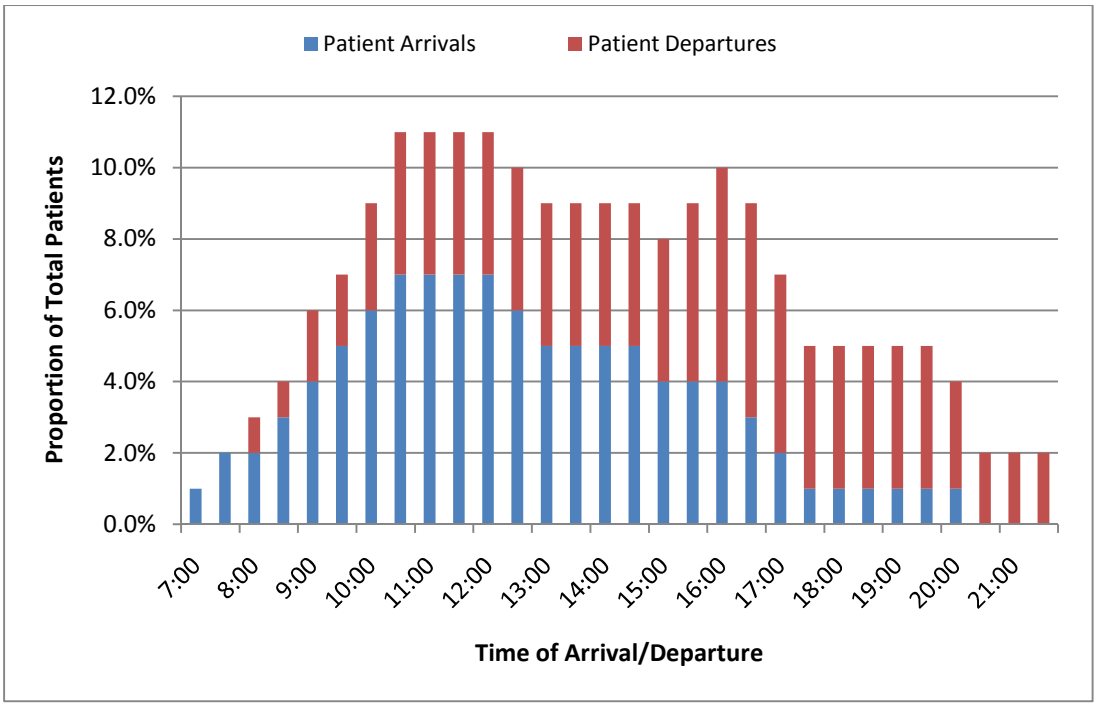
It is anticipated Lifehouse at RPA will attract in the order of 56,000 outpatients in the course of its opening year. This number is forecast to rise to approximately 84,000 following the opening of Stage B1 of the development. These forecast patient numbers are presented in Table 5.

Table 5 Forecast Patient Numbers

Patient Type	Patients per Annum	
	Stage A	Stage B1
Short Course Chemotherapy	53,844	78,833
Melanoma	2,352	3,444
Total	**56,196**	**82,277**

Patients are forecast to arrive at regular intervals throughout the day. A typical arrival and departure profile for all patients and visitors to Lifehouse at RPA is presented in Figure 8.

Figure 8 Forecast Arrival and Departure Profile - Patients



3.4 Forecast Staff Numbers

A maximum of 617 staff and researchers will be present at the centre at any one time on a typical weekday during Stage A of the project. This represents an increase of 94 staff compared to those already present in the RPAH precinct.

Following completion of Stage B1 works, the maximum number of staff on site is forecast to be 818, representing an increase of 295 compared to the existing situation.

The majority of these staff and researchers are already employed within the RPAH precinct. These staff will simply move over across to Lifehouse at RPA from the existing RPA campus.

An analysis of the existing and forecast staff to service the Lifehouse at RPA during Stage A and B1 is presented in Table 6.

Table 6 Forecast Staff Numbers

Staff Type	Maximum Staff Present on Site			Net Staff Increase	
	Existing	Stage A	Stage B1	Stage A	Stage B1
Sydney Cancer Centre	236	329	529	93	293
Administration	12	22	23	10	11
Research	275	266	266	-9	-9
Total	**523**	**617**	**818**	**94**	**295**

3.5 Consultation

A meeting was held with the City of Sydney Council regarding the Missenden Road streetscape upgrade project on the 12th May 2010. Key issues discussed included:

- Cycleway treatment along the eastern side of Missenden Road, involving a separated two way cycleway
- The implementation of a 40km/hr speed limit on Missenden Road which has been approved in principle by the RTA
- New signal phasing at the existing Carillion Avenue and Salisbury Road traffic signals to accommodate a dedicated bicycle phase
- Future traffic signals at John Hopkins Drive, which is linked to the construction of the new KGV multi storey car park
- The proposed taxi zone on the western side of Missenden Road (south of the Salisbury Road intersection)
- The principles of the traffic and service vehicle movements associated with the proposed development

Consultations were held with the City of Sydney Area Traffic Engineer during the concept design phase of the project, to discuss alternative access arrangements for cars and trucks. In principle agreement was reached for primary access to be via Salisbury Road, with Brown Street being used for truck only egress.

4 Transport and Accessibility Impacts

4.1 Site Traffic Generation

4.1.1 Factors Influencing Site Traffic

An assessment of the forecast traffic generation across the entire day has been undertaken for the purposes of this study. This assessment has the following factors:

- **On Site Parking Provision**
  - 100 on-site parking spaces are to be provided, approximately 40 of which would be allocated to staff. The remainder would be provided for patients and visitors, who arrive and depart the site according the typical profile as presented in Figure 8.
- **Additional and relocated daily staff at Lifehouse at RPA**
  - As indicated in Table 6, an additional 94 staff members will be on-site at any one time during a typical weekday during Stage A, rising to 295 following the completion of inpatient facilities. Of these, it is forecast that 80% would use the existing staff multi-storey car park, accessed via New Hospital Road. The remainder would use other staff car parks which are accessed via Salisbury Road.
- **Traffic Distribution**
  - Traffic has been distributed based on existing journey to work car-based travel patterns for persons travelling to and from the local area, with 30% of vehicles approaching the site from the southern leg of Missenden Road, with the remainder utilising the northern leg.
- **Staff and patient mode split**
  - For development Stage A, existing mode splits for staff, researchers and patients as outlined in Section 2.9 have been utilised. As a result of the sustainable transport initiatives described in Section 4.4.3 of this study, it is expected this reliance on private vehicle will decline to 60% following the completion of Stage B1
- **Vehicle occupancy**
  - A vehicle occupancy rate of 1.2 and 1.1 passengers per vehicle has been assumed for staff and patients respectively – consistent with that used by Arup when undertaking hospital parking studies
- **Service Vehicles**
  - Service vehicles will access the loading dock on Susan Street via Salisbury Road. A summary of daily and peak hour service vehicle movements is shown in Table 7.

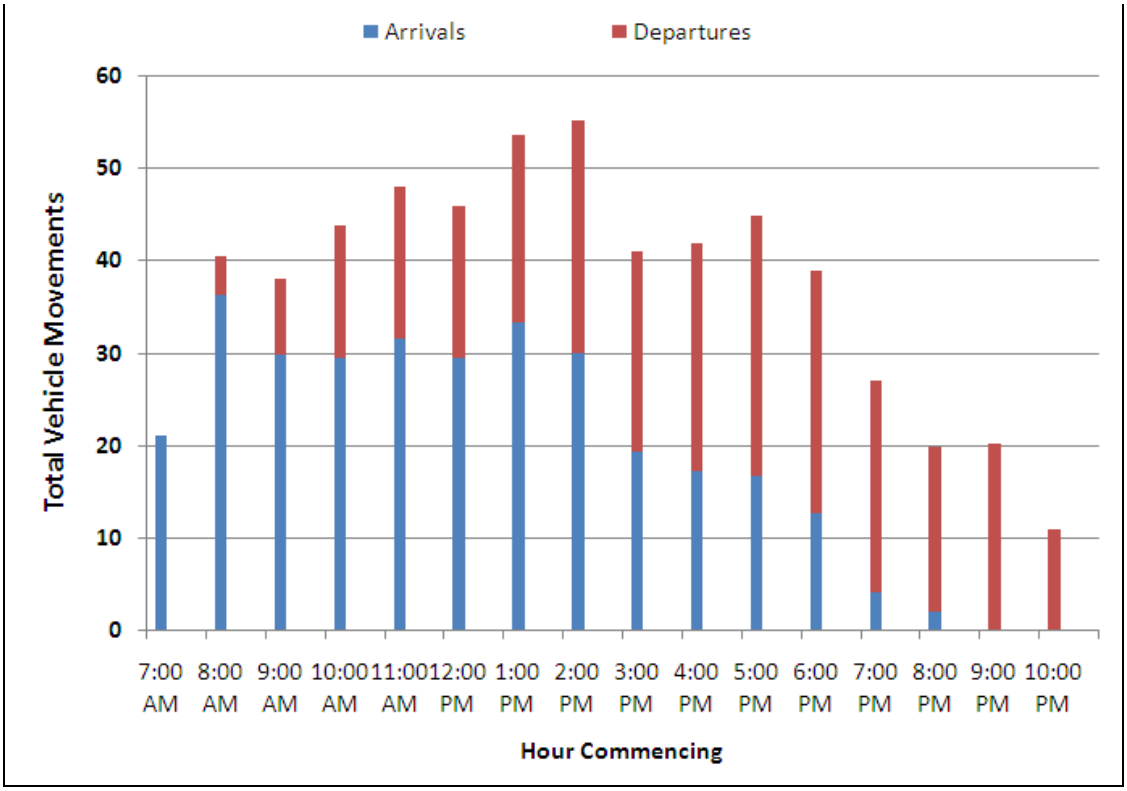
Table 7 Forecast Service Vehicle Movements

Delivery Type	Total Vehicle Movements		
	Daily	AM Peak (8am – 9am)	PM Peak (5pm – 6pm)
Garbage	1	0	0
Medical Deliveries	16	2	2
Food Deliveries	4	0	0
Maintenance	2	1	1
Linen/Hospitality	6	1	1
Retail	2	1	0
Admin	4	1	0
Contaminated Waste	1	0	0
Recyclables (1 / week)	0	0	0
TOTAL	**36**	**6**	**4**

4.1.2 Forecast Traffic Movements

A daily profile of total additional vehicles generated resulting from the proposed development during both Stage A and Stage B1 is presented in Figure 9 and Figure 10.

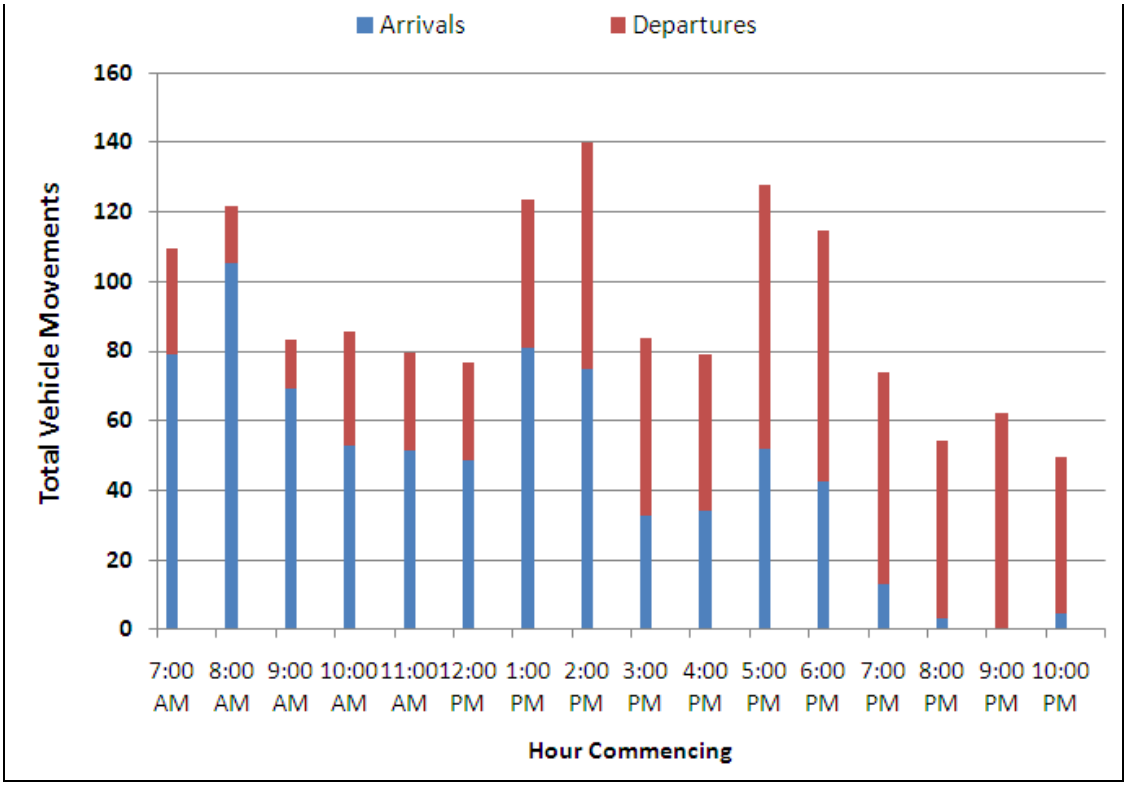
Figure 9 Forecast Additional Traffic Generation – Stage A



Key results of the analysis during Stage A of the development include:

- 591 additional daily traffic movements, which are forecast composed of:
  - 146 staff vehicle movements
  - 408 patient/visitor vehicle movements
  - 36 service vehicle movements
  - 20 Lifehouse shuttle bus movements
- AM peak hour (8am – 9am) traffic movements amount to approximately 40 vehicles
- PM peak hour (5pm – 6pm) movements make amount to approximately 45 vehicles

Figure 10 Forecast Additional Traffic Generation – Stage B1



Key results of the analysis during Stage A of the development include:

- 1466 additional daily traffic movements, which are forecast composed of:
  - 619 staff vehicle movements
  - 777 patient/visitor vehicle movements
  - 50 service vehicle movements
  - 20 Lifehouse shuttle bus movements
- AM peak hour (8am – 9am) traffic movements amount to approximately 122 vehicles
- PM peak hour (5pm – 6pm) movements make amount to approximately 128 vehicles

4.2 Impact on Local Road Network

An analysis of the local road network has been undertaken based on existing traffic volumes (see Figure 2) and the forecast site traffic generation. The analysis has considered the reconfigured future road network operation along Missenden Road as outlined in Section 2.3 of this report, for both development stages A and B1.

4.2.1 SIDRA Analysis

For the purposes of this investigation, an individual intersection traffic control model, Sidra, has been used to assess the performance of Missenden Road – Salisbury Road intersection.

The existing intersection performance is assessed in this report in terms of the following four factors for each intersection.

- Degree of Saturation
- Average Delay (Seconds per vehicle)
- Level of Service
- Length and direction of peak traffic queue (95^{th} percentile traffic queue)

In urban areas, the performance of the major road network is generally a function of the performance of key intersections. This performance is quantified in terms of Level of Service (LOS), which is an index of the operational performance of traffic at an intersection and is based on the average delay per vehicle. LOS ranges from A = very good to F = highly congested travel conditions, as shown in Table 8.

Table 8 Level of Service Definitions

Description	Level of Service (RTA Definition)	Average Delay per Vehicle (s)
Very Good	A	< 14.5
Good	B	14.5 ≤ 28.5
Satisfactory	C	28.5 ≤ 42.5
Near Capacity	D	42.5 ≤ 56.5
At Capacity	E	56.5 ≤ 70.5
Over Capacity	F	≥ 70.5

Generally it is desirable to aim at achieving a Level of Service of C or better at all major road intersections. However, in practice, it is reasonable for some intersections to operate at Level of Service D at peak times. Another common measure of intersection performance is the degree of saturation (DOS), which provides an overall measure of the capability of the intersection to accommodate additional traffic. A DOS of 1.0 indicates that an intersection is operating at capacity. The desirable maximum degree of saturation for an intersection with traffic signals is 0.9.

For the purposes of this project, Sidra analysis was conducted on the following intersections:

- Missenden Road / Salisbury Road
- Missenden Road / Brown Street
- Missenden Road / Carillion Avenue

Results of this analysis are presented in the section below

4.2.2 Results

Results of the Sidra analysis for the three analysed intersections along Missenden Road are presented in Table 9. Full Sidra results are provided as an Appendix A

Table 9 SIDRA Intersection Results

Intersection	Scenario	Time Period	LOS	DOS	AVD* (sec)	HMD** (sec)	Movement
Missenden Road & Salisbury Street	No development	AM Peak	A	0.778	12.8	35.7	*Left egress from Salisbury Rd*
		PM Peak	B	0.896	18.4	36.1	*Right egress from Salisbury Rd*
	Stage A of development	AM Peak	B	0.881	17.7	36.4	*Left egress from Salisbury Rd*
		PM Peak	B	0.939	24.7	47.7	*Left egress from Salisbury Rd*
	Stage B of development	AM Peak	B	0.910	20.3	36.8	*Left egress from Salisbury Rd*
		PM Peak	B	0.951	26.9	46.0	*Left egress from Salisbury Rd*
Missenden Road & Brown Street	No development	AM Peak	n/a	0.353	n/a	n/a	*n/a*
		PM Peak	n/a	0.343	n/a	n/a	*n/a*
	Stage A of development	AM Peak	n/a	0.360	n/a	52.0	*Left egress from Brown St*
		PM Peak	n/a	0.347	n/a	47.9	*Left egress from Brown St*
	Stage B of development	AM Peak	n/a	0.362	n/a	53.0	*Left egress from Brown St*
		PM Peak	n/a	0.348	n/a	48.5	*Left egress from Brown St*
Missenden Road & Carillion Avenue	No development	AM Peak	E	0.933	63.8	92.8	*Right from Missenden Rd south approach*
		PM Peak	E	0.895	60.9	86.3	*Right from Missenden Rd south approach*
	Stage A of development	AM Peak	E	0.955	66.9	94.4	*Right from Missenden Rd south approach*
		PM Peak	E	0.904	62.1		*Right from Missenden Rd south approach*
	Stage B of development	AM Peak	F	0.964	72.6	106.1	*Left from Missenden Rd north approach*
		PM Peak	E	0.920	64.9	88.9	*Right from Missenden Rd south approach*

Note: * - AVD – Average Vehicle Delay, ** - HMD – Highest Movement Delay

The analysis indicates that the Missenden Road / Salisbury Road intersection will continue to operate at an acceptable LOS B during both the morning and evening peak hours. The movement with the most significant delay is the left turning vehicles out of Salisbury Rd. These delays however are no more than 37 seconds in the AM and 48 seconds in the PM, which is considered a more than acceptable level of operation during peak hours.

The priority junction at Missenden Road and Brown Street is currently operating with significant spare capacity. This is forecast to continue following the completion of both development stages.

As the forecast peak traffic generation does not coincide with the commuter peak hours, the overall impact on the surrounding road network is considered to be minimal. Once the traffic disperses from the Missenden Road / Salisbury Road intersection, the impact on the surrounding intersections is relatively insignificant. Despite the Missenden Road / Carillion Avenue intersection being forecast to operate at a poor level of service, the additional level of traffic is as a result of the proposed development does not significantly impact the overall operation of the intersection.

The remaining vehicles travel north on Missenden Road through Grose Street / John Hopkins Drive, which was forecast to operate with spare capacity following the completion of the Missenden Road cycleway.

4.3 Parking and Access Arrangements

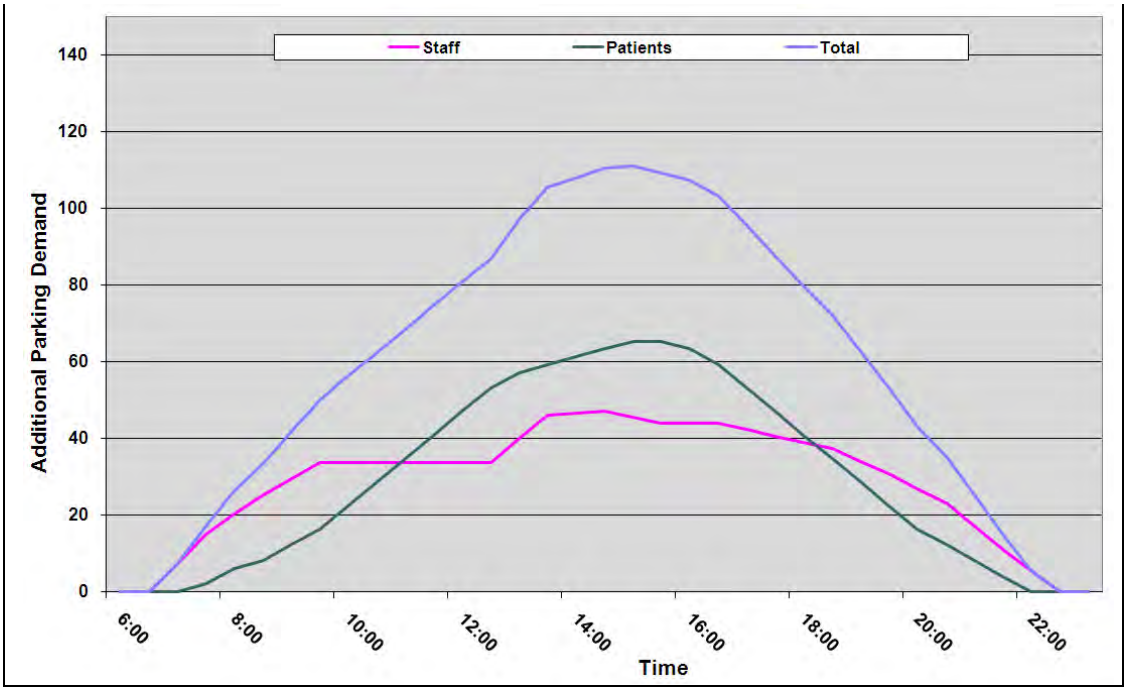
4.3.1 Forecast Parking Demand

As the proposed development is well connected to existing public transport infrastructure networks, limited on-site parking is to be provided. The majority of staff will continue to park in the existing staff car parks in and around the RPAH precinct as detailed in Section 2.4.

A maximum of 617 staff and researchers will be present at the centre at any one time on a typical weekday during Stage A of the project. This represents an increase of 94 staff compared to those already present in the RPAH precinct.

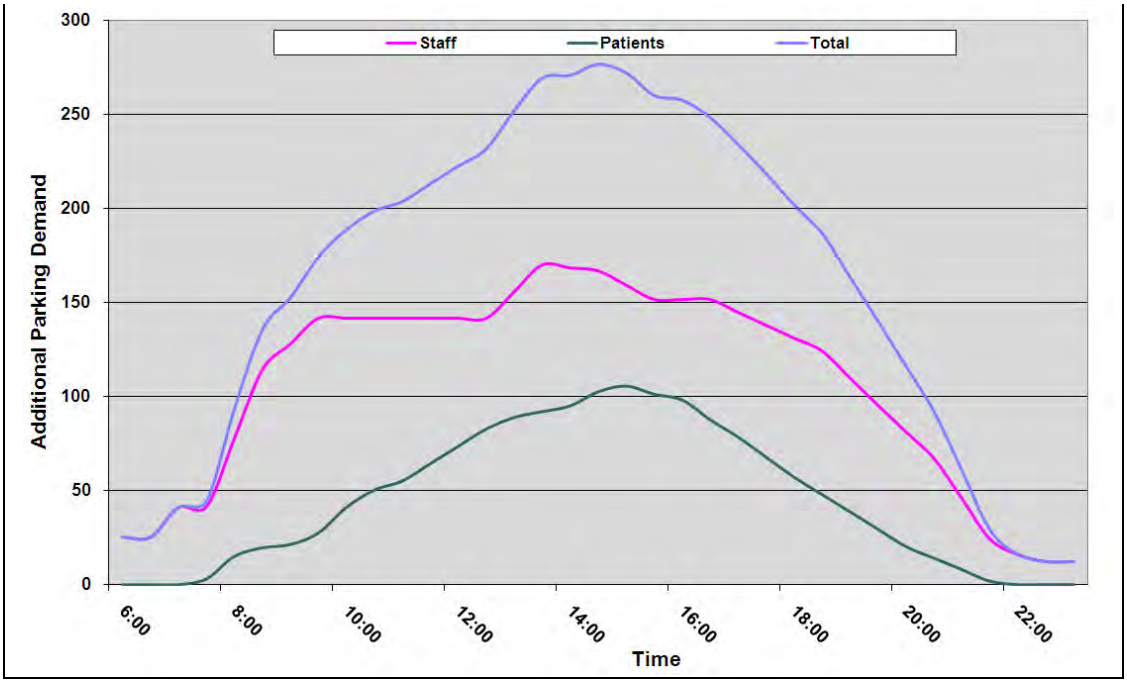
For Stage A of the development, parking demand is forecast to peak at approximately 110 vehicles at 3pm for the additional staff and patients (see Figure 11). The majority of this demand will be serviced through the 100 space basement car park, with the small overflow to be accommodated through existing car parking areas.

Figure 11 Forecast Additional Parking Demand (Stage A)



With the addition of new inpatients facilities and staff associated with Stage B1 of the proposed development, there is forecast to be an increase in parking demand. This is presented in Figure 12.

Figure 12 Forecast Additional Parking Demand (Stage B1)



Parking demand is forecast to peak at approximately 280 vehicles as a result of the development Stage B1. This represents an increase of 170 vehicles compared to that forecast in Stage A. These vehicles would park in the already approved 1,000 space multi-storey car park to be located behind the existing KGV building. It is expected that this car park would be constructed prior to the completion of Stage B1 works for the Lifehouse at RPA, or alternative parking arrangements would be available on campus.

4.3.2 Car Park Operation

The car park will service both staff/visitor parking, as well as loading vehicles, consisting of:

- 100 car parking spaces (including 6 accessible parking bays)
- 3 contractor/loading spaces
- 10 motorcycle spaces
- 1 morgue van space
- Parking for 65 bicycles (equivalent to 5% of total staff)

Access to the car park is to be provided via Susan Street adjacent to Salisbury Road. A vehicle drop-off facility is proposed outside the entrance to Lifehouse at RPA on Salisbury Road. Access to the loading dock will be via the southern end of Susan Street, where parking is available for 3 heavy vehicles. Vehicle swept paths indicating movements into the loading docks on Susan Street and Rochester Street is presented as an Appendix B.

The car park is to be designed in accordance with AS 2890.1 – Australian Standards for Off-Street Car Parking. Entry to the car park will be controlled via swipe card access and electronic boom gate to prevent unauthorised entries.

4.4 Sustainable Transport Measures

The NSW State Plan 2010 includes the following transport targets:

- Increase the proportion of total journeys to work by public transport in the Sydney Metropolitan Region to 28% by 2016 (2009 value 24%)

- Increase the mode share of bicycle trips made in the Greater Sydney region, at a local and district level, to 5% by 2016 (2009 value 1%)

These targets will be met by measures to promote sustainable means of transport including public transport usage, car sharing, car pooling and pedestrian and bicycle linkages as described below.

4.4.1 Public Transport Accessibility

The 412 bus route runs along Missenden Road directly adjacent to the site, with frequencies of between 15 and 20 minutes in the AM and PM peaks. This service runs between Campsie and the Sydney CBD. In addition to this, a further 19 bus services are available within an approximate 500m walk of the site, running along both King Street and Parramatta Road. These routes service the Sydney CBD and numerous suburban areas, providing various options for people wishing to travel to the site via bus.

Newtown railway station is located approximately 1km (15 minute walk) from the proposed site. With its location on the main CityRail network, the station can provide easy access for people arriving to Lifehouse at RPA via train.

It is therefore considered that Lifehouse at RPA is well connected to a number of existing public transport services.

4.4.2 Walking and Cycling Accessibility

The site is well situated to cater for people arriving by either walking or cycling. Strong walking connections are provided through the Sydney University Campus and also the RPAH precinct.

Current Journey to Work data for the RPAH precinct indicates approximately 13.1% of full time workers arrive to the either via either walking or cycling. As a comparison, across the entire Sydney region this figure is only 4.8%.

The City of Sydney is currently constructing a high quality, separated two-way cycleway along Missenden Road and Lyons Road. Running adjacent to Lifehouse at RPA, this will dramatically increase the attractiveness of this mode of transport for people accessing the site.

To encourage cycling as a viable form of transport for staff, appropriate facilities will be provided in the development. This includes a total of 65 parking bays in a dedicated bicycle parking area. Located in the vehicle car park, this room will provide staff with secure and convenient access to the building. Provision of this area will provide an attractive option for staff who potentially may choose to cycle instead of using private vehicles.

In addition to bicycle parking, appropriate end of trip facilities are provided in the development. This includes lockers, showers and changing facilities.

As a component of the Missenden Road cycleway, traffic calming measures along Missenden Road are being implemented to create a more pedestrian friendly environment. These measures, as outlined on The City of Sydney Council website, include:

- Raising the road surface at the entrances to Longdown, Campbell and Aylesbury Streets to calm traffic and increase pedestrian safety
- Widening the footpath on the western side of Missenden Road at King Street
- Creating shared footpaths along Carillon Avenue for both pedestrians and bike riders
- Distinctive road and footpath pavements between Grose Street and Salisbury Road to calm traffic in the hospital precinct

The existing and future pedestrian and cycle infrastructure in the precinct of the site is therefore considered adequate to meet the likely future demand for increased public transport and pedestrian and cycle access.

4.4.3 Site Travel Plan

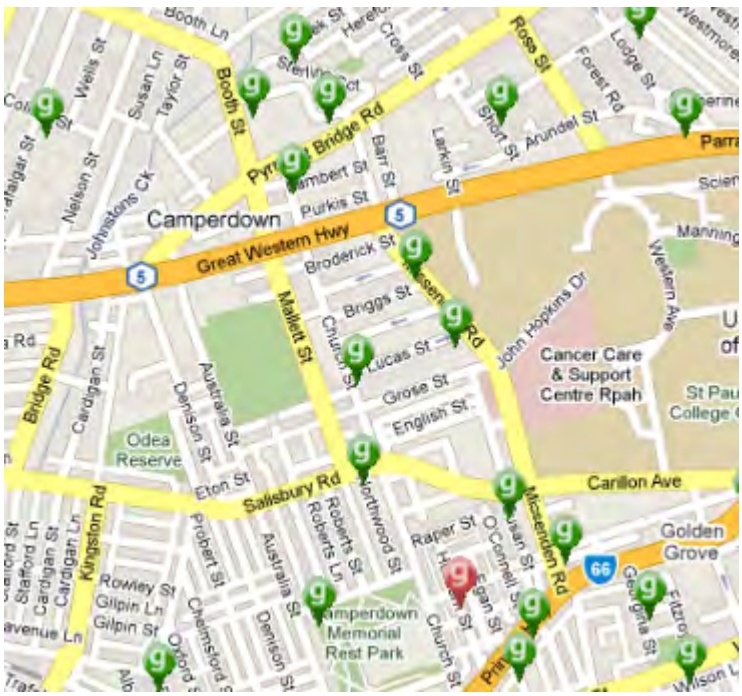
With the numerous transport options available to staff and visitors to access the site, the Lifehouse will establish a green transportation plan. A green transport plan is a package of measures introduced to promote the use of public transport, walking and cycling by patrons and employees for travel to and from work and for business related trips. Some specific measures that could be incorporated in this travel plan include:

- Public transport timetables and maps
- Key local walking and cycling routes
- Possibly subsidising/salary sacrificing cost of public transport tickets for staff
- Improvement of current website detailing transport options for both staff and patients
- Establishment of transport information packs to new staff explaining the various ways (other than motor vehicle) of travelling to the site
- Development of a travel plan booklet for staff and visitors
- Liaising with Lifehouse staff, either face to face or via email/telephone, providing them with advice where needed about travelling to work

In addition to these measures, the site will benefit from a dedicated staff and visitor shuttle bus that is proposed by Lifehouse. This service would operate at frequent intervals, and transport people to major transport interchanges such as Newtown and Central railway stations. A pick-up point is designated nearby to the front door of Lifehouse for good accessibility by patients and staff.

An opportunity to reduce the reliance on private vehicle would be to utilise the popular car sharing initiatives that are in place across Sydney. Independent studies by the University of Sydney have shown that each car share vehicle normally replaces about 7 private motor vehicles. A number of car share spaces or 'pods' currently exist within the vicinity of the site, as indicated in Figure 13. This car sharing initiative could be promoted as a component of the green travel plan.

Figure 13 Current 'GoGet' Car Sharing Pick Up/Drop Off Locations



Source: GoGet.com.au

Provision of this service, complemented with the implementation of a green travel plan and shuttle bus service, would reduce the reliance on private vehicle for Lifehouse staff and patients.

4.5 Construction Impacts

A detailed construction traffic management plan would be prepared at the construction stage of the project. A summary of measures to mitigate potential impacts for pedestrians and cyclists during the construction stage of the project is given below. The measures recognise the high volumes of pedestrians in the vicinity of the site.

Provisions will be made for pedestrians and cyclists to pass the worksite safely. A minimum footpath width of 2.0m on Missenden Road would be maintained at all times. Suitable pedestrian road crossing points would be maintained.

At times it may be necessary to direct pedestrians and cyclists onto the road carriageway and adequate warning signs and barricades would be provided. Traffic controllers or other traffic devices to direct traffic would be provided in accordance with AS 1742.3: 1996.

The construction schedule for the development will also aim to minimise:

- disruption to traffic movements particularly at peak periods
- interference with public transport services

Adequate fencing will be installed around the perimeter of the construction site to restrict unauthorised public access.

All demolition and construction related vehicles would comply with relevant City of Sydney Council traffic and parking regulations. Vehicular access points to the construction site will be selected to avoid conflict with high volume pedestrian desire lines.

5 Conclusions

This report has discussed the transport and accessibility impacts relating to the proposed operation The Chris O'Brien Lifehouse at RPA. Key findings of the study include:

- As the proposed development is well connected to existing public transport infrastructure networks, limited on-site parking is to be provided. The majority of staff will continue to park in the existing staff car parks in and around the RPAH precinct. The 100 space car park will service both senior staff/visitor parking, as well as loading vehicles.
- The site is well situated to cater for people arriving by either walking or cycling. Strong walking connections are provided through the Sydney University Campus and also the RPAH precinct. Current Journey to Work data for the RPAH precinct indicates approximately 13.1% of full time workers arrive to the either via either walking or cycling. As a comparison, across the entire Sydney region this figure is only 4.8%.
- The City of Sydney is currently constructing a high quality, separated two-way cycleway along Missenden Road and Lyons Road. Running adjacent to Lifehouse at RPA, this will dramatically increase the attractiveness of this mode of transport for people accessing the site.
- An analysis of the local road network has been undertaken based on existing traffic volumes and the forecast site traffic generation. The analysis has considered the reconfigured future road network operation along Missenden Road as a result of the streetscape works associated with the new cycleway.
- The analysis indicates that the intersection of Salisbury Road with Missenden Road, which provides the site access, will continue to operate at an acceptable Level of Service B during both the morning and evening peak hours. Movements with the most significant delays are left turning vehicles out of Salisbury Rd, and those vehicles exiting the hospital driveway. These delays however are no more than 37 seconds in the AM and 48 seconds in the PM, which is considered a more than acceptable level of operation.
- As the forecast peak traffic generation does not coincide with the commuter peak hours, the overall impact on the surrounding road network is considered to be minimal.
- Implementation of a green travel plan and shuttle bus service will reduce the reliance on private vehicle for Lifehouse staff and patients. It is envisioned that the current 80% mode split generally applicable for RPA staff would decrease significantly as a direct result of these measures. Research staff are already at a significantly lower car mode.
- A detailed construction traffic management plan would be prepared at the construction stage of the project, which would detail a series of measures to mitigate potential impacts for pedestrians and cyclists during the construction stage of the project.

Appendix A

SIDRA Intersection Results

MOVEMENT SUMMARY

Site: AM Existing

Missenden Rd & Salisbury Rd
Signals - Fixed Time Cycle Time = 80 seconds

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South	Missenden Rd (South)										
1	L	54	0.0	0.550	12.2	LOS A	9.1	63.5	0.36	0.98	39.4
2	T	592	0.0	0.549	5.8	LOS A	9.1	63.5	0.36	0.36	42.0
Approach		645	0.0	0.549	6.3	LOS A	9.1	63.5	0.36	0.41	41.8
East	Hospital Exit										
4	L	13	7.7	0.157	34.1	LOS C	2.5	19.3	0.77	0.76	28.0
5	T	35	14.3	0.157	27.4	LOS B	2.5	19.3	0.77	0.59	28.6
6	R	11	9.1	0.157	34.8	LOS C	2.5	19.3	0.76	0.81	27.9
Approach		58	11.9	0.157	30.0	LOS C	2.5	19.3	0.77	0.67	28.4
North East	RoadName										
25	T	5	100.0	0.007	15.4	LOS B	0.1	1.6	0.39	0.63	37.9
Approach		5	100.0	0.007	15.4	LOS B	0.1	1.6	0.39	0.63	37.9
North	Missenden Rd (North)										
8	T	552	6.0	0.775	14.0	LOS A	18.0	132.2	0.71	0.67	35.8
9	R	58	5.3	0.778	20.7	LOS B	18.0	132.2	0.71	0.95	34.6
Approach		609	5.9	0.776	14.6	LOS B	18.0	132.2	0.71	0.70	35.7
West	Salisbury Rd										
10	L	52	0.0	0.648	35.7	LOS C	2.4	16.5	0.76	0.77	26.9
12	R	38	0.0	0.120	34.9	LOS C	1.7	12.0	0.77	0.73	27.1
Approach		89	0.0	0.647	35.4	LOS C	2.4	16.5	0.76	0.75	27.0
All Vehicles		1407	3.4	0.778	12.8	LOS A	18.0	132.2	0.55	0.57	37.0

Level of Service (Aver. Int. Delay): LOS A. Based on average delay for all vehicle movements. LOS Method: Delay (RTA NSW).
Level of Service (Worst Movement): LOS C. LOS Method for individual vehicle movements: Delay (RTA NSW).
Approach LOS values are based on average delay for all vehicle movements.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	Across S approach	194	23.3	LOS C	0.3	0.3	0.76	0.76
P5	Across N approach	56	23.3	LOS C	0.1	0.1	0.76	0.76
P7	Across W approach	233	8.6	LOS A	0.2	0.2	0.46	0.46
All Pedestrians		483	16.2				0.62	0.62

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all pedestrian movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS C. LOS Method for individual pedestrian movements: Delay (HCM).

MOVEMENT SUMMARY

Site: PM Existing

Missenden Rd & Salisbury Rd
Signals - Fixed Time Cycle Time = 90 seconds

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South	Missenden Rd (South)										
1	L	42	2.4	0.545	13.4	LOS A	9.8	70.2	0.36	1.01	38.6
2	T	585	2.5	0.545	6.9	LOS A	9.8	70.2	0.36	0.38	41.0
Approach		627	2.5	0.545	7.3	LOS A	9.8	70.2	0.36	0.42	40.9
East	Hospital Exit										
4	L	9	0.0	0.104	34.2	LOS C	2.1	14.6	0.71	0.75	27.9
5	T	27	0.0	0.104	27.7	LOS B	2.1	14.6	0.71	0.54	28.6
6	R	9	0.0	0.104	34.9	LOS C	2.1	14.6	0.71	0.81	27.7
Approach		46	0.0	0.104	30.4	LOS C	2.1	14.6	0.71	0.64	28.2
North East	RoadName										
25	T	5	100.0	0.007	16.6	LOS B	0.1	1.8	0.40	0.63	37.2
Approach		5	100.0	0.007	16.6	LOS B	0.1	1.8	0.40	0.63	37.2
North	Missenden Rd (North)										
8	T	822	1.0	0.895	23.5	LOS B	36.2	255.5	0.85	0.89	30.6
9	R	33	3.0	0.896	30.2	LOS C	36.2	255.5	0.85	1.04	30.1
Approach		855	1.1	0.895	23.8	LOS B	36.2	255.5	0.85	0.90	30.6
West	Salisbury Rd										
10	L	45	0.0	0.592	35.6	LOS C	2.1	14.9	0.71	0.74	26.9
12	R	60	0.0	0.165	36.1	LOS C	2.8	19.7	0.75	0.74	26.7
Approach		105	0.0	0.593	35.9	LOS C	2.8	19.7	0.73	0.74	26.8
All Vehicles		1639	1.8	0.896	18.4	LOS B	36.2	255.5	0.65	0.70	33.4

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all vehicle movements. LOS Method: Delay (RTA NSW).
Level of Service (Worst Movement): LOS C. LOS Method for individual vehicle movements: Delay (RTA NSW).
Approach LOS values are based on average delay for all vehicle movements.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	Across S approach	96	24.2	LOS C	0.2	0.2	0.73	0.73
P5	Across N approach	65	24.2	LOS C	0.1	0.1	0.73	0.73
P7	Across W approach	128	8.9	LOS A	0.1	0.1	0.44	0.44
All Pedestrians		289	17.4				0.61	0.61

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all pedestrian movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS C. LOS Method for individual pedestrian movements: Delay (HCM).

MOVEMENT SUMMARY

Site: AM Stage A

Missenden Rd & Salisbury Rd
Signals - Fixed Time Cycle Time = 80 seconds

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South	Missenden Rd (South)										
1	L	66	0.0	0.564	12.4	LOS A	9.3	65.2	0.37	0.98	39.3
2	T	592	0.0	0.564	6.0	LOS A	9.3	65.2	0.37	0.38	41.8
Approach		658	0.0	0.564	6.6	LOS A	9.3	65.2	0.37	0.44	41.5
East	Hospital Exit										
4	L	13	7.7	0.157	34.1	LOS C	2.5	19.3	0.77	0.76	28.0
5	T	35	14.3	0.157	27.4	LOS B	2.5	19.3	0.77	0.59	28.6
6	R	11	9.1	0.157	34.8	LOS C	2.5	19.3	0.76	0.81	27.9
Approach		58	11.9	0.157	30.0	LOS C	2.5	19.3	0.77	0.67	28.4
North East	RoadName										
25	T	5	100.0	0.007	15.4	LOS B	0.1	1.6	0.39	0.63	37.9
Approach		5	100.0	0.007	15.4	LOS B	0.1	1.6	0.39	0.63	37.9
North	Missenden Rd (North)										
8	T	552	6.0	0.880	24.5	LOS B	25.5	187.5	0.86	0.92	30.0
9	R	83	5.3	0.881	31.3	LOS C	25.5	187.5	0.86	1.05	29.6
Approach		635	5.9	0.880	25.4	LOS B	25.5	187.5	0.86	0.94	30.0
West	Salisbury Rd										
10	L	54	0.0	0.674	36.4	LOS C	2.5	17.3	0.76	0.79	26.6
12	R	40	0.0	0.127	34.9	LOS C	1.8	12.7	0.77	0.73	27.1
Approach		94	0.0	0.674	35.8	LOS C	2.5	17.3	0.77	0.76	26.8
All Vehicles		1449	3.4	0.881	17.7	LOS B	25.5	187.5	0.63	0.69	33.9

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all vehicle movements. LOS Method: Delay (RTA NSW).
Level of Service (Worst Movement): LOS C. LOS Method for individual vehicle movements: Delay (RTA NSW).
Approach LOS values are based on average delay for all vehicle movements.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	Across S approach	194	23.3	LOS C	0.3	0.3	0.76	0.76
P5	Across N approach	56	23.3	LOS C	0.1	0.1	0.76	0.76
P7	Across W approach	233	8.6	LOS A	0.2	0.2	0.46	0.46
All Pedestrians		483	16.2				0.62	0.62

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all pedestrian movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS C. LOS Method for individual pedestrian movements: Delay (HCM).

MOVEMENT SUMMARY

Site: AM Stage B1

Missenden Rd & Salisbury Rd
Signals - Fixed Time Cycle Time = 80 seconds

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South	Missenden Rd (South)										
1	L	71	0.0	0.569	12.7	LOS A	9.5	66.8	0.39	0.98	39.1
2	T	592	0.0	0.569	6.3	LOS A	9.5	66.8	0.39	0.40	41.5
Approach		662	0.0	0.569	7.0	LOS A	9.5	66.8	0.39	0.46	41.3
East	Hospital Exit										
4	L	13	7.7	0.158	34.1	LOS C	2.5	19.3	0.77	0.76	28.0
5	T	35	14.3	0.158	27.4	LOS B	2.5	19.3	0.77	0.59	28.6
6	R	11	9.1	0.157	34.8	LOS C	2.5	19.3	0.76	0.81	27.9
Approach		58	11.9	0.157	30.0	LOS C	2.5	19.3	0.77	0.67	28.4
North East	RoadName										
25	T	5	100.0	0.007	15.4	LOS B	0.1	1.6	0.39	0.63	37.9
Approach		5	100.0	0.007	15.4	LOS B	0.1	1.6	0.39	0.63	37.9
North	Missenden Rd (North)										
8	T	552	6.0	0.910	30.0	LOS C	28.7	211.3	0.90	1.02	27.7
9	R	91	5.3	0.910	36.8	LOS C	28.7	211.3	0.90	1.11	27.5
Approach		642	5.9	0.909	31.0	LOS C	28.7	211.3	0.90	1.03	27.7
West	Salisbury Rd										
10	L	55	0.0	0.687	36.8	LOS C	2.5	17.8	0.76	0.79	26.5
12	R	41	0.0	0.130	35.0	LOS C	1.9	13.0	0.78	0.73	27.1
Approach		96	0.0	0.687	36.0	LOS C	2.5	17.8	0.77	0.77	26.7
All Vehicles		1463	3.4	0.910	20.3	LOS B	28.7	211.3	0.66	0.74	32.5

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all vehicle movements. LOS Method: Delay (RTA NSW).
Level of Service (Worst Movement): LOS C. LOS Method for individual vehicle movements: Delay (RTA NSW).
Approach LOS values are based on average delay for all vehicle movements.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	Across S approach	194	23.3	LOS C	0.3	0.3	0.76	0.76
P5	Across N approach	56	23.3	LOS C	0.1	0.1	0.76	0.76
P7	Across W approach	233	8.6	LOS A	0.2	0.2	0.46	0.46
All Pedestrians		483	16.2				0.62	0.62

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all pedestrian movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS C. LOS Method for individual pedestrian movements: Delay (HCM).

MOVEMENT SUMMARY

Site: PM Stage A

Missenden Rd & Salisbury Rd
Signals - Fixed Time Cycle Time = 90 seconds

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South	Missenden Rd (South)										
1	L	48	2.4	0.552	13.5	LOS A	10.0	71.2	0.37	1.01	38.6
2	T	585	2.5	0.551	7.0	LOS A	10.0	71.2	0.37	0.38	40.9
Approach		634	2.5	0.551	7.5	LOS A	10.0	71.2	0.37	0.43	40.8
East	Hospital Exit										
4	L	9	0.0	0.105	34.2	LOS C	2.1	14.6	0.71	0.75	27.8
5	T	27	0.0	0.105	27.8	LOS B	2.1	14.6	0.71	0.54	28.6
6	R	9	0.0	0.105	34.9	LOS C	2.1	14.6	0.71	0.81	27.7
Approach		46	0.0	0.105	30.4	LOS C	2.1	14.6	0.71	0.64	28.2
North East	RoadName										
25	T	5	100.0	0.007	16.6	LOS B	0.1	1.8	0.40	0.63	37.2
Approach		5	100.0	0.007	16.6	LOS B	0.1	1.8	0.40	0.63	37.2
North	Missenden Rd (North)										
8	T	822	1.0	0.939	34.0	LOS C	44.7	316.1	0.93	1.06	26.4
9	R	44	3.0	0.938	40.7	LOS C	44.7	316.1	0.93	1.13	26.2
Approach		866	1.1	0.939	34.4	LOS C	44.7	316.1	0.93	1.07	26.4
West	Salisbury Rd										
10	L	64	0.0	0.846	47.7	LOS D	3.4	23.6	0.81	0.85	23.3
12	R	71	0.0	0.194	36.4	LOS C	3.3	23.1	0.75	0.75	26.6
Approach		135	0.0	0.847	41.8	LOS C	3.4	23.6	0.78	0.80	24.9
All Vehicles		1686	1.8	0.939	24.7	LOS B	44.7	316.1	0.70	0.79	30.3

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all vehicle movements. LOS Method: Delay (RTA NSW).
Level of Service (Worst Movement): LOS D. LOS Method for individual vehicle movements: Delay (RTA NSW).
Approach LOS values are based on average delay for all vehicle movements.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	Across S approach	96	24.2	LOS C	0.2	0.2	0.73	0.73
P5	Across N approach	65	24.2	LOS C	0.1	0.1	0.73	0.73
P7	Across W approach	128	8.9	LOS A	0.1	0.1	0.44	0.44
All Pedestrians		289	17.4				0.61	0.61

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all pedestrian movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS C. LOS Method for individual pedestrian movements: Delay (HCM).

MOVEMENT SUMMARY

Site: PM Stage B1

Missenden Rd & Salisbury Rd
Signals - Fixed Time Cycle Time = 90 seconds

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South	Missenden Rd (South)										
1	L	51	2.4	0.552	13.5	LOS A	10.0	71.5	0.37	1.01	38.6
2	T	585	2.5	0.554	7.0	LOS A	10.0	71.5	0.37	0.38	40.9
Approach		636	2.5	0.554	7.5	LOS A	10.0	71.5	0.37	0.43	40.7
East	Hospital Exit										
4	L	9	0.0	0.105	34.2	LOS C	2.1	14.6	0.71	0.75	27.8
5	T	27	0.0	0.105	27.8	LOS B	2.1	14.6	0.71	0.54	28.5
6	R	9	0.0	0.105	34.9	LOS C	2.1	14.6	0.71	0.81	27.7
Approach		46	0.0	0.105	30.4	LOS C	2.1	14.6	0.71	0.64	28.2
North East	RoadName										
25	T	5	100.0	0.007	16.6	LOS B	0.1	1.8	0.40	0.63	37.2
Approach		5	100.0	0.007	16.6	LOS B	0.1	1.8	0.40	0.63	37.2
North	Missenden Rd (North)										
8	T	822	1.0	0.951	38.2	LOS C	47.7	337.4	0.96	1.12	25.0
9	R	47	3.0	0.949	44.9	LOS D	47.7	337.4	0.96	1.16	24.9
Approach		869	1.1	0.951	38.6	LOS C	47.7	337.4	0.96	1.13	25.0
West	Salisbury Rd										
10	L	69	0.0	0.918	46.0	LOS D	3.4	23.6	0.88	0.78	23.7
12	R	74	0.0	0.203	36.4	LOS C	3.4	24.1	0.76	0.75	26.5
Approach		143	0.0	0.917	41.1	LOS C	3.4	24.1	0.82	0.77	25.1
All Vehicles		1700	1.8	0.951	26.9	LOS B	47.7	337.4	0.72	0.82	29.4

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all vehicle movements. LOS Method: Delay (RTA NSW).
Level of Service (Worst Movement): LOS D. LOS Method for individual vehicle movements: Delay (RTA NSW).
Approach LOS values are based on average delay for all vehicle movements.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	Across S approach	96	24.2	LOS C	0.2	0.2	0.73	0.73
P5	Across N approach	65	24.2	LOS C	0.1	0.1	0.73	0.73
P7	Across W approach	128	8.9	LOS A	0.1	0.1	0.44	0.44
All Pedestrians		289	17.4				0.61	0.61

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all pedestrian movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS C. LOS Method for individual pedestrian movements: Delay (HCM).

MOVEMENT SUMMARY

Site: AM Future

Brown St - Missenden Rd
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South	Missenden Rd South										
2	T	679	2.0	0.353	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		679	2.0	0.353	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
North	Missenden Rd North										
8	T	639	2.0	0.166	0.0	LOS A	0.0	0.0	0.00	0.00	50.0
Approach		639	2.0	0.166	0.0	LOS A	0.0	0.0	0.00	0.00	50.0
West	Brown St										
10	L	1	0.0	0.002	13.2	LOS A	0.0	0.1	0.60	0.69	43.9
Approach		1	0.0	0.002	13.2	LOS A	0.0	0.1	0.60	0.69	43.9
All Vehicles		1319	2.0	0.353	0.0	NA	0.0	0.1	0.00	0.00	54.8

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

Level of Service (Worst Movement): LOS A. LOS Method for individual vehicle movements: Delay (RTA NSW).

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

SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: PM Future

Brown St - Missenden Rd
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South	Missenden Rd South										
2	T	660	2.0	0.343	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		660	2.0	0.343	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
North	Missenden Rd North										
8	T	944	2.0	0.245	0.0	LOS A	0.0	0.0	0.00	0.00	50.0
Approach		944	2.0	0.245	0.0	LOS A	0.0	0.0	0.00	0.00	50.0
West	Brown St										
10	L	1	0.0	0.002	13.0	LOS A	0.0	0.1	0.59	0.68	44.2
Approach		1	0.0	0.002	13.0	LOS A	0.0	0.1	0.59	0.68	44.2
All Vehicles		1605	2.0	0.343	0.0	NA	0.0	0.1	0.00	0.00	53.8

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

Level of Service (Worst Movement): LOS A. LOS Method for individual vehicle movements: Delay (RTA NSW).

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

MOVEMENT SUMMARY

Site: AM Stage A

Brown St - Missenden Rd
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South	Missenden Rd South										
2	T	693	2.0	0.360	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		693	2.0	0.360	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
North	Missenden Rd North										
8	T	641	2.0	0.167	0.0	LOS A	0.0	0.0	0.00	0.00	50.0
Approach		641	2.0	0.167	0.0	LOS A	0.0	0.0	0.00	0.00	50.0
West	Brown St										
10	L	8	100.0	0.093	52.0	LOS D	0.3	4.5	0.87	0.96	28.0
Approach		8	100.0	0.093	52.0	LOS D	0.3	4.5	0.87	0.96	28.0
All Vehicles		1342	2.6	0.360	0.3	NA	0.3	4.5	0.01	0.01	54.5

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

Level of Service (Worst Movement): LOS D. LOS Method for individual vehicle movements: Delay (RTA NSW).

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

SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: AM Stage B1

Brown St - Missenden Rd
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South	Missenden Rd South										
2	T	697	2.0	0.362	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		697	2.0	0.362	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
North	Missenden Rd North										
8	T	643	2.0	0.167	0.0	LOS A	0.0	0.0	0.00	0.00	50.0
Approach		643	2.0	0.167	0.0	LOS A	0.0	0.0	0.00	0.00	50.0
West	Brown St										
10	L	10	100.0	0.118	53.0	LOS D	0.4	5.7	0.88	0.96	27.7
Approach		10	100.0	0.118	53.0	LOS D	0.4	5.7	0.88	0.96	27.7
All Vehicles		1350	2.7	0.362	0.4	NA	0.4	5.7	0.01	0.01	54.4

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

Level of Service (Worst Movement): LOS D. LOS Method for individual vehicle movements: Delay (RTA NSW).

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

SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: PM Stage A

Brown St - Missenden Rd
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South	Missenden Rd South										
2	T	667	2.0	0.347	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		667	2.0	0.347	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
North	Missenden Rd North										
8	T	955	2.0	0.248	0.0	LOS A	0.0	0.0	0.00	0.00	50.0
Approach		955	2.0	0.248	0.0	LOS A	0.0	0.0	0.00	0.00	50.0
West	Brown St										
10	L	8	100.0	0.084	47.9	LOS D	0.3	4.1	0.86	0.95	29.2
Approach		8	100.0	0.084	47.9	LOS D	0.3	4.1	0.86	0.95	29.2
All Vehicles		1630	2.5	0.347	0.2	NA	0.3	4.1	0.00	0.00	53.5

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

Level of Service (Worst Movement): LOS D. LOS Method for individual vehicle movements: Delay (RTA NSW).

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

SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: PM Stage B1

Brown St - Missenden Rd
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South	Missenden Rd South										
2	T	669	2.0	0.348	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		669	2.0	0.348	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
North	Missenden Rd North										
8	T	959	2.0	0.249	0.0	LOS A	0.0	0.0	0.00	0.00	50.0
Approach		959	2.0	0.249	0.0	LOS A	0.0	0.0	0.00	0.00	50.0
West	Brown St										
10	L	10	100.0	0.105	48.5	LOS D	0.4	5.2	0.86	0.95	29.0
Approach		10	100.0	0.106	48.5	LOS D	0.4	5.2	0.86	0.95	29.0
All Vehicles		1638	2.6	0.348	0.3	NA	0.4	5.2	0.01	0.01	53.5

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

Level of Service (Worst Movement): LOS D. LOS Method for individual vehicle movements: Delay (RTA NSW).

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

MOVEMENT SUMMARY

Site: AM Future

Carillon Ave - Missenden Rd
Signals - Fixed Time Cycle Time = 150 seconds

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South	Missenden Rd - Sth										
1	L	107	3.7	0.689	56.8	LOS E	24.6	178.3	0.95	0.87	21.6
2	T	265	4.1	0.688	50.3	LOS D	24.6	178.3	0.95	0.82	21.7
3	R	44	4.5	0.745	92.8	LOS F	4.9	35.6	1.00	0.83	15.5
Approach		416	4.0	0.745	56.5	LOS D	24.6	178.3	0.95	0.84	20.8
East	Carillon Ave - East										
4	L	27	3.6	0.690	75.7	LOS F	9.6	67.9	0.98	0.84	18.1
5	T	243	0.8	0.691	70.0	LOS E	13.1	92.3	0.99	0.83	18.0
6	R	93	1.1	0.933	82.9	LOS F	8.6	61.0	0.97	0.87	16.7
Approach		363	1.1	0.933	73.8	LOS F	13.1	92.3	0.99	0.84	17.7
North	Missenden Rd - Nth										
7	L	182	6.0	0.912	88.4	LOS F	30.9	227.7	1.00	1.15	16.2
8	T	203	5.9	0.911	81.8	LOS F	30.9	227.7	1.00	1.15	16.2
9	R	56	5.5	0.417	76.2	LOS F	5.4	39.7	0.97	0.77	17.7
Approach		441	5.9	0.912	83.8	LOS F	30.9	227.7	1.00	1.10	16.4
West	Carillon Ave - West										
10	L	69	1.4	0.923	61.3	LOS E	66.5	469.3	1.00	1.02	20.8
11	T	767	1.0	0.925	54.9	LOS D	66.5	469.3	1.00	1.02	20.8
12	R	66	1.5	0.252	28.9	LOS C	3.7	26.1	0.57	0.70	29.5
Approach		902	1.1	0.925	53.5	LOS D	66.5	469.3	0.97	1.00	21.2
All Vehicles		2122	2.7	0.933	63.8	LOS E	66.5	469.3	0.97	0.96	19.3

Level of Service (Aver. Int. Delay): LOS E. Based on average delay for all vehicle movements. LOS Method: Delay (RTA NSW).
Level of Service (Worst Movement): LOS F. LOS Method for individual vehicle movements: Delay (RTA NSW).
Approach LOS values are based on average delay for all vehicle movements.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	Across S approach	192	57.2	LOS E	0.7	0.7	0.87	0.87
P3	Across E approach	306	37.5	LOS D	0.9	0.9	0.71	0.71
P5	Across N approach	54	20.3	LOS C	0.1	0.1	0.52	0.52
P7	Across W approach	199	46.4	LOS E	0.7	0.7	0.79	0.79
All Pedestrians		751	43.6				0.76	0.76

Level of Service (Aver. Int. Delay): LOS E. Based on average delay for all pedestrian movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS E. LOS Method for individual pedestrian movements: Delay (HCM).

MOVEMENT SUMMARY

Site: PM Future

Carillon Ave - Missenden Rd
Signals - Fixed Time Cycle Time = 150 seconds

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South	Missenden Rd - Sth										
1	L	127	2.3	0.541	46.4	LOS D	21.7	154.8	0.85	0.86	24.1
2	T	238	2.1	0.542	40.0	LOS C	21.7	154.8	0.85	0.74	24.4
3	R	37	2.7	0.488	86.3	LOS F	4.0	28.7	1.00	0.74	16.2
Approach		402	2.2	0.542	46.3	LOS D	21.7	154.8	0.86	0.78	23.2
East	Carillon Ave - East										
4	L	41	2.4	0.798	65.5	LOS E	11.6	82.3	0.87	0.93	19.8
5	T	475	1.1	0.797	60.2	LOS E	26.7	188.4	0.97	0.89	19.8
6	R	105	1.0	0.895	69.1	LOS E	8.6	61.0	0.87	0.86	18.8
Approach		621	1.2	0.895	62.0	LOS E	26.7	188.4	0.95	0.89	19.6
North	Missenden Rd - Nth										
7	L	193	1.0	0.880	72.5	LOS F	37.5	265.1	1.00	1.05	18.5
8	T	305	1.0	0.881	66.0	LOS E	37.5	265.1	1.00	1.05	18.5
9	R	129	0.8	0.587	66.6	LOS E	10.5	73.9	0.96	0.82	19.2
Approach		627	1.0	0.881	68.1	LOS E	37.5	265.1	0.99	1.00	18.6
West	Carillon Ave - West										
10	L	79	2.5	0.875	70.1	LOS E	36.4	259.5	1.00	0.98	19.1
11	T	394	2.0	0.874	63.6	LOS E	36.4	259.5	1.00	0.98	19.0
12	R	86	2.3	0.435	48.9	LOS D	6.2	44.2	0.79	0.74	23.0
Approach		559	2.1	0.874	62.3	LOS E	36.4	259.5	0.97	0.94	19.6
All Vehicles		2209	1.5	0.895	60.9	LOS E	37.5	265.1	0.95	0.91	19.9

Level of Service (Aver. Int. Delay): LOS E. Based on average delay for all vehicle movements. LOS Method: Delay (RTA NSW).
Level of Service (Worst Movement): LOS F. LOS Method for individual vehicle movements: Delay (RTA NSW).
Approach LOS values are based on average delay for all vehicle movements.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	Across S approach	109	42.6	LOS E	0.3	0.3	0.75	0.75
P3	Across E approach	311	30.7	LOS D	0.8	0.8	0.64	0.64
P5	Across N approach	38	37.5	LOS D	0.1	0.1	0.71	0.71
P7	Across W approach	162	38.9	LOS D	0.5	0.5	0.72	0.72
All Pedestrians		620	35.3				0.68	0.68

Level of Service (Aver. Int. Delay): LOS D. Based on average delay for all pedestrian movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS E. LOS Method for individual pedestrian movements: Delay (HCM).

MOVEMENT SUMMARY

Site: AM Stage A

Carillon Ave - Missenden Rd
Signals - Fixed Time Cycle Time = 150 seconds

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South	Missenden Rd - Sth										
1	L	107	3.7	0.706	57.2	LOS E	25.4	184.0	0.95	0.87	21.5
2	T	275	4.1	0.706	50.6	LOS D	25.4	184.0	0.95	0.83	21.6
3	R	44	4.5	0.796	94.4	LOS F	4.9	35.8	1.00	0.85	15.3
Approach		426	4.0	0.796	56.8	LOS E	25.4	184.0	0.96	0.84	20.7
East	Carillon Ave - East										
4	L	27	3.6	0.666	74.0	LOS F	9.3	65.6	0.97	0.82	18.3
5	T	243	0.8	0.667	68.5	LOS E	13.2	92.7	0.99	0.82	18.3
6	R	96	1.1	0.955	78.9	LOS F	8.6	61.0	0.97	0.83	17.2
Approach		366	1.1	0.954	71.6	LOS F	13.2	92.7	0.98	0.82	18.0
North	Missenden Rd - Nth										
7	L	182	6.0	0.925	92.0	LOS F	32.3	237.6	1.00	1.17	15.8
8	T	209	5.9	0.925	85.4	LOS F	32.3	237.6	1.00	1.17	15.7
9	R	56	5.5	0.438	77.4	LOS F	5.5	40.1	0.98	0.77	17.5
Approach		447	5.9	0.925	87.1	LOS F	32.3	237.6	1.00	1.12	15.9
West	Carillon Ave - West										
10	L	72	1.4	0.941	68.0	LOS E	70.4	497.5	1.00	1.06	19.5
11	T	767	1.0	0.942	61.6	LOS E	70.4	497.5	1.00	1.06	19.4
12	R	66	1.5	0.254	29.5	LOS C	3.7	26.4	0.58	0.70	29.3
Approach		905	1.1	0.942	59.8	LOS E	70.4	497.5	0.97	1.03	19.9
All Vehicles		2144	2.7	0.955	66.9	LOS E	70.4	497.5	0.98	0.98	18.7

Level of Service (Aver. Int. Delay): LOS E. Based on average delay for all vehicle movements. LOS Method: Delay (RTA NSW).
Level of Service (Worst Movement): LOS F. LOS Method for individual vehicle movements: Delay (RTA NSW).
Approach LOS values are based on average delay for all vehicle movements.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	Across S approach	192	56.3	LOS E	0.7	0.7	0.87	0.87
P3	Across E approach	306	37.5	LOS D	0.9	0.9	0.71	0.71
P5	Across N approach	54	20.8	LOS C	0.1	0.1	0.53	0.53
P7	Across W approach	199	46.4	LOS E	0.7	0.7	0.79	0.79
All Pedestrians		751	43.5				0.76	0.76

Level of Service (Aver. Int. Delay): LOS E. Based on average delay for all pedestrian movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS E. LOS Method for individual pedestrian movements: Delay (HCM).

MOVEMENT SUMMARY

Site: AM Stage B1

Carillon Ave - Missenden Rd
Signals - Fixed Time Cycle Time = 150 seconds

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South	Missenden Rd - Sth										
1	L	117	3.7	0.750	59.0	LOS E	26.9	195.1	0.97	0.88	21.1
2	T	280	4.1	0.751	52.5	LOS D	26.9	195.1	0.97	0.85	21.1
3	R	44	4.5	0.835	95.4	LOS F	4.9	35.9	1.00	0.86	15.2
Approach		441	4.0	0.835	58.5	LOS E	26.9	195.1	0.98	0.86	20.3
East	Carillon Ave - East										
4	L	27	3.6	0.691	72.6	LOS F	9.6	68.1	0.96	0.84	18.6
5	T	273	0.8	0.692	67.3	LOS E	14.7	103.7	0.99	0.83	18.5
6	R	98	1.1	0.956	76.4	LOS F	8.6	61.0	0.95	0.82	17.6
Approach		398	1.1	0.957	69.9	LOS E	14.7	103.7	0.98	0.83	18.3
North	Missenden Rd - Nth										
7	L	182	6.0	0.964	106.1	LOS F	35.7	262.4	1.00	1.24	14.2
8	T	214	5.9	0.964	99.5	LOS F	35.7	262.4	1.00	1.24	14.2
9	R	66	5.5	0.597	82.1	LOS F	6.5	47.8	1.00	0.80	16.8
Approach		462	5.9	0.964	99.6	LOS F	35.7	262.4	1.00	1.18	14.5
West	Carillon Ave - West										
10	L	74	1.4	0.958	75.6	LOS F	74.5	526.1	1.00	1.09	18.2
11	T	767	1.0	0.958	69.2	LOS E	74.5	526.1	1.00	1.09	18.2
12	R	66	1.5	0.257	30.1	LOS C	3.8	26.7	0.59	0.70	29.0
Approach		907	1.1	0.958	66.9	LOS E	74.5	526.1	0.97	1.06	18.7
All Vehicles		2208	2.7	0.964	72.6	LOS F	74.5	526.1	0.98	1.00	17.8

Level of Service (Aver. Int. Delay): LOS F. Based on average delay for all vehicle movements. LOS Method: Delay (RTA NSW).
Level of Service (Worst Movement): LOS F. LOS Method for individual vehicle movements: Delay (RTA NSW).
Approach LOS values are based on average delay for all vehicle movements.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	Across S approach	192	54.6	LOS E	0.7	0.7	0.85	0.85
P3	Across E approach	306	38.2	LOS D	0.9	0.9	0.71	0.71
P5	Across N approach	54	21.3	LOS C	0.1	0.1	0.53	0.53
P7	Across W approach	199	47.2	LOS E	0.7	0.7	0.79	0.79
All Pedestrians		751	43.6				0.76	0.76

Level of Service (Aver. Int. Delay): LOS E. Based on average delay for all pedestrian movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS E. LOS Method for individual pedestrian movements: Delay (HCM).

MOVEMENT SUMMARY

Site: PM Stage A

Carillon Ave - Missenden Rd
Signals - Fixed Time Cycle Time = 150 seconds

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South	Missenden Rd - Sth										
1	L	127	2.3	0.545	46.5	LOS D	21.8	155.7	0.85	0.86	24.1
2	T	240	2.1	0.545	40.0	LOS C	21.8	155.7	0.85	0.74	24.3
3	R	37	2.7	0.515	87.5	LOS F	4.0	28.9	1.00	0.74	16.1
Approach		404	2.2	0.545	46.4	LOS D	21.8	155.7	0.86	0.78	23.2
East	Carillon Ave - East										
4	L	41	2.4	0.780	63.2	LOS E	11.3	79.9	0.86	0.92	20.2
5	T	475	1.1	0.780	58.2	LOS E	26.3	186.0	0.97	0.87	20.1
6	R	107	1.0	0.904	68.1	LOS E	8.6	61.0	0.88	0.85	18.9
Approach		623	1.2	0.904	60.2	LOS E	26.3	186.0	0.95	0.87	19.9
North	Missenden Rd - Nth										
7	L	196	1.0	0.893	74.6	LOS F	38.9	274.9	1.00	1.06	18.2
8	T	309	1.0	0.893	68.2	LOS E	38.9	274.9	1.00	1.06	18.1
9	R	132	0.8	0.604	66.9	LOS E	10.7	75.6	0.96	0.82	19.1
Approach		637	1.0	0.893	69.9	LOS E	38.9	274.9	0.99	1.01	18.4
West	Carillon Ave - West										
10	L	81	2.5	0.898	75.3	LOS F	38.2	272.2	1.00	1.01	18.2
11	T	394	2.0	0.899	68.8	LOS E	38.2	272.2	1.00	1.01	18.2
12	R	86	2.3	0.439	49.7	LOS D	6.2	44.6	0.79	0.74	22.8
Approach		561	2.1	0.899	66.8	LOS E	38.2	272.2	0.97	0.97	18.8
All Vehicles		2225	1.5	0.904	62.1	LOS E	38.9	274.9	0.95	0.92	19.6

Level of Service (Aver. Int. Delay): LOS E. Based on average delay for all vehicle movements. LOS Method: Delay (RTA NSW).
Level of Service (Worst Movement): LOS F. LOS Method for individual vehicle movements: Delay (RTA NSW).
Approach LOS values are based on average delay for all vehicle movements.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	Across S approach	109	41.8	LOS E	0.3	0.3	0.75	0.75
P3	Across E approach	311	30.7	LOS D	0.8	0.8	0.64	0.64
P5	Across N approach	38	38.2	LOS D	0.1	0.1	0.71	0.71
P7	Across W approach	162	38.9	LOS D	0.5	0.5	0.72	0.72
All Pedestrians		620	35.3				0.68	0.68

Level of Service (Aver. Int. Delay): LOS D. Based on average delay for all pedestrian movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS E. LOS Method for individual pedestrian movements: Delay (HCM).

MOVEMENT SUMMARY

Site: PM Stage B1

Carillon Ave - Missenden Rd
Signals - Fixed Time Cycle Time = 150 seconds

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South	Missenden Rd - Sth										
1	L	142	2.3	0.569	46.9	LOS D	22.9	163.5	0.86	0.86	23.9
2	T	241	2.1	0.568	40.5	LOS C	22.9	163.5	0.86	0.75	24.2
3	R	37	2.7	0.550	88.9	LOS F	4.1	29.2	1.00	0.75	15.9
Approach		420	2.2	0.568	46.9	LOS D	22.9	163.5	0.87	0.79	23.0
East	Carillon Ave - East										
4	L	41	2.4	0.829	69.0	LOS E	12.3	87.2	0.88	0.97	19.1
5	T	495	1.1	0.828	62.9	LOS E	28.4	200.8	0.97	0.92	19.3
6	R	108	1.0	0.920	67.9	LOS E	8.6	61.0	0.90	0.83	19.0
Approach		644	1.2	0.921	64.1	LOS E	28.4	200.8	0.95	0.91	19.2
North	Missenden Rd - Nth										
7	L	198	1.0	0.908	77.9	LOS F	40.7	287.1	1.00	1.08	17.7
8	T	315	1.0	0.907	71.5	LOS F	40.7	287.1	1.00	1.08	17.6
9	R	134	0.8	0.646	69.6	LOS E	11.1	78.2	0.98	0.83	18.7
Approach		647	1.0	0.907	73.0	LOS F	40.7	287.1	1.00	1.03	17.9
West	Carillon Ave - West										
10	L	82	2.5	0.917	78.7	LOS F	41.2	293.2	1.00	1.04	17.7
11	T	414	2.0	0.916	72.2	LOS F	41.2	293.2	1.00	1.04	17.6
12	R	91	2.3	0.461	49.1	LOS D	6.5	46.5	0.79	0.74	23.0
Approach		587	2.1	0.916	69.5	LOS E	41.2	293.2	0.97	1.00	18.3
All Vehicles		2298	1.5	0.920	64.9	LOS E	41.2	293.2	0.95	0.94	19.1

Level of Service (Aver. Int. Delay): LOS E. Based on average delay for all vehicle movements. LOS Method: Delay (RTA NSW).
Level of Service (Worst Movement): LOS F. LOS Method for individual vehicle movements: Delay (RTA NSW).
Approach LOS values are based on average delay for all vehicle movements.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	Across S approach	109	42.6	LOS E	0.3	0.3	0.75	0.75
P3	Across E approach	311	30.7	LOS D	0.8	0.8	0.64	0.64
P5	Across N approach	38	37.5	LOS D	0.1	0.1	0.71	0.71
P7	Across W approach	162	38.9	LOS D	0.5	0.5	0.72	0.72
All Pedestrians		620	35.3				0.68	0.68

Level of Service (Aver. Int. Delay): LOS D. Based on average delay for all pedestrian movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS E. LOS Method for individual pedestrian movements: Delay (HCM).

Appendix B

Vehicle Swept Paths

A3

A B C D E F G

1 2 3 4 5 6

STREET

ROAD

STREET

STREET

SUSAN

STREET

ROCHESTER

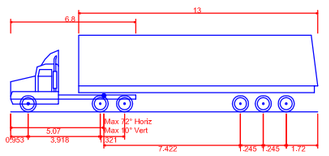
AUTO CONSOL 4916-151 COMPRISING
1 D P 66645
1 D P 74291
1 D P 79561
1 D P 79785
1 D P 116729
1 D P 133045
1 D P 721834

WB-15 - Semitrailer Combination

Legend

- Body Envelope
- Body Envelope Reverse
- 300mm Envelope
- 300mm Envelope Reverse
- 600mm Envelope
- 600mm Envelope Reverse

Design Vehicle(s)



WB-15 - Semitrailer Combination

Overall Length	16.703m
Overall Width	2.500m
Overall Body Height	4.150m
Min Body Ground Clearance	0.417m
Track Width	2.500m
Lock to Lock Time	6.00 sec
Curb to Curb Turning Radius	11.000m

Issue	Date	By	Chkd	Appd

ARUP

Arup, Level 10, 201 Kent St
Sydney, NSW, 2000
Tel +61(02)9320 9320 Fax +61(02)9320 9321
www.arup.com.au

Client
Rice Daubney

Job Title
Lifehouse Traffic

Drawing Title
Turning Paths

Scale at A3 1:400

Discipline

Drawing Status
Sketch

Job No	Drawing No	Issue
220147	**SKT016**	**A**

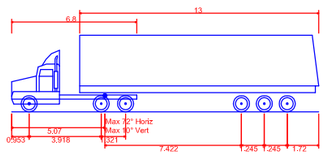
Do not scale

A3

Legend

- Body Envelope
- Body Envelope Reverse
- 300mm Envelope
- 300mm Envelope Reverse
- 600mm Envelope
- 600mm Envelope Reverse

Design Vehicle(s)



WB-15 - Semitrailer Combination

Overall Length	16.703m
Overall Width	2.500m
Overall Body Height	4.150m
Min Body Ground Clearance	0.417m
Track Width	2.500m
Lock to Lock Time	6.00 sec
Curb to Curb Turning Radius	11.000m

Issue	Date	By	Chkd	Appd

ARUP

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Sydney, NSW, 2000
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www.arup.com.au

Client
Rice Daubney

Job Title
Lifehouse Traffic

Drawing Title
Turning Paths

Scale at A3 1:400

Discipline

Drawing Status
Sketch

Job No	Drawing No	Issue
220147	**SKT017**	**A**

Do not scale