Royal Prince Alfred Hospital
North West Precinct Redevelopment
Transport Impact Assessment

transportation planning, design and delivery

1259004000 04/07/12

GTAconsultants

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North West Precinct Redevelopment

Transport Impact Assessment

Issue: A 04/07/12

Client: NSW Health Infrastructure
Reference: 12S9004000
GTA Consultants Office: NSW

Quality Record

Issue	Date	Description	Prepared By	Checked By	Approved By
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1. Introduction

1.1 Background

It is understood that NSW Health Infrastructure is proposing to construct a new Mental Health Facility and Ambulatory Services Building within the North West Precinct of the Royal Prince Alfred Hospital (RPAH) Campus. The location of the proposed development is on the western side of Missenden Road between Brodie Street and Lucas Street, Camperdown. Vehicular access is provided via these local roads adjacent to the southern and northern boundaries of the site.

The proposed Mental Health Facility is to accommodate a minimum of 67 psychiatry in-patients within a seven storey building with associated basement level car parking for 38 vehicles. The main structure will be located within the western section of the site, with the planned extension of New Hospital Road linking Brodie Street with Lucas Street adjacent to the western boundary of the site. A temporary car park is proposed east of the main structure, adjacent to Missenden Road. This site is subject to separate approval and is not considered as part of the proposed development.

1.2 Purpose of this Report

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

i existing traffic and parking conditions surrounding the site
ii existing public transport facilities and initiative surrounding the site
iii suitability of the proposed parking in terms of supply (quantum) and layout
iv service vehicle requirements
v pedestrian and bicycle requirements
vi the traffic generating characteristics of the proposed development
vii suitability of the proposed access arrangements for the site
viii the transport impact of the development proposal on the surrounding road network.

This study also considered the Director General's Requirements (DGR's) for the Environmental Assessment of the proposed development. The DGR's were issued by the NSW Government Department of Planning for the redevelopment of the North West Precinct of the RPAH Campus (MP 10_0166) on 22 October 2010. Section 4 of the document addresses the Transport and Accessibility Impacts, as detailed in Table 1.1.

Table 1.1: Director General's Requirements (DGRs)

DGR Number	Description
DGR 4.1	Demonstrate how users of the development will be able to make travel choices that support the achievement of relevant State Plan targets.
DGR 4.2	Detail the existing and proposed pedestrian and cycle movements within the vicinity of the site and determine the adequacy of the proposal to meet the likely future demand for increased public transport and pedestrian and cycle access.
DGR 4.3	Identify potential traffic impacts during the construction stage of the project, and measures to mitigate these impacts.
DGR 4.4	Travel demand management measures to be implemented 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.
DGR 4.5	Daily and peak traffic movements likely to be generated by the proposed development, including the impact on near intersections and the need /associated funding for upgrading or road improvement works (if required). The traffic impact assessment should consider base models with future traffic generated by the proposal and traffic generated for other approved and proposed major projects in the vicinity.
DGR 4.6	Details of the proposed access, parking provisions and service vehicle movements associated with the proposed development.
DGR 4.7	Minimal levels of on-site car parking for the proposed development having regard to the high public transport accessibility of the site, opportunities for car sharing, local planning controls and RTA guidelines (note: The Department supports reduced parking provisions, if adequate public transport is available to access the site).

1.3 References

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

- several inspections of the site and its surrounds
- NSW 2021: A Plan to make NSW number one, NSW Dept. of Premier and Cabinet, 2011
- City of Cities Metropolitan Strategy, NSW Government, 2005
- NSW Planning Guidelines for Walking and Cycling, NSW Government, 2004
- Guide to Traffic Generating Developments, Roads and Maritime Services (RMS), 2002
- City of Sydney, South Sydney Council Development Control Plan (DCP) 11, 1996
- City of Sydney, Draft Development Control Plan (DCP) 2010
- City of Sydney, Draft Local Environmental Plan (LEP) 2011
- The Chris O'Brien Lifehouse at RPA, Transport and Accessibility Impact Report, Arup, June 2010
- Australian Standard, Parking Facilities, Part 1: Off-Street Car Parking AS 2890.1:2004
- Australian Standard, Parking Facilities, Part 2: Off-Street Commercial Vehicle Facilities AS 2890.2:2002
- Australian Standard, Parking Facilities, Part 6: Off-Street Parking for People with Disabilities AS 2890.6:2009
- traffic and car parking surveys undertaken by GTA Consultants as referenced in the context of this report
- plans for the proposed development prepared by Peckvonhartel and Silver Thomas Hanley, Drawing Number SK0-099 – 105, Revision 1, dated 25 June 2012
- other documents and data as referenced in this report.

2. Existing Conditions

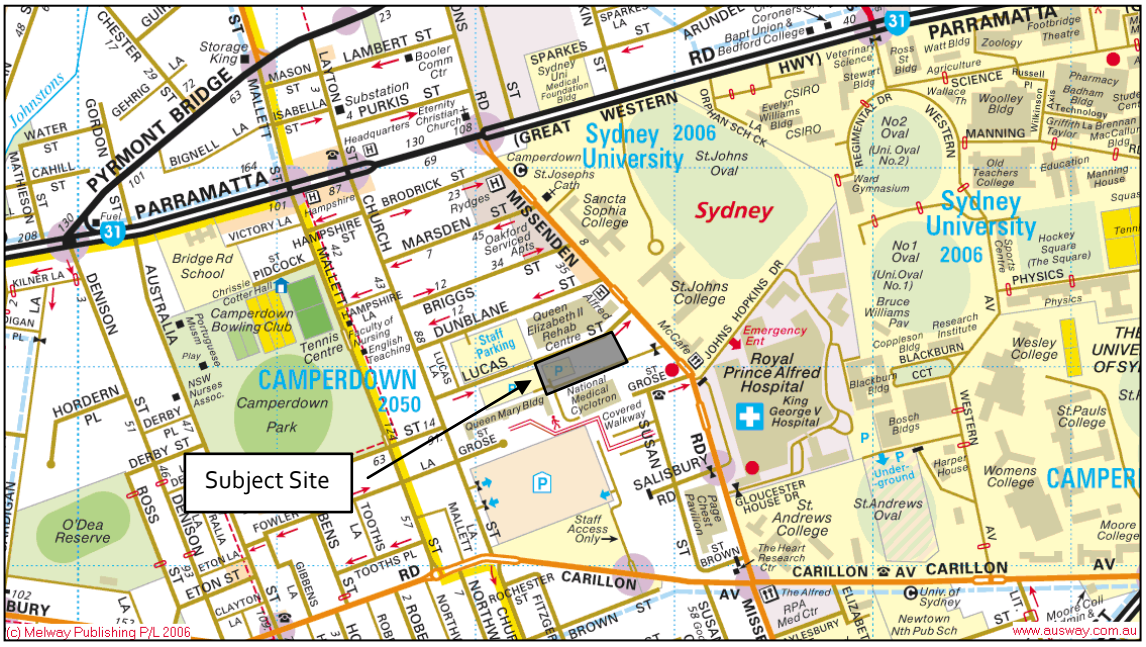
2.1 Site Description

The subject site is located at 67-73 Missenden Road, Camperdown. The site of approximately 6,000m^2 has a frontage of 55 metres to Missenden Road. The subject site forms part of the North West Precinct of the RPAH Campus and is currently occupied by a single building that accommodated a number of medical facilities including the outpatient's pharmacy and the RPAH School.

The surrounding properties predominantly include the RPAH Campus and associated medical facilities. St John's Residential College is located opposite the site on the eastern side of Missenden Road, with the broader local and surrounding regional area predominantly comprising a mix of retail, commercial and residential uses. A multi-storey staff car park is located west of the site, adjacent to Church Street.

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

Figure 2.1: Subject Site and Its Environs



Basemap source: Reproduced with permission from Sydway Publishing Pty Ltd)

2.2 Surrounding Development

The local area within and surrounding the RPAH Campus is subject to development activity, most notably, the following:

- Lifehouse at RPA is located south of the site and is currently under construction. Once completed by mid-2013, it will comprise a new cancer treatment and research facility with associated support facilities. Car parking is to be provided for 100 car spaces with access proposed via Susan Street, west of Missenden Road.
- The Queen Mary Building is located west of the site and has recently been granted approval for refurbishment to accommodate approximately 800 students and associated car parking for 30 vehicles. Construction on the site is yet to commence.

- It is understood that approval has recently been granted for a multi-storey car park with capacity for 1,000 vehicles, to be located on the RPAH West Campus located west of the King George V Building. The existing site comprises an at-grade staff/ visitor car park (west of Missenden Road with access via Salisbury Road). Staff access is to be via New Hospital Road (under security control) and visitor access via Salisbury Road.

2.3 Road Network

The subject site is well served by a number of arterial roads in the vicinity with Missenden Road and Carillon Avenue providing the main approach routes to the RPAH Campus. Parramatta Road is located north of the site and forms the major east-west traffic route through the area linking Sydney's CBD in the east with Parramatta in the west. Carillon Avenue and Salisbury Road combine to provide a secondary east-west traffic route, south of the site, linking City Road with Inner West suburbs west of the site.

2.3.1 Adjoining Roads

Missenden Road

Missenden Road is a collector road aligned in a north-south direction adjacent to the eastern boundary of the site. It is a two-way road configured with a four lane (one traffic lane and one parking lane in each direction), 11 metre wide carriageway, set within a 19 metre wide road reserve (approx).

Kerbside parking is permitted, subject to time restrictions on both sides of Missenden Road.

Missenden Road is shown in Figure 2.2 and Figure 2.3 and carries approximately 11,500 vehicles per day[1].

Lucas Street

Lucas Street is a local road and in the vicinity of the site is aligned in an east-west direction, travelling along the northern boundary of the site. It is a one-way eastbound road configured with a 2-lane (one traffic lane and one parking lane), 6 metre wide carriageway, set within a 10 metre wide road reserve (approx).

Kerbside parking is permitted, subject to time restrictions on the northern side of Lucas Street along the frontage of the site, and on the southern side west of the site.

Lucas Street is shown in Figure 2.4 and carries approximately 700 vehicles per day[1].

Brodie Street

Brodie Street is a private local road internal to the RPAH North West Precinct travelling along the southern boundary of the site. It is a one-way westbound road providing access via Missenden Road (under security control) to the site and surrounding RPAH services. Brodie Street is configured with one traffic lane with angled parking on both sides. It provides access to a number of facilities, including staff car parking and the Cyclotron building on the southern side of Brodie Street.

Brodie Street is shown in Figure 2.5.

1 Based on the peak hour traffic counts undertaken by GTA in March 2012 and assuming a peak-to-daily ratio of 8% for arterial roads and 10% for local roads.

Figure 2.2: Missenden Road (looking north)

Figure 2.3: Missenden Road (looking south)

Figure 2.4: Lucas Street (looking west)

Figure 2.5: Brodie Street (looking west)

2.3.2 Surrounding Intersections

The following intersections currently exist in the immediate vicinity of the site:

- Missenden Road/ Lucas Street (unsignalised)
- Missenden Road/ Brodie Street (unsignalised).

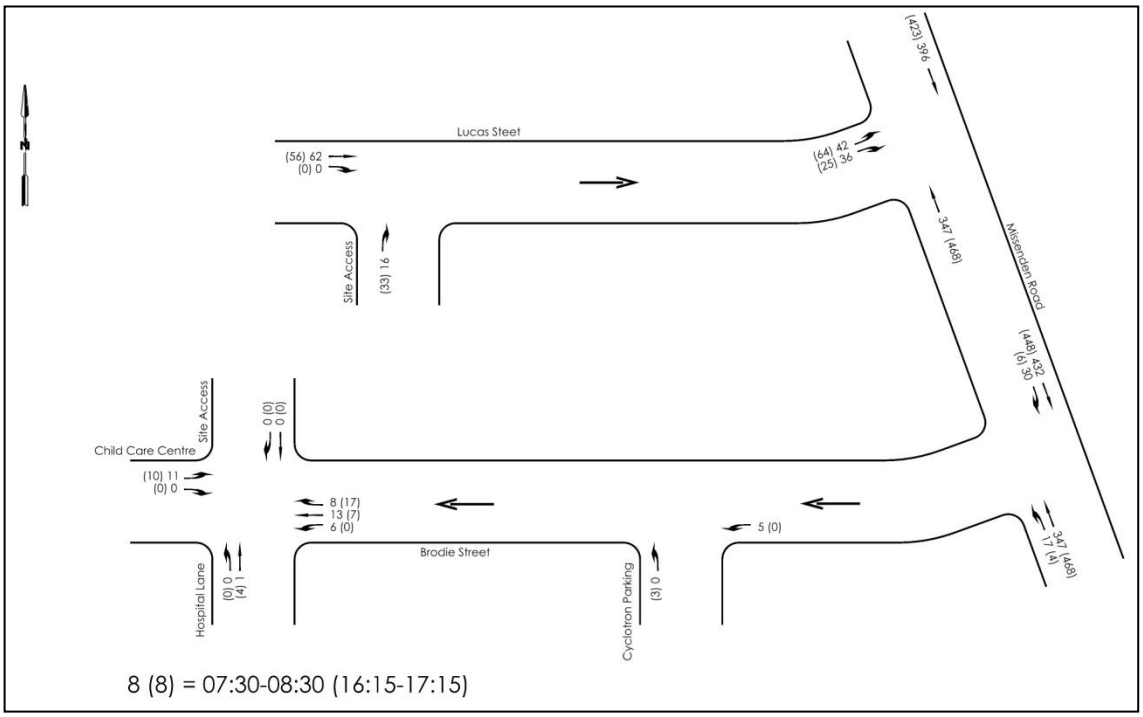
2.4 Traffic Volumes

GTA Consultants undertook traffic movement counts on key roads in the vicinity of the site during the following peak periods:

- 4:00pm and 6:00pm (Tuesday 27 March 2012)
- 7:30am and 9:30am (Wednesday 28 March 2012).

The AM and PM peak hour traffic volumes are summarised in Figure 2.6, with full results contained in Appendix A.

Figure 2.6: Existing AM / PM Peak Hour Traffic Volumes



2.5 Intersection Operation

The operation of the key intersections within the study area have been assessed using SIDRA INTERSECTION[2], a computer based modelling package which calculates intersection performance.

The commonly used measure of intersection performance, as defined by the RMS, is vehicle delay. SIDRA INTERSECTION determines the average delay that vehicles encounter and provides a measure of the level of service.

Table 2.1 shows the criteria that SIDRA INTERSECTION adopts in assessing the level of service.

Table 2.1: SIDRA INTERSECTION Level of Service Criteria

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

[2] Program used under license from Akcelik & Associates Pty Ltd.

Table 2.2 presents a summary of the existing operation of the intersection, with full results presented in Appendix B of this report.

Table 2.2: Existing Operating Conditions

Intersection	Peak	Leg	Degree of Saturation (DOS)	Average Delay (sec)	95th Percentile Queue (m)	Level of Service (LOS)
Missenden Road/ Lucas Street	AM	South	0.19	0	0	A
		North	0.22	0	0	
		West	0.08	11	2	
	PM	South	0.26	0	0	A
		North	0.24	0	0	
		West	0.13	11	2	
Missenden Road/ Brodie Street	AM	South	0.20	0	0	A
		North	0.27	3	18	
		West	0.00	0	0	
	PM	South	0.26	0	0	A
		North	0.26	4	20	
		West	0.00	0	0	

On the basis of the above assessment, the intersections of Missenden Road/ Lucas Street and Missenden Road/ Brodie Street currently operate satisfactorily with short delays on the north approach of Missenden Road.

2.6 Car Parking

Several car parking areas are available within the grounds of the RPAH Campus. The main multi-storey staff car park is located west of the site, with access provided via New Hospital Road and Grose Street. On-street public parking is generally subject to time restrictions with at-grade off-street public car parks located opposite the site, on the eastern side of Missenden Road and south of the site, with access provided via Salisbury Road (at Missenden Road).

Various other at-grade staff car parking facilities are provided within close proximity to the site, as shown in Figure 2.7.

Figure 2.7: Car Parking Facilities

Basemap source: Google Earth

2.6.1 Supply

A site visit by GTA Consultants identified a total of 65 off-street staff car parking spaces and 76 on-street staff car parking spaces surrounding the subject site.

2.6.2 Demand

GTA Consultants conducted car parking demand surveys within the nominated areas at the time of the traffic surveys (7:30am – 9:30am and 4:00pm – 6:00pm), with the results summarised in Table 2.3 and Table 2.4.

Table 2.3: Summary of Weekday AM Parking Demand

Location	Supply (No of spaces)	Peak Demand (Vehicles)				Minimum Vacancies at 9:00am*
		7:30	8:00	8:30	9:00	
Cyclotron	15	4	7	9	11	4
Child Care	22	10	7	11	10	11
On-site Car Park	28	9	9	11	13	15
Brodie Street (N)	39	26	29	35	38	1
Brodie Street (S)	27	14	17	18	22	5
New Hospital Rd	10	7	13	13	13	0
Total	**141**	**70**	**82**	**97**	**107**	**37**
% Occupancy	-	50%	58%	69%	76%	-
Vacancies	-	71	59	44	34	-

* Peak demand for whole of study area

Table 2.4: Summary of Weekday PM Parking Demand

Location	Supply (No of spaces)	Peak Demand (Vehicles)					Minimum Vacancies at 4:00pm
		4:00	4:30	5:00	5:30	6:00	
Cyclotron	15	13	11	9	7	5	2
Child Care	22	8	6	4	3	0	14
On-site Car Park	28	12	11	8	8	8	16
Brodie Street (N)	39	24	19	14	12	13	15
Brodie Street (S)	27	20	16	15	14	12	7
New Hospital Rd	10	13	11	11	10	9	0
Total	**141**	**90**	**74**	**61**	**54**	**47**	**54**
% Occupancy		64%	53%	43%	39%	33%	-
Vacancies		51	67	80	87	94	-

* Peak demand for whole of study area

Table 2.3 and Table 2.4 indicate that car parking demand within the vicinity of the site remains moderately high, with peak demand equal to an occupancy rate of 76% (37 vacancies). It is worth noting that New Hospital Road, south of the site is generally at (or in excess of) capacity during throughout the day with Brodie Street also experiencing heavy demand for parking.

2.7 Public Transport

2.7.1 Rail Network

The site is located within approximately 1 kilometre of Newtown Railway Station, representing an easy 10-15 minute walk. Newtown Station is a key link in the City Rail network and operates regular train services to/ from multiple destinations with weekday peak services operating at 5-8 minute intervals.

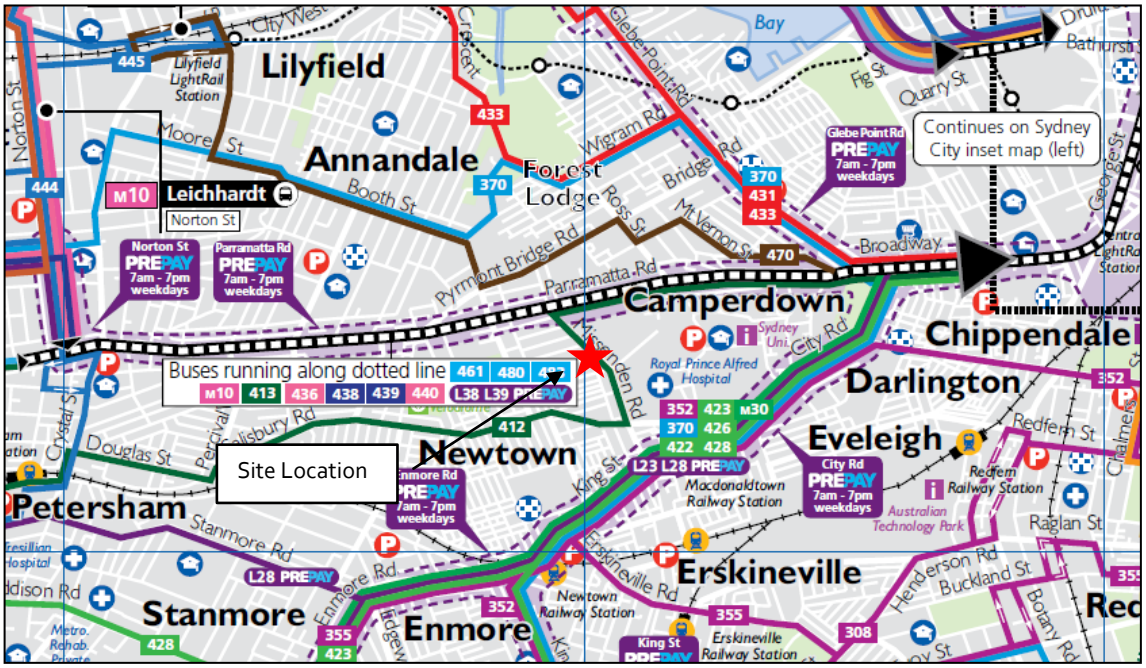
2.7.2 Bus Services

Sydney Buses operate a significant number of bus services in the vicinity of the site with Parramatta Road (north of the site) and King Street (south of the site) forming key major routes in the Sydney bus network. A review of the bus services available in the vicinity of the site is summarised below and illustrated in Figure 2.8.

- Parramatta Road - up to 12 bus services
- King Street/ City Road - 6 bus services
- Missenden Road - bus route 412, Campsie to City.

Bus shelters and bus stops are located along Missenden Road in the vicinity of the site with the closest stop approximately 30 metres south of the site, on the western side of Missenden Road.

Figure 2.8: Bus Network Map



Source: http://www.131500.com.au/maps/upload/docs/R6_southern_region_guide_map.pdf

2.8 Pedestrian Infrastructure

There are well established existing pedestrian paths in the vicinity of the site. Missenden Road generally provides 5 metre wide paths on both sides to cater for existing heavy pedestrian activity associated with RPAH, Sydney University and other surrounding retail/ commercial activity.

Safe crossing points include marked pedestrian crossings on Missenden Road 50 metres north and south of the site.

Lucas Street and Brodie Street each provide 2 metre wide pedestrian paths on each side to serve existing pedestrian demand generated by staff parking within the security controlled car park facilities both in the immediate vicinity of the site (Brodie Street) and west of the site within the RPAH Campus. It is also understood that Brodie Street and to a lesser extent, Lucas Street will become primary pedestrian routes between the redeveloped Queen Mary Building (for student accommodation) and the University of Sydney and St John's College. The development of the subject site will also strengthen this pedestrian environment.

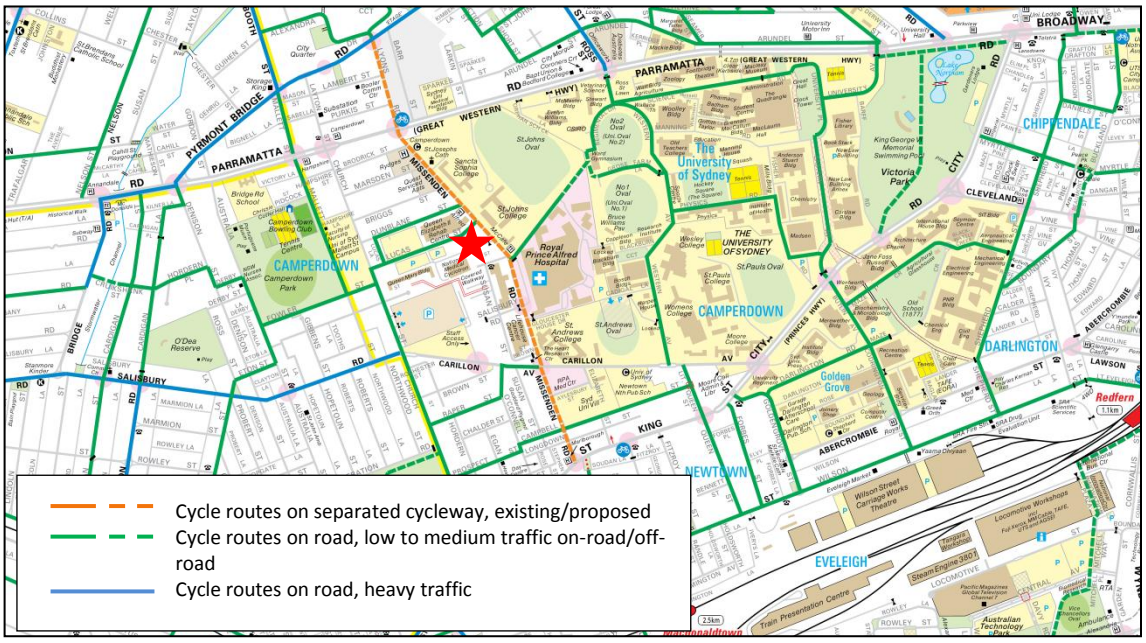
2.9 Cycle Infrastructure

GTA Consultants completed the Missenden Road Cycleway Study in February 2010 which detailed the design for a separated two-way cycleway along Missenden Road and Lyons Road (north of Parramatta Road) connecting King Street in the south with Pyrmont Bridge Road in the north.

Lucas Street forms part of the City of Sydney's cycle network and operates as mixed traffic conditions however is currently unmarked. Lucas Street is proposed to become a contra-flow bicycle lane to connect the proposed Missenden Road cycleway and Church Street, west of the site.

The cycling network in the vicinity of the site is shown in Figure 2.9.

Figure 2.9: Cycling network in the vicinity of subject site



Source: http://www.sydneycycleways.net/documents/maps/Cycling-Map-Section-C.pdf

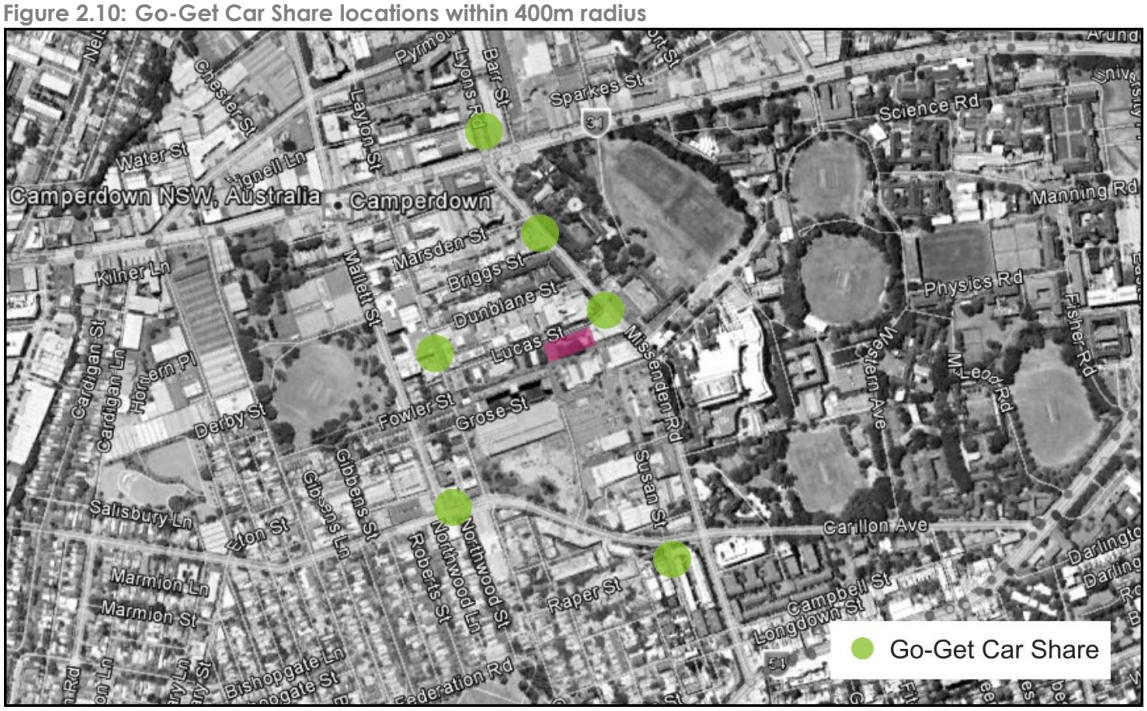
2.10 Local Car Sharing Initiatives

A number of Go-Get car sharing pods are located in the vicinity of the site as detailed in Table 2.5 and shown in Figure 2.10.

Table 2.5: Go-Get Car Share Facilities

Location	Distance from Site
Lucas Street	<10m
Missenden Road	150m
Lyons Road	350m
Church Street	250m
Salisbury Road	350m
Susan Street	350m

Figure 2.10: Go-Get Car Share locations within 400m radius



Basemap source: Google Earth

2.11 Mode Split Patterns

The 2006 Journey to Work (JTW) data for the travel zone incorporating the RPAH Campus has been assessed, with the mode split detailed in Table 2.6.

Table 2.6: Existing Journey to Work Mode Split

Mode	Total Trips	Proportion of Total Trips
Car driver/passenger	2,636	62.4%
Train	511	12.1%
Walk	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	**4,223**	**100%**

Source: Arup, 2010

The JTW analysis indicates that a large percentage of employees within the travel zone incorporating RPAH drive to work, however a significant number or people utilise public transport or walk, with a smaller number of people cycling. There is a significant potential to increase the public transport mode share as a result of the site being within close proximity to bus services and railway stations.

To further understand the JTW data, the worker origin location within a 10km radius for journeys into the travel zone is assessed and detailed in Table 2.7.

Table 2.7: Origin Location of Workers (within 10km radius)

Origin	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**	-

Source: Arup, 2010

The analysis indicates that 50% of workers arriving in the travel zone originate within a 10km radius; an acceptable commuter cycling distance. There is therefore opportunity to increase the mode share of cycling for workers to the travel zone with a general improvement cycling facilities. Further, the improved use of public transport and potential for increase in cycling as a mode of transport aids the reduction in the future demand for car parking spaces in the vicinity of the site.

3. Development Proposal

3.1 Land Uses

The proposal includes the construction of a Mental Health Facility and Ambulatory Services Building within the North West Precinct of the RPAH Campus, Camperdown. This will involve the construction of a new seven storey building designed to accommodate a number of uses, including accommodation for a minimum of 67 psychiatry in-patients.

It is proposed to provide for ambulatory care services over the lower three levels including mental health, renal, sexual health and child and family. Mental health services are proposed over the upper two levels and include acute care, high dependency units and mental health specialists with a maximum Gross Floor Area (GFA) of approximately 14,000m^2, as summarised in Table 3.1.

Table 3.1: Development Schedule

Level	Primary Uses	Size
Basement	Car Park	-
Ground	Physical therapies, eating disorders, ancillary uses	1,698m^2
Level 1	Renal	1,921m^2
Level 2	Child and family, sexual health, nutrition	2,885m^2
Level 3	Acute care, psychiatry	2,720m^2
Level 4	Mental health, education and research	2,292m^2
Level 5	Mental health	1,986m^2
Level 6	Plant and services	-
	Total	**13,502m^2**

3.2 Vehicle Access

It is proposed to provide access to the site via Lucas Street and Brodie Street. The basement level car park will be accessed via Lucas Street, with the entry forecourt designed for entry/ exit via Brodie Street and entry only via Lucas Street adjacent to the eastern boundary of the site. All servicing will be via Brodie Street, specifically a mid-block secure area for access by police vehicles (for specific psychiatric admissions) and a loading dock located adjacent to the western boundary of the site.

The suitability of the proposed access arrangements is discussed in Section 4 of this report.

3.3 Car Parking

Plans prepared by Silver Thomas Hanley and peckvonhartel architects indicate the proposed provision of 38 on-site car parking spaces accommodated within a basement level car park. The entry forecourt is designed to accommodate parking for one bariatric ambulance, with short stay parking for two vehicles, close to Brodie Street.

The suitability of the car parking provision and layout is discussed in Section 4 of this report.

3.4 Pedestrian Facilities

Pedestrian access to the site is proposed along Lucas Street and Brodie Street for staff, visitors and patients in the vicinity of the entry forecourt adjacent to the eastern boundary of the site.

The suitability of the proposed pedestrian facilities is discussed in Section 5 of this report.

3.5 Bicycle Facilities

Bicycle storage space is proposed within the basement car park, close to the Lucas Street entry/ exit driveway. It is understood that a bike rack or rails capable of holding in excess of 20 bikes will be provided at the western end of the car park, adjacent to a lift well. In addition, end-of-trip facilities include provision for 3 showers split into 3 separate uses (male/ female/ disabled). It is understood that lockers will be provided for staff.

It is recommended that the proposed development also include options for visitor bicycle parking to be located adjacent to the site along the Lucas Street frontage and particularly the Brodie Street frontage. These bicycle facilities would include space-efficient storage systems together with o-rings on existing and/ or proposed structures along each street.

3.6 Loading Areas

Loading facilities are proposed to be located adjacent to the western boundary of the site and have been designed to accommodate vehicles up to 8.8m medium rigid vehicles. All servicing and garbage collection will occur within the loading dock with access via Brodie Street.

The suitability of the proposed loading arrangements is discussed in Section 6 of this report.

4. Car Parking

4.1 Car Parking Requirements

The *Guide to Traffic Generating Developments* (RMS, 2002) outlines applicable car parking rates for various land uses. In this case, private hospital developments represents the closest land use with the Peak Parking Accumulation (PPA) estimated using the following formula:

Peak Parking Accumulation = -19.56 + 0.85B + 0.27ASDS where 'B' represents the number of beds proposed and 'ASDS' is the average staff per day shift.

Application of the RMS formula establishes a parking provision for the proposed development of 65 car parking spaces, while also recognising that additional administrative and ancillary uses will also add to the on-site parking requirement.

It is, however, considered that given the location of the site to public transport services and active travel facilities, as well as the complex nature of the on-site uses and associated user (patient, staff and visitor) movements to/ from the proposed development, the application of typical car parking rates is not a suitable assessment methodology. Instead, a first principles analysis adopting the proposed basement level car parking spaces has been used in this instance to establish likely travel patterns. Given this, the development proposes a total of 38 car parking spaces and is expected to be capable of accommodating the car parking demands associated with the proposed development.

Minimising the supply of off-street car parking is consistent with the NSW State Plan targets and the City of Sydney's strategic objectives, assist with encouraging non-car mode choice and reduces the likely traffic impact on the surrounding road network.

4.2 Car Parking and Site Layout Review

The car park layout has been reviewed against the requirements of the Australian Standard for Off Street Car Parking (AS2890.1:2004 and AS2890.6:2009). This assessment included, however was not limited to, a review of the bay and aisle widths, adjacent structures, car park circulation, set-down/ pick-up area and parking for persons with disabilities.

This review indicates that the proposed car parking layout is expected to operate satisfactorily. The car parking bays are proposed to be 5.4 metres long by 2.6 metres wide with an aisle width of 6.2 metres in accordance with Australian Standard (AS2890.1:2004). The two-way ramps are proposed to be 5.5 metres wide with a maximum ramp gradient of 1:8.

It is proposed to provide a 'shared zone' within Brodie Street to allow appropriate access through the local area for pedestrians and vehicles alike. This; combined with the reduction in width of Brodie Street to accommodate the realigned building to take advantage of the southern site boundary results in the loss of angled staff parking. Staff will have the opportunity to park either on-site within the basement level car park, or within other dedicated staff car parks located within the RPAH Campus.

Brodie Street will also be open to two-way traffic west of the entry forecourt while maintaining one-way westbound access via Missenden Road at the eastern end.

Swept paths illustrating vehicles manoeuvring to/ from the loading dock via Brodie Street and New Hospital Road are included in this report as Appendix C.

5. Sustainable Transport

The NSW State Plan 2010 includes the following transport targets:

- Increase in 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 discussed below.

5.1 Public Transport

The site is accessible by a number of public transport services, with a bus stop located within 300m of the site and Newtown Railway Station within a 10-15 minute walk.

Sydney Buses provide numerous bus services in the vicinity of the site, primarily along the major east-west corridors including Parramatta Road north of the site and King Street/ City Road south of the site. Each of these is located within approximately 500m of the site. In addition, bus route 412 (Campsie to Sydney CBD) travels along Missenden Road adjacent to the eastern boundary of the site. It operates at regular intervals of between 15 and 20 minutes during the weekday AM and PM peak periods. The proximity, frequency and network connectivity of these existing services provides efficient and convenient access for people arriving to the site (staff/ visitors).

5.2 Walking and Cycling Network

The site is well located for people arriving by walking or cycling. Strong pedestrian links within the RPAH Campus and the adjacent Sydney University Campus link the site with the surrounding local and regional environment.

GTA Consultants provided design plans and reporting in February 2010 supporting the implementation of a separated cycleway along the eastern alignment of Missenden Road. This facility was designed to service existing demand in the local and regional area, particularly associated with the RPAH Campus and adjoining Sydney University Campus. It is however understood that this project is not part of the City of Sydney's six-year cycleway construction program and may be considered a medium term prospect.

Lucas Street does however form part of the City of Sydney's cycle network and is planned to operate as marked and signposted mixed traffic conditions.

As discussed, the proposed development includes provision of a 'shared zone' within Brodie Street between Missenden Road and New Hospital Road. This will further strengthen the pedestrian links between the proposed redevelopment of the Queen Mary Building for student accommodation (west of the site) and St John's College and Sydney University, located east of the site. This shared zone will include a raised road surface with variable pavement type to enforce the shared priority between vehicles, pedestrians and cyclists.

In addition, it is worth noting that current Journey to Work data for the RPAH Campus indicates that approximately 13% of full-time workers arrive to the precinct via either walking or cycling. This can be compared with the broader Sydney region with just 4.8%.

5.3 Green Travel Plan

With a variety of easily accessible transport options available to staff and visitors, a Green Travel Plan (and associated Transport Access Guide) will be prepared for the proposed development. A Green Travel Plan will further help encourage staff and visitors to use environmentally forms of travel and will include the following:

- review of public transport within the vicinity of the site
- review of walking and cycling network within the vicinity of the site
- transport information booklet available to staff and visitors
- website details to convey the available transport options.

Further, the implementation of workplace Green Travel Plans can also provide financial benefits to employers, employees and the community as detailed below:

i Employer – reduction in parking costs, recruitment costs, absenteeism, fleet management costs, and increase in productivity.

ii Employee – reduction in private vehicle operating costs, increase in health and fitness, improved staff moral and social interaction.

iii Community – reduction in road trauma costs, road traffic congestion, air pollution, greenhouse gas emissions, traffic noise and water pollution, an increase in health and fitness levels due to exercise and improved sense of community as a result of walking and cycling activity.

As discussed in Section 2, opportunities to further reduce reliance on the private vehicle is evident with the expansion of car sharing initiatives, particularly Go-Get. A total of 6 Go-Get car share facilities are located within 350m of the site and further emphasise the diverse range of transport options available to staff and visitors to the site.

6. Loading Facilities

6.1 Proposed Loading Arrangements

A loading area is proposed to be located adjacent to the western boundary of the site. Access into this loading area is provided via Brodie Street with the design allowing for vehicles up to an 8.8m medium rigid vehicle to reverse into and exit in a forward direction.

Given the on-site uses and the discussion in Section 6.2, the provision of one loading bay is considered appropriate for the servicing requirements of the proposed development. It is also understood that the bulk oxygen store, to be relocated from within the property boundary to a location west of the Cyclotron Building (adjacent to New Hospital Road) will require servicing using a 13.3m articulated vehicle, using dimensions as provided by BOC. Access to this facility and the on-site loading dock will be via New Hospital Road to the south, or Brodie Street via Missenden Road. Service vehicles will exit the area via New Hospital Road to the south or Lucas Street to the north.

6.2 Garbage Collection Arrangements

Kerbside and loading dock garbage collection are proposed as part of the development. Discussions with the RPAH confirm that the garbage collection arrangements will be operated via the main RPAH environmental services department located on the eastern side of Missenden Road (Level 2 Building 89, RPAH) Campus). It is understood that Sita will operate garbage collection vehicles up to 8.8m medium rigid vehicles with RPAH also operating specially designed 'tugs' to ensure the efficiency between all sites within the RPAH Campus.

It should be noted that the RPAH Campus provides a focus on waste minimisation through efficient waste management services and, as such are able to provide waste services for a variety of medical uses including clinical waste, general (dry) waste, recyclables and sharps.

7. Traffic Impact Assessment

7.1 Traffic Generation

7.1.1 Design Rates

For private hospitals, the *Guide to Traffic Generating Developments* (RMS, 2002) recommends the following trip generation rates:

- Peak Vehicle Trips (PVT) = -14.69 + 0.69B + 0.31ASDS
- Morning Vehicle Trips (MVT) = -10.21 + 0.47B + 0.06ASDS
- Evening Vehicle Trips (EVT) = -2.84 + 0.25B + 0.40ASDS.

where 'B' represents the number of beds proposed and 'ASDS' is the average staff per day shift.

The trip generation rates were developed using survey data collected by the RMS in 1994 from 19 private hospitals across the Sydney region. The hospitals surveyed had between 30 to 99 beds and an average day shift workforce of between 10 and 102 employees.

Of the 19 hospitals surveyed, the majority recorded their respective daily traffic peak (or PVT) between 3:00pm and 4:00pm. This time period generally coincided with a staff shift change at the surveyed hospitals and would coincide with the start of the on-road peak in the vicinity of the site.

It should also be noted that of the 19 hospitals surveyed, an average of 87.4% of people travelling to each hospital did so by private motor vehicle and the mode share attributed to car-based trips ranged from 67.3% to 98.2%. Average vehicle occupancy was 1.3 persons per vehicle.

Application of the RMS rates to the proposed development comprising 67 beds and an envisaged day shift staffing of 100 employees would generate:

- 62 vehicle trips during the afternoon peak (3:00pm-4:00pm)
- 26 vehicle trips during the morning peak (8:00am-9:00am)
- 54 vehicle trips during the evening peak (5:15pm-6:15pm).

7.2 Distribution and Assignment

For the distribution of development traffic, the following assumptions were applied in order to present a conservative assessment:

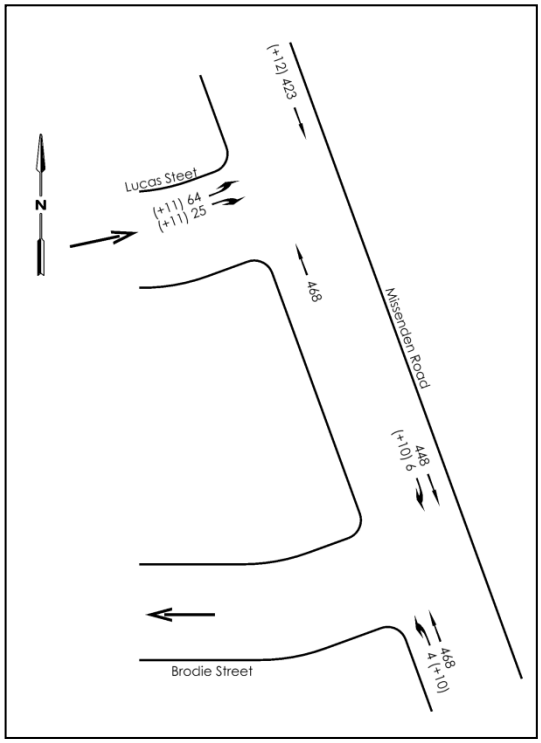
- All traffic would arrive generally evenly from the south (New Hospital Road), the north and east (Missenden Road/ Brodie Street) and the west (Lucas Street).
- All traffic would depart generally evenly to the south (New Hospital Road), the north and the east (Missenden Road).
- During the morning peak, 60% of development traffic would be inbound and 40% of development traffic would be outbound.
- During the afternoon and evening peak, 40% of development traffic would be inbound and 60% of development traffic would be outbound.

Application of these in/out percentage splits to the estimated development traffic would result in the following:

- morning peak – 11 vehicles inbound, 7 vehicles outbound
- afternoon peak – 37 vehicles inbound, 25 vehicles outbound
- evening peak – 32 vehicles inbound, 22 vehicles outbound.

The trip distribution and assignment associated with the afternoon/ evening peak is presented in Figure 7.1 and have been prepared to show the estimated marginal increase in turning movements at the Missenden Road intersections site following full site development.

Figure 7.1: Existing PM Peak Hour Traffic Volumes plus Site Generated Traffic



7.3 Traffic Impact

Given the negligible increase in traffic volumes associated with the proposed development, traffic associated with the redevelopment of the Queen Mary Building west of the site has not been considered as part of the future traffic assessment. This is a result of the known low traffic volumes anticipated to be generated by the 30 on-site car spaces, with traffic largely distributed away from the RPAH Campus.

In addition, an increase in north-south traffic volumes along Missenden Road as a result of the Lifehouse at RPA development and the future multi-deck car park to be located west of the King George V Building have not been modelled using SIDRA INTERSECTION analysis.

Against existing traffic volumes in the vicinity of the site, the additional traffic generated by the proposed development could not be expected to compromise the safety or function of the surrounding road network and as such, no road upgrading or intersection works are warranted as part of the proposed development.

The future operation of the study intersections are detailed in Table 7.1.

Table 7.1: Future Operation Conditions

Intersection	Peak	Leg	Degree of Saturation (DOS)	Average Delay (sec)	95th Percentile Queue (m)	Level of Service (LOS)
Missenden Road/ Lucas Street	PM	South	0.26	0	0	A
		North	0.24	0	0	
		West	0.16	12	3	
Missenden Road/ Brodie Street	PM	South	0.27	0	0	A
		North	0.26	4	21	
		West	0.00	0	0	

8. Conclusion

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

i The proposed development is located within the North West Precinct of the RPAH Campus and is well served by existing public transport services.

ii The site is accessible by a number of public transport services, with a bus stop located within 300m of the site and two major railway stations within a 15 minute walk.

iii Current Journey to Work data for the RPAH Campus indicates that approximately 13% of full-time workers arrive to the precinct via either walking or cycling. This can be compared with the broader Sydney region with just 4.8%.

iv The development proposes on-site parking to be located within a basement level car park with access via Lucas Street. An entry forecourt will provide for emergency services and passenger set-down/ pick-up.

v The proposed supply of 38 spaces is appropriate given the proximity of the site to various public transport services and active travel facilities.

vi The proposed parking layout is consistent with the dimensional requirements as set out in the Australian Standard for Off Street Car Parking (AS/NZS2890.1:2004 and AS/NZS2890.6:2009.

vii The provision for bicycle facilities and end of trip facilities is considered appropriate with consideration to the requirements of the relevant DCP. It is recommended that the proposed development also include options for visitor bicycle parking to be located adjacent to the site along the Lucas Street and particularly the Brodie Street frontages.

viii The implementation of a Green Travel Plan (and associated Transport Access Guide) will further reduce reliance on the private vehicle for staff and visitors.

ix The provision of loading facilities accommodating one vehicle up to an 8.8m medium rigid vehicle with access provided via Brodie Street is appropriate given the anticipated loading requirements of the proposed development together with waste management and minimisation services provided by RPAH.

x The site is expected to generate up to 49 vehicle movements in any peak hour.

xi There is adequate capacity in the surrounding road network to cater for the traffic generated by the proposed development.

xii Provision is made for all access arrangements to the site to operate safely and efficiently with adequate sight lines and design principles considered as part of the design process.

Appendix A

Survey Results

TURNING MOVEMENT SURVEY

Flower Street / Hospital Lane, Camperdown

Date: Wednesday 27/03/2012

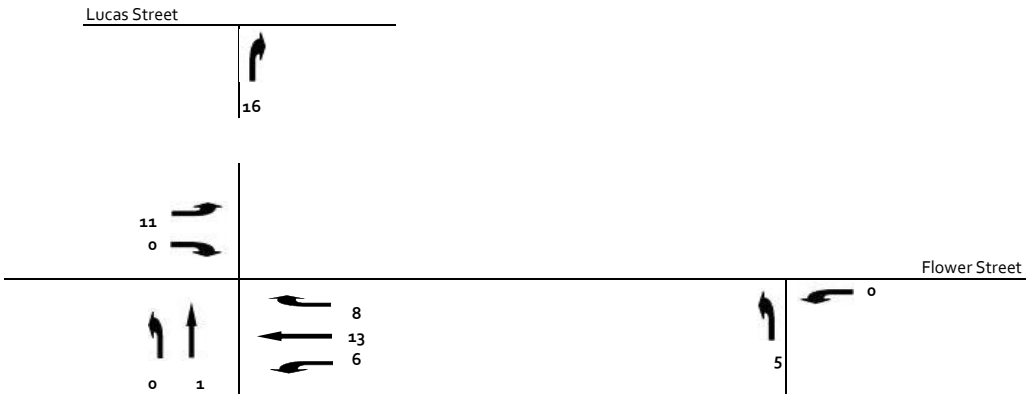
15 minute Data

Time	Hospital Lane		Flower Street (E)			Car Park		Flower Street (W)		Total	Lucas Street Access		Cyclotron Car Park Access	
	South Approach		East Approach			North Approach		West Approach						
	Left	Through	Left	Through	Right	Through	Right	Left	Right		In	Out	In	Out
6:00-6:15														
6:15-6:30														
6:30-6:45														
6:45-7:00														
7:00-7:15														
7:15-7:30														
7:30-7:45	0	0	5	2	2	0	0	2	0	11	0	4	0	1
7:45-8:00	0	0	0	1	2	0	0	3	0	6	0	5	0	2
8:00-8:15	0	1	1	6	4	0	0	4	0	16	0	5	0	1
8:15-8:30	0	0	0	4	0	0	0	2	0	6	0	2	0	1
8:30-8:45	0	0	0	3	1	0	0	3	0	7	0	4	0	2
8:45-9:00	0	0	0	3	1	0	0	3	0	7	0	2	0	0
9:00-9:15	0	0	1	0	3	0	0	1	0	5	0	1	0	0
9:15-9:30														
9:30-9:45														
9:45-10:00														
Total	0	1	7	19	13	0	0	18	0	58	0	23	0	7

Hourly flows

Time	Movement													
	Hospital Lane		Flower Street (E)			Car Park		Flower Street (W)		Total	Lucas Street Access		Cyclotron Car Park Access	
	South Approach		East Approach			North Approach		West Approach						
	Left	Through	Left	Through	Right	Through	Right	Left	Right		In	Out	In	Out
6:00-7:00														
6:15-7:15														
6:30-7:30														
6:45-7:45														
7:00-8:00														
7:15-8:15														
7:30-8:30	0	1	6	13	8	0	0	11	0	74	0	16	0	5
7:45-8:45	0	1	1	14	7	0	0	12	0	66	0	16	0	6
8:00-9:00	0	1	1	16	6	0	0	12	0	62	0	13	0	4
8:15-9:15	0	0	1	10	5	0	0	9	0	59	0	9	0	3
8:30-9:30														
8:45-9:45														
9:00-10:00														

Peak Hour 07:30 - 08:30



TURNING MOVEMENT SURVEY

Intersection of Missenden Rd & Flower St, Camperdown

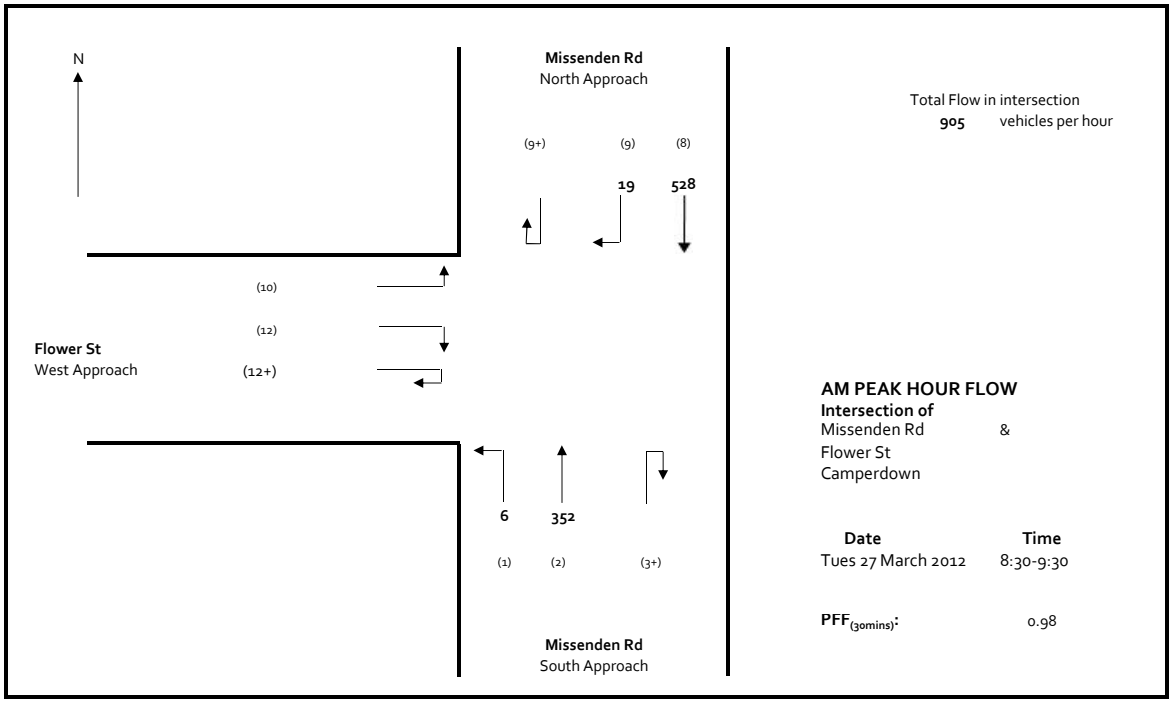
Date: Tues 27 March 2012

15 minute Data

Time	Movement									Total
	Missenden Rd South Approach			Missenden Rd North Approach			Flower St West Approach			
	Left 1	Through 2	U Turn 3+	Through 8	Right 9	U Turn 9+	Left 10	Right 12	U Turn 12+	
6:00-6:15										
6:15-6:30										
6:30-6:45										
6:45-7:00										
7:00-7:15										
7:15-7:30										
7:30-7:45	2	78		108	8					196
7:45-8:00	2	93		112	9					216
8:00-8:15	10	79		85	7					181
8:15-8:30	3	97		127	6					233
8:30-8:45	0	66		129	7					202
8:45-9:00	1	89		148	5					243
9:00-9:15	1	91		118	3					213
9:15-9:30	4	106		133	4					247
9:30-9:45										
9:45-10:00										
Total	23	699	0	960	49	0	0	0	0	1731

Hourly flows

	Time	Movement									Total	
		Missenden Rd South Approach			Missenden Rd North Approach			Flower St West Approach				
		Left 1	Through 2	U Turn 3+	Through 8	Right 9	U Turn 9+	Left 10	Right 12	U Turn 12+		
	6:00-7:00											
	6:15-7:15											
	6:30-7:30											
	6:45-7:45											
	7:00-8:00											
	7:15-8:15											
	7:30-8:30	17	347		432	30					826	
	7:45-8:45	15	335		453	29					832	
	8:00-9:00	14	331		489	25					859	
	8:15-9:15	5	343		522	21					891	
Peak	8:30-9:30	6	352		528	19					905	Peak
	8:45-9:45											
	9:00-10:00											
	Peak Hour	6	352		528	19					905	



TURNING MOVEMENT SURVEY

Intersection of Missenden Rd & Flower St, Camperdown

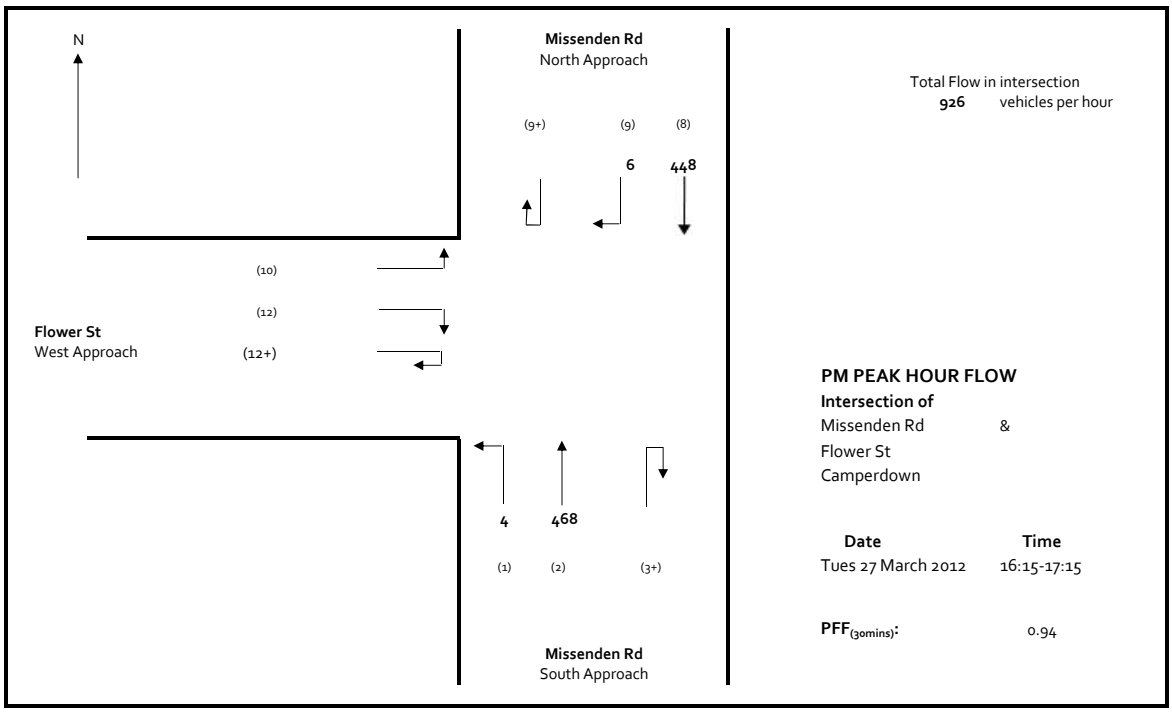
Date: Tues 27 March 2012

15 minute Data

Time	Movement									Total
	Missenden Rd South Approach			Missenden Rd North Approach			Flower St West Approach			
	Left	Through	U Turn	Through	Right	U Turn	Left	Right	U Turn	
	1	2	3+	8	9	9+	10	12	12+	
15:00-15:15										
15:15-15:30										
15:30-15:45										
15:45-16:00										
16:00-16:15	3	104		113	1					221
16:15-16:30	2	99		125	1					227
16:30-16:45	2	147		112	4					265
16:45-17:00	0	94		104	0					198
17:00-17:15	0	128		107	1					236
17:15-17:30	3	93		107	0					203
17:30-17:45	2	108		104	1					215
17:45-18:00	1	107		137	0					245
18:00-18:15										
18:15-18:30										
18:30-18:45										
18:45-19:00										
Total	13	880	0	909	8	0	0	0	0	1810

Hourly flows

	Time	Movement									Total	
		Missenden Rd South Approach			Missenden Rd North Approach			Flower St West Approach				
		Left	Through	U Turn	Through	Right	U Turn	Left	Right	U Turn		
		1	2	3+	8	9	9+	10	12	12+		
	15:00-16:00											
	15:15-16:15											
	15:30-16:30											
	15:45-16:45											
	16:00-17:00	7	444		454	6					911	
Peak	16:15-17:15	4	468		448	6					926	Peak
	16:30-17:30	5	462		430	5					902	
	16:45-17:45	5	423		422	2					852	
	17:00-18:00	6	436		455	2					899	
	17:15-18:15											
	17:30-18:30											
	17:45-18:45											
	18:00-19:00											
	Peak Hour	4	468		448	6					926	



Total Flow in intersection
926 vehicles per hour

PM PEAK HOUR FLOW
Intersection of
Missenden Rd &
Flower St
Camperdown

Date	**Time**
Tues 27 March 2012	16:15-17:15

$PFF_{(30mins)}$: 0.94

TURNING MOVEMENT SURVEY

Intersection of Missenden Rd & Lucas St, Camperdown

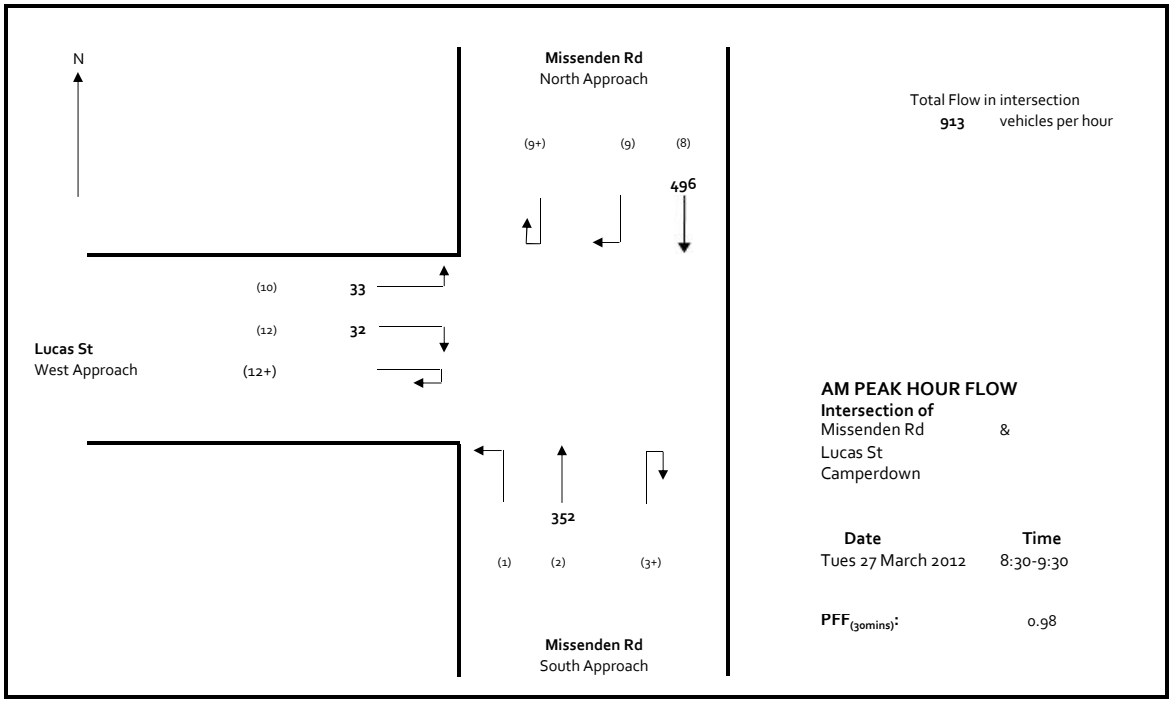
Date: Tues 27 March 2012

15 minute Data

Time	Movement									Total
	Missenden Rd South Approach			Missenden Rd North Approach			Lucas St West Approach			
	Left 1	Through 2	U Turn 3+	Through 8	Right 9	U Turn 9+	Left 10	Right 12	U Turn 12+	
6:00-6:15										
6:15-6:30										
6:30-6:45										
6:45-7:00										
7:00-7:15										
7:15-7:30										
7:30-7:45		78		99			10	9		196
7:45-8:00		93		102			15	10		220
8:00-8:15		79		79			9	6		173
8:15-8:30		97		116			8	11		232
8:30-8:45		66		116			10	13		205
8:45-9:00		89		140			6	8		243
9:00-9:15		91		114			10	4		219
9:15-9:30		106		126			7	7		246
9:30-9:45										
9:45-10:00										
Total	0	699	0	892	0	0	75	68	0	1734

Hourly flows

	Time	Movement									Total	
		Missenden Rd South Approach			Missenden Rd North Approach			Lucas St West Approach				
		Left 1	Through 2	U Turn 3+	Through 8	Right 9	U Turn 9+	Left 10	Right 12	U Turn 12+		
	6:00-7:00											
	6:15-7:15											
	6:30-7:30											
	6:45-7:45											
	7:00-8:00											
	7:15-8:15											
	7:30-8:30		347		396			42	36		821	
	7:45-8:45		335		413			42	40		830	
	8:00-9:00		331		451			33	38		853	
	8:15-9:15		343		486			34	36		899	
Peak	8:30-9:30		352		496			33	32		913	Peak
	8:45-9:45											
	9:00-10:00											
	Peak Hour		352		496			33	32		913	



Total Flow in intersection
913 vehicles per hour

AM PEAK HOUR FLOW
Intersection of
Missenden Rd &
Lucas St
Camperdown

Date	**Time**
Tues 27 March 2012	8:30-9:30

PFF$_{(30mins)}$: 0.98

TURNING MOVEMENT SURVEY

Intersection of Missenden Rd & Lucas St, Camperdown

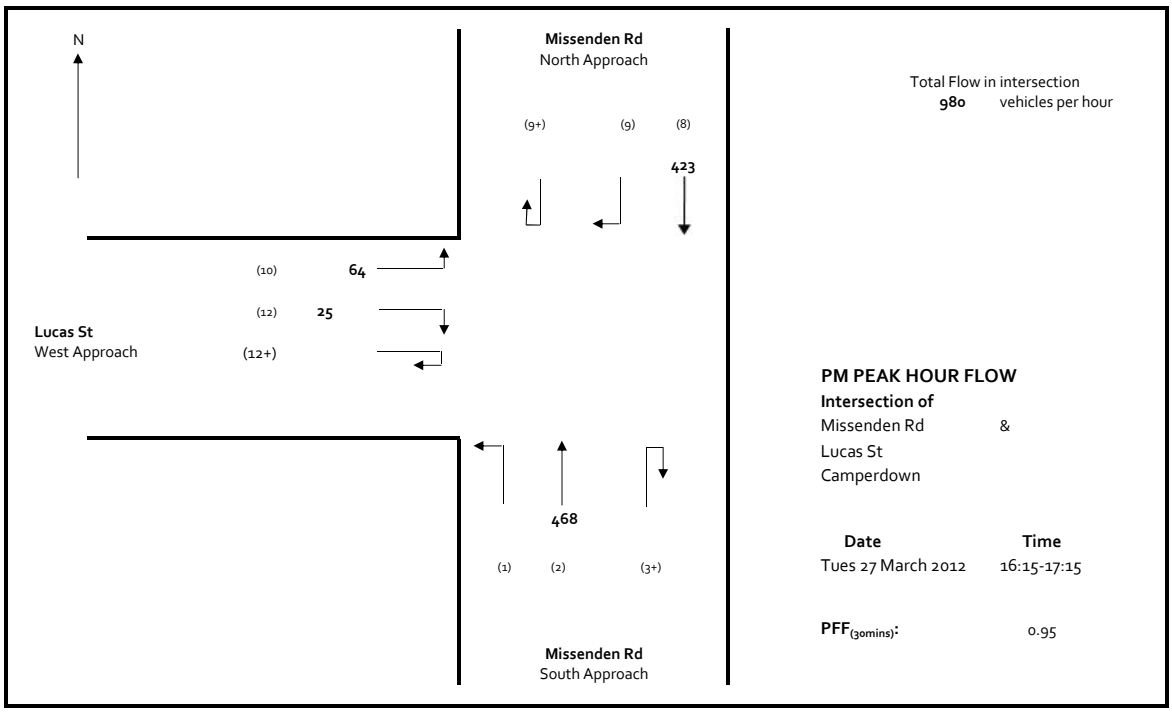
Date: Tues 27 March 2012

15 minute Data

Time	Movement									Total
	Missenden Rd South Approach			Missenden Rd North Approach			Lucas St West Approach			
	Left 1	Through 2	U Turn 3+	Through 8	Right 9	U Turn 9+	Left 10	Right 12	U Turn 12+	
15:00-15:15										
15:15-15:30										
15:30-15:45										
15:45-16:00										
16:00-16:15		104		107			24	6		241
16:15-16:30		99		113			9	12		233
16:30-16:45		147		110			23	2		282
16:45-17:00		94		99			14	5		212
17:00-17:15		128		101			18	6		253
17:15-17:30		93		101			11	6		211
17:30-17:45		108		100			6	4		218
17:45-18:00		107		133			6	4		250
18:00-18:15										
18:15-18:30										
18:30-18:45										
18:45-19:00										
Total	0	880	0	864	0	0	111	45	0	1900

Hourly flows

	Time	Movement									Total	
		Missenden Rd South Approach			Missenden Rd North Approach			Lucas St West Approach				
		Left 1	Through 2	U Turn 3+	Through 8	Right 9	U Turn 9+	Left 10	Right 12	U Turn 12+		
	15:00-16:00											
	15:15-16:15											
	15:30-16:30											
	15:45-16:45											
	16:00-17:00		444		429			70	25		968	
Peak	16:15-17:15		468		423			64	25		980	Peak
	16:30-17:30		462		411			66	19		958	
	16:45-17:45		423		401			49	21		894	
	17:00-18:00		436		435			41	20		932	
	17:15-18:15											
	17:30-18:30											
	17:45-18:45											
	18:00-19:00											
	Peak Hour		468		423			64	25		980	



Total Flow in intersection
980 vehicles per hour

PM PEAK HOUR FLOW
Intersection of
Missenden Rd &
Lucas St
Camperdown

Date	**Time**
Tues 27 March 2012	16:15-17:15

$PFF_{(30mins)}$: 0.95

Appendix B

SIDRA INTERSECTION Results

MOVEMENT SUMMARY

Site: Weekday AM 7:30-8:30

Missenden Road/ Lucas Street
Existing Conditions
AM Peak Hour
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 Road											
2	T	365	5.0	0.193	0.0	LOS A	0.0	0.0	0.00	0.00	50.0
Approach		365	5.0	0.193	0.0	NA	0.0	0.0	0.00	0.00	50.0
North: Missenden Road											
8	T	417	5.0	0.221	0.0	LOS A	0.0	0.0	0.00	0.00	50.0
Approach		417	5.0	0.221	0.0	NA	0.0	0.0	0.00	0.00	50.0
West: Lucas Street											
10	L	44	5.0	0.080	8.2	LOS A	0.2	1.3	0.42	0.65	41.8
12	R	38	5.0	0.082	13.5	LOS A	0.3	2.0	0.64	0.89	37.8
Approach		82	5.0	0.082	10.7	LOS A	0.3	2.0	0.52	0.76	39.8
All Vehicles		864	5.0	0.221	1.0	NA	0.3	2.0	0.05	0.07	48.8

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

MOVEMENT SUMMARY

Site: Weekday AM (7:30-8:30)

Missenden Road/ Brodie Street
Existing Conditions
AM Peak Hour
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 Road											
1	L	18	5.0	0.203	6.5	LOS A	0.0	0.0	0.00	0.91	43.3
2	T	365	5.0	0.203	0.0	LOS A	0.0	0.0	0.00	0.00	50.0
Approach		383	5.0	0.203	0.3	NA	0.0	0.0	0.00	0.04	49.6
North: Missenden Road											
8	T	455	5.0	0.274	2.5	LOS A	2.5	18.0	0.60	0.00	43.2
9	R	32	5.0	0.274	9.9	LOS A	2.5	18.0	0.60	0.96	42.3
Approach		486	5.0	0.274	3.0	NA	2.5	18.0	0.60	0.06	43.1
All Vehicles		869	5.0	0.274	1.8	NA	2.5	18.0	0.33	0.05	45.8

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

MOVEMENT SUMMARY

Site: Weekday PM 16:15-17:15

Missenden Road/ Lucas Street
Existing Conditions
PM Peak Hour
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 Road											
2	T	493	5.0	0.261	0.0	LOS A	0.0	0.0	0.00	0.00	50.0
Approach		493	5.0	0.261	0.0	NA	0.0	0.0	0.00	0.00	50.0
North: Missenden Road											
8	T	445	5.0	0.236	0.0	LOS A	0.0	0.0	0.00	0.00	50.0
Approach		445	5.0	0.236	0.0	NA	0.0	0.0	0.00	0.00	50.0
West: Lucas Street											
10	L	67	5.0	0.133	9.1	LOS A	0.3	2.2	0.50	0.73	41.1
12	R	26	5.0	0.073	15.9	LOS B	0.2	1.7	0.71	0.91	36.2
Approach		94	5.0	0.133	11.0	LOS A	0.3	2.2	0.56	0.78	39.6
All Vehicles		1032	5.0	0.261	1.0	NA	0.3	2.2	0.05	0.07	48.8

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

MOVEMENT SUMMARY

Site: Weekday PM (16:15-17:15)

Missenden Road/ Brodie Street
Existing Conditions
PM Peak Hour
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 Road											
1	L	4	5.0	0.263	6.5	LOS A	0.0	0.0	0.00	0.92	43.3
2	T	493	5.0	0.263	0.0	LOS A	0.0	0.0	0.00	0.00	50.0
Approach		497	5.0	0.263	0.1	NA	0.0	0.0	0.00	0.01	49.9
North: Missenden Road											
8	T	472	5.0	0.257	3.6	LOS A	2.7	19.6	0.68	0.00	42.5
9	R	6	5.0	0.257	10.9	LOS A	2.7	19.6	0.68	1.02	41.8
Approach		478	5.0	0.257	3.7	NA	2.7	19.6	0.68	0.01	42.5
All Vehicles		975	5.0	0.263	1.8	NA	2.7	19.6	0.33	0.01	46.0

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

MOVEMENT SUMMARY

Site: Weekday PM 16:15-17:15 - Development

Missenden Road/ Lucas Street
Development Traffic
PM Peak Hour
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 Road											
2	T	493	5.0	0.261	0.0	LOS A	0.0	0.0	0.00	0.00	50.0
Approach		493	5.0	0.261	0.0	NA	0.0	0.0	0.00	0.00	50.0
North: Missenden Road											
8	T	456	5.0	0.241	0.0	LOS A	0.0	0.0	0.00	0.00	50.0
Approach		456	5.0	0.241	0.0	NA	0.0	0.0	0.00	0.00	50.0
West: Lucas Street											
10	L	78	5.0	0.153	9.2	LOS A	0.4	2.6	0.51	0.74	41.1
12	R	37	5.0	0.104	16.2	LOS B	0.3	2.5	0.73	0.91	36.0
Approach		115	5.0	0.153	11.4	LOS A	0.4	2.6	0.58	0.79	39.3
All Vehicles		1063	5.0	0.261	1.2	NA	0.4	2.6	0.06	0.09	48.6

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

MOVEMENT SUMMARY

Site: Weekday PM (16:15-17:15)-Development

Missenden Road/ Brodie Street
Development Traffic
PM Peak Hour
Giveway / Yield (Two-Way)

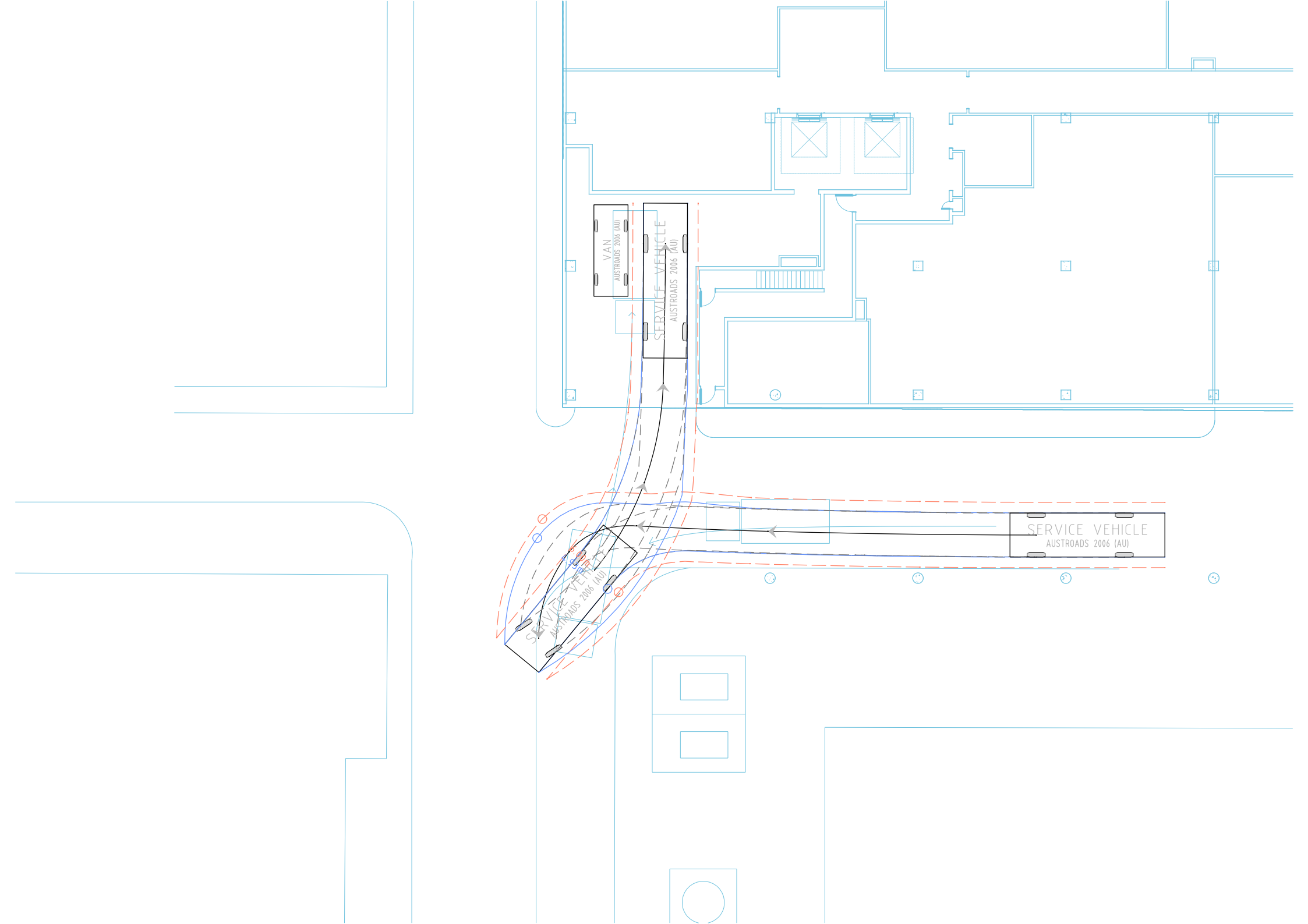
Movement Performance - Vehicles

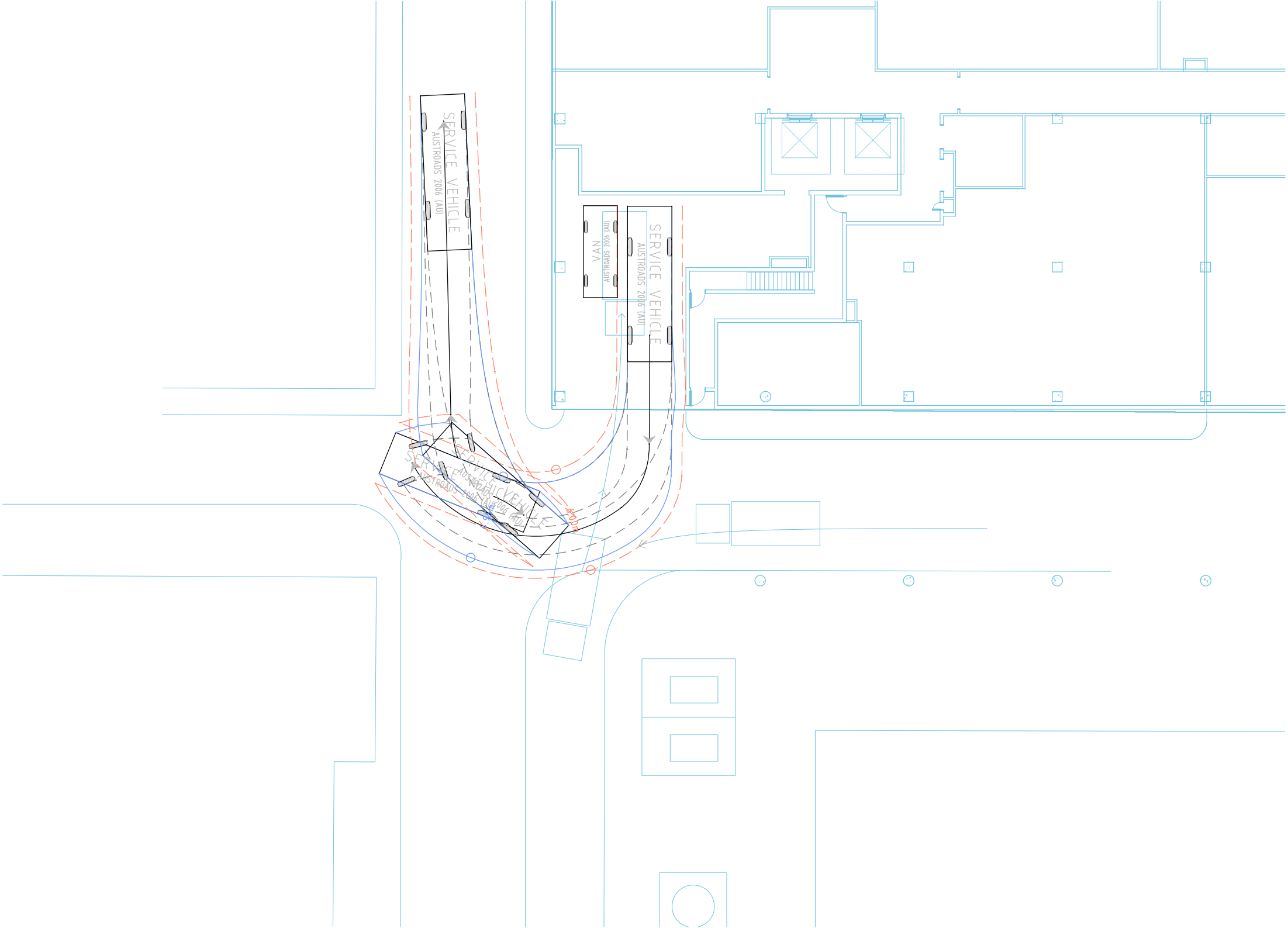
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Missenden Road											
1	L	15	5.0	0.269	6.5	LOS A	0.0	0.0	0.00	0.91	43.3
2	T	493	5.0	0.269	0.0	LOS A	0.0	0.0	0.00	0.00	50.0
Approach		507	5.0	0.269	0.2	NA	0.0	0.0	0.00	0.03	49.8
North: Missenden Road											
8	T	472	5.0	0.271	3.8	LOS A	2.8	20.7	0.69	0.00	42.3
9	R	17	5.0	0.271	11.1	LOS A	2.8	20.7	0.69	1.02	41.6
Approach		488	5.0	0.271	4.0	NA	2.8	20.7	0.69	0.04	42.3
All Vehicles		996	5.0	0.271	2.1	NA	2.8	20.7	0.34	0.03	45.8

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

Appendix C

Vehicle Swept Paths


VAN
AUSTROADS 2006 (AU)
SERVICE VEHICLE
AUSTROADS 2006 (AU)
SERVICE VEHICLE
AUSTROADS 2006 (AU)
SERVICE VEHICLE
AUSTROADS 2006 (AU)


SERVICE VEHICLE
AUSTROADS 2006 (AU)
VAN
AUSTROADS 2006 (AU)
SERVICE VEHICLE
AUSTROADS 2006 (AU)
SERVICE VEHICLE
AUSTROADS 2006 (AU)
SERVICE VEHICLE
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