GTAconsultants

3-5 Help Street, Chatswood
Planning Proposal
Transport Impact Assessment

Client // H & J Vakili

Office // NSW

Reference // N102342

Date // 17/10/18

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Quality Record

Issue	Date	Description	Prepared By	Checked By	Approved By	Signed
A	17/08/17	Final	Liam Stevens	Andrew Farran	Tim De Young	
B	15/12/17	Updated	Will Croagh	Andrew Farran	Tim De Young	
C	15/06/18	Updated Final	Daniel Mead	Andrew Farran	Andrew Farran	
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1. Introduction

1.1 Background

A Planning Proposal is to be lodged with Willoughby City Council for a proposed mixed-use development on land located at 3-5 Help Street, Chatswood. The proposed development includes a multi-storey building consisting of 128 residential apartments, 1,774sqm of office and 503sqm of retail. The total GFA of the development will be 16,030sqm.

GTA Consultants (GTA) was commissioned by H & J Vakili in May 2017 to undertake a transport impact assessment for the Planning Proposal.

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

1.3 References

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

- an inspection of the site and its surrounds
- Willoughby Council Development Control Plan (DCP)
- Australian Standard/ New Zealand Standard, Parking Facilities, Part 1: Off-Street Car Parking AS/NZS 2890.1:2004
- Australian Standard, Parking Facilities, Part 2: Off-Street Commercial Vehicle Facilities AS 2890.2:2002
- Australian Standard / New Zealand Standard, Parking Facilities, Part 6: Off-Street Parking for People with Disabilities AS/NZS 2890.6:2009
- traffic and car parking surveys undertaken by Data Audit Systems as referenced in the context of this report
- plans for the proposed development prepared by Kann Finch, Project Number 6521, dated 13 June 2018 (Revision G).
- other documents and data as referenced in this report.

2. Existing Conditions

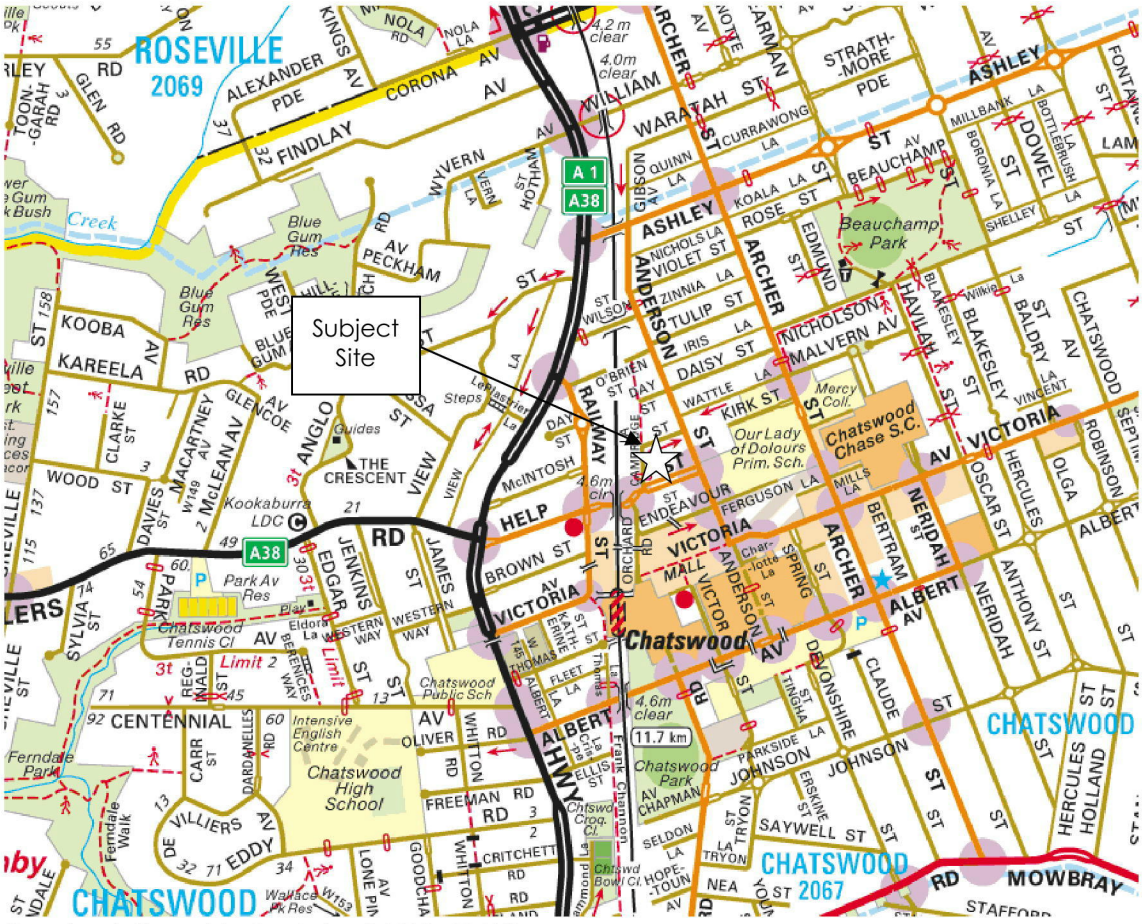
2.1 Subject Site

The subject site is located at 3-5 Help Street, Chatswood. The site of approximately 2,290sqm has approximate frontages of 38m to Help Street, 18m to McIntosh Street and 68m to Cambridge Lane. The site currently has a land use classification of 'B4 Mixed Use' and is occupied by two medium density residential buildings.

The site is located on the periphery of the Chatswood CBD with surrounding properties including predominantly retail, commercial and high density residential uses, with some low density residential land uses located to the northeast of the site. The Chatswood Transport Interchange is located approximately 100m south of the site.

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

Figure 2.1: Subject Site and Its Environs



(Reproduced with permission from Sydway Publishing Pty Ltd)

2.2 Road Network

2.2.1 Overview

The subject site is located between the intersections of Orchard Road and Anderson Street with Help Street. In this respect, Help Street forms a key access route to the Chatswood CBD and includes a signalised intersection with Pacific Highway and a grade separated crossing of the railway line. Anderson Street provides access between Victoria Avenue and Ashley Street (which provides an onward connection to the Pacific Highway). Cambridge Lane and McIntosh Street are local roads and provide property access.

2.2.2 Adjoining Roads

Help Street

Help Street functions as a collector road and is aligned in an east-west direction.

It is a two-way road configured with a four-lane, 13m wide carriageway and has a sign posted speed limit of 40km/h. Kerbside parking is permitted on the southern side of the carriageway outside of clearway times and subject to time restrictions.

Help Street is shown in Figure 2.2 and carries approximately 11,000 vehicles per day[1].

Anderson Street

Anderson Street functions as a collector road and is aligned in a north-south direction.

It is a two-way road configured with a four-lane, 13m wide carriageway and has signposted speed of 40km/h. Kerbside parking north of the Help Street intersection is permitted outside of clearway times, subject to time restrictions.

Anderson Street is shown in Figure 2.3 and carries approximately 13,200 vehicles per day[1].

Cambridge Lane

Cambridge Lane functions as a shared zone for cars, cyclists and pedestrians (although also has a separated pedestrian path provided on the east side of the carriageway) and is aligned in a north-south direction.

It is a one-way road configured with a single-lane northbound traffic lane, albeit with two-way cycle paths. Cambridge Lane has a signposted speed limit of 10km/h. Kerbside parking is permitted on the western side of the lane, subject to time restrictions (10 minutes parking between 7:00am and 6:00pm Monday to Friday).

Cambridge Lane is shown in Figure 2.4 and carries approximately 700 vehicles per day[2].

McIntosh Street

McIntosh Street functions as a local road and is aligned in an east-west direction in the vicinity of the site.

It is a one-way road eastbound configured with a single-lane, 7m wide carriageway and has a sign posted speed limit of 40km/h. Kerbside parking is permitted on the northern side of the street,

1 Based on the peak hour traffic counts commissioned by GTA in June 2017 and assuming a peak-to-daily ratio of 8% for arterial roads and 10% for local roads.

2 Based on the tube counts commissioned by GTA in June 2017.

subject to time restrictions. A dedicated on-road bike lane is provided on the southern side of the carriageway.

McIntosh Street is shown in Figure 2.5 and carries approximately 700 vehicles per day[1].

Figure 2.2: Help Street, facing east

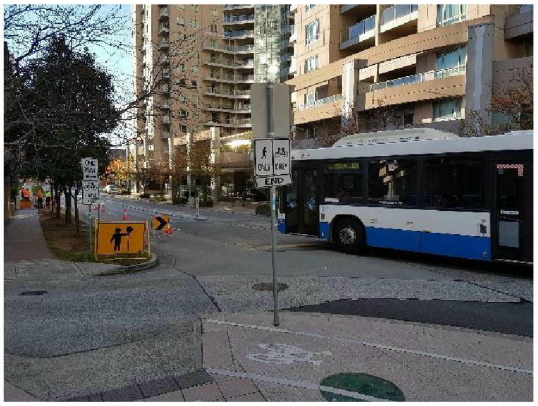
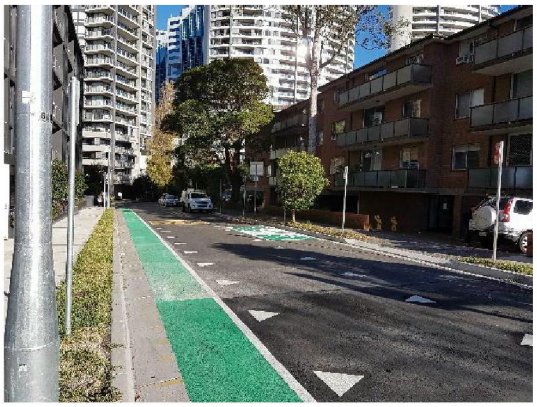


Figure 2.3: Anderson Street, facing south

Figure 2.4: Cambridge Lane, facing east

Figure 2.5: McIntosh Street, facing south



2.2.3 Surrounding Intersections

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

- Orchard Road / Help Street (signalised)
- Anderson Street / Help Street (signalised)
- Help Street / Cambridge Lane (unsignalised)
- Anderson Street / McIntosh Street (unsignalised).

2.3 Traffic Volumes

GTA commissioned traffic movement counts on key roads in the vicinity of the site on Wednesday 7 June 2017 during the following peak periods:

- 7:00am and 9:00am
- 4:00pm and 6:00pm.

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

Figure 2.6: Existing AM Peak Hour Traffic Volumes

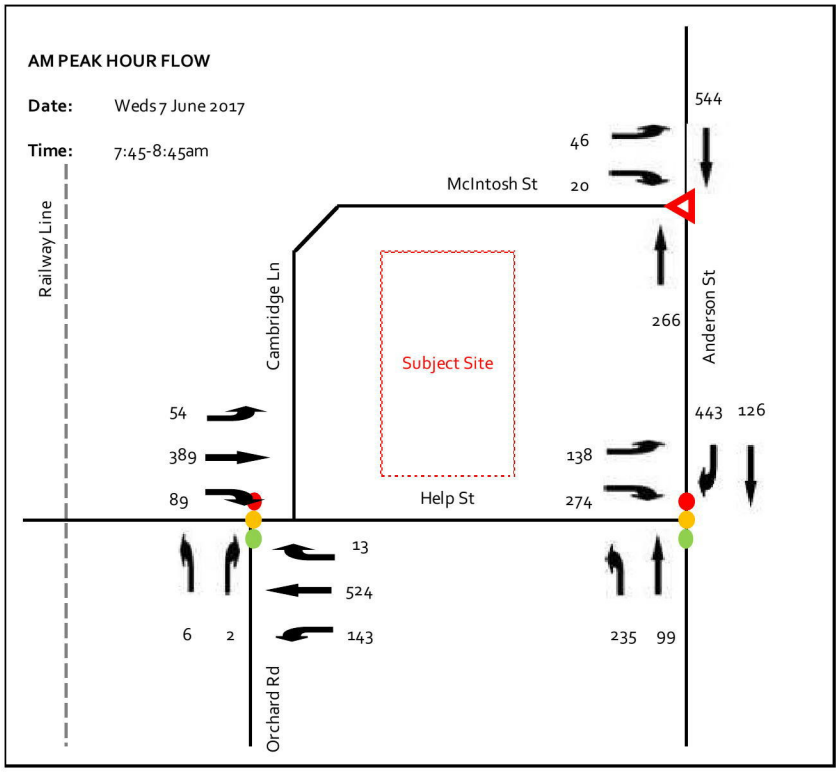
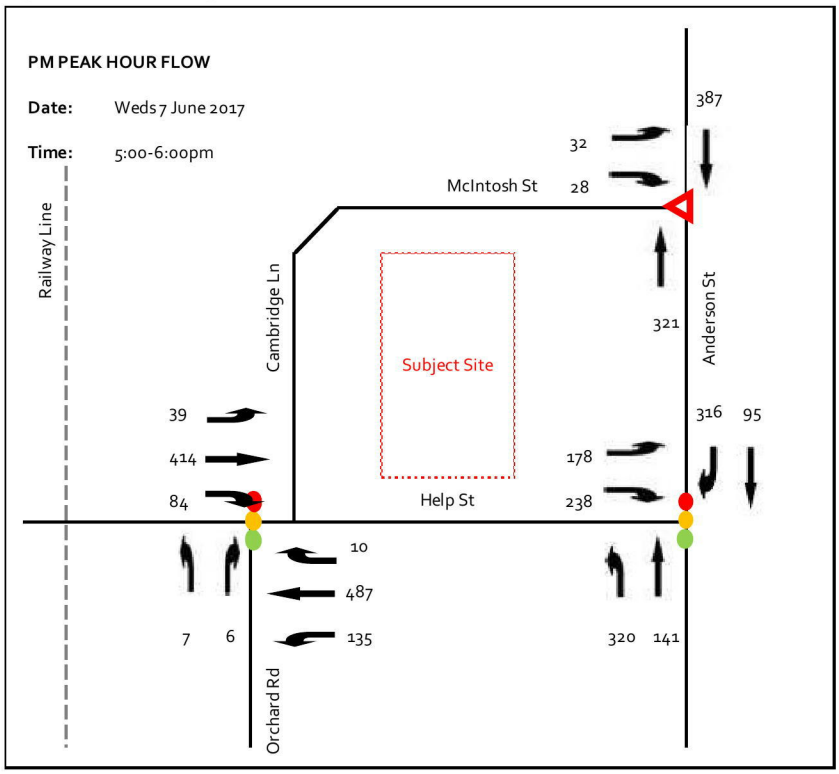


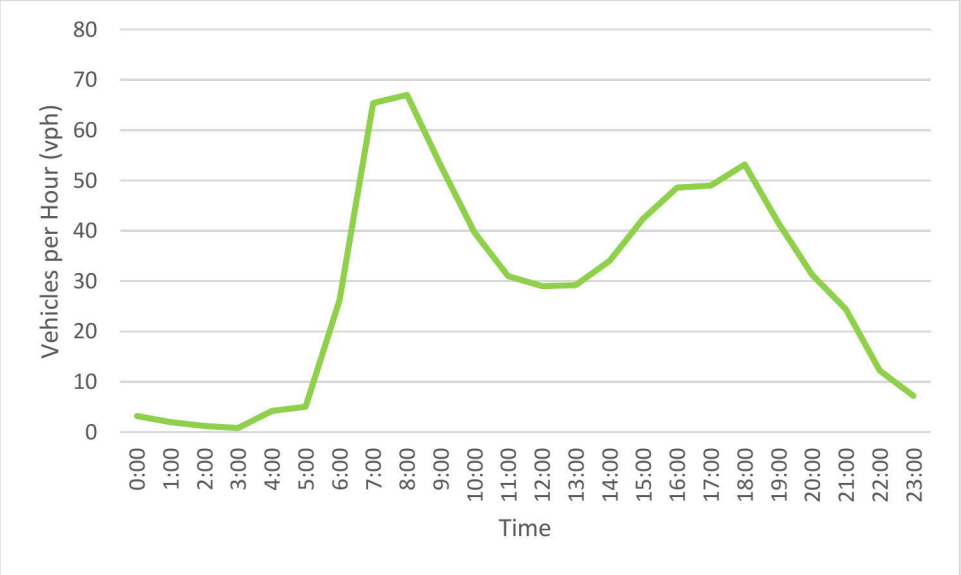
Figure 2.7: Existing PM Peak Hour Traffic Volumes



In addition, GTA commissioned 7-day, 24-hour tube counts on Cambridge Lane for the week commencing Sunday 4 June 2017. The weekday average traffic volumes are presented in Figure 2.8 and indicate that the laneway carries up to approximately 50 and 70 vehicles during the AM

and PM peak hours, respectively. These volumes are consistent with typical RMS Guidelines for shared zones (i.e. less than 100vph).

Figure 2.8: Cambridge Lane Daily Traffic Volumes



2.4 Intersection Operation

The operation of the three surveyed intersections within the study area have been assessed using SIDRA INTERSECTION[3], 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

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

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

Table 2.2: Existing Operating Conditions

Intersection	Peak	Average Delay (sec)	95th Percentile Queue (m)	Level of Service (LOS)
Orchard Road/ Help Street	AM	25	85	C
	PM	23	73	C
Anderson Street/ Help Street	AM	30	121	C
	PM	29	90	C
Anderson Street/ McIntosh Street	AM	1	2	A
	PM	1	2	A

Table 2.2 indicates that the three intersections in the vicinity of the site currently operate with acceptable levels of service (LOS C or better) during peak periods.

2.5 Car Parking

GTA compiled an inventory of publicly available on-street parking in the vicinity of the site. The inventory identified a number of on-street car parking spaces on Help Street, McIntosh Street and Anderson Street, all subject to various time restrictions.

Parking demand sample surveys were undertaken by GTA during daytime periods and indicate that the majority of on-street parking spaces in the vicinity of the site are typically occupied, with minimal vacancies available.

It is also noted that the site is located in close proximity to three publicly available off-street car parks, which provide additional car parking beyond that provided on-street, as summarised in Table 2.3.

Table 2.3: Public Off-Street Parking Summary

Location	Distance to Site	Number of Spaces (approx.)
Chatswood Chase	250m	2,550
Westfield Chatswood	300m	2,800
Mandarin Centre	350m	300
Total		**5,650**

2.6 Public Transport

The subject site is well served by public transport services with Chatswood Transport Interchange located approximately 100m south of the site.

Chatswood is considered a major node in the CityRail network having undergone a major redevelopment in recent years and is well served by the Northern, North Shore and Western Lines. In the near future (and prior to the likely occupation of any development on the site), Chatswood will also serve as a major interchange for the North-West rail link. The rail journey time between Chatswood and Town Hall is 23 minutes. Chatswood Interchange also functions as one of the main bus interchanges in the northern suburbs of Sydney.

A review of the rail and bus services available in the vicinity of the site are summarised in Table 2.4 and Table 2.5.

Table 2.4: Chatswood Interchange Rail Services

Route	Route Description	Frequency On/Off Peak
Northern Line	Hornsby or Epping to the City	15 mins peak/ 20-30 mins off peak
North Shore Line	Berowra to Parramatta via City	3-5 mins peak/ 5-10 mins off peak
Western Line	Emu Plains or Richmond to Chatswood	3-5 mins peak/ 5-10 mins off peak

Table 2.5: Chatswood Interchange Bus Services

Route	Route Description	Frequency On/Off Peak
136/137	Chatswood to Manly, Dee Why & Mona Vale	15 mins peak/ 30 mins off peak
143/144	Chatswood to Manly	15 mins peak/ 15-20 mins off peak
200	Chatswood to Bondi Junction	15 mins, peak only
255/256	Chatswood to Chatswood West	30 mins, peak only
257/258	Chatswood to Balmoral/ Lane Cove Industrial	30 mins peak and off peak
267	Chatswood to Crows Nest	30 mins peak and off peak
273	Chatswood to City - Wynyard via Willoughby and North Sydney	10 mins peak/ 20-30 mins off peak
277/278/279	Chatswood to Castle Cove/ Killarney Heights/ Frenchs Forest	Hourly peak and off peak/ 20 mins peak only/ 3 services daily
280/281/283	Chatswood to Warringah Mall/ Davidson/ Belrose	15-30 mins peak/ hourly off peak
284	Chatswood to Duffys Forest via Frenchs Forest and Terrey Hills	10-30 mins peak/ hourly off-peak
533/534	Chatswood to Sydney Olympic Park via Mowbray Rd and Ryde	40 mins peak and off peak
536	Gladesville via Lane Cove and Hunters Hill	40 mins peak and off peak
545/550	Chatswood to Parramatta	15 mins peak and off peak
558	Chatswood to Lindfield	Hourly peak and off peak
565	Chatswood to Macquarie University via UTS Ku-ring-gai, Lindfield and West Lindfield	Hourly off peak
M40	Chatswood to Bondi Junction	10 mins peak/ 15 mins off peak
N90	Hornsby to Town Hall via Chatswood	30 mins, night only

2.7 Pedestrian Infrastructure

Pedestrian paths are located as follows:

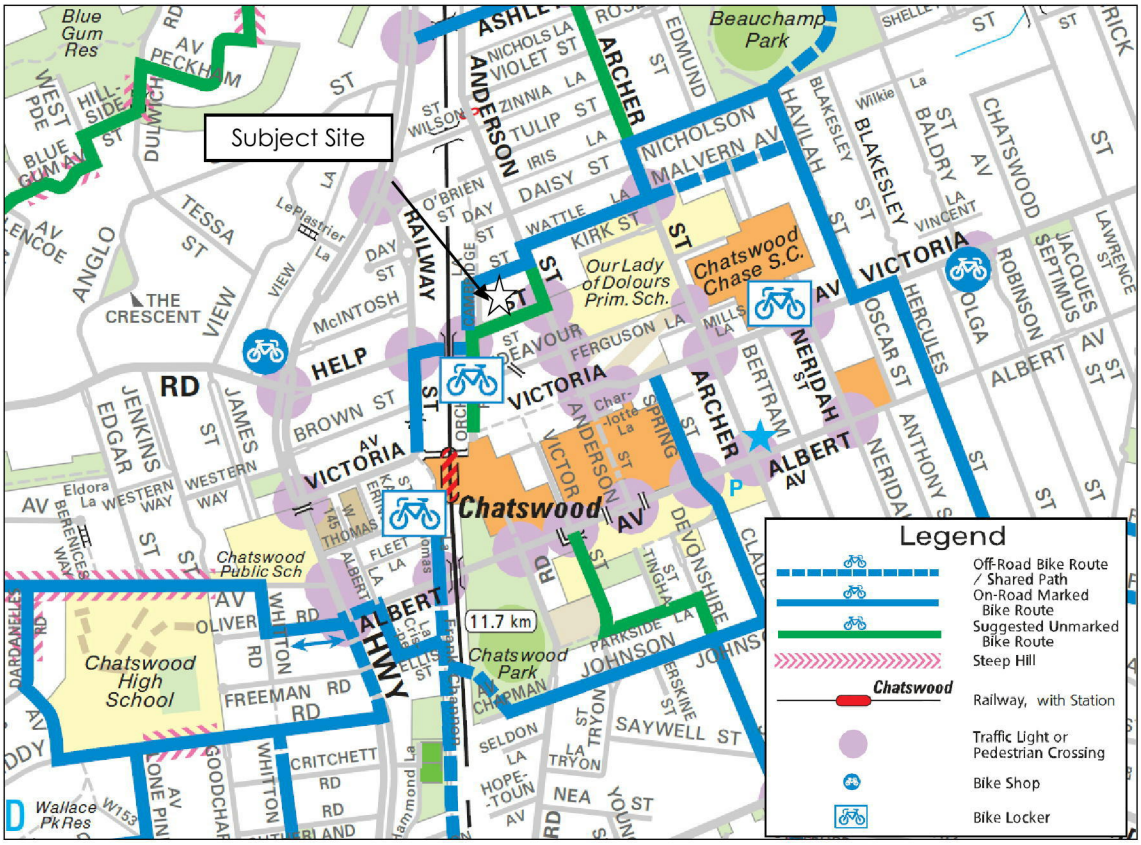
- Help Street (2 sides) – 1.6m wide path northside and 2.9m wide path southside
- Cambridge Lane (2 sides) – 1.3m wide path eastside and 2m wide path westside
- McIntosh Street (2 sides) – 1.6m wide path northside and 1.8m wide path southside.

Signalised pedestrian crossings are provided at the Orchard Road / Help Street, Anderson Street / Help Street and Railway Street / Help Street intersections.

2.8 Cycle Infrastructure

The subject site is located close to several established cycle routes. An extract of the Northern Sydney Cycling Map showing cycling infrastructure surrounding the subject site is shown in Figure 2.9. Of particular note, a 1m wide cycle lane is located along Cambridge Lane and McIntosh Street.

Figure 2.9: Cycle Infrastructure



Source: Northern Sydney Cycling Map

2.9 Transport Policy Direction – CBD Strategy

In January 2018, Willoughby City Council released the Chatswood CBD Strategy. The Strategy establishes a framework to guide future development in the Chatswood CBD for the next 20 years. The vision for the CBD Strategy sets out seven guiding principles, including "sustainable and active transport".

The key items relating to transport are provided in Section 3.1 of the strategy and have been reproduced below:

"Traffic and Transport

The CBD Strategy employs a Travel Demand Management approach seeking to modify travel decisions to achieve more desirable transport, social, economic and environmental objectives. A new CBD Transport Strategy will build on the approach. In addition, site specific traffic and transport issues are to be addressed as follows:

a) Vehicle entry points to a site are to be rationalised to minimise streetscape impact, with one entry into and exiting a site. To achieve this objective loading docks, including garbage and residential removal trucks, are to be located within Basement areas.

b) In order to facilitate rationalisation of vehicle entry points on neighbouring sites, all development sites are to provide an opportunity within Basement levels to provide vehicle access to adjoining sites when they are developed.

c) All vehicles are to enter and exit a site in a forward direction. In this regard vehicle turntables should be provided where necessary.

d) All commercial and residential loading and unloading is required to occur on-site and not in public streets.

e) Car parking should be reduced by utilising RMS car parking rates for sites close to public transport, as well as reciprocal parking and car share strategies."

This Planning Proposal has been prepared having regard for the transport recommendations of the strategy.

3. Development Proposal

3.1 Land Uses

The Planning Proposal intends to amend the existing planning controls imposed on the site to allow for an increase in the maximum height controls and increase the maximum floor space ratio.

The amended planning controls are being sought with a view to constructing mixed use development incorporating residential uses set above lower level commercial uses. The indicative proposed land uses are summarised in Table 3.1.

Table 3.1: Planning Proposal Land Use Summary (Indicative)

Use	Dwelling Type	Size
Dwellings	1-bedroom	40 dwellings
	2-bedroom	80 dwellings
	3-bedroom	8 dwellings
	Sub-Total	**128 dwellings**
Commercial	Retail	503sqm
	Office	1,774sqm
	Sub-Total	**2,277sqm**

Table 3.1 indicates that the Planning Proposal anticipates some 128 residential apartments, 2,277sq.m of commercial floor area (incorporating retail and office floor area).

3.2 Vehicle Access, Car Parking and Loading

Vehicle access to the site is proposed via two locations, as follows:

- car parking via Mcintosh Street
- loading area via Help Street

A loading area is provided on the lower ground level, with car parking generally provided in the basement levels. A total of 174 car parking spaces and 9 motorcycle spaces (approx.) are to be provided across the basement levels.

3.3 Pedestrian and Bicycle Facilities

Pedestrian access to the residential components of the site are proposed via a lift lobby located on the lower ground level connecting to Help Street and a lift lobby located on the upper ground level connecting to Cambridge Lane. The commercial components of the development directly front Help Street and Cambridge Lane on the lower ground level and McIntosh Street on the upper ground level.

The development will include parking for 34 bicycles (16 visitor spaces, 13 resident spaces and 5 employee spaces), which are located on the lower ground level. In addition, the plans show a storage cage at the front of each of the car spaces which would be capable of accommodating a bicycle.

4. Car Parking

4.1 Council Transport Objectives

The transport requirements of future developments within Willoughby Council area are set out in Part C.3 of the Willoughby Development Control Plan (DCP).

There are 12 standards and guidelines that seek to establish the intent of the DCP Transport Requirements. These are reproduced below:

"1. Minimise the adverse environmental effects of car use within the City;

2. Manage the existing and future on and off road car parking in a manner that sustains and enhances the economic and environmental qualities of Willoughby;

3. Encourage the use of public transport in areas close to transport nodes;

4. Encourage alternative modes of transport;

5. Ensure that appropriate facilities are provided for bicycles;

6. Provide for the safe, convenient, and efficient movement and accommodation of vehicles within the City;

7. Ensure that provision is made for a reasonable number of parking spaces for vehicles generated by a development including visitor, employee, service and commercial vehicles;

8. Ensure that vehicular movements and parking do not impede pedestrian traffic safety and efficiency;

9. Ensure that the design of parking and servicing areas and their access is safe and compatible with the best practice standards;

10. Ensure that car parking facilities contribute positively to the public domain;

11. Minimise hard surfaces in order to enhance areas for on-site infiltration of stormwater, where relevant; and

12. Manage demand for car use by employing the principle of travel demand management. Travel Demand Management is intervention (excluding provision of major infrastructure) to modify travel decisions so that more desirable transport, social, economic and/or environmental objectives can be achieved, and the adverse impacts of travel can be reduced. The purpose of travel demand management is to reduce the total amount of travel, minimise the need to expand road systems, reduce the incidents of vehicle crashes, prevent further congestion, reduce air pollution, conserve scarce resources and increase the share of non-car based transport. Increasing the supply of parking can induce a greater number of vehicular trips which increases congestion, impacting negatively on the city environment."

In summary, the Council transport objectives seek to minimise the reliance on private motor vehicle usage by minimising car parking provisions (in appropriate locations), promoting alternate transport modes and leveraging off existing public transport nodes.

4.2 Car Parking Requirements

4.2.1 DCP Requirements

The car parking requirements for different development types are set out in Willoughby DCP 2006. A review of the car parking rates and the floor area schedule results in a DCP parking requirement for the Planning Proposal as summarised in Table 4.1.

Table 4.1: DCP 2006 Car Parking Requirements

Description	DCP Parking Rate	No. of Dwellings/ NLA (sq.m)	DCP Parking Requirement
Residential Flats within Railway Precincts	1 space / 1-bedroom	40 dwellings	40 spaces
	1 space / 2-bedroom	80 dwellings	80 spaces
	1.25 space / 3-bedroom	8 dwellings	10 spaces
		Sub-Total	**130 spaces**
	1 space / 4 dwellings (visitor parking)	128 dwellings	32 spaces
		Sub-Total	**162 spaces**
Shop	1 space / 25sq.m NFA	503sq.m	20 spaces
Office	1 space / 110sq.m NFA	1,774sq.m	16 spaces
	Total		**198 spaces**

Note: where the parking spaces required is not a whole number, DCP 2006 states that the number of spaces required is to be rounded down to the nearest whole number.

Table 4.1 indicates that the Planning Proposal is required to provide 198 car parking spaces. The proposed car parking provision of 174 spaces is less than the prescribed DCP parking requirements.

Given the sites location within Chatswood CBD and adjacent to the Chatswood Transport Interchange it would be considered appropriate to reduce the overall car parking provision on the site (discussed further in the following section).

4.2.2 Departure from DCP Parking Requirements

Alternate Parking Approach

The standard approach to car parking provision (i.e. provide a minimum) has historical origins which follow a 'predict and provide' approach. The recently released Austroads 'Guide to Traffic Management Part 11 (2017)' describes the 'predict and provide' approach to car parking as a technique which readily interprets a 'parking problem' as an issue of 'inadequate supply'. It goes on to note that this ideology is underlined by the premise that:

- *"More parking is better,*
- *Every destination should satisfy its own parking needs (minimum ratios),*
- *Car parks should never fill,*
- *Parking should always be free or subsidised or incorporated into buildings costs."*

In more recent times, the 'predict and provide' approach is being replaced by a range of travel demand management (TDM) techniques which challenge historical travel behaviours and encourage mode change away (reversing the trend) from private motor vehicle travel, particularly during road network peak hours.

The TDM approach involves the individual or collective application of techniques including:

- Congestion pricing.
- Car parking management.

- Land use management & Urban design.
- The delivery of compact mixed use development.
- The provision of high capacity transit services.

Overall, it is considered that there is potential to adopt a reduced car parking rate approach for the subject site that would be consistent with TDM orientated transport and land use planning practise, as well as Councils' overarching transport objectives.

Shared Car Parking Demand Assessment

To comprehensively assess the likely car parking demands, consideration must also be given to the extent to which the car parking associated with each use does, or does not, coincide throughout the day.

When consideration is given to the different patterns of activity of the various land uses, and the correspondingly different pattern of car parking demand, an assessment of the overall parking requirement for the proposed development can be made. Such an assessment is presented in Table 4.2.

Table 4.2: Variation in Non-Resident Car Parking Demand

Land Use	DCP Parking Requirement	Proportion of Peak Car Parking Demand (approx.)		Resultant Car Parking Demand	
		Daytime	Evening	Daytime	Evening
Residential (visitors)	32 spaces	25%	100%	8 spaces	32 spaces
Shop	20 spaces	100%	0%	20 spaces	-
Office	16 spaces	100%	0%	16 spaces	-
Total	**68 spaces**	**-**	**-**	**44 spaces**	**32 spaces**

Table 4.2 indicates that the site has a non-resident peak car parking demand of 68 spaces assuming all the demands peak simultaneously or 44 spaces when consideration is given to how the demands vary across the day for each of the uses.

4.2.3 Adequacy of Parking Provision

Based upon the above discussions and analysis, it is evident that the proposed car parking provision of 174 spaces is appropriate to accommodate the peak parking demand of 174 spaces (130 resident spaces + 44 other spaces) likely to be generated by the development.

4.3 Motorcycle Parking

DCP 2006 requires motorcycle parking to be provided at the rate of one space per 25 car parking spaces. Given the car parking requirements outlined above, the Planning Proposal is required to provide some 9 motorcycle parking spaces, with these able to be accommodated within the basement car parking levels.

The proposed motorcycle parking provision is 9 spaces which meets the DCP minimum requirement.

4.4 Car Parking Layout

The car park layout and site access provisions should be designed in accordance with the requirements of the Willoughby City Council's DCP 2006 and the Australian Standard for Off Street Car Parking (AS2890.1:2004 and AS2890.6:2009).

General car park access and circulation is considered appropriate and would be further addressed at the development application stage. Vehicle access to and from the site is also discussed in Section 6.2 of this report.

5. Sustainable Transport Infrastructure

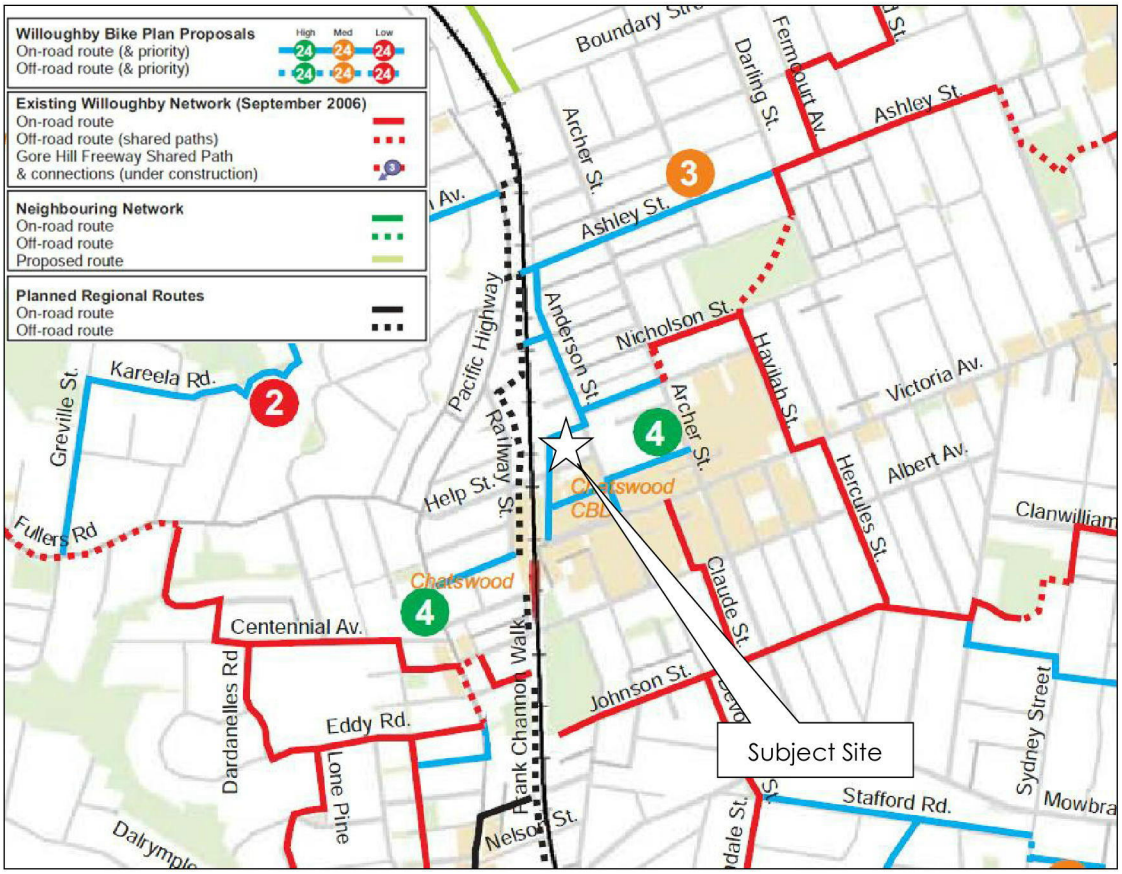
5.1 Cycle Network

Willoughby Bike Plan (2006) identified and prioritised 27 proposed cycle routes to be implemented in Willoughby LGA including the following two on-road routes in Chatswood CBD:

- Anderson Street and Ashley Street Bike Route (Route 3, medium priority)
- Chatswood CBD Access Bike Routes (Route 4, high priority).

These proposed cycle routes will improve cycling accessibility in and around Chatswood CBD and are shown in Figure 5.1. Both of these routes would directly benefit cyclists accessing the subject site.

Figure 5.1: Willoughby Bike Plan Proposed Cycle Routes



Source: Willoughby Bike Plan (2006)

5.2 Bicycle End-of-Trip Facilities

5.2.1 Supply

DCP 2006 contains a guide to bicycle parking facilities for different types of developments as summarised in Table 5.1.

Table 5.1: DCP 2006 Bicycle Parking Guide

Description	Suggested Parking Rate		No. of Dwellings/ NLA (sq.m)	Suggested Parking Provision	
	Bicycle Lockers	Bicycle Rails		Bicycle Lockers	Bicycle Rails
Residential	1 per 10 units	1 per 12 units	128 dwellings	13	11
Retail	1 per 450sqm	1 per 150m^2	503sqm	1	3
Office	1 per 600sqm	1 per 2,500sqm	1,774sqm	2	1
Total				**16**	**15**

Table 5.1 suggests that the DCP requires 116 bicycle lockers for residents/ employees and 15 bicycle rails for visitors. It is proposed that the development will meet the DCP requirements.

5.2.2 Design

DCP 2006 contains general requirements for bicycle parking as follows:

- enable wheels and frame to be locked to the device without damaging the bicycle
- be placed in public view and well-lit for security purposes
- be in a convenient and accessible location outside pedestrian and vehicular movement paths
- be protected from the weather.

DCP 2006 requires that the design of bicycle parking facilities be in accordance with AS2890.3. It is anticipated that shower and change facilities will be provided within individual commercial tenancies.

Bicycle lockers are intended for use by residents and therefore should be included within the secure areas of the building noting that where security devices are provided for resident car parking, these are acceptable and can replace bike lockers. Bicycle-rails are intended for use by visitors/ employees and as such will be located in publicly accessible areas within close proximity to the site.

5.3 Pedestrian Network

The site is well connected to the existing pedestrian network with pedestrian paths provided on both sides of the roads in the immediate vicinity of the site. The site is located in close vicinity of Chatswood Transport Interchange, and as such experiences high pedestrian activity.

5.4 Public Transport

As discussed previously, the site is easily accessible by public transport with Chatswood Transport Interchange located 100m south of the site. The proximity to public transport will increase the use of public transport by residents and employees and discourage the use of private motor vehicles.

6. Loading Facilities

6.1 Loading Requirements

The loading requirements for different development types are contained in DCP 2006, noting that residential developments in excess of 12 apartments are to provide for removalist trucks to park, load and unload on-site. DCP 2006 also notes that Council will determine the required number of loading bays.

6.2 Proposed Loading Arrangements

A loading area is proposed on the lower ground level, with vehicle access proposed from the Help Street crossover. The loading dock is shown on the plans on the plans as approximately 4m wide and 11m long.

Preliminary planning suggests that the loading dock would be capable of accommodating the Council's 9.7m long waste collection vehicle (assuming no other vehicles are at the loading dock) or alternatively could accommodate two smaller loading vehicles simultaneously (including one 6.4 SRV and one 8.8m MRV). Swept path assessments of the 9.7m waste collection vehicle been completed using AutoTURN (a computer package designed to simulate vehicle swept paths in a CAD environment), with the results provided in Appendix C.

Overall, the proposed loading arrangements are considered to be an acceptable outcome and would be refined at the development application stage.

6.3 Waste Collection

A garbage room is provided on the lower ground level adjacent to the on-site loading area. It is anticipated that waste will be collected as part of the weekly Council collection.

7. Traffic Impact Assessment

7.1 Traffic Generation

7.1.1 Residential

Traffic generation estimates for the residential use have been sourced from the RMS Technical Direction (August 2013).

The dataset indicates a "Sydney Average" traffic generation rate of 0.17 movements per dwelling for high density residential flat dwellings. Further interrogation of the RMS dataset indicates that those sites with excellent public transport accessibility (i.e. located within 250m of a railway station) exhibit lower traffic generation rates than the remaining sites (i.e. located further than 250m from a railway station). A summary of this data is provided below:

- < 250m of a railway station[4]: 0.11 movements per apartment per weekday peak hour
- >250m from a railway station: 0.20 movements per apartment per weekday peak hour

Furthermore, it is noted that one of the eight sites surveyed was located at 1 Cambridge Lane, Chatswood directly opposite the subject site. This site consisted of 129 residential dwellings (8 x 1-bedroom, 96 x 2-bedroom and 25 x 3-bedroom dwellings) and 206 car parking spaces (at a rate of 1.6 spaces per dwelling). The surveys of this site indicated a weighted peak hour traffic generation (average of AM and PM) rate of 0.11 movements per dwelling.

Based on the above data, it is considered appropriate to adopt a peak hour traffic generation rate of 0.11 movements per dwelling. Application of this rate to the residential component of the development indicates a traffic generation of 14 vehicle movements.

7.1.2 Office

The commercial traffic generation estimates have been sourced from the data that informs the RMS Technical Direction (August 2013). Given that the commercial car parking provision is lower than a traditional office use, it is considered appropriate to adopt a 'per space' traffic generation rate than a traditional 'per floor area' rate.

In this respect, GTA has collated the 'per space' traffic generation data for each of the inner and middle ring office sites surveyed as part of the RMS Guide (this excludes sites at Liverpool and Bella Vista). The full dataset is attached and indicates the following peak hour traffic generation rates:

- AM Peak hour: 0.44 movements per space
- PM Peak hour: 0.36 movements per space

Application of this rate to the office component of the development indicates a traffic generation of 7 and 6 vehicle movements during the AM and PM peak hour periods, respectively.

7.1.3 Retail

Traffic generation rates of 0.5 and 1 movements per space has been adopted for each of the retail car parking spaces during the AM and PM peak hours, respectively. Application of this rate to the

[4] Includes St Leonards, Strathfield and Chatswood.

retail car parking allocation (20 spaces) indicates a traffic generation of 10 and 20 vehicle movements during the AM and PM peak hours, respectively.

7.1.4 Summary

A summary of the peak hour and daily traffic volumes estimates resulting from the proposal are set out in Table 7.1.

Table 7.1: Traffic Generation Estimates

Land Use	Size	Traffic Generation Rate			Resultant Traffic Generation		
		AM Peak Hour	PM Peak Hour	Daily	AM Peak Hour	PM Peak Hour	Daily
Residential	128 dwellings	0.11 movements per dwelling	0.11 movements per dwelling	1.1 movements per dwelling [1]	14	14	141
Retail	503sqm (20 spaces)	0.5 movement per space	1 movement per space	10 movements per space [1]	10	20	200
Office	1,774sqm (16 spaces)	0.44 movements per space	0.36 movements per space	2.4 movements per space	7	6	38
				Total	**31**	**40**	**379**

[1] Assuming a peak to daily ratio of 10% for the residential and retail uses.
[2] Assuming each office car parking space turns over 1.5 times throughout the day.

Table 7.1 indicates that the site could potentially generate in the order of 31 to 40 vehicle movements in a peak hour with 379 vehicle movements over the entire day.

7.2 Distribution and Assignment

The directional distribution and assignment of traffic generated by the proposed development will be influenced by a number of factors, including the:

i configuration of the arterial road network in the immediate vicinity of the site
ii existing operation of intersections providing access between the local and arterial road network
iii distribution of households in the vicinity of the site
iv surrounding employment centres, retail centres and schools in relation to the site
v likely distribution of employee's residences in relation to the site
vi configuration of access points to the site.

Having consideration to the above, for the purposes of estimating vehicle movements, the following directional distributions have been assumed and are generally based on the existing turning movements observed in the vicinity of the site:

Vehicle Ingress

- Help Street (west): 80%
- Anderson Street (south): 10%
- Anderson Street (north): 10%

Vehicle Egress

- Help Street (west): 20%
- Anderson Street (south): 20%
- Anderson Street (north): 60%

In addition, the directional split of traffic (i.e. the ratio between the inbound and outbound traffic movements) for each of the land uses is presented in Table 7.2.

Table 7.2: Adopted Directional Distributions

Land Use	Directional Distribution Splits				Resultant Directional Distribution					
	AM Peak hour		PM Peak Hour		AM Peak Hour			PM Peak Hour		
	In	Out	In	Out	In	Out	Total	In	Out	Total
Residential	20%	80%	60%	40%	3	11	14	8	6	14
Retail	80%	20%	40%	60%	8	2	10	8	12	20
Office	90%	10%	10%	90%	6	1	7	1	5	6
Total					**17**	**14**	**31**	**17**	**23**	**40**

Based on the above, Figure 7.1 and Figure 7.2 have been prepared to show the estimated marginal increase in turning movements in the vicinity of the subject property following full site development. The figures indicate a maximum traffic volume increase on Cambridge Lane of 23 vehicle movements (being the egress volume during the PM peak hour).

Figure 7.1: AM Peak Hour Site Generated Traffic Volumes

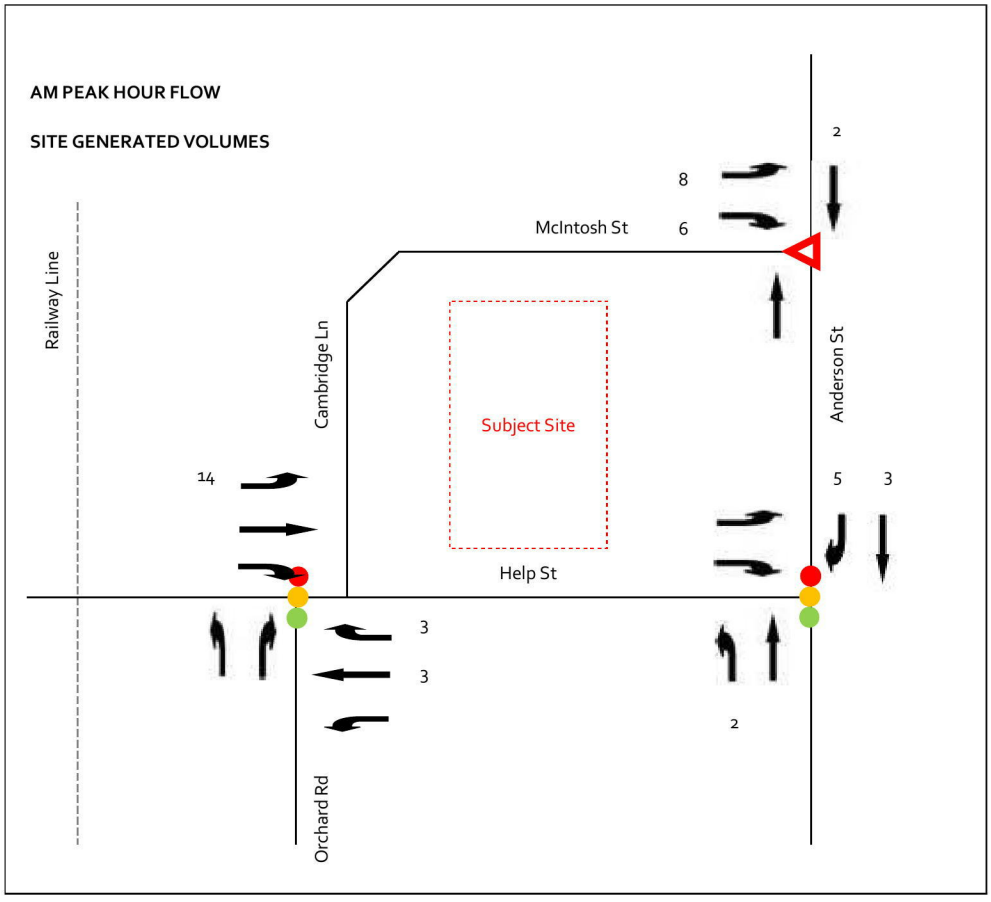
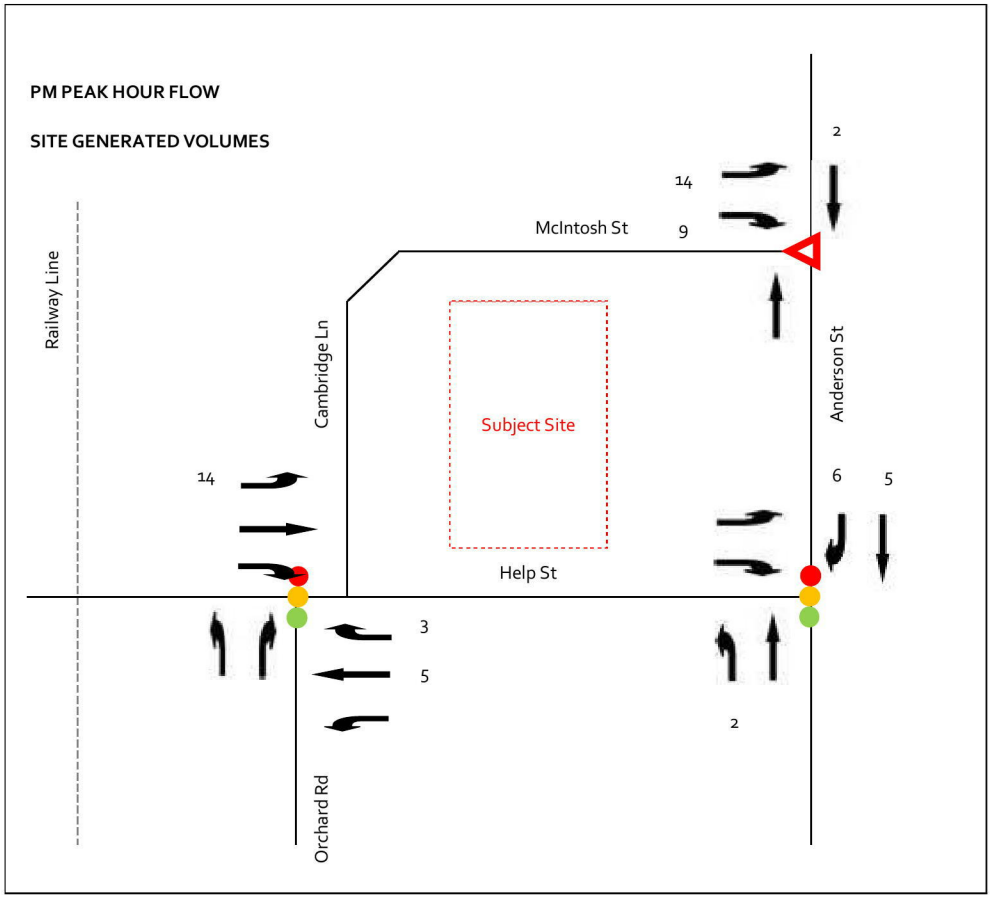


Figure 7.2: PM Peak Hour Site Generated Traffic Volumes



7.3 Surrounding Development Traffic Generation

7.3.1 Preamble

There are a number of developments currently being constructed or proposed in the vicinity of the subject site that will increase traffic volumes along the Help Street and Anderson Street corridors. The following developments are considered the most relevant and have been included in the cumulative traffic assessment presented in this report:

- 1 Help Street, Chatswood – TOGA site (traffic surveys completed prior to occupation)
- Chatswood Chase Shopping Centre (Planning Proposal)

The anticipated traffic generation from these developments is presented below, with the anticipated traffic volume estimates presented in Appendix D.

7.3.2 1 Help Street, Chatswood

A summary of the proposed development yield for the neighbouring Toga site is provided in Table 7.3. The table also includes a summary of the anticipated traffic generation to the site (adopting the traffic generation rates assumed for the subject site).

Table 7.3: Development Summary – 1 Help Street, Chatswood

Land Uses	Size [1]	Car Parking Provision	Resultant Traffic Generation	
			Peak Hour	Daily
Residential	136 dwellings	170 spaces (136 resident and 34 visitor spaces)	15	150
Café/Restaurant	650sqm	23 spaces	23	230
Office	368sqm			
Retail	270sqm			
Total	**-**	**193 spaces**	**38**	**380**

[1] development schedule sourced from the Council Assessment Report dated 19 November 2013 – incorporating the change of use from part seniors living to residential dwelling.

Table 7.3 indicates that the recently completed development at 1 Help Street is anticipated to generate in the order of 38 additional peak hour movements (the traffic surveys were completed prior to the completion of the development). Vehicle access to the site is provided solely via a left in / left out access to Help Street and therefore would not increase traffic volumes on Cambridge Lane.

The anticipated resultant traffic volumes are presented in Appendix D.

7.3.3 Chatswood Chase Shopping Centre

A Planning Proposal was submitted to Willoughby City Council seeking to expand the existing shopping centre from 58,650sq.m to 75,650sq.m; an increase of 17,000sqm.

Reference to the transport impact assessment report that accompanied the application[5] indicates the Centre is expected to generate 237 additional vehicle movements during the PM peak hour.

The report FURTHER indicates that up to 6 additional vehicle movements would be distributed to Victoria Avenue from the expanded shopping centre (eastbound during the PM peak hour). In order to present a conservative assessment, this additional traffic has been assumed for both the AM and PM peak hours.

The anticipated resultant traffic volumes are presented in Appendix D.

7.4 Post Development Traffic Volumes

A summary of the existing and future traffic volume scenarios assessed are provided in Table 7.4.

Table 7.4: Traffic Volume Scenarios Assessed

Scenario	Existing Road Network Traffic Volumes	Surrounding Developments	Subject Site	Traffic Volume Figure
Existing Traffic Volumes	✓	-	-	Figure 2.6 and 2.7
Base Scenario	✓	✓	-	Appendix B5 and B6
Post Development	✓	✓	✓	Appendix B7 and B8

5 GTA Report titled 'Archer Street Planning Proposal – Chatswood Chase: Transport Impact Assessment Report' dated 20 April 2017.

7.5 Traffic Impact

7.5.1 Peak Hour

The base and post development scenarios have been assessed using the SIDRA INTERSECTION. An overview of the results for each scenario is presented in Table 7.5, with the detailed results provided in Appendix E.

Table 7.5: SIDRA INTERSECTION – Base Case and Post Development Operating Conditions

Intersection	Peak Hour	Base Case			Post Development		
		Average Delay (sec)	95th Percentile Queue (m)	LOS	Average Delay (sec)	95th Percentile Queue (m)	LOS
Orchard Road/ Help Street	AM	25	85	C	25	85	C
	PM	23	73	C	23	74	C
Anderson Street/ Help Street	AM	30	121	C	30	123	C
	PM	29	90	C	29	91	C
Anderson Street/ McIntosh Street	AM	1	2	A	1	2	A
	PM	1	2	A	1	3	A

Table 7.5 indicates that each of the intersections in the vicinity of the site is anticipated to continue to operate with acceptable levels of service (LOS C or better) with only minor increases to average delays and 95th percentile queues predicted.

7.5.2 Midblock

McIntosh Street

The midblock capacity assessment assesses the forecast future traffic demands against the indicative two-way volume capacity of a road.

The capacity of a road varies depending on a number of factors, such as number of traffic lanes, carriageway width, property access, on-street car parking, land use frontages, etc. The indicative capacity of McIntosh Street has been sourced from RMS Guide to Traffic Generating Developments document.

An assessment of the midblock capacity of McIntosh Street has been undertaken with a summary of the results provided in Table 7.6.

Table 7.6: Midblock Capacity Assessment

Road (Location)	Indicative Daily Capacity	Daily Traffic Volume (vpd)			Adequacy of Road Link
		Existing	Additional	Post Development	
McIntosh Street	~2,000 to 3,000vpd	700	+190 [1]	890	✓

[1] All vehicles exiting the site travel on McIntosh Street (i.e. 50% x 379vpd).

Table 7.6 indicates that McIntosh Street is anticipated to operate well within its theoretical daily volume capacities.

Cambridge Lane

Transport for New South Wales (TfNSW) has a speed zone policy and guidelines relating to shared zones, published in 2012. The guidelines state that shared zones must meet specific site conditions and are assessed against the following site criteria:

- the current speed limit is ≤50km/h
- the current traffic flow is ≤100 vehicles/h and ≤1,000 vehicles/day

- the speed limit on approaching roads to be ≤50km/h
- the shared zone must be less than 400 metres in length
- the shared zone must not be on a bus route or a heavy vehicle route
- the minimum trafficable width must be 2.8m
- any delineation, kerb and gutter shall be removed to enhance the sense of equality between pedestrians and vehicles, unless excepted by Roads and Maritime Services
- there must be no designated pedestrian facilities located within a shared zone.

An assessment of the existing and post development peak hour and daily traffic volumes is presented in Table 7.7.

Table 7.7: Shared Zone Capacity Assessment – Cambridge Lane

Period	Shared Zone Threshold	Traffic Volume			Adequacy of Road Link
		Existing	Additional	Post Development	
AM Peak Hour	~100vph	67vph	+17vph	84vph	✓
PM Peak Hour	~100vph	49vph	+24vph	73vph	✓
Daily	~1,000vph	701vpd	+190vpd [2]	891vpd	✓

[1] Conservatively adopting the higher in / out peak hour volume accessing the site for each peak hour.
[2] All vehicles entering the site travel on Cambridge Lane (i.e. 50% x 379vpd).

Table 7.7 indicates that the post development traffic volumes on Cambridge Lane during the AM peak hour, PM peak hour and totally daily volume will continue to be in accordance with the thresholds set out in the TfNSW documentation.

7.5.3 Summary

The additional development traffic volumes through each of the surrounding intersections is less than 6% of the existing traffic volumes at each of these locations. Indeed, the anticipated additional traffic generated by the development is the equivalent of approximately 1 additional vehicle movement every minute and a half during the weekday peak periods.

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. In addition, on Cambridge Lane, the traffic volume increases are not expected to exceed RMS shared zone limits, and accordingly could not be expected to compromise the safety of pedestrians or cyclists.

Moreover, the use of Cambridge Lane and McIntosh Street by vehicles accessing residential uses which abut them is entirely appropriate and consistent with their functional role in the road network. Furthermore, the provision of direct vehicle access to Help Street would not be consistent with RMS access management policies.

Should the level of additional traffic to Cambridge Lane and McIntosh Street be perceived as an issue by Council there would be opportunities to limit car parking on-site and in turn supress traffic generation. This could be explored further at the development application stage.

7.5.4 Long-Term McIntosh Street Operation

It is understood that Willoughby Council have identified a potential opportunity to convert Mcintosh Street to allow two-way traffic in the future. Whilst the implications of such a treatment have not been examined in this report, it is not a requirement of this development nor will the development prevent such a change in the future.

8. Conclusion

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

i The indicative proposal generates a Willoughby DCP 2006 parking requirement of 198 car parking spaces.

ii It is proposed to provide 174 car parking spaces on-site which is considered appropriate having regard for the likelihood of shared car parking demands across the day. Given the sites attributes (CBD location, proximity to transport interchange, etc.), there would be opportunities to explore a further reduced car parking provision at the Development Application stage.

iii The proposed car park access and circulation, as well as the on-site loading facilities, are considered appropriate and would be further addressed at the Development Application stage.

iv The proposed bicycle parking will be provided in accordance with the minimum requirements of the DCP.

v The development is expected to generate up to 31, 40 and 379 vehicle movements during the weekday AM, weekday PM and daily periods, respectively.

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

vii If desired, a reduced car parking provision (below the DCP parking requirements), particularly for the retail land use, would reduce the traffic generation to and from the site and in turn reduce the traffic impact to the surrounding road network. This could be explored further at the Development Application stage.

Appendix A

Survey Results

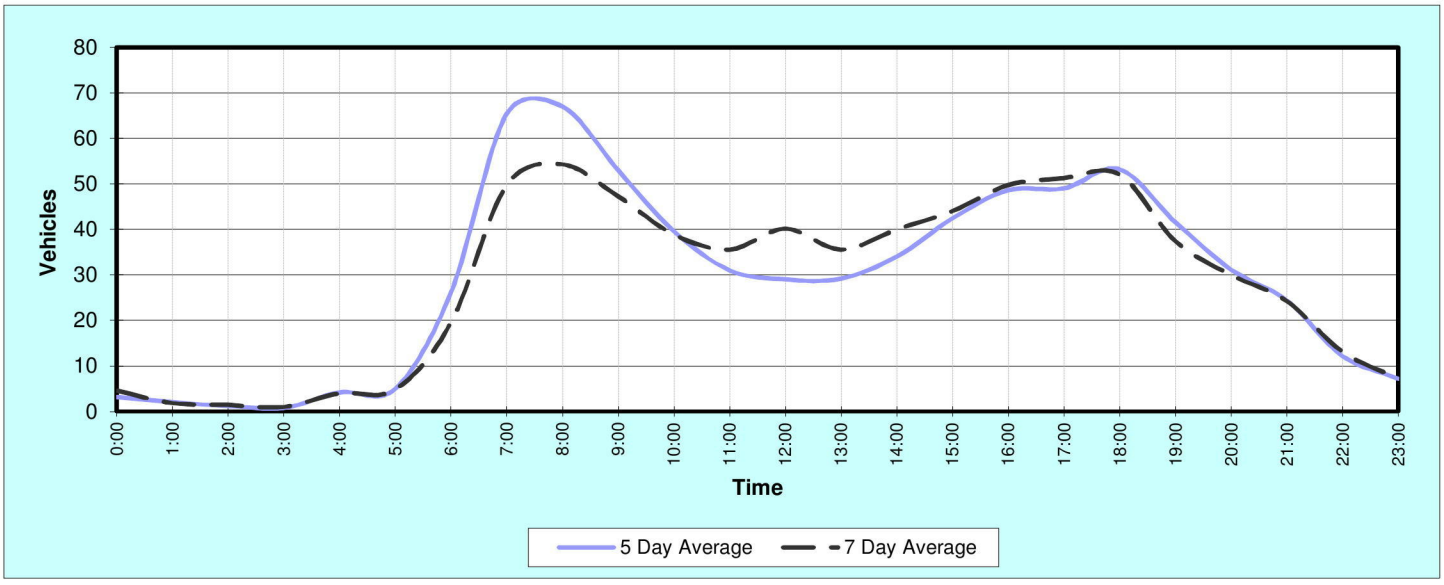
Volume Summary

Data Audit Systems
TRAFFIC SURVEYS

Street	Cambridge Lane		
Suburb	Chatswood		
Location	Between Help Street and McIntosh Street		
Count No.	1		
Start Date	Sunday	4-Jun-17	Speed Limit 10 km/h
Direction	Northbound		

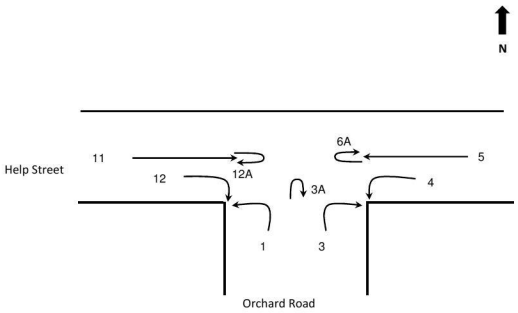
5 Day Average	701
7 Day Average	688
5 Day Heavy (Class 3 to 12)	1.7%
7 Day Heavy (Class 3 to 12)	1.4%

	Day of Week - Class 1 to 12							5 Day Average	7 Day Average
	Mon	Tue	Wed	Thu	Fri	Sat	Sun		
Time	5-Jun	6-Jun	7-Jun	8-Jun	9-Jun	10-Jun	4-Jun		
AM Peak	69	87	66	76	62	47	47		
PM Peak	64	55	62	47	56	67	83		
0:00	2	3	4	4	3	6	10	3	5
1:00	1	2	5	1	1	2	1	2	2
2:00	1	1	1	2	1	4	0	1	1
3:00	2	0	1	0	1	1	2	1	1
4:00	3	8	4	4	2	2	5	4	4
5:00	5	2	10	5	3	6	3	5	5
6:00	22	39	24	20	26	3	3	26	20
7:00	69	79	66	76	37	16	5	65	50
8:00	61	87	61	64	62	25	20	67	54
9:00	61	63	49	48	44	30	36	53	47
10:00	44	57	32	40	25	37	37	40	39
11:00	48	31	20	22	34	47	47	31	36
12:00	27	33	26	33	26	53	83	29	40
13:00	25	35	30	36	20	37	66	29	36
14:00	37	32	36	32	33	57	53	34	40
15:00	49	41	40	35	47	58	38	42	44
16:00	57	51	45	42	48	51	54	49	50
17:00	51	55	62	36	41	67	47	49	51
18:00	64	54	47	45	56	52	46	53	52
19:00	42	25	41	47	53	25	29	42	37
20:00	19	31	25	34	47	33	21	31	30
21:00	23	24	27	21	27	29	19	24	24
22:00	11	12	14	14	10	20	11	12	13
23:00	6	10	7	3	10	10	5	7	7
Total	730	775	677	664	657	671	641	701	688
Heavy %	1.6%	1.0%	2.1%	2.1%	1.8%	0.7%	0.2%	1.7%	1.4%



Data Audit Systems
FOR INFORMED DECISION MAKING
TRAFFIC SURVEYS

Location: Help Street/Orchard Road
Weather: Overcast
Date: Wednesday, 7 June 2017
Survey Period : 7:00am-9:00am and 4:00pm-6:00pm
AM Peak: 7:45am-8:45am
PM Peak: 5pm-6pm



Approach	Light	Heavy	Total
AM	931	40	971
PM	971	11	982

Departure	Light	Heavy	Total
AM	888	32	920
PM	912	28	940

Departure	Light	Heavy	Total
AM	789	30	819
PM	800	16	816

Approach	Light	Heavy	Total
AM	1059	104	1163
PM	1090	104	1194

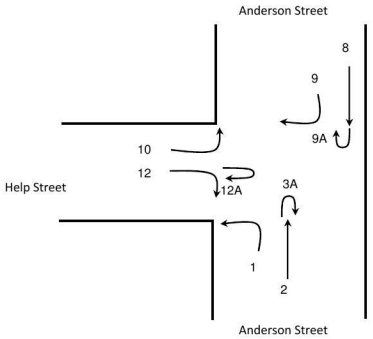
Approach	Light	Heavy	Total	Departure	Light	Heavy	Total
AM	4	15	19	AM	317	97	414
PM	0	23	23	PM	349	94	443

	1			3			3A			4			5			6A			11			12			12A			AM PEAK	
TIME	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Hour	Total
07:00	0	0	**0**	0	0	**0**	0	0	**0**	16	8	**24**	71	1	**72**	0	0	**0**	63	2	**65**	8	4	**12**	0	0	**0**	**7:00 - 8:00**	**976**
07:15	0	1	**1**	1	3	**4**	0	0	**0**	20	15	**35**	82	2	**84**	0	0	**0**	86	5	**91**	13	4	**17**	0	0	**0**	**7:15 - 8:15**	**1102**
07:30	1	1	**2**	0	2	**2**	0	0	**0**	15	12	**27**	117	5	**122**	0	0	**0**	105	4	**109**	17	1	**18**	0	0	**0**	**7:30 - 8:30**	**1189**
07:45	0	1	**1**	0	1	**1**	0	0	**0**	28	10	**38**	116	4	**120**	0	0	**0**	107	2	**109**	21	1	**22**	0	0	**0**	**7:45 - 8:45**	**1207**
08:00	0	0	**0**	0	0	**0**	0	0	**0**	32	10	**42**	109	2	**111**	0	0	**0**	120	4	**124**	18	4	**22**	0	0	**0**	**8:00 - 9:00**	**1177**
08:15	1	1	**2**	0	1	**1**	0	0	**0**	25	8	**33**	151	3	**154**	0	0	**0**	108	0	**108**	19	2	**21**	0	0	**0**		
08:30	1	2	**3**	0	0	**0**	0	0	**0**	22	8	**30**	137	2	**139**	0	0	**0**	100	2	**102**	22	1	**23**	1	0	**1**		
08:45	0	1	**1**	0	1	**1**	0	0	**0**	17	8	**25**	101	6	**107**	0	0	**0**	99	3	**102**	24	1	**25**	0	0	**0**		
TOTAL	**3**	**7**	**10**	**1**	**8**	**9**	**0**	**0**	**0**	**175**	**79**	**254**	**884**	**25**	**909**	**0**	**0**	**0**	**788**	**22**	**810**	**142**	**18**	**160**	**1**	**0**	**1**		
AM PEAK	**2**	**4**	**6**	**0**	**2**	**2**	**0**	**0**	**0**	**107**	**36**	**143**	**513**	**11**	**524**	**0**	**0**	**0**	**435**	**8**	**443**	**80**	**8**	**88**	**1**	**0**	**1**		

	1			3			3A			4			5			6A			11			12			12A			PM PEAK	
TIME	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Hour	Total
16:00	0	0	**0**	0	1	**1**	0	0	**0**	21	14	**35**	107	2	**109**	0	0	**0**	84	0	**84**	26	4	**30**	0	0	**0**	**16:00 - 17:00**	**1027**
16:15	0	2	**2**	0	0	**0**	0	0	**0**	19	15	**34**	118	2	**120**	0	0	**0**	97	0	**97**	17	0	**17**	0	0	**0**	**16:15 - 17:15**	**1085**
16:30	0	1	**1**	0	4	**4**	0	0	**0**	22	12	**34**	108	1	**109**	0	0	**0**	92	1	**93**	16	1	**17**	0	0	**0**	**16:30 - 17:30**	**1093**
16:45	0	1	**1**	0	1	**1**	0	0	**0**	16	11	**27**	99	5	**104**	0	0	**0**	77	0	**77**	30	0	**30**	0	0	**0**	**16:45 - 17:45**	**1120**
17:00	0	3	**3**	0	2	**2**	0	0	**0**	25	10	**35**	137	3	**140**	0	0	**0**	117	0	**117**	19	1	**20**	0	0	**0**	**17:00 - 18:00**	**1172**
17:15	0	1	**1**	0	3	**3**	0	0	**0**	25	9	**34**	107	0	**107**	0	0	**0**	109	0	**109**	23	1	**24**	0	0	**0**		
17:30	0	1	**1**	0	0	**0**	0	0	**0**	17	5	**22**	121	4	**125**	0	0	**0**	113	2	**115**	22	0	**22**	0	0	**0**		
17:45	0	2	**2**	0	1	**1**	0	0	**0**	33	11	**44**	115	0	**115**	0	0	**0**	111	1	**112**	18	0	**18**	0	0	**0**		
TOTAL	**0**	**11**	**11**	**0**	**12**	**12**	**0**	**0**	**0**	**178**	**87**	**265**	**912**	**17**	**929**	**0**	**0**	**0**	**800**	**4**	**804**	**171**	**7**	**178**	**0**	**0**	**0**		
PM PEAK	**0**	**7**	**7**	**0**	**6**	**6**	**0**	**0**	**0**	**100**	**35**	**135**	**480**	**7**	**487**	**0**	**0**	**0**	**450**	**3**	**453**	**82**	**2**	**84**	**0**	**0**	**0**		

Data Audit Systems
FOR INFORMED DECISION MAKING
TRAFFIC SURVEYS

Location: Help Street/Anderson Street
Weather: Overcast
Date: Wednesday, 7 June 2017
Survey Period : 7:00am-9:00am and 4:00pm-6:00pm
AM Peak: 7:45am-8:45am
PM Peak: 5pm-6pm



N

Approach	Light	Heavy	Total
AM	704	29	733
PM	735	17	752

Departure	Light	Heavy	Total
AM	1042	108	1150
PM	1129	104	1233

Departure	Light	Heavy	Total
AM	418	35	453
PM	519	30	549

Approach	Light	Heavy	Total
AM	920	43	963
PM	779	37	816

Approach	Light	Heavy	Total
AM	487	101	588
PM	771	99	870

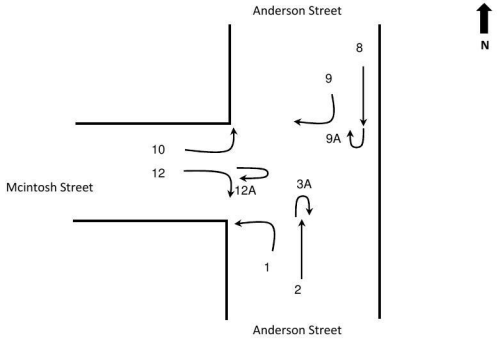
Departure	Light	Heavy	Total
AM	651	30	681
PM	637	19	656

	1			2			3A			8			9			9A			10			12			12A			AM PEAK	
TIME	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Hour	Total
07:00	31	8	39	12	3	15	0	0	0	13	0	13	59	2	61	0	0	0	22	1	23	37	1	38	0	0	0	7:00 - 8:00	1042
07:15	30	11	41	20	5	25	0	0	0	17	1	18	70	7	77	0	0	0	30	1	31	47	6	53	0	0	0	7:15 - 8:15	1187
07:30	32	11	43	19	7	26	0	0	0	24	1	25	92	7	99	1	0	1	43	1	44	45	5	50	0	0	0	7:30 - 8:30	1282
07:45	44	10	54	23	6	29	0	0	0	27	0	27	109	5	114	0	0	0	33	0	33	60	3	63	0	0	0	7:45 - 8:45	1315
08:00	48	7	55	17	4	21	0	0	0	34	2	36	100	4	104	0	0	0	37	0	37	77	4	81	0	0	0	8:00 - 9:00	1242
08:15	50	8	58	25	4	29	0	0	0	30	0	30	115	3	118	0	0	0	39	0	39	64	2	66	0	0	0		
08:30	61	7	68	18	2	20	0	0	0	33	0	33	103	4	107	0	0	0	29	0	29	62	2	64	0	0	0		
08:45	34	7	41	23	1	24	0	0	0	29	0	29	64	7	71	0	0	0	27	0	27	52	3	55	0	0	0		
TOTAL	330	69	399	157	32	189	0	0	0	207	4	211	712	39	751	1	0	1	260	3	263	444	26	470	0	0	0		
AM PEAK	203	32	235	83	16	99	0	0	0	124	2	126	427	16	443	0	0	0	138	0	138	263	11	274	0	0	0		

	1			2			3A			8			9			9A			10			12			12A			PM PEAK	
TIME	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Hour	Total
16:00	58	11	69	24	2	26	0	0	0	23	1	24	61	6	67	0	0	0	24	0	24	60	1	61	0	0	0	16:00 - 17:00	1150
16:15	70	10	80	20	6	26	0	0	0	24	2	26	86	5	91	0	0	0	22	0	22	63	1	64	0	0	0	16:15 - 17:15	1213
16:30	57	10	67	29	2	31	0	0	0	36	0	36	71	4	75	0	0	0	33	1	34	50	4	54	0	0	0	16:30 - 17:30	1228
16:45	67	12	79	26	5	31	0	0	0	17	0	17	66	3	69	0	0	0	36	0	36	40	1	41	0	0	0	16:45 - 17:45	1227
17:00	78	9	87	29	1	30	0	0	0	21	0	21	76	4	80	0	0	0	58	0	58	56	2	58	0	0	0	17:00 - 18:00	1288
17:15	69	6	75	42	5	47	0	0	0	23	0	23	79	3	82	0	0	0	45	0	45	50	2	52	0	0	0		
17:30	72	5	77	28	3	31	0	0	0	22	0	22	67	5	72	0	0	0	35	0	35	57	2	59	0	0	0		
17:45	74	7	81	28	5	33	0	0	0	29	0	29	78	4	82	0	0	0	40	0	40	66	3	69	0	0	0		
TOTAL	545	70	615	226	29	255	0	0	0	195	3	198	584	34	618	0	0	0	293	1	294	442	16	458	0	0	0		
PM PEAK	293	27	320	127	14	141	0	0	0	95	0	95	300	16	316	0	0	0	178	0	178	229	9	238	0	0	0		

Data Audit Systems
FOR INFORMED DECISION MAKING
TRAFFIC SURVEYS

Location: Mcintosh Street/Anderson Street
Weather: Overcast
Date: Wednesday, 7 June 2017
Survey Period : 7:00am-9:00am and 4:00pm-6:00pm
AM Peak: 7:45am-8:45am
PM Peak: 5pm-6pm



N

Approach	Light	Heavy	Total
AM	117	3	120
PM	106	1	107

Departure	Light	Heavy	Total
AM	1	0	1
PM	1	0	1

Departure	Light	Heavy	Total	Approach	Light	Heavy	Total
AM	498	37	535	AM	922	42	964
PM	591	31	622	PM	736	36	772

Approach	Light	Heavy	Total	Departure	Light	Heavy	Total
AM	422	35	457	AM	962	43	1005
PM	534	31	565	PM	784	37	821

	1			2			3A			8			9			9A			10			12			12A			AM PEAK	
TIME	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Hour	Total
07:00	0	0	0	32	4	36	1	0	1	67	2	69	0	0	0	0	0	0	11	0	11	2	0	2	0	0	0	7:00 - 8:00	708
07:15	0	0	0	49	6	55	0	0	0	84	7	91	0	0	0	1	0	1	7	1	8	4	1	5	0	0	0	7:15 - 8:15	805
07:30	0	0	0	61	8	69	0	0	0	121	9	130	0	0	0	0	0	0	10	0	10	3	0	3	0	0	0	7:30 - 8:30	878
07:45	0	0	0	62	6	68	0	0	0	124	4	128	0	0	0	0	0	0	14	0	14	7	0	7	0	0	0	7:45 - 8:45	878
08:00	0	0	0	56	4	60	0	0	0	135	7	142	0	0	0	0	0	0	12	0	12	2	0	2	0	0	0	8:00 - 9:00	833
08:15	1	0	1	65	4	69	1	0	1	142	2	144	0	0	0	0	0	0	10	0	10	8	0	8	0	0	0		
08:30	0	0	0	47	2	49	0	0	0	139	7	146	0	0	0	0	0	0	10	1	11	6	0	6	0	0	0		
08:45	0	0	0	47	1	48	0	0	0	109	4	113	0	0	0	0	0	0	4	0	4	7	0	7	0	0	0		
TOTAL	1	0	1	419	35	454	2	0	2	921	42	963	0	0	0	1	0	1	78	2	80	39	1	40	0	0	0		
AM PEAK	1	0	1	230	16	246	1	0	1	540	20	560	0	0	0	0	0	0	46	1	47	23	0	23	0	0	0		

	1			2			3A			8			9			9A			10			12			12A			PM PEAK	
TIME	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Hour	Total
16:00	0	0	0	52	3	55	0	0	0	84	8	92	0	0	0	0	0	0	5	0	5	6	0	6	0	0	0	16:00 - 17:00	676
16:15	0	0	0	50	6	56	0	0	0	102	5	107	0	0	0	0	0	0	9	0	9	3	1	4	0	0	0	16:15 - 17:15	712
16:30	1	0	1	64	3	67	0	0	0	97	5	102	0	0	0	0	0	0	7	0	7	9	0	9	0	0	0	16:30 - 17:30	733
16:45	0	0	0	60	5	65	0	0	0	81	3	84	0	0	0	0	0	0	5	0	5	2	0	2	0	0	0	16:45 - 17:45	731
17:00	0	0	0	87	1	88	0	0	0	91	4	95	0	0	0	0	0	0	4	0	4	7	0	7	0	0	0	17:00 - 18:00	768
17:15	0	0	0	79	5	84	0	0	0	93	2	95	0	0	0	0	0	0	11	0	11	7	0	7	0	0	0		
17:30	0	0	0	69	2	71	0	0	0	89	5	94	0	0	0	0	0	0	8	0	8	11	0	11	0	0	0		
17:45	0	0	0	72	6	78	0	0	0	99	4	103	0	0	0	0	0	0	9	0	9	3	0	3	0	0	0		
TOTAL	1	0	1	533	31	564	0	0	0	736	36	772	0	0	0	0	0	0	58	0	58	48	1	49	0	0	0		
PM PEAK	0	0	0	307	14	321	0	0	0	372	15	387	0	0	0	0	0	0	32	0	32	28	0	28	0	0	0		

Appendix B

SIDRA INTERSECTION Results – Existing Conditions

MOVEMENT SUMMARY

Site: 101 [AM Anderson Street / Help Street]

New Site
Signals - Fixed Time Isolated Cycle Time = 80 seconds (User-Given Cycle Time)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Anderson Street											
1	L2	247	13.6	0.731	41.2	LOS D	9.8	76.7	0.99	0.88	35.0
2	T1	104	16.2	0.295	30.1	LOS C	3.6	28.4	0.89	0.71	40.2
Approach		352	14.4	0.731	37.9	LOS D	9.8	76.7	0.96	0.83	36.4
North: Anderson Street											
8	T1	133	1.6	0.110	6.4	LOS A	2.1	14.6	0.43	0.35	54.3
9	R2	466	3.6	0.736	31.7	LOS C	16.7	120.7	0.94	0.87	38.7
Approach		599	3.2	0.736	26.1	LOS C	16.7	120.7	0.82	0.76	41.3
West: Help Street											
10	L2	145	0.0	0.120	11.2	LOS B	2.1	14.8	0.40	0.68	49.5
12	R2	288	4.0	0.710	38.6	LOS D	11.0	79.9	0.98	0.87	36.1
Approach		434	2.7	0.710	29.4	LOS C	11.0	79.9	0.79	0.80	39.7
All Vehicles		1384	5.9	0.736	30.1	LOS C	16.7	120.7	0.85	0.79	39.4

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	53	32.5	LOS D	0.1	0.1	0.90	0.90
P3	North Full Crossing	53	32.5	LOS D	0.1	0.1	0.90	0.90
P4	West Full Crossing	53	34.3	LOS D	0.1	0.1	0.93	0.93
All Pedestrians		158	33.1	LOS D			0.91	0.91

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 101 [PM Anderson Street / Help Street]

New Site
Signals - Fixed Time Isolated Cycle Time = 80 seconds (User-Given Cycle Time)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Anderson Street											
1	L2	337	8.4	0.669	33.6	LOS C	12.0	89.8	0.94	0.84	37.8
2	T1	148	9.9	0.282	24.1	LOS C	4.6	34.6	0.82	0.66	43.0
Approach		485	8.9	0.669	30.7	LOS C	12.0	89.8	0.90	0.79	39.3
North: Anderson Street											
8	T1	100	0.0	0.080	5.9	LOS A	1.5	10.2	0.40	0.32	54.7
9	R2	333	5.1	0.675	34.5	LOS C	12.0	87.4	0.95	0.85	37.6
Approach		433	3.9	0.675	27.8	LOS C	12.0	87.4	0.82	0.73	40.5
West: Help Street											
10	L2	187	0.0	0.179	14.6	LOS B	3.5	24.7	0.52	0.71	47.3
12	R2	251	3.8	0.652	38.0	LOS D	9.3	67.4	0.97	0.84	36.3
Approach		438	2.2	0.652	28.0	LOS C	9.3	67.4	0.77	0.78	40.3
All Vehicles		1356	5.1	0.675	28.9	LOS C	12.0	89.8	0.83	0.77	40.0

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	53	33.4	LOS D	0.1	0.1	0.91	0.91
P3	North Full Crossing	53	33.4	LOS D	0.1	0.1	0.91	0.91
P4	West Full Crossing	53	28.1	LOS C	0.1	0.1	0.84	0.84
All Pedestrians		158	31.6	LOS D			0.89	0.89

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 101 [AM Help Street / Orchard Road]

New Site
Signals - Fixed Time Isolated Cycle Time = 80 seconds (User-Given Cycle Time)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Orchard Road											
1	L2	6	66.7	0.074	38.6	LOS D	0.3	3.8	0.92	0.67	35.1
3	R2	2	100.0	0.074	38.4	LOS D	0.3	3.8	0.92	0.67	35.3
Approach		8	75.0	0.074	38.5	LOS D	0.3	3.8	0.92	0.67	35.1
East: Help Street											
4	L2	151	25.2	0.566	29.6	LOS C	10.9	84.2	0.87	0.78	40.6
5	T1	552	2.1	0.566	23.7	LOS C	11.9	84.8	0.87	0.76	42.8
Approach		702	7.0	0.566	24.9	LOS C	11.9	84.8	0.87	0.77	42.3
West: Help Street											
11	T1	466	1.8	0.358	21.7	LOS C	6.9	49.2	0.80	0.67	44.2
12	R2	94	9.0	0.537	45.1	LOS D	3.7	28.1	0.99	0.78	33.7
Approach		560	3.0	0.537	25.6	LOS C	6.9	49.2	0.83	0.69	42.0
All Vehicles		1271	5.7	0.566	25.3	LOS C	11.9	84.8	0.85	0.73	42.1

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	53	21.1	LOS C	0.1	0.1	0.73	0.73
P2	East Full Crossing	53	34.3	LOS D	0.1	0.1	0.93	0.93
P4	West Full Crossing	53	34.3	LOS D	0.1	0.1	0.93	0.93
All Pedestrians		158	29.9	LOS C			0.86	0.86

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 101 [PM Help Street / Orchard Road]

New Site
Signals - Fixed Time Isolated Cycle Time = 80 seconds (User-Given Cycle Time)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Orchard Road											
1	L2	7	100.0	0.174	41.1	LOS D	0.5	6.9	0.96	0.69	34.5
3	R2	6	100.0	0.174	41.1	LOS D	0.5	6.9	0.96	0.69	34.4
Approach		14	100.0	0.174	41.1	LOS D	0.5	6.9	0.96	0.69	34.5
East: Help Street											
4	L2	142	25.9	0.475	26.5	LOS C	9.3	72.4	0.81	0.74	42.0
5	T1	513	1.4	0.475	20.6	LOS C	10.3	72.8	0.81	0.71	44.4
Approach		655	6.8	0.475	21.9	LOS C	10.3	72.8	0.81	0.72	43.9
West: Help Street											
11	T1	477	0.7	0.327	19.2	LOS B	6.7	46.9	0.76	0.63	45.5
12	R2	88	2.4	0.484	44.6	LOS D	3.5	24.8	0.99	0.77	33.9
Approach		565	0.9	0.484	23.2	LOS C	6.7	46.9	0.79	0.66	43.2
All Vehicles		1234	5.1	0.484	22.7	LOS C	10.3	72.8	0.80	0.69	43.4

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	53	18.9	LOS B	0.1	0.1	0.69	0.69
P2	East Full Crossing	53	34.3	LOS D	0.1	0.1	0.93	0.93
P4	West Full Crossing	53	34.3	LOS D	0.1	0.1	0.93	0.93
All Pedestrians		158	29.2	LOS C			0.85	0.85

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 101 [AM Anderson Street / McIntosh Street]

New Site
Giveway / Yield (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Anderson Street											
2	T1	282	6.3	0.075	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		282	6.3	0.075	0.0	NA	0.0	0.0	0.00	0.00	60.0
North: Anderson Street											
8	T1	573	3.7	0.150	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		573	3.7	0.150	0.0	NA	0.0	0.0	0.00	0.00	60.0
West: McIntosh Street											
10	L2	48	2.2	0.042	6.1	LOS A	0.1	1.1	0.24	0.56	52.8
12	R2	21	0.0	0.065	15.3	LOS C	0.2	1.6	0.72	0.89	46.6
Approach		69	1.5	0.065	8.9	LOS A	0.2	1.6	0.38	0.66	50.7
All Vehicles		924	4.3	0.150	0.7	NA	0.2	1.6	0.03	0.05	59.2

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [PM Anderson Street / McIntosh Street]

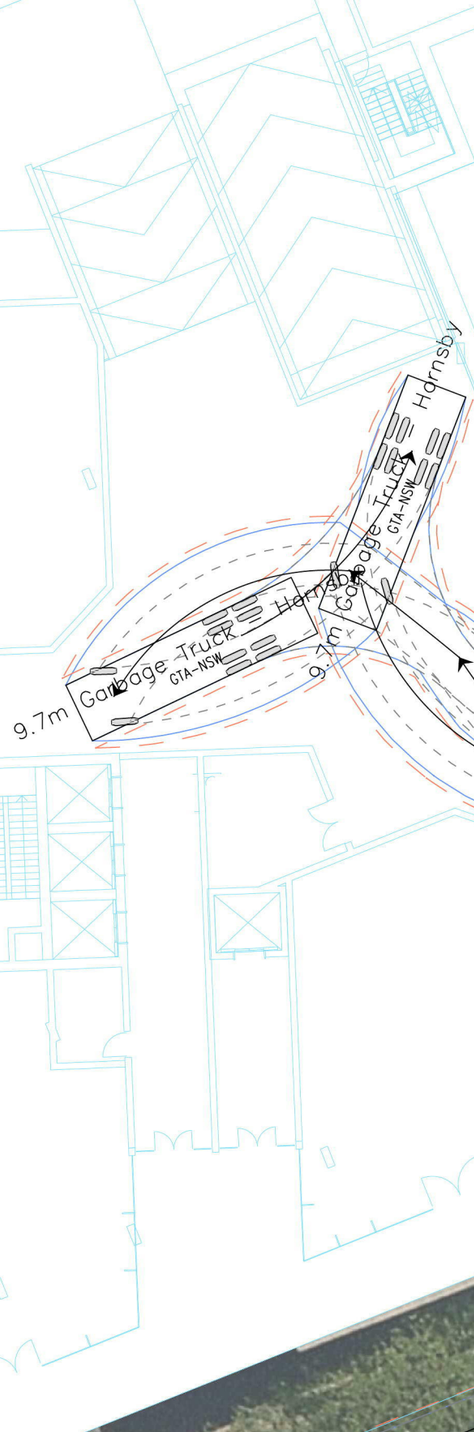
New Site
Giveway / Yield (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Anderson Street											
2	T1	338	4.4	0.089	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		338	4.4	0.089	0.0	NA	0.0	0.0	0.00	0.00	60.0
North: Anderson Street											
8	T1	407	3.9	0.107	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		407	3.9	0.107	0.0	NA	0.0	0.0	0.00	0.00	60.0
West: McIntosh Street											
10	L2	34	0.0	0.030	6.2	LOS A	0.1	0.7	0.26	0.56	52.8
12	R2	29	0.0	0.075	13.1	LOS B	0.3	1.9	0.66	0.86	47.9
Approach		63	0.0	0.075	9.4	LOS A	0.3	1.9	0.45	0.70	50.4
All Vehicles		808	3.8	0.107	0.7	NA	0.3	1.9	0.03	0.05	59.1

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Appendix C

Swept Path Assessment



SWEPT PATH KEY

- VEHICLE CENTRE LINE
- VEHICLE TYRE PATH
- VEHICLE BODY PATH
- 300mm CLEARANCE FROM VEHICLE BODY

ASSUMED SPEED 5km/h

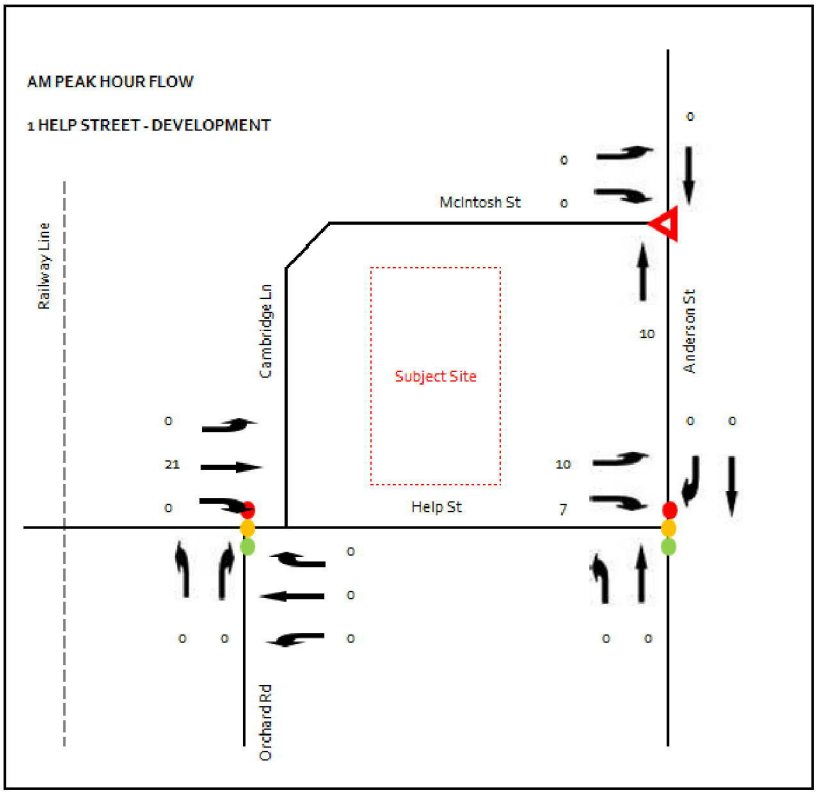
9.7m Garbage Truck – Hornsby

	meters
Width	: 2.40
Track	: 2.40
Lock to Lock Time	: 6.0
Steering Angle	: 35.0

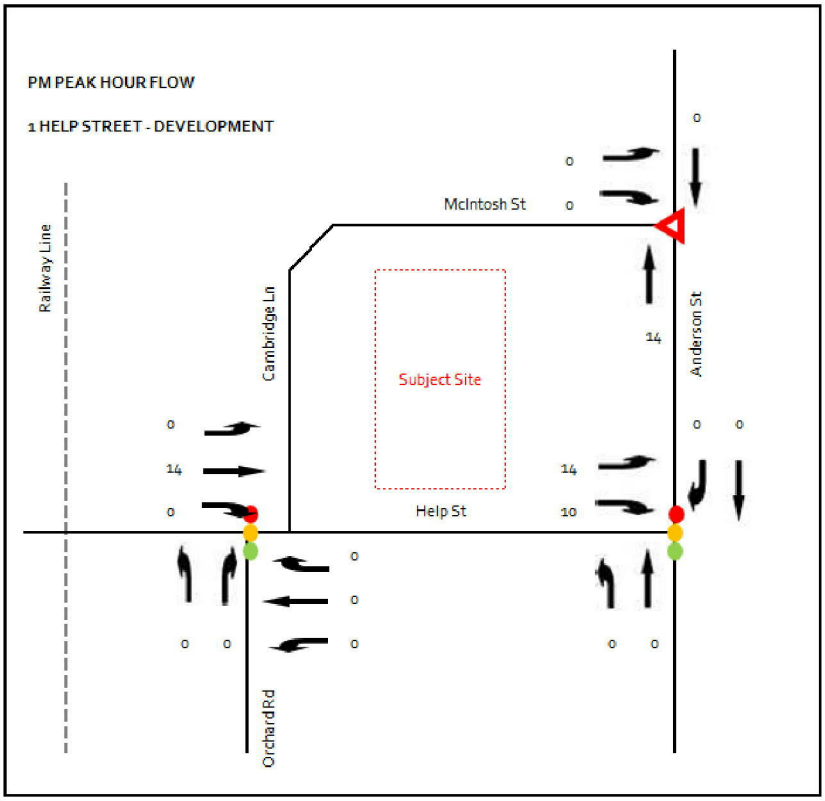
Appendix D

Traffic Volume Estimates

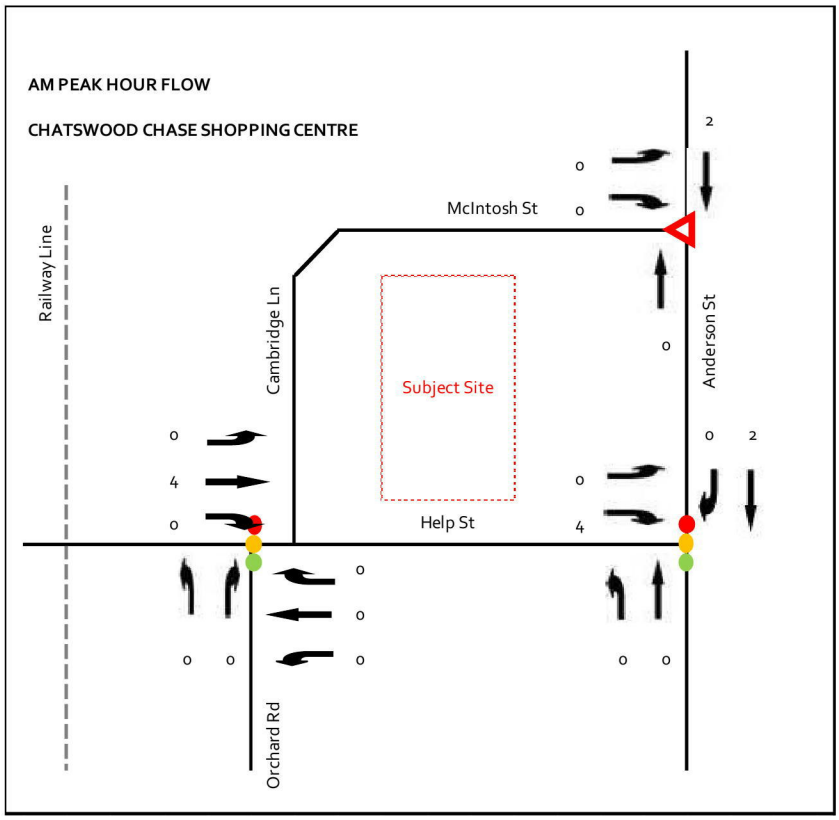
Appendix D1: 1 Help Street, Chatswood – AM Peak Hour Additional Traffic Volumes



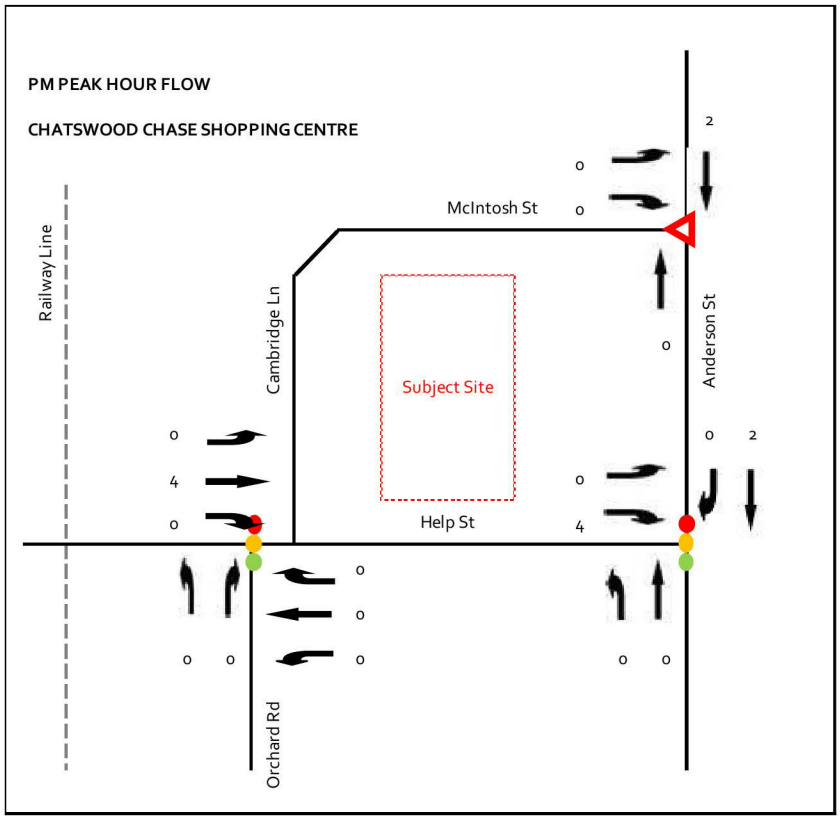
Appendix D2: 1 Help Street, Chatswood – PM Peak Hour Additional Traffic Volumes



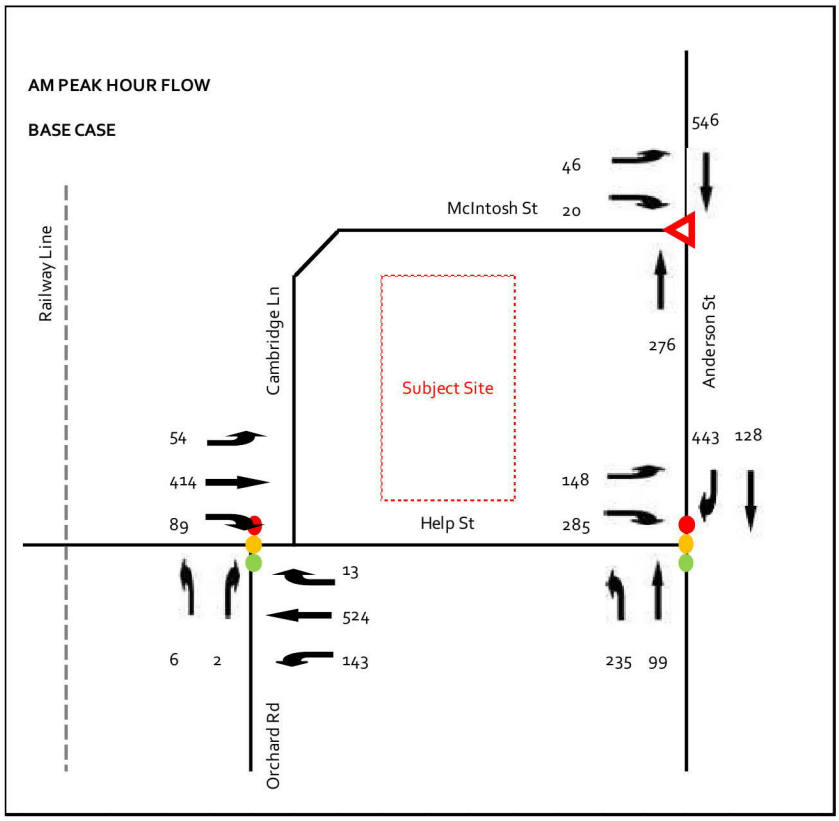
Appendix D3: Chatswood Chase Shopping Centre – AM Peak Hour Additional Traffic Volumes



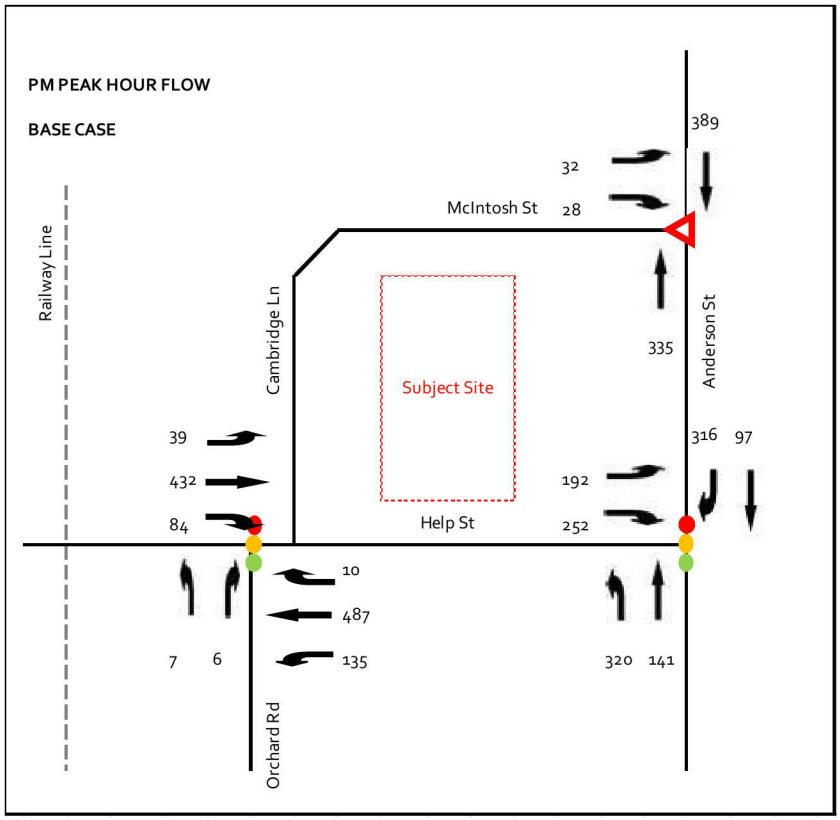
Appendix D4: Chatswood Chase Shopping Centre – PM Peak Hour Additional Traffic Volumes



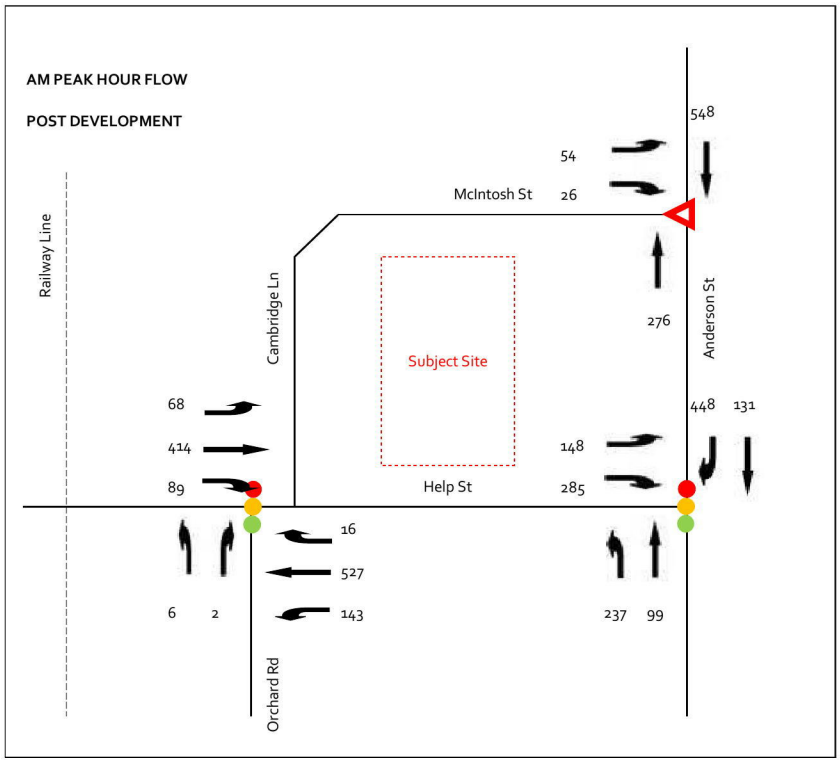
Appendix D5: Base Case AM Peak Hour Traffic Volumes



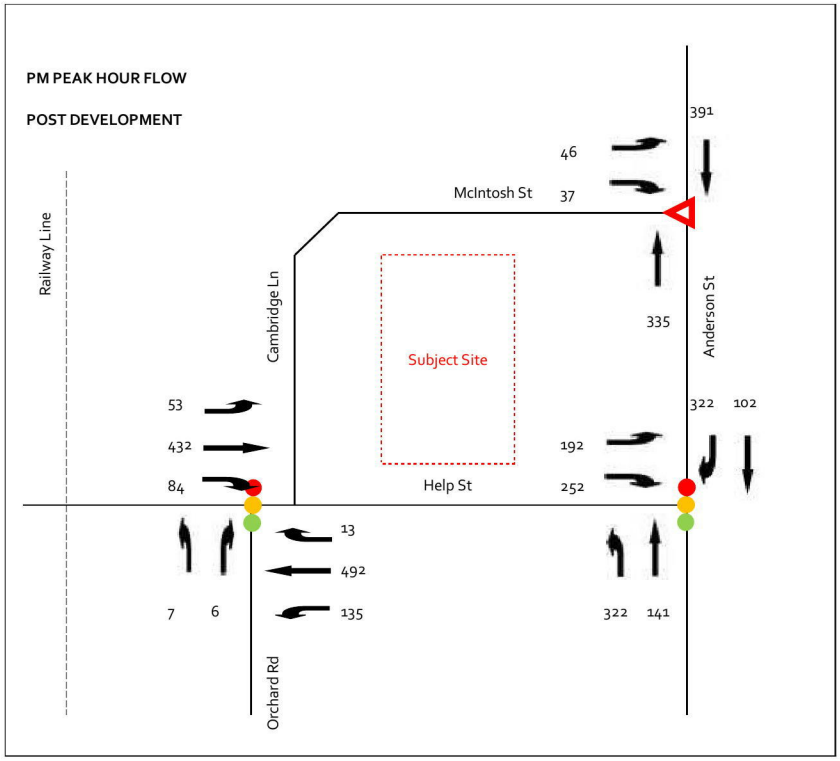
Appendix D6: Base Case PM Peak Hour Traffic Volumes



Appendix D7: Post Development AM Peak Hour Traffic Volumes



Appendix D8: Post Development PM Peak Hour Traffic Volumes



Appendix E

SIDRA INTERSECTION – Post Development

MOVEMENT SUMMARY

Site: 101 [AM Anderson Street / Help Street - Post Development]

New Site
Signals - Fixed Time Isolated Cycle Time = 80 seconds (User-Given Cycle Time)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Anderson Street											
1	L2	249	13.5	0.736	41.4	LOS D	9.9	77.5	0.99	0.88	35.0
2	T1	104	16.2	0.295	30.1	LOS C	3.6	28.4	0.89	0.71	40.2
Approach		354	14.3	0.736	38.0	LOS D	9.9	77.5	0.96	0.83	36.4
North: Anderson Street											
8	T1	138	1.5	0.114	6.4	LOS A	2.1	15.2	0.43	0.35	54.3
9	R2	472	3.6	0.744	32.1	LOS C	17.1	123.1	0.94	0.88	38.5
Approach		609	3.1	0.744	26.3	LOS C	17.1	123.1	0.82	0.76	41.3
West: Help Street											
10	L2	156	0.0	0.129	11.2	LOS B	2.3	16.0	0.40	0.68	49.5
12	R2	300	3.9	0.738	39.4	LOS D	11.7	84.7	0.99	0.88	35.7
Approach		456	2.5	0.738	29.8	LOS C	11.7	84.7	0.79	0.81	39.5
All Vehicles		1419	5.7	0.744	30.3	LOS C	17.1	123.1	0.85	0.79	39.4

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped

P1	South Full Crossing	53	32.5	LOS D	0.1	0.1	0.90	0.90
P3	North Full Crossing	53	32.5	LOS D	0.1	0.1	0.90	0.90
P4	West Full Crossing	53	34.3	LOS D	0.1	0.1	0.93	0.93
All Pedestrians		158	33.1	LOS D			0.91	0.91

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 101 [AM Anderson Street / Help Street - Base]

New Site
Signals - Fixed Time Isolated Cycle Time = 80 seconds (User-Given Cycle Time)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Anderson Street											
1	L2	247	13.6	0.731	41.2	LOS D	9.8	76.7	0.99	0.88	35.0
2	T1	104	16.2	0.295	30.1	LOS C	3.6	28.4	0.89	0.71	40.2
Approach		352	14.4	0.731	37.9	LOS D	9.8	76.7	0.96	0.83	36.4
North: Anderson Street											
8	T1	135	1.6	0.112	6.4	LOS A	2.1	14.8	0.43	0.35	54.3
9	R2	466	3.6	0.736	31.7	LOS C	16.7	120.7	0.94	0.87	38.7
Approach		601	3.2	0.736	26.0	LOS C	16.7	120.7	0.82	0.76	41.3
West: Help Street											
10	L2	156	0.0	0.129	11.2	LOS B	2.3	16.0	0.40	0.68	49.5
12	R2	300	3.9	0.738	39.4	LOS D	11.7	84.7	0.99	0.88	35.7
Approach		456	2.5	0.738	29.8	LOS C	11.7	84.7	0.79	0.81	39.5
All Vehicles		1408	5.8	0.738	30.2	LOS C	16.7	120.7	0.85	0.79	39.4

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped

P1	South Full Crossing	53	32.5	LOS D	0.1	0.1	0.90	0.90
P3	North Full Crossing	53	32.5	LOS D	0.1	0.1	0.90	0.90
P4	West Full Crossing	53	34.3	LOS D	0.1	0.1	0.93	0.93
All Pedestrians		158	33.1	LOS D			0.91	0.91

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 101 [AM Anderson Street / McIntosh Street - Base]

New Site
Giveway / Yield (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Anderson Street											
2	T1	291	6.2	0.077	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		291	6.2	0.077	0.0	NA	0.0	0.0	0.00	0.00	60.0
North: Anderson Street											
8	T1	575	3.7	0.151	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		575	3.7	0.151	0.0	NA	0.0	0.0	0.00	0.00	60.0
West: McIntosh Street											
10	L2	48	2.2	0.042	6.1	LOS A	0.2	1.1	0.24	0.56	52.8
12	R2	21	0.0	0.067	15.5	LOS C	0.2	1.6	0.72	0.89	46.4
Approach		69	1.5	0.067	9.0	LOS A	0.2	1.6	0.39	0.66	50.7
All Vehicles		935	4.3	0.151	0.7	NA	0.2	1.6	0.03	0.05	59.2

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [AM Anderson Street / McIntosh Street - Post Development]

New Site
Giveway / Yield (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Anderson Street											
2	T1	291	6.2	0.077	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		291	6.2	0.077	0.0	NA	0.0	0.0	0.00	0.00	60.0
North: Anderson Street											
8	T1	577	3.6	0.151	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		577	3.6	0.151	0.0	NA	0.0	0.0	0.00	0.00	60.0
West: McIntosh Street											
10	L2	57	1.9	0.050	6.1	LOS A	0.2	1.3	0.24	0.56	52.8
12	R2	27	0.0	0.087	15.7	LOS C	0.3	2.1	0.73	0.89	46.3
Approach		84	1.3	0.087	9.2	LOS A	0.3	2.1	0.40	0.67	50.5
All Vehicles		952	4.2	0.151	0.8	NA	0.3	2.1	0.04	0.06	59.0

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [AM Help Street / Orchard Road - Base]

New Site
Signals - Fixed Time Isolated Cycle Time = 80 seconds (User-Given Cycle Time)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Orchard Road											
1	L2	6	66.7	0.074	38.6	LOS D	0.3	3.8	0.92	0.67	35.1
3	R2	2	100.0	0.074	38.4	LOS D	0.3	3.8	0.92	0.67	35.3
Approach		8	75.0	0.074	38.5	LOS D	0.3	3.8	0.92	0.67	35.1
East: Help Street											
4	L2	151	25.2	0.566	29.6	LOS C	10.9	84.2	0.87	0.78	40.6
5	T1	552	2.1	0.566	23.7	LOS C	11.9	84.8	0.87	0.76	42.8
Approach		702	7.0	0.566	24.9	LOS C	11.9	84.8	0.87	0.77	42.3
West: Help Street											
11	T1	493	1.7	0.378	21.8	LOS C	7.4	52.3	0.81	0.68	44.1
12	R2	94	9.0	0.537	45.1	LOS D	3.7	28.1	0.99	0.78	33.7
Approach		586	2.9	0.537	25.6	LOS C	7.4	52.3	0.84	0.69	42.0
All Vehicles		1297	5.6	0.566	25.3	LOS C	11.9	84.8	0.86	0.73	42.1

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped

P1	South Full Crossing	53	21.1	LOS C	0.1	0.1	0.73	0.73
P2	East Full Crossing	53	34.3	LOS D	0.1	0.1	0.93	0.93
P4	West Full Crossing	53	34.3	LOS D	0.1	0.1	0.93	0.93
All Pedestrians		158	29.9	LOS C			0.86	0.86

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 101 [AM Help Street / Orchard Road - Post Development]

New Site
Signals - Fixed Time Isolated Cycle Time = 80 seconds (User-Given Cycle Time)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Orchard Road											
1	L2	6	66.7	0.074	38.6	LOS D	0.3	3.8	0.92	0.67	35.1
3	R2	2	100.0	0.074	38.4	LOS D	0.3	3.8	0.92	0.67	35.3
Approach		8	75.0	0.074	38.5	LOS D	0.3	3.8	0.92	0.67	35.1
East: Help Street											
4	L2	151	25.2	0.569	29.6	LOS C	10.9	84.6	0.87	0.78	40.6
5	T1	555	2.1	0.569	23.7	LOS C	12.0	85.2	0.87	0.76	42.8
Approach		705	7.0	0.569	25.0	LOS C	12.0	85.2	0.87	0.77	42.3
West: Help Street											
11	T1	512	1.6	0.393	22.0	LOS C	7.7	54.6	0.81	0.68	44.0
12	R2	94	9.0	0.537	45.1	LOS D	3.7	28.1	0.99	0.78	33.7
Approach		605	2.8	0.537	25.6	LOS C	7.7	54.6	0.84	0.70	42.0
All Vehicles		1319	5.5	0.569	25.3	LOS C	12.0	85.2	0.86	0.73	42.1

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped

P1	South Full Crossing	53	21.1	LOS C	0.1	0.1	0.73	0.73
P2	East Full Crossing	53	34.3	LOS D	0.1	0.1	0.93	0.93
P4	West Full Crossing	53	34.3	LOS D	0.1	0.1	0.93	0.93
All Pedestrians		158	29.9	LOS C			0.86	0.86

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 101 [PM Anderson Street / Help Street - Base]

New Site
Signals - Fixed Time Isolated Cycle Time = 80 seconds (User-Given Cycle Time)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Anderson Street											
1	L2	337	8.4	0.669	33.6	LOS C	12.0	89.8	0.94	0.84	37.8
2	T1	148	9.9	0.282	24.1	LOS C	4.6	34.6	0.82	0.66	43.0
Approach		485	8.9	0.669	30.7	LOS C	12.0	89.8	0.90	0.79	39.3
North: Anderson Street											
8	T1	102	0.0	0.082	5.9	LOS A	1.5	10.5	0.40	0.32	54.7
9	R2	333	5.1	0.675	34.5	LOS C	12.0	87.4	0.95	0.85	37.6
Approach		435	3.9	0.675	27.7	LOS C	12.0	87.4	0.82	0.72	40.6
West: Help Street											
10	L2	202	0.0	0.193	14.7	LOS B	3.8	26.9	0.52	0.71	47.3
12	R2	265	3.6	0.689	38.8	LOS D	10.1	72.8	0.98	0.86	36.0
Approach		467	2.0	0.689	28.4	LOS C	10.1	72.8	0.78	0.79	40.1
All Vehicles		1387	5.0	0.689	29.0	LOS C	12.0	89.8	0.83	0.77	40.0

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped

P1	South Full Crossing	53	33.4	LOS D	0.1	0.1	0.91	0.91
P3	North Full Crossing	53	33.4	LOS D	0.1	0.1	0.91	0.91
P4	West Full Crossing	53	28.1	LOS C	0.1	0.1	0.84	0.84
All Pedestrians		158	31.6	LOS D			0.89	0.89

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 101 [PM Anderson Street / Help Street - Post Development]

New Site
Signals - Fixed Time Isolated Cycle Time = 80 seconds (User-Given Cycle Time)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Anderson Street											
1	L2	339	8.4	0.673	33.7	LOS C	12.1	90.6	0.94	0.85	37.8
2	T1	148	9.9	0.282	24.1	LOS C	4.6	34.6	0.82	0.66	43.0
Approach		487	8.9	0.673	30.8	LOS C	12.1	90.6	0.90	0.79	39.3
North: Anderson Street											
8	T1	108	0.0	0.087	5.9	LOS A	1.6	11.2	0.40	0.33	54.7
9	R2	341	4.9	0.691	34.9	LOS C	12.4	90.6	0.95	0.86	37.4
Approach		449	3.7	0.691	27.9	LOS C	12.4	90.6	0.82	0.73	40.5
West: Help Street											
10	L2	202	0.0	0.193	14.7	LOS B	3.8	26.9	0.52	0.71	47.3
12	R2	265	3.6	0.689	38.8	LOS D	10.1	72.8	0.98	0.86	36.0
Approach		467	2.0	0.689	28.4	LOS C	10.1	72.8	0.78	0.79	40.1
All Vehicles		1404	4.9	0.691	29.1	LOS C	12.4	90.6	0.84	0.77	39.9

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped

P1	South Full Crossing	53	33.4	LOS D	0.1	0.1	0.91	0.91
P3	North Full Crossing	53	33.4	LOS D	0.1	0.1	0.91	0.91
P4	West Full Crossing	53	28.1	LOS C	0.1	0.1	0.84	0.84
All Pedestrians		158	31.6	LOS D			0.89	0.89

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 101 [PM Anderson Street / McIntosh Street - Base]

New Site
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Anderson Street											
2	T1	353	4.2	0.093	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		353	4.2	0.093	0.0	NA	0.0	0.0	0.00	0.00	60.0
North: Anderson Street											
8	T1	409	3.9	0.108	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		409	3.9	0.108	0.0	NA	0.0	0.0	0.00	0.00	60.0
West: McIntosh Street											
10	L2	34	0.0	0.030	6.2	LOS A	0.1	0.7	0.27	0.56	52.8
12	R2	29	0.0	0.077	13.3	LOS B	0.3	1.9	0.67	0.87	47.7
Approach		63	0.0	0.077	9.5	LOS A	0.3	1.9	0.45	0.70	50.3
All Vehicles		825	3.7	0.108	0.7	NA	0.3	1.9	0.03	0.05	59.1

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [PM Anderson Street / McIntosh Street - Post Development]

New Site
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Anderson Street											
2	T1	353	4.2	0.093	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		353	4.2	0.093	0.0	NA	0.0	0.0	0.00	0.00	60.0
North: Anderson Street											
8	T1	412	3.8	0.108	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		412	3.8	0.108	0.0	NA	0.0	0.0	0.00	0.00	60.0
West: McIntosh Street											
10	L2	48	0.0	0.043	6.2	LOS A	0.2	1.1	0.27	0.57	52.8
12	R2	39	0.0	0.102	13.5	LOS B	0.4	2.5	0.67	0.87	47.6
Approach		87	0.0	0.102	9.5	LOS A	0.4	2.5	0.45	0.70	50.4
All Vehicles		852	3.6	0.108	1.0	NA	0.4	2.5	0.05	0.07	58.8

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [PM Help Street / Orchard Road - Base]

New Site
Signals - Fixed Time Isolated Cycle Time = 80 seconds (User-Given Cycle Time)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Orchard Road											
1	L2	7	100.0	0.174	41.1	LOS D	0.5	6.9	0.96	0.69	34.5
3	R2	6	100.0	0.174	41.1	LOS D	0.5	6.9	0.96	0.69	34.4
Approach		14	100.0	0.174	41.1	LOS D	0.5	6.9	0.96	0.69	34.5
East: Help Street											
4	L2	142	25.9	0.475	26.5	LOS C	9.3	72.4	0.81	0.74	42.0
5	T1	513	1.4	0.475	20.6	LOS C	10.3	72.8	0.81	0.71	44.4
Approach		655	6.8	0.475	21.9	LOS C	10.3	72.8	0.81	0.72	43.9
West: Help Street											
11	T1	496	0.6	0.340	19.4	LOS B	7.0	49.0	0.76	0.64	45.5
12	R2	88	2.4	0.484	44.6	LOS D	3.5	24.8	0.99	0.77	33.9
Approach		584	0.9	0.484	23.2	LOS C	7.0	49.0	0.79	0.66	43.2
All Vehicles		1253	5.0	0.484	22.7	LOS C	10.3	72.8	0.80	0.69	43.4

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped

P1	South Full Crossing	53	18.9	LOS B	0.1	0.1	0.69	0.69
P2	East Full Crossing	53	34.3	LOS D	0.1	0.1	0.93	0.93
P4	West Full Crossing	53	34.3	LOS D	0.1	0.1	0.93	0.93
All Pedestrians		158	29.2	LOS C			0.85	0.85

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 101 [PM Help Street / Orchard Road - Post Development]

New Site
Signals - Fixed Time Isolated Cycle Time = 80 seconds (User-Given Cycle Time)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Orchard Road											
1	L2	7	100.0	0.174	41.1	LOS D	0.5	6.9	0.96	0.69	34.5
3	R2	6	100.0	0.174	41.1	LOS D	0.5	6.9	0.96	0.69	34.4
Approach		14	100.0	0.174	41.1	LOS D	0.5	6.9	0.96	0.69	34.5
East: Help Street											
4	L2	142	25.9	0.479	26.6	LOS C	9.4	73.2	0.81	0.74	42.0
5	T1	519	1.4	0.479	20.7	LOS C	10.4	73.6	0.81	0.71	44.4
Approach		661	6.7	0.479	21.9	LOS C	10.4	73.6	0.81	0.72	43.8
West: Help Street											
11	T1	512	0.6	0.351	19.5	LOS B	7.2	50.8	0.76	0.64	45.4
12	R2	88	2.4	0.484	44.6	LOS D	3.5	24.8	0.99	0.77	33.9
Approach		600	0.9	0.484	23.2	LOS C	7.2	50.8	0.80	0.66	43.3
All Vehicles		1275	5.0	0.484	22.7	LOS C	10.4	73.6	0.81	0.69	43.4

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	53	18.9	LOS B	0.1	0.1	0.69	0.69
P2	East Full Crossing	53	34.3	LOS D	0.1	0.1	0.93	0.93
P4	West Full Crossing	53	34.3	LOS D	0.1	0.1	0.93	0.93
All Pedestrians		158	29.2	LOS C			0.85	0.85

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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