Mandarin Centre
61-65 Albert Avenue, Chatswood
Planning Proposal

transportation planning, design and delivery

13S1416000 17/09/13

GTAconsultants

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Planning Proposal

Issue: A 17/09/13

Client: Mandarin Developments Pty Ltd and Blue Papaya Ltd
Reference: 13S1416000
GTA Consultants Office: NSW

Quality Record

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

1.1 Background

As GTA Consultants understands it, a planning proposal is to be lodged with Willoughby City Council for land currently occupied by the Mandarin Centre at 61-65 Albert Avenue, Chatswood. The planning proposal intends to rezone the site for an increase in floor space ratio and height controls to facilitate the development of residential units above the Mandarin Centre.

Bates Smart and Urbis have been engaged to prepare a Building Envelope Plan (Stage 1) and Planning Proposal (Stage 2) for Willoughby City Council's consideration. GTA Consultants was commissioned by Mandarin Developments Pty Ltd and Blue Papaya Ltd in April 2013 to complete a transport impact overview considering the planning proposal and indicative site layout.

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 City Council Development Control Plan (DCP) 2006
- Willoughby City Council Local Environmental Plan (LEP) 1995 and Draft LEP 2012
- Willoughby Bike Plan, prepared by PBAI Australia, September 2006
- Australian Standard, Parking Facilities, Part 1: Off-Street Car Parking AS 2890.1:2004
- Australian Standard, Parking Facilities, Part 2: Off-Street Commercial Vehicle Facilities AS 2890.2:2002
- Australian Standard, Parking Facilities, Part 6: Off-Street Parking for People with Disabilities AS 2890.6:2009
- traffic and car parking surveys undertaken by GTA Consultants as referenced in the context of this report
- planning proposal design concepts and urban design analysis, 17 September 2013, Bates Smart
- other documents and data as referenced in this report.

2. Existing Conditions

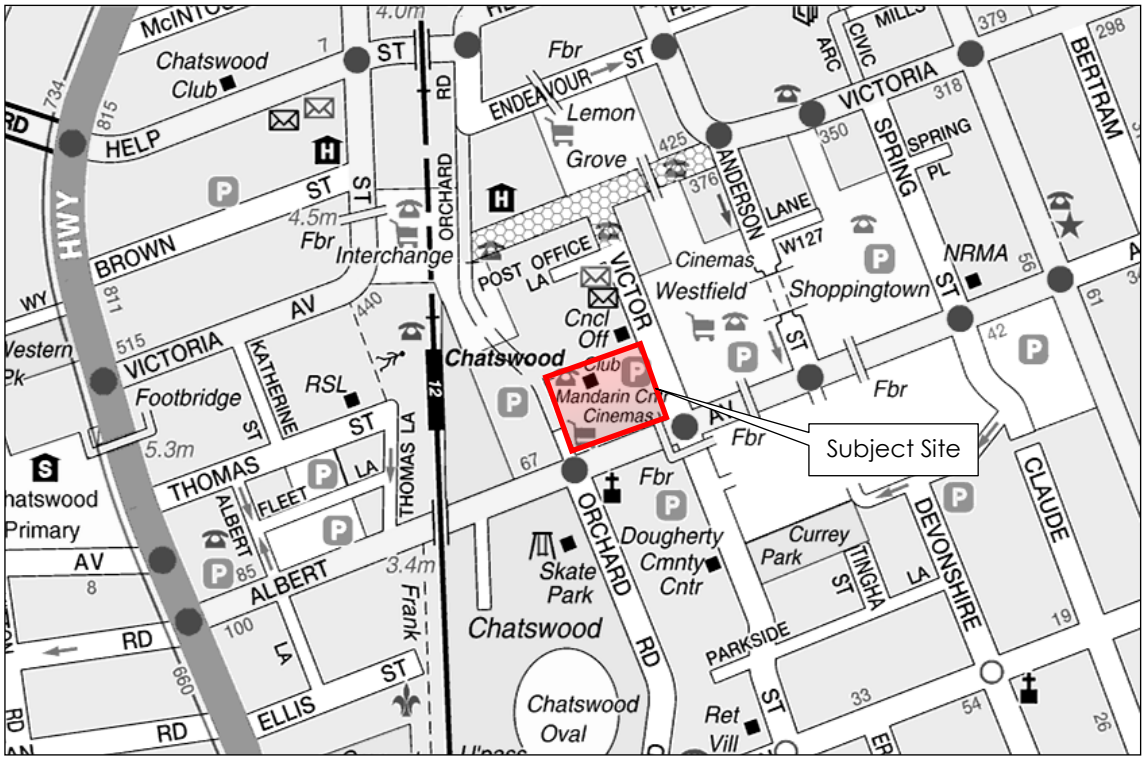
The subject site is located at 61-65 Albert Avenue, Chatswood. The site of approximately 3,520m^2 has a frontage of 75m to Albert Avenue and 45m to Victor Street and is currently occupied by the Mandarin Centre. The site has a land use classification of 'B3 Commercial Core' under Willoughby City Council Local Environmental Plan (LEP) 2012.

The existing Mandarin Centre building comprises 13,044sq.m of retail (shop and food court uses) and entertainment (bowling, cinema uses and the Chatswood Club) land uses set across 5 levels. These land uses are supported by approximately 303 car parking spaces provided over three basement levels. Vehicle access to the existing car park is provided via a driveway crossover to Victor Street.

The site is located within Chatswood CBD with surrounding properties including predominantly retail, commercial and high density residential uses. The pedestrian-only section of Victoria Avenue is located north of the site, with Westfield Chatswood located directly opposite the site on Victor Street. A number of residential properties are located on Victor Street, the largest of which is The Sebel Residence accommodating approximately 200 residential and serviced apartments. Willoughby City Council is also located within this building, north 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



Basemap source: UBD

2.1 Road Network

2.1.1 Adjoining Roads

Albert Avenue

Albert Avenue a local road and in the vicinity of the site is aligned in an east-west direction. It is a two-way road with a 15 metre wide carriageway, set within a 21 metre wide road reserve (approx.), configured with two lanes in each direction. Kerbside parking is not permitted on Albert Avenue in the vicinity of the site.

Albert Avenue is shown in Figure 2.2 and Figure 2.3 and carries approximately 12,000 vehicles per day[1].

Figure 2.2: Albert Avenue (looking west)

Figure 2.3: Albert Avenue (looking east)

Victor Street

Victor Street is a local road and in the vicinity of the site is aligned in a north-south direction. It is a two-way, no-through road with a 9 metre wide carriageway, set within a 13 metre wide road reserve (approx.), configured with one lane in each direction. Traffic calming measures are located along the length of Victor Street and include speed cushions. Kerbside parking is permitted on the western side of Victor Street, subject to time restrictions.

Victor Street is shown in Figure 2.4 and carries approximately 4,000 vehicles per day[1].

Orchard Road

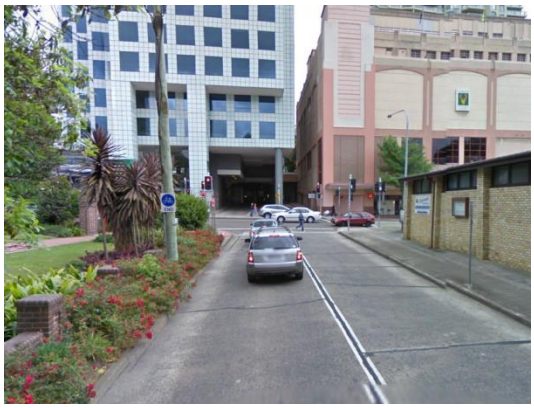
Orchard Road is a local road and in the vicinity of the site is aligned in a north-south direction. It is a two-way, with a 7.6 metre wide carriageway, configured with one lane in each direction. Traffic calming measures are located along the length of Orchard Road and include speed humps. North of Albert Avenue, Orchard Road (extension) passes underneath the existing Sage Building and provides back oh house access to properties fronting Victor Street.

Orchard Road is shown in Figure 2.5.

[1] Based on the peak hour traffic counts undertaken by GTA on Tuesday 26 June 2012 and assuming a peak-to-daily ratio of 8% for arterial roads and 10% for local roads.

Figure 2.4: Victor Street (looking south)

Figure 2.5: Orchard Road (looking north)



2.1.2 Surrounding Intersections

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

- Victor Street/ Albert Avenue (signalised)
- Albert Avenue / Orchard Road (signalised).

2.2 Traffic Volumes

GTA Consultants undertook peak hour traffic movement counts on at the intersection of Victor Street and Albert Avenue on Thursday 15 August 2013 and Saturday 17 August 2013. The Thursday and Saturday peak hour traffic volumes are summarised in Figure 2.6 to Figure 2.8, with full results contained in Appendix A.

Figure 2.6: Existing Thursday AM Peak Hour Traffic Volumes

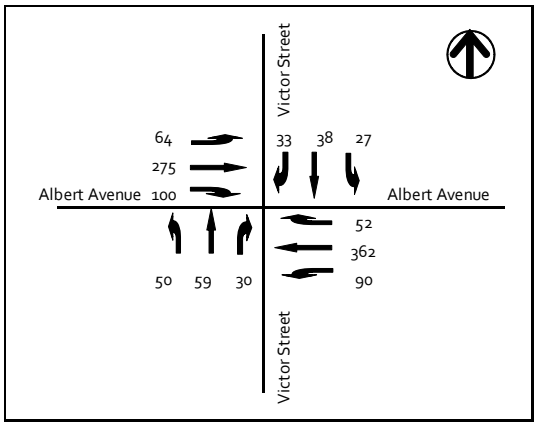


Figure 2.7: Existing Thursday PM Peak Hour Traffic Volumes

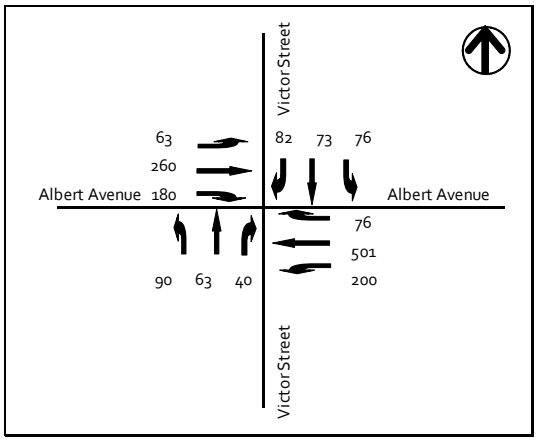
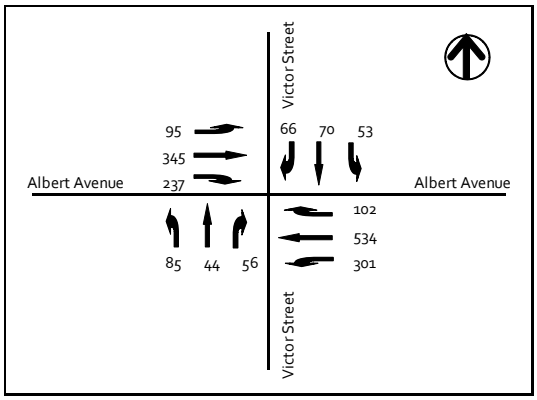


Figure 2.8: Existing Saturday Peak Hour Traffic Volumes



2.3 Intersection Operation

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

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

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

Table 2.1: SIDRA INTERSECTION Level of Service Criteria

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

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

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

Table 2.2: Existing Operating Conditions (2013 Traffic Volumes)

Intersection	Peak	Leg	Degree of Saturation (DOS)	Average Delay (sec)	95th Percentile Queue (m)	Level of Service (LOS)
Victor Street/ Albert Avenue	AM	Victor Street (South)	0.24	32	22	C
		Albert Avenue (East)	0.21	10	30	A
		Victor Street (North)	0.16	32	16	C
		Albert Avenue (West)	0.39	11	22	A
		Overall	**0.39**	**15**	**30**	**B**
	PM	Victor Street (South)	0.33	34	27	C
		Albert Avenue (East)	0.32	11	51	A
		Victor Street (North)	0.40	35	38	C
		Albert Avenue (West)	0.80	18	46	B
		Overall	**0.80**	**19**	**51**	**B**
	Sat	Victor Street (South)	0.33	35	26	C
		Albert Avenue (East)	0.39	12	64	A
		Victor Street (North)	0.32	34	31	C
		Albert Avenue (West)	1.00	15	46	B
		Overall	**1.00**	**17**	**64**	**B**

On the basis of the above assessment, the signalised intersection of Victor Street and Albert Avenue currently operates satisfactorily with minimal queues and delays on all approaches. It is noted that there is generally some congestion in the local area on Saturdays, largely as a result of queuing associated with the Pacific Highway to the west.

The right turn from Albert Avenue into Victor Street experiences some delay and queuing (beyond the length of the turn bay) however this approach still operates at a LOS B with a maximum queue of less than 50m.

2.4 Parking

2.4.1 On-Site

The Mandarin Centre currently provides 303 on-site car parking spaces operated by Secure Parking. The car park currently provides free parking for durations up to three hours, with charges applied after this time.

2.4.2 On-Street

GTA Consultants compiled an inventory of publicly available on-street parking along Victor Street. The inventory identified a total of six on-street car parking spaces, including three ¼P spaces, two disabled spaces and one '5 min' space, together with two motorcycle spaces.

Parking demand sample surveys were undertaken by GTA Consultants during the weekday AM and PM peak periods and indicate that the majority of Victor Street parking spaces are typically occupied, with little to no vacancies.

2.4.3 Off-Street

The site is located in close proximity to two publicly available off-street car parks as summarised in Table 2.3.

Table 2.3: Public Off-Street Parking Summary

Location	Distance to Site	Number of spaces (approx.)
Westfield Chatswood	30m	2,800
Chatswood Chase	550m	2,550
	Total	**5,350**

2.5 Public Transport

The subject site is well served by public transport services with Chatswood Transport Interchange located approximately 100m west 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. 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 with further details of bus services contained in Appendix C.

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

The site is also located within close proximity to taxi services with the nearest designated taxi rank located on Victoria Avenue, 150m west of the site.

2.6 Pedestrian Infrastructure

Pedestrian paths are located as follows:

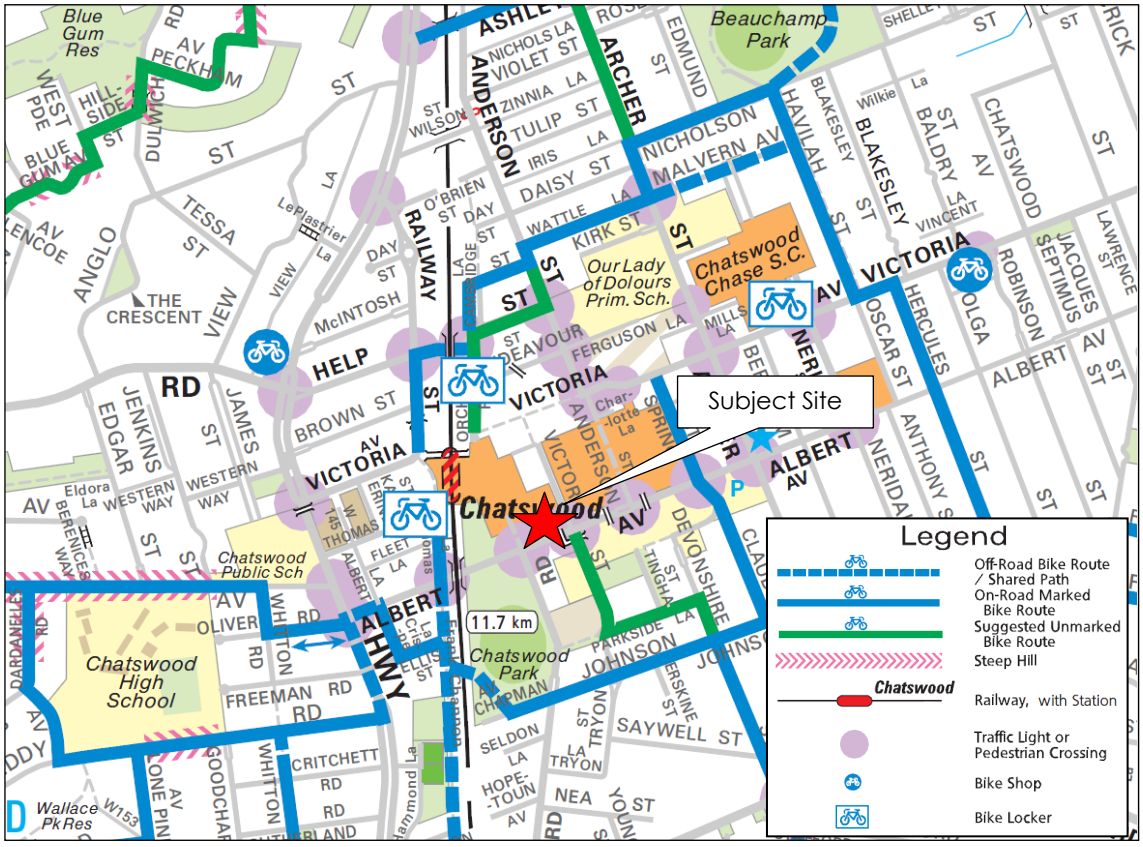
- Albert Avenue (both sides) – 2-3m wide path;
- Victor Street (both sides) – 3-4.5m wide path providing access to the pedestrianised section of Victoria Avenue, Westfield and Chatswood Interchange.

Safe crossing points in vicinity of the site include pedestrian crossings on all legs of the Albert Avenue/ Victor Street intersection.

2.7 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.

Figure 2.9: Cycle Infrastructure



Source: Northern Sydney Cycling Map

End-of-trip facilities are available in close proximity to the site as follows:

- 4 cycle racks in Victor Street pedestrian area – 10m from site. (see Figure 2.10)
- 2 cycle racks on Victor Street – 50m from site (see Figure 2.11)
- 2 cycle racks on Albert Avenue – 70m from site
- cycle lockers at Chatswood Interchange – 80m from site.

The majority of these facilities are conveniently located and the high pedestrian activity offers good passive surveillance.

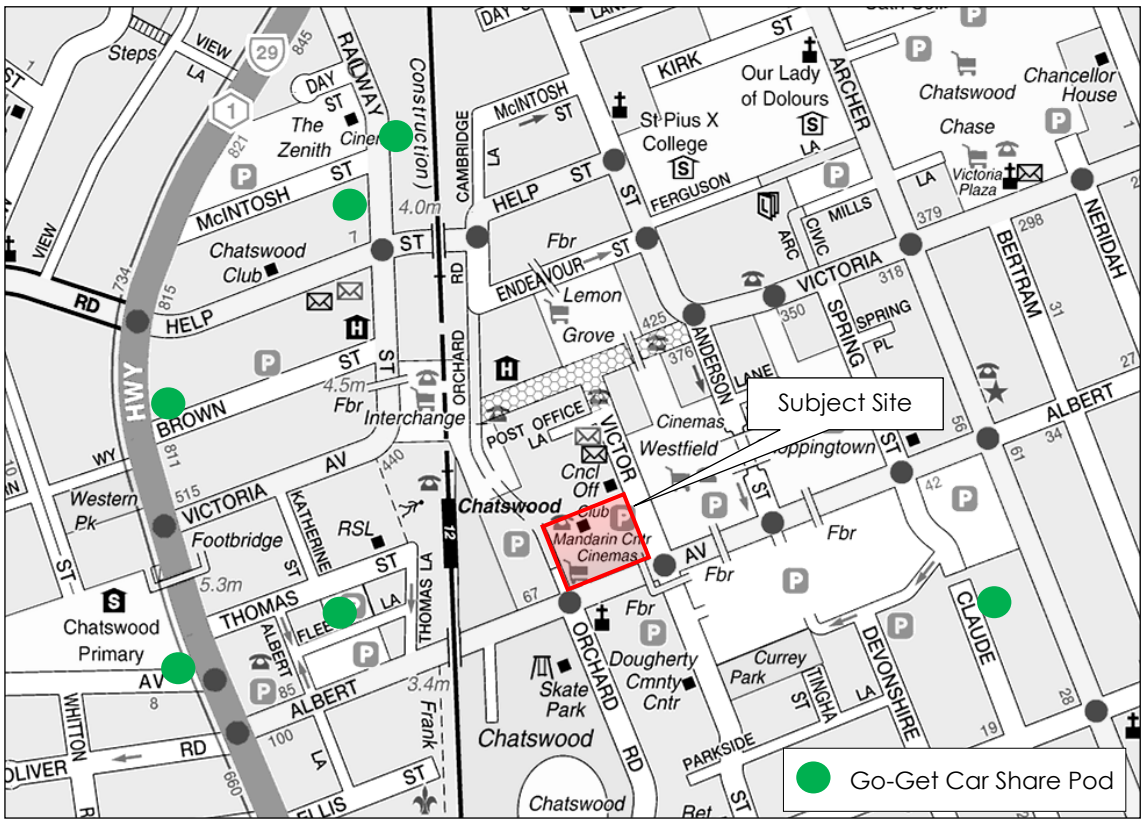
Figure 2.10: Victor Street Pedestrian Area Cycle Racks

Figure 2.11: Victor Street Cycle Racks

2.8 Local Car Sharing Initiatives

Several Go-Get car sharing pods are located in the vicinity of the site as shown Figure 2.12.

Figure 2.12: Go-Get Car Share Locations



Basemap source: UBD

3. Development Proposal

3.1 Land Uses

The planning proposal intends to amend the existing planning controls imposed on the site by rezoning the land from B3 Commercial Core to B4 Mixed Use, together with an increase in the maximum height controls from 28m to 94m (RL185, approx. 28 levels) and increase the maximum floor space ratio from 2.5:1 to 13:1.

The amended planning controls are being sought with a view to constructing a 28 storey mixed use development incorporating commercial and residential uses. The planning proposal includes 22 and 8 level residential towers set above 6 levels of commercial tenancies.

The proposal schedule is summarised in Table 3.1.

Table 3.1: Planning Proposal Schedule

Use	Dwelling Type	Size
Residential	1 bedroom	152 dwellings
	2 bedroom	70 dwellings
	3 bedroom	36 dwellings
	4 bedroom	2 dwellings
	Sub-Total	**260 dwellings**
Commercial	Retail / Entertainment uses (6 levels)	15,750sq.m
	Supermarket (basement level)	1,450sq.m

Table 3.1 indicates that the planning proposal anticipates some 260 residential apartments, 15,750sq.m of commercial floor area (incorporating retail and entertainment uses) and 1,450sq.m of supermarket.

3.2 Vehicle Access

Vehicle access to the subject site is to be provided via a shared crossover with the existing Sage building which forms a signalised intersection with Albert Avenue and Orchard Road. The shared crossover will provide vehicle access to the basement car park and on-site loading facilities.

The suitability of the proposed access arrangements is discussed in Section 7 of this report.

3.3 Car Parking

The planning proposal will provide an indicative total of 610 car parking spaces over 7 basement levels, including all loading areas.

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

3.4 Pedestrian Facilities

A number of pedestrian connections to the commercial uses are proposed to be maintained, including at-grade connections to Victor Street and Albert Avenue and above ground connections to the Sebel Building, the Sage building and the existing adjacent car park structure.

Pedestrian access to the main residential building 28 levels is provided via a dedicated lobby accessed directly from Victor Street, with the 14 level residential building accessed via a shared pedestrian access with the commercial uses from Albert Avenue.

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

3.5 Bicycle Facilities

As this is a planning proposal the indicative layout plans do not contain details of bicycle facilities. Bicycle facilities will be covered in more detail during the Development Application stage.

The recommended bicycle facilities are discussed in Section 5 of this report.

3.6 Loading Areas

A loading area capable of accommodating 1-2 service vehicles is proposed within the basement level car park. Vehicle access to the loading area is proposed to be shared with the vehicle access facilities to the site. The loading area is to accommodate vehicles up to 8.8m medium rigid vehicles and 12.5m large rigid vehicles.

There is also capacity for an additional 4 courier/ delivery vehicles adjacent to the loading dock.

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

4. Car Parking

4.1 Car Parking 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	152 dwellings	152 spaces
	1 space/2 bedroom	70 dwellings	70 spaces
	1.25 spaces/3+ bedroom	38 dwellings	47 spaces
		Sub-Total	**269 spaces**
	1 space/4 dwellings (visitor parking)	260 dwellings	65 spaces
		Sub-Total	**334 spaces**
Shop	1 space/25sq.m NFA	15,750sq.m	630 space
Supermarket	6 spaces/100sq.m NFA	1,450sq.m[1]	87 spaces
		Total	**1,051 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 theoretically required to provide up to 1,051 car parking spaces. As such, there will be a car parking shortfall of 441 spaces, based on an indicative car parking supply of 610 spaces. It is noted that the DCP 2006 parking rates are neither minimum nor maximum rates and any departure from these rates requires justification.

4.2 Council Decision Criteria Assessment

DCP 2006 contains a list of criteria against which development applications are assessed when considering any departures from the DCP car parking rates, and detailed as follows:

- the size and nature of the development, amount of additional floor area relative to the existing floor area and the parking demand generated;
- whether a Green Travel Plan has been provided;
- encouraging less use of motor vehicles, especially those developments close to railway stations and major public transport routes;
- availability and accessibility of other public parking;
- accessibility of public transport and the probable transport mode of users;
- proximity to bicycle routes;
- existing and likely future traffic volumes on the surrounding road network and the nature of this network;
- the environmental implications of providing parking with particular regard to vegetation and landscape impacts;
- results of a parking survey submitted to Council to justify demand for the proposed use
- the impact of not providing the parking.

The abovementioned decision guidelines relevant to the planning proposal have been considered and discussed below.

4.2.1 Green Travel Plan

Green Travel Plans have also proven to be a successful way of changing travel behaviour for a number of employers throughout Australia and overseas. A Green Travel Plan is a way in which a development is able to manage the transport needs of staff and visitors. The aim of the plan is to reduce the environmental impact of travel to and from a given site and in association with its operation. In essence, the plan encourages more efficient use of motor vehicles as well as alternatives to single occupant car usage.

4.2.2 Reduction in Motor Vehicle Usage

Encouraging the use of public transport and walking and cycling as modes of transport is central to reducing motor vehicle usage. The site is easily accessible by public transport and is within the Chatswood CBD. There are some existing and proposed on/off-road cycle lanes along the nearby major roads that can service the site. End of trip cycle facilities would be provided.

The proposed development is a prime opportunity to promote this vision by encouraging the use of public transport, cycling, and walking and not encouraging an abundance of car parking within this area, and in turn an over use of motor vehicles.

4.2.3 Car Parking Availability

In addition, and as discussed in Section 2, the site is located within close proximity to two off-street public car parks; Westfield Chatswood and Chatswood Chase. These car parks have a capacity in excess of 5,000 car spaces all within an easy walking distance of the site. These car parks have the potential to accommodate additional visitor parking associated with the future site uses, it is noted that the on-site car park within The Mandarin Centre is currently open to at least 12:30am every day and would be capable of accommodating after hours residential visitor car parking demands.

It is worth noting that ease and availability of public parking is something that is generally not expected in a CBD environment. Visitors to Chatswood are therefore encouraged to seek alternative modes of travel based on a general expectation that on-site parking is not readily available, albeit with knowledge of the surrounding public car parks. Education and information about the services of the other modes is also provided through the use of a Green Travel Plan.

4.2.4 Public Transport Availability

The site is located within 80m, or 2 minutes walk of Chatswood Interchange which provides access to high frequency bus and train services. As such, the provision of reduced on-site car parking will encourage residents, staff and visitors to use public transport instead of private motor vehicles. This is in-line with the overall objectives of DCP 2006 to "encourage the use of public transport in areas close to transport nodes"[3].

This level of public transport accessibility will support a zero level of car ownership on the subject land.

4.2.5 Impacts of not Providing Parking

It is noted that as a result of not providing on-site car parking for residents, they will be required to use alternate transport modes such as public transport, cycling and walking. The surrounding on-

[3] Willoughby City Council DCP 2006, p. C32

street car parking facilities in the vicinity of the site are time restricted and as such, residents of the development will not be able to utilise these spaces for long-term parking.

Similarly, a reduction in the provision of residential visitor and retail customer spaces from those specified in the DCP, will require these users to seek alternate transport modes or park within the surrounding pool of on and off-street car parking spaces.

4.3 Other Considerations

An assessment of the anticipated likely car parking demands associated with each of the proposed uses is provided in Appendix D. Table 4.2 has been prepared to present a summary of the likely car parking demands to be generated by the proposed development.

Table 4.2: Site Generated Parking Demands

Use	Size	Car Parking Rate	Source	Car Parking Demand
Residential (resident)	152 (1-bedroom dwellings) 70 (2-bedroom dwellings) 38 (3+-bedroom dwellings)	0.4 spaces per dwelling 0.7 spaces per dwelling 1.2 spaces per dwelling	RMS	156 spaces
Retail / Entertainment	15,750sq.m	2.32 spaces per 100m^2	Existing Centre Car Parking Rate	365 spaces
Supermarket	1,450sq.m	4.2 spaces per 100m^2	RMS	61 spaces
Residential (visitor)	260 dwellings	1 space per 7 dwellings [1]	RMS	19-37 spaces
			Total	**601-619 spaces**

[1] Daytime visitor parking demands are typically 50% of the peak evening demands.

Table 4.2 indicates the site could be expected to generate a peak parking demand of up to 619 spaces assuming all uses peak simultaneously.

4.4 Adequacy of Parking Supply

The proposed dispensation from the DCP parking requirement is considered appropriate, noting the following:

- The sites proximity to the Chatswood Transport Interchange.
- ABS Data indicates low car parking for residents in high density buildings in the Chatswood area.
- The sites location within Chatswood CBD.
- A reduced car parking provision for the retail and supermarket uses is consistent with the assessment completed for the adjacent Metro development.

Based upon the above discussions and analysis, it is evident that the proposed on-site car parking provision of 610 spaces is generally sufficient to cater for the anticipated peak daytime car parking demand of 601-619 spaces generated by the proposed development.

It is noted that there is a shortfall of 9 car parking spaces for the peak parking demand assuming all uses peak simultaneously. However, typically car parking demands associated with the supermarket and retail uses will peak during the daytime and as such, the visitor parking shortfall of 9 additional spaces could be accommodated within on-site shared car parking pool of approximately 426 spaces.

4.5 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 24 motorcycle parking spaces, with these able to be accommodated within the basement car parking levels.

4.6 Bicycle Parking

DCP 2006 contains a guide to bicycle parking facilities for different types of developments as summarised in Table 4.3.

Table 4.3: 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	260 dwellings	26	22
Commercial	1 per 450m^2	1 per 150m^2	17,200sq.m	38	115
			Total	**64**	**137**

Based on the above, DCP 2006 suggests that the planning proposal incorporate 64 bicycle lockers for residents/ employees and 137 bicycle rails for visitors. The 64 bicycle lockers could be accommodated as bicycle racks within a secure cage facility to improve space efficiency and usage.

4.7 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).

5. Sustainable Transport Infrastructure

This chapter discusses potential for further measures that could encourage alternative means of travel to the private car and encourage the use of more environmentally sustainable forms of travel.

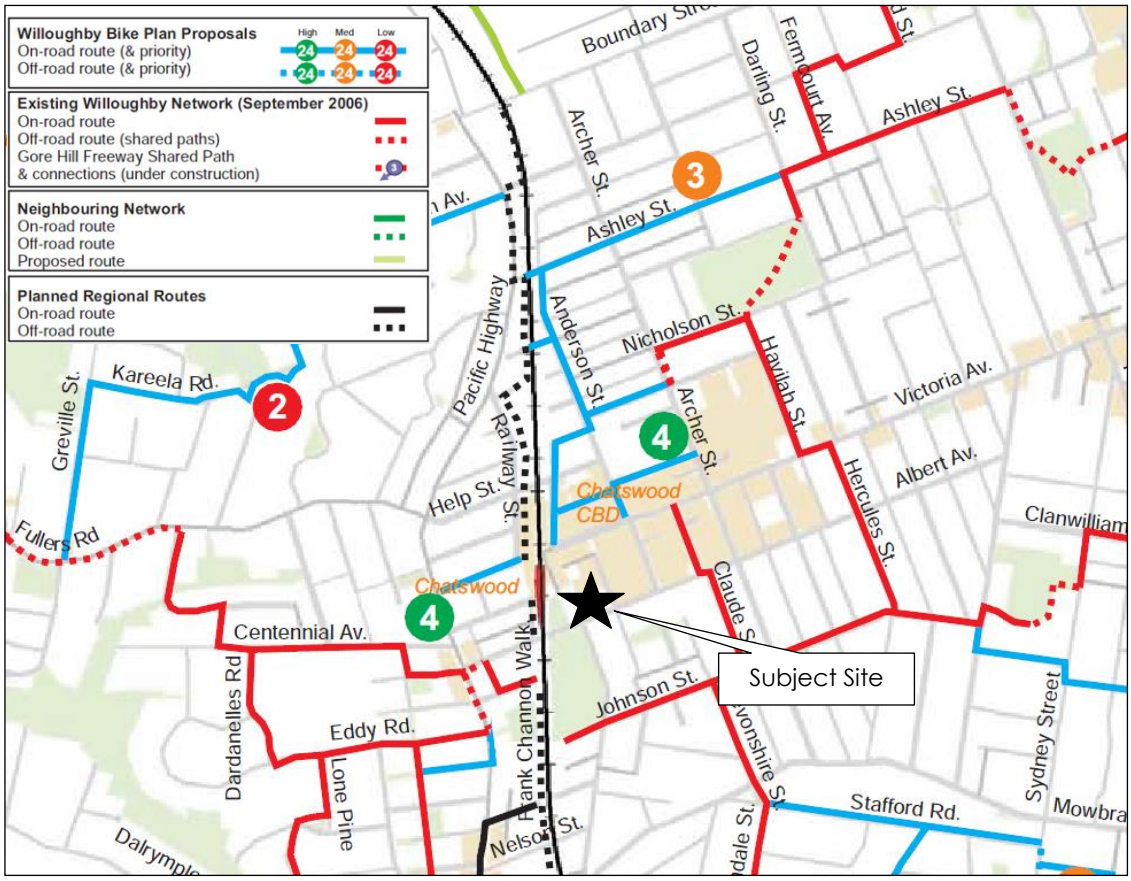
5.1 Cycle Network

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.

Figure 5.1: Willoughby Bike Plan Proposed Cycle Routes



Source: Willoughby Bike Plan (2006)

5.2 Bicycle End-of-Trip Facilities

DCP 2006 contains general requirements for bicycle parking as follows:

i enable wheels and frame to be locked to the device without damaging the bicycle;
ii be placed in public view and well lit for security purposes;
iii be in a convenient and accessible location outside pedestrian and vehicular movement paths;
iv 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 need to 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 Victoria Avenue pedestrian mall, 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 west 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 and indicate that the site should provide loading facilities for the retail and residential land uses.

6.2 Proposed Loading Arrangements

An indicative loading area is provided on basement level 1. The design of this facility will be further developed at the Development Application stage and will be required to accommodate the swept path requirements of the design vehicle.

Refuse will be required to be collected by a private contractor from within the subject site.

7. Traffic Impact Assessment

7.1 Preamble

Vehicle access to the site is proposed to be shared with the existing Orchard Road extension under the adjacent Sage (commercial office) building. This access currently provides access to the Sage building as well as the rear of a number of buildings that front Victor Street. In the future this access will also provide vehicle access to the Metro development currently being constructed above the Chatswood Transport Interchange.

The provision of vehicle access to the site via the Orchard Road extension is consistent with the objectives of the Willoughby Council DCP which seeks to minimise vehicle crossovers to Victor Street.

The below provides an overview of the anticipated traffic generation from the site, the future access provisions and discussion regarding the anticipated future operation of the Orchard Road (site access) / Albert Avenue intersection.

7.2 Traffic Generation

7.2.1 Design Rates

An assessment of the anticipated likely traffic generation rates associated with each of the proposed uses is provided in Appendix E. Estimates of the peak hour traffic volumes resulting from the proposal are set out in Table 7.1.

Table 7.1: Estimated Traffic Generation

Use	No. of Allocated Car Parking Spaces	Peak Hour Traffic Generation Rate(movements per space)			Peak Hour Traffic Generation Estimate (vehicles)		
		AM	PM	SAT	AM	PM	SAT
Residential (260 apartments)	156 spaces	0.29	0.29	0.29	45	45	45
Retail (17,200m^2)	426 spaces	0.52	0.92	1.20	222	392	511
				Total	**267**	**437**	**556**

Table 7.1 indicates the site could generate up to 267, 437 and 556 vehicle movements during the weekday AM and PM and Saturday lunchtime peak periods, respectively. This compares with 158, 279 and 364 vehicle movements anticipated to be generated by the current Mandarin Centre.

Given the existing traffic generation of the site, the planning proposal can be expected to generate approximately 109, 158 and 192 additional vehicle movements during the weekday AM and PM and Saturday lunchtime peak periods, respectively.

7.2.2 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 for the above, for the purposes of estimating vehicle movements, the following directional distributions have been assumed:

- Albert Avenue (east) – 45%
- Orchard Road (south) – 10%
- Albert Avenue (west) – 45%.

In addition, the directional split of traffic (i.e. the ratio between the inbound and outbound traffic movements) has been assumed to be a commercial inbound and residential outbound in the morning peak period and a corresponding reversal in the evening peak.

This results in a directional split during the AM and PM peak periods as shown in Table 7.2 noting that the generation rates have been rounded up as required.

Table 7.2: Net Increase in Traffic Generation

Weekday Peak Period	Land Use	Inbound	Outbound
AM	Residential	20% (9 vehicles)	80% (36 vehicles)
	Retail/Entertainment/Supermarket	50% (114 vehicles)	50% (112 vehicles)
	Total	**123 vehicles**	**149 vehicles**
PM	Residential	80% (36 vehicles)	20% (9 vehicles)
	Retail/Entertainment/Supermarket	50% (200 vehicles)	50% (201 vehicles)
	Total	**236 vehicles**	**210 vehicles**
Sat	Residential	50% (22 vehicles)	50% (23 vehicles)
	Retail/Entertainment/Supermarket	50% (262 vehicles)	50% (261 vehicles)
	Total	**284 vehicles**	**284 vehicles**

Based on the above, Figure 7.1, Figure 7.2 and Figure 7.3 have been prepared to show the estimated marginal increase in turning movements as a result of the development.

Figure 7.1: AM Peak Hour Site Generated Traffic Volumes

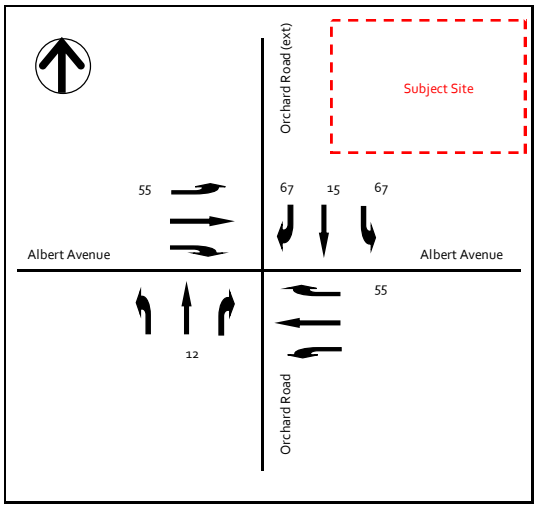


Figure 7.2: PM Peak Hour Site Generated Traffic Volumes

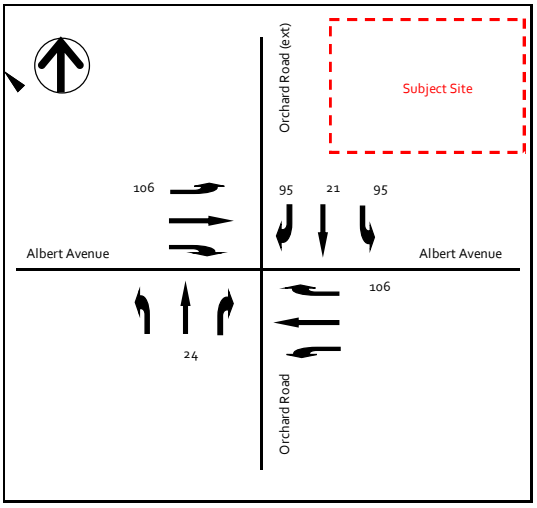
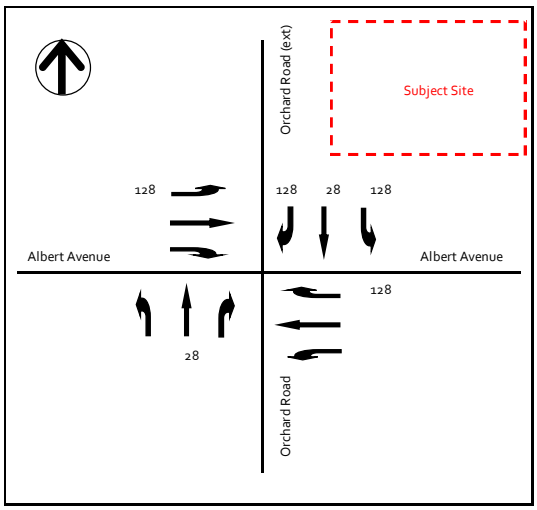


Figure 7.3: Saturday Peak Hour Site Generated Traffic Volumes



7.3 Vehicle Access

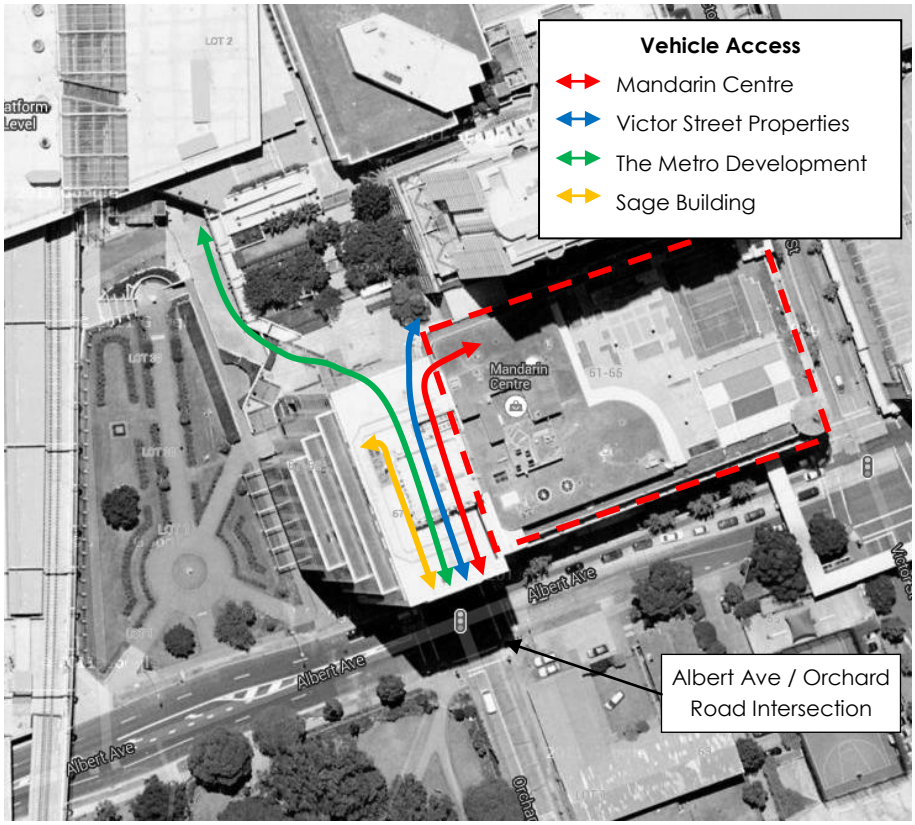
The Orchard Road (extension) will provide access to the following properties:

- Mandarin Centre (subject site)
- Sage Building (existing)
- Metro Development (under construction).

The Metro development (currently under construction) will provide car parking for approximately 500 vehicles, with access provided via Thomas Lane and Orchard Road (extension). The site is anticipated to generate in the order of 116 vehicle movements in each of the peak hours. However, the distribution between the Orchard Road (extension) and Thomas Lane access points is unknown.

The indicative access provisions are illustrated in Figure 7.4.

Figure 7.4: Vehicle Access Provisions



Having regard for the above, it is apparent that any detailed traffic assessment of the future operation of the Albert Avenue / Orchard Road intersection will need to have regard for each of the above uses.

7.4 Traffic Impact

With the exception of the southern approach, the existing Albert Avenue / Orchard Road intersection is configured with 2 stand-up lanes on each of the approaches. Specifically the Orchard Road (extension) approach is configured with a dedicated right turn egress, shared through and left turn egress and one ingress lane. The existing Sage Building is located above the Orchard Road (extension) and as a result there is limited scope to modify the existing intersection provisions.

Traffic surveys of the Albert Avenue/ Victor Street intersection indicate that it currently carries comparable traffic volumes as to what the Albert Avenue/ Orchard Road intersection could be expected to carry in the future. The SIDRA Intersection assessment undertaken of the Albert Avenue/ Victor Street intersection indicates that this intersection currently operates adequately, with an overall intersection Level of Service B.

Based on the above, and noting that the proposed vehicle access provisions are consistent with Councils preferred access strategy for the site, the proposed access provisions are considered to be satisfactory (subject to further detailed assessment).

It is recommended that a more detailed assessment of the proposed access provisions be undertaken at the Development Application stage. In order to complete this detailed assessment it is recommended that the following be undertaken:

- traffic movement counts be undertaken of the existing Mandarin Centre (to more accurately estimate the likely traffic generation of the future retail uses);
- traffic movement counts of the Albert Avenue / Orchard Road (extension) intersection;
- a more thorough investigation of the impacts of the Metro development.

Notwithstanding, the high level assessment undertaken above is considered satisfactory to inform the Planning Proposal.

8. Conclusion

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

i A planning proposal is to be lodged with Willoughby City Council for the land currently occupied by the Mandarin Centre, Chatswood. The planning proposal seeks to amend the existing planning controls by rezoning the land from B3 Commercial Core to B4 Mixed Use.

ii The amended planning controls are being sought with a view to provision for a mixed use development to RL 185 (approximately 28 levels) containing 260 residential apartments above 17,200sq.m commercial/ retail land uses.

iii The planning proposal includes an indicative maximum on-site car parking provision of 610 car parking spaces over 7 basement levels.

iv The indicative proposal generates a DCP parking requirement of 1,051 car parking spaces.

v Given the proximity to Chatswood Transport Interchange and surrounding off-street parking facilities, a reduced parking provision is appropriate.

vi The proposed car parking supply is below the DCP 2006 requirement and is considered to be appropriate having regard to several data sources, including ABS car ownership data, RMS Technical Direction and The Guide especially given the CBD location and proximity to high frequency public transport services.

vii Loading facilities will be located within the basement with provision for 1-2 service vehicles and an additional 4 spaces for courier/ delivery use.

viii DCP 2006 suggests that the planning proposal incorporate 64 bicycle lockers for residents/ employees and 137 bicycle rails for visitors.

ix Based on the RMS Guide, the site would be expected to generate approximately 560 vehicle movements during a typical Saturday peak hour. This represents a net increase of less than 200 vehicles.

x SIDRA INTERSECTION analysis indicates that there is adequate capacity in the surrounding road network to cater for the traffic generated by the planning proposal.

Appendix A

Survey Results

TURNING MOVEMENT SURVEY

Victor StreetAlbert AvenueChatswood

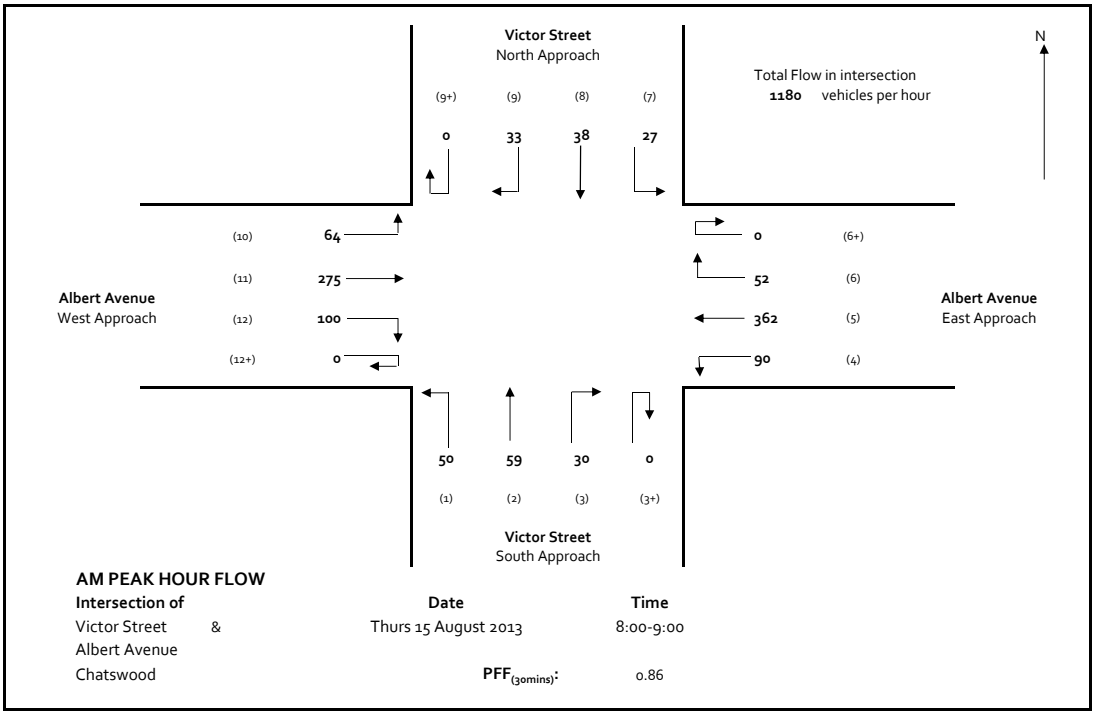
Date: Thurs 15 August 2013

15 minute Data

Time	Movement																Total
	Victor Street South Approach				Albert Avenue East Approach				Victor Street North Approach				Albert Avenue West Approach				
	Left 1	Through 2	Right 3	U Turn 3+	Left 4	Through 5	Right 6	U Turn 6+	Left 7	Through 8	Right 9	U Turn 9+	Left 10	Through 11	Right 12	U Turn 12+	
6:00-6:15																	
6:15-6:30																	
6:30-6:45																	
6:45-7:00																	
7:00-7:15	3	1	2	0	4	24	3	0	1	1	3	0	3	20	4	0	69
7:15-7:30	5	8	6	0	9	65	7	0	4	5	7	0	14	65	16	0	211
7:30-7:45	2	4	5	0	8	73	10	0	10	9	6	0	8	53	20	0	208
7:45-8:00	7	4	8	0	9	68	8	0	4	5	5	0	14	51	9	0	192
8:00-8:15	3	12	5	0	18	85	12	0	7	8	10	0	12	60	17	0	249
8:15-8:30	10	15	9	0	20	75	13	0	5	4	5	0	11	55	19	0	241
8:30-8:45	19	19	5	0	26	118	18	0	10	12	11	0	27	79	35	0	379
8:45-9:00	18	13	11	0	26	84	9	0	5	14	7	0	14	81	29	0	311
9:00-9:15																	
9:15-9:30																	
9:30-9:45																	
9:45-10:00																	
Total	67	76	51	0	120	592	80	0	46	58	54	0	103	464	149	0	1860

Hourly flows

Time	Movement																Total
	Victor Street South Approach				Albert Avenue East Approach				Victor Street North Approach				Albert Avenue West Approach				
	Left 1	Through 2	Right 3	U Turn 3+	Left 4	Through 5	Right 6	U Turn 6+	Left 7	Through 8	Right 9	U Turn 9+	Left 10	Through 11	Right 12	U Turn 12+	
6:00-7:00																	
6:15-7:15																	
6:30-7:30																	
6:45-7:45																	
7:00-8:00	17	17	21	0	30	230	28	0	19	20	21	0	39	189	49	0	680
7:15-8:15	17	28	24	0	44	291	37	0	25	27	28	0	48	229	62	0	860
7:30-8:30	22	35	27	0	55	301	43	0	26	26	26	0	45	219	65	0	890
7:45-8:45	39	50	27	0	73	346	51	0	26	29	31	0	64	245	80	0	1061
8:00-9:00	50	59	30	0	90	362	52	0	27	38	33	0	64	275	100	0	1180
8:15-9:15																	
8:30-9:30																	
8:45-9:45																	
9:00-10:00																	
Peak Hour	50	59	30	0	90	362	52	0	27	38	33	0	64	275	100	0	1180



AM PEAK HOUR FLOW

Intersection of		Date	Time
Victor Street	&	Thurs 15 August 2013	8:00-9:00
Albert Avenue			
Chatswood		**PFF$_{(3omins)}$:**	0.86

TURNING MOVEMENT SURVEY

Victor StreetAlbert AvenueChatswood

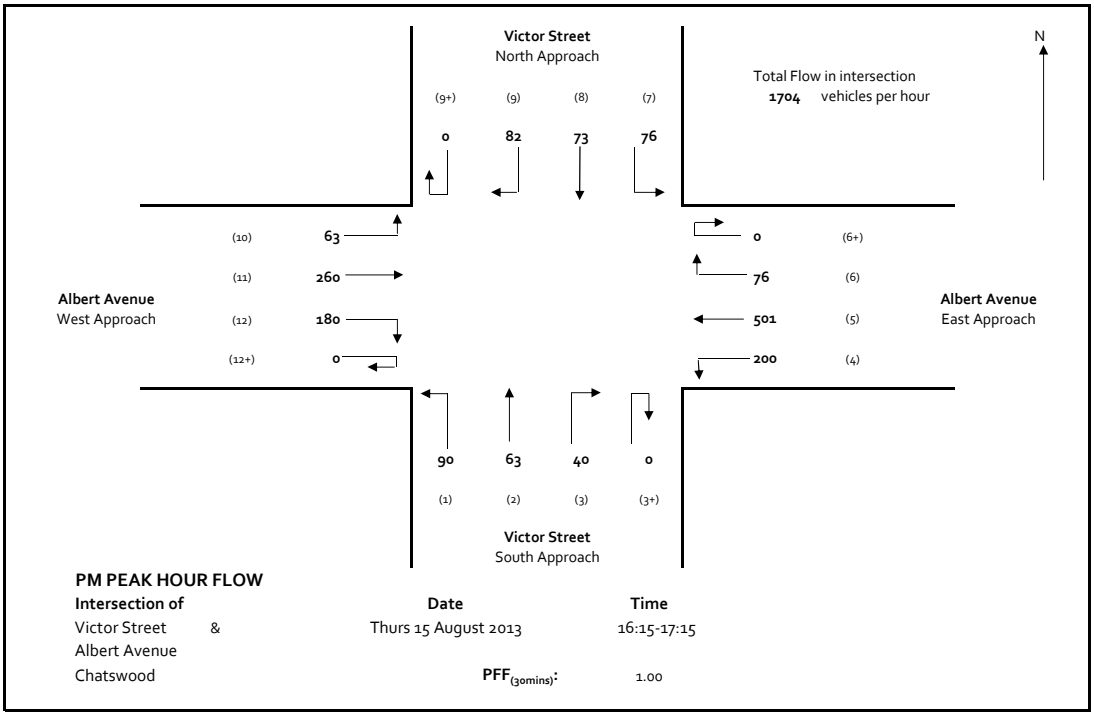
Date: Thurs 15 August 2013

15 minute Data

Time	Movement																Total
	Victor Street South Approach				Albert Avenue East Approach				Victor Street North Approach				Albert Avenue West Approach				
	Left 1	Through 2	Right 3	U Turn 3+	Left 4	Through 5	Right 6	U Turn 6+	Left 7	Through 8	Right 9	U Turn 9+	Left 10	Through 11	Right 12	U Turn 12+	
15:00-15:15																	
15:15-15:30																	
15:30-15:45																	
15:45-16:00																	
16:00-16:15	18	38	12	0	42	108	22	0	15	24	20	0	10	46	45	0	400
16:15-16:30	21	26	10	0	47	122	22	0	12	23	22	0	11	55	56	0	427
16:30-16:45	33	24	13	0	46	132	15	0	18	18	26	0	10	54	38	0	427
16:45-17:00	19	7	9	0	49	121	18	0	18	15	15	0	17	64	40	0	392
17:00-17:15	17	6	8	0	58	126	21	0	28	17	19	0	25	87	46	0	458
17:15-17:30	33	14	8	0	43	130	16	0	22	21	13	0	19	40	41	0	400
17:30-17:45	21	8	12	0	37	124	19	0	22	10	12	0	20	62	52	0	399
17:45-18:00	19	10	9	0	35	128	32	0	12	12	18	0	17	81	42	0	415
18:00-18:15																	
18:15-18:30																	
18:30-18:45																	
18:45-19:00																	
Total	181	133	81	0	357	991	165	0	147	140	145	0	129	489	360	0	3318

Hourly flows

Time	Movement																Total
	Victor Street South Approach				Albert Avenue East Approach				Victor Street North Approach				Albert Avenue West Approach				
	Left 1	Through 2	Right 3	U Turn 3+	Left 4	Through 5	Right 6	U Turn 6+	Left 7	Through 8	Right 9	U Turn 9+	Left 10	Through 11	Right 12	U Turn 12+	
15:00-16:00																	
15:15-16:15																	
15:30-16:30																	
15:45-16:45																	
16:00-17:00	91	95	44	0	184	483	77	0	63	80	83	0	48	219	179	0	1646
16:15-17:15	90	63	40	0	200	501	76	0	76	73	82	0	63	260	180	0	1704
16:30-17:30	102	51	38	0	196	509	70	0	86	71	73	0	71	245	165	0	1677
16:45-17:45	90	35	37	0	187	501	74	0	90	63	59	0	81	253	179	0	1649
17:00-18:00	90	38	37	0	173	508	88	0	84	60	62	0	81	270	181	0	1672
17:15-18:15																	
17:30-18:30																	
17:45-18:45																	
18:00-19:00																	
Peak Hour	90	63	40	0	200	501	76	0	76	73	82	0	63	260	180	0	1704



TURNING MOVEMENT SURVEY

Intersection of Victor Street & Albert Avenue, Chatswood

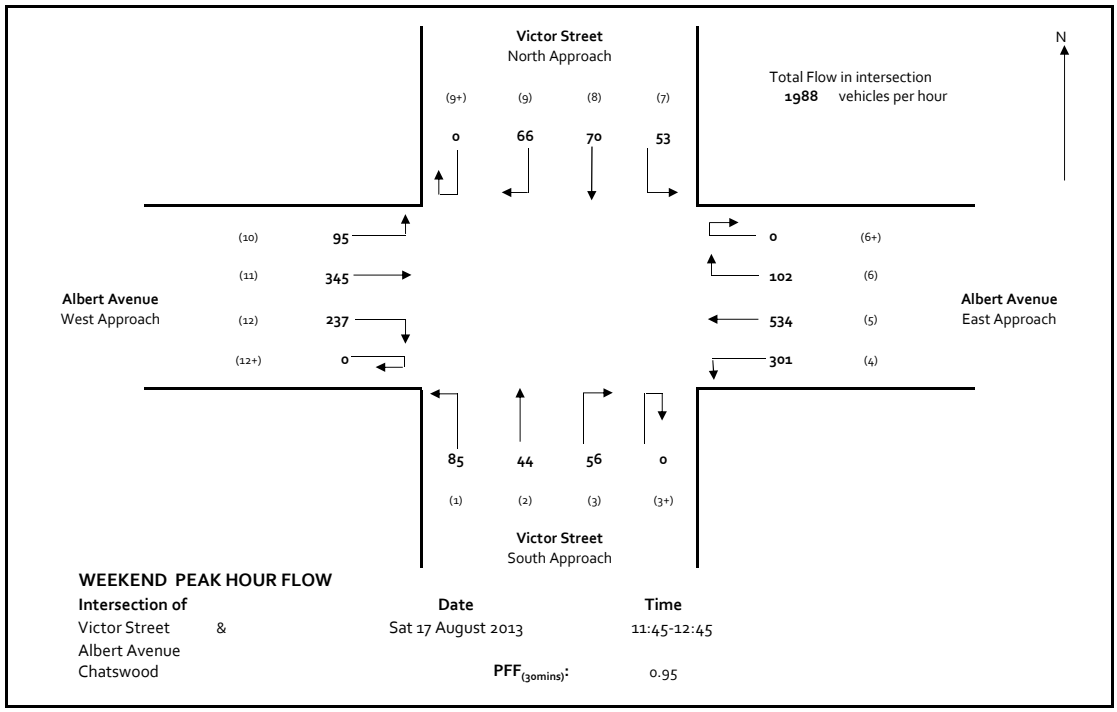
Date: Sat 17 August 2013

15 minute Data

Time	Movement																Total
	Victor Street South Approach				Albert Avenue East Approach				Victor Street North Approach				Albert Avenue West Approach				
	Left 1	Through 2	Right 3	U Turn 3+	Left 4	Through 5	Right 6	U Turn 6+	Left 7	Through 8	Right 9	U Turn 9+	Left 10	Through 11	Right 12	U Turn 12+	
10:00-10:15																	
10:15-10:30																	
10:30-10:45																	
10:45-11:00																	
11:00-11:15	16	7	5	0	59	114	25	0	10	10	9	0	21	71	53	0	400
11:15-11:30	23	12	12	0	65	118	31	0	15	13	11	0	25	75	69	0	469
11:30-11:45	18	11	7	0	59	97	23	0	8	9	6	0	19	76	65	0	398
11:45-12:00	29	6	25	0	65	106	33	0	9	14	13	0	28	106	58	0	492
12:00-12:15	22	12	9	0	83	162	33	0	17	18	18	0	21	81	73	0	549
12:15-12:30	15	13	5	0	69	119	22	0	14	15	15	0	17	64	42	0	410
12:30-12:45	19	13	17	0	84	147	14	0	13	23	20	0	29	94	64	0	537
12:45-13:00	24	12	13	0	80	115	25	0	16	20	19	0	23	86	55	0	488
13:00-13:15																	
13:15-13:30																	
13:30-13:45																	
13:45-14:00																	
Total	166	86	93		564	978	206		102	122	111		183	653	479		3743

Hourly flows

Time	Movement																Total
	Victor Street South Approach				Albert Avenue East Approach				Victor Street North Approach				Albert Avenue West Approach				
	Left 1	Through 2	Right 3	U Turn 3+	Left 4	Through 5	Right 6	U Turn 6+	Left 7	Through 8	Right 9	U Turn 9+	Left 10	Through 11	Right 12	U Turn 12+	
10:00-11:00																	
10:15-11:15																	
10:30-11:30																	
10:45-11:45																	
11:00-12:00	86	36	49	0	248	435	112	0	42	46	39	0	93	328	245	0	1759
11:15-12:15	92	41	53	0	272	483	120	0	49	54	48	0	93	338	265	0	1908
11:30-12:30	84	42	46	0	276	484	111	0	48	56	52	0	85	327	238	0	1849
11:45-12:45	85	44	56	0	301	534	102	0	53	70	66	0	95	345	237	0	1988
12:00-1:00	80	50	44	0	316	543	94	0	60	76	72	0	90	325	234	0	1984
12:15-1:15																	
12:30-13:30																	
13:45-13:45																	
13:00-14:00																	
Peak Hour	85	44	56	0	301	534	102	0	53	70	66	0	95	345	237	0	1988



WEEKEND PEAK HOUR FLOW

Intersection of		Date	Time
Victor Street & Albert Avenue Chatswood	&	Sat 17 August 2013	11:45-12:45
		$PFF_{(30mins)}$:	0.95

Appendix B

SIDRA INTERSECTION Results

MOVEMENT SUMMARY

Victor Street - Albert Avenue
Existing
AM Peak Hour
Signals - Fixed Time Cycle Time = 80 seconds (User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Victor Street (S)											
1	L	53	5.0	0.124	34.5	LOS C	1.6	11.9	0.82	0.74	30.8
2	T	62	5.0	0.244	27.2	LOS B	3.0	22.1	0.85	0.67	32.1
3	R	32	5.0	0.244	35.5	LOS C	3.0	22.1	0.85	0.80	31.4
Approach		146	5.0	0.244	31.6	LOS C	3.0	22.1	0.84	0.73	31.5
East: Albert Avenue (E)											
4	L	95	5.0	0.208	15.7	LOS B	4.0	29.5	0.47	0.86	43.0
5	T	381	5.0	0.208	7.3	LOS A	4.1	30.1	0.47	0.40	47.7
6	R	55	5.0	0.102	16.6	LOS B	1.0	7.0	0.47	0.72	41.3
Approach		531	5.0	0.208	9.8	LOS A	4.1	30.1	0.47	0.52	46.1
North: Victor Street (N)											
7	L	28	5.0	0.156	34.7	LOS C	2.1	15.6	0.83	0.79	31.6
8	T	40	5.0	0.156	26.4	LOS B	2.1	15.6	0.83	0.64	32.4
9	R	35	5.0	0.156	35.6	LOS C	1.1	8.1	0.83	0.73	30.4
Approach		103	5.0	0.156	31.8	LOS C	2.1	15.6	0.83	0.71	31.5
West: Albert Avenue (W)											
10	L	67	5.0	0.156	15.4	LOS B	2.9	21.3	0.45	0.86	43.2
11	T	289	5.0	0.156	7.1	LOS A	3.0	21.7	0.45	0.38	48.1
12	R	105	5.0	0.392	17.6	LOS B	2.0	14.8	0.51	0.74	40.5
Approach		462	5.0	0.392	10.7	LOS A	3.0	21.7	0.47	0.53	45.4
All Vehicles		1242	5.0	0.392	14.5	LOS B	4.1	30.1	0.54	0.56	42.0

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

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	Across S approach	53	10.5	LOS B	0.1	0.1	0.51	0.51
P3	Across E approach	53	34.2	LOS D	0.1	0.1	0.93	0.93
P5	Across N approach	53	9.0	LOS A	0.1	0.1	0.48	0.48
P7	Across W approach	53	34.2	LOS D	0.1	0.1	0.93	0.93
All Pedestrians		212	22.0	LOS C			0.71	0.71

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

Victor Street - Albert Avenue
Existing
PM Peak Hour
Signals - Fixed Time Cycle Time = 80 seconds (User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Victor Street (S)											
1	L	95	5.0	0.222	35.3	LOS C	3.0	22.1	0.84	0.77	30.5
2	T	66	5.0	0.331	29.7	LOS C	3.7	27.1	0.89	0.71	30.8
3	R	42	5.0	0.331	38.0	LOS C	3.7	27.1	0.89	0.80	30.3
Approach		203	5.0	0.331	34.0	LOS C	3.7	27.1	0.87	0.76	30.6
East: Albert Avenue (E)											
4	L	211	5.0	0.324	16.4	LOS B	6.8	49.7	0.52	0.83	42.2
5	T	527	5.0	0.324	8.0	LOS A	7.0	51.1	0.52	0.45	46.8
6	R	80	5.0	0.149	16.8	LOS B	1.4	10.4	0.48	0.73	41.2
Approach		818	5.0	0.324	11.0	LOS A	7.0	51.1	0.51	0.58	45.0
North: Victor Street (N)											
7	L	80	5.0	0.359	36.3	LOS C	5.2	38.1	0.88	0.81	30.8
8	T	77	5.0	0.359	28.0	LOS B	5.2	38.1	0.88	0.71	31.4
9	R	86	5.0	0.405	39.9	LOS C	3.0	22.2	0.91	0.77	28.7
Approach		243	5.0	0.405	35.0	LOS C	5.2	38.1	0.89	0.77	30.2
West: Albert Avenue (W)											
10	L	66	5.0	0.148	15.4	LOS B	2.8	20.2	0.45	0.85	43.2
11	T	274	5.0	0.148	7.0	LOS A	2.8	20.6	0.45	0.38	48.2
12	R	189	5.0	0.801	34.4	LOS C	6.3	45.7	0.71	0.92	30.9
Approach		529	5.0	0.801	17.9	LOS B	6.3	45.7	0.55	0.63	39.7
All Vehicles		1794	5.0	0.801	18.9	LOS B	7.0	51.1	0.61	0.64	38.8

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

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	Across S approach	53	10.5	LOS B	0.1	0.1	0.51	0.51
P3	Across E approach	53	34.2	LOS D	0.1	0.1	0.93	0.93
P5	Across N approach	53	9.0	LOS A	0.1	0.1	0.48	0.48
P7	Across W approach	53	34.2	LOS D	0.1	0.1	0.93	0.93
All Pedestrians		212	22.0	LOS C			0.71	0.71

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

Victor Street - Albert Avenue
Existing
Sat Midday Peak Hour
Signals - Fixed Time Cycle Time = 80 seconds (User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Victor Street (S)											
1	L	89	5.0	0.210	35.2	LOS C	2.9	20.8	0.84	0.77	30.5
2	T	46	5.0	0.332	29.8	LOS C	3.6	26.3	0.89	0.71	30.5
3	R	59	5.0	0.332	38.0	LOS C	3.6	26.3	0.89	0.80	30.0
Approach		195	5.0	0.332	34.8	LOS C	3.6	26.3	0.87	0.76	30.4
East: Albert Avenue (E)											
4	L	317	5.0	0.387	16.8	LOS B	8.5	62.0	0.54	0.82	41.6
5	T	562	5.0	0.387	8.4	LOS A	8.8	64.4	0.54	0.48	46.3
6	R	107	5.0	0.213	17.7	LOS B	2.1	15.1	0.52	0.75	40.5
Approach		986	5.0	0.387	12.1	LOS A	8.8	64.4	0.54	0.62	44.0
North: Victor Street (N)											
7	L	56	5.0	0.295	35.8	LOS C	4.2	30.9	0.86	0.81	31.1
8	T	74	5.0	0.295	27.5	LOS B	4.2	30.9	0.86	0.69	31.8
9	R	69	5.0	0.321	38.4	LOS C	2.4	17.3	0.88	0.76	29.2
Approach		199	5.0	0.321	33.6	LOS C	4.2	30.9	0.87	0.75	30.7
West: Albert Avenue (W)											
10	L	100	5.0	0.216	15.7	LOS B	4.2	30.8	0.48	0.86	43.0
11	T	393	5.0	0.216	7.4	LOS A	4.3	31.3	0.48	0.40	47.5
12	R	220	5.0	1.000[3]	28.4	LOS B	6.3	45.7	0.95	0.85	33.8
Approach		713	5.0	1.000	15.0	LOS B	6.3	45.7	0.62	0.61	41.7
All Vehicles		2093	5.0	1.000	17.3	LOS B	8.8	64.4	0.63	0.64	39.9

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

3 x = 1.00 due to short lane. Refer to the Lane Summary report for information about excess flow and related conditions.

Movement Performance - Pedestrians

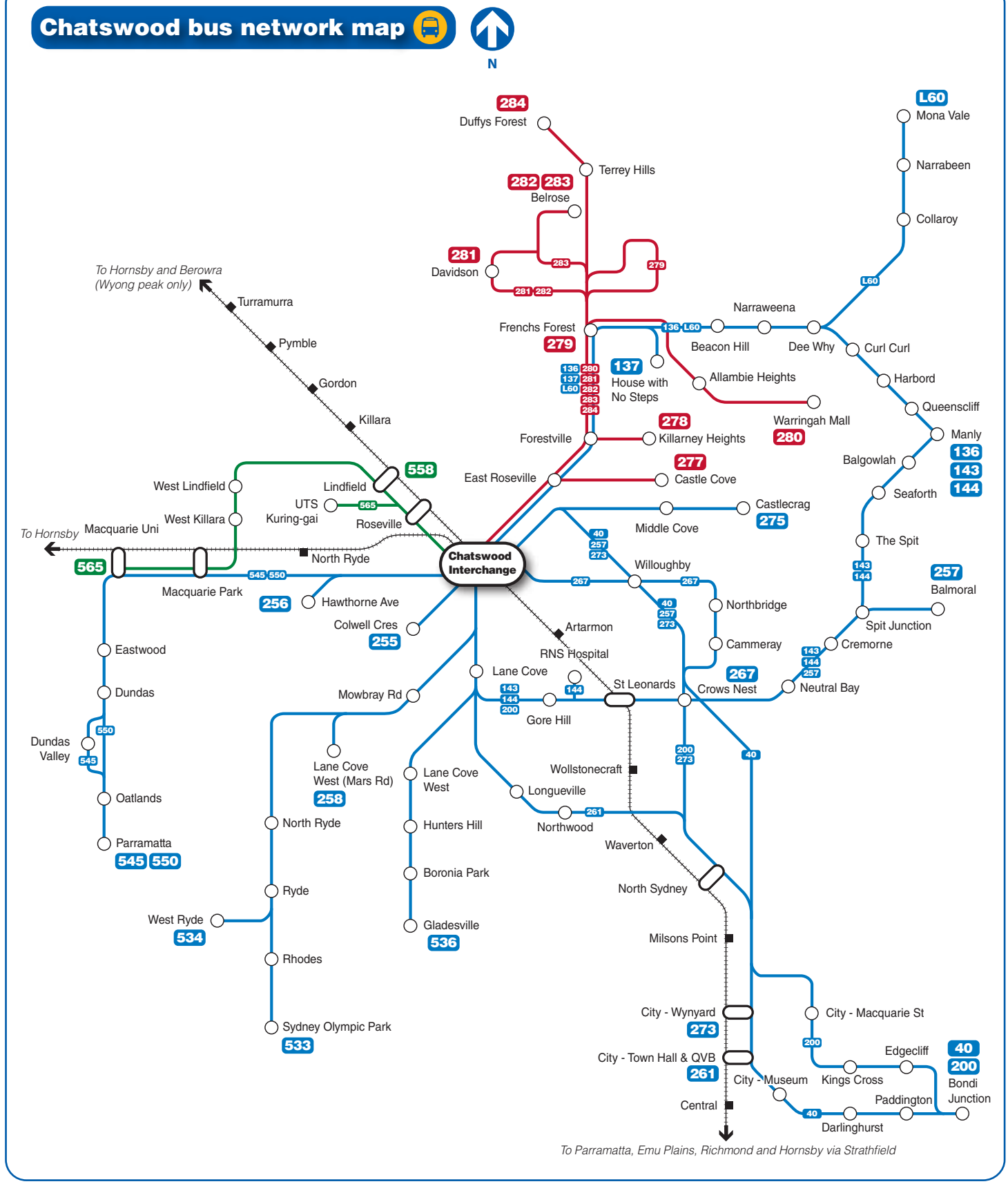
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	Across S approach	53	10.5	LOS B	0.1	0.1	0.51	0.51
P3	Across E approach	53	34.2	LOS D	0.1	0.1	0.93	0.93
P5	Across N approach	53	9.0	LOS A	0.1	0.1	0.48	0.48
P7	Across W approach	53	34.2	LOS D	0.1	0.1	0.93	0.93
All Pedestrians		212	22.0	LOS C			0.71	0.71

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.

Appendix C

Chatswood Bus Network Map

Chatswood bus network map

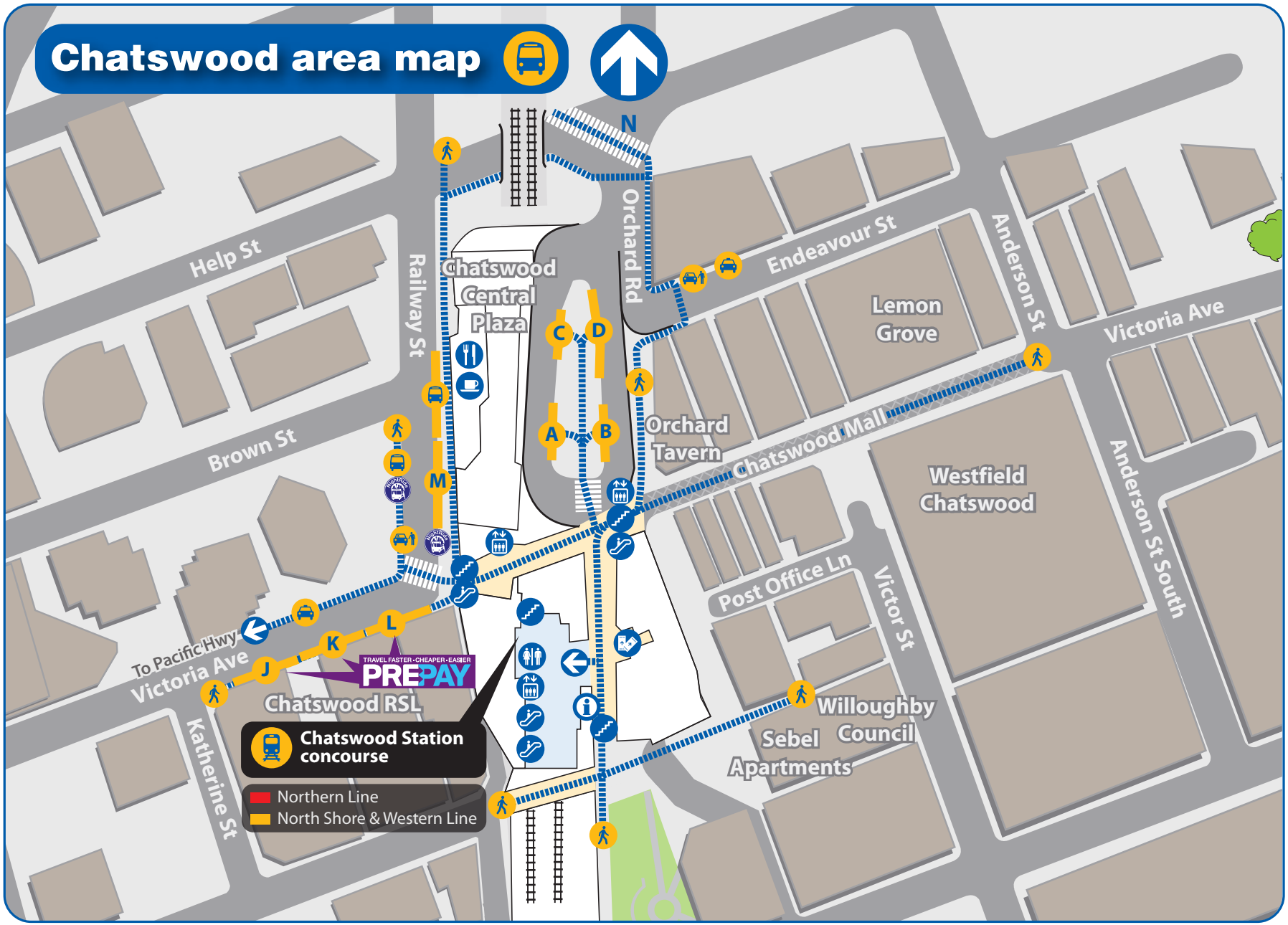


Legend

- Forest Coach Lines routes
- Sydney Buses routes
- TransdevTSL Shorelink Buses routes

Diagrammatic Map - Not to Scale

- Rail line
- Railway station
- Bus route/suburb
- Bus/Rail interchange



Legend

Bus stop · Bus stand · Taxi rank · Kiss & ride · Walking route · Bus zone · Lift · Stairs · Escalator · Tickets · Toilets · Food · Refreshments · Station entrance · Information

Bus services at Chatswood

Bus departure information

Please use this listing to find your bus number, route destination and bus stand.
Refer to the Interchange Map to find the bus stand location.

Bus Stand	Route Number	Bus Route Destination	
B	**40**	Metrobus to Bondi Junction via Willoughby and City (PrePay only)	PREPAY
D	**136**	Manly via Frenchs Forest, Dee Why and Harbord	
D	**137**	House With No Steps	
K(p)	**143**	Manly via Neutral Bay and Balgowlah	
K(p)	**144**	Manly via RNS Hospital, Neutral Bay and Balgowlah	
D	**L60**	Mona Vale via Dee Why (Limited Stops)	
K(p)	**200**	Bondi Junction via North Sydney and Kings Cross (Limited Stops)	
J(p)	**255**	Chatswood West (Colwell Cres)	
L(p)	**256**	Chatswood West (Hawthorne Ave)	
B	**257**	Balmoral Beach via Willoughby and Neutral Bay	
J(p)	**258**	Lane Cove West (Mars Rd) via Mowbray Rd	
J(p)	**261**	City - QVB via Lane Cove, Longueville and Northwood	
B	**267**	Crows Nest via Willoughby and Cammeray	
B	**273**	City - Wynyard via Willoughby and North Sydney	
D	**275**	Castlecrag via Middle Cove	
A	**277**	Castle Cove	
A	**278**	Killarney Heights via Forestville	
A	**279**	Frenchs Forest via Forestville (Limited Service)	
A	**280**	Warringah Mall via Frenchs Forest and Allambie Heights	
A	**281**	Davidson via Frenchs Forest	
A	**282**	Davidson/Belrose via Frenchs Forest	
A	**283**	Belrose via Frenchs Forest	
A	**284**	Duffys Forest via Frenchs Forest and Terrey Hills	
J(p)	**533**	Sydney Olympic Park via Mowbray Rd and Ryde	
J(p)	**534**	Ryde/West Ryde via Mowbray Rd	
J(p)	**536**	Gladesville via Lane Cove and Hunters Hill	
L(p)	**545**	Parramatta via Macquarie Centre, Eastwood and Dundas Valley	
L(p)	**550**	Parramatta via Macquarie Centre, Eastwood and Kissing Point Rd	
Railway St	**558**	Lindfield via Roseville and East Lindfield	
Railway St	**565**	Macquarie University via UTS Kuring-gai and West Lindfield	
Railway St	**N90**	NightRide - City to Town Hall via North Sydney	
Railway St	**N90**	NightRide - Hornsby via Gordon	

Bus Operator Legend

- Sydney Buses
- PrePay (Sydney Buses)
- Forest Coach Lines
- TransdevTSL Shorelink Buses
- NightRide

Notes

(p) Sydney Buses bus stops in Victoria Ave and Railway St are PrePay only stops from 7am to 7pm Weekdays.

Appendix D

Car Parking Demand Assessment

Residential Apartments (Resident)

In order to assess the likely car ownership of the future residents or more specifically the recognition of zero car ownership, reference is made to the 2006 and 2011 Census undertaken by the Australian Bureau of Statistics (ABS). The Census collected data on the car ownership levels associated with a variety of dwelling types and in this instance GTA have reviewed the data to provide a summary of existing car ownership levels of studio, 1 and 2 bedroom apartments (for developments of four or more storeys) in Chatswood and Chatswood West (Postcode: 2067).

The recorded "zero" car ownership rates for studio, one, two and three bedroom apartments within the three areas described above are illustrated in Figure A1.

Figure A1: Percentage of Zero Car Ownership in Chatswood and Chatswood West (Postcode: 2067)

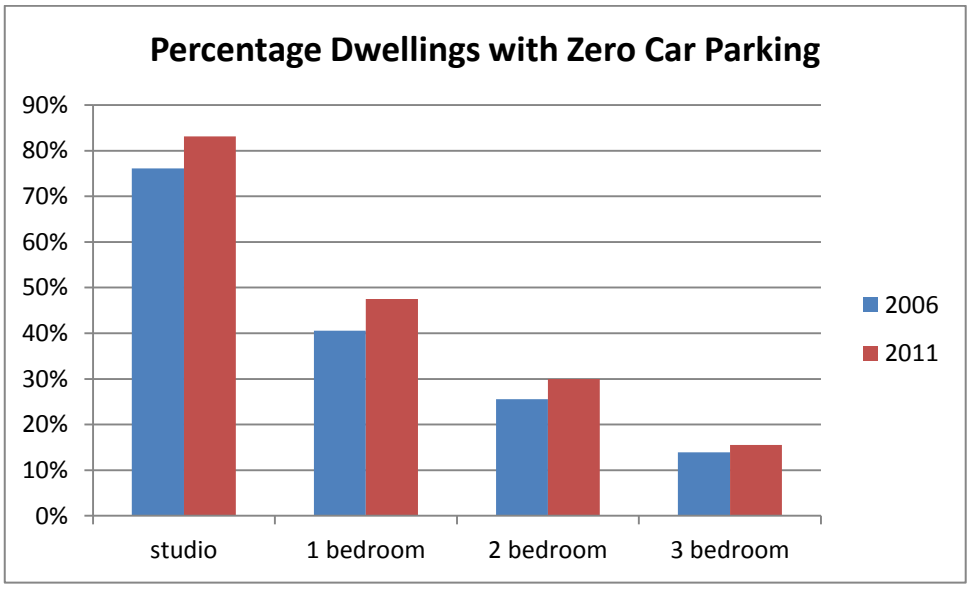


Figure A1 indicates that there are a substantial number of households which do not own a car in the studio, one and two bedroom classifications and to a lesser extent three bedroom household classifications. Indeed there is currently some 83% (79 of 95 dwellings), 47% (416 of 876) and 30% (490 of 1,634) studio, one and two bedroom households within the suburbs of Chatswood and Chatswood West that do not exhibit any level of car ownership (2011 census). The data also indicates that the proportion of households in the study area that do not own a car has consistently increased across all dwelling types since the 2006 census (745 to 1,091).

The study area subject to this review exhibits higher levels of "zero" ownership against than the Metropolitan Sydney average. This outcome is most likely influenced by Chatswood's proximity to public transport and the high density nature of the Chatswood CBD and surrounds.

Given the propensity for lower than average car parking rates for existing residents of Chatswood, reference has been made to the *'Guide to Traffic Generating Developments'* RMS (October 2002). This document indicates the following resident car parking rates for high density residential uses in Metropolitan Regional (CBD) Centres which is considered to best represent the proposed development:

- *0.4 spaces per 1 bedroom unit.*
- *0.7 spaces per 2 bedroom unit.*
- *1.20 spaces per 3 bedroom unit.*

Application of these rates to the proposed development yield indicates a resident car parking provision of 156 spaces.

Residential Apartments (Visitors)

The DCP indicates a residential visitor parking requirement of 1 car space per 4 dwellings which is applicable across the entire Willoughby Council area.

In this instance, having regard to the site's high level of accessibility to nearby commercial land uses (which can be expected to lead to 'multi-purpose' trips), public transport services and pedestrian and cycling pathways, it is considered likely that residential visitor car parking demands would be significantly lower, on a rate basis, than the DCP rate.

RMS (October 2002) indicates a visitor car parking rate for metropolitan Regional (CBD) Centres of 1 space per 7 dwellings. Application of this rate to the proposal indicates that a peak residential visitor parking demand of 37 car spaces can be expected, noting that such demand is typically short in its duration (e.g. 2 hours) and variable throughout the day. Surveys undertaken by GTA indicate that daytime demands are typically 50% of evening demands and as such, a peak daytime demand of 19 spaces could be expected.

Retail/Entertainment Uses

It is proposed to maintain the existing mix of retail and entertainment uses currently provided within the Mandarin Centre. The existing retail and entertainment floor area of 13,044sq.m is supported by 303 car parking spaces, equating to a rate of 2.32 spaces per 100sq.m. It is understood that this car parking provision has been provided in conjunction with Councils requirements for the site.

In this regard, it is proposed to provide car parking for the future retail and entertainment uses at the existing Council approved rate of 2.32 spaces per 100sq.m. Application of this rate to the proposed retail and entertainment uses indicates a future car parking requirement of 365 spaces.

In addition to the above, it is understood that the approved Metro development located at the Chatswood Interchange does not provide any car parking for the proposed retail (and supermarket) uses. This further supports the provision of a car parking rate less than the DCP parking rate of 6 spaces per 100sq.m is considered.

Supermarket

The generic DCP car parking rate for the supermarket use is not considered to accurately reflect the sites proximity to Chatswood Transport Interchange and dense residential development in the immediate vicinity of (and above) the subject site (i.e. increased walk up trade). Furthermore it is noted that the proposed supermarket has a small footprint (i.e. not a full size supermarket) and therefore is less likely to attract shoppers who would complete a weekly shop which would typically require a car. Given the above, it is anticipated that the supermarket would operate ancillary to the other retail uses and as such, generate car parking at a lower rate than that specified in the DCP.

In this regard, reference has been made to car parking surveys undertaken of supermarket uses within metropolitan Sydney by the RMS and documented in RMS (October 2002).

The nominated documents specify peak parking demands for supermarkets at a rate of 4.2 spaces per 100m^2 GLFA. Application of this rate to the proposed development would indicate a peak car parking demand of 61 spaces.

Appendix E

Traffic Generation Assessment

Preamble

Peak hour traffic generation estimates for the planning proposal have been sourced from the original *Guide to Traffic Generating Developments* (RMS, 2002).

Residential

The RMS (2002) document indicates a peak hour traffic generation of 0.29 movements per peak hour. Application of this rate to the residential car parking spaces (156 spaces) indicates a peak hour traffic generation of 45 movements for the residential component.

A subsequent RMS Technical Direction, published in May 2013, has been released to update the traffic generation rates as detailed in RMS 2002. High density residential flat dwellings return an average weekday AM and PM peak hour generation rate of 0.19 and 0.15 vehicle movements per apartment respectively. This equates to 0.15 and 0.12 vehicle movements per car space. Clearly the RMS Technical Direction is reflective of current generation rates for such developments in Metropolitan Regional (CBD) locations.

As such, the adopted traffic generation rate of 0.29 spaces per residential car space is considered to represent a conservative assessment.

Retail/Entertainment/Supermarket

Typically reference would be made to RMS 2002 to determine future traffic generation rates for the retail uses. The RMS traffic generation rates are typically presented as a 'per 100m^2' rate. However as a result of the reduced car parking provision (2.32 spaces per 100sq.m), it is considered appropriate to determine the traffic generation as a 'per space' rate. This approach is consistent with the residential assessment.

In this regard, reference is made to 'Trip Generation and Parking Demand Surveys of Shopping Centre – Analysis Report' prepared by Halcrow (September 2011) for RMS as part of their Technical Direction (May 2013).

This report indicates the following average peak hour traffic generation rates for shopping centres (per parking space):

- AM Peak Hour: 0.52 movements per parking space
- PM Peak Hour: 0.92 movements per parking space

The PM peak hour traffic generation rate would equate to each space turning over every 2 hours and 10 minutes.

The above surveys were undertaken of 10 centres throughout the Sydney metropolitan region. Specific reference is made to the surveys of the Burwood Shopping Centre, which like the Mandarin Centre is located in close proximity to a railway station. Surveys of the Burwood site indicated a traffic generation rate of 0.20 and 0.54 movements per space. As such, the adopted rates of 0.52 and 0.92 are considered represent a conservative assessment.

Application of the above rates indicates the retail/entertainment/supermarket uses could be expected to generate 222 and 392 movements in the AM and PM peak hours, respectively (assuming 426 spaces).

The existing site (303 spaces) is anticipated to generate approximately 158 and 279 vehicle movements during the AM and PM peak periods, respectively.

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