Meriton Group

112 Talavera Road, Macquarie Park

Transport Assessment

Rev A | 6 November 2017

This report takes into account the particular instructions and requirements of our client.

It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Job number 252454-00

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1 Introduction

1.1 Overview

Meriton Group has engaged Arup to provide a transport assessment to support the development application of 112 Talavera Road, Macquarie Park. The site, also currently known as the Macquarie View Corporate Park, is located within the northern section of the Macquarie University Station Priority Precinct. The site is approximately 1.95 hectares and currently supports a predominately commercial/ industrial land use.

The development proposal looks to transform the site over three phases, into a mixed use development supporting approximately 1,256 apartments and 1,500 sqm of childcare/retail uses.

1.2 Reference documentation

Specific documentations referred to in this report includes:

- Development Control Plan (DCP), City of Ryde, 2014
- Ryde Local Environmental Plan, 2014
- State Environmental Planning Policy No 65 – Design Quality of Residential Apartment Development (SEPP 65)
- Apartment Design Guide, NSW Department of Planning and Environment, 2015
- Guide to Traffic Generating Developments, Road and Maritime Services, 2002
- Herring Road, Macquarie Park Finalisation Report, Department of Planning, 2015

1.3 Report Scope

The scope of this report will outline the following:

- Planning context
- Proposed development yields
- Existing transport conditions
- Vehicle access and parking
- Traffic impact assessment
- Public transport access
- Pedestrian and cycle access

2 Planning Context

2.1 Sydney Metro Northwest

Sydney Metro Northwest represents Stage 1 of the NSW Government's Sydney Metro project. Sydney Metro is a new proposed railway line that will deliver 31 metro stations and more than 65 kilometre of new metro rail (Figure 1).

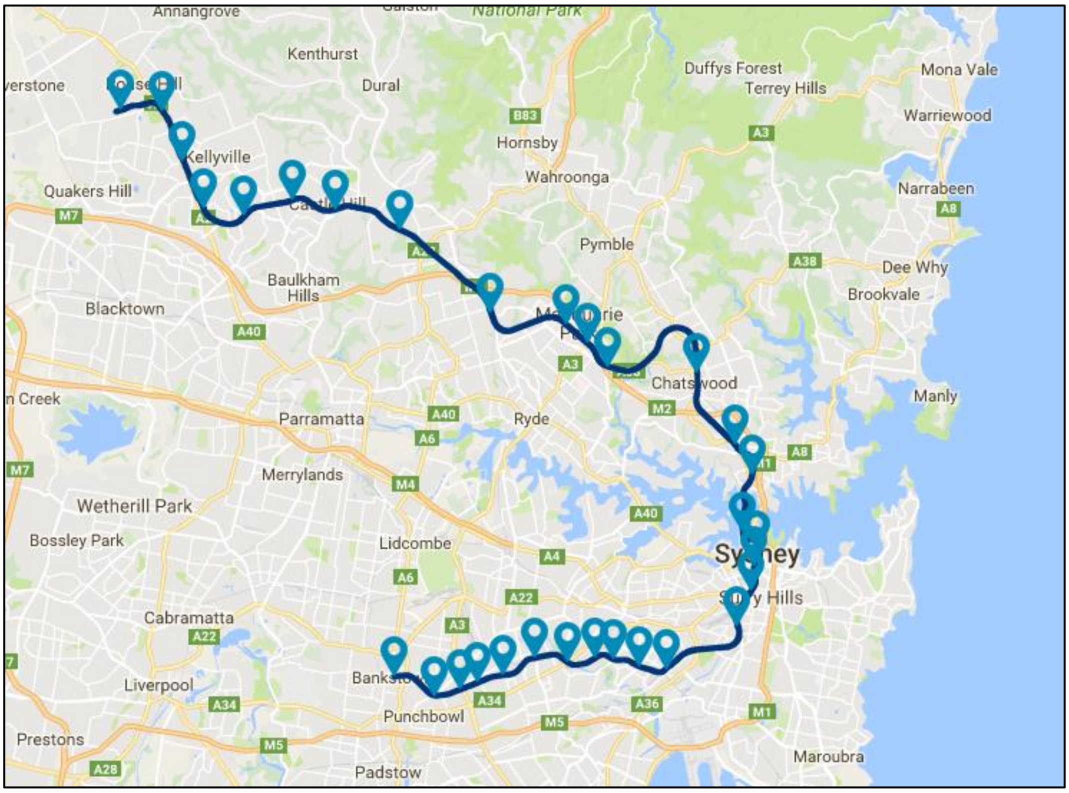


Figure 1: Proposed Sydney Metro alignment

Source: TfNSW (accessed 04/2017) https://www.sydneymetro.info/map/interactive-map

Sydney Metro Northwest will connect Rouse Hill to Chatswood, via Epping. This project proposes to convert the existing Epping to Chatswood railway line to rapid transit standard and extend this line to Cudgegong Road and Rouse Hill. This latter section of railway line was originally referred to as the North West Rail Link. A review of Transport for NSW's Sydney Metro website indicates project completion of Stage 1 is forecast for the first half of 2019, with rail replacement buses between Epping and Chatswood in late 2018.

The Macquarie University Station, which is within 400m of the development site, currently sits along the Epping to Chatswood railway line. It is one of five current railway stations which will be upgraded to metro standards as part of the Sydney Metro project. The number of train services between Epping and Chatswood is anticipated to increase by almost four times during the peak hour to 15 trains an hour in both direction. Direct services to Crows Nest, Barangaroo and Martin Place will also be introduce once Sydney Metro City and Southwest (Stage 2) is finished in 2024.

2.2 Epping and Macquarie Park Urban Renewal Area

The Epping and Macquarie Park Urban Renewal Area is a priority growth area outlined by the NSW government's Department of Planning and Environment (Department). As part of this initiative, the Department has worked with the Ryde Council and other stakeholders to identify opportunities to revitalise the Macquarie University Station (Herring Road) precinct.

The Finalisation Report for this precinct, completed by the department in 2015, focused on the walking catchment around Macquarie University Station and along Herring Road, which are currently zoned mixed use in the City of Ryde's Local Environmental Plan (LEP), 2014.

The report proposes amendments to Ryde's LEP to increase the height and density controls, especially around the station. The precinct will look to deliver up to 5,800 dwellings by 2031.

2.3 Macquarie Park Bus Priority and Capacity Improvements

Transport for NSW (TfNSW) and Roads and Maritime Services (Roads and Maritime) are proposing a range of road and intersection upgrades in Macquarie Park. Given the precinct's growth, these upgrades aim to improve the reliability and efficiency of bus services, while easing congestion and improving traffic flow for all road users in the area.

The proposal is currently out for public comment, with the feedback window closing in May 2017. This proposal would be delivered as part of the Bus Priority Infrastructure Program and will be separated into two stages.

Stage 1

As highlighted in section 2.1, Sydney Metro Northwest will temporarily close in late 2018, with rail replacement buses operating for approximately seven months. During this period the Temporary Transport Plan (TfNSW, 2014) will be implemented. Works on the proposed road and intersection upgrades will commence mid-2017 and once complete will support the running of current and additional rail replacement bus services and improved traffic flow in the area.

Stage 2

Following the completion of the Sydney Metro Northwest, the remainder of the proposed road and intersection upgrades will be carried out. These works will focus on long term improvements and ongoing support for the Parramatta to Macquarie Park and Hurstville to Burwood bus corridors as well as other bus services operating the in the area.

Some of the key proposed upgrades within proximity of 112 Talavera Road are outline in Figure 2.

Figure 2: Key features of the Macquarie Park bus priority and capacity improvements

3 Existing Context

3.1 Site description

The site subject to the planning proposal is located at 112 Talavera Road, Macquarie Park, approximately 17 km from Sydney CBD. The site is approximately 1.95 hectares in size and is situated within the City of Ryde local government area. The location plan is shown in Figure 3.

The site is bound by the M2 Motorway to the north, Herring Road to the east, Talavera Road to the south and Christie Road to the west. The site currently comprises of the Macquarie View Corporate Park with the Fujitsu Head Office commercial building abutting the site to the west.

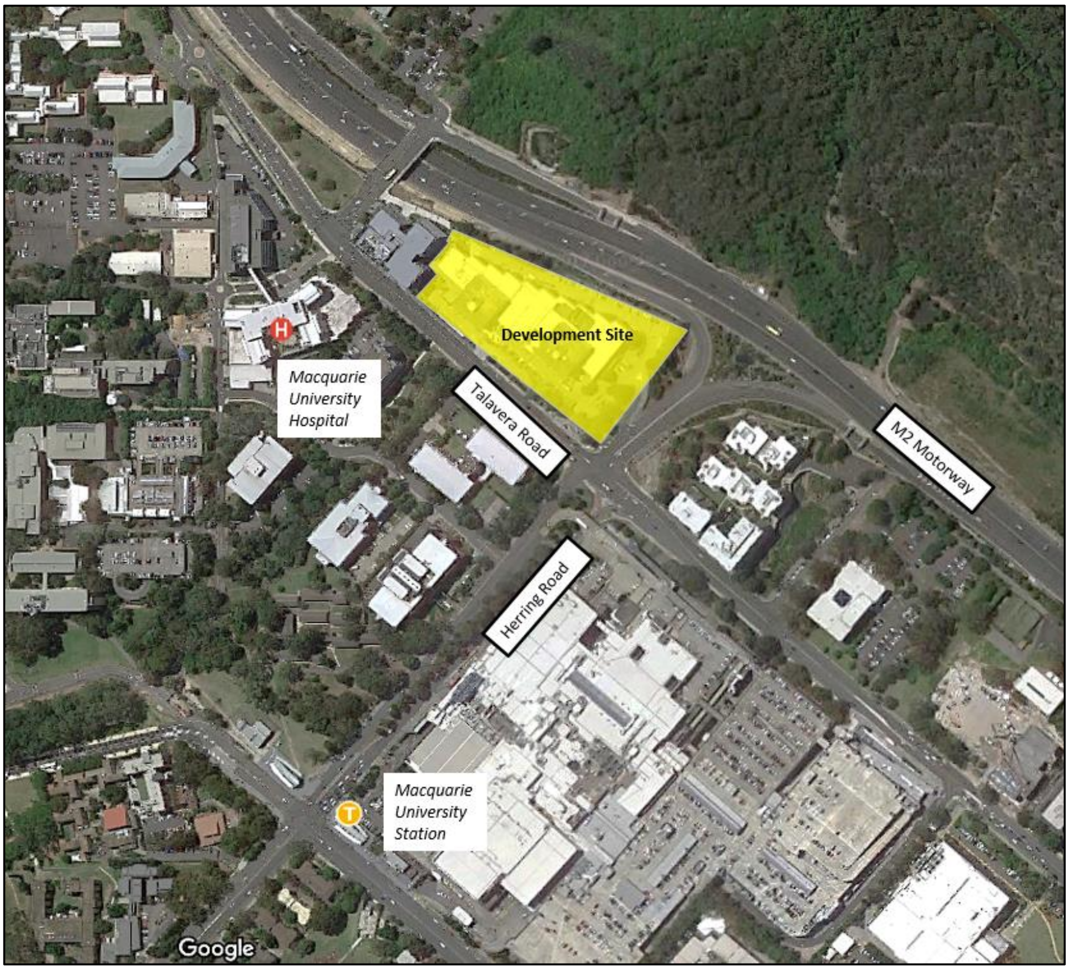


Figure 3: Location plan

Background image source: Google Maps, accessed 2017

The site currently consists of an office tower and associated business park/ industrial uses. Existing vehicular access is provided along Talavera Road, Herring Road and Christie Road. The access from Christie Road is shared with a right of way easement with Fujitsu. As per the Ryde's LEP (2014) the development site is zoned B4, mixed use. This is shown in Figure 4.

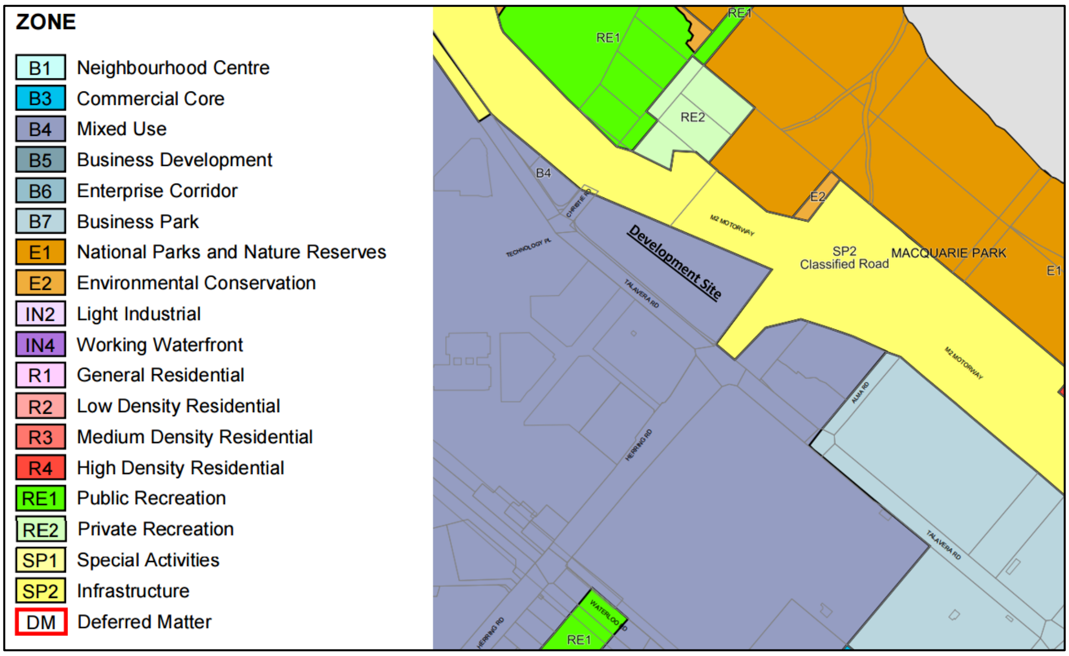


Figure 4: Land use zoning

Source: City of Ryde LEP (2014)

3.2 Road network

The site is bound by the M2 Motorway to the north, the Herring Road M2 on-ramp to the east, Talavera Road to the south and the Fujitsu commercial building to the west.

The M2 Motorway is a toll road that is operated by Transurban. It has a sign posted speed limit of 100km/h. In this vicinity, it operates as a six lane dual carriage way.

Talavera Road is an east-west regional road and generally consists of two lanes in each direction.

Herring Road is a north-south regional road. The section north of Talavera Road forms the on/off ramp to the M2 Motorway.

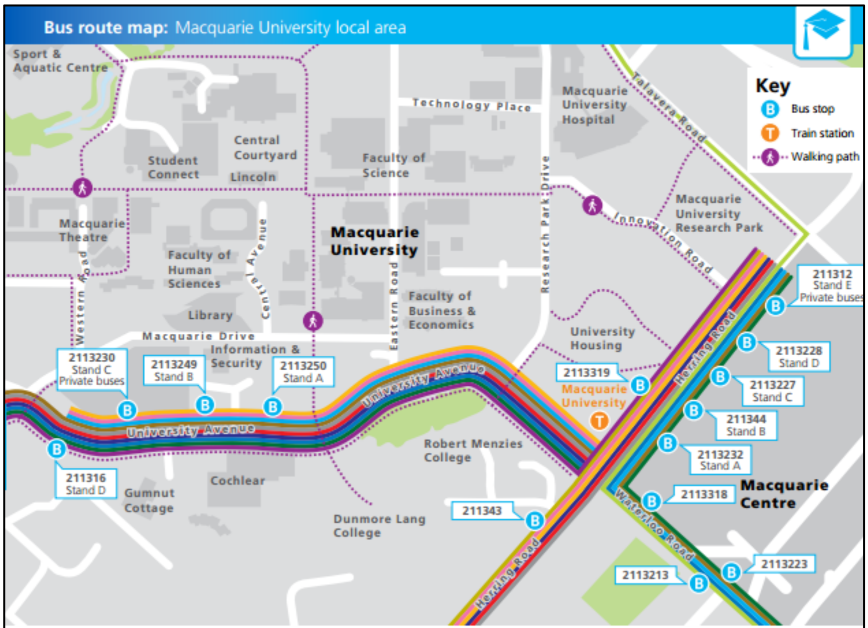
The key intersections surrounding the development site consists of:

- **Herring Road/ Talavera Road/ M2 Ramps:** Pedestrian crossing facilities are provided to all approaches to the intersection expect the eastern leg. A bus priority lane is provided on the western approach along Talavera Road, with the right turn movement from Talavera Road to Herring Road restricted for buses only.
- **Talavera Road/ Christie Road:** This signalised intersection caters for pedestrian crossing facilities on the north and west approaches. The Christie Road approach provides vehicular access to and from the M2 Motorway for traffic travelling eastbound.

3.3 Public transport

The site has good access to public transport and is within walking distance to both rail and bus services. Macquarie University Station is located 400m to the south of the development site and forms part of the Epping to Chatswood line. This station provides services between 5am to 11pm on a topical weekday and 13 train services arrive at the station during peak hours.

Several bus services operate along Talavera Road, fronting the development site. Macquarie University and Macquarie Centre are within close proximity, both of which provide high frequency buses connecting to Parramatta CBD, Sydney City and other major centres. Public transport options for the local area are summarised via Macquarie University's local area map (Figure 5).



Stop	Stand	Routes	Towards
University Avenue			
2113250	Stand A	288 290 291 292 294 506 507 518	City, McMahons Point
2113249	Stand B	M54 140 459 545	Macquarie Park, Manly, Strathfield, Chatswood
211316	Stand D	M54 140 288 290 291 292 544 545 550	Marsfield, Epping, Parramatta, Auburn
Herring Road			
2113232	Stand A	M54 506 507 518 544 545 550	Parramatta, City, Auburn
211344	Stand B	458 459 545	Strathfield, Burwood, Chatswood
2113227	Stand C	M54 140 288 290 291 292 294	Macquarie Park, Manly, McMahons Point, City
2113228	Stand D	140 288 290 291 292 295	Marsfield, Epping, North Epping
211343		288 290 291	Epping
2113319		M41	Marsfield
Waterloo Road			
2113213		292 545 550	Marsfield, Parramatta
2113223		M41 M54 292 294 458 459 506 545	Macquarie Park, Ryde, Rhodes, Burwood, Strathfield, Hurstville, City, Chatswood
2113318		M41	Ryde, Rhodes, Burwood, Hurstville

Figure 5: Local area public transport map

Source: Transport for NSW, September 2016

3.4 Active transport

The pedestrian network in the vicinity of the proposed development is of a reasonable quality with footpaths on both sides of Talavera Road. Good connectivity to nearby attractors such as Macquarie Centre, Macquarie University and Macquarie University Station is provided.

Walking isochrones from the proposed development site are shown in Figure 6, using the Arup developed T3A tool. This tool utilises pedestrian data from Open Street Map, with a walking speed of 5km/h. The isochrones indicate the area which can be reached within a certain walking time.

The assessment indicates that Macquarie Centre and Macquarie University Station are both approximately five minutes walk of the development site, while Macquarie University can be accessed within 15 minutes.

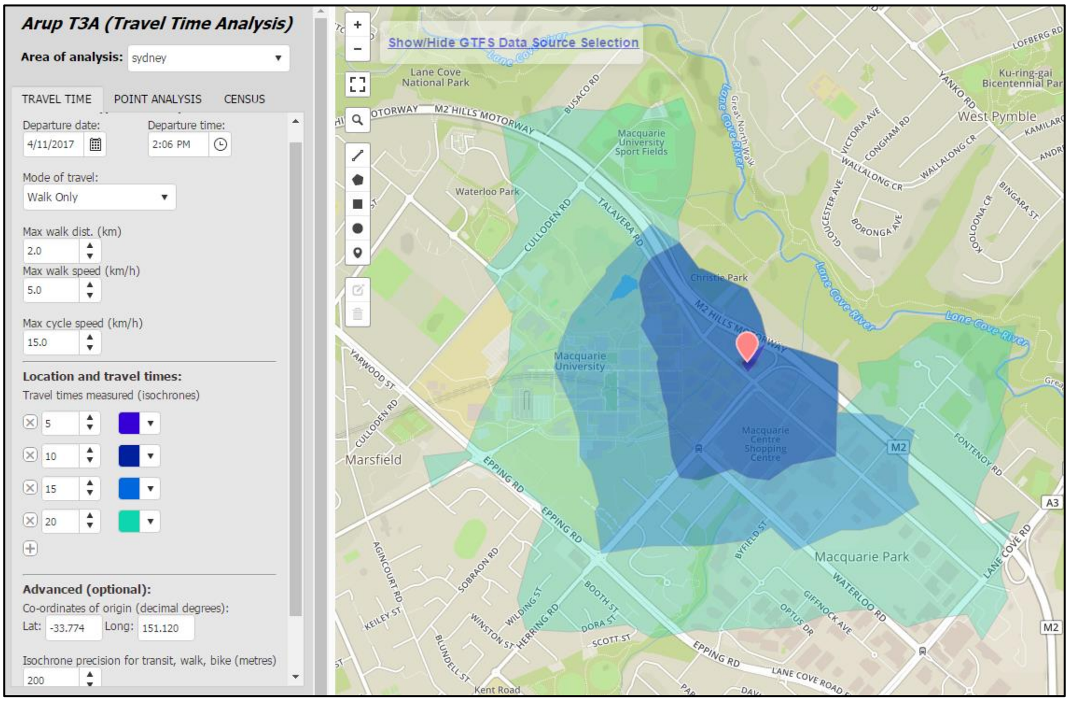


Figure 6: Walking isochrones, Arup T3A

The existing dedicated and low difficulty cycle routes, recommended by the Roads and Maritime Cycleway Finder is shown in Figure 7. Existing cycle routes are relatively well connected with off-road paths located along Talavera Road and Waterloo Road.

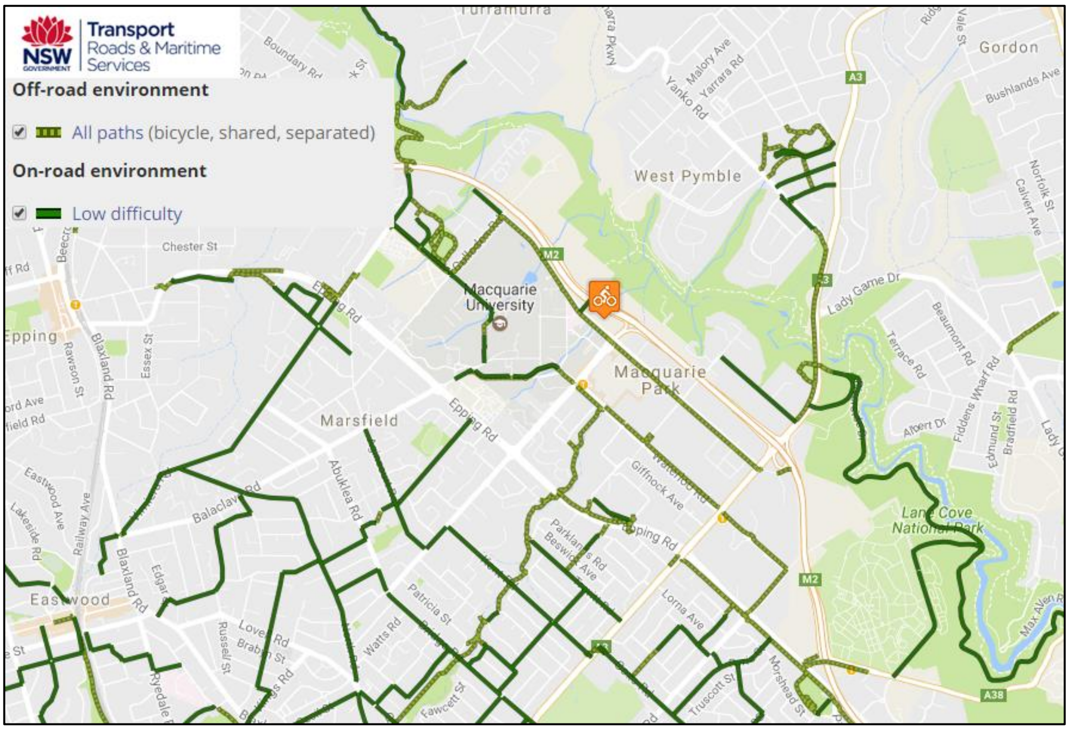


Figure 7: Cycle network map

Source: Roads and Maritime Cycleway Finder

3.5 Travel patterns

Analysis of travel patterns of people who live and work in the immediate area has been undertaken. A review of the 2011 Journey to Work (JTW) data was conducted to assess where people work and their method of commute. This information is collected as part of the Census and it captures commuter travel behaviours for one particular day.

3.5.1 Workers of Macquarie Park

A total of 35,000 people were recorded to be working in the Macquarie Park area in 2011. The majority of workers, approximately 4,200 people, live within the Ryde - Hunters Hill area. A summary is shown in Figure 8.

%	No.	Origin or place of residence (SA3)
12%	4,139	Ryde - Hunters Hill
	2,099	Baulkham Hills
	1,651	Ku-ring-gai
	1,546	Chatswood - Lane Cove
	1,509	Parramatta
	1,307	Hornsby
	1,236	Carlingford
	1,224	Sydney Inner City
	1,219	Pennant Hills - Epping
	1,179	Warringah
	16,393	Other

Figure 8: Where workers of Macquarie Park live (JTW, 2011)

The JTW data indicates that the majority of workers in the area use private vehicle as the primary form of commute. Public and active transport make up less than 25% of all respondents in the area. A summary of worker mode share is shown in

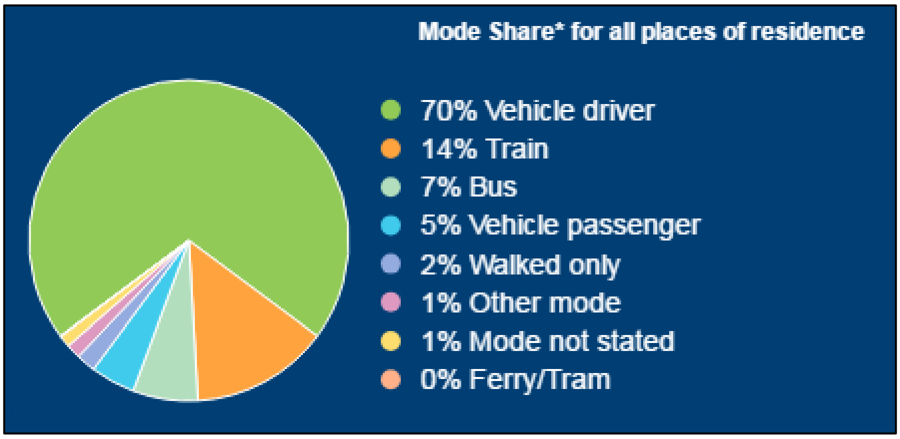


Figure 9: How workers in Macquarie Park commute to work (JTW, 2011)

3.5.2 Residents of Macquarie Park

The JTW survey indicate 2,600 working residents live in Macquarie Park in 2011. The main areas which these people work in are shown in Figure 10. The data indicates that the majority of the precinct's residents work in Ryde - Hunters Hill, followed by the Sydney CBD.

%	No.	Destination or place of work (SA3)
38%	979	Ryde - Hunters Hill
	452	Sydney Inner City
	315	Chatswood - Lane Cove
	143	North Sydney - Mosman
	81	Ku-ring-gai
	68	Warringah
	64	No fixed place of work
	54	Auburn
	49	Parramatta
	39	Strathfield - Burwood - Ashfield
	366	Other

Figure 10: Where residents of Macquarie Park work (JTW, 2011)

Unlike the workers within the area, the data shows that the commuting patterns of residents in Macquarie Park are more balanced. With an approximate 50/50 split of survey respondents indicating private vehicle compared to public and active transport as a method of travel to work.

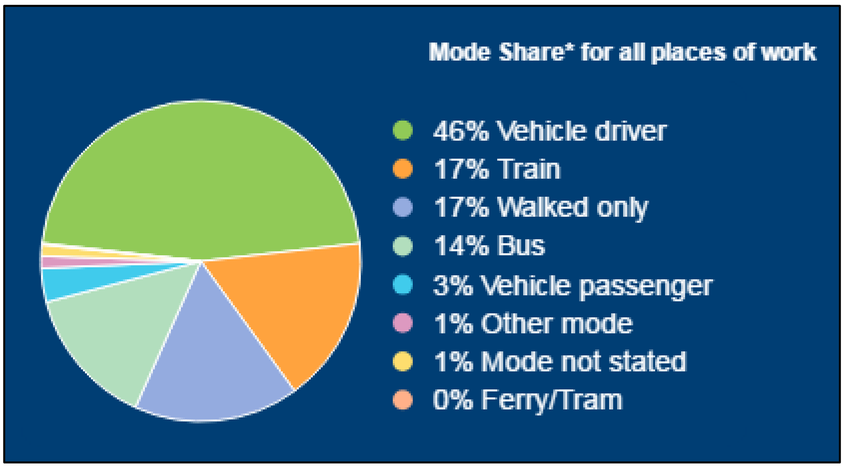


Figure 11: How residents in Macquarie Park commute to work (JTW, 2011)

3.6 Road safety

Crashes were analysed on the surrounding streets of the site over the most recent five year period (from July 2011 – June 2016 inclusive). Overall, there were 82 crashes recorded, of which there were no fatalities, 47 injury crashes involving 59 casualties and 35 non-casualty (tow away) crashes. The data also indicates a fairly even distribution of crashes per year as shown in Figure 12 (accounting for the half years for 2011 and 2016).

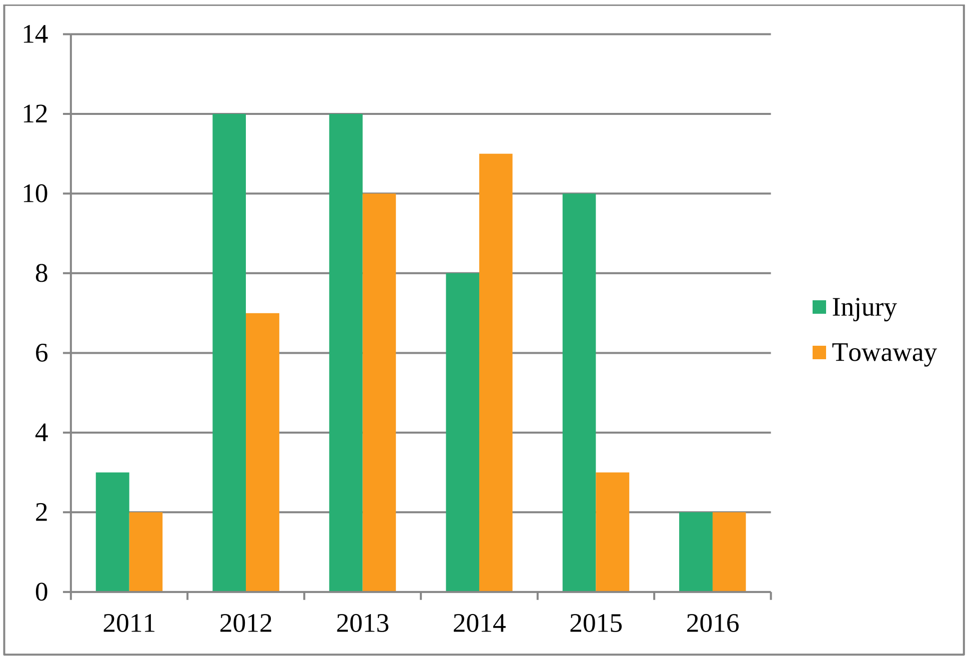


Figure 12: Degree of crashes per year (2011-2016) on surrounding streets

The crash data was classified into the various road user movement (RUM) codes to analyse crash clustering. The majority of crash types were recorded as vehicles from opposing directions, followed by vehicles in the same direction which are common along arterial roads and at intersections (Figure 13).

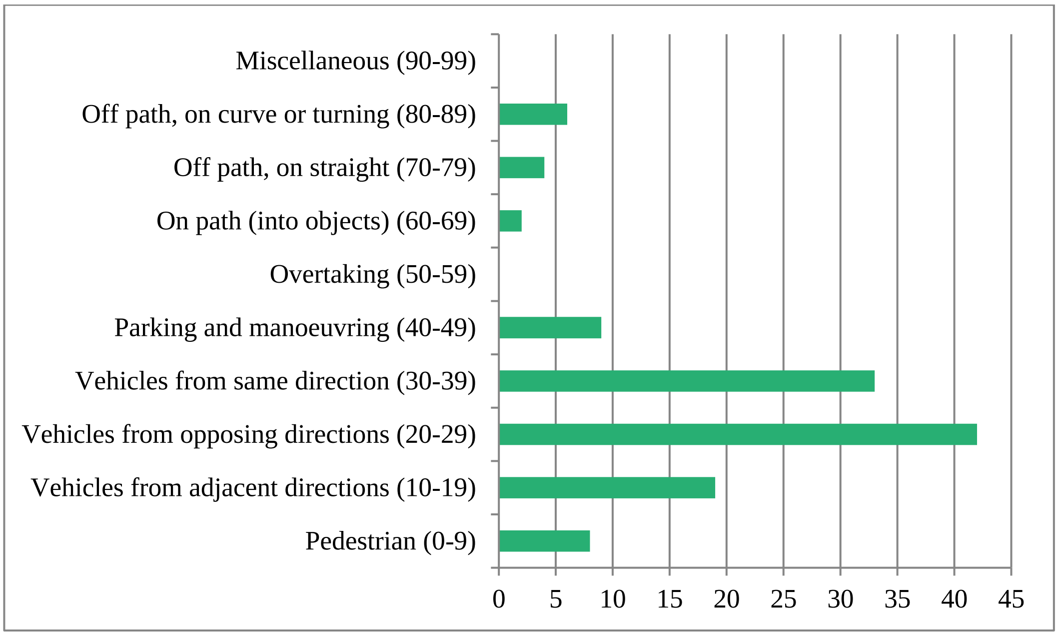


Figure 13: Crash types by road user movement categories

The majority of crashes occurred at intersections and included the lower rum codes. However, there were some crashes recorded midblock on Talavera Road, which included a rear-left, opposing right-thru crash and a rear end due to another crash. The opposing right-thru crash was recorded in 2013 and involved a vehicle turning right into the site access. The other rear-left crash was attributed to the University access opposite the site.

4 Proposed Development

The development proposes approximately 1,256 residential apartments over four buildings. Arup understands that this is approximately 350 apartments in addition to the current planning controls for this site. The proposed development is planned to be constructed over three phases. A summary of the residential development yields per phase is shown in Table 1

Table 1: Residential yield summary of the proposed development per building

Yield Summary	Building A	Building B	Building C	Building D	Total
One Bedroom	55	194	56	128	433
Two Bedroom	102	240	126	195	663
Three Bedroom	30	59	26	45	160
TOTAL	**187**	**493**	**208**	**368**	**1,256**

Arup understands that up to 25 apartments may be dedicated to Council affordable housing. It should be noted that no affordable housing has been allowed for in this transport assessment.

In addition to the residential component, the two 600sqm child care centres are proposed to be included as part of the first two phases. Each child care centre is anticipated to cater for 100 children and 20 staff per phase. There is also a small retail component of 300sqm proposed.

A concept site plan is shown in Figure 14 below.

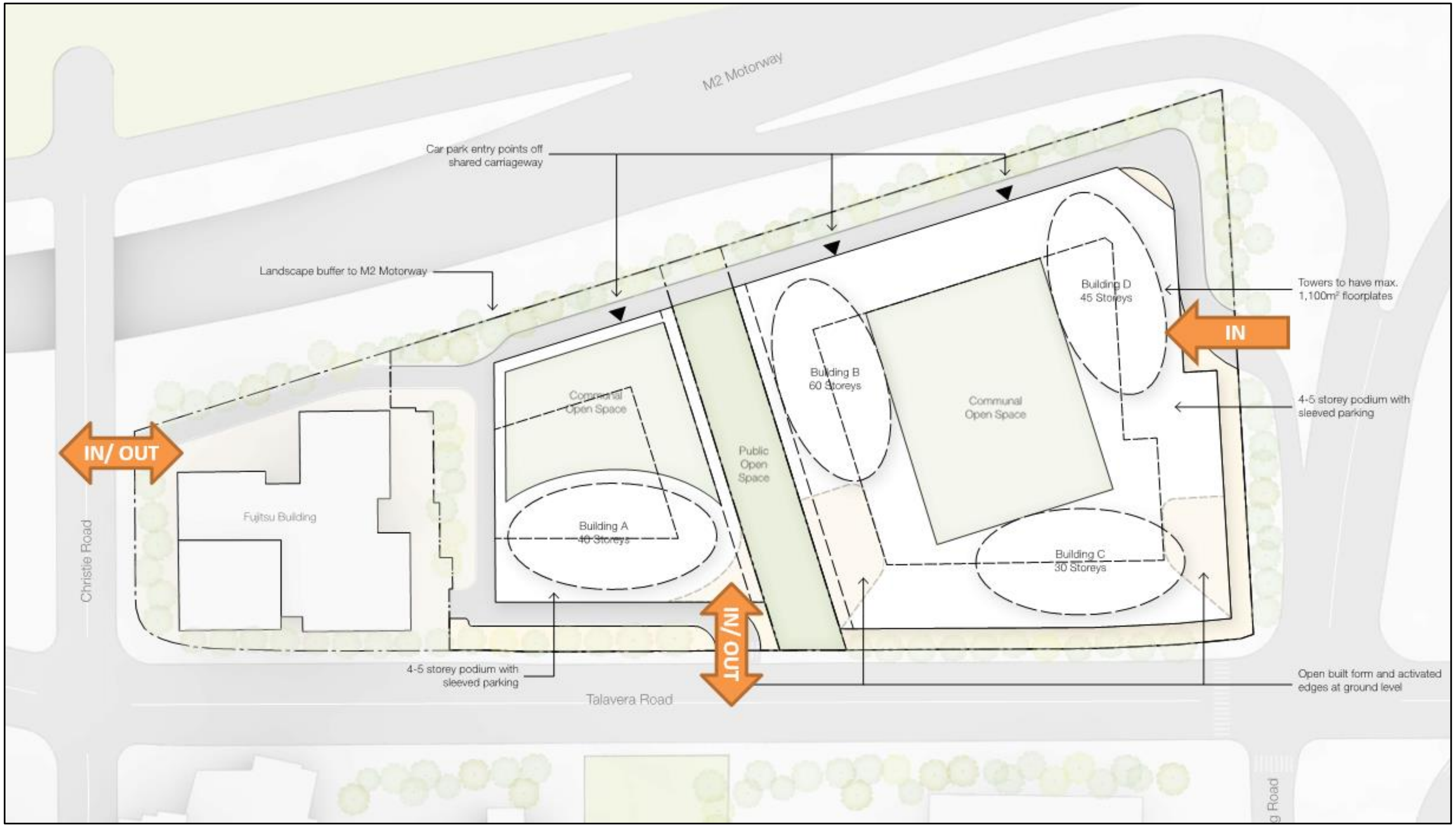


Figure 14 Site concept plan (Source: SJB Architects, May 2017)

5 Parking and Vehicle Access

5.1 Existing parking

A review of the existing parking supply was conducted. The capacity and occupancy during the morning peak of a typical weekday is summarised in Table 2.

Table 2: Existing parking supply and occupancy

Site	Level	Spaces	Occupancy*
Fujitsu Site	Lower level	85	25%
	Middle level	86	50%
	Upper level	72	25%
Development Site	At Grade	187	100%
	Service Bays	8	-
	Upper Basement	60	50%
	Lower Basement	60	50%

* Occupancy was recorded during the morning peak hour of a typical weekday

5.2 Parking requirements

5.2.1 Car parking

A review of the City of Ryde Development Control Plan (DCP) 2014 indicates the following **maximum** residential parking rates for the Macquarie Park Corridor:

- 1 bedroom – 0.6 bays per dwelling
- 2 bedroom – 0.9 bays per dwelling
- 3 bedroom or more – 1.4 bays per dwelling
- Visitor parking – 1 bay per 10 dwellings
- Car Share – 1 bay per 50 required parking spaces

The Apartment Design Guide provides design criteria and general guidance regarding how development proposals can achieve the quality principles identified in the State Environmental Planning Policy No 65 - Design Quality of Residential Apartment Development (SEPP 65). Applying transit oriented development principles, the guide indicates that on-site car parking on a site that is within 800m of a railway station in the Sydney metropolitan area should take the minimum of either the council DCP or Roads and Maritime's Guide to Traffic Generating Developments. In this case, the parking rates outlined in the DCP are the governing rates and as a result has been utilised in this assessment.

A review of the DCP was also conducted to identify the baseline parking requirements for the proposed child care centres. The rates were as follows:

- 1 space per 8 children – this is to facilitate the drop off and pick up of children
- 1 space per 2 staff – to facilitate parking for employees

The assumptions applied to the calculation of parking requirements are as follows:

- As the child care centres are anticipated to predominately serve the residents on site, it is proposed to share the residential visitor parking with the child care component

The estimated parking requirements per phase for this development are summarised in Table 3.

Table 3: Summary of potential maximum parking on site

Use types	Building				Total
	A	B	C	D	
1 bed	33	116	34	77	260
2 bed	92	216	113	176	597
3 bed	42	83	36	63	224
Visitor Parking	19	49	21	37	126
Car Share Parking	4	9	4	7	24*
TOTAL	**190**	**473**	**208**	**360**	**1,232**

* From experience on other residential projects, it is recommended that consultation with car share companies such as Go Get be conducted during subsequent stages of design to achieve a more realistic provision of allocated car share bays.

Traffic generation will be discussed in more detail in the Section 6, however it is important to note that the actual supply of parking will have an influencing factor on traffic generation. Though this statement may seem obvious, current guidance does not correlate these two factors. Arup recently undertook research which considered the influencing factors that contribute to the level of traffic generated by high density residential developments. The research specifically considered how the provision of on-site parking and site location may influence traffic generation rates.

Key findings of the research was that the rate at which parking is provided within residential developments was found to influence the overall level of traffic generated by that development. Further, the consideration of public transport accessibility was found to influence the level of traffic generation. Figure 15 shows the relatively positive correlation between peak hour traffic generation and parking provision.

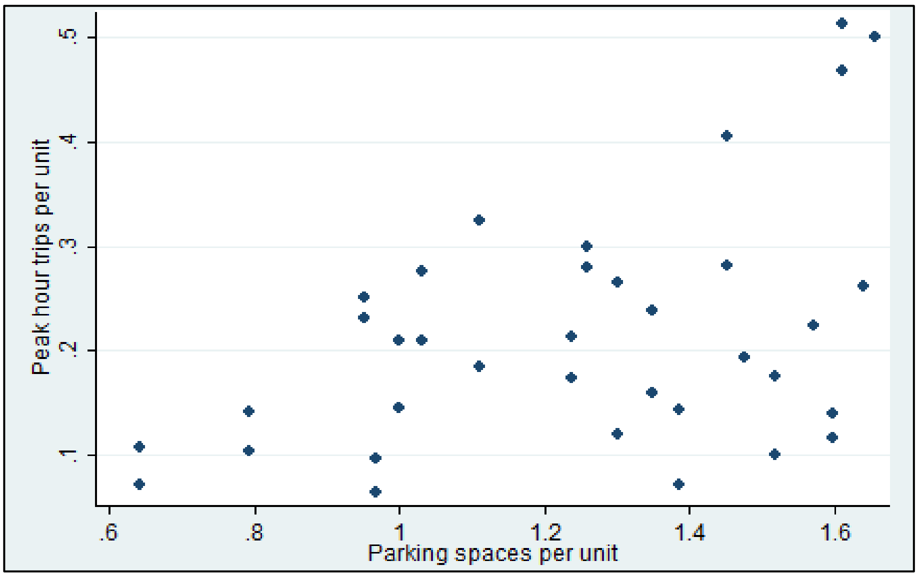


Figure 15: Correlation between peak traffic generation and parking spaces per unit

Given the Macquarie Park Corridor's evolution from business park uses to a specialised employment centre, this development should be cognisant that increased parking provision will likely lead to higher traffic generation.

It is understood that the development will provide parking compliant with the rates identified in the City of Ryde's DCP and will be mindful of the impacts of parking supply on traffic generation.

5.2.2 Bicycle parking

The City of Ryde's DCP highlights that cycling accounts for approximately 10% of the journey to work in the Ryde local government area and as a result requires bicycle parking to be provided at 10% of the required car spaces. This control looks to provide for the minimum quantum of bicycle parking and to cater for anticipated increases in demand.

Secure bicycle parking should designed in accordance with the requirements of AS2890.3. The required bicycle parking result in a total of 124 bicycle spaces summarised by building below:

- Building A: 19 bicycle spaces
- Building B: 48 bicycle spaces
- Building C: 21 bicycle spaces
- Building D: 36 bicycle spaces

The development proposes to adopt the bicycle parking provision above.

5.3 Vehicle access

It is generally recommended that there should be one access point per 500 car parking spaces on a site as per AS2890. If the development supplies parking consistent with the maximum parking requirement outlined in section 5.2.1 (1,232 spaces); in additional to the parking for Fujitsu (243 spaces), a total of approximately 1,475 spaces will be provided by the completion of Phase 3.

This would imply that conceptually three external access points should be allowed for to serve the anticipated traffic accessing the site. It is recommended to maximise the amount of vehicle storage space between the frontage road and the access gates for all driveways to minimise any impacts on the network traffic.

In order to better facilitate access onto the east bound on ramp of the M2 Motorway, it is recommended that a right turn out of the site is maintained at Talavera Road. Keep clear line marking can contribute to improving exiting movement from right turn vehicles at this location.

5.4 Service vehicles

It is recommended that one service bay is provided for each of the three phases of the development given that the Roads and Maritime Guide to Traffic Generating Development (Section 5.4.3) for high density housing states that:

The provision of at least one loading dock for residential use is desirable, although a dock intended for commercial uses may be sufficient.

Where service bays are to be located on the site circulation (private) road, they should be located such that sufficient sightlines to the one-way oncoming traffic is provided. A minimum recommend width of 7m should be provided to allow cars to pass stationary service vehicles.

Swept path analysis using a 12.5m long heavy rigid vehicle (as per AS2890.2) has been conducted to check access around the development site. It is not anticipated that service vehicles will be required to access the car park. This has been used to inform the development of the concept design.

6 Transport Impact Assessment

6.1 Person trip generation

Taking the proposed yields for the development site, an assessment of the person trip generation for the various modes was conducted. Reviewing data collected by Roads and Maritime (2014) for high density residential flat buildings; a peak hour person trip rate of 0.67 per unit was utilised for this assessment. Applying the residential yields outlined in section 4, the peak hour people trips for each phase was calculated (Table 4).

Table 4: Forecast peak hour pedestrian trips

Building	Units	Peak Hour People Trips
A	187	125
B	493	329
C	208	139
D	368	245
Total	**1,256**	**838**

To determine how these trips would be distributed across different modes, a forecast mode share shift from private vehicles to public transport was estimated using Chatswood as a comparable area. There is currently very little high density housing in Macquarie Park and so Chatswood, with its mix of high density residential and commercial development and proximity to the rail station, is used to estimate expected mode share for the development. A summary of the approximate forecast pedestrian trips per mode for the proposed development is shown in Table 5.

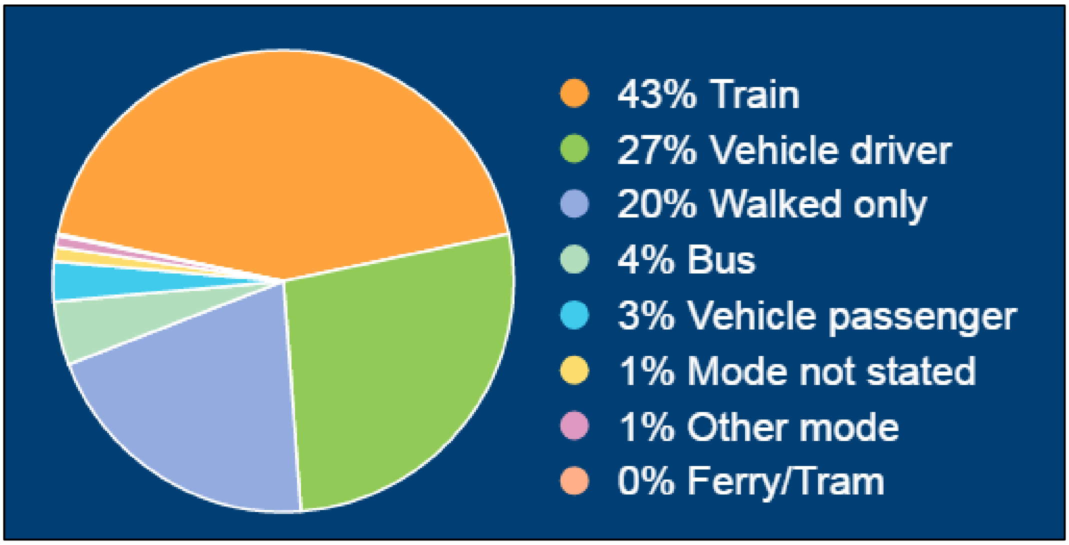


Figure 16 Mode share for workers living in Chatswood (TZ 1806, 1805, 1803)

Table 5: Peak hour pedestrian generation per mode

Mode	**Mode Share**		**Building**				**Total**
	Current	**Forecast**	**A**	**B**	**C**	**D**	
Private Vehicle	51%	28%	35	92	39	69	**235**
Train	17%	40%	50	132	56	98	**336**
Bus	14%	12%	15	39	17	29	**100**
Walking and Cycling	18%	20%	25	66	28	49	**168**
Total Peak Hour Person Trips			**125**	**329**	**140**	**245**	**839**

These volumes are relatively low and can easily be accommodated by the public transport networks in the area, particularly in light of the increase in capacity due to Sydney Metro.

6.2 Traffic generation

6.2.1 Existing

Traffic surveys were conducted for traffic accessing the development site and the surrounding the road network during the AM and PM peak hours on a typical week day. This is displayed in Figure 17 and Figure 18 below. A summary of the peak hour trips accessing the current site are as shown in Table 6.

Table 6: Summary of baseline traffic generation

Peak Hour	**Fujitsu**		**Development Site (Existing)**		**Total**	
	In	**Out**	**In**	**Out**	**In**	**Out**
AM (8am – 9am)	69	1	137	50	206	51
PM (5pm – 6pm)	3	54	58	162	61	216

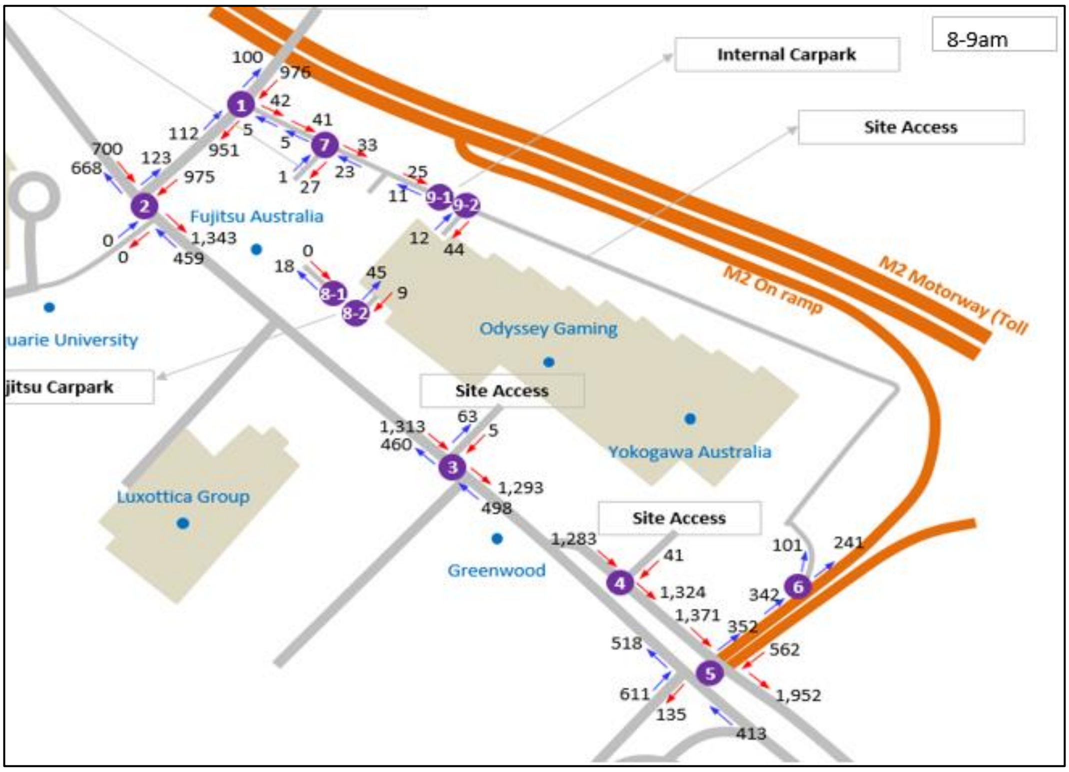


Figure 17: Baseline traffic generation - AM Peak

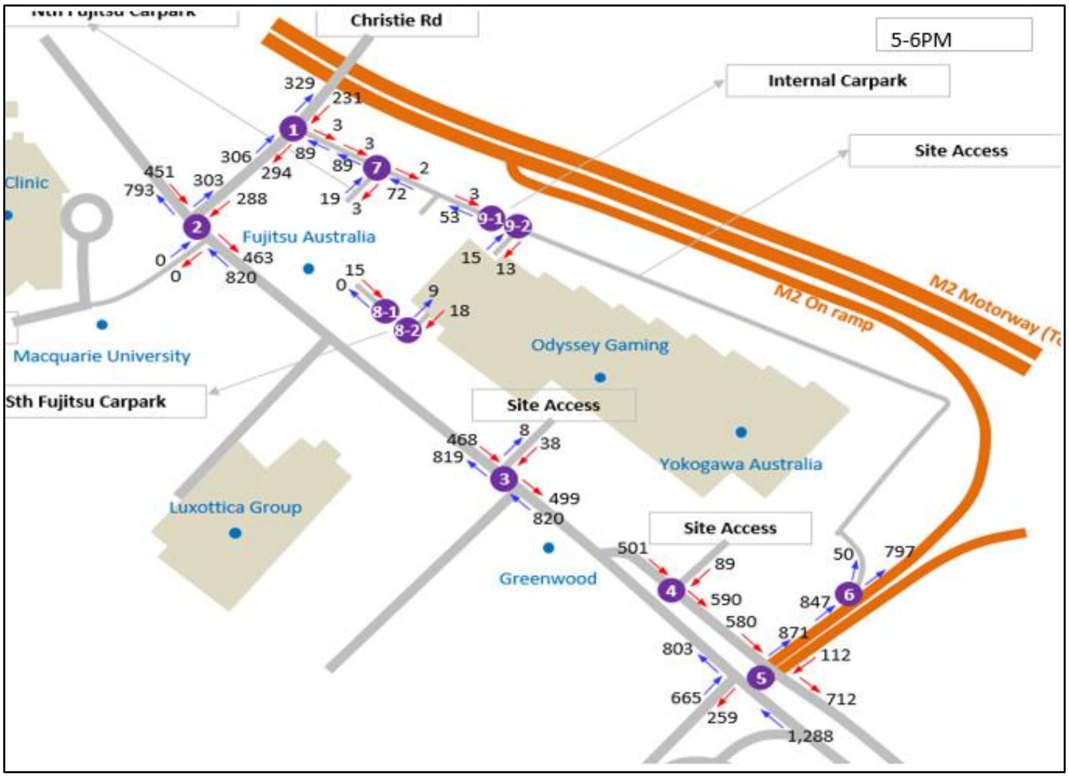


Figure 18: Baseline trip generation - PM Peak

6.2.2 Development

Under the proposed development yields, trip generation was estimated with the following assumptions (Table 8):

- The childcare centres serve mostly residents living on site and so only one quarter of the usual rate of trip generation has been applied.
- The following Roads and Maritime peak hour trip generation rates were applied.

Table 7: Expected development trip generation rates per use

Land Use	AM	PM	Weekend
High density residential flat dwelling	0.19	0.15	0.24
Child Care*	0.2	0.18	-

*Child care trip generation rates reduced by 75% due to containment

The following in/ out proportions for the respective peak hours:

- AM (8:00 – 9:00) – 80% (out), 20% (in)
- PM (17:00 – 18:00) – 20% (out), 80% (in)
- Weekend – 50% (out), 50% (in)

- The Fujitsu site will continue to generate the same amount of traffic as observed in 2016, with negligible traffic on the weekend.

Table 8: Expected development trip generation per building

Building	AM		PM		Weekend	
	In	Out	In	Out	In	Out
A	37	58	49	32	22	22
B	49	105	85	41	59	59
C	8	32	25	6	25	25
D	14	56	44	11	44	44
Total	**108**	**251**	**203**	**90**	**151**	**151**

6.2.3 Additional trips relative to existing

Traditionally, traffic generation at high density residential developments is dictated by the number of dwellings proposed. However, considering the maximum parking requirements imposed on the Macquarie Park corridor as well as the restrictive nature of on-street parking surrounding the development, traffic generation rates relating to the number of parking bays provided was also investigated.

Comparison of the baseline with the development trip generation is shown in Table 9. Overall, the proposed development will generate an increase in traffic to the network relative to the existing land use. However, it should be noted that with the change in land use from commercial to residential, the proportion of trips entering and exiting the site will switch for the respective peak hours. With the adjacent commercial development (Fujitsu) this will have a balancing effect to in/out movements during the respective peak hours.

Table 9: Additional trip generation relative to existing

Peak hour	Baseline Traffic	Trip Rate per Unit		Trip Rate per Car Space*	
		Development Traffic	Relative Difference	Development Traffic	Relative Difference
AM	187	239	+52	184	-3
PM	220	188	-32	148	-72

*Roads and Maritime trip generation rate of 0.15 and 0.12 trips per car space for the AM and PM peaks, respectively.

The trip comparison shows that the maximum parking limits has the potential to reduce the trips forecast to be generated for this development. However, for conservatism and robustness, this assessment has been conducted using the per unit trip rate.

6.2.4 Background growth

Growth was applied to background traffic at a rate of:

- 1.5% p.a. for the AM peak hour, and
- 1.1% p.a. for the PM peak hour.

These rates were sourced from previous Arup modelling for the Macquarie Park area and is based on an understanding of proposed key developments and land uses.

A 10 year development horizon was considered for this analysis.

6.3 Traffic distribution

6.3.1 Existing distribution

Approximately 50% of the current 206 trips into the site are made via the M2 on-ramp entrance to the east of the site. The access point on Talavera Road is used by a further 30% of people entering the site, with the remaining 20% using the Christie Road entrance.

In the afternoon when majority of trips are leaving the site, the most common direction is left turn out of Christie Road (30%) and left out onto Talavera Road (16%). The right-turn movement out of Christie Road, while signed as left-only (facing inside the site), receives over 10% of trips. The right turn onto Talavera Road is difficult due to high traffic volumes and is used by only 2% of people exiting the site.

Figure 19: Trips into site in morning peak and out of site in evening, 2016

6.3.2 Potential future distribution

Changing the major land use of the site from commercial space to residential shifts the dominant traffic directions. Residential traffic generates mostly outbound trips in the morning peak and inbound trips in the evening, while commercial space has the opposite pattern. Combining the new residential development with the existing Fujitsu site evens out the traffic distribution so that entries and exits are more balanced than they currently are.

Given the traffic generation estimated in Table 8, future traffic patterns can be estimated by assuming that:

1. Fujitsu access is maintained as-is (entrance off Christie Road and Talavera Road maintained)
2. Access to the site via M2 on-ramp is entry only
3. Entry and exit to/from the site is made via Christie Road and Talavera Road
4. Left turn out of Christie Road only for site traffic.

Note that since the access point off Talavera Road is an entrance for Fujitsu only, there are vehicles entering only in the AM peak since in the evening all traffic is leaving Fujitsu.

The future access points have been assumed to ban right turns, so that traffic movements (including Fujitsu) were required to account for the banned right turns, including:

- Vehicles turning right onto Talavera Road were reallocated to the left turn movement onto Christie Street, to either continue north along Talavera Road or perform a U-Turn at Talavera Road / Management Drive;
- Right turning vehicles into the site from Talavera Road were reallocated to the access from the Herring Road on-ramps, with appropriate changes to the turning volumes at Talavera Road / Herring Road.

A review of 2011 JTW data for the residential catchment immediately to the north of the development site was conducted. This indicatively provided a trip distribution outlined in Figure 20. This trip distribution was then applied to assess the local network performance.

Figure 20: Network trip generation

6.4 Local network performance

The intersections have been assessed using RMS approved software SIDRA software (version 7). The intersections have been considered as a network to account for the effect of queuing on the network as a whole.

In urban areas, the traffic capacity of the major road network is generally a function of the performance of key intersections. This performance is quantified in terms of Level of Service (LOS), is based on the average delay per vehicle. LOS ranges from A = very good to F = unsatisfactory. In urban environments, no worse than a LOS of D is often aimed for.

The base case (2016 volumes) is compared against the 2026 future development case, which is considered to be 2016 volumes with background growth of 1.5%pa (AM) and 1.1%pa (PM) and development traffic generated by the site.

6.4.1 Modelling calibration

The existing signals have been observed (through the traffic count videos) to operate at the following average cycle times:

- In the AM peak hour, approximately 120 seconds;
- In the PM peak hour, approximately 100 seconds.

These cycle times were modelled across the SIDRA network in the AM and PM peak hour base models, while a summary of the modelled cycle times between the two revisions of modelling are presented in Table 10. Results of the cycle times were reflected in the observed queue lengths at the intersections during the peak hours both from site visit and video footage.

Table 10: SIDRA Network Cycle Times

Model	Observed	Analysis
2016 AM Base	120s	120s
2026 AM with Development		120s
2016 PM Base	100s	100s
2026 PM with Development		100s

Council also advised that both the right turns at the site access onto Talavera Road should be banned (even though it was observed that right turns are currently undertaken). The intersection layouts have been altered accordingly to allow left in and left out movements only. The right turn onto Christie Street from the site was also banned to reflect current signposting at the egress, although it is still possible in the base case, as there were vehicles observed illegally turning right.

6.4.2 Talavera Road / Herring Road

The critical intersection in the local network is Talavera Road and Herring Road. This intersection is able to meet current demand although the performance is at saturation for both the base and development scenarios in the morning peak. Changing the travel patterns of the study site by converting from commercial to residential land use improves the performance of the intersection in the morning peak as it improves the balance of trips and in particular reduces the number of trips going into the site (which cause the most delay) by around 35%.

In the morning, queues build up from Talavera Road, west of the intersection due to the large volumes of east bound traffic, as well as Herring Road south of the intersection. These queues will impact the site access along Talavera Road.

The AM peak hour maintains an LoS D with a 3 second increase in the average delay. Similarly, in the PM peak hour, a 5 second increase in delay moves this intersection from LoS C to LoS D. However, the operation at LoS D of a medium to large intersection in this sort of urban environment is both satisfactory, and to be expected.

Table 11: Talavera Road / Herring Road intersection performance

Time period	Scenario	Degree of saturation	Average delay	Level of service
AM	Base	91%	48 sec	D
	Future	93%	51 sec	D
PM	Base	67%	38 sec	C
	Future	86%	43 sec	D

6.4.3 Talavera Road / Christie Road

Table 12 below shows the results for the performance of the intersection of Talavera Road and Christie Road. This intersection is currently operating well and able to service the new traffic associated with the development of the study site. The west approach (Talavera Road) has higher delays than the other approaches in all cases since traffic must either give way or is held to allow the respective east-west and north-south pedestrian crossing.

The Future AM imposes a 22 second increase in delay at this intersection when compared with the Base AM performance, moving from LoS C to Los E. This LoS E is interpreted as “approaching capacity” and is acceptable in an urban road network. The Future PM (LoS C) operates worse than the Base PM (LoS C). In summary, this intersection is expected to perform satisfactorily to “approaching capacity” in the range of Los D to LoS E.

Table 12: Talavera Road / Christie Road performance

Time period	Scenario	Degree of saturation	Average delay	Level of service
AM	Base	91%	39 sec	C
	Future	100%	61 sec	E
PM	Base	28%	20 sec	B
	Future	89%	38 sec	C

6.4.4 Christie Road / Site access

This access point is left out only, although some traffic was observed to turn right out of the driveway regardless particularly in the afternoon peak hour. The analysis assumes that all traffic (including Fujitsu traffic) will obey the signage and use it for left turns out only.

The removal of the right turn out of the site and overall traffic redistribution have had minimal impact on the analysis when compared with the base. There are also very minimal changes between the base and future scenarios to the point where the difference is considered imperceptible. This intersection is expected to operate well, within LoS A for all approaches.

The access driveway for the site on Christie Road is currently performing with spare capacity. Maintaining two-way access for Fujitsu and designating it as an exit point for the study site does not change the performance of the intersection significantly.

The driveway access operates well due to the up and downstream signalised intersections, meaning that traffic arrives in platoons. Between these platoons, there are quiet breaks where cars are easily able to exit the site.

Table 13: Christie Road / Site access intersection performance

Time period	Scenario	Degree of saturation	Average delay	Level of service*
AM	Base	23%	0.4 sec	A (site access)
	Future	20%	0.6 sec	A (site access)
PM	Base	10%	1 sec	A (site access)
	Future	9%	0.5 sec	A (site access)

* Worst case movement for site access

6.4.5 Talavera Road / Site access

The driveway on Talavera Road is assumed to act as an entry/exit for Fujitsu traffic in the future scenarios and an exit only (all movements allowed) for the site traffic.

The intersection performs well as a whole in all scenarios, although the right turn movement out of the site in the morning peak experiences high delays (just under 1.5 minutes). However, this movement is not anticipated to become over-saturated and is generating 95 percentile queues of 4 vehicles. Furthermore, co-ordinated signals up and downstream of the access point give breaks in the traffic, and queuing along Talavera Road heading east means that there are periods of stopped traffic which can make the right turn out safer if the area is kept clear.

In the afternoon peak in the future, there will be less traffic leaving the site as people return home and the intersection performs well from all approaches.

Table 14: Talavera Road / Site access intersection performance

Time period	Scenario	Degree of saturation	Average delay	Level of service*
AM	Base	68%	1.6 sec	B (site access)
	Future	40%	1.8 sec	A (site access)
PM	Base	14%	1.3 sec	A (site access)
	Future	16%	1.4 sec	A (site access)

* Worst case movement for site access

6.4.6 M2 ramps / Christie Road

The intersection of Christie Road and the M2 ramps is operating within capacity. The M2 off ramp experiences some queuing, particularly in the morning peak. The addition of the proposed development does not contribute to queuing along this link. The 95 percentile queues along the ramp is forecast to be approximately 220m and is not expected to impact the performance of the M2 Motorway.

The revised future scenario in comparison with the Base scenario is only marginally worsened in both the AM and PM peak hours (3 and 4 seconds respectively). Consequently, the Base performance is essentially maintained in the future, with both AM peak hour models operating at LoS E, and both PM peak hour models at LoS C. It should also be noted that LoS C is satisfactory operation, while LoS E is approaching capacity but to be expected in congested urban environments.

Table 15: M2 Ramps / Christie Road intersection performance

Time period	Scenario	Degree of saturation	Average delay	Level of service
AM	Base	89%	59 sec	E
	Future	90%	62 sec	E
PM	Base	95%	38 sec	C
	Future	86%	41 sec	C

Figure 21 below shows the difference in queue lengths coming off the M2 in the morning peak. The current queue length is only extended by around 6m, causing no change in function of the M2. In the afternoon peak, queues are significantly shorter (20 and 21m for the base and future cases respectively).

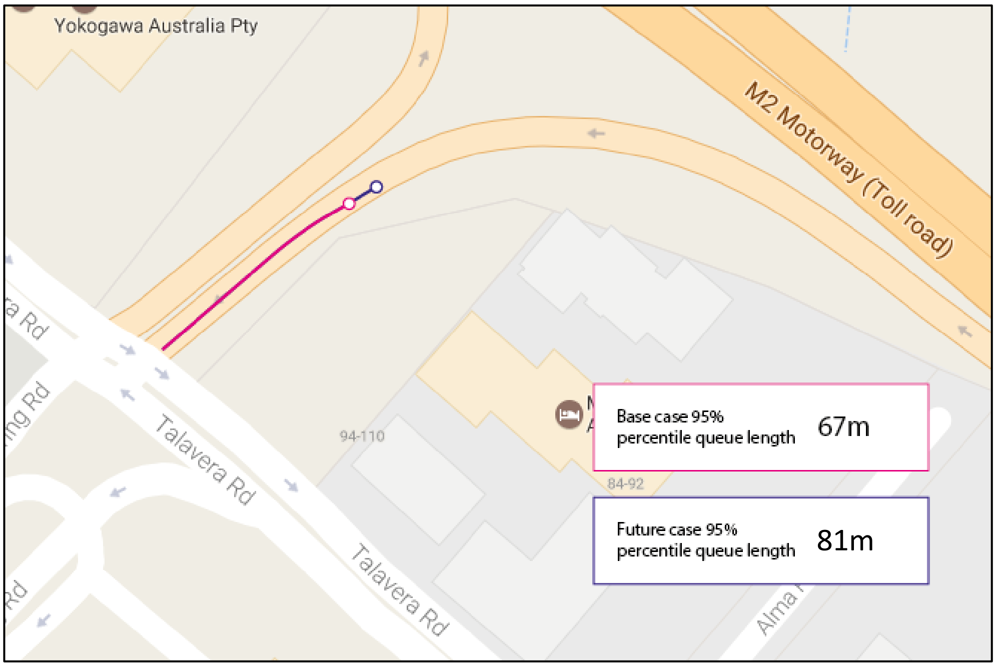


Figure 21: Comparison of AM queue lengths on M2 off ramps

Summary

In conclusion this assessment, which conservatively assumed the provision of maximum parking rates, indicates that the proposed development will not have a detrimental impact on the local road network. The proposed increase in density on the site can be accommodated with application of the maximum parking rates in the City of Ryde DCP. Through the detail design process, given the site's high level of public transport accessibility due to the proximity to the future Metro station, opportunities for reducing the extent of on-site parking may be considered which would further reduce the road network impacts associated with the proposal.

The slight increase in traffic does not vary the effect the road performance, and removal of the right turn on Talavera Road resolved the difficulty of egress from the site from the site access on Talavera Road, while maintaining intersection performance at the other locations.

However, as indicated by the analysis, the performance of the road network under these road network changes and altered yields remains satisfactory in the future scenario, essentially maintaining the existing road performance in terms of level of service at most locations.

7 Recommendations and Conclusion

7.1 Public transport

As discussed in preceding sections, the site is currently serviced by a good array of public transport options. Macquarie University Station is located approximately 400m away and multiple bus routes service the area, with bus stops along Talavera Road as well Macquarie Centre and Macquarie University.

The construction of Sydney Metro Northwest, which is scheduled to be completed in late 2018, will boost the capacity of the public transport network with the inclusion of 15 peak hour trains in both directions along the Epping to Chatswood line. This is almost an increase of four times the current train frequencies.

Furthermore, Transport for NSW has plans to inject $60 million worth of bus priority and road infrastructure works in order to improve travel times, upgrade pedestrian safety and increase public transport reliability. This will commence prior to the construction of Sydney Metro Northwest and Stage 1 of the 2 stage programme will be focused on supporting the existing bus services during the construction shut down period of Macquarie University Station.

With current mode share for public transport of residents in Macquarie Park of approximately 30%, it is reasonable to expect this to increase to 40% with the boost in public transport infrastructure. As a result, this development site will likely generate approximately 350 peak hour pedestrian trips onto the public transport network.

7.2 Pedestrian and cycling

Walking and cycling are forecast to account for one in five trips generated by the site, a similar proportion to the current rate of 18%. In the peak hour the site is expected to generate around 200 trips on bike or on foot.

Pedestrian facilities in the area surrounding the site are generally of a reasonable quality, with footpaths of both sides of Talavera Road. Nearby Macquarie Centre, Macquarie University and Macquarie University Station are all well connected to the site and are all within a 15 minute walk of the site.

Cycling connections in the area are reasonable, with the southern footpath along Talavera Road marked as a shared pedestrian/cycle path and a number of smaller roads in the area considered low-difficulty.

7.3 Road network

The additional traffic generated from the proposed development does not significantly impact the performance of the surrounding the road network.

The following improvements may be considered:

- The intersection of Talavera Road and Christie Road currently accommodates a pedestrian crossing on the western approach along Talavera Road. Given the geometry of the intersection and the current signal phasing there is potential to increase the capacity of the intersection if the pedestrian crossing was shifted to the eastern leg. This measure is not required to support this development.

7.4 Summary

A transport assessment was conducted to examine the impacts of the proposed development at 112 Talavera Road on the surrounding transport network. The development is anticipated to accommodate approximately 1,256 new dwellings (approximately 350 apartments above the current planning controls) and two child care centres over three phases of development.

The site is serviced by reasonable pedestrian and cyclist connections as well as excellent access to public transport. The introduction of Sydney Metro Northwest will only add to the accessibility of this development to public transport.

Proposed parking for the site is limited by the maximum parking requirements imposed by the City of Ryde's Development Control Plan.

A SIDRA model was conducted for the local road network surrounding this development for a plus 10 year scenario (design year of 2026). The analysis showed that the local road network will be operating either at or below capacity for the development scenario.

In conclusion this assessment, which conservatively assumed the provision of maximum parking rates, indicates that the proposed development will not have a detrimental impact on the local road network. The proposed increase in density on the site can be accommodated with application of the maximum parking rates in the City of Ryde DCP. Through the detail design process, given the site's high level of public transport accessibility due to the proximity to the future Metro station, opportunities for reducing the extent of on-site parking may be considered which would further reduce the road network impacts associated with the proposal.