Avenor Pty Limited

173-179 Walker Street North Sydney

Traffic and Transport Assessment

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Job number 255880

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ARUP

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Appendices

1 Introduction

1.1 Background

Avenor Pty Limited has engaged Arup to carry out a traffic and transport assessment for a new high density mixed use development at 173-179 Walker Street, North Sydney. The proposed development will consist of a 47 storey high rise tower, providing 284 apartments and 1,515m^2 of community space to be dedicated to Council. 252 parking spaces are proposed on the site over six basement levels.

Figure 1 Subject Site Location

Source: Urbis

1.2 Report Structure

This traffic and transport report is structured as follows:

- Existing Conditions
- Proposed Development
- Transport Assessment
- Summary

2 Existing Conditions

2.1 Site Location

The proposed development site is located in North Sydney and is bounded by Walker Street to the west and by residential developments to the north, south and east.

Figure 2 Site location

2.2 Existing Road Network

The development site is in close proximity to two high-capacity roads (the Pacific Highway and the Warringah Freeway). In addition, Miller Street is the main arterial route running through the North Sydney CBD area.

In the vicinity of the site, Walker Street is a two-way road running parallel to Miller Street between the Pacific Highway and Ridge Street. Adjacent to the development, a local access road runs parallel to Walker Street and provides access to 173 – 179 Walker Street (the development site) as well as residential properties along Hampden Street.

Walker Street forms a four-arm signalised intersection with Berry Street to the south. Berry Street is a one-way road eastbound is a key link in terms of providing access to the Warringah Freeway.

2.3 Pedestrian and Cycle Network

The pedestrian network generally consists of the footpaths running along both sides of the roads along the surrounding road network. There is little permeability through the Ward Street Precinct at present.

Pedestrian crossings are provided on three arms of the Berry Street/Walker Street intersection and on all arms of most other intersections.

North Sydney train station is within the 10 minute walking catchment of the development site, while the nearest bus stop is located on Miller Street, just over 5 minutes by foot from the development site.

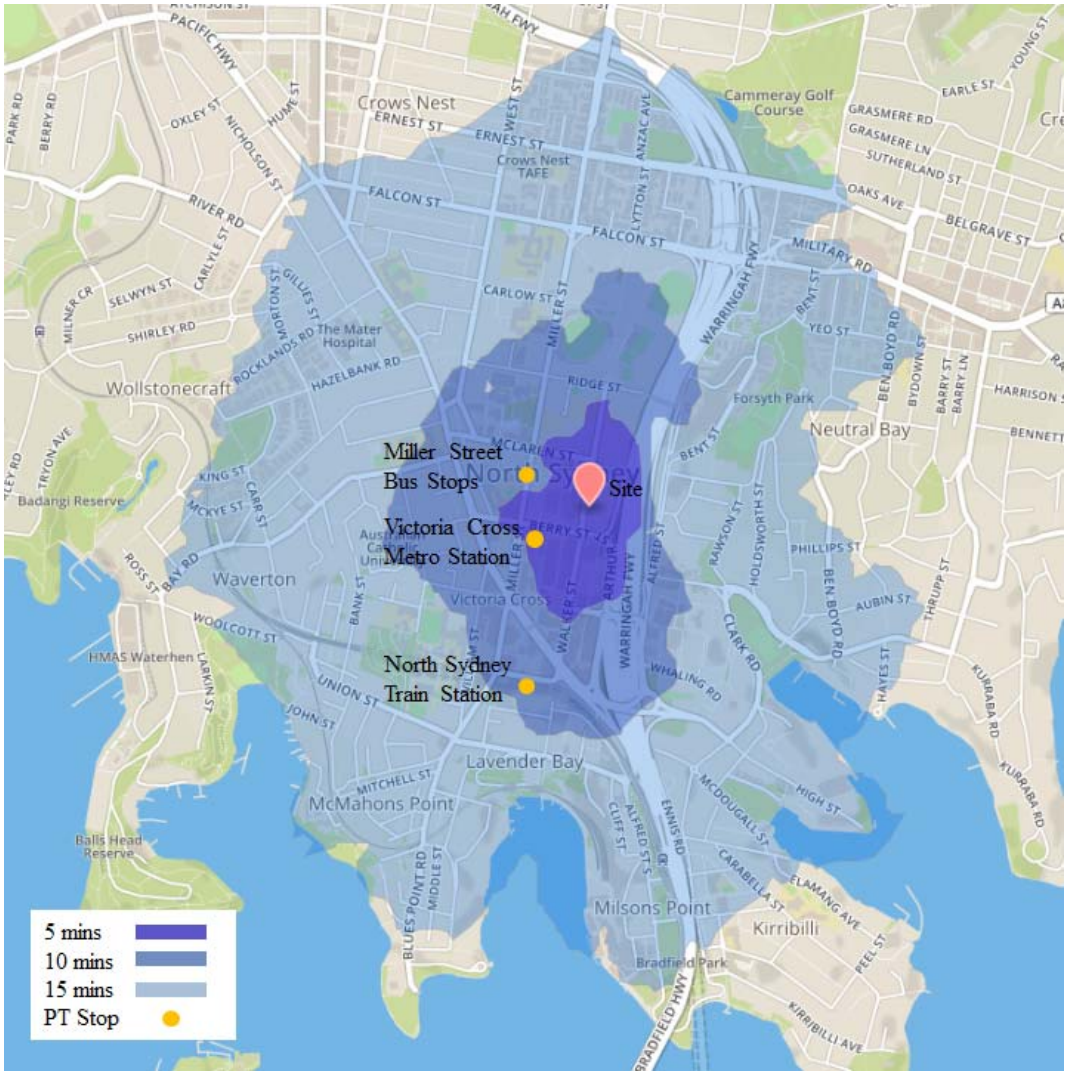


Figure 3 Walk catchment

North Sydney is served by a network of local and regional bicycle routes as shown in Figure 4 below.

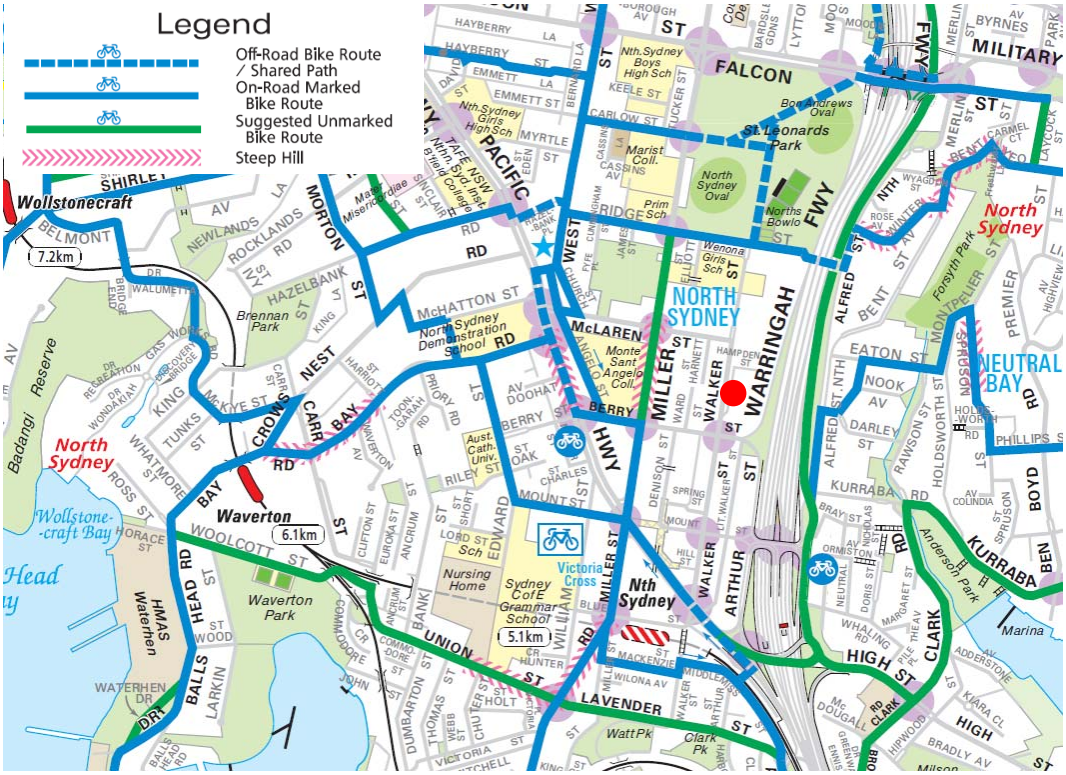


Figure 4 Existing bicycle network

2.4 Public Transport Network

The public transport network in the vicinity of the site consists of bus and rail services. A large number of bus routes within a 5 minute walk of the site (along Miller Street) with additional services available from the Pacific Highway while T1 northern line train services are available from North Sydney Train Station (10 minutes by foot). The 15, 30 and 45 minute journey time catchment of the site by public transport is presented in Figure 5.

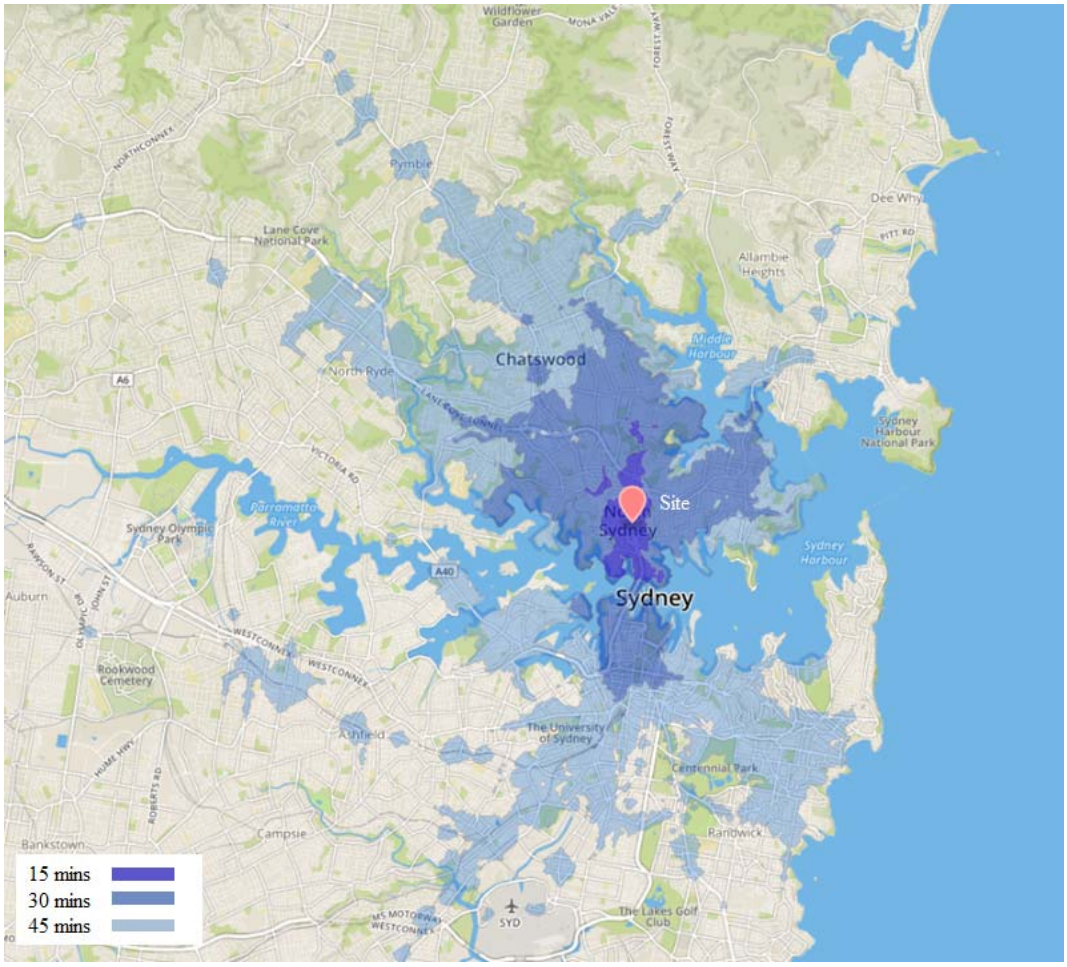


Figure 5 Public transport catchment

2.5 Mode Split

The Bureau of Transport Statistics 'Journey to Work' explorer has been used to estimate the mode split of residents in the area and is presented in Figure 6. The data is based on 2011 Census data.

The data shows that approximately 39% of residents travel to work by public transport (train and bus), with 29% of driving to work and 25% walking.

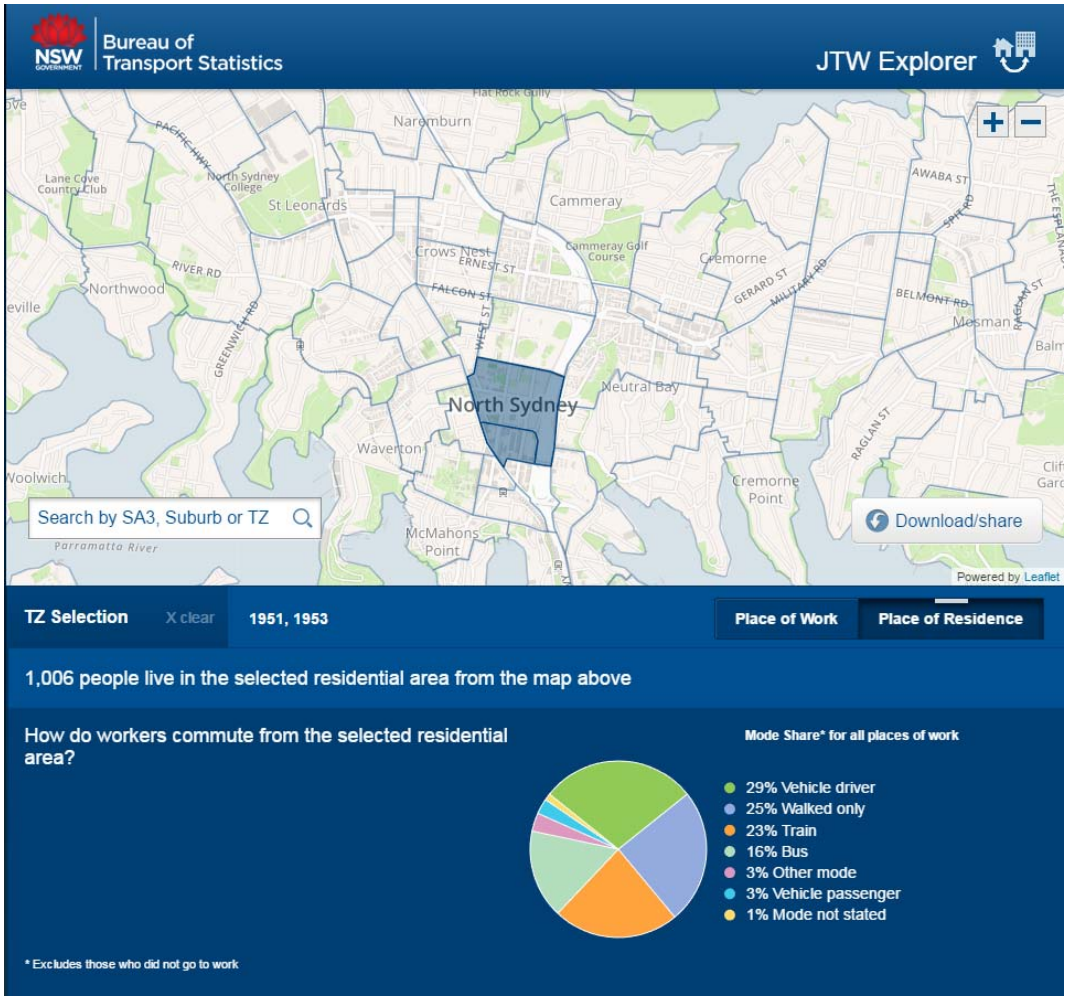


Figure 6 Mode Split

2.6 Existing Traffic Flows

Arup previously conducted traffic counts in 2014 to understand the level of traffic movements in and around the local area. Current traffic volumes in the streets surrounding the development site are summarised in Table 1 below.

Table 1 Existing traffic volumes

Street	**Traffic Volumes**	
	AM Peak Hour	PM Peak Hour
Berry Street (eastbound)	1,553	1,221
Walker Street (northbound)	338	394
Walker Street (southbound)	376	387
McLaren St (eastbound)	218	102
McLaren St (westbound)	381	266

3 Proposed Development

The proposed development will consist of a 47 storey high rise tower, providing 284 apartments and 1,515m^2 of community space to be dedicated to Council. 252 parking spaces are proposed on the site over six basement levels.

3.1 Vehicular access

The main vehicular access to the development will be off Walker Street. On-street parking is presently located along the eastern side of Walker Street, extending along the local access road towards Hampden Street. The proposed position of the driveway will result in the loss off of approximately 4 on-street parking spaces. It should be noted that these spaces are currently used by residents of the existing dwellings on Walker Street.

These changes are presented in Figure 7 and Figure 8.

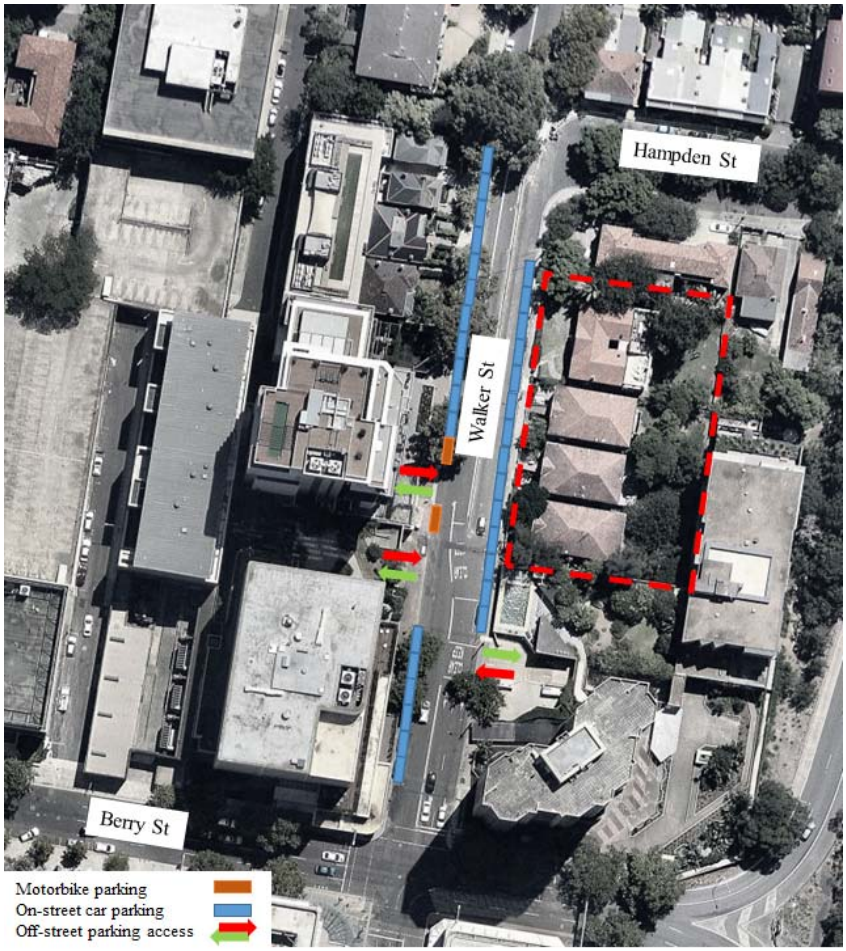


Figure 7 Existing external road layout

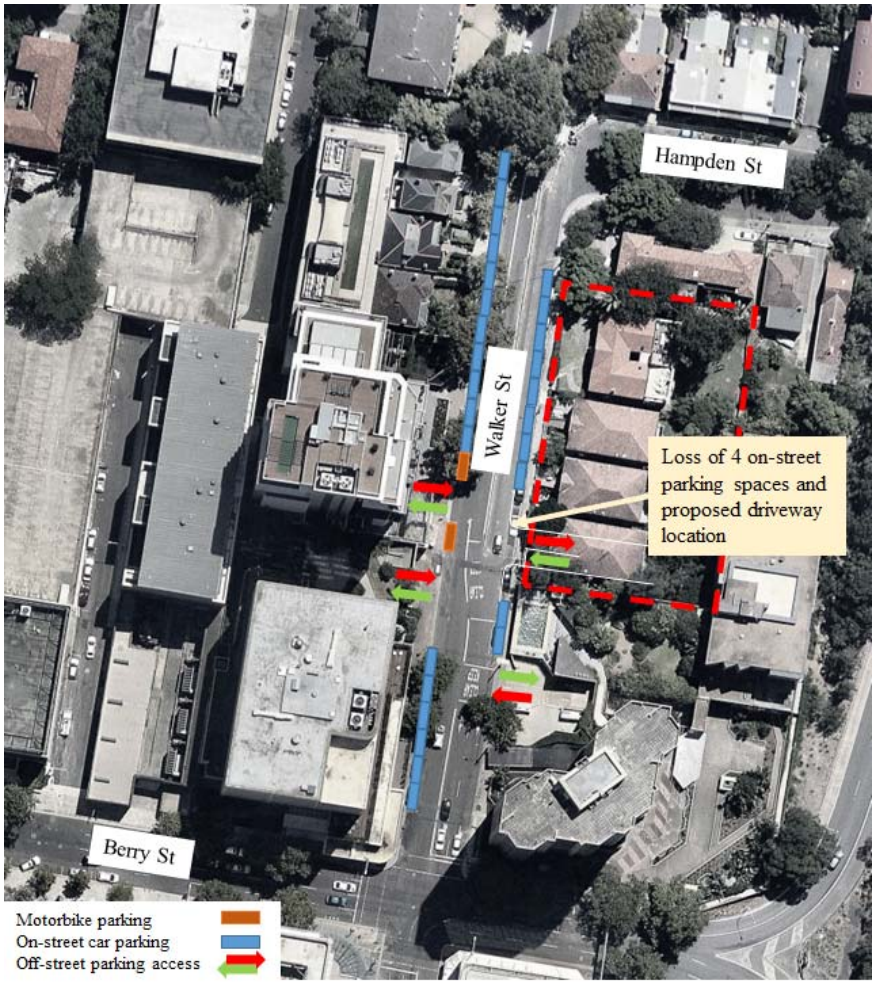


Figure 8 Proposed external road layout

It is proposed to ban left-turn movements into the development from Walker Street (i.e. vehicles travelling southbound), meaning all vehicle will access the development via the Berry Street/Walker Street intersection and turn right. This movement can not currently be safely undertaking by vehicles travelling south along Walker Street, with vehicles required to undertake a three point turn.

The swept path of garbage vehicle accessing the site is presented in Figure 9. This swept path avoids the heritage retaining wall in the centre of Walker Street.

Figure 9 Garbage vehicle swept path

3.2 Car parking

The maximum residential car parking rate, as set out in Table B-10.2 of the North Sydney Development Control Plan 2013 (and as amended in 2015), permits the maximum parking rates as shown in Table 2 for residential development in zones other than B4 (development is located in Zone R4).

The proposed residential parking provision of 227 spaces is significantly below the maximum allowable number of spaces permitted under Council's DCP of 369 spaces. This number of spaces is considered appropriate to meet the parking needs of the development while also minimising the impact on the adjacent road network by reducing traffic generation.

In addition to the residential parking provision, 25 parking spaces are to be allocated to the community use within the development.

Table 2 Proposed Parking Provision

Apartment schedule	**No.**	**DCP Parking Rate (maximum rate)**		**Proposed Provision**	
		Parking rate	No. spaces	Parking rate	No. spaces
1 bedroom	89	1 / unit	89	0.2 / unit	18
2 bedroom	167	1 / unit	167	1 / unit	167
3 bedroom	28	1.5 / unit	42	1.5 / unit	42
Visitor	284	0.25 / unit	71	0 / unit	0
Sub-Total - Residential			***369***		***227***
Community	1,515m^2				25
Total	**284**		**369**	**387**	**252**

3.3 Service area

The North Sydney Development Control Plan 2013 requires that for developments with more than 60 dwellings, that at least two Medium Rigid Vehicle (MRV) bays be provided.

It is proposed to provide two MRV bays within the development (see Figure 10). MRV's will reverse into the spaces (within the site) and enter/exit the site from street level in a forward direction.

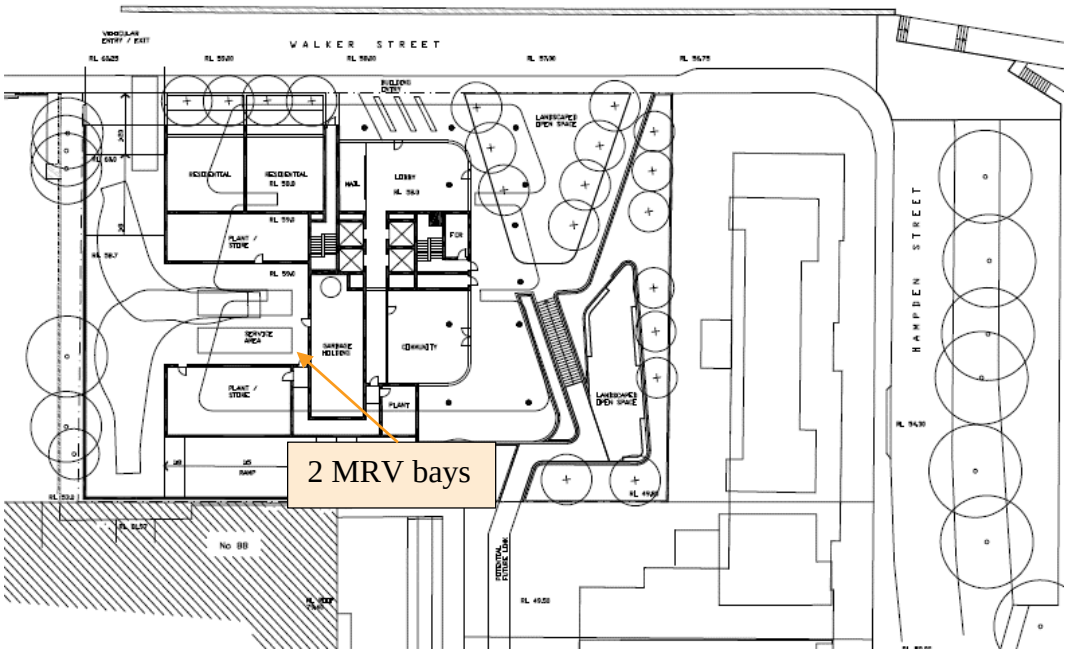


Figure 10 Proposed MRV bays

3.4 Cycle Parking

For residential developments, the North Sydney Development Control Plan 2013 requires that a minimum of 1 resident space per dwelling and 1 visitor space per dwelling be provided with the following exception:

'where an apartment in a residential building has a basement storage area on title that is large enough to accommodate a bike and being no smaller than a Class 1 bike locker, then additional bike parking for that apartment is not required'.

4 Future Context

4.1 Ward Street Precinct Masterplan

North Sydney Council has prepared a Masterplan for the Ward Street precinct which is adjacent to the site. The Precinct is bound by McLaren Street to the north, Berry Street to the south, Miller Street to the west and includes a number of properties on the eastern side of Walker Street, south of Hampden Street.

Within the precinct is a variety of commercial, mixed use and residential development. The precinct also contains the Ward Street car park, which is Council owned and privately operated under a long term lease.

The upcoming expiry of the lease, in combination with the arrival of the Metro, brings the opportunity for Council to re-imagine how these facilities work for the community. These opportunities are shown in Figure 11.

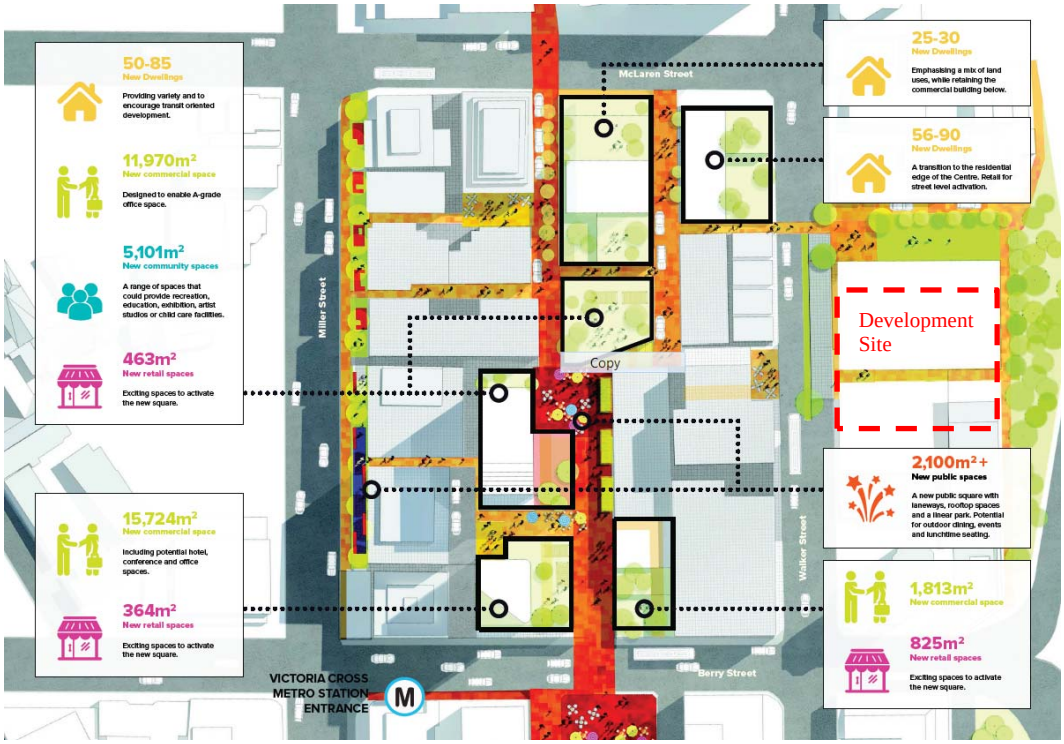


Figure 11 Ward Street Precinct Masterplan

Of particular benefit to the proposed development will be the increased permeability of the precinct and the provision of a strong pedestrian link across Walker Street, just north of the site. This will reduce the walk time to bus services along Miller Street.

4.2 Sydney Metro & Victoria Cross Metro station

Sydney Metro is the next major rail project identified in Sydney's Rail Future. Sydney Metro scope has been developed to meet the Project objectives and deliver key elements of Stages 4 and 5 of Sydney's Rail Future.

In June 2014 the NSW Government announced the Sydney Metro concept, including the Sydney Harbour Crossing and Western Extension to Bankstown proposals. The project would extend rapid transit under Sydney Harbour, through the central business district (CBD) of Sydney and west to Bankstown, with capacity to run up to 30 trains per hour in each direction through the city on the new line.

The Project represents a major increase in the capacity of Sydney's rail network, providing a 60 per cent increase in the number of trains in the peak periods and catering for an extra 100,000 customers per hour. Sydney Metro will significantly improve reliability across the rail network by addressing current and emerging constraints such as train crowding, platform and station crowding, and network complexity.

The NSW Government has announced a new station would be constructed in North Sydney, known as Victoria Cross, as part of the Sydney Metro project. The station is located beneath Miller Street (to the north of the Pacific Highway) between McLaren Street and south of Berry Street. Station access and entry is via the pedestrian plaza opening to Miller, Denison and Berry streets. Residents of the proposed development will benefit from the future northern access point into Victoria Cross station located at the corner of Miller Street and McLaren Street.

Key employment centres will be easily accessible from Victoria Cross station, with 9 minutes travel time to Central Station and 5 minutes travel time to Martin Place metro station.

The station includes:

- new bike parking near the corner of Miller and Berry streets
- new kiss and ride bays on Berry Street
- existing bus stops close to the station retained on Miller Street
- wayfinding signage and Sydney Metro information within the North Sydney CBD
- a traction substation integrated into the station building (partially underground)
- a services building on Miller Street to the north of the station providing station and tunnel services
- enhancement of pedestrian infrastructure around the station. This is being investigated further in consultation with Roads and Maritime Services and North Sydney Council.

The new metro station is located within a 5 minute walk of the proposed Walker Street development, and will be operational from 2024.

Figure 12 Victoria Cross metro station

Source: Transport for NSW

5 Transport Assessment

5.1 Vehicle trip generation

Recent surveys undertaken by the RMS of high density residential developments in key centres such as St Leonards has one of the lowest traffic generation rates during peak hours. For every 100 residential car parking spaces, only 10 car trips are generated during the AM peak hour and 5 car trips during the PM peak hour. This residential development would be considered to be reasonably similar to the proposed development in terms of it scale, location and proximity to public transport.

On the basis of providing 227 residential car parking spaces for the 284 units, the development is estimated to generate only 23 vehicle trips during the AM peak hour and 12 vehicle trips during the PM peak hour. The community uses would generate a small number of additional vehicle trips in the PM peak hour.

Using the AM peak hour trip generation of 23 vehicle trips, this would equate to approximately 18 vehicle trips leaving the development in the morning (assuming an 80% of trip are egress), the majority of which would be directly accessing either the Warringah Freeway or the Pacific Highway. This is less than 1 vehicle every three minutes during the peak period and is considered to be of negligible impact and does not require further assessment.

In addition, given the proximity of the residential development to significant levels of employment in North Sydney, the estimated vehicle trip generation is considered to be conservative. Further, the opening of the Sydney Metro from 2024 which will increase the alternative transport options available to residents.

5.2 Person trip generation

Using the residential development at St Leonards described above, the person trips generated by the development are 0.64 per unit during the AM peak hour and 0.54 per unit during the PM peak hour. This equates to a development person trip generation of 191 trips during the AM peak hour and 161 trips during the PM peak hour. The mode split for the development is estimated to be as presented in Table 3.

Table 3 Mode Share and peak period person trips and

Mode Share		AM Peak Trips	PM Peak Trips
Car Driver	13%	24	20
Car Passenger	5%	9	8
Train / metro	30%	55	46
Bus	15%	27	23
Walk	34%	62	52
Cycling/Other	3%	5	5
Total	**100%**	**182**	**153**

5.3 Public transport

The development is forecast to generate demand for 48 trips by train/metro and 29 trips by bus during the AM peak hour. As shown in Figure 13, the distance to the train station is less than 600m, while the bus stops on Miller Street are approximately 200m away.

There are a high number of bus services serving the stops on Miller Street during the morning peak period, while trains operate at a 3 minute frequency through North Sydney. Once operational, the Sydney Metro is expected to operate at a 4 minute frequency.

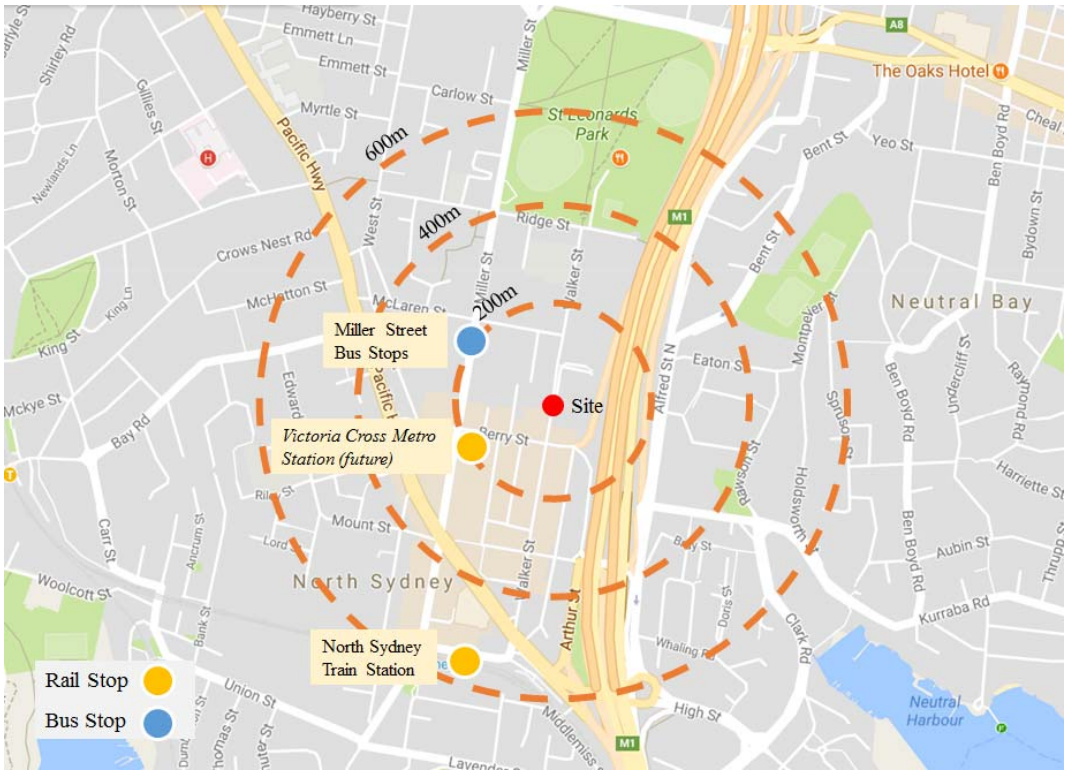


Figure 13 Distance to public transport stops

5.4 On-site car parking

The proposed residential parking provision of 227 spaces is significantly below the maximum allowable number of spaces permitted under Council's DCP of 369 spaces. This number of spaces is considered appropriate to meet the parking needs of the development while also minimising the impact on the adjacent road network by reducing traffic generation.

It is important to note that the actually 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. Figure 14 shows the relatively positive correlation between peak hour traffic generation and parking provision.

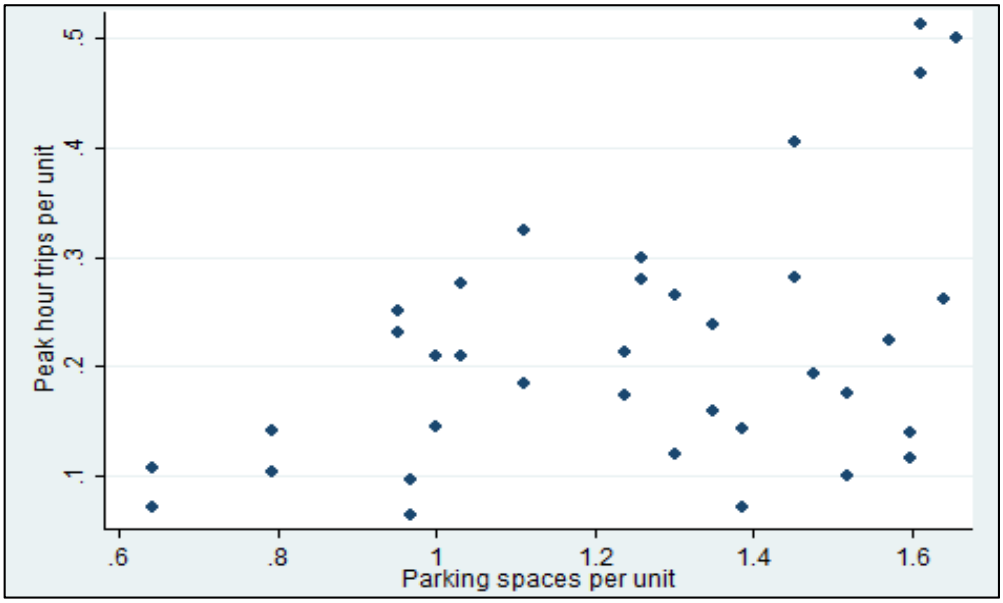


Figure 14: Correlation between peak traffic generation and parking spaces per unit

This strategy proposes car parking to be provided at rates lower than the maximum rates recommended by the North Sydney Council DCP.

5.5 On-street car parking

As previously noted in Section 3.1, the new driveway access point on Walker Street into the proposed development will necessitate the loss of approximately 4 on-street parking spaces. It is acknowledged parking demand is high in the area, however this loss of spaces is considered acceptable given that:

- The existing four dwellings, containing a total of 24 units, which make up the proposed site do not have any off-street parking. Each of the 24 units would be entitled to a residential parking permit, with 19 parking permits currently issued to these residents
- Total demand for on-street parking in the vicinity of the site will reduce should the development proceed, as residents of the existing 24 units would no longer be competing for parking spaces.
- Residents of the proposed development will not have access to residential parking permits. Therefore there would be a reduction of 19 parking permits in the area, with a net loss of four parking spaces.

5.6 Vehicle queuing

Arup has undertaken an analysis to confirm the suitability of the existing road network to accommodate traffic flows into the site. Specifically, the analysis has focused on the potential of the northbound lanes on Walker Street to queue back to Berry Street if a vehicle is waiting to turn right into the driveway of the proposed development.

A SIDRA model has been developed to understand the maximum queue that is likely to form behind vehicles waiting to turn right into the proposed driveway, based on historical traffic counts (2014) at the Berry Street / Walker Street intersection. The analysis considers up to 35 vehicles turning right into the proposed development during the PM peak hour, which is a conservative assumption given the traffic generation forecasts previously noted in section 5.1 of this report.

The modelling demonstrates that the maximum queue length that is likely to form in the PM peak hour behind right turning traffic is no more than one vehicle. This is illustrated in Figure 15, and confirms the proposed development will not cause northbound lanes on Walker Street to queue back to Berry Street.

Traffic modelling outputs are provided in Appendix A.

Figure 15 Forecast maximum queue length

Notwithstanding the above analysis, northbound vehicles have the ability to pass traffic waiting to turn right into the proposed development, as illustrated in Figure 16 below.

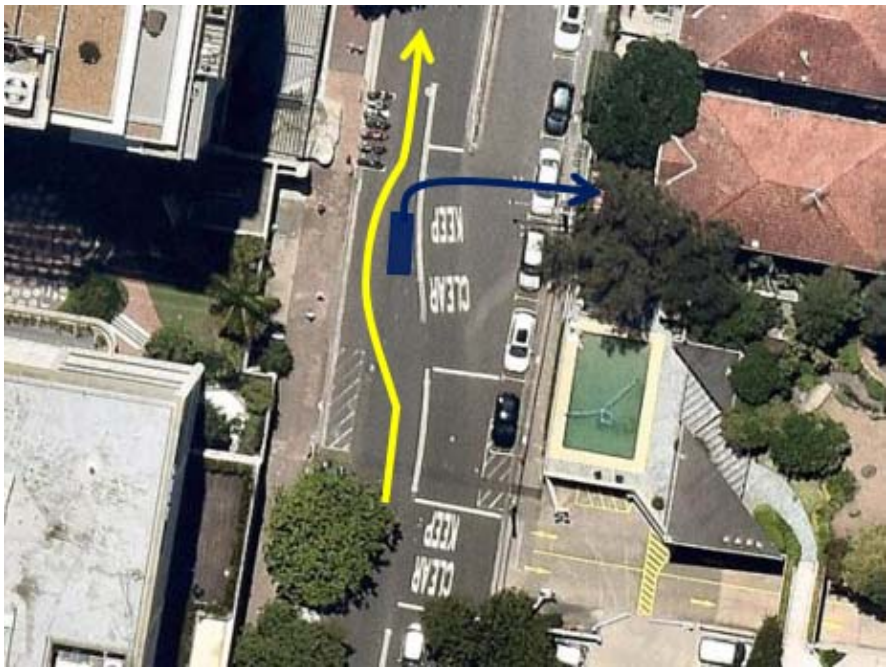


Figure 16 Ability for northbound vehicles to pass traffic waiting to turn right

6 Summary

Avenor Pty Limited engaged Arup to carry out a traffic and transport assessment of their proposed high density residential development at 173-179 Walker Street. Key findings of the study are as follows:

- The provision of the driveway will result in the loss of approximately four on-street car parking bays, which are currently used by residents of the subject site. It is acknowledged parking demand is high in the area, however this loss of spaces is considered acceptable given that:
    - The existing four dwellings, containing a total of 24 units, which make up the proposed site do not have any off-street parking. Each of the 24 units would be entitled to a residential parking permit, with 19 parking permits currently issued to these residents
    - Total demand for on-street parking in the vicinity of the site will reduce should the development proceed, as residents of the existing 24 units would no longer be competing for parking spaces.
    - Residents of the proposed development will not have access to residential parking permits. Therefore there would be a reduction of 19 parking permits in the area, with a net loss of four parking spaces.
- The proposed residential parking provision of 227 spaces is significantly below the maximum allowable number of spaces permitted under Council's DCP of 369 spaces.
- On the basis of providing 227 residential car parking spaces for the 284 units, the development is estimated to generate only 23 vehicle trips during the AM peak hour and 12 vehicle trips during the PM peak hour.
- The future measures proposed under the Ward Street Precinct Masterplan and the Victoria Cross Metro Station will significantly improve the accessibility of the development by foot and by public transport.

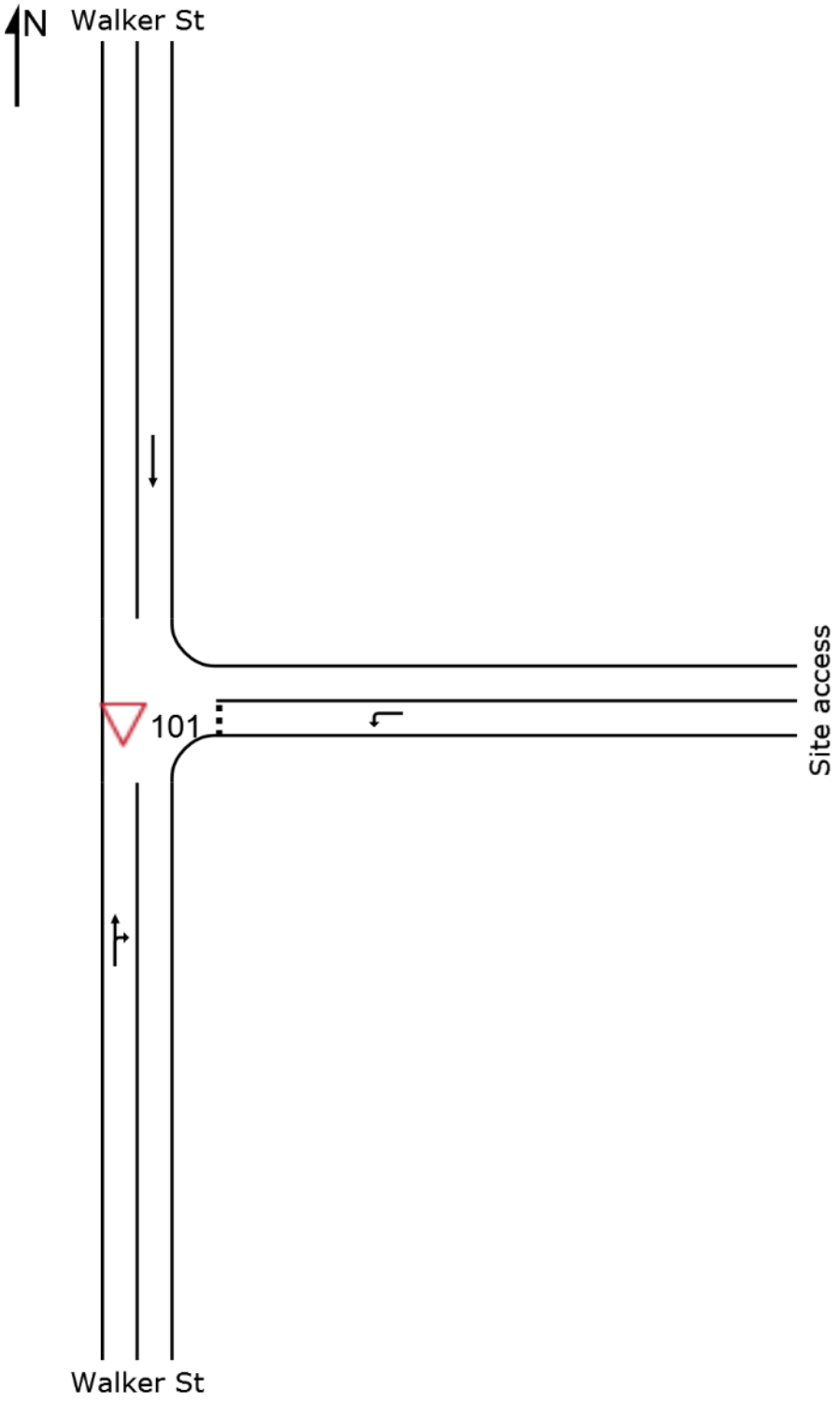
Appendix A

Traffic Modelling Outputs

SITE LAYOUT

Site: 101 [Walker St North Sydney PM]

New Site
Giveway / Yield (Two-Way)



MOVEMENT SUMMARY

Site: 101 [Walker St North Sydney PM]

New Site
Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Walker St											
2	T1	415	0.8	0.245	0.3	LOS A	0.4	2.8	0.11	0.05	59.1
3	R2	37	0.0	0.245	7.4	LOS A	0.4	2.8	0.11	0.05	56.9
Approach		452	0.7	0.245	0.8	NA	0.4	2.8	0.11	0.05	58.9
East: Site access											
4	L2	11	0.0	0.009	6.9	LOS A	0.0	0.2	0.42	0.59	52.3
Approach		11	0.0	0.009	6.9	LOS A	0.0	0.2	0.42	0.59	52.3
North: Walker St											
8	T1	407	0.3	0.209	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		407	0.3	0.209	0.0	NA	0.0	0.0	0.00	0.00	60.0
All Vehicles		869	0.5	0.245	0.5	NA	0.4	2.8	0.06	0.03	59.3

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