

Macquarie University
8-12 University Avenue
Transport Assessment

Rev B | 7 November 2018

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 224322-00

Arup
Arup Pty Ltd ABN 18 000 966 165



Arup
Level 10 201 Kent Street
PO Box 76 Millers Point
Sydney 2000
Australia
www.arup.com

ARUP

Executive Summary

This transport assessment has been prepared by Arup on behalf of Macquarie University for the main works associated with a proposed new university office and laboratory development known as 8-12 University Avenue. The subject site is adjacent to two existing commercial buildings, Cochlear and the Australian Hearing Hub and is currently occupied by multi-storey car park, a surface car park, a security building, a substation and an area of open lawn.

The assessment has been undertaken based on the guidelines and framework as outlined in the Macquarie University Concept Plan (2009), relating to:

- Site access arrangements;
- Car parking rates;
- Design standards;
- Mode share targets; and
- Sustainable travel options

The site is well located with respect to nearby public transport, with bus stops located on University Avenue and Macquarie University rail station within 5 minutes walk. This is reflected in current travel trends, with almost half of all trips to the campus now made by public transport. Public transport access is to be further improved following the introduction of the Sydney Metro northwest service in 2019, which will provide high frequency metro services directly to the campus.

The proposed development consists of a six to seven storey building to be occupied for university-related office, administration and laboratory uses, as well as some commercially-leased office and laboratory space. The development also proposes 619 car parking spaces in a shared multi-level basement car park. The total proposed GFA is 49,445m².

Vehicle access to the site will be provided via University Avenue, with two existing roundabouts to be removed and one to be relocated to facilitate access. This is illustrated in Figure 1.

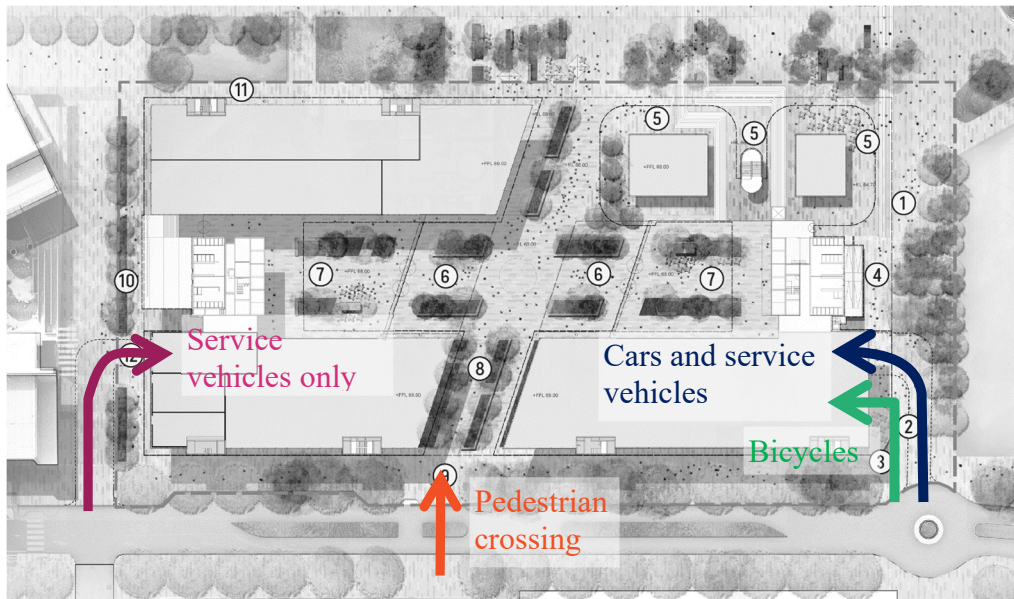


Figure 1 Proposed access arrangements

It is proposed to provide 140 bicycle parking spaces for the development, which is well above the 62 spaces required under the City of Ryde Development Control Plan 2014. It is proposed to provide 7 accessible parking spaces which meets the minimum requirement of 1 space per 100 car parking spaces as outlined in Australian Standards.

The development is anticipated to generate approximately 147 vehicle trips (two-way) at both the Herring Road / Waterloo Road and Epping Road / Balaclava Road intersections during the AM peak hour and 128 vehicle trips (two-way) during the PM peak. It should be noted however that the current public car park, which contains 1,050 spaces, would generate a greater quantum of traffic relative to the 8-12 University Avenue site which has 619 parking spaces. Therefore there is likely to be a net reduction in traffic movements at the Herring Road / Waterloo Road intersection as a result of the proposal.

Contents

	Page
Executive Summary	1
1 Introduction	1
1.1 Background	1
1.2 Scope of Works	2
1.3 Secretary's Environmental Assessment Requirements	3
1.4 Report Structure	5
1.5 Consultation	5
2 Transport Planning Context	6
2.1 Macquarie University Concept Plan	6
2.2 Macquarie University Gateway Project	7
2.3 Relevant Policies and Guidelines	8
3 Existing Situation	9
3.1 Site Location	9
3.2 Pedestrian Network	9
3.3 Cycle Network	11
3.4 Public Transport Network	12
3.5 Road Network	14
3.6 Car Parking	16
3.7 Travel Patterns	16
4 Proposed Development	20
4.1 Description	20
4.2 Building Population	20
4.3 Pedestrian Access and Facilities	21
4.4 Cycle Access and Facilities	22
4.5 Private and Service Vehicle Access	23
4.6 Car Parking and Standards	23
5 Transport Assessment	24
5.1 Compliance with Concept Plan	24
5.2 Total Trips	25
5.3 Road Network Changes	26
5.4 Parking	27
5.5 Traffic Generation	28
5.6 Trip Distribution and Assignment	29
5.7 Road Network Impacts	30
5.8 Pedestrian and Cycle Movements	32

5.9	Loading and Servicing	33
5.10	Workplace Travel Plan	34
5.11	Road safety	35
5.12	Construction traffic management	35
6	Conclusions	36

Appendices

Appendix A

Preliminary Construction Pedestrian Traffic Management Plan

Appendix B

Framework green travel plan

1 Introduction

1.1 Background

Arup has been appointed by Macquarie University to undertake a Transport Assessment for the main works associated with a proposed new university office and laboratory development known as 8-12 University Avenue (as identified in the Macquarie University Concept Plan).

The development will be located on the northern side of University Avenue and proposes to provide a new building with a mix of A-grade office, laboratory, and collaborative spaces (see Figure 2).

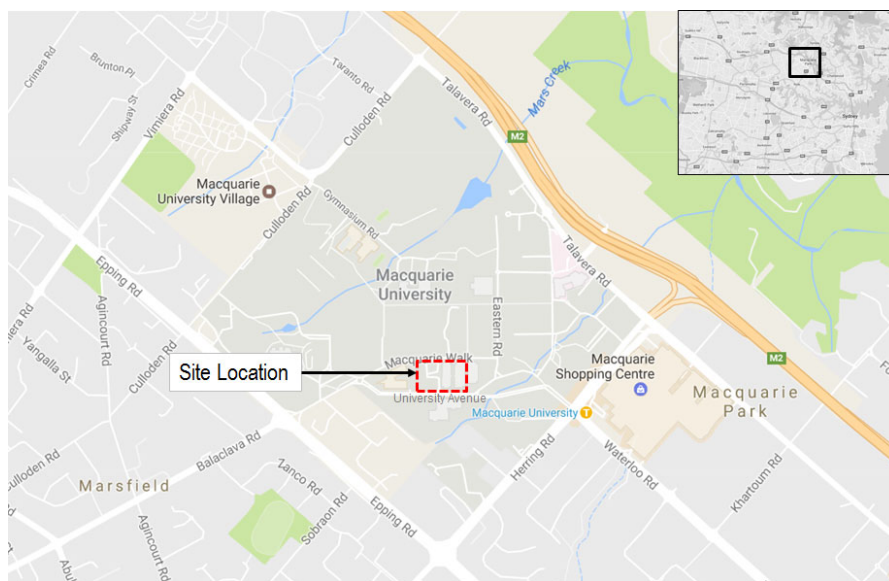


Figure 2 Site Location

The subject site is adjacent to two existing commercial buildings, Cochlear and the Australian Hearing Hub and is currently occupied by multi-storey car park, a surface car park, a security building, a substation and an area of open lawn. The site boundary for the main works is presented in Figure 3.

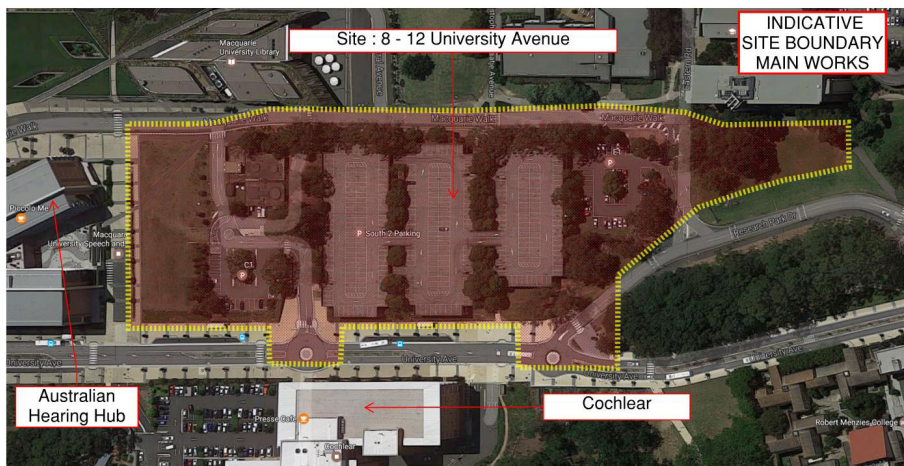


Figure 3 Site Boundary

1.2 Scope of Works

The scope of works for the project includes the following:

- Retention and protection of up to 84 trees including trees adjoining the site;
- Bulk excavation works to a maximum depth of between approximately 4 metres and 10.6 metres and a volume of approximately 86,000m³ to accommodate basement levels.
- Remediation works as required by the project's Stage 2 Environmental Site Assessment and Asbestos Management Plan, including asbestos removal in accordance with requirements of NSW WorkCover, including stockpiling of approximately 17,614m³ immediately east of the development but within the development site;
- Construction of new part two-, part three- level shared basement carpark that accommodates:
 - 619 parking spaces (of which seven (7) are accessible),
 - Two (2) courier bays,
 - One (1) loading dock (note: additional loading dock at ground level),
 - 140 bicycle parking spaces and end of journey facilities (lockers, showers) accessed via the eastern building elevation;
- Erection of a new campus-style university office and laboratory building comprising two attached buildings (Building 8 and Building 12) of six and seven storeys respectively, with a total GFA of 49,445sqm.
- New plantings at all street frontages, along the diagonal link and within the atrium and other locations within the campus over time (including at least 111 trees applying the MQU policy of offsetting at least 1:1 compared to trees removed campus-wide); and
- Road and public domain works around the proposed building.

1.3 Secretary's Environmental Assessment Requirements

The NSW Department of Planning and Environment (DP&E) issued a list of the Secretary's Environmental Assessment Requirements (SEARs) that inform the Environmental Impact Statement (EIS). Table 1.1 describes the SEARs that are specific to transport, traffic, parking and access; and also provides a cross reference to the relevant sections of this report which address these requirements.

Table 1: SEARs relevant to transport, traffic, parking and access

Requirement	Section Addressed
The current daily and peak hour vehicle, public transport, pedestrian and bicycle movements and existing traffic and transport facilities provided on the road network located adjacent to the proposed development	3.2, 3.3, 3.4 & 3.5
The number of students and staff currently using the site and the likely number using the site due to the proposed development	4.2
An estimate of the total daily and peak hour trips generated by the proposal, including vehicle, public transport, pedestrian and cycle trips	5.2, 0
Assessment of the operation of existing and future transport networks, and their ability to accommodate the forecast number of trips to and from the development	5.7 & 5.8
Existing and future pedestrian and cyclist desire lines and the adequacy of pedestrian and bicycle provisions to meet the likely future demand of the proposed development including suitable bicycle parking and end of trip facilities	5.8
The operational impact of the proposed development on existing and future pedestrian network, bicycle network and public transport infrastructure within the vicinity of the site	5.7 & 5.8
Existing and proposed pedestrian, cyclist and vehicle access, including car, taxi and point to point transport for staff, students and visitors and compliance with Australian Standards	3.2, 3.3, 3.1, 4.4 & 4.5
Sustainable travel initiatives for employees, students and visitors that support the achievement of concept plan targets, particularly the provision of bicycle parking, end-of-trip facilities, green travel plans and wayfinding strategies	5.10
Assessment of the impact of additional traffic generated by the proposed development on the existing road network	5.7.3 & 5.7.4
The daily and peak vehicle movements impact on nearby intersections utilising traffic modelling endorsed by Roads and Maritime Services, with consideration of the cumulative impacts from other approved developments in the vicinity and the need/associated funding for upgrading or road improvement works (if required)	0, 5.7.3 & 5.7.4
Measures to mitigate any associated traffic impacts and impacts on public transport, pedestrian and bicycle networks	5.10 & 5.7.3
Anticipated student and staff numbers and subsequent implications for car and bicycle parking demand on the campus	4.2, 4.4 & 0
Existing and proposed car and bicycle parking provision, including end of trip facilities, and the consideration of the availability of public transport and the requirements of the relevant parking codes and Australian Standards	3.6, 3.3, 4.6 & 4.4
Assessment of road and pedestrian safety adjacent to the proposed development and details of any required road safety measures	0

Requirement	Section Addressed
Location of bicycle parking facilities in secure, convenient, accessible areas close to main entries incorporating lighting and passive surveillance	4.4
Service vehicle access, including swept path diagrams of largest vehicle showing forward in and forward out movements, delivery and loading arrangements and estimated service vehicle movements (including vehicle type and the likely arrival and departure times	5.9
<p>Traffic and transport impacts during construction, including:</p> <ul style="list-style-type: none"> • how these impacts will be mitigated for any associated traffic, pedestrian, cyclists, parking and public transport; • the preparation of a draft Construction Traffic Management Plan to demonstrate the proposed management of the impact; • any cumulative impacts from construction activities for the Sydney Metro and operation of Station Link services • an assessment of road safety at key intersections and locations subject to heavy vehicle construction traffic movements and high pedestrian activity; and • construction programming detailing significant milestones and events during the construction process. 	5.12 and Appendix A
<p>Relevant Policies and Guidelines:</p> <ul style="list-style-type: none"> • Guide to Traffic Generating Developments (Roads and Maritime Services) • EIS Guidelines – Road and Related Facilities (DoPI) • Cycling Aspects of Austroads Guides • NSW Planning Guidelines for Walking and Cycling • Austroads Guide to Traffic Management Part 12: Traffic Impacts of Development • Healthy Urban Development Checklist, NSW Health • Development Near Rail Corridors and Busy Roads – Interim Guideline 2008 • Ryde Draft Traffic Impact Assessment Guidelines 	2.3

1.4 Report Structure

This reports describes the current and future transport environment surrounding the 8-12 University Avenue development. It describes the transport related features and impacts of the development, specifically in the context of the Macquarie University Concept Plan. The report considers the following:

- Existing walking, cycling, public transport and road networks
- Existing staff and student travel patterns
- Details of the proposed development including vehicular access, design and circulation
- Car parking arrangements
- Traffic generated by the development and impact
- Compliance with the objectives of the Macquarie University Concept Plan

1.5 Consultation

Macquarie University has undertaken consultation for many years now with Transport for NSW, Roads and Maritime (RMS) and City of Ryde Council in relation to the development of the Macquarie University Concept Plan, which incorporates the 8-12 University Avenue site. This consultation has focused on addressing the relevant conditions of consent of the Macquarie University Concept Plan (see Section 5.1), as well as transport upgrades works in the vicinity of the campus such as the RMS led Bus Priority Improvement Program (BPIP). The outcomes of this consultation have informed the development of this transport assessment.

2 Transport Planning Context

This section of the report outlines the framework which guides development and transport planning on campus, including the development which is the subject of this application.

2.1 Macquarie University Concept Plan

The Macquarie University Concept Plan 2009 along with the Macquarie University Transport Management and Accessibility Plan (TMAP) provide the framework under which development on campus is to take place. They provide for a structured and staged growth of the University Campus.

2.1.1 Relevant conditions of consent

In relation to transport and parking, the following conditions are set out:

Car Parking

- Car parking for non-academic uses shall not exceed a maximum rate of 1 space per 80m² of gross floor area across Precincts E and F.
- The maximum car parking across the campus is 10,800 spaces
- New car parking for non-academic buildings within Precincts D, E and F shall be located within basements (which may be above ground on sloping sites) and generally contained within the footprint of the building above. The design of any above ground car parking shall include architectural treatment of the elevations to reduce their visual impact and dominance.

2.1.2 Statement of commitments

The following commitments have been compiled based on the environmental assessment undertaken in the preparation of the approved Concept Plan. The relevant transport commitments are as follows:

- A University Travel Plan (UTP) will be formulated by Macquarie University for the uses at the site only.
- A car parking management strategy will be developed as part of the UTP.
- A strategy for bicycle parking including end of trip facilities will be developed as part of the UTP.
- A strategy for intra-university travel will be developed as part of the UTP and will include recommendations on travel to/from university housing, connections to the rail station, and night travel. Consideration will be given to the development of a campus shuttle bus service in the UTP.
- A detailed micro-simulation transport model of the University internal road network and surrounding “area of influence” will be developed. The model will be used to assess in detail proposed changes to the internal road network and review internal intersection performance. The model will be utilised for

assessment of project applications and to determine staging of works. The timing of the model would be based on full operation of the Epping-Chatwood rail link being realised and any major redevelopment of the Station South portion of Precinct E.

- Development on the site shall promote as far as practicable reduced use of private single occupant vehicles and promote public transport use, walking and cycling – including implementation of the Macquarie University Cycle Access Plan.
- New developments will be required to prepare a Workplace Travel Plan (WTP) for individual sites in accordance with City of Ryde DCP 2006 Part 4.5 (Section 6.3.9).
- All internal roads are to be designed and constructed consistent with the requirements of all relevant Australian Standards, and the requirements of Council and Austroads as applicable.

2.2 Macquarie University Gateway Project

The Macquarie University Gateway project aims to enhance the pedestrian amenity, safety and connectivity through the campus. To achieve those aims, a reconfiguration of the road network is proposed which includes the following measures:

- Removal of right hand turn out of University Avenue and onto Herring Road;
- Closure of Research Park Drive near University Avenue;
- Road realignment and line marking alterations;
- Road grading works, including levelling of University Avenue; and
- Landscaping works and provision of new street furniture.

The key outcome of the Gateway project will be the ability to provide pedestrians with a direct and uninterrupted link between the Macquarie University railway station to the campus core.

2.3 Relevant Policies and Guidelines

The following documents have been considered in the development of this transport strategy for the Sydney Modern project:

- **RMS Guide to Traffic Generating Developments**
Used to inform the traffic assessment undertaken for the project.
- **EIS Guidelines – Road and Related Facilities**
Used to inform the preparation of the transport strategy, in particular the assessment of transport impacts.
- **NSW Planning Guidelines for Walking and Cycling & Cycling Aspects of Austroads Guides**
This document has been used to inform the development of the walking and cycling measures proposed in this strategy.
- **Guide to Traffic Management – Part 12: Traffic Impacts of Developments (AUSTROADS)**
This guide has been referenced for the appropriate methodology to be used for traffic impact assessment of the development.
- **Ryde Draft Traffic Impact Assessment Guidelines**
This guide has been referenced for the appropriate methodology to be used for traffic impact assessment of the development.
- **Healthy Urban Development Checklist 2010**
This guide has been referenced to inform the active transport assessment for the project

3 Existing Situation

3.1 Site Location

The proposed development is located north of University Avenue, within Macquarie University which is approximately 15km north-west of Sydney CBD. The site is towards the southern end of the campus (Precinct E) and is currently occupied by a surface car park (C1), a multi-storey car park (C2, C3, E1), a security building (C1A), a substation and an area of open lawn. There are three vehicular accesses to the site at present, (off University Avenue, Macquarie Walk and Eastern Road).

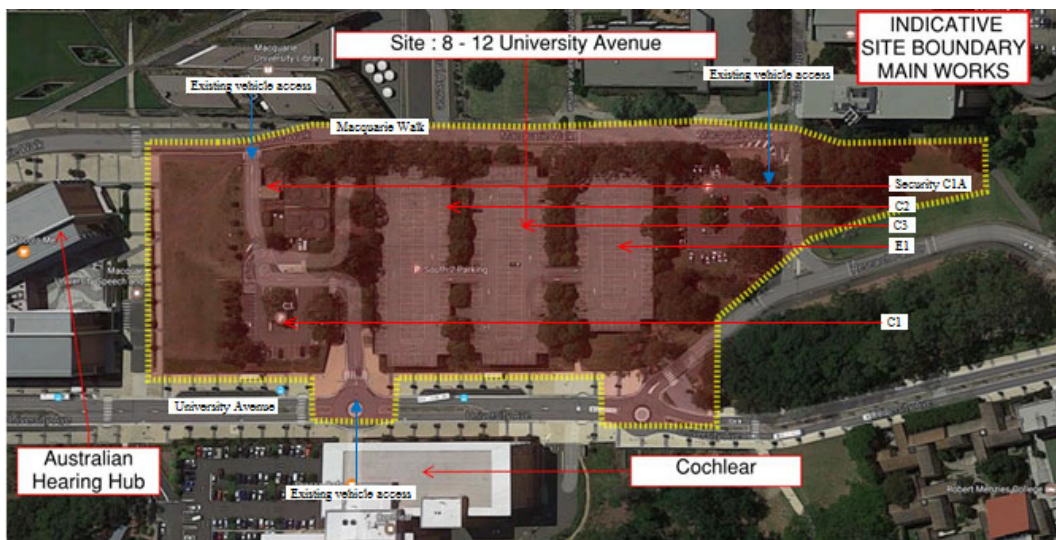


Figure 4 Main works site boundary

3.2 Pedestrian Network

The pedestrian network in the vicinity of the proposed development is generally of high quality, with wide paths and regular crossing points along University Avenue in particular which provides a direct connection with Macquarie University Station.

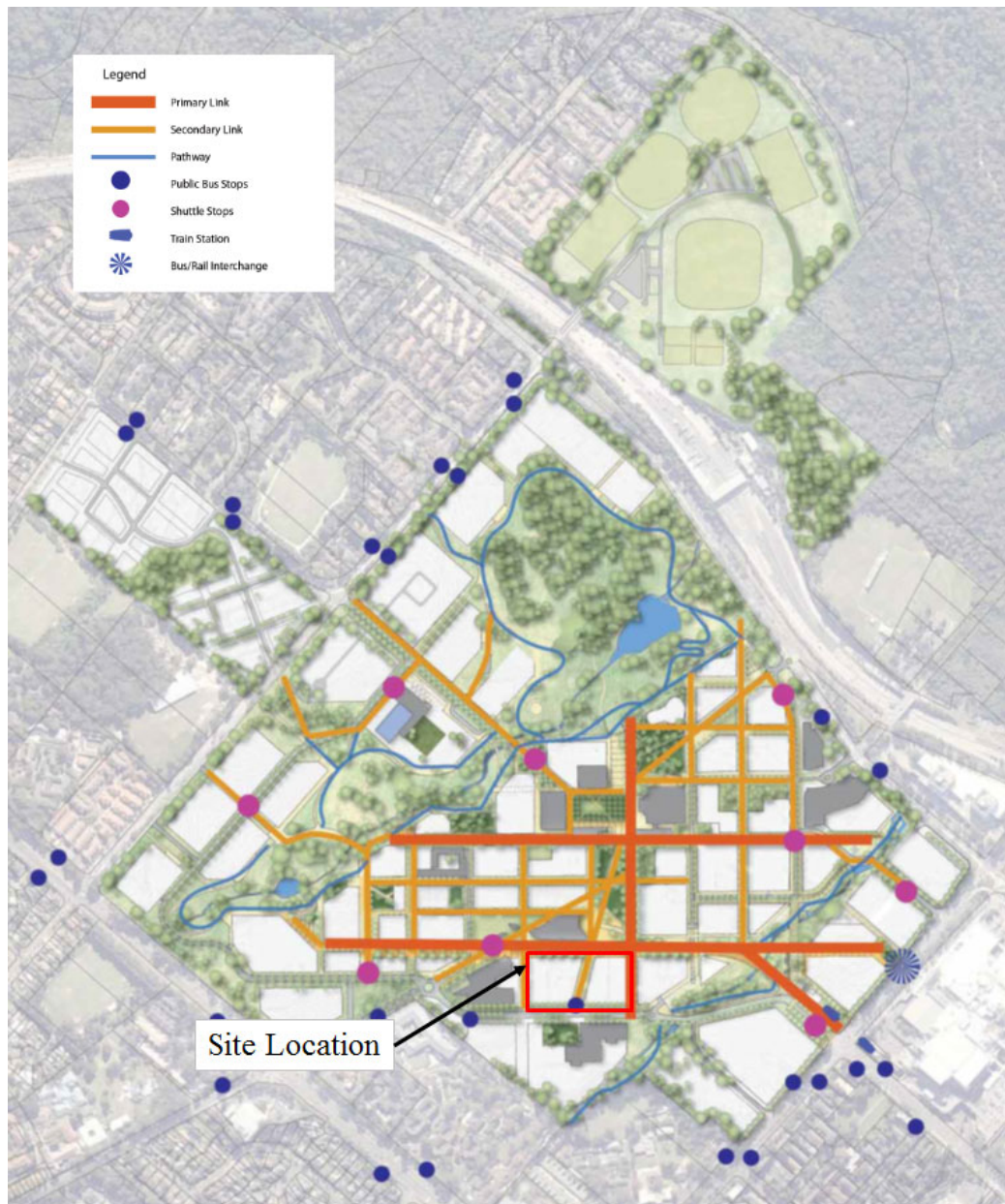


Figure 5 Proposed Pedestrian Network

3.3 Cycle Network

There are presently no dedicated cycling facilities (i.e. on road bike lanes, shared paths) within MQU. Some end of trip facilities are provided, such as parking, showers and lockers. Two additional bike hubs have recently been constructed on campus, adjacent to both Eastern Road near the Central Courtyard and Western Road near the W4 car park. Each of these hubs include capacity to store 26 bikes in a secure cage, 2 solar powered showers and 28 lockers.

Cycling currently makes up only a small proportion of overall trips to MQU. Reasons for this may include:

- The University is surrounded by high traffic, major arterial roads which are not conducive to walking and cycling.
- Isolated on and off-road cycle facilities currently exist in the vicinity of the campus, but these do not yet constitute a comprehensive network.

A summary of the existing cycle network surrounding MQU is shown in Figure 6. The majority of the cycle routes located within MQU are shared with pedestrians.

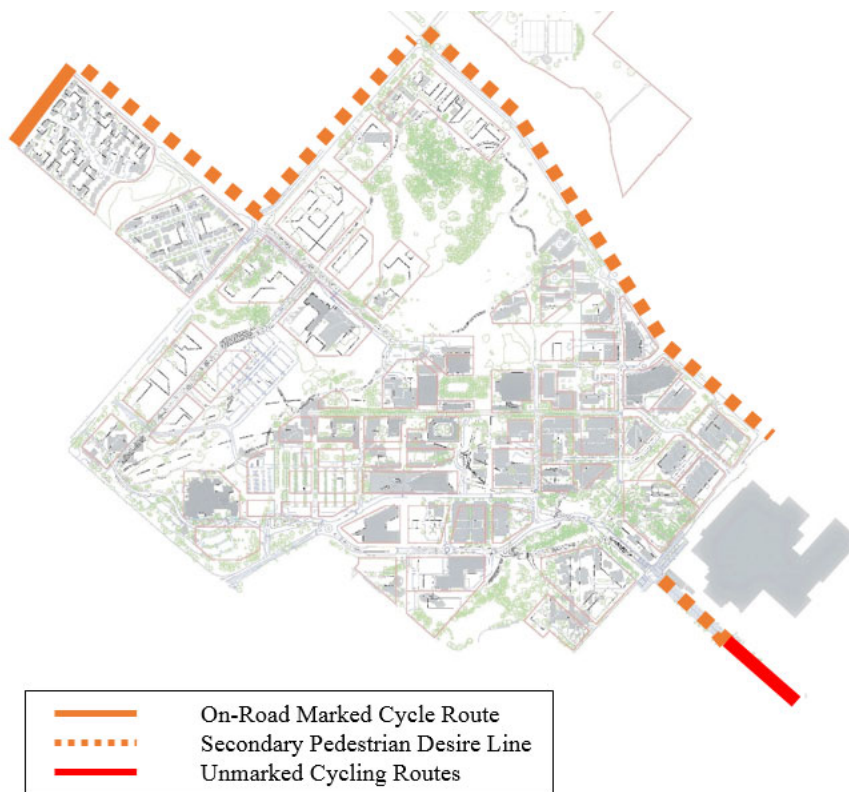


Figure 6 Existing cycling routes

3.4 Public Transport Network

3.4.1 Bus

The campus is also served by both public and private bus services. A number of routes that stop along University Avenue (i.e. adjacent to the proposed development), with other routes stopping along Herring Road and Waterloo Road as presented in Figure 7. In addition to public bus services, there are a number of private bus services in operation (i.e. Forest Coach Lines, Transdev NSW Buses and Hillsbus).

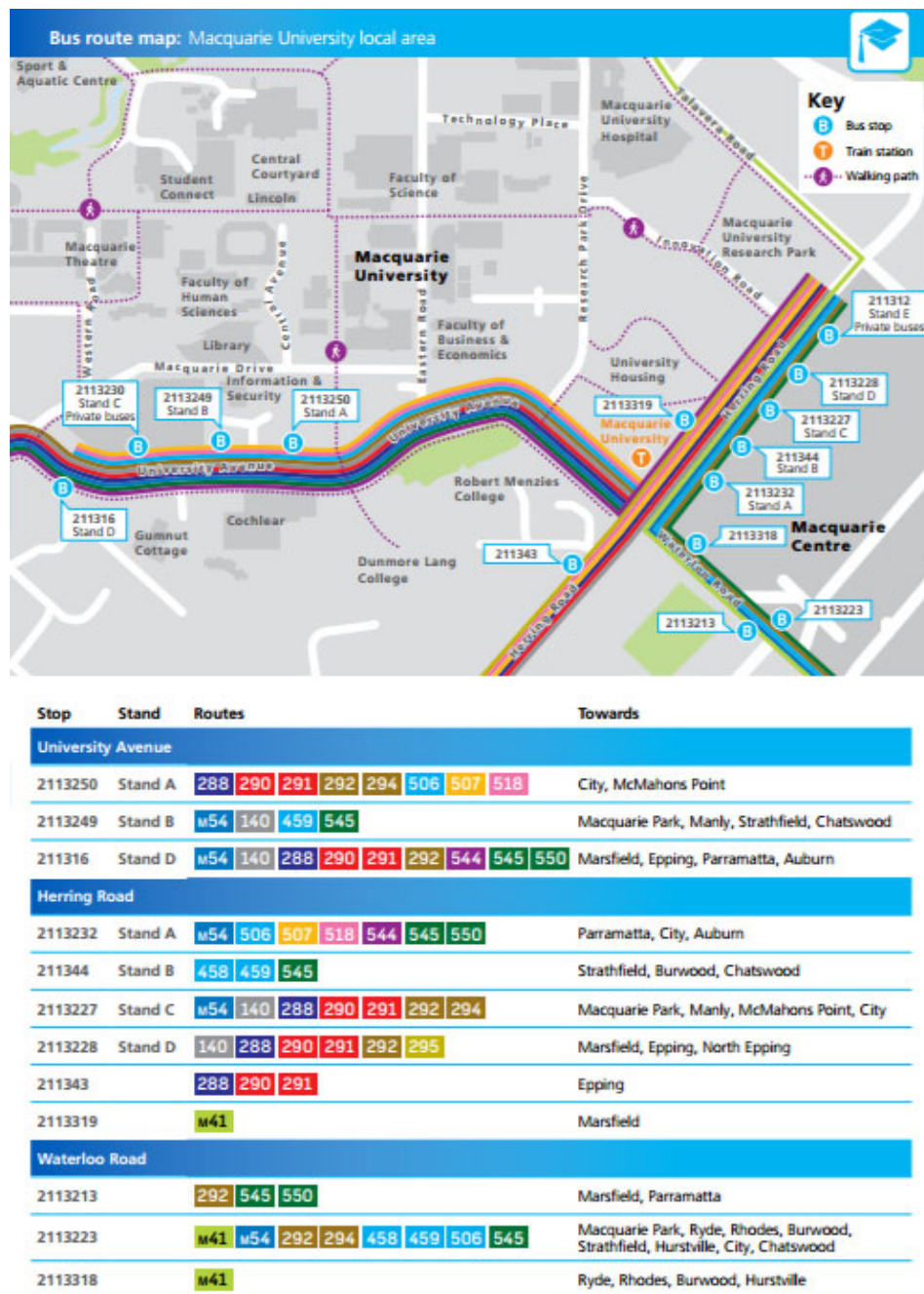


Figure 7 Macquarie University bus route map

The University also operates a complimentary shuttle bus during semester time between 4pm and 12.30am. The shuttle bus routes around the campus, serving buildings, the Hub, train station and student accommodation.

A summary of existing bus services through MQU is presented in Table 2.

Table 2 Macquarie University bus services

Route No.	Route	Frequency during peak hour		Operator
		8.00am to 9.00am	5.00pm to 6.00pm	
M41	Hurstville to Macquarie	6	6	Metro Bus
M54	Parramatta to Macquarie Park	6	6	Metro Bus
140	Manly to Epping	1	1	Sydney Buses
197	Macquarie University to Mona Vale	1	3	Forest Coach Lines
288	Epping to City	3	3	Sydney Buses
290	Epping to City	5	2	Sydney Buses
292	Marsfield to City	2	2	Sydney Buses
294	Macquarie Centre to City	2	1	Sydney Buses
295	North Epping to Macquarie Centre	4	4	Sydney Buses
459	Macquarie University to Strathfield	2	2	Sydney Buses
506	Macquarie University to City	3	3	Sydney Buses
507	Macquarie University to City	2	3	Sydney Buses
518	Macquarie University to City	2	3	Sydney Buses
544	Auburn to Macquarie Centre	2	2	Sydney Buses
545	Parramatta to Chatswood	6	6	Sydney Buses
550	Chatswood to Parramatta	0	0	Sydney Buses
565	Chatswood to Macquarie University	1	2	Transdev NSW Buses
575	Macquarie University to Hornsby	4	4	Transdev NSW Buses
611	Macquarie University to Blacktown	5	7	Hills Bus
619	Castle Hill to Macquarie Park	4	2	Hills Bus
621	Castle Hill to City	2	3	Hillsbus
630	Blacktown to Macquarie Centre	2	2	Hillsbus
651	Castle Hill to Macquarie and City	2	3	Hillsbus
740	Plumpton to Macquarie Park	3	2	Busways

Source: Sydney Buses, Hills Buses, Transdev, Busways and Forest Coach Lines 2015

3.4.2 Rail

MQU is unique in that it is the only metropolitan university in Sydney with a dedicated railway station. Macquarie University Station is located only a short walk from the Academic Core, providing services between 5am and 11pm on a typical weekday. Since the integration of the station with the CityRail network in October 2009, 13 train services every hour (nine towards the city) arrive at the station during peak hours. These services provide direct rail access to Epping and Chatswood.

Sydney Metro Northwest is an upgrade of the existing Epping to Chatswood railway line to next-generation Metro standard. The works will include overhauling the stations, new cabling, power and signalling systems and customer improvements such as platform screen doors. When completed, there will be a train at least every four minutes at peak times.

From September 2018, buses will replace trains for around seven months between Epping and Chatswood whilst the line is converted to metro operations. When Sydney's metro services start in the first half of 2019, 15 trains an hour will run in both directions between Epping and Chatswood during the peak – almost four times the number of trains running in the peak direction today.

3.5 Road Network

3.5.1 External Network

Macquarie University is surrounded by a number of major roads which carry significant traffic volumes (refer to Figure 8). These roads, including the administrative classification, are:

- Epping Road (State road)
- M2 Motorway (State road)
- Herring Road (Regional road between Epping Road and Talavera Road)
- Talavera Road (Regional road between Lane Cove Road and Talavera Road)
- Waterloo Road (Local road)
- Balaclava Road (Local road)
- Culloden Road (Local road)

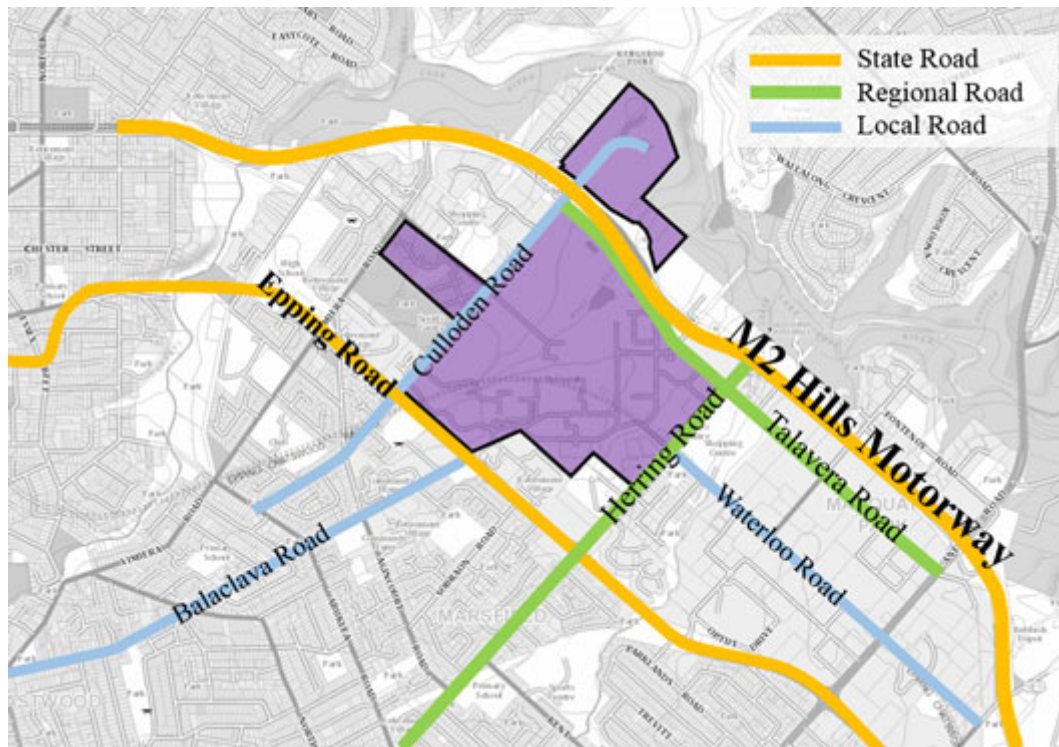


Figure 8 Road network

3.5.2 Key Intersections

The operation of the Macquarie Park road network is primarily a function of the performance of key intersections including:

- **Waterloo Road / Herring Road:** Directly adjacent to the University, train station and Macquarie Shopping Centre, this intersection is signalised with pedestrian crossing facilities on all approaches. The northern leg of this intersection provides direct access to the university, becoming University Avenue within the campus.
- **Epping Road / Balaclava Road:** Controlled by traffic signals with pedestrian crossing facilities on all approaches. Left turn slip lanes are provided on all approaches. Bus priority lanes exist on Epping Road, with a bus priority lane provided on Balaclava Road (east approach) to the junction.
- **Epping Road / Herring Road:** Controlled by traffic signals with pedestrian crossing facilities on all approaches. Left turn slip lanes are in place on all approaches. A bus priority lane exists on Epping Road (north approach) on approach to the junction.
- **Herring Road / Talavera Road / M2 Ramps:** The eastern leg of this signalised intersection provides vehicular access to and from the M2 Motorway. Pedestrian crossing facilities are provided on the northern, eastern and western approaches to the junction. A bus priority lane is provided on Talavera Road (southbound), with the right turn movement from Talavera Road to Herring Road restricted for buses only. Straight ahead movements from the M2 off ramp to Herring Road are not catered for.

- **Talavera Road / Christie Road:** This intersection is controlled by traffic signals, with pedestrian crossing facilities on the north and east approach. The Christie Road approach provides vehicular access from the M2 Motorway for traffic travelling in an eastbound direction.
- **Culloden Road / Waterloo Road:** At the northern end of the campus, this intersection is controlled by a roundabout. There are no dedicated pedestrian crossing facilities provided. The southern leg (Gymnasium Road) of the intersection is off-centre with the other three approaches.

3.5.3 Internal Network

Within the campus, key roads in the vicinity of the proposed development site are University Avenue and Macquarie Walk.

3.6 Car Parking

There are currently approximately 4,800 on-site parking spaces across the campus in a mixture of multi-storey and at-grade car parks available to staff, student and visitors. 1,050 of these spaces are located within the site boundary of the proposed development (i.e. car parks C1, C2, C3 and E1). These spaces will be accommodated within the temporary car park following the closure of this car park.

All car parking on campus is managed, with permits or tickets required between 06:00 and 20:00 every day.

In addition to the spaces for University uses, a number of spaces are restricted for use by the tenants of the Australian Hearing Hub, Cochlear Building and the visitors and patients of Macquarie University Hospital.

The 2009 Concept Plan for the University permits a maximum of 10,800 car parking spaces on campus, with provision within Precinct E to be provided at a maximum rate of 1 per 80m².

3.7 Travel Patterns

Existing data relating to student and staff travel patterns to MQU has been taken from 2011 Journey to Work Census data, and a user travel survey undertaken as part of a campus sustainability strategy in 2014. The 2006 census data is also analysed to gain and understanding the travel habits before the opening of the Epping to Chatswood rail line.

3.7.1 Journey to Work

The Journey to Work Census data for all trips with a final destination of Macquarie Park is presented in Table 3. It should be noted that this data only includes those people who consider Macquarie Park to be their location of full time employment and therefore excludes student trips.

Table 3 Journey to Work Census Data – Trips to Macquarie Park

Mode	2006	2011	2016
Car as driver	74%	67%	47%
Bus	8%	7%	14%
Car as passenger	6%	4%	3%
Train	5%	16%	23%
Walked only	5%	4%	12%
Other mode	2%	2%	1%

As seen from the table, more recent census data indicates a significant mode shift from car users to public transport as a journey to work method. The proportion of car users decreased from 74% to 47% in 2016, while train users increased from 5% to 23% following the opening of the Epping to Chatswood rail line in 2009.

3.7.2 2014 Travel Survey

GTA Consultants was commissioned by MQU in July 2014 to undertake a travel demand survey of the site. A total of 967 students, staff and employees completed both physical and online surveys. The results of the travel survey with respect to access mode into MQU is shown in Figure 9. This indicates that private vehicle at 30% is still the most popular mode of transport to the University, however access by bus (21%) and rail (27%) are also popular modes of transport.

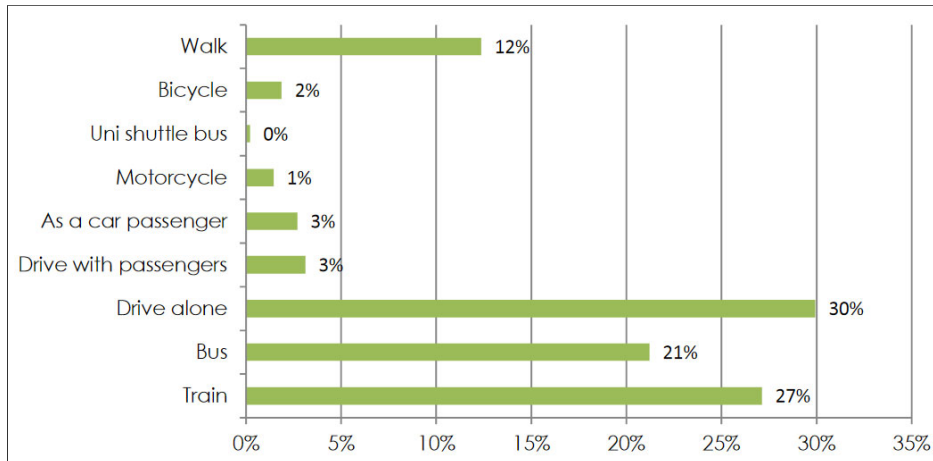


Figure 9 Main mode of transport to Macquarie University

Source: 2014 Macquarie University travel survey report (GTA Consultants)

The level of public transport usage (train and bus) has increased significantly from 13% in 2010 to 37% in 2012 (plus a proportion of 14% multi-modal trips) and 48% in 2014. Bus usage has increased from 8% to 21% over this period, whilst train usage has increased from 6% to 27%. The increase in train patronage is reflective of the improved train frequencies servicing the Macquarie University Railway Station. A summary of the travel trends to MQU is shown in Figure 10.

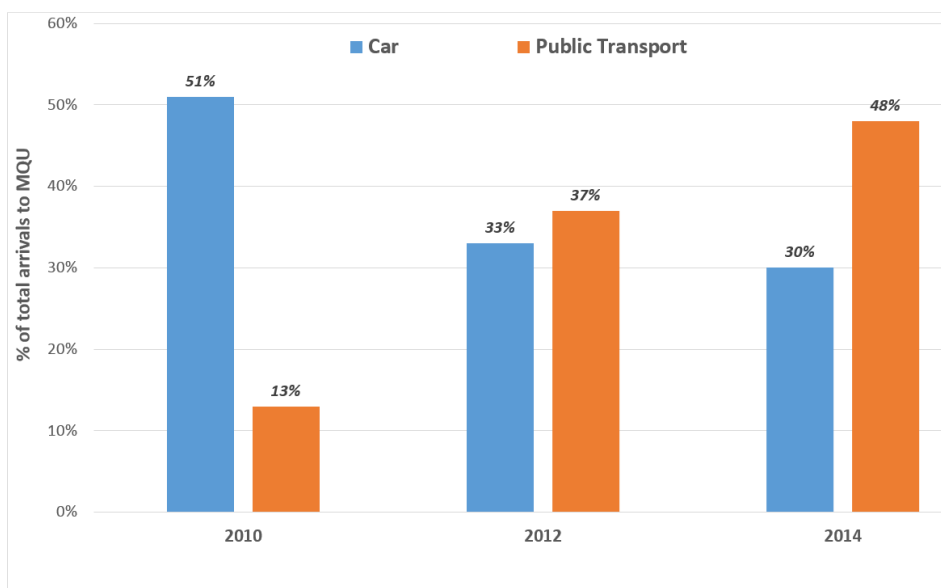


Figure 10 MQU travel trends

3.7.3 Demographic Data

The 2014 Macquarie University Travel Survey analysed the distribution of the home location of students and staff. This distribution is presented in Figure 11, and demonstrates a high proportion of students and staff live within close proximity (5km) to the campus. This is within feasible cycling distance. Further, a high number of students and staff live within a 2km radius of the campus which is a viable walking distance.

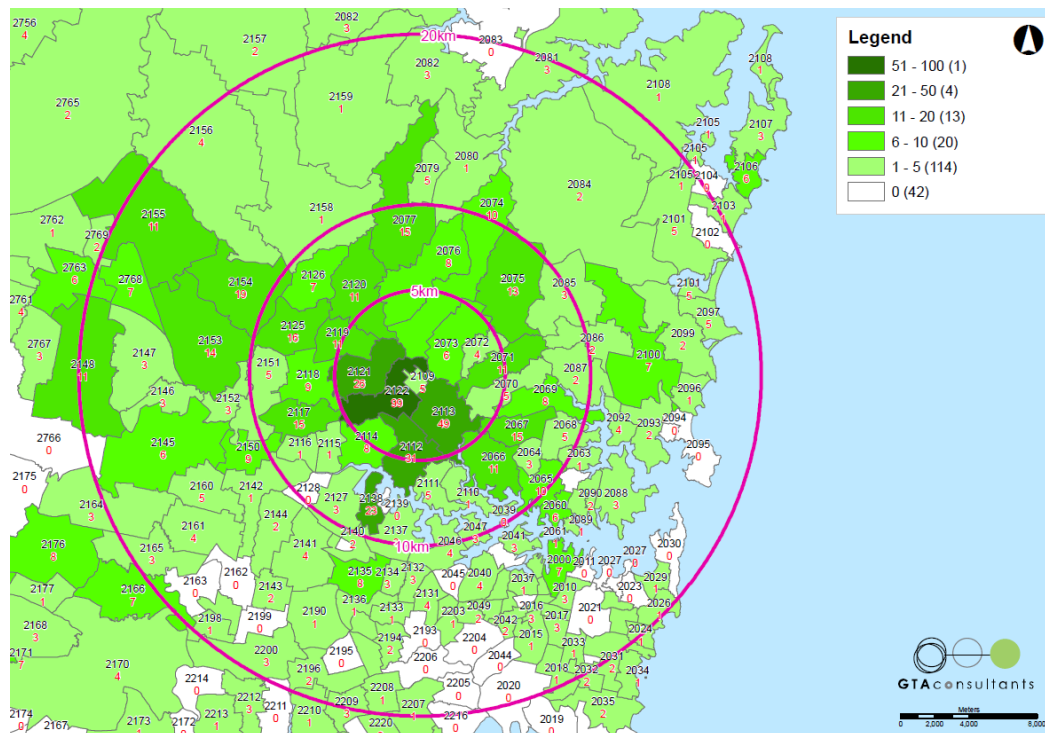


Figure 11 Home location of MQU students and staff

Source: 2014 Macquarie University travel survey report (GTA Consultants)

The majority of staff and students were found to reside in the northern Sydney area. The top five postcodes for student/staff population were as follows:

- 2122: Eastwood, Marsfield
- 2133: Macquarie Park, North Ryde, East Ryde
- 2112: Putney, Ryde, Denistone East
- 2121: Epping, North Epping
- 2138: Rhodes, Liberty Grove, Concord

4 Proposed Development

4.1 Description

The proposed development consists of a six to seven storey building to be occupied for university-related office, administration and laboratory uses, as well as some commercially-leased office and laboratory space. The development also proposes 619 car parking spaces in a shared multi-level basement car park. The total proposed GFA is 49,445m². A breakdown of the proposed GFA is broken down by use in Table 4.

Table 4: Proposed development GFA per land use

Use	GFA (m ²)
University office space	19,231
University laboratory space	6,594
Office space	16,112
Laboratory space	6,635
Retail	873
Total	49,445

Works will be carried out along University Avenue as part of the main works also in order to facilitate access to the development. These works consist of:

- Removal of two existing roundabouts along University Avenue
- Construction of a new roundabout providing access to the basement car park of the proposed development as well as the existing Cochlear basement car park.
- Footpath realignment, road markings, signage and a new pedestrian crossing

In addition to the new buildings and road works, the development proposes high quality landscaping and a strong north-south pedestrian link through the site which connects University Avenue and Macquarie Walk.

4.2 Building Population

The proposed development will accommodate approximately 3,450 staff and 215 students at any one time.

4.3 Pedestrian Access and Facilities

The main pedestrian routes to the new development will be along University Avenue and Macquarie Walk.

A new, wide, high quality north-side pedestrian link between the two buildings and connecting University Avenue with Macquarie Walk is proposed. The main entrance to 8 – 12 University Avenue will be off this link, with the buildings also accessible off each of the streets.

A widened zebra crossing will be provided across University Avenue which will align with the through site link. This is shown in Figure 12.

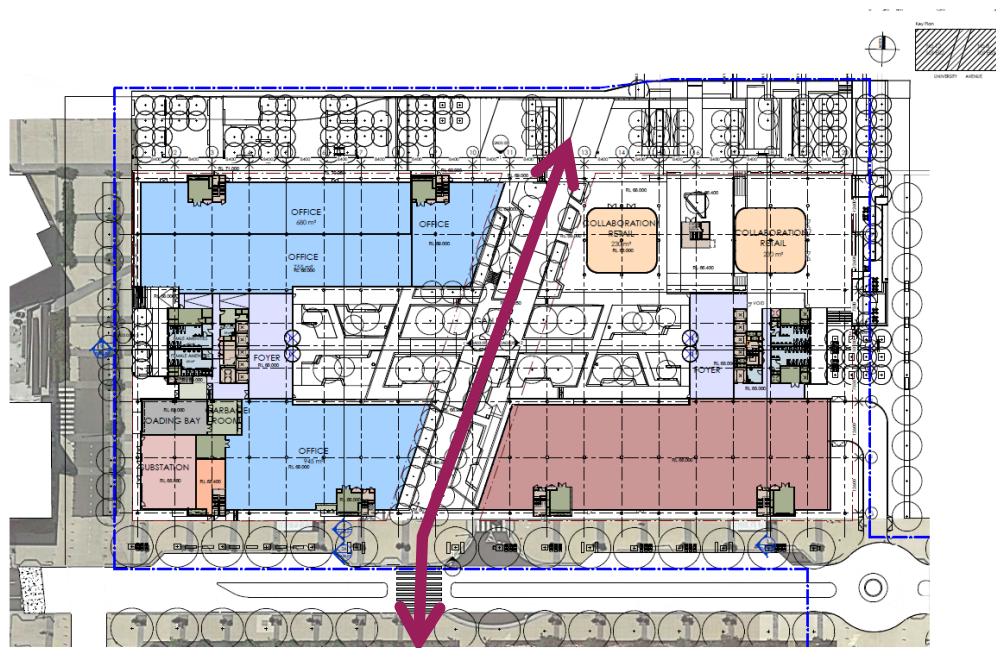


Figure 12 Future pedestrian connection

This link is expected to be an attractive route for pedestrians as it matches a key desire line between the bus stands along University Avenue and University Common and Wallys Walk (the pedestrian spine of the campus).

Shower and changing facilities are proposed to be provided in both buildings at basement level.

Pedestrian routes to access destinations outside the University campus are expected to predominately use University Avenue and Waterloo Road. Research Park Drive and Herring Road will also be significant, particularly for those pedestrians accessing the bus stands along Herring Road. Pedestrian routes to key destinations surrounding the campus are shown in Figure 13.

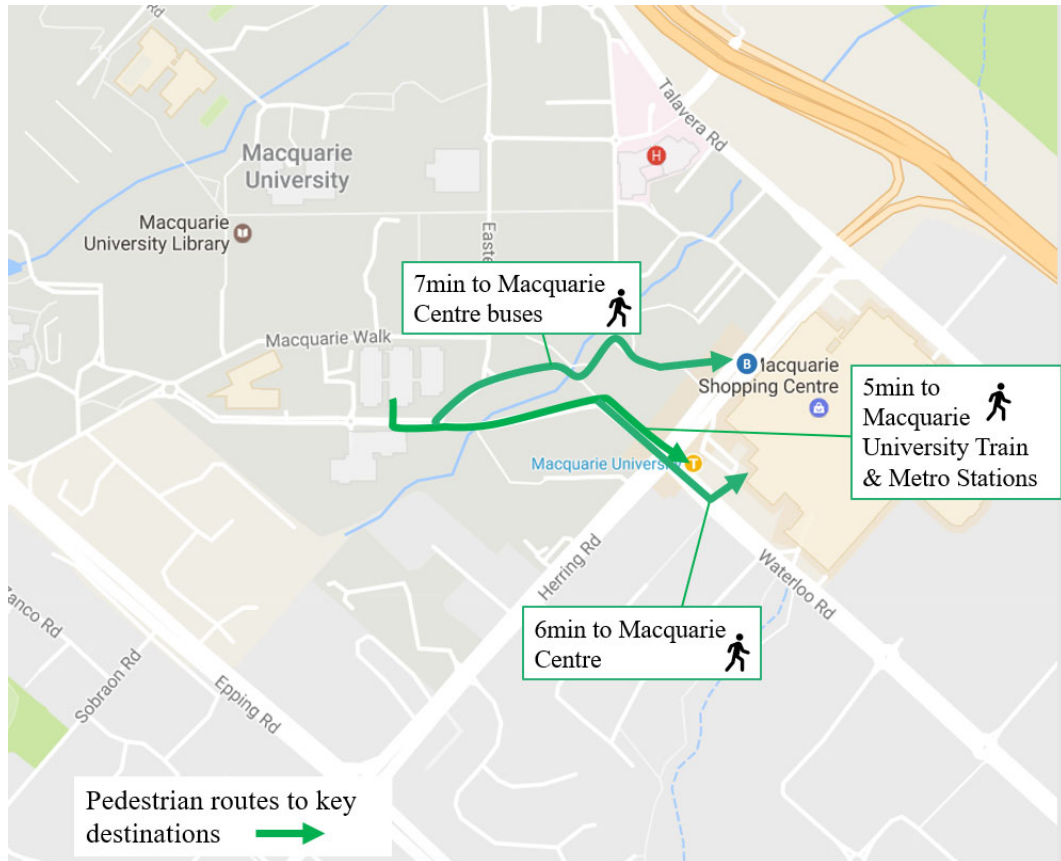


Figure 13 Pedestrian routes to key external destinations

4.4 Cycle Access and Facilities

It is proposed to provide 140 bicycle parking spaces for the development, which is well above the 62 spaces required under the City of Ryde Development Control Plan 2014 - which requires bicycle parking to be provided at a rate of 10% of the required car parking. In addition, 8 – 12 University Avenue will accommodate a total of 10 showers across both buildings. The bicycle parking is located adjacent to the changing facilities associated with each building.

140 bicycle parking spaces is equivalent to approximately 5% of the overall staff population of 3,450. Therefore this provision is suitable to accommodate current and expected growth in cycling to the campus.

Dedicated cycle access has been proposed off Eastern Road, ramping down to BL2 where the bicycle and changing facilities for E03 are located.

4.5 Private and Service Vehicle Access

It is proposed that cars enter the basement car park via the eastern end of the site via the existing roundabout on University Avenue. This entry would also provide access for service vehicles. A separate service vehicle entry is also proposed at the western end of the site which will generally accommodate waste collection. These access arrangements are illustrated in Figure 14 below.

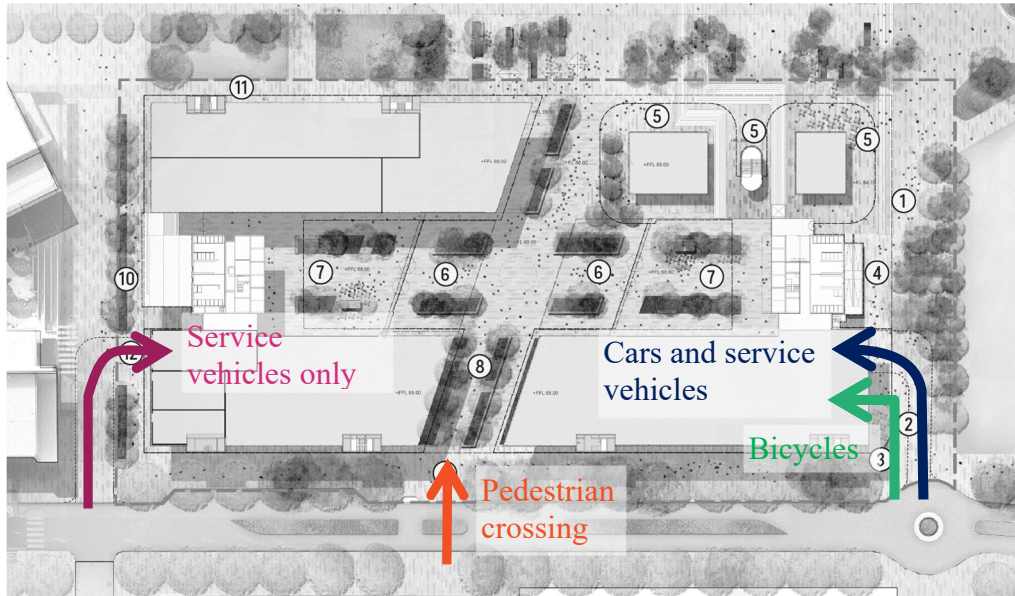


Figure 14 Proposed access arrangements

It is proposed to provide two loading bays and three courier bays within the basement car park which will be located on Level 2, close to the car park entry point.

4.6 Car Parking and Standards

The Macquarie University Concept Plan sets a car parking standard of a maximum of 1 parking space per 80m² of non-academic development within Precinct E. On the basis of the approximately 49,445m² Gross Floor Area for the 8-12 University Avenue project, a maximum of 619 car parking spaces could be provided. A total of 619 spaces are proposed which complies with the maximum permissible number of parking bays and therefore the provision complies with the Concept Plan approvals.

Parking will be provided underground across three basement levels. It is proposed to provide 233 spaces on Basement Level 1 (BL1), 266 spaces on BL2 and 120 spaces on BL3.

It is proposed to provide 7 accessible parking spaces which meets the minimum requirement of 1 space per 100 car parking spaces as outlined in Australian Standards.

5 Transport Assessment

5.1 Compliance with Concept Plan

A summary of how the proposal complies with the relevant conditions and statement of commitments of the Macquarie University Concept Plan is provided in Table 5 below.

Table 5 Compliance with Macquarie University Concept Plan

Condition	Addressed in strategy for 8-12 University Avenue
Car parking for non-academic uses shall not exceed a maximum rate of 1 space per 80m ² of gross floor area across Precincts E and F	Car parking is to be provided at a rate of 1 space per 80m ² of gross floor area.
New car parking for non-academic buildings within Precincts D, E and F shall be located within basements	All parking for the site is to be provided within a basement
A 40% non-car mode share target shall be adopted for the academic and non-academic uses on the site.	The design has targeted a 40% non-car mode share by providing for a high quality walking environment – particularly connecting to nearby public transport, as well as providing bicycle parking at rates exceeding that recommended in the Ryde Council DCP
A detailed micro-simulation transport model of the University internal road network and surrounding “area of influence” will be developed	The micro-simulation model has not yet been endorsed. However, some agreement has now been reached on the intersection upgrades, with RMS acknowledging that only two intersection upgrades (Epping Road /Herring Road and Epping Road / Balaclava Road) remaining outstanding. A VPA is being prepared between the University and RMS to finalise this agreement. Following the execution of this VPA, the RMS has proposed to endorse the micro-simulation model
New developments will be required to prepare a Workplace Travel Plan (WTP) for individual sites in accordance with City of Ryde DCP 2006 Part 4.5	A draft workplace travel plan has been prepared as part of this study
All internal roads are to be designed and constructed consistent with the requirements of all relevant Australian Standards, and the requirements of Council and Austroads as applicable	The design has provided for roads and parking layouts that are consistent with the requirements of Australian Standards and Austroads.
The design is to make provision for adequate setbacks along Balaclava Road (from Epping Road to University Avenue) and Waterloo Road (from Herring Road to Research Park Drive) to facilitate additional capacity improvements and bus priority	In September 2018 correspondence was provided from TfNSW to Macquarie University in relation to this condition. The correspondence noted that, following consultation with RMS, TfNSW endorses that this condition is closed out.

5.2 Total Trips

The number of people travelling to the site has been forecast based on existing travel patterns as described in section 3.7 of this study as well as the future building population. Vehicle mode share has been adjusted down to reflect the constrained parking environment on site as well as the forecast traffic generation (described further in Section 5.5).

The forecast number of people travelling to site over the day and peak period is summarised in Table 6 below.

Table 6 Total trips to the site

Mode	Mode Share		Number of people travelling to the site		
	Staff	Students	Daily	AM peak period (3 hours)	AM peak hour
Car as driver	23%	10%	798	598	299
Bus	18%	25%	675	506	253
Car as passenger	3%	3%	110	82	41
Train / Metro	42%	45%	1546	1159	580
Walked only	13%	16%	483	362	181
Other mode	1%	1%	37	27	14
Total	100%	100%	3,648	2,736	1,368

5.3 Road Network Changes

To facilitate efficient access into the site, it is proposed to modify the internal road network within the University as follows:

- Removal of the existing roundabout on University Avenue (opposite Cochlear building)
- Provision of a new roundabout at the eastern boundary of the 8-12 University Avenue site. This would have the roundabout aligned with access to Cochlear and 8-12 University Avenue.

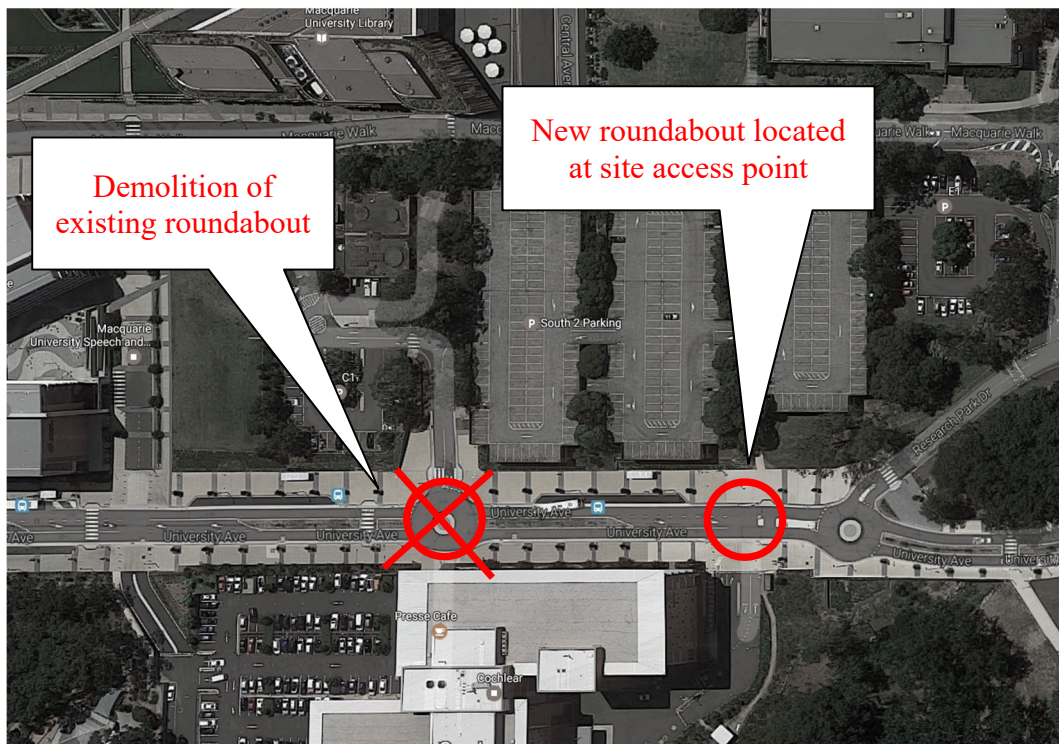


Figure 15 Proposed road network changes

5.4 Parking

The site at present contains approximately 1,050 parking spaces. Car park changes are being undertaken to maintain the parking balance on campus when the 'South 2' car parks (C2, C3, E1) are demolished to make way for the new 8-12 University Avenue building.

To compensate for their demolition, the West 5 (X8) car park is being extended (see Figure 16) to fully offset the loss spaces on the current site of 8-12 University Avenue. The DA for the temporary car park was submitted and approved in 2009 and form part of a car park staging plan associated with the University Concept Plan.

The temporary car park has been completed and is available for use.



Figure 16 Temporary car park location

5.5 Traffic Generation

The peak hour vehicle trip generation rates below are based upon surveys undertaken at Macquarie University as part of the development of the Precinct E Concept Plan.

These rates are as follows:

- AM peak hour (7.45 – 8.45) 0.6 vehicle trips per 100m² GFA
- PM peak hour (4.45 – 5.45) 0.5 vehicle trips per 100m² GFA

These rates are considered to be robust and conservative considering the 40% non-car mode share for academic and non-academic uses set out in the Macquarie University Concept Plan.

Table 7: Peak hour traffic generation

GFA	AM Peak Rate (per 100m ²)	AM – No. of car trips	PM Peak Rate (per 100m ²)	PM – No. of car trips
49,445	0.6	295	0.5	246

As set out in Table 7, the development is estimated to generate 295 car trips (two-way) in the AM peak period and 246 car trips in the PM peak period.

In the AM peak, it is assumed that 80% of vehicles are accessing the car park and 20% are egressing the car park, while in the PM peak it is assumed that 80% of vehicles are egressing the car park and 20% are accessing the car park.

Table 8 Directional trips

AM Peak		PM Peak	
Entry car trips	Exit car trips	Entry car trips	Exit car trips
236	59	49	197

It is estimated that the number of daily vehicle trips will be roughly equivalent to five times those in the AM peak hour. This accounts for trips made for business during the day as well as trips outside of the commuter peak hours. This provides a total of 1,475 daily vehicle trips.

It should be noted that the impact of decanting spaces from around the campus into the temporary car park (see Figure 16) was assessed at that time for both the temporary car park DA and the REF for the demolition of the car parks on the site of the proposed works.

5.6 Trip Distribution and Assignment

The Macquarie University Gateway Traffic Management Plan proposes to close Research Park Drive as well as prohibit the right-turn movement from University Avenue onto Herring Road. Taking these changes to the internal road network into account, the internal vehicular routes between the car park entrance and the external road network will be:

- Eastbound along University Avenue to the junction with Waterloo Road and Herring Road
- Westbound along University Avenue and Balaclava Road to the junction with Epping Road

Based on existing traffic volumes, it is anticipated that traffic will be distributed 50/50 between the junctions of Waterloo Road/Herring Road and Epping Road/Balaclava Road as presented in Figure 17.

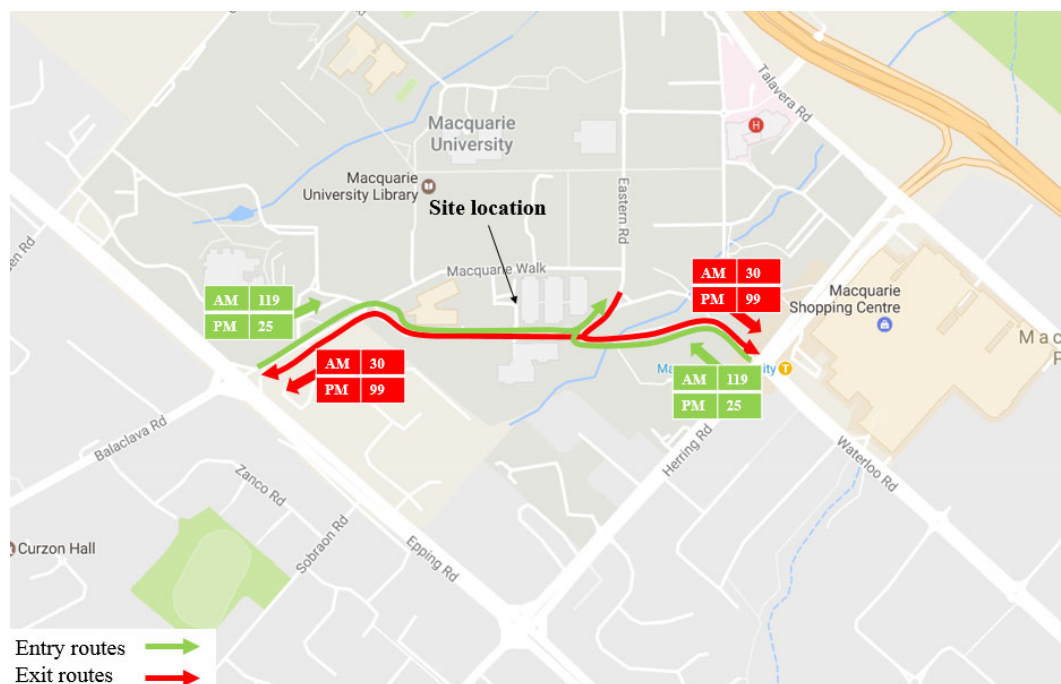


Figure 17 AM and PM peak trip distribution

The development is anticipated to generate approximately 147 vehicle trips (two-way) at both intersections during the AM peak hour and 128 vehicle trips (two-way) during the PM peak hour. It should be noted however that the current public car park, which contains 1,050 spaces, would generate a greater quantum of traffic relative to the 8-12 University Avenue site which has 619 parking spaces. Even taking into account the small number of vehicles that may access the temporary car park via Waterloo Road, there will be a net reduction in traffic movements at the Herring Road / Waterloo Road intersection as a result of the proposal.

5.7 Road Network Impacts

5.7.1 Background

Condition C10 of the Macquarie University Precinct E Concept Plan was the development of a detailed micro-simulation model, to be prepared in liaison with Council, the RTA and the Ministry of Transport and submitted to the Department of Planning for approval prior to or with the submission of the first application for new non-academic floor space on the site.

The traffic modelling involved extensive consultation with key agencies, including RMS, City of Ryde and Transport NSW. Numerous meetings were held with the RMS to agree key parameters for the modelling and to provide feedback at key stages of the modelling process.

5.7.2 Assumed development

The traffic modelling undertaken considered the maximum additional GFA across the Campus as limited by the Concept Plan conditions of approval as follows:

• Precinct D (Macquarie University Research Park)	136,000 m ²
• Precinct E (Station North)	90,000 m ²
• Precinct E (Station South)	85,000 m ²
• Precinct E (Triangle South of University Ave)	155,000 m ²
• Precinct F	70,000 m ²
• Academic Core	61,200 m ²

A total of 400,000 m² of new non-academic GFA and associated parking is located outside the Academic Core and the Macquarie University Research Park in Precincts E and F.

The maximum parking allowed across the Campus is 10,800 spaces and was distributed as follows:

• Precincts A, G, and H (total)	4,095
• Precinct B	1,000
• Precinct D	705
• Precinct E and F (total)	5,000

5.7.3 Outcomes of traffic modelling

The traffic modelling undertaken for the Concept Plan identified a number of road network upgrades required to support the growth of Macquarie University (as envisaged in the Concept Plan) and the wider Macquarie Park precinct. Macquarie University is currently in negotiations with both City of Ryde Council and the Department of Planning and Environment to enter into a Voluntary Planning Agreement (VPA) to provide monetary contributions for the following transport infrastructure:

- Epping Road / Balaclava Road intersection – additional through lane on Balaclava Road (south) and additional right turn lane on Balaclava Road (north)
- Epping Road / Herring Road intersection – additional through lane on Herring Road (south), additional right turn lane on Epping Road (east), two through lanes and two right turn lanes on Herring Road (north) and adjusted signal phasing.
- Waterloo Road / Culloden Road intersection – realign Gymnasium Road to make fourth leg at roundabout and provide two lane circulating roundabout.
- Contributions towards an enhanced shared use path network

5.7.4 Future road network performance

The future operation of the road network in Macquarie Park was considered by RMS in the development of the Bus Priority Infrastructure Program (BPIP), which aims to deliver bus priority improvements in the precinct. The supporting traffic and transport assessment utilised an Aimsun traffic model to understand future performance of key intersections. This modelling included all approved developments in Macquarie Park, including the Macquarie University Concept Plan. Table 9 provides a summary of the forecast future performance of key intersections in the area.

Table 9 Future intersection performance

Intersection	Level of Service (2031)	
	AM peak hour	PM peak hour
Epping Rd / Herring Rd	F	F
Epping Rd / Lane Cove Rd	F	F
Lane Cove Rd / Waterloo Rd	D	D
Waterloo Rd / Khartoum Rd	C	C
Waterloo Rd / Byfield St	C	B
Waterloo Rd / Macquarie Centre	B	B
Herring Rd / Waterloo Rd	D	D
Herring Rd / Ivanhoe Pl	A	A

5.8 Pedestrian and Cycle Movements

As described in Section 3.2 and 3.3, the University Concept Plan has pedestrian and cycle network which prioritises movements by those modes over private car movements.

The majority of trips by foot to and from the development will be towards public transport nodes, such as the bus stands on University Avenue or the Macquarie University train station. Based on the 2011 Journey to Work data, approximately 4% of employees will walk to work (assumed to be living within 2km of the University which is towards the upper limit of distance people commute by foot), while 23% will be walking toward bus and rail services.

Pedestrian connectivity around the site will be improved via a new, wide, high quality north-side pedestrian link between the two building and connecting University Avenue with Macquarie Walk. The main entrance to 8 – 12 University Avenue will be off this link, with the buildings also accessible off each of the streets. A widened zebra crossing will be provided across University Avenue which will align with the through site link

5.9 Loading and Servicing

As described in Section 4.5, service vehicles are proposed to enter the basement car park either via the:

- Eastern end of the site via the existing roundabout on University Avenue (also used by cars); or
- Western end of the site (generally just for waste collection and some other service vehicles).

Arup conducted a previous study¹ that led to the development of relationship between GFA and loading dock peak hour vehicle movements (shown in Figure 18). While the level of loading activity is dependent on a number of factors and not simply the GFA of the building, this does provide a useful forecasting tool when assessing the loading and servicing requirements for planned office buildings.

Given the development is expected to have approximately 49,000 m² GFA, 16 loading dock movements are anticipated during the peak hour.

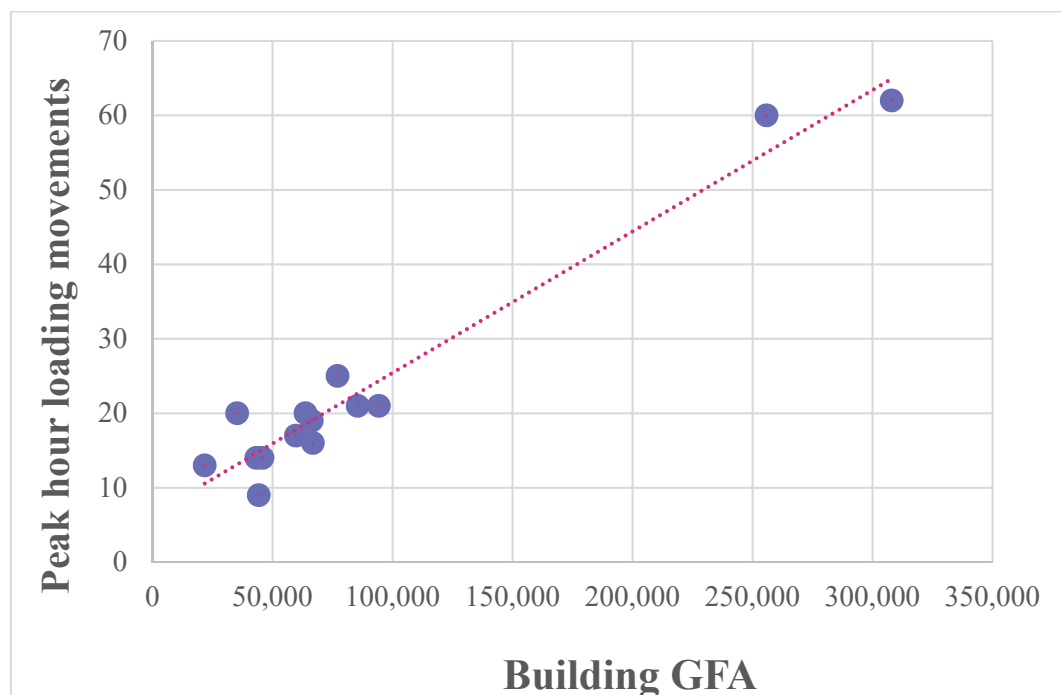


Figure 18 Relationship between building GFA and peak hour service vehicle activity

The development proposes to provide two loading bays for medium rigid vehicles (MRVs) and three courier bays within the basement car park. This provision (at a turnover rate of approximately 20 minutes) is considered sufficient to accommodate the loading and servicing demands during peak hours.

¹ 15 commercial sites across Sydney were used to develop the relationship for TfNSW

5.10 Workplace Travel Plan

A number of travel initiatives are proposed in order to reduce single occupancy vehicle trips and car ownership. This can be enforced through the introduction of a suite of travel demand management measures contained within a Workplace Travel Plan (WTP).

The main objectives of the Workplace Travel Plan are to reduce the need to travel and promotion of sustainable means of transport. Specifically for the site, the primary purpose of the measures is to achieve the target mode splits for journey to work trips as outlined in the Macquarie University Concept Plan.

The more specific objectives to enable staff to adopt the WTP include:

- High modal share for public transport, cycling and walking to work and residential journeys;
- To ensure adequate facilities are provided at the site to enable staff, residents and visitors to commute by sustainable transport modes;
- To reduce the number of car journeys associated with business travel by staff and visitors;
- To facilitate the sustainable and safe travel of new employees;
- To reduce the need to travel for work-related activities, particularly air travel; and
- To raise awareness of sustainable transport amongst staff.

The WTP details proposed initiatives to encourage sustainable travel alternatives. The WTP also includes aspects of monitoring and administration to ensure the schemes are executed and improved over time.

The objectives of the WTP will only be achieved with the support of the staff. Marketing the benefits and promoting the sustainable alternatives available are therefore crucial in encouraging staff to adopt the WTP measures. It is important that at an early stage, staff are made aware of the need for the WTP, and that it is emphasised that the measures are being introduced to support and encourage people to use cars more wisely. In addition to raising general awareness, any successes achieved will be fully publicised to staff in order to motivate them to use sustainable modes of transport.

A framework workplace travel plan is provided in Appendix B of this document.

5.11 Road safety

The proposal will enhance road safety through the introduction of a new zebra crossing on University Avenue, which aligns with the future through site link.

While the development will generate some traffic throughout the day, the overall number of vehicles using University Avenue will reduce as a result of the proposal. This is due to the removal of the existing public car parking area (with capacity for approximately 1,000 cars) which will be relocated to the periphery of the campus. This reduction in vehicle movements will in turn improve pedestrian safety around the site.

A number of safety measures are proposed during the construction phase of the project. These are further detailed in the preliminary construction pedestrian traffic management plan prepared and contained within this document.

5.12 Construction traffic management

Prior to the commencement of construction, a Construction Pedestrian and Traffic Management Plan (CPTMP) will be prepared to ensure the safest possible management of construction access and appropriate mitigation measures. The CPTMP would be prepared by the Construction Contractor and address:

- The likely construction vehicle numbers and frequency;
- Approach and departure routes;
- Parking access arrangements during construction; and
- Provision of acceptable pedestrian management measures

A preliminary CTMP has been prepared follows the following framework:

- Description of proposed works
- Impact of proposed measures
- Effects on existing and future developments
- Detailed of provisions made for emergency vehicles, heavy vehicles and cyclists
- Measures to ameliorate impacts
- Public transport services affected
- Public consultation

The preliminary CPTMP is provided in Appendix A of this report.

6 Conclusions

Arup has been appointed by Macquarie University to undertake a Transport Assessment for the main works associated with a proposed new university office and laboratory development known as 8-12 University Avenue (as identified in the Macquarie University Concept Plan).

The proposed development consists of two A-grade buildings of approximately 49,445m² of Gross Floor Area, with 619 car parking spaces and 140 bicycle parking spaces.

The study has concluded that the proposed development complies with the relevant guidelines and framework as outlined in the Macquarie University Concept Plan (2009), relating to:

- Site access arrangements;
- Car parking rates;
- Design standards;
- Mode share targets; and
- Sustainable travel options

Appendix A

Preliminary Construction Pedestrian Traffic Management Plan

Macquarie University
8-12 University Avenue
Construction Traffic Management
Plan

Issue | 7 November 2018

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 224322-14

Arup Pty Ltd ABN 18 000 966 165

Arup
Level 10 201 Kent Street
PO Box 76 Millers Point
Sydney NSW 2000
Australia
www.arup.com

ARUP

Contents

	Page
1 Introduction	1
1.1 Overview	1
1.2 Scope of works	2
2 Staging and Activities	3
3 Construction Details	4
3.1 Construction timing	4
3.2 Personnel and Working Hours	4
3.3 Construction traffic movements	4
4 Construction Traffic Routes	6
4.1 Emergency Vehicles	7
4.2 Public Transport Services Affected	7
5 Cumulative Construction Traffic	8
5.1 Road Network Impacts	8
5.2 Parking	8
5.3 Pedestrians and Cyclists	10
5.4 Public Transport	10
6 Measures to Ameliorate Impacts	12
6.1 Mitigation Measures	12
6.2 Driver Code of Conduct	13
6.3 Next Steps	13
7 Summary	14

1 Introduction

1.1 Overview

This report details a preliminary Construction Traffic Management Plan (CTMP) for the construction of a proposed new development at Macquarie University, known as 8-12 University Avenue (SSD 9313). The proposal comprises a six to seven storey building to be occupied for university-related office, administration and laboratory uses, as well as some commercially-leased office and laboratory space.

The purpose of this CTMP is to assess the proposed access and operation of construction traffic associated with the construction of the development.

The site is located on the northern side of University Avenue (as shown in Figure 1) and is currently occupied by a multi-storey car park, at-grade car park, a security building and an area of open lawn (as shown in Figure 2).

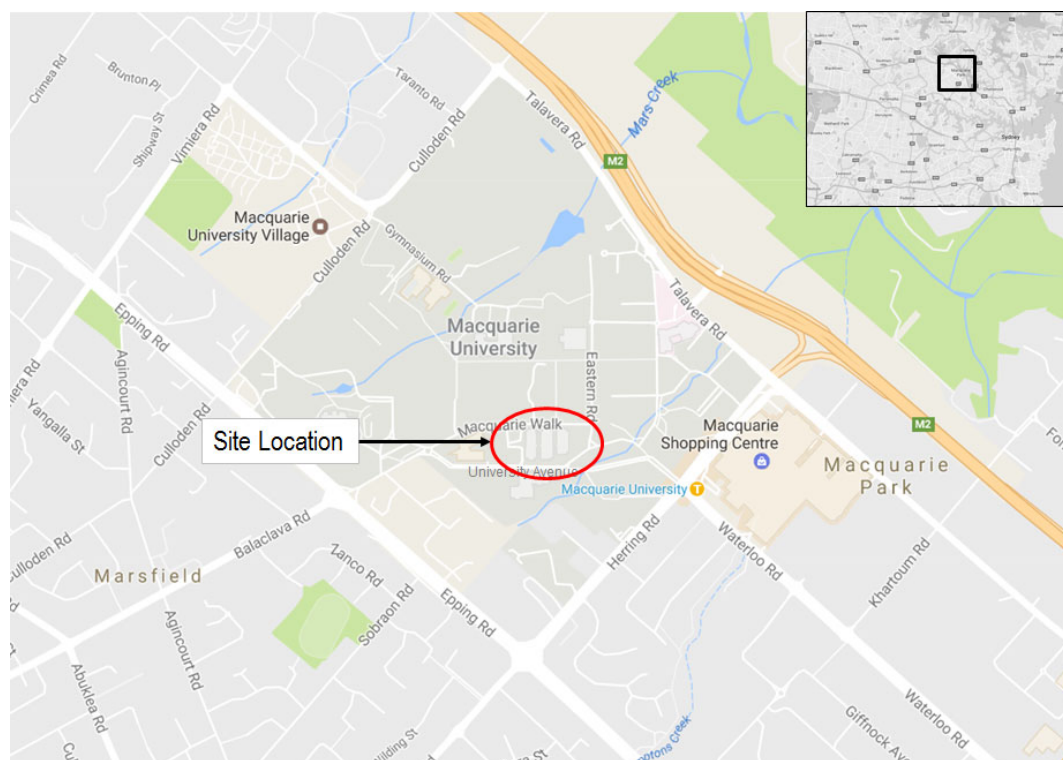


Figure 1: Site location

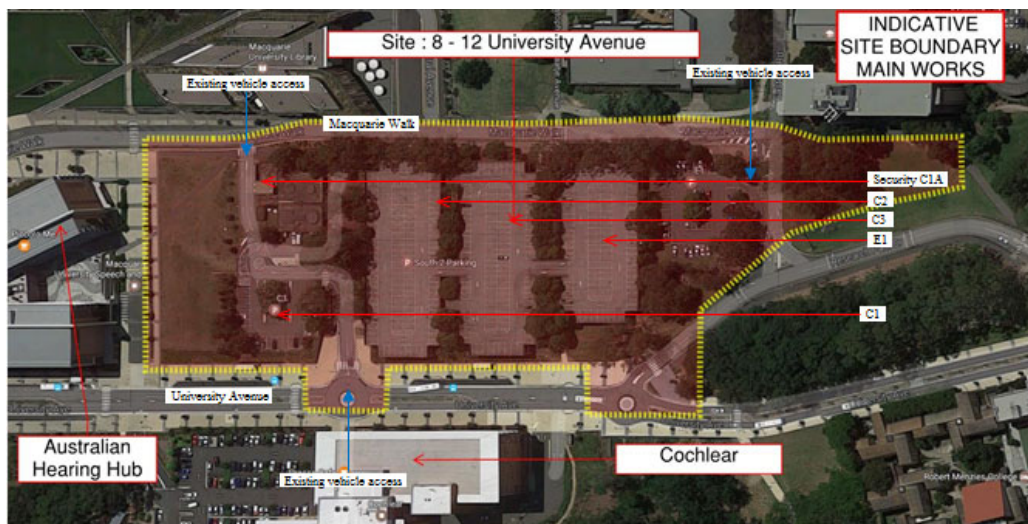


Figure 2: Aerial photo of the site boundary

1.2 Scope of works

The scope of works for the project includes the following:

- Retention and protection of up to 84 trees including trees adjoining the site;
- Bulk excavation works to a maximum depth of between approximately 4 metres and 10.6 metres and a volume of approximately 86,000m³ to accommodate basement levels.
- Remediation works as required by the project's Stage 2 Environmental Site Assessment and Asbestos Management Plan, including asbestos removal in accordance with requirements of NSW WorkCover, including stockpiling of approximately 17,614m³ immediately east of the development but within the development site;
- Construction of new part two-, part three- level shared basement carpark that accommodates:
 - 619 parking spaces (of which seven (7) are accessible),
 - Two (2) courier bays,
 - One (1) loading dock (note: additional loading dock at ground level),
 - 140 bicycle parking spaces and end of journey facilities (lockers, showers) accessed via the eastern building elevation;
- Erection of a new campus-style university office and laboratory building comprising two attached buildings (Building 8 and Building 12) of six and seven storeys respectively, with a total GFA of 49,445sqm.
- New plantings at all street frontages, along the diagonal link and within the atrium and other locations within the campus over time (including at least 111 trees applying the MQU policy of offsetting at least 1:1 compared to trees removed campus-wide); and
- Road and public domain works around the proposed building.

2 Staging and Activities [SZ2]

There will be two main elements associated with the construction of the proposed development, the demolition of the existing site (Early Works) and the construction of the new development (Main Works).

During the Early Works, the main activities that will generate large vehicle traffic will be the demolition of the existing multi-storey car park and security building. A Demolition Traffic Management Plan (DTMP) has been prepared separately for the Early Works. The DTMP concluded that the traffic impacts related to the demolition works are anticipated to be low, with traffic generation expected to be in the order of 4-6 construction vehicles per hour. These works have been separately addressed and considered as part of a Review of Environmental Factors (REF), which was approved in February 2018.

During the Main Works, the main activities that will generate large vehicle traffic will be excavation works associated with the basement construction and concrete pours associated with the construction of the office buildings.

This project is part of a long-term vision for the development of Macquarie University campus. In addition, the campus adjoins the fast-growing Macquarie Park regional centre. Other current and future projects being planned for at the campus that may coincide with the staging of this project include:

- Central Courtyard Precinct redevelopment (anticipated construction until 2020);
- Arts Precinct Project; and
- Macquarie Law School (anticipated construction between early 2020 and 2022).

3 Construction Details

3.1 Construction timing

At this stage it is expected that construction will take place over a 30 month period, with commencement no earlier than July 2019 and completion no earlier than December 2021.

3.2 Personnel and Working Hours

Typically it is expected there will be 200 people on site during the construction period.

Working hours will be as follows:

- Weekdays: 7am – 6pm
- Saturdays: 7am -1pm
- Sundays and public holidays: No work

3.3 Construction traffic movements

The demolition and construction works would generate vehicle traffic travelling to, from, and within the University campus. Site traffic generation has been divided into light vehicles and heavy vehicles below.

3.3.1 Light vehicles

Workers will generate some additional traffic to the site. Typically, the main stage of the construction is likely to have a workforce of approximately 200 personnel. Given the public transport availability to the site and limited on-site parking opportunities, the majority of construction workers will be required to take public transport to work. Typically construction workers have a high vehicle occupancy of between 2-3 people per vehicle, particularly for sites with constrained parking environments. Therefore the likely number of light vehicles generated by the project would be in the order of 30-40 per day.

Additionally, construction workers generally start earlier and finish earlier than the commuter peak periods, and would likely not coincide with the site's peak periods.

3.3.2 Heavy Vehicles

It is expected that the construction project will generate in the order of 40 heavy vehicles per day, based on a 30 month construction program. This equates to approximately 4 vehicles per hour. This volume of traffic is significantly less than the existing level of traffic that currently utilise the C1, C2, C3 and E1 car parks on the site.

As the project is in its preliminary stages, the following forecasts are approximate and may vary once a contractor is appointed.

4 Construction Traffic Routes

Construction vehicles would be restricted to collector and arterial roads, with movements along local residential streets prohibited. It is envisaged that the key traffic routes for construction vehicles would be via the M2 Motorway, Epping Road and Herring Road. This is shown in Figure 3.

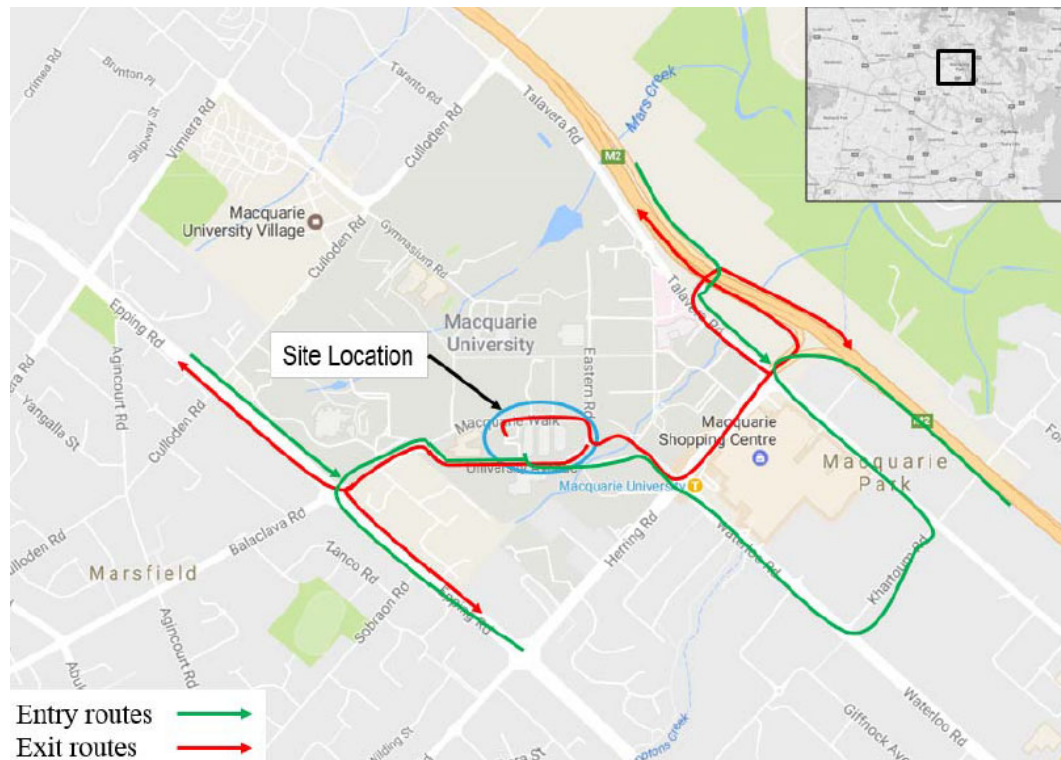


Figure 3: Construction traffic routes

Access for construction vehicles into the campus is proposed to be via the intersections of Balaclava Road/Epping Road and Herring Road/University Avenue.

Macquarie Walk (from east of the Library) will be restricted to construction traffic only and may be occasionally used as a loading zone if required. The egress route toward Herring Road also proposes to use a section of Research Park Drive which is currently closed.

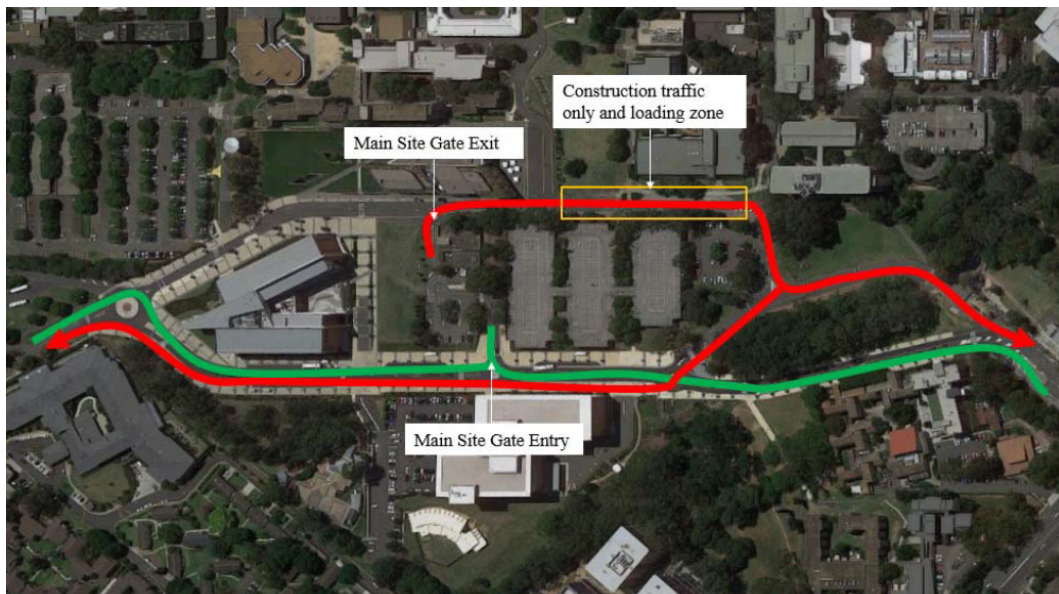


Figure 4: Site vehicle access plan

All movements into and from the site will be in a forward direction, with more detail provided when a contractor is appointed.

4.1 Emergency Vehicles

Construction works and vehicle storage would be confined to the site. As such, no additional specific provisions for emergency vehicles have been identified on the surrounding road network.

4.2 Public Transport Services Affected

It is not expected that public transport services would be affected by the works. The small number of additional construction vehicles would not impact the operation of the public transport network in the vicinity of the site. The number of daily vehicles associated with the works is likely to be less than that currently using the C1, C2, C3 and E1 car parks.

5 Cumulative Construction Traffic

5.1 Road Network Impacts

Workers will generate additional traffic to the site. Road network impacts may be mitigated by the fact that construction workers generally start earlier and finish earlier than the commuter peak periods, and would likely not coincide with the peak traffic period of the Macquarie Park road network.

The good availability of public transport in the precinct, with Macquarie University railway station within walking distance and a number of buses serving the campus adjacent to the site, will encourage workers to minimise private vehicle use which will further reduce the impacts on the local road network.

The total traffic generated by the construction project is significantly less than the amount of trips generated and assessed for the operational phase of the development and therefore the potential impacts are anticipated to be minimal.

The closure of Macquarie University train station as part of the Sydney Metro Upgrade works will commence from 30 September 2018 and continue for seven months. The construction works will not commence until (at least) July 2019 and therefore will not overlap with the station closure.

5.2 Parking

5.2.1 Public car parking

The site at present contains approximately 1,050 parking spaces. Car park changes are being undertaken to maintain the parking balance on campus when the 'South 2' car parks (C2, C3, E1) are demolished.

To compensate for their demolition, the West 5 (X8) car park has been extended (see Figure 5) and the West 6 (X13) will be upgraded and extended to fully offset the lost spaces on the current site of 8-12 University Avenue. The DA for the temporary car park was submitted and approved in 2009 and forms part of a car park staging plan associated with the University Concept Plan.



Figure 5: Temporary car park location

5.2.2 Contractor car parking

Car parking for staff and contractors will be located in the remaining at-grade E1 car park. This will provide for at least 20 on-site parking spaces for construction staff. The location of construction staff parking is indicatively shown in Figure 6. Construction staff will generally be encouraged to either carpool or arrive to the site via public transport.

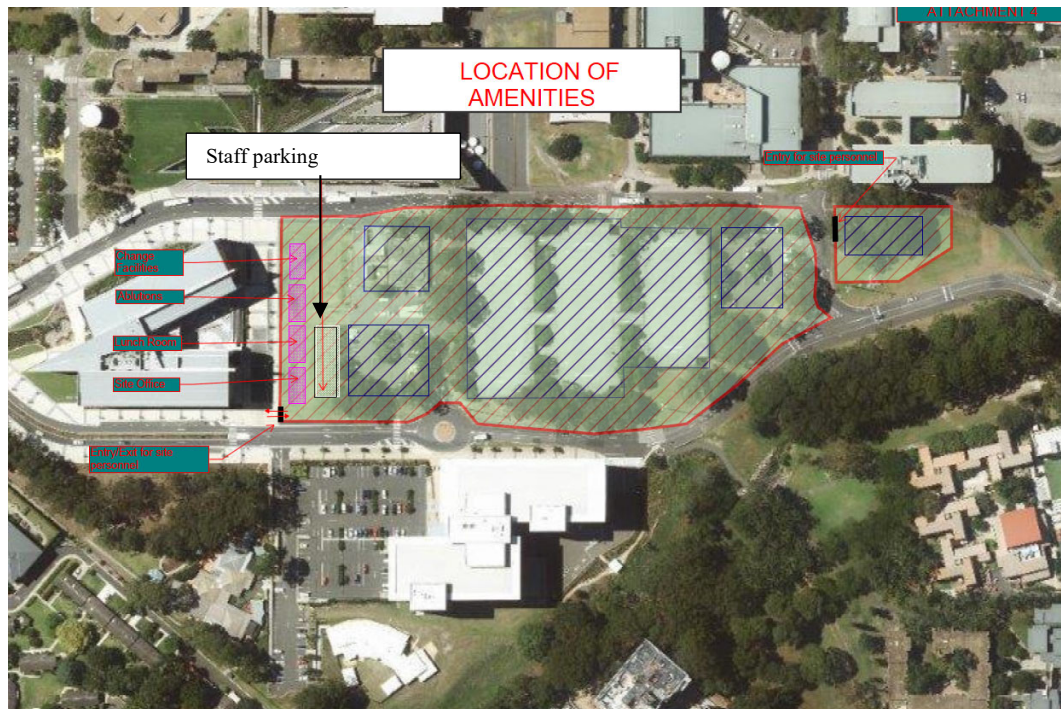


Figure 6: Location of amenities plan

5.3 Pedestrians and Cyclists

Pedestrians and cyclists on Macquarie Drive and on University Avenue may be impacted from walking past the site during construction. Traffic controllers with appropriate accreditation will manage construction vehicles and allow pedestrians and cyclists to cross the works areas. The contractor appointed will prepare a detailed Construction Pedestrian and Traffic Management Plan (CPTMP) prior to works being carried out on site. This will include details in relation to advanced warning signage and the location of traffic controllers.

In general, all footpaths adjacent to the site will remain open for pedestrians at all times. Traffic controllers will be present in key locations to manage the interaction of pedestrians and construction vehicles.

Construction vehicles entering, exiting and driving around the site will be required to give way to pedestrians at all times, as required under the NSW Road Rules.

There are presently no dedicated cycling facilities (i.e. on road bike lanes, shared paths) within the University campus, with the majority of the cycle routes being shared with pedestrians. Access to the two bike hubs located adjacent to Eastern Road near the Central Courtyard and Western Road near the W4 car park are not anticipated to be impacted by the construction of the development.

5.4 Public Transport

No bus services would be impacted by construction traffic as the work is confined to off-street works. The appointed contractor will ensure that trucks do not queue along University Avenue (which is also a bus route through the campus) and

instead, trucks will directly enter and be wholly accommodated within the site. No loading/works zones will be established along University Avenue.

6 Measures to Ameliorate Impacts

6.1 Mitigation Measures

Mitigation measures will be adopted during the demolition and construction phases to ensure traffic movements have minimal impact on surrounding land uses and the community in general, and would include the following:

- Manage and control construction traffic movements on the adjacent road network and vehicle movements to and from the site;
- Trucks to enter and exit the site in a forward direction;
- Displaced parking to be relocated in temporary car park on campus;
- Limited amount of parking to be provided for construction workers;
- Maintain traffic capacity at intersections in the vicinity of the site;
- Restrict construction vehicle activity to designated truck routes;
- Construction access driveways to be managed and controlled by certified site personnel;
- Pedestrian movements adjacent to demolition activity, across construction access driveways and to/from public transport facilities will be managed and controlled by site personnel where required;
- Pedestrian warning signs and construction safety signs/devices to be utilised in the vicinity of the site and to be provided in accordance with WorkCover requirements;
- Construction activity to be carried out in accordance with Council's approved hours of work;
- Truck loads would be covered during transportation off-site;
- Establishment and enforcement of appropriate on-site vehicle speed limits (30km/h), which would be reviewed depending on weather conditions or safety requirements;
- Activities related to the demolition works would not impede traffic flow along local roads;
- Materials would be delivered and spoil removed during standard construction hours;
- Construction vehicles not to queue on University Avenue and be wholly accommodated within the site; and
- Minimal construction traffic movements to/from the site will be made during peak hours to minimise the impact on the wider road network.

6.2 Driver Code of Conduct

To manage driver conduct, the following measures are to be considered for implementation:

- All deliveries are to be pre-booked;
- All deliveries are to check-in at the site office; and
- Drivers are to give way to pedestrians.

Traffic controllers will be used to stop traffic on the public streets to allow trucks to enter or leave the site. Vehicles must enter and exit the site in a forward direction. They must wait until a suitable gap in traffic allows them to assist trucks to enter or exit the site. The Roads Act does not give any special treatment to trucks leaving a construction site - the vehicles already on the road have right-of-way. Vehicles entering, exiting and driving around the site will be required to give way to pedestrians.

6.3 Next Steps

The contractor (once appointed) will prepare a more detailed CPTMP prior to the commencement of works which will include the following:

- Traffic Control Plans;
- Specific methods of safely managing construction vehicle and pedestrian traffic within the surrounding area;
- Crane locations;
- Vehicle turning paths;
- Site compound layout and access;
- Driver facility areas; and
- Additional work zones / road closures.

7 Summary

This preliminary CTMP has been prepared to support the planning application (SSD 9313) for the construction of a new university office and laboratory development known as 8-12 University Avenue. The concept proposal comprises a six to seven storey building to be occupied for university-related office, administration and laboratory uses, as well as some commercially-leased office and laboratory space. The key features of the plan are:

- Traffic impacts related to the construction of the project are anticipated to be low, with traffic generation expected to be in the order of 4 construction vehicles per hour;
- No public transport services are expected to be affected by the project;
- Construction traffic is to be wholly contained within the site and not queue on University Avenue;
- A limited amount of parking is to be provided for construction workers, especially given the proximity of the site to Macquarie University Station and Macquarie Centre bus stands;
- Construction access driveways to be managed and controlled by certified site personnel;
- The construction works will not commence until (at least) July 2019 and therefore will not overlap with the temporary closure of Macquarie University railway station
- Pedestrian movements adjacent to demolition activity, across construction access driveways and to/from public transport facilities will be managed and controlled by site personnel where required; and
- Pedestrian warning signs and construction safety signs/devices to be utilised in the vicinity of the site and to be provided in accordance with WorkCover requirements.

Appendix B

Framework green travel plan

B1.1 What is a Framework Travel Plan?

A Framework Travel Plan (FTP) is a tool to minimise the negative impact of private vehicle travel on the environment. The Plan is a package of measures put in place to encourage more sustainable travel. FTP describes ways in which the use of sustainable transport may be encouraged. Using public transport, cycling, walking, working from home, carpooling, making business vehicles more fuel efficient and the use alternative fuels are all more sustainable means of transport than single occupant driving.

More generally, the principles of a Framework Travel Plan are applied to all people travelling to and from a site. Government authorities around the nation are placing increasing emphasis on the need to reduce the number and lengths of motorised journeys and in doing so encourage greater use of alternative means of travel which have less environmental impact than cars.

B1.2 Benefits of a Framework Travel Plan

The Framework Travel Plan can bring a number of benefits to Macquarie University visitors and staff:

- Employees can enjoy improved health, less stress, a better quality of life, cost and time savings, and greater travel choice;
- Reduced traffic congestion;
- Benefit from improved air quality, less noise and pollutants; and
- Deliver health benefits, tackle obesity and improve residents quality of life

B1.3 Framework Travel Plan Framework

A Framework Travel Plan for the 8-12 University Avenue site will need to address the following issues:

- What are the objectives for the buildings in terms of travel journeys including trips to work, retail and other land uses.
- How are the set objectives going to be met? What measures are going to be implemented and encouraged?
- Who is going to be responsible for the management, implementation and administration of the measures?

B1.4 Framework Travel Plan Objectives

The main objectives of the Framework Travel Plan are to reduce the need to travel and promotion of sustainable means of transport. Specifically for the 8-12 University Avenue site, the primary purpose of the Framework Travel Plan measures is to achieve the target mode split for journey to work trips of 40% public transport / 60% private vehicle for commercial workers.

The more specific objectives to enable staff to adopt the FTP include:

- High modal share for public transport, cycling and walking to work and residential journeys;
- To ensure adequate facilities are provided at the site to enable staff, residents and visitors to commute by sustainable transport modes;
- To reduce the number of car journeys associated with business travel by staff and visitors;
- To facilitate the sustainable and safe travel of new employees;
- To reduce the need to travel for work-related activities, particularly air travel; and
- To raise awareness of sustainable transport amongst staff.

B2 Staff Framework Travel Plan Measures

This section discusses the travel demand measure which can be adopted to reduce the need for staff to travel to work and promote a sustainable means of transport.

A FTP for staff of 8-12 University Avenue will need to address the following issues:

- What are the objectives for the buildings in terms of travel journeys to and from work, during work hours and other travel to and from the building?
- How are the set objectives going to be met? What measures are going to be implemented and encouraged?
- Who is going to be responsible for the management, implementation and administration of the measures?

B2.1 Framework Travel Plan Objectives

The main objectives of the FTP are to reduce the need to travel and promotion of sustainable means of transport, with focus on altering the travel demand to work.

The more specific objectives include:

- High modal share for public transport, cycling and walking to work and residential journeys;
- To ensure adequate facilities are provided at the site to enable staff, residents and visitors to commute by sustainable transport modes;
- To reduce the number of car journeys associated with business travel by staff and visitors;
- To facilitate the sustainable and safe travel of new employees;
- To reduce the need to travel for work-related activities, particularly air travel; and

- To raise awareness of sustainable transport amongst staff.

B2.2 Framework Travel Plan Measures

In order to meet the objectives and targets of the FTP, the following physical and management measures should be implemented.

B2.2.1 General Marketing and Promotion

The objectives of the FTP will only be achieved with the support of the staff of 8-12 University Avenue. Marketing the benefits and promoting the sustainable alternatives available are therefore crucial in encouraging staff to adopt the FTP measures. It is important that at an early stage, staff are made aware of the need for the FTP, and that it is emphasised that the measures are being introduced to support and encourage people to use cars more wisely. In addition to raising general awareness, any successes achieved will be fully publicised to staff in order to motivate them to use sustainable modes of transport.

B2.2.2 Reducing The Need To Travel

To ensure that sustainable transport options are promoted to staff when making journeys for work purposes, and to reduce the need to travel, the following measures should be implemented. These measures require implementation by staff members across the building.

- Active promotion of the office teleconferencing facilities as an alternative to face to face meetings. This can be achieved by placing ‘reducing the need to travel’ as an item on internal group meeting agendas;
- Include teleconference meetings as a standard option in client proposals in preference to face to face meetings where practical; and
- Consider a more formal approach to working from home and actively encourage staff to consider this option. Include working from home as an item on the agenda for internal group meetings.

B2.2.3 Travel During the Working Day

To provide staff with a choice of convenient sustainable transport option for work – related travel during the working day the following initiatives should be promoted:

- Use of the Sydney Trains network to travel to places that are on or near a train line;
- Walk to places that are close by rather than taking the taxi;
- Promotion of the taxi pooling system which would cross check for common destinations and inform the passenger of possible taxi pooling options.

B2.2.4 Cycling

Macquarie University has good access to the cycling network and will provide onsite facilities for cyclists i.e. easily accessible bike room/shelter, changing rooms and showers, lockers and

good access from those facilities to the office. In order to activate and promote cycling the following measures should be taken:

- Provide Sydney cycle maps to staff;
- Participate in annual events such as 'Ride to Work Day';
- Provide secure bicycle parking and end of trip facilities for staff
- Broadcasts in staff areas should have news of events / generic posters promoting cycling;
- Staff who cycle to work should be encouraged to form a Bicycle User Group in order to provide a body of regular cyclists who can discuss issues relating to the provision of on-site cycling facilities and the maintenance of off-site cycle routes; and
- Set up 'Bike Buddies' scheme for less confident staff interested in cycling.

B2.2.5 Public Transport

To promote the use of public transport work related trips and journeys to/from the site.

- Create and maintain an intranet 'Public Transport links page' containing useful links to journey planning websites in Sydney;
- Provide useful public transport maps and promotional items to potential and current public transport users; and
- Investigate the possibility of purchasing an Opal Card for general use of building staff for business journeys, in lieu of cars and taxis

B2.2.6 Walking

Specific Travel Plan measures designed to encourage more walking trips to and from work by those employees living within a reasonable distance.

- Produce walking related articles for inclusion in the office newsletter focussing on 'walking champions' to highlight best practise in walking to business meetings;
- Participate in Walk to Work day.

B2.2.7 Staff Induction

To ensure new members of staff are aware of the FTP, all new staff members should be made aware of the Plan as part of their induction process. The FTP section of the induction should provide new starters with the following:

- A brief introduction to the FTP and its purpose;
- Tour of the office to include a visit to cycle parking areas and shower and changing facilities; and
- Provision of FTP information which would include information on incentives to use sustainable means of transport e.g. /taxi share system.