TDG NSW Pty Ltd
5 Wilson Street, Newtown, Sydney, NSW 2042
PO Box 937, Newtown, Sydney, NSW 2042, Australia
P +61 2 8378 7145 www.tdgaustralia.com.au

Mr S Christoforidis
Director
TLB Engineers
Level 6, 1 James Place
North Sydney NSW 2060

TDG Ref: 14699
23 January 2018

Issued via email: savas@tlbengineers.com

Dear Savas

State Significant Development - Macquarie University Arts Precinct Project
Response to Submissions

TDG has previous been engaged to prepare a Traffic and Parking Assessment to accompany a Secretary's Environmental Assessment Requirements Report, associated with the Macquarie University Arts Precinct Project (MUAPP). Submissions have been received following public consultation, including comments relating to traffic and parking matters, which were made by Transport for NSW and the City of Ryde. The following provides a response to the comments made by the relevant authorities.

1. Transport for NSW Comments

1.1 Truck Access Route

Transport for NSW (TfNSW) has raised concerns about the proposed truck access route. The truck access route is proposed within the Preliminary Construction Traffic Management Plan (CTMP) prepared by TDG, dated October 2017, and forms an Appendix to the Traffic and Parking Assessment. TfNSW make the following comments in relation to the proposed truck route:

> *"The proposed truck access route… is not supported as it has the potential to adversely affect the traffic/transport network"*
>
> *"The Applicant should demonstrate why the alternate truck routes provided in the response to the comments provided by TfNSW (as detailed in Section 7.3 of the CTMP) are not suitable"*

The truck access route proposed by TfNSW would utilise Culloden Road. The following comments are made in relation to the proposed route by TfNSW:

- The intersections of Culloden Road with Talavera Road and Waterloo Road, which are controlled by roundabouts, do not permit easy access for larger vehicles due to the layout of the intersections.
- Culloden Road acts as a residential street and is not appropriate to be used on a regular basis by trucks.
- Macquarie University has strong instructions to separate construction and student traffic to mitigate WHS risks, which would not be achieved by using Culloden Road.

Notwithstanding the above, an alternative truck access route is proposed from the route outlined within the CTMP, in order to address comments made by TfNSW. The revised route is as follows:

- Vehicles travelling to/from the east will access Epping Road via the Pittwater Road / M2 Motorway Interchange.
- Vehicles travelling to/from the west will access Epping Road via Lane Cove Road and the associated interchange with the M2 Motorway.

Vehicles will then enter the University via Balaclava Road, as shown within **Figure 1**.

These roads are all classified within the Roads and Maritime Services *NSW Combined Higher Mass Limits and Restricted Access Vehicle Map*, as roads permitted for 25m/26m B-Double trucks. Accordingly, these roads have been assessed as being appropriate for use by vehicles larger than that proposed as part of this proposal (truck and dog or HRV).

The revised route will prevent trucks being required to use Herring Road, ensuring that construction traffic associated with the MUAPP will be separated as far as possible from:

- The bus interchange and bus routes that operate along Herring Road;
- Construction traffic associated with the MUAPP; and
- The high pedestrian and cyclist traffic along Herring Road.

Accordingly, the revised truck route addresses key concerns raised by TfNSW, will ensure separation of construction traffic from nearby developments and vulnerable road users, and provides an appropriate alternative to the use of Culloden Road.

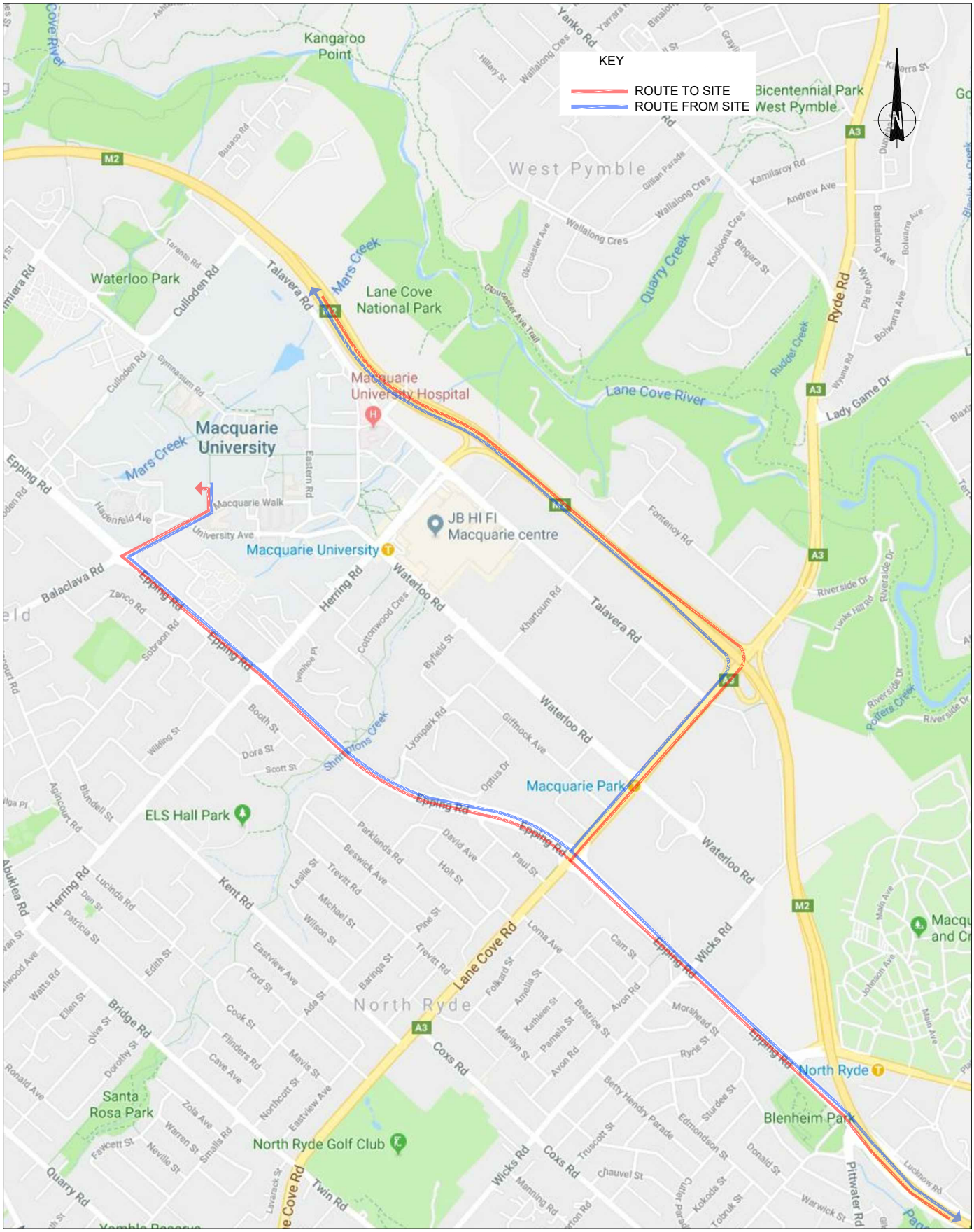
1.2 Truck Traffic Impacts

The comments provided by TfNSW make several references to the impacts generated by the truck movements associated with the construction of the MUAPP, as follows:

> *"The increase in construction vehicle movements from the proposed development has the potential to impact on general traffic and bus operations during commuter peak hours, as well as the safety of pedestrians and cyclists"*
>
> *"The CTMP should stipulate the existing AM and PM peak period for the Macquarie Park precinct and specify that all heavy vehicles will travel outside these hours"*
>
> *"No assessment of the cumulative impact of adjacent developments including the redevelopment of Macquarie Centre is provided"*

In response to these comments, it is noted:

- During the construction of the MUAPP there will be a maximum of 10 truck movements per hour, or one movement every six minutes.
- The traffic surveys presented within the Traffic and Parking Assessment indicate Epping Road, south of its intersection with Balaclava Road, accommodates 3,174 and 2,797 vehicles during the AM and PM peak hour, respectively. Therefore, the additional 10 truck movements per hour will not be discernible given the traffic volumes on the surrounding road network.
- The revised truck route does not rely on the use of Herring Road, where there is increased bus, pedestrian, and cycling movements. Further, the revised truck route will utilise roads appropriate for trucks as specified by RMS.



MACQUARIE UNIVERSITY, W6A & W6B TRAFFIC STUDY

TRUCK ACCESS ROUTE

TDG

1

SCALE: N.T.S

- In order to maintain pedestrian and cyclist safety within the University campus, marshals will be placed at key pedestrian crossing points to control truck and pedestrian movements.

Accordingly, it is concluded that there is ample capacity to accommodate the peak hour truck movements of up to five trucks at all times of the day. The revised truck route will utilise roads that are appropriate for construction vehicles. Therefore, the impacts generated by truck movements to all road users, including that of other developments occurring in the area, will be negligible.

1.3 Bus Operations

TfNSW have noted that the bus layover on the northern kerb of Hadenfeld Avenue will need to be removed based on the swept path analysis presented in the CTMP. The swept path diagram has been updated, which shows that the northern kerb does not need to be removed, and is provided within **Figure 2**.

2. City of Ryde Comments

2.1 Bicycle and Pedestrian Movements

As part of the traffic surveys undertaken at the intersection of First Walk / Macquarie Walk / University Avenue / Balaclava Road, as part of the Traffic and Parking Study, the bicycle and pedestrian movements were recorded. The results of the survey are presented below in **Figure 3** and **Figure 4**.

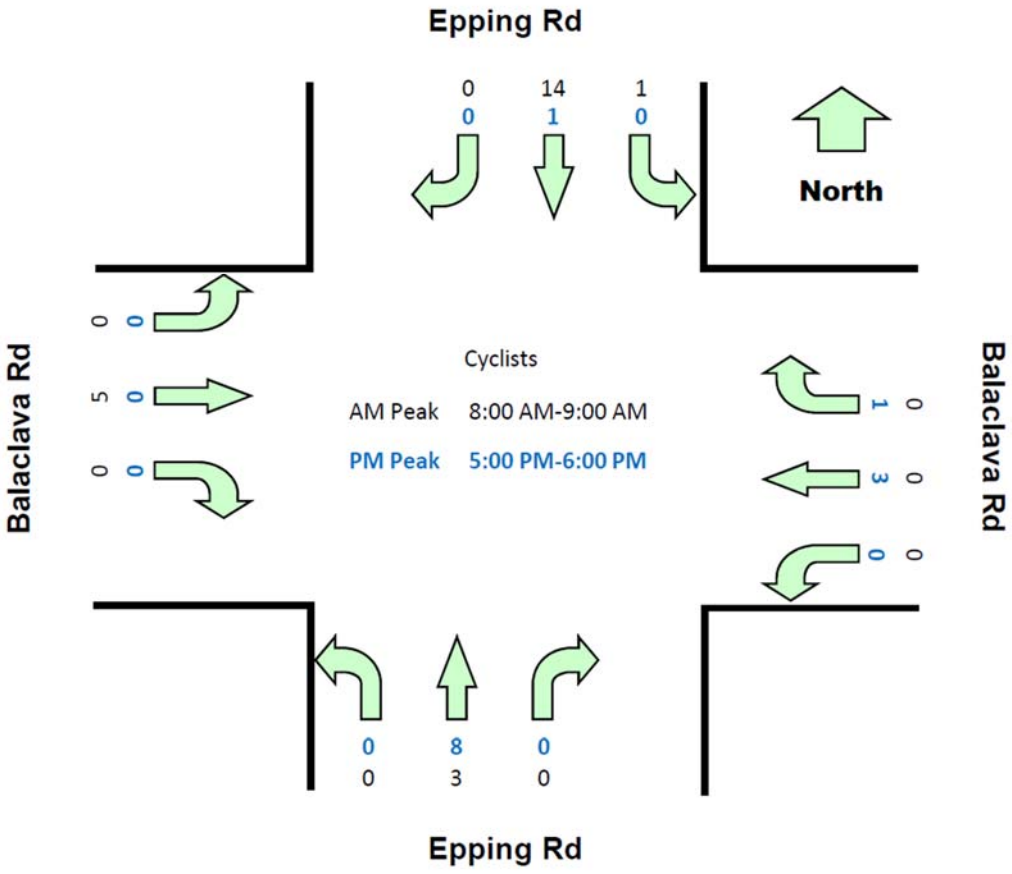
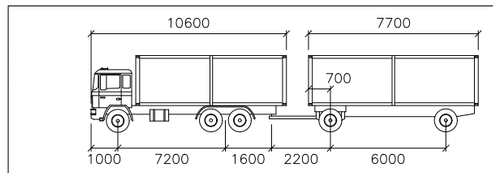


Figure 3: Peak Hour Cyclist Movement Count Results



19.0 Truck+Dog mm

First Unit Width	: 2500	Lock to Lock Time	: 6.0
Trailer Width	: 2500	Steering Angle	: 40.0
First Unit Track	: 2500	Articulating Angle	: 70.0
Trailer Track	: 2500		

PROJECT

UNIVERSITY AVENUE

HADENFELD AVENUE

N

nearmap

Thursday, January 11, 2018 0 20mm

REVISION	DATE	DESCRIPTION
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MacQuarie University

Swept Path Analysis - Truck & Dog Circulation - Site Entrance

DRAWN: TJG
DATE: 01/11/18
SCALE: 1:600 @ A3
DWG NO:14699-0S1D

TDG

2

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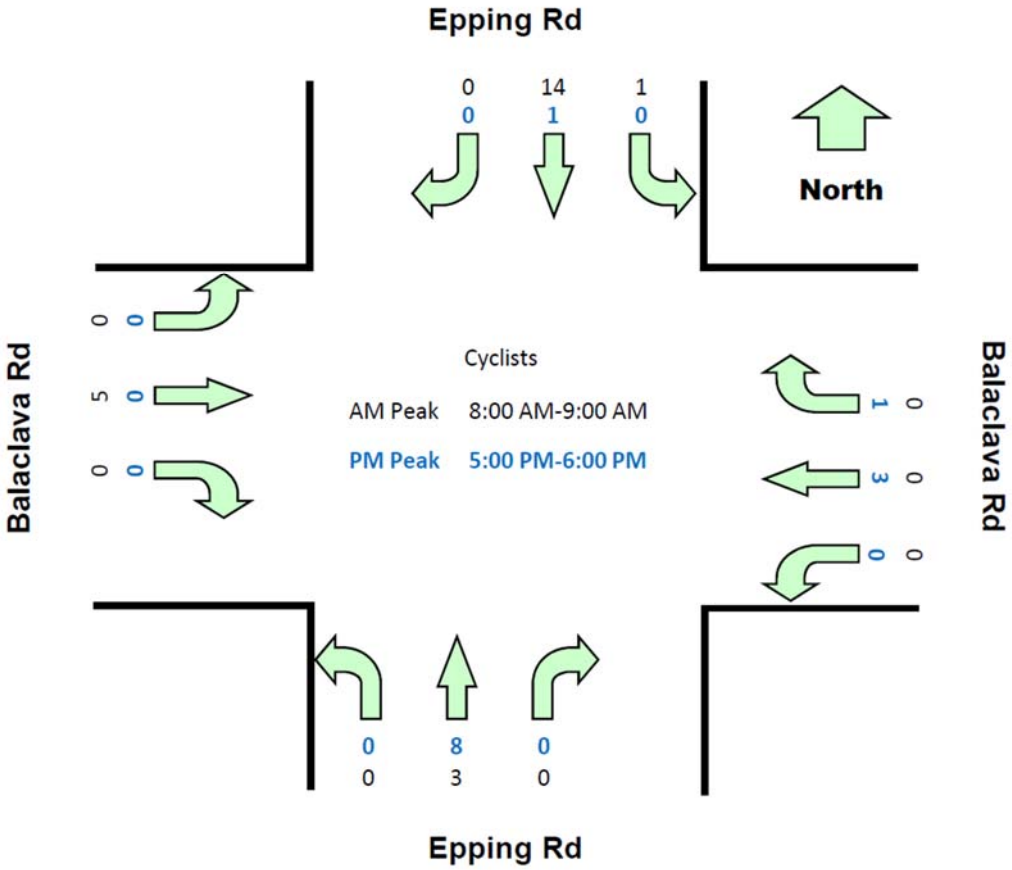


Figure 4: Peak Hour Pedestrian Movement Count Results

2.2 Changes to Staff and Student Numbers

The City of Ryde has identified an error in the Traffic and Parking Assessment that noted there would be a minor increase to staff and student numbers as part of the proposal, within Section 5.8 of the document. It is confirmed that there is to be no change to staff or student numbers at the University as part of the MUAPP. However, some staff and students may be moved between buildings on campus as part of the project.

Given there is no increase in the number of staff or students proposed as part of the MUAPP, no mitigation measures are required associated with traffic impacts and impacts on public transport, pedestrian and bicycle networks.

2.3 University Travel Plan

A copy of the existing University Travel Plan 2012-2017, prepared by GTA Consultants, is provided within **Appendix A**. It is noted that the Travel Plan for 2018-2023 is still being prepared. However, as the Application was submitted in 2017 it is considered appropriate to adopt the actions outlined within the existing Travel Plan.

The Travel Plan recommends achieving a mode share of 70% public transport and active transport by the year 2032, and notes the following six key objectives:

- Reduce barriers to non-car travel modes;
- Incentives for non-car travel modes;
- Establish cultures of active and public travel use;

- Enhance intra-Campus mobility and accessibility;
- Placemaking and reducing the need to travel; and
- Ensure the most efficient use of parking.

The MUAPP will provide wide pedestrian walkways to allow staff and students to easily access the public transport and active transport facilities located within the University and the surrounding area. Further, the MUAPP is in line with the Action Plan outlined within Section 10 of the Travel Plan.

2.4 Loading Arrangements

The City of Ryde has requested that:

> *"Loading bay management plan should be established to provide guidance and restriction"*

The MUAPP is proposed to have a dedicated loading bay at the western end of the new Museum building on the ground floor. It is expected that the loading bay will be used no more than once per day, and will be used by smaller delivery vehicles (e.g. courier vans) more commonly than larger delivery trucks. For larger delivery vehicles, it is expected that they will access the site outside of peak pedestrian and traffic hours to minimise potential conflicts.

Given the infrequent use of the loading bay and the simple arrangement of the loading area, it is concluded that the loading bay will operate without the need for a Loading Bay Management Plan.

2.5 Pedestrian Access Drawings

A wider pedestrian interface is proposed along the southern side of the new Museum building, and a generous thoroughfare is proposed between the Museum and Building W6A. Detailed drawings for these facilities have been requested. Plans showing the new pedestrian facilities have been provided by C&M Consulting Engineers, and are provided within **Appendix B**.

2.6 Construction Traffic Management Plan

The City of Ryde has specified that the following inclusions be made to the CTMP:

- *Machine operated Street Sweepers to be used to clean local and state roads of spoil.*
- *Roads to be kept in a serviceable state at all times. Council staff to direct site manager accordingly. Rectification works to be undertaken by applicant at no cost to council.*
- *No staff are to park in on-street car parking spaces. all are to park within dedicated off-street parking spaces.*
- *Traffic Control signage should be installed in accordance with TCWS Manual V4 and AS1742.3.*

A detailed Construction Pedestrian and Traffic Management Plan is proposed as a Condition, and will be prepared by the appointed contractor closer to construction. It is recommended these inclusions form part of the Condition.

3. Conclusion

The above has addressed submissions received from TfNSW and the City of Ryde in relation to the Traffic and Parking Assessment prepared by TDG, dated October 2017. The response has provided the additional information requested, provides alternative solutions to issues identified, or articulates why the conclusions made within the Traffic and Parking Study remain relevant. Accordingly, it is concluded that the comments provided by TfNSW and the City of Ryde have been suitably addressed.

Yours sincerely
Traffic Design Group Ltd

Michael Willson
Senior Associate / NSW Branch Manager
michael.willson@tdgaustralia.com.au

Tom Guernier
Senior Traffic Engineer
tom.guernier@tdgaustralia.com.au

enc: Appendix A – University Travel Plan 2012-2017
Appendix B – Pedestrian Facility Plans (provided by C&M Consulting Engineers)

Appendix A

University Travel Plan 2012-2017

MACQUARIE UNIVERSITY

University Travel Plan

2012-2017

Table of contents

Glossary

- CoR: *City of Ryde*
- EFTP: *Equivalent Full-Time Persons*
- EFTSL: *Equivalent Full-Time Student Load*
- GHG: *Green House Gas emissions*
- Modeshare: *the percentage of persons using a particular travel mode to arrive at a destination*
- Modal shift: *refers to a percentage of persons who switch from private vehicles towards more environmental friendly travel modes such as public transport, walking and cycling.*
- PAYG Parking: *Pay-As-You-Go Parking, a system of parking management that requires drivers to purchase parking permits on an individual usage base rather than paying an annual fee.*
- Peak parking demand: *the peak in demand for available parking spaces. It is measured in terms of time of day in which the highest proportion of parking spaces occupied at a destination.*
- SUP: *Shared User Path, a shared pathway for use by pedestrians and bicycle riders*
- Spill-over parking: *the number of parking spaces used on local roads outside a travel destination which are not contained within on-site parking.*
- Travel Blending: *transport demand management tool that focuses on individuals changing parts of the travel behaviour to reduce total car use. Blended travel recognises that behaviour change programs 'should not rely on an 'overnight' change in lifestyle but rather should be based on sustainable reductions in vehicle use' (Rose and Ampt 2001)*
- TDM: *Travel Demand Management*
- UTP: *University Travel Plan*

Executive Summary

The University Travel Plan (UTP) has been developed meet the objective of maximising public transport, walking and cycling into the future while establishing clear targets for modal shift away from car use on Campus over the next twenty years.

The UTP has been developed after extensive research into existing travel behaviour including travel questionnaires, transport and parking surveys, spatial mapping, and consultation with the University's Sustainability Representative Network. This research has identified that a significant shift towards greater public transport is taking place; however there are still a number of barriers that limit the greater use of public transport, walking, and cycling. Research has also found that if unchecked, growth in the Campus population associated car use, could have detrimental effects on the University's competitiveness, local area congestion, and Campus amenity. With the Campus anticipating moderate continued growth over the next 20 years, this Plan has identified that a target of 70% non-car travel is required by 2032, to ensure that the University meet the growing travel demand in a way that is socially, environmentally and economically responsible.

In order to increase the use of public transport, walking and cycling, this Plan has identified six key objectives to effect change.

1. Reduce barriers to non-car travel modes
2. Provide incentives for non-car travel modes
3. Establish cultures of active and public transport use
4. Enhance intra-Campus mobility and accessibility
5. Develop Placemaking and reduce the need to travel
6. Ensure the most efficient use of parking

The above objectives are complementary in effect and form the basis of a program of actions which detailed at the end of this report.

1. Introduction

Macquarie University (the University) is a major travel destination attracting approximately 30,000 staff and students from across the Sydney metropolitan region.

The University is located on a 126 hectare site at the northern end of the Macquarie Park Corridor and is identified as an area of future economic development and employment growth within consecutive Sydney metropolitan plans (NSW Government 2005; Department of Planning 2010).

As the Campus is expected to grow with an addition 460,000m^2 Gross Floor Area (GFA) of commercial and academic developments (Macquarie University 2009c), transport will be a critical factor in determining the future success of both the University and Macquarie Park Corridor as vibrant centre of education and commerce. With the capacity of local roads and car parking facilities already under stress, there is a strong imperative for the University ensure that staff and students can travel to Campus by the best means available and to reduce the negative impacts of car traffic on both the Campus and local community.

The University Travel Plan (UTP) aligns with a number of other environmental, social and economic policy aims of the University and provides the strategies and actions to manage transport demand on Campus in order to reduce car-based trips.

2. Background

In order to understand the function of the University Travel Plan, it is necessary to understand it's purpose as a strategic planning document. In order to achieve this, the following section details what a University Travel Plan is, what the drivers are for preparing a UTP, and the strategic context within which the UTP fits.

2.1. What is a University Travel Plan?

A University Travel Plan (UTP) is a strategy for managing transport demand on Campus that embraces the principles of sustainable transport whilst recognising the unique context of travel planning at universities. In its simplest form, the UTP encourages systems of transportation that have low impacts to the environment such as walking, cycling, public transport and better management of car-use. The UTP also supports urban transportation systems that are fuel efficient, reduce travel demand, promote healthy lifestyles and make a positive contribution to the environmental, social and economic aspects of communities. Because travel to and from the University has wide-ranging impacts on the Campus and broader community, the UTP has been developed as a way of managing transport impacts while also meeting a number of aligned policy agendas. Some of the key drivers for the UTP are detailed as follows.

2.2 Drivers for the University Travel Plan

There are a number of social, environmental and economic drivers for developing and implementing a University Travel Plan at Macquarie University. These drivers are detailed as follows:

The Impact of Traffic Congestion

The Macquarie Park Traffic Study (City of Ryde 2008) estimates there will be a 20% increase in traffic by 2031 which will potentially cause significant capacity problems at intersections around the Campus. Additional traffic within the Campus will have a significant impact on the University in terms of increased time delays, reduced local area amenity, parking problems, increased frustration amongst Campus users, as well as impact the value of commercial properties. Strategies to ensure reduced car-use are therefore essential to facilitate development and to reduce the negative effects traffic congestion.

The Costs of Supplying More Car Parking

Carparks on Campus utilise valuable land resources and impact Campus amenity. With a growing Campus population, peak parking demand could rise to 14,000 vehicles on Campus by 2032 if there is no modal shift towards non-car transport modes. The ability of the University to provide parking to so many vehicles would have significant costs in terms of land and infrastructure, as well as negative flow-on effects caused by increased congestion and reduced Campus amenity. The cost of building additional parking is estimated at approximately $20,000 per parking space in a multi-storey car park (Curtis and Holling 2003). As such, there is a strong economic imperative to reduce parking demand through supporting modal shift to sustainable transport modes (Poinsatte and Toor 1999).

Environmental Impacts

The transport sector amounts to 13.5% of greenhouse gas emissions (GHG) in Australia (Department of Sustainability, Environment, Water, Population and Communities 2011). Mitigating this impact is a key driver of the UTP. Within Australia, GHG emissions in the transport sector have risen by 30% in the last 20 years with the greatest emissions growth coming from the use of private vehicles (Department of Climate Change and Energy Efficiency, 2011). In comparison, travel modes such as walking and cycling have the lowest emissions while public transportation has far less impacts than the private car (Dave 2011).

Health Benefits

The use sustainable transport modes can have wide-ranging health benefits across the population (World Health Organisation, 2009). High levels of car-use and long commuting times are also associated with decreased physical activity and sedentary lifestyle diseases such as obesity, heart disease and type-2 diabetes (Wen et al. 2006). Medibank Private (2007) estimates the cost of physical inactivity to the health care system to be $1.5 billion per year. Active transport modes (including public transport) also provide more sustained health benefits because physical activity becomes part of everyday routine. Sustainable transport modes also improve air quality by lowering air pollution and reducing exposure to particulates, sulphates and atmospheric ozone. A Bureau of Transport and Regional Economics (2007) report estimates that between 900 and 2,000 early deaths are caused by motor vehicle pollution in Australia each year. Reducing pollution has both environmental and health benefits.

Social Inclusion

Transport has a fundamental role in supporting social equity through providing access to essential amenities, employment opportunities and social and recreational goods (Lucas and Currie, 2011). Greater levels of walking and cycling hold significant benefits in terms of equity and community cohesion (Hart 2008). Car dependency accentuates inequalities of access amongst certain groups who are less likely to drive including the unemployed, persons on low incomes, children and young people, the aged, and persons with disabilities (Sustainable Development Commission 2011). University students are highly sensitive to the costs of driving and maintaining a car, while sustainable transport modes can provide a more affordable alternative to car use.

Staff and Student Attraction

Ease of access has a significant impact on choices of work and study. Negative experiences and costs associated with travel can reduce the competitiveness of the University. High quality and efficient transport systems is a key to attracting and retaining staff and students. Support for active transport modes is also highly desired by employers and employees, because it improves health and productivity (Colliers International 2011).

Education and Leadership

As aspiring leaders in sustainability, universities are expected to reduce their transportation impacts (Poinsatte and Toor 1999). As universities have great numbers of new persons coming through the organisation each year, they have a unique opportunity to educate students into sustainable travel behaviours (Mees 2010). As many travel behaviours are learned behaviours, these skills can help shape life-long travel behaviours that extend long after university life.

Compliance with Regulatory Frameworks

Organisation and workplace travel planning is increasingly required by Local and State Governments as a way of managing travel demand and meeting sustainable transport objectives (e.g. City of Ryde 2010a; Macquarie University 2009c). Universities, like other large workplaces, are required to develop travel plans because of the impact of their developments on the surrounding local area. Successful travel planning can reduce impacts while potentially supporting a positive influence on local areas by raising public transport service demand and improving amenity.

3. Methodology

The University Travel Plan has been developed out of a number of background studies and investigations; included the Campus Travel Survey 2008 (GTA Consultants 2008), University Travel Survey 2010, Student and Staff postcodes analysis 2008 and 2010, Austraffic Traffic and Parking Occupancy Counts 2010, Parking Consultants International Travel and Parking Survey 2010, Pedestrian Audit 2010, Bicycle Parking Audit 2010, and the Bus Services Audit 2010.

These studies have been used to establish a benchmark of current transport performance on Campus and to identify areas of changing modeshare and geographical distribution amongst staff and students (see Section 5).

These studies were then used to help identify some of the key challenges facing the University in terms of its current a future transport performance (see Section 6) along with a analysis of the likely population growth of the Campus and the impacts of growing travel demand over the next twenty years (see Section 7).

The consolidations of these studies has been used to paint a robust picture of Campus travel behaviour as it is and where it needs to change in the future (see Section 8).

Following the six key objectives developed in the strategic framework, a process of a consultation was undertaken through University's Sustainability Representative Network to help identify potential actions for travel planning on Campus.

These actions have subsequently been reviewed and consolidated into a UTP Action Plan (see Section 10). The approach developed within the Action Plan aims to provide a range of complimentary strategies for changing the travel profile of the University within the next five years.

4. The Existing Policy Framework

The University Travel Plan enhances and supports a number of strategic directions both within University and more broadly across several Local, State and Federal Government planning and urban development policies. Tables 1-4 identify how the UTP supports and enhances a number of the existing policies/frameworks.

Table 1 - Macquarie University Policies/Frameworks

Policy/Strategy	Key Aims/Objectives	Associated Targets/Goals
Sustainability Strategy Target 2012 (Macquarie University 2009a)	Achieve a Transport Greenhouse Reduction target of 40% over the next 5-10 years based on 2008 levels	60% of total equivalent full time persons primarily travelling to campus by public or active transport
Macquarie University Social Inclusion Plan 2009-2012 (Macquarie University 2009b)	Build a more diverse student population over time prioritising indigenous and low SES students	To increase the percentage of 25-34 year olds in higher education to 40% by 2025
Campus Experience Strategic Goals	Staff, students and members of the local community have the opportunity to lead healthier, more productive lives and achieve a better work/life balance	Increase the percentage of staff and students undertaking more than 30 minutes of moderate exercise per day

Table 2 - City of Ryde Council Policies/Frameworks

4. The Existing Policy Framework

Policy/Strategy	Key Aims/Objectives	MQU Associated Targets/Goals
Macquarie Park Corridor Development Control Plan 2010 (CoR 2010a)	1. Provide incentives for employers to encourage staff to utilise improved accessibility (by public transport, cycling and walking) to, from, and within the Corridor; 2. Minimise rates of private vehicle use for commuters and business trips as a contribution to the regional goal of 20% transport modal shift; 3. More effectively manage the use of private vehicles within the area; 4. Encourage the use of alternative modes of transport within the region; and 5. Reduce congestion and the cumulative impacts of vehicle emissions upon air quality.	Minimise rates of private vehicle use for commuters and business trips as a contribution to the regional goal of 20% transport modal shift.
Macquarie Park Corridor Traffic Study (CoR 2008)	Develop a case for target public transport for the area, given likely rail and bus improvements mixed with an emphasis on workplace travel plans and parking management.	Target of 40% public transport mode share for all businesses in the Macquarie Park Corridor
Ryde Local Environmental Plan 2010 (CoR 2010b)	The objectives for off-street parking controls in the Macquarie Park Corridor are as follows: (a)to encourage accessibility by foot, bicycle and public transport, (b)to support the management and supply of parking as the primary means to influence travel behaviour of employees, (c) to encourage greater reliance on public transport, (d) to assist in the management of increased car usage and traffic congestion in the corridor, (e) to effect a greater shift to public transport.	N/A

Table 3 - NSW State Government Policies/Frameworks

Policy/Strategy	Key Aims/Objectives	MQU Associated Targets/Goals
Metropolitan Strategy: Transport Strategy for Sydney (NSW Government 2005)	• Improve transport between Sydney's centres • Improve the existing transport system • Influence travel choices to encourage more sustainable travel	• Implement physical bus priority to target a 25 km/h average bus speed on each strategic bus corridor. • Ensure 80% of Sydney residents can access a major centre, regional city or global Sydney within 30 minutes by public transport.
Metropolitan Plan for Sydney 2036 (Department of Planning 2010)	• To build on Sydney's strengths by further integrating transport and land use planning and decision–making to support increased public transport mode share • To improve the passenger experience of public transport and promote active transport opportunities	
NSW State Plan 2010 (NSW Government 2010a)	• Increase the proportion of total journeys to work by public transport and bicycles within the Sydney Metropolitan Region	• Increase the proportion of total journeys to work by public transport in the Sydney Metropolitan Region to 28% by 2016 • Increase the mode share of bicycle trips made in the Greater Sydney region, at a local and district level, to 5% by 2016
NSW Bike Plan 2010 (NSW Government 2020b)	• Completing missing links in the Metro Sydney Bike Network of low-stress regional routes • To connect all Metropolitan Strategy centres • Provide local cycle links to new public transport interchanges through the delivery of major projects. • Ensure strategic planning for regions and subregions encourages cycling-friendly development concentrated in centres. • Encourage employers to promote themselves as cycling-friendly workplaces, based on the quality of their end-of bike trip facilities, production of Workplace Travel Plans and Transport Access Guides, and corporate participation in events like Ride to Work Day.	

Table 4 - Australian Government Policies/Frameworks

4. The Existing Policy Framework

Policy/Strategy	Key Aims/Objectives	Associated Targets/Goals
Our Cities, Our Future: A national urban policy for a productive, sustainable and liveable future (Department for Transport and Infrastructure 2011)	• Improve accessibility and reduce dependence on private motor vehicles • Reducing travel demand by co-location of jobs, people and facilities • Investing in urban passenger transport	Double the number of cyclists by 2016

5. Benchmark of Existing Transport Behaviour

Macquarie University has historically held high levels of car use in line with many university campuses and workplaces across Australia. However, since the opening of the Epping to Chatswood railway in early 2009, the University's travel profile has shifted significantly towards greater public transport modeshare. This change has been benchmarked through University travel surveys in 2008 (GTA 2008) and 2010 (Macquarie University 2010a).

5.1 Student Travel Behaviour

In 2010, the primary modes of travel for students were the private car (42.5%), train (31%) and bus (19%). Collectively, public transport mode share amongst students has grown from 41.5% in 2008 to 50% in 2010. Public transport modeshare has increased by 8.5% since the opening of the train station; however a significant part of this modal shift was from buses to rail. Active transport modes such as walking and cycling have remained low at 10.5% of student modeshare. Walking has declined slightly since 2008 however some changes might be due to the higher proportion of students living further from Campus.

The majority of students at Macquarie University live within the region of Northern Sydney and North West Sydney. The top 20 suburb postcodes for students are listed in Table 5.

Figure. 1: Macquarie University Student Travel Modeshare

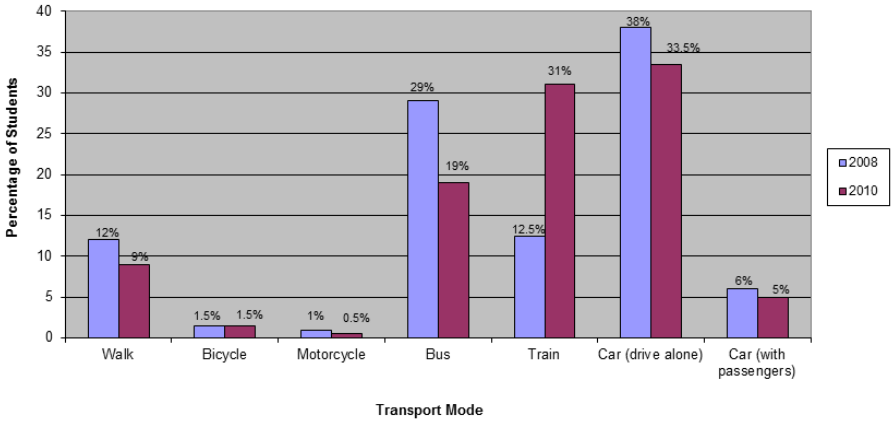


Table 5 - Top 20 Student Postcodes 2010

Rank	Suburb	Students	Rank	Suburb	Students
1	Eastwoood/ Marsfield	3644	11	Concord West	398
2	North Ryde/ Macquarie Park	1216	12	Carlingford	393
3	Epping	1129	13	Cherrybrook	369
4	Sydney CBD	761	14	Wahroonga/ Normanhurst	364
5	Baulkham Hills	534	15	Lane Cove/ Longueville	359
6	Chatswood	532	16	Pennant Hills	359
7	Castle Hill	489	17	St Ives	353
8	Ryde	484	18	Turramurra/ Warrawee	345
9	Hornsby	464	19	West Pennant Hills	342
10	West Ryde/ Denistone	464	20	Kellyville/ Rouse Hill	327

Between 2008 and 2010, there have been some changes in the geographical catchment of students. Students travelling between 10km and 20km to the University now make up 36% of all students on Campus. This growth can partly be explained by increased public transport accessibility provided by the train station and the CityRail network. The proportion of students living within 10km of the Campus has declined from 53% in 2008 to 47% in 2010. There has also been a decline the percentage of students travelling more than 20km to Campus.

5. Benchmark of Existing Transport Behaviour

Spatial analysis of student residences confirms the geographical distribution of the student population is broadly spread across the Sydney metropolitan region. Some of the key sub-regions include the Ryde area, the North Shore, Northern Beaches and Hills district.

While many of these regions are well serviced by public transport, the Northern Beaches and Western Sydney (including North-West Sydney) have lower levels of public transport accessibility. Conversely, car accessibility to Campus is very easy via the M2 motorway and Sydney orbital road network (see Figure 2).

Figure 2 - Student Postcode Locations 2010

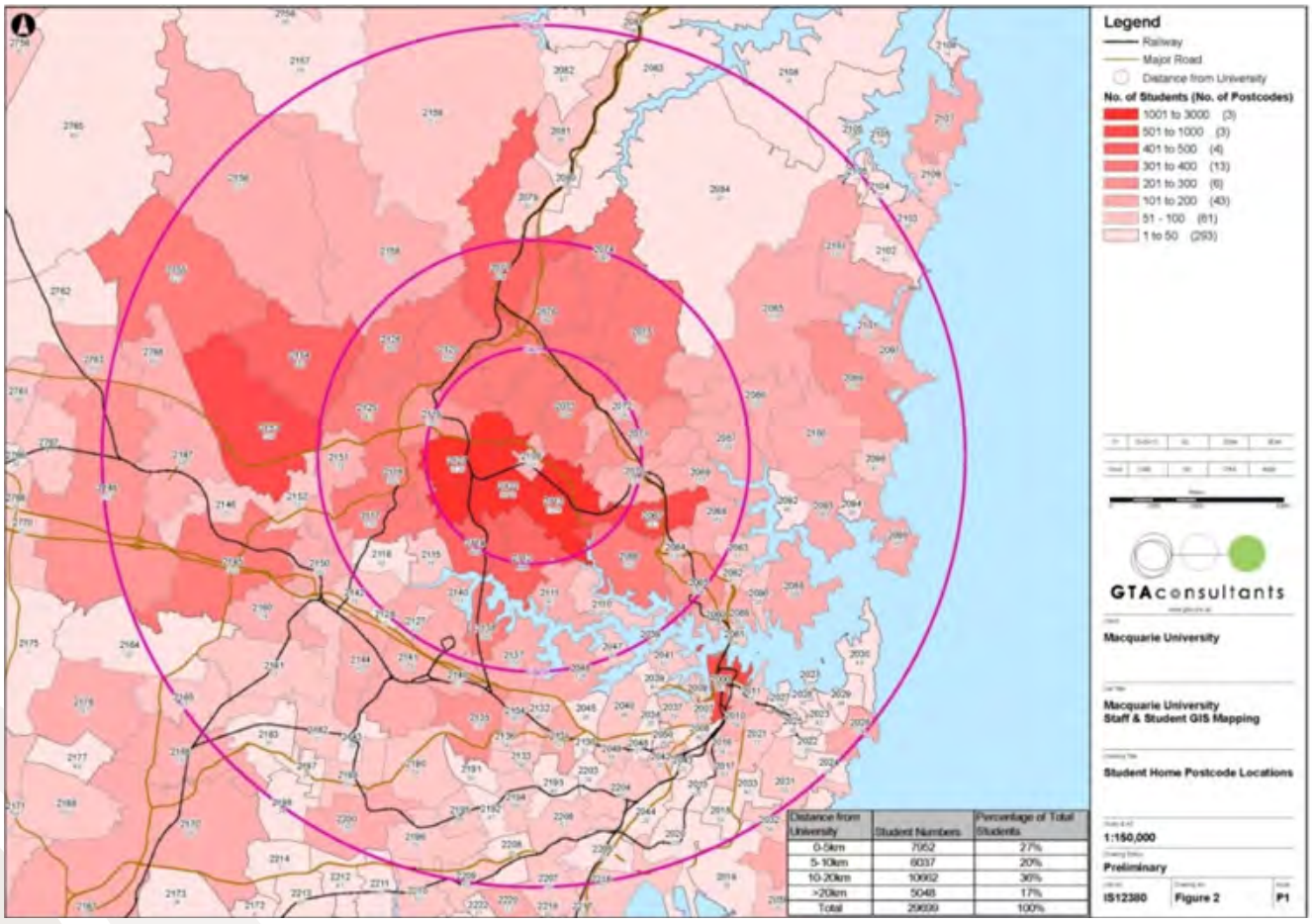


Table 6 - Distance from Campus (Students)

Distance from Campus	2008	2010
0 - 5km	30%	27%
5 - 10km	23%	20%
10 - 20km	23%	36%
>20km	24%	17%

5.2 Staff Travel Behaviour

Staff travel behaviour differs from student travel. In 2010, dominant modes of travel for staff were private car (65.5%), train (17%), and bus (9.5%). Between 2008 and 2010, there was a modal shift to public transport amongst staff from 17% to 26.5% of total public transport modeshare. This modal shift was due to growth in train use.

An increasing number of staff members are now using the train as their preferred travel mode.

However, the higher percentage of staff driving with passengers suggests that many staff members are driving with children as part of their daily travel behaviours. Active transport amongst staff is low with only 4.5% walking and 3% cycling to Campus.

Geographically, staff members are far more dispersed than students in terms of places of their residence. Staff members are more likely to travel longer distances from more dispersed locations. GIS analysis of staff postcode data has indicated that up to 50% of staff members travel over 20km each day to get to Campus.

However, this data is limited to staff members who are full or part-time and as such does not represent the complete snapshot of casual and contract staff on Campus.

5.3. Data Gaps and Limitations

There are a number of data gaps within the existing travel surveys. At present there is little data on the location of international and local students, and what travel modes they use from which destinations. Another data gap is information on the percentage of staff and students who travel to work with children.

This data can help provide a better understanding of current and future travel behaviours.

Figure. 3: Macquarie University Staff Travel Modeshare

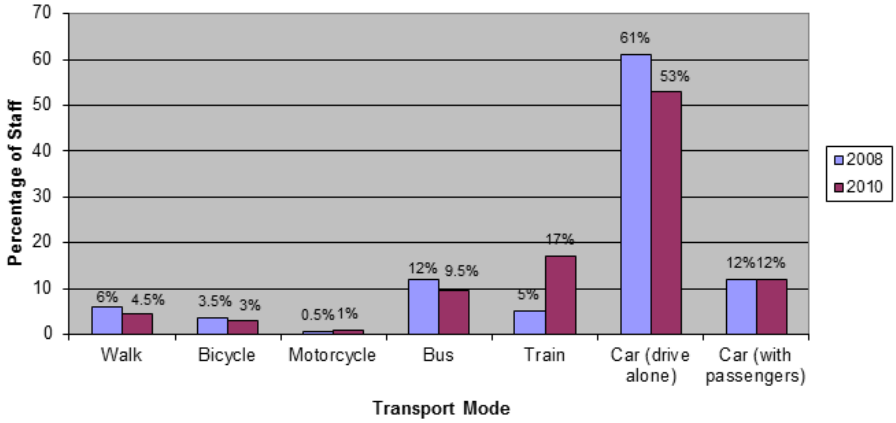
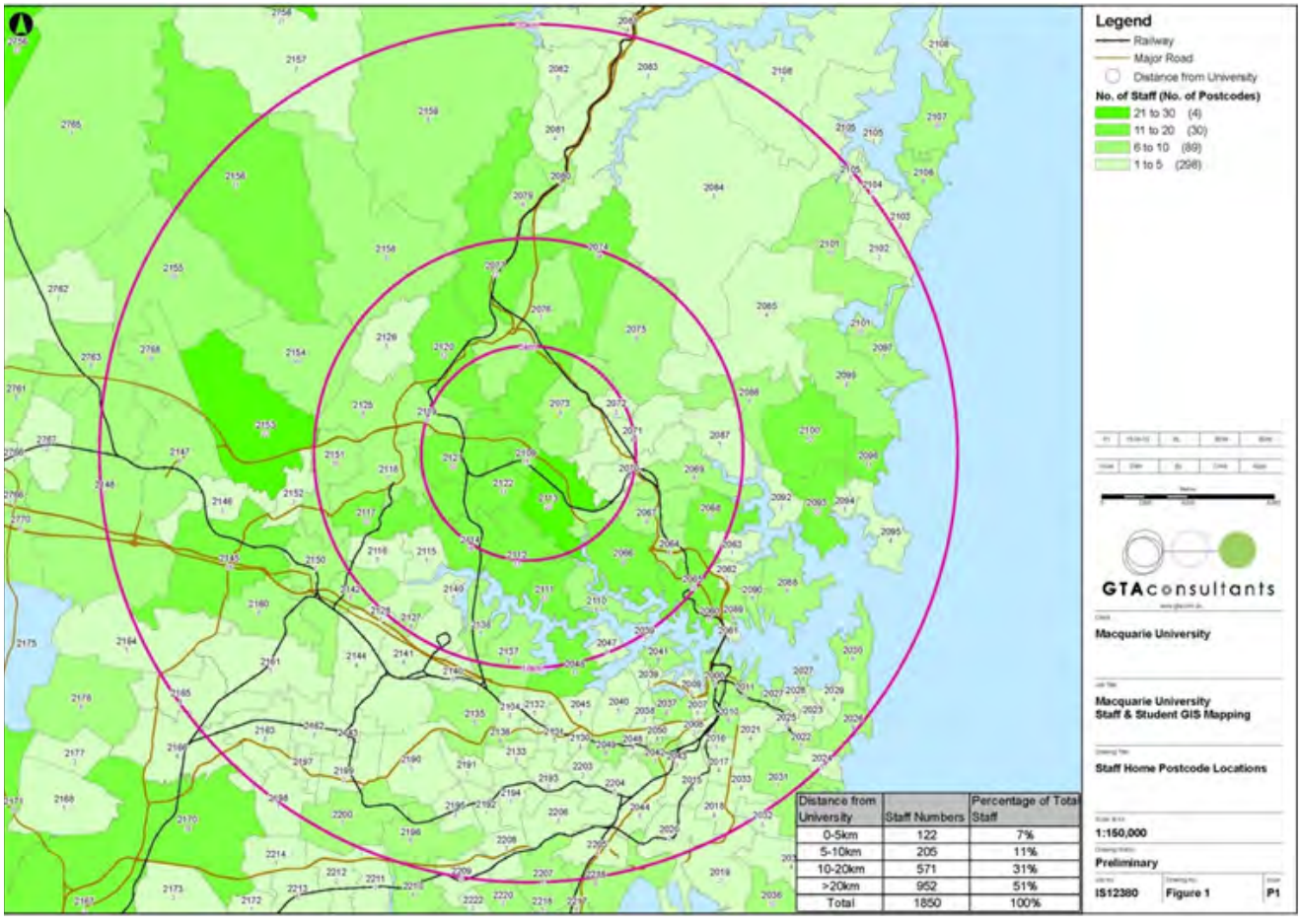


Figure 4 - Staff Postcode Locations 2010



6. Key Transportation Challenges

6.1 Dispersed and distant travel catchment

Macquarie University attracts staff and students from across the Sydney Metropolitan Area. While distance from Campus is not a direct measure of transport accessibility, there is a strong correlation between long distance travel and car use.

The University's location adjacent to the M2 Motorway has favoured long distance car-based transportation across Sydney.

While the Chatswood to Epping railway line has significantly improved public transport accessibility, there is still a large proportion of the Campus community who live in areas of Sydney where public transport is inaccessible or perceived as undesirable or convenient in terms of total travel time.

The geographically dispersed nature of staff and student travel highlights the requirement for long-term public transport network planning to provide more viable alternatives to car use.

6.2 Infrequent public transport services and greater travel demand non-peak periods

Existing public transport services to Campus are designed to cater for highest level of demand during periods of peak periods (7-9am and 3-6pm) associated with the journey to work. However, analysis of pedestrian, bus and train passenger movements within Campus has found that the University has three peaks in travel behaviour in the morning, middle of day and late afternoon. In general, these peaks are less defined peaks with greater transport demand throughout the day and after hours.

The adoption of more frequent public transport services are known to have an effect in boosting total public transport modeshare (HiTrans 2005, Mees 2010). However, as many bus services to Campus are timetabled for low frequencies in non-peak times, current service frequencies are a significant barrier for many campus users.

6.3 Limited incentives to blend travel modes

Blended travel behaviour is when travellers mix their transport modes to suite their daily travel needs and activities. For example, a staff member may wish to catch public transport to the University three days a week then drive on two other days when they have a special need for a car.

Blended travel behaviour is a desirable outcome because it reduces overall car use, while allowing individuals to become more experienced in using other travel modes (Rose and Ampt 2001).

With existing parking fees and public transport ticketing systems oriented towards fixed travel behaviour, there is limited incentive to blend transport modes for staff and students. The University's current parking fee schedule is a particular barrier as it charges a relatively low annual permit fee of $228 per year with a much higher daily parking fee of $19.

An appropriately priced pay-as-you-go (PAYG) parking system could reduce overall parking demand through incentivising blended travel behaviour.

6.4 Extensive barriers to active transport generated by land-use planning and arterial roads

Macquarie University was developed during an era of car-oriented transport policy and the development of the internal and external road network has favoured the movement of cars over persons walking or riding bikes.

While within the University there are opportunities to improve accessibility for walking and cycling, high levels of traffic flowing around the Campus have generated physical and psychological barriers to active transport within the local area. The arterial road network along Epping, Herring and Waterloo Roads effectively cuts the Campus off from local neighbourhoods.

Physical barriers include the absence of footpaths, pedestrian crossings and

dedicated bicycle facilities within the streetscape.

Psychological barriers, often referred to as 'community severance' effects, include an exposure to high levels of noise, pollution and traffic dangers. The design of surrounding road network is a major barrier to promoting active transport to Campus.

6.5 Public transport modeshare

Public transport modeshare at Macquarie University is largely contingent on how well the broader public transport system functions in terms of price, comfort, journey times and passenger convenience.

With a long wait for new rail links on the CityRail network, improvement in public transport modeshare is most likely to come from bus priority and improved service speeds and frequencies.

As such, the way the University integrates with bus services both within and alongside the Campus will be critical to the growth of public transport modeshare in the near future.

7. Travel Demand Forecast and Modeshare Target Scenarios

A target of 40% non-car modes to Campus has been set by the Department of Planning as part of the initial Campus Concept Plan (Macquarie University 2009c). However, limitations to the current infrastructure and capacity of carparking availability impose limits on the number of vehicles that can reasonably be accommodated on Campus and with the local area.

This section reviews the current car parking capability in light of Campus population growth, parking demand, and forecast modal share scenarios.

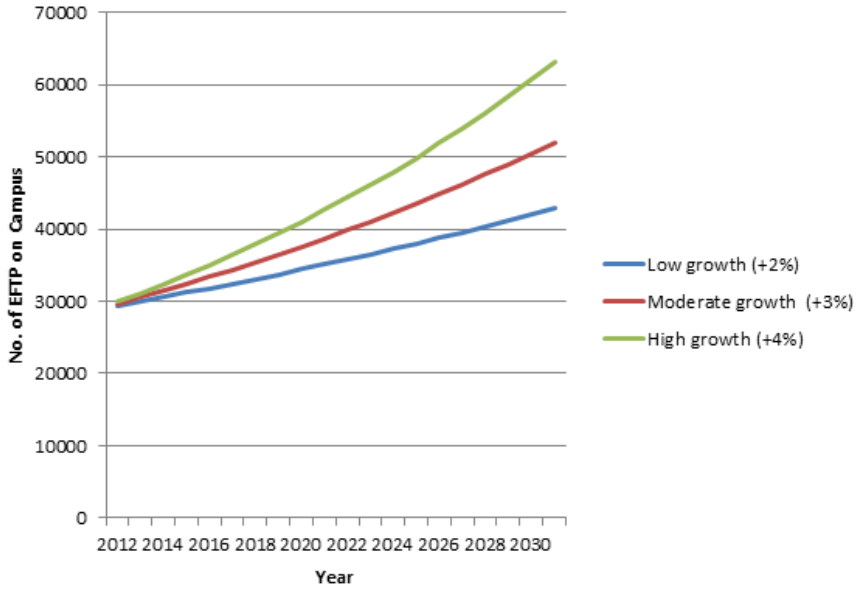
7.1 Campus Population

Macquarie University currently holds just under 30,000 full-time-equivalent persons (Macquarie University, 2010b). Approximately 90% of the Campus population is made up of students and 10% is academic and professional staff.

Over the next twenty years, the Campus is expected to grow at an annual rate of between 2% and 4% per annum (See Figure. 5). According to the Macquarie University Learning and Teaching Space White Paper (2010) the Equivalent Full-Time Student Load could reach 40,000 by 2020 (Arina Consultants 2010).

Following this growth forecasts and the ongoing development of new housing within Sydney, the Campus population may pass 50,000 Equivalent Full-Time Persons by the year 2030.

Figure. 5: Campus population growth scenarios (2012-2032)



7.2 Peak Parking Demand Forecast

The forecast growth of the Campus is going to have a significant effect on parking availability. With anticipated growth, there will be further pressures on transport in terms of congestion and parking both within and around the Campus. Figure 6 indicates how peak parking demand is forecast to grow over the next 20 years given a range of different mode-share scenarios.

Changes in the University's travel profile will be fundamental to the future of the Campus. The different scenarios for future modeshare are:

No Modal Shift (i.e.. 59.2% Public and Active Transport modeshare)

If the Campus modeshare of private vehicles remains unchanged at 40.8%, over 14,000 car parking spaces will be required (either within or outside the Campus) to meet peak parking demand by the year 2032. Approximately 3,000 spill-over parking spaces are currently utilised by University staff and students who park along local roads.

With no modal shift, spill-over parking would reach almost 9,000 parking spaces by 2032, having a detrimental effect on parking availability and local area amenity. Students and staff members would experience significant difficulties finding parking and local streets would experience far greater traffic congestion.

70% Public and Active transport modeshare target by 2032

A target of 70% public transport and active transport would significantly reduce the impacts

of car use on Campus including the demand for parking spaces. For this modeshift target to be achievable, a 0.5% modal-shift per annum would need to be maintained over the next 20 years.

Under this scenario, peak parking demand would be reduced to 10,500 parking spaces by 2032. This target would significantly limit the impacts of excessive car use on Campus and associated congestion and loss of amenity.

80% Public and Active transport modeshare target by 2032

A more radical target of 80% public and active transport would be achievable with a 1% modal-shift per annum until 2032. This target would see a tapering off of peak parking demand leading to a reduction in spill-over parking.

This modal shift target is highly desirable for the Campus, however with the strong contingency of public transport improvements being a fundamental factor, a target of 80% public and active transport target may be unrealistic within a 20 year time frame.

Recommendation

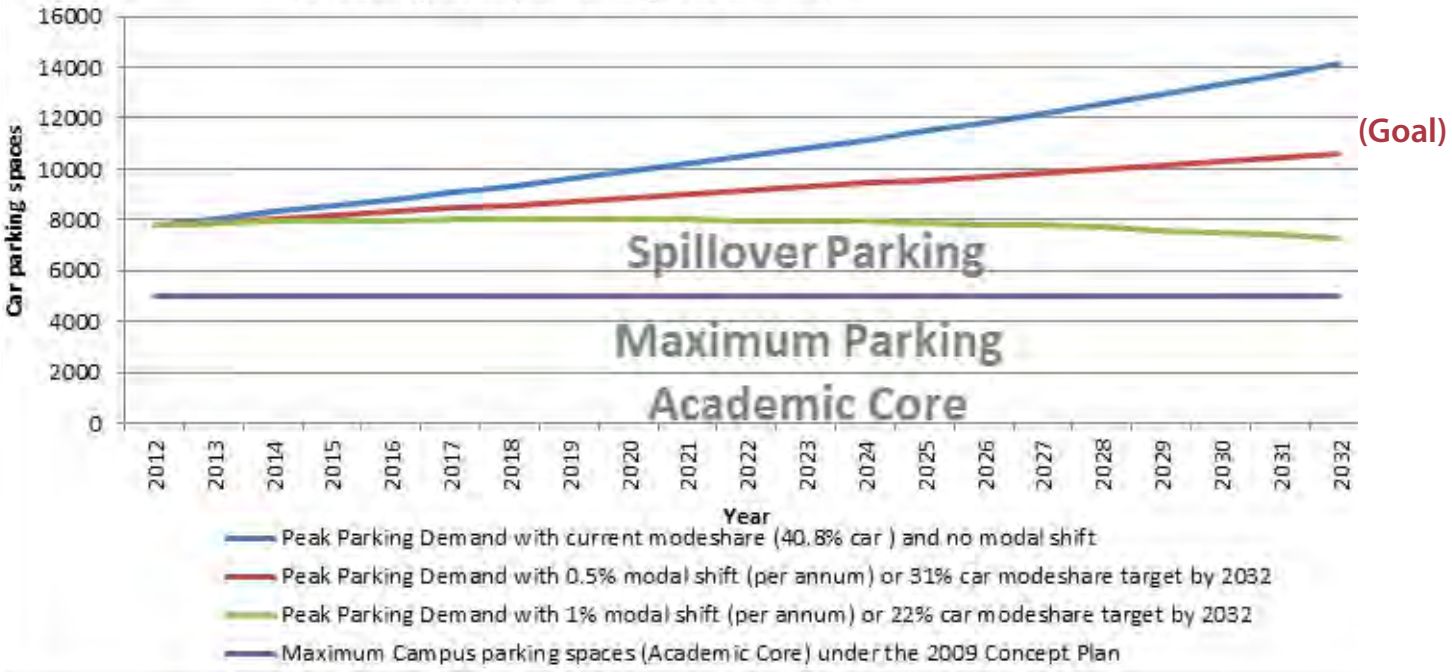
Following each of the above scenarios, a modeshare of 70% public and active transport is recommended as the target for the University travel by the year 2032.

While such a target would imply only a modest 0.5% public and active transport modal shift per annum, this change is achievable within the context a long-term (i.e. 15-20 year) roll out of public transport infrastructure such as the North-West Rail link and Epping to Parramatta links.

A modal shift of 8% was achieved after the opening of the Macquarie University train station in 2009, however these major gains will not be repeated as the station opening is a one-off occurrence.

As such, future modal shift will require significantly more effort. A modeshare target of 70% public and active transport by 2032 is an achievable goal for Campus travel.

Fig. 6: Peak parking demand scenarios 2012-2032 (3% Campus population growth rate)



8. University Travel Plan Objectives

Travel behaviours are made up of many factors including distance travelled each day, available infrastructure, services, time, costs, social norms, attitudes, information, awareness, and life circumstances. Influencing travel behaviours towards sustainable transport objectives requires multiple strategies to address a variety of barriers and concerns.

8.1 Six Key Objectives

The objectives of the University Travel Plan (UTP) provide the basis for guiding travel demand management activities on Campus. They provide the framework for the UTP Action Plan (see Section 10) as well as means of monitoring the progress of travel demand management on Campus.

1. Reduce barriers to non-car travel modes

There are numerous existing barriers to using active and public transport modes. Barriers are particularly strong in localities where car-focused planning has made driving essential to a range of everyday activities.

Reducing barriers to non-car travel modes means addressing specific barriers to ensure that the quality of the transport experience meets the expectations and desires of travellers. As many barriers to non-car travel modes exist beyond the Campus, advocacy efforts and partnerships are necessary to enhance sustainable travel modes at the local and metropolitan context.

Figure 10: Strategic Framework for University Travel Plan

2. Incentives for non-car travel modes

Providing incentives for non-car travel modes aims to enhance the overall desirability of sustainable travel modes with benefits for those who utilise them. Incentives include targeted programs to promote particular travel modes (e.g. free bike services) or reducing the up front costs of travel (e.g. staff travel loan scheme). Incentives also help to maintain positive attitudes towards sustainable transport while also enticing others to consider changing their travel behaviour.

3. Establish cultures of active and public transport use

Travel behaviours are often learned from habits and experiences with different travel modes. Transport behaviours are often normalised within social networks, however not all people are aware of their travel options nor do they have the skills to negotiate different travel modes.

Establishing cultures of active and public transport use aims to 'normalise' sustainable transport modes through knowledge-sharing in both formal and informal settings.

Establishing cultures of active and public transport also aims to target new staff and students when they come to the University, as it is easier to change travel behaviours when new habits are being developed.

4. Enhance intra-Campus mobility and accessibility

Getting to a destination is the primary objective of travel planning, however a large number of journeys also take place within the Campus environment. The vast majority of such journeys are undertaken by foot, bicycle or bus.

Enhancing intra-Campus mobility aims to make such journeys as convenient as possible, particularly in terms of connecting to public transport services and local area trips.

5. Placemaking and reducing the need to travel

Individual travel behaviours are often made up of multiple trip purposes (e.g. essential amenities, education, employment, recreation, and family commitments). Travelling between journey destinations can incur significant time costs. Reducing the need to travel recognises that in some cases, an individual does not need to travel if there are alternatives available (e.g. working from home, online lectures, or electronic assignment submissions).

Similarly, enhancing the range of social and academic activities within a destination can reduce travel demand, because more destinations and activities can be accessed within a more local area. Placemaking reduces transport demand by making the Campus and surrounding locality more desirable as a destination with multiple journey purposes.

Placemaking on universities has been identified in the 'sticky campus' (UTS 2008) concept which aims to make social activity and connectedness the centre of campus planning.

6. Ensure the most efficient use of parking

The most efficient use of parking aims to reduce demand through demand based pricing and alternative driving options such as car-sharing and carpooling.

The development of demand responsive pricing is an important mechanism for to flatten peaks in parking demand and create incentives to mix travel modes. Furthermore, the development of improved information on parking availability can also improve efficiency by avoiding unnecessary 'hunting for parking'.

9. Principles for Implementation

To achieve the goals and objectives of the University Travel Plan, a number of short, medium, and long-term actions are required. The Principles for Implementation have been identified in recognition that actions require ongoing commitments, values, accountabilities, and processes to ensure that implementation is achieved. These are identified as follows:

1. Collaboration

Transport services and infrastructure operate at a scale that is well beyond the boundaries and influence of the Campus. To ensure successful outcomes, the University needs to collaborate with key stakeholders to identify and address actions required to achieve sustainable transport outcomes.

2. Measurement and Refinement

The impacts of transport programs need to be measured and refined if they are to prove effective. The principle of refinement suggests that many programs operate as pilots to begin with before being broadly adopted to ensure the best practice and use of resources.

3. Integration

Sustainability needs to function in a whole of Campus framework. Transport policies need to be integrated across University operations to ensure continuity and consistency over time.

4. Consistency

Travel behaviours can be made and unmade. As an organisation with new cohorts of staff and students entering and leaving the University each year, travel planning requires consistent implementation to ensure that new persons are targeted and that modal shift targets remain on track.

10. Action Plan

The following action plan has been developed into order to achieve the 6 primary objectives of the University Travel Plan
The action plan is divided in 6 sections. Each section provides a guidance the range of actions and how they should be d

1. Reduce Barrier to non-car travel modes

No.	Action	Outcome
1.1	Widen Staff Travel Loan Scheme to include some contact staff and HDR scholarship holders	Assist HDR students and contract staff in benefiting from the travel loan scheme
1.2	Advocate flexible 'smartcard' ticketing system to support passenger comfort and 'travel blending amongst staff and students	Provide all public transport users with more convenience and better pricing mechanisms which support blended travel behaviour
1.3	Centralise campus bus stops at University Ave and provide high quality waiting areas.	Provide improved accessibility, safety and comfort at Campus bus stops
1.4	Liaise with key stakeholders to redevelop Herring Road bus stop with high quality waiting areas.	Provide improved safety and comfort at this bus stop
1.5	Advocate for Pre-Pay Only bus services at all Macquarie University Bus Stops	Improve the speed of buses during loading times for faster bus services and greater passenger comfort
1.6	Work with existing transport authorities to install Bus Network Map and updated timetable information at all University bus stops.	Support greater legibility of the Campus bus network and service information.
1.7	Distribute Regional Bike Map	Assist staff and students in travelling by bike.
1.8	Encourage local area bicycle route signage	Assist staff and students in travelling by bike.

. The action plan is divided in 6 sections.
efined, delegated, measured and scheduled.

Stakeholders	Indicator	Measurement	Priority	Timeframe
Human Resources	Successful completion of project	Increase in travel loan scheme applications per year	High	Short-term
Transport for NSW	Successful completion of project	Demonstrated engagement with transport policy makers	Medium	Medium-term
Transport for NSW	Successful completion of project	N/A	High	Medium-term
Transport for NSW, GTP, City of Ryde	Successful completion of project	N/A	High	Medium-term
Transport for NSW	Successful completion of project	Reducing loading times for bus passengers	Medium	Medium-term
Transport for NSW	Successful completion of project	N/A	High	Short-term
City of Ryde	Distribution of bicycle maps per year	More than 2000 maps distributed per year	High	Short-term
City of Ryde	Outcomes generated from CoR Bicycle Committee attendance	Number of new bicycle signs	High	Short-term

10. Action Plan

No.	Action	Outcome
1.9	Provide cycle skills workshops during the year	Assist staff and students in developing cycling skills.
1.10	Pilot Loaner Bike Fleet of 8 bicycles for cycle training courses and other cycling promotion events.	Assist staff and students develop cycling skills.
1.11	Review Pilot Loaner Bike Scheme	Assist staff and students develop cycling skills.

2. Provide Incentives for non-car travel modes

No.	Action	Outcome
2.1	Provide a pack of 5 FREE daily parking vouchers for all recipients' of the staff travel loan scheme	Encourage 'travel blending' and greater flexibility for staff who drive and use public transport
2.2	Investigate staff bicycle purchase scheme to allow staff members to purchase a bicycle or electric bicycle to the value of $2000 via salary deductions.	Assist staff in financing the up-front costs of purchasing a new bicycle for commuting to work.
2.3	Establish bicycle tools and work stand area	Assist students and staff in fixing up bikes for transport and developing practical skills.

3. Establish Cultures of public transport and active transport

No.	Action	Outcome
3.1	Partner with campus accommodation providers to establish new bicycle parking enclosures near student housing	Support cycling as a local transport option for students who live in nearby accommodation
3.2	Encourage staff and students to participate in one mass cycling event per year	Encourage more people to get interesting cycling in a fun and supportive environment

Stakeholders	Indicator	Measurement	Priority	Timeframe
	Growth in cycling modeshare on Campus	Number of person trained per year	Medium	Ongoing
	Successful completion of project	N/A	Medium	Medium-term
	Successful completion of Pilot Review	N/A	Medium	Medium-term

Stakeholders	Indicator	Measurement	Priority	Timeframe
HR	Number of travel loan participants	Number of persons using the travel loan scheme	Medium	Short-term
HR	No. of staff using the bicycle loan scheme	Number of persons using the pilot bicycle loan scheme	Medium	Short-term
	Successful completion of project	N/A	Low	Short-term

Stakeholders	Indicator	Measurement	Priority	Timeframe
Campus Experience, DLC, RMC, CLV	Development of new bicycle parking infrastructure	Number of new bicycle parking spaces at student accommodation	Medium	Medium-term
	Successful completion of event	Number of persons participating in event	Low	Ongoing

10. Action Plan

No.	Action	Outcome
3.3	Participate in Ride to Uni Day	Encourage more people to try commuting to Uni by bike
3.4	Advocate for better bicycle parking at the local area level at key destinations (i.e. train station, Macquarie centre & Trafalgar Place)	Support cycling as a local transport option for students and staff who live locally
3.5	Develop travel loan brochure and application form and include in staff induction	Support change in travel behaviour amongst new staff
3.6	Improve Shuttle Bus Capacity	Support local transport needs after hours
3.7	Review walkways and shared-user path infrastructure access across campus	Improve the quality and experience of walking across campus
3.8	Identify and promote smartphone applications for up-to-date transport information on Campus	Assist in up-to-date travel information
3.9	Maintain and update Transport Access Guides and promote events including O-week and Open Day	Assist staff, students and visitors in choosing sustainable transport options.
3.10	Maintain and update University Transport webpage	Assist staff, students and visitors in choosing sustainable transport options
3.11	Increase Campus bicycle parking and end of trip facilities	Support staff and students with quality bicycle parking and end of trip facilities for cycling
3.12	Establish online community for bicycle riders at Macquarie University	Create a creative medium for engaging students and staff with cycling information and events

Stakeholders	Indicator	Measurement	Priority	Timeframe
Bicycle Network, City of Ryde, Cochlear	Successful completion of event	Number of persons participating in event/ Number of new riders at Ride to Uni Day	Medium	Ongoing
City of Ryde, AMP, Woolworths, Ranch Hotel	Successful partnerships to establish bicycle parking at local travel destinations	Number of new bicycle parking spaces around Campus	Medium	Medium-term
Transport for NSW	Successful completion of project	N/A	High	Short-term
	Growth in patronage on shuttle bus service	Average number of shuttle bus users per week	Medium	Medium-term
	Number of pedestrian and Shared User Path enhancements per year	Growth in pedestrian and bicycle counts on Campus	High	Short-term
Informatics	Successful completion of project	N/A	Low	Short-term
	Public transport modeshare stabilisation or increase	Number of events and TAG Distributed per year	High	Ongoing
	Successful development of webpage	Average number of webpage hits per week	High	Ongoing
	Cycling modeshare stabilisation or increase	Number of bicycle parking spaces and types of bicycle parking facilities	High	Ongoing
	Successful use of social media	Number of participants in social media	High	Ongoing

10. Action Plan

4. Enhance Intra-Campus Mobility

No.	Action	Outcome
4.1	Review Pedestrian shared paths/streets within Campus Masterplan	Support a quality walking environment on campus
4.2	Review pedestrian crossings and traffic calming	Enhance pedestrian safety and encourage walking
4.3	Working with stakeholders, develop addition bicycle parking facilities near the University train station	Support inter-modal travel behaviour between the bicycles and the train station.
4.4	Promote Campus shuttle bus service with service information at bus stops and brochure	Promote use and awareness of the shuttle bus

5. Placemaking and Reduced Demand Travel

No.	Action	Outcome
5.1	Increase Campus accommodation for students in line with University accommodation strategy	Encourage more students to live on Campus
5.2	Review access to essential IT services to support promote working from home	Allow staff and students to access software to work or study from home
5.3	Create Placemaking strategies at eastern and western edges of the Campus	Direct campus planning to support liveability and reduced travel demand
5.4	Investigate the feasibility of a Campus supermarket and fruit and veg stall	Support pedestrian and public transport oriented shopping in order to reduce excess travel needs.

Stakeholders	Indicator	Measurement	Priority	Timeframe
	Completion of pedestrian amenity and shared space projects completed	N/A	High	Medium-term
	Completion of pedestrian crossings and traffic calming projects completed per year	No. of reported pedestrian incidents on Campus	Low	Ongoing
RailCorp	Partnership on bicycle parking facilities	Number of bicycle parking spaces near train station	Medium	Medium-term
	Successful completion of project	Average weekly patronage of shuttle bus	Short	Short-term

Stakeholders	Indicator	Measurement	Priority	Timeframe
Property	Development of new student accommodation	Number of accommodation beds on Campus	High	Medium /Long-term
HR, Informatics and relevant managers	Successful completion of project	Number of employees working from home	Medium	Short-term
Property	Successful completion of project/Publication of Placemaking study	N/A	High	Long-term
Property & Campus Experience	Publication of feasibility study	N/A	Medium	Medium /Long-term

10. Action Plan

No.	Action	Outcome
5.5	Investigate the potential for staff housing	Identify the potential for staff to live closer to Campus
5.6	Investigate the opportunity to identify log-term land use and accessibility planning along Herring Rd and Balaclava Rd	Promote more diverse land-users, greater local area accessibility and amenity.

6. Ensure the most efficient use of carparking

No.	Action	Outcome
6.1	Review carpool priority parking areas	Incentivise carpooling
6.2	Review carpool priority parking incentives	Ensure carpool priority parking incentives are effective
6.3	Phase in PAYG parking in new campus parking facilities	Establish demand management pricing
6.4	Review Pay Per Day parking rates to encourage mixed travel behaviour	Reduce parking permits and encourage pay per use through incentive pricing
6.5	Develop new motorcycle parking area with secure storage facilities	Support motorcycle riders with an undercover area including lockers and changing facilities
6.6	Provide discount on parking permit cost for more energy efficient vehicles	Reward fuel efficiency with lower-fuel use cars

Stakeholders	Indicator	Measurement	Priority	Timeframe
Property	Successful completion of project	N/A	Low	Long-term
Property	Successful completion of project/Publication of Planning study	N/A	High	Long-term

Stakeholders	Indicator	Measurement	Priority	Timeframe
Property	Successful completion of project	Number and visibility of carpool parking spaces	Medium	Short / Medium-term
Property & Sustainability	Successful completion of project	Number of parking priority permits	High	Short-term
Property	Successful completion of project	N/A	High	Medium/ Long-term
Property	Successful completion of project	N/A	Medium	Short-term
Property	Successful completion of project	Number of motorcycle parking spaces and lockers on Campus	Medium	Medium-term
Property	Successful completion of project	Number of parking permits discount applications	Low	Medium-term

11. Monitoring and Reporting on the University Travel Plan

Monitoring of implementation of this Plan will be reported on as part of a biennial University Transport Report. For ongoing implementation, the University's Transport Working Group will need to convene at bi-monthly meetings to review and prioritise actions.

The University Travel Survey will need to be conducted every second year (i.e. 2012, 2014, 2016) to review progress against modal shift targets. The Travel Survey needs to be publicised and promoted to ensure high participation rates amongst staff and students. The results of the survey will help to identify priorities and actions for ongoing implementation.

A new University Travel Plan should be developed in 5 years (e.g. 2017) to review strategic directions and actions for future travel planning on Campus.

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Balaclava Road, North Ryde, Sydney, Australia
Telephone (02) 9850 7111, Facsimile (02) 9850 7433

Macquarie University CRICOS Provider Number 00002J

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Appendix B

Pedestrian Facility Plans
(provided by C&M Consulting Engineers)

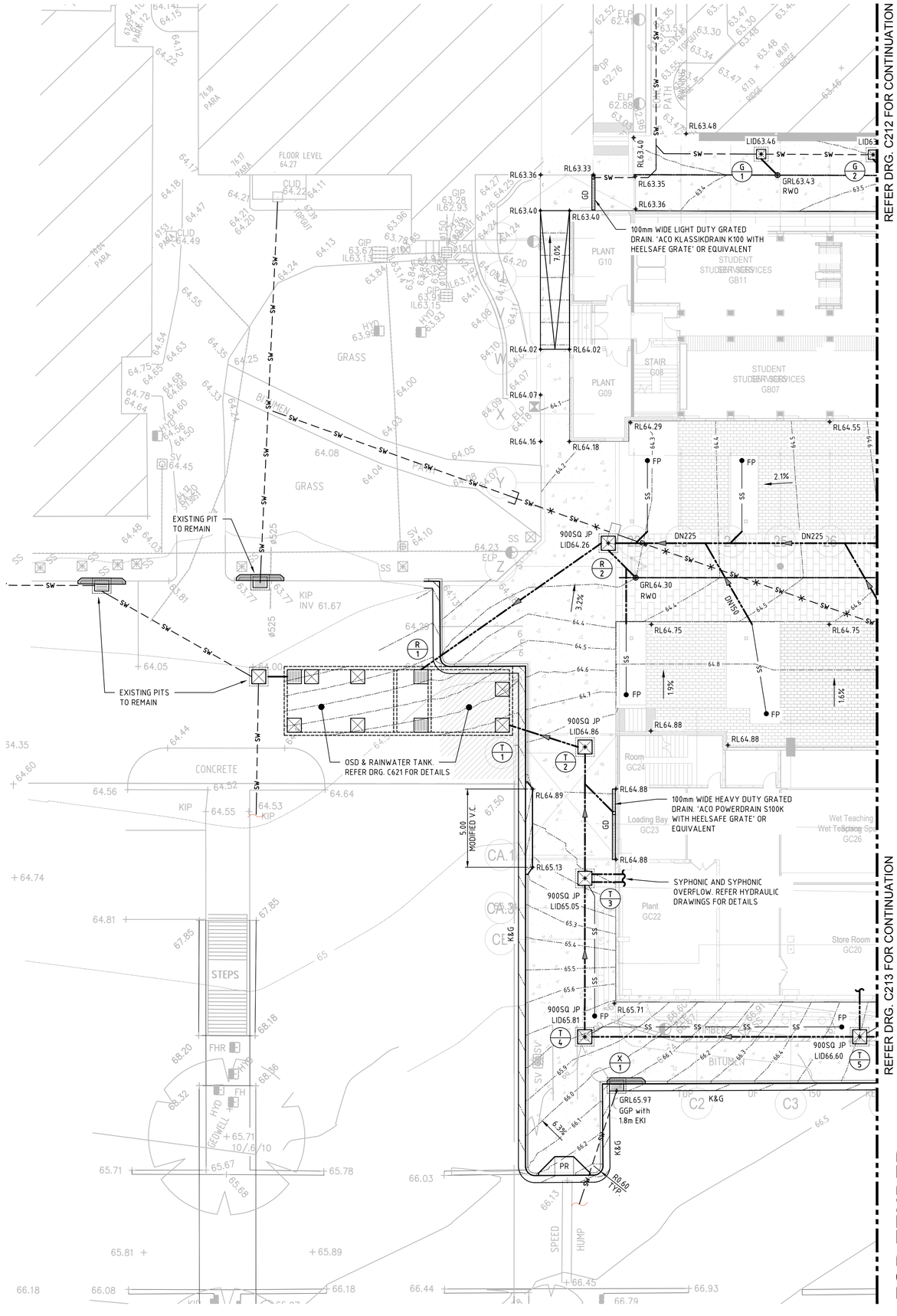
LEGEND

- BOUNDARY
- K&G — KERB & GUTTER
- K.O. — KERB ONLY
- C.E.S. — CONCRETE EDGE STRIP
- I.K. — INTEGRAL KERB
- RIDGE/VALLEY — GRADE DEFINITION
- TOP OF BATTER
- BOTTOM OF BATTER
- 88.4 — FINISHED SURFACE CONTOUR
- STORMWATER DRAINAGE LINE
- FP — SS — SS — FP — STORMWATER SUBSOIL DRAINAGE LINE WITH FLUSHING POINT
- SW — SW — SW — EXISTING STORMWATER DRAINAGE LINE TO REMAIN
- SW — SW — SW — EXISTING STORMWATER DRAINAGE LINE TO BE REMOVED

- GSIP — STORMWATER GRATED SURFACE INLET PIT
- JP — STORMWATER JUNCTION PIT WITH INFILL LID
- GGP — STORMWATER GRATED GULLY PIT
- (REFER DETAILS ON DRG. C501 & C502)
- RWO — STORMWATER RAINWATER OUTLET 'SPS 150mm SUPERFLO RWO WITH HEAVY DUTY FLATE GRATE' OR EQUIVALENT
- GD — STORMWATER GRATED DRAIN AS SPECIFIED
- A/3 — STORMWATER DRAINAGE LINE LETTER / STORMWATER STRUCTURE NUMBER
- RL91.86 — FINISHED SURFACE LEVEL
- TK91.86 — FINISHED TOP OF KERB LEVEL
- GRL91.86 — FINISHED STORMWATER PIT GRATE LEVEL
- LID91.86 — FINISHED STORMWATER PIT INFILL LID LEVEL

Stormwater Pit Schedule

Pit	Pit Type	Pit Size	Grate/Lid Level	Grate/Lid Type
A/1	EXISTING	EXISTING	62.63	Adjust Lid to Class B Infill
A/2	EXISTING	EXISTING	63.07	Nom. 600 x 900 Class D Heelproof Grate
B/1	GSIP	600 x 600	TBC	Nom. 600 x 600 Class B Grate
B/2	GSIP	600 x 600	TBC	Nom. 600 x 600 Class B Grate
B/3	GSIP	600 x 600	TBC	Nom. 600 x 600 Class B Grate
B/4	GSIP	600 x 600	TBC	Nom. 600 x 600 Class B Grate
C/1	GSIP	600 x 600	TBC	Nom. 600 x 600 Class B Grate
D/1	GSIP	600 x 600	TBC	Nom. 600 x 600 Class B Grate
G/1	EXISTING	EXISTING	63.46	Adjust Lid to Class D Infill
G/2	EXISTING	EXISTING	63.50	Adjust Lid to Class D Infill
J/1	EXISTING	EXISTING	N/A	Existing Pit to Remain
J/2	EXISTING	EXISTING	63.60	Adjust Lid to Class D Infill
J/3	EXISTING	EXISTING	66.63	Adjust Lid to Class D Infill
K/1	GSIP	900 x 900	62.87	Nom. 900 x 900 Class D Heelproof Grate
L/1	GSIP	900 x 900	63.02	Nom. 900 x 900 Class D Heelproof Grate
M/1	GSIP	900 x 900	63.53	Nom. 900 x 900 Class D Heelproof Grate
N/1	GSIP	600 x 600	64.20	Nom. 600 x 600 Class D Grate
P/1	GSIP	900 x 900	64.20	Nom. 900 x 900 Class D Heelproof Grate
P/2	GSIP	600 x 600	66.54	Nom. 600 x 600 Class D Grate
R/1	OSD TANK. REFER DRAWING C621 FOR LID DETAILS			
R/2	JP	900 x 900	64.26	Nom. 900 x 900 Class D Infill
R/3	JP	900 x 900	64.74	Nom. 900 x 900 Class D Infill
R/4	JP	900 x 900	64.83	Nom. 900 x 900 Class D Infill
R/5	GSIP	600 x 600	TBC	Nom. 600 x 600 Class B Grate
S/1	GSIP	600 x 600	64.84	Nom. 600 x 600 Class D Heelproof Grate
T/1	OSD TANK. REFER DRAWING C621 FOR LID DETAILS			
T/2	JP	900 x 900	64.86	Nom. 900 x 900 Class D Infill
T/3	JP	900 x 900	65.05	Nom. 900 x 900 Class D Infill
T/4	JP	900 x 900	65.81	Nom. 900 x 900 Class D Infill
T/5	JP	900 x 900	66.60	Nom. 900 x 900 Class D Infill
T/6	JP	900 x 900	67.46	Nom. 900 x 900 Class D Infill
T/7	JP	900 x 900	67.96	Nom. 900 x 900 Class D Infill
Y/1	GGP	900 x 600	67.30	Nom. 900 x 600 Class D Grate
Y/2	GGP	900 x 600	TBC	Nom. 900 x 600 Class D Grate
X/1	GSIP	600 x 600	68.20	Nom. 600 x 600 Class D Heelproof Grate



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client
MACQUARIE University

architects
BUDDEN NANGLE MICHAEL HUDSON ARCHITECTS
Budden Nangle Michael & Hudson Architects
17/130 Pacific Highway
Greenwich NSW 2065
T (61 2) 9906 5599
F (61 2) 9906 8220

architectus™
Architectus Sydney
Level 18 MLC Centre
19 Martin Place
Sydney NSW 2000
T (61 2) 8252 8400
F (61 2) 8252 8600
sydney@architectus.com.au
ABN 90 131 245 684

project manager
capital insight
LEVEL 6, 77 BERRY STREET
NORTH SYDNEY NSW 2060
T (61 2) 9955 2300
F (61 2) 9955 5574
enquiries@capitalinsight.com.au
www.capitalinsight.com.au

landscape architect
GROUPGSA
LEVEL 7, 80 WILLIAM STREET
EAST SYDNEY NSW 2011
T (61 2) 9361 4144
F (61 2) 9332 3458
sydney@groupgsa.com
www.groupgsa.com

structural engineer
tlb
LEVEL 6, 1 JAMES PLACE
NORTH SYDNEY NSW 2062
T (61 2) 9409 3300
F (61 2) 9929 6667
info@tlbengineers.com
www.tlbengineers.com
ABN 94 074 717 892

civil engineer
C&M CONSULTING ENGINEERS
CIVIL AND HYDRAULIC ENGINEERING DESIGN AND PROJECT MANAGEMENT
SUITE 26
11 - 13 BROOKHOLLOW AVE
BAULKHAM HILLS NSW 2153
PHONE: (02) 9680 3100
FAX: (02) 9634 6989
ABN 21 118 134 240

project
Macquarie University Arts Precinct Project

drawing
MAIN WORKS
GENERAL ARRANGEMENT PLAN
SHEET 1

scale: As indicated@A1
drawing no.: **C211**
drawn: W.M.
engineer: X.P.
project no: **01790**
issue: **C**

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SCALE 1:150

100mm WIDE HEAVY DUTY GRATED DRAIN. 'ACO POWERDRAIN S100K WITH HEELSAFE GRATE' OR EQUIVALENT

100mm WIDE HEAVY DUTY GRATED DRAIN. 'ACO POWERDRAIN S100K WITH HEELSAFE GRATE' OR EQUIVALENT

EXISTING PIT LID TO BE ADJUSTED TO SUIT LID62.30

CONSTRUCT 600SQ GSIP OVER EXISTING PIPE

100mm WIDE LIGHT DUTY GRATED DRAIN. 'ACO KLASSIKDRAIN K100 WITH HEELSAFE GRATE' OR EQUIVALENT

CONSTRUCT 600SQ GSIP OVER EXISTING PIPE

EXISTING GRATE TO BE RECONSTRUCTED TO PROPOSED SURFACE LEVEL GRL63.07

600SQ GSIP UNDER DECKING GRL64.25

600SQ GSIP UNDER DECKING GRL64.25

EXISTING PIT & PIPE TO BE REMOVED

NOTE: DRAINAGE UNDER DECKING/BONDEK SLAB TO SUIT FINAL BLOCK WALL SETOUT INCLUDING FALLS TO SUIT

DIRECT PIPE CONNECTION

DIRECT PIPE CONNECTION

EXISTING LID TO BE RECONSTRUCTED TO PROPOSED SURFACE LEVELS

REFER DRG. C211 FOR CONTINUATION

REFER DRG. C213 FOR CONTINUATION

REFER DRG. C213 FOR CONTINUATION

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client

MACQUARIE University

architects

BUDDEN NANGLE MICHAEL HUDSON ARCHITECTS

Budden Nangle Michael & Hudson Architects
17/130 Pacific Highway
Greenwich NSW 2065
T (61 2) 9906 5599
F (61 2) 9906 8220

architectus™

Architectus Sydney
Level 18 MLC Centre
19 Martin Place
Sydney NSW 2000
T (61 2) 8252 8400
F (61 2) 8252 8600
sydney@architectus.com.au
ABN 90 131 245 684

project manager

capital insight

LEVEL 6, 77 BERRY STREET
NORTH SYDNEY NSW 2060
T (61 2) 9955 2300
F (61 2) 9955 5574
enquiries@capitalinsight.com.au
www.capitalinsight.com.au

landscape architect

GROUPGSA

LEVEL 7, 80 WILLIAM STREET
EAST SYDNEY NSW 2011
T (61 2) 9361 4144
F (61 2) 9332 3458
sydney@groupgsa.com
www.groupgsa.com

structural engineer

tlb

LEVEL 6, 1 JAMES PLACE
NORTH SYDNEY NSW 2062
T (61 2) 9409 3300
F (61 2) 9929 6667
info@tlbengineers.com
www.tlbengineers.com
ABN 94 074 717 892

civil engineer

C&M CONSULTING ENGINEERS

CIVIL AND HYDRAULIC ENGINEERING DESIGN AND PROJECT MANAGEMENT
SUITE 26
11 - 13 BROOKHOLLOW AVE
BAULKHAM HILLS NSW 2153
PHONE: (02) 9680 3100
FAX: (02) 9634 6989
ABN 21 118 134 240

project

Macquarie University Arts Precinct Project

drawing

MAIN WORKS GENERAL ARRANGEMENT PLAN SHEET 2

scale	As indicated@A1
drawing no.	**C212**
drawn	W.M.
engineer	X.P.
project no	**01790**
issue	**C**

REFER DRG. C212 FOR CONTINUATION

REFER DRG. C212 FOR CONTINUATION

REFER DRG. C211 FOR CONTINUATION

NOTE: ALL DRAINAGE PIT GRATES, LIDS & RWO'S TO BE CLASS D HEAVY DUTY BETWEEN BUILDINGS 25WWB & 25WWC TO CATER FOR HEAVY SCISSOR LIFTS

EXISTING STORMWATER PIT TO BE DEMOLISHED

EXISTING STORMWATER PIT TO BE DEMOLISHED

NOM. Ø90mm REMOVABLE BOLLARDS TO ARCHITECTS DETAILS (TYPICAL)

100mm WIDE HEAVY DUTY GRATED DRAIN. 'ACO POWERDRAIN S100K WITH HEELSAFE GRATE' OR EQUIVALENT

SYPHONIC AND SYPHONIC OVERFLOW. REFER HYDRAULIC DRAWINGS FOR DETAILS

DIRECT PIPE CONNECTION

DIRECT PIPE CONNECTION

DIRECT PIPE CONNECTION

EXISTING LID TO BE RECONSTRUCTED TO PROPOSED SURFACE LEVELS

EXACT LOCATION OF KERB BLISTER TO BE LOCATED ON-SITE TO FIT WITH EXISTING CARSPACES

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SCALE 1:150

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MACQUARIE University

architects

BUDDEN NANGLE MICHAEL HUDSON ARCHITECTS

Budden Nangle Michael & Hudson Architects
17/130 Pacific Highway
Greenwich NSW 2065
T (61 2) 9906 5599
F (61 2) 9906 8220

architectus™

Architectus Sydney
Level 18 MLC Centre
19 Martin Place
Sydney NSW 2000
T (61 2) 8252 8400
F (61 2) 8252 8600
sydney@architectus.com.au
ABN 90 131 245 684

project manager

capital insight

LEVEL 6, 77 BERRY STREET
NORTH SYDNEY NSW 2060
T (61 2) 9955 2300
F (61 2) 9955 5574
enquiries@capitalinsight.com.au
www.capitalinsight.com.au

landscape architect

GROUPGSA

LEVEL 7, 80 WILLIAM STREET
EAST SYDNEY NSW 2011
T (61 2) 9361 4144
F (61 2) 9332 3458
sydney@groupgsa.com
www.groupgsa.com

structural engineer

tlb

LEVEL 6, 1 JAMES PLACE
NORTH SYDNEY NSW 2062
T (61 2) 9409 3300
F (61 2) 9929 6667
info@tlbengineers.com
www.tlbengineers.com
ABN 94 074 717 892

civil engineer

C&M CONSULTING ENGINEERS

CIVIL AND HYDRAULIC ENGINEERING DESIGN AND PROJECT MANAGEMENT
SUITE 26
11 - 13 BROOKHOLLOW AVE
BAULKHAM HILLS NSW 2153
PHONE: (02) 9680 3100
FAX: (02) 9634 6989
ABN 21 118 134 240

project

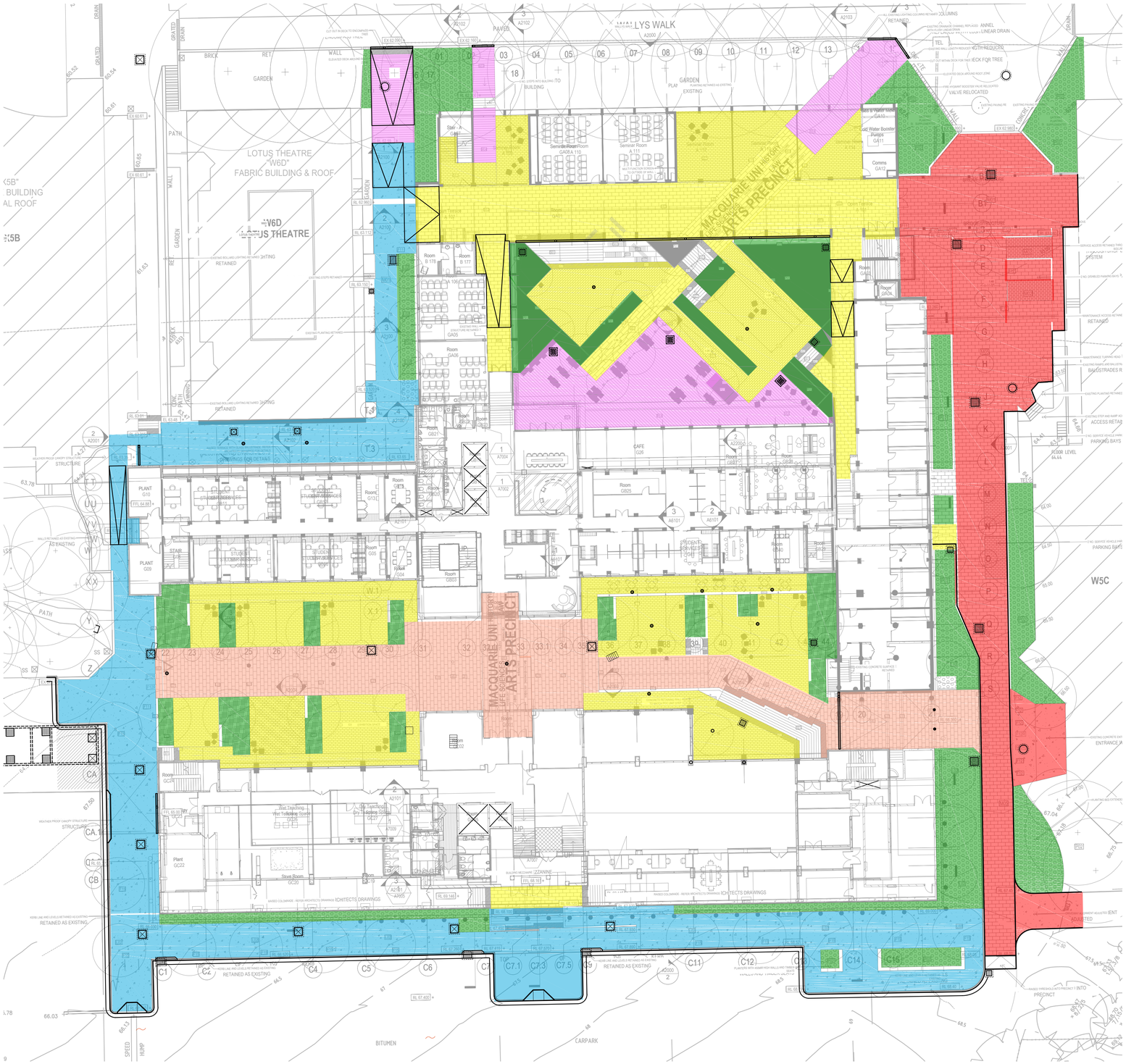
Macquarie University Arts Precinct Project

drawing

MAIN WORKS
GENERAL ARRANGEMENT PLAN
SHEET 3

scale	As indicated@A1	drawing no.	C213
drawn	W.M.	engineer	X.P.
project no	01790	issue	C

FOR TENDER



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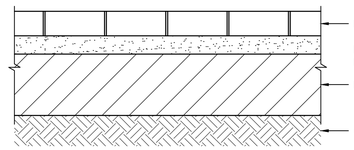

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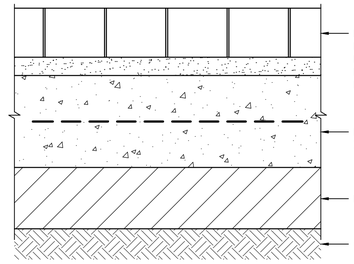
(OCCASSIONAL TRAFFIC)



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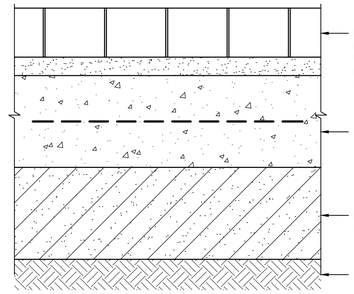
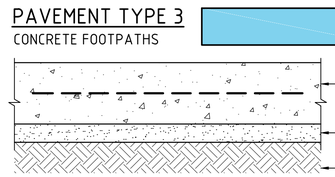


PAVEMENT TYPE 3
CONCRETE FOOTPATHS



PAVEMENT TYPE 4
DECKING TO LANDSCAPE
ARCHITECTS DETAILS

PAVEMENT TYPE 5
GARDENS TO LANDSCAPE
ARCHITECTS DETAILS

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5 2.5 0 5 10 15 20 25m
SCALE 1:250

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MACQUARIE University

architects
BUDDEN NANGLE MICHAEL HUDSON ARCHITECTS

Budden Nangle Michael & Hudson Architects
17/130 Pacific Highway
Greenwich NSW 2065
T (61 2) 9906 5599
F (61 2) 9906 8220

architectus™

Architectus Sydney
Level 18 MLC Centre
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Sydney NSW 2000
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ABN 90 131 245 684

project manager
capital insight

LEVEL 6, 77 BERRY STREET
NORTH SYDNEY NSW 2060
T (61 2) 9955 2300
F (61 2) 9955 5574
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www.capitalinsight.com.au

landscape architect
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tlb

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FOR TENDER

project
Macquarie University Arts Precinct Project

drawing
MAIN WORKS PAVEMENT PLAN

scale As indicated@A1
drawn W.M. engineer X.P.
drawing no. **C221**
project no **01790**
issue **B**