TRANSPORT

Macquarie Park Detailed Precinct Transport Study

September 2023

NSW GOVERNMENT

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Acknowledgement of Country

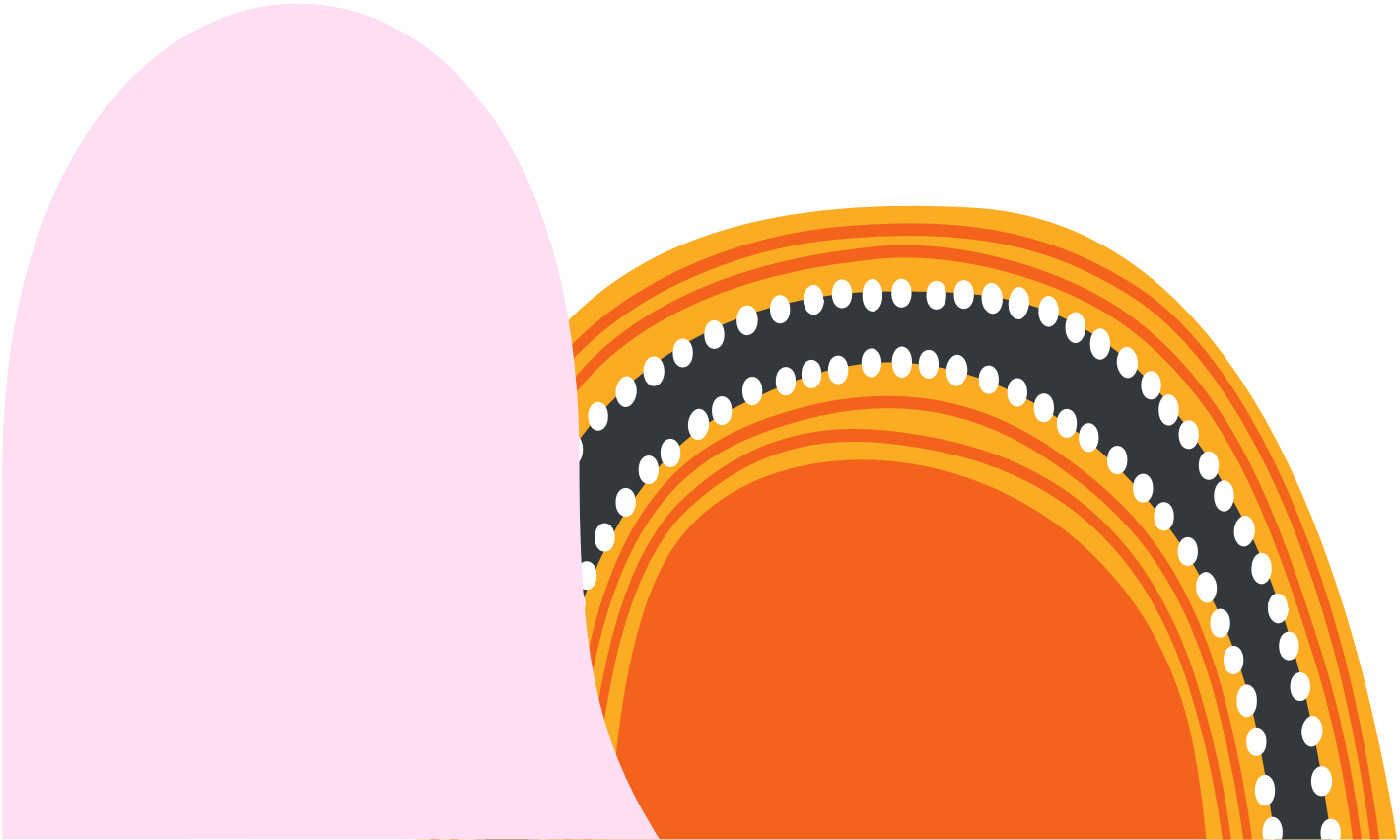
We acknowledge that this project is on the land of Wallumatta Ngurrungra, the place of the Wallumai (Black Snapper fish).

We pay our respects to elders past, and present.

We acknowledge that the vision for Macquarie Park embeds an understanding of Ngurra (Country) and its people to help reconnect Macquarie Park with purpose and culture.

Songlines have crisscrossed the Australian continent with a net of power and meaning since time immemorial. They haven't disappeared: they are to be rediscovered and made visible again in places like Macquarie Park.

This project aims to uncover and reconnect with Ngurra through transport networks and activation of places that will enable people to experience Ngurra, walking with their feet on the ground, and yarning together in welcoming public spaces.



Glossary

Acronym	Term
AT	Active transport
CBD	Central business district
CPTED	Crime Prevention Through Environmental Design
DCP	Development Control Plan
DPE	Department of Planning and Environment
EV	Electric vehicles
GCC	Former Greater Cities Commission
GDP	Gross domestic product
Km/h	Kilometres per hour
LOS	Level of service
LSPS	Local Strategic Planning Statement
MPIP	Macquarie Park Innovation Precinct
PT	Public transport
Sec/km	Seconds per kilometre
SISA	Strategic Infrastructure and Services Assessment
STM	Strategic Traffic Model
TfNSW	Transport for NSW
VKT	Vehicle kilometres travelled

REV	DATE	DETAILS
A	09/06/2023	Silver Report
B	03/07/2023	Gold Report
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Executive Summary

Macquarie Park, situated in Wallumedegal Country, is the fourth largest employment hub in Greater Sydney, fostering world-class businesses, innovation, research and education. It is undergoing a major transformation into a vibrant place for people and business, catalysed by the opening of three Sydney Metro stations. With the area's population growing at four times the Greater Sydney average, the vision for Macquarie Park is to be a successful place for people that puts community and Country at the centre.

This Detailed Precinct Transport Study will support bringing this vision to life, by evaluating and recommending the necessary transport investments that will best enable the transformation.

The NSW Government's ambition for Macquarie Park Innovation Precinct (MPIP) includes the addition of 20,000 jobs and 7,650 new homes. This growth is supported by the MPIP Place Strategy (Place Strategy), MPIP Master Plan (Master Plan), and Macquarie Park Strategic Infrastructure and Services Assessment (SISA) which identified 180 initiatives ranging from mass transit to schools, green spaces, and fine-grain walking and cycling networks, noting that the majority of these initiatives are currently unfunded.

The key guiding themes for Macquarie Park are economic development as a growing education and innovation precinct; the need for public and active transport improvements to better connect and support place; meaningful integration with Wallumedegal Country; leveraging existing infrastructure where feasible; and ensuring transport supports land use and place outcomes.

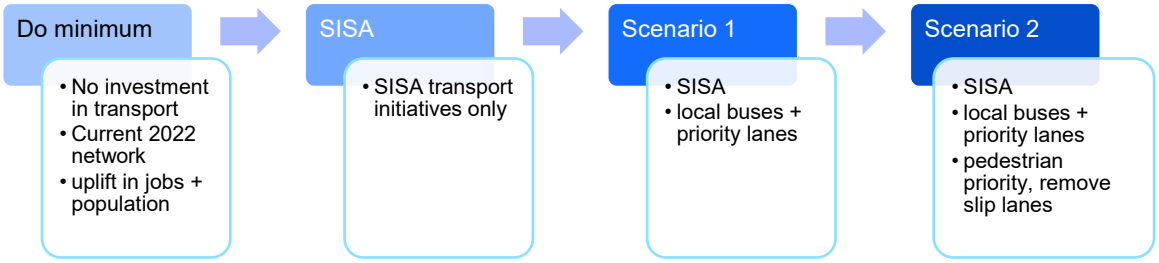
Transport vision for Macquarie Park, based on the Place Strategy; Image: supplied.

The key recommendations of this Study are (see chapter 10 for details):

1. Deliver **Scenario 2** as the best placed transport scenario to achieve the transport vision for Macquarie Park. This will deliver the SISA initiatives and provide additional enhancements to bus priority, and pedestrian access, amenity and safety.
2. Implement a holistic approach to drive a **shift to public and active transport.**
3. Develop a **fine grain street and pathway network** to provide high-quality walking and cycling connections.
4. Integrate **Connection with Country** and **women's safety** in tandem to acknowledge and connect with Wallumedegal Country, increase walkability; and foster safe, inclusive public spaces and transport systems for everybody.
5. Formulate an **implementation plan**, in concert with a business case process, to deliver the proposed initiatives in a phased approach, ensuring that transport infrastructure keeps pace with growth and rezoning.

The transport vision for Macquarie Park, based on the Place Strategy vision, is pictured above. A 'vision and validate' approach was used to evaluate the outcomes of transport modelling and analysis against the transport vision. The primary consideration was to deliver the desired place outcomes with pedestrians, bicycle riders and then public transport as the top priorities. Scenario 2 was found to be the most supportive of the vision.

Four scenarios were tested: from 'Do Minimum'; a 'SISA scenario' that modelled only the transport initiatives identified in the SISA; Scenario 1 which modelled the SISA initiatives and added local bus services and bus priority lanes; and Scenario 2 which included all the above initiatives with additional pedestrian priority initiatives.



In addition to the technical modelling, this study analysed opportunities to integrate Connection with Country and Women's Safety. It found that, by integrating both cultural heritage and safety for women's and girls', Macquarie Park can create a more connected, inclusive, and safe environment for people walking and cycling, while experiencing the rich heritage of Wallumedegal Country.

This Transport Study finds that, if the proposed infrastructure investments are not made cohesively and comprehensively, the envisioned development of MPIP may be hindered, leaving the community and businesses to grapple with the consequences of unsupported growth. This would manifest as constrained transport access and continued dominance of private vehicle use, while also forfeiting the opportunity to evolve MPIP into a sustainable, attractive hub for an intellectual and creative workforce.

It is therefore important to synchronise transport and access improvements with anticipated growth, catering to community, business, and MPIP's overarching transformation goals. This report concludes with detailed recommendations for next steps including implementation and business cases (section 10.3).

1 Introduction

1.1 Context

Macquarie Park, in Wallumedegal Country, is a strategic centre fostering world-class businesses, innovation, research, and education. It is undergoing a major transformation into a vibrant place for people and business, catalysed by the opening of Sydney Metro.

The Macquarie Park Innovation Precinct (MPIP) is the largest non-central business district (CBD) market in Australia and the fourth largest employment centre in Greater Sydney. The NSW Government's ambition for MPIP includes 20,000 additional jobs and 7,650 new homes, as outlined in the MPIP Place Strategy and Strategic Master Plan. The Strategic Infrastructure and Services Assessment (SISA) includes 180 proposed initiatives to support the Place Strategy and land uplift.

MPIP is 16 kilometres northwest of Sydney CBD and 14 kilometres northeast of Parramatta CBD. It includes a university (Macquarie University), a shopping centre (Macquarie Centre) and a predominance of commercial development with some pockets of housing. Notably, the MPIP area is about the same size as Sydney CBD (Figure 1.1)

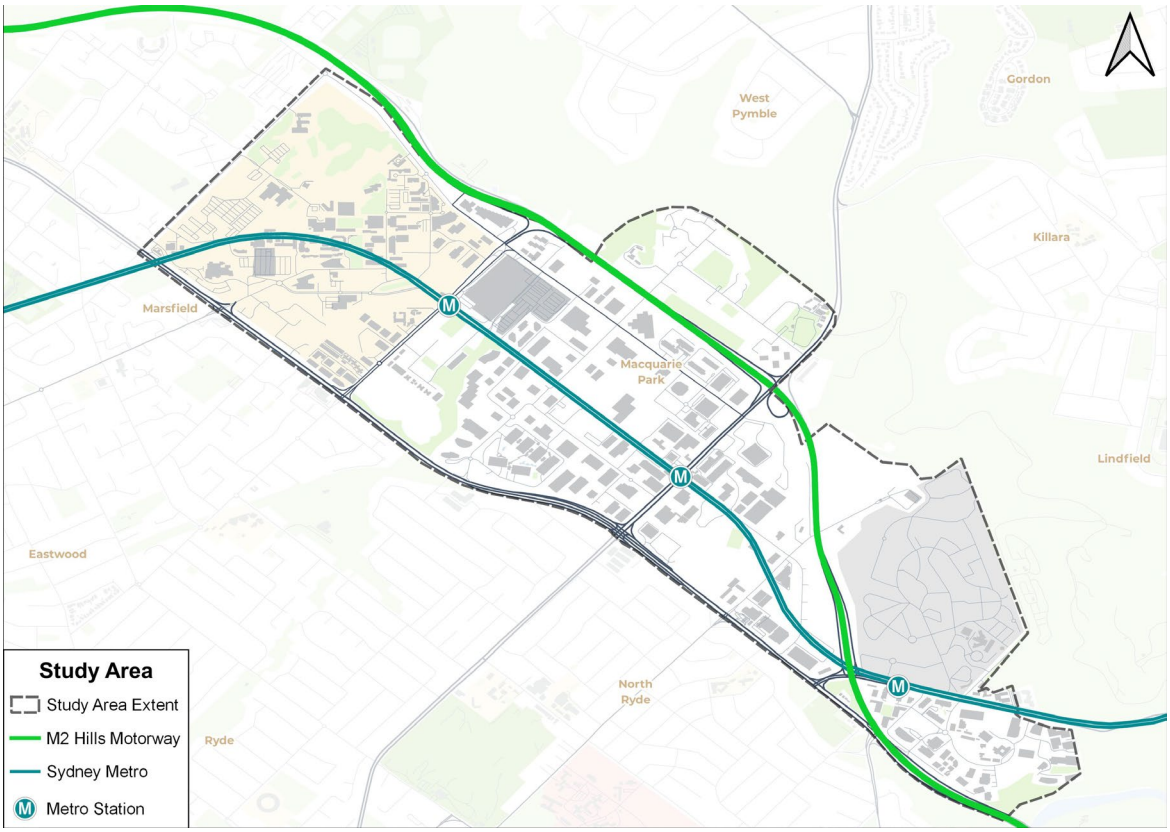


Figure 1.1 Map of the study area showing surrounding suburbs.

1.2 Purpose

The purpose of the Macquarie Park Detailed Precinct Transport Study (Transport Study) is to enable the successful delivery of the Macquarie Park place vision and growth ambitions through the staged rezoning of the precinct. It makes recommendations for transport investments to support this using a 'vision and validate' approach in which the primary consideration is to deliver the desired transport and place vision, and then validate which transport investment scenarios would support this vision to arrive at a series of recommendations.

This process included the following steps:

- Identify and recommend potential new or amended transport initiatives to complement the SISA initiatives, to enhance the delivery of the transport vision (Chapter 6 and Appendix C)
- Prepare options to integrate Country and women's safety holistically across the Precinct (Chapter 5 and Appendices A and B)
- Develop a range of investment scenarios for testing out to the year 2041 (Chapter 8)
- Use a vision and validate approach to assess and validate which traffic modelling scenarios support the transport vision (Chapter 9)
- Make recommendations to progress transport and place initiatives through to future business cases for funding decisions and delivery (Chapter 10).

1.3 Vision

Guided by the vision set out in the Macquarie Park Place Strategy, and in consultation with key stakeholders at the commencement of this project, the following transport vision for Macquarie Park was established:

> *Enable successful places for people that connect to Wallumedegal Country, and put the community at the centre, through adaptable transport planning and transport services.*
>
> *Enable economic activity through efficient and sustainable goods movement that optimises existing infrastructure.*
>
> *Connect our customers' whole lives by providing multi-modal end-to-end journeys that are equitable, sustainable, accessible, and safe.*

This transport vision has been fully embedded into the processes used to develop this Transport Study, including the final recommendations.

1.4 Strategic Alignment

Section 2.4 establishes the relevant strategic context for the planning of Macquarie Park, including the NSW Government's 40-year land use and transport plans, being Future Transport and the Metropolis of Three Cities; the North District Plan which applies these objectives to the region covering Macquarie Park; and the City of Ryde plans for land use and transport.

It outlines the relevant Macquarie Park plans, including the Place Strategy, Strategic Master Plan, Strategic Infrastructure and Services Assessment (SISA), and draft Integrated Transport Plan. Finally, it outlines how state guidance can be applied, such as Movement and Place, the Net Zero Plan, and Connecting with Country.

The themes in Future Transport and the desired outcomes that are relevant to Macquarie Park are summarised in Table 1.1.

Table 1.1 Future Transport themes

Theme	Desired outcomes
Connecting our customers' whole lives	• Improving connectivity across NSW • Multimodal mobility supports end-to-end journeys. • Equitable, accessible and secure transport for all • Our transport networks are safe
Successful places for communities	• Supporting growth through smarter planning • Transport infrastructure makes a tangible improvement to places. • Transition to net zero greenhouse gas emissions • Transport minimises environmental impacts. • Transport is resilient and adaptable to shocks and stresses
Enabling economic activity	• Freight networks and supply chains are efficient and reliable. • Existing infrastructure is optimised. • Transport supports the visitor economy. • The transport system is financially sustainable. • Leverage our procurement power for better outcomes

1.5 Legacy of land use and transport planning

Due to its original conception and formation as a relatively isolated technology park with abundant car parking and motorway connections, the predominant mode of travel to access Macquarie Park was by private motor vehicle. MPIP is a similar size to the Sydney CBD but has much larger block sizes which make movement by walking and cycling difficult and unpleasant. It lacks the fine grain street permeability that makes the Sydney CBD walkable and vibrant.

With the opening of three train stations in 2009, and their subsequent conversion to Metro, there have been increasing options for public transport, but little improvement in walkability and accessibility due to structural factors the inhibit walking and cycling. These include:

- Large blocks with limited permeability, which unnecessarily increase walking distances to reach local destinations.
- Lack of public space, large building setbacks and limited activation of the street, making it unwelcoming and lacking in vibrancy
- The abundant availability of car parking and motorway connections make it relatively easy and convenient to drive.
- Bus reliability and travel speeds are affected by traffic congestion, with buses travelling at around half the target speed.
- Street layouts are rectilinear and ignore the natural topography of creek beds and ridgelines, thus limiting connection with Country.
- Limited tree canopy, vegetation and shade, leading to urban heat island effects and a hostile walking environment. This is further exacerbated by noise and localised air pollution from fast-moving traffic.
- Barriers to people walking, including missing pedestrian crossings on some legs of signalised intersections, barrier fencing, slip lanes that increase vehicle speed, and limited crossing opportunities.
- Limited catchment area to bus stops and metro stations due to limitations on pedestrian comfort and access. This results in less use of public transport than could be attained with improved catchments.

1.6 Integrating Country and Women's Safety

In addition to the technical analysis and transport modelling, this study analysed opportunities to integrate Caring for Country and Women's Safety. It found that, by integrating both cultural heritage and improved safety for women's and girls', Macquarie Park can become a more connected, inclusive, and safe environment for people walking and cycling, while experiencing the rich heritage of Wallumedegal Country.

Integration actions include:

- develop a fine grain walking and cycling network, including incorporating natural terrain, significant trees and waterways to experience Country
- dual indigenous naming for streets and wayfinding
- position paths with good visibility and active street frontages to encourage 'eyes on the street' combined with storytelling stations which serve as gathering places to increase activation and welcoming
- ensure pathways are well-lit, avoiding shadows from trees and structures.
- integrate pedestrian-friendly crossings at regular intervals, with a focus on safety for all users, including women, children, and people living with disabilities.

Wallumattagal / Wallumedegal Country derives from *wallumai* (snapper fish) combined with *matta* (place, usually a water place) being the Lane Cove River. The Connecting with Country framework, outlined in Section 5.1 and Appendix A, makes a series of recommendations for future design stages in MPIP to incorporate Connecting with Country principles. In undertaking the framework, consultation was undertaken with the local indigenous community to learn about Country and the Dharug traditional owners/local custodians; learning about the history of the precinct from the perspective of the local Aboriginal community; and ensuring the project supports Aboriginal people to gain tangible and intangible intergenerational benefits.

It is also intended that this learning will inspire future design teams to connect and integrate with Country through culturally informed co-design methodologies; support the design guide and instruct design teams on how Country can influence the design of MPIP and future development; and support mutually beneficial capacity building across Aboriginal and non-Aboriginal communities.

Opportunities to improve Women's Safety were also assessed. The findings are summarised in Section 5.2 and Appendix B.

2 Background

This section summarises the strategic context of Macquarie Park of relevance to the Transport Study.

2.1 Strategic context

As noted in the Introduction, Macquarie Park is undergoing a major transformation into a vibrant place for people and business. The NSW Government's ambition for MPIP includes 20,000 additional jobs and 7,650 new homes, as outlined in the MPIP Place Strategy.

Key destinations in MPIP include a large shopping centre (Macquarie Centre), a university (Macquarie University), residential buildings (Ivanhoe Estate and Lachlan's Line), three Metro Stations (Macquarie University, Macquarie Park and North Ryde) and commercial precincts.

A map of the MPIP study area is shown in Figure 2.1, which is around the same size as the Sydney CBD.

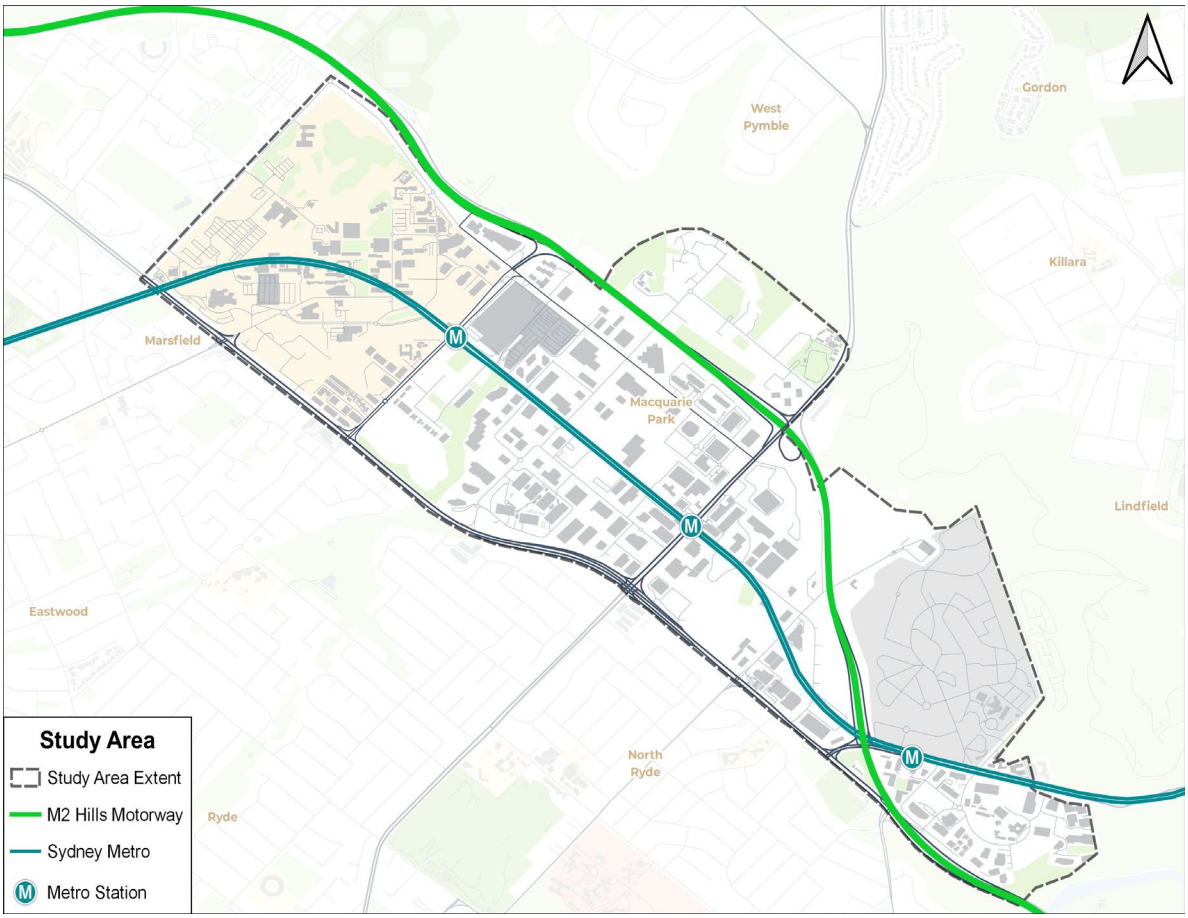


Figure 2.1 Map of the study area

MPIP is located 16 kilometres northwest of Sydney CBD and 14 kilometres northeast of Parramatta CBD. The MPIP area is bound by Epping Road, Culloden Road, and Fontenoy Road and includes the area around the North Ryde Metro Station. The study area does not include the M2 Motorway.

2.2 Key statistics

The following key statistics indicate the broader character of Macquarie Park:

- Nationally significant research and employment centre that is among the top ten precincts contributing to Australia's Gross Domestic Product (GDP)[1]
- Fourth largest employment centre in Greater Sydney (number of employees)
- Three Sydney Metro stations and around 25 bus routes
- 70 per cent of people who work in Macquarie Park commute by private motor vehicle[2]
- Lane Cove National Park provides 670 hectares of regional open space, however, the waterways such as Shrimptons, Kikiya, and Mars Creeks are difficult to access due to the M2 motorway.
- The Place Strategy identifies an open space shortfall of 16 hectares.[3]
- The precinct currently hosts approximately 72,850 jobs, 12,800[4] residents and 45,000 students[5]
- Macquarie University is expected to grow to 55,000 students by 2030[6].

2.3 Regional travel patterns

Figure 2.2 maps the travel origins for those who work within the Macquarie Park area. It shows the quantum of commuting trips originating from SA3s to Macquarie Park in 2016. Notably, most of these commuters travelled from north of the Parramatta River. The key origins were:

- Parramatta
- Carlingford
- Baulkham Hills
- Pennant Hills – Epping
- Ku-ring-gai
- Chatswood – Lane Cove

1 City of Ryde, *Local Strategic Planning Statement,* 2020
2 Department of Planning and Environment (2022), Macquarie Park Place Strategy
3 Department of Planning and Environment (2022), Macquarie Park Place Strategy
4 Greater Cities Commission (2022), Macquarie Park Strategic Infrastructure and Services Assessment
5 Department of Planning and Environment (2022), Macquarie Park Place Strategy
6 City of Ryde, *Local Strategic Planning Statement,* 2020

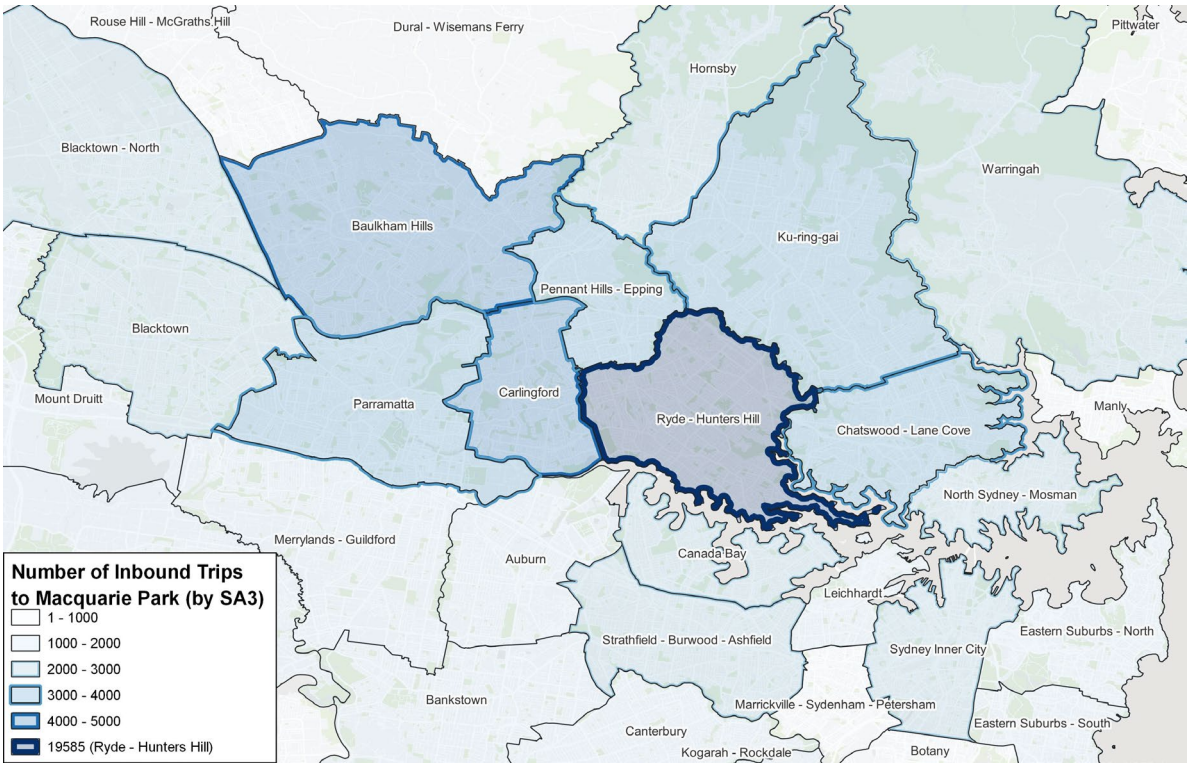


Figure 2.2 Top SA3 origins for people working in Macquarie Park (Journey to Work) *Source: ABS 2016*

2.4 Vision

The transport vision for Macquarie Park is closely aligned with the place vision established in the Place Strategy. Table 2.1 shows how the place vision and transport vision are aligned. This alignment was agreed upon by stakeholders at the early stages of the project development.

Table 2.1 The place vision and transport's contribution to the vision for Macquarie Park

Place vision	Corresponding transport vision
A growing home to world-class businesses, innovation, research and education, Macquarie Park is competitive and resilient, with a stronger role within Greater Sydney's and Australia's economies.	Enable economic activity through efficient and sustainable goods movement and optimising existing infrastructure.
It is a place for people, characterised by its connectivity and the unique setting of Wallumedegal Country — a place of rivers and fertile wetlands with a deep history of learning, trade and culture.	Enable successful places for people that connect to Wallumedegal Country, and put the community at the centre, through adaptable transport planning and transport services
Macquarie Park is a place where people go to share ideas; a place that fosters creativity through interconnected relationships between people, businesses, places of education and a renewed connection to Country.	Connect our customers' whole lives by providing multi-modal end-to-end journeys that are equitable, sustainable, accessible, and safe.

2.5 Planning and Policy Context

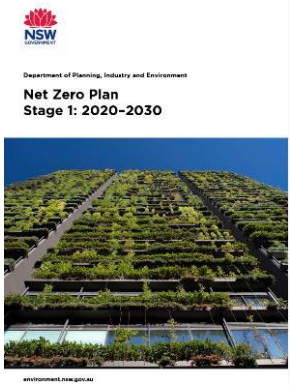
Figure 2.3 shows the hierarchy of planning and policy documents reviewed to inform this Transport Study, from high-level NSW Government guidance to TfNSW, City of Ryde and Macquarie Park specific plans.

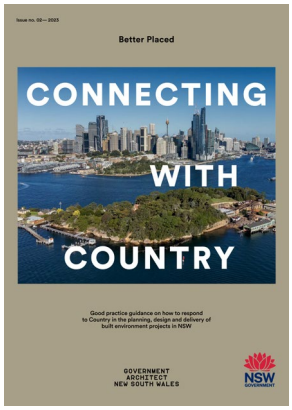
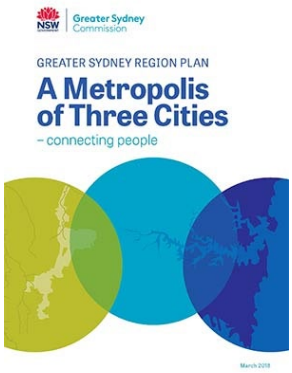
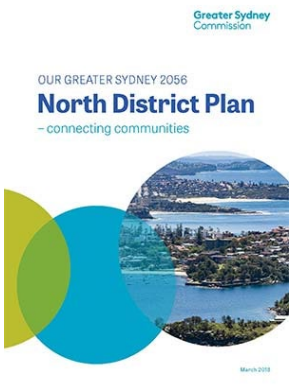
Figure 2.3 Planning and policy hierarchy

2.5.1 NSW Government

Table 2.2 summarises the background policy documents from the NSW Government that were relevant to this Study:

Table 2.2 Relevant NSW Government policy

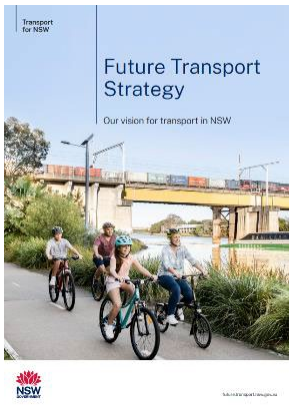
NSW Government	Overview
	The Net Zero Plan Stage 1: 2020–2030 (Net Zero Plan) (DPE, 2020) sets out the steps that the NSW Government will take over the next decade to work towards net zero emissions while also creating new jobs, cutting household costs and attracting investment. The Net Zero Plan notes that the transport sector is the second highest emitting sector in NSW. **Relevance to this study** Promoting sustainable travel behaviours, such as walking, cycling and public transport supports reducing transport sector emissions. There are actions regarding the rollout of charging facilities that could be implemented in Macquarie Park.

NSW Government	Overview
	The NSW Movement and Place Framework (Framework) (DPE, 2021) is a cross-government framework for planning, designing and managing transport networks and their interaction with public spaces of which they are a part to maximise benefits for the people and places they serve. The Framework includes a range of guides and tools to assist authorities and practitioners with the implementation of the Framework. **Relevance to this study** The Movement & Place Framework was used to assess how the transport network interacts with places within Macquarie Park.
	The Connecting with Country Framework (Government Architect NSW, 2023) provides a framework for developing Connections with Country to inform the planning, design and delivery of 'built environment' projects in NSW. The purpose of Connecting with Country is to consider Aboriginal culture and heritage and be guided by Aboriginal people to enable projects to support the health and wellbeing of Country. **Relevance to this study** This document was used to inform the Connecting with Country Framework document that accompanies this study.
	The Greater Sydney Region Plan, A Metropolis of Three Cities (GCC, 2018) was developed as a 40-year vision for Greater Sydney to guide strategic planning and manage growth and change. This is articulated through ten directions across the themes of Infrastructure and collaboration, Liveability, Productivity and Sustainability. **Relevance to this study** The Plan is built on the vision that where residents live within 30 minutes of their jobs, essential services such as health and education and great places which is relevant to this study.
	The North District Plan (GCC, 2018) is a supporting Plan of the Greater Sydney Region Plan and applies to the North District of Greater Sydney. It shares the ten directions from the Greater Sydney Region Plan and expands them into Planning Priorities and actions specific to the district. **Relevance to this study** The District Plan highlights the importance of bringing together stakeholders, including the City of Ryde Council and State Agencies to grow jobs and infrastructure in Macquarie Park.

2.5.2 Transport for NSW

Table 2.3 summarises the background strategic documents from TfNSW that were relevant to this study.

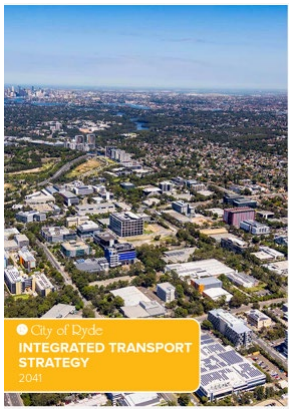
Table 2.3 Relevant Transport for NSW policy

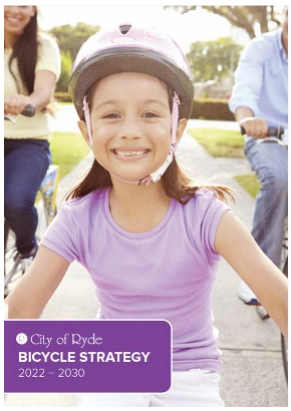
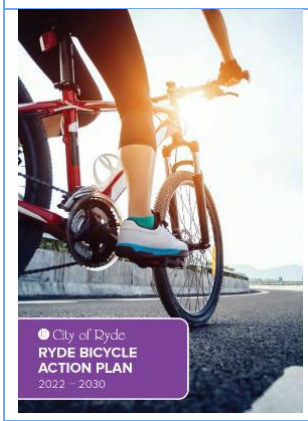
TfNSW policy	Overview
	The Future Transport Strategy (TfNSW, 2021) sets the 40-year vision, directions, and principles for customer mobility in NSW around three key outcomes: • Connecting our customers' whole lives. • Successful places for communities. • Enabling economic activity. The outcomes are supported by Strategic Directions and responses which align with the vision and outcomes. **Relevance to this study** Stronger emphasis than previous transport strategies on: • Net zero/sustainability • Capping traffic growth • Improving place and amenities through transport Where there is conflict or contradiction in other Transport for NSW strategic documents, the Future Transport Strategy takes precedence.
	The Bus Interchange upgrade will occur on Herring Road between Waterloo Road/University Avenue and Talavera Road. A layover is also planned off Talavera Road next to the M2 Motorway by Culloden Road. The design consists of: • New areas for public domain, greenspace and vegetation • Improved pedestrian crossings, access and connections • Better footpaths that link places so people can move in and around the area • More bus stops and shelters for improved accessibility to public transport • Dedicated bus lanes on Herring Road • The removal of the existing bus layover and parking from Herring Road. This will be moved to Talavera Road. **Relevance to this study** The upgrade needs to be incorporated into future planning as part of this study.

2.5.3 City of Ryde

Table 2.4 summarises the relevant background policy documents by the City of Ryde.

Table 2.4 Relevant City of Ryde policy

City of Ryde policy	Overview
	The Ryde Integrated Transport Strategy (City of Ryde, 2022) builds on previous transport and land use strategies and explores the impacts of the growing population and economy while leveraging the use of technology to influence travel journeys. The main themes of the strategy are integrated transport, land use, parking, active and public transport, roads and freight and local centres, which are supported by technological inputs such as parking management, micro mobility, the rollout of electric vehicles and cost-effective traffic monitoring. **Relevance to this study** Key strategies to improve the transport system are included as part of the objectives for this study such as: • Prioritise behavioural and infrastructure delivery to increase active transport use. • Improve residential amenities in streets by limiting the volume and speed of through traffic with road space allocation measures and incorporating Movement and Place principles.
	The Ryde Local Strategic Planning Statement 2020 (City of Ryde, 2020) defines the vision for the broader Council area of Ryde over 20 years: *"The City of Ryde will be a liveable, prosperous and connected city, that provides for our future needs while protecting nature and our history. As a city with diverse and vibrant centres, our neighbourhoods will reflect and serve our residents and business. Our well-planned places will enhance the health, wellbeing, and resilience of our future community. They will also foster innovation, equity, inclusion and resilience."* **Relevance to this study** The Macquarie Park section of the LSPS outlines relevant planning priorities for the Detailed Transport Study: • M6.1: Investigate mass transit. • M6.2: Increase public and active transport mode share; enhance pedestrian safety and priority. • M6.3 Investigate parking options to manage demand; convert existing private parking to other uses; maximise business benefit; reduce traffic congestion and increase the use of public transport. • M6.4 Prepare a movement-place future vision. • M7.1 Deliver a physical environment that supports pedestrian activity.

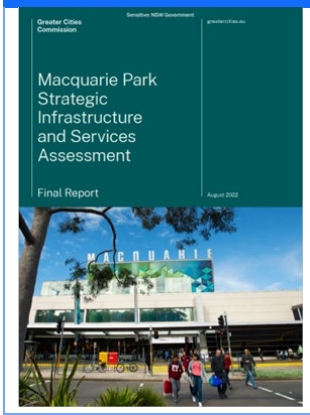
City of Ryde policy	Overview
	City of Ryde's Bicycle Strategy (City of Ryde, 2022) outlines the importance of cycling for the local government area: "Attracting more people to walk and ride will support our city's growth, improve the quality of our environment, and the health and well-being of our community." The regional bicycle network is designed to provide connectivity for people who ride to major destinations. This network aims to support trips between major centres such as Chatswood, North Sydney and Macquarie Park. **Relevance to this study** There are strategic aims in this document that aim to connect fragmented cycle networks and improve cycling access and bicycle parking facilities.
	The Action Plan (City of Ryde, 2022) maps existing and proposed bicycle routes across the Council and guides Council's intentions for cycling in Macquarie Park. Macquarie Park is the only strategic centre located in the Council area. The regional network connects to and expands from Macquarie Park across the Ryde Local Government Area. **Relevance to this study** There is a future bicycle network map and an implementation plan for delivery.

2.5.4 Macquarie Park Strategies

Table 2.5 summarises the background policy documents related to Macquarie Park specifically, those that were directly relevant to this study.

Table 2.5 Relevant Macquarie Park specific policy

Macquarie Park	Overview
	This 20-year Strategy (DPE, 2022) aims to help Macquarie Park establish itself as a place for innovation, creativity, and collaboration. The DPE's Strategy aims to: • Transform Macquarie Park into an innovation district with opportunities for new investments. • Enable easier movement for walking and cycling and improve connections to public transport. • Create sustainable neighbourhoods, each with its own identity and role. • Connect to Country through quality public open spaces and natural landscapes. **Relevance to this study** Informed how the vision of this study will complement the vision of the Place Strategy. The movement considerations were also used to inform the initiative selection and provide a starting point for developing objectives for the study.

Macquarie Park	Overview
	The Strategic Infrastructure and Services Assessment (SISA) (GCC, 2022) was prepared to inform the Place Strategy and the Macquarie Park Innovation Precinct (MPIP) Master Plan to consider the need for supporting place outcomes and making Macquarie Park liveable for the 15,000 recently built and planned new homes over the next 15 years. **Relevance to this study** The SISA was used as a starting point for testing transport-related initiatives through a microsimulation traffic model.
	The Strategic Masterplan (DPE, 2022) guides sustainable growth and infrastructure investment over the next 20 years while ensuring Macquarie Park continues to thrive as a key economic and job creation centre for Greater Sydney. This masterplan directly informs the DPE Place Strategy. **Relevance to this study** The Macquarie Park Master Plan was used to inform the objectives of this project.
	The Macquarie Park Draft Integrated Transport Plan (Draft Integrated Transport Plan) (Arup, 2021) was prepared as a strategy for transport to support the place-based vision and objectives for Macquarie Park. The report summarised that the existing transport infrastructure in Macquarie Park has resulted in high travel mode share by private vehicles. This results in road performance issues that impact buses and freight. Pedestrians and cyclists have issues regarding block permeability, lack of amenities around Macquarie Park and safety issues. **Relevance to this study** The Draft Integrated Transport Plan was used to support identified issues and recommendations for the study area.
	The Macquarie Park Masterplan Appendix: Placemaking Strategy (Arup, 2021) lays out the following placemaking principles: 1. Reveal Country and Culture. 2. Redefine the suburban. 3. Lifelong learning. 4. Cultivate the undergrowth. 5. Reconnecting to the Macquarie Park community. **Relevance to this study** The Placemaking Strategy informed the vision and provided context to supporting studies of this work like Connecting with Country.

2.5.5 Strategic guidance summary

Across the strategic guidance documents, the following common themes were synthesised:

- Macquarie Park will continue in its role as an economic hub and will develop further as a Health and Education Precinct.

- There is a need to improve public transport and active transport, so they become viable alternatives to private vehicles. This is to ensure that future development and economic success can be guaranteed.
- Pedestrian amenities must be improved particularly to address the large distances between formal crossing opportunities. Most of the strategies agreed that the whole precinct must be more walkable.
- A desire to enhance the precinct further by Connecting with Country in a meaningful way that is actionable and visible in the end state for the study area.
- Substantial actions are needed to enable the growth planned for Macquarie Park by matching land use to transport and making use of existing infrastructure. This could be through making better use of existing assets which currently are private vehicle oriented.

Across all documents, there are multiple visions and objectives. Table 2.6 highlights the common features/phrases and related themes.

Table 2.6 Common vision and objective features in relevant strategic guidance

Common vision and objective features in strategic guidance	Related themes
Innovation hub	Economy
Vibrant business district for work, recreation and entertainment	Place (live/work)
Place for people (human scale, walkable)	Sustainable
Safe and liveable environment (increased residential use)	Safe
Connectivity and connection to Wallumedegal Country	Connecting with Country
Convenient public transport	Resilient
Direct cycling and walking networks across a fine grain grid	Connected/Accessible

2.6 Movement and Place

The Built Environment Indicators (BEIs) form a core part of the Movement and Place Framework. This Transport Study explores these (summarised in the Case of Change in Section 3) and provides detailed recommendations under each of the BEIs in Appendix D.

The Draft Macquarie Park Integrated Transport Plan assessed MPIP's Movement and Place performance. The following points were made regarding the study area's performance in particular the limited sense of place and interaction with the public road realm:

- The prevalent built form is that of a traditional business park; large plots, with large buildings that have large floor plates, set back from the boundary. This typology can result in the lack of a 'clear front door' for buildings as entrances to these buildings are often away from the street.
- There are places for people to gather around Macquarie Centre and the outdoor dining areas of the cafes and restaurants up and down Macquarie Park, as well as around North Ryde Station. However, the area is lacking in terms of benches and small pocket parks where people can run into a friend and catch up.
- Most night-time activity is limited to visiting and shopping at Macquarie Centre. While the asset of the shopping centre is a significant one, users of Macquarie Park describe the shopping centre as inward facing.

Multiple roads in Macquarie Park were found to have strong movement functions with limited placemaking aspects on Waterloo Road, Herring Road, Talavera Road, Khartoum Road, Epping Road and Lane Cove Road. The Macquarie Park Strategic Master Plan intends to make provisions for new and enhanced pedestrian movement functions through:

- New pedestrian-only links to improve permeability across the large land plots.
- Park trails that follow the creek lines.
- Local roads in the fine grain street network with higher priority for pedestrians.

2.7 Vision and Validate

This project employs a vision and validate approach to first agree, and then assess, the appropriate type and supply of transport services. Instead of relying on a traditional predict-and-provide method, this approach first establishes a vision and desired outcomes for the study area, before identifying the necessary initiatives or interventions needed to achieve these outcomes. These proposed actions are then validated through testing against relevant metrics and analytical tools. This ensures that the chosen initiatives align with the desired vision, thereby ensuring the attainment of the intended outcomes. And then finally a sense check is undertaken to ensure the results align with the initial vision.

Unlike traditional approaches that rely on predicting future travel demands based on existing environments and behaviours – and then meeting that demand without question – this approach focuses on realising the place vision for Macquarie Park. This concept is illustrated in Figure 2.4.

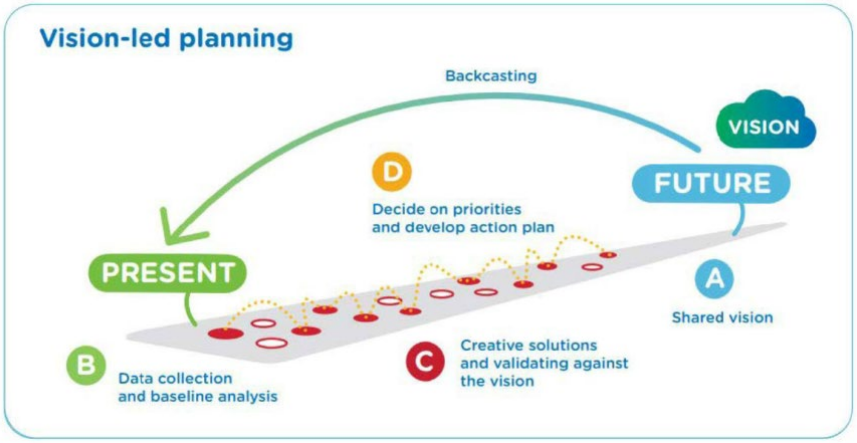


Figure 2.4 Vision and validate approach, from TfNSW Future Transport Strategy

The methodology applied in this study included testing planned transport services, infrastructure and initiatives identified in the SISA against the Macquarie Park place and transport vision. An operational model was used to test and confirm how vehicle traffic is likely to function on the proposed road network to meet the vision in 2041.

The operational model informs and validates whether the recommended investments can be achieved through changes to the management of the road and street network. It will also better define identified transport projects and initiatives identified through the SISA and stakeholder engagement.

In undertaking this assessment, we reviewed previous strategies, studies and plans to identify improvement initiatives and additional initiatives for testing were identified by a working group comprising state and local government representatives. The SISA contained an investment plan for timed and staged infrastructure capacity enhancement to meet the forecast growth in the area. Initiatives included additional pedestrian crossings, the creation of a fine grain street

network, changes to the allocation of road space (such as introducing bus lanes), and changes in speed limits.

These initiatives were then validated by using analytical tools like transport models to test the extent to which initiatives and interventions meet the desired vision.

Validation was informed by two layers of transport modelling – strategic modelling of the future development undertaken by Transport for NSW using the Strategic Travel Model (STM), which simulates work travel and the travel modes chosen, across Greater Sydney, and a precinct-scale transport operational model called AIMSUN, that assigns vehicles to the road network at what is called a mesoscopic level of detail and can report on the overall performance of the road network with future land use and transport demands.

The transport modelling was complemented by an active transport mode shift opportunity assessment, which assesses the potential for measures and initiatives to encourage a change of mode to walking and cycling.

2.8 Connection with Country

Present day Macquarie Park sits on Wallumedegal Country.

Historically it contained a great diversity of native vegetation communities, remnants of which still exist. Vegetation types occur on three different geological formations: shale, sandstone, and saline wetlands (estuarine). Modern-day Macquarie Park was covered by Sydney Turpentine Ironbark Forest, some of which remains. This type of forest is tall and open, found on shale and sandstone soils rich in shale. Canopy trees, including turpentine, red mahogany and various ironbark species, tower over a mid-storey of shrubs and small trees, with grassy ground cover. Down by Macquarie Park, along the bank of Turranburra, Lane Cove River, on Wallumedegal Country, coastal shale sandstone forest and coastal enriched sandstone dry forest provided tall open eucalypts and a range of grasses, rushes and herbs for continuous groundcover.

Slightly further away from the study site, Wallumedegal Country also hosts rainforest, a unique vegetation type for the northern part of Sydney. The weir north of Fuller's Bridge, Chatswood, marks the spot where the tidal water naturally gives way to the freshwater of the Lane Cove River. Estuarine vegetation types on this lower part of the river and down along the Port Jackson coastline included salt marsh, swamp oak forest, reed land and mangrove forest. These vegetation communities provided flora and fauna that were of incredible importance to the Wallumedegal people.

The Wallumedegal made great use of the abundant flora species in the area, for food, medicinal remedies and the raw materials required for daily life. Plants were consumed in a variety of ways. Warrigal Greens ('wild' greens in Dharug language), seaberry saltbush, glasswort, lilly pilly and coffee bush were just some of the edible plants growing in abundance on Wallumedegal Country.

Appendix A has the full Connecting with Country Framework report, and aspects of this report and its findings are integrated throughout this Transport Study including in section 5.1.

3 Case for change

This section summarises additional issues identified within the study area that have been identified through:

- An evidence-based approach through background research from relevant studies, including the Macquarie Park Place Strategy
- Site visits
- Research and engagement on Connecting with Country
- Research on perceptions of safety for women and children, through a Women's Safety Audit

This supplements the work completed in the Place Strategy and draft Transport Master Plan.

These issues are mapped against the Built Environment Indicators (from the NSW Government's Movement and Place framework) which are illustrated in Figure 3.1.

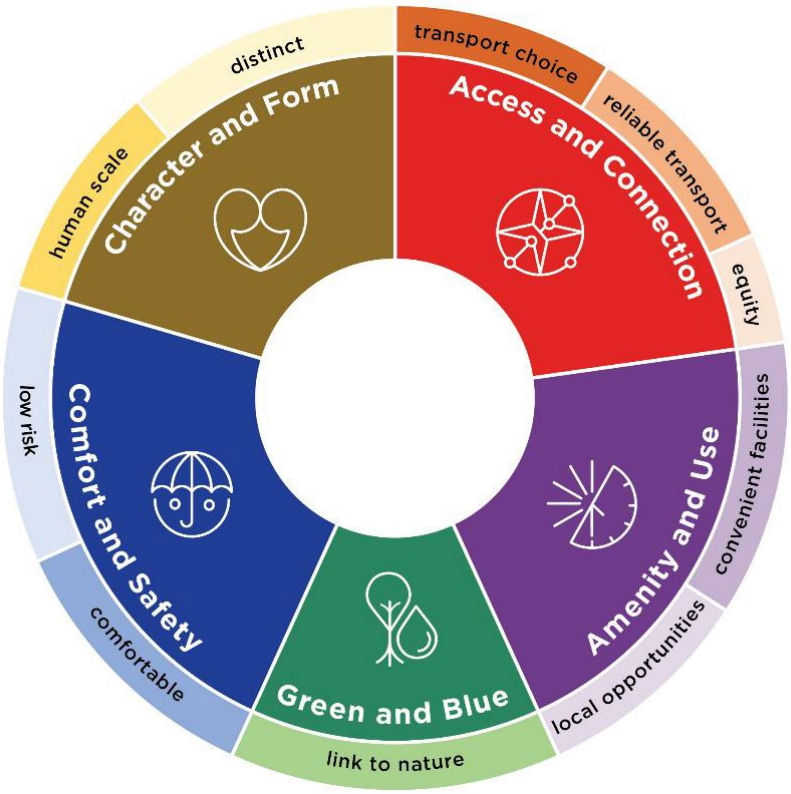


Figure 3.1 Built environment indicators (NSW Government Movement and Place framework)

Table 3.1 outlines the built environment indicators and a summary of potential key interventions. These interventions are further detailed in Appendix D, linking each of the built environment indicators and the key interventions in Macquarie Park that would lead to significant movement and place outcomes.

Table 3.1 Built environment indicators linked to key interventions for Macquarie Park

Theme	User Outcome	Indicator name	Summary of key interventions
Access and connection	Transport Choice	Mode share	Reduce reliance on private cars through a wide range of interventions in this report. Reduce car parking capacity, especially near stations
		Walking paths	Wider footpaths, increased crossing opportunities, slowed street environments, permeable blocks
		Cycling accessibility	Dedicated cycleway network, shared paths, 30km/h quiet ways as per NSW Cycleway Design Toolbox
		Public transport accessibility	Improve bus frequency and journey time reliability to achieve a larger 30-minute public transport catchment. Improve walking and cycling access to bus stops and Metro stations
	Reliable Transport	Freight network accessibility	Enable last-mile micro-freight delivery. Remove through-freight except on arterial corridors
		Bus and strategic freight reliability	Maintain strategic (regional) freight on identified arterial corridors
Amenity and Use	Equity	Equitable access	Improve access for those with reduced mobility (people with disability, the elderly, people with prams). Address women's safety.
	Convenient Facilities	Public space	Improve access to Lane Cove River and Shrimpton's Creek. Improve public space through placemaking
		Local living	Improve local 15-minute walking access. Activate street fronts on key walking and cycling routes
		Transport node facilities	Bus stops with shelter, seating, real time timetables Pedestrian crossings between bus stop pairs Bicycle parking at key destinations
		Places to stop and rest	Add seating, shelter, shade, water and toilets in public spaces and on streets
Green + Blue	Link to nature	Tree canopy	Deliver linear park on Waterloo Road and increase tree canopy. Tree planting in surface car parks and along streets
Comfort and Safety	Low Risk	Road safety	Increase pedestrian crossings and slow streets on all streets except arterial corridors. Apply recommendations of the women's safety audit
		Pedestrian crowding	Review the use of pedestrian fencing, especially around stations
		Safe speed for the environment	Narrow local streets and slower speeds
	Comfortable	Community safety	Improve street lighting over footpaths
		Air quality and noise	Reduce vehicles travelling in and around the precinct
		Urban heat island effect	Reduce surface parking and dark roofs. Increase tree canopy and vegetation
Character + Form	Human Scale	Street space for pedestrians	Reallocate road space to people walking, outdoor dining, trees and vegetation
		Permeability [intersection density]	Reduce large block sizes by adding additional streets and through-site links
	Distinct	Legibility	Better sight lines, wayfinding and ramps
		Culture and heritage	Connect with Country: Bring creek lines into public space, introduce public art, indigenous naming

4 The role of transport in achieving place outcomes

The MPIP Place Strategy outlines six 'Big Moves' aimed at achieving desired place outcomes. Central to this is the provision of efficient and accessible transport options that connect people, businesses, and resources to foster innovation and collaboration. The Place Strategy makes recommendations to:

- improve public transport.
- promote walking and cycling for transport.
- reduce the dependence on private vehicles.

This would contribute to a more sustainable and interconnected precinct, enabling a vibrant and connected community to thrive.

The transformation of Macquarie Park into a world-class innovation precinct requires a movement network that enables the diverse economic and employment opportunities that will arise. The SISA outlines an investment plan to ensure that infrastructure capacity is scaled and timed to meet the growing demands of the area. A well-planned transport system will enable the economy by attracting and serving businesses, visitors, and residents, driving the precinct's transformation.

Rebalancing transport uses is a key aspect of the Place Strategy. The aim is to reduce reliance on private cars, resulting in less congestion, improved air quality, and an overall better quality of life for residents and workers. Integrating and enabling sustainable modes of transport into the precinct's design will make it easier for people to navigate and access the area, fostering a more vibrant and connected community.

Creating a thriving and liveable innovation precinct also requires enriching the pedestrian experience. Improving the quality of pedestrian routes and spaces is essential to making Macquarie Park more welcoming and accessible, encouraging people to explore, collaborate, and engage with their surroundings.

Connecting to Country and delivering better quality open spaces is also important. Creating more public open spaces and connections within the unique setting of Wallumedegal Country will foster a deeper sense of community and belonging (see section 5).

4.1 Problem definition

4.1.1 Place

The study area's issues can be divided into three themes related to Place which can be addressed through transport outcomes:

- Public Space – improvements to public spaces, including night-time safety.
- Activity – measures to activate the public realm and encourage people to enjoy and stay longer in the area.
- Movement Equity – actions targeting specific modes to achieve equitable movement and access.

These are summarised in Figure 4.1.

Public Space

- Absence of authentic Country centred design throughout the whole precinct
- Inconsistent lighting levels and the infrastructure available, discourage s women and children to use the space at night.
- Absence of accurate and real time public transport timetables
- Removal of median barriers along Waterloo Road to allow safe crossing points and improve cross precinct access
- Lack of seating and rest stops at regular intervals along thoroughfares and limited bike racks for bike parking
- Limited activation and amenities along main pedestrian and cycling corridors, hindering opportunities to linger and passive surveillance.
- Limited sense of personal safety, particularly at night
- Insufficient tree coverage on key walking routes, discouraging walking around the precinct.
- Pedestrian infrastructure not accommodating important desire lines such as bus stop pairs and entrances to key commercial locations.
- The absence of public art on the streets creates a sterile environment that limits interaction and play.
- Large blocks, wide streets, and significant setbacks give the precinct an uninviting feel for walking.

Activity

- Lack of community events and well-designed public spaces showcasing culture, identity and community
- Lack of shared use paths across the study area (especially lacking for children's activity)
- Waterloo linear park is uninviting and should be integrated better with the design of Waterloo Road and particularly the pedestrian space and buffer to the carriageway.
- Limited activation of streetscapes. Where activation is unlikely to be provided in the short term due to existing built forms (such as the residential colleges on Talavera Road), there is no space provided for permanent on-street activation such as kiosks.
- Insufficient tree coverage, resulting in a heat island effect and reducing the appeal of these spaces in summer.
- Limited connections to Lane Cove River and Lane Cove National Park
- Lack of street-based amenities such as bike racks, street furniture, water and public toilets
- Some bus stops lack amenities such as shelter and seating.
- Absence of physical security and cameras

Movement equity

- Lack of Country design in walking infrastructure that acknowledges the Wallumedegal Peoples and Country
- Insufficient bus priority on key bus corridors
- Inadequate public transport network coverage to and from key locations
- Insufficient walking and cycling infrastructure that is safe, direct, welcoming and easy to use.
- Bus stops are not optimally aligned with crossing opportunities; some bus stops lack amenities within the study area and should be improved to promote bus usage.
- Excessive parking availability, encouraging private car use instead of public transport despite major investment in Metro and the bus interchange.
- Ample road network capacity in off-peak times or school holidays, easy access on arterial corridors and motorways adjacent to the precinct, and abundant parking combine to make driving attractive.
- Low frequency and long spacing between pedestrian crossing opportunities make walking unappealing.
- Delay at intersections for pedestrian/cycling movements compared to general motor traffic.
- Lack of kiss and ride locations especially near metro stations
- Add lack of kiss and ride locations especially near metro stations . Refers to comments from womens safety audit about nowhere for anyone to stop if they want to help someone o the footpath or to get into an uber etc

Figure 4.1 Macquarie Park place problem definition

4.1.2 Movement

The study area's issues can be divided into three themes related to Movement which can be addressed through transport outcomes:

- Movement within – primarily focused on walking and cycling where the origin and destination are within the study area. May also include short local bus travel.
- Movement to/from – primarily focused on public transport, private vehicles, and goods delivery where the origin or destination is in the study area.
- Movement through – through-traffic movement without an origin or destination in the study area

These are summarised in Figure 4.2.

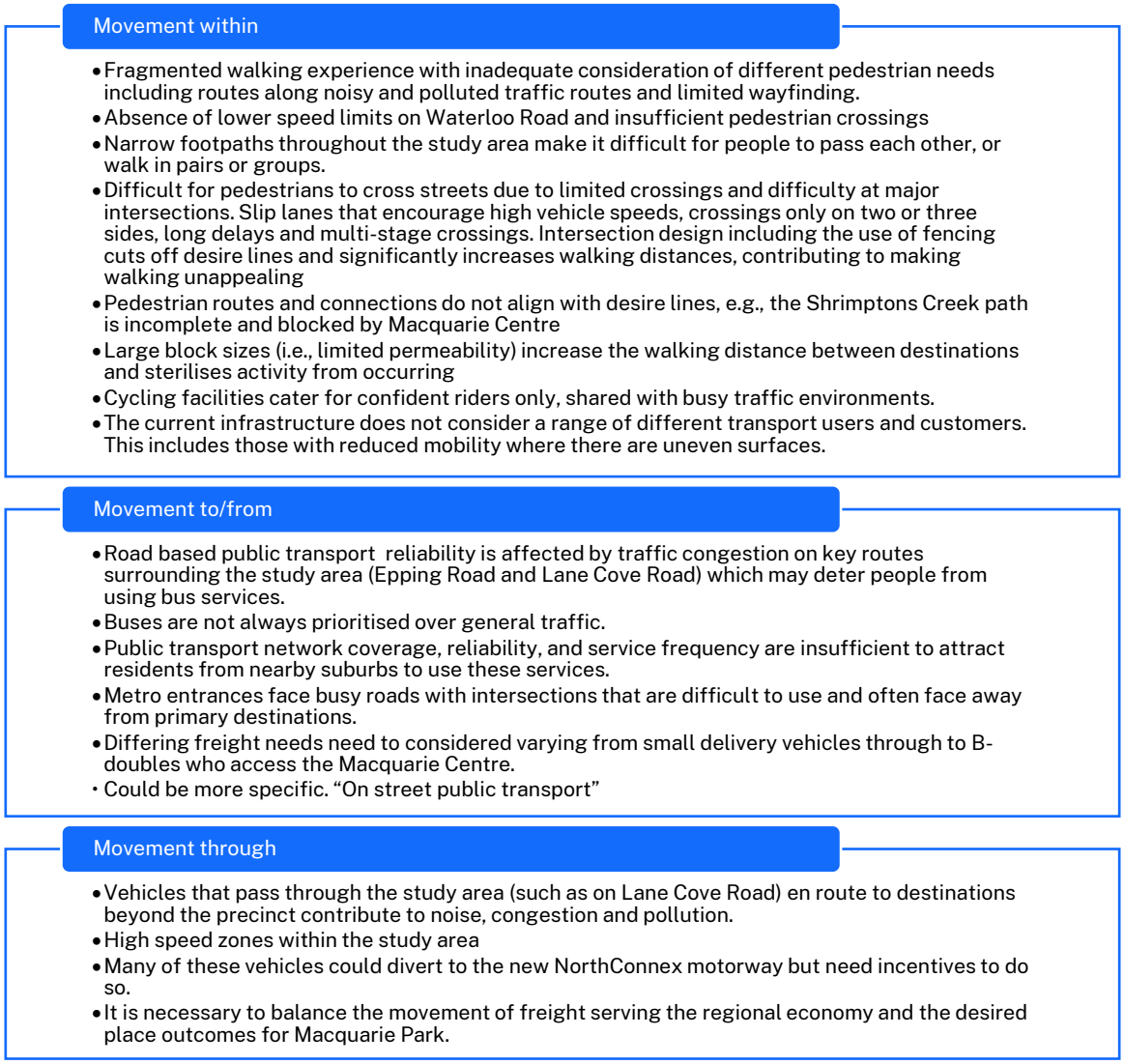


Figure 4.2 Macquarie Park movement problem definition

4.1.3 Objectives

After defining the core problems in Macquarie Park, these were grouped into common themes, and the finalised objectives selected, as shown in Figure 4.3.

Figure 4.3 Agreed objectives for the Macquarie Park Detailed Precinct Transport Study

These objectives were then used to assess the suitability of initiatives to achieve the transport and place vision of this Transport Study (see sections 6 and 7).

Shared path infrastructure in Macquarie Park

5 Place and community outcomes

This section outlines specific place and community-related factors that relate to MPIP and were core considerations for this Transport Study: Connecting with Country, Women's Safety and Active Transport.

5.1 Connecting with Country Framework

A Connecting with Country Framework was prepared as part of this project. This included consultation with local Aboriginal stakeholders from Wallumedegal Country and surrounds. A cross-section of community members was consulted, with a particular focus on community-nominated elders and leaders with strong connections to the area. These consultations gathered the Aboriginal narrative for the project area. This consultation process brought out some specific stories and knowledge but most importantly it prioritised key outcomes and themes from a community perspective.

The Connecting with Country can be summarised in eight themes with the following design integration opportunities, shown in Table 5.1. More detail is available in Appendix A.

Table 5.1 Connecting with Country framework opportunities for Macquarie Park

Design theme	Design Integration Opportunities
Acknowledging Wallumedegal Country and People 	**Public spaces:** The project presents major opportunities for public spaces to successfully integrate, protect and encourage cultural practices and protocols. Co-design should play a necessary part in the spatial distribution and orientation of public spaces to reflect Country and draw from the site-specific narrative of Wallumedegal Country.
	Street interface: The street interface has the potential to integrate design considerations that acknowledge and connect to Wallumedegal peoples and Country. This includes opportunities for co-design to influence the project street interface, contributing to occupant experience when moving through the precinct and furthering opportunities for public art integration, wayfinding and signage integration.
Country-Centred Design 	**Materiality and fabrication:** The project presents much potential to focus on Country and its resilience and robustness. Artistic expression of Wallumedegal Country can be reflected in the choice of materiality and fabrication of different infrastructure elements across the project. This design integration also has the potential to be implemented through different scales, contributing to the overall design response to Country.
	Landscape design: Landscape design and planting surrounding the site is rich in opportunities for integration of Country, particularly to contribute to the overall sustainability outcomes of the project. Integrating green spaces that are landscaped with site-specific native flora and reflect the natural topography will allow for the interaction of occupants with Country and reflect the topographical history of the site. This design integration can contribute to public parks and spaces through abstract design patterns, reflecting Country and evoking a connection back to it for occupants.

Design theme	Design Integration Opportunities
Regenerating Country 	**Native planting and land management:** Landscaping opportunities to regenerate native species and ecosystems within the area can be integrated into the project, which includes the planting of edible bush food, management of significant sites connected to the project site and the reintroduction of ecosystems.
	High-performing green space: Important waterways and waterfalls surround and connect to the site, highlighting the need for consideration of how grey infrastructure may affect and/or contribute to the regeneration of these waterways. The scale of the project presents a concern for the project encroaching on the river systems, further declining their quality. Therefore, the project's grey infrastructure needs to be examined with caution and investigated to benefit Country.
	Artwork and/or text integration: Cultural knowledge can be shared through a public art piece and or text incorporation into footpaths or other public infrastructure.
Revitalising Culture 	**Green public spaces:** By providing public green spaces, community members are encouraged to engage with the site with direction from the infrastructure and spatial arrangement of the landscape. For example, open spaces with native grasses encourage connecting with Country and practising culture on Country.
	Wayfinding and signage: Wayfinding strategies can incorporate Dharug knowledge. The orientation and positioning on site need to be considered carefully, depending on what knowledge they are integrating.
	Public art: Public artworks provide an opportunity to reflect the cultural narrative of the project and Country itself. Public art will also contribute to occupant connection to the site. This could include incorporating artwork into the design of signage, building fabric and spaces.
Integrating Language 	**Signage:** Incorporating language dialects into the site's infrastructure through signage and wayfinding strategies encourages interaction, education and revitalisation of language. This design integration opportunity also challenges and influences the engagement and interaction of site visitors with the built form and the Dharug Language simultaneously.
	Text and/or art integration: Providing text and art allows for language to be integrated and engaged interactively. This can contribute to the public domain through implementation into the design of elements such as footpaths, facades and other built forms.
	Spatial arrangement: The site's spatial arrangement, particularly the pedestrian areas present an opportunity to replicate the knowledge and language of the Dharug community. This may include the placement of public spaces, walkways, bikeways and connections to any waterways in the area.
A Travelling and Gathering Place 	**Key public space:** Key public spaces can include retreat spaces for rest and reflection. Further exploring waterways and bush tracks can direct orientation and master planning on these key spaces, providing viewpoints and visual connections to Country. These spaces can also support native planting as well as be spaces for Indigenous businesses.
	Public artwork: By integrating artwork that projects the narrative of Country and the site's significance as a meeting place, occupants travelling through the space will be further connected to the cultural narrative of the project. Public art pieces incorporated into the built form could be elements that encourage occupant engagement as well as influence accessibility for pedestrian traffic.
	Inclusive and accessible street design: The project can foster inclusivity by ensuring accessible design, particularly across landscaping, green spaces,

Design theme	Design Integration Opportunities
	public spaces, and art integrations that allow the community to gather and connect with Country.
Story Telling and Truth Telling 	**Fabrication and materiality:** The natural materials of the site should be considered and further explored for opportunities to integrate them into the fabrication of infrastructure for the project.
	Interactive urban design: Interactive design concepts provide the opportunity to interpret and connect occupants to the site's stories and truth. These design concepts can include text installation and visual interpretations that provide connection and acknowledge significant cultural sites and knowledge.
Social and Cultural Inclusivity 	**Urban mobility:** Cultural and social inclusivity can inform how boundaries throughout the urban context integrate and weave together throughout the site, ensuring safe welcoming connections for all.
	Design of welcome space: Designing spaces that cater for cultural practice will provide the community opportunity to perform protocols such as Welcome and smoking ceremonies as well as publicly and safely engage with the site's built forms and landscapes to practise culture. These spaces can be designed as 'yarning circles' through consideration of their orientation, spatial and form arrangement and design should be given to allow for further engagement with the space from the broader community.

5.2 Women's Safety Audit

A Women's Safety Audit was conducted on-site with a wide range of diverse people from the local community including a range of ages, LGBTQI+, people living with a disability representing residents, workers and university students. The objectives of the audit are summarised in Figure 5.1 and detailed findings are in Appendix B.

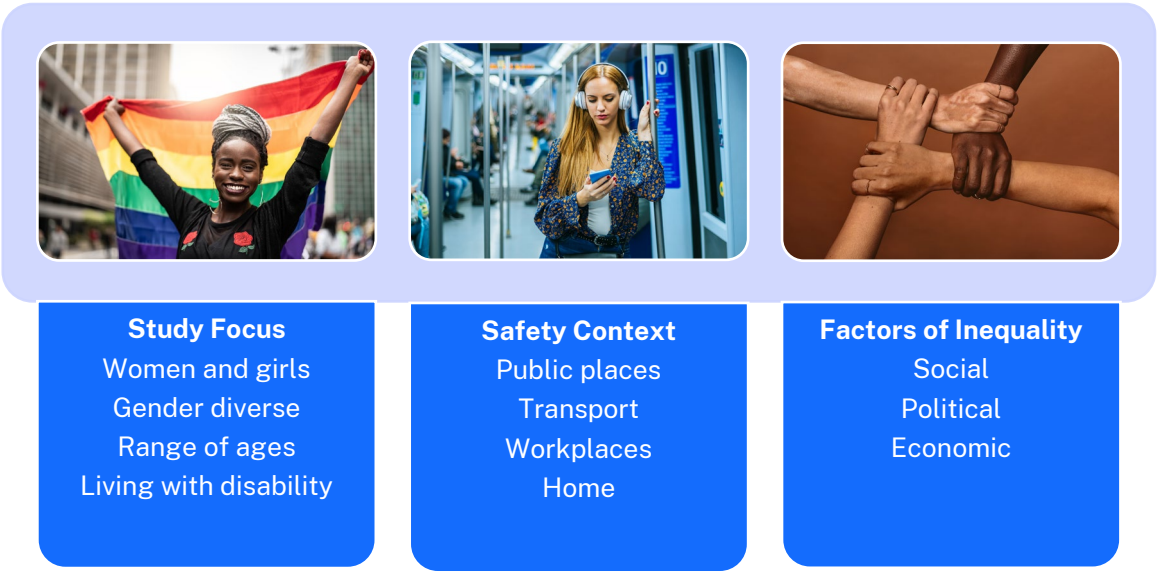


Figure 5.1 Objectives of the Women's Safety Audit

The audit was conducted in the early evening after dark and provided an opportunity to:

- Incorporate lived experiences and concerns of residents and visitors navigating the Macquarie Park precinct after dark.

- Seek feedback to inform further planning for the Macquarie Park precinct and other relevant places.
- Consider intersecting identities across culture, gender, sexuality and the ability to uncover diverse experiences.
- Review and comment on women's safety initiatives undertaken so far, such as the distress call button at the Metro station.

Figure 5.2 maps the night walk route and key findings. The night walk took place mostly along Waterloo Road between Macquarie University Station and Macquarie Park Station and incorporated side streets.

Participants completed an online survey during the walk and participated in a short debrief after the walk to discuss top-of-mind experiences. In the week following the night walk, follow-up interviews were conducted with each participant to obtain further insights into their experience of the audit and their experiences navigating the Macquarie Park precinct in general.

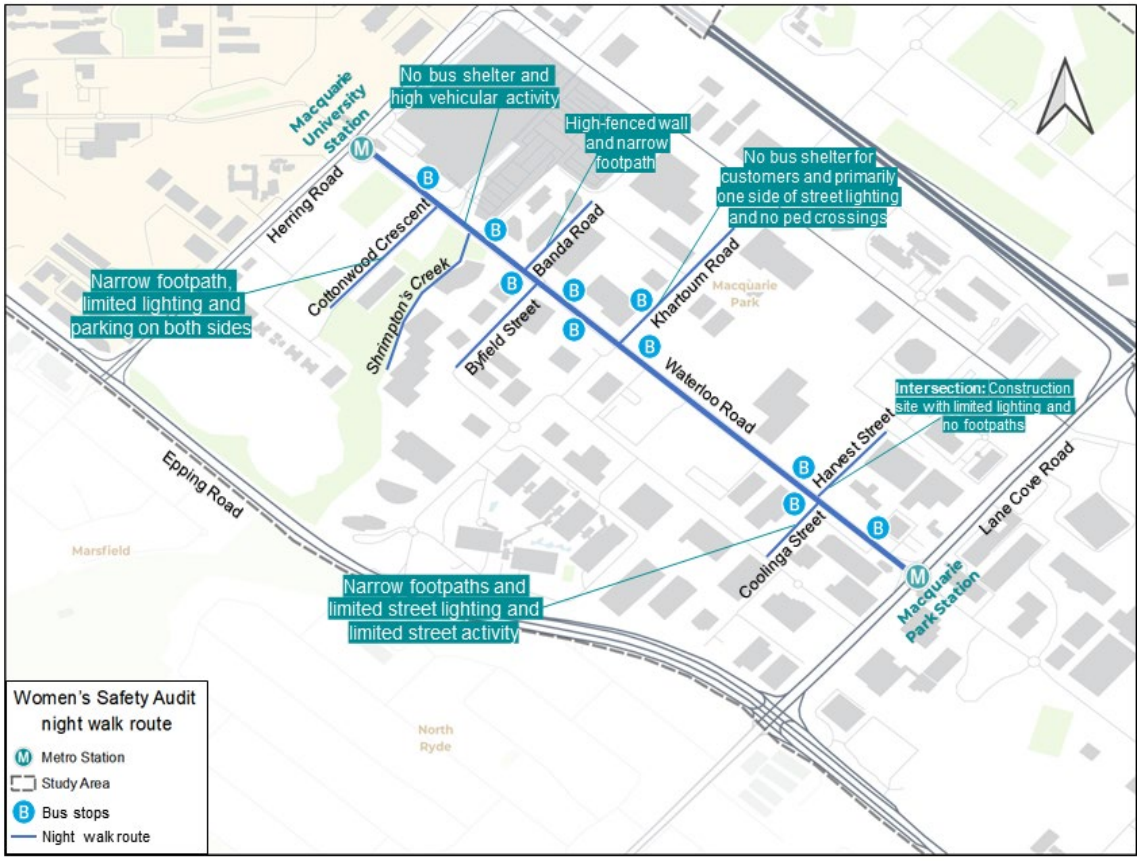


Figure 5.2 Women's Safety Audit night walk route

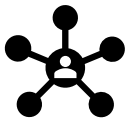
Overall, the audit found the following impacts:

- A lack of people in public spaces contributes to perceptions of safety
- Poor lighting on main pedestrian routes, residential areas and public spaces
- A lack of regular safe pedestrian crossing points
- High traffic speeds make it noisy and uncomfortable to walk along arterial roads and reduce the sense of passive surveillance
- A need for better security and access around Metro stations and bus stops
- Public toilets are often seen as unsafe spaces for women and girls.

The findings from the Women's Safety audit were categorised into three outcome areas: safe public infrastructure, transport improvements, and collaboration and communications. The findings and recommendations are summarised under each theme in Table 5.2.

Table 5.2 Summary of recommendations from the Women's Safety Audit

Theme	Women's Safety Recommendations
Safe public infrastructure 	**Lighting:** was identified as a key issue, particularly through main pedestrian routes and residential areas. Recommendations include: • Layered lighting allows users to see beyond their immediate area and if someone is approaching. • Consistent lighting along paths. • Design solutions that ensure lighting can be provided underneath tree canopies, to maximise visibility for street users. • Lighting often provides more light for cars than footpaths. A reorientation of light poles could be considered. • Using lighting as art, or to create atmosphere may also assist in activating spaces and bringing more people into public spaces. • Provide lighting where this is currently no or limited infrastructure (e.g. Shrimptons Creek) with due consideration given to neighbours and local fauna.
	Safe crossing points and access: removing the median barriers along Waterloo Road or providing regular breaks and safe crossing points will give people more options to cross the road when needed. This will help people to make quick decisions to cross the road if feeling uncomfortable or threatened by someone approaching. This should also be designed in a way that assists people who use mobility aids or those who require additional assistance to cross a road.
	Footpath design and maintenance and supporting infrastructure: Footpaths should be designed with adequate width to accommodate people walking in both directions, people with mobility aids and young people on bicycles. Existing paths on Waterloo Road are shared paths, however, they are not designed in a way that supports shared uses. Footpaths should be regularly maintained, especially along major routes and ensuring that safe alternatives are provided when construction or works is encroaching onto footpaths. There should be seating and rest stops at regular intervals along thoroughfares such as Waterloo Road and walking paths.
Transport improvements 	**Consider speed limits and drop-off areas**: lowering the speed limit on Waterloo Road would improve feelings of safety. Slower vehicles make pedestrians less vulnerable and may encourage further active transport modes through the precinct. Creating a pedestrian and cycling friendly precinct can encourage more women and families into public space and increase activation. It was also identified during the night walk that there are no easy and safe drop-off or pick-up areas around Metro stations, making it difficult for cars or taxis to stop.
	Metro maintenance and security: Improving security at the Metro stations may increase women's feelings of safety and encourage more use. This may include CCTV, which is monitored in real time and signage informing of their presence, but physical security presence will provide the most impact. Providing an authority figure who is adequately trained in bystander intervention not only improves perceptions of safety but can ensure that appropriate intervention is provided in the case of an incident. There are also regular issues with lifts at Macquarie University Metro Station, which may force people to cross the road again and be "in the dark more than they need to be".
	Provision of safe and maintained amenities: Toilets were described in follow-up interviews as sometimes unsafe spaces for women, due to risks of assault and experiences with people loitering in a confined space with only one way out. They are however crucial spaces to provide particularly for women in the public domain and should be safe and clean.

Theme	Women's Safety Recommendations
	A participant mentioned that unisex toilets, which tend to be popular now, do not support feelings of safety unless they can be accessed directly from a concourse or hallway.
	Redesign and expand the 'Help Point' buttons: The existing help point buttons in Metro stations can be helpful tools however they should be more visible and designed with more contrast to the colour scheme adopted throughout the station. More help points could be provided outside the Metro stations at street level to support people approaching and leaving the stations and bus stops. These should be accessible to all abilities and provided in multiple languages.
	Provide accurate, real-time public transport timetables and wayfinding: There is an opportunity to provide real-time scheduling and updates of public transport arrivals, by using screens or announcements at bus stops, similar to Metro stations, that inform of the time remaining until the next service. This would enable people to better plan their trips and avoid having to wait in the dark for longer. While there are several transport planner apps available, they were not regarded by the audit group as being reliable. A negative experience using these apps can be a deterrent for ongoing public transport use.
Collaboration and communications 	**Working together and precinct coordination:** Regular stakeholder coordination should continue through working groups and activities that encourage investment and innovation in the local area. This may involve a more robust funding model for the Macquarie Park Innovation District. A stakeholder working group can help to identify issues early, opportunities for improvement and encourage more diverse ideas for the Macquarie Park precinct. Another aspect to continue is to actively seek out and prioritise diverse voices and experiences so that those factors that intersect with gender can become an integral part of the design and decision making of public places and policies. This includes Aboriginal and Torres Strait Islander voices, people living with disability, LGBTIQA+ voices and neurodiverse voices.
	Events and activation: A lack of people around was identified as fundamental to feeling unsafe. There are numerous opportunities to activate places and spaces in Macquarie Park through land use planning – to support active street frontages and eyes on the street – and programming to encourage people into public spaces more often and for positive, community building purposes. Community events, public art and well-designed public spaces that showcase culture, identity and community can contribute to a sense of inclusion, connection and belonging.
	Primary prevention: Communication and education campaigns should be implemented to highlight the impact of harassment and violence against women and other minority groups. This would encourage whole of community responses, including men and boys and educate them on what it takes to be a positive bystander. Positive bystander training could be offered to community groups and workplaces to increase the opportunity for members of the public to safely and confidently intervene when witnessing harassment or violence against women, girls and gender diverse people. Campaigns and training could also include content to improve the broader public's understanding of the intersectional factors that increase women's vulnerability such as race and ethnicity, disability, sexuality and gender identity.
	Deliver regular community safety workshops: There should be regular engagement with the local community, both permanent and temporary (e.g. students, workers, and users of spaces), with workshops that focus on current and emerging safety issues in the precinct. Opportunities should be identified to work with women, girls and gender diverse people to co-design new development and public space infrastructure and apply gender sensitive design principles towards improving and maintaining the Macquarie Park precinct.

5.3 Walking and Cycling

The presence of people walking (and lingering) is a key indicator that a place is successful and vibrant.

The NSW Government is committed to enabling walking and cycling as the preferred mode of travel for short trips to centres and key destinations, and to access public transport.

A study by Transport for NSW of strategic centres across NSW analysed the key factors that make a place walkable. Figure 5.3 illustrates these key factors averaged across all strategic centres across Greater Sydney. It shows that, for every 100 people walking around a centre, 54 can be explained by structural factors, 22 because of demographic factors, 18 due to adaptable factors, and less than two are there because of environmental factors alone.

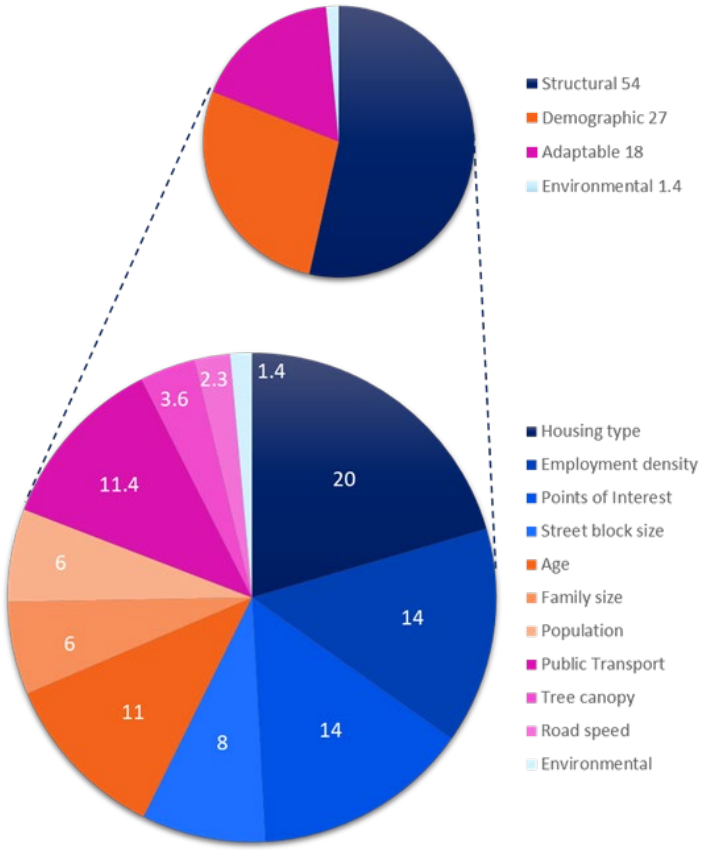


Figure 5.3 Key factors that make places walkable in Greater Sydney (Transport for NSW, 2021)

Structural factors influence around 54 per cent of walkability in Greater Sydney. These include street layout, population density, employment density, housing type and so on. Structural factors with the highest influence on walkability are:

- Housing types (residential, community, apartments) have a 20 per cent influence.
- Employment density and job opportunities: 14 per cent
- Points of interest/Places to visit (shops, restaurants, parks, etc): 14 per cent.
- Street block size (measured by intersection density. Also known as permeability or crossing opportunity): 8 per cent

Demographic factors influence 22 per cent of walkability in Greater Sydney and include:

- Age: 11 per cent
- Family size/composition: 6 per cent
- Population: 6 per cent

Adaptable factors (which can be adapted relatively quickly) influence 18 of walkability and include:

- Public transport (buses, trains, light rail, Metro access): 11.4 per cent
- Tree canopy: 3.6 per cent
- Road speed: 2.3 per cent

Environmental factors influence 1.4 per cent of walking in Sydney centres and include:

- Topography, rainfall, and temperature.

5.3.1 What makes Macquarie Park walkable?

The above study found that every day in Macquarie Park people walk around 26,000 kilometres within the commercial strategic centre (per square kilometre) which is comparable with Bankstown, Burwood and Randwick.

The study found there is 10 per cent more walking in Macquarie Park than predicted by its modelling, based on its street layout and other key features. In this regard, it is similar to Windsor and Macarthur which scored similarly.

However, given that the population of Macquarie Park more than triples during the day due to people commuting to work and study (at least pre-COVID when this study was conducted), this has a significant impact on walking behaviour. When only the residential population of Macquarie Park strategic centre is included (around 25,000 people) there is more walking in Macquarie Park than predicted. When the daytime working and studying population is included (around 78,000 people) there is less walking than predicted.

Severance refers to corridors that act as a major barrier to walking, such as motorways. The study also found that Macquarie Park suffers greater severance than any other strategic centre in Greater Sydney except Blacktown and Mt Druitt. There are ten corridors of severance in Macquarie Park including motorways, arterial roads that are difficult or impossible to cross mid-block (e.g. Lane Cove Road, Talavera Road) or other features such as Lane Cove River. These can be very difficult to change.

Overall, the study by TfNSW found that the key factors impacting walkability in Macquarie Park are:

- Structural factors:
  - Large block sizes, lack of crossing opportunities and intersections, and low residential density are having a **24 per cent downward pressure** on walkability. This is a significant negative impact that is difficult to overcome without major changes to the structural layout (as per the Place Strategy)
  - There are ten key corridors of severance.
  - On the other hand, employment density is a structural factor that improves walkability in Macquarie Park. This advantage needs to be leveraged particularly for people working and studying in the area. The study shows they would walk more but are being held back by the other structural factors listed above.
- Adaptable factors (which can be changed such as tree canopy and public transport services) have a **19 per cent downward pressure** on walkability in Macquarie Park. These will be largely addressed by the SISA initiatives and the recommendations in this Transport Study – such as tree canopy cover and bus service improvements.
- Demographic factors are having a **24 per cent upward pressure** on walkability. This is a very positive result, and further enhancements should take advantage of these adaptable and demographic success factors.

Another key factor for walkability is the quality and width of footpaths. This was not assessed in the above study by TfNSW; however, it was picked up in the Macquarie Park Women's Safety Audit. The recommendation for this is to ensure that footpaths are built in accordance with the NSW Walking Space Guide.

5.3.2 How far will people walk to public transport?

Most people walk as part of their journey to or from public transport, whether they walk from home or work, the beach or shopping. Walking is also integral to place – a successful place has lots of people walking in and around the area, stopping and lingering, shopping and socialising.

Walking to access public transport accounts for half of all walking trips in Ryde (see Table 5.3). To improve public transport patronage, and the customer whole-of-journey experience, it is imperative to improve walking access and quality – with direct, safe, wide footpaths.

As shown in Figure 5.4, in Sydney, people who walk as part of their public transport journey ("linked" walking trip,) predominantly walk between 200 and 1000 metres to access bus stops and stations, with around 78 per cent walking less than 800 metres.

For very high quality, fast public transport such as Metro, people may walk up to 1200 metres.

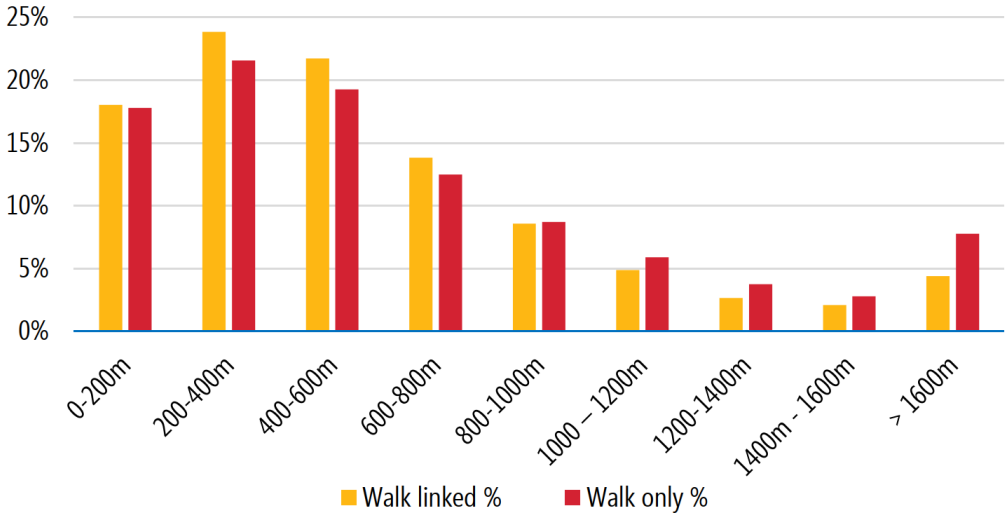


Figure 5.4 Distance of walking trips for commuting purposes (orange) or accessing public transport (red). Source Transport for NSW Household Travel Survey 2018-19

5.3.3 What makes Macquarie Park rideable?

Currently, Macquarie Park is a relatively hostile area to ride a bicycle because it lacks safe separated cycling infrastructure or slow (30 km/h) streets. Instead, particularly on roads with high traffic volume and speed, people may feel compelled to ride on the narrow footpaths, which is illegal in NSW for anyone over the age of 16 and detracts from people feeling comfortable and safe to walk. As a result, only around 1 per cent of trips in the local area are made by bicycle.

The SISA initiatives include investment in cycling and shared path infrastructure, which will improve cycling and micro mobility access. Depending on the extent to which a comprehensive network of safe, direct cycling infrastructure is delivered in MPIP, then up to 70 per cent of the population may ride occasionally (based on TfNSW and national CWANZ surveys), however, this would be mostly for recreation. Around 7 to 8 per cent of the population might feasibly ride for transport purposes, and this could increase as electric bicycles gain popularity.

5.3.4 Switching mode to walking and cycling

As part of this study, an assessment of existing short trips in the City of Ryde area was undertaken. Figure 5.5 shows that around 11,000 daily car trips are less than one kilometre. Many of these could switch to walking if the right infrastructure and pedestrian amenities were provided (as described in Section 5.3.1 above).

A further 33,000 daily car trips are one kilometre to five kilometres which is an easy distance to cover by bicycle. For this distance, studies have shown the bicycle riders can cover the journey with a much higher degree of confidence about journey time reliability, particularly at peak times when traffic is congested.

Around 19,000 daily car trips are five kilometres to 15 kilometres. A small proportion of these could switch to cycling, particularly by electric bike, if strategic cycleway corridors are provided to access the broader region.

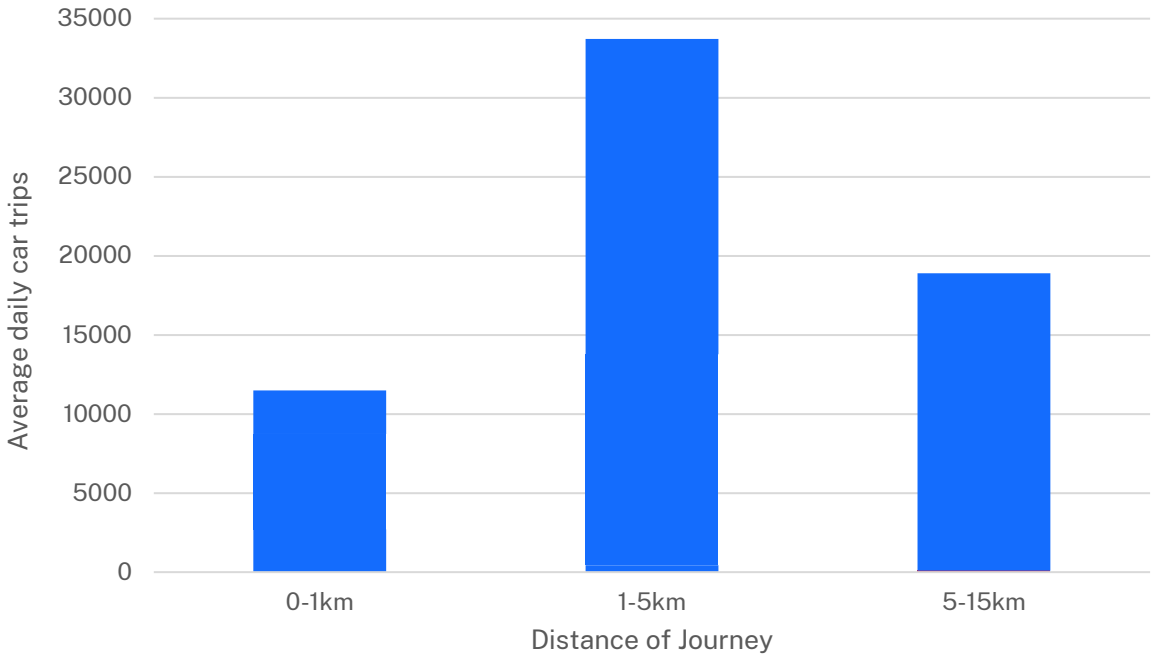


Figure 5.5: Number of daily car trips that are <1km, 1-5km or 5-15km in City of Ryde, Source: DSpark

Table 5.3 shows the percentage of all trips by purpose in the City of Ryde area (2019/20 HTS).

Table 5.3 Trip purpose in City of Ryde LGA (%)

Purpose	Vehicle	Public transport	Walk linked to PT	Walk only	Other incl. bicycles	Total % of trips
Social visits /recreation	22.9	3.0	5.4	6.3	0.2	**37.9**
Shopping	8.9	1.1	1.9	2.2	0.3	**14.4**
Commute	6.1	0.3	1.2	1.4	0.2	**9.3**
Serve passenger	10.5	1.3	2.3	2.7	0.1	**16.8**
Personal	5.1	0.0	1.0	1.2	0.0	**7.3**
Other	8.8	1.0	1.9	2.2	0.4	**14.3**
Per cent of trips	**46.9**	**6.7**	**13.7**	**16**	**1.2**	**100**

It shows that in the Ryde local government area, only a small proportion (9.3 per cent) of all trips are for commuting. Social and recreational trips total 37.9 per cent of trips, with most of these by motor vehicle. With the right infrastructure, and with the aid of electric bicycles, a relatively large proportion of these trips could be taken by bicycle.

In addition, 14.4 per cent of trips are for shopping, and 16.8 per cent are for taking a passenger. With the rapidly increasing popularity of electric cargo bikes – and assuming safe and direct cycling infrastructure is provided – a proportion of these may switch to cycling.

6 Proposed initiatives

The Macquarie Park SISA, (GCC, 2022), proposes more than 180 infrastructure initiatives required to support the forecast growth in the area. The key focus of this study was on the contribution of the proposed transport and placemaking initiatives.

Initiatives related to schools, power and water were not tested as part of this transport assessment.

In addition to the SISA, additional initiatives were identified through:

- Stakeholder consultation
- Project team analysis
- TfNSW and NSW Government strategic priorities
- Women's Safety Audit
- Planning with Country
- Urban design considerations

These initiatives were shortlisted and, where relevant, included in model scenarios 1 and 2.

7 Evaluation criteria

This section summarises how initiatives were evaluated against the desired or intended outcomes.

Figure 7.1 shows the ten objectives that were agreed upon with stakeholders for the MPIP study area (in 4.1.3). For each objective, it denotes which metrics should increase (upwards arrow) or decrease (downwards arrow) to achieve that desired outcome.

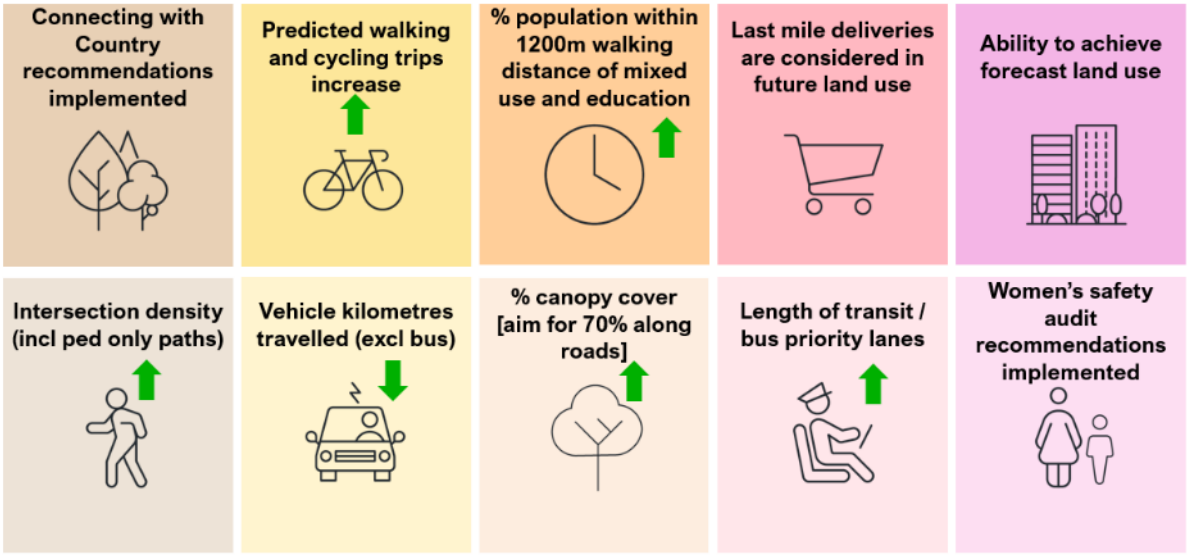


Figure 7.1 Desired outcomes for each of the ten objectives

7.1 Testing methodology

Each of the proposed infrastructure initiatives (from Appendix D) was tested against the objectives in Figure 7.1 and evaluated for alignment with that objective.

There were several ways that the objectives could be assessed:

- Subjective – where the working group scores each option based on its collective view of whether the option is aligned or misaligned with each objective.
- Objective – where the project team scores each option based on a proxy metric and ranks the options from best to worst based on those scores (this was the method chosen)
- Baselined – where the project team scores each option based on a proxy metric and benchmark and ranks options based on their performance against the benchmark.

An example of how these assessment methods would be applied and the differences between the three methods are shown in Table 7.1. The outcomes of scoring for this study are in 9.3.

Table 7.1 Example assessment

Vision objective	Metrics for scoring	Subjective scoring	Objective scoring	Benchmarked scoring
Increase tree canopy cover	% mature canopy cover Or Number of trees	Score using footpath vs carriageway width as an indicator	Measure the number of trees or canopy of each option, options ranked best to worst	Measure the number of trees or canopy of each option, 0 = 40% cover target, a positive score requires ≥ 40%

8 Transport Modelling

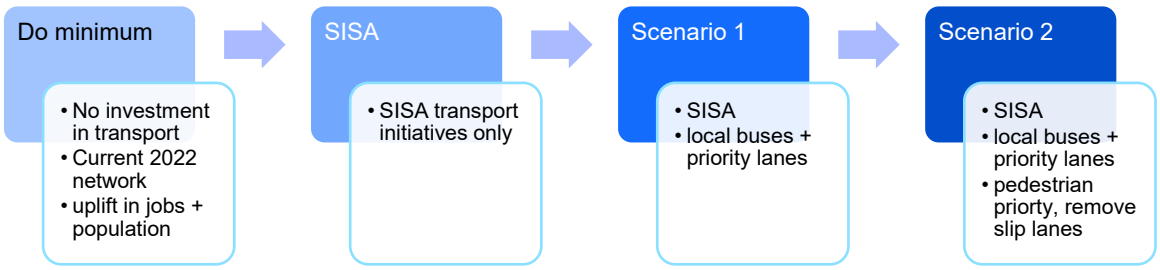
To test the proposed transport-related initiatives and evaluate their likely impact on the road network system, an operational traffic model (AIMSUN) was employed. Rather than simply report the findings and select an optimal scenario based on the modelling metrics, this study adopted a 'vision and validate' approach. Under this approach, if the envisaged place outcomes for the area are achieved, then the road network should continue to operate congruently with the overarching vision for Macquarie Park. Further detail about this approach is provided in Section 2.7.

The following section summarises the findings of the traffic modelling, with further details on the modelling methodology provided in Appendix E.

8.1 Four scenarios for 2041

The modelling process tested four scenarios as summarised in Table 8.1 and detailed in sections 9.2.1 to 9.2.4. The scenarios were prepared from a base case, testing an increasing number of initiatives. This started from 'do minimum'; to a 'SISA scenario' that modelled only the transport initiatives that were identified in the SISA; to Scenario 1 which modelled the SISA initiatives and added local bus services and some bus priority lanes; to Scenario 2 which included all the above initiatives with additional pedestrian priority initiatives and a road closure.

Table 8.1 Summary of four scenarios tested in the transport modelling.



Scenario	Infrastructure initiatives tested up to 2041
Do minimum	No infrastructure changes from the 2022 network, but land uplift occurs with an additional 20,000 population and 7,650 jobs

SISA Scenario	This modelled only the transport initiatives listed in the SISA and assumed the land uplift occurs. SISA included:
	• Planned Macquarie University bus interchange and changes to lane allocations.
	• Mass transit connections (to Randwick and Epping) and additional metro services
	• Road network changes including:
	  • Signalising key intersections with Talavera Road and Waterloo Road
	  • Left in and left out on Epping Road and Lane Cove Road
	  • Give way controls on the fine grain street network

Scenario 1	• SISA initiatives as above • Addition of bus lanes on reallocated road space on Waterloo Road and Herring Road • Increased frequency of local bus routes

Scenario	Infrastructure initiatives tested up to 2041
Scenario 2	• Scenario 1 including SISA initiatives as above. • Walking and cycling only connection at Lyon Park Road and Waterloo Road • Adding missing pedestrian crossings at eight locations • Slip lane removal [at 4 intersections]

8.2 Model limitations

The following limitations of the operational modelling apply:

- The AIMSUN model will not replicate congestion or bottlenecks outside the model boundary for future years.
- The operation of the M2 Motorway was not included in this assessment, but the on and off-ramps to the M2 have been included to capture traffic that interacts with the study area.
- Pedestrians and bicycle riders are not included in this microsimulation model, but their needs are replicated with signal timings as appropriate in future models. Further work was manually undertaken to understand the opportunity to re-mode private vehicle trips to walking or cycling.

8.3 Model road network

The model road network is shown in Figure 8.1, showing key roads in MPIP. The model is bound by Culloden Road in the northwest, Epping Road along the southern boundary and Talavera Road along the northern boundary. All major intersections and select driveway accesses are included in the modelled road network.

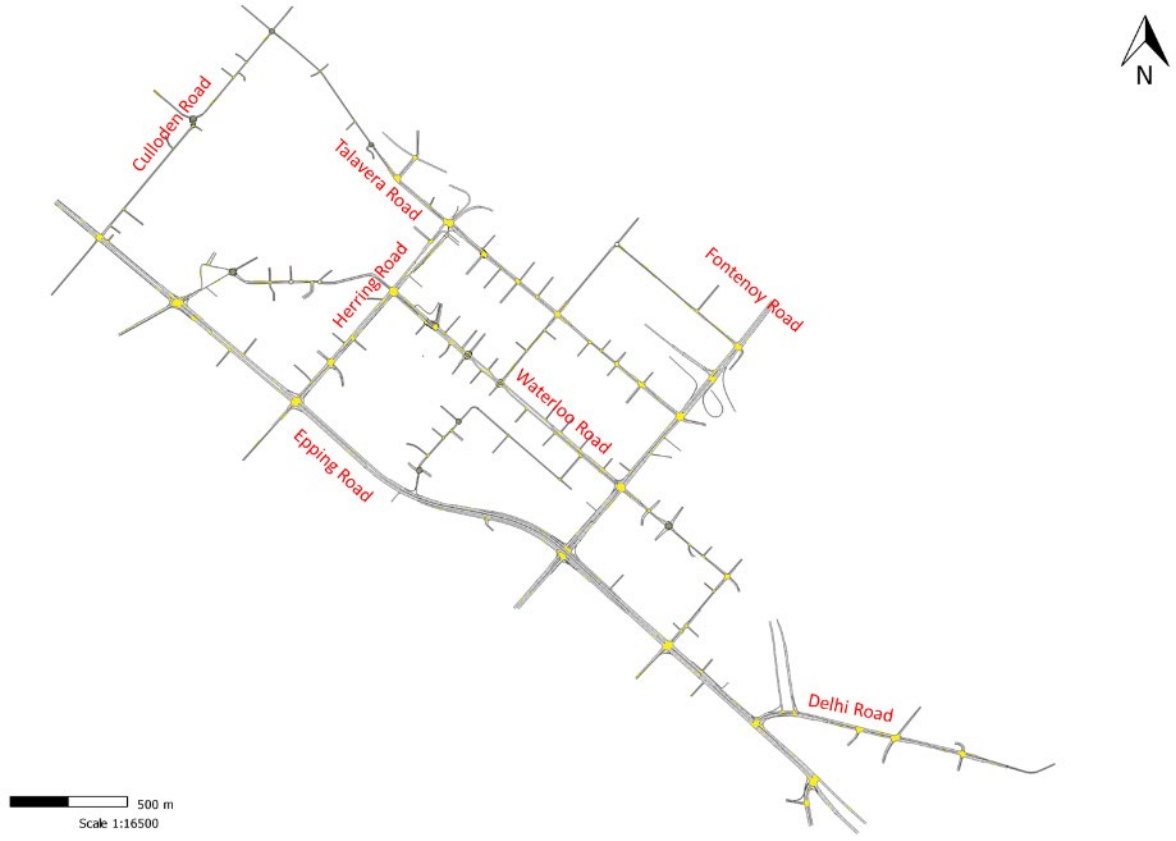


Figure 8.1 Model in AIMSUN

8.4 Operational model calibration and validation

The calibration and validation report for the AIMSUN operational model and full list of model assumptions are provided in Appendix F.

9 Validating the vision

9.1 Validation overview

An overarching objective is to prepare a strategy to manage transport within and around the Macquarie Park Precinct for the next 20 years through to 2041. This study will provide a platform for the strategy and the flexibility to test emerging scenarios.

Figure 9.1 shows the relationship between the vision and objectives, that inform the validation and lead to the recommendations.

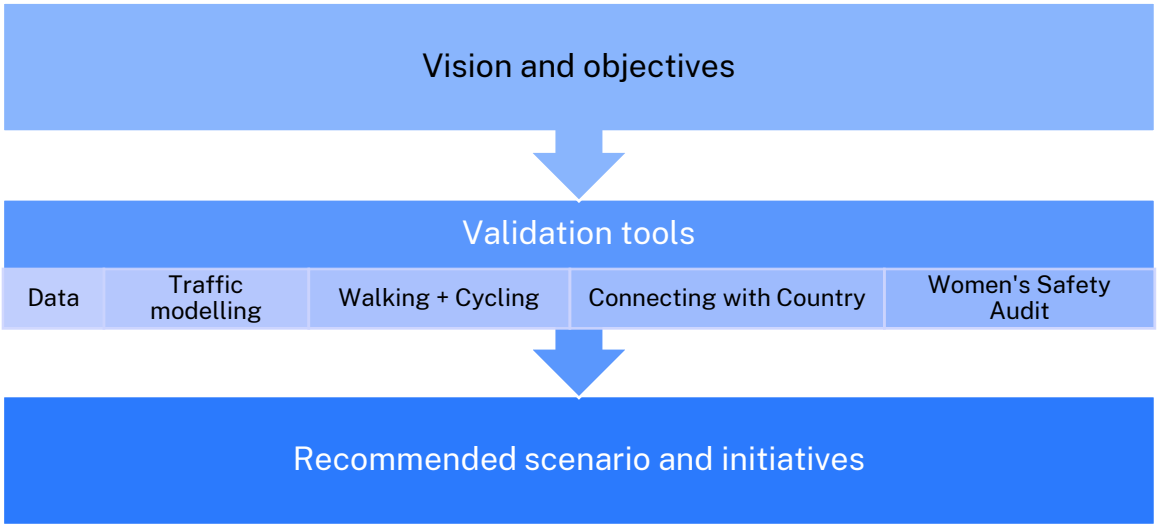


Figure 9.1 Validation approach based on vision and objectives

As part of this, the study objectives include:

- Evaluate current network performance and travel patterns.
- Forecast travel demand up to 2041, accounting for future development and committed infrastructure projects.
- Evaluate future network performance and travel patterns.
- Assess different improvement options in terms of alignment with the vision and objectives.
- Develop an implementation strategy for the improvement options.

Operational (traffic) modelling is one tool that can be used to validate proposed initiatives for the study area. A limitation of traffic modelling is that it is focused on the operation of the road network, so reports results for cars and buses. It does not report on any place-based or walking and cycling initiatives. For this study, most of the initiatives proposed recommend improvements to:

- Walking and cycling connectivity and amenities
- Urban and place making outcomes.
- Bus journey time reliability.

9.1.1 Operational modelling process

The following sections outline the modelling results from the AIMSUN operational model developed for the study area. The operational model was used to validate the initiatives and their impacts on the road network. The results discussed in this section are for the year 2041.

Figure 9.2 shows how the operational models were obtained for testing initiatives.

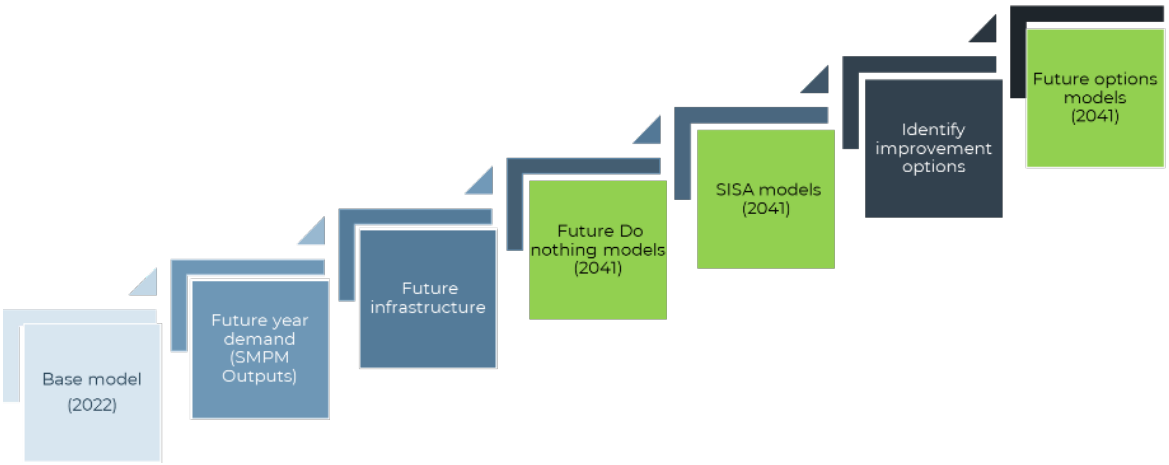


Figure 9.2 Modelling interfaces

The Sydney Strategic Traffic Model (STM) and Sydney Motorway Project Model (SMPM) were used to forecast travel demand for use in the operational model. Road network scenarios were then coded in the operational model for testing. Examples of future infrastructure are:

- The new Macquarie University Bus Interchange
- The fine grain street network and associated infrastructure changes such as signals
- Road space reallocation such as changing general traffic lanes to bus lanes.

The following sections summarise the results for each scenario using 2041 traffic volumes and infrastructure assumptions.

9.2 Network scenarios and findings

Four different scenarios were tested using forecast travel demand for 2041. A summary of infrastructure initiatives tested in the operational model is provided in Table 8.1. A more detailed description of each of these scenarios is provided below.

9.2.1 Do minimum scenario

The 'Do Minimum' scenario assumes that no road network or public transport services changes are made from the base year, and no placemaking SISA initiatives are delivered. However, the population and employment growth proceeds with the addition of 20,000 population and 7,650 jobs. Figure 9.3 shows the existing road network in 2022.

Figure 9.3 Map of Do Minimum road network – 2041 remains the same as 2022

9.2.1.1 *Do minimum placemaking opportunities*

Table 9.2 summarises the objectives for this Transport Study (defined in section 4.1.3), and assumptions made in the Do Minimum scenario.

Table 9.1 Do minimum network place and active transport outcomes

Objective	Metric	Assumptions for Do Minimum
Country is visible and accessible	Connecting with Country recommendations implemented	Connecting with Country recommendations are not implemented
Public and active transport mode share is maximised	Increase in non-car mode share	No changes to the existing walking and cycling network
Great places of 15-minute neighbourhoods	% of the population within 1,200m walking distance of mixed-use and education	No changes to block sizes or improved crossing opportunities
Last mile deliveries facilities and impact minimised	Last mile deliveries are considered in future land use	No changes to the road network mean any land use intensification may affect how freight vehicles and activities move within the study area
Commercial and residential uplift enabled	Ability to achieve forecast land use	Forecast land use takes place without supporting infrastructure
Dense network of walking routes (off busy roads)	Intersection density	No changes in intersection density
Increase tree canopy cover	% canopy cover	No additional tree canopy
Plan for future mass transit	Length of transit/bus priority lanes	No priority transit/ bus lanes
Safe walking 24/7 for women, children and elderly people	Women's safety audit recommendations implemented	No recommendations for women's safety are implemented

9.2.1.2 *Do Minimum scenario 2041 AM peak results*

Key road network performance changes during the AM peak in the Do Minimum scenario are shown in Figure 9.4. The results indicate that:

- Bus speeds slow to 10.7 km/h, compared to 12.1 km/h in the base year.
- Lane Cove Road is congested and at capacity between the M2 and Epping Road.

- Epping Road, Talavera Road and Khartoum Road are nearing capacity.
- Herring Road, Waterloo Road and Delhi Road are operating with spare capacity.

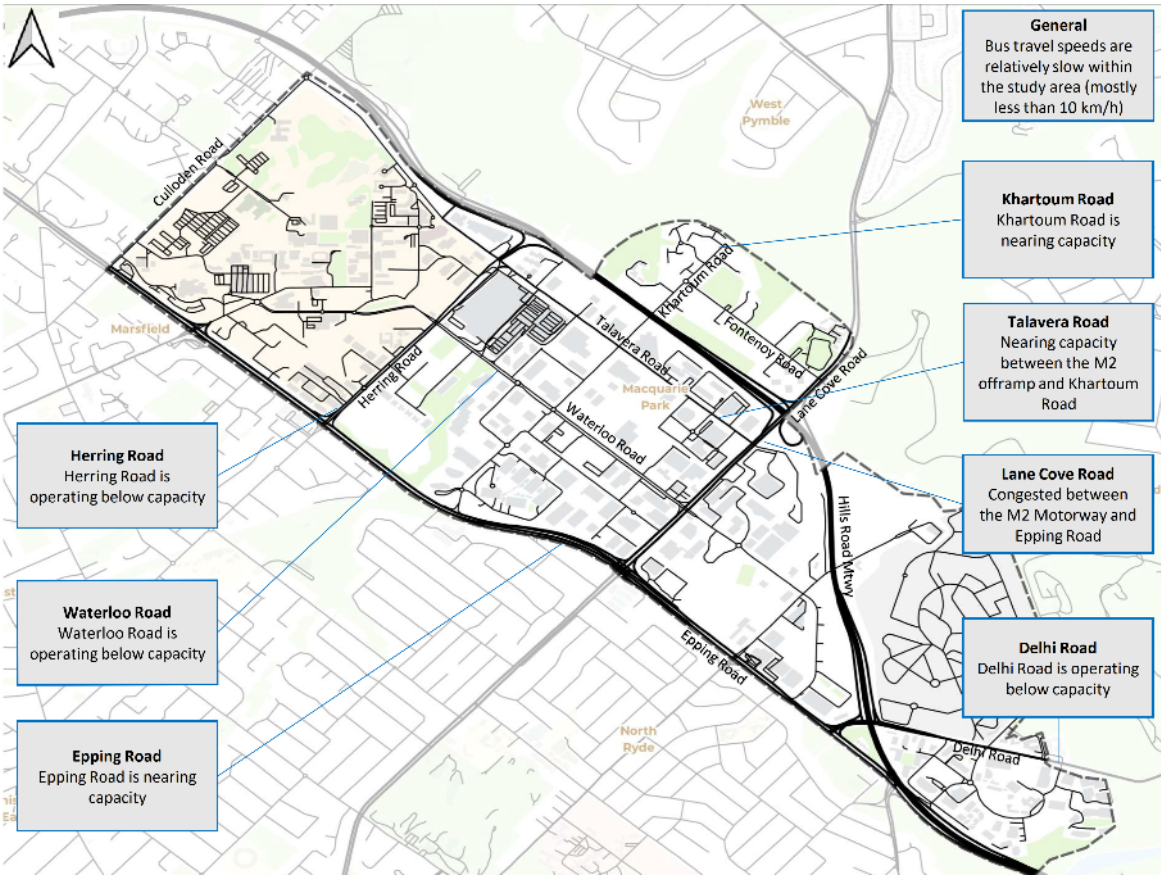


Figure 9.4 Do Minimum AM peak road network results

Table 9.3 compares road network metrics for this scenario against the base case. Key findings were:

- More trips were made by car, leading to 3.7 per cent more vehicles driving in the precinct with a corresponding increase in vehicle kilometres travelled (VKT). This results in increased traffic congestion in the morning peak.
- There is a 44 per cent increase in delays, from 102 seconds delay per kilometre to 147 seconds.
- The average travel speed for buses is reduced by 1.4 km/h (11.5 per cent speed reduction) and all vehicles by 4.3 km/h (16 per cent speed reduction).

Table 9.2 Do minimum scenario AM peak metrics

Measure	Base (2022)	Do Minimum (2041)	Change from base
Average Network Delay (sec/km)	102	147	44%
Total modelled vehicles	51,100	53,000	3.7%
Vehicle km Travelled (km)	101,700	105,900	3.9%
Average Speed (km/h) - All	27.3	23.0	-16%
Average Speed (km/h) - Bus	12.1	10.7	-11.5%

9.2.1.3 *Do Minimum scenario 2041 PM peak results*

Key road network performance changes during the PM peak in the Do Minimum scenario are shown in Figure 9.5. The results indicate that:

- Bus speeds slow to 10.3 km/h, compared to 11.6 km/h in the base year.
- Lane Cove Road is congested near the M2 interchange.
- Epping Road, Lane Cove Road and Khartoum Road are nearing capacity.
- Herring Road, Waterloo Road and Delhi Road will still operate below capacity.

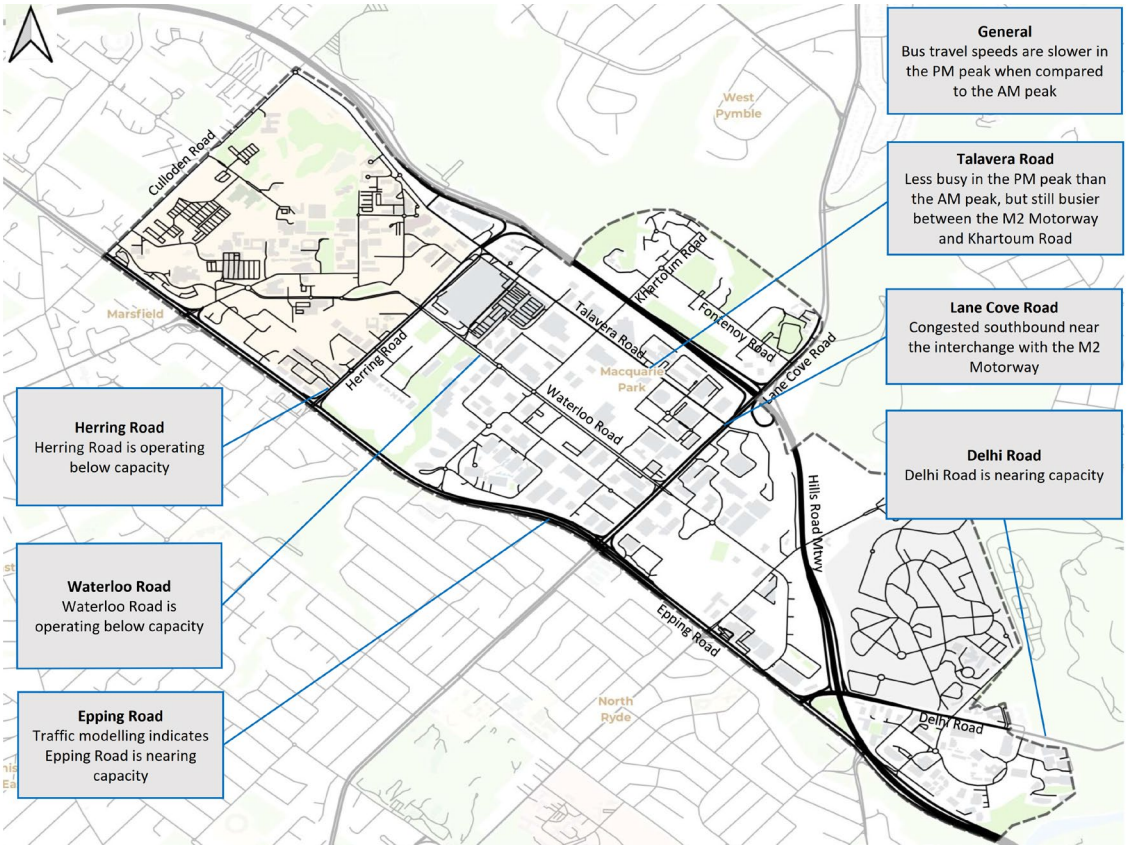


Figure 9.5 Do Minimum PM peak road network results

Table 9.4 compares road network metrics for this scenario against the base case. Key findings were:

- More trips were made my car, leading to 6.6 per cent more vehicles driving in the precinct with a corresponding increase in vehicle kilometres travelled (VKT). This results in traffic delays in the afternoon peak.
- Epping Road, Lane Cove Road and sections of Khartoum Road are near capacity.
- There is a 78 per cent increase in delays, from 106 seconds delay per kilometre to 189 seconds.
- The average travel speed for buses is reduced by 1.4 km/h (11 per cent speed reduction) and all vehicles by 7.2 km/h (26 per cent speed reduction).

Table 9.3 Do minimum scenario PM peak metrics

Measure	Base (2022)	Do Minimum (2041)	Change from base
Average Network Delay (sec/km)	106	189	78%
Total modelled vehicles	53,200	56,700	6.6%
Vehicle Km Travelled (km)	107,000	113,800	6.3%
Average Speed (km/h) - All	27.7	20.5	-26%
Average Speed (km/h) - Bus	11.6	10.3	-11%

9.2.1.4 Do Minimum scenario 2041 conclusions

Analysis of the Do Minimum scenario indicated that, if the recommended SISA initiatives are not delivered the precinct may struggle to accommodate anticipated population and employment growth and the NSW Government's vision for the precinct is unlikely to be realised.

Outcomes include:

- Constrained transport access and continued dominance of private vehicle use.
- Walkability – a key indicator of successful places – would remain limited due to the large block sizes and lack of crossing opportunities, making walking around the precinct unattractive.
- A four per cent increase in VKT and a 44 per cent to 78 per cent increase in vehicle delays from the present day would buses and goods delivery in the precinct.
- The objective of maximising public and active transport is not likely to be achieved.

9.2.2 SISA scenario

The SISA scenario assumes that all the transport and place-making initiatives that were recommended in the SISA are delivered; and the expected population and employment growth takes place with the addition of 20,000 residents and 7,650 jobs.

The SISA initiatives that were tested in this scenario are shown in Figure 9.6. These include:

- Additional Metro services and two new mass-transit/heavy rail lines.
- The Macquarie Park Precinct Bus Interchange is delivered.
- Road network changes :
  - New signalised intersections on Talavera Road and Waterloo Road
  - 'Left-in, left-out' few new intersections of the fine grain street network with Epping Road and Lane Cove Road .
  - Give way controls for vehicles on the fine grain street network.

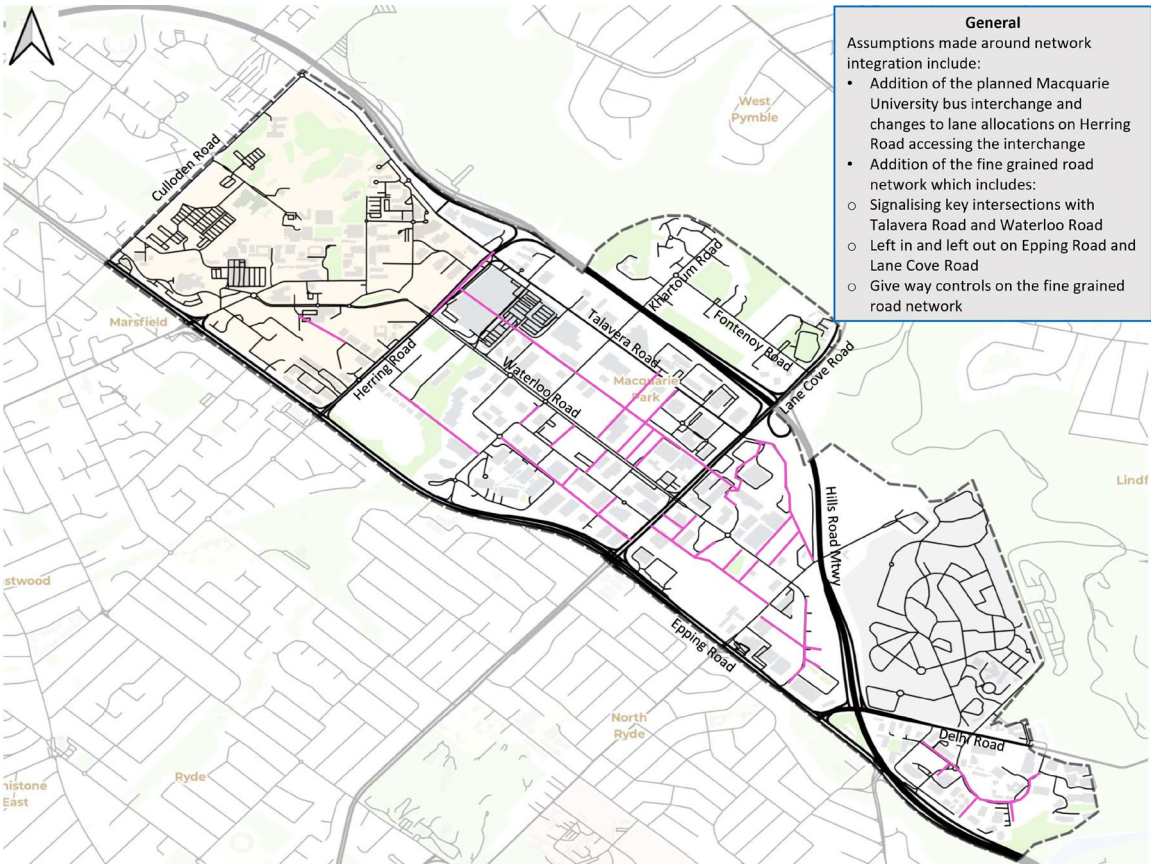


Figure 9.6 SISA 2041 road network scenario

9.2.2.1 *Strategic Infrastructure and Services Assessment placemaking opportunities*

Table 9.5 summarises the objectives for this Transport Study (defined in section 4.1.3), and the assumptions made for each in the SISA scenario. This scenario assumes that only initiatives recommended in the SISA are delivered. This includes some overlap with recommendations of the Connecting with Country Framework and Women's Safety Audit, but would not deliver all of their recommendations.

Table 9.4 SISA network place and active transport outcomes

Objective	Metric	Assumptions for the SISA scenario
Country is visible and accessible	Connecting with Country implemented	Only implements aspects of Connecting with Country that is part of SISA
Public and active transport mode share is maximised	Increase in non-car mode share	All walking and cycling initiatives in the SISA are delivered
Great places of 15-minute neighbourhoods	% of the population within 1200m walking distance of mixed-use and education	The denser uplift and fine grain street network created by SISA initiatives would result in more people living close to mixed-use and education
Last mile deliveries facilities and impact minimised	Last mile deliveries are considered in future land use	Some aspects improved – such as cycling connections, but not other options such as micro-hubs which were not in the SISA
Commercial and residential uplift enabled	Ability to achieve forecast land use	SISA aims to enable the forecast land use uplift to be achieved
Dense network of walking routes (off busy roads)	Intersection density	SISA will increase the intersection density, to some extent, to make walking easier

Objective	Metric	Assumptions for the SISA scenario
Increase tree canopy cover	% canopy cover	SISA will increase the tree canopy significantly
Plan for future mass transit	Length of transit/bus priority lanes	No priority transit lanes in this option
Safe walking 24/7 for women, children and elderly people	Women's safety audit recommendations implemented	Only implements aspects of Women's Safety that are part of SISA, but not all

9.2.2.2 SISA scenario 2041 AM Peak results

Key impacts on the road network in the AM peak in the SISA scenario modelling are shown in Figure 9.7.

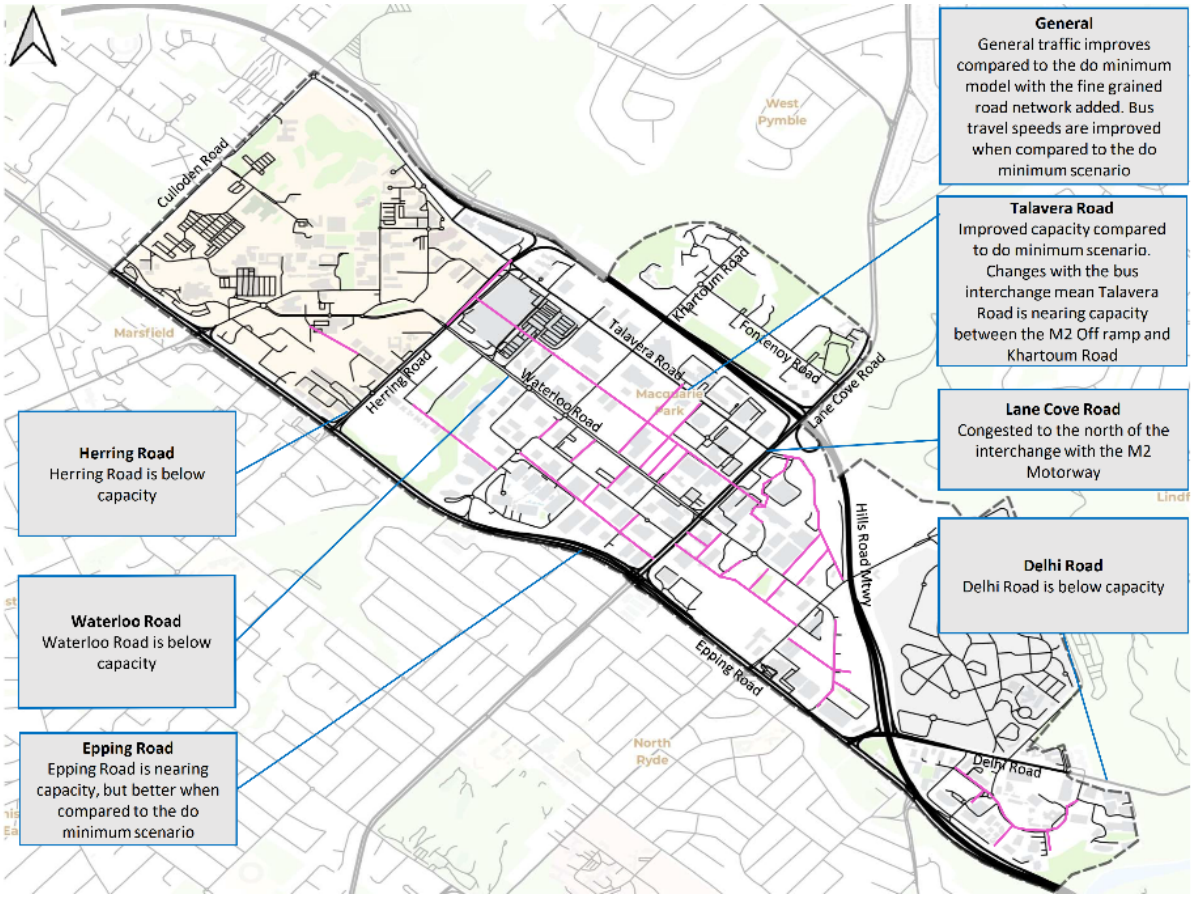


Figure 9.7 SISA AM peak road network results

The results indicate that:

- Overall, the road network performs better than in the Do Minimum scenario.
- Bus speeds are only 5 per cent slower than the base case.
- Lane Cove Road is congested near the M2
- Epping Road is nearing capacity.
- Herring Road, Waterloo Road, Delhi Road and Talavera Roads will still operate with spare capacity.
- Talavera Road will be near capacity for a short section due to the bus interchange.

Table 9.6 summarises the network metrics for the Do Minimum scenario 2041 AM peak compared to the base case.

Table 9.5 SISA AM peak metrics

Measure	Base (2022)	SISA (2041)	Change from base
Average Network Delay (sec/km)	102	128	25%
Total modelled vehicles	51,100	53,200	4.1%
Vehicle Km Travelled (km)	101,700	104,500	2.7%
Average Speed (km/h) - All	27.3	24.2	-11%
Average Speed (km/h) - Bus	12.1	11.5	-5%

Compared to the base case, the SISA scenario for AM peak shows:

- More trips were made by car, leading to 4.1 per cent more vehicles and a 2.7 per cent increase in VKT.
- There is a 25 per cent increase in delays, from 102 seconds delay per kilometre to 128 seconds.
- The average travel speed for buses is reduced by 0.6 km/h (five per cent speed reduction) and all vehicles by 3.1 km/h (11 per cent speed reduction).
- Lane Cove Road is at capacity and Epping Road is nearing capacity.

Compared to the Do Minimum scenario (Table 9.3), the SISA scenario the morning peaks shows:

- Less traffic delay than in the Do Minimum scenario due to the addition of the fine grain street network which takes pressure off the major roads.
- Buses experience less delay (four to five per cent) compared to the Do Minimum scenario
- Slightly lower overall VKT, despite more vehicles.
- Average speeds increase by 1.2 km/h for all vehicles (five per cent) and 0.8 km/h for buses (seven per cent) compared to the Do Minimum scenario.

9.2.2.3 SISA scenario 2041 PM peak results

Key impacts on the road network in the PM peak in the SISA scenario are shown in Figure 9.8. The results show:

- Herring Road and Waterloo Roads will still operate below capacity.
- Epping Road, Talavera Road and Delhi Road experience some delays at key intersections but are generally less congested than in the Do Minimum scenario.

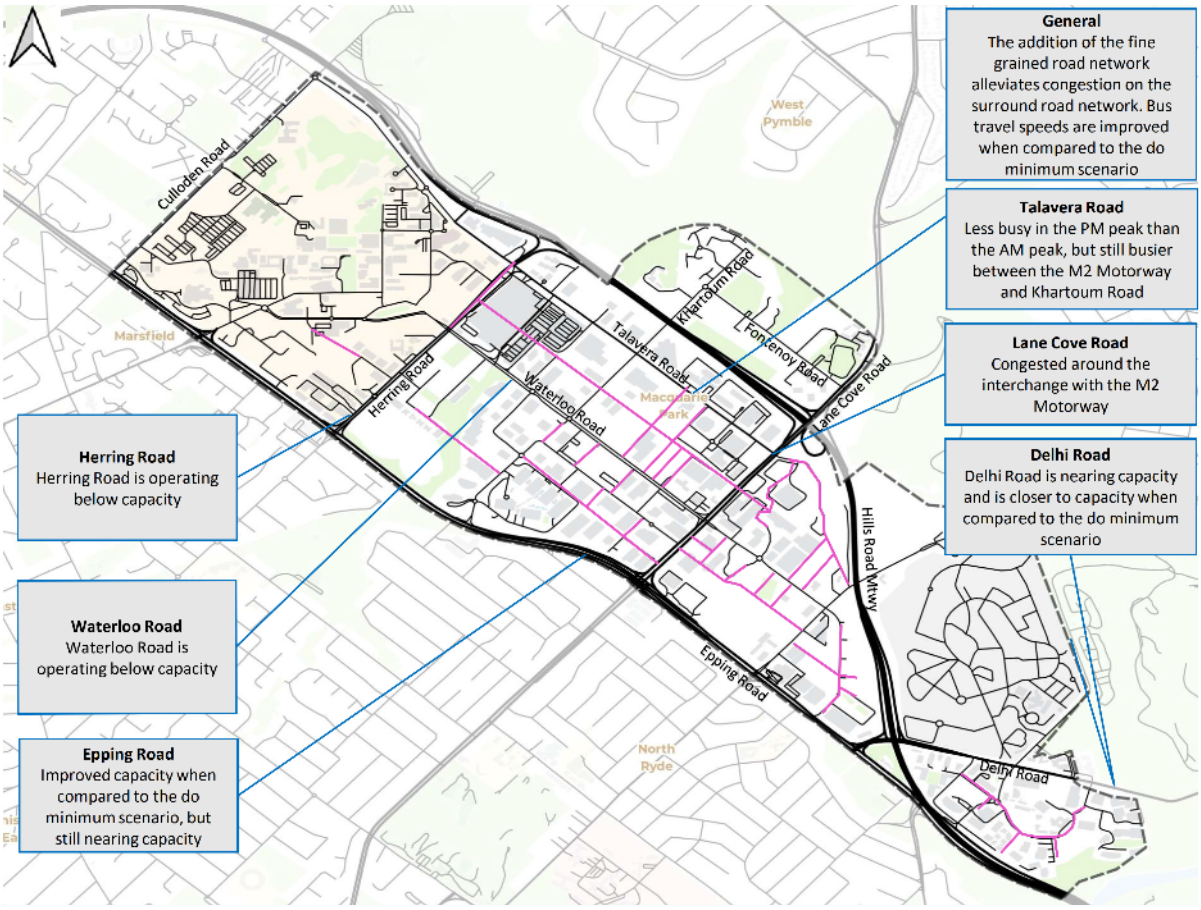


Figure 9.8 SISA PM peak road network results

Table 9.7 summarises network metrics for the SISA scenario 2041 PM peak compared to the base case.

Table 9.6 SISA scenario PM peak metrics

Measure	Base (2022)	SISA (2041)	Change from base
Average Network Delay (sec/km)	106	156	47%
Total modelled vehicles	53,200	58,000	9%
Vehicle Km Travelled (km)	107,000	113,300	6%
Average Speed (km/h) - All	27.7	22.5	-19%
Average Speed (km/h) - Bus	11.6	11.1	-4%

Compared to the base case, the SISA scenario for the PM peak shows:

- More trips were made by car, leading to nine per cent more vehicles and a six per cent increase in VKT.
- There is a 47 per cent increase in delays, from 106 seconds delay per kilometre to 156 seconds.
- The average travel speed for buses is reduced by 0.5km/h (four per cent speed reduction) and all vehicles by 5.2km/h (19 per cent speed reduction).

Compared to the Do Minimum scenario (Table 9.4), the SISA scenario for the PM peak shows:

- Less traffic delay than in the Do Minimum scenario due to the fine grain street network taking pressure off the major roads.

- Slightly lower VKT, despite more vehicles.
- Average speed increases by 2.0 km/h for all vehicles (ten per cent) and 0.8 km/h for buses (eight per cent) when compared to Do Minimum.

9.2.2.4 SISA scenario 2041 conclusions

The SISA scenario assumed that only the initiatives recommended by the SISA are delivered and included additional Metro services and two new mass-transit/heavy rail lines.

Delivery of the SISA initiatives enables planned population and employment growth, with the fine grain street network and key walking and cycling routes included. The SISA recommendations include some, but not all, of the recommendations of the Connecting with Country Framework and Women's Safety Audit.

Buses experience less delay than in the Do Minimum scenario, with only four to five per cent delay down from 11 per cent. Average vehicle speeds are also higher than the Do Minimum scenario.

There would be a four per cent increase in VKT but up to nine per cent more vehicles than in the base case (2022).

9.2.3 Scenario 1

Scenario 1 included all SISA road network initiatives, in addition to (see Figure 9.9):

- Re-allocation of the kerb-side lanes on Waterloo Road and Herring Road from general traffic lanes to priority bus lanes
- Increased frequencies for local bus services.

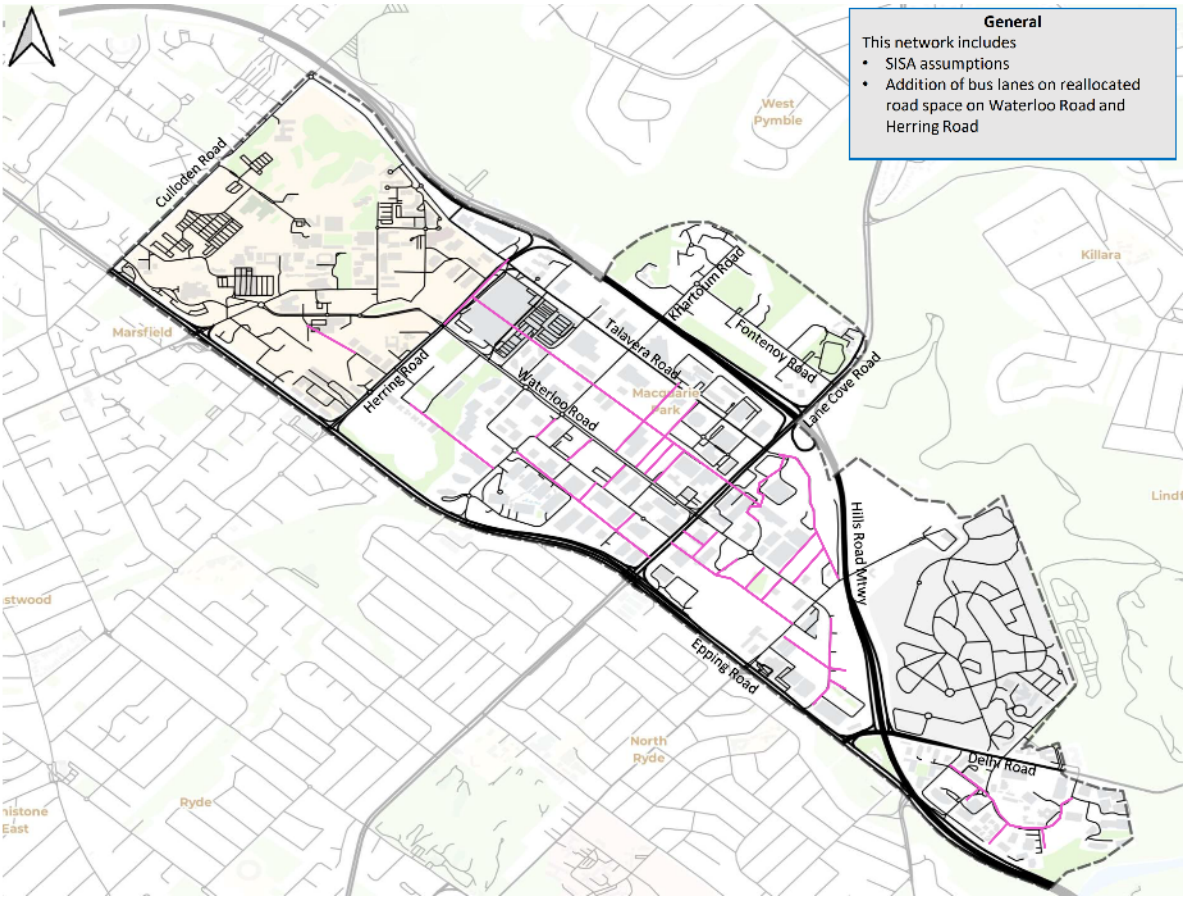


Figure 9.9 Scenario 1 2041 road network

9.2.3.1 *Scenario 1 placemaking opportunities*

Table 9.8 summarises the objectives for this Transport Study (defined in section 4.1.3), and the assumptions made for each under Scenario 1. It assumes the SISA initiatives and recommendations of this Transport Study (such as Connecting with Country or Women's Safety) are delivered. Any changes from the SISA scenario are highlighted below.

Table 9.7 Scenario 1 place and active transport outcomes

Objective	Metric	Assumptions for Scenario 1 (changes from SISA scenario in bold)
Country is visible and accessible	Connecting with Country implemented	**Opportunity to implement all aspects of Connecting with Country in addition to SISA**
Public and active transport mode share is maximised	Increase in non-car mode share	**All walking and cycling initiatives in the SISA are delivered, and some additional bus services and priorities are added**
Great places of 15-minute neighbourhoods	% of the population within 1200m walking distance of mixed-use and education	The denser uplift and fine grain street network created by SISA initiatives would result in more people living close to mixed-use and education
Last mile deliveries facilities and impact minimised	Last mile deliveries are considered in future land use	Some aspects would be improved – such as cycling connections, but not other options such as micro-hubs which were not in the SISA
Commercial and residential uplift enabled	Ability to achieve forecast land use	SISA aims to enable the forecast land use uplift to be achieved
Dense network of walking routes (off busy roads)	Intersection density	SISA will increase the intersection density, to some extent, to make walking easier
Increase tree canopy cover	% canopy cover	SISA will increase the tree canopy significantly
Plan for future mass transit	Length of transit/bus priority lanes	**Priority bus lanes added to Waterloo Road and Herring Road**
Safe walking 24/7 for women, children and elderly people	Women's safety audit recommendations implemented	**Opportunity to implement all Women's Safety recommendations in addition to SISA**

9.2.3.2 *Scenario 1 2041 AM Peak results*

Key impacts on the road network in the AM peak in the Scenario 1 modelling are shown in Figure 9.10. Importantly, it shows that **reallocating the kerb-side lanes on Herring Road and Waterloo**

Road to bus priority lanes does not reduce the capacity of these roads. The rest of the network performs similarly to the SISA scenario.

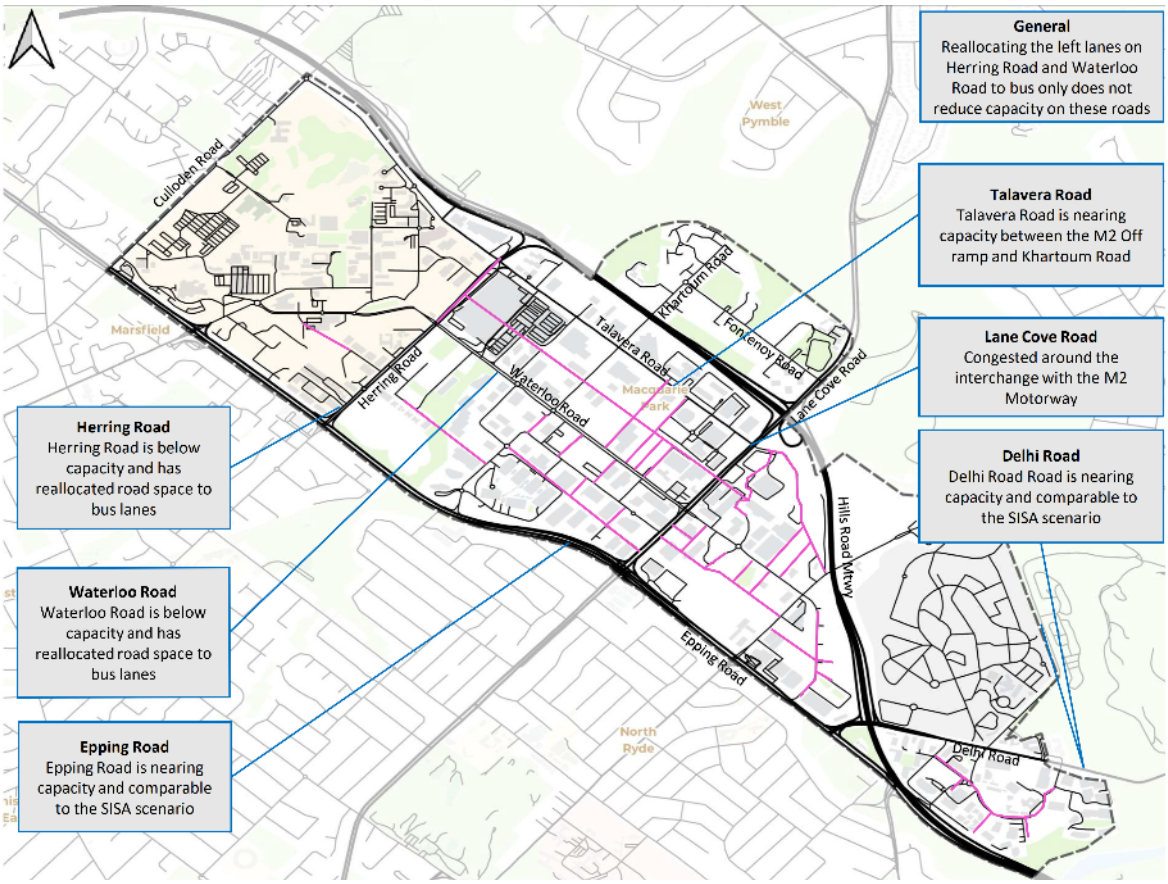


Figure 9.10 Scenario 1 AM peak road network results

Table 9.9 summarises the network metrics for Scenario 1 for the 2041 AM peak.

Table 9.8 Scenario 1 AM peak metrics

Measure	Base (2022)	Do minimum (2041)	SISA (2041)	Scenario 1 (2041)	Change from the base case
Average Network Delay (sec/km)	102	147	128	151	48%
Total modelled vehicles	51,100	53,000	53,200	53,200	4.1%
Vehicle Km Travelled (km)	101,700	105,900	104,500	104,300	2.6%
Average Speed (km/h) - All	27.3	23.0	24.2	22.8	-16.4%
Average Speed (km/h) - Bus	12.1	10.7	11.5	11.4	-5.8%

Compared to the current base model, Scenario 1 AM peak shows:

- Similarly to the SISA scenario, more trips were made by car , leading to 4.1 per cent more vehicles and a 2.6 per cent increase in VKT.
- There is a 48 per cent increase in delays, from 102 seconds delay per kilometre to 151 seconds.
- The average travel speed for buses is reduced by 0.7 km/h (5.8 per cent speed reduction) and all vehicles by 4.5 km/h (16.4 per cent speed reduction).

Compared to the SISA scenario (Table 9.6), the Scenario 1 AM peak shows:

- The reallocation of traffic lanes to bus priority lanes on Herring Road and Waterloo Road does not adversely impact the capacity of these roads.
- The same increase in vehicles and VKT as the SISA scenario.
- More general vehicle delay, though little change to delay for buses.

9.2.3.3 Scenario 1 2041 PM Peak results

Key impacts on the road network in the PM peak in the SISA modelling are shown in Figure 9.11. Importantly, it shows that, as with the AM peak results, **reallocating the kerb-side lanes on Herring Road and Waterloo Road to bus priority lanes does not reduce the capacity of these roads**. Other network effects are similar to the SISA scenario, although Delhi Road is operating closer to capacity.

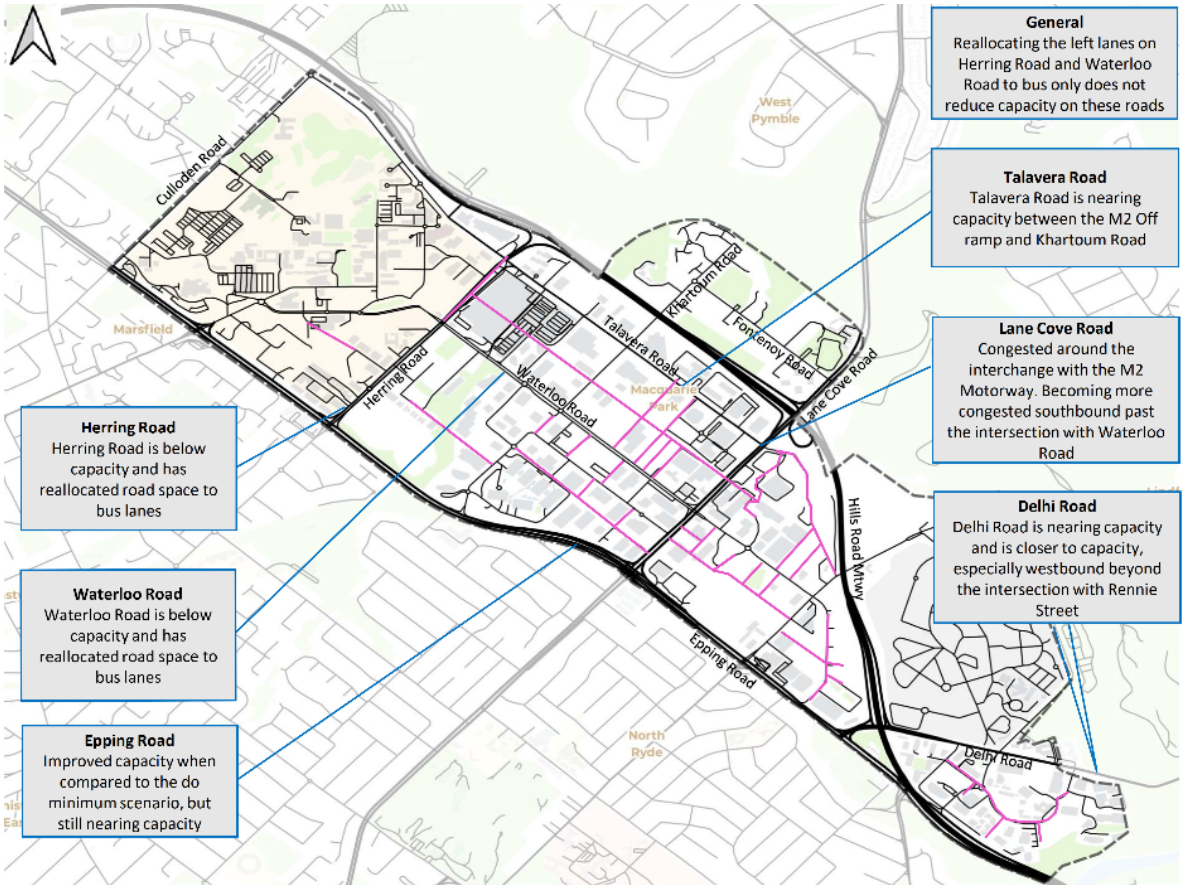


Figure 9.11 Scenario 1 PM peak road network results

Table 9.10 summarises the network metrics for Scenario 1 in the 2041 PM peak.

Table 9.9 Scenario 1 PM peak metrics

Measure	Base (2022)	Do minimum (2041)	SISA (2041)	Scenario 1 (2041)	Change from the base case
Average Network Delay (sec/km)	106	189	156	157	48%
Total modelled vehicles	53,200	56,700	58,000	58,100	9.2%
Vehicle Km Travelled (km)	107,000	113,800	113,300	112,600	5.2%
Average Speed (km/h) - All	27.7	20.5	22.5	22.9	-17%
Average Speed (km/h) - Bus	11.6	10.3	11.1	11.0	-5.2%

Compared to the base case, the Scenario 1 PM peak shows:

- More people will drive, leading to 9.2 per cent more vehicles and a 5.2 per cent increase in VKT.
- There is a 48 per cent increase in delays, the same as the SISA scenario.
- This will reduce the average travel speed for buses by 0.4km/h (5.2 per cent speed reduction) and all vehicles by 5.2km/h (17 per cent speed reduction).

Compared to the SISA scenario (Table 9.7), the Scenario 1 PM peak shows:

- The reallocation of the kerb-side traffic lanes to bus priority lanes on Herring Road and Waterloo Road does not adversely impact the capacity of these roads.
- Lower VKT than the SISA scenario.

9.2.3.4 Scenario 1 2041 conclusions

Scenario 1 included all of the recommendations of the SISA in addition to:

- T re-allocation of the kerb-side lanes from general traffic to priority bus lanes on Waterloo Road and Herring Road.
- Increased service frequencies for local bus services.

Compared to the Do Minimum scenario, buses experience less delay of only 5.5 per cent instead of an 11 per cent increase in delay. **Reallocation of the kerb-side general traffic lanes to bus priority lanes does not impact on the performance of Waterloo Road and Herring Roads with .** Average vehicle speeds are slower than the other scenarios in the AM peak and marginally better in the afternoon compared to Do Minimum. This would affect goods delivery in the precinct about as much as the Do Minimum scenario.

Compared to the base case (2022), there would be a 2.6 per cent to 5.0 per cent increase in VKT and between four per cent and nine per cent more vehicles.

9.2.4 Scenario 2

Scenario 2 included all measures included in the SISA case and Scenario 1 in addition to (see Figure 9.12):

- A walking and cycling connection at Lyon Park Road and Waterloo Road
- Additional pedestrian crossings at eight locations (see map)
- Slip lanes removed at five locations (see map)

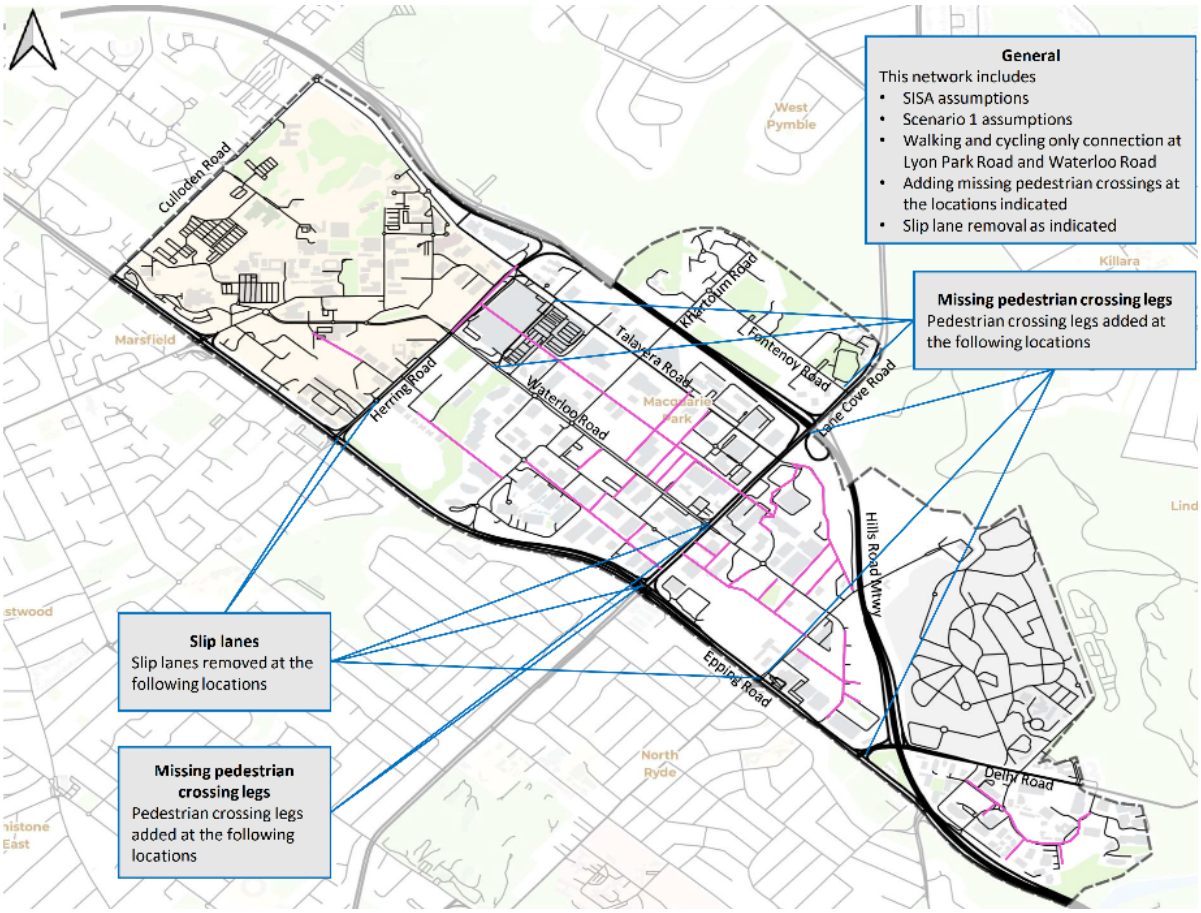


Figure 9.12 Scenario 2 2041 road network with pedestrian improvement indicated

9.2.4.1 Scenario 2 placemaking opportunities

Table 9.11 summarises the changes to the Objectives compared to Scenario 1 only. These changes relate to pedestrian crossings and slip lane removal.

Table 9.10 Scenario 2 network place and active transport outcomes

Objective	Metric	Opportunities/comments
Country is visible and accessible	Connecting with Country recommendations implemented	Improved pedestrian accessibility increases connection with Country
Public and active transport mode share is maximised	Increase in non-car mode share	The additional pedestrian crossings and removed slip lanes will increase safety and accessibility for walking, cycling and public transport
Great places of 15-minute neighbourhoods	% of the population within 1200m walking distance of mixed-use and schools	Adding crossings will reduce delays for pedestrians to help meet this objective
Dense network of walking routes (off busy roads)	Intersection density	Improving the quality of intersections doesn't change this metric
Safe walking 24/7 for women, children, elderly	Women's safety audit recommendations implemented	Additional pedestrian crossings and removed slip lanes increases safety

9.2.4.2 Scenario 2 2041 AM Peak results

Key impacts on the road network in the AM peak in Scenario 2 are shown in Figure 9.13. Importantly, it shows that **removing slip lanes on the Lane Cove Road/ Waterloo Road intersection and the Herring Road/Ivanhoe Place intersection does not increase congestion at these intersections**. Other network impacts are broadly similar to Scenario 1.

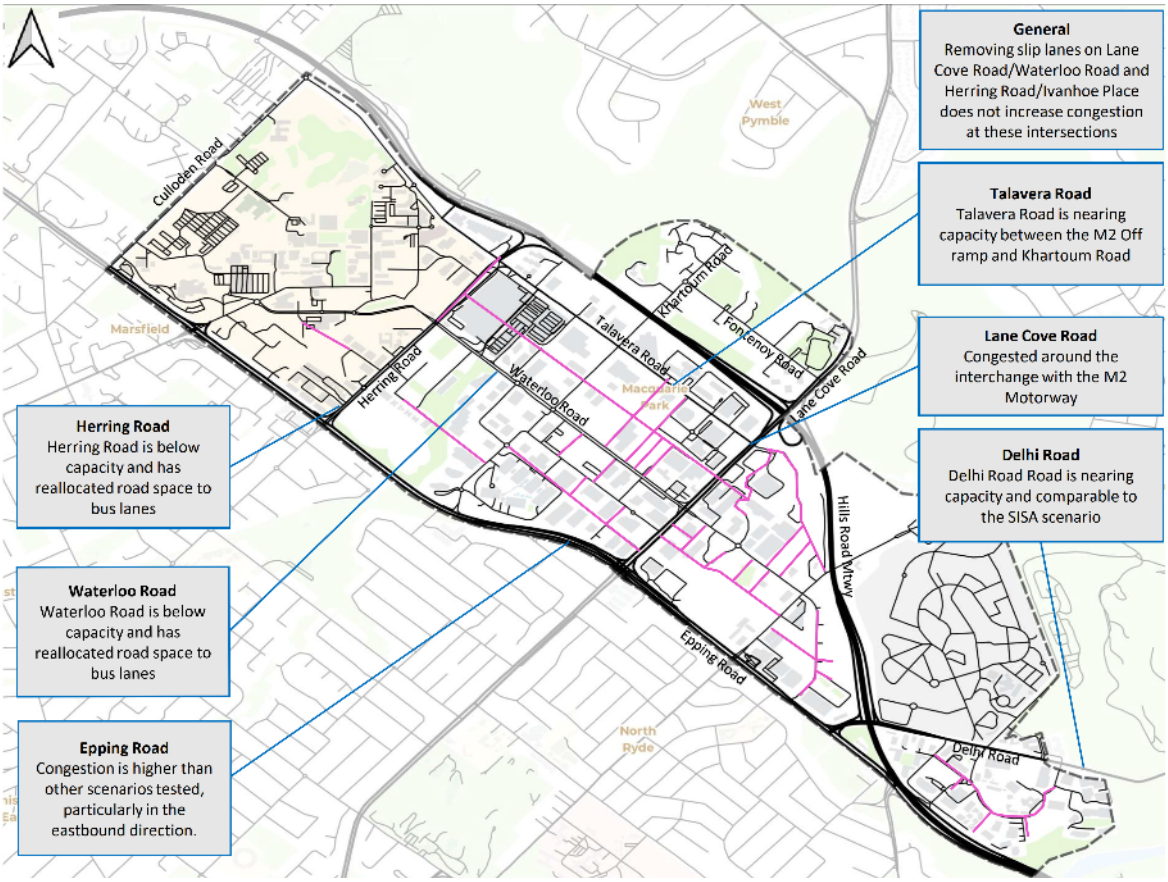


Figure 9.13 Scenario 2 AM peak road network results

Table 9.12 summarises the network metrics for Scenario 2 the 2041 AM peak.

Table 9.11 Scenario 2 AM peak metrics

Measure	Base (2022)	Scenario 1 (2041)	Scenario 2 (2041)	Change from base
Average Network Delay (sec/km)	102	151	145	42%
Total modelled vehicles	51,100	53,200	53,200	4.1%
Vehicle Km Travelled (km)	101,700	104,300	105,100	3.3%
Average Speed (km/h) - All	27.3	22.8	23.0	-15.8%
Average Speed (km/h) - Bus	12.1	11.4	11.0	-9%

Compared to the current base model, Scenario 2 AM Peak modelling shows:

- More trips were made by car, leading to 4.1 per cent more vehicles and a 3.3 per cent increase in VKT.
- A 42 per cent increase in average delay, from 102 seconds delay per kilometre to 145 seconds

- The average travel speed for buses is reduced by 1.1 km/h (nine per cent speed reduction) and all vehicles by 4.3km/h (15.8 per cent speed reduction).

Compared to Scenario 1, the Scenario 2 shows for morning peaks:

- The removal of slip lanes at the intersections of Lane Cove Road/Waterloo Road and Herring Road/ Ivanhoe Place doesn't adversely impact traffic congestion.
- The same increase in vehicles and a slight increase in VKT (possibly drivers travel further to avoid delays)
- A slight reduction in operating speed for buses due to increased delay at intersections where slip lanes have been removed, predominantly on Epping Road.
- Minimal impact on general vehicle average speed.

9.2.4.3 Scenario 2 2041 PM Peak results

Key impacts on the road network in the PM peak in the Scenario 2 modelling are shown in Figure 9.14. It shows that **removing slip lanes at the intersections of Lane Cove Road/Waterloo Road and Herring Road/Ivanhoe Place does not increase congestion at these intersections**. Other network impacts are similar to Scenario 1.

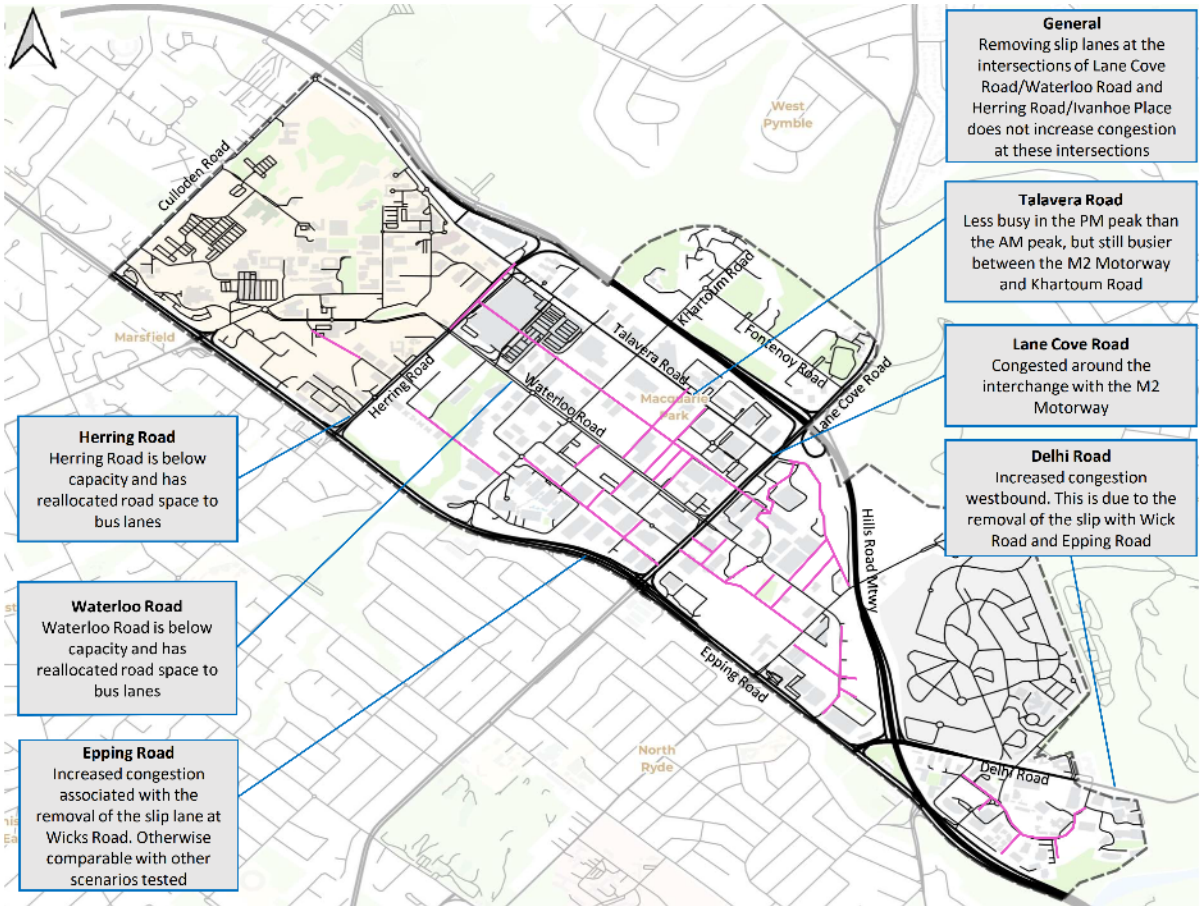


Figure 9.14 Scenario 2 PM peak road network results

Table 9.13 summarises the network metrics for Scenario 1 in the 2041 PM peak when compared to the SISA PM peak scenario.

Table 9.12 Scenario 2 PM peak metrics

Measure	Base (2022)	Scenario 1 (2041)	Scenario 2 (2041)	Change from base
Average Network Delay (sec/km)	106	157	196	84.9%
Total modelled vehicles	53,200	58,100	57,800	8.6%
Vehicle Km Travelled (km)	107,000	112,600	112,800	5.4%
Average Speed (km/h) - All	27.7	22.9	20.1	-27.4%
Average Speed (km/h) - Bus	11.6	11.0	10.6	-8.6%

Compared to the current base model, Scenario 2 afternoon peak modelling shows:

- More trips were made by car, leading to 8.6 per cent more vehicles and a 5.4 per cent increase in VKT.
- A very significant 86 per cent increase in delays, from 102 seconds delay per kilometre to 196 seconds. This is more than any other scenario.
- The average travel speed for buses is reduced by 1.0 km/h (8.6 per cent speed reduction) and for all vehicles by 7.6km/h (27.5 per cent speed reduction).

Compared to Scenario 1, this Scenario 2 shows for afternoon peaks:

- The removal of slip lanes at the intersections of Lane Cove Road/Waterloo Road and Herring Road/Ivanhoe Place doesn't adversely impact traffic congestion at these intersections.
- Fewer vehicles and a slight increase in VKT
- Improved operating speed for buses, but slower speeds for other vehicles.
- The removal of slip lanes marginally slows bus travel speeds by 0.4 km/h compared to Scenario 1. This reduction in bus travel speeds is primarily as a result of slower bus travel speeds on Delhi Road and westbound on Talavera Road.

9.2.4.4 Scenario 2 2041 conclusions

Scenario 2 provides an opportunity to significantly improve pedestrian safety, place outcomes and amenity, including recommendations of the Connecting with Country Framework and Women's Safety Audit (as described in Table 9.11).

It also showed that the removal of slip lanes at the intersections of Lane Cove Road/Waterloo Road and Herring Road/Ivanhoe Place does not increase congestion at these intersections. However, the results indicated that the slip lane at the intersection of Delhi Road and Epping Road needed to be retained to prevent the build-up of congestion at this location.

Scenario 2 resulted in some increased delays for buses when compared to the SISA case and Scenario 1. Further investigation of bus lanes on Lane Cove Road to support the future rapid buses may address these delays.

Of all the scenarios tested, Scenario 2 has the highest VKT in the AM peak and is the second highest in the PM peak. Scenario 2 also has the lowest vehicle speeds for all vehicles and buses, although speeds are still higher than the Do Minimum scenario.

9.2.5 Place and active transport summary

9.2.5.1 Tree canopy

It has been identified that there is a lack of canopy cover within Macquarie Park. In addressing the objective regarding tree canopy cover and achieving 70 per cent in road corridors, Figure 9.15 shows where the biggest deficiencies are to achieve 70 per cent canopy cover.

Figure 9.15 Tree canopy deficiency along roads in Macquarie Park

The largest deficiencies can be seen:

- Around the Macquarie Centre
- Lane Cove Road
- Epping Road

To achieve a 70 per cent canopy cover, tree spacing depends on the road width and the type of tree being used to achieve canopy cover. The Draft Urban Design Guide, 2021 suggests that to achieve 70 per cent canopy cover, one large tree (10 metres in diameter at the canopy) should be planted every 10 metres.

9.2.5.2 Cycling networks

To respond to improving cycling networks, a proposed bicycle network was developed. This is shown in Figure 9.16. This shows the existing bicycle network for reference. The fine grain street network can be used as well for cycling away from busy routes to move through the study area.

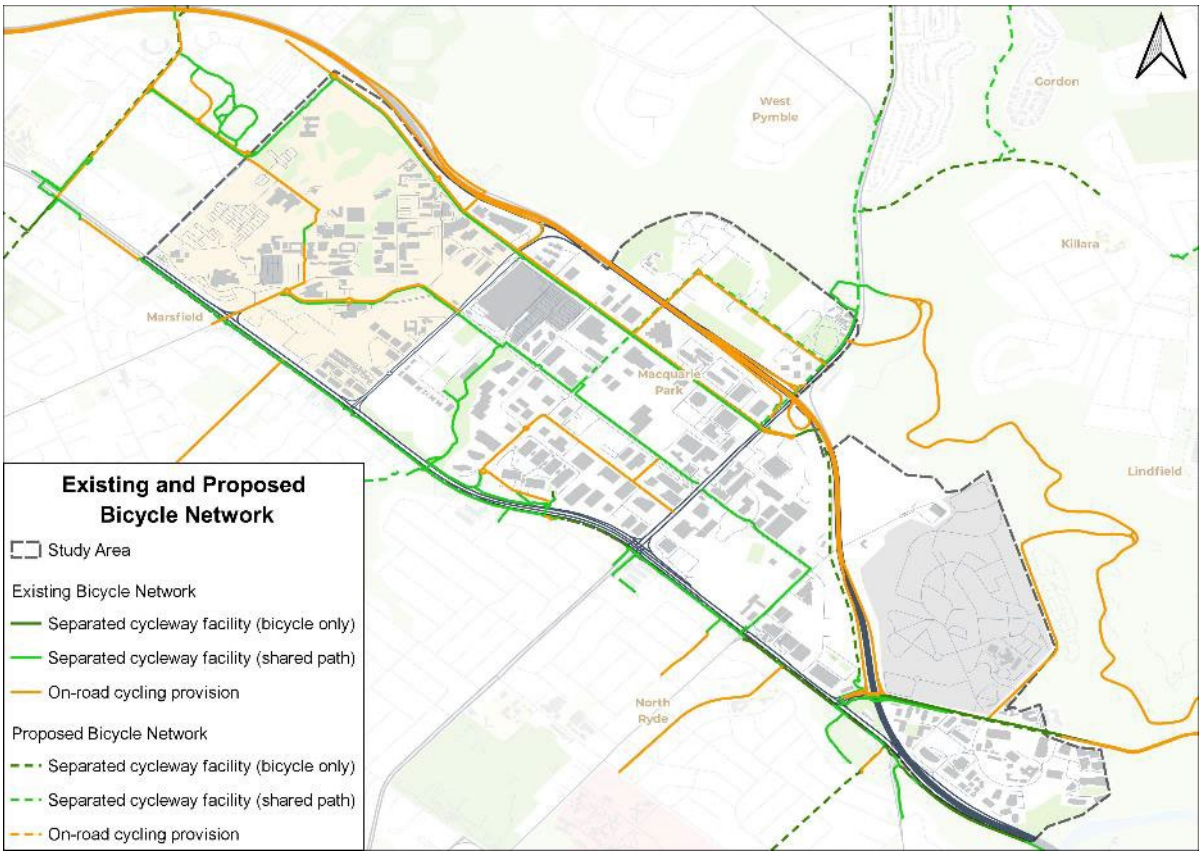


Figure 9.16 Suggested future cycle network

The Greater Sydney Strategic Cycleway Corridor Plan was released in February 2023. It shows Macquarie Park connecting:

- South to Top Ryde
- East from North Ryde to Lane Cove National Park and Chatswood
- West to Marsfield and Epping.

It does not include any connection to the north. This should be considered to allow safer cycling to occur for those living north of the study area.

9.2.6 Operational traffic modelling summary

Table 9.14 summarises the modelling outputs from operational traffic modelling. The table compares the AM and PM peaks of the 2022 base model against the four scenarios in 2041.

Table 9.13 Operational modelling metric summary

	Measure	Base Case (2022)	Do minimum (2041)	SISA (2041)	Scenario 1 (2041)	Scenario 2 (2041)
MORNING	Average Network Delay (sec/km)	102	147	128	151	145
	Total modelled vehicles	51,100	53,000	53,200	53,200	53,200
	Vehicle Km Travelled (km)	101,700	105,900	104,500	104,300	105,100
	Average Speed (km/h) - All	27.3	23.0	24.2	22.8	23.0
	Average Speed (km/h) - Bus	12.1	10.7	11.5	11.4	11.0

	Measure	Base Case (2022)	Do minimum (2041)	SISA (2041)	Scenario 1 (2041)	Scenario 2 (2041)
AFTERNOON	Average Network Delay (sec/km)	106	189	156	157	196
	Total modelled vehicles	53,200	56,700	58,000	58,100	57,800
	Vehicle Km Travelled (km)	107,000	113,800	113,300	112,600	112,800
	Average Speed (km/h) - All	27.7	20.5	22.5	22.9	20.1
	Average Speed (km/h) - Bus	11.6	10.3	11.1	11.0	10.6

Key findings from the scenario testing are:

- **In all scenarios the road network was able to accommodate the expected future demand**, meaning that there was no "wrong" scenario from a traffic modelling perspective. Under the vision and validate approach, this means that the vision takes primacy, and **all traffic models were validated as being able to support the transport and place vision**. There was a minor exception for Scenario 2 which required the slip lane at the intersection with Delhi Road and Epping Road to be retained to limit congestion. This means that any place benefits from removing slip lanes and implementing bus only lanes can be implemented and the network will still function.
- **Bus performance: The aim is for bus speeds to increase.** SISA and Scenario 1 obtained the best results for bus average speeds at around 11.5km/h.in the morning and 11.0km/h in the afternoon. A traffic lane could be reallocated on Waterloo Road in each direction to buses with minimal negative impact, improving bus reliability and efficiency.
- **Vehicle kilometres travelled: The aim is to reduce VKT within the precinct** (i.e. less private vehicle travel). SISA and Scenario 1 resulted in the lowest VKT in the morning peak, while Scenario 1 and 2 performed best in the afternoon peak.
- **Average network delay: There is no target for vehicle delay, as this was not a key performance metric sought in this Transport Study.**
- **Average vehicle speed: The aim is to reduce average vehicle speed** to achieve other objectives such as road safety, pedestrian accessibility, and reduced vehicle travel within the precinct. Scenario 2 resulted in the most reduced average vehicle speeds. It created some congestion through the removal of slip lanes.
- **In conclusion, Scenario 1 and Scenario 2 were relatively even in traffic modelling outcomes. Scenario 2 supported greater pedestrian amenity and place outcomes.**

9.3 Evaluation of options – multi-criteria analysis

To determine the best scenario the findings were scored against how well they respond to the objectives set for the study. Table 9.15 shows the key to the scoring. Table 9.17 shows the results and how each scenario scored against each objective. Each objective was weighted evenly in the scoring.

Table 9.14 Key to multi-criteria scoring

Descriptor	Score
Negative impact compared to existing conditions	-2
Slightly negative impact compared to existing conditions	-1
No change compared to existing conditions	0
Slightly positive impact compared to existing conditions	+1
Positive impact compared to existing conditions	+2

Table 9.16 shows how the scoring was applied across the objectives against each of the scenarios tested.

Table 9.15 Guide to scoring for objectives

Objective	-2	-1	0	+1	+2
Country is visible and accessible	None of the Connecting with Country recommendations implemented	Minimal Connecting with Country recommendations implemented	Some Connecting with Country recommendations implemented	Most Connecting with Country recommendations implemented	All Connecting with Country recommendations implemented
Public and active transport mode share is maximised	A large decrease in predicted walking and cycling trips	A small decrease in predicted walking and cycling trips	No change in predicted walking and cycling trips	A small increase in predicted walking and cycling trips	A large increase in predicted walking and cycling trips
Great places of 15-minute neighbourhoods	A large decrease in population living within 1200 metres walking distance of mixed used and education	A small decrease in population living within 1200 metres walking distance of mixed used and education	No change to the population living within 1200 metres walking distance of mixed used and education	A small increase in population living within 1200 metres walking distance of mixed used and education	A large increase in population living within 1200 metres walking distance of mixed used and education
Last mile deliveries facilitated and impact minimised	N/A	Last mile deliveries not considered in future land use	N/A	Last mile deliveries not considered in future land use	N/A
Commercial and residential uplift is enabled	N/A	Commercial and residential uplift is not enabled	N/A	Commercial and residential uplift is enabled	N/A
Dense network of walking	A large decrease in intersection density	A small decrease in intersection density	No change in intersection density	A small increase in intersection density	A large increase in intersection density
Reduced transport emissions and vehicles kilometres travelled	VKT increases >1,000 when compared to do minimum (2041)	VKT increases <1,000 when compared to do minimum (2041)	VKT remains the same as do minimum (2041)	VKT decreases <1,000 when compared to do minimum (2041)	VKT decreases >1,000 when compared to do minimum (2041)
Increase tree canopy cover	Tree canopy reduces by 20% over roads	Tree canopy reduces by 10% over roads	No change in tree canopy coverage	Tree canopy achieves 50% over roads	Tree canopy achieves 70% over roads
Plan for future mass transit	Length of transit/bus priority lanes decrease >3km	Length of transit/bus priority lanes decrease <3km	No change in transit/bus priority lanes	Length of transit/bus priority lanes increase <3km	Length of transit/bus priority lanes increase >3km
Safe walking 24/7 for women children and elderly people	None of the Women's Safety Audit recommendations implemented	Minimal Women's Safety Audit recommendations implemented	Some Women's Safety Audit recommendations implemented	Most Women's Safety Audit recommendations implemented	All Women's Safety Audit recommendations implemented

Table 9.16 Multi-criteria analysis for scenarios tested

Scenario	Country is visible and accessible	Public and active transport mode share maximised	Great places of 15-minute neighbourhoods	Last mile deliveries facilitated and impact minimised	Commercial and residential uplift enabled	Dense network of walking routes (off busy roads)	Reduced transport-related emissions and vehicle kilometres travelled	Increase tree canopy cover	Plan for future mass transit	Safe walking 24/7 for women, children and elderly people	Total score
Do minimum	-2	-2	0	-1	-1	0	0	0	0	-2	-8
SISA	0	1	1	1	1	2	1	2	0	1	10
Scenario 1 (SISA plus lanes reallocated on Waterloo Road and Herring Road for buses)	2	1	1	1	1	2	2	2	2	2	16
Scenario 2 (Scenario 1 plus removal of most slip lanes, completing pedestrian arms on signalised intersections and bus lanes on Waterloo Road and Herring Road)	2	2	2	1	1	2	1	2	2	2	17

Table 9.17 shows that Scenario 2 achieves the highest score in the multi-criteria analysis when responding to the agreed objectives for the study area. While Country is visible and accessible and the increase in tree canopy cover did not change through the transport initiatives, these should be considered in developing the study area in parallel with implementing the transport initiatives. Further work should be done to understand how last mile deliveries can be facilitated once land use has been confirmed.

10 Recommendations and next steps

The key recommendations of this Study are:

1. Deliver **Scenario 2** as the best-performing transport scenario to achieve the transport vision for Macquarie Park. This will deliver the SISA initiatives and provide additional enhancements to bus priority, and pedestrian access and safety.
2. Implement a holistic approach to drive a **shift to public and active transport.**
3. Develop a **fine grain street and pathway network** to provide high-quality walking and cycling connections.
4. Integrate **Caring for Country** and **women's safety** in tandem to acknowledge and reinstate Wallumedegal Country, including through increased walkability; and foster safe, inclusive public spaces and transport systems for everybody.
5. Formulate an **implementation plan**, in concert with a business case process, to deliver the proposed initiatives in a phased approach, ensuring that transport infrastructure keeps pace with growth and rezoning.

10.1 Recommended policy, land use and operational measures

Table 10.1 summarises how we can achieve the objectives set for the study area. These identify non-infrastructure or policy measures that are unable to be tested in an operational transport model. Refer also to Appendix D detailing how the BEIs could be implemented.

Table 10.1 Non-infrastructure/policy measure to address the study area's objectives

Non-infrastructure / policy measure	Considerations	Owner	Mechanism
Objective 1: Country is visible and accessible			
Dual naming policy – enable the use of Aboriginal names in local development	Reduce the risk of inappropriate naming by releasing background studies (e.g.: Woven Ways) or proposing names based on research.	DPE or City of Ryde	Policy or guideline
Dual naming of key neighbourhoods	Undertake public consultation before submission to Geographic Names Board.	DPE	Propose dual names to the Geographic Names Board
Scheme for delivery of Woven Ways paths on private land	Provide landholders with detailed information (narratives, exact pathways to ensure through site links align to creek lines etc.)	*see 'Dense Network of Walking Routes' below*	
Public art / Storytelling in public space	Consider expanding the *Aboriginal Public Art Project* into Macquarie Park. Consider funding through contributions or in kind.	City of Ryde	Arts Plan
Public art / Storytelling in private space	*Ryde Public Art: Planning Guide for Developers* recommends 1 per cent of construction cost spent on public art, but Ryde DCP only requires 0.1 per cent of construction cost capped at $1.5m for the Macquarie Park Corridor. Consider lifting the percentage and cap.	City of Ryde	DCP (Part 4.5, s5.0(a)

Non-infrastructure / policy measure	Considerations	Owner	Mechanism
Objective 2: Public and active transport mode share maximised			
Safe access 24/7 including for women and children	*Ryde LSPS Priority M1* has a target of 60 per cent public and active transport mode share, but DCP only sets a 1:10 ratio of bicycle: car parking rate based on an anticipated 10 per cent cycling mode share. *Ryde Bicycle Strategy* shows 71 per cent of Macquarie Park workers ride, used to ride, or plan to ride to work	City of Ryde (or DPE)	DCP Part 9.3 s2.7(a) (or custom rate for Macquarie Park in DCP Part 4.5 s4.0(f))
Safe access 24/7 including for women and children	Consider designating geofenced parking areas	Macquarie Connect, or TfNSW	Trial with a provider e.g.: Lime
Safe access 24/7 including for women and children	The City of Sydney offers a similar program for around $20 per person	Macquarie Connect, City of Ryde or TfNSW	Subsidy trial
Safe access 24/7 including for women and children	Some commercial building owners already provide this service	Macquarie Connect or Ryde Council	Subsidy trial
Objective 3: Great places of 15-minute neighbourhoods			
Roll out a wayfinding program throughout Macquarie Park	This could integrate Connecting with Country. Improved wayfinding is identified in the Night Time Economy Study #RydeAfter5	City of Ryde	Wayfinding strategy
Active frontage strategy along key walking routes	Identify key frontages to be activated in new development to ensure pedestrian and cycle paths are passively surveyed.	DPE	Master plan
		City of Ryde	DCP Part 4.5
Objective 4: Last mile deliveries enabled through micro-hubs			
Freight consolidation and last mile delivery by micro mobility through the delivery of micro-hubs	Explore opportunities for large redevelopments to provide an integrated freight hub. Develop a suite of options to facilitate deliveries by broader freight micro mobility approaches.	City of Ryde, supported by TfNSW Freight/ DPE	Pre-DA / DA process for micro-hubs
Objective 5: Commercial and residential uplift enabled			
Parking policy for new development – parking cap, parking pricing, carshare minimum provision and bike parking	Consider aligning parking rates for alterations + additions to the maximum rates for Macquarie Park (Fig 2.3.1 and 2.3.2), and supplement with an overall cap. Consider an on-street parking scheme. Consider car share for employment (currently residential only 2.2)	City of Ryde (or DPE)	DCP
Objective 6: Dense network of walking routes			
Fine grain road network delivered through rezoning	Requires coordination with the master plan by DPE	City of Ryde (and DPE)	DCP Part 4.5
Objective 7: Reduce transport-related emissions			

Non-infrastructure / policy measure	Considerations	Owner	Mechanism
Travel Demand Management (TDM)	*Travel Choices 2018* program in Macquarie Park was very successful – while continued by Connect Macquarie Park Innovation District could benefit from additional state resources	TfNSW / Connect Macquarie Park Innovation District	New rolling program for Macquarie Park
Objective 8: Increase tree canopy cover			
Identify methods for encouraging the retention of high value trees during redevelopment	Potential to place a value on trees in the precinct to encourage retention or payment in lieu of iTree / CAVAT – see Interim Framework for Valuing Green Infrastructure and Public Space (DPE)	DPE / City of Ryde	Feasibility study DCP Part 4.5 (if adopted)
Objective 9: Plan for future mass transit			
Trial of bus priority on key corridors e.g.: Ryde Road / Lane Cove Road (south of the study area)	There is an opportunity during post-COVID to test capacity reassignment before further traffic build-up occurs	TfNSW	Bus priority lane trials, on future rapid bus routes
Objective 10: Safe access 24/7 including for women and children			
Women's safety program on public transport	A suite of options to enhance safety e.g., lighting, safety call buttons. Consider all routes from residential and commercial areas (not only trunk routes)	TfNSW with the City of Ryde	TfNSW/ DPE Women's Safety Program
Accessible walking routes to healthcare	Consider the needs of healthcare shift workers, visitors, and patients – e.g., disability and mobility impaired	TfNSW with the City of Ryde	
Safe routes to school	Potential for active travel to school program. Focused on both behaviour change and infrastructure provision	TfNSW with the City of Ryde	Potential future TfNSW Program
Safe routes through/ to the University campus	Consider 24-hour access to campus, with a suite of options to enhance safety e.g., lighting, safety call buttons, and street activation.	TfNSW with the City of Ryde	

10.2 Service and Infrastructure Recommendations

This section summarises the findings from operational modelling, the Connecting with Country Framework and Women's Safety Audit.

10.2.1 Transport modelling findings

Scenario 1 and Scenario 2 performed similarly in road network outcomes. Scenario 2 is recommended due to better supporting delivery of the pedestrian amenity and place outcomes identified in the Place Strategy and transport vision.

All model scenarios were able to accommodate travel demand associated with planned growth in the precinct in the year 2041. Scenario 2 indicated that the slip lane at the intersection of Epping Road and Delhi Road needed to be retained.

The SISA scenario and Scenario 1 obtained the best results for bus travel speeds at around 11.5 km/h in the morning and 11.0 km/h in the afternoon. It was also found that one traffic lane in each direction on Waterloo Road could be reallocated to be bus priority lanes with minimal negative impact on road network performance.

The SISA scenario and Scenario 1 resulted in the lowest VKT in the morning peak, while Scenario 1 and 2 performed best in the afternoon peak.

The introduction of the local street network (fine grain street network) was found to alleviate congestion on the major roads in the SISA scenario, and Scenarios 1 and 2.

10.2.2 Actioning Connecting with Country and Women's Safety Audit

Integrating Connecting with Country and the Women's Safety Audit together into the improvement of place outcomes and the development of a fine grain walking and cycling network for Macquarie Park presents a major opportunity for a harmonised approach. The following steps would help to achieve this integration more holistically:

1. **Collaboration with Indigenous Community:** Engage with the Wallumedegal community to understand their connection with the land and incorporate elements that reflect their heritage. This can include naming paths and spaces with indigenous language, installing art and sculptures that signify cultural elements, and utilizing native plants in landscaping.

2. **Walking and Cycling to Connect with Country:** Design walking and cycling paths to respect and integrate the natural features of the land. This might include creating paths that follow the natural contours of the terrain, protecting and incorporating significant trees, and utilizing materials that are harmonious with the natural surroundings.

3. **Safety through Natural Surveillance:** Enhance the safety of walking and cycling paths by employing natural surveillance. Position paths in locations with good visibility and encourage "eyes on the street" through active street frontages and transparent facades in nearby buildings. Incorporate cultural elements such as storytelling stations, which will also serve as gathering places, improving the sense of community welcoming.

4. **Lighting and Visibility**: Ensure that pathways are well-lit, with consideration given to avoiding shadows from trees and structures. Employ culturally inspired lighting fixtures that not only improve safety but also resonate with the indigenous heritage.

5. **Inclusive Spaces and Signage:** Design resting spaces along walking and cycling paths that are inclusive and acknowledge cultural diversity. Employ multilingual and culturally sensitive signage, integrating indigenous languages.

6. **Regularly Spaced Safe Crossings**: Integrate pedestrian-friendly crossings at regular intervals, with a focus on safety for all users, including women, children, and individuals with disabilities. Include safety measures such as clear signage, pedestrian refuges, and tactile paving.

7. **Community Programs and Education:** Encourage community programs that involve indigenous locals, marginalised groups, women and girls. These programs could include cultural walks, safety workshops, and educational sessions about the importance of respecting both cultural heritage and the safety and respect for all community members.

8. **Monitoring and Feedback**: Continuously monitor the safety and usability of the walking and cycling network, and actively seek feedback from the community for improvements, especially women and indigenous populations.

9. **Policy Integration:** Adopt policies that encourage developers and urban planners to consider both the cultural aspects of Connecting with Country and the findings of the Women's Safety Audit in all new developments and infrastructural projects.

By ensuring that both cultural heritage and safety are at the forefront of urban planning and design, Macquarie Park can create a connected, inclusive, and safe environment for pedestrians,

bicycle riders, and users of public space, while honouring the rich heritage of Wallumedegal Country.

10.3 Next steps

The findings in this report outline the transport initiatives and supporting place making initiatives required to support the land rezoning within Macquarie Park. Once the business case is assured, an implementation plan including a stakeholder consultation plan should be created prioritising the proposed initiatives into a delivery program.

Appendix A – Connecting with Country Framework

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MACQUARIE PARK DETAILED PRECINCT TRANSPORT STUDY

Connecting with Country Framework

REDACTED VERSION

21/06/23

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CONTENTS

1. PROTOCOLS

CULTURAL SENSITIVITY NOTE

Aboriginal and Torres Strait Islander readers are advised that this report may contain names, images or descriptions – for example, discussions, images and historical accounts – of people who have passed.

TERMINOLOGY NOTE

There are a large number of Aboriginal and Torres Strait Islander cultural groups across Australia, many of whom like to be called by the name of their particular group/s, such as Wallumedegal. In this report, we refer to cultural groups by their specific names where possible. The terms 'traditional owners/custodians', 'Aboriginal' and/or 'Torres Strait Islander' have been used when general terms are necessary (e.g. to encompass multiple groups) or when specific cultural group names are not known. Other terminology (e.g. 'First Nations' or 'Indigenous') may also be used when quoted or with acknowledgement that these more generic terms also have international meaning and value and should not be used interchangeably with 'Aboriginal and/or Torres Strait Islander'.

CULTURAL SAFETY NOTE

Balarinji ensures cultural safety in our community approach. Cultural safety in the co-design context includes:

- shared respect, shared meaning and shared knowledge
- the experience of learning together with respect and deep listening
- creating supportive opportunities for Aboriginal and Torres Strait Islander people that ensure they have decision-making roles, that biases are broken down and barriers are removed.

2. PERMITTED PURPOSE

This Connecting with Country Framework has been prepared for WSP and Transport for New South Wales (TfNSW) for the Macquarie Park Detailed Precinct Transport Study. The Confidential Information contained within the report remains the Intellectual Property of the locally connected elders, knowledge holders and community members engaged by Balarinji (who co-developed the framework with Balarinji) and Balarinji. It is provided as a commercial-in-confidence document.

To observe Intellectual Property protocols, Balarinji and the locally connected elders, knowledge holders and community members engaged by the project confirm that we permit the distribution of this co-developed framework for review only (Permitted Purpose), and under the following conditions:

The Recipient may only:

- use Confidential Information, Intellectual Property or Indigenous Cultural Intellectual Property (ICIP) within the report for the Permitted Purpose and must ensure that any Authorised Person to whom the information is disclosed does not use, reproduce, communicate or disclose Confidential Information, Intellectual Property or ICIP in the report for another purpose: and
- disclose Confidential Information, Intellectual Property or ICIP within the report to an Authorised Person (but only if and to the extent the Authorised Person needs to know) for the Permitted Purpose. Should the Recipient desire to use the Confidential Information, Intellectual Property or ICIP provided for purposes other than review, authority must be sought and given by Balarinji, the locally connected Elders, Knowledge Holders and community members engaged by the project.

The Permitted Purpose is to enable evaluation and information sharing, at the same time protecting Indigenous Cultural Intellectual Property. It is also to enable Balarinji to ensure continuity of collaboration so the project is grounded in the unique culture and narrative of the project site, and knowledge holders specific to the report will continue to be properly engaged and recognised in all future co-design processes.

3. EXECUTIVE SUMMARY

This Connecting to Country Framework for the Macquarie Park Detailed Precinct Transport Study is designed to serve all design teams involved in the project's scope of work.

This framework should be used to:

- learn about Country and the Dharug traditional owners/local custodians who are connected to the Country surrounding Macquarie Park Precinct
- explore the history of the precinct from the perspective of the local Aboriginal community
- inspire design teams to connect with Country through culturally informed co-design methodologies, and use this connection to prioritise Country in design outcomes
- support the design guide and instruct design teams on how Country can influence the design of the Macquarie Park Precinct and future development
- ensure the project supports Aboriginal people to gain tangible and intangible intergenerational benefits
- support mutually beneficial capacity building across Aboriginal and non-Aboriginal communities

Co-design is a participatory design approach that empowers community by recognising them as equal collaborators in design and experts of their own experience. It is a best-practice approach and builds capacity when engaging with Aboriginal and Torres Strait Islander communities, businesses and organisations.

This Connecting with Country Framework supports co-design by providing community stakeholder responses to key themes and questions informed by each of the seven Government Architect NSW (GANSW) Connecting with Country Statements of Commitment. It also provides practical steps and recommendations for design and project teams to incorporate connecting with Country principles.

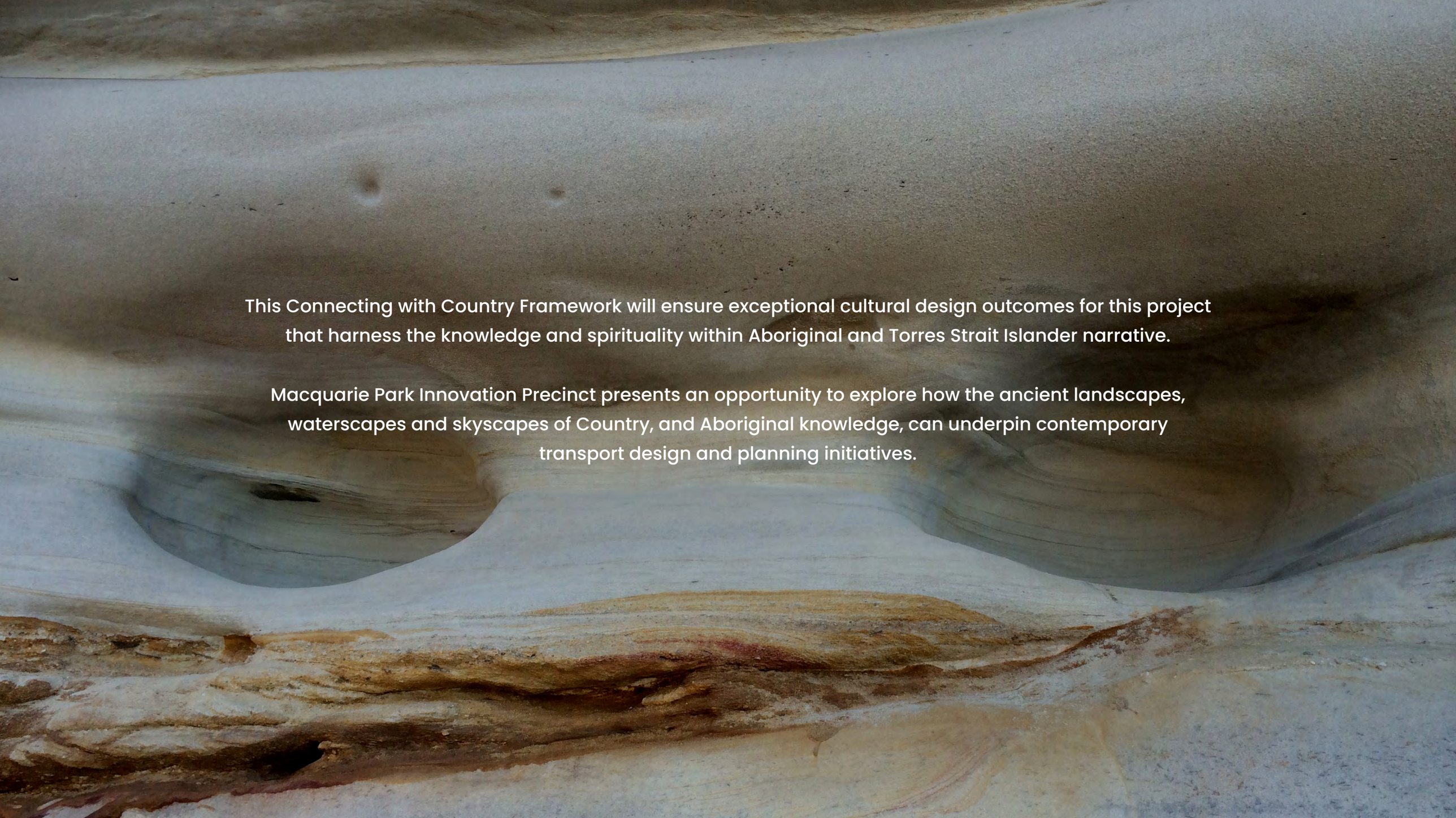
We commit to helping support the health and wellbeing of Country by valuing, respecting and being guided by Aboriginal people, who know that if we care for Country – it will care for us.

– GANSW, Connecting with Country Draft Framework[1]

This framework draws from a collaborative methodology that has produced deeply embedded responses to place made possible by appropriately facilitated community co-design. Balarinji's methodology for the Macquarie Park project contained an initial planning phase concluding with a walk on Country with the WSP team. Following on, Balarinji planned and successfully delivered a community engagement phase that allowed locally-connected Aboriginal community voices to be heard and integrated into this framework.

Significantly, Balarinji's co-design methodology ensures all design themes and recommendations included in this report are informed directly by locally-connected Aboriginal community members.

True co-design needs to occur throughout all stages of a project, and therefore, this framework should be used from the earliest stages of design through to completion. This will ensure that the project, and all parties involved, remain committed and transparent when engaging with connecting with Country principles, creating mutually beneficial outcomes for all people connected to the Macquarie Park Precinct.



This Connecting with Country Framework will ensure exceptional cultural design outcomes for this project that harness the knowledge and spirituality within Aboriginal and Torres Strait Islander narrative.

Macquarie Park Innovation Precinct presents an opportunity to explore how the ancient landscapes, waterscapes and skyscapes of Country, and Aboriginal knowledge, can underpin contemporary transport design and planning initiatives.

4. ABOUT MACQUARIE PARK PRECINCT

4.1 Project Overview

TfNSW is responding to an Innovation Precinct Place Strategy developed by the Department of Planning and Environment (DPE) for the Macquarie Park Precinct. The strategy recognises the opportunity for improvement of the quality of movement around Macquarie Park, encouraging walking, cycling and public transport use rather than privatised transport options.

In collaboration with DPE, Greater Cities Commission and City of Ryde, the transport study will focus on how people and goods move around the Macquarie Park Precinct to rebalance transport use within the investigation area and its connections to Greater Western Sydney.

Balarinji has been engaged by WSP for TfNSW to develop a Connecting with Country Framework to guide the development opportunities throughout the planning of the Macquarie Park Detailed Precinct Transport Study and the Macquarie Park Precinct itself.

Artist impression of Macquarie Park.
Sourced from: https://www.planning.nsw.gov.au/Plans-for-your-area/Priority-Growth-Areas-and-Precincts/Macquarie-Park

5. ABOUT THIS REPORT

5.1 Purpose

This report provides a detailed Connecting with Country Framework to guide the Macquarie Park Precinct Transport Study. It recognises WSP and TfNSW's goals of protecting the health and wellbeing of Country and embedding Aboriginal culture and narrative into the broader precinct planning for the Macquarie Park Precinct.

Underpinned by the functionality and spirit of Wallumedegal Country, the framework explores the cultural landscapes, waterscapes and skyscapes of the study area in collaboration with elders, traditional owners/custodians and cultural knowledge holders and provides guidance on how Country can be integrated into the project.

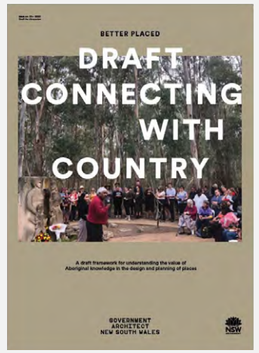
Macquarie Park. Sourced from: Department of Planning and Environment.

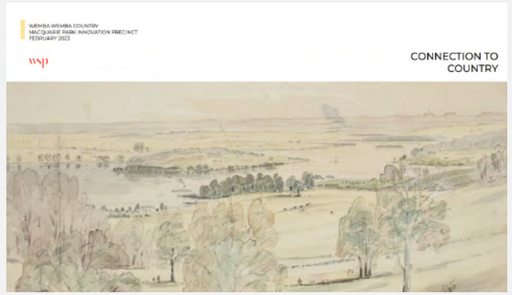
5. ABOUT THIS REPORT

5.2 Connecting with Country planning context

The Macquarie Park Precinct sits within a comprehensive national, state and local strategic planning context. Balarinji has focused on the following policies and documents to inform this framework and guide the progress of Connecting with Country:

- *Better Placed: Connecting with Country Draft Framework*, GANSW, 2020
- *Designing with Country, discussion paper*, GANSW, 2020
- *Macquarie Park Innovation Precinct Place Strategy*, NSW DPE, 2022
- *Wallumatta Macquarie Park Masterplan: Draft Country Centered Design Framework and Report*, Old Ways New, 2021
- *Connecting to Country Report: Macquarie Park Innovation Precinct*, WSP – Ongoing
- *Macquarie Park Precinct Bus Interchange (MPPBI): Connecting with Country Engagement Report*, GHD – Ongoing
- *Reconciliation Action Plan*, WSP, 2022
- *Reconciliation Action Plan 2022–2025*, TfNSW
- *Principles and Framework for Aboriginal Engagement*, TfNSW
- *Aboriginal Culture and Heritage Framework*, TfNSW
- *Aboriginal Art Strategy*, TfNSW
- *2022-2024 NSW Implementation Plan for Closing the Gap*, NSW Government, 2022





6. WHAT IS COUNTRY AND HOW CAN IT INFLUENCE DESIGN

6.1 What is Country?

Country is not a Western concept; it is an Aboriginal worldview. It is nature at a deeper level, where all things are interconnected, and the spiritual underlies the physical. The Aboriginal sense of Country is that past, present and future are not confined by time, they merge into a continuum. Aboriginal thinking, therefore, embraces what was on Country before, what is there now and what might come back or evolve in the future. It is about a continuum of places too, where borders and boundaries are open to culture crossing Country, and where stories interconnect with surrounding peoples and places.

Country commands care and respect. Respect between people, animals, plants and earth is required to keep Country healthy so Country can care for and sustain life. Aboriginal principles for sustaining Country are embedded in language, stories and Songlines which all reflect physical and spiritual understandings of the land. The diversity of traditional language groups, stories and Songlines reflects the diversity of Country's landforms and ecosystems. The significance of ceremony and lore between language groups ensures caring for Country principles and responsibilities to Country are shared across Australia. All things belong to Country; Country does not belong to anyone.

Since colonisation, Western philosophies have shaped Country to their own ideologies and understandings of nature. This has significantly disrupted the ecosystems that had been carefully managed by Aboriginal people in order for Country to thrive. Increasing loss of biodiversity, natural disasters and the broader implications of climate change all signify that Country is suffering. However, the resilience of Aboriginal people and their commitment to caring for Country have allowed traditional knowledge to continue to be passed down through generations. Country underpins the social organisation and utility in Aboriginal Australia, enabling over 60 000 years of sustainable living in Australia. Aboriginal knowledge of Country provides alternative thinking that can influence a wide range of disciplines such as design, agriculture, land management, geology and health and wellbeing.[2]

Aboriginal people have a deep and interconnected relationship with the physical and spiritual elements of Country. Their lives are entirely integrated with the places where they belong, where language, culture, knowledge, Law/Lore, and ceremony are interdependent and one with Country. A change in one of these elements affects all the others.

As well as its spiritual dimension, Country has an enduring physicality. Deep knowledge and respect for Country, developed over centuries and passed down through generations, traditionally informed the patterns of daily life, for instance, food and water availability, when to plant and cultivate crops, where to reside at different times of the year, when it is time for ceremony or gatherings, and the materials that are utilised for tools, building and artefacts.

Everything starts and ends with Country in the Aboriginal worldview. Yet there are no endings in this worldview, nor are there any beginnings. Time and place are infinite and everywhere. Everything is a part of a continuum, an endless flow of life and ideas emanating from Country, which some refer to as the Dreaming. In the Dreaming, as in Country, there is no separation between the animate and inanimate. Everything is living – people, animals, plants, earth, water and air. We speak of Sea, Land and Sky Country. Creator ancestors created the Country and its interface, the Dreaming. In turn, Dreaming speaks for Country, which holds the law and knowledge. Country has Dreaming. Country is Dreaming. It is this oneness of all things that explains how and why Aboriginal knowledges belong to an integrated system of learning.

– Margo Neale, Kulin and Gumbaynggirr woman, First Knowledges: Songlines[3]

6. WHAT IS COUNTRY AND HOW CAN IT INFLUENCE DESIGN

6.2 How can Country influence design?

Australian Aboriginal culture is phenomenally resilient. Aboriginal people have successfully sustained life on our fragile ancient continent for 60 000+ years. Aboriginal knowhow has much to say about sustainable construction.

A central pillar of Aboriginal culture is a collective responsibility for sustaining Country for generations to come. Caring for, and sustaining Country involves a complex biodiverse system that has been managed for tens of thousands of years within cultural rules and protocols. Country is more than nature, it is Dreaming, an all-embracing concept from the Aboriginal worldview which has no European equivalent. Regeneration is at its heart.

However, despite the resonance Country can bring to the whole of the design, it is still more common to see Aboriginal elements integrated into precincts as art installations or in Aboriginal-influenced landscape design than in built form. There are very few architectural examples that have been deeply informed by the Aboriginal worldview, whether through the creative team lacking a cultural design principles toolkit, or the Aboriginal narrative not being considered relevant or important for contemporary urban developments.

Yet, the philosophies of Aboriginal society, culture, and wellbeing, including the importance of family, and the principles of living close to and looking after Country, have great potential to influence how Australian designers, architects and builders think about climate, sustainability and the intimacy of built form. Collective obligation to care for Country is an Indigenous protocol with cooperation at its core. Urban thinking shaped by Country is a cultural driver of biophilic design. These are ancient ways of being that focus a new lens on resilience planning and illustrate how Country can influence design.

We all have one mother and that is Mother Earth and Mother Earth knows each and every one of us, and she loves us all equally, it doesn't matter who we are, where we come from, we're all part of the same and we're all loved the same. So regardless of whether we've been here (in Australia) for 10 000 years, one year, or a new child born today, if you're born on Country, then you are part of Country. Now because of that, each and every one of us has an obligation to care for Country, to make sure that Country is taken care of so she can then take care of us.

– Gadigal Elder Ray Davison, Warrane exhibition, Macquarie Group's Martin Place Sydney headquarters

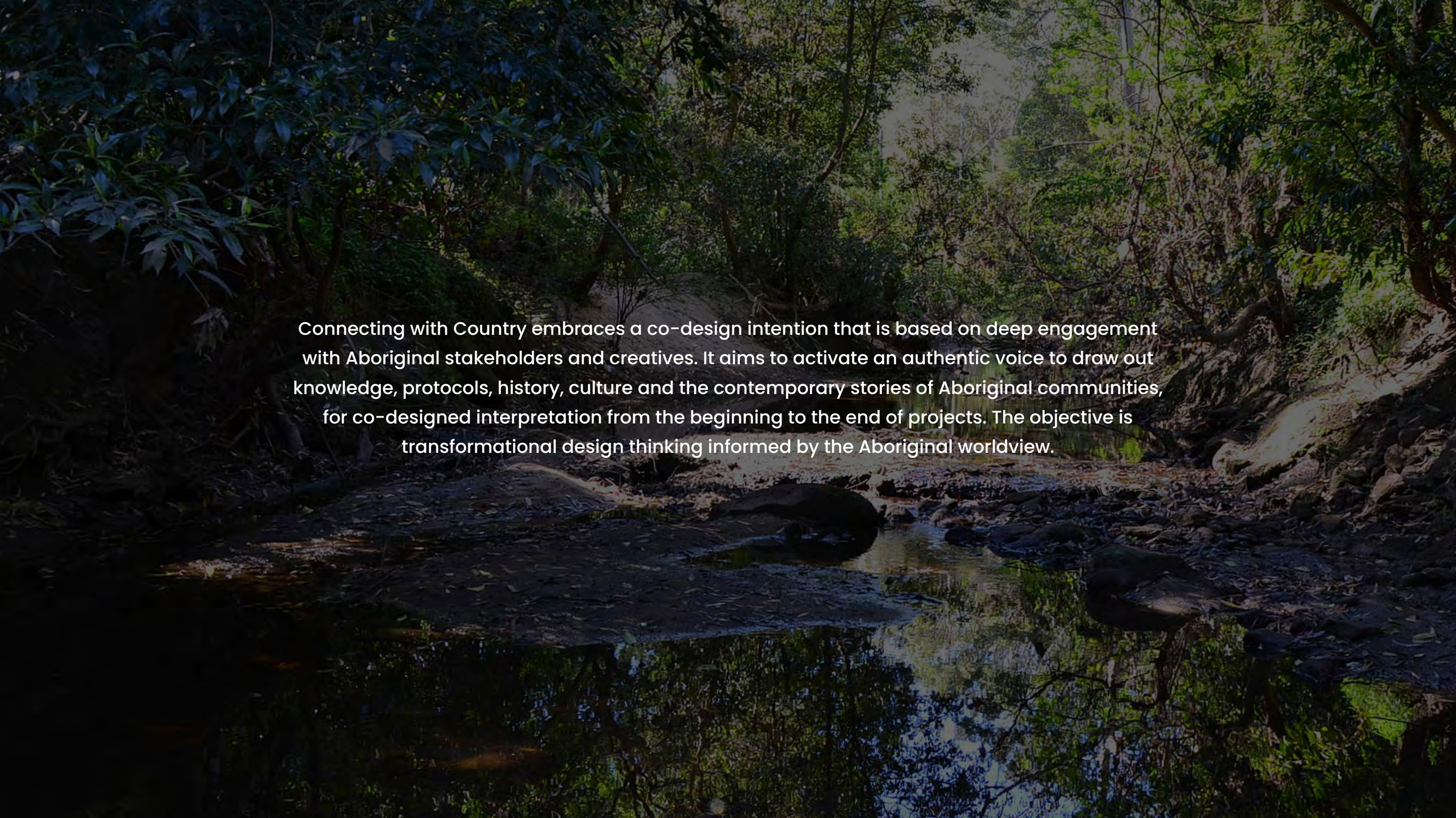
6. WHAT IS COUNTRY AND HOW CAN IT INFLUENCE DESIGN

6.2 How can Country influence design?

An example of successful First Nations co-design can be seen in the involvement of Mana Whenua in projects across Tāmaki Makaurau (Auckland, New Zealand). With these projects, Mana Whenua are more than just stakeholders; they are partners in design. Using a bi-cultural design framework allows for the expression and integration of both Māori and European New Zealander worldviews in the buildings and spaces across Tāmaki Makaurau.[4]

The Aboriginal worldview on spirituality, science, cosmology and ecology is an original frame of creativity for architects, designers and builders to explore. It is not possible to take this knowledge theoretically or without collaboration, deep engagement and co-design with locally connected Aboriginal stakeholders. Nor is it ethical to do so. Aboriginal and Torres Strait Islander people rightly expect an evolution away from past approaches to integrating Aboriginal culture and knowledge into built projects. For instance, the 'shallow' solution of installing Aboriginal artwork that is unrelated to a place in a completed project or the 'exploratory' approach (still the most common on public projects) of 'provide us with your stories and images, and we'll bring you what we've done for approval' are not best practice. The goal of this Connecting with Country Framework is to provide a positive pathway for deep engagement and authentic co-design in the Macquarie Park Detailed Precinct Transport Study.

Te Wānanga – a new Tāmaki Makaurau public space at the meeting point of Te Waitematā and the City Centre. Source: Auckland Design Manual. Te Wānanga, www.aucklanddesignmanual.co.nz/design-subjects/maori-design/te_aranga_principles/case-studies/te-w%C4%81nanga



Connecting with Country embraces a co-design intention that is based on deep engagement with Aboriginal stakeholders and creatives. It aims to activate an authentic voice to draw out knowledge, protocols, history, culture and the contemporary stories of Aboriginal communities, for co-designed interpretation from the beginning to the end of projects. The objective is transformational design thinking informed by the Aboriginal worldview.

7. STAKEHOLDER ENGAGEMENT METHODOLOGY

Stakeholder engagement is a fundamental process in developing this Connecting with Country Framework for the Macquarie Park Detailed Precinct Transport Study. A key pillar of Balarinji's cultural design methodology is collaborative engagement with local Aboriginal and Torres Strait Islander groups through authentic, thorough and ongoing consultation.

Sydney is a place with a diverse Aboriginal population from around the country and Balarinji's policy is to engage widely with both Wallumedegal and the local community who also have deep ties to the area. Following comprehensive stakeholder mapping, consultation included a series of one-on-one interviews with key stakeholders within the locally connected community.

Balarinji met with eight community members with a connection to Macquarie Park and the surrounding area. A cross-section of community members was consulted, with a particular focus on community-nominated elders and leaders with strong connections to the area. These consultations gathered the Aboriginal narrative for the project area. This consultation process has brought out some specific stories and knowledge but most importantly has prioritised key outcomes and themes from a community perspective.

7. STAKEHOLDER ENGAGEMENT METHODOLOGY

Some individuals or organisations were approached but declined or were unavailable during the time in which consultations were being conducted. Most stakeholders that declined to consult were at capacity and, as such, were unable to be involved in the consultation process.

Co-design is a best-practice methodology when engaging with Aboriginal and Torres Strait Islander people and communities and should continue in future phases of the project. This includes re-engaging the local Aboriginal and Torres Strait Islander community and working with community-endorsed creatives and organisations to continue embedding Country and the stories of place into the Macquarie Park Precinct.

8. KEY DESIGN THEMES AND RECOMMENDATIONS

Through consultation with the locally connected Aboriginal community and stakeholders, eight key design themes were identified for integration in the Macquarie Park Detailed Precinct Transport Study.

The following section provides recommendations for how each theme might be integrated into the project. A co-design process was used to construct these recommendations. They draw from responses from the local Aboriginal community during stakeholder consultations, a close analysis of GANSW's Connecting with Country Draft Framework (see Appendix A), and comprehensive research of the Aboriginal history of the site (see Appendix B).

Along with the recommendations, socio-economic outcomes for each theme have been explored to illustrate the positive impacts of connecting with Country. Summaries and quotes have been included to provide project teams with specific and detailed comments and knowledge from the locally connected Aboriginal community.

Project teams can use the responses presented here to understand the Country and Aboriginal narrative of this specific site and take practical steps to implement connecting with Country principles into the project.

ACKNOWLEDGING WALLUMEDEGAL COUNTRY AND PEOPLE

COUNTRY-CENTRED DESIGN

REGENERATING COUNTRY

REVITALISING CULTURE

INTEGRATING LANGUAGE

A TRAVELLING AND GATHERING PLACE

STORYTELLING AND TRUTHTELLING

SOCIAL AND CULTURAL INCLUSIVITY

8. KEY DESIGN THEMES AND RECOMMENDATIONS

Acknowledging Wallumedegal Country and people

Acknowledging Wallumedegal people and Country ensures project teams apply a Country-centred design approach that considers how the local custodians have always managed and maintained Country. By recognising the local custodians of the project area, project teams can input site-specific Aboriginal principles and knowledge in planning, design and construction to create more sustainable, interactive and inclusive spaces connected with Country. The community members provided recommendations that explored the significance of Country-centred design, cultural awareness and being grounded on Country. Applying these recommendations has the power to influence master planning, architecture, wayfinding, landscaping and public art within the transport study.

Going into that area you wouldn't want to take from it or damage it. You would want to bring it into it that shows a sign of respect. It's a place of bringing ideas or bringing good intentions and acknowledging where you are and why you have the opportunity to enjoy it or work on it or create on that County.

– Garigal horticulturist

We would just like that respect that Dharug people as traditional owners deserve... [Connecting with Country] needs to be Country specific not generic Aboriginal stories.

– Dharug elder

8. KEY DESIGN THEMES AND RECOMMENDATIONS

Acknowledging Wallumedegal Country and people

COMMUNITY RECOMMENDATIONS

- Have an authentic focus on Country-centred design throughout the whole precinct, drawn from the site-specific narrative of Wallumedegal Country.
- Ensure all opportunities and integrations of Country are co-designed with the Wallumedegal/Dharug community.
- Create opportunities for commuters and all people using the space to pause, engage and interact with Country.
- Include design features that encourage users to walk on Country as a way to understand it and be grounded in Country.
- Refer to the language or cultural group (e.g. the Wallumedegal or Dharug), rather than generic terms like 'Aboriginal' wherever possible (e.g. Welcomes to Country, Acknowledgments of Country).
- Ensure project team members engage on a walk on Country led by the Dharug/ Wallumedegal community, to gain a greater understanding of Wallumedegal People and Country. (Note: Balarinji attended an initial walk on Country with the project team on 16 March, 2023.)
- Provide cultural awareness training for all on-site workers to explore basic Caring for Country principles.

DESIGN INTEGRATION OPPORTUNITIES

Public spaces

The project presents major opportunities for public spaces to successfully integrate, protect and encourage cultural practices and protocols. Co-design should play a necessary part in the spatial distribution and orientation of the public spaces to reflect Country and draw from the site-specific narrative of Wallumedegal Country.

Street interface

The street interface has the potential to integrate design considerations that acknowledge and connect to Wallumedegal peoples and Country. This includes opportunities for co-design to influence the project street interface, contributing to occupant experience when moving through the precinct and furthering opportunities for public art integration, wayfinding and signage integration.

8. KEY DESIGN THEMES AND RECOMMENDATIONS

Acknowledging Wallumedegal Country and people

SOCIO-ECONOMIC OUTCOMES AND IMPACTS	RELATED GANSW STATEMENT OF COMMITMENTS
• Relationships between the project team and Aboriginal community are enhanced, encouraging further collaboration and co-design. • Cultural protocols are respected and followed. • Reconciliation and healing occurs through ongoing acknowledgment of Country and the site's history. • Aboriginal community receive remuneration and economic benefits for their shared knowledge and stories. • Civic engagement and reconciliation are enhanced through the creation of ongoing educational opportunities. • Aboriginal community are supported in maintaining a distinctive cultural, spiritual, physical and economic relationship with their land, sky and waters. • Aboriginal community are supported in revitalising language and culture. Aboriginal cultures and languages are strong, supported and flourishing. • A sense of belonging, connection and pride is created through tailoring the project to local context and priorities. • Aboriginal community feel a greater sense of belonging and high levels of social and emotional wellbeing. • Social equity is improved by ensuring that Aboriginal people have a say in project design, access and spaces. This reduces the disparities in access to spaces, services and resources for Aboriginal and Torres Strait Islander peoples.	Commitment 1 Commitment 2 Commitment 3 Commitment 4 Commitment 5 Commitment 6 Commitment 7

8. KEY DESIGN THEMES AND RECOMMENDATIONS

Country-centred design

A Country-centred design approach is at the core of any connecting with Country implementation for the project team. Country-centred design acknowledges the transformational design thinking of Aboriginal and Torres Strait Islander worldviews. It embraces the intersection of nature, people and design and focusses on the connections of Country and how it impacts wellbeing and belonging. For this project, the community members recommended a Country-centred approach that draws from the site-specific elements and narrative of Wallumedegal Land, Water and Sky Country. In particular, they would like to see natural places, colour palettes, iconography, landmarks, and flora and fauna of Wallumedegal Country integrated into transport study and precinct design.

We know that when we are looking at Country, it's not just what's in front of you, it's not just what you are standing on, but it's Sky Country and goes down deep into the Country way down below, all the rocks and all the way through. It's all around, where you can see, as far as the eye can see, depending on where you are from the mountains to the sea, it all comes back and connects.

– Dharug knowledge holder

Bring back our original signage of Country – artworks, engravings and scarred trees – plus our natural landmarks like waterways that acted as natural boundaries.

– Ngemba-Dharug knowledge holder

8. KEY DESIGN THEMES AND RECOMMENDATIONS

Country-centred design

COMMUNITY RECOMMENDATIONS

- Explore how design can evoke the connections of Country, for example, connections between water, land and sky.
- Reintroduce the original signage and artistic style of Wallumedegal Country, for example, single-lined sandstone engravings and scarred trees that reflect nowies (canoes) and coolamons. Incorporate this style within the wayfinding strategy.
- Explore how Aboriginal art can be integrated into the built environment, for example, embossing art into concrete. Create opportunities for Indigenous art to evolve, for example, digital installations, large-scale artworks and sculptural pieces.
- Challenge materiality palettes by extending the reflection of natural elements that influence these palettes. Consider how colour can reflect Country, for example, the colours of white ochre of Wallumedegal sandstone, shades of water (e.g. brackish water), colours from native plants (e.g. local grey gums), and the colours of Sky Country.
- Create spaces and sightlines where people can see and connect with Sky Country.
- Integrate green spaces and native planting that reflects the original landscape and will connect people with Country.
- Explore how significant flora and fauna (for example, snapper) have to Wallumedegal Country and how this can be represented through design.
- Utilise recycled materials in construction and artworks.
- Use site-specific native planting, texture representation and revitalisation of the natural topography of Country to evoke the Country which previously existed but now has been built upon.
- Consider how including more bikeways, walkways and less heavy transport will allow for people to feel grounded on Country.

DESIGN INTEGRATION OPPORTUNITIES

Materiality and fabrication

The project presents much potential to focus on Country and its resilience and robustness. Artistic expression of Wallumedegal Country can be reflected in the choice of materiality and fabrication of different infrastructure elements across the project. This design integration also has the potential to be implemented through different scales, contributing to the overall design response to Country.

Landscape design

Landscape design and planting surrounding the site is rich in opportunities for integration of Country, particularly to contribute to the overall sustainability outcomes of the project. Integrating green spaces that are landscaped with site-specific native flora and reflect the natural topography will allow for interaction of occupants with Country and reflect the topographical history of the site. This design integration can contribute to public parks and spaces through abstract design patterns, reflecting Country and evoking a connection back to it for occupants.

8. KEY DESIGN THEMES AND RECOMMENDATIONS

Country-centred design

SOCIO-ECONOMIC OUTCOMES AND IMPACTS	RELATED GANSW STATEMENT OF COMMITMENTS
• Aboriginal community are supported in maintaining a distinctive cultural, spiritual, physical and economic relationship with their land, sky and waters. • Aboriginal community are supported in revitalising language and culture. Aboriginal cultures and languages are strong, supported and flourishing. • Heals Country and enhances the wellbeing and belonging of the Dharug community and all visitors. • Intercultural communication is enhanced, allowing non-Indigenous people to recognise and appreciate Aboriginal language and culture and Aboriginal people to feel seen and respected within the built form. • Reconciliation and healing occur through ongoing acknowledgment of Country and the site's history. • Social equity is improved by ensuring that Aboriginal people have a say in project design, access and spaces. This reduces the disparities in access to spaces, services and resources for Aboriginal and Torres Strait Islander peoples. • Relationships between the project team and Aboriginal community are enhanced, encouraging further collaboration and co-design. • Aboriginal community receive remuneration and economic benefits for their shared knowledge and stories. • A sense of belonging, connection and pride is created through tailoring the project to local context and priorities. • Traditional knowledges and caring for Country principles ensure ongoing civic engagement and connection to place. • Positive environmental impact through the use of sustainable approaches drawn from traditional knowledges. • Invests in community and the ongoing involvement of local Aboriginal people and businesses in the project and into the future of the precinct.	Commitment 1 Commitment 2 Commitment 3 Commitment 4 Commitment 5 Commitment 6 Commitment 7

8. KEY DESIGN THEMES AND RECOMMENDATIONS

Regenerating Country

Regenerating Country explores the diverse and interconnected elements of Country and the underpinning Aboriginal principles that can allow Country to be regenerated throughout the project. The community members provided knowledge and recommendations that explored the deep social, cultural and environmental significance of the waterways, sandstone outcrops, seasons and native flora and fauna of the project area. Regenerating Country challenges the project team to consider how Country, including the land, water and sky, can be reawakened and regenerated through landscaping, architecture and public art. Regenerating Country promotes sustainability, cultural awareness and healing that empowers the local Aboriginal community and contributes to a sense of belonging for all users of the area.

Even though we are building with Country, we should be building around Country. If we can't do that anymore, it's about replicating that feel of what was there.

– Garigal horticulturist

Bring back, infuse, and embed Country

– Dharug elder

Be mindful of what footprint is going on Country, because it alters Country.

– Dharug elder

8. KEY DESIGN THEMES AND RECOMMENDATIONS

Regenerating Country

COMMUNITY RECOMMENDATIONS

- Consider how caring for Country and being mindful of Country can be embedded by project teams, and government, as well as how the project can encourage these ideas with the public (e.g. remove invasive species in the water/bush).
- Recognise and protect the area's important waterways and waterfalls, and explore their significance to Wallumedegal and Dharug healing and women's stories, and the opportunities to teach culture through the connections of waterways.
- Ensure no major developments encroach on the river systems and damage water quality.
- Consider how the waterways in the area have changed since colonisation, for example from being more winding with many hiding places for flora and fauna to structured waterways that serve human colonial purposes.
- Protect the sandstone outcrops between Lane Cove River and Castle Hill. Limit the amount of sandstone that is taken off Country.
- Apply the Dharug and Dharawal six seasons calendar as a holistic framework when designing with Country, for example use it as a guide when incorporating native plants and explore how to educate users of the precinct on the six seasons.
- Integrate edible bush foods that people and local fauna can eat when moving through Country (e.g. geebung, lilly pilly).
- Acknowledge the abundant endemic fauna dispossessed from Wallumedegal Country, including birds, possums, wallabies and kangaroos. Provide resources through native planting to allow endemic fauna to return to the area.
- Explore endemic plants of the area and how their uses and applications can be integrated into the project. Consider reintroducing ecosystems rather than just native plants, for example, integrating tall trees, mid-level trees and shrubs.
- Consider partnering with local schools to help regenerate large parcels of land through on Country outdoor education.

DESIGN INTEGRATION OPPORTUNITIES

Native planting and land management

Landscaping opportunities to regenerate native species and ecosystems within the area can be integrated into the project, which include the planting of edible bush food, management of significant sites connected to project site and the reintroduction of ecosystems.

High-performing green space

Important waterways and waterfalls surround and connect to the site, highlighting the need for consideration of how grey infrastructure may affect and/or contribute to the regeneration of these waterways. The scale of the project presents concern for the project encroaching on the river systems, further declining their quality. Therefore, the project's grey infrastructure needs to be examined with caution and investigated to benefit Country.

Artwork and/or text integration

Cultural knowledge can be shared through a public art piece and or text incorporation into footpaths or other public infrastructure.

8. KEY DESIGN THEMES AND RECOMMENDATIONS

Regenerating Country

SOCIO-ECONOMIC OUTCOMES AND IMPACTS	RELATED GANSW STATEMENT OF COMMITMENTS
• Heals Country and enhances the wellbeing and belonging of the Dharug community and all visitors. • Traditional knowledges and caring for Country principles ensure ongoing civic engagement and connection to place. • Site-specific cultural practices simultaneously regenerate the physical environment and empower the local Aboriginal community. • Positive environmental impact through the use of sustainable approaches drawn from traditional knowledges. • Reconciliation and healing occurs through ongoing acknowledgment of Country and the site's history. • Civic engagement and reconciliation are enhanced through the creation of ongoing educational opportunities. • Aboriginal community are supported in maintaining a distinctive cultural, spiritual, physical and economic relationship with their land, sky and waters. • Aboriginal community are supported in revitalising language and culture. Aboriginal cultures and languages are strong, supported and flourishing. • Civic engagement and connection with the site for all people is enhanced through intercultural learning and communication.	Commitment 1 Commitment 2 Commitment 3 Commitment 5 Commitment 7

8. KEY DESIGN THEMES AND RECOMMENDATIONS

Revitalising culture

Revitalising culture highlights the inextricable link between Country, culture and people that has always existed in the project area. Understanding and applying local Dharug cultural knowledge and practices can inevitably lead to the regeneration of Country. It also strengthens the unique cultural identity of the local Aboriginal community. The community recommendations explore how creating spaces for cultural practices such as weaving, ceremony, dance and connecting with Country enhances the social, cultural and environmental outcomes of the project. Revitalising culture can be explored through archaeological processes, architecture and landscaping within the transport study.

If I go to any Country, I kick my shoes off and stand in the dirt. And in these days with people's mental health, that connection to Country and connection to the dirt is such an important thing…So I think spaces where you can connect to Country and explain why and how we connect to Country… It's good for everybody's health to spend time on Country.

– Dharug knowledge holder

For more than 50,000 years we have sustained, maintained and survived in our Country (as Aboriginal people).

– Wiradjuri and inner-Sydney elder

8. KEY DESIGN THEMES AND RECOMMENDATIONS

Revitalising culture

COMMUNITY RECOMMENDATIONS

- Ensure that Dharug knowledge and practices are implemented in design and allowed to continue on Country.
- Recognise the significance of freshwater and saltwater and how this connects to gathering and ceremony for the local custodians.
- Include dedicated places where community can gather, meet, weave and practice culture on Country. Ensure there are both public and more intimate or private spaces available. Include yarning circles, lush gardens with signage and educational opportunities.
- Integrate simple open spaces with native grass, bushland and limited signage and information to allow people moments of respite along busy travel ways.
- Incorporate plants, such as weaving plants, to allow Aboriginal people to practice culture and interact with Country.
- Acknowledge the importance of the feeling of Country for people's health and wellbeing, for example, consider the benefits to your central nervous system from standing, dancing and interacting on Country with your feet.
- Consider the creation of a keeping place for all artefacts that are found on Country during archaeological investigations.
- Allow for the collection of white ochre during construction.

DESIGN INTEGRATION OPPORTUNITIES

Green public spaces

By providing public green spaces, community members are encouraged to engage with the site with direction from the infrastructure and spatial arrangement of the landscape. For example, open spaces with native grasses encourage connecting with Country and practising culture on Country.

Wayfinding and signage

Wayfinding strategies can incorporate Dharug knowledge. The orientation and positioning on site needs to be considered carefully, depending on what knowledge they are integrating.

Public art

Public artworks provide an opportunity to reflect the cultural narrative of the project and Country itself. Public art will also contribute to occupant connection to the site. This could include incorporating artworks into the design of signage, building fabric and spaces.

8. KEY DESIGN THEMES AND RECOMMENDATIONS

Revitalising culture

SOCIO-ECONOMIC OUTCOMES AND IMPACTS	RELATED GANSW STATEMENT OF COMMITMENTS
• Intercultural communication is enhanced, allowing non-Indigenous people to recognise and appreciate Aboriginal language and culture and Aboriginal people to feel seen and respected within the built form. • Invests in community and the ongoing involvement of local Aboriginal people. • Aboriginal cultural identity and Aboriginal self-determination are promoted and supported. • Aboriginal community are supported in maintaining a distinctive cultural, spiritual, physical and economic relationship with their land, sky and waters. • Aboriginal community are supported in revitalising language and culture. Aboriginal cultures and languages are strong, supported and flourishing. • Heals Country and enhances the wellbeing and belonging of the Dharug community and all visitors. • Site-specific cultural practices simultaneously regenerate the physical environment and empower the local Aboriginal community. • Positive environmental impact through the use of sustainable approaches drawn from traditional knowledges.	Commitment 1 Commitment 2 Commitment 5 Commitment 6 Commitment 7

8. KEY DESIGN THEMES AND RECOMMENDATIONS

Integrating Language

Integrating language reawakens Country and provides knowledge of the local custodians, cultural practices and their connections to surrounding cultural groups. Aboriginal languages are essential to people's identities, and the Dharug Language connected to the project area is in the process of revitalisation. Integrating language can help restore the stories, history and Songlines of Country that were passed on since time immemorial, strengthening the local Aboriginal community's cultural identity whilst contributing a unique cultural layer that all users of the precinct can connect with. The community highlighted particular dialects of the Dharug language, cultural protocols surrounding language integration and identified key Dharug language experts to be further engaged. Language integration has the capacity to influence master planning, architecture, wayfinding, public art and landscaping within the project.

[Using Language] *is an invitation to the broader community to have some depth of understanding.*

– Dharug elder

It's about educating but also doing it in a form that is interactive…Things that kids could go up and touch and feel… Listen to the Dharug story.

– Dharug knowledge holder

8. KEY DESIGN THEMES AND RECOMMENDATIONS

Integrating Language

COMMUNITY RECOMMENDATIONS

- Integrate Dharug Language into the design, signage and wayfinding, for example, incorporating dual naming opportunities and integrating language along travel ways, walkways and cycle ways.
- Ensure that any dual naming or naming in Dharug Language is connected with the larger story of place.
- Consider how to educate non-Dharug people and the wider community about Dharug connection to Country and efforts to revilatise Dharug/ Sydney Language.
- Understand that there are differences between Coastal Dharug Language and Inland Dharug Language and that appropriate words for this site must be used.
- Consult with language experts, as well as the wider Dharug community, regarding language integration (see Appendix C for a list of community-recommended language specialists).
- Consider how language can be integrated in engaging and interactive ways.
- Use language to help tell stories and educate people, for example, include signage along with native planting.
- Consider ways that language can be engaged with other than just written signage (e.g. audio recordings, video).

DESIGN INTEGRATION OPPORTUNITIES

Signage

Incorporating language dialects into the site's infrastructure through signage and wayfinding strategies encourages interaction, education and revitalisation of language. This design integration opportunity also challenges and influences the engagement and interaction of site visitors with the built form and the Dharug Language simultaneously.

Text and/or art integration

Providing text and art allows for language to be integrated and engaged with in an interactive way. This can contribute to the public domain through implementation into the design of elements such as footpaths, facades and other built forms.

Spatial arrangement

The sites spatial arrangement, particularly the pedestrian areas present an opportunity to replicate the knowledges and language of the Dharug community. This may include the placement of public spaces, walkways, bikeways and the connections to any waterways in the area.

8. KEY DESIGN THEMES AND RECOMMENDATIONS

Integrating Language

SOCIO-ECONOMIC OUTCOMES AND IMPACTS	RELATED GANSW STATEMENT OF COMMITMENTS
• Aboriginal community are supported in revitalising language and culture. Aboriginal cultures and languages are strong, supported and flourishing. • Intercultural communication is enhanced, allowing non-Indigenous people to recognise and appreciate Aboriginal language and culture and Aboriginal people to feel seen and respected within the built form. • Aboriginal community is invested in, and the ongoing involvement of local Aboriginal people in the precinct is ensured. In particular, jobs are created for local Aboriginal language experts. • Reawakens Country enhances the wellbeing and belonging of the Dharug community and all visitors. • Civic engagement and reconciliation are enhanced through the creation of ongoing educational opportunities. • Aboriginal community are supported in maintaining a distinctive cultural, spiritual, physical and economic relationship with their land, sky and waters.	Commitment 1 Commitment 2 Commitment 3 Commitment 4 Commitment 5 Commitment 7

8. KEY DESIGN THEMES AND RECOMMENDATIONS

A travelling and gathering place

Exploring the project site as a travelling and gathering place evokes its unique functionality of Country. Applying an Aboriginal perspective, and considering the site as a place that has always been a place of travel and gathering, provides an additional cultural layer that is inherently linked with the site's contemporary context. The community members explored how key elements of Country, such as the waterways and bush tracks that have always existed in the area, remain important connections to ceremony, cultural practices, kinship systems and trade. The community recommendations highlight the importance of understanding, educating, and celebrating the project area as a place of travel and gathering that has always occurred on Country. These recommendations have the power to influence master planning and place-making, urban design (e.g. walkways and cycleways) and public art within the project area.

The paths people took before white invasion… You can trace the links between families… You can draw those links, if you think of the main roads that link places, they were the original Aboriginal tracks, because they were the way of getting up to the Blue Mountains and the food sources along the way.

– Dharug knowledge holder

8. KEY DESIGN THEMES AND RECOMMENDATIONS

A travelling and gathering place

COMMUNITY RECOMMENDATIONS

- Consider the history of the site as a meeting place. Understand that there are traditional tracks that would have been used from this area to allow people to gather at significant sites for ceremony and cultural practice.
- Understand the kinship ties that connect families from this Country to other families on the Hawkesbury River and towards Awabakal Country. There would have been trading, trade languages and ceremonies.
- Consider waterways as the natural landmarks and borders of cultural groups, and ensure they are protected to allow knowledge of Country and the original cultural groups of Sydney to survive.
- Explore ways in which Country can be experienced when walking and cycling through public spaces as an opportunity for people to understand the diverse ecological spaces on different parts of Country.
- Explore innovative design technologies and tangible educational options that provide environments for a diverse range of occupants.
- Consider including a market space to encourage gathering and support Indigenous businesses, for example the Blak Markets in La Perouse.

DESIGN INTEGRATION OPPORTUNITIES

Key public space

Key public spaces can include retreat spaces for rest and reflection. Further exploring waterways and bush tracks can direct orientation and masterplanning on these key spaces, providing viewpoints and visual connections to Country. These spaces can also support native planting as well as be spaces for Indigenous businesses.

Public artwork

Through integrating artwork that projects the narrative of Country and the site's significance as a meeting place, occupants travelling through the space will be further connected to the cultural narrative of the project. Public art pieces incorporated into the built form could be elements that encourage occupant engagement as well as influence accessibility for pedestrian traffic.

Inclusive and accessible street design

The project can foster inclusivity by ensuring accessible design, particularly across landscaping, green spaces, public spaces, and art integrations that allow the community to gather and connect with Country.

Prioritising pedestrian access

The pedestrian access for the project provides the opportunity to further link connections throughout the site and integrate more cultural narratives throughout the precinct. Prioritising access allows for greater freedom of movement and safety for community members travelling through the space, creating potential opportunities for public art, native planting and cultural spaces for community and the public to use and experience. Integrating walkways that activate pedestrian traffic encourages people to experience and interact with Country.

8. KEY DESIGN THEMES AND RECOMMENDATIONS

A travelling and gathering place

SOCIO-ECONOMIC OUTCOMES AND IMPACTS

- Civic engagement is enhanced through education, encouraging people to consider the site's history and its impacts on the area.
- Reconciliation and healing occur through ongoing acknowledgment of Country and the site's history.
- Aboriginal community feel a greater sense of belonging and high levels of social and emotional wellbeing.
- Aboriginal community are supported in maintaining a distinctive cultural, spiritual, physical and economic relationship with their land, sky and waters.
- Aboriginal community receive remuneration and economic benefits through the provision of free or affordable spaces and ongoing financial support for Indigenous businesses.
- Community cohesion is fostered, allowing for community to meet and come together in safe and welcoming spaces.
- Knowledge sharing is facilitated through making sure people of all abilities, including elders, can come together at the precinct
- Strong economic participation and development of Aboriginal start-ups, freelancers and small businesses.
- Aboriginal community are supported in revitalising language and culture. Aboriginal cultures and languages are strong, supported and flourishing.
- A sense of belonging, connection and pride is created through tailoring the project to local context and priorities.

RELATED GANSW STATEMENT OF COMMITMENTS

Commitment 1

Commitment 2

Commitment 5

Commitment 6

Commitment 7

8. KEY DESIGN THEMES AND RECOMMENDATIONS

Storytelling and truthtelling

Storytelling and truthtelling is essential to revitalising culture and empowering the local Aboriginal community through design. Exploring the site-specific Dreaming stories, Aboriginal history and truthtelling can help establish a renewed meaningful and inclusive identity of the project area that is informed by Country and Aboriginal knowledge and culture. In Aboriginal culture, stories reflect Country, and can explain its creation and evolution through time. Transport planning has the capacity to implement place-based storytelling through public art, wayfinding and living technology that can tell stories such as the Eel Creation Story as people move through Country. The community recommends utilising technology, urban design and transport infrastructure to implement Dharug storytelling and truthtelling specific to place.

Now is the time to embed our stories in place.
– Dharug elder

They [stories] have to be the truth.
– Dharug elder

8. KEY DESIGN THEMES AND RECOMMENDATIONS

Storytelling and truthtelling

COMMUNITY RECOMMENDATIONS

- Explore the significance of Dreaming and Creation Stories to the site and consider how these can be interpreted or integrated in design, for example the Eel Creation Story.
- Tell Dreaming Stories as people move throughout the area, so people understand how they connect with site-specific parts of Country.
- Respect cultural protocols, ICIP and how not all information should be shared. Consider how elements of stories and knowledge can be subtly told or alluded to without revealing things to the public.
- Ensure that any stories or knowledge shared is confirmed by appropriate Dharug knowledge holders/elders and co-designed with community.
- Highlight the local Aboriginal community's ongoing connections with Country-specific cultural practices. For example, while Aboriginal families often had to hide their identities in these areas to survive, people continued to fish and collect food around the Lane Cove River.
- Include design opportunities for truthtelling as a way to acknowledge and respect the full Dharug history of the site, for example how Dharug were some of the first to have contact with colonists, movement from Country for survival and integration with other peoples.
- Consider ways that transport routes can be used to tell a story and engage people on their journey (e.g. rest areas, water fountains) where a continuous story or educational stories can be told as people engage with Dharug Country and history.
- Consider opportunities for interactive, play-based learning (e.g. playgrounds) where children and people of all ages can interact and learn of Dharug Country and people.
- Implement educational features where users of transport links can listen to stories and Dharug history told by Dharug people.

DESIGN INTEGRATION OPPORTUNITIES

Fabrication and materiality

The natural materials of the site should be considered and furthered explored for opportunities to integrate them into the fabrication of infrastructure for the project.

Interactive urban design

Interactive design concepts provide the opportunity to interpret and connect occupants to the site's stories and truth. These design concepts can include text installation and visual interpretations that provide connection and acknowledged significant cultural sites and knowledges.

8. KEY DESIGN THEMES AND RECOMMENDATIONS

Storytelling and truthtelling

SOCIO-ECONOMIC OUTCOMES AND IMPACTS

- Aboriginal community are supported in revitalising language and culture.
- Relationships between the project team and Aboriginal community are enhanced, encouraging further collaboration and co-design.
- Aboriginal community receive remuneration and economic benefits for their shared knowledge and stories.
- Social justice is promoted through recognising the historical exploitation of ICIP and power imbalances with how ICIP has been used in the past.
- Aboriginal community is invested in, and the ongoing involvement of local Aboriginal people in the precinct is ensured through sustained collaboration throughout all phases of the project.
- Reconciliation and healing occur through ongoing acknowledgment of Country and the site's history.
- Social equity is improved by ensuring that Aboriginal people have a say in project design, access and spaces.
- Aboriginal community are supported in maintaining a distinctive cultural, spiritual, physical and economic relationship with their land, sky and waters.
- Accessible design supports knowledge sharing through making sure people of all abilities, including elders, can come together.
- Civic engagement and connection with the site for all people is enhanced through intercultural learning and communication, encouraging people to consider the site's history and its impacts on the area.
- Intercultural communication is enhanced, allowing non-Indigenous people to recognise and appreciate Aboriginal language and culture and Aboriginal people to feel seen and respected within the built form.

RELATED GANSW STATEMENT OF COMMITMENTS

Commitment 1

Commitment 2

Commitment 5

Commitment 6

Commitment 7

8. KEY DESIGN THEMES AND RECOMMENDATIONS

Social and Cultural Inclusivity

Social and cultural inclusivity is vital to the health, wellbeing and belonging of the local Aboriginal community as well as the wider community. Inclusive and accessible design addresses social and cultural inequities and ensures that community feel welcomed and safe. Transport planning and precinct design must foster inclusivity. The community would like to see this realised through the inclusion of spaces to safely gather, practice culture and ceremony, and share knowledge, as well as general design, wayfinding, artworks, language integration and other storytelling or truthtelling integrations.

Will there be spaces where community can come together, where you are ensuring that if someone has a disability that it is easy access, that it is educational, that you are learning about Country, that you are connecting to Country, and that has a family atmosphere? If there is going to be less traffic, more bikeways, more walkways…it is coming back to a more grounding and more natural feeling. Have it be open and inclusive. It's going to connect people.

– Dharug knowledge holder

8. KEY DESIGN THEMES AND RECOMMENDATIONS

Social and Cultural Inclusivity

COMMUNITY RECOMMENDATIONS

- Understand and respect both the Dharug traditional owners/custodians and the Aboriginal and Torres Strait Islander community members with strong connections in the area, and acknowledge the benefits that the wider Aboriginal and Torres Strait Islander community can bring to understanding of Country and connection to Country.
- Provide a space for smoking ceremonies to occur to ensure the Aboriginal community can safely practice culture and be on Country.
- Ensure cultural spaces and meeting places are accessible and welcoming.
- Consider ways to make language integrations, artworks, signage and other storytelling or truthtelling integrations accessible and inclusive.

DESIGN INTEGRATION OPPORTUNITIES

Urban mobility

Cultural and social inclusivity can inform how boundaries throughout the urban context integrate and weave together throughout the site, ensuring safe welcoming connections for all.

Design of welcome space

Designing spaces that cater for cultural practice will provide community opportunity to perform protocols such as Welcome and smoking ceremonies as well as publicly and safely engage with the site's built forms and landscapes to practise culture. These spaces can be designed as 'yarning circles' though consideration into their orientation, spatial and form arrangement and design should be given to allow for further engagement with the space from the broader community.

8. KEY DESIGN THEMES AND RECOMMENDATIONS

Social and Cultural Inclusivity

SOCIO-ECONOMIC OUTCOMES AND IMPACTS	RELATED GANSW STATEMENT OF COMMITMENTS
• Social equity is improved by ensuring that Aboriginal people have a say in project design, access and spaces. This reduces the disparities in access to spaces, services and resources for Aboriginal and Torres Strait Islander peoples. • Community cohesion is fostered, allowing for community to meet and come together in safe and welcoming spaces. • Aboriginal and wider community feel a greater sense of belonging and high levels of social and emotional wellbeing. • Accessible design supports knowledge sharing through making sure people of all abilities, including elders, can come together at the precinct. • Aboriginal community are supported in maintaining a distinctive cultural, spiritual, physical and economic relationship with their land, sky and waters. • Intercultural communication is enhanced, allowing non-Indigenous people to recognise and appreciate Aboriginal language and culture and Aboriginal people to feel seen and respected within the built form.	Commitment 1 Commitment 2 Commitment 3 Commitment 4 Commitment 6 Commitment 7

9. APPENDIX

APPENDIX A: GANSW CONNECTING WITH COUNTRY STATEMENTS OF COMMITMENT

This Connecting with Country Framework has been informed by Government Architect NSW's (GANSW) Connecting with Country Draft Framework. GANSW's Framework establishes a set of pathways, commitments, and principles for action intended to help form, design, and deliver government infrastructure including building projects such as roads, transport, and major public facilities. Government Architect's Draft Framework comprises seven overarching statements of commitment. Within each statement of commitment, are specific principles of action, considerations and challenges, which provide practical guidance for implementing each of the seven commitments. The connections between these commitments and the identified themes for this project have been indicated in Section 8.

GANSW STATEMENT OF COMMITMENT 1

We will respect the rights of Aboriginal peoples to Indigenous cultural intellectual property, and we will support the right of Country to be cared for.

Principles for Action: Connect with Country through first languages in collaboration with local community groups and their recognised Aboriginal knowledge-holders.

Considerations: Work with Traditional Custodians and draw upon available research to understand the connections between the ways of relating and recording knowledge.

How are you building relationships with the Aboriginal community – both the Traditional Custodians and community members from off-Country?

GANSW STATEMENT OF COMMITMENT 2

We will prioritise Aboriginal people's relationship to Country and their cultural protocols, through education and enterprise by and for Aboriginal people.

Principles for Action: Connect with Country by engaging with, and responding to, cultural practices led by community groups and their recognised Aboriginal knowledge-holders with spiritual links to Country.

Considerations: How will the project help Traditional Custodians to continue their practices on Country?

What are the opportunities for education and enterprise for Aboriginal community groups from the earliest stages through to maintenance?

APPENDIX A: GANSW CONNECTING WITH COUNTRY STATEMENTS OF COMMITMENT

GANSW STATEMENT OF COMMITMENT 3

We will prioritise financial and economic benefits to the Country where we are working, and by extension to the Traditional Custodians of that Country.

Principles for Action: Include impacts to Country and culture when evaluating economic, environmental, and social benefits and disadvantages of the project.

Considerations: Create a clear framework for identifying the group of people that will benefit from/influence/guide the project – be clear about how views will be considered and how contested ideas will be resolved.

Be clear about how financial benefits of the project (not just engagement fees) will be shared with community.

GANSW STATEMENT OF COMMITMENT 4

We will share tangible and intangible benefits with the Country where we are working, and by extension the Traditional Custodians of that Country, including current and future generations.

Principles for Action: Develop indicators to measure impacts to Country and culture during project formation.

Considerations: Agree on what success looks like for the project in terms of the health and wellbeing of Country.

GANSW STATEMENT OF COMMITMENT 5

We will respect the diversity of Aboriginal cultures, but we will prioritise the local, place-specific cultural identity of the Country we're working on. Aboriginal people will determine the representation of their cultural materials, customs and knowledge.

Principles for Action: Build relationships with local Aboriginal communities and incorporate enterprise opportunities for Aboriginal businesses (local and beyond, existing and emerging) at all stages through the project life cycle, including future opportunities.

Considerations: Establish (or learn about) protocols for Aboriginal consultants from off- Country – local government authorities often have information relating to this.

Consider how people are given space to participate. Avoid exploitative processes and allow sufficient budget and time.

APPENDIX A: GANSW CONNECTING WITH COUNTRY STATEMENTS OF COMMITMENT

GANSW STATEMENT OF COMMITMENT 6

We will prioritise recognition and responsibility of Aboriginal people, supporting capacity building across Aboriginal and non-Aboriginal communities, and across government project teams.

Principles for Action: Partner with Aboriginal-owned and run businesses and professional services, from project formation through to delivery and maintenance, to help guide design and engagement processes.

Considerations: What are the opportunities for education and enterprise for Aboriginal community groups from the earliest stages through to maintenance?

GANSW STATEMENT OF COMMITMENT 7

We will support Aboriginal people to continue their practices of managing land, water, and air through their ongoing reciprocal relationships with Country. We will create opportunities for traditional first cultures to flourish.

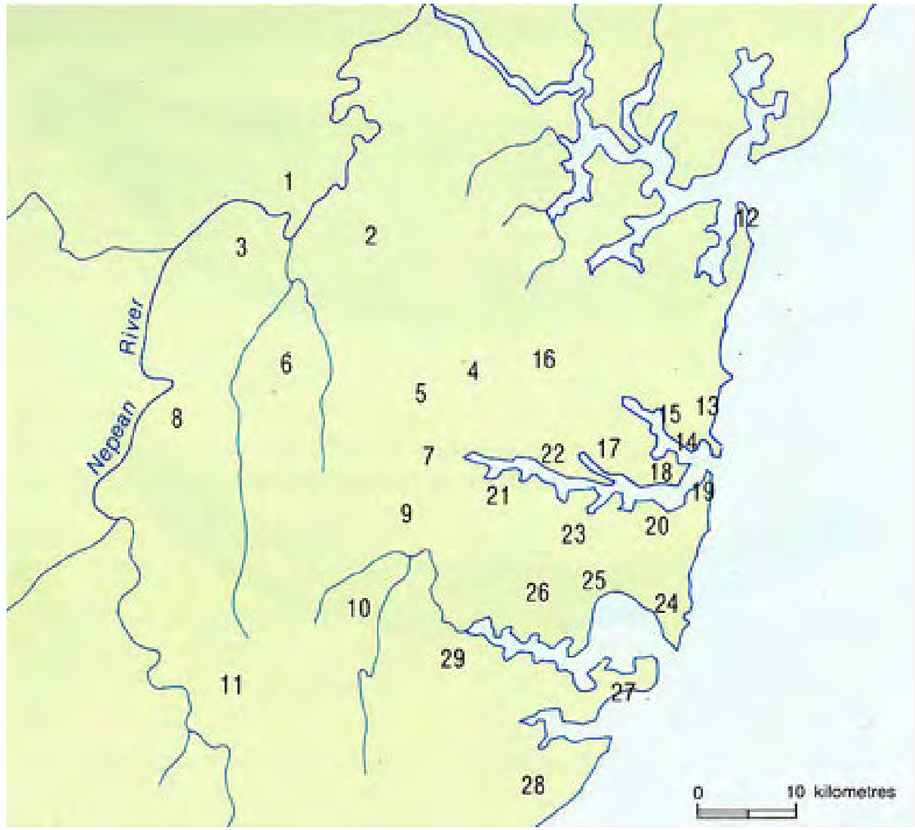
Principles for Action: Identify and nurture immediate and longer-term opportunities to support cultural practice on Country – through the development and delivery of the project as well as future use.

Considerations: How will the project help Traditional Custodians continue their practices on Country?

APPENDIX B: HISTORY OF AREA

The following section provides a brief history of the area to introduce project teams to the complex pre and post contact history of the area and its significant to Wallumedegal and the wider Aboriginal and Torres Strait Islander communities connected to the Macquarie Park site. The information in this history supports the community responses from Section 8 of this report.

Given the minimal availability of recorded Aboriginal oral or written histories, this has been prepared primarily from ethnographic, colonial and historical records. This history will require confirmation and augmentation by locally connected Aboriginal and Torres Strait Islander communities through a deep, ongoing, culturally informed engagement process.



LOCATION OF ABORIGINAL GROUPS IN SYDNEY AREA

1. KURRAJONG
2. CATTAI
3. BOOROOBERONGAL
4. BIDJIGAL
5. TOOGAGAL
6. GOMERRIGAL
7. CANNEMEGAL
8. MULGOA
9. BOOL-BAIN-ORA
10. CABROGAL
11. MURINGONG
12. CARIGAL
13. CANNALGAL
14. BOROGEGAL
15. KAYIMAI
16. TERRAMERRAGAL
17. CAMMERAIGAL
18. GORUALGAL
19. BIRRABIRRAGAL
20. CADIGAL
21. BURRAMATTAAGAL
22. WALLUMATTAGAL
23. WANGAL
24. MURU-ORA-DIAL
25. KAMEYGAL
26. BEDIAGAL
27. GWEAGAL
28. TAGARY
29. NORONGERRAGAL

Based on a map by J. Goodrum in D. J. Mulvaney and P. White, Australians to 1788 (Sydney: Fairfax, Syme & Weldon, 1987), 345, www.sydneybarani.com.au/sites/aboriginal-people-and-place/

APPENDIX B: HISTORY OF AREA

1. The Wallumedegal Landscape

Wallumedegal Country contained a great diversity of native vegetation communities, remnants of which still exist. Vegetation types occur on three different geological formations: shale, sandstone, and saline wetlands (estuarine). Modern-day Macquarie Park was covered by Sydney Turpentine Ironbark Forest, some of which remains. This type of forest is tall and open, found on shale and sandstone soils rich in shale. Canopy trees, including turpentine, red mahogany and various ironbark species, tower over a mid-storey of shrubs and small trees, with grassy ground cover. Down by Macquarie Park, along the bank of Turranburra, Lane Cove River, on Wallumedegal Country, coastal shale sandstone forest and coastal enriched sandstone dry forest provided tall open eucalypts and a range of grasses, rushes and herbs for continuous groundcover.[5] Slightly further away from the study site, Wallumedegal Country also hosts rainforest, a unique vegetation type for the northern part of Sydney.

The weir north of Fuller's Bridge, Chatswood, marks the spot where the tidal water natural gives way to the fresh water of the Lane Cove River. Estuarine vegetation types on this lower part of the river and down along the Port Jackson coastline included saltmarsh, swamp oak forest, reedland and mangrove forest.[6] These vegetation communities provided flora and fauna that were of incredible importance to the Wallumedegal people.

FLORA

The Wallumedegal made great use of the abundant flora species in the area, for food, medicinal remedies and the raw materials required for daily life. Plants were consumed in a variety of ways. Warrigal Greens ('wild' greens in Darug language), seaberry saltbush, glasswort, lilly pilly and coffee bush were just some of the edible plants growing in abundance on Wallumedegal Country. The flowers from the Blackbutt tree and the Crimson Bottlebrush both contain a sweet nectar similar to honey, that can be eaten straight from the tree.[7] In 1788, Hunter and Bradley undertook a surveying journey the south bank of the Parramatta River, during which they noted: 'in one of the Coves we found a peice [sic] of Cake which appeared to be made of the Wild Fig.'[8]

Plants were also used for medicinal purposes and to construct tools. The gum of the Blackbutt tree was heated in water and prescribed to ease dysentery, whilst its chewed leaves were applied on wounds to assist in the healing process. The red bark exudate of Smooth Barked Apple was dissolved in warm water, and when cooled, the liquid was taken to relieve severe diarrhoea. Spiny Headed Matt Rush was a very useful plant: its seeds were ground into flower and its leaves were used to make baskets, as were the leaves of the Blue Flax Lilly. The wood from wattles was used to make weapons, such as shields and woomeras, whilst Blackbutt was used for canoes. Resin from gadi, grass tree plants, was used to bind stones to woods for the production of tools and weapons. This diverse environment not only sustained the Wallumedegal, but also provided a secure and plentiful habitat for the extensive wildlife in the area. In turn, the local fauna and marine life provided them with abundant food sources.

APPENDIX B: HISTORY OF AREA

1. The Wallumedegal Landscape

SALTWATER PEOPLE AND COUNTRY

With significant tracts of Wallumedegal Country bordered by the estuarine Parramatta River to the south and Lane Cove river to the east, the Wallumedegal are saltwater people. Prior to colonisation the waterways provided both food and a place for cultural practices. The Wallumedegal harvested shellfish from the harbour shore. Men also fished from the shallows with long four-pronged spears, while women fished in bark canoes, called nowie, using turban shell hooks and lines.

MANGROVES

Sydney Harbour and its estuarine rivers were known for the density of mangroves. Mangroves are an essential ecosystem that provide a unique nursery environment for aquatic life and a refuge for fauna.[9] Before colonisation the mangroves, supported land management – helping to manage the pH levels of the waterways, providing a breeding habitat for marine and other species and stabilising sediment and fringes of the estuaries.[10] The Wallumedegal also used mangroves as a source of food and timber.[11]

FISHERWOMEN

The role of fisherwoman was significant in Sydney, with the women being the main food provider for their families.[12] Historian Keith Vincent Smith notes that 'Fishing from canoes with handlines was an everyday social activity for women, who hugged their small children between their knees, keeping their hands free for paddling.'[13] Their hand fishing lines, car-re-jun, were so-called because they were fashioned from the bark of the kurrajong tree.

The women dominated the water during the day and at night, singing together to keep time while they rowed and fished. Colonists recorded the skills of Eora women in handling the nowie with children on board, and described the fires in clay pots that were also aboard for warmth and cooking. While fishing, women would take children out with them to teach them culture and the life of the water, including Creation stories and songs to help children stay away from dangerous areas of the water and to avoid animals and spirits.[14] Fisherwomen were recorded as fishing in the harbour for as long as forty years after colonisation.[15]

APPENDIX B: HISTORY OF AREA

2. Adapting to change

Since colonial times, Aboriginal culture has often been represented as timeless and unchanging. The reality, however, is that its survival into the twenty-first century has depended on 'a long-honed ability to adapt to change' which historian and archaeologist Paul Irish suggests lays at the heart of Aboriginal responses to colonialism.[16]

The Wallumedegal met the challenges of a changing environment over thousands of years by developing new technologies.[17] For example, they began using the mogo (ground-stone hatchet) and other stone implements for cutting, incising, drilling and woodworking around four to five thousand years ago. Around three thousand years ago, they began using animal and fish bones to fashion barbs for their garrara (fishing spears).[18] Even more recently, around one thousand years ago, they began using tools made of shell, such as burra (fish-hooks).[19]

Burra, like other tools developed, changed how Aboriginal people carried out their daily lives. As the lives of Sydney's Aboriginal people revolved around the sea and its resources, burra was a major innovation. Primarily made and used by women, burra enabled them to take their canoes further from the shore, catching fish from the deeper waters. They may also have altered the balance of gender politics, giving women increased status.[20]

Burra also influenced cultural practices. Burra became one of the ornaments along with shells and fish jaws that people of Sydney's cultural groups wore; their bodies also decorated with white clay-circles drawn around the eyes and wavy lines down the arms and legs and over the ribs.[21]

Australian aborigines, their implements & weapons, ca. 1845 / sketched by Samuel Thomas Gill: Mitchell Library, State Library of New South Wales

APPENDIX B: HISTORY OF AREA

2. Adapting to change

A MANANGED LANDSCAPE

Aboriginal people, like the Wallumedegal, were actively managing the landscapes in which they lived, as noted in colonial records. With a variety of environments on their Country, the Wallumedegal deliberately and carefully organised the location of their camps and movements according to the seasonal availability of food from different plant species like tubers.[22] Numerous reports in colonial texts reveal that across southeastern Australia, Aboriginal people cultivated fields of tubers for a staple food source, a practice Yuin and Bunurong historian Bruce Pascoe has argued is part of a comprehensive system of Aboriginal agriculture.[23]

Another common land management technique was the use of fire. Fire was a constant presence in early Sydney, evidenced by the 'moving lights' seen by Joseph Banks on the harbour at night.[24] Fire was used fire to open paths and to clean Country; to drive animals into the paths of hunters and then to cook the kill; to keep warm at night and to carry as a torch the next day; to treat wood, melt resin and crack stone for tools; to gather around and dance and share stories.

Wallumedegal burning regimes were in part described in the journals of early colonists. On a hot dry day in September 1790, John Hunter observed Aboriginal people 'burning the grass on the north shore opposite to Sydney, in order to catch rats and other animals.'[25] Almost exactly twelve months later, on 31 August 1791, they were again 'firing the country' in the same place on a hot day ahead of heavy rains. While Hunter regarded this to be another 'remarkable coincidence', it suggests a connection to the land and an understanding of the seasons which the settlers could not fathom.[26]

Certainly, the Wallumedegal carefully cultivated Country. The green landscape they shaped was admired by Surgeon George Worgan in 1788: 'The Trees are small and grow almost in regular Rows, so that together with the Evenness of the Land for a considerable Extent, it resembles a beautiful park'.[27] In the same year, William Bradley also ventured into Wallumedegal Country to find 'the trees a considerable distance apart & the Soil in general good[.] Grass very long and no underwood.'[28] What Worgan and Bradley witnessed was the result of careful and consistent land management over millennia.

In 1788, the Wallumedegal were a thriving people, a culture adapted in every way to the diverse Country they called home. With the advent of British colonisation, the resilience of this attachment to place would be challenged by the imposition of a vastly different people and their culture.

Joseph Lycett, 'Aborigines using fire to hunt kangaroos', c.1817 (National Library of Australia, nla.pic-an2962715-s20)

APPENDIX B: HISTORY OF AREA

3. Colonial History

From the first week of the First Fleet's arrival, parties were sent up Lane Cove River, along Parramatta River and on inland expeditions to explore the unfamiliar country north of Parramatta River. On Tuesday 5 February, 1788 Captain John Hunter and First Lieutenant William Bradley ventured to the 'upper part of the harbour' to Walumetta Country, when a group of Aboriginal people called out to them and followed their boats. Bradley recorded: 'We landed to cook our Breakfast on the opposite shore to them [later named Breakfast Point]. We made signs to them to come over and waved green boughs [a sign of friendship]', following which seven unarmed men crossed the river in canoes to join them.[29]

As Hunter recounts, 'we met them and shook hands.' After noting they were alarmed by marines armed with muskets, he ordered the soldiers to put down their weapons. The Aboriginal group then 'came up with great chearfulness [sic] and good humour, and seated themselves by our fire amongst us, where we ate what we had got and invited them to partake, but they did not relish our food or drink.' As Bradley notes, the meeting ended when 'We tied beads etc. about them and left them our fire to dress their muscles [mussels] which they went about as soon as our boats put off.'[30]

On 15 February 1790, Lieutenant Ralph Clark passed directly near Macquarie Park on an exploratory expedition 'about six miles up' the Lane Cove River. He described the following encounter with two Aboriginal men, 'Dourrawan' and 'Tirriwan':

Fine clear weather — went up the Harbour in my Boat and went into Lane Cove where I was Yesterday to See Dourrawan and Tirriwan the two Natives that I exchanged the hatchet withYesterday for there two Spears — I had not gone far up the cove before I Saw the Smook of there fires … the[y] had left Some Muscle on the fire to roast which the[y] both begged of me to eat Some of … I then desired Tirriwan to go and bring me down one of his children as Dourrawan informed me that he was the father of the Child he had brought down and that his woman the mother of his child was (poc) dead of the (mittayon) Small Pox — Tirriwan brought also down a Boy much a bout the same age as the other — Tirriwan child was not quite Recovered from the Small Pox … after staying with them for about two hours I got into the Boat and left them and went up the cove about Six miles — the[y] were much afraid of our Guns — I eat one of there Muscles which made me very sick — in coming back the[y] called to use to come on shore but it beginning to grow dark I wished to get home — I therefore did not go on Shore to them — the[y] are very fond of asking your names — I told them mine Yesterday which the[y] recollected and called me by it to day.[31]

A view in upper part of Port Jackson; when the fish was shot, 1788 / possibly by William Bradley Mitchell Library, State Library of New South Wales

APPENDIX B: HISTORY OF AREA

3. Colonial History

SMALLPOX

In April 1789, a devastating epidemic of smallpox swept through the Aboriginal population of the Sydney region, taking a heavy toll on both their numbers and way of life. Traditional burial practices were abandoned as people fled. First Fleet Officer David Collins recorded that '[n]ot a living person was anywhere to be met with. It seems as if, fleeing from the contagion, they had left the dead to bury the dead.'[32] Those who fled from the devastation spread the disease further, as Europeans later realised when they saw signs of smallpox far beyond the local area. The death toll was immense, probably at least half of the Sydney Aboriginal community; hundreds upon hundreds of Aboriginal people died within a matter of months.

Through the loss of life and connections to land, smallpox effectively cleared the way for European settlement. Faced with rapidly declining populations, neighbouring cultural groups joined forces to ensure their survival.[33] The remaining Wallumedegal joined the survivors of surrounding cultural groups from the north of the harbour, such as the Cammeraygal and the Burramuttagal; and the Wangal from the southern side of the harbour. Many of them gathered on Wallumedegal Country. As this area later became known as Kissing Point, this new configuration of cultural groups became known to the settlers as the 'Kissing Point Tribe'.[34]

Although the Aboriginal groups in Sydney continued to exercise their culture as much as possible, displacement and disease made this increasingly difficult as the Country on which they depended physically, culturally and spiritually was further invaded. Following Governor Philip's return to England in 1792, there was a period of military rule before John Hunter assumed office at the end of 1795. During this time, 430 acres were distributed to colonists through the first land grants. With these grants, the frontier expanded and traditional Country was converted to farm and pastoral land; former yam beds were replaced with fields of corn. By the late 1790s, the area supported over 400 European farmers.[35]

Leroy, Sebastien. Nouvelle-Hollande,
Port Jackson, ceremonie de l'enterrement des sauvages : , 1820.
Web. 2 December 2020 <http://nla.gov.au/nla.obj-136796389>

APPENDIX B: HISTORY OF AREA

3. Colonial History

SURVIVAL AND RESISTANCE

On Wallumedegal Country in 1792, eight marines were granted land at what was named the 'Field of Mars', including present-day Marsfield, Macquarie Park and North Ryde. They immediately set about clearing the land of timber and planting crops of wheat, maize and barley. Aboriginal people resisted these incursions and on a number of occasions raided the maize (Indian Corn) that was being grown on their land. As a visiting surgeon noted in 1793, although the Aboriginal people relied principally on fish for their diet, 'of late [they] have become extremely addicted to Indian Corn which they steal with great Boldness'. A raid in 1797 that caused the first known European fatality in the Ryde area was reported in the Sydney Gazette in May 1797:

At Kissing Point … they dangerously wounded a settler and his wife, first burning every article belonging to them'. The following day soldiers fired at 'a large body of natives' who 'instantly fled, leaving behind them their spears, etc. and about 40 bushels of Indian corn which they had stolen.[37]

William Small, who was born in Ryde in 1796, later reflected on the atmosphere of fear that pervaded these early years:

I remember this place when we were a handful of white men camping in an unknown country crowded with hostile or doubting blacks. Even during the day we scarcely dared go outside the house unarmed; and constant alarms added to the toils of us first settlers.[38]

The frequent conflicts that broke out between 1797 and 1805, were part of a wider campaign of resistance led by Bidjigal warrior Pemulwuy and Gai-Marigal man Musquito.

In 1804, the Sydney Gazette characterised Aboriginal groups in Sydney as 'very troublesome' because approximately 200 warriors had taken possession of James Wilshire's farm at Lane Cove. The following day, they were 'dispersed' by 'a discharge of shots'. A few months later, in April 1805, James Weavers of Eastern Farms was 'killed by the Natives'.[40]

This initial surge of resistance died down by about 1810, when, as journalist Diana Plater explains, there was 'a visible shift in the newspapers' attitudes towards the Aborigines. Although the clashes continued, the sentiments of anxiety and fear were being replaced by pity.'[41]

APPENDIX B: HISTORY OF AREA

3. Colonial History

KISSING POINT TRIBE

The formation of the Kissing Point Tribe was driven both by the devastation of smallpox along with forced displacement following early land grants. This group was one of few, along with other Aborginal groups of the Sydney area and some others camped near Parramatta, to be exempt from Governor King's effective declaration of war in 1801. Historian Grace Karskens surmises that the group gathered at Kissing Point on the lands of 'white friends and absentee landholders', connected to Bennelong and Nanbarry.[42] One of these was the emancipist James Squires who was granted land in 1795. This land was on the riverside flats, easily enabling the Kissing Point Tribe to continue their lifestyle of saltwater subsistence.

In addition to fishing, the members of this conglomerate tribe on Wallumedegal Country continued other cultural practices. On 18 October 1817, naval officer John Septimus Roe recorded in his diary that there were 'more Native Inhabitants in the Town today than I remember having seen together at any one time' as they were gathering for 'a grand dance which is to take place in the evening among the Kissing Point Tribe, near Eliza Point'.[43]

A month later, he hosted some members of the Kissing Point Tribe at his home in the Rocks, including "Chief of the Tribe", Bidgee Bidgee. Roe notes that 'In the afternoon we were highly amused and diverted with a "Caraubery" or dance performed by some natives of the Kissing Point Tribe, who sought shelter in our house from a Thunderstorm.'[44]

Corroborees were still continuing five years later, when on 31 July 1821, Lieutenant Allen Francis Gardiner described an Aboriginal woman dancing and singing at Squire's farm. He noted she was about 50 years old, wearing an 'Opossum Cloake' and carrying a net bag.[45] He described her hair as a mass of 'Gorgon locks', decorated with eel bones, the 'brush of a native dog's tail, and a bunch of Emu feathers' behind'.[46] He believed she was Bennelong's sister, Carangarang.[47]

BIDGEE BIDGEE

Bidgee Bidgee (ca.1786–1837) was the youngest son of Maugoran, a Burramuttagal man. His family was displaced to Kissing Point where they built a strong connection with Wallumedegal Country. Governor Lachlan Macquarie gave him the title of 'Chief of the Kissing Point Tribe' in 1816, a position he held for twenty years. Bidgee Bidgee was one of many Sydney Aboriginal people adapting to what Paul Irish describes as a 'new colonial reality'.[48] In 1811, it was reported he was one of several 'who had made themselves useful onboard colonial vessels employed in the fishing and sealing trade, for which they are in regular receipt of wages'.[49] His attachment to the Country at Kissing Point was strong enough for him to refuse to move to the Parramatta mission in 1821. Bidgee Bidgee asked to be buried with Bennelong and Nanberry at Kissing Point, though there is no record of his death or burial. Blanket registers suggest that the Kissing Point Tribe as a whole disbanded after 1840.[50]

APPENDIX B: HISTORY OF AREA

3. Colonial History

CORRANGIE

Corrangie who was called 'Harry' by the colonizers was referred to as the "King of Kissing Point".[51] As a child, he was taught to read by Reverend Samuel Marsden in Parramatta. After Corrangie left him, Reverend Marsden noted him as having left to join the 'natives in the woods' and 'never seems to think he lost anything by living in the woods'.[52] Appearing sporadically in the colonial record and much less toward the end of his life, Corrangie was often noted for his eloquence. An example of this is the account of William Macarthur who spoke about Corrangie's connection with the Macarthur family.

But Harry seemed to have his heart full, he hesitated a moment, then putting his hand on his glass, turned towards my father, and made a short but most beautiful speech. I regret much I cannot remember the words. But I remember thinking I had never seen manner more graceful or heard expressions better turned than his.[53]

Corrangie is recorded as a guide for Captain Schaw's detachment in the Appin massacre. A reprisal raid in 1816 reportedly killed 14 people but likely killed many more. That Schaw's detachment did not find anyone has been taken as evidence that guides led the military away from campsites.[54] Later in his life, Corrangie lived at Kissing Point with his wife Carangarang.

CARANGARANG

Carangarang was born around 1771 into the Wangal cultural group. One of Bennelong's sisters, her name likely meant pelican although it had been misinterpreted by Collins as 'the sea'.[55] In 1791 she is recorded as attending a 'family party' where she and Bennelong's new wife Kurubarabula fished from nowies, keeping time with their oars as they sang.[56] Smith assumes it is again Carangarang is being discussed when Collins recounts an incident where one of Bennelong's sisters was fishing with convict William Bryant. When the cutter they were fishing in was swamped, Carangarang hoisted two children onto her shoulders and swam them ashore.

By 1817 Carangarang had become a member of the Kissing Point Tribe. That year, she partook in the corroboree hosted by the tribe and was recorded dancing in another corroboree four years later. After these two accounts, Carngarang's appearances in the colonial record become more infrequent. In 1822, she is recorded as amongst the group who petitioned Governor Brisbane for clothing and in 1837 the last reference to her appears, this time on a Brisbane Waters blanket list.[57]

APPENDIX B: HISTORY OF AREA

4. Recent history

Records of more recent Wallumedegal history and the broader Aboriginal history of the Macquarie Park area are sparse. The continuous displacement and dispossession alienated Aboriginal people from the area. In 1834, the newspaper The Australian reported:

It is a matter worthy of serious reflection, how rapidly the black native tribe have fallen off within the last few years, in the vicinity of Sydney. Within our recollection the Kissing Point tribe was a very numerous one. It is now reduced to only six individuals, and with them only one child.[58]

The wider Darug community is working to revitalise language and culture however this work has been largely centred upon areas south of the Parramatta River. The discovery of Bennelong's gravesite in 2018 brought greater attention to the Aboriginal history of Wallumedegal Country.

BENNELONG'S GRAVESITE

Despite his renowned place in Australian colonial history, Bennelong's gravesite on James Squire's old orchard was unmarked for two centuries. He lies buried at 25 Watson Street, Putney, alongside his third wife Boorong and friend Nanberry.[59] In 2018, the Watson Street property was purchased by the New South Wales government 'to ensure protection and preservation of the site.'[60] The aim is to turn the site into a public memorial. Desmond Lee Madde of the Bennelong Putney Committee said of the memorial: 'It's going to be culturally appropriate, it's going to be somewhere that everyone can celebrate the life of Bennelong and also learn more about the story.'[61]

25 Watson St, Putney. Bennelong's grave is said to be at the front of the property near the nature strip. Source: Jessica Hromas/The Guardian

APPENDIX C: RECOMMENDED LANGUAGE AND LAND MANAGEMENT SPECIALISTS

The following community-endorsed Dharug Language and land management and horticulture specialists were recommended for the project during the one-on-one interviews.

DHARUG LANGUAGE SPECIALISTS

CORINA NORMAN

Corina is an experienced class teacher, knowledge holder and artist with a demonstrated history of working in these industries spanning over 25 years. In her current work capacity, Corina is a language teacher and cultural/language consultant, teaching and delivering Darug Language and cultural programs across the Sydney Basin.

JASMINE SEYMOUR

Jasmine Seymour is a Darug woman and a descendant of Maria Lock, daughter of Yarramundi, the Boorooberongal Elder who met Governor Phillip on the banks of the Hawkesbury in 1791. Jasmine is a language expert, teacher, author and illustrator, known for children's books Cooee Mittigar and Baby Business. It is Jasmine's wish that through her books, everyone will know that the Darug mob are still here, still strong.

APPENDIX C: RECOMMENDED LANGUAGE AND LAND MANAGEMENT SPECIALISTS

The following community-endorsed Dharug Language and land management and horticulture specialists were recommended for the project during the one-on-one interviews.

LAND MANAGEMENT SPECIALISTS

MURU MITTIGAR
PATHWAY TO FRIENDS

MURU MITTIGAR
Muru Mittigar includes a Caring for Country division which includes arboriculture, bushfire mitigation, landscape construction, landscape maintenance, vegetation management and native nursery services which allows stakeholders such as land managers, mining groups, landholders and the government to outsource their environmental and community projects to an Aboriginal solutions-focused organisation.

LEX DADD
Lex Dadd is a Darug Custodian and assistant manager of the Blue Mountains Aboriginal Culture & Resource Centre (ACRC). He is also an adjunct fellow at the Department of Geography & Planning, Macquarie University. Lex holds cultural knowledge of land management, in particular the practice of cultural burning.

BUSH TO BOWL

BUSH TO BOWL
Bush to Bowl is a 100% Aboriginal-owned business located in Terry Hills that aims to create spaces people can engage with Australia's native plants and traditional Aboriginal knowledge and culture. Bush to Bowl provides cultural landscaping services including the design and installation of bush tucker and multipurpose gardens in commercial spaces along with workshops and walkthroughs of their gardens and local bushland.

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Appendix B – Women's Safety Audit

TRANSPORT

Women's Safety Audit Study Report

Macquarie Park Detailed Precinct Transport Plan

June 2023

NSW GOVERNMENT

transport.nsw.gov.au

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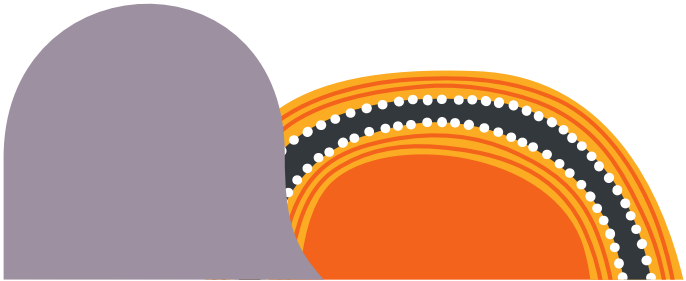


Acknowledgement of Country

Transport for NSW acknowledges the traditional custodians of the land and pays respect to Elders past and present. We acknowledge Aboriginal people as the traditional custodians of the lands and waterways on which we build infrastructure, deliver projects and serve Transport's customers and are grateful to Elders past and present for their continual leadership.

Transport acknowledges for tens of thousands of years the continuous deep relationship and connections of Aboriginal people to their land, language, song, dance, art and story. Transport pays respect to those ancestors who defended, walked and managed these lands for many generations before us and who have left a legacy of strong cultural wisdom and knowledge embedded within Country today.

Transport acknowledges many of the transport routes we use today – from rail lines, to roads and water crossings – follow traditional Songlines, trade routes and ceremonial pathways in Country that Aboriginal people followed for thousands of years.

Transport is committed to honouring Aboriginal peoples' cultural and spiritual connections to the land, waters and seas, and their rich contribution to society.

We recognise the impacts we make on Aboriginal culture and heritage through our infrastructure projects and commit ourselves to a future with reconciliation and restorative programs at their heart.

We acknowledge that our First Nations people and our customers today are still travelling these ancient Songlines, still doing business and still moving resources. To do this, we will engage early with Aboriginal people on projects; respect and value their expertise; and integrate their understanding of Country and place into the design process and outcome. This is Planning for Country and Designing with Country.

Executive summary

Women's safety is of critical concern globally. There is growing recognition of the need for effective measures to prevent and reduce violence against women, and to ensure that women and other vulnerable groups feel safe in both public and private life. Conducted on behalf of Transport for NSW (TfNSW), the Macquarie Park Women's Safety Audit has delivered an understanding of women's perceptions of safety, and recommendations to support their increased participation in public life including use of public and active transport.

The Audit and recommendations will be used to inform the broader *Macquarie Park Detailed Precinct Transport Plan* being developed by WSP on behalf of TfNSW. The purpose of the Audit was to consider the Macquarie Park Precinct through a women's safety lens and identify opportunities to achieve better safety outcomes for women, girls and gender diverse people through the study recommendations. WSP and TfNSW collaborated with key stakeholders throughout delivery of the Women's Safety Audit through a Working Group. This Group included representatives from the Department of Planning, NSW Police, Macquarie University and other agencies.

A key part of the study was the design and conduct of a 'night walk' that involved a group of specifically recruited women, girls and gender diverse participants, to identify and explore their lived experience of the study area. Participants were invited to consider and provide feedback on how physical, behavioural and environmental factors contribute to their feelings of safety.

The first phase of the project involved a comprehensive literature review and preparation of an audit tool, which was used to collect participant feedback as part of the 'night walk'. The audit tool was developed based on learnings from the literature review and feedback from the Project Working Group.

In phase 2, we led two groups of participants on the night walk and audit to provide feedback on a series of key safety indicators. The Audit results were then supported by learnings from related qualitative inquiry, in the form of follow-up interviews.

Phase 3 involved analysis and reporting, to synthesise the study findings and identify community-driven recommendations for the study area.

Overall, the Women's Safety Audit found that lack of appropriate lighting and lack of activation within the study area were key drivers of feeling unsafe, particularly late at night. The farther participants walked from the more active parts of the study area, around Macquarie University Metro station, Macquarie University and Macquarie shopping centre, the less safe they felt. Areas that were poorly lit, less active, with fewer potential positive bystanders and physical barriers that limited opportunities 'to quickly get away' from an unsafe situation, scored lower in perceived safety.

The recommendations address observations from audit participants and Project Working Group members, as well as best practice, as identified through the literature review. The recommendations have been set out under three themes – Safe public space and infrastructure, Transport improvements, and Collaboration and communications.

This Women's Safety Audit is one of the first initiatives of its kind to be conducted by a NSW State Government agency. With the NSW Government's $30 million investment to improve safety in cities and towns, and the United Nations specifically supporting safe, inclusive and accessible public spaces for women, children, older persons and persons with disabilities, there is an opportunity for the Macquarie Park Women's Safety Audit to be used as a case study and or adapted, to enhance safety for women and all members of the community, as part of future transport projects. It demonstrates the value of co-design and user-centred approaches where users of the public domain are asked to contribute to identifying issues and solutions.

1 Introduction

1.1 Study context

1.1.1 Macquarie Park Detailed Precinct Transport Study

As part of the Macquarie Park Detailed Precinct Transport Study, Transport for NSW (TfNSW) engaged WSP to deliver a Women's Safety Audit as an input to this ongoing project. The main objective of the Audit was to consider the Macquarie Park Precinct through a women's safety lens and identify opportunities and measures to achieve better safety outcomes for women and girls through the recommendations of the study. A 'Women's Safety Working Group' was convened with Macquarie Park stakeholders to support the development of the study approach and audit tool. The Group provided advice on key stakeholders and background studies for inclusion, identified safety issues and points of interest within the precinct, and provided feedback on draft deliverables and recommendations to support women's safety.

1.1.2 Macquarie Park Innovation Precinct Place Strategy

TfNSW is leading this work to contribute to the vision for the Macquarie Park Innovation Precinct as identified in the Place Strategy:

> A growing home to world-class businesses, innovation, research and education, Macquarie Park is competitive and resilient, with a stronger role within Greater Sydney's and Australia's economies. It is a place for people, characterised by its connectivity and the unique setting of Wallumattagal Country - a place of rivers and fertile wetlands with a deep history of learning, trade and culture. Macquarie Park is a place where people go to share ideas; a place that fosters creativity through interconnected relationships between people, businesses, places of education and a renewed connection to Country.

1.1.3 Women's Safety Charter

In addition, TfNSW is a foundation partner of the Greater Sydney Women's Safety Charter, a commitment with the Greater Cities Commission and Committee for Sydney. The Charter aims to shift attitudes and behaviours around women's safety, and has defined its focus areas as:

- Safe places
- Transport, active transport and mobility
- Communication and education
- Events and activations
- Data and knowledge sharing.[1]

[1] Women's Safety Charter | Greater Cities Commission

2 About the Women's Safety Audit

2.1 Study purpose

The purpose of the Women's Safety Audit was to consider the Macquarie Park Precinct through a women's safety lens and identify opportunities and measures to achieve better safety outcomes for women, girls and gender diverse people through the recommendations of the study. Safety in this context refers to the conditions and attitudes in public places, transport, workplaces and in the home that enable women and gender-diverse people to participate in the community without fear or restriction. The study considered the social, political and economic factors that drive gender inequality and lead to harassment and violence.

The findings of the study will inform future initiatives to increase the use of public transport, active transport and participation in public life by women in particular, and by members of the community more broadly.

The audit tool developed for the study can be applied to future Women's Safety Audits for other precincts across NSW.

2.2 Study objectives

The study provided an opportunity to:

1. Test and trial women's safety initiatives undertaken to date in the specific context of Macquarie Park.
2. Incorporate the lived experience of residents and visitors who navigate the Macquarie Park Precinct.
3. Seek feedback to inform further planning for the Macquarie Park Precinct and other places.
4. Consider intersecting identities across culture, gender, sexuality and ability to uncover diverse experiences.

Figure 2.1 Objectives of the Women's Safety Audit

This report documents the process (see section 3) and a review of the evidence, based on data, literature and community perceptions and recommendations for the precinct.

This Women's Safety Audit informs the Macquarie Park Detailed Precinct Transport Plan. This is a vision and validate transport approach to support land use changes in Macquarie Park. The intention of the Women's Safety Audit and the Connecting with Country Framework is to ensure a place-based approach is used to deliver community outcomes. The suite of studies and analysis that will be used to inform the Transport Plan is shown in Figure 2.1.

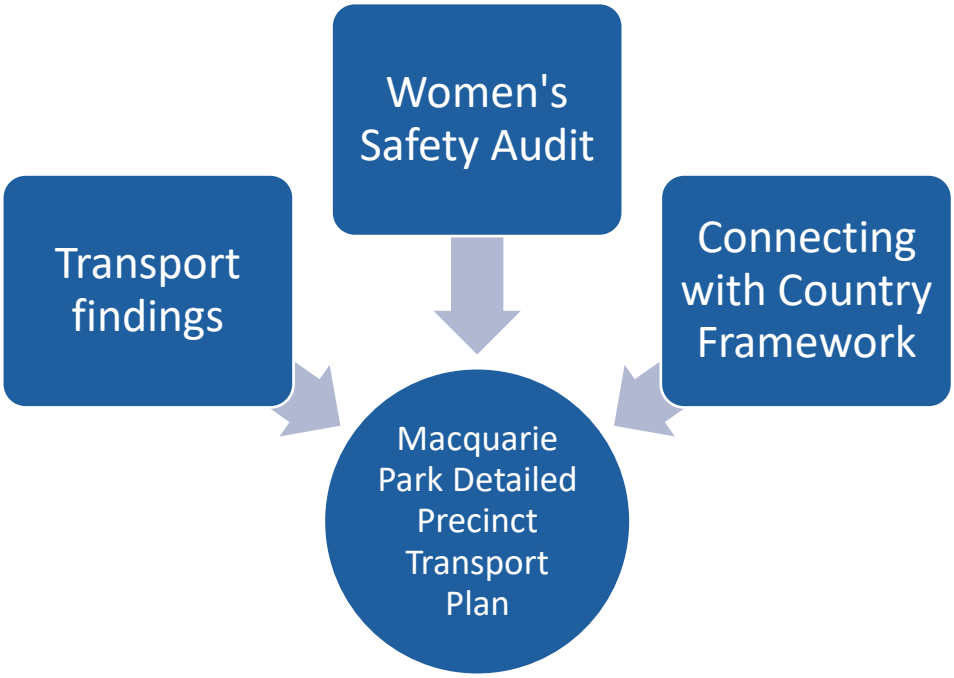


Figure 2.1 Macquarie Park Detailed Precinct Transport Plan supporting studies

3 Study methodology

The Study was designed to reach intersecting identities across culture, gender, sexuality and ability to ensure the research and recommendations were informed by diverse experiences. The methodology was collaborative, evidence-based and informed by a range of stakeholders. It involved the following key steps:

1. **Project inception:** Women's Safety Working Group ('Working Group') established and membership, meeting agendas and meeting dates confirmed. At the first Working Group meeting, scope was clarified, relevant documents identified and the ongoing integration for the project mapped.
2. **Literature review and data analysis on women's safety:** WSP reviewed a range of literature provided by the Working Group and other relevant information sourced by the project team. A summary of this review is provided in section 5.1.

   Data analysis was undertaken using various Local and State Government sources including the Australian Census and reported crime data. This included a one-hour meeting with NSW Police to discuss localised crime and safety issues.
   The review and data analysis informed the development of the draft audit tool.
3. **Working Group meeting #2 and finalisation of audit tool:** At the second Working Group meeting, WSP presented the findings from the literature review and demonstrated how these were used to support the development of the site audit tool (Appendix A).

   This meeting was an opportunity for Working Group members to provide feedback on the audit tool, before finalising it for use on a night walk.
4. **Recruitment of audit group:** Taverner Research Group was contracted to recruit a panel of 11 participants to form the 'audit group' who participated in the Women's Safety Audit Night Walk. The audit group consisted of women, girls and gender diverse people from the local area and reflected a range of age groups, experiences and interests. The participants were recruited via social media and random phone contact to meet the agreed demographic specifications (see section 5.1.3). These specifications were determined by evidence through the literature review recommending that diverse perspectives should be considered to understand all experiences in public spaces.
5. **Site assessment and visit:** The WSP team accompanied the audit group on the night walk of the Macquarie Park study area, with the exact location agreed in consultation with the Working Group. Working Group members also joined the night walk as a separate group and did not complete the full audit. The night walk route and assessment stops are shown in Figure 3.1.

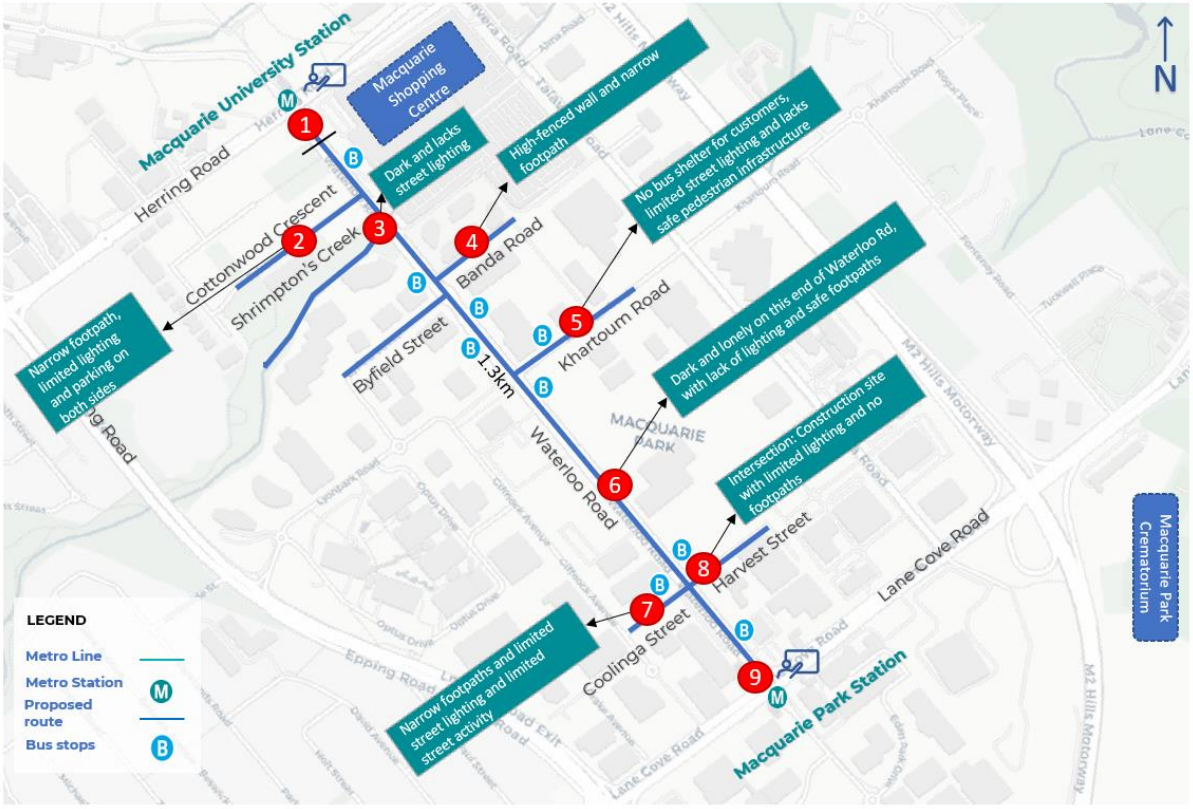


Figure 3.1 Women's Safety Audit night walk route

The night walk was conducted over a 90-minute period and involved walking along a section of Waterloo Road, commencing at Macquarie University Metro Station and finishing at Macquarie Park Metro Station. The walk incorporated various side streets and a short post-walk debrief to discuss participants' top-of-mind thoughts and experiences.

In the week following the night walk, a follow up interview was conducted with each participant to obtain further insights into their experience of the walk and audit, as well as their broader experiences and perceptions.

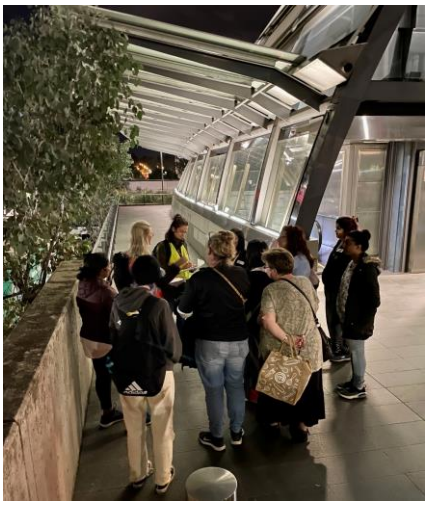
6. **Draft documentation and Working Group meeting #3:** A summary of findings from the night walk and follow-up interviews was collated, along with recommendations and lessons learnt. This was presented to the Working Group at its third meeting for reflections and feedback.
7. **Final documentation and recommendations:** Following feedback from the Working Group and TfNSW, the Macquarie Park Women's Safety Assessment and Audit Report (this document) was finalised and distributed for comment. This final report has been incorporated into the Macquarie Park Detailed Precinct Transport Study, contributing to its key findings. The audit tool developed during this study was revised for inclusion in similar future TfNSW place-based projects.

4 Participation in the Women's Safety Audit

Key stakeholders and community members were engaged in design and delivery of the Women's Safety Audit. Their feedback and insights were used to inform the study process and recommendations. Opportunities for participation were:

4.1.1 Women's Safety Working Group

The Women's Safety Working Group was convened by TfNSW and included representatives from government, education and private organisations.



- Greater Cities Commission
- Macquarie University
- NSW Police - Ryde Local Area Command
- Department of Planning and Environment
- TfNSW
- WSP.

4.1.2 Key stakeholder interviews

Interviews were held with stakeholders representing five groups or organisations to understand their members' experiences and perceptions of safety in the Macquarie Park area, as well as any related plans or initiatives from their organisations:

- Macquarie University
- NSW Police – Ryde Local Area Command
- TfNSW – Partnerships and Research
- City of Ryde
- Connect MPID (Macquarie Park Innovation District).

Findings from the stakeholder interviews are discussed in section 5.3.

4.1.3 Safety Audit night walk and interview participants

WSP worked with Taverner Research to recruit 11 woken, girls and gender diverse community members to participate in the night walk and follow-up interviews. Participants were recruited in accordance with the following specifications:

- All were either a resident of the Ryde LGA living within a one-to-two-kilometre radius of Macquarie Park, or a regular visitor to Macquarie Park (student or worker)
- All identified as a woman or girl or non-binary
- All were aged between 16-65 years
- Participants also included:

- Aboriginal and/or Torres Strait Islander women, girls or gender diverse people
- Women from culturally and linguistically diverse backgrounds
- People who identify as LGBTIQA+
- People living with disability, including those that affect mobility.

Recruited candidates participated in a one-and-a-half-hour night walk and audit and a half hour follow-up interview by phone or online. Participants were rewarded for their contribution with a gift voucher at the completion of the follow-up interviews.

4.1.4 Project Working Group night walk participants

Members of the Project Working Group were invited to participate in the night walk separately to the recruited group. Those who attended completed the audit tool at a number of stops and provided their own observations into the process. Representatives from the following organisations attended the night walk:

- Transport for NSW
- Macquarie University
- Department of Planning and Environment
- Greater Cities Commission.

5 Research findings

5.1 Literature review

The safety of women and gender diverse people in public spaces is a significant issue that requires responses across policy, public space and infrastructure design, and activation and public education. A review of public policies, research and safety studies identified a number of key themes and trends that were used to inform an understanding of women's safety in the Macquarie Park area and more broadly. The outcomes of the review were used to inform the Macquarie Park Women's Safety Audit study approach and audit tool. The resources considered as part of the review are shown in Figure 5.1.

Figure 5.1 The Women's Safety Audit was informed by local and global resources

5.1.1 Women's safety principles

Overwhelmingly, women do not feel safe at night in public places.

90% of young women feel unsafe on Sydney streets at night
92% of young women are uncomfortable using public transport
Plan International

Women lack opportunity to plan alternative routes to feel safer, putting them in vulnerable situations

Of women who had experienced sexual harassment or violence, one in five said that they would never return to the location where the incident occurred. However, only six per cent of those commuting for work reported being able to change their route or travel options.

In a national student survey conducted by Universities Australia (Respect Now, Always), one in six students have reported harassment since starting university and one in 20 have experienced sexual assault since starting university. University students experience sexual harassment or sexual assault in a number of contexts, as shown in Figure 5.2.

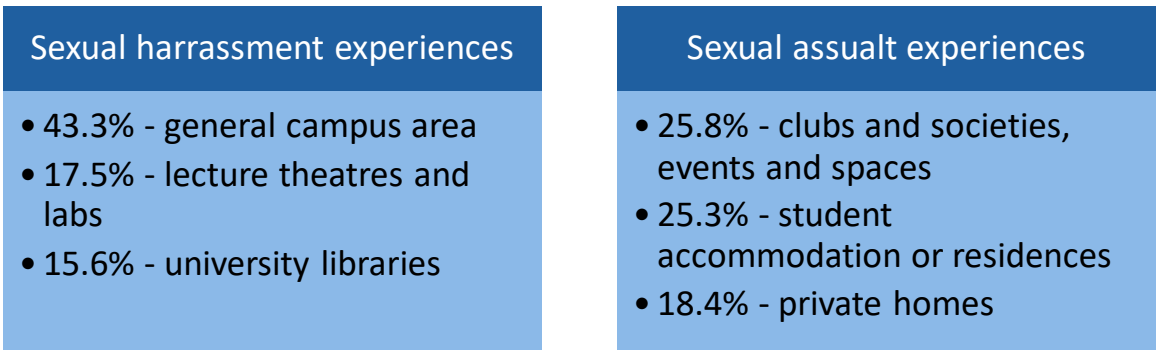


Figure 5.2 Location of harassment and assault experiences at universities

Source: Universities Australia (Respect Now, Always)

The literature review revealed a number of key principles for women's safety that should be considered when designing spaces, policies or activities that are safe and inclusive for women, girls and gender diverse community members, as outlined in Figure 5.3:

Figure 5.3 Key principles to support women's safety

Perceptions of safety	Street harassment	Public space design
All people in a community should feel safe and comfortable when using streets and public spaces, without experiencing danger or threats to personal safety. Sexual harassment of any kind is a reminder of women's social and physical vulnerability and increases fear. Factors that influence perceived safety include: — conditions of public space (design, maintenance, access and amenity) — presence and behaviour of other people — level of activation and positive influences such as open businesses and events. **Reduced perceptions of safety shape and limit women's decisions around journey mapping, transport mode options and other behaviours particularly at night.** **Active transport can act as a barrier for women and gender diverse people** due to inadequate infrastructure or feelings of vulnerability when walking or cycling. If walking, women have reported taking a longer route to avoid certain areas they perceive to be unsafe. Women must feel safe when in public spaces and when commuting to allow them to fully participate in social and civic life and pursue career opportunities. Lowering	**Street harassment of women and gender diverse people is prevalent, though under-reported** One study (City Alive, Designing Cities that Work for Women, ARUP, UNDP, University of Liverpool) found that only 31 per cent of respondents were likely to report incidences of harassment. Respondents to the study *Safety after Dark: creating a city for women living and working in Sydney (Committee for Sydney, 2019)*, said they seldom formally reported incidences and commented that they may not always be illegal. Crime data is therefore not an adequate indicator of how safe a local area might be for women and gender diverse people as it will not capture the prevalence of sexual harassment and sexual violence. **The type of sexual harassment that women and gender diverse people experience varies depending on whether they were commuting from work at night or going out for recreation.** 20 per cent of women travelling to and from work reported experiencing sexual harassment and one out of three reported an experience when out recreationally. Groups of men were cited as the usual source of sexual harassment in public spaces at night. **Bystander intervention is uncommon, further compounding perceived and actual safety issues for women and gender diverse people**	**The condition and intended use of public spaces impact womens' perceived and actual safety** Crime Prevention through Environmental Design (CPTED) principles are useful for managing public space, but a key point made throughout the literature was that the practice lacks a gender lens. Additionally, CPTED is about crime prevention but much of what is considered harassment is not criminal. This leads to design and safety responses that do not necessarily respond to the concerns of the people they are supposed to protect. **Vulnerable groups are not often consulted in design and decision-making processes** The communities that are most at risk (women, gender diverse, Aboriginal, culturally diverse and those living with disability) are rarely consulted in design and decision-making processes. Initiatives and public space design should be co-designed by the people who use them. Other tools and practices have been considered, such as Socially Inviting Public Places through Environmental Design (SIPPTED) and Gender Responsive Planning. **Socially Inviting Public Places through Environmental Design play a role in enhancing perceptions of safety** Amy Wilkins of the NSW Young Planners' Committee proposes a method of identifying safety obstructions through non-defensive and non-territorial approaches that

Perceptions of safety	Street harassment	Public space design
rates of harassment and improving public spaces will contribute to feelings of safety, but significant cultural changes are also required.	In the above study, respondents reported that other people are unlikely to speak up or intervene when a woman was experiencing harassment. Public awareness and education campaigns that challenge current cultural norms around how women are represented in public space are important to improve safety. Providing messages or training for positive bystander intervention is one way of creating cultural change.	are typical of CPTED. Four main categories are proposed through SIPPTED: 1. Inviting: public art and active 24/7 land uses 2. Maintenance: lack of graffiti and quality low level planting 3. Accessibility: removal of barriers and clear sight lines 4. Facilities: transparent bus shelters and ride share facilities **Gender Responsive Planning is important** This approach is discussed in a publication by UN Women looking into practices of providing safe cities and safe public spaces across the world. Gender Responsive Planning was applied in Cairo, Egypt to create safe and friendly spaces with and for women and girls. Gender Responsive Planning: 1. Acknowledges factors that contribute to social and urban inequality 2. Promotes women's participation in the design, maintenance and use of public space on equal terms 3. Ensures the allocation of resources 4. Addresses gender bias and discrimination 5. Includes data disaggregated by sex and age as part of the assessment 6. Increases women's safety and mobility 7. Promotes mix-use of spaces 8. Enhances gender-friendly codes of conduct, reinforcing positive dialogue and attitudes on gender equality.

5.1.2 Intersectionality analysis

An intersectional analysis better informs local authorities and policy makers in planning and implementing programs that respond to the experiences and needs of diverse populations. Women face additional roadblocks to safety in public places based on their age, physical and mental ability, sexuality, cultural background, income, faith and where they live and work. Other factors such as intellectual disability also impact women's sense of safety and how they move around a space as well as those who are caring for young children and girls.

Sexually diverse people (pansexual, bisexual and gay or lesbian) are more likely to have experienced sexual harassment than heterosexual people, both in a university context and in the community. Gender diverse people are more likely to experience acts of physical violence.

Women from diverse cultural and religious backgrounds and gender diverse people are more likely to encounter acts of verbal or physical assault in public places. These contribute to perceived vulnerability and can lead to them avoiding public spaces or not feeling welcomed when they do use these places. In one article on queerness in public space[2], the author notes the social perception that "when groups of people of colour enjoy public space it is perceived as loitering, when they are queer it's perverted but when they are white and/or cis-normative it's site activation."

This raises important considerations for inclusion in public space and how spaces are designed and activated to represent different cultures and backgrounds. WSP partnered with the Helen Clark Foundation in 2022 to explore safe city design, published in the paper *Safer Cities by Design: how urban form can lead to safer and more vibrant city centres in Aotearoa New Zealand*[3]. The paper considers how different societal groups modify and limit their use of public space and provides recommendations to update CPTED to ensure a more contemporary approach to safer city design.

In particular, this paper discusses the experience of Māori people and how representing **culture in public places** reinforces welcome and inclusion and a sense of belonging. In Australia, cultural safety in public spaces requires strong engagement and codesign with Traditional Owners so that living culture is celebrated and present in various ways through our communities.

Living with a disability was acknowledged as an additional barrier that some women may face when using public spaces. In the National Student Survey, 2021 (Respect now, always[4]), students with a disability were more likely to have experienced sexual harassment than other students in the university context. When public spaces do not provide adequate accessibility, people with disability are forced to negotiate inaccessible routes or not use public spaces at all. At the very least, this contributes to people living with disability as invisible in the community and at worst can increase vulnerability to harassment and violence people do use public space.

5.1.3 Actions and initiatives

The actions and initiatives identified through the literature review can be grouped into three main categories for holistic physical and cultural change to prevent sexual harassment and increase perceived and actual safety for women and gender diverse people in public places:

2 The infinite value of Queerness in public space - Parlour
3 HCF_WSPNZ-Safer-Cities-By-Design-LR.pdf (helenclark.foundation)
4 Respect. Now. Always. – Universities Australia

KEY AREAS OF FOCUS TO IMPROVE SAFETY

1. Infrastructure upgrades and maintenance
2. Public education and awareness
3. Co-design and activation

Infrastructure upgrades and maintenance

It is critical that public assets and infrastructure are maintained and upgraded for their intended use. Regular audits and appropriate funding of infrastructure maintenance can ensure appropriate levels of lighting, safe green spaces and public amenities.

Additionally, new and emerging approaches to public space design using contemporary and gender focused applications of CPTED will provide a public space that is inclusive and welcoming for a wide range of communities.

Public education and awareness

A lack of bystander intervention increases the vulnerability for women and gender diverse people who feel they cannot rely on members of the public to intervene when they are at risk.

Public education and campaigns around 'bystander support' promoted on public transport and in public places can help other commuters and pedestrians feel empowered to intervene safely when witnessing harassment.

Primary prevention and initiatives to drive behaviour change will create a culture where everyone feels safe and supported in public spaces. The Gender Sensitive Communication Toolkit (TramLab and Victorian Government[5]), recommends campaigns that appeal to men as allies, in contrast to representing males as perpetrators of violence. This approach can help men consider themselves an essential part of the solution.

Gender sensitive training for public transport employees and others who work in the public realm will create more positive influences and active bystanders. The Gender Sensitive Data Toolkit (TramLab and Victorian Government[6]), notes that training and support for staff, which is perceived as male dominated can help improve public transport culture and guide staff to respond appropriately and on time to reports of sexual harassment and violence in public places.

Co-design and activation

Working with women and gender diverse people in the design phase of new public spaces can help identify issues and invite co-designed solutions. However, this approach can also be leveraged through audits and during projects upgrades.

Co-design processes can apply a gender lens to CPTED so that the experience of women and gender diverse people is considered when planning the features that make a safe space. The Safer Cities by Design (WSP and Helen Clark Foundation) paper notes that collaboration and diverse perspectives can result in tools that identify bias and counter inequity. Used alongside, or incorporated into CPTED, these new tools can ensure that the design goes beyond standard solutions, e.g., lighting and sightlines and offers a more nuanced approach that leads to innovative solutions.

Positive public activity inclusive of diverse communities reinforces the reality that all people are welcome in public spaces at all times of the day and night. By activating spaces with welcoming and inclusive events and programs that do not preference a dominant culture and instead celebrates community and cultural identity, we can create opportunities for shared ownership of public spaces. This can include cultural events, public artwork that represents different community groups, and retail and business offerings that bring a diverse range of people into an area.

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5 211027_Toolkit_Comms-Campaign.pdf (monash.edu)

6 211027_Toolkit_Data.pdf (monash.edu)

5.1.4 Key learnings from the literature review

1. Many women and gender diverse people do not feel safe in public spaces or using public transport, particularly at night. They will often change their behaviour or movements to avoid being in certain spaces at certain times.
2. Queer people, culturally and spiritually diverse women, women living with disability and women from lower socio-economic backgrounds are at greater risk of safety issues and have less resources to change their behaviour to enhance their safety.
3. Traditional CPTED methods have limitations and do not use a gender lens to respond to public safety issues. A more contemporary approach is needed.
4. Cultural change and public education are critical to change attitudes to women and address gender inequality which are drivers of sexual harassment and violence against women.
5. Co-design is a critical approach for policymakers and service providers to adopt, to ensure more inclusive and safer public spaces and services.

5.2 Reported crime data

Rates of crime in an area can influence people's perceived and actual safety in public spaces. The NSW Bureau of Crime Statistics and Research (BOCSAR) publishes data by suburb (year to December 2022) on the rate of individual offences per 100,000 population, based on incidents reported to NSW Police. Crime rates for Macquarie Park are outlined in the following table and shown in comparison with those for the Ryde Local Government Area (LGA) and NSW.

Table 5.1 Rates of offences per 100,000 people in Macquarie Park, Ryde Local Government Area and NSW

Offence type	Macquarie Park	Ryde LGA	NSW
Assault	509.2	386.3	818.1
Homicide	0	0	1
Robbery	12.5	47.1	22.4
Sexual offences	150.9	84.1	185.9
Theft	3866.1	1364.7	2167.7
Damage to property	641.2	277.3	592.5
Against justice procedures	198	875.5	1035.2
Disorderly conduct	75.4	65.4	221.5
Drug offences	227.4	330	536.4
Prostitution offences	0	0	0.3
More offences	0	0	0.3

Source: Crime Maps | BOCSAR (nsw.gov.au)

The BOCSAR data shows that when compared to the broader LGA, Macquarie Park had higher rates of assault, sexual offences and disorderly conduct. There were also considerably higher rates of theft and damage to property in Macquarie Park, compared with the LGA and NSW.

The representative of NSW Police – Ryde Area Command, commented that often instances of violence against women are not reported to police, so offenders are unknown, and these issues are unable to be addressed. They commented that many reported incidents are related to mental health episodes, and some require assistance from NSW Ambulance and mental health support workers.

The identified under reporting of sexual assault is consistent with findings from the literature review. Further to this, as *sexual harassment* is not regarded as a crime, it is not reflected in the reported crime statistics.

5.3 Key stakeholder interview findings

Interviews were conducted with key stakeholders who operate in the Macquarie Park Precinct and their input was used to inform the study approach, audit tool and this report.

The following organisations provided input into the Women's Safety Audit study.:

- Macquarie University
- NSW Police – Ryde Area Command
- Transport for NSW – Partnerships and Research
- City of Ryde
- Connect MPID (Macquarie Park Innovation District).

Each interview discussion covered the following areas of focus below.

5.3.1 Identified safety issues

Stakeholders were asked about safety related issues in Macquarie Park, particularly as they relate to women, girls and gender diverse people.

Isolation emerged as a significant issue, particularly at night and as people get further away from Macquarie University and Macquarie Centre. The higher concentration of commercial buildings in the precinct results in less activation outside work hours.

The City of Ryde noted that Macquarie Park has traditionally attracted '**drive in, drive out' workers**, so there is less opportunity to see people walking on streets to and from work. Recently, there has been some mode shift with the delivery of Metro stations which may increase pedestrian activity.

NSW Police noted some areas of Macquarie Park that are isolated and **intimidating**, including Shrimpton's Creek, which runs off Waterloo Road through to Epping Road, Cottonwood Crescent and Lachlan Avenue which both run parallel to the creek. The creek was also noted as a location with lower perceived safety by other stakeholders. These areas are **not well lit** and have **low pedestrian activity**, even though it is highly residential.

Macquarie University noted that the north-western part of the campus hosts the main student accommodation providers and there is anecdotal information at that **end of Waterloo Road and the campus is dark**, with lots of bushland. The University is proactive in providing security, lighting, CCTV and help points, but once people exit the campus into public space there may be less surveillance.

A particular concern raised by Macquarie University and NSW Police was the **role of alcohol** and related anti-social behaviour on perceptions of safety. Currently, the only licensed premises are the Uni Bar and the Ranch Hotel further down on Epping Road and police note patrons of these premises are generally well-behaved. Future development of the precinct may develop a night-time economy and a bar culture that will change the culture in the area. This could have benefits to the precinct in that it may encourage more activation, although the potential for alcohol related issues also increases.

Existing public and social infrastructure has contributed to perceived or actual safety issues. For example, Connect MPID noted that though the **pedestrian barriers** between the road footpath on Waterloo Road are designed to improve road safety, they detract from individual feelings of safety. It creates a **feeling of entrapment**, that a person cannot quickly run to the other side of the road if confronted by someone.

The **presence of large trees** in the area provides welcome shade and green canopy during the day but contributes to an extra feeling of darkness and **hiding spots at night**. Connect MPID also commented that

Macquarie Park showed some signs of 'broken windows theory', i.e. that visible signs of crime or antisocial behaviour, or lack of infrastructure maintenance contribute to further negative perceptions of safety. **Poorly maintained footpaths, lighting and inaccessible buildings** do not encourage activation or positive use of public space. Along the commercial section of Waterloo Road, many of the setbacks are privately owned and feature **high fences or hedges**. This reduces sightlines and creates more opportunities for concealment.

5.3.2 Vulnerable populations

To acknowledge the mix of communities that live, visit and work in Macquarie Park, stakeholders were asked to identify vulnerable cohorts in the precinct.

International students were cited as a particularly vulnerable group, due to experiences of racism and as they may not be aware of certain elements of living in Australia including how to safely navigate public transport and use public facilities such as parks and public toilets. Knowledge around consent and sexual laws and how to contact police is also a factor that increases international students' vulnerability.

NSW Police also noted the vulnerability of students in general, particularly **female students** and discussed students' mental health. This could be due to a number of circumstances, not just those relating after dark safety or transport use. Police have responded to several incidents related to the mental health of students who live in student housing, are away from family and can be isolated. Police now attend these incidents with a mental health worker; however, they do sometimes result in involuntary admission to hospital.

The City of Ryde acknowledged that the development of Ivanhoe Estate to the east of Waterloo Rd, will return social housing to the area, along with affordable housing. Local social housing may bring in new vulnerable populations to the area. Proposed new primary schools in the precinct will increase the number of **children and young families** that also have unique safety requirements.

5.3.3 Public transport use by women and girls

While stakeholders acknowledged they have not consulted any evidence on the use of public transport by women and girls in Macquarie Park, many provided anecdotal information that suggested accessing and using public transport was an issue.

One factor cited by Connect MPID was that the Covid-19 pandemic changed the way people viewed public transport in terms of **public health** and the choices they made regarding their mode of transport. When reviewing public transport use by women and girls, it would be useful to determine whether use has returned to pre-pandemic levels.

The original design of the Macquarie Park commercial and retail precincts encourages **car usage** to and from the precinct. The university, shopping centre and many commercial office buildings provide adequate parking that makes driving a relatively easy option. Another factor cited for disincentivising use of the Metro line was the requirement to **transfer at Chatswood Train Station** to travel to the city. As the Metro is expanded, however, this may encourage more public transport use into and out of Macquarie Park.

Connect MPID discussed the **'last mile' experience** and suggested that the trip from public transport stops to home is where people may feel most vulnerable. Lack of lighting and active street frontages can contribute to lower perceptions of safety for people making this trip from bus and metro stations into residential areas.

The City of Ryde discussed ongoing issues with **unsafe crossing points** and a lack of crossing points across Waterloo Road. This impacts the ability of people to access bus stops safely and quickly on either side of the road and may influence decisions around the use of buses for commuting.

5.3.4 Precinct coordination and initiatives in Macquarie Park

Stakeholders identified some local safety response initiatives that were in planning or delivery phases.

Macquarie University provides shuttle buses and escorts for students to the accommodation provided by the university. They actively encourage private accommodation providers to have their own strategies to ensure student safety. The City of Ryde works with Macquarie University and NSW Police on road safety initiatives around the university.

From an operational perspective, NSW Police works with TfNSW to get live reports of incidents on or around the Metro so that a response is provided in real time. Precinct-level CCTV is used to support the response to an incident rather than intervene in real time as an incident is occurring.

Connect MPID understands that there are initiatives led by community members during 16 days of Activism against Gender-based Violence, and annual, global campaign highlighting the prevalence of violence against women. A student union group at Macquarie University often lead initiatives on women's safety for students on campus.

Connect MPID has also noted that much of the current discussion has been informed by how the Macquarie Park Precinct is currently designed and operating. The Macquarie Park Place Strategy[7], led by the Greater Cities Commission and the NSW Department of Planning and Environment presents an opportunity for these identified safety concerns to be considered during planning and design of the precinct. The strategy initiatives are expected to change how people commute to and from the precinct, how public space is designed and used and will improve the perceptions of safety for women, girls, and gender diverse people. The Strategy will bring 20,000 new workers to the precinct, see the development of up to 7,650 new homes and new public open space. Stakeholders recommended that infrastructure being designed and delivered now should consider the residents, employees and visitors to the future precinct.

Interviews highlighted an understanding of the value of collaboration and coordination among Macquarie Park stakeholders for better outcomes. The recent participatory approach by the State Government for Macquarie Park planning was encouraging and stakeholders would like to see this continue.

5.3.5 Key learnings from the stakeholder interviews

1. Isolation is a significant issue, particularly at night and as people get further away from the university and shopping centre.
2. The Shrimpton's Creek area is intimidating and contributes to lower perceived safety.
3. Pedestrian barriers along Waterloo Road detract from individua feelings of safety.
4. Students, particularly International students were identified as a vulnerable population in Macquarie Park.
5. Accessing and using public transport in Macquarie Park is an issue for women and girls due to public health, the current limitations of the Metro line, and barriers to getting to and from public transport stops.
6. Greater precinct coordination could contribute to a more streamlined and positive experience for Macquarie Park residents, workers, students and visitors.

5.4 Findings from night walk and interviews with women and girls

Night walk participants met at 6 pm at the Macquarie University Metro Station and split into two groups, each led by a WSP project team member.

The night walk route is shown in Figure 5.4. Group One audited stops one, four, five, and six. While Group Two audited stops two, three, seven and nine.

Both groups met at the finish point at Macquarie Park Metro station at 7.15 pm for a debrief.

Stop eight was not assessed in order to keep time. The number of stops originally planned was ambitious for the scheduled duration for the night walk and audit. In addition, the initial route plan did not consider the need for

[7] Macquarie Park | Planning (nsw.gov.au)

additional time that was required to support participation by an individual with disability in Group Two to complete the route.

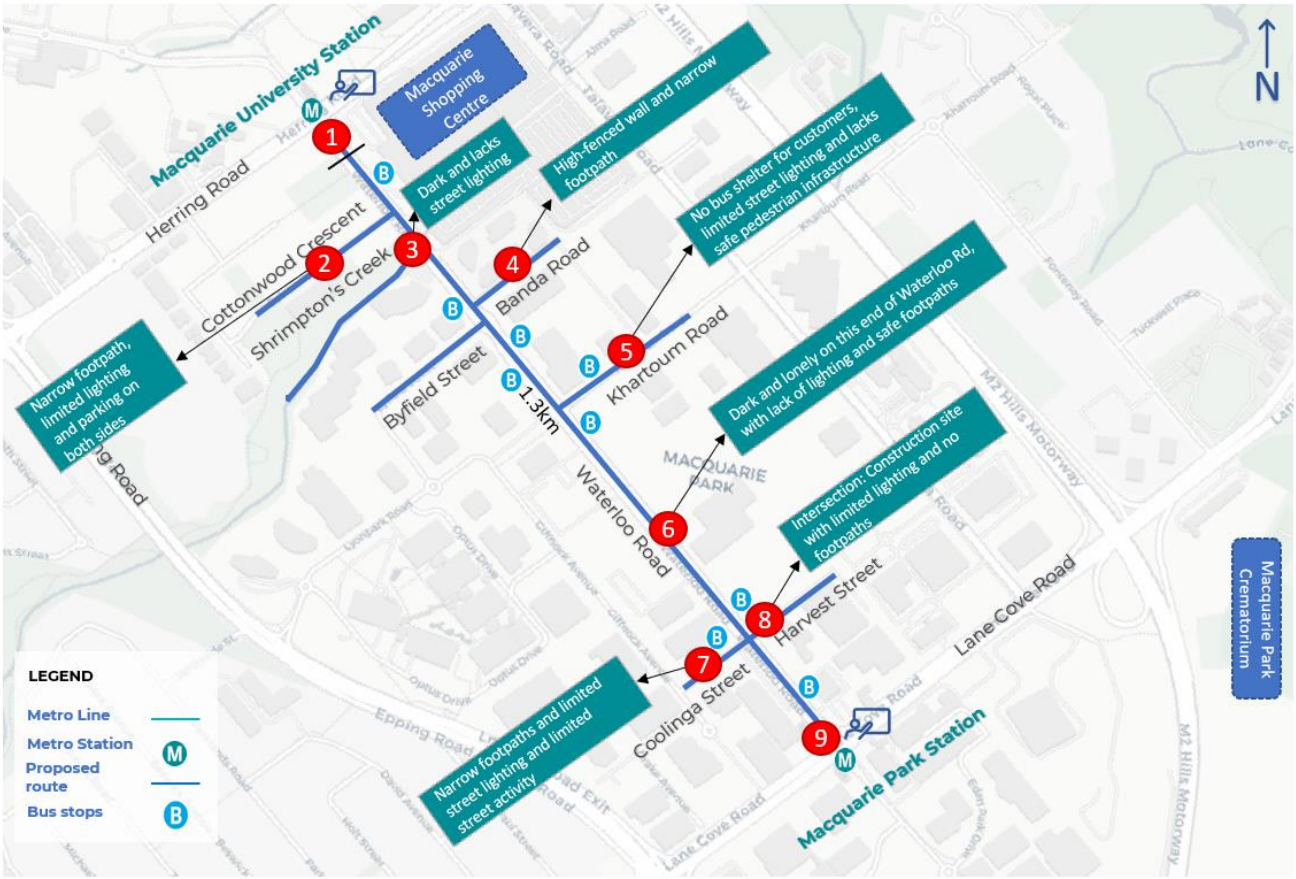

Figure 5.4 Women's Safety Audit night walk route (stops 1-9)

5.4.1 Overall perceptions of safety

Overall perceptions of safety for each of the Women's Safety Audit stops are shown in Table 5.4.

Audit data has been collated, showing participant responses to the question, 'How safe do you feel at this location?'. A sample of participant comments reiterates key findings.

Table 5.4 Women's Safety Audit – Overall perceptions of safety at each audit stop

Stop number	How safe do you feel in this location?	Comments from participants
1. Macquarie University Metro Station (lower ground, outside station barriers)	**All six participants felt safe or very safe at this location.**	— It's okay now, but late at night when there's no people around, it wouldn't feel safe. — You don't really know what will happen when you press the [help point] button. I want to know if it's connected to a person, and whether they're far away. — The help point isn't very visible [only one group member noticed it]. The blue colour blends in with the other colours in the station. Make it hot pink or bright orange, so that people see it. — Also, you have to understand English to know what it is. Rather than marking it with an 'i' for information, why not use a [more universally recognised symbol]! — It's not helpful for me that there's CCTV because it's post the fact. It wouldn't help me if something were to happen. — [A Metro announcement was made that frequency of metro services would be reduced from 9pm. The group was asked what they thought about this]. If it was a less frequent service and there were sketchy people around me, it would make me feel unsafe. But either way, I would just have to wait as I don't have an alternative form of transport.
2. Cottonwood Crescent	**Responses at this location were mixed.** One participant felt unsafe.	— You know the road isn't far, you can hear it, so don't feel too unsafe right now, but if I was alone I wouldn't like to have to walk this street. — Vegetation and lighting doesn't work, it's not well lit.

Stop number	How safe do you feel in this location?	Comments from participants
	Two participants felt neither safe nor unsafe. Two participants felt safe or very safe.	— Poor reputation of the area since childhood. Won't be coming to this street unless someone to see.
3. Shrimptons Creek	**All five participants felt unsafe or very unsafe at this location.**	— No one would come back here unless they had to. — You are 'going into the darkness', there's zero lighting, completely uncertain where you are going. — There are apartment buildings right along so you can hope that if you scream, someone can hear you. — *One participant noted that she lives down on the corner, so she knows the area well, and would probably feel safer using the path. She also mentioned there is construction activity down the path, so it's even more difficult to access.*
4. Banda Road	**Four participants felt safe,** and another two felt neither safe nor unsafe, at this location. Although, participants reported specific elements and that at different times, that would contribute to feeling unsafe.	— The crossing [just before Banda Road] feels really dangerous. You have to turn and look right over your shoulder to see whether someone is coming, and cars usually approach fast here. — The bus stop has lighting, but it's not working, which makes me feel unsafe. — [Outside Macquarie Centre] At night when the shops close, you wouldn't come here. — It's well-lit here, but on my own I would feel concerned, because it feels so isolated. There's not much action. — I feel okay because it's all residential [in the adjacent building, with balconies overlooking the street]. If I scream someone would hear me. — But I'd be curious to know who would come. I don't think people want to get involved these days. I don't think anyone would help.

Stop number	How safe do you feel in this location?	Comments from participants
		— There are a lot of empty offices [at street level], due to the time of night. There's no CCTV around. It doesn't feel safe. I would never walk this way at night. The nearest Police station is in Eastwood, so quite a way. — If I had the money to put my safety first, if coming this way at night, I'd be in a taxi. — [Re fenced area] You want a hole [gap] in the fence, so you can get away immediately. — *Observation that the participant using a walking cane had to walk a long distance (approximately 50m) to find a bench to sit down and have a break from walking*
5. Khartoum Road	**Responses at this location were mixed.** Three participants felt safe. Two participants felt unsafe. One felt neither safe nor unsafe.	— There is a lack of seating in the public domain. — *Observation: one participant thought the 'No racism' sign was put up because people in the area had been racist.* — There are lots of fences around [i.e. on all four corners of the street/prohibiting easy crossing]. I feel like they're good because someone can't drag you off the footpath into a car. But they're also bad, because you can't get away if someone is harassing you on the street. — This roundabout is always really busy. You can see the evidence of a car crash [i.e. a dent in the fencing on facing street corners], which doesn't make you feel like this is a safe place to walk. — The fences [on facing street corners] don't look good and make it really inconvenient for pedestrians to cross the street. — The area [approximately 10 metres back from Waterloo Road] where people are supposed to cross isn't obvious. It's not clearly marked for either pedestrians or for drivers. — There's not a lot of light in this location.

Stop number	How safe do you feel in this location?	Comments from participants
		— The huge number of footpath markings on this part of the Khartoum Road are confusing and don't make it pedestrian friendly. Also the fact that it's a shared path just adds another layer of safety hazard for people walking here at night.
6. Waterloo Road, commercial area	**Responses at this location were mixed.** Two participants felt unsafe. Two felt neither safe nor unsafe. One participant felt safe.	— There are lots of trip hazards in this location — It's a bit daunting to walk past the college with lots of bushes fronting the footpath, and no lighting. It would be good if the bushes were cut back and there was lighting in the bushes. — As it is, you can't see if someone is hiding in the bushes. — It's nice that the median strip is 'open', not like the earlier stretch of Waterloo Road where you couldn't easily cross the road to get away. You could break away and get across the centre island if you needed to. — I also feel it would be better to be able to cross the road, which I sometimes do if I need to get away from someone who is behaving strangely. The traffic moves so fast along Waterloo Road, and it's noisy. I don't think a driver would see you or notice if something were to happen to you here. And they're moving too fast to stop. — It's really loud here. Even if you screamed for help no one would see or hear you. — I feel like when there are businesses around [as there are here], rather than pubs and drinking venues, it's safer. It's a boring area which is good. — Several of the street lights are out [not working]. — There's a restaurant in the Excelsior College which makes me feel safer – to know that there are people around. — The College carpark is not well lit, so it doesn't feel safe to walk past. — [Young woman] It looks like there's a person at the front desk of the college which is good, makes me feel safer.

Stop number	How safe do you feel in this location?	Comments from participants
		— There's no help points or Police around in this whole strip that we've walked.
7. Coolinga Street	**Responses at this location were mixed.** Two participants felt unsafe. Two felt neither safe nor unsafe. One participant felt very safe.	— Lots of construction and you're not sure where to walk. — It's very quiet. — *Observation that the area has really poor maintenance. Footpaths, walls and fences in bad condition.* — *One student felt that the Macquarie University building made them feel safer as it is recognisable, but unsure how to get in – perhaps there needs to be a bell.*
9. Macquarie Park Metro Station	**All five participants felt safe or very safe at this location.**	— Inside the metro station, feeling OK. Don't like the escalators, they are very steep, and I'm always worried I'll fall. — There's no guard around. — Very quiet after office hours, only a couple of people using the station. Macquarie University station is much busier.

5.4.2 Location-specific safety observations

At each stop along the night walk, participants were asked to rate their perceptions of safety. The night walk audit tool invited participants to consider a range of elements of public space. .

Participants used the tool to indicate whether or not the element was present, and to rate their feelings of safety.

During the follow up interviews, participants were asked to consider and further expand on their responses, and to also provide feedback on the audit tool and process of participating in the night walk.

An analysis of data collected through the Women's Safety Audit is presented below. The analysis discusses feedback on each stop and the key elements that contributed to that location as feeling safe or unsafe. Commentary provided during the night walk and follow up interviews is also presented.

*5.4.2.1 **Stop one:** Macquarie University Metro Station*

Overall, respondents felt relatively safe around Macquarie University Metro Station and the majority indicated they would continue to feel safe if they were alone or accompanied. Some of the key features of the built environment that contributed to feelings of safety in this location were:

- open sightlines
- ease of navigation
- wayfinding.

The aspect of the built environment rated as least safe was public toilets, with over half of all participants indicating that the presence of public toilets made them feel unsafe or very unsafe.

> "The Metro station and public toilets make me feel uncomfortable."

The condition and maintenance of stop one was rated highly, with respondents indicating that buildings and infrastructure were in good condition and the level of noise was appropriate for the time of day.

All respondents indicated that the level of lighting made them feel safe or very safe and the presence of CCTV cameras contributed to their feelings of safety. Respondents noted that security guards were not present and more than half indicated that this made them feel unsafe.

> "Security cameras are great, but there's no visible security guard, so having a CCTV camera doesn't mean someone can help me in real time."

When asked if there were 'barriers or other things that could stop me getting away easily from this location', one participant reported that the escalators were not working, which made it difficult to exit the station. This contributed to the participant feeling very unsafe. Very steep escalators in the station were also identified as a safety concern.

In terms of activity levels, participants reported that the presence of people at this location made them feel safe. However, only half indicated that they people could act as a positive bystander if they witnessed harassment or an incident. The presence of retail and commercial activity in this location also contributed to feelings of safety.

5.4.2.2 ***Stop two:*** *Cottonwood Crescent*

Night walk participants' overall perceptions of safety at this location were mixed, with two indicating they felt safe, two neutral and one who felt unsafe. Just over half of all respondents indicated they would not feel safe walking alone in this location, while most reported that they would feel safe if accompanied.

"There are residents walking down the road from time to time. It's good to know there are people around using this road and it's not deserted".

Almost all participants reported:

- Buildings and infrastructure were not in good condition and this made them feel unsafe.
- Walking paths were not in good condition, contributing to them to feeling unsafe, or neither safe or unsafe.
- Trip or fall hazards at stop two made them feel unsafe or very unsafe.
- Lighting was not present and this made them feel unsafe. Those who identified the presence of lighting commented that lights were spaced too far apart and levels of lighting were not adequate.
- A lack of safe crossing points at this location contributed to participants feeling unsafe, as did the lack of CCTV.

Participants expressed mixed views on the following elements:

Sightlines, footpaths, navigation and separation from vehicles:

- Lack of signage indicating where the road leads, or location of the nearest bus stop
- Low levels of lighting impacted participants' ability to understand the condition of footpaths in this location.

Condition of landscaping and trees:

- More people disagreed that these elements were easy to see around and did not provide hiding places.
- One respondent commented that landscaping and trees "give out creepy vibes at night".

All participants agreed that:

- There was no presence of loitering, anti-social behaviour or intoxicated people which contributed to their feelings of safety.
- Activity levels in general were low around stop two, although were mixed on whether that contributes to feelings of safety.

5.4.2.3 ***Stop three:*** *Shrimptons Creek*

Shrimptons Creek was identified as the *stop that felt least safe* along the Women's Safety Audit walking route. All respondents indicated that they felt unsafe or very unsafe at this location. All indicated that they would not feel safe walking in this location alone at night, and only half said they would feel safe walking accompanied at night.

"There are apartment buildings right along here, so you hope that if you scream, someone can hear you."

All participants commented on the following features at Shrimptons Creek:

- Footpaths are present but are very uneven and could not be clearly seen without a torch, due to lack of lighting.
- Ease of navigation and wayfinding was not present at this location, making all respondents feel unsafe or very unsafe. One respondent commented that not knowing where the road led to made them feel very unsafe.
- Public art was not present in the area and this made participants feel unsafe or neither safe or unsafe.
- A nearby park contributed to feeling unsafe or very unsafe. One person commented that it was closed off and that they were unable to tell that it was actually a park.
- Landscaping and trees were not in good condition and respondents disagreed that they were easy to see around and did not provide hiding places. This contributed to all participants feeling unsafe or very unsafe.
- No security features such as presence of police, security officers or CCTV not present, and when combined with the other elements made all respondents feel unsafe.
- The presence of barriers or other things could stop participants from getting away easily from the location. One participant reported that there was only one way out which contributed to a sense of entrapment.
- Loitering, intoxicated people or concerning behaviour were not present and helped them to feel safe, the absence of people and positive behaviours contributed to feeling unsafe.

Most participants reported the following observations:

- Sightlines were not present and all respondents indicated that their inability to clearly see the space around them made them feel unsafe.
- There was no indication of the nearest public transport stop, and not having a stop nearby made most respondents feel unsafe.
- Buildings and infrastructure were not in good condition, including walking paths, cycle paths and spaces such as parks and plazas. This contributed overwhelmingly to respondents feeling unsafe or very unsafe, and in a couple of instances neither safe or unsafe.
- Trip or fall hazards were present and all participants rated this element as unsafe or very unsafe.
- That there was no one who could act as a positive bystander and there was a lack of atmosphere, families, older people and dog walkers in the area

Mixed views were expressed in relation to:

- The presence of walls or fences, with one participant commenting that these made them feel trapped and unsafe, while others indicated feeling safe due to fences separating the neighbourhood residences.

5.4.2.4 ***Stop four:*** *Banda Road*

"I don't think people want to get involved these days. I don't think anyone would help."

Four participants indicated they felt safe at Banda Road, and another two reported that they felt neither safe nor unsafe in this location. All participants reported that they would feel safe accompanied at night, while only two would feel safe at night walking alone. One participant commented that the quiet nature of this location contributed to their perceived lack of safety. By contrast another felt safe in this location due to it being a residential area, providing a sense that there are people around. Another participant commented that the area felt isolated, due to the low level of pedestrian activity. They felt that the people who were around would not help if they were in danger.

All participants indicated that:

- Sightlines were present and made them feel safe
- Footpaths and walkways were present, but one indicated it made them feel unsafe
- That separation from the roadway and vehicles was present, which made the majority feel safe.
- Buildings and infrastructure were in good condition, although mostly did not make people feel safe or unsafe
- Walking paths were in good condition which made them feel safe
- Lighting was present and made people feel safe
- There were no security features such as police, security guards or CCTV which made most people feel unsafe.

Most participants indicated that:

- Landscaping and trees were in good condition, although there were mixed responses as to whether that made them feel safe or unsafe and that the trees were easy to see around and did not provide places to hide.
- The high speed of vehicles in the area made them feel unsafe
- There were no people present who could act as positive bystanders, and this made participants feel unsafe. Other activity levels were low, however, there were mixed responses as to whether this made people feel safe or unsafe.

5.4.2.5 ***Stop five:*** *Khartoum Road*

Khartoum Road attracted mixed responses in terms of participants' overall perceptions of safety. Two participants reported feeling unsafe at this location, one felt neither safe nor unsafe and three felt safe. Only two participants indicated that they would feel safe walking in the area alone, while three said they would feel unsafe and one was unsure. Four participants reported that they would feel safe accompanied by another person in this location, while another two said they would feel unsafe unaccompanied that this location.

"The fences [on facing street corners] don't look good and make it really inconvenient for pedestrians to cross the street."

When reviewing the elements of the space and their impacts on safety, all participants indicated that:

- Walls or fences were present, and that made most people feel unsafe. One respondent indicated that the barrier between the footpath and road made them feel safe because it protected them from the cars, but unsafe because there was only one way to run if being chased.
- There was no presence of public art, and that made people feel either unsafe to neither safe or unsafe.
- There was no activity or other people in the area, and this prompted a mixed response as to whether it made people feel safe.

Most participants indicated that:

- Sightlines were present. For two participants this made them feel unsafe, while another two did not feel safe or unsafe. Two participants indicated that the lighting was poor.
- There were no safe crossing points for pedestrians and for some this made them feel unsafe.
- The buildings and infrastructure were regarded as being in good condition, which made people feel safe or neither safe or unsafe.
- They disagreed that landscaping and trees were easy to see around and did not provide places to hide. For most people, this contributed to feeling unsafe.
- That there were barriers that stop them from getting away easily.

5.4.2.6 ***Stop six:*** *Waterloo Road commercial area*

Stop six, in the commercial area of Waterloo Road, was audited by the Project Working Group participants who reported on their overall perceptions of safety in this location. Participant responses were mixed. Two Working Group members felt unsafe, two felt neither safe nor unsafe and one felt safe. Three participants indicated they would feel safe walking alone at night, while two said they would feel unsafe. Only one participant indicated they would feel unsafe walking in the area accompanied.

Comments from Working Group members on the Waterloo Road commercial area included:

"Lots of traffic, but not many people."

"Poor lighting and lack of passive surveillance."

"There is a construction site, and the footpath is rocky, uneven and not very wide."

"You can't see if someone is hiding in the bushes."

"There's a restaurant in the Excelsior College which makes me feel safer – to know that there are people around."

5.4.2.7 ***Stop seven:*** *Coolinga Street*

Most participants felt either unsafe, or neither safe nor unsafe at the Coolinga Street stop. Only one participant indicated that they felt safe in this location. Two participants reported that they would feel safe walking alone at night, while two others indicated they would not. One was unsure. Four participants reported that they would feel safe walking accompanied in the area and one was unsure.

All participants agreed that:

- sightlines were present and this made them feel safe, including the visibility around landscaping and trees.
- The level of noise was appropriate for the time of day and this made people feel safe.
- Lighting was present and most people felt safe, although most commented that the lights were a low yellow colour and not very bright.
- There was no concerning behaviour, loitering or intoxicated people which made people feel safe.

Most participants indicated that:

- Buildings and infrastructure were in good condition and this made them feel safe.
- There were barriers present that could stop them from getting away easily.
- There were no positive bystanders or a presence of families, older people and dog walkers and this contributed to feeling unsafe.

All participants agreed that:

- sightlines were present and this made them feel safe, including the visibility around landscaping and trees.
- The level of noise was appropriate for the time of day and this made people feel safe.
- Lighting was present and most people felt safe, although most commented that the lights were a low yellow colour and not very bright.
- There was no concerning behaviour, loitering or intoxicated people which made people feel safe.

5.4.2.8 ***Stop nine:*** *Macquarie Park Metro Station*

Stop eight was the last stop on the audit route at Macquarie Park Metro Station. This stop was rated the safest with all respondents indicating they felt safe. One participant indicated that they would not feel safe walking alone and one was unsure. All participants indicated they would feel safe walking accompanied at this stop.

"You don't really know what will happen when you press the [help point] button. I want to know if it's connected to a person, and whether they're far away."

The elements at Macquarie Park Metro Station that all participants agreed on were:

- Sightlines and lighting were good and contributed to feeling safe
- Footpaths and walkways were present and in good condition and made people feel safe
- Public art was not present but did not impact on feeling unsafe
- CCTV was present and made most respondents feel safe
- There was no concerning behaviour, loitering or intoxicated people and this made respondents feel safe.

Most participants indicated that:

- Wayfinding was present and easy to navigate, making them feel safe
- Public toilets were present but did not impact on feeling unsafe
- There was no public seating, but this would be helpful in the Metro station
- Buildings, infrastructure and walking paths were in good condition
- Activity levels from the presence of other people and events were not high, but that only impacted on two people feeling unsafe.

5.4.3 Follow up interview findings

All Women's Safety Audit night walk participants also took part in a one-on-one interview during the week following the night walk, to further explore their experiences of the night walk and Macquarie Park more broadly, and their use of public transport. They were also asked about the top three changes they would like to see in the Macquarie Park area and on or around the Macquarie University and Macquarie Park Metro Stations. The interview discussion guide is provided in Appendix B.

5.4.3.1 Perceptions of safety in Macquarie Park

Participants felt least safe waiting for public transport in the Macquarie Park area after dark, as shown in Figure 5.5. This was followed by using public transport alone after dark and walking alone in the Macquarie Park area after dark.

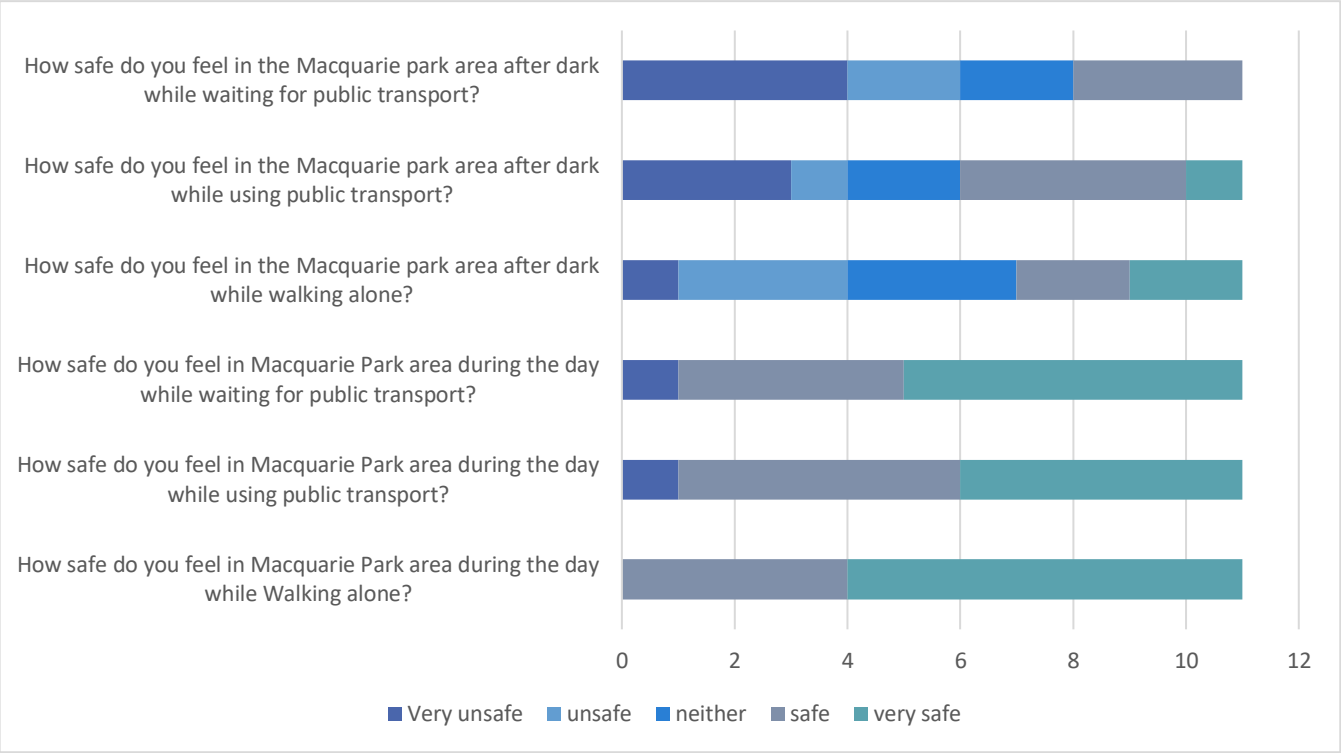

Figure 5.5 Participant perceptions of safety responses in Macquarie Park

Feelings of safety in Macquarie Park were higher during the day and lower at night. Participants reported that their familiarity with the area enhanced their feelings of safety, as residents or regular visitors to the area. Their experiences were mostly positive.

> "I find it faster to use public transport than I do driving and having to navigate Sydney traffic. When you're on the train you can also focus on other things."

However, one young woman commented on a series of negative experiences using public transport during the day, which had influenced her future travel choices toward private vehicle use.

> "In the past week I've been harassed four times on public transport. Luckily there were some nice girls on the train who I could sit with, to get away from one guy. I'm doing my driver's test on the weekend and buying a car. I'm going to be broke, but at least I won't have to be asked out by weirdos anymore."

More than half of all participants reported that they did not feel safe waiting for public transport in Macquarie Park after dark. That is, more than the number who indicated they felt unsafe while using public transport and while walking alone. One participant commented that while they were waiting for public transport or using a train or bus, they felt more vulnerable than walking – likening it to being a "sitting duck." Even among those participants who reported feeling safe at night, some noted that their feelings were dependent on the time of night, and that after 9 pm they would feel less safe.

> "It all depends on *what time of night* it is. For example, between 6-9pm is fine, but after that I wouldn't feel great because the buses aren't frequent. They only run on the hour."

The lack of security around at night was cited as a factor that contributed to participants feeling unsafe at the Metro stations and bus stops. Around Macquarie Park, participants commented on the lack of lighting, low light levels and feelings of isolation, particularly as they walked through the commercial area in the direction of Macquarie Park Metro station.

Participants were also asked about their current behaviours in relation to public transport use and safety, and whether their use of public transport would change if safety measures were in place.

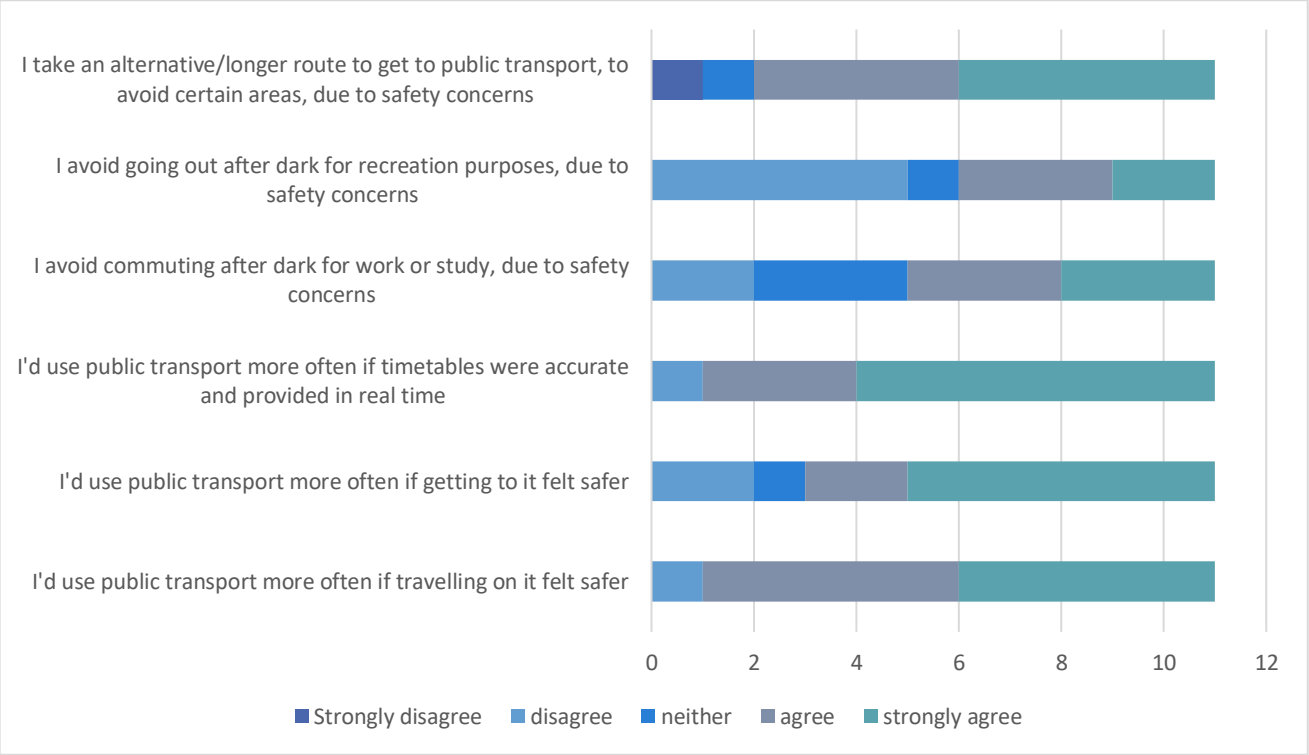

Figure 5.6 Current and likely participant behaviour in relation to perceptions of safety

When considering their current behaviours, more than half of all participants indicated that they avoid commuting after dark for work or study due to safety concerns. Fewer people were likely to avoid going out after dark for recreation, while some reported that they would change their behaviour if they did. For example, not using their ear buds or not staying out beyond a particular time.

> "I try to leave uni before it gets dark because the lighting isn't the best. The way I walk home there is no lighting, so it's quite nerve wracking. I do feel quite nervous when I catch the bus home, as you can't really see the stops. It would make sense if the bus had lighting on the outside so that people on the bus could see out more clearly."

Among those participants who commuted for work after dark, some mentioned that it was their work policy to get a taxi home. Others reported that they would pay for the taxi themselves, even though this was more costly than using public transport. The frequency and reliability of public transport outside peak times was also an issue that impacted travel patterns, with women and girls commenting that some bus services just don't arrive.

"For recreation after dark – depending on where I go, I might drive for reliability and safety. Friday and Saturday night if I'm staying out late, I'd prefer to drive, because there is increased antisocial behaviour late at night."

"I wouldn't catch public transport at night unless someone was picking me up from the stop."

"There should be more frequent public transport (not just in morning and evening peaks). Where I wait on Balaclava Road, where I wait, buses come every 20-30 minutes, but sometimes they are cancelled. Buses should run until 2am, not finish at midnight. Taxis are more expensive after 10pm."

"If I'm doing paid market research late at night, I'll use public transport at night. If I'm getting home late at night and I've got some money, I'll get a taxi home safely (i.e. if after 9pm when the bus service is less frequent), but only if I've got money. I'd still get the bus really late at night if that's not the case, as I don't drive."

The majority of participants reported that they take a longer walking route to get to a public transport stop, to avoid areas that make them feel unsafe. Commonly avoided areas were parks, poorly lit areas, back streets, areas known for people loitering or rough sleeping, and non-residential areas. Participants who changed their walking route at night believed that this added an extra five to ten minutes to their trip to access the bus stop or Metro station.

Nearly all respondents indicated that they would increase their use of public transport if measures were taken to increase safety getting to public transport and while using it. All but one respondent agreed that they would use public transport more often if timetables were accurate and provided in real time. This would allow them to plan their trip more accurately, including the route to the stop or station and avoid longer than necessary waiting times for the next service.

"[It would be good to have a] clearer timetable, so it's quicker to get in and get out and not having to wait there. Not as many cancellations would be good and the Metro often pretty late like 10 minutes."

5.4.3.2 Reflections of the night walk and suggestions for improvement

Almost all participants reflected that they felt most safe around the Macquarie University Metro station and shopping centre and their feelings of safety declined as they moved further down Waterloo Road.

Activated centres

People commented on how the earlier stops and around the Metro stations felt safe because they were *"loud and busy which signifies people are around",* however around the more commercial areas, after business hours, reasons for decreased feelings of safety included, less lighting and more isolation.

Lighting

Most people commented that lighting was an issue along the audit route, not just the amount of lighting, but the type. Where there was lighting, it was perceived to be either too bright or too dim and the presence of trees and

foliage created darker spaces. The condition of the footpaths was also widely commented on, with many people noticing trip hazards and unclear walkways around construction areas.

Social and public infrastructure

Participants also commented on the infrastructure along Waterloo Road, particularly a lack of seating to support people requiring mobility support or just a space to stop and make a phone call or message someone. The barriers along the centre of Waterloo Road and at a number of intersections were also commented on as they create fewer opportunities for safe crossing and require a longer walking route to get across the road and can also make people feel trapped and unable to escape quickly if approached by someone.

Personal reflections

Participants also commented on how undertaking the audit made them think more about what contributes to their own safety in Macquarie Park and what they could look out for in the future.

> "One of the positives was the questions asked made me think what I would do to improve safety and what are the things that make me feel safe."

Recommendations to improve perceptions of safety in the precinct

Participants were asked for changes they would like to prioritise in the Macquarie Park night walk area to improve perceptions of safety.

Overwhelmingly participants recommended:

1. Improved lighting along walking areas but also in side streets and in the trees and bushes
2. Improved footpath conditions, including the width, maintenance and lighting. Clear and safe footpath options around construction areas was identified.
3. Removing the barriers down Waterloo Road or providing more breaks and safe crossing points
4. Expanding the help button service along the street
5. Well-lit back streets so people can avoid main roads
6. More public art and representation of indigenous culture.

Recommendations to improve perceptions of safety on Metro services and at Metro stations

"We can fund transport officers to check that we have used our Opal card, so why can't we fund safety officers to patrol the trains and provide support?"

1. Security or transport staff member presence at Metro stations and on the Metro service
2. Most respondents felt they would be much safer if they knew someone was available to help when needed.
3. Make emergency buttons more visible and obvious to use
4. Better management of loitering and anti-social behaviour
5. Taxi ranks or pick up spots at station entrances
6. Improve accuracy and reliability of the timetable
7. Community education to encourage people to be active bystanders.
8. Female-only carriages for women to choose when travelling alone.

"It's very hard to know who's going to be a positive bystander. For instance, there was a study on conformity done in the UK that talked about diffusion of responsibility. The research suggests that in an area with a lot of people, many people assume that someone else would stop to help [and so they don't themselves stop to help]. Positive bystanders – I wouldn't rely on them or base my safety on them."

Recommendations to improve perceptions of safety on other public transport

1. Better bus stop facilities
2. Maintenance of vandalised glass bus shelters
3. Live signage to communicate timing for arrival of the next bus service.

6 Recommendations and lessons learned

6.1 Recommendations for the Women's Safety Audit study area

The Women's Safety Audit study has been used to inform a series of recommendations to improve perceptions of safety in and around the Macquarie Park precinct. The recommendations are organised under three outcome areas: safe public infrastructure; transport improvements; and collaboration and communications.

6.1.1 Safe public spaces and infrastructure

6.1.1.1 Lighting

Lighting was identified as a key issue, particularly through main pedestrian routes and residential areas. The night walk identified different levels of lighting along different portions of Waterloo Road, some areas with no lighting (e.g. Shrimptons Creek), and other design limitations. Some participants would prefer better designed and lit back streets to avoid using main roads, where there is more interaction with cars.

Recommendations include:

- Layered lighting allowing users to see beyond their immediate area and if someone is approaching.
- Differences in light intensity and colour along Waterloo Road impacted perceptions of safety, with brighter white lights usually providing more visibility. Lighting should be consistent along the road.
- Trees and bushes create additional darkness by blocking out night-time lighting. Design solutions that ensure lighting can be provided underneath tree canopies, to maximise visibility for street users should be explored.
- Lighting often provides more light for cars than footpaths. A reorientation of light poles could be considered.
- Using lighting as art, or to create atmosphere may also assist in activating spaces and bringing more people into public spaces.
- Provide lighting where this is currently no or limited infrastructure (e.g. Shrimptons Creek) with due consideration given to neighbours and local fauna.

6.1.1.2 Safe crossing points and access

Removing the median barriers along Waterloo Road or providing regular breaks and safe crossing points will give people more options to cross the road when needed. This will help people to make quick decisions to cross the road if feeling uncomfortable or threatened by someone approaching. This should also be designed in a way that assists people who use mobility aids or those who require additional assistance to cross a road. Reducing the feeling of being trapped, should someone need to move away quickly may improve perceptions of safety as women move through the precinct.

6.1.1.3 Footpath design and maintenance and supporting infrastructure

A well-designed and maintained environment contributes to perceptions of safety as well as actual physical safety.

Footpaths should be designed with adequate width to accommodate people walking in both directions, people with mobility aids and young people on bicycles. Existing paths on Waterloo Road are shared paths, however, they are not designed in a way that supports shared uses. A participant in the night walk mentioned they would never have thought these were shared paths and would not use them for cycling. Adequate cycling infrastructure should be designed in Macquarie Park.

Footpaths should be regularly maintained, especially along major routes and ensuring that safe alternatives are provided when construction or works is encroaching onto footpaths. Well designed and maintained footpaths not

only increase pedestrian's physical safety, but the presence of good quality infrastructure also improves perceptions of safety and that the area is cared for and valued.

There should be seating and rest stops at regular intervals along thoroughfares such as Waterloo Road and walking paths. This is to support people who might need mobility support or opportunities to rest and provide meeting points and opportunities for informal gathering.

6.1.2 Transport improvements

6.1.2.1 Consider speed limits and drop-off areas

As a busy road, with limited safe crossing points, lowering the speed limit on Waterloo Road would improve feelings of safety. Slower vehicles make pedestrians less vulnerable and may encourage further active transport modes through the precinct. The projected increase in workers and residents in Macquarie Park brings an opportunity to create more slow-speed and shared zones. This will create a more suitable environment for people to choose active transport more regularly to access their destinations. Creating a pedestrian and cycling friendly precinct can encourage more women and families into public space and increase activation.

It was also identified during the night walk that there are no easy and safe drop-off or pick-up areas around Metro stations, making it difficult for cars or taxis to stop. This should be improved.

6.1.2.2 Metro maintenance and security

Improving security at the Metro stations may increase women's feelings of safety and encourage more use. This may include CCTV, which is monitored in real time and signage informing of their presence, but physical security presence will provide the most impact. Providing an authority figure, that is adequately trained in bystander intervention, not only improves perceptions of safety but can ensure that an appropriate intervention is provided in the case of an incident. As identified during the research, security presence on both sides of ticket areas would improve feelings of safety for those accessing and exiting transport stations or passing through.

There are also regular issues with lifts at Macquarie University Metro Station, which may force people to cross the road again and be "in the dark more than they need to be".

6.1.2.3 Provision of safe and maintained amenities

Toilets were described in follow-up interviews as sometimes unsafe spaces for women, due to risks of assault and experiences with people loitering in a confined space with only one way out. They are however crucial spaces to provide particularly for women in the public domain and should be safe and clean. The participant mentioned that unisex toilets, which tend to be popular now, do not support feelings of safety unless they can be accessed directly from a concourse or hallway.

6.1.2.4 Redesign and expand the 'Help Point' buttons

The existing help point buttons in Metro stations can be helpful tools however they should be more visible and designed with more contrast to the colour scheme adopted throughout the station. More help points could be provided outside the Metro stations at street level to support people approaching and leaving the stations and bus stops. These should be accessible to all abilities and provided in multiple languages.

6.1.2.5 Provide accurate, real-time public transport timetables and wayfinding

There is an opportunity to provide real-time scheduling and updates of public transport arrivals, by using screens or announcements at bus stops, similar to Metro stations, that inform of the time remaining until the next service. This would enable people to better plan their trips and avoid having to wait in the dark for longer. It was also mentioned that the quality of bus services has significantly decreased over the last few years, with many buses "not showing up" resulting in a low level of trust in services. This should be reviewed.

Digital options could be considered to provide people with access to accurate and up to date transport service and timetabling information in real-time, including wayfinding capability to assist with trip planning and decision

making and support safety when walking to and from public transport stops and stations. While there are a number of transport planner apps available, they were not regarded as being reliable. And a negative experience using these apps can be a deterrent for ongoing public transport use.

6.1.3 Collaboration and communications

6.1.3.1 Working together and precinct coordination

Regular stakeholder coordination should continue through working groups and activities that encourage investment and innovation in the local area. This may involve a more robust funding model for the Macquarie Park Innovation District. A stakeholder working group can help to identify issues early, opportunities for improvement and encourage more diverse ideas for the Macquarie Park precinct. A coordinated approach with existing and new stakeholders will support the delivery of the Macquarie Park Place Strategy.

Another aspect to continue is to actively seek out and prioritise diverse voices and experiences so that those factors that intersect with gender can become an integral part of the design and decision making of public places and policies. This includes Aboriginal and Torres Strait Islander voices, people living with disability, LGBTIQA+ voices and neurodiverse voices.

6.1.3.2 Events and activation

A lack of people around was identified as fundamental to feeling unsafe. There are numerous opportunities to activate places and spaces in Macquarie Park through land use planning – to support active street frontages and eyes on the street – and programming to encourage people into public spaces more often and for positive, community building purposes. Community events, public art and well-designed public spaces that showcase culture, identity and community can contribute to a sense of inclusion, connection and belonging. However, it should be noted that while study participants commented that these measures may enhance their feelings of safety, they were not regarded as being able to transform a place that feels unsafe, into one that feels safe, without further safety focused measures also being in place.

6.1.3.3 Primary prevention

Communication and education campaigns should be implemented to highlight the impact of harassment and violence against women and other minority groups discussed in this research. This would encourage whole of community responses, including men and boys and educate them on what it takes to be a positive bystander. Positive bystander training could be offered to community groups and workplaces to increase the opportunity for members of the public to safely and confidently intervene when witnessing harassment or violence against women, girls and gender diverse people.

Campaigns and training could also include content to improve the broader public's understanding of the intersectional factors that increase women's vulnerability such as race and ethnicity, disability, sexuality and gender identity.

6.1.3.4 Deliver regular community safety workshops

There should be regular engagement with the local community, both permanent and temporary (e.g. students, workers, and users of spaces), with workshops that focus on current and emerging safety issues in the precinct. Opportunities should be identified to work with women, girls and gender diverse people to co-design new development and public space infrastructure and apply gender sensitive design principles towards improving and maintaining the Macquarie Park precinct.

As described above, actively seeking out and prioritising diverse voices and experiences will ensure that factors that intersect with gender are a part of the design and decision making of public places and policies.

6.2 Recommendations for future Women's Safety Audits

A number of learnings were identified through delivery of the Macquarie Park Women's Safety Audit that can be applied to future women's safety audits. These are discussed below.

6.2.1 Participant recruitment

The recruitment process delivered a great response for participants in the Women's Safety Audit night walk. Identifying the demographic requirements up front ensured that a diverse group of women and girls participated in the study. A more direct effort was required to recruit a First Nations participant. In future audits, it could be useful to connect with indigenous community groups or Traditional Owners.

6.2.2 Audit tool

The development of the audit tool was informed by the background document review and stakeholder interviews. The tool was detailed and robust and considered all the aspects of public space that contribute to perceptions of safety. However, using the tool on the survey platform Zoho proved to be time consuming along with analysing the data post audit. A more streamlined method of data collection would improve the audit experience. Additionally, allowing for more qualitative methods such as conversation between audit participants may result in further insight to feelings of safety.

A proposed amended audit tool has been provided in Appendix C. This tool asks participants to tick each element as safe, unsafe or not applicable, and builds in additional time for comments and discussion, and to take and upload photos. The tool is developed to be able to adapt to different audit locations. Details such as the route, number of stops, time required and participant recruitment should be adapted to suit the individual project and the locality.

6.2.3 Conducting fieldwork

The night walk was scheduled for between 6:00 pm and 7:30 pm with a briefing and debrief. The route covered 1.3 kilometres and had nine stops in total. The schedule for the walk was ambitious and timing was tight to complete all stops, particularly when supporting a participant with a mobility aid. A more concise study area or a longer audit time would allow for more considered responses. Allowing a total of two hours for the Macquarie Park Audit would have provided more time for assessment and discussion among the audit group.

Many of the participants commented that they felt comparatively comfortable in the early evening when the audit was conducted but may feel less safe later at night. Consideration of the timing of future audits may deliver a different perspective of safety if it was later at night.

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Appendix A

Women's Safety Audit site assessment tool

Macquarie Park Precinct Women's Safety Audit Tool

Welcome to the audit survey! Please make sure you assess each stop carefully by answering all survey questions.

What is your name?

Which stop are you currently reviewing?

□ Stop 1	□ Stop 2	□ Stop 3
□ Stop 4	□ Stop 5	□ Stop 6
□ Stop 7	□ Stop 8	□ Stop 9

How safe do you feel now at this location? Any comments?	□ Very Unsafe □ Unsafe □ Neither safe nor unsafe □ Safe □ Very Safe
Would you feel safe walking in this location alone at night? Any comments?	□ Yes □ No □ Don't know
Would you feel safe walking in this location accompanied at night? Any comments?	□ Yes □ No □ Don't know
Would you feel safe cycling alone in this location at night? Any comments?	□ Yes □ No □ Don't know

Elements of the built environment

Looking around you, how much do each of the following elements contribute to your sense of feeling safe or unsafe? Please tell us if you can see the element, and how it makes you feel.

Rate each element according to the following and add any comments:

The element is present/the element is not present. [Select one]

Makes me feel… very unsafe/unsafe/neither safe nor unsafe/safe/very safe [Select one]

□ Sight lines (i.e. how well you're able to see the space around you)	□ Public art
□ Footpath/s or walkways	□ Reflection of local heritage and culture (ego Aboriginal culture, ethnic culture, stories of the area)
□ Crossing points for pedestrians	□ Public transport hub or stop (e.g. bus stop)
□ Cycle path (e.g. separated from vehicles)	□ Separation from roadway/vehicles
□ Wall/s or fences/s	□ Public toilets
□ Weather protection/shelter	□ Public seating
□ Ease of navigation/wayfinding (e.g. layout and signage to help you get around)	□ Park or plaza

Condition and maintenance of the space

Do you agree with the following statements, and how safe do they make you feel?

Rate each element according to the following and add any comments:

I agree with this statement/I disagree with this statement/NA [Select one]

Makes me feel… very unsafe/unsafe/neither safe nor unsafe/safe/very safe. [Select one]

□ Buildings/infrastructure are in good condition	□ Landscaping and trees are easy to see around and don't provide places to hide
□ Walking paths are in good condition	□ Level of noise is appropriate for the place/time of day
□ Cycle paths are in good condition	□ Air quality is pleasant and inviting
□ Other spaces, such as parks or plazas are in good condition	□ The presence of music is pleasant and inviting and appropriate for time of day
□ Landscaping. Trees are in good condition	□ There is wildlife present (i.e. fauna such as birds, possums)

Security features

Looking around you, how much do each of the following elements contribute to your sense of feeling safe or unsafe? Please tell us if you can see the element, and how it makes you feel.

Rate each element according to the following and add any comments:

The element is present/the element is not present. [Select one]

Makes me feel… very unsafe/unsafe/neither safe nor unsafe/safe/very safe [Select one]

□ Trip or fall hazards	□ Speed of vehicles
□ Lighting	□ Safe road crossing points
□ Presence of Police	□ CCTV cameras
□ Presence of security officer	

What's happening in this location?

Looking around you, how much do each of the following elements contribute to your sense of feeling safe or unsafe? Please tell us if you can see the element, and how it makes you feel.

Rate each element according to the following and add any comments:

The element is present/the element is not present. [Select one]

Makes me feel… very unsafe/unsafe/neither safe nor unsafe/safe/very safe [Select one]

□ Illegal or concerning behaviour (e.g. antisocial behaviour, harassment)	□ Are there barriers or other things that could stop me getting away easily from this location?
□ Loitering	□ Are there people present who could act as positive bystanders?
□ Intoxicated people	

Activity levels

Looking around you, how much do each of the following elements contribute to your sense of feeling safe or unsafe? Please tell us if you can see the element, and how it makes you feel.

Rate each element according to the following and add any comments:

The element is present/the element is not present. [Select one]

Makes me feel… very unsafe/unsafe/neither safe nor unsafe/safe/very safe [Select one]

□ People around/buzzing	□ Retail/commercial activity (e.g. active shop frontages, 24/7 uses)
□ Overcrowding/queuing	□ Activities and events
□ Presence of families with kids, older people, dog walkers	

Appendix B

Women's Safety Audit participant interview guide

Women's Safety Audit – Follow up interviews (30 min)

Participant Name	Interviewer Name	Interview time/date

Introduction:

- Thank you for participating in the Women's Safety Audit night walk.
- We greatly appreciate your time and contribution.
- I'd like to ask you a few further questions in follow up to the walk, now that we're seated comfortably in our own environments, rather than standing in the street.
- Your feedback and the feedback from other participants in the night walk and interviews, will be used to inform a report that our team at WSP is preparing for Transport for NSW.
- However, no individual will be identified. For instance, we won't include participants' names.
- Do you have any questions before we begin?

Interview questions:

The first few questions are about what a typical week looks like for you…

1 How safe do you feel in the Macquarie Park area during the day while…? *[Interviewer select one option per question]*

a	Walking alone	Very unsafe	Unsafe	Neither	Safe	Very safe	N/A
b	Using public transport	Very unsafe	Unsafe	Neither	Safe	Very safe	N/A
c	Waiting for public transport	Very unsafe	Unsafe	Neither	Safe	Very safe	N/A

Please tell me about your responses:

2 How safe do you feel in the Macquarie Park area after dark while…? *[Interviewer select one option per question]*

a	Walking alone	Very unsafe	Unsafe	Neither	Safe	Very safe	N/A
b	Using public transport	Very unsafe	Unsafe	Neither	Safe	Very safe	N/A
c	Waiting for public transport	Very unsafe	Unsafe	Neither	Safe	Very safe	N/A

Please tell me about your responses:

3 In the last week did you use public transport during the day to get to/from work, study or for recreation purposes? *[Interviewer tick all that apply]*

☐ No to all	☐ Work
☐ Study	☐ Recreation

4 In the last week did you use public transport <u>after dark</u> to get to/from work, study or for recreation purposes? *[Interviewer tick all that apply]*

☐ No to all	☐ Work
☐ Study	☐ Recreation

5 What were the main reasons you did / did not use public transport during the day?
[Interviewer to test is safety a factor in decision making? Convenience? Affordability? etc]

6 What were the main reasons you did / did not use public transport after dark?
[Interviewer to test is safety a factor in decision making? Convenience? Affordability? etc]

7 Do you agree or disagree with each of the following statements…? *[Interviewer tick one option per question]*

a	I'd use public transport more often if travelling on it felt safer	Strongly disagree	Disagree	Neither	Agree	Strongly agree
b	I'd use public transport more often if getting to it felt safer	Strongly disagree	Disagree	Neither	Agree	Strongly agree
c	I'd use public transport more often if timetables were accurate and provided in real time	Strongly disagree	Disagree	Neither	Agree	Strongly agree
d	I avoid commuting after dark for work or study, due to safety concerns	Strongly disagree	Disagree	Neither	Agree	Strongly agree
e	I avoid going out after dark for recreation purposes, due to safety concerns	Strongly disagree	Disagree	Neither	Agree	Strongly agree
f	I take an alternative/longer route to get to public transport, to avoid certain areas, due to safety concerns	Strongly disagree	Disagree	Neither	Agree	Strongly agree

8 (If participant agrees or strongly agrees to 7f) Which area/s do you avoid to get to public transport? How much longer in minutes does this make your walk to/from public transport?
[Interviewer to record length of walk in minutes]

The next few questions focus on the walk and your thoughts since doing it…

9 Do you have any further reflections about the night walk?

Prompts: Where did you feel least safe? Where did you feel most safe? What did you feel unsafe about? (e.g. assault, harassment, hurting themselves, etc)? Could you please tell me more about that? [interviewer to refer to completed audit form and prompt for any particular areas where the participant made comments]

10 What are the top 3 changes you'd like to see in the Macquarie Park night walk area, to improve your feelings of safety?

[e.g. features, updates, activations]

11 What are the top 3 changes you'd like to see in and around the Metro stations and or while using Metro services, to improve your feelings of safety and encourage public transport use?

[e.g. features, updates, activations, personnel]

Thank you again for participating in the Women's Safety Audit. On behalf of the team from WSP and Transport for NSW, we'd like to thank you again for your time and contribution to this important study.

We'll be in touch in the next few days with your gift voucher in recognition of your contribution.

Appendix C

Women's Safety Audit Tool Template

Women's Safety Audit Tool

Welcome to the audit survey! Please make sure you assess each stop carefully by answering all survey questions.

What is your name?

Which stop are you currently reviewing?

How safe do you feel now at this location? **Any comments?**	☐ Very Unsafe ☐ Unsafe ☐ Neither safe nor unsafe ☐ Safe ☐ Very Safe
Would you feel safe walking in this location alone at night? **Any comments?**	☐ Yes ☐ No ☐ Don't know
Would you feel safe walking in this location accompanied at night? **Any comments?**	☐ Yes ☐ No ☐ Don't know
Would you feel safe cycling alone in this location at night? **Any comments?**	☐ Yes ☐ No ☐ Don't know

1. **Elements of the built environment**

Please indicate whether each element makes you feel safe or unsafe, or if not applicable and add any comments/photos

Safe	Unsafe	NA		Safe	Unsafe	NA	
			Sight lines (ie how well you're able to see the space around you) Footpath/s or walkways Crossing points for pedestrians Cycle path (eg separated from vehicles) Wall/s or fences/s Weather protection/shelter Ease of navigation/wayfinding (eg layout and signage to help you get around)				Public art Reflection of local heritage and culture (eg Aboriginal culture, ethnic culture, stories of the area) Public transport hub or stop (eg bus stop) Separation from roadway/vehicles Public toilets Public seating Park or plaza

2. **Condition and maintenance of the space**

Please indicate whether each element makes you feel safe or unsafe, or if not applicable and add any comments/photos

Safe	Unsafe	NA		Safe	Unsafe	NA	
			Buildings/infrastructure are in good condition Walking paths are in good condition Cycle paths are in good condition Other spaces, such as parks or plazas are in good condition Landscaping. Trees are in good condition				Landscaping and trees are easy to see around and don't provide places to hide Level of noise is appropriate for the place/time of day Air quality is pleasant and inviting The presence of music is pleasant and inviting and appropriate for time of day There is wildlife present (ie fauna such as birds, possums)

3. Security features

Please indicate whether each element makes you feel safe or unsafe, or if not applicable and add any comments/photos

Safe	Unsafe	NA		Safe	Unsafe	NA	
			Trip or fall hazards Lighting Presence of Police Presence of security officer				Speed of vehicles Safe road crossing points CCTV cameras

4. What's happening in this location?

Please indicate whether each element makes you feel safe or unsafe, or if not applicable and add any comments/photos

Safe	Unsafe	NA		Safe	Unsafe	NA	
			Illegal or concerning behaviour (eg antisocial behaviour, harassment) Loitering Intoxicated people				Are there barriers or other things that could stop me getting away easily from this location? Are there people present who could act as positive bystanders?

5. Activity levels

Please indicate which elements make you feel unsafe at this location and add any comments/photos

Safe	Unsafe	NA		Safe	Unsafe	NA	
			People around/buzzing Overcrowding/queuing Presence of families with kids, older people, dog walkers				Retail/commercial activity (eg active shop frontages, 24/7 uses) Activities and events

NSW GOVERNMENT

Appendix C – List of recommended initiatives

Initiative/Location	Country is visible and accessible	Public and active transport mode share maximised	Great places of 15-minute neighbourhoods	Last mile deliveries facilitated and impact minimised	Commercial and residential uplift enabled	Dense network of walking routes (off busy roads)	Reduced transport-related emissions and vehicle kilometres travelled	Increase tree canopy cover	Plan for future mass transit	Safe walking 24/7 for women, children and elderly people	Timing Short (0-5 years) (S) Medium (5-10 years) (M) Long (over 10 years) (L)	Source	Responsible agency
Macquarie University													
Macquarie Park Bus Priority and Capacity Improvements Stage 1B: Upgrades to Herring Road and the intersections with Waterloo Road, Epping Road, and Ivanhoe Place		✓			✓		✓		✓		S	SISA	NSW Government
Macquarie Park Precinct Bus Interchange and northern bus layover	✓	✓			✓		✓	✓	✓	✓	M	SISA	Combination General Commonwealth/NSW Government
Talavera Road/Christie Road intersection – pedestrian crossings on all legs		✓	✓							✓	M	SISA	Combination General NSW Government and SIC
Talavera Road/Macquarie Shopping Centre intersection – pedestrian crossings on all legs		✓	✓			✓				✓	M	SISA	Combination General NSW Government and SIC
Quandong Reserve, Cottonwood Reserve and Wilga Park shared user path upgrade	✓	✓				✓				✓	L	SISA	Local government
North Ryde Station													
Epping Road/Delhi Road Intersection – Pedestrian Crossings on all legs		✓	✓							✓	L	SISA	Combination General NSW Government and SIC
Better access to existing local and district open space	✓	✓	✓			✓				✓	L	SISA	Local government
Macquarie Park													
Macquarie Park to South–East Sydney Transit / Train Link (land for transport hub and project development only)											L	SISA	Combination General Commonwealth/NSW Government
Macquarie Park Zero Emissions Bus Deport (formerly Macquarie Park southern bus layover)		✓					✓		✓		L	SISA	NSW Government
Macquarie Park Bus Priority and Capacity Improvements Stage 1A: Waterloo Road and Lane Cove Road intersection upgrade		✓			✓		✓		✓		M	SISA	NSW Government
Macquarie Park Bus Priority and Capacity Improvements Stage 2: Waterloo Road bus lanes through road space reallocation (Lane Cove Road to Herring Road)		✓			✓		✓		✓		L	SISA	NSW Government
Fine grain Street Network		✓	✓			✓				✓	L	SISA	Local government

Initiative/Location	Country is visible and accessible	Public and active transport mode share maximised	Great places of 15-minute neighbourhoods	Last mile deliveries facilitated and impact minimised	Commercial and residential uplift enabled	Dense network of walking routes (off busy roads)	Reduced transport-related emissions and vehicle kilometres travelled	Increase tree canopy cover	Plan for future mass transit	Safe walking 24/7 for women, children and elderly people	Timing Short (0-5 years) (S) Medium (5-10 years) (M) Long (over 10 years) (L)	Source	Responsible agency
Waterloo Road intersection improvements (Byfield Road, Khartoum Road, Thomas Holt Dr, Eden Park Road)				✓		✓				✓	L	SISA	Local government
Waterloo Road pedestrian improvements		✓	✓			✓				✓	L	SISA	Special Infrastructure Contribution
Waterloo Road local area traffic management improvements			✓		✓	✓			✓	✓	L	SISA	Special Infrastructure Contribution
Talavera Road road space reallocation		✓					✓		✓	✓	L	SISA	Special Infrastructure Contribution
Lower speed limit on local roads			✓				✓			✓	L	SISA	NSW Government
More signalised pedestrian and cyclist crossings (Waterloo Road, Talavera Road)		✓				✓				✓	L	SISA	Combination General NSW Government and SIC
Khartoum Road/Banfield Road intersection improvements			✓			✓				✓	L	SISA	Combination General NSW Government and SIC
Rennie Street / Pittwater Road, North Ryde – Active transport crossing over Epping Road		✓	✓			✓				✓	L	SISA	Special Infrastructure Contribution
Lower speed limit on Lane Cove Road			✓							✓	L	SISA	NSW Government
Lane Cove Road: Intersection improvement at Talavera Road (at grade)			✓							✓	L	SISA	Special Infrastructure Contribution
Lane Cove Road pedestrian bridges near Hyundai Drive, Dirrabari Road and Waterloo Road		✓	✓			✓				✓	L	SISA	Combination General NSW Government and SIC
Multi precinct													
New and upgraded bus stops, including improved accessibility		✓					✓		✓		M	SISA	Combination General NSW Government and SIC
Increase Northwest Metro Services		✓									L	SISA	NSW Government
Create a network of dedicated cycle and micro-mobility connections		✓				✓	✓			✓	M	SISA	Combination General NSW Government and SIC
Increase publicly accessible bicycle parking		✓	✓								M	SISA	Local government
Complete missing links in Macquarie Park's centre-serving local/regional cycling network		✓	✓				✓				M	SISA	Combination General NSW Government and SIC, Local government
Lower speed limit on regional roads							✓			✓	M	SISA	NSW Government

Initiative/Location	Country is visible and accessible	Public and active transport mode share maximised	Great places of 15-minute neighbourhoods	Last mile deliveries facilitated and impact minimised	Commercial and residential uplift enabled	Dense network of walking routes (off busy roads)	Reduced transport-related emissions and vehicle kilometres travelled	Increase tree canopy cover	Plan for future mass transit	Safe walking 24/7 for women, children and elderly people	Timing Short (0-5 years) (S) Medium (5-10 years) (M) Long (over 10 years) (L)	Source	Responsible agency
Investigate rapid route bus priority: - Lane Cove Road: SB from Waterloo Road to Epping Road - Lane Cove Road: NB from Epping Road to Waterloo Road - Lane Cove Road: NB from Waterloo Road to Talavera Road		✓							✓		L	Transport Study	NSW Government
Plan for removal of slip lanes at intersections: - Waterloo Road/Lane Cove Road - Herring Road/Ivanhoe Place - Epping Road/Lane Cove Road - Epping Road/Wicks Road - Herring Road/Ivanhoe Place		✓								✓	L	Transport Study	NSW Government
Waterloo Linear Park	✓		✓					✓		✓	L	SISA	Local government
Precinct Wide													
Investigate Parramatta to Epping mass transit/train link											L	SISA	Combination General Commonwealth/NSW Government
Strategic bus corridors for rapid services from Macquarie Park (to Hurstville, Parramatta via Eastwood, Blacktown via M2)		✓			✓		✓		✓		L	SISA	NSW Government
Mona Vale to Macquarie Park public transport improvements for rapid services		✓			✓		✓		✓		L	SISA	NSW Government
Upgrade Ryde bus depot									✓		M	SISA	Combination General Commonwealth/NSW Government
Epping Road / Pittwater Road, North Ryde – Intersection upgrade										✓	M	SISA	Combination General NSW Government and local government
Browns Waterhole Track – Lane Cove River crossing upgrade		✓	✓			✓				✓	M	SISA	Local government
New eastern footpath on Lane Cove Road – Talavera Road to Fontenoy Road										✓	L	SISA	Local government
Cycle link to Northern Beaches via A3		✓					✓				L	SISA	Combination General NSW Government and SIC
Review bus network coverage to increase 30-minute Public Transport catchment		✓			✓		✓			✓	M	Transport Study	NSW Government
Increase bus frequencies to better enable 30-minute Public Transport access		✓			✓		✓			✓	M	Transport Study	NSW Government
Enhancing tree canopies and green spaces	✓		✓					✓		✓	L	SISA	Local government

Initiative/Location	Country is visible and accessible	Public and active transport mode share maximised	Great places of 15-minute neighbourhoods	Last mile deliveries facilitated and impact minimised	Commercial and residential uplift enabled	Dense network of walking routes (off busy roads)	Reduced transport-related emissions and vehicle kilometres travelled	Increase tree canopy cover	Plan for future mass transit	Safe walking 24/7 for women, children and elderly people	Timing Short (0-5 years) (S) Medium (5-10 years) (M) Long (over 10 years) (L)	Source	Responsible agency
Electric vehicle charging stations							✓				M	SISA	Local government
Investigate freight micro mobility hubs for last mile delivery and distribution				✓							L	Transport Study	NSW Government
Investigate improved signal and intersections interactions for pedestrians		✓	✓			✓				✓	M	Transport Study	NSW Government
Review the level of parking supply and availability		✓		✓			✓				M	SISA	Local government
Public domain improvements to support improved place-making, amenity and personal security including: - Improved public lighting - Investigate removal of pedestrian barriers and median fences - Provide seating and rest stops at regular intervals.		✓	✓			✓	✓			✓	S	Transport study	Local government

Appendix D – Applying the Built Environment Indicators to Macquarie Park

Access and Connection

Transport Choice

Macquarie Park requires significant investment and systemic change to transition away from private car use towards sustainable modes. A wide range of interventions are outlined in this report.

Walking paths

Issues: The pedestrian environments around all the precincts in Macquarie Park present a range of challenges including limited permeability (very large blocks compared to the Sydney CBD), lack of crossings, poor signage, interrupted or uneven footpaths, fencing that prevents access, lack of kerb ramps for wheeled devices, and topographic difficulties. This makes it difficult for people of all ages and abilities to access schools, work, shopping, recreation and workplaces. Figure 1 shows the existing network of footpaths in Macquarie Park. It shows that while there are footpaths on both sides of the road in most places, it is difficult to connect between blocks.

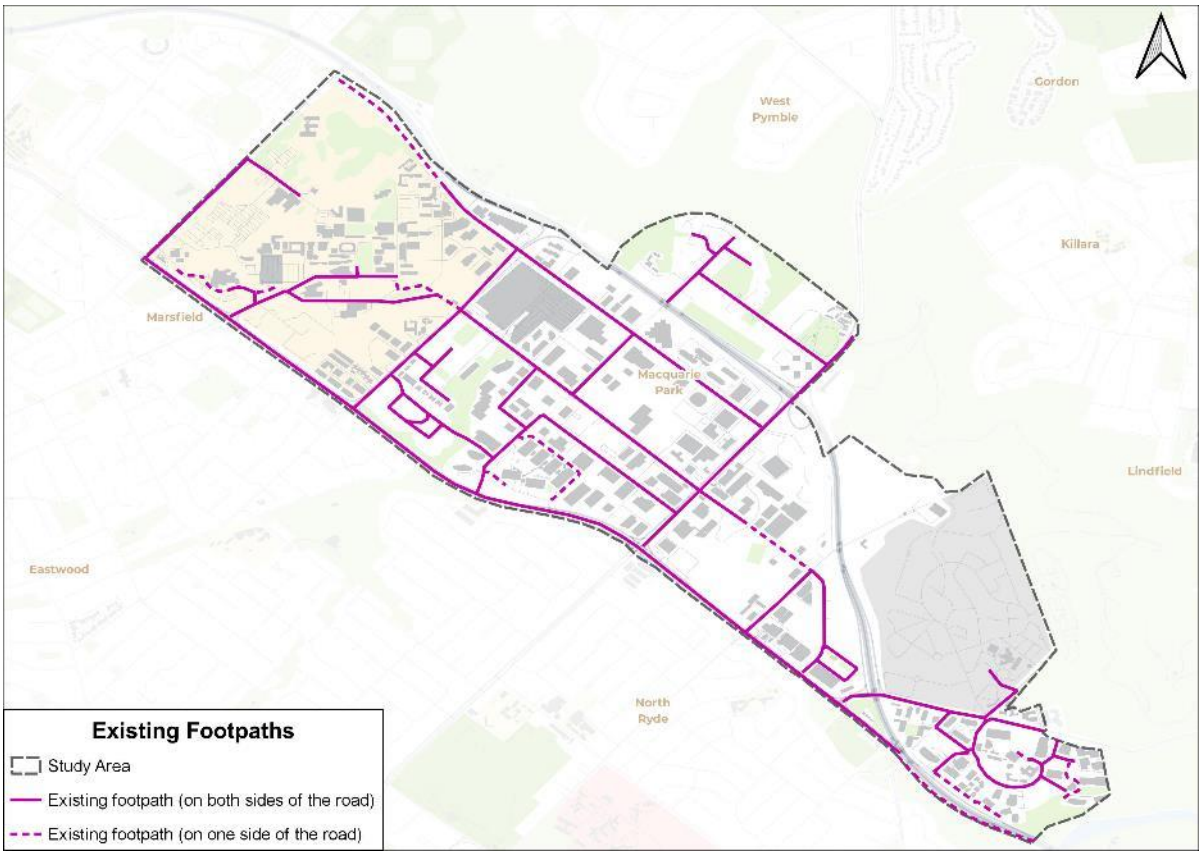


Figure 1 Existing pedestrian network in Macquarie Park

Potential Actions:

- Generally: Provide wide shared paths and footpaths as per the NSW Walking Space Guide.
- Provide through-site links and a fine-grained network of streets.
- For North Ryde Station Precinct: Create lower level access to the station entrance, review the use of fencing, ensure crossing arms at all intersections, and install pedestrian crossings in the business park.
- For Macquarie Park Cemetery: Improve signage and widen footpaths.
- For Lachlans Line: Implement infrastructure changes to accommodate grade differences and assist pedestrians with disabilities, children, and older pedestrians.

- For Herring Road: Provide more pedestrian crossings and treatments at the Ivanhoe Estate between Ivanhoe Place and Waterloo Road.
- For Macquarie University Station and Bus Interchange: Increase crossing space for pedestrians and proceed with planned improvements for the bus interchange.
- For Waterloo Road: Redesign the former school site porte-cochere to improve footpath access and address issues related to the supermarket inhibiting the footpath connection to the north.

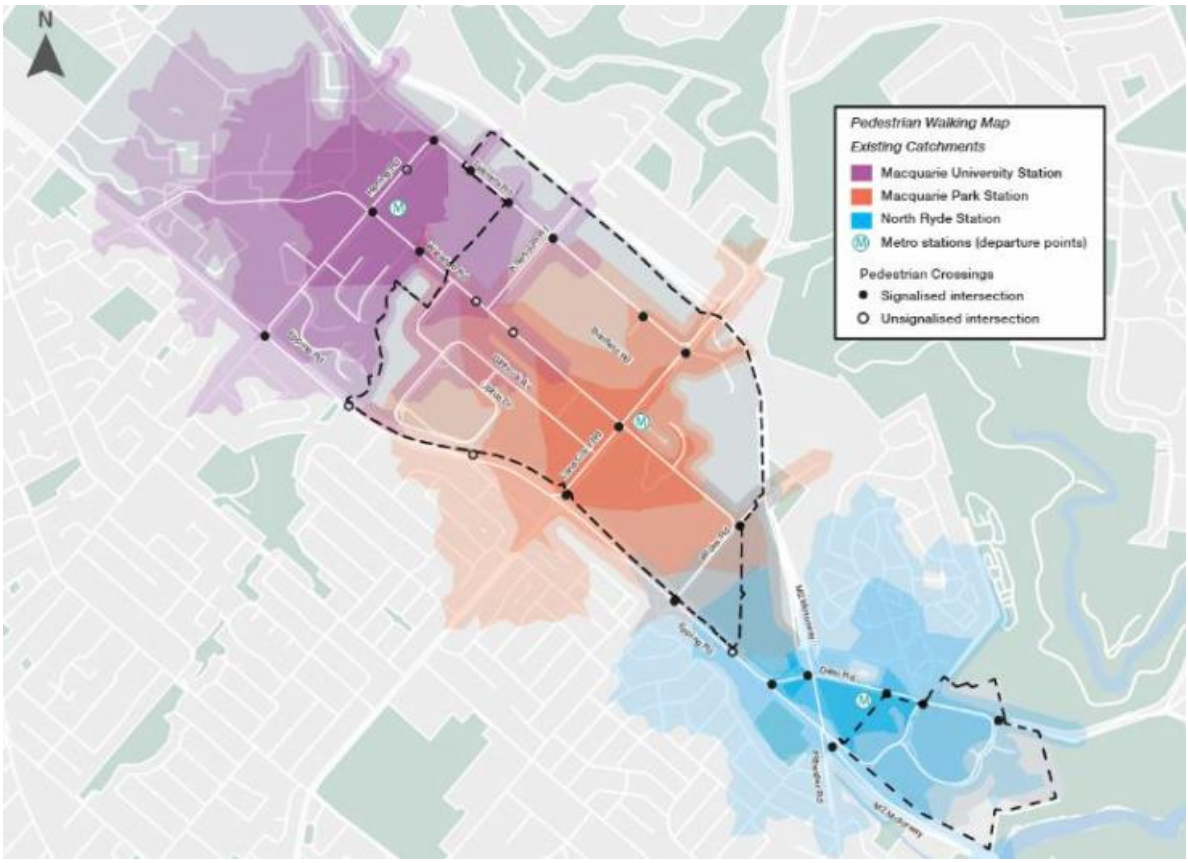
15-minute walking catchments from Metro stations and bus interchange

Issue: The walking network around the metro stations (North Ryde, Macquarie Park, and Macquarie University) and bus interchange is fragmented due to large block sizes and a lack of a fine grain street network, and long delays at traffic signals, leading to inefficient pedestrian movement and longer walking trips to access mass transit. The Macquarie Centre vehicular access and egress from the shopping centre is also a factor in fragmented (and delayed) pedestrian access.

Potential Actions:

- Improve pedestrian networks to make them more comprehensive and interconnected.
- Reduce block sizes and introduce a finer-grain street network, including through-site links.
- Encourage diagonal pedestrian movements within the metro station catchments.
- Reduce waiting times at traffic signals – for example, scramble crossings; and ensure walking crossings on all sides of signalised intersections.
- Introduce mid-block pedestrian crossings.
- Review precinct traffic arrangements should future development occur at the Macquarie Centre

Figure 2 shows the walking catchments of the three Metro stations and how the lack of a fine grained pedestrian network can affect movement out from the Metro Station catchments. Note that the shapes around the Metro stations are highly irregular, demonstrating that walking access is severely limited. In particular, the large block sizes and limited crossings limit direct access between origins and destinations.



Source: *Draft Macquarie Park Integrated Transport Plan*

Figure 2 Metro station walking catchments in the study area

Cycling accessibility

Issues: Cycling infrastructure throughout the precinct is insufficient, featuring narrow shared paths, unprotected on-road bicycle lanes, lack of safe connections, particularly at intersections, and high-traffic or fast-moving traffic that discourages cycling. It generally doesn't meet the NSW Cycleway Design Guide.

Figure 3 shows the existing bicycle network in Macquarie Park.

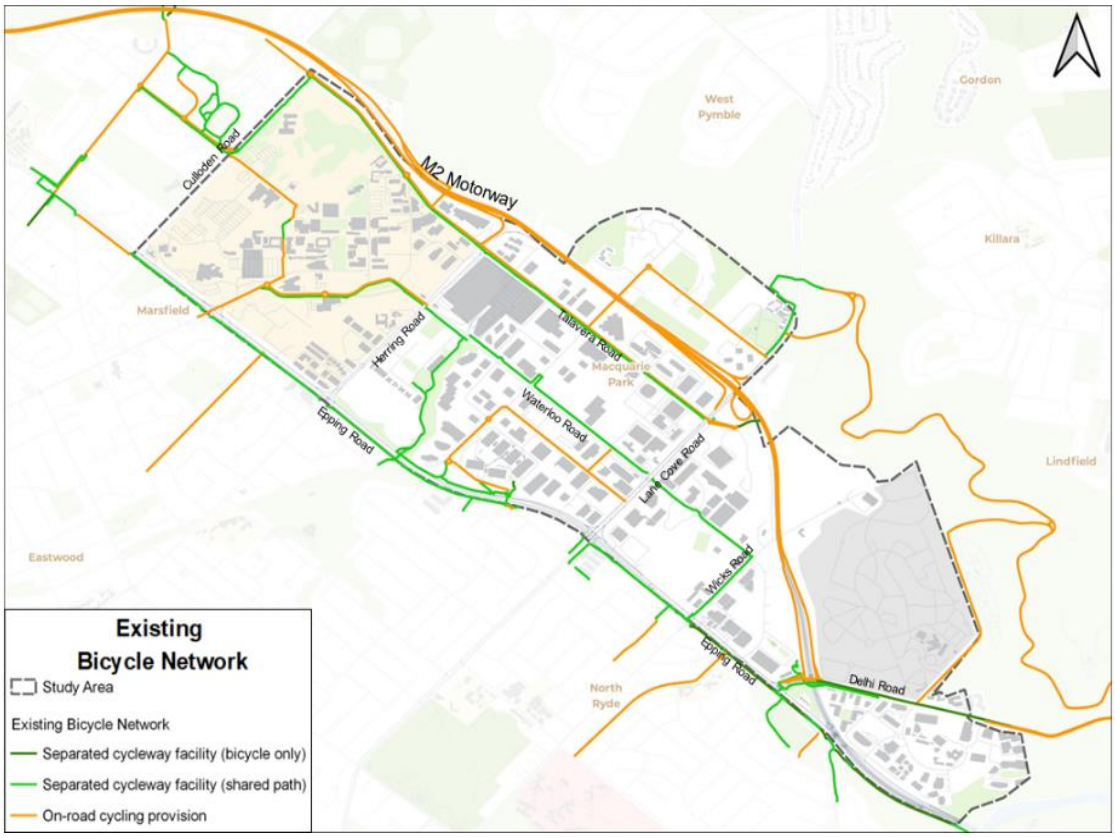


Figure 3 Existing bicycle network

Potential Actions:

- Generally: Provide wide shared paths, separated cycleways and 30 km/h quietways as per the NSW Cycleway Design Guide
- For Delhi Road: Widen and protect cycleways and connect the two-way shared path outside the station to the north side cycleway.
- For Macquarie Park Cemetery: Develop a comfortable and accessible cycle path through or around the cemetery.
- For Herring Road/Ivanhoe Estate: Implement cycle lanes and measures to reduce the speed and volume of traffic to enhance cycling safety.

Public transport accessibility

Issues: Public transport in Macquarie Park is underutilised due to limited walking and cycling access to bus stops and metro stations, lack of bus-only lanes and limited bus priority at intersections.

Potential Actions:

- General: Enhance the safety and convenience of walking and cycling to access public transport, considering the whole-of-journey experience for transport customers. This includes the ability to take bicycles on trains or buses.
- For buses: Implement bus-only lanes and increase bus priority at intersections on Lane Cove Road, Waterloo Road, and Wicks Road South. Enforce the bus lane on Herring Road and resolve vehicle and bus conflicts in front of the shopping centre near Macquarie University Station and Bus Interchange.
- For Metro access: consider station entries facing key destinations and remove barriers to walking.
- Improve the frequency of buses outside of peak times and consider extending operating hours.

Parking

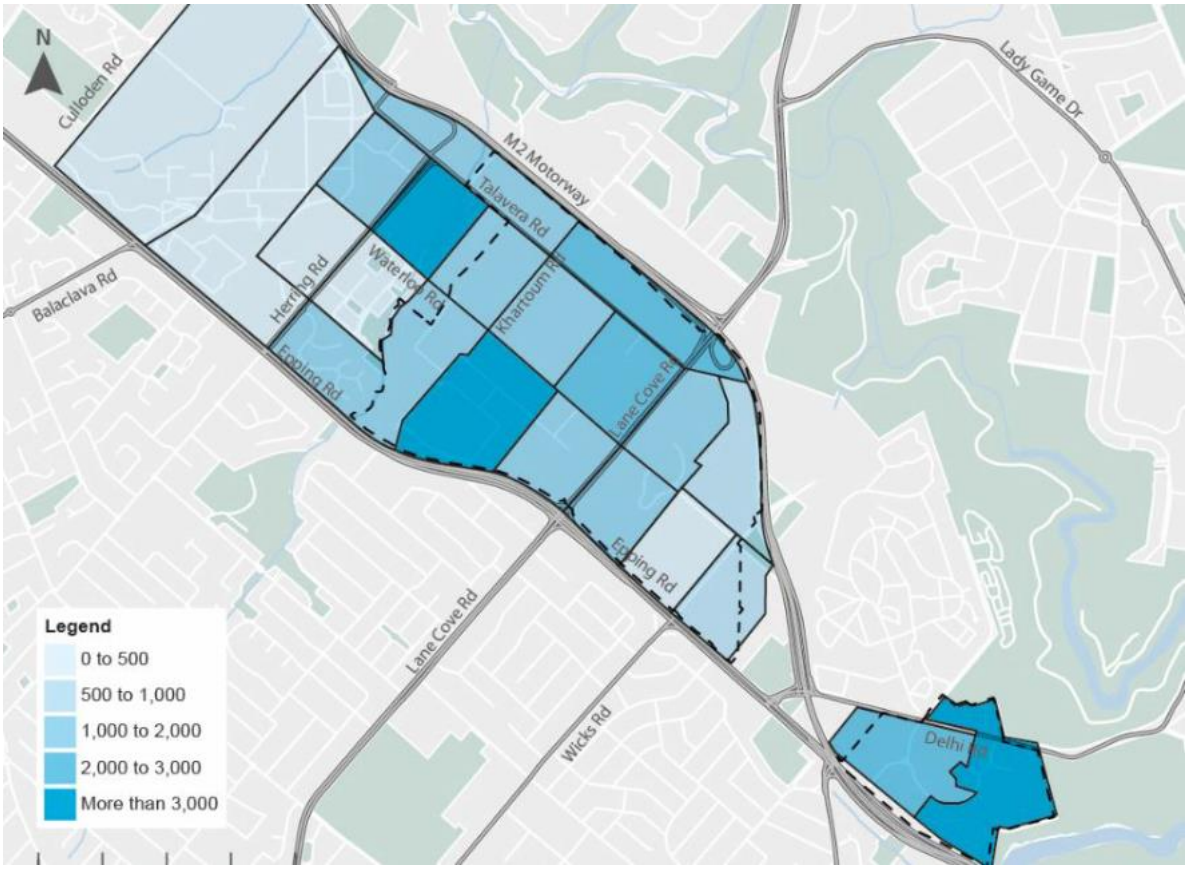
In addition to the potential interventions listed above, car parking is a key tool as part of a broader travel demand management strategy.

Issue: The abundance of off-street parking in the Macquarie Park area, particularly in areas adjacent to public transportation hubs, encourages private vehicle use, potentially exacerbating congestion and undermining the mode shift to public and active transport. Three different locations within the study area (Delhi Road, between Waterloo and Talavera Road and next to Epping Road) contain more than 3,000 off street parking spaces.

Potential Actions:

- Review and reduce the number of off-street parking spaces, particularly in areas near public transport stations such as the Macquarie Centre and commercial land south of Waterloo Road and next to Delhi Road.
- Implement parking management strategies such as time restrictions or dynamic pricing to discourage long-term parking.
- Encourage alternatives to private vehicle use by improving pedestrian, cycling, and public transport infrastructure and services.
- Develop initiatives for shared parking and carpooling to reduce the demand for individual parking spaces.
- Strict caps on parking allowances for new builds of residential and commercial properties.

Figure 4 shows the parking numbers within the study area that were identified in the Draft Macquarie Park Integrated Transport Plan.



Source: *Draft Macquarie Park Integrated Transport Plan*

Figure 4 Off-street parking analysis

Reliable Transport

Freight Network accessibility

Issue: Last-mile delivery in Macquarie Park is predominantly carried out by large vans and trucks, leading to localised air pollution, noise, and unnecessary vehicle travel within the precinct. Figure 5 shows the existing freight network map in and around Macquarie Park. The following routes are approved for B-doubles:

- Lane Cove Road
- Epping Road
- Delhi Road (access to/from the M2 Motorway only)

The M2 Motorway is an approved freight route but with travel conditions regarding load sizes.

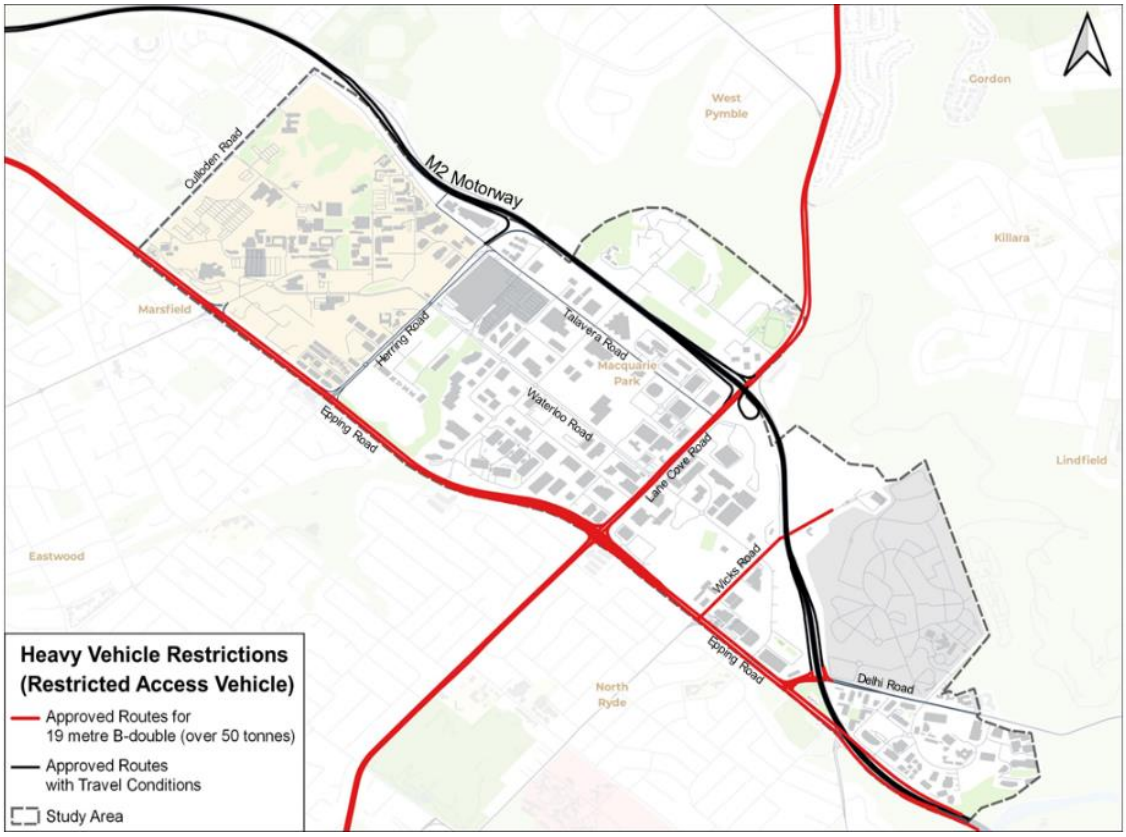


Figure 5 Existing freight network map

Potential Actions:

- Develop a strategy and network for micro-mobility and micro-freight.
- Encourage the use of right-size vehicles for last-mile delivery tasks, such as utilising micromobility options like cargo bikes.
- Establish microhubs on the periphery of the area, close to arterial roads, where larger vehicles can transfer goods to smaller cargo bikes for local deliveries.
- Provide incentives for local businesses to adopt sustainable delivery practices, such as using cargo bikes for their deliveries.
- Promote the benefits of using micromobility options for last-mile delivery, including reduced air pollution, noise, and congestion.
- Collaborate with delivery service providers to implement and support the adoption of sustainable and efficient delivery practices in the precinct.
- Consider how freight vehicles will be powered in the future and consider what refuelling or charging technologies are needed in the precinct.

Bus and strategic freight accessibility

Issue: Within the Macquarie Park precinct, the movement of through traffic, including freight, is discouraged. However, strategic (regional) freight should be maintained on identified arterial corridors, specifically Lane Cove Road, Epping Road, M2 Motorway, and NorthConnex.

Potential actions:

- Implement measures to discourage through traffic within the precinct to prioritise local access and reduce congestion.
- Designate and prioritise identified arterial corridors (Lane Cove Road, Epping Road, M2, and NorthConnex) for strategic freight movements, ensuring efficient regional freight connectivity.
- Collaborate with freight transport operators and stakeholders to optimise freight routes and scheduling on the designated corridors.
- Implement last-mile freight delivery options to reduce the need for large freight vehicle movements within the precinct.

Amenity and Use

Equitable access

Issue: There are two key issues with equitable access in Macquarie Park. Firstly, accessibility for people with mobility issues or living with a disability; and secondly to ensure women, children, seniors, minorities and people who may feel vulnerable have a sense of personal safety and security.

Potential actions:

- Enhance pedestrian infrastructure, kerb ramps, wider footpaths, tactile markers, and accessible raised-threshold crossings
- Provide well-lit and well-maintained footpaths and cycling paths to ensure safety and visibility, particularly for women and vulnerable groups
- Implement the recommendations of the women's safety audit, including addressing lighting, visibility, and personal security concerns in public spaces.
- Engage with community organisations and advocacy groups representing people with disabilities, women, children, and seniors to gather ongoing feedback

Women's Safety Audit

The purpose of the Women's Safety Assessment was to understand the experiences and perceptions of women and girls concerning safety within the Macquarie Park precinct.

To support increased use of public transport, active transport, and participation in public life by women and by members of the community more broadly.

The study provided an opportunity to test and trial women's safety work undertaken to date in this specific context, with residents of and visitors to the local area, with lived experience of safely navigating the Macquarie Park precinct.

Further information about the Women's Safety Audit is provided in Appendix E.

Public spaces

The condition and intended use of public spaces impact women's perceived and actual safety. The communities that are most at risk (women, gender diverse, Aboriginal, culturally diverse and living with disability) are rarely consulted in design and decision-making processes. Crime Prevention through Environmental Design (CPTED) principles are useful for managing public space.

Lighting

Lighting was identified as a key issue, particularly through main pedestrian routes and residential areas. The night walk for the Women's Safety Audit (Appendix B) identified different levels of lighting along different portions of Waterloo Road, some areas with no lighting (e.g., Shrimptons Creek), and other design limitations. Figure 6 shows the lighting conditions on Waterloo Road and the Shrimptons Creek path at night.

Some participants would prefer better designed and lit back streets to avoid using main roads, where there is more interaction with cars.

Figure 6 Waterloo Road and Shrimptons Creek path at night

Safe crossing

Removing the median barriers along Waterloo Road or providing regular breaks and safe crossing points will give people more options to cross the road when needed. This will help people to make quick decisions to cross the road if feeling uncomfortable or threatened by someone approaching. Figure 7 shows examples of where this is used on Delhi Road and Waterloo Road.

Figure 7 Examples of pedestrian fencing on Delhi Road and Waterloo Road

Footpath design

A well-designed and maintained environment contributes to perceptions of safety as well as actual physical safety. Footpaths should be designed with adequate width to accommodate people walking in both directions, people with mobility aids and young people on bicycles. Existing paths on Waterloo Road are shared paths, however, they are not designed in a way that supports shared uses. Figure 8 shows examples of shared paths within Macquarie Park. Note that a participant in the night walk mentioned they would never have thought these were shared paths and would not use them for cycling.

Figure 8 Examples of shared paths in Macquarie Park

Speed limits

As a busy road, with limited safe crossing points, lowering the speed limit on Waterloo Road would improve feelings of safety. Slower vehicles make pedestrians less vulnerable and may encourage further active transport modes through the precinct.

The projected increase in workers and residents in Macquarie Park brings an opportunity to create more slow-speed and shared zones. This will create a more suitable environment for people to choose active transport more regularly to access their destinations.

Metro maintenance

Improving security at the Metro stations may increase women's feelings of safety and encourage more use. This may include CCTV, which is monitored in real time and signage informing of their presence, but physical security presence will provide the most impact. Providing an authority figure, that is adequately trained in bystander intervention, not only improves perceptions of safety but can ensure that an appropriate intervention is provided in the case of an incident.

Safe amenities

Toilets were described in follow-up interviews as sometimes unsafe spaces for women, due to risks of assault and experiences with people loitering in a confined space with only one way out. They are however crucial spaces to provide particularly for women in the public domain and should be safe and clean.

Expanding help points

The existing help point buttons in Metro stations can be helpful tools however they should be more visible and designed with more contrast to the colour scheme adopted throughout the station. More help points could be provided outside the Metro stations at street level to support people approaching and leaving the stations and bus stops. These should be accessible to all abilities and provided in multiple languages.

Real time public transport information

There is an opportunity to provide real-time scheduling and updates of public transport arrivals, by using screens or announcements at bus stops, similar to Metro stations, that inform of the time remaining until the next service. This would enable people to better plan their trips and avoid having to wait in the dark for longer.

Events and activation

A lack of people around was identified as fundamental to feeling unsafe. There are numerous opportunities to activate places and spaces in Macquarie Park through land use planning – to support active street frontages and eyes on the street – and programming to encourage people into public spaces more often and for positive, community building purposes. Community events, public art and well-designed public spaces that showcase culture, identity and community can contribute to a sense of inclusion, connection and belonging. Examples of public spaces near the Lachlans Line development and Elounera Reserve are shown in Figure 9.

Figure 9 Examples of public spaces within Macquarie Park

Waterloo Road

Given the prominence of Waterloo Road, enhancing pedestrian safety and accessibility could greatly benefit the community. Removing median barriers or implementing safe crossing points would offer individuals more options when crossing the road, allowing them to make quick decisions if they feel uncomfortable or threatened. These changes should also consider the needs of those using mobility aids or requiring additional assistance. Examples of these are shown in

Figure 10 Examples of crossing facilities on Waterloo Road

Convenient facilities

Local living

Issue: Most of the local streets in the precinct lack street-front activation, which makes it less attractive for people to linger and socialise and reduces the likelihood of walking.

Potential actions to increase activation could include:

- Introduce a second entrance at the Network Place level in North Ryde station to increase pedestrian traffic.
- Encourage redevelopment along Waterloo Road with amenities that promote walking, like shops or a small supermarket at Macquarie Park Station, and consider a second station entrance facing west.
- Implement playgrounds, outdoor gym equipment, and flower, magazine, and food kiosks to stimulate street life and improve surveillance.
- Utilise unactivated street spaces and bus stops for local amenities such as small kiosks, akin to the 'Kick Start Café' at Macquarie Park, which can be either pop-up parklets or permanent street furniture. Examples of this are shown in Figure 11.
- Repurpose temporary street closures and unused bays for temporary amenities and uses, like markets.
- Utilise the wide carriageways and landscape setbacks on Talavera Road and Waterloo Road to create permanent street-based activations, improving the activity levels in these areas.
- Recognise the constraints due to existing infrastructure like setbacks and linear parks on Waterloo Road and residential colleges on Talavera Road, and strategically plan development around them. Noting that lack of activation may persist for some time due to development constraints, these areas are more suitable for permanent street-based activation.
- Consider existing and potential locations to provide seating to increase activation.

Figure 11 The Kick Start Café (pop-up) behind Macquarie Park bus stop, pop-up on-street food trucks on Ramsgate Avenue, Bondi Beach and temporary street closures for flower/food markets - Paris, France

Transport node facilities

Issue: Throughout the precinct, there is a general lack of convenient facilities for people to use at transport nodes. For example, bus stops lack shelter and seating; there is limited access across roads to conveniently reach bus stops; and a lack of bicycle parking.

A program of bus stop improvement should be undertaken to ensure that bus stops are following best practice guidance, including a seat, a shelter and real-time travel information. Where there is a shared path, additional space should be allowed for the bus stop furniture and waiting area to minimise conflicts between cycling and pedestrian activity including customers using the bus stop.

Potential actions to increase convenient facilities for transport customers include:

- Improve bus stops by ensuring they include a seat, a shelter, and real-time travel information. In addition, bus stops should be compliant with disability access requirements.
- Allow additional space for bus stop furniture and waiting areas on shared paths to avoid conflicts between cycling and pedestrian activities.
- Strategically locate pedestrian crossings near bus stop pairs, or space bus stops to conveniently access crossings, making travel safer for pedestrians. For example, if the Waterloo Road / Khartoum Road roundabout is signalised, then the two bus stops near the existing roundabout could be brought closer to the crossings.
- Consider signalising roundabouts and repositioning nearby bus stops for more convenient access.
- Install bicycle racks near bus stops, stations and major destinations like supermarkets to facilitate local cycling.
- Add benches and cycle racks throughout the precinct for the convenience of walkers and cyclists when they take breaks.
- Consider providing public toilets in the precinct.

Green and Blue

Link to Nature and Tree Canopy

Linear Park and Waterloo Road

Issue: The designated 'linear park' along Waterloo Road between Lane Cove Road and Herring Road pushes pedestrians towards the edge of the road as there is no continuous pedestrian pathway through the landscaped setback. There are several low-rise buildings in the linear park which also inhibit access. There are also inconsistencies with the tree canopy coverage along the road. As a result, the linear park cannot be enjoyed as a continuous edge, and the pedestrian experience is focused on the edge of Waterloo Road where there is greater localised air pollution and noise.

Figure 12 shows the existing tree canopy coverage in the study area.

Figure 12 Tree canopy coverage in Macquarie Park

Potential actions:

- Relocate pedestrian pathways towards the building line, away from the edge of the roadway, to minimise the impact of road noise, pollution and fast-moving traffic.
- Reduce the number or impact of low-rise buildings in the linear park.
- Correct inconsistencies in tree canopy coverage to provide ample shade.
- Include more space behind the curb for a landscaped edge, continuous street trees, and wider footpaths that are set back from the road.
- Continuous median planting to extend the concept of the linear park across the street.

Access to Lane Cove River and Shrimptons Creek

Issue: There are few through-site links and limited connections down to the Lane Cove River, which limits pedestrians from accessing the available amenity in the area. Likewise, there is no current access along Shrimpton's Creek beyond Waterloo Road to Lane Cove River, due to the carpark entrance of the Macquarie Centre and a small culvert under the M2 Motorway behind the residential development.

Potential actions:

- Enhance and better mark through-site links to improve pedestrian access to the Lane Cove River, using a wayfinding scheme focused on Khartoum Road and Christie Road.
- Investigate a connection to join the Shrimpton's Creek Trail to a public road, such as Khartoum Road, via the M2 Motorway maintenance access path.
- Strengthen the existing shared path from Waterloo Road towards Epping Road by establishing a good connection across Epping Road and through the west-east cycle paths across Macquarie Park.
- Work towards providing access along Shrimpton's Creek beyond Waterloo Road to Lane Cove River, which could involve reviewing existing access to the Macquarie Centre and considering the long-term redevelopment to restore creek access for pedestrians and cyclists.

- Consider repurposing an existing access point to the Macquarie Centre to connect existing cycling facilities, close the main shopping centre car park entrance along Shrimpton's Creek, and provide a connection through to Talavera Road.

Surface car parking

Issue: The area is dominated by surface parking and parking stations, resulting in a lack of green canopy cover and stormwater permeability.

Potential actions:

- Mandate minimum tree canopy coverage on new through-site links, minor roads, and any retained surface carparks.
- Adopt the Department of Planning and Environment's Urban Design Guide targets for street tree canopy:
  - 35 per cent for existing industrial streets with overhead power lines
  - 45 per cent if power lines are placed underground
  - 60 to 70 per cent for new residential and industrial streets with underground power
- Implement the Urban Design Guide recommendation to plant a tree for every fifth parking space in a chequerboard pattern, which will require a reduction of approximately 16.7 per cent of surface parking. This 'retrofit' should be mandated for any retained surface parking going forward.

Comfort and Safety

Low Risk - Road safety and pedestrian safety

Issue: Figure 13 maps crashes involving people walking or cycling. It illustrates a cluster of walking and cycling crashes at the intersection of Lane Cove Road and Epping Road. There were also pedestrian crashes at the intersection of Lane Cove Road and Waterloo Road. This is significant as the access point to Macquarie Park Station is located next to this intersection and generates high pedestrian volumes as people cross Waterloo Road. This requires pedestrians to cross a slip lane where the speed limit for approaching cars is 70 km/h.

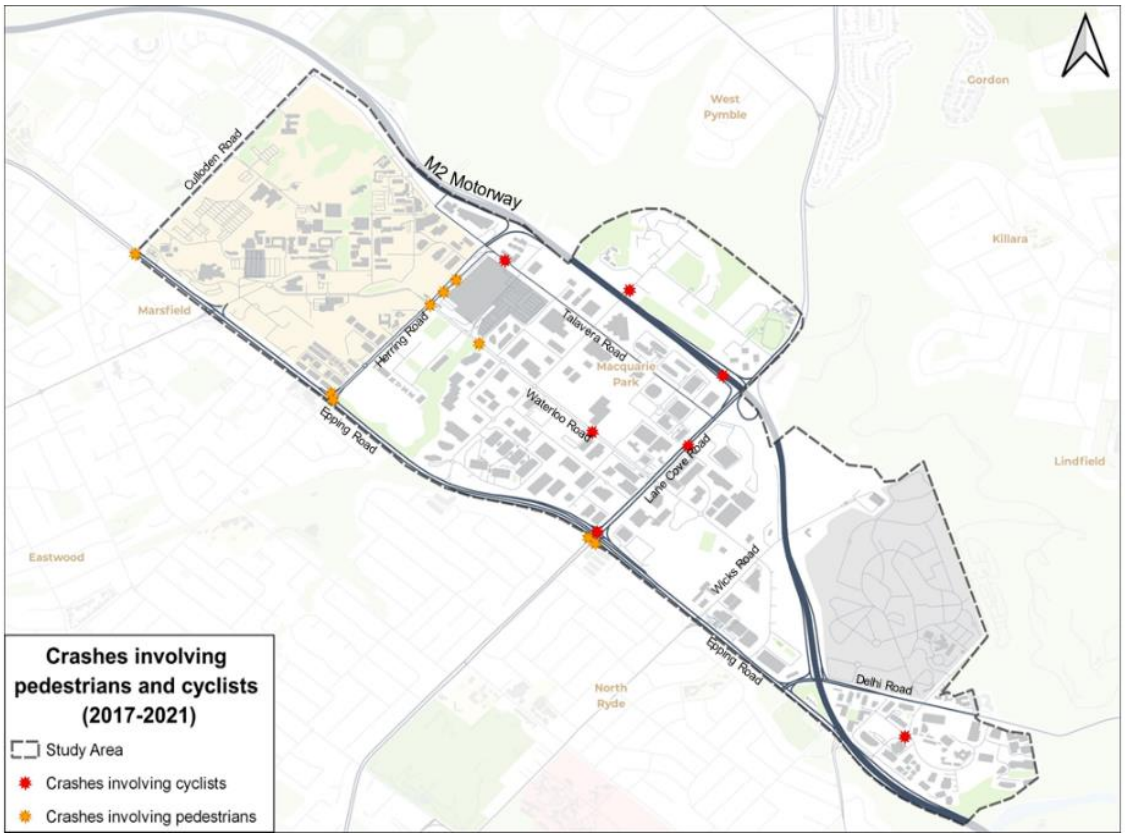


Figure 13 Study area crashes involved pedestrians and cyclists

Potential Actions:

- Concentrate efforts to improve road safety for people walking and cycling in areas where there have been patterns of crashes.
- In particular, address the high rate of crashes at Lane Cove Road and Epping Road, such as removing the slip lane.
- Reducing speed limits where there is a high rate of crashes at Lane Cove Road and Epping Road.

Local Streets

Issue: Local streets in the precinct have wide carriageways, narrow footpaths, and surplus vehicular space dedicated to unnecessary turn bays and parking, which reduces safety and comfort for pedestrians and bike riders. For example, the carriageway of Khartoum Road (two lanes) is 12 metres wide, and Talavera Road (four lanes) is 16 metres wide. Much of the surplus vehicular space is given over to dedicated turn bays and parking.

Potential Actions:

- Review space allocations in line with the Road User Space Allocation Policy.
- Narrow traffic lanes and reduce road speeds to create a safer environment for people walking and cycling.
- Introduce safe bicycle facilities to provide segregated space for cyclists.
- Widen footpaths to improve pedestrian comfort and safety.
- Install street furniture such as benches every 50 metres for less mobile pedestrians to rest.
- Provide bicycle racks outside shops and businesses.
- Consider modal networks to reduce conflicts between walking and cycling and vehicles and freight.

Figure 14 shows examples of streetscapes that enable mixed-use.

Figure 14 Consider the design of local networks to encourage slower speeds, walking and cycling, and to provide regular opportunities for people to stop and rest (Redfern, City of Sydney; Kogarah, Bayside council)

Waterloo Road

Issue: Waterloo Road's pedestrian environment lacks safety and comfort due to narrow footpaths, fast-moving traffic, lack of buffers between footpaths and roads, long pedestrian fencing which blocks access, limited crossing opportunities, and challenging station access. It also lacks crossing arms on all four sides of intersections even outside Metro stations. The connection between the two station portals requires pedestrians and bicycle riders to descend into the station and then ascend to the other side of the intersection as there is no southern pedestrian leg at this intersection.

Potential Actions:

- Widen footpaths on the edge of the linear park to improve pedestrian comfort and safety.
- Implement buffers between the footpath and road to enhance the comfort of walking in the area.
- Remove long pedestrian fencing along Waterloo Road and increase crossing opportunities.
- Remove the need for pedestrians to descend into the metro station and then ascend to cross to the other side.
- Implement pedestrian-friendly redesigns of problematic intersections, such as reducing pedestrian crossing distances, increasing pedestrian and cycling spaces, and lowering speed limits.
- Enhance personal security measures, such as better lighting and security patrols, to encourage walking.
- Conduct regular safety audits to identify and address emerging pedestrian safety issues on Waterloo Road.

Character and Form

Human Scale

Issue: Due to its history as a tech park, Macquarie Park is characterised by large blocks with excessive surface parking and parking stations, a lack of fine-grain, street-level activity, and limited through-site links and connections to Lane Cove River, resulting in a lack of human scale and reduced walking, cycling, and access to amenities.

Potential Actions:

- Reduce block sizes and provide narrower streets, as seen in Halifax Street, to reinforce a human scale following NSW Better Placed.
- Enhance and create more through-site links and connections to increase walking, cycling, and access to amenities.

- Provide clear sight lines along paths from street to street, avoiding chicanes and blind corners.
- Use design and signage to emphasise their public character, such as matching footpath paving and street signs.
- Replace stairs with shallow ramps for small level changes and provide regular lighting.

Distinct

Issue: Due to the era and typology of its development, Macquarie Park lacks distinctness in its built form. Its streets could better reflect the unique character of the area including its indigenous cultural history, connection with Country, and status as Australia's third-largest Central Business District.

Potential Actions:

- In the short term, implement placemaking strategies in public spaces to increase activity and distinctness, similar to the Streets as Shared Spaces interventions across Sydney. Figure 15 shows examples of Streets as Shared Spaces interventions.
- Apply the Connecting with Country Strategy to street design, using opportunities to reintroduce Aboriginal place names, make creek lines publicly accessible, and integrate art and interpretation where feasible.
- Develop a unique, high-quality palette of street furniture to define and characterise the area, drawing inspiration from initiatives in the Sydney and North Sydney CBDs.
- Incorporate public art and signage into the streetscape to mark historical or symbolic places and engage the community. Figure 16 shows examples of public art.
- Encourage street art on private buildings and colourful crossings, drawing inspiration from places like Bankside, London or Taylor Square, Sydney.
- Incorporate public art into street furniture and sculptures.
- Encourage art incorporation as part of redevelopment processes, following the example of the City of Sydney's area-based public art strategies and Interim Guidelines for Public Art in Private Developments.

Figure 15 Placemaking during temporary street closures, Young St, Neutral Bay; Church St, Drummoyne

Issue: Residential areas in Macquarie Park lack a neighbourhood feel that promotes communal interaction and connection.

Potential Actions:

- Design and implement communal spaces like parks, gardens, and recreational facilities that act as a communal backyard.
- Design street layouts and public spaces that are conducive to social interaction – small, narrow streets with slow (30km/h) traffic speeds, shaded with trees.

- Develop community programs and initiatives that encourage residents to participate in community life – such as neighbourhood events and gatherings to foster community connections.

Figure 16 A distinct character can take a variety of forms and artistic expressions, from formal (National Trust plaque at Pen Dinas) to the playful and expressive (street art by Invader in North Annandale)

Connecting with Country

Issue: Macquarie Park lacks representation of, and connection to, its Indigenous cultural history and connection to Country in its built environment and transport design.

Potential Actions:

- Implement the Connecting to Country Framework (see Appendix A) in all design processes related to the Macquarie Park Innovation Precinct.
- Incorporate Aboriginal art into the built environment, such as embossing art into concrete or including large-scale artworks and sculptural pieces.
- Utilise digital installations to explore and display both traditional and contemporary Indigenous art.
- Adopt materiality palettes that reflect the natural elements of Country, including the colours of sandstone, water, native plants, and the sky, to honour Aboriginal culture authentically and create a sense of connection to the land.
- Incorporate Aboriginal knowledge into contemporary transport design and planning initiatives.

Appendix E – Modelling methodology report

Design
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Transport for NSW

Macquarie Park Detailed Precinct Transport Study

Modelling Methodology Report

wsp

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Macquarie Park Detailed Precinct Transport Study
Modelling Methodology Report

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Approved by:	Chris Carlaw	11/10/2022	

WSP acknowledges that every project we work on takes place on First Peoples lands.
We recognise Aboriginal and Torres Strait Islander Peoples as the first scientists and engineers and pay our respects to Elders past and present.

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1 Introduction

1.1 Background

Macquarie Park has a strong role within Greater Sydney's and Australia's economies and is a growing home to world-class businesses, innovation, research, and education. It is necessary to develop a Detailed Precinct Transport Study to test the transport services, infrastructure and initiatives identified and further define these while the area continues to grow and change.

WSP has been engaged by TfNSW to develop a detailed transport study that is underwritten by robust modelling results based on effective strategic improvements. WSP will work together in an Integrated Project Team alongside TfNSW to develop models and clear reporting that will inform the transport study.

This technical report has been prepared to document the modelling methodology proposed to assess the traffic implications of future infrastructure proposals in the Macquarie Park precinct and addresses the traffic modelling requirements documented in TfNSW's Technical Direction Traffic Management TTD 2017/001 Operational Modelling Report Structure.

1.2 Modelling objectives

Project's key modelling drivers

- Assist in identifying and recommending new or changed transport services to meet the vision and place outcomes for Macquarie Park
- Help identify any infrastructure changes required to obtain better transport network outcomes
- Understand staging and timing of any infrastructure changes

Project's modelling needs and outcomes

- Inform the strategic business case for the precinct
- Assist with developing place-based outcomes
- Confirm infrastructure improvements and limitations

1.3 Scope of works

The scope of work was outlined in the WSP proposal and agreed by TfNSW. The scope of work is summarised in Table 1.1.

Table 1.1 Scope of works

TASK	DESCRIPTION
Stage 1 – Project inception and data collection	
Project inception	Confirm traffic modelling scope and methodology Finalise modelling methodology report
Site inspection and meeting	Site visit Inception Meeting with TfNSW

TASK	DESCRIPTION
Data collection	Traffic surveys Processing of count data, queue surveys, and travel times surveys for model input
Receipt of Demands	The traffic demands for the base 2022, 2026, 2031 and 2041 weekday AM and PM peak periods will be developed based on the STFM outputs (supplied by TfNSW), which will be used for travel pattern analysis and then to provide "cordon" traffic matrices for input into the Aimsun models. Disaggregation of the initial matrices will be required to allow for a finer distribution of traffic within the Aimsun Model and will be based on the provided STFM zone structure.
Stage 2 – Base year model development	
2022 Aimsun modelling	Develop a 2022 base year model Process travel demand from STFM and turning counts Calibrate and validate the 2022 Aimsun base year model based on the survey data Prepare Base Model Development, Calibration and Validation Report
Stage 3 – Future Base, Options and COVID Sensitivity Testing	
Future year base case modelling – 2041	TfNSW to confirm the planned and committed network upgrades within the study area Future year matrix development Future year "base case" Aimsun modelling
Future year options modelling – 2041	SISA case SISA + Option 1, 2 and 3 Options Assessment and Modelling Result memo
Future year preferred option modelling – 2026 and 2031	The preferred option finalised from the above will be tested for the years 2026 and 2031
COVID sensitivity testing – 2022, 2026, 2031 and 2041	2022, 2026, 2031 and 2041 COVID sensitivity cases, to better understand how the potential reduction in trips and migrations could impact the precinct
Stage 4 – Reporting and project delivery	
Reporting & Presentations	Methodology Report Calibration and Validation Report Options Testing Report Final Options Testing - Stakeholder Presentation Workshop Outcomes Report
Outputs	Delivery of Aimsun model files

1.4 Stakeholders

The key stakeholders involved in this project are as below:

- Transport for New South Wales - TfNSW
- City of Ryde - Council
- Department of Planning, Industry and Environment - DPIE

1.5 Report Outline

Section 1: Introduction: Includes the project background, objective, scope of work, stakeholders, and report outline

Section 2: Project Description: This section describes the study area, land-use, transport infrastructure, and assessment years and time periods

Section 3: Input data: Consists of traffic surveys, assumptions, strategic model, and traffic signals

Section 4: Methodology: Details about building the base and future model.

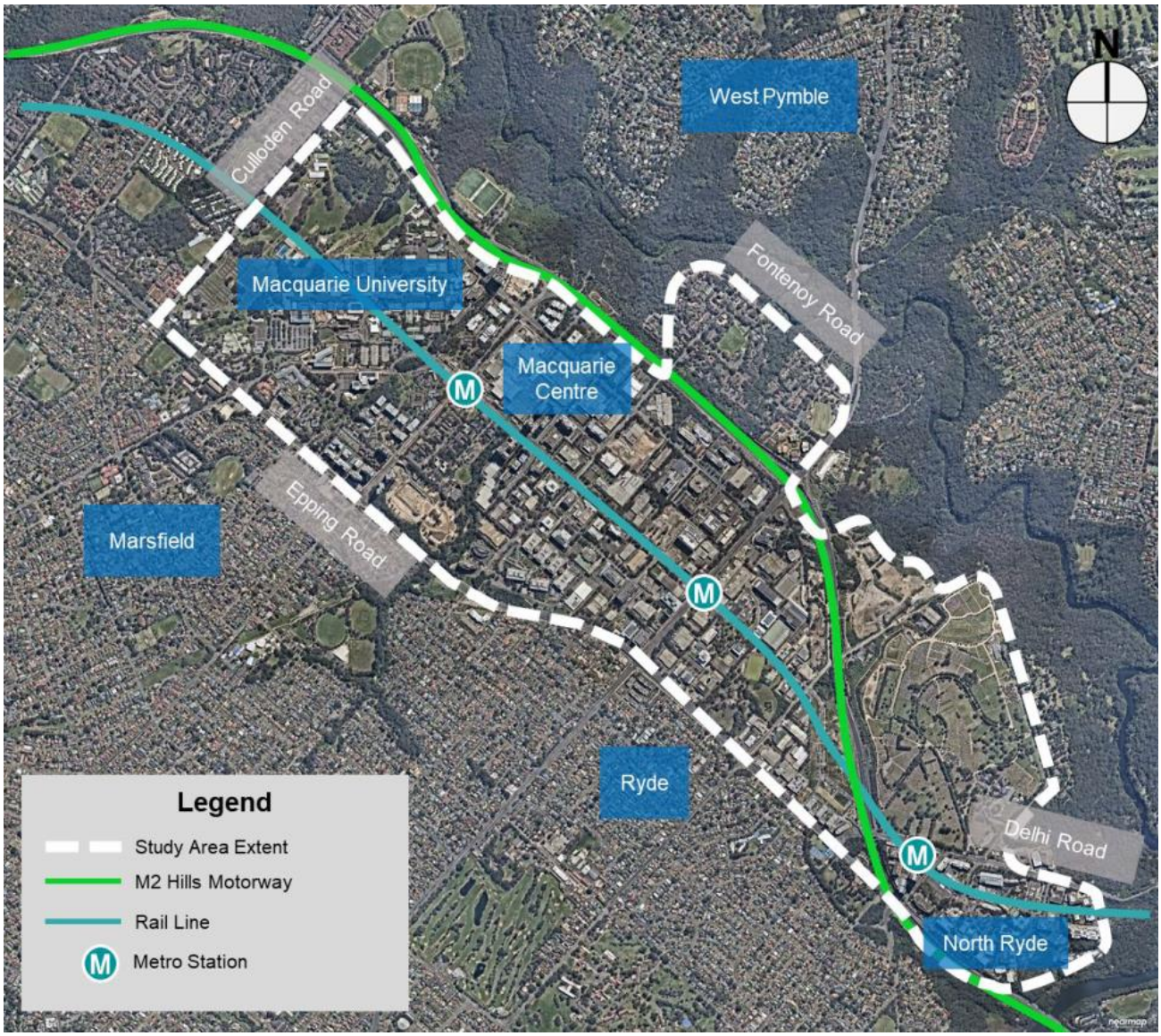
Section 5: Reporting: Summary of the contents of each report for the modelling phase of the study

2 Project description

2.1 Study Area

Figure 2.1 shows the study area that will be included in the Aimsun model. The study area is bounded by Culloden Road to the west, Epping Road to the south, the Hills Motorway M2 with an appendage for Fontenoy Road, and Delhi Road & Epping Road to the east. The M2 Motorway mainline will not be simulated in the Aimsun model.

Figure 2.1 Study area



Source: Macquarie Park Detailed Precinct Transport Study Services Brief – TfNSW

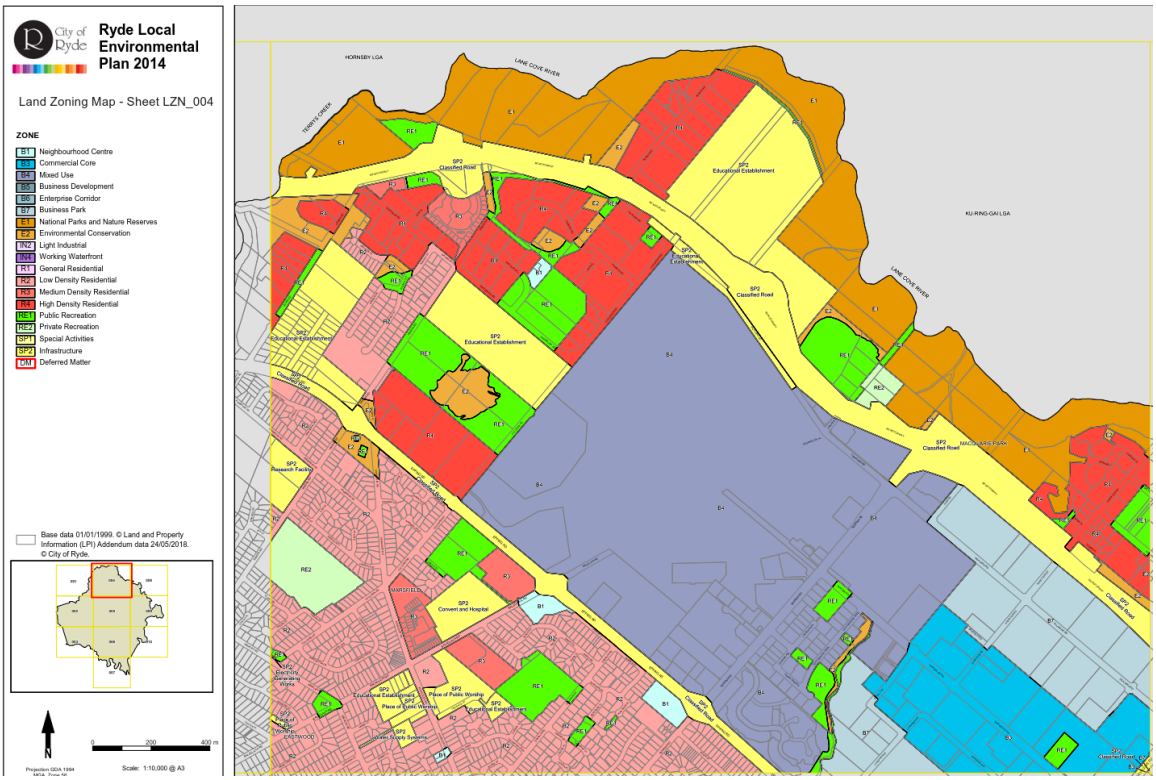
The modelled network within the study area is shown in Figure 2.2, including all the key side roads.

Figure 2.2 Aimsun Model Area

2.2 Land Use

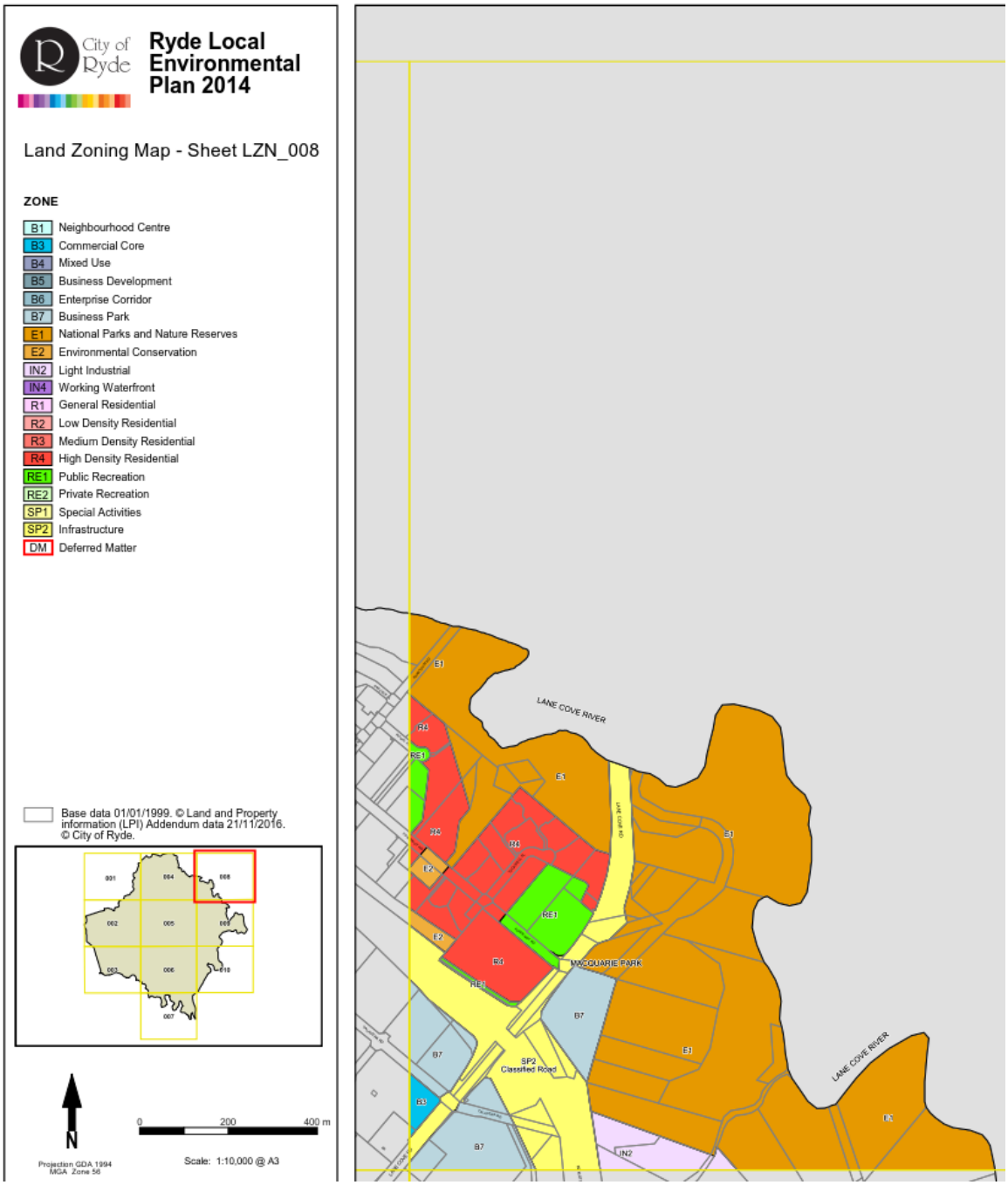
The existing land uses in the study area are shown in Figure 2.3 through Figure 2.5. The zones in the study area are SP1 – Special Activities, SP2 – Infrastructure, B3 – Commercial use, B4 – Mixed use, B7 – Business Park, R2 – Low Density Residential, R4 – High Density Residential, RE1 – Public Recreation, E1 – National Park and Nature Reserves, E2 – Environmental Conservation, IN2 – Light Industrial.

Figure 2.3 Land Use Map 1 of 3



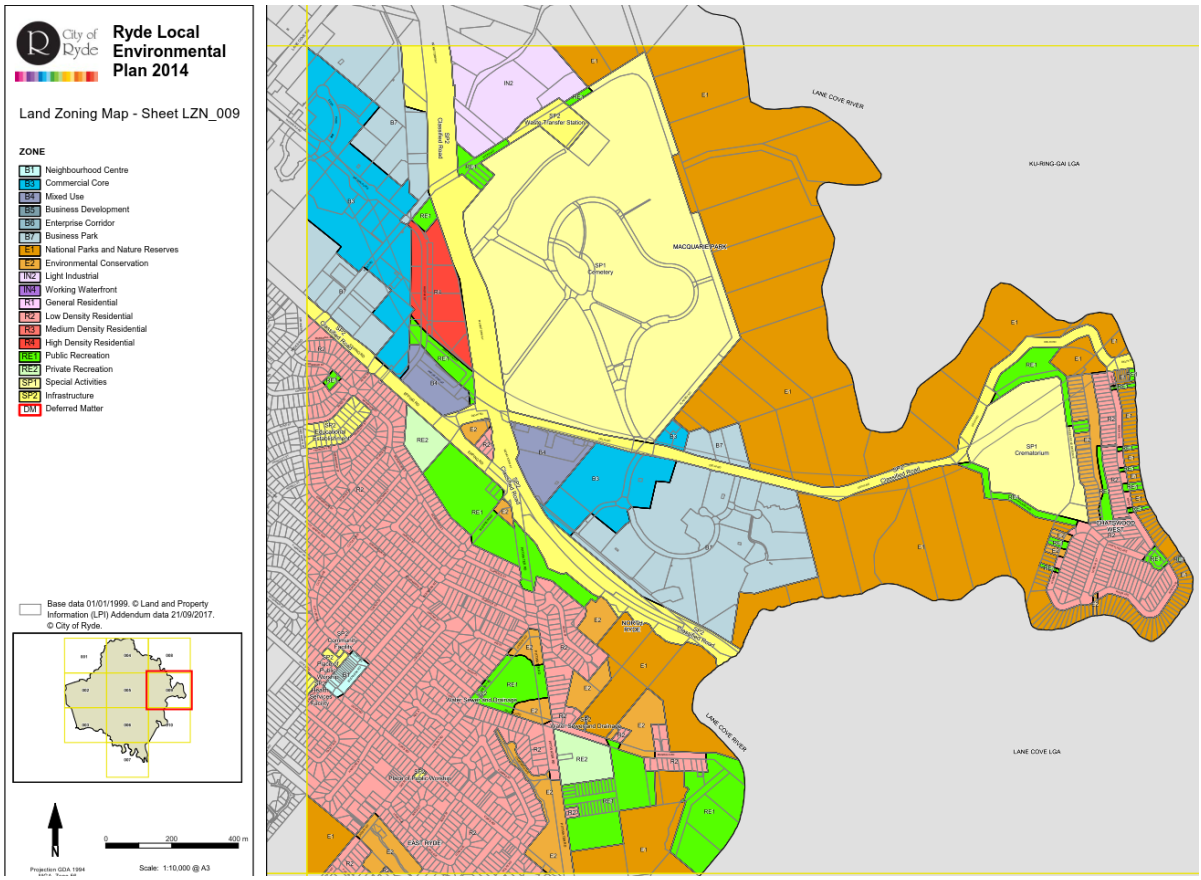
Source: Land Zoning Map – Sheet LZN_004, Ryde Local Environmental Plan 2014

Figure 2.4 Land Use Map 2 of 3



Source: Land Zoning Map – Sheet LZN_008, Ryde Local Environmental Plan 2014

Figure 2.5 Land Use Map 3 of 3



Source: Land Zoning Map – Sheet LZN_009, Ryde Local Environmental Plan 2014

Seven new neighbourhoods are proposed for Macquarie Park. Figure 2.6 shows these neighbourhoods along with Macquarie University (Herring Road) Precinct and North Ryde Station Precinct. The Macquarie Park Place Strategy work encompasses previous rezoning activity but does not propose land use changes to these precincts.

Figure 2.6 Proposed Neighbourhoods

Source: Draft Macquarie Park Place Strategy 2021, Department of Planning, Industry and Environment

These neighbourhoods are:

1 North Park – Ngalawala (Reciprocity)

This will be mainly a commercial neighbourhood, with a restored Industrial Creek weaving through connected open spaces.

2 Waterloo Park – Butbut (Heart)

This area connects Herring Road Precinct and the university to Macquarie Park Station. It will be a new green centre for Macquarie Park with mainly commercial uses and an activity hub.

3 Shrimptons Quarter – Waragal Birrung (Evening Star)

This area will focus on commercial and residential growth.

4 Macquarie Living Station – Gari Nawi (Saltwater Canoe)

This area is based around Macquarie Park Metro Station. It will be a place of activity with a commercial core and new homes.

5 Porters Creek – Burbigal (Morning)

This will be a commercial and retail space near the station.

6 Wicks Road South – Garungul (Unbreakable)

This area will have commercial, retail and residential uses, with a cluster of education, sports and recreation and cultural spaces.

7 North Ryde Riverside – Narrami Badu-Gumada (Connecting Water Spirit)

This area will have new housing with connecting paths and open spaces.

2.3 Transport Infrastructure

2.3.1 Road Network and Hierarchy

A summary of the key nearby roads and their relative hierarchy in the study area is provided in the sections below.

2.3.1.1 Talavera Road

Talavera Road is a collector road servicing the Macquarie Park region, with the key section for this study ranging between Culloden Road and Lane Cove Road. It is mostly a four lane, two-way road with two travel lanes in each direction, with a number of short turning lanes.

2.3.1.2 Waterloo Road

Waterloo Road is a collector road running parallel to Talavera Road in the NW-SE direction between Herring Road and Wicks Road. Within the main Macquarie Park area, Waterloo Road is primarily a four lane, two-way separated road with two travel lanes in each direction.

2.3.1.3 Khartoum Road

Khartoum Road is a local collector road running perpendicular to Talavera Road ranging from Waterloo Road to Carlisle Close. It is primarily a two lane, two-way road with one travel lane in each direction, with on-street kerbside parking in both directions available

2.3.1.4 Lane Cove Road

Lane Cove Road is an arterial road connecting the Ryde region with the M2 Motorway. Within the main Macquarie Park area, Lane Cove Road is primarily a six lane, two-way separated road with three travel lanes in each direction.

2.3.1.5 Herring Road

Herring Road is a distributor road connecting the Ryde region with the M2 Motorway. Within the main Macquarie Park area, Herring Road is primarily a six lane, two-way separated road with two travel lanes and one parking lane in each direction

2.3.1.6 Epping Road

Epping Road is an arterial road connecting Epping to Lane Cove and M2 Motorway. Where it bypasses the main Macquarie Park area, Epping Road is primarily a six lane, two-way separated road with three travel lanes in each direction.

2.3.1.7 Fontenoy Road

Fontenoy Road is a local collector road running perpendicular to Khartoum Road ranging from Khartoum Road to Lane Cove. It is primarily a two lane, two-way road with one travel lane in each direction, with on-street kerbside parking in both directions available

2.3.1.8 Delhi Road

Delhi Road is an arterial road connecting the Macquarie Park Cemetery and Crematorium region to the M2 Motorway. Delhi Road is primarily a four lane, two-way road with two travel lanes in each direction.

2.3.1.9 Culloden Road

Culloden Road is a collector road servicing the Macquarie Park region, with the key section for this study ranging between Epping Road and M2 Motorway. It is primarily a two lane, two-way road with one travel lane in each direction.

2.3.1.10 M2 Motorway

M2 Motorway is a six-lane motorway, two-way with three lanes in each direction.

2.3.2 Public Transport Network and Services

2.3.2.1 Bus Services

The Macquarie Park area is well serviced by multiple public bus routes. Table 2.1 lists the bus routes existing on the key roads in the study area.

Table 2.1 Bus Routes

SR NO.	ROAD	ROUTE NOS. – EB/NB	ROUTE NOS. – WB/SB
1	Talavera Road	294, 410, 506, 562, 565, 572, 575, 611, 619	294, 506, 562, 565, 572, 575
2	Waterloo Road	11M, 197, 259, 292, 294, 410, 506, 545, 550, 562, 565, 572, 575, 611, 619	197, 259, 292, 294, 410, 506, 545, 550, 562, 565, 572, 575, 611, 619
3	Khartoum Road	259, 292, 294, 506, 562, 565, 572, 575	259, 292, 294, 506, 562, 565, 572, 575
4	Lane Cove Road	11M, 197, 259, 292, 294, 410, 506, N91, N92	11M, 197, 259, 292, 294, 410, 506, N91, N92
5	Herring Road	288, 290, 291, 292, 410, 517, 518, 544, 611, 619	11M, 197, 288, 290, 291, 292, 294, 506, 517, 518, 544, 545, 550
6	Epping Road	259, 286, 288, 290, 291, 292, 293, 294, 297, 533, 544, 622	259, 286, 287, 288, 290, 291, 292, 293, 294, 533, 550, 544, 622
7	Fontenoy Road	259, 292, 572	259, 292
8	Delhi Road	11M, 12M, 259, N91	11M, 12M, 259, N91
9	Culloden Road	292, 293, 410, 551	292, 293, 410, 551

Overall, there are a wide range of bus services providing connections towards the Greater Western Sydney region, Sydney CBD, and North Shore region.

2.3.3 Rail Services

Sydney Metro services the Macquarie Park area. The Sydney Metro line from Chatswood to Tallawong currently provides connectivity to the Hills District region and North Shore Region, and there are ongoing developments from TfNSW to extend the coverage of the network towards the Sydney CBD, Greater Western Sydney region and Inner West Sydney region. Sydney Metro also provides a connection between the T1 and T9 train lines. The three metro stations servicing the study area are: the Macquarie University station located at the intersection of Herring Road / Waterloo Road, Macquarie Park station located at the intersection of Lane Cove Road / Waterloo Road and the North Ryde station located along Delhi Road approximately 150 m east of the M2 / Delhi Road intersection.

The Sydney Metro services have a frequency of approximately 1-5 minutes and a typical trip towards the Sydney CBD or Hills District region is around 30-40 minutes.

2.4 Assessment years and time periods

It is assumed that up to 12 model scenarios will be required to meet the project needs and outcomes. Upon agreement with TfNSW, additional Options will be run as required as per the price defined in our proposal. The confirmed model scenarios are summarised in Table 2.2 and include:

- A calibrated and validated base model built upon surveyed data and STFM outputs
- A future base model (2041) utilising growth data from the strategic modelling
- The SISA case to assist in determining the required infrastructure and policies that will be tested
- Three option scenarios that incorporate a suite of mitigations to determine the preferred scenario
- Staging and sensitivity testing of the preferred scenario at interim years and COVID impacted demand

Table 2.2 Modelling Scenarios

NETWORK VARIATIONS	EXISTING (BASE CASE)	FUTURE WITH FORECAST DEVELOPMENT		
	2022	2026	2031	2041
Base Case	✓			
Future Base (Do Minimum)				✓
SISA Case				✓
SISA + Option 1				✓
SISA + Option 2				✓
SISA + Option 3				✓
Preferred Scenario		✓	✓	
COVID Sensitivity	✓	✓	✓	✓

Aimsun models will be developed for the 2-hour AM and PM weekday peak periods, which will be determined upon review of collected data and consultation with TfNSW. A 30-minute warm up and cool down period will be simulated for each model.

3 Input data

3.1 Traffic Surveys

Classified turning movement counts for 6-10 AM and 3-7 PM were conducted on 14 September 2022 and 15 September 2022. There are 22 signalised intersections and 14 unsignalised locations as shown in Figure 3.1. The counts were classified into cars, rigid trucks and articulated trucks and recorded in 15-minute increments.

Figure 3.1 Intersection Count Locations

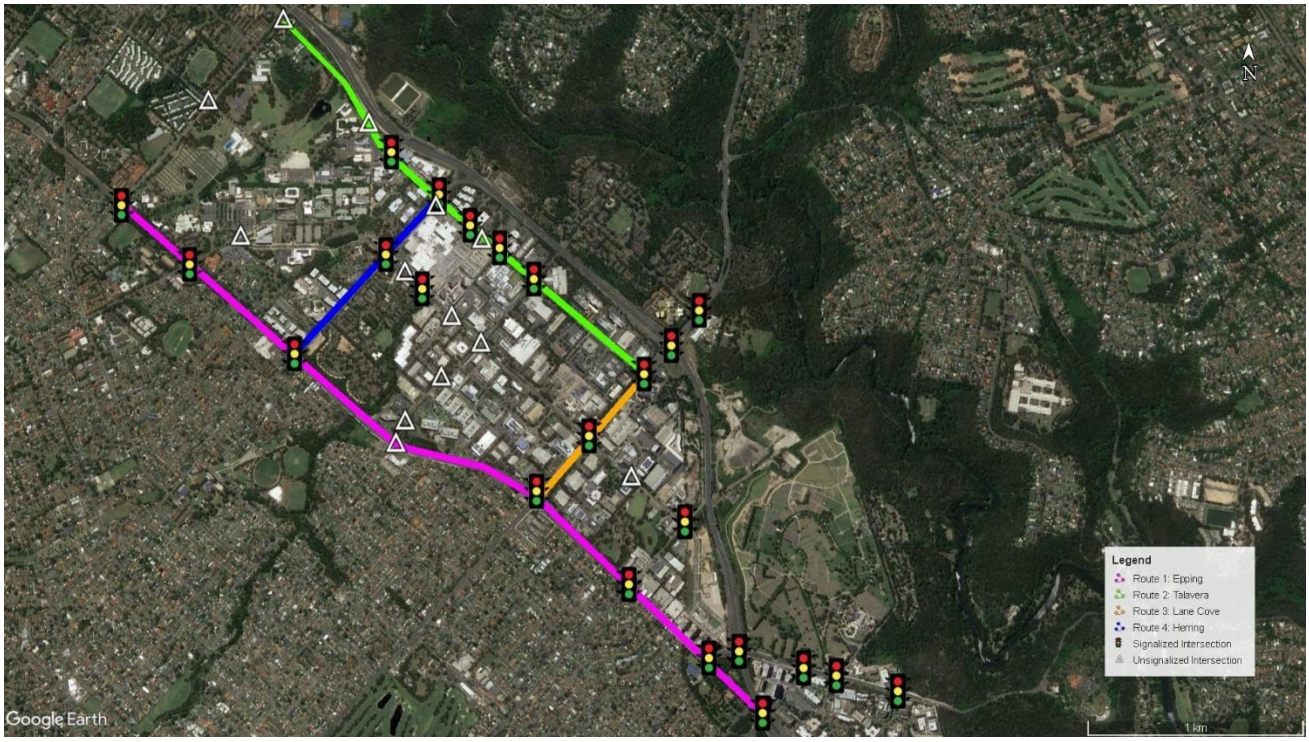


Table 3.1 Signalised Intersections

SIGNAL LOCATION	NAME	SIGNAL LOCATION	NAME
1	Epping Road / Balaclava Road	**12**	Talavera Road / Banda Road
2	Epping Road / Herring Road	**13**	Talavera Road / Macquarie Centre 1
3	Waterloo Road / Herring Road	**14**	Fontenoy Road / Lane Cove Road
4	Waterloo Road / Macquarie Centre 1	**15**	Epping Road / Wicks Road
5	Talavera Road / Herring Road	**16**	Waterloo Road / Wicks Road
6	Talavera Road / Christie Road	**17**	Epping Road / Delhi Road
7	Epping Road / Lane Cove Road	**18**	Epping Road / Pittwater Road
8	Waterloo Road / Lane Cove Road	**19**	M2 / Delhi Road
9	M2 / Lane Cove Road	**20**	Rennie Street / Delhi Road

10	Talavera Road / Lane Cove Road	**21**	Plassey Road / Delhi Road
11	Talavera Road / Khartoum Road	**22**	Julius Avenue (E) / Delhi Road

Table 3.2 Unsignalised Intersections

UNSIGNALISED LOCATION	NAME	UNSIGNALISED LOCATION	NAME
1	Balaclava Road / University Avenue	**8**	Optus Drive (S) / Lyonpark Road
2	Byfield Street / Lyonpark Road	**9**	Research Park Drive / Talavera Road
3	Byfield Street / Waterloo Road	**10**	Talavera Road / Culloden Road
4	Epping Road / Lyonpark Road	**11**	Talavera Road / Macquarie Centre 2
5	Herring Road / Macquarie Centre 1	**12**	Thomas Holt Drive / Waterloo Road (roundabout)
6	Waterloo Road / Macquarie Centre 2	**13**	Waterloo Road / Culloden Road / Gymnasium Road
7	Khartoum Road / Waterloo Road	**14**	Epping Road / Culloden Road

Travel Time surveys from 6-10 AM and 3-7 PM were conducted on 14 September 2022 and 15 September 2022 for four travel time routes, broken down by segment (between major intersections) as detailed in Table 3.3.

Table 3.3 Travel Time Routes

TRAVEL TIME ROUTES	NAME
1	Epping Road from Culloden Road to Pittwater Road
2	Talavera Road from Culloden Road to Lane Cove Road
3	Lane Cove Road from Epping Road to Talavera Road
4	Herring Road from Epping Road to Talavera Road

3.2 Assumptions

As agreed with TfNSW, the Sydney Aimsun Foundation Model (SAFM) parameters will be used in the development of the base model. However, at certain locations, it may be required to make slight changes to parameters to calibrate localised traffic behaviours and better reflect actual lane-changing behaviour in the network. All adjustments to parameters will be detailed in the calibration and validation report.

The M2 motorway itself will not be coded in the model, however the associated ramps and interchanges will be included.

3.3 Strategic Model

The prior matrix for the base model will be derived from STFM. Disaggregation of the initial matrices will be required to allow for a finer distribution of traffic within the Aimsun Model.

Matrices will be used for Light vehicles (LVs) and Heavy vehicles (HVs) separately. The strategic model scenario runs are required for the years 2022 (Base), 2026, 2031 and 2041.

3.4 Traffic Signals

SCATS IDM data is required for all the signalised intersections within the study area. As listed in Table 3.1, there are 23 signalised intersections within the study area. WSP has obtained the SCATS IDM data for these intersections along with relevant "LX" files and intersection graphics from TfNSW for Wednesday, 14 September 2022 and Thursday, 15 September 2022.

4 Methodology

4.1 Base Model

WSP is proposing to complete the traffic modelling of the Macquarie Park Precinct using Aimsun Next 22, utilising microsimulation. Aimsun is a traffic modelling software that provides the necessary detail to achieve the traffic modelling objectives of the project.

Geo-referenced images using NearMap will be used to initiate the base model coding. Thereafter, refinements to each road section, intersection and centroids, will be carried out based on wide-ranging information from Google Street View and NearMap as well as from the knowledge gathered during site visits.

4.1.1 Traffic demand

STFM model outputs, traffic survey data and site visit observations will be used to develop the prior matrix for each peak period. Each matrix will be adjusted using Aimsun matrix adjustments with manual adjustments where appropriate to achieve a satisfactory representation of base traffic patterns while achieving TfNSW's calibration criteria for the count versus modelled GEH statistics.

The matrix estimation will use the cordon matrix as the initial demand matrix and traffic count data as the "observed data set".

Separate demand matrices will be developed for each of the following vehicle types:

- cars
- rigid trucks
- articulated trucks.

The matrices will be developed for the typical weekday two-hour AM and PM peak periods. We have nominally assumed that these peak hours will be 7.00 am–9.00 am and 4.00 pm–6.00 pm. However, this will be confirmed based on the traffic count data provided. 30-minute warm-up and cool-down periods will also be included on either side of the peak hours to reflect the build-up of traffic volumes into the peak hour, and the gradual reduction in traffic after the peak hour. The demand matrices will be divided into 15-minute periods and profiled to reflect the build-up and decline of traffic over the peak period.

4.1.2 Traffic zones

To increase the model's resolution in the study area and provide more realistic network loading and unloading onto major corridors, collector and arterial roads, a subdivision of STFM zones will be required.

Traffic zones will be defined in the model to cover the key traffic entry and exit points in the model network.

4.1.3 Traffic profile

For each of the model periods, the traffic profile will be developed in 15-minute intervals. This traffic profile will be based on the proportion of traffic passing through key intersections on the network during each 15-minute interval, compared to the hourly traffic flow. The traffic surveys will be used to determine the traffic profile. Vehicles are released based on the profile in the model to reflect the traffic flow changes in the network.

4.1.4 Road type

Table 4.1 consist of the road details including road type and lane capacity derived from the SAFM (Sydney Aimsun Foundation Model). These vary with location and can be higher or lower than mentioned.

Table 4.1 Road details

SR NO.	ROAD	ROAD TYPE	LANE CAPACITY (PCUS/H)	SPEED LIMIT (KM/HR)
1	Talavera Road	Sub Arterial	925	50
2	Waterloo Road	Sub Arterial	1,100	50
3	Khartoum Road	Local	1,000	40
4	Lane Cove Road	Arterial (Divided)	1,200	60
5	Herring Road	Arterial (Undivided)	800	60
6	Epping Road	Arterial (Divided)	1,400	70
7	Fontenoy Road	Local	1,000	40
8	Delhi Road	Arterial (Divided)	800	60
9	Culloden Road	Sub Arterial	1,050	34

Source: Sydney Aimsun Foundation Model

4.1.5 Driving behaviour and speed profile

Driving behaviour and vehicle classes defined in the SAFM (Sydney Aimsun Foundation Model) will be used.

4.1.6 Penalty / Delay functions

As agreed with TfNSW, we will use the turn penalty functions (TPF) and volume delay functions (VDF) as defined in the SAFM (Sydney Aimsun Foundation Model).

4.1.7 Public transport

The published timetables by bus operators and General Transit Feed Specification (GTFS) will be used to code the public transport routes to replicate the bus movements (including school buses) within the model. This is also used by Google to provide public transport information.

4.1.8 Traffic signals

SCATS IDM data will be analysed to obtain average cycle and phase times for all signalised intersections within the study area. All the signals will be coded as actuated signals. “Late starts” at traffic lights for left-turns would be coded into the model to reflect the impact of signalised pedestrian crossings on left-turning traffic.

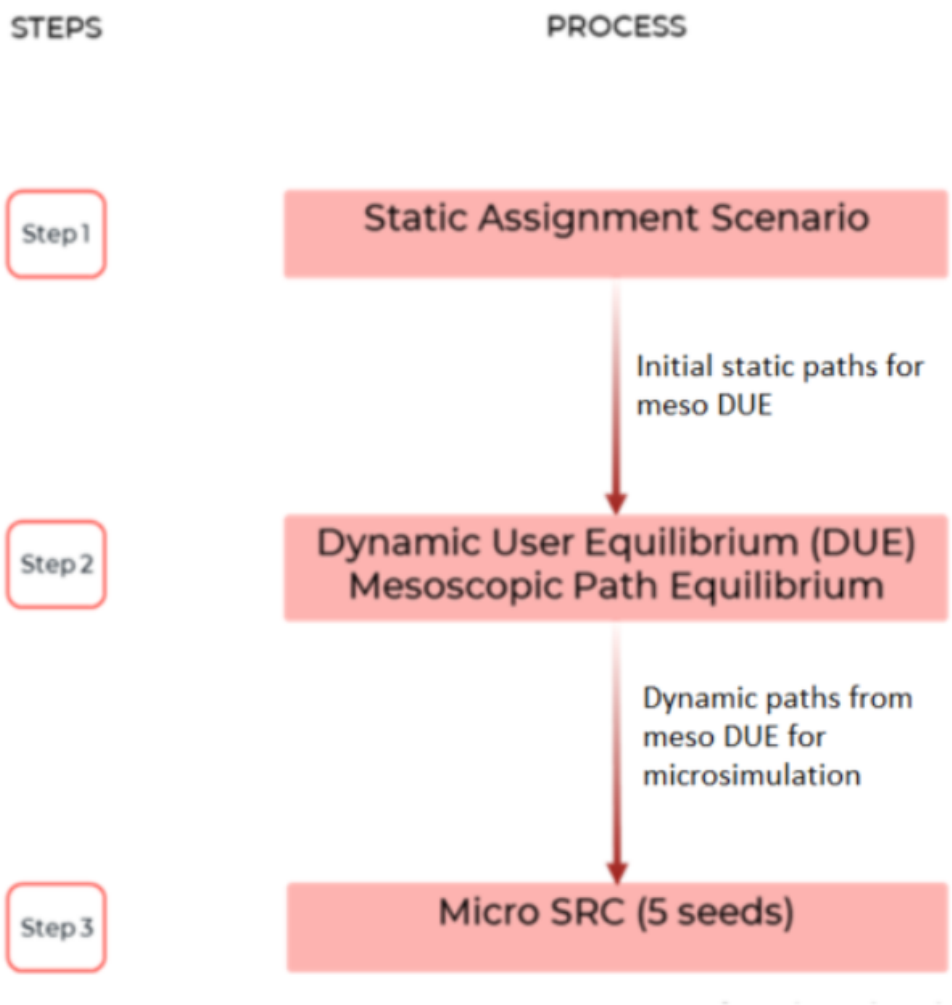
4.1.9 Pedestrians and cyclists

No cyclists will be included in the model. The pedestrian late starts in signal phasing will be considered for the signalised intersections in the network.

4.1.10 Assignment type

Figure 4.1 shows the assignment and path building process.

Figure 4.1 Assignment Process



The model will be simulated with five seed values, 560, 28, 7771, 86524 and 2849 based on Traffic Modelling Guidelines. These values are used by the random number generator to set underlying variables for each vehicle such as the time they enter the model network and the aggressiveness of acceleration and braking. To include variability in the model and develop confidence that the model reflects the wide range of driving behaviours that exist on the road, multiple seed values can be used.

The stochastic Route Choice (SRC) assignment is based on discrete route choice models or a user-defined assignment. The discrete route choice models are based on discrete choice theory and emulate a driver's decision to select a path from those available.

4.1.11 Calibration

The comparison between the modelled and observed traffic count data will be undertaken using the commonly used GEH statistic as well as the regression R-squared value, based on TfNSW's Modelling Guidelines.

The GEH statistic measures the degree of divergence of the modelled value from the observed value whilst accounting for the relative scale of each movement-volume (i.e. the higher volume movements are more important to match than the lower volume movements).

Three target criteria that will be used to ensure the model is adequately calibrated are as follows:

- a minimum of 85% of turn volumes with a GEH ≤ 5
- if volumes with a GEH > 10 (explain in the report)
- a minimum R-squared value of 0.9 for turning volumes
- directional screen lines with a GEH < 3.

4.1.12 Validation

The travel time surveys will be used to validate the model. In accordance with TfNSW's Modelling Guidelines, average modelled journey times are to be within 15% or one minute (whichever is greater) of average observed journey times for the full length of the route. The travel time route will also be split into several parts with the section average modelled journey times also to be within 15% of the average observed journey time.

4.2 Future Model

Future Year Assumptions Memo will be prepared to summarise the following:

- Proposed growth rates to estimate the future year traffic demand
- Planned and committed network upgrades for the project precinct for inclusion in the future year models.

4.2.1 Scenario Testing

As detailed in Table 2.2, several scenarios will be developed in Aimsun to quantitatively determine the benefits of the mitigations, and whether the vision goals of the precinct are met. A collaborative process throughout the modelling to work with the wider project team will be adopted to adjust and improve any mitigations that were identified.

To understand the impacts of the proposed infrastructure proposals and policies, the SISA case will be modelled. Subsequently, we will run up to three option cases consisting of mitigations identified. An option will be finalised post comparison and will be called as the preferred option.

The preferred option will then proceed to the final state of modelling which will incorporate staging and COVID sensitivity testing analysis. These will consist of:

- 2026 and 2031 interim years of the preferred scenario
- 2022, 2026, 2031 and 2041 COVID sensitivity cases, to better understand how the potential reduction in trips and migration could impact the precinct.

4.2.2 Future base case assumptions

The committed, planned, or proposed road upgrades agreed with TfNSW for inclusion will be incorporated into the future base models for the "Do Minimum" scenario.

4.2.3 Traffic demand/growth

The future traffic demand will be established based on the following:

Internal Zone Growth: All committed developments in the study area will be identified and interrogated. The potential trip generation from these developments will be extracted from respective Traffic Impact Assessment (TIA) reports or first-principles calculations while considering any modified modal share assumptions.

External Growth: This includes traffic growth to, from and between the travel zones at the edge of the model. The traffic demands for the horizon years 2026, 2031 and 2041 weekday AM and PM peak periods will be developed based on the STFM outputs, which will be used for travel pattern analysis and then to provide "cordon" traffic matrices for input into the Aimsun models.

The traffic demand of the COVID scenarios will be based on Project Phoenix outputs, from which we will establish a set of trip reduction factors for external-external, internal-internal, internal-external and external-internal trips.

4.2.4 Traffic profile

There will be no changes to the traffic profile in the future models and will be based on the calibrated and validated base year model profiles.

4.2.5 Public transport

It will be assumed that the existing public transport timetable is carried forward for future year scenarios. However, if directed by TfNSW, bus routes and timetables in the future year models can be increased as appropriate.

4.2.6 Traffic signals

Traffic signals will be altered and optimised where appropriate based on future changes in traffic demand patterns.

5 Reporting

5.1 Summary

Five modelling reports and presentations will be undertaken as part of the Macquarie Park Detailed Precinct Study including:

- Modelling methodology report (this report)
- Calibration and validation report
- Options testing report
- Final options testing - stakeholder presentation
- Workshop outcomes report

5.1.1 Calibration and validation report

This report documents the data collection/collation, model development process and key assumptions as well as the calibration and validation of the base model.

5.1.2 Options testing report

The option testing report documents the SISA options modelled as part of this project. It includes (for each option), the problem definition, mitigation measures and/or improvement proposed as well as the modelling results/outcomes.

This report will summarise the key parts of the future year modelling, including:

- Forecast growth in traffic demand, including key planned developments, new land releases, and population and employment growth
- Future network performance, including only the committed improvements to the Macquarie Park Precinct
- Network options development process, including the outcomes of the workshops
- Future network performance for each option modelled, including comparisons to other options and the future base models (with only the committed improvements)
- Identifying the preferred option/s based on the results of the modelling
- Key risks that may need to be investigated further, such as potential design constraints.

5.1.3 Final options testing - stakeholder presentation

WSP will facilitate a presentation to present the key findings of the modelling to the major stakeholders of the project. We will work with TfNSW to develop the workshop structure at the time. However, this workshop will likely include a structure similar to Figure 5.1.

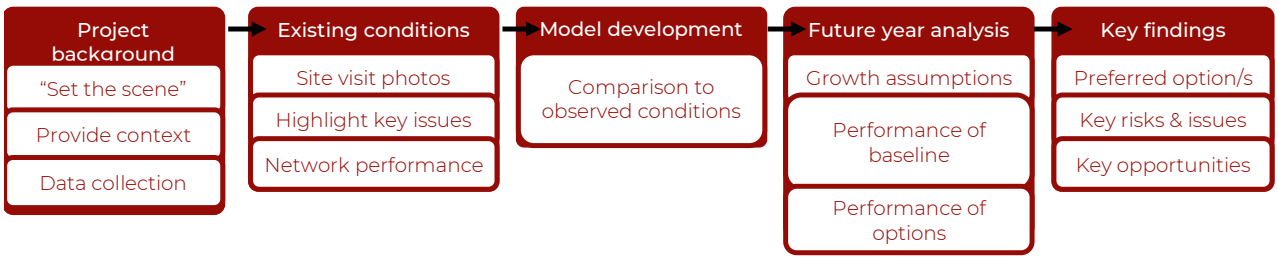


Figure 5.1 Indicative Final Presentation Structure

Before the presentation, we will also prepare a briefing note to be distributed to the invitees to the workshop. This briefing note will be succinct (expected to be two pages maximum) to provide some background information to potential attendees of the modelling process to date.

5.1.4 Workshop outcomes report

Following the final options testing presentation, WSP will prepare a brief report to summarise the following:

- Objectives of the presentation
- Summary of discussions, including questions and responses
- Key actions and outcomes agreed from the presentation.

Appendix F – Calibration validation report

TRANSPORT

Macquarie Park Detailed Precinct Transport Study

Base Model Calibration and Validation Report

January 2023

NSW GOVERNMENT

transport.nsw.gov.au

TRANSPORT

Macquarie Park Detailed Precinct Transport Study

Base Model Calibration and Validation Report

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REV	DATE	DETAILS
A	19/12/2022	Draft Report
B	23/01/2023	Final Report

	Name	Date
Prepared by:	Faiq Khan Pranav Dhikale	23/01/2023
Reviewed by:	Vince Oliveri	23/01/2023
Approved by:	Chris Carlaw	23/01/2023

Table of Contents

1. Introduction

1.1 Background

Macquarie Park is a growing home to world-class businesses, innovation, research, and education, and has a strong role within Greater Sydney's and Australia's economies. As the area continues to grow and change, there is a need to develop a Detailed Precinct Transport Study to identify improvements to transport services, infrastructure, and initiatives.

The Transport Study's purpose is to reinvigorate the network within the precinct by promoting active travel and public transport usage. To understand the impact that proposed interventions will have on the transport network, WSP is undertaking microsimulation modelling of the precinct. The microsimulation modelling will be used to determine road network capacity, and travel times of private vehicles, trucks, and bus routes.

1.2 Project objective

The project's key objectives include:

- Identify improved transport services to meet the vision and place outcomes for Macquarie Park
- Identify any infrastructure changes required to obtain a best for transport network outcome
- Understand staging and timing of any infrastructure changes

The modelling is needed to:

- Inform the further project stages such as any strategic business cases
- Assist with developing place-based outcomes
- Confirm infrastructure changes that may be required

1.3 Scope of work

The primary deliverables of the traffic modelling tasks include:

- Base calibrated and validated model to be used as a basis for option testing
- Base calibration and validation report detailing the process (this report)
- Future year models, including 'do minimum' and option models incorporating interventions
- Options testing report detailing and comparing the assessed options

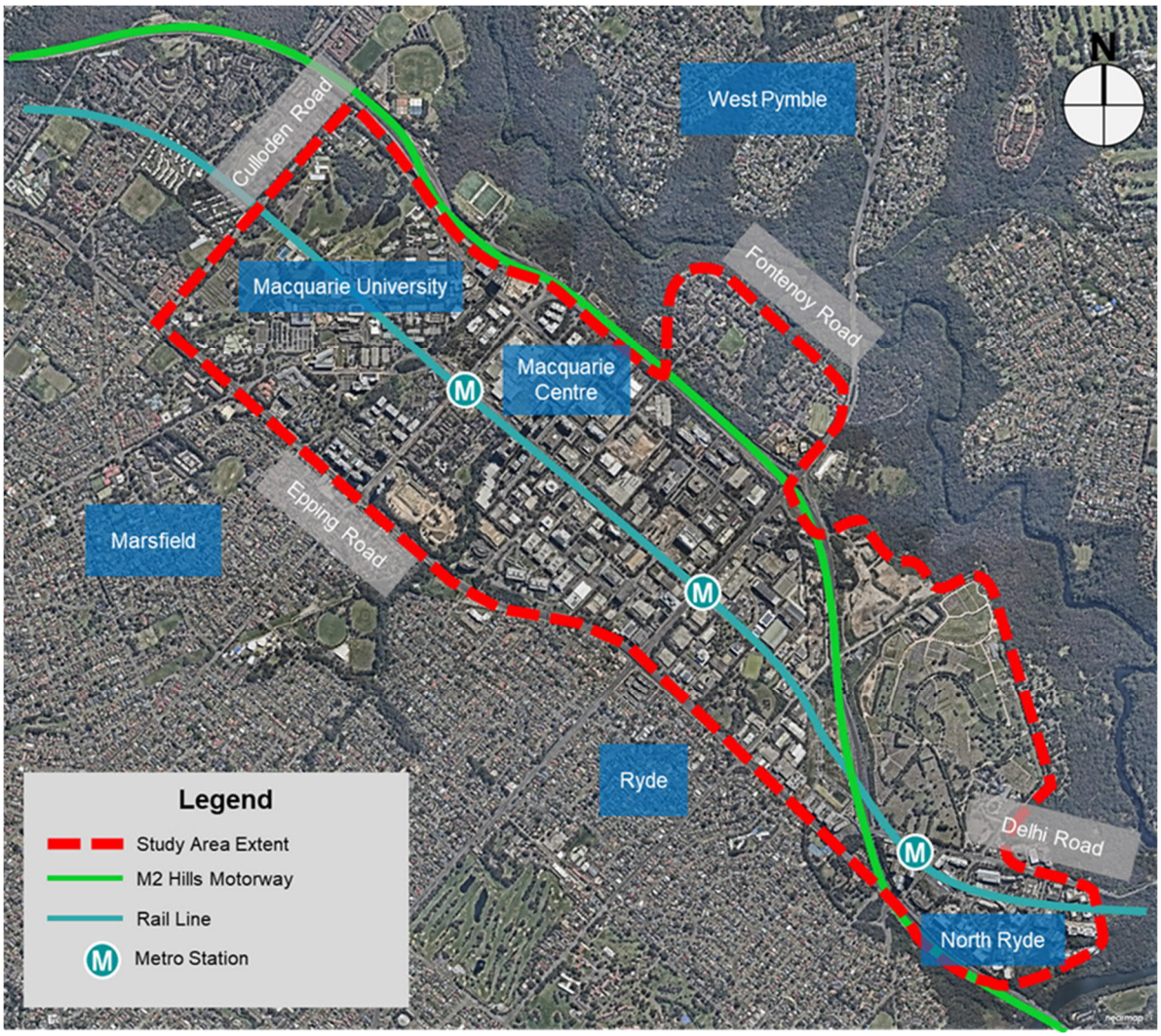
Table 1 Scope of work

Network Variations	Existing (Base Case)	Future With Forecast Development		
	2022	2026	2031	2041
Base Case - 'Do Minimum'	✓			✓
SISA Case				✓
SISA + Option 1				✓
SISA + Option 2				✓
SISA + Option 3				✓
Preferred Scenario		✓	✓	
COVID Sensitivity	✓	✓	✓	✓

1.4 Study area

The Macquarie Park Precinct study area is shown in Figure 1. The study area is predominantly bound by Epping Road, Culloden Road and the M2 motorway, with expanded areas to the east bound by Fontenoy Road and Plassey Road. The model includes key arterial and state roads and local roads that incorporate signalised intersections or roundabouts. The M2 motorway mainline has not been simulated within the model however, the interchanges have been coded to simulate the impact of delay on the Macquarie Park Precinct.

Figure 1 Model study area



1.5 Report Outline

The sections of this report include:

1. Introduction: Outlines the project objectives and background
2. Existing conditions: Details the operations of the study area with the current network
3. Model assumptions: List of assumptions and inputs coded into the model
4. Model stability: Information relating to guidelines and median seed
5. Model calibration and validation: Results of the model calibration process
6. Model limitations: Limitations to using the model for future testing
7. Conclusion: Summary of the model process and next steps

2. Existing conditions

2.1 Traffic surveys/data

As part of this base model development, WSP engaged Trans Traffic Survey (TTS) to undertake the following traffic surveys:

- Classified intersection count data
- Travel time data

TTS carried out the surveys on 14 and 15 September 2022. In addition, SCATS data was sourced from Transport for New South Wales (TfNSW) for all the signalised intersections within the study area.

2.1.1 Intersection Counts

Intersection counts were undertaken by Trans Traffic Survey for the AM peak (06:00 AM - 10:00 AM) and PM peak (03:00 PM - 07:00 PM) periods on Wednesday 14 September 2022 and Thursday 15 September 2022, at the intersections shown in Figure 2 and listed in Table 2 and Table 3.

The intersection count data was used for matrix estimation and calibration of the Aimsun model.

Figure 2 Intersection count locations

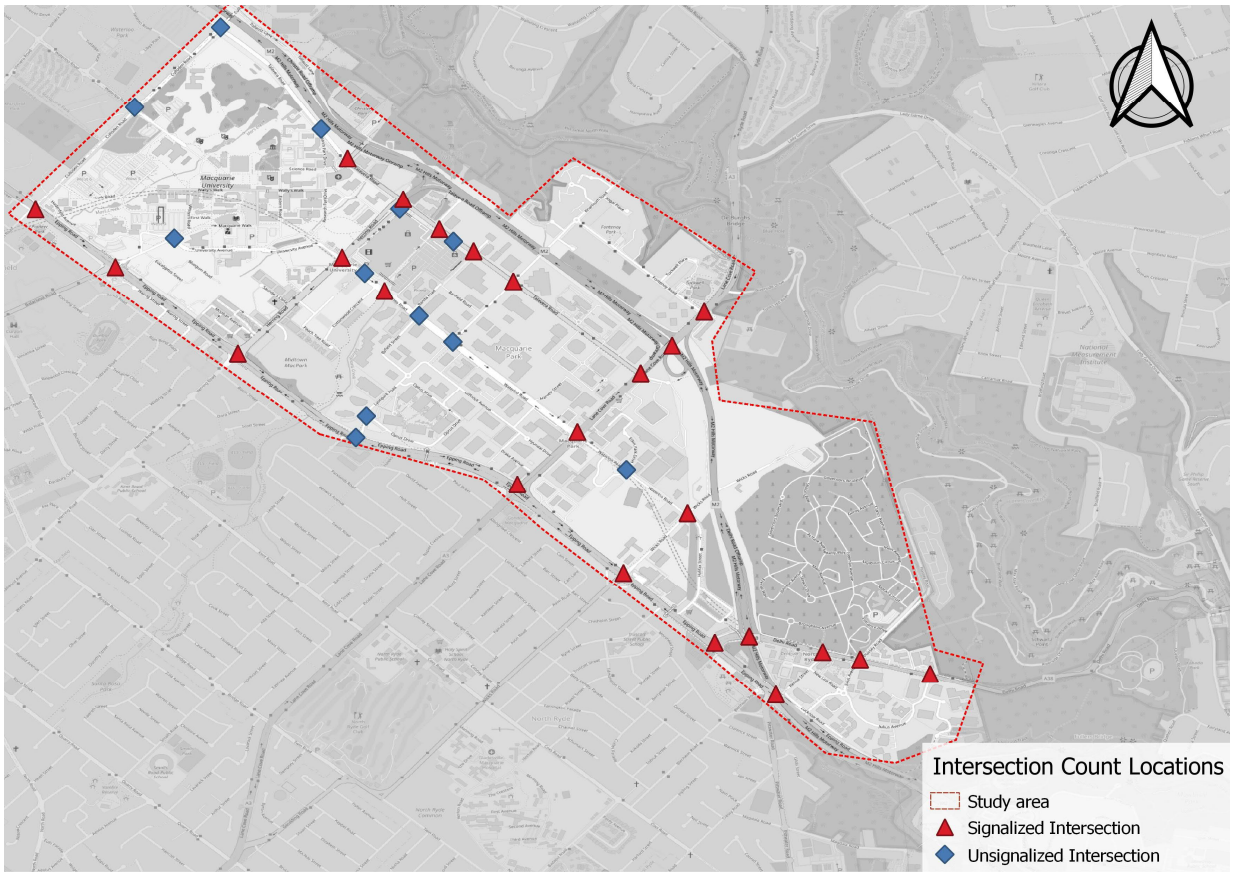


Table 2 Signalised intersections

Location	Intersection Name
1	Epping Road / Balaclava Road
2	Epping Road / Herring Road
3	Waterloo Road / Herring Road
4	Waterloo Road / Macquarie Centre 1
5	Talavera Road / Herring Road
6	Talavera Road / Christie Road
7	Epping Road / Lane Cove Road
8	Waterloo Road / Lane Cove Road
9	M2 / Lane Cove Road
10	Talavera Road / Lane Cove Road
11	Talavera Road / Khartoum Road
12	Talavera Road / Banda Road
13	Talavera Road / Macquarie Centre 1
14	Fontenoy Road / Lane Cove Road
15	Epping Road / Wicks Road
16	Waterloo Road / Wicks Road
17	Epping Road / Delhi Road
18	Epping Road / Pittwater Road
19	M2 / Delhi Road
20	Rennie Street / Delhi Road
21	Plassey Road / Delhi Road
22	Julius Ave (E) / Delhi Road
23	Herring Road / Ivanhoe Place

Table 3 Unsignalised intersections

Location	Intersection Name
1	Balaclava Road / University Avenue
2	Byfield Street / Waterloo Road
3	Epping Road / Lyonpark Road
4	Herring Road / Macquarie Centre 1
5	Waterloo Road / Macquarie Centre 2
6	Khartoum Road / Waterloo Road
7	Optus Drive (S) / Lyonpark Road
8	Research Park Drive / Talavera Road
9	Talavera Road / Culloden Road
10	Talavera Road / Macquarie Centre 2
11	Thomas Holt Drive / Waterloo Road (roundabout)
12	Waterloo Road / Culloden Road / Gymnasium Road
13	Fontenoy Road / Lane Cove Road
14	Epping Road / Culloden Road

The traffic counts were manually balanced in a network diagram to ensure that the flows out of each intersection matched the flows into adjacent intersections.

2.1.2 Travel Time Data

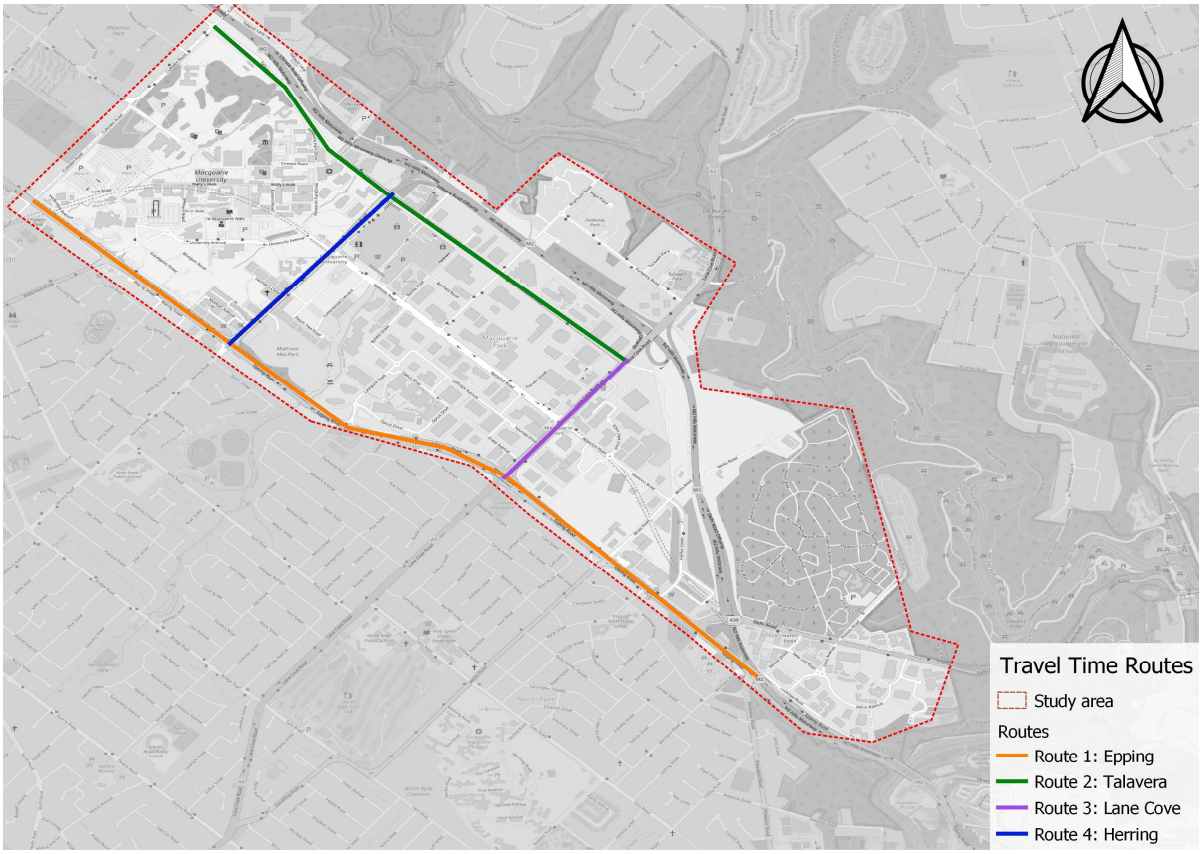
Intersection counts were undertaken by Trans Traffic Survey for the AM peak (06:00 AM - 10:00 AM) and PM peak (03:00 PM - 07:00 PM) periods.

Travel time data was required for validation of the Aimsun model. Travel time surveys were conducted by TTS on Wednesday 14 September 2022. Bi-directional travel time survey data was collected between major intersections during the AM peak (06:00 AM - 10:00 AM) and PM peak (03:00 PM - 07:00 PM) periods. The routes analysed as part of this assessment are shown in Table 4 and Figure 3.

Table 4 Travel time survey routes

Road Name	Section Between
Epping Road	Culloden Road to Pittwater Road
Talavera Road	Culloden Road to Lane Cove Road
Lane Cove	Epping Road to Talavera Road
Herring Road	Epping Road to Talavera Road

Figure 3 Travel time survey routes map



2.1.3 SCATS Signal Data

SCATS history data was recorded by TfNSW for Wednesday, 14 September 2022 for the 23 intersections within the study area. Data was provided for 24 hours (12:00:00 AM to 11:59:59 PM) every 15 minutes.

The locations of the data provided are listed in Table 5.

Table 5 SCATS signal data

Location	Intersection Name	TCS ID
1	Epping Road / Balaclava Road	592
2	Epping Road / Herring Road	793
3	Waterloo Road / Herring Road	1798
4	Waterloo Road / Macquarie Centre 1	3428
5	Talavera Road / Herring Road	3162
6	Talavera Road / Christie Road	3167
7	Epping Road / Lane Cove Road	195
8	Waterloo Road / Lane Cove Road	1012
9	M2 / Lane Cove Road	3161
10	Talavera Road / Lane Cove Road	1799
11	Talavera Road / Khartoum Road	3170
12	Talavera Road / Banda Road	4475
13	Talavera Road / Macquarie Centre 1	3299
14	Fontenoy Road / Lane Cove Road	3446
15	Epping Road / Wicks Road	226
16	Waterloo Road / Wicks Road	4690
17	Epping Road / Delhi Road	551
18	Epping Road / Pittwater Road	794
19	M2 / Delhi Road	3160
20	Rennie Street / Delhi Road	4194
21	Plassey Road / Delhi Road	2993
22	Julius Ave (E) / Delhi Road	3799
23	Herring Road / Ivanhoe Place	4867

2.2 Site visit

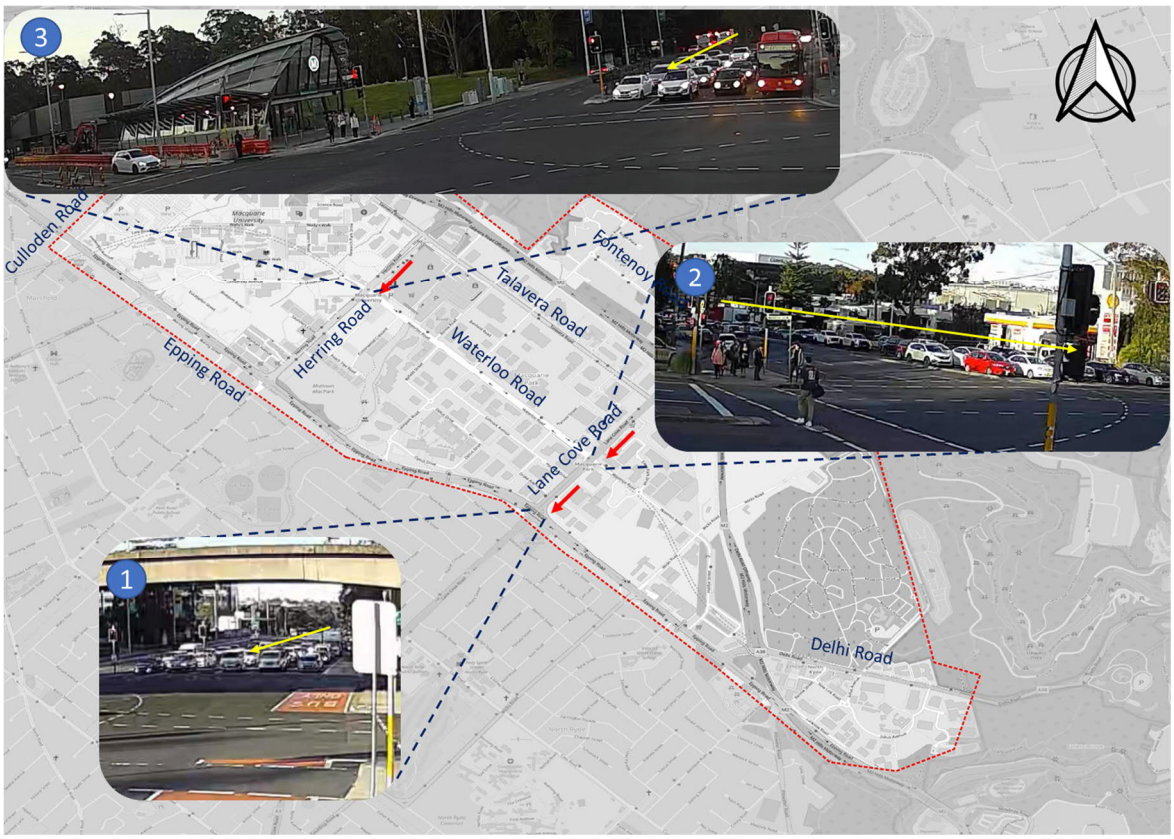
A site visit was undertaken on Wednesday, 14 September 2022 on the same day as the traffic surveys undertaken by TTS, to validate the speed of moving queues, confirm the regularity of queue lengths at intersections and identify pinch points within the study area during peak periods. This information along with the survey video footage has been referred to while validating the Aimsun model to verify the matching of the congestion initiation sources and queue propagation effects, as well as any unusual traffic behaviours or patterns.

Key observations from the site visit and survey video footage are documented below.

Figure 4 Key observations from the site visit and survey videos during the AM peak

1. Eastbound queues at Epping Road/Herring Road
2. Southbound queues at Epping Road/Lane Cove Road
3. Southbound queues at Waterloo Road/Lane Cove Road
4. Eastbound and southbound queues at Waterloo Road/Herring Road

Figure 5 Key observations from the site visit and survey videos during the PM peak



1. Southbound queues at Epping/Lane Cove
2. Southbound queues at Waterloo/Lane Cove
3. Southbound queues at Waterloo/Herring

Figure 6 Operations at the Macquarie Park Bus Interchange

2.4 Existing condition analysis

2.4.1 Road Network and Hierarchy

A summary of the key nearby roads and their relative hierarchy in the study area is provided in the sections below.

Talavera Road

Talavera Road is a collector road servicing the Macquarie Park region, with the key section for this study ranging between Culloden Road and Lane Cove Road. It is mostly a four-lane, two-way road with two travel lanes in each direction, with several short turning lanes.

Waterloo Road

Waterloo Road is a collector road running parallel to Talavera Road in the Northwest-Southeast direction between Herring Road and Wicks Road. Within the main Macquarie Park area, Waterloo Road is primarily a four-lane, two-way separated road with two travel lanes in each direction.

Khartoum Road

Khartoum Road is a local collector road running perpendicular to Talavera Road ranging from Waterloo Road to Carlisle Close. It is primarily a two-lane, two-way road with one travel lane in each direction, with on-street kerbside parking in both directions available

Lane Cove Road

Lane Cove Road is an arterial road connecting the Ryde region with the M2 Motorway. Within the main Macquarie Park area, Lane Cove Road is primarily a six-lane, two-way separated road with three travel lanes in each direction.

Herring Road

Herring Road is a distributor road connecting the Ryde region with the M2 Motorway. Within the main Macquarie Park area, Herring Road is primarily a six-lane, two-way separated road with two travel lanes and one parking lane in each direction

Epping Road

Epping Road is an arterial road connecting Epping to Lane Cove and M2 Motorway. Where it bypasses the main Macquarie Park area, Epping Road is primarily a six-lane, two-way separated road with three travel lanes in each direction.

Fontenoy Road

Fontenoy Road is a local collector road running perpendicular to Khartoum Road ranging from Khartoum Road to Lane Cove. It is primarily a two-lane, two-way road with one travel lane in each direction, with on-street kerbside parking in both directions available

Delhi Road

Delhi Road is an arterial road connecting the Macquarie Park Cemetery and Crematorium region to the M2 Motorway. Delhi Road is primarily a four-lane, two-way road with two travel lanes in each direction.

Culloden Road

Culloden Road is a collector road servicing the Macquarie Park region, with the key section for this study ranging between Epping Road and M2 Motorway. It is primarily a two-lane, two-way road with one travel lane in each direction.

M2 Motorway

M2 Motorway is a six-lane motorway, two-way with three lanes in each direction.

2.3.2 Public Transport Network and Services

Bus Services

The Macquarie Park area is well serviced by multiple public bus routes. Table 2.1 lists the bus routes existing on the key roads in the study area.

Table 6 Public Transport Routes

No.	Road	Route – EB/NB	Route – WB/SB
1	Talavera Road	294, 506, 562, 565, 572, 575, 611, 619	294, 506, 562, 565, 572, 575
2	Waterloo Road	197, 259, 292, 294, 506, 545, 562, 565, 572, 575, 611, 619	197, 259, 292, 294, 506, 545, 562, 565, 572, 575, 611, 619
3	Khartoum Road	259, 292, 294, 506, 562, 565, 572, 575	259, 292, 294, 506, 562, 565, 572, 575
4	Lane Cove Road	197, 259, 292, 294, 506, N91	197, 259, 292, 294, 506, N91
5	Herring Road	288, 290, 291, 292, 518, 544, 611, 619	197, 288, 290, 291, 292, 294, 506, 518, 544, 545
6	Epping Road	259, 288, 290, 291, 292, 293, 294, 533, 544, 622	259, 286, 287, 288, 290, 291, 292, 293, 294, 533, 544, 622
7	Fontenoy Road	259, 292, 572	259, 292
8	Delhi Road	259, N91	259, N91
9	Culloden Road	292, 293, 551	292, 293, 551

Overall, there are a wide range of bus services providing connections towards the Greater Western Sydney region, Sydney CBD, and North Shore region.

Rail Services

Sydney Metro services the Macquarie Park area. The Sydney Metro line from Chatswood to Tallawong currently provides connectivity to the Hills District region and North Shore Region, and there are ongoing developments from TfNSW to extend the coverage of the network towards the Sydney CBD, Greater Western Sydney region and Inner West Sydney region. Sydney Metro also provides a connection between the T1 and T9 train lines. The three metro stations servicing the study area are the Macquarie University station located at the intersection of Herring Road / Waterloo Road, Macquarie Park Station located at the intersection of Lane Cove Road / Waterloo Road and the North Ryde Station located along Delhi Road approximately 150 metres east of the M2 / Delhi Road intersection.

The Sydney Metro services have a frequency of approximately one to five minutes and a typical trip towards the Sydney CBD or Hills District region is around 30 to 40 minutes.

3. Model assumptions

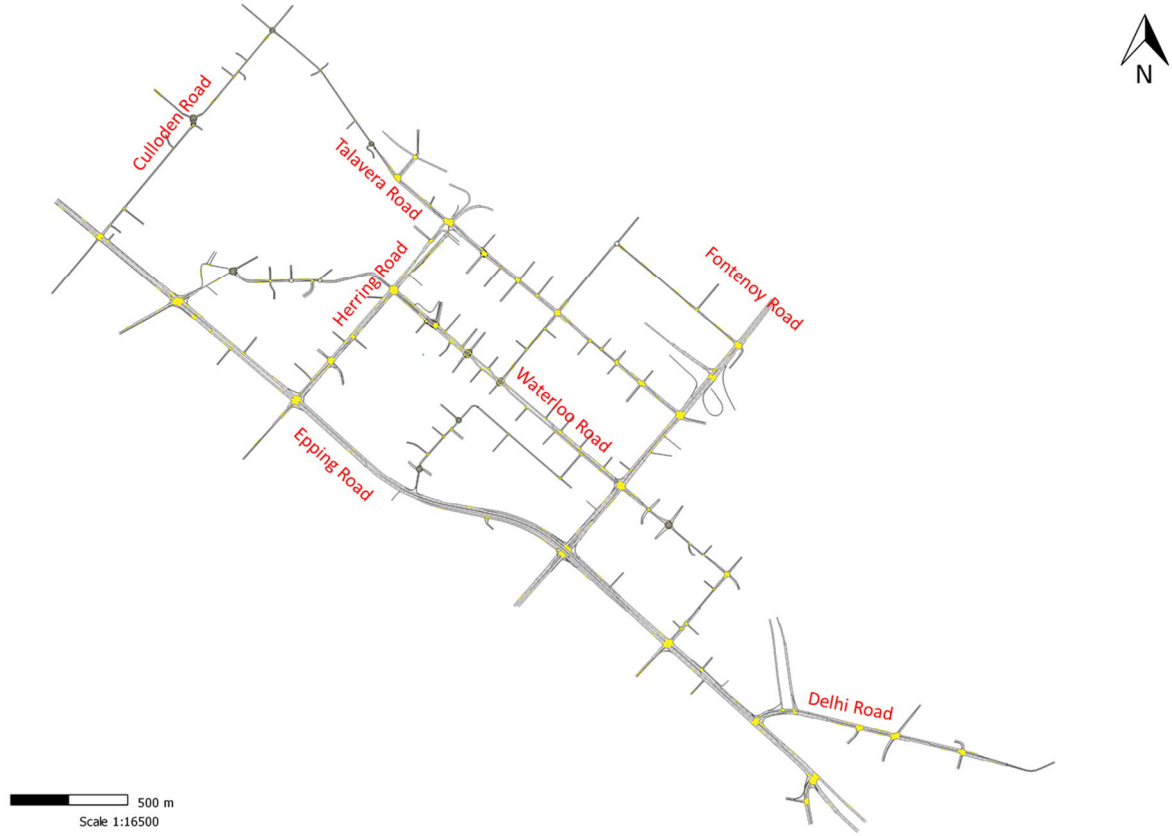
3.1 Modelling platform

Aimsun Version 22.0.1 (2022-02-07) was used for the calibration and validation of the Macquarie Precinct Model.

3.2 Model network

The model network is shown in Figure 7. Key roads are shown on the model output. The model is bound by Culloden Road in the west, Epping Road in the south and Talavera Road in the north. All major intersections and select driveway accesses are included in the network.

Figure 7 Model in AIMSUN



3.3 Time period

The base model has been developed to replicate traffic operations on Wednesday 14th of September 2022. The time periods for each peak are:

- AM Peak: 07:30 – 09:30
- PM Peak: 16:15 – 18:15

A 30-minute warm-up period was applied upfront to provide a good representation of traffic conditions within the road network before the peak period, with a 30-minute cool-down period applied to allow traffic to exit the network and enable the model to record performance data for these vehicles.

3.4 Road Geometry

Before the network refinement, the study area was carefully checked using Nearmap aerial photography, Google StreetView images and site visit observations to ensure model details corresponded to the existing road network. Key features that were checked within the study area included:

- Number of lanes
- Turn bans
- Length of short/turning lanes
- Lane configurations
- Speed limits
- Priorities (e.g. give way and stop controls)
- School zones

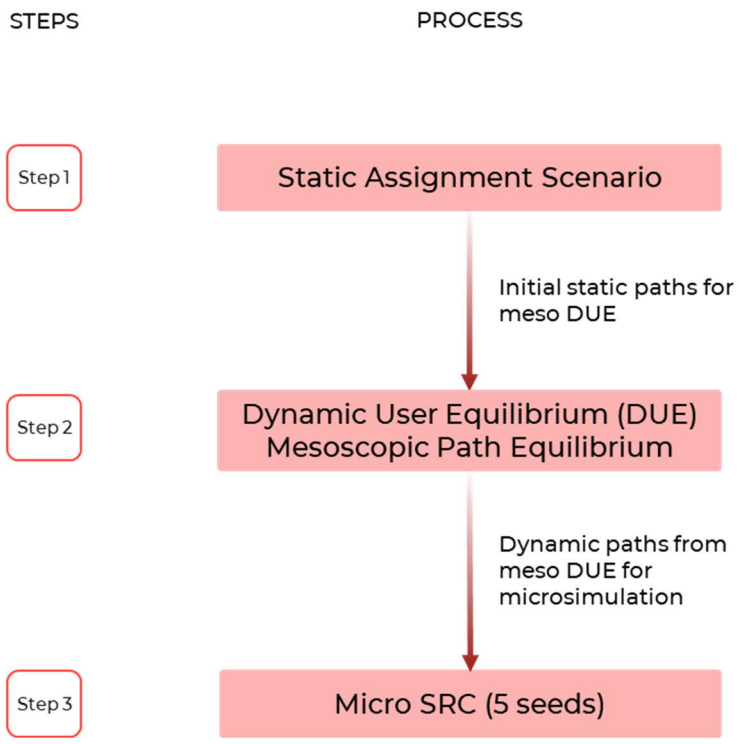
3.5 Road gradient

TfNSW suggests coding slopes on gradients more than 3%, where there are significant volumes of heavy vehicles or for high-speed roads. The road gradients were imported for all the roads within the study area using Nearmap's elevation profile.

3.6 Assignment type

A three-stage process was used to obtain path assignment for the microscopic assignment. First, the static assignment was run to obtain a set of paths and was used as an initial input in the Dynamic Assignment. The Dynamic Assignment process then outputs a refined set of paths for use in the Microsimulation model (SRC one-shot) as shown in Figure 8.

Figure 8 Assignment process



The model was simulated with five seed values, 560, 28, 7771, 86524 and 2849 based on Traffic Modelling Guidelines. These values are used by the random number generator to set underlying variables for each

vehicle such as the time they enter the model network and the aggressiveness of acceleration and braking. To include variability in the model and develop confidence that the model reflects the wide range of driving behaviours that exist on the road, multiple seed values can be used.

The stochastic Route Choice (SRC) assignment is based on discrete route choice models or a user-defined assignment. The discrete route choice models are based on discrete choice theory and emulate a driver's decision to select a path from those available.

User Defined Costs

Throughout the study area, there is more than one route for the key origin and destination pairs. It is an acceptable modelling practice to use "User Defined Costs" to influence route choice through the study area. User Defined Costs are used in both the AM and PM peak models. Generally, the same costs are used in both the AM and PM peak models. However, to represent a slight variation in the route choice behaviour, the PM peak model has additional costs.

3.7 Vehicle types

Four vehicle types have been used in the model as detailed in Table 7.

Table 7 Vehicle types

Vehicle Name	Description	Usage	Vehicle length	Vehicle weight	Max Acceleration
Car	Light passenger vehicle Austroads Class 1-2	Matrix	4.6m	1,202kg	3.00m/s^2
Truck	Small to medium trucks Austroads Class 3-10	Matrix	13.0m	10,000kg	1.00m/s^2
Heavy Truck	Large articulated trucks Austroads Class 11-12	Matrix	20.0m	30,000kg	0.80m/s^2
Bus	Public transport buses	PT Lines	12.0m	6,172kg	0.80m/s^2

3.8 Traffic zones/input

The cordon map was provided by TfNSW for the Macquarie Park study area which consists of 39 zones. The cordon map for STFM within the study area is shown in Figure 9. Further subdivision of zones was required to increase the model's resolution in the study area and provide a more realistic network loading and unloading onto major corridors, collector, and arterial roads.

Traffic zones have been defined in the model to cover the key traffic entry and exit points in the model network. In addition, all major developments within the Macquarie Park Precinct were represented by a few zones with their driveways coded as per existing arrangements and accessibility.

A total of 127 traffic zones were coded in the model. The adopted model network and traffic zones are illustrated in Figure 10.

Figure 9 STFM cordon map

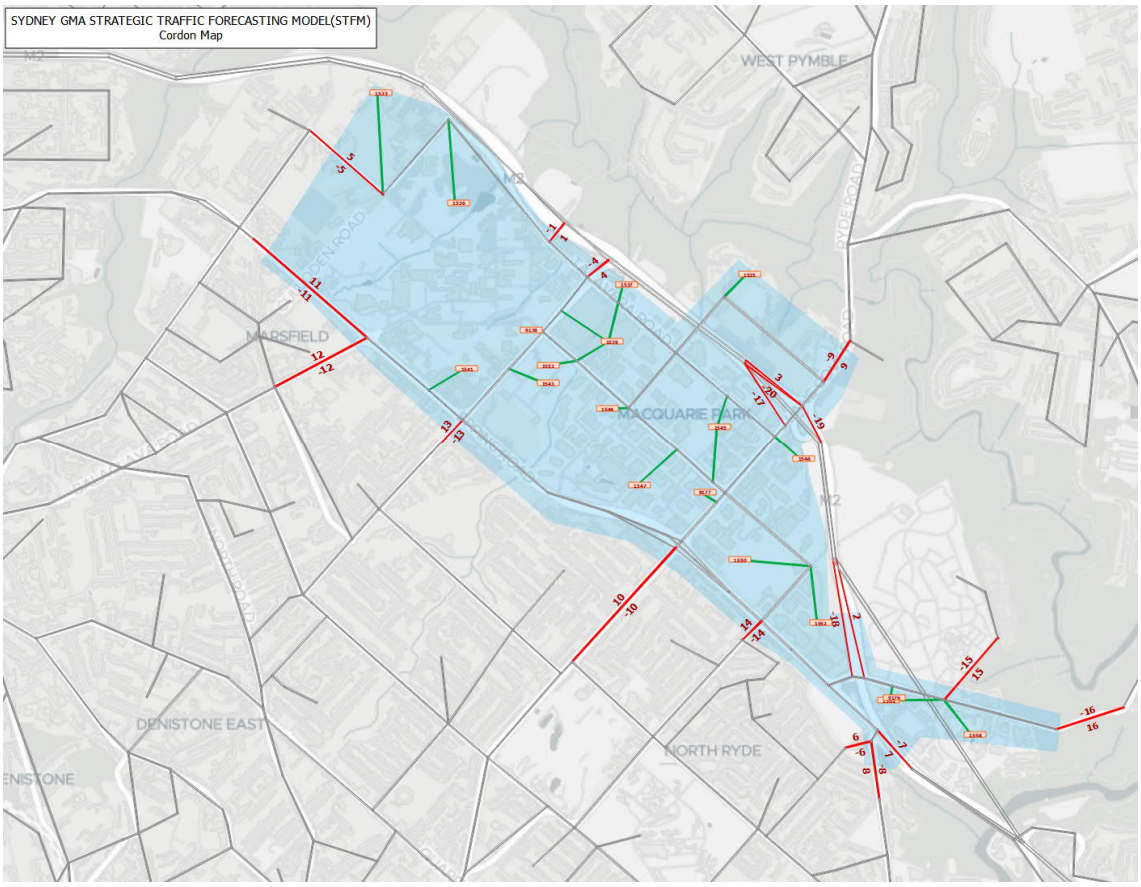


Figure 10 Aimsun model traffic zones

3.9 Road types

A description of key roads within the study area is detailed in Table 8. The road types and hierarchy adopted in the base model are shown in Figure 11. These road types are based on the road types defined in the Sydney Aimsun Foundation Model (SAFM).

Figure 11 Road types

Table 8 Road type details

Sr no.	Road Name	Road Type	Lane Capacity (PCUs/h)	Speed Limit (km/hr)
1	Talavera Road	Sub Arterial	925	50
2	Waterloo Road	Sub Arterial	1,100	50
3	Khartoum Road	Local	1,000	40
4	Lane Cove Road	Arterial (Divided)	1,200	60
5	Herring Road	Arterial (Undivided)	800	60
6	Epping Road	Arterial (Divided)	1,400	70
7	Fontenoy Road	Local	1,000	40
8	Delhi Road	Arterial (Divided)	800	60
9	Culloden Road	Sub Arterial	1,050	50

Source: Sydney Aimsun Foundation Model

3.10 Speed limits

The road section speeds in the base model are coded according to the existing posted speed limits in the study area. Posted speed limits vary from 50 km/h on local roads to 70 km/h on Lane Cove Road and Epping Road. The posted speeds are shown in Figure 12.

Figure 12 Speed profiles

3.11 School zones

There are no defined school zones within the immediate vicinity of the model study area. Although there are universities and colleges within the study area, they do not warrant a reduced speed zone of 40 kph.

3.12 Traffic signals

The signal control plans were incorporated into the model as an “Actuated” signal to capture variability in signal operation across the peak periods. A total of 23 signalised intersections within the study area were coded during the modelled period. Each subsystem's highest average cycle time was rounded up to the nearest 10 seconds and used as the common subsystem cycle time. Section 2.1.3 lists all the intersections with TCS references that are signalised within the study area. During the model calibration stage, minor adjustments to the phase lengths were made as necessary to ensure that observed conditions were replicated accurately. SCATS.LX files were interrogated to calculate the intersection offsets:

- Progression Plan (PP) and Link Plan (LP) 4 were adopted for the AM peak model
- Progression Plan (PP) and Link Plan (LP) 2 were adopted for the PM peak model

3.13 Public transport

The public transport network development was undertaken based on public transport information available on the TfNSW OpenData website - Bus and General Transit Feed Specification (GTFS) databases. The public

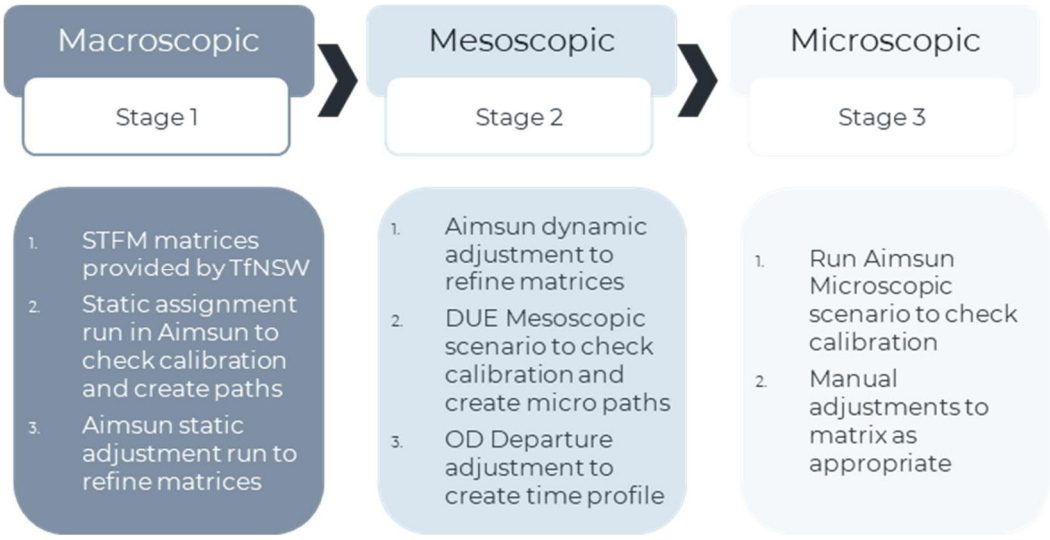
transport network was focused on the bus network. The modelling of existing public transport covers the following elements:

- Bus routes were imported from the schedule and route information in the GTFS database. Routes were constructed by linking up bus stops as identified in the stopping pattern of each route
- Bus stops were imported from the GTFS database with a default length of 20 meters, and this will allow for a single bus to stop at any one time. Further refinement of stops was undertaken to identify bus stops with higher capacity and increase their lengths accordingly.
- Bus timetables were coded for each route and sub-route variant based on their departure times as set out in the GTFS database.
- A fixed bus dwell time at bus stops of 30 seconds, with a 10-second deviation, has been assumed in the model.

3.14 Demand assumptions/adjustment

Matrices have been run in the three modelling stages as illustrated in Figure 13. Aimsun has been used to adjust matrices to real data sets incorporating turning movement counts at each stage.

Figure 13 Matrix adjustment process



Initial matrix

The STFM model provided 2-hour AM and 2-hour PM peak matrices, which were used as 'prior' matrices for calibration of the 2022 Aimsun base model.

Static adjustment

Use the Aimsun Static OD Adjustment tool to refine the matrix using the imported real data set and produce the first iteration of route choice estimation.

Departure adjustment

Departure adjustment is a procedure that was used to create a profiled demand from a static demand. To obtain profiled demand, the original static demand was distributed through smaller time intervals (every 15 minutes) over the simulation period. The objective was to reproduce the observed traffic counts specified in the real data set per interval while keeping as close as possible to the original number of OD trips for the period.

Manual adjustment

The last step in the traffic demand estimation process was to match the modelled turn counts with the observed turn counts via manual adjustments to the model until the overall network calibration was at a point where little value can be added by making a further adjustment.

3.15 Trip length distribution and through traffic changes

Figure 14 and Figure 15 illustrate the trip length distribution and provide a comparison between the prior cordoned STFM OD trip matrix (before OD matrix adjustment) and the adjusted Macquarie Park final OD matrix (after OD matrix adjustment) for the AM and PM peak periods.

The trip length comparison shows the adjusted OD trip matrix generally has a similar trip length distribution compared to the prior OD trip matrix for both the AM and PM peak periods.

Figure 14 Trip length distribution - AM

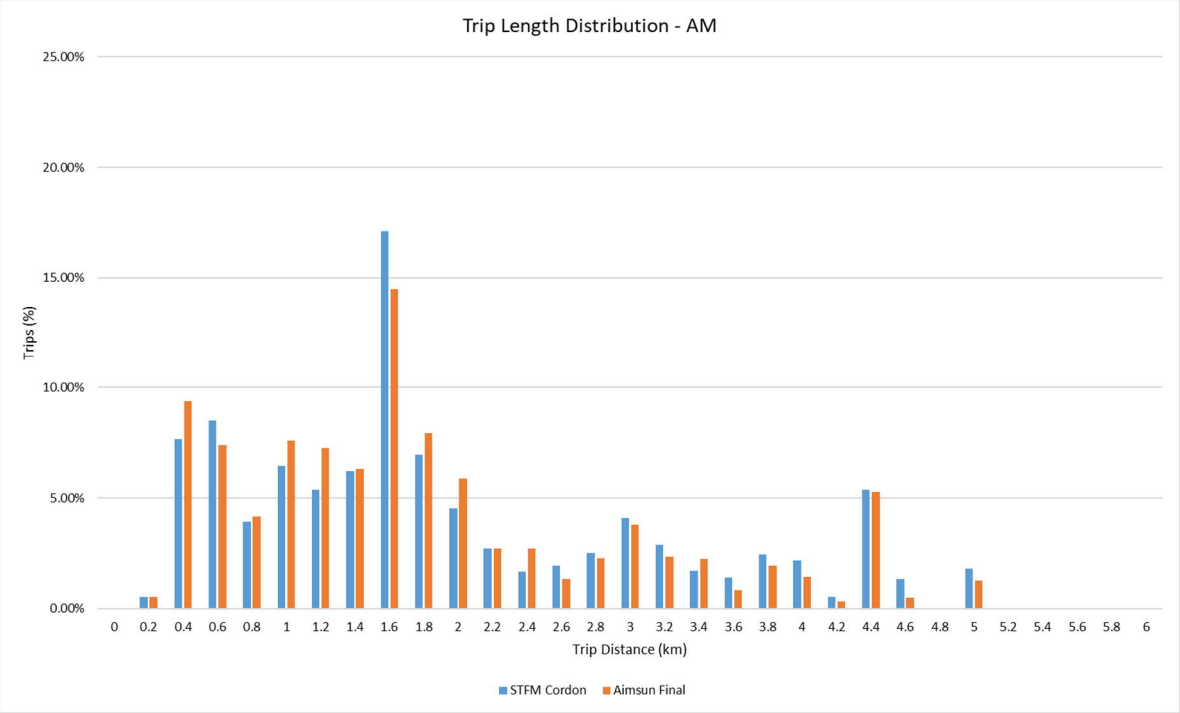
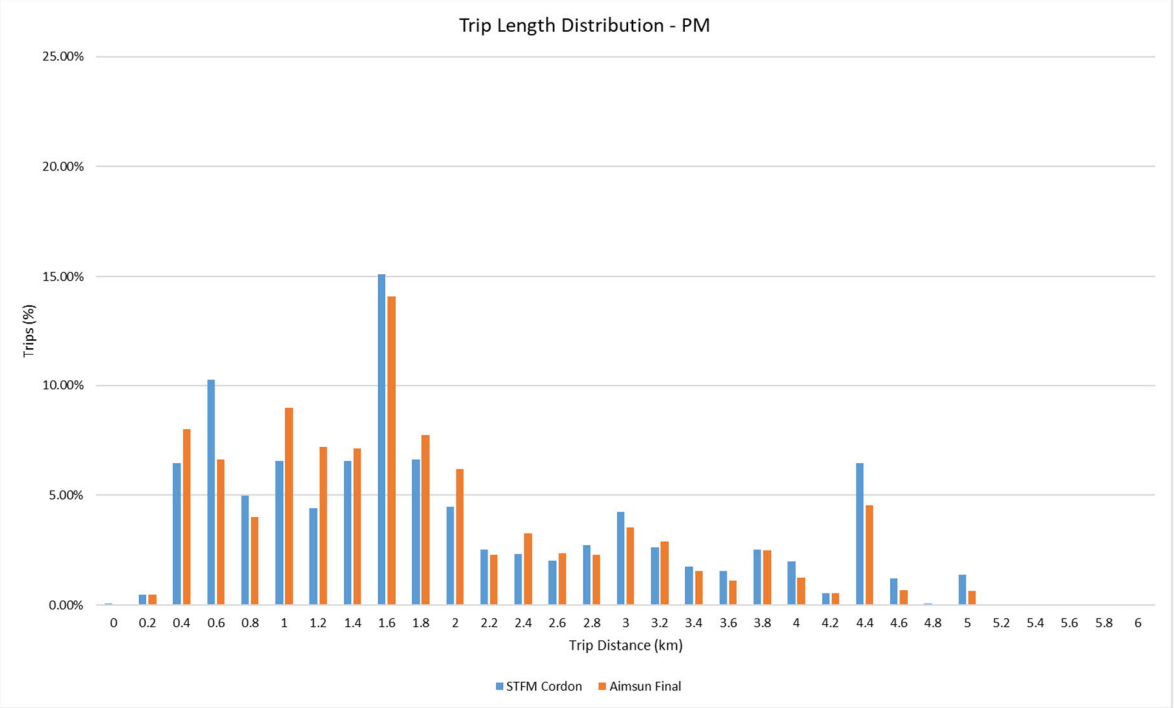


Figure 15 Trip length distribution - PM



3.16 Pedestrians and cyclists

No pedestrians or cyclists have been included in the Macquarie Park base model. Pedestrian late start in signal phasing was applied to the timings for the intersections in the network.

3.17 Traffic profile

The demand matrices were profiled at 15-minute intervals based on the intersection counts to achieve the best validation results regarding travel time during the AM and PM peak periods. Vehicles are released based on the profile in the model to reflect the traffic flow changes in the network. The profile was established using the existing 2022 survey data. Figure 16 and Figure 17 illustrate the vehicle release profile for each 15-minute in both AM and PM peak periods.

Figure 16 Traffic profile - AM

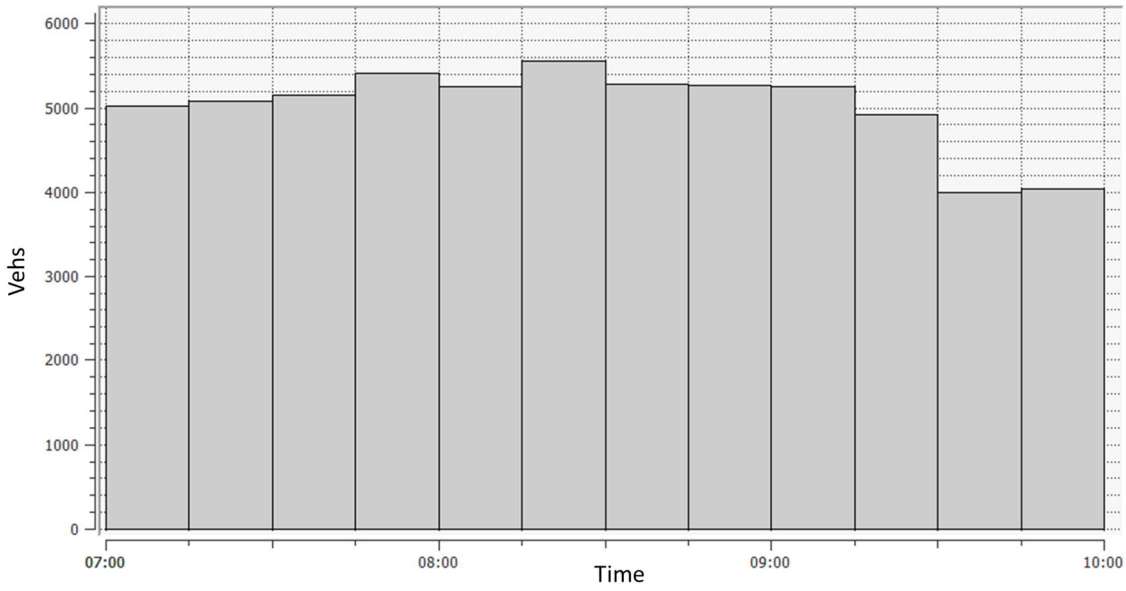
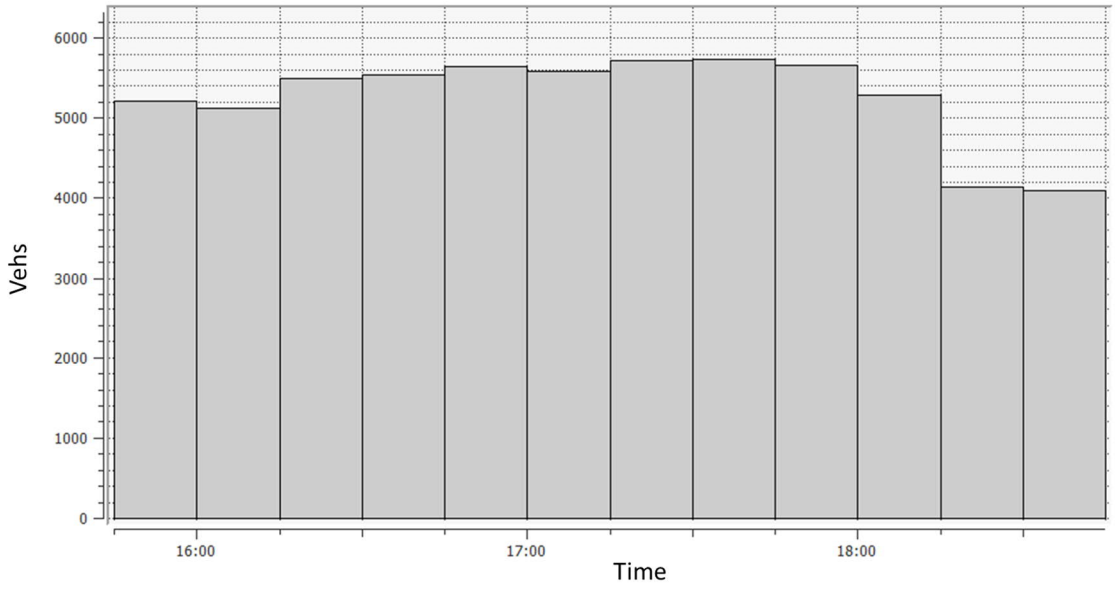


Figure 17 Traffic profile - PM



3.18 Behaviour parameters

The default behaviour parameters have been maintained the same where possible. The parameters for the microscopic model 'Look-Ahead Distance' and 'Critical Look-Ahead Distance' have been modified to correct and refine lane usage and queuing propagation at intersections as per site observations.

3.19 General assumptions

As agreed with TfNSW, the Sydney Aimsun Foundation Model (SAFM) parameters will be used in the development of the base model.

The M2 motorway itself will not be coded in the model however, the associated ramps and interchanges will be included.

4. Model stability

4.1 Guidelines/criteria for stability

Model stability between runs/seed values is particularly important in microsimulation modelling and is demonstrably using a variety of network performance measures. TfNSW Modelling guidelines suggest the below criteria for establishing model stability:

- 5 set seeds should be reported
- Model convergence should be achieved

To comply with the Guidelines, the following network performance measures were used to demonstrate model stability:

• Number of vehicles in the model

• Cumulative Vehicle-Hours Travelled (VHT) in the model network

Each model was run five times with five different seed values as shown in Table 9. Model outputs for each of the two measures are presented at 15-minute intervals in Figure 18 through to Figure 21.

Table 9 Seed values for each peak

Run	AM Peak	PM Peak
1	560	560
2	28	28
3	7771	7771
4	86524	86524
5	2849	2849

Figure 18 Number of vehicles modelled - AM

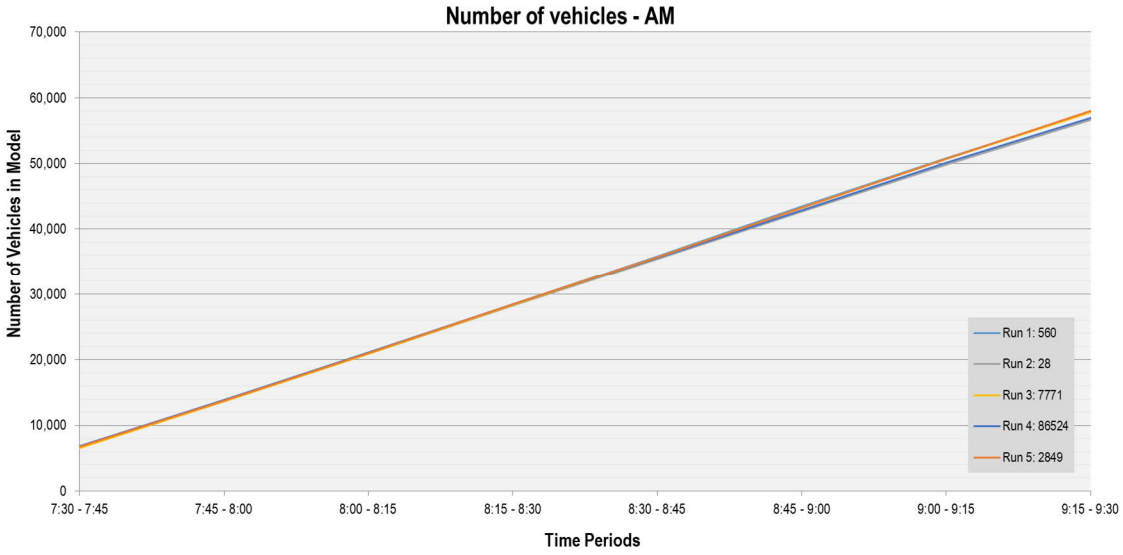


Figure 19 Number of vehicles - PM

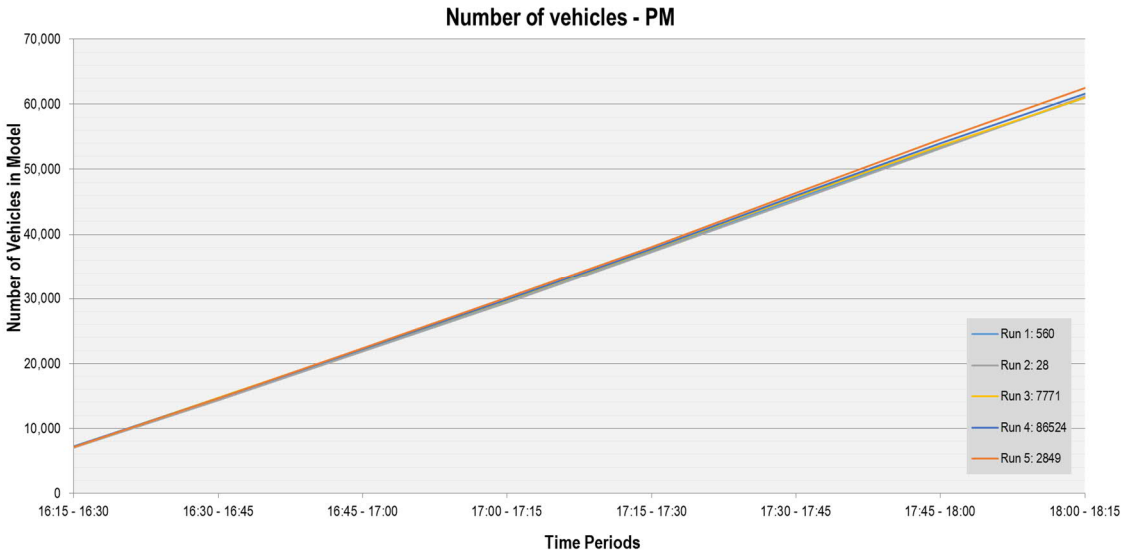


Figure 20 VHT - AM

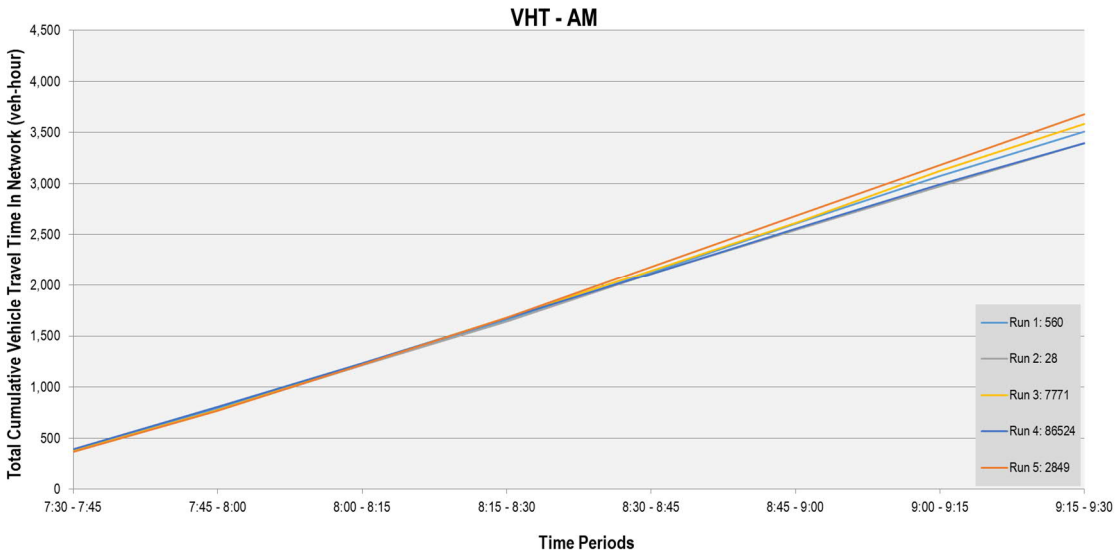
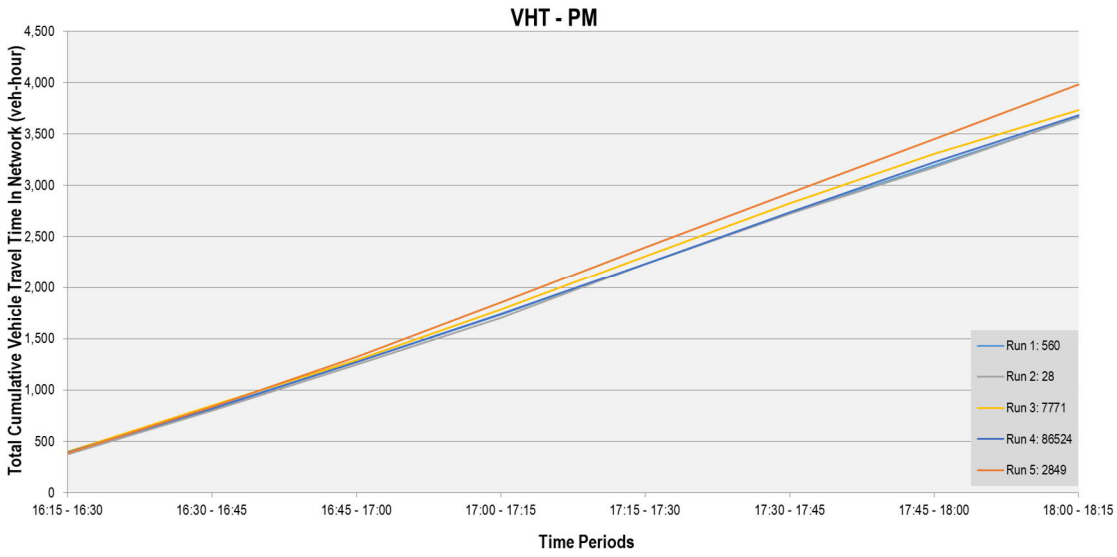


Figure 21 VHT - PM



As evidenced by the above figures, the model behaviour across the two stability measures tested is consistent across the 5 different seed value runs for both the AM and PM. The models are therefore considered to be stable.

4.2 Median Seed

The median seed for the entire modelled period has been identified by assessing Vehicle Hours Travelled (VHT) for each simulation run.

The AM and PM median seeds for the SLR Base model are:

AM Peak: 560

PM Peak: 86524

All calibration and validation outcomes in the following sections are derived from the median seed run.

5. Model calibration and validation

This chapter details the convergence, calibration results and validation results of the Aimsun model.

5.1. Convergence

The Macquarie Park Base Traffic Model has been developed using dynamic user equilibrium (DUE) assignment. The dynamic user equilibrium assignment convergence has been used to assess the variability between each iteration for a relative gap of 1%.

As can be seen in Figure 22 and Figure 23, the model converges in both the AM and PM peaks in 10 iterations.

Figure 22 Meso DUE Convergence – AM

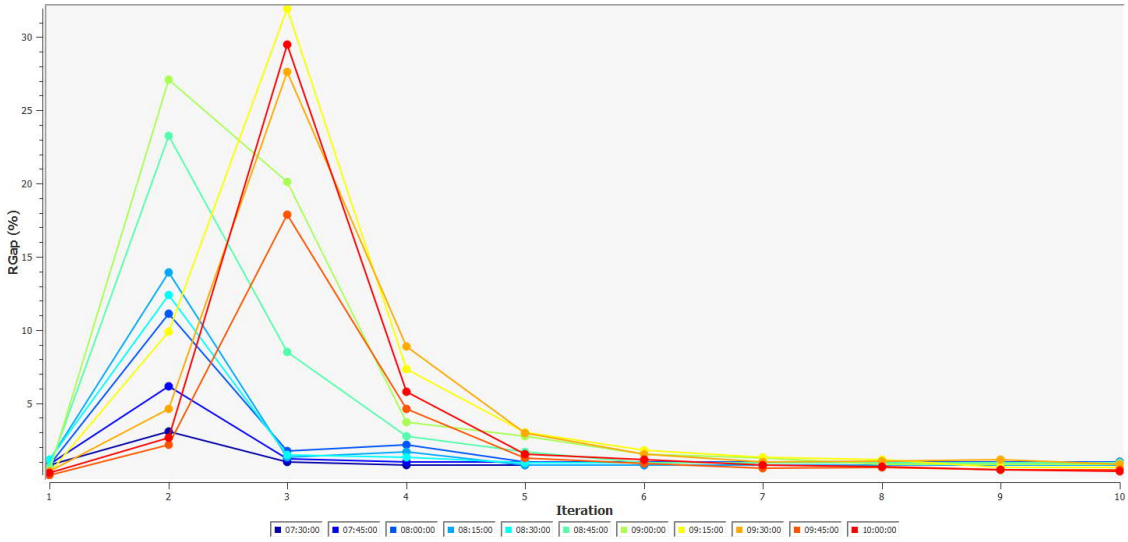
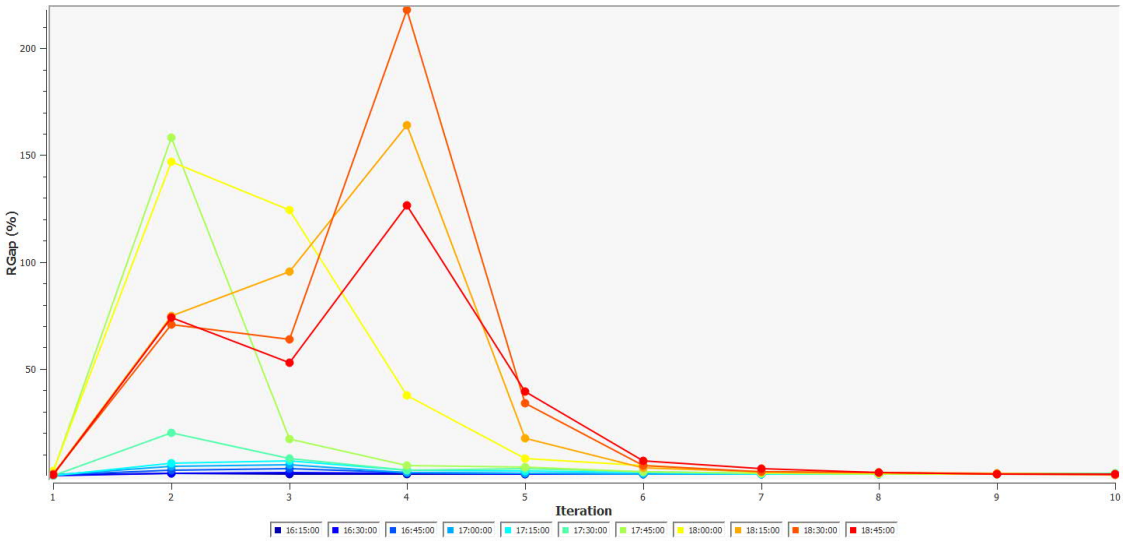


Figure 23 Meso DUE Convergence - PM



5.2. Calibration results

A summary of the calibration results is presented in this section. Calibration for each turn is detailed in Appendix A.

5.2.1. Calibration Targets

The model calibration exercise involved comparisons between modelled and observed traffic count data. The GEH statistic was used during the calibration of the models to compare the difference between observed flow and assigned flow on each turning movement.

The GEH statistic is calculated using the following equation:

$$GEH = \sqrt{\frac{(V_o - V_m)^2}{0.5\,(V_o + V_m)}}$$

Where:

Vo = observed flow in vehicles per hour

Vm = is the modelled flow in vehicles per hour

Comparisons between the modelled and observed flow are made using the GEH statistic since its nonlinear scalable metric can cope with a wide range of traffic flows. For example, a difference of 100 vehicles per hour is significant in a flow of 200 vehicles per hour but it is insignificant in a flow of thousands of vehicles per hour.

Network-Wide Criteria

For links or turns, the following target criteria that will be used to ensure the model is adequately calibrated are as follows:

- 100% of turn and link flow comparisons with GEH less than 10
- 85% of turn and link flow comparisons with GEH less than 5
- Regression of modelled and observed counts to show R^2 and slope between 0.9 and 1.05 for each hour
- Each directional screenline or cordon total to have GEH < 3

5.2.1. Calibration Statistics for Turn Counts

The calibration statistics for the AM peak are shown in Table 10 and the PM peak in Table 11. The calibration criteria are met for all turns within the network.

Table 10 Calibration for turns: AM

CRITERIA		ACHIEVED							
		HR 1 (7:30 – 8:30)				HR 2 (8:30 – 9:30)			
		LV	Trucks	Heavy Trucks	Total	LV	Trucks	Heavy Trucks	Total
Turn count GEH < 5	85%	95%	96%	100%	94%	92%	95%	100%	91%
Turn count GEH > 10	0%	0%	0%	0%	0%	0%	0%	0%	0%
R^2 Value	>0.9				0.99				0.99
Slope	<1.05				0.99				1.01

Table 11 Calibration for turns: PM

CRITERIA		ACHIEVED							
		HR 1 (16:15 – 17:15)				HR 2(17:15 – 18:15)			
		LV	Trucks	Heavy Trucks	Total	LV	Trucks	Heavy Trucks	Total
Turn count GEH < 5	85%	96%	98%	100%	95%	93%	97%	100%	92%
Turn count GEH > 10	0%	0%	0%	0%	0%	0%	0%	0%	0%
R^2 Value	>0.9				0.99				0.99
Slope	<1.05				1.00				1.01

Screenline analysis was undertaken through the centre of the model as shown in Figure 24. The calibration results for the screenlines are shown in Table 12. Although the screenlines slightly exceed the criteria in 3 incidences, they remain under a GEH of 5. Due to the number of driveways and the extent of congestion throughout the precinct, it still shows a high degree of calibration.

Figure 24 Screenlines on model network

Table 12 Screenline calibration

CRITERIA	ACHIEVED							
	HR 1 (7:30 – 8:30)		HR 2 (8:30 – 9:30)		HR 1 (16:15 – 17:15)		HR 2(17:15 – 18:15)	
	NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB
Screenline 1 Total GEH < 3	1.84	0.46	0.53	4.15	1.48	0.19	0.66	0.88
Screenline 2 Total GEH < 3	1.10	0.63	1.43	1.08	2.06	3.18	3.98	0.84

Regression analysis for each peak hour period is shown in Figure 25 through Figure 28. The plots confirm that the model is well calibrated with the majority of counts within GEH of 5. The slope and R^2 values indicate that overall demand throughout the network matches the observed flows.

Figure 25 Observed vs Modelled counts – AM 7:30-8:30

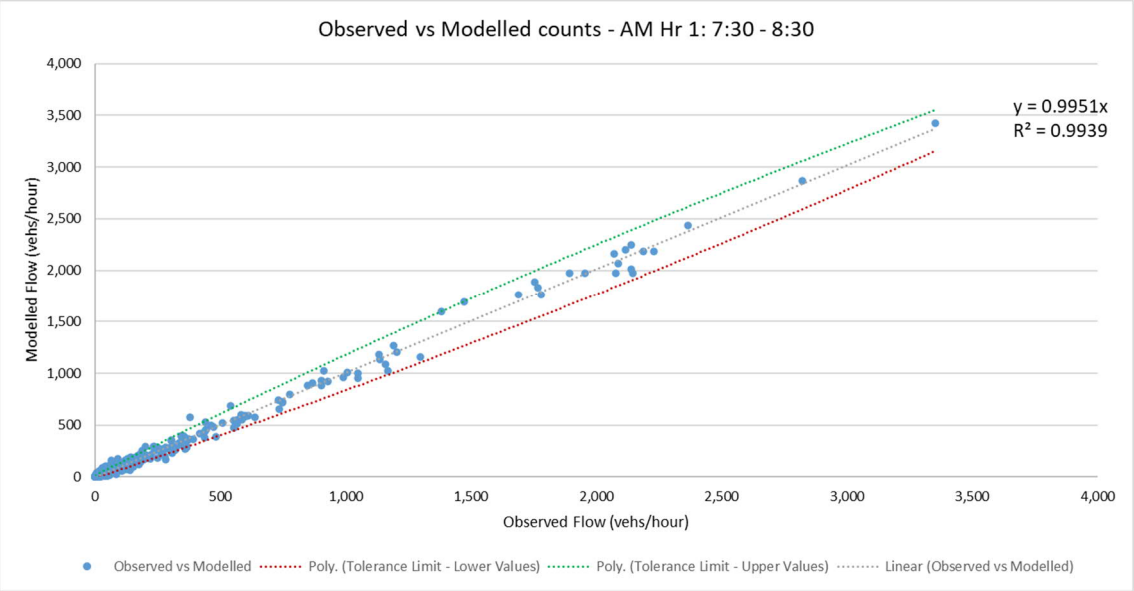


Figure 26 Observed vs Modelled counts – AM 8:30-9:30

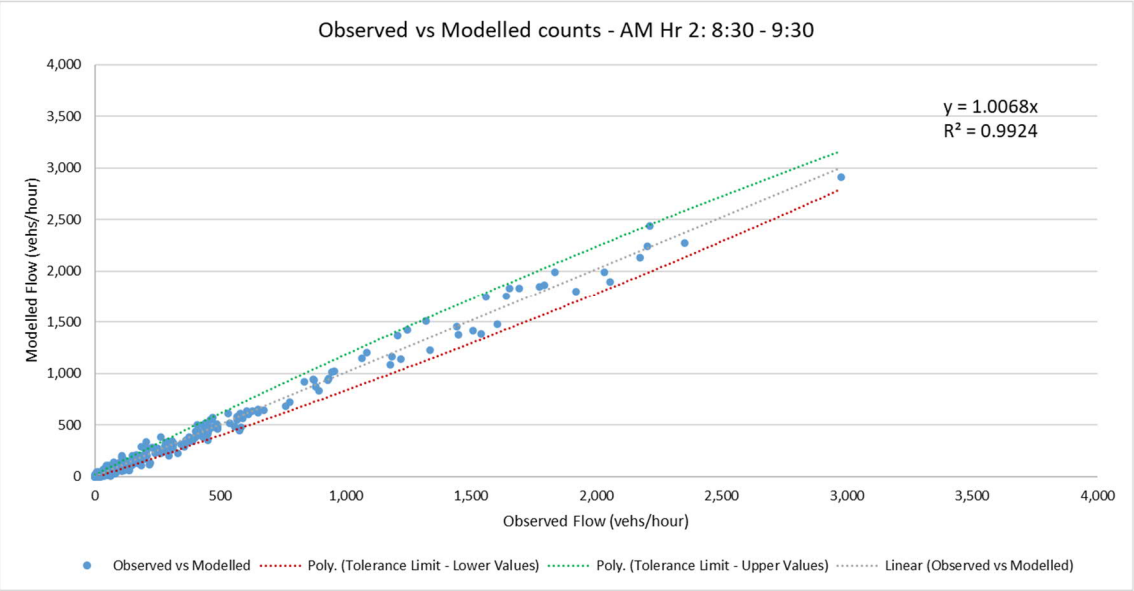


Figure 27 Observed vs Modelled counts – PM 16:15-17:15

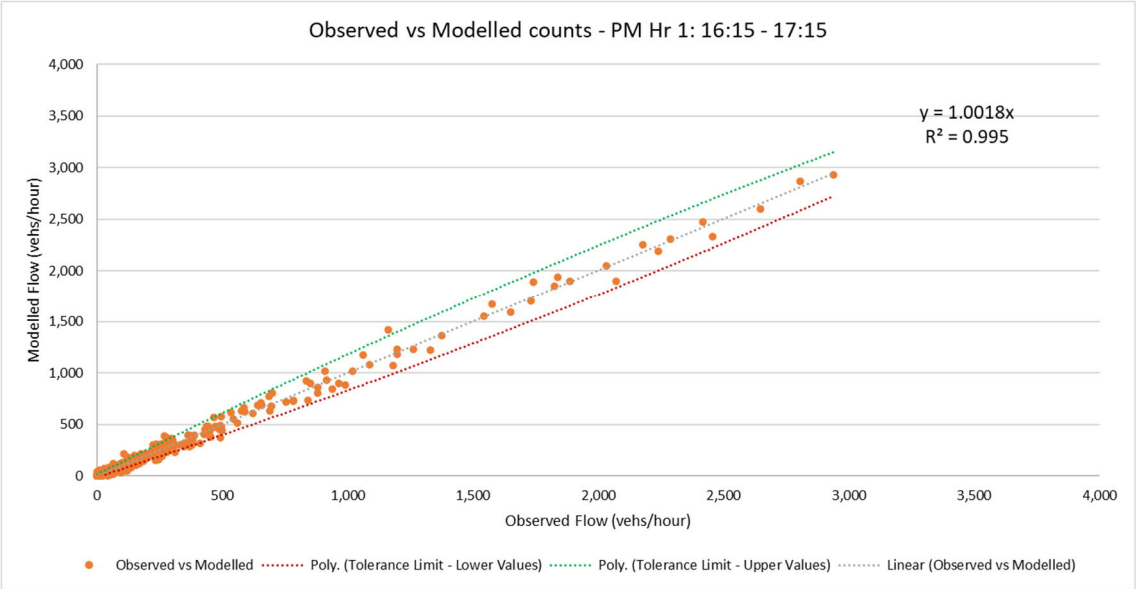
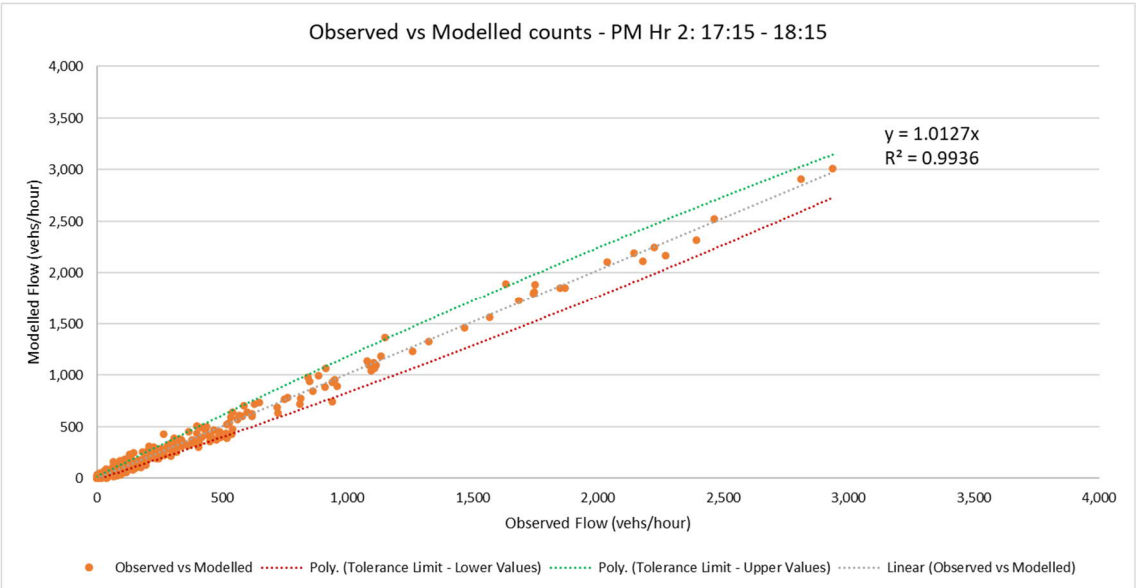


Figure 28 Observed vs Modelled counts – PM 17:15-18:15



5.3. Travel time validation

Travel time validation was undertaken following the requirements of TfNSW's Traffic Modelling Guidelines (2013). This requires the average model travel times on the overall route should be validated to within 15 per cent of the surveyed average travel time or one minute, whichever is greater. In addition, graphical plots comparing the average model travel time to the observed travel time (observed, minimum and maximum) are provided. Detailed travel time results are presented in Appendix B.

The travel time validation has been undertaken for each peak hour modelled. Table 13 through Table 16 and Figure 29 through Figure 59 summarise the travel time validation for the peak hours of the AM and PM peak periods. Based upon the travel time validation results, and given the variability in the survey data, the travel time routes are satisfactorily validated. There are two travel time routes outside the criteria however, they remain within the minimum and maximum observed times during the peak period, demonstrating the variability of travel times within the precinct.

Table 13 Travel Time: 7:30 – 8:30

Travel Time Route		Travel Time (minutes)						Validation
		Observed	Modelled	Observed -15%	Observed +15%	Min	Max	
Epping Road	EB	00:08:41	00:08:52	00:07:23	00:09:59	00:07:30	00:13:29	Pass
	WB	00:09:42	00:08:11	00:08:15	00:11:10	00:05:22	00:12:37	Fail
Talavera Road	EB	00:05:42	00:05:12	00:04:51	00:06:33	00:03:34	00:08:48	Pass
	WB	00:04:21	00:04:30	00:03:42	00:05:00	00:03:04	00:06:25	Pass
Lane Cove Road	NB	00:02:16	00:02:06	00:01:55	00:02:36	00:00:51	00:03:12	Pass
	SB	00:02:23	00:02:32	00:02:02	00:02:44	00:01:29	00:04:26	Pass
Herring Road	NB	00:02:30	00:02:36	00:02:07	00:02:52	00:01:09	00:03:54	Pass
	SB	00:02:51	00:02:49	00:02:25	00:03:16	00:01:10	00:04:31	Pass

Table 14 Travel Time: 8:30 – 9:30

Travel Time Route		Travel Time (minutes)						Validation
		Observed	Modelled	Observed -15%	Observed +15%	Min	Max	
Epping Road	EB	00:09:06	00:09:05	00:07:44	00:10:28	00:05:45	00:15:02	Pass
	WB	00:07:55	00:08:20	00:06:44	00:09:06	00:05:20	00:10:22	Pass
Talavera Road	EB	00:06:35	00:06:22	00:05:36	00:07:34	00:04:46	00:09:11	Pass
	WB	00:05:57	00:05:18	00:05:04	00:06:51	00:03:56	00:08:12	Pass
Lane Cove Road	NB	00:03:08	00:03:27	00:02:40	00:03:36	00:01:22	00:05:45	Pass
	SB	00:02:52	00:02:35	00:02:26	00:03:18	00:01:40	00:04:27	Pass
Herring Road	NB	00:02:52	00:02:48	00:02:26	00:03:18	00:01:08	00:05:25	Pass
	SB	00:02:18	00:02:50	00:01:57	00:02:38	00:01:06	00:04:11	Pass

Table 15 Travel Time: 16:15 – 17:15

Travel Time Route		Travel Time (minutes)						Validation
		Observed	Modelled	Observed -15%	Observed +15%	Min	Max	
Epping Road	EB	00:08:06	00:07:14	00:06:53	00:09:19	00:05:47	00:15:32	Pass
	WB	00:08:06	00:08:55	00:06:53	00:09:19	00:05:19	00:11:21	Pass
Talavera Road	EB	00:05:40	00:05:38	00:04:49	00:06:31	00:03:51	00:07:46	Pass
	WB	00:05:58	00:04:40	00:05:05	00:06:52	00:03:54	00:08:16	Fail
Lane Cove Road	NB	00:02:03	00:02:22	00:01:44	00:02:21	00:00:50	00:04:22	Pass
	SB	00:02:57	00:02:21	00:02:30	00:03:23	00:02:31	00:03:50	Pass
Herring Road	NB	00:02:40	00:03:05	00:02:16	00:03:04	00:01:10	00:04:22	Pass
	SB	00:03:49	00:03:35	00:03:15	00:04:24	00:01:52	00:05:55	Pass

Table 16 Travel Time: 17:15 – 18:15

Travel Time Route		Travel Time (minutes)						Validation
		Observed	Modelled	Observed -15%	Observed +15%	Min	Max	
Epping Road	EB	00:10:29	00:09:45	00:08:55	00:12:04	00:06:23	00:13:41	Pass
	WB	00:09:00	00:07:55	00:07:39	00:10:21	00:05:30	00:12:24	Pass
Talavera Road	EB	00:05:48	00:05:17	00:04:56	00:06:40	00:04:24	00:07:09	Pass
	WB	00:05:07	00:05:01	00:04:21	00:05:53	00:04:00	00:07:38	Pass
Lane Cove Road	NB	00:03:29	00:03:20	00:02:58	00:04:00	00:01:46	00:04:57	Pass
	SB	00:03:27	00:03:20	00:02:56	00:03:58	00:01:26	00:04:43	Pass
Herring Road	NB	00:02:39	00:02:59	00:02:15	00:03:02	00:01:27	00:04:47	Pass
	SB	00:03:18	00:03:30	00:02:48	00:03:47	00:01:50	00:04:32	Pass

Figure 29 Travel Time – Epping Road EB – 7:30 - 8:30

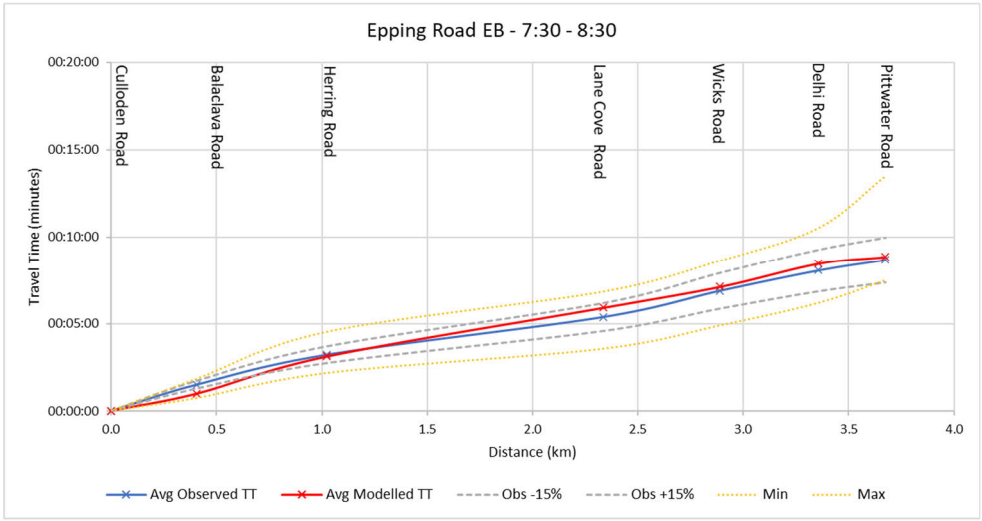


Figure 30 Travel Time – Epping Road EB – 8:30 - 9:30

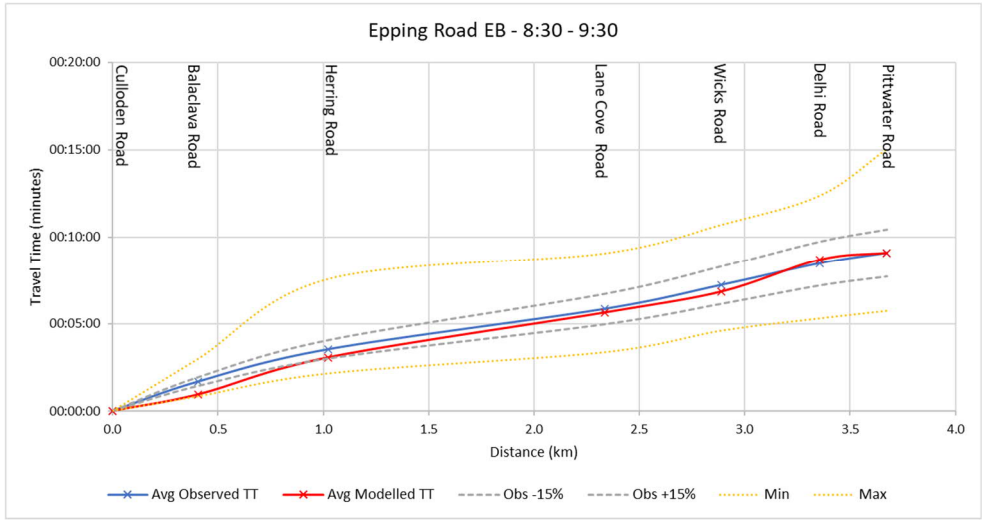


Figure 31 Travel Time – Epping Road WB – 7:30 - 8:30

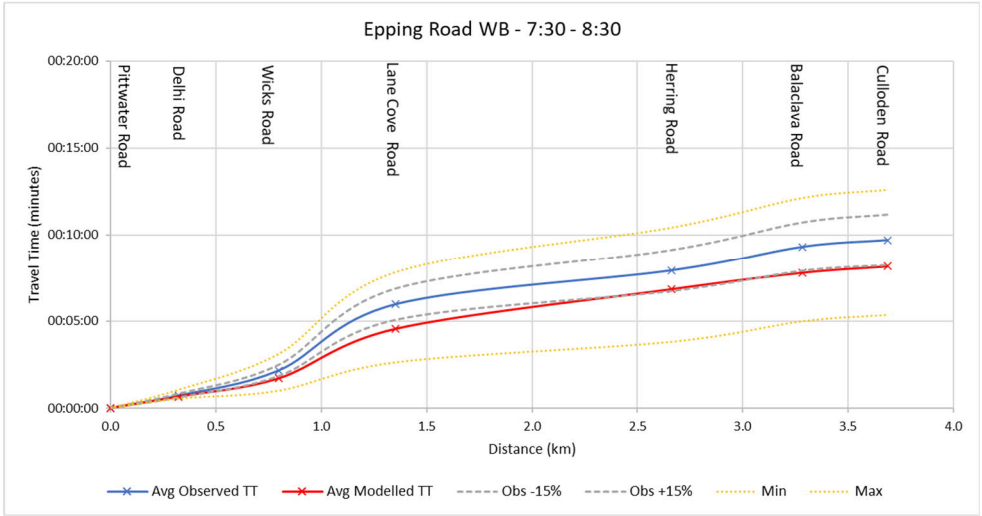


Figure 32 Travel Time – Epping Road WB – 8:30 - 9:30

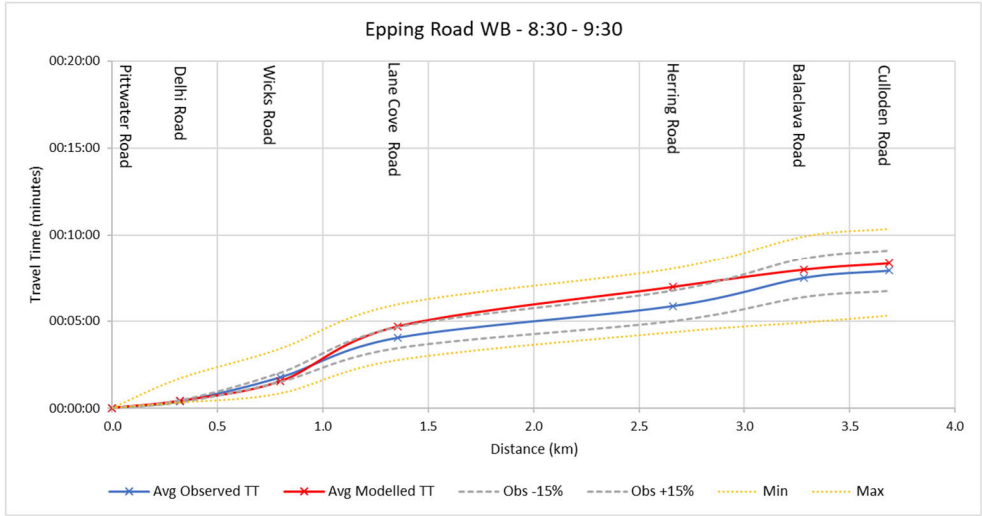


Figure 33 Travel Time – Talavera Road EB – 7:30 - 8:30

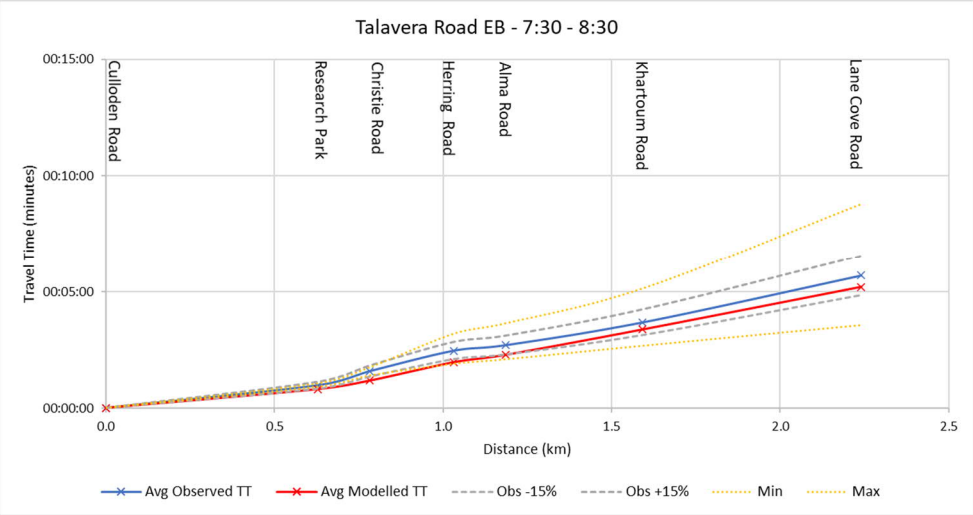


Figure 34 Travel Time – Talavera Road EB – 8:30 - 9:30

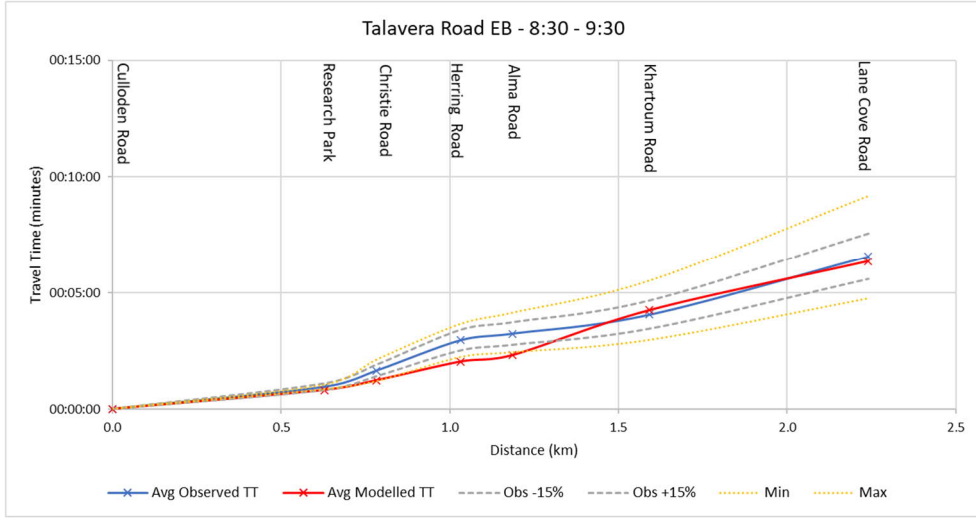


Figure 35 Travel Time – Talavera Road WB – 7:30 – 8:30

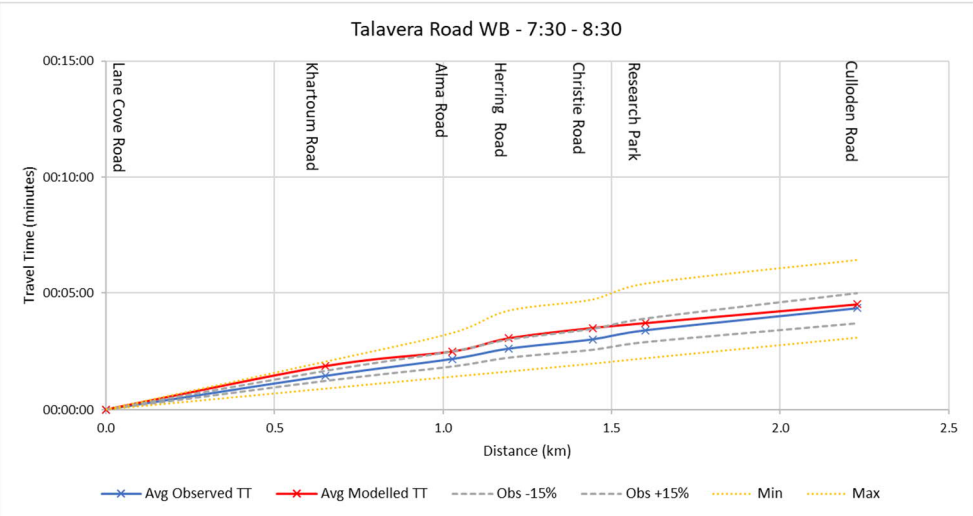


Figure 36 Travel Time – Talavera Road WB – 8:30 - 9:30

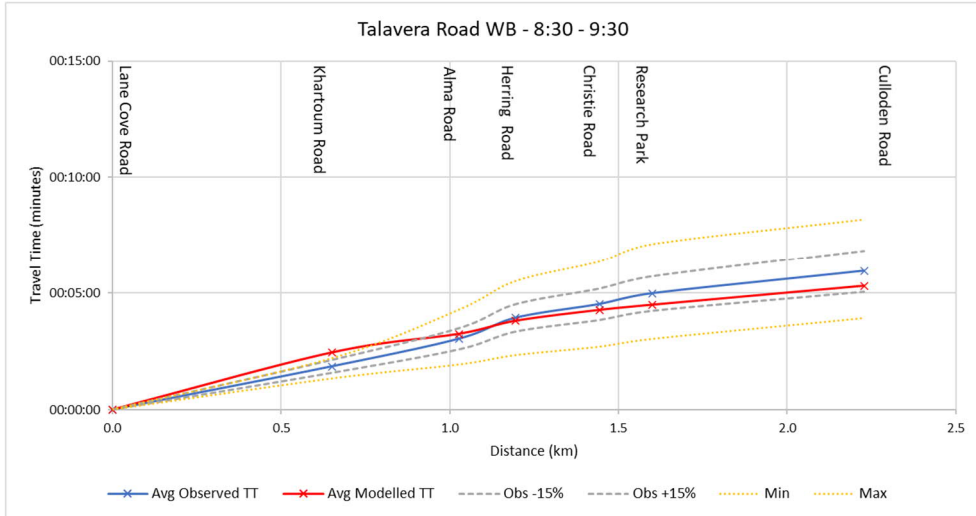


Figure 37 Travel Time – Lane Cove Road NB – 7:30 - 8:30

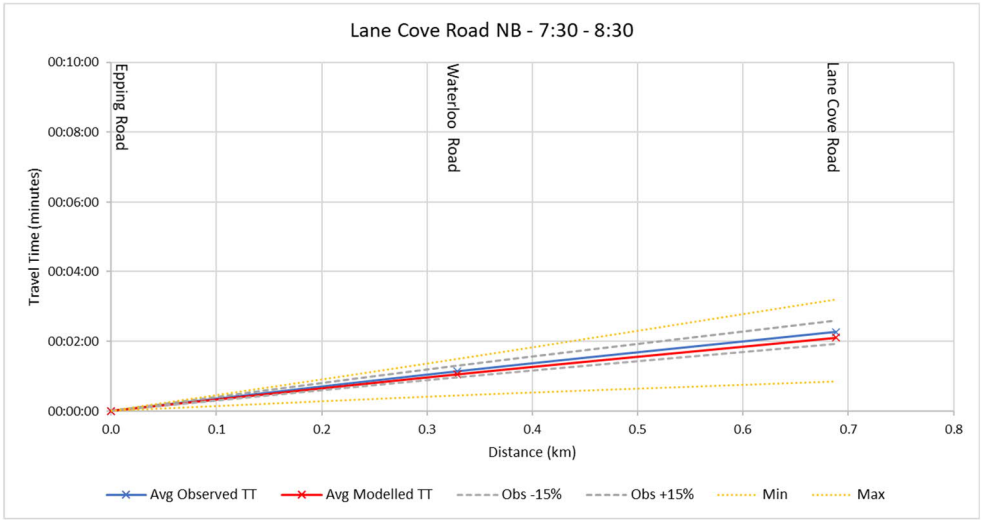


Figure 38 Travel Time – Lane Cove Road NB – 8:30 - 9:30

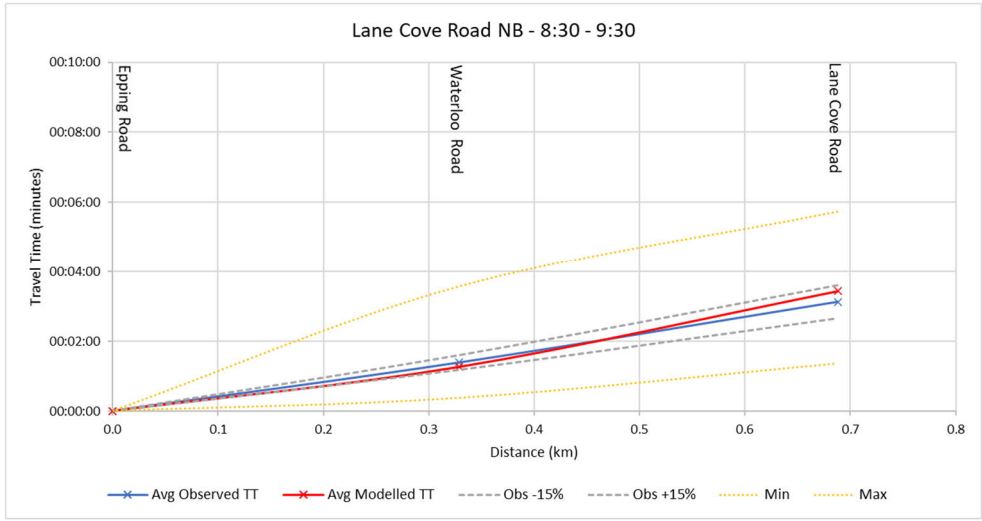


Figure 39 Travel Time – Lane Cove Road SB – 7:30 - 8:30

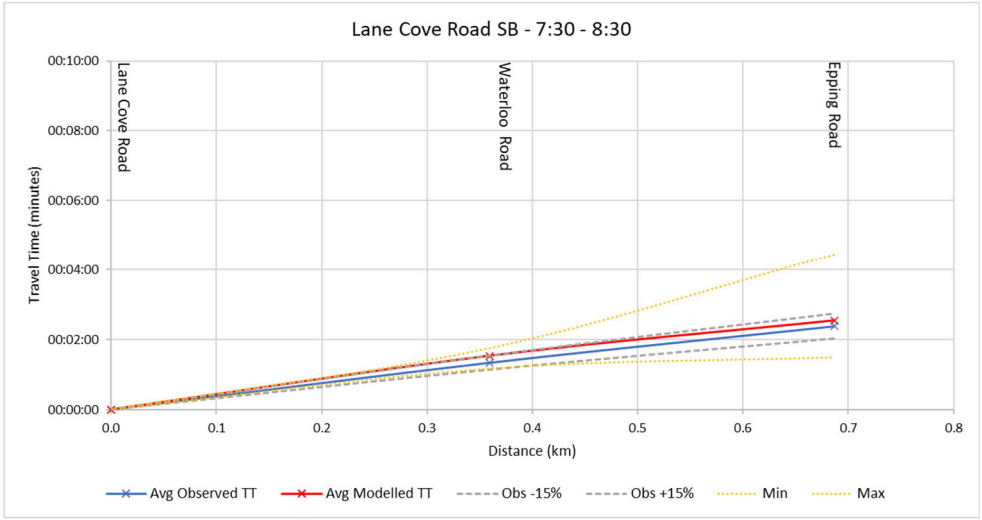


Figure 40 Travel Time – Lane Cove Road SB – 8:30 - 9:30

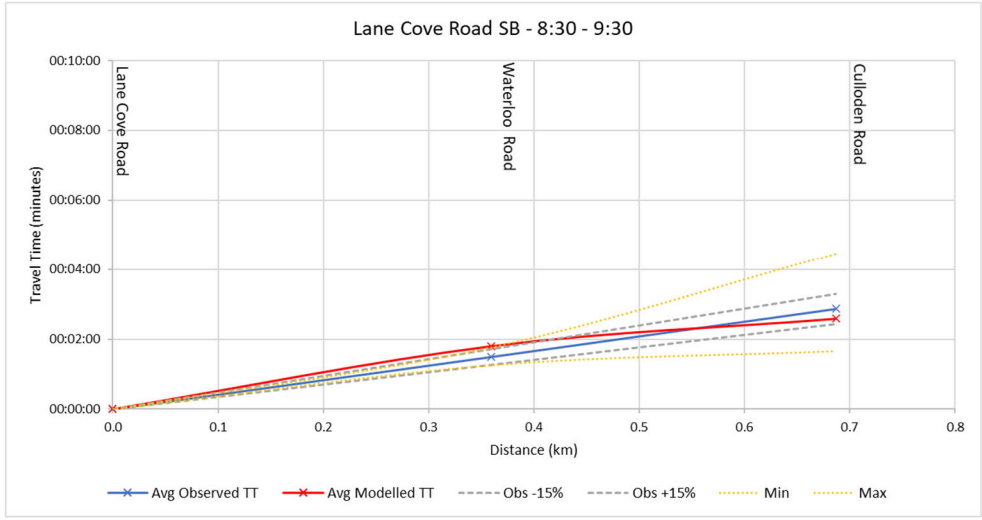


Figure 41 Travel Time – Herring Road NB – 7:30 - 8:30

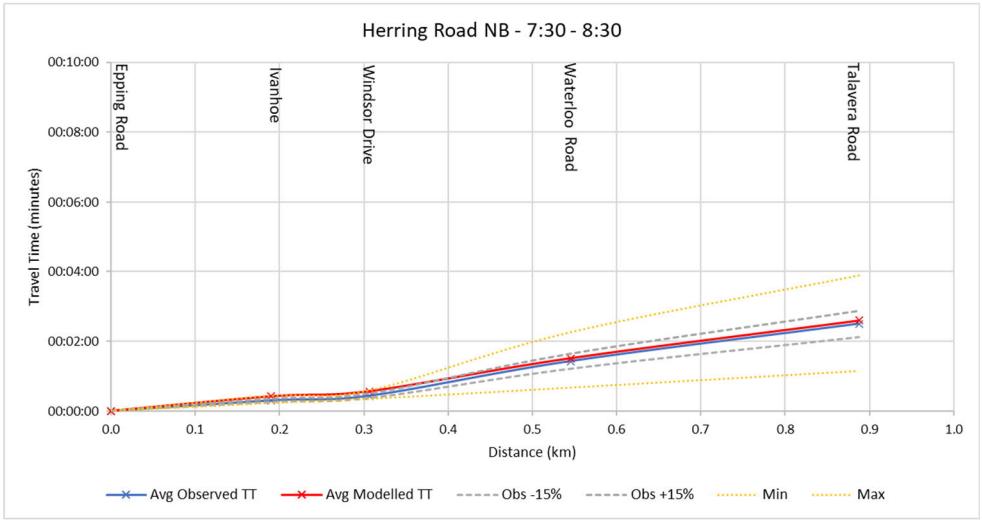


Figure 42 Travel Time – Herring Road NB – 8:30 - 9:30

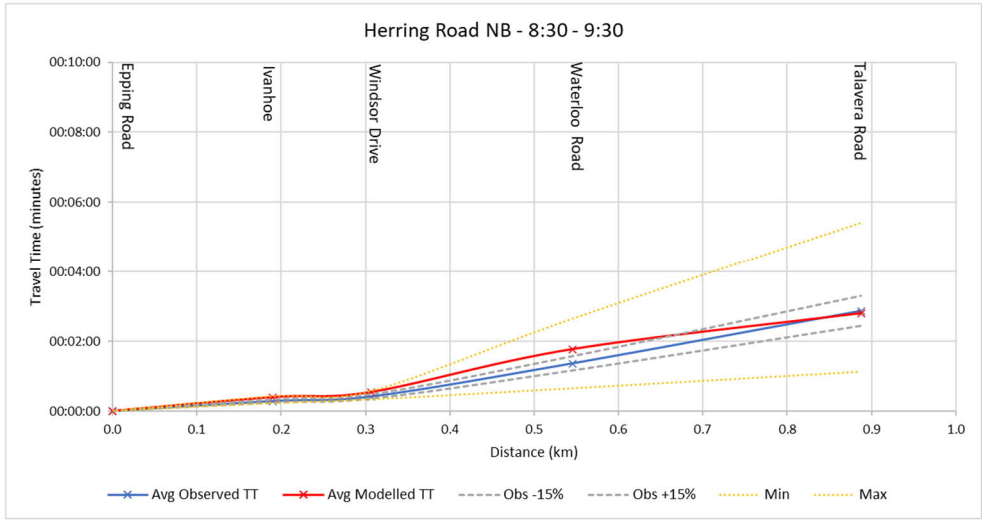


Figure 43 Travel Time – Herring Road SB – 7:30 - 8:30

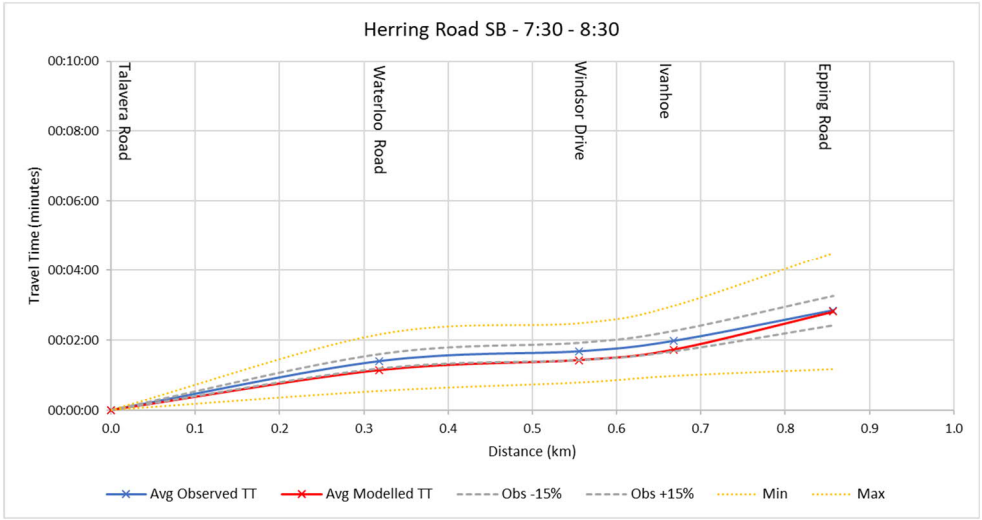


Figure 44 Travel Time – Herring Road SB – 8:30 - 9:30

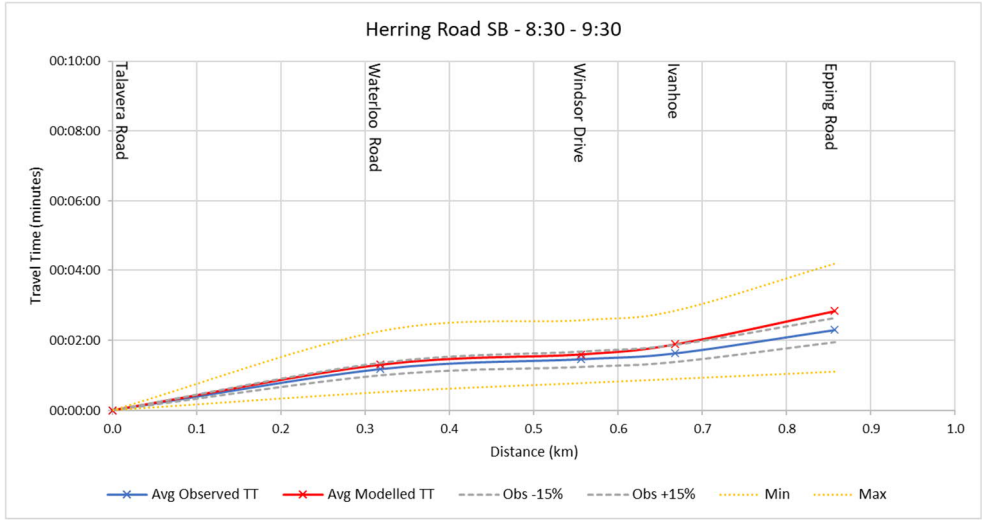


Figure 45 Travel Time – Epping Road EB – 16:15 - 17:15

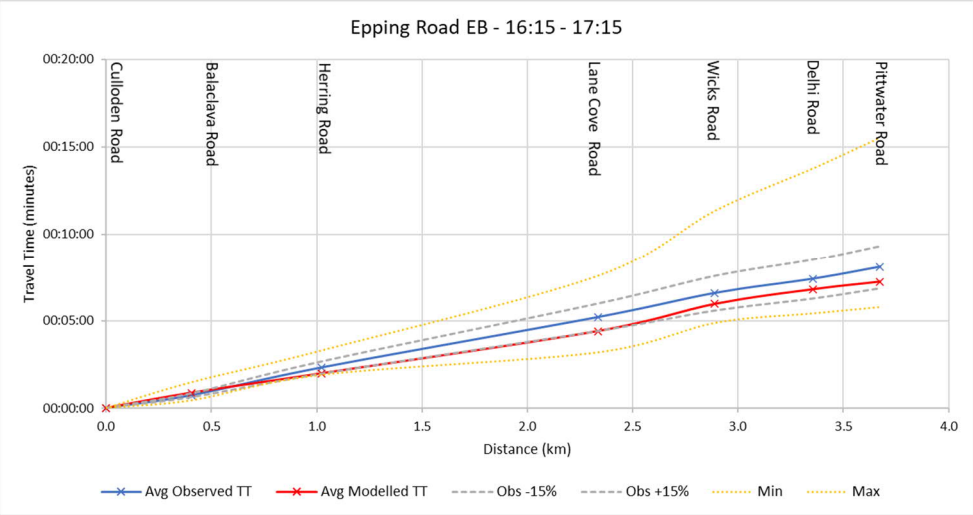


Figure 46 Travel Time – Epping Road EB – 17:15 - 18:15

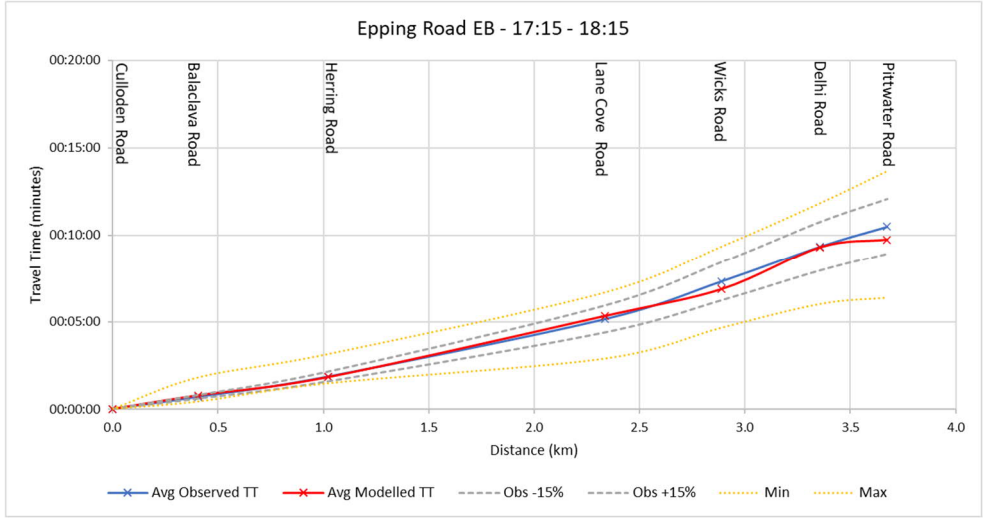


Figure 47 Travel Time – Epping Road WB – 16:15 - 17:15

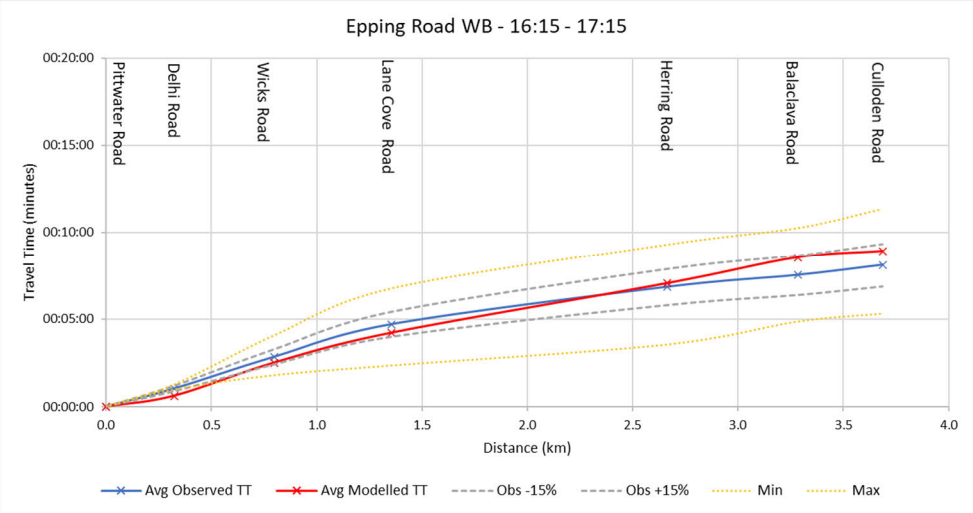


Figure 48 Travel Time – Epping Road WB – 17:15 - 18:15

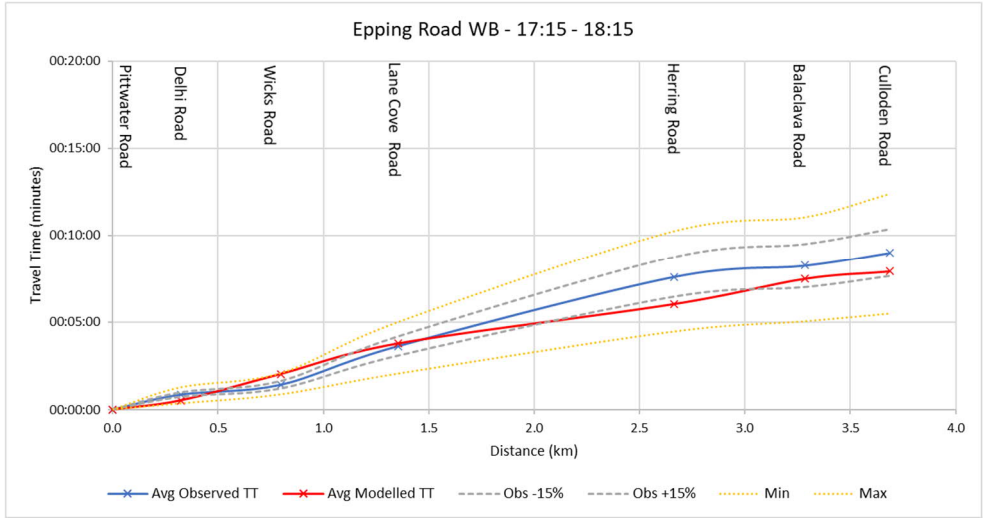


Figure 49 Travel Time – Talavera Road EB – 16:15 - 17:15

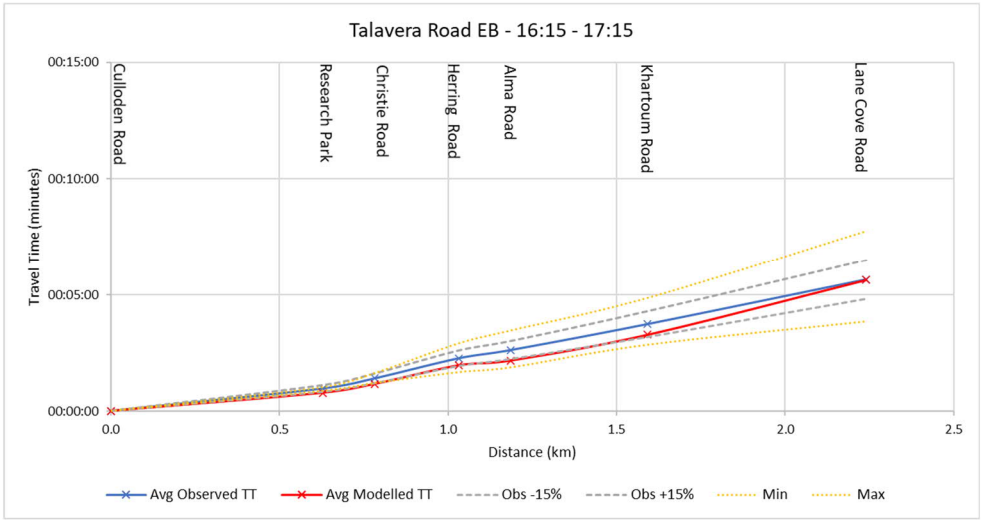


Figure 50 Travel Time – Talavera Road EB – 17:15 - 18:15

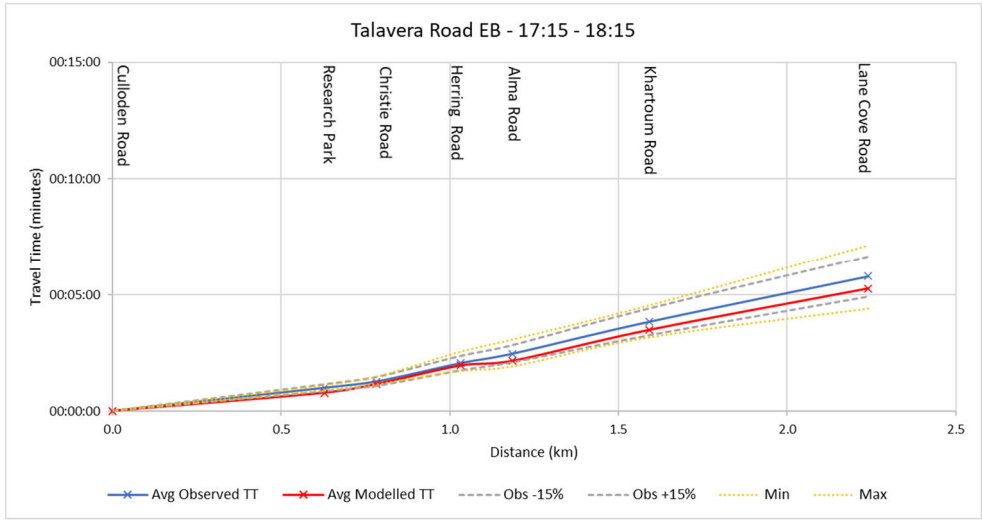


Figure 51 Travel Time – Talavera Road WB – 16:15 - 17:15

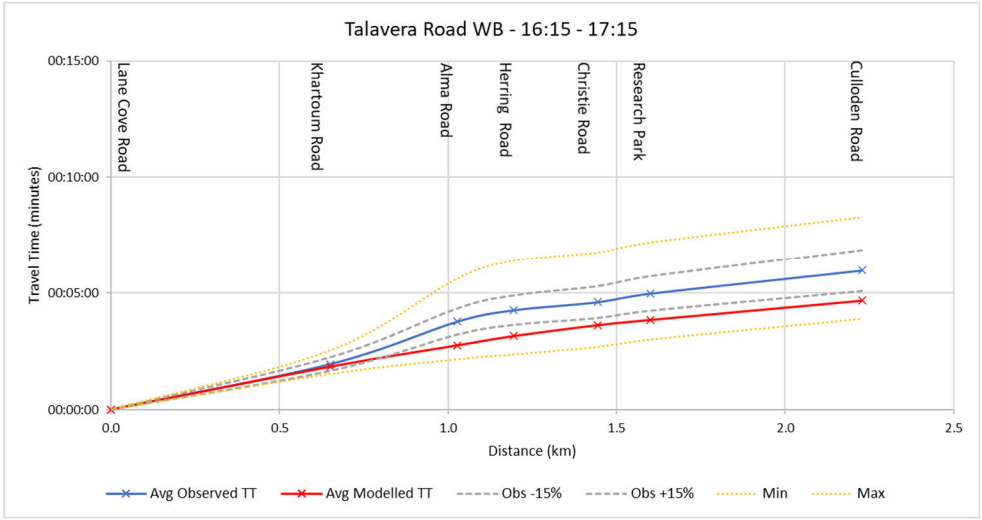


Figure 52 Travel Time – Talavera Road WB – 17:15 - 18:15

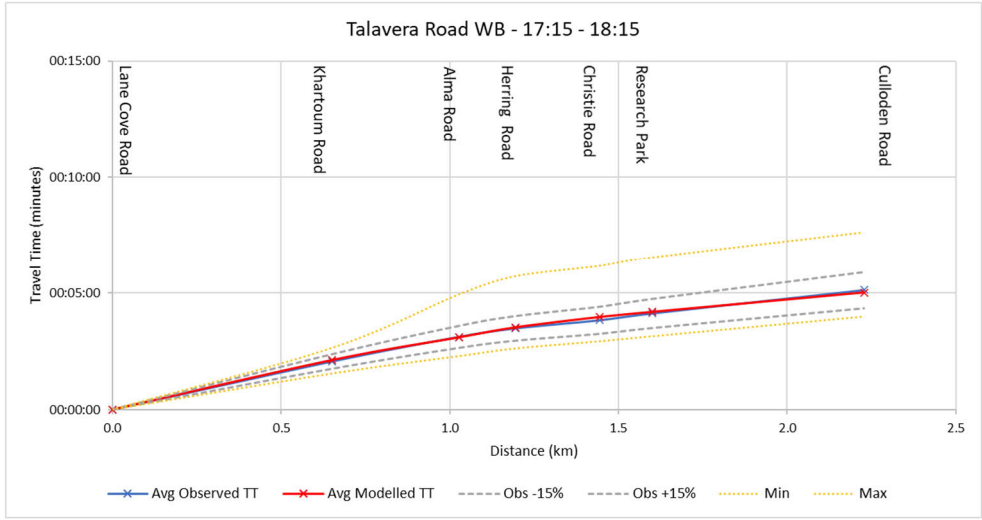


Figure 53 Travel Time – Lane Cove Road NB – 16:15 - 17:15

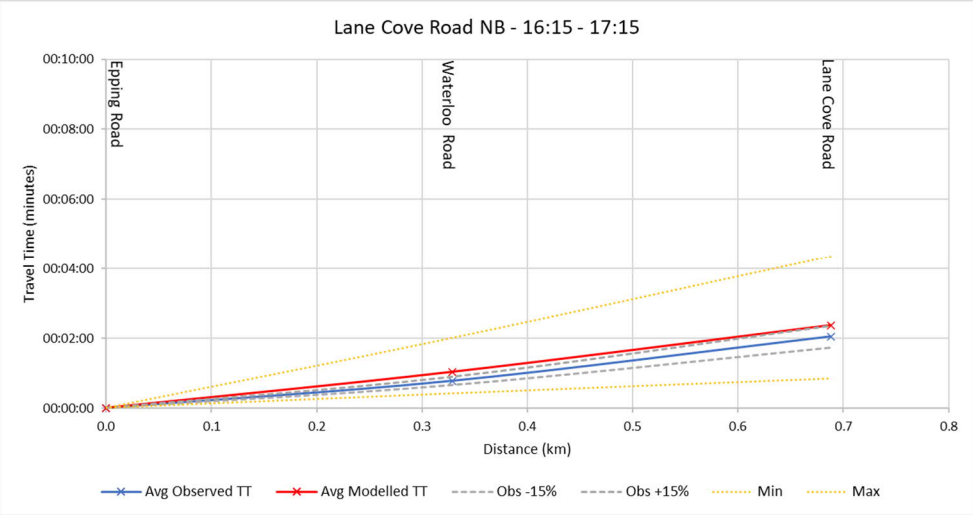


Figure 54 Travel Time – Lane Cove Road NB – 17:15 - 18:15

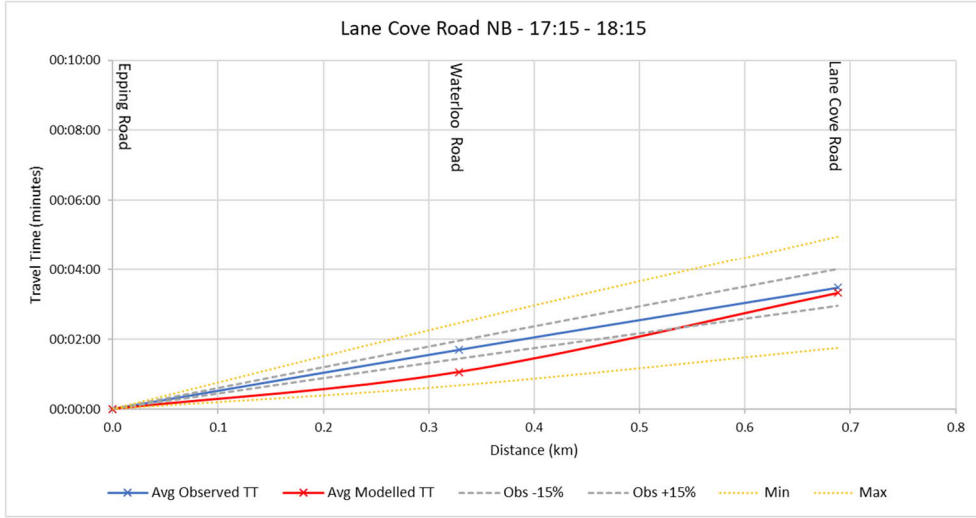


Figure 55 Travel Time – Lane Cove Road SB – 16:15 - 17:15

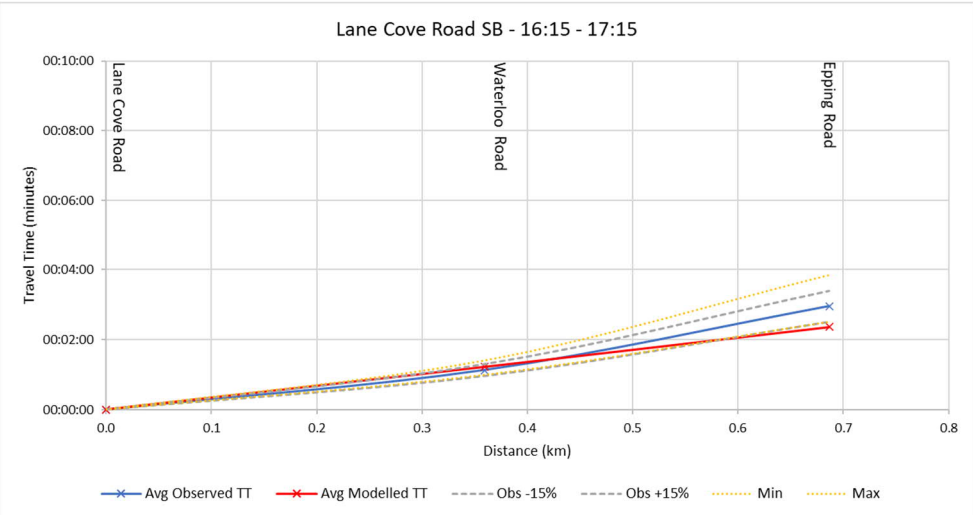


Figure 56 Travel Time – Lane Cove Road SB – 17:15 - 18:15

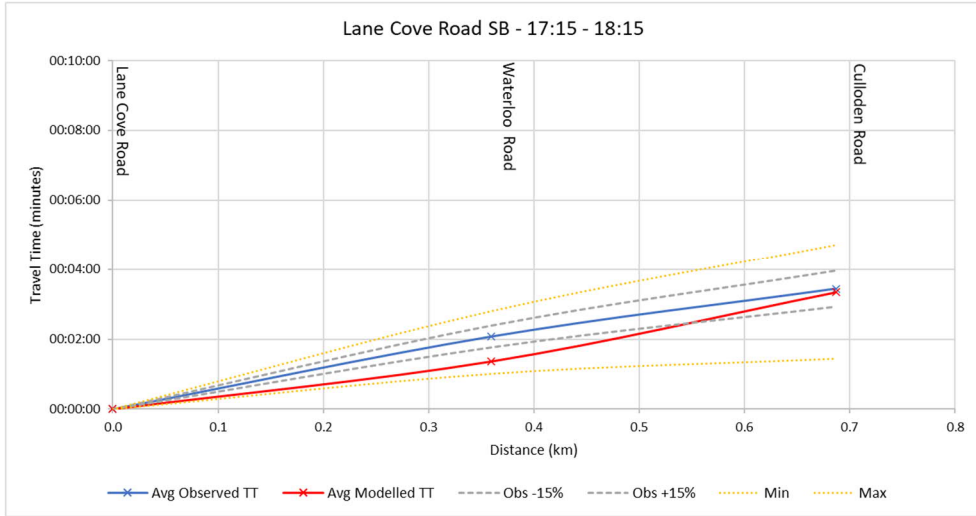


Figure 57 Travel Time – Herring Road NB – 16:15 - 17:15

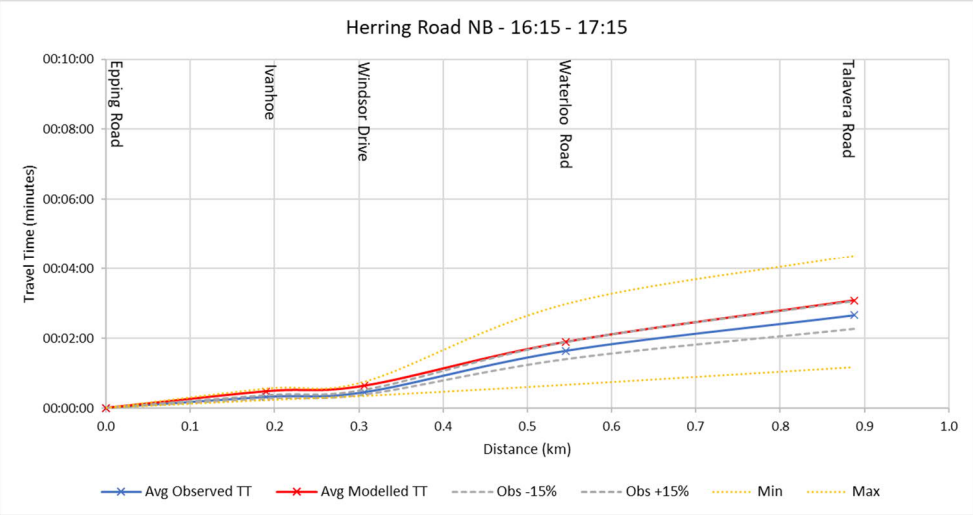


Figure 58 Travel Time – Herring Road NB – 17:15 - 18:15

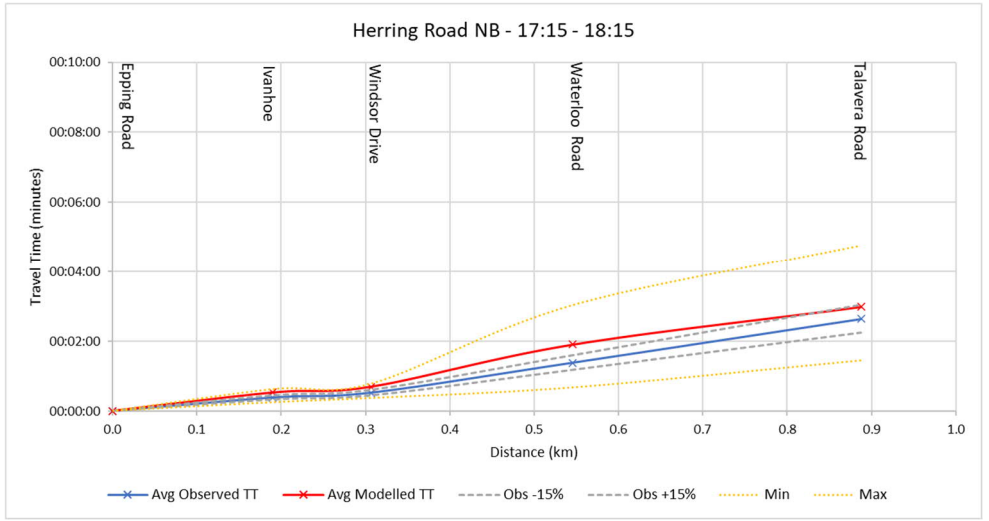


Figure 59 Travel Time – Herring Road SB – 16:15 - 17:15

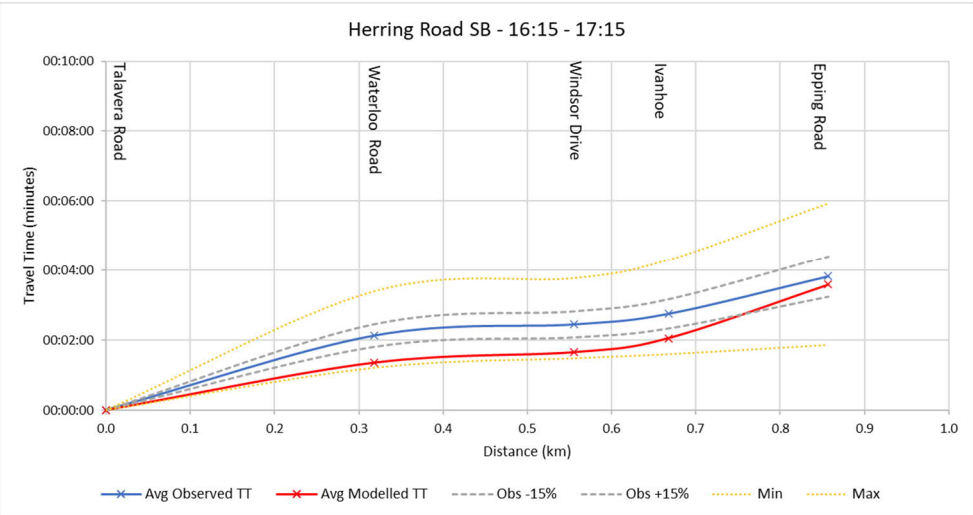
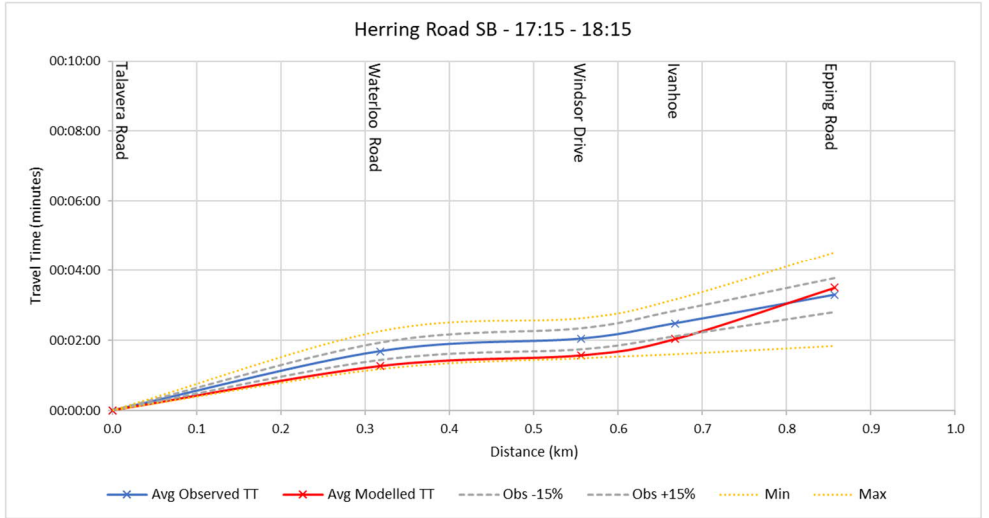


Figure 60 Travel Time – Herring Road SB – 17:15 - 18:15



5.4. Congestion hotspot validation

Model simulated queues were compared against Google's typical traffic conditions. Table 17 and Table 18 show the comparison of typical "slow points" in the AM and PM peaks. As seen in the figures, the modelled and observed delays within the study area compare reasonably well in both the AM and PM peak periods.

Table 17 Congestion locations in AIMSUN model – AM

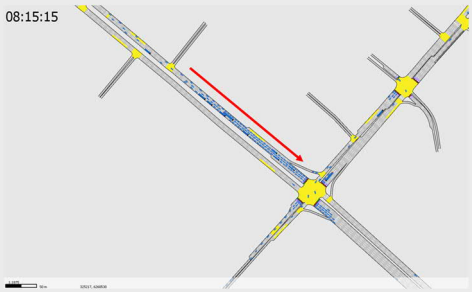
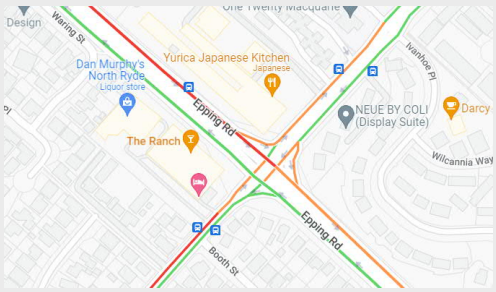
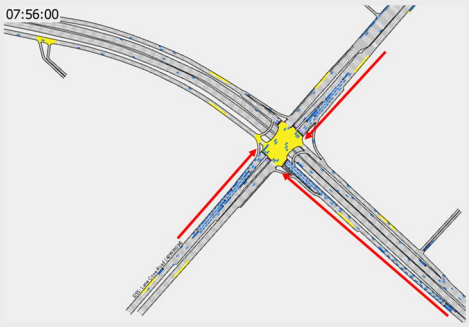
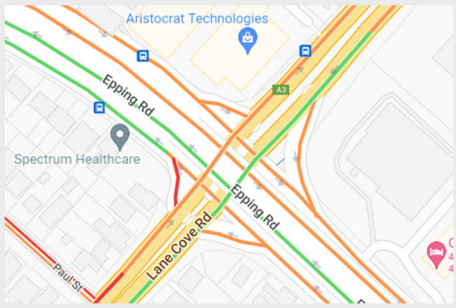
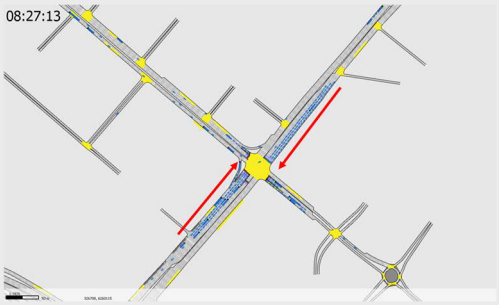
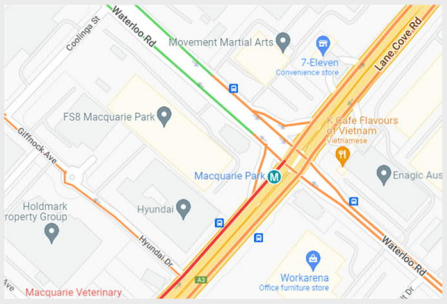
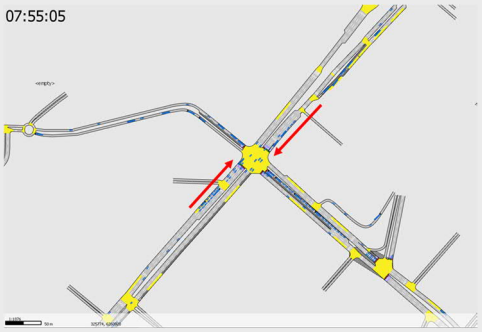
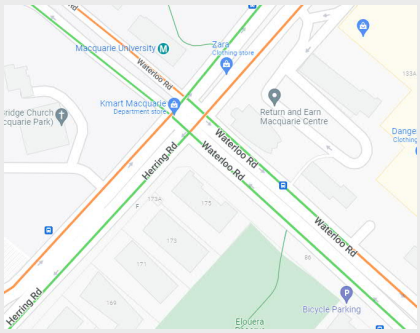
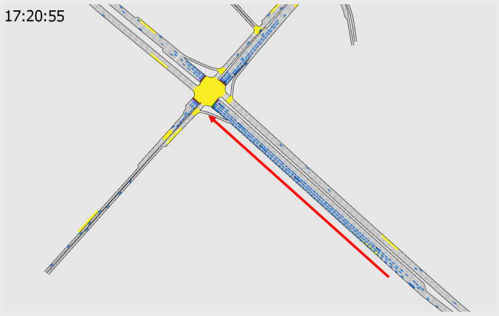
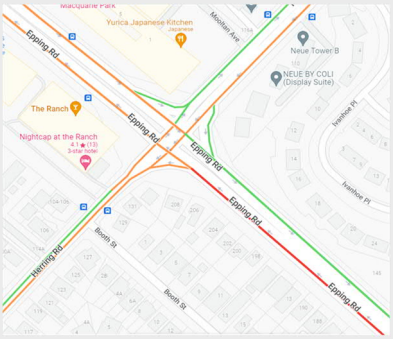
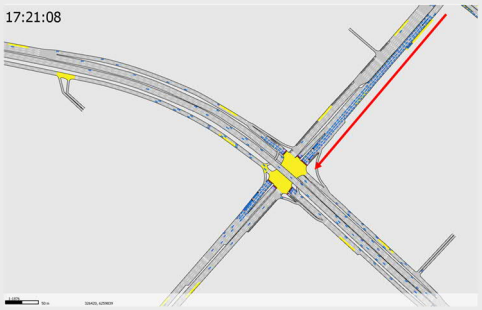
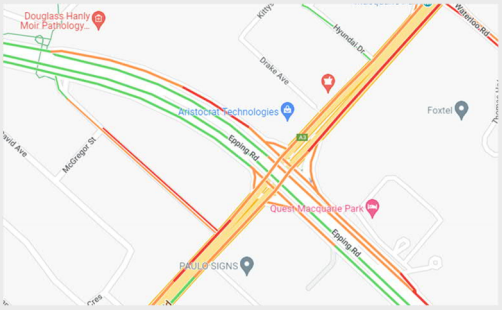
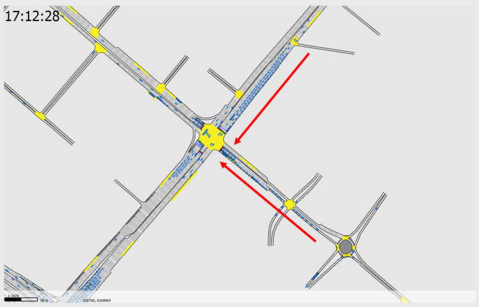
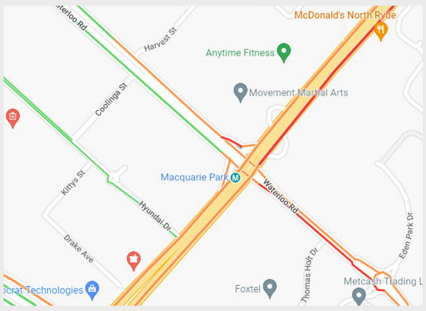
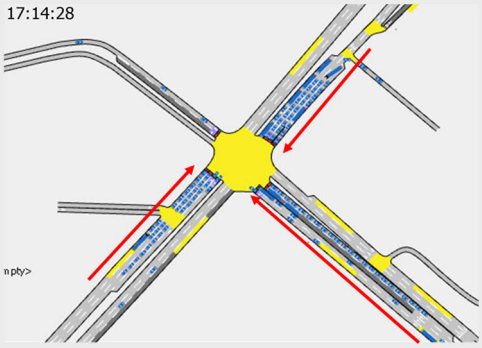
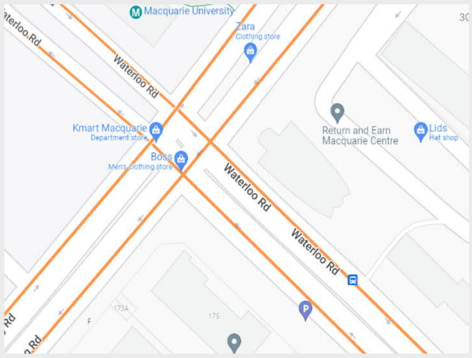
Intersection Name	Model screenshot - AM	Google Typical Traffic - AM
Epping Road / Herring Road		
Epping Road/Lane Cove Road		
Lane Cove Road/Waterloo Road		
Herring Road/Waterloo Road		

Table 18 Congestion locations in AIMSUN model – PM

Intersection Name	Model screenshot - PM	Google Typical Traffic - PM
Epping Road / Herring Road		
Epping Road/Lane Cove Road		
Lane Cove Road/Waterloo Road		
Herring Road/Waterloo Road		

6. Model limitations

1. The Aimsun model will not replicate congestion or bottlenecks outside the model boundary for future years
2. The M2 Motorway has not been included in this assessment
3. Pedestrians and cyclists are not included in this microsimulation model and will need to be replicated with signal timings as appropriate in the future models.

7. Conclusion

The 2022 Aimsun base model primarily meets the requirements of the TfNSW Traffic Modelling Guidelines (2013) and the criteria agreed with TfNSW at the commencement of the Macquarie Park Precinct Study. The modelling results show that the models have generally achieved:

- At least 90% of the turning counts with a GEH of less than 5 and 100% of the turning counts with a GEH of less than 10, for both light and heavy vehicle types;
- The average travel times from the model against the observed travel times replicate the expected travel patterns and behaviour for the overall traffic model with enough statistical accuracy.

Thus, the model is considered satisfactory for use in the modelling and assessment of future year scenarios for the Macquarie Park Precinct.

Appendix A – Calibration

Intersection ID	Intersection Name	Approach	Road Name	Movement	AIMSUN Movement ID	2022-AM HR1 (7:30 – 8:30)											
						LV			Trucks			Heavy Trucks			Total		
						Observed	Modelled	GEH	Observed	Modelled	GEH	Observed	Modelled	GEH	Observed	Modelled	GEH
1	Epping & Culloden	North	Culloden Rd	U - Turn	1-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	1-N-R	0	0	0	0	0	0	0	0	0	0	0	0
				Through	1-N-T	0	0	0	0	0	0	0	0	0	0	0	0
				Left	1-N-L	125	154	2	8	19	3	0	0	0	133	173	3
		East	Epping Rd	U - Turn	1-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	1-E-R	2	31	7	3	4	1	0	0	0	5	35	7
				Through	1-E-T	592	528	3	44	44	0	2	1	1	638	573	3
				Left	1-E-L	12	10	1	0	0	0	0	0	0	12	10	1
		South	Culloden Rd	U - Turn	1-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	1-S-R	0	0	0	0	0	0	0	0	0	0	0	0
				Through	1-S-T	0	0	0	0	0	0	0	0	0	0	0	0
				Left	1-S-L	45	48	0	2	0	2	0	0	0	47	48	0
		West	Epping Rd	U - Turn	1-W-U	1	0	1	0	0	0	0	0	0	1	0	1
				Right	1-W-R	45	45	0	1	0	1	0	0	0	46	45	0
				Through	1-W-T	1,728	1,683	1	52	71	2	0	6	3	1,780	1,760	0
				Left	1-W-L	135	118	2	3	4	1	0	0	0	138	122	1
2	Epping & Balaclava	North	Balaclava Rd	U - Turn	2-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	2-N-R	21	37	3	12	3	3	0	0	0	33	40	1
				Through	2-N-T	58	83	3	7	3	2	0	0	0	65	86	2
				Left	2-N-L	39	71	4	3	3	0	0	1	1	42	75	4
		East	Epping Rd	U - Turn	2-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	2-E-R	110	93	2	3	7	2	0	0	0	113	100	1
				Through	2-E-T	566	539	1	35	45	2	1	1	0	602	585	1
				Left	2-E-L	234	240	0	3	11	3	0	0	0	237	251	1
		South	Balaclava Rd	U - Turn	2-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	2-S-R	566	526	2	18	24	1	0	3	2	584	553	1
				Through	2-S-T	286	277	1	9	4	2	0	0	0	295	281	1
				Left	2-S-L	19	19	0	0	0	0	1	0	1	20	19	0
		West	Epping Rd	U - Turn	2-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	2-W-R	70	43	4	2	0	2	0	0	0	72	43	4
				Through	2-W-T	1,648	1,695	1	42	65	3	0	4	3	1,690	1,764	2
				Left	2-W-L	135	81	5	16	19	1	0	1	1	151	101	4
3	Epping & Herring	North	Herring Rd	U - Turn	3-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	3-N-R	139	90	5	6	10	1	0	0	0	145	100	4

Intersection ID	Intersection Name	Approach	Road Name	Movement	AIMSUN Movement ID	2022-AM HR1 (7:30 – 8:30)											
						LV			Trucks			Heavy Trucks			Total		
				Through	3-N-T	91	79	1	22	8	4	0	0	0	113	87	3
				Left	3-N-L	158	163	0	8	10	1	0	0	0	166	173	1
		East	Epping Rd	U - Turn	3-E-U	1	0	1	0	0	0	0	0	0	1	0	1
				Right	3-E-R	265	197	4	11	1	4	1	2	1	277	200	5
				Through	3-E-T	747	756	0	31	40	2	0	1	1	778	797	1
				Left	3-E-L	85	172	8	4	7	1	0	0	0	89	179	8
		South	Herring Rd	U - Turn	3-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	3-S-R	305	225	5	1	9	4	0	0	0	306	234	4
				Through	3-S-T	426	418	0	11	20	2	0	0	0	437	438	0
				Left	3-S-L	25	31	1	5	13	3	0	0	0	30	44	2
		West	Epping Rd	U - Turn	3-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	3-W-R	34	60	4	1	0	1	0	0	0	35	60	4
				Through	3-W-T	1,908	1,891	0	48	72	3	0	7	4	1,956	1,970	0
				Left	3-W-L	298	284	1	9	15	2	0	0	0	307	299	0
4	Waterloo & Herring	North	Herring Rd	U - Turn	4-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	4-N-R	20	6	4	28	4	6	0	0	0	48	10	7
				Through	4-N-T	94	56	4	14	6	3	0	0	0	108	62	5
				Left	4-N-L	48	55	1	35	1	8	0	0	0	83	56	3
		East	Waterloo Rd	U - Turn	4-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	4-E-R	84	82	0	42	14	5	0	0	0	126	96	3
				Through	4-E-T	91	84	1	4	11	3	0	0	0	95	95	0
				Left	4-E-L	135	178	3	5	14	3	1	0	1	141	192	4
		South	Herring Rd	U - Turn	4-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	4-S-R	436	439	0	5	12	2	0	0	0	441	451	0
				Through	4-S-T	463	371	5	20	15	1	0	0	0	483	386	5
				Left	4-S-L	67	62	1	0	4	3	0	0	0	67	66	0
		West	Waterloo Rd	U - Turn	4-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	4-W-R	1	10	4	0	0	0	0	0	0	1	10	4
				Through	4-W-T	175	139	3	7	7	0	0	0	0	182	146	3
				Left	4-W-L	84	79	1	33	7	6	0	0	0	117	86	3
5	Waterloo & Macquarie	North	Macquarie Centre	U - Turn	5-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	5-N-R	12	6	2	0	0	0	0	0	0	12	6	2
				Through	5-N-T	0	0	0	0	0	0	0	0	0	0	0	0
				Left	5-N-L	20	36	3	0	0	0	0	0	0	20	36	3
		East	Waterloo Rd	U - Turn	5-E-U	2	0	2	0	0	0	0	0	0	2	0	2

Intersection ID	Intersection Name	Approach	Road Name	Movement	AIMSUN Movement ID	2022-AM HR1 (7:30 – 8:30)											
						LV			Trucks			Heavy Trucks			Total		
				Right	5-E-R	45	77	4	0	1	1	0	0	0	45	78	4
				Through	5-E-T	286	298	1	47	29	3	1	0	1	334	327	0
				Left	5-E-L	14	32	4	4	2	1	0	0	0	18	34	3
		South	Cottonwood Cres	U - Turn	5-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	5-S-R	1	0	1	0	0	0	0	0	0	1	0	1
				Through	5-S-T	0	0	0	0	0	0	0	0	0	0	0	0
				Left	5-S-L	19	38	4	0	8	4	0	0	0	19	46	5
		West	Waterloo Rd	U - Turn	5-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	5-W-R	0	0	0	0	0	0	0	0	0	0	0	0
				Through	5-W-T	521	536	1	48	15	6	0	0	0	569	551	1
				Left	5-W-L	56	30	4	1	2	1	0	0	0	57	32	4
6	Talavera & Herring	North	Herring Rd	U - Turn	6-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	6-N-R	56	82	3	0	17	6	1	1	0	57	100	5
				Through	6-N-T	0	0	0	0	0	0	0	0	0	0	0	0
				Left	6-N-L	152	177	2	10	15	1	0	0	0	162	192	2
		East	Talavera Rd	U - Turn	6-E-U	1	0	1	0	0	0	0	0	0	1	0	1
				Right	6-E-R	28	42	2	7	5	1	0	0	0	35	47	2
				Through	6-E-T	148	115	3	8	3	2	0	0	0	156	118	3
				Left	6-E-L	55	84	3	3	12	3	0	0	0	58	96	4
		South	Herring Rd	U - Turn	6-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	6-S-R	191	151	3	2	17	5	0	0	0	193	168	2
				Through	6-S-T	79	74	1	14	1	5	0	0	0	93	75	2
				Left	6-S-L	70	48	3	10	5	2	0	0	0	80	53	3
		West	Talavera Rd	U - Turn	6-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	6-W-R	1	0	1	20	0	6	0	0	0	21	0	6
				Through	6-W-T	891	987	3	20	35	3	0	0	0	911	1,022	4
				Left	6-W-L	62	24	6	23	1	6	0	0	0	85	25	8
7	Talavera & Christie	North	Christie Rd	U - Turn	7-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	7-N-R	113	148	3	5	11	2	0	0	0	118	159	3
				Through	7-N-T	0	0	0	0	0	0	0	0	0	0	0	0
				Left	7-N-L	430	473	2	34	24	2	0	0	0	464	497	2
		East	Talavera Rd	U - Turn	7-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	7-E-R	25	29	1	4	4	0	0	0	0	29	33	1
				Through	7-E-T	250	217	2	14	21	2	1	1	0	265	239	2
				Left	7-E-L	0	0	0	0	0	0	0	0	0	0	0	0

Intersection ID	Intersection Name	Approach	Road Name	Movement	AIMSUN Movement ID	2022-AM HR1 (7:30 – 8:30)											
						LV			Trucks			Heavy Trucks			Total		
		South	Technology Pl	U - Turn	7-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	7-S-R	0	0	0	0	0	0	0	0	0	0	0	0
				Through	7-S-T	0	0	0	0	0	0	0	0	0	0	0	0
				Left	7-S-L	0	0	0	0	0	0	0	0	0	0	0	0
		West	Talavera Rd	U - Turn	7-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	7-W-R	0	0	0	0	0	0	0	0	0	0	0	0
				Through	7-W-T	547	505	2	19	11	2	0	0	0	566	516	2
				Left	7-W-L	60	51	1	0	12	5	1	0	1	61	63	0
8	Epping & Lane Cove	North	Lane Cove Rd	U - Turn	8-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	8-N-R	192	173	1	3	5	1	1	0	1	196	178	1
				Through	8-N-T	1,293	1,537	6	72	58	2	16	3	4	1,381	1,598	6
				Left	8-N-L	350	341	0	17	23	1	0	0	0	367	364	0
		East	Epping Rd	U - Turn	8-E-U	23	48	4	0	4	3	0	0	0	23	52	5
				Right	8-E-R	811	826	1	35	58	3	1	0	1	847	884	1
				Through	8-E-T	3	0	2	3	13	4	0	0	0	6	13	2
				Left	8-E-L	108	93	1	17	6	3	1	0	1	126	99	3
		South	Lane Cove Rd	U - Turn	8-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	8-S-R	314	376	3	32	0	8	5	0	3	351	376	1
				Through	8-S-T	1,367	1,573	5	96	118	2	9	2	3	1,472	1,693	6
				Left	8-S-L	23	14	2	3	0	2	0	0	0	26	14	3
		West	Epping Rd	U - Turn	8-W-U	19	21	0	5	4	0	0	0	0	24	25	0
				Right	8-W-R	87	71	2	5	6	0	0	3	2	92	80	1
				Through	8-W-T	47	20	5	11	3	3	0	0	0	58	23	5
				Left	8-W-L	355	354	0	16	7	3	0	1	1	371	362	0
9	Waterloo & Lane Cove	North	Lane Cove Rd	U - Turn	9-N-U	1	0	1	0	0	0	0	0	0	1	0	1
				Right	9-N-R	335	320	1	8	17	3	0	0	0	343	337	0
				Through	9-N-T	1,663	1,823	4	74	57	2	17	3	4	1,754	1,883	3
				Left	9-N-L	258	223	2	8	22	4	3	0	2	269	245	1
		East	Waterloo Rd	U - Turn	9-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	9-E-R	132	141	1	14	16	1	0	3	2	146	160	1
				Through	9-E-T	50	54	1	19	19	0	0	0	0	69	73	0
				Left	9-E-L	23	19	1	3	5	1	0	0	0	26	24	0
		South	Lane Cove Rd	U - Turn	9-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	9-S-R	83	123	4	1	8	3	0	1	1	84	132	5
				Through	9-S-T	2,092	2,081	0	128	104	2	10	2	3	2,230	2,187	1

Intersection ID	Intersection Name	Approach	Road Name	Movement	AIMSUN Movement ID	2022-AM HR1 (7:30 – 8:30)											
						LV			Trucks			Heavy Trucks			Total		
				Left	9-S-L	359	508	7	18	71	8	0	0	0	377	579	9
		West	Waterloo Rd	U - Turn	9-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	9-W-R	150	147	0	15	14	0	0	0	0	165	161	0
				Through	9-W-T	114	68	5	24	1	7	0	0	0	138	69	7
				Left	9-W-L	158	117	3	16	8	2	0	0	0	174	125	4
10	M2 Motorway & Lane Cove	North	Lane Cove Rd	U - Turn	10-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	10-N-R	553	573	1	28	25	1	2	0	2	583	598	1
				Through	10-N-T	2,286	2,354	1	75	79	0	6	2	2	2,367	2,435	1
				Left	10-N-L	492	495	0	14	25	2	2	0	2	508	520	1
		East	M2 Motorway	U - Turn	10-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	10-E-R	0	0	0	0	0	0	0	0	0	0	0	0
				Through	10-E-T	0	0	0	0	0	0	0	0	0	0	0	0
				Left	10-E-L	0	0	0	0	0	0	0	0	0	0	0	0
		South	Lane Cove Rd	U - Turn	10-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	10-S-R	0	0	0	0	0	0	0	0	0	0	0	0
				Through	10-S-T	1,966	2,085	3	143	111	3	7	5	1	2,116	2,201	2
				Left	10-S-L	35	41	1	9	0	4	0	0	0	44	41	0
		West	M2 Motorway	U - Turn	10-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	10-W-R	183	267	6	13	28	3	6	0	3	202	295	6
				Through	10-W-T	0	0	0	0	0	0	0	0	0	0	0	0
				Left	10-W-L	606	619	1	135	101	3	6	5	0	747	725	1
11	Talavera & Lane Cove	North	Lane Cove Rd	U - Turn	11-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	11-N-R	367	351	1	7	12	2	1	0	1	375	363	1
				Through	11-N-T	2,049	2,150	2	79	95	2	10	2	3	2,138	2,247	2
				Left	11-N-L	53	90	4	2	0	2	1	0	1	56	90	4
		East	Talavera Rd	U - Turn	11-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	11-E-R	10	7	1	0	0	0	0	0	0	10	7	1
				Through	11-E-T	9	5	2	1	0	1	0	0	0	10	5	2
				Left	11-E-L	23	44	4	3	0	2	1	0	1	27	44	3
		South	Lane Cove Rd	U - Turn	11-S-U	2	0	2	0	0	0	0	0	0	2	0	2
				Right	11-S-R	93	143	5	1	5	2	0	0	0	94	148	5
				Through	11-S-T	1,749	1,862	3	137	107	3	7	5	1	1,893	1,974	2
				Left	11-S-L	168	241	5	18	14	1	0	0	0	186	255	5
		West	Talavera Rd	U - Turn	11-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	11-W-R	119	109	1	4	6	1	0	0	0	123	115	1

Intersection ID	Intersection Name	Approach	Road Name	Movement	AIMSUN Movement ID	2022-AM HR1 (7:30 – 8:30)											
						LV			Trucks			Heavy Trucks			Total		
				Through	11-W-T	38	54	2	0	0	0	0	0	0	38	54	2
				Left	11-W-L	242	249	0	15	3	4	0	0	0	257	252	0
12	Talavera & Khartoum	North	Khartoum Rd	U - Turn	12-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	12-N-R	43	22	4	3	1	1	0	0	0	46	23	4
				Through	12-N-T	83	100	2	7	4	1	0	1	1	90	105	2
				Left	12-N-L	16	58	7	0	0	0	0	0	0	16	58	7
		East	Talavera Rd	U - Turn	12-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	12-E-R	32	37	1	3	2	1	1	0	1	36	39	0
				Through	12-E-T	173	214	3	8	12	1	0	0	0	181	226	3
				Left	12-E-L	109	66	5	11	7	1	2	0	2	122	73	5
		South	Khartoum Rd	U - Turn	12-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	12-S-R	65	61	1	13	2	4	0	0	0	78	63	2
				Through	12-S-T	69	64	1	7	2	2	0	0	0	76	66	1
				Left	12-S-L	48	99	6	7	12	2	2	0	2	57	111	6
		West	Talavera Rd	U - Turn	12-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	12-W-R	421	351	4	16	29	3	1	0	1	438	380	3
				Through	12-W-T	534	470	3	18	7	3	0	0	0	552	477	3
				Left	12-W-L	264	273	1	4	0	3	0	0	0	268	273	0
13	Talavera & Unnamed	North	Unnamed Rd	U - Turn	13-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	13-N-R	0	0	0	0	0	0	0	0	0	0	0	0
				Through	13-N-T	0	0	0	0	0	0	0	0	0	0	0	0
				Left	13-N-L	6	8	1	1	2	1	0	0	0	7	10	1
		East	Talavera Rd	U - Turn	13-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	13-E-R	0	0	0	0	0	0	0	0	0	0	0	0
				Through	13-E-T	218	273	4	19	21	0	0	0	0	237	294	3
				Left	13-E-L	54	68	2	1	2	1	0	0	0	55	70	2
		South	Banda Rd	U - Turn	13-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	13-S-R	13	19	2	3	0	2	0	0	0	16	19	1
				Through	13-S-T	9	0	4	0	0	0	0	0	0	9	0	4
				Left	13-S-L	14	5	3	0	0	0	0	0	0	14	5	3
		West	Talavera Rd	U - Turn	13-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	13-W-R	23	48	4	4	0	3	0	0	0	27	48	3
				Through	13-W-T	1,105	1,096	0	30	38	1	0	0	0	1,135	1,134	0
				Left	13-W-L	28	70	6	2	17	5	0	0	0	30	87	7
14		North	Alma Rd	U - Turn	14-N-U	0	0	0	0	0	0	0	0	0	0	0	0

Intersection ID	Intersection Name	Approach	Road Name	Movement	AIMSUN Movement ID	2022-AM											
						HR1 (7:30 – 8:30)											
						LV			Trucks			Heavy Trucks			Total		
	Talavera & Alma			Right	14-N-R	1	0	1	0	0	0	0	0	0	1	0	1
				Through	14-N-T	0	0	0	0	0	0	0	0	0	0	0	0
				Left	14-N-L	25	27	0	0	4	3	0	0	0	25	31	1
		East	Talavera Rd	U - Turn	14-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	14-E-R	0	0	0	0	0	0	0	0	0	0	0	0
				Through	14-E-T	205	198	0	19	20	0	0	0	0	224	218	0
				Left	14-E-L	26	75	7	0	1	1	0	0	0	26	76	7
		South	Macquarie Centre	U - Turn	14-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	14-S-R	35	59	4	0	0	0	0	0	0	35	59	4
				Through	14-S-T	0	0	0	0	0	0	0	0	0	0	0	0
				Left	14-S-L	19	43	4	1	0	1	0	0	0	20	43	4
		West	Talavera Rd	U - Turn	14-W-U	7	0	4	0	0	0	0	0	0	7	0	4
				Right	14-W-R	66	155	8	0	2	2	0	0	0	66	157	9
				Through	14-W-T	1,096	1,131	1	36	52	2	0	0	0	1,132	1,183	1
				Left	14-W-L	37	39	0	0	12	5	0	0	0	37	51	2
15	Fontenoy & Lane Cove	North	Lane Cove Rd	U - Turn	15-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	15-N-R	1	0	1	0	0	0	0	0	0	1	0	1
				Through	15-N-T	3,237	3,292	1	106	127	2	10	2	3	3,353	3,421	1
				Left	15-N-L	3	0	2	0	0	0	0	0	0	3	0	2
		East	Fontenoy Rd	U - Turn	15-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	15-E-R	0	0	0	0	0	0	0	0	0	0	0	0
				Through	15-E-T	1	3	1	1	0	1	0	0	0	2	3	1
				Left	15-E-L	0	1	1	0	0	0	0	0	0	0	1	1
		South	Lane Cove Rd	U - Turn	15-S-U	1	0	1	0	0	0	0	0	0	1	0	1
				Right	15-S-R	7	12	2	1	0	1	0	0	0	8	12	1
				Through	15-S-T	2,540	2,654	2	270	204	4	13	8	2	2,823	2,866	1
				Left	15-S-L	24	31	1	7	5	1	0	1	1	31	37	1
		West	Fontenoy Rd	U - Turn	15-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	15-W-R	93	120	3	11	1	4	0	0	0	104	121	2
				Through	15-W-T	1	0	1	0	0	0	0	0	0	1	0	1
				Left	15-W-L	318	272	3	2	4	1	0	0	0	320	276	3
16	Epping & Wicks	North	Wicks Rd	U - Turn	16-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	16-N-R	23	31	2	7	0	4	1	0	1	31	31	0
				Through	16-N-T	65	34	4	6	2	2	0	3	2	71	39	4
				Left	16-N-L	155	177	2	11	1	4	0	0	0	166	178	1

Intersection ID	Intersection Name	Approach	Road Name	Movement	AIMSUN Movement ID	2022-AM HR1 (7:30 – 8:30)											
						LV			Trucks			Heavy Trucks			Total		
		East	Epping Rd	U - Turn	16-E-U	1	0	1	0	0	0	0	0	0	1	0	1
				Right	16-E-R	294	236	4	25	20	1	0	5	3	319	261	3
				Through	16-E-T	1,686	1,725	1	78	101	2	2	3	1	1,766	1,829	1
				Left	16-E-L	714	698	1	32	15	4	2	1	1	748	714	1
		South	Wicks Rd	U - Turn	16-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	16-S-R	698	627	3	36	25	2	0	1	1	734	653	3
				Through	16-S-T	98	69	3	11	14	1	0	0	0	109	83	3
				Left	16-S-L	60	103	5	1	5	2	0	0	0	61	108	5
		West	Epping Rd	U - Turn	16-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	16-W-R	82	129	5	3	6	1	0	0	0	85	135	5
				Through	16-W-T	1,985	2,077	2	85	81	0	2	5	2	2,072	2,163	2
				Left	16-W-L	91	69	2	5	6	0	0	0	0	96	75	2
17	Halifax & Wicks	North	Wicks Rd	U - Turn	17-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	17-N-R	6	4	1	11	3	3	0	0	0	17	7	3
				Through	17-N-T	19	38	4	20	1	6	0	0	0	39	39	0
				Left	17-N-L	0	0	0	1	0	1	0	0	0	1	0	1
		East	Halifax St	U - Turn	17-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	17-E-R	0	0	0	0	0	0	0	0	0	0	0	0
				Through	17-E-T	28	21	1	6	2	2	0	0	0	34	23	2
				Left	17-E-L	66	66	0	3	0	2	0	0	0	69	66	0
		South	Wicks Rd	U - Turn	17-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	17-S-R	20	30	2	1	0	1	0	0	0	21	30	2
				Through	17-S-T	18	11	2	23	0	7	0	0	0	41	11	6
				Left	17-S-L	351	284	4	10	32	5	0	5	3	361	321	2
		West	Waterloo Rd	U - Turn	17-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	17-W-R	192	177	1	2	3	1	1	0	1	195	180	1
				Through	17-W-T	20	24	1	5	0	3	0	0	0	25	24	0
				Left	17-W-L	6	10	1	10	0	4	2	0	2	18	10	2
18	Epping & Delhi	North	Delhi Rd	U - Turn	18-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	18-N-R	700	703	0	30	35	1	1	0	1	731	738	0
				Left	18-N-L	412	496	4	24	33	2	3	0	2	439	529	4
		East	Epping Rd	U - Turn	18-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	18-E-R	580	563	1	19	30	2	0	0	0	599	593	0
				Through	18-E-T	1,990	1,956	1	91	101	1	5	9	2	2,086	2,066	0
		West	Epping Rd	U - Turn	18-W-U	0	0	0	0	0	0	0	0	0	0	0	0

Intersection ID	Intersection Name	Approach	Road Name	Movement	AIMSUN Movement ID	2022-AM HR1 (7:30 – 8:30)											
						LV			Trucks			Heavy Trucks			Total		
				Through	18-W-T	2,045	1,941	2	89	72	2	4	3	1	2,138	2,016	3
				Left	18-W-L	870	851	1	30	31	0	4	2	1	904	884	1
19	Epping & Pittwater	East	Epping Rd	U - Turn	19-E-U	5	0	3	0	0	0	0	0	0	5	0	3
				Through	19-E-T	2,048	1,875	4	93	94	0	5	5	0	2,146	1,974	4
				Left	19-E-L	157	187	2	14	18	1	0	0	0	171	205	2
		South	Pittwater Rd	U - Turn	19-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	19-S-R	1,005	977	1	44	21	4	0	0	0	1,049	998	2
				Left	19-S-L	522	644	5	17	38	4	0	4	3	539	686	6
		West	Epping Rd	U - Turn	19-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	19-W-R	368	348	1	21	17	1	1	0	1	390	365	1
				Through	19-W-T	2,089	2,092	0	92	88	0	6	3	1	2,187	2,183	0
20	Epping & M2 Motorway	North	M2 Motorway	U - Turn	20-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	20-N-R	283	327	3	19	29	2	2	0	2	304	356	3
				Left	20-N-L	324	287	2	14	19	1	0	3	2	338	309	2
		East	Epping Rd	U - Turn	20-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	20-E-R	232	178	4	17	8	3	1	0	1	250	186	4
				Through	20-E-T	829	866	1	35	39	1	2	0	2	866	905	1
		West	Epping Rd	U - Turn	20-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Through	20-W-T	1,121	1,038	3	35	43	1	4	2	1	1,160	1,083	2
				Left	20-W-L	329	376	3	14	18	1	0	0	0	343	394	3
21	Delhi & Rennie	East	Delhi Rd	U - Turn	21-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Through	21-E-T	951	963	0	52	46	1	3	0	2	1,006	1,009	0
				Left	21-E-L	12	19	2	0	6	3	0	1	1	12	26	3
		South	Rennie St	U - Turn	21-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	21-S-R	18	39	4	0	4	3	0	0	0	18	43	5
				Left	21-S-L	110	81	3	0	1	1	0	0	0	110	82	3
		West	Delhi Rd	U - Turn	21-W-U	1	0	1	0	0	0	0	0	0	1	0	1
				Right	21-W-R	201	199	0	0	18	6	0	0	0	201	217	1
				Through	21-W-T	1,243	1,107	4	49	45	1	4	5	0	1,296	1,157	4
22	Delhi & Plassey Entry	North	Plassey Entry Rd	U - Turn	22-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	22-N-R	21	17	1	1	1	0	0	0	0	22	18	1
				Through	22-N-T	7	0	4	0	0	0	0	0	0	7	0	4
				Left	22-N-L	5	4	0	0	0	0	0	0	0	5	4	0
		East	Delhi Rd	U - Turn	22-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	22-E-R	14	3	4	0	0	0	0	0	0	14	3	4

Intersection ID	Intersection Name	Approach	Road Name	Movement	AIMSUN Movement ID	2022-AM HR1 (7:30 – 8:30)											
						LV			Trucks			Heavy Trucks			Total		
				Through	22-E-T	852	884	1	47	44	0	3	1	1	902	929	1
				Left	22-E-L	57	39	3	2	1	1	0	0	0	59	40	3
		South	Julius Ave	U - Turn	22-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	22-S-R	71	95	3	0	0	0	0	1	1	71	96	3
				Through	22-S-T	7	0	4	0	0	0	0	0	0	7	0	4
				Left	22-S-L	90	82	1	4	5	0	0	0	0	94	87	1
		West	Delhi Rd	U - Turn	22-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	22-W-R	101	114	1	0	4	3	0	0	0	101	118	2
				Through	22-W-T	1,116	975	4	48	43	1	4	5	0	1,168	1,023	4
				Left	22-W-L	44	58	2	1	1	0	0	0	0	45	59	2
23	Delhi & Carpark	North	Carpark	U - Turn	23-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	23-N-R	12	1	4	1	0	1	0	0	0	13	1	5
				Through	23-N-T	1	0	1	0	0	0	0	0	0	1	0	1
				Left	23-N-L	3	0	2	1	0	1	0	0	0	4	0	3
		East	Delhi Rd	U - Turn	23-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	23-E-R	9	0	4	0	0	0	0	0	0	9	0	4
				Through	23-E-T	878	875	0	48	42	1	3	1	1	929	918	0
				Left	23-E-L	107	106	0	0	0	0	0	0	0	107	106	0
		South	Julius Ave	U - Turn	23-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	23-S-R	32	17	3	0	0	0	0	0	0	32	17	3
				Through	23-S-T	0	0	0	0	0	0	0	0	0	0	0	0
				Left	23-S-L	33	42	1	0	3	2	0	0	0	33	45	2
		West	Delhi Rd	U - Turn	23-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	23-W-R	172	148	2	0	7	4	0	0	0	172	155	1
				Through	23-W-T	939	917	1	48	39	1	3	6	1	990	962	1
				Left	23-W-L	2	5	2	1	0	1	0	0	0	3	5	1
24	Macquarie Walk & Uni	North	University Ave	U - Turn	24-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	24-N-R	0	0	0	0	0	0	0	0	0	0	0	0
				Through	24-N-T	4	0	3	0	0	0	0	0	0	4	0	3
				Left	24-N-L	3	0	2	0	0	0	0	0	0	3	0	2
		East	Macquarie Walk	U - Turn	24-E-U	0	0	0	4	0	3	0	0	0	4	0	3
				Right	24-E-R	9	3	2	0	1	1	0	0	0	9	4	2
				Through	24-E-T	0	0	0	0	0	0	0	0	0	0	0	0
				Left	24-E-L	86	85	0	26	4	6	0	0	0	112	89	2
		South	University Ave	U - Turn	24-S-U	0	0	0	0	0	0	0	0	0	0	0	0

Intersection ID	Intersection Name	Approach	Road Name	Movement	AIMSUN Movement ID	2022-AM HR1 (7:30 – 8:30)											
						LV			Trucks			Heavy Trucks			Total		
				Right	24-S-R	0	0	0	0	0	0	0	0	0	0	0	0
				Through	24-S-T	0	0	0	0	0	0	0	0	0	0	0	0
				Left	24-S-L	0	0	0	0	0	0	0	0	0	0	0	0
		West	Balaclava Rd	U - Turn	24-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	24-W-R	39	97	7	4	4	0	0	1	1	43	102	7
				Through	24-W-T	436	458	1	36	24	2	0	0	0	472	482	0
				Left	24-W-L	19	13	2	1	2	1	0	0	0	20	15	1
26	Waterloo & Carpark	North	Carpark	U - Turn	26-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	26-N-R	3	0	2	0	0	0	0	0	0	3	0	2
				Through	26-N-T	1	0	1	0	0	0	0	0	0	1	0	1
				Left	26-N-L	0	0	0	0	0	0	0	0	0	0	0	0
		East	Waterloo Rd	U - Turn	26-E-U	4	16	4	0	1	1	0	0	0	4	17	4
				Right	26-E-R	3	5	1	0	3	2	0	0	0	3	8	2
				Through	26-E-T	259	319	4	43	31	2	1	0	1	303	350	3
				Left	26-E-L	275	150	9	8	14	2	0	1	1	283	165	8
		South	Byfield St	U - Turn	26-S-U	1	0	1	0	0	0	0	0	0	1	0	1
				Right	26-S-R	37	35	0	0	6	3	0	0	0	37	41	1
				Through	26-S-T	0	0	0	0	0	0	0	0	0	0	0	0
				Left	26-S-L	51	21	5	5	1	2	0	0	0	56	22	5
		West	Waterloo Rd	U - Turn	26-W-U	34	32	0	3	1	1	0	0	0	37	33	1
				Right	26-W-R	144	155	1	0	3	2	0	0	0	144	158	1
				Through	26-W-T	373	406	2	45	12	6	0	0	0	418	418	0
				Left	26-W-L	12	11	0	0	0	0	0	0	0	12	11	0
27	Epping & Lyonpark	North	Lyonpark Rd	U - Turn	27-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	27-N-R	0	0	0	0	0	0	0	0	0	0	0	0
				Left	27-N-L	119	115	0	11	14	1	0	3	2	130	132	0
		East	Epping Rd	U - Turn	27-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	27-E-R	0	0	0	0	0	0	0	0	0	0	0	0
				Through	27-E-T	1,155	1,151	0	48	49	0	1	3	1	1,204	1,203	0
		West	Epping Rd	U - Turn	27-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Through	27-W-T	2,028	1,892	3	48	78	4	0	6	3	2,076	1,976	2
				Left	27-W-L	344	385	2	8	13	2	0	1	1	352	399	2
28	Harring & Macquarie	North	Harring Rd	U - Turn	28-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Through	28-N-T	55	84	3	23	12	3	0	0	0	78	96	2
				Left	28-N-L	0	0	0	0	0	0	0	0	0	0	0	0

Intersection ID	Intersection Name	Approach	Road Name	Movement	AIMSUN Movement ID	2022-AM HR1 (7:30 – 8:30)											
						LV			Trucks			Heavy Trucks			Total		
		East	Macquarie Centre	U - Turn	28-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	28-E-R	0	0	0	0	0	0	0	0	0	0	0	0
				Left	28-E-L	20	5	4	0	0	0	0	0	0	20	5	4
		South	Harring Rd	U - Turn	28-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	28-S-R	291	261	2	69	12	9	0	0	0	360	273	5
				Through	28-S-T	340	267	4	26	22	1	0	0	0	366	289	4
29	Waterloo & Macquarie	North	Macquarie Centre	U - Turn	29-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	29-N-R	0	0	0	4	0	3	0	0	0	4	0	3
				Left	29-N-L	8	0	4	6	0	3	0	0	0	14	0	5
		East	Waterloo Rd	U - Turn	29-E-U	1	0	1	0	0	0	0	0	0	1	0	1
				Right	29-E-R	6	0	3	0	0	0	0	0	0	6	0	3
				Through	29-E-T	310	342	2	47	37	2	1	0	1	358	379	1
		West	Waterloo Rd	U - Turn	29-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Through	29-W-T	568	574	0	43	17	5	0	0	0	611	591	1
				Left	29-W-L	91	63	3	4	3	1	0	0	0	95	66	3
30	Waterloo & Khartoum	North	Khartoum Rd	U - Turn	30-N-U	3	16	4	0	3	2	0	0	0	3	19	5
				Right	30-N-R	274	254	1	26	23	1	0	0	0	300	277	1
				Through	30-N-T	5	10	2	0	2	2	0	0	0	5	12	2
				Left	30-N-L	166	193	2	8	13	2	0	1	1	174	207	2
		East	Waterloo Rd	U - Turn	30-E-U	88	150	6	1	6	3	0	0	0	89	156	6
				Right	30-E-R	129	151	2	10	20	3	0	0	0	139	171	3
				Through	30-E-T	266	243	1	25	26	0	1	1	0	292	270	1
				Left	30-E-L	22	39	3	0	4	3	0	0	0	22	43	4
		South	Carpark	U - Turn	30-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	30-S-R	0	1	1	0	0	0	0	0	0	0	1	1
				Through	30-S-T	0	0	0	0	0	0	0	0	0	0	0	0
				Left	30-S-L	0	0	0	0	0	0	0	0	0	0	0	0
		West	Waterloo Rd	U - Turn	30-W-U	1	2	1	0	0	0	0	0	0	1	2	1
				Right	30-W-R	3	5	1	0	2	2	0	0	0	3	7	2
				Through	30-W-T	287	245	3	26	12	3	0	0	0	313	257	3
				Left	30-W-L	113	173	5	16	4	4	0	0	0	129	177	4
31	Optus & Lyonpark	North	Lyonpark Rd	U - Turn	31-N-U	5	0	3	0	0	0	0	0	0	5	0	3
				Right	31-N-R	23	19	1	0	0	0	0	0	0	23	19	1
				Through	31-N-T	108	106	0	9	14	1	0	3	2	117	123	1
				Left	31-N-L	122	82	4	6	15	3	0	0	0	128	97	3

Intersection ID	Intersection Name	Approach	Road Name	Movement	AIMSUN Movement ID	2022-AM											
						HR1 (7:30 – 8:30)											
						LV			Trucks			Heavy Trucks			Total		
		East	Optus Dr	U - Turn	31-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	31-E-R	2	1	1	0	0	0	0	0	0	2	1	1
				Through	31-E-T	0	0	0	0	0	0	0	0	0	0	0	0
				Left	31-E-L	3	4	1	2	0	2	0	0	0	5	4	0
		South	Lyonpark Rd	U - Turn	31-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	31-S-R	92	79	1	6	4	1	0	1	1	98	84	1
				Through	31-S-T	230	283	3	2	9	3	0	0	0	232	292	4
				Left	31-S-L	22	16	1	0	0	0	0	0	0	22	16	1
		West	Carpark	U - Turn	31-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	31-W-R	8	4	2	0	0	0	0	0	0	8	4	2
				Through	31-W-T	1	0	1	0	0	0	0	0	0	1	0	1
				Left	31-W-L	4	0	3	0	0	0	0	0	0	4	0	3
32	Research Park & Talavera	West	Talavera Rd	U - Turn	32-W-U	4	2	1	0	1	1	0	0	0	4	3	1
				Right	32-W-R	70	73	0	1	10	4	0	4	3	71	87	2
				Through	32-W-T	546	505	2	14	15	0	0	0	0	560	520	2
		East	Talavera Rd	U - Turn	32-E-U	23	25	0	2	4	1	0	0	0	25	29	1
				Through	32-E-T	184	191	1	16	18	0	1	0	1	201	209	1
				Left	32-E-L	156	147	1	1	9	4	0	1	1	157	157	0
		South	Research Park Dr	U - Turn	32-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	32-S-R	38	24	3	3	3	0	1	0	1	42	27	3
				Left	32-S-L	29	14	3	2	1	1	0	0	0	31	15	3
33	Talavera & Culloden	North	Culloden Rd	U - Turn	33-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	33-N-R	0	0	0	0	0	0	0	0	0	0	0	0
				Through	33-N-T	5	9	2	0	0	0	0	0	0	5	9	2
				Left	33-N-L	7	9	1	0	0	0	0	0	0	7	9	1
		East	Talavera Rd	U - Turn	33-E-U	6	3	1	0	2	2	0	0	0	6	5	0
				Right	33-E-R	9	10	0	0	0	0	0	0	0	9	10	0
				Through	33-E-T	20	19	0	1	2	1	0	0	0	21	21	0
				Left	33-E-L	182	166	1	17	15	1	1	0	1	200	181	1
		South	Culloden Rd	U - Turn	33-S-U	7	0	4	0	0	0	0	0	0	7	0	4
				Right	33-S-R	537	527	0	15	15	0	0	4	3	552	546	0
				Through	33-S-T	5	42	8	1	0	1	0	0	0	6	42	7
				Left	33-S-L	19	60	7	7	4	1	0	0	0	26	64	6
		West	Talavera Rd	U - Turn	33-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	33-W-R	74	83	1	7	7	0	0	0	0	81	90	1

Intersection ID	Intersection Name	Approach	Road Name	Movement	AIMSUN Movement ID	2022-AM											
						HR1 (7:30 – 8:30)											
						LV			Trucks			Heavy Trucks			Total		
				Through	33-W-T	70	91	2	0	9	4	0	0	0	70	100	3
				Left	33-W-L	0	0	0	0	0	0	0	0	0	0	0	0
34	Talavera & Macquarie	East	Talavera Rd	U - Turn	34-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Through	34-E-T	230	266	2	19	21	0	0	0	0	249	287	2
				Left	34-E-L	2	12	4	0	0	0	0	0	0	2	12	4
		South	Macquarie Centre	U - Turn	34-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	34-S-R	0	0	0	0	0	0	0	0	0	0	0	0
				Left	34-S-L	1	7	3	0	0	0	0	0	0	1	7	3
		West	Talavera Rd	U - Turn	34-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	34-W-R	0	0	0	0	0	0	0	0	0	0	0	0
				Through	34-W-T	1,156	1,215	2	36	55	3	0	0	0	1,192	1,270	2
35	Waterloo & Eden Park	North	Eden Park Dr	U - Turn	35-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	35-N-R	18	8	3	2	2	0	0	0	0	20	10	3
				Through	35-N-T	2	0	2	0	0	0	0	0	0	2	0	2
				Left	35-N-L	14	23	2	1	0	1	0	0	0	15	23	2
		East	Waterloo Rd	U - Turn	35-E-U	6	5	0	0	0	0	0	0	0	6	5	0
				Right	35-E-R	48	8	8	2	0	2	0	0	0	50	8	8
				Through	35-E-T	253	249	0	27	31	1	0	5	3	280	285	0
				Left	35-E-L	66	40	4	0	4	3	0	0	0	66	44	3
		South	Thomas Holt Dr	U - Turn	35-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	35-S-R	4	24	5	0	0	0	0	0	0	4	24	5
				Through	35-S-T	0	0	0	0	0	0	0	0	0	0	0	0
				Left	35-S-L	3	3	0	1	0	1	0	0	0	4	3	1
		West	Waterloo Rd	U - Turn	35-W-U	8	22	4	13	6	2	0	0	0	21	28	1
				Right	35-W-R	75	97	2	0	14	5	0	1	1	75	112	4
				Through	35-W-T	199	172	2	17	8	3	3	0	2	219	180	3
				Left	35-W-L	104	108	0	1	2	1	0	0	0	105	110	0
36	Gymnasium & Culloden	North	Culloden Rd	U - Turn	36-N-U	2	0	2	0	0	0	0	0	0	2	0	2
				Right	36-N-R	131	122	1	16	8	2	0	0	0	147	130	1
				Through	36-N-T	133	107	2	4	12	3	0	0	0	137	119	2
				Left	36-N-L	33	33	0	5	2	2	0	0	0	38	35	0
		East	Gymnasium Rd	U - Turn	36-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	36-E-R	14	7	2	3	0	2	0	0	0	17	7	3
				Through	36-E-T	9	8	0	0	0	0	0	0	0	9	8	0
				Left	36-E-L	10	0	4	3	0	2	0	0	0	13	0	5

Intersection ID	Intersection Name	Approach	Road Name	Movement	AIMSUN Movement ID	2022-AM HR1 (7:30 – 8:30)											
						LV			Trucks			Heavy Trucks			Total		
		South	Culloden Rd	U - Turn	36-S-U	1	9	4	0	0	0	0	0	0	1	9	4
				Right	36-S-R	3	7	2	0	3	2	0	0	0	3	10	3
				Through	36-S-T	116	141	2	5	4	0	0	0	0	121	145	2
				Left	36-S-L	17	22	1	1	2	1	0	0	0	18	24	1
		West	Waterloo Rd	U - Turn	36-W-U	3	0	2	0	0	0	0	0	0	3	0	2
				Right	36-W-R	35	60	4	0	9	4	0	0	0	35	69	5
				Through	36-W-T	30	73	6	1	5	2	0	0	0	31	78	6
				Left	36-W-L	428	437	0	16	14	1	0	4	3	444	455	1
37	Herring Road & Ivanhoe Road	North	Herring Road	U - Turn	37-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	37-N-R	13	1	5	1	0	1	0	0	0	14	1	5
				Through	37-N-T	307	302	0	34	24	2	0	0	0	341	326	1
				Left	37-N-L	9	20	3	1	0	1	0	0	0	10	20	3
		East	Ivanhoe Road	U - Turn	37-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	37-E-R	4	6	1	0	0	0	0	0	0	4	6	1
				Through	37-E-T	2	0	2	0	0	0	0	0	0	2	0	2
				Left	37-E-L	34	9	5	1	3	1	0	0	0	35	12	5
		South	Herring Road	U - Turn	37-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	37-S-R	51	43	1	4	1	2	1	2	1	56	46	1
				Through	37-S-T	1,022	923	3	26	33	1	0	0	0	1,048	956	3
				Left	37-S-L	7	8	0	1	0	1	0	0	0	8	8	0
		West	Morling College Road	U - Turn	37-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	37-W-R	47	20	5	1	2	1	0	0	0	48	22	4
				Through	37-W-T	3	2	1	0	0	0	0	0	0	3	2	1
				Left	37-W-L	10	17	2	2	0	2	0	0	0	12	17	1

Intersection ID	Intersection Name	Approach	Road Name	Movement	AIMSUN Movement ID	2022-AM HR2 (8:30 – 9:30)											
						LV			Trucks			Heavy Trucks			Total		
						Observed	Modelled	GEH	Observed	Modelled	GEH	Observed	Modelled	GEH	Observed	Modelled	GEH
1	Epping & Culloden	North	Culloden Rd	U - Turn	1-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	1-N-R	0	0	0	0	0	0	0	0	0	0	0	0
				Through	1-N-T	0	0	0	0	0	0	0	0	0	0	0	0
				Left	1-N-L	173	264	6	11	26	3	0	1	1	184	291	7
		East	Epping Rd	U - Turn	1-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	1-E-R	8	41	7	0	1	1	0	1	1	8	43	7
				Through	1-E-T	607	611	0	43	36	1	1	1	0	651	648	0
				Left	1-E-L	18	23	1	0	0	0	0	0	0	18	23	1
		South	Culloden Rd	U - Turn	1-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	1-S-R	0	0	0	0	0	0	0	0	0	0	0	0
				Through	1-S-T	0	0	0	0	0	0	0	0	0	0	0	0
				Left	1-S-L	44	48	1	0	0	0	0	0	0	44	48	1
		West	Epping Rd	U - Turn	1-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	1-W-R	47	43	1	1	0	1	0	0	0	48	43	1
				Through	1-W-T	1,475	1,327	4	65	52	2	1	4	2	1,541	1,383	4
				Left	1-W-L	148	150	0	3	1	1	0	0	0	151	151	0
2	Epping & Balaclava	North	Balaclava Rd	U - Turn	2-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	2-N-R	45	49	1	13	1	5	0	0	0	58	50	1
				Through	2-N-T	78	68	1	5	1	2	0	0	0	83	69	2
				Left	2-N-L	44	95	6	0	9	4	1	0	1	45	104	7
		East	Epping Rd	U - Turn	2-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	2-E-R	179	184	0	2	0	2	0	0	0	181	184	0
				Through	2-E-T	550	572	1	29	36	1	1	1	0	580	609	1
				Left	2-E-L	265	283	1	15	10	1	0	3	2	280	296	1
		South	Balaclava Rd	U - Turn	2-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	2-S-R	544	533	0	22	13	2	1	3	1	567	549	1
				Through	2-S-T	293	288	0	7	13	2	0	0	0	300	301	0
				Left	2-S-L	38	37	0	1	0	1	0	1	1	39	38	0
		West	Epping Rd	U - Turn	2-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	2-W-R	84	64	2	4	0	3	0	0	0	88	64	3
				Through	2-W-T	1,385	1,399	0	57	51	1	1	5	2	1,443	1,455	0
				Left	2-W-L	179	185	0	15	23	2	0	0	0	194	208	1
3	Epping & Herring	North	Herring Rd	U - Turn	3-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	3-N-R	138	94	4	9	9	0	0	2	2	147	105	4

Intersection ID	Intersection Name	Approach	Road Name	Movement	AIMSUN Movement ID	2022-AM HR2 (8:30 – 9:30)											
						LV			Trucks			Heavy Trucks			Total		
				Through	3-N-T	171	107	5	9	7	1	2	0	2	182	114	6
				Left	3-N-L	163	172	1	18	12	2	0	0	0	181	184	0
		East	Epping Rd	U - Turn	3-E-U	3	0	2	0	0	0	0	0	0	3	0	2
				Right	3-E-R	436	341	5	13	5	3	1	1	0	450	347	5
				Through	3-E-T	795	878	3	39	35	1	0	2	2	834	915	3
				Left	3-E-L	101	101	0	3	5	1	0	0	0	104	106	0
		South	Herring Rd	U - Turn	3-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	3-S-R	289	189	6	5	9	2	0	0	0	294	198	6
				Through	3-S-T	453	461	0	8	14	2	0	2	2	461	477	1
				Left	3-S-L	33	63	4	1	4	2	0	0	0	34	67	5
		West	Epping Rd	U - Turn	3-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	3-W-R	60	54	1	2	0	2	0	0	0	62	54	1
				Through	3-W-T	1,584	1,758	4	66	65	0	4	9	2	1,654	1,832	4
				Left	3-W-L	331	302	2	11	11	0	1	0	1	343	313	2
4	Waterloo & Herring	North	Herring Rd	U - Turn	4-N-U	1	0	1	0	0	0	0	0	0	1	0	1
				Right	4-N-R	26	13	3	29	1	7	0	0	0	55	14	7
				Through	4-N-T	115	55	7	20	3	5	0	1	1	135	59	8
				Left	4-N-L	69	57	2	49	5	8	0	0	0	118	62	6
		East	Waterloo Rd	U - Turn	4-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	4-E-R	96	99	0	52	16	6	0	0	0	148	115	3
				Through	4-E-T	129	134	0	4	14	3	0	0	0	133	148	1
				Left	4-E-L	194	226	2	11	14	1	0	1	1	205	241	2
		South	Herring Rd	U - Turn	4-S-U	1	0	1	0	0	0	0	0	0	1	0	1
				Right	4-S-R	482	467	1	7	14	2	0	2	2	489	483	0
				Through	4-S-T	514	498	1	22	19	1	1	1	0	537	518	1
				Left	4-S-L	91	77	2	0	0	0	0	0	0	91	77	2
		West	Waterloo Rd	U - Turn	4-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	4-W-R	0	20	6	0	0	0	0	0	0	0	20	6
				Through	4-W-T	196	161	3	3	8	2	0	0	0	199	169	2
				Left	4-W-L	97	123	2	30	12	4	0	0	0	127	135	1
5	Waterloo & Macquarie	North	Macquarie Centre	U - Turn	5-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	5-N-R	18	5	4	0	0	0	0	0	0	18	5	4
				Through	5-N-T	2	0	2	0	0	0	0	0	0	2	0	2
				Left	5-N-L	58	34	4	0	0	0	0	0	0	58	34	4
		East	Waterloo Rd	U - Turn	5-E-U	10	0	4	0	0	0	0	0	0	10	0	4

Intersection ID	Intersection Name	Approach	Road Name	Movement	AIMSUN Movement ID	2022-AM HR2 (8:30 – 9:30)											
						LV			Trucks			Heavy Trucks			Total		
				Right	5-E-R	106	88	2	1	0	1	0	0	0	107	88	2
				Through	5-E-T	378	420	2	64	41	3	0	1	1	442	462	1
				Left	5-E-L	10	28	4	3	3	0	0	0	0	13	31	4
		South	Cottonwood Cres	U - Turn	5-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	5-S-R	0	0	0	0	0	0	0	0	0	0	0	0
				Through	5-S-T	0	0	0	0	0	0	0	0	0	0	0	0
				Left	5-S-L	26	37	2	3	3	0	0	0	0	29	40	2
		West	Waterloo Rd	U - Turn	5-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	5-W-R	0	0	0	0	0	0	0	0	0	0	0	0
				Through	5-W-T	519	566	2	53	22	5	0	2	2	572	590	1
				Left	5-W-L	101	49	6	5	2	2	0	0	0	106	51	6
6	Talavera & Herring	North	Herring Rd	U - Turn	6-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	6-N-R	73	124	5	2	17	5	0	1	1	75	142	6
				Through	6-N-T	1	0	1	0	0	0	0	0	0	1	0	1
				Left	6-N-L	213	263	3	15	15	0	0	0	0	228	278	3
		East	Talavera Rd	U - Turn	6-E-U	1	0	1	0	0	0	0	0	0	1	0	1
				Right	6-E-R	34	26	1	6	12	2	2	0	2	42	38	1
				Through	6-E-T	170	174	0	2	1	1	0	0	0	172	175	0
				Left	6-E-L	79	76	0	1	7	3	0	1	1	80	84	0
		South	Herring Rd	U - Turn	6-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	6-S-R	171	181	1	5	14	3	0	0	0	176	195	1
				Through	6-S-T	84	82	0	22	1	6	1	0	1	107	83	2
				Left	6-S-L	71	68	0	10	3	3	0	1	1	81	72	1
		West	Talavera Rd	U - Turn	6-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	6-W-R	0	0	0	24	0	7	0	0	0	24	0	7
				Through	6-W-T	1,055	1,099	1	10	47	7	0	3	2	1,065	1,149	3
				Left	6-W-L	50	36	2	10	0	4	0	0	0	60	36	3
7	Talavera & Christie	North	Christie Rd	U - Turn	7-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	7-N-R	159	191	2	8	16	2	0	1	1	167	208	3
				Through	7-N-T	0	0	0	0	0	0	0	0	0	0	0	0
				Left	7-N-L	601	593	0	28	37	2	0	2	2	629	632	0
		East	Talavera Rd	U - Turn	7-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	7-E-R	31	43	2	0	2	2	0	0	0	31	45	2
				Through	7-E-T	296	323	2	13	19	2	0	2	2	309	344	2
				Left	7-E-L	0	0	0	0	0	0	0	0	0	0	0	0

Intersection ID	Intersection Name	Approach	Road Name	Movement	AIMSUN Movement ID	2022-AM HR2 (8:30 – 9:30)											
						LV			Trucks			Heavy Trucks			Total		
		South	Technology Pl	U - Turn	7-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	7-S-R	0	0	0	0	0	0	0	0	0	0	0	0
				Through	7-S-T	0	0	0	0	0	0	0	0	0	0	0	0
				Left	7-S-L	0	0	0	0	0	0	0	0	0	0	0	0
		West	Talavera Rd	U - Turn	7-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	7-W-R	0	0	0	0	0	0	0	0	0	0	0	0
				Through	7-W-T	449	536	4	12	7	2	0	1	1	461	544	4
				Left	7-W-L	48	68	3	2	8	3	0	0	0	50	76	3
8	Epping & Lane Cove	North	Lane Cove Rd	U - Turn	8-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	8-N-R	214	124	7	6	4	1	0	0	0	220	128	7
				Through	8-N-T	1,010	1,146	4	57	56	0	19	3	5	1,086	1,205	4
				Left	8-N-L	404	364	2	24	22	0	2	0	2	430	386	2
		East	Epping Rd	U - Turn	8-E-U	46	38	1	1	2	1	0	0	0	47	40	1
				Right	8-E-R	870	793	3	23	41	3	2	1	1	895	835	2
				Through	8-E-T	11	0	5	2	13	4	0	0	0	13	13	0
				Left	8-E-L	107	92	2	26	8	4	0	0	0	133	100	3
		South	Lane Cove Rd	U - Turn	8-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	8-S-R	330	379	3	42	0	9	4	0	3	376	379	0
				Through	8-S-T	1,514	1,346	4	81	118	4	10	9	0	1,605	1,473	3
				Left	8-S-L	30	40	2	3	1	1	0	0	0	33	41	1
		West	Epping Rd	U - Turn	8-W-U	35	39	1	5	5	0	0	0	0	40	44	1
				Right	8-W-R	117	89	3	4	4	0	1	1	0	122	94	3
				Through	8-W-T	68	29	6	7	0	4	0	0	0	75	29	6
				Left	8-W-L	265	326	4	20	11	2	3	0	2	288	337	3
9	Waterloo & Lane Cove	North	Lane Cove Rd	U - Turn	9-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	9-N-R	444	413	1	10	28	4	0	3	2	454	444	0
				Through	9-N-T	1,418	1,351	2	68	57	1	21	3	5	1,507	1,411	3
				Left	9-N-L	228	241	1	17	11	2	0	0	0	245	252	0
		East	Waterloo Rd	U - Turn	9-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	9-E-R	162	164	0	21	15	1	0	1	1	183	180	0
				Through	9-E-T	100	52	6	20	24	1	0	0	0	120	76	4
				Left	9-E-L	35	21	3	4	3	1	0	0	0	39	24	3
		South	Lane Cove Rd	U - Turn	9-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	9-S-R	162	176	1	3	6	1	0	0	0	165	182	1
				Through	9-S-T	1,936	1,788	3	107	100	1	14	7	2	2,057	1,895	4

Intersection ID	Intersection Name	Approach	Road Name	Movement	AIMSUN Movement ID	2022-AM HR2 (8:30 – 9:30)											
						LV			Trucks			Heavy Trucks			Total		
				Left	9-S-L	551	518	1	14	61	8	1	3	1	566	582	1
		West	Waterloo Rd	U - Turn	9-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	9-W-R	183	173	1	15	17	1	0	0	0	198	190	1
				Through	9-W-T	107	54	6	29	4	6	0	0	0	136	58	8
				Left	9-W-L	116	102	1	9	5	2	0	0	0	125	107	2
10	M2 Motorway & Lane Cove	North	Lane Cove Rd	U - Turn	10-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	10-N-R	388	457	3	43	22	4	4	2	1	435	481	2
				Through	10-N-T	2,257	2,180	2	83	82	0	13	9	1	2,353	2,271	2
				Left	10-N-L	284	267	1	10	15	1	1	7	3	295	289	0
		East	M2 Motorway	U - Turn	10-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	10-E-R	0	0	0	0	0	0	0	0	0	0	0	0
				Through	10-E-T	0	0	0	0	0	0	0	0	0	0	0	0
				Left	10-E-L	0	0	0	0	0	0	0	0	0	0	0	0
		South	Lane Cove Rd	U - Turn	10-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	10-S-R	0	0	0	0	0	0	0	0	0	0	0	0
				Through	10-S-T	1,573	1,710	3	113	121	1	7	4	1	1,693	1,835	3
				Left	10-S-L	34	63	4	28	0	7	0	0	0	62	63	0
		West	M2 Motorway	U - Turn	10-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	10-W-R	291	256	2	14	27	3	6	0	3	311	283	2
				Through	10-W-T	0	0	0	0	0	0	0	0	0	0	0	0
				Left	10-W-L	536	557	1	64	74	1	5	0	3	605	631	1
11	Talavera & Lane Cove	North	Lane Cove Rd	U - Turn	11-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	11-N-R	547	463	4	11	19	2	0	3	2	558	485	3
				Through	11-N-T	1,928	1,897	1	86	83	0	19	5	4	2,033	1,985	1
				Left	11-N-L	73	83	1	0	6	3	0	1	1	73	90	2
		East	Talavera Rd	U - Turn	11-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	11-E-R	17	8	3	1	0	1	0	0	0	18	8	3
				Through	11-E-T	11	1	4	0	1	1	0	0	0	11	2	4
				Left	11-E-L	40	40	0	2	4	1	0	0	0	42	44	0
		South	Lane Cove Rd	U - Turn	11-S-U	3	0	2	0	0	0	0	0	0	3	0	2
				Right	11-S-R	163	124	3	3	2	1	0	2	2	166	128	3
				Through	11-S-T	1,426	1,622	5	128	116	1	7	4	1	1,561	1,742	4
				Left	11-S-L	288	244	3	10	5	2	0	1	1	298	250	3
		West	Talavera Rd	U - Turn	11-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	11-W-R	125	77	5	8	5	1	0	1	1	133	83	5

Intersection ID	Intersection Name	Approach	Road Name	Movement	AIMSUN Movement ID	2022-AM											
						HR2 (8:30 – 9:30)											
						LV			Trucks			Heavy Trucks			Total		
				Through	11-W-T	40	65	3	1	0	1	0	0	0	41	65	3
				Left	11-W-L	164	142	2	12	5	2	0	0	0	176	147	2
12	Talavera & Khartoum	North	Khartoum Rd	U - Turn	12-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	12-N-R	51	50	0	2	3	1	0	0	0	53	53	0
				Through	12-N-T	89	104	2	2	9	3	0	0	0	91	113	2
				Left	12-N-L	12	17	1	1	0	1	0	0	0	13	17	1
		East	Talavera Rd	U - Turn	12-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	12-E-R	43	28	3	3	5	1	0	0	0	46	33	2
				Through	12-E-T	351	269	5	7	14	2	0	2	2	358	285	4
				Left	12-E-L	164	96	6	19	9	3	1	1	0	184	106	6
		South	Khartoum Rd	U - Turn	12-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	12-S-R	77	92	2	6	6	0	1	1	0	84	99	2
				Through	12-S-T	75	87	1	5	1	2	0	0	0	80	88	1
				Left	12-S-L	75	107	3	1	12	4	0	1	1	76	120	4
		West	Talavera Rd	U - Turn	12-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	12-W-R	574	525	2	15	39	5	0	0	0	589	564	1
				Through	12-W-T	567	431	6	11	9	1	0	2	2	578	442	6
				Left	12-W-L	203	333	8	2	6	2	0	0	0	205	339	8
13	Talavera & Unnamed	North	Unnamed Rd	U - Turn	13-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	13-N-R	0	0	0	0	0	0	0	0	0	0	0	0
				Through	13-N-T	0	0	0	0	0	0	0	0	0	0	0	0
				Left	13-N-L	12	6	2	0	2	2	0	0	0	12	8	1
		East	Talavera Rd	U - Turn	13-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	13-E-R	0	0	0	0	0	0	0	0	0	0	0	0
				Through	13-E-T	353	311	2	12	23	3	2	1	1	367	335	2
				Left	13-E-L	111	106	0	0	7	4	0	2	2	111	115	0
		South	Banda Rd	U - Turn	13-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	13-S-R	28	18	2	0	0	0	0	0	0	28	18	2
				Through	13-S-T	12	0	5	0	0	0	0	0	0	12	0	5
				Left	13-S-L	24	4	5	0	0	0	0	0	0	24	4	5
		West	Talavera Rd	U - Turn	13-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	13-W-R	56	55	0	1	3	1	0	0	0	57	58	0
				Through	13-W-T	1,177	1,314	4	30	51	3	0	2	2	1,207	1,367	4
				Left	13-W-L	56	70	2	0	10	4	0	1	1	56	81	3
14		North	Alma Rd	U - Turn	14-N-U	0	0	0	0	0	0	0	0	0	0	0	0

Intersection ID	Intersection Name	Approach	Road Name	Movement	AIMSUN Movement ID	2022-AM HR2 (8:30 – 9:30)											
						LV			Trucks			Heavy Trucks			Total		
	Talavera & Alma			Right	14-N-R	0	0	0	0	0	0	0	0	0	0	0	0
				Through	14-N-T	0	0	0	0	0	0	0	0	0	0	0	0
				Left	14-N-L	15	30	3	1	1	0	0	0	0	16	31	3
		East	Talavera Rd	U - Turn	14-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	14-E-R	0	0	0	0	0	0	0	0	0	0	0	0
				Through	14-E-T	263	229	2	12	19	2	2	1	1	277	249	2
				Left	14-E-L	92	70	2	0	1	1	0	0	0	92	71	2
		South	Macquarie Centre	U - Turn	14-S-U	2	0	2	0	0	0	0	0	0	2	0	2
				Right	14-S-R	58	56	0	0	0	0	0	0	0	58	56	0
				Through	14-S-T	0	0	0	0	0	0	0	0	0	0	0	0
				Left	14-S-L	35	49	2	2	1	1	0	0	0	37	50	2
		West	Talavera Rd	U - Turn	14-W-U	10	0	4	0	0	0	0	0	0	10	0	4
				Right	14-W-R	156	136	2	0	3	2	0	0	0	156	139	1
				Through	14-W-T	1,216	1,355	4	30	64	5	0	3	2	1,246	1,422	5
				Left	14-W-L	64	57	1	1	9	4	0	0	0	65	66	0
15	Fontenoy & Lane Cove	North	Lane Cove Rd	U - Turn	15-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	15-N-R	0	0	0	0	0	0	0	0	0	0	0	0
				Through	15-N-T	2,828	2,776	1	131	115	1	18	18	0	2,977	2,909	1
				Left	15-N-L	13	0	5	0	0	0	0	0	0	13	0	5
		East	Fontenoy Rd	U - Turn	15-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	15-E-R	0	0	0	0	0	0	0	0	0	0	0	0
				Through	15-E-T	10	0	4	0	0	0	0	0	0	10	0	4
				Left	15-E-L	5	4	0	0	0	0	0	0	0	5	4	0
		South	Lane Cove Rd	U - Turn	15-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	15-S-R	12	10	1	1	0	1	0	0	0	13	10	1
				Through	15-S-T	2,034	2,238	4	169	195	2	12	5	2	2,215	2,438	5
				Left	15-S-L	63	24	6	7	1	3	0	0	0	70	25	7
		West	Fontenoy Rd	U - Turn	15-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	15-W-R	96	123	3	5	4	0	0	0	0	101	127	2
				Through	15-W-T	3	0	2	0	1	1	0	0	0	3	1	1
				Left	15-W-L	234	275	3	2	6	2	0	0	0	236	281	3
16	Epping & Wicks	North	Wicks Rd	U - Turn	16-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	16-N-R	46	33	2	3	3	0	1	0	1	50	36	2
				Through	16-N-T	66	49	2	13	3	4	0	0	0	79	52	3
				Left	16-N-L	137	203	5	11	0	5	1	0	1	149	203	4

Intersection ID	Intersection Name	Approach	Road Name	Movement	AIMSUN Movement ID	2022-AM HR2 (8:30 – 9:30)											
						LV			Trucks			Heavy Trucks			Total		
		East	Epping Rd	U - Turn	16-E-U	3	0	2	0	0	0	0	0	0	3	0	2
				Right	16-E-R	379	347	2	18	29	2	0	2	2	397	378	1
				Through	16-E-T	1,835	1,717	3	82	80	0	3	6	1	1,920	1,803	3
				Left	16-E-L	714	670	2	45	14	6	2	0	2	761	684	3
		South	Wicks Rd	U - Turn	16-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	16-S-R	620	575	2	32	44	2	0	0	0	652	619	1
				Through	16-S-T	117	113	0	3	15	4	0	0	0	120	128	1
				Left	16-S-L	107	198	7	1	5	2	0	0	0	108	203	8
		West	Epping Rd	U - Turn	16-W-U	1	0	1	0	0	0	0	0	0	1	0	1
				Right	16-W-R	105	175	6	7	6	0	0	0	0	112	181	6
				Through	16-W-T	1,678	1,781	2	109	78	3	6	6	0	1,793	1,865	2
				Left	16-W-L	84	82	0	9	2	3	0	0	0	93	84	1
17	Halifax & Wicks	North	Wicks Rd	U - Turn	17-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	17-N-R	15	4	4	9	0	4	0	0	0	24	4	5
				Through	17-N-T	12	31	4	13	0	5	2	0	2	27	31	1
				Left	17-N-L	0	0	0	0	0	0	0	0	0	0	0	0
		East	Halifax St	U - Turn	17-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	17-E-R	0	0	0	0	0	0	0	0	0	0	0	0
				Through	17-E-T	40	19	4	4	2	1	0	0	0	44	21	4
				Left	17-E-L	81	80	0	6	1	3	0	0	0	87	81	1
		South	Wicks Rd	U - Turn	17-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	17-S-R	18	21	1	4	2	1	0	0	0	22	23	0
				Through	17-S-T	26	20	1	14	0	5	0	0	0	40	20	4
				Left	17-S-L	458	437	1	13	39	5	0	2	2	471	478	0
		West	Waterloo Rd	U - Turn	17-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	17-W-R	173	150	2	11	4	3	0	0	0	184	154	2
				Through	17-W-T	18	24	1	5	1	2	0	0	0	23	25	0
				Left	17-W-L	7	10	1	8	0	4	1	0	1	16	10	2
18	Epping & Delhi	North	Delhi Rd	U - Turn	18-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	18-N-R	730	684	2	44	35	1	2	2	0	776	721	2
				Left	18-N-L	434	519	4	32	37	1	0	0	0	466	556	4
		East	Epping Rd	U - Turn	18-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	18-E-R	585	569	1	25	29	1	2	3	1	612	601	0
				Through	18-E-T	2,072	2,038	1	101	85	2	3	7	2	2,176	2,130	1
		West	Epping Rd	U - Turn	18-W-U	0	0	0	0	0	0	0	0	0	0	0	0

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						LV			Trucks			Heavy Trucks			Total		
				Through	18-W-T	1,656	1,762	3	110	76	4	7	7	0	1,773	1,845	2
				Left	18-W-L	834	826	0	46	45	0	1	0	1	881	871	0
19	Epping & Pittwater	East	Epping Rd	U - Turn	19-E-U	2	0	2	0	0	0	0	0	0	2	0	2
				Through	19-E-T	2,089	2,149	1	111	78	3	5	11	2	2,205	2,238	1
				Left	19-E-L	218	206	1	44	15	5	0	1	1	262	222	3
		South	Pittwater Rd	U - Turn	19-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	19-S-R	901	914	0	32	36	1	0	1	1	933	951	1
				Left	19-S-L	568	442	6	15	36	4	0	1	1	583	479	5
		West	Epping Rd	U - Turn	19-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	19-W-R	385	407	1	18	19	0	2	0	2	405	426	1
				Through	19-W-T	1,705	1,888	4	124	93	3	5	7	1	1,834	1,988	4
20	Epping & M2 Motorway	North	M2 Motorway	U - Turn	20-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	20-N-R	343	339	0	29	20	2	0	0	0	372	359	1
				Left	20-N-L	357	326	2	32	17	3	0	0	0	389	343	2
		East	Epping Rd	U - Turn	20-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	20-E-R	182	174	1	14	9	1	0	0	0	196	183	1
				Through	20-E-T	821	885	2	47	53	1	2	3	1	870	941	2
		West	Epping Rd	U - Turn	20-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Through	20-W-T	1,140	1,107	1	43	52	1	3	1	1	1,186	1,160	1
				Left	20-W-L	279	286	0	28	21	1	0	2	2	307	309	0
21	Delhi & Rennie	East	Delhi Rd	U - Turn	21-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Through	21-E-T	893	957	2	59	57	0	2	3	1	954	1,017	2
				Left	21-E-L	13	21	2	1	2	1	0	0	0	14	23	2
		South	Rennie St	U - Turn	21-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	21-S-R	12	33	4	0	1	1	0	0	0	12	34	5
				Left	21-S-L	110	103	1	2	5	2	0	0	0	112	108	0
		West	Delhi Rd	U - Turn	21-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	21-W-R	238	213	2	1	13	5	0	0	0	239	226	1
				Through	21-W-T	1,259	1,174	2	74	53	3	3	0	2	1,336	1,227	3
22	Delhi & Plassey Entry	North	Plassey Entry Rd	U - Turn	22-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	22-N-R	22	6	4	3	1	1	0	0	0	25	7	5
				Through	22-N-T	14	0	5	0	0	0	0	0	0	14	0	5
				Left	22-N-L	9	4	2	2	0	2	0	0	0	11	4	3
		East	Delhi Rd	U - Turn	22-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	22-E-R	14	5	3	0	0	0	0	0	0	14	5	3

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23	Delhi & Carpark			Through	22-E-T	818	886	2	54	43	2	2	3	1	874	932	2
				Left	22-E-L	83	36	6	0	4	3	0	0	0	83	40	5
		South	Julius Ave	U - Turn	22-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	22-S-R	57	94	4	0	0	0	0	0	0	57	94	4
				Through	22-S-T	4	0	3	0	0	0	0	0	0	4	0	3
				Left	22-S-L	66	81	2	3	15	4	0	0	0	69	96	3
		West	Delhi Rd	U - Turn	22-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	22-W-R	109	130	2	4	10	2	0	0	0	113	140	2
				Through	22-W-T	1,112	1,036	2	65	44	3	3	0	2	1,180	1,080	3
				Left	22-W-L	50	42	1	5	1	2	0	0	0	55	43	2
		North	Carpark	U - Turn	23-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	23-N-R	10	2	3	1	1	0	0	0	0	11	3	3
				Through	23-N-T	1	1	0	0	0	0	0	0	0	1	1	0
				Left	23-N-L	3	0	2	0	0	0	0	0	0	3	0	2
		East	Delhi Rd	U - Turn	23-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	23-E-R	10	0	4	0	0	0	0	0	0	10	0	4
				Through	23-E-T	874	890	1	53	43	1	2	3	1	929	936	0
				Left	23-E-L	118	98	2	0	4	3	0	0	0	118	102	2
		South	Julius Ave	U - Turn	23-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	23-S-R	22	11	3	1	0	1	0	0	0	23	11	3
				Through	23-S-T	3	0	2	0	0	0	0	0	0	3	0	2
				Left	23-S-L	31	35	1	0	3	2	0	0	0	31	38	1
		West	Delhi Rd	U - Turn	23-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	23-W-R	182	159	2	1	8	3	0	0	0	183	167	1
				Through	23-W-T	884	979	3	59	35	4	1	0	1	944	1,014	2
				Left	23-W-L	0	2	2	1	1	0	0	0	0	1	3	1
24	Macquarie Walk & Uni	North	University Ave	U - Turn	24-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	24-N-R	0	0	0	0	0	0	0	0	0	0	0	0
				Through	24-N-T	7	3	2	1	0	1	0	0	0	8	3	2
				Left	24-N-L	3	2	1	0	1	1	0	0	0	3	3	0
		East	Macquarie Walk	U - Turn	24-E-U	1	0	1	5	0	3	0	0	0	6	0	3
				Right	24-E-R	16	0	6	1	0	1	0	0	0	17	0	6
				Through	24-E-T	0	0	0	0	0	0	0	0	0	0	0	0
				Left	24-E-L	107	133	2	27	2	7	1	0	1	135	135	0
		South	University Ave	U - Turn	24-S-U	0	0	0	0	0	0	0	0	0	0	0	0

Intersection ID	Intersection Name	Approach	Road Name	Movement	AIMSUN Movement ID	2022-AM HR2 (8:30 – 9:30)											
						LV			Trucks			Heavy Trucks			Total		
				Right	24-S-R	0	0	0	0	0	0	0	0	0	0	0	0
				Through	24-S-T	0	0	0	0	0	0	0	0	0	0	0	0
				Left	24-S-L	0	0	0	0	0	0	0	0	0	0	0	0
		West	Balaclava Rd	U - Turn	24-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	24-W-R	82	72	1	1	9	4	0	0	0	83	81	0
				Through	24-W-T	500	590	4	31	23	2	0	0	0	531	613	3
				Left	24-W-L	15	24	2	2	4	1	0	0	0	17	28	2
26	Waterloo & Carpark	North	Carpark	U - Turn	26-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	26-N-R	7	3	2	0	0	0	0	0	0	7	3	2
				Through	26-N-T	1	0	1	0	0	0	0	0	0	1	0	1
				Left	26-N-L	3	2	1	0	0	0	0	0	0	3	2	1
		East	Waterloo Rd	U - Turn	26-E-U	8	11	1	0	2	2	0	0	0	8	13	2
				Right	26-E-R	8	8	0	0	1	1	0	0	0	8	9	0
				Through	26-E-T	356	382	1	53	42	2	0	1	1	409	425	1
				Left	26-E-L	395	366	1	10	21	3	0	1	1	405	388	1
		South	Byfield St	U - Turn	26-S-U	3	0	2	0	0	0	0	0	0	3	0	2
				Right	26-S-R	72	24	7	4	2	1	0	0	0	76	26	7
				Through	26-S-T	3	0	2	0	0	0	0	0	0	3	0	2
				Left	26-S-L	62	62	0	12	3	3	0	0	0	74	65	1
		West	Waterloo Rd	U - Turn	26-W-U	79	29	7	3	1	1	0	0	0	82	30	7
				Right	26-W-R	178	151	2	2	6	2	0	1	1	180	158	2
				Through	26-W-T	359	422	3	51	13	7	0	1	1	410	436	1
				Left	26-W-L	18	8	3	0	0	0	0	0	0	18	8	3
27	Epping & Lyonpark	North	Lyonpark Rd	U - Turn	27-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	27-N-R	0	0	0	0	0	0	0	0	0	0	0	0
				Left	27-N-L	179	154	2	18	14	1	1	0	1	198	168	2
		East	Epping Rd	U - Turn	27-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	27-E-R	0	0	0	0	0	0	0	0	0	0	0	0
				Through	27-E-T	1,394	1,325	2	54	44	1	1	3	1	1,449	1,372	2
		West	Epping Rd	U - Turn	27-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Through	27-W-T	1,561	1,679	3	77	68	1	4	7	1	1,642	1,754	3
				Left	27-W-L	478	438	2	12	18	2	0	2	2	490	458	1
28	Harring & Macquarie	North	Harring Rd	U - Turn	28-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Through	28-N-T	79	75	0	25	7	5	0	1	1	104	83	2
				Left	28-N-L	0	0	0	0	0	0	0	0	0	0	0	0

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		East	Macquarie Centre	U - Turn	28-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	28-E-R	0	0	0	0	0	0	0	0	0	0	0	0
				Left	28-E-L	27	13	3	0	0	0	0	0	0	27	13	3
		South	Harring Rd	U - Turn	28-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	28-S-R	382	381	0	67	29	5	0	0	0	449	410	2
				Through	28-S-T	326	331	0	37	17	4	1	1	0	364	349	1
29	Waterloo & Macquarie	North	Macquarie Centre	U - Turn	29-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	29-N-R	0	0	0	1	0	1	0	0	0	1	0	1
				Left	29-N-L	1	0	1	2	0	2	0	0	0	3	0	2
		East	Waterloo Rd	U - Turn	29-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	29-E-R	3	0	2	1	0	1	0	0	0	4	0	3
				Through	29-E-T	419	461	2	66	44	3	0	1	1	485	506	1
		West	Waterloo Rd	U - Turn	29-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Through	29-W-T	619	616	0	56	23	5	0	2	2	675	641	1
				Left	29-W-L	128	69	6	3	4	1	0	0	0	131	73	6
30	Waterloo & Khartoum	North	Khartoum Rd	U - Turn	30-N-U	0	6	3	0	1	1	0	0	0	0	7	4
				Right	30-N-R	392	370	1	31	34	1	0	1	1	423	405	1
				Through	30-N-T	8	5	1	0	0	0	0	0	0	8	5	1
				Left	30-N-L	195	258	4	9	21	3	0	0	0	204	279	5
		East	Waterloo Rd	U - Turn	30-E-U	120	136	1	3	9	2	0	0	0	123	145	2
				Right	30-E-R	191	252	4	5	24	5	0	1	1	196	277	5
				Through	30-E-T	371	401	2	32	32	0	0	1	1	403	434	2
				Left	30-E-L	32	19	3	0	3	2	0	0	0	32	22	2
		South	Carpark	U - Turn	30-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	30-S-R	0	0	0	0	0	0	0	0	0	0	0	0
				Through	30-S-T	0	0	0	0	0	0	0	0	0	0	0	0
				Left	30-S-L	0	0	0	0	0	0	0	0	0	0	0	0
		West	Waterloo Rd	U - Turn	30-W-U	4	8	2	0	0	0	0	0	0	4	8	2
				Right	30-W-R	10	6	1	0	0	0	0	0	0	10	6	1
				Through	30-W-T	290	216	5	40	10	6	0	0	0	330	226	6
				Left	30-W-L	147	196	4	16	5	3	0	1	1	163	202	3
31	Optus & Lyonpark	North	Lyonpark Rd	U - Turn	31-N-U	7	0	4	0	0	0	0	0	0	7	0	4
				Right	31-N-R	49	20	5	0	2	2	0	1	1	49	23	4
				Through	31-N-T	153	137	1	17	13	1	1	0	1	171	150	2
				Left	31-N-L	208	100	9	9	13	1	0	2	2	217	115	8

Intersection ID	Intersection Name	Approach	Road Name	Movement	AIMSUN Movement ID	2022-AM											
						HR2 (8:30 – 9:30)											
						LV			Trucks			Heavy Trucks			Total		
		East	Optus Dr	U - Turn	31-E-U	0	0	0	1	0	1	0	0	0	1	0	1
				Right	31-E-R	2	3	1	0	0	0	0	0	0	2	3	1
				Through	31-E-T	1	0	1	0	0	0	0	0	0	1	0	1
				Left	31-E-L	6	6	0	1	1	0	0	0	0	7	7	0
		South	Lyonpark Rd	U - Turn	31-S-U	5	0	3	0	0	0	0	0	0	5	0	3
				Right	31-S-R	129	114	1	6	3	1	0	2	2	135	119	1
				Through	31-S-T	308	313	0	6	10	1	0	0	0	314	323	1
				Left	31-S-L	36	14	4	0	5	3	0	0	0	36	19	3
		West	Carpark	U - Turn	31-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	31-W-R	15	11	1	0	0	0	0	0	0	15	11	1
				Through	31-W-T	3	0	2	0	0	0	0	0	0	3	0	2
				Left	31-W-L	5	0	3	0	2	2	0	0	0	5	2	2
32	Research Park & Talavera	West	Talavera Rd	U - Turn	32-W-U	0	10	4	0	0	0	0	0	0	0	10	4
				Right	32-W-R	83	66	2	0	13	5	0	0	0	83	79	0
				Through	32-W-T	428	505	4	13	13	0	0	1	1	441	519	4
		East	Talavera Rd	U - Turn	32-E-U	22	36	3	0	1	1	0	0	0	22	37	3
				Through	32-E-T	264	309	3	17	15	1	0	3	2	281	327	3
				Left	32-E-L	169	170	0	4	19	4	0	0	0	173	189	1
		South	Research Park Dr	U - Turn	32-S-U	1	0	1	0	0	0	0	0	0	1	0	1
				Right	32-S-R	47	62	2	1	1	0	0	0	0	48	63	2
				Left	32-S-L	28	19	2	4	2	1	0	0	0	32	21	2
33	Talavera & Culloden	North	Culloden Rd	U - Turn	33-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	33-N-R	0	0	0	0	0	0	0	0	0	0	0	0
				Through	33-N-T	3	12	3	4	0	3	0	0	0	7	12	2
				Left	33-N-L	6	7	0	0	0	0	0	0	0	6	7	0
		East	Talavera Rd	U - Turn	33-E-U	11	1	4	0	0	0	0	0	0	11	1	4
				Right	33-E-R	28	27	0	2	1	1	0	0	0	30	28	0
				Through	33-E-T	23	36	2	0	0	0	0	0	0	23	36	2
				Left	33-E-L	230	254	2	19	16	1	0	3	2	249	273	1
		South	Culloden Rd	U - Turn	33-S-U	11	0	5	0	0	0	0	0	0	11	0	5
				Right	33-S-R	457	551	4	12	17	1	0	1	1	469	569	4
				Through	33-S-T	14	42	5	1	0	1	0	0	0	15	42	5
				Left	33-S-L	36	78	6	5	2	2	0	0	0	41	80	5
		West	Talavera Rd	U - Turn	33-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	33-W-R	76	95	2	6	10	1	0	0	0	82	105	2

Intersection ID	Intersection Name	Approach	Road Name	Movement	AIMSUN Movement ID	2022-AM											
						HR2 (8:30 – 9:30)											
						LV			Trucks			Heavy Trucks			Total		
				Through	33-W-T	37	68	4	1	9	4	0	0	0	38	77	5
				Left	33-W-L	1	0	1	0	0	0	0	0	0	1	0	1
34	Talavera & Macquarie	East	Talavera Rd	U - Turn	34-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Through	34-E-T	346	298	3	12	20	2	2	1	1	360	319	2
				Left	34-E-L	31	16	3	0	2	2	0	0	0	31	18	3
		South	Macquarie Centre	U - Turn	34-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	34-S-R	0	0	0	0	0	0	0	0	0	0	0	0
				Left	34-S-L	9	1	4	0	0	0	0	0	0	9	1	4
		West	Talavera Rd	U - Turn	34-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	34-W-R	0	0	0	0	0	0	0	0	0	0	0	0
				Through	34-W-T	1,289	1,439	4	31	66	5	0	3	2	1,320	1,508	5
35	Waterloo & Eden Park	North	Eden Park Dr	U - Turn	35-N-U	2	0	2	0	0	0	0	0	0	2	0	2
				Right	35-N-R	29	6	5	6	1	3	0	0	0	35	7	6
				Through	35-N-T	2	0	2	0	0	0	0	0	0	2	0	2
				Left	35-N-L	15	32	4	1	0	1	0	0	0	16	32	3
		East	Waterloo Rd	U - Turn	35-E-U	4	5	0	0	0	0	0	0	0	4	5	0
				Right	35-E-R	78	37	5	2	1	1	0	0	0	80	38	5
				Through	35-E-T	238	350	7	24	33	2	0	0	0	262	383	7
				Left	35-E-L	85	49	4	3	7	2	0	2	2	88	58	4
		South	Thomas Holt Dr	U - Turn	35-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	35-S-R	6	20	4	0	0	0	0	0	0	6	20	4
				Through	35-S-T	1	0	1	1	0	1	0	0	0	2	0	2
				Left	35-S-L	7	6	0	0	0	0	0	0	0	7	6	0
		West	Waterloo Rd	U - Turn	35-W-U	11	20	2	18	6	3	0	0	0	29	26	1
				Right	35-W-R	93	125	3	0	6	3	0	0	0	93	131	4
				Through	35-W-T	179	196	1	27	5	6	1	0	1	207	201	0
				Left	35-W-L	135	133	0	4	3	1	0	0	0	139	136	0
36	Gymnasium & Culloden	North	Culloden Rd	U - Turn	36-N-U	4	0	3	0	0	0	0	0	0	4	0	3
				Right	36-N-R	143	127	1	15	11	1	0	0	0	158	138	2
				Through	36-N-T	169	190	2	8	7	0	0	1	1	177	198	2
				Left	36-N-L	36	47	2	4	8	2	0	2	2	40	57	2
		East	Gymnasium Rd	U - Turn	36-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	36-E-R	17	8	3	1	0	1	0	0	0	18	8	3
				Through	36-E-T	26	7	5	0	0	0	0	0	0	26	7	5
				Left	36-E-L	13	0	5	3	0	2	0	0	0	16	0	6

Intersection ID	Intersection Name	Approach	Road Name	Movement	AIMSUN Movement ID	2022-AM											
						HR2 (8:30 – 9:30)											
						LV			Trucks			Heavy Trucks			Total		
		South	Culloden Rd	U - Turn	36-S-U	1	4	2	0	0	0	1	0	1	2	4	1
				Right	36-S-R	14	7	2	2	0	2	0	0	0	16	7	3
				Through	36-S-T	101	181	7	5	2	2	0	1	1	106	184	6
				Left	36-S-L	23	25	0	0	3	2	0	0	0	23	28	1
		West	Waterloo Rd	U - Turn	36-W-U	1	0	1	0	0	0	0	0	0	1	0	1
				Right	36-W-R	55	92	4	0	18	6	0	0	0	55	110	6
				Through	36-W-T	41	67	4	0	5	3	0	0	0	41	72	4
				Left	36-W-L	396	481	4	12	17	1	0	0	0	408	498	4
37	Herring Road & Ivanhoe Road	North	Herring Road	U - Turn	37-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	37-N-R	28	1	7	2	0	2	0	0	0	30	1	7
				Through	37-N-T	375	353	1	20	24	1	2	2	0	397	379	1
				Left	37-N-L	9	13	1	2	1	1	0	0	0	11	14	1
		East	Ivanhoe Road	U - Turn	37-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	37-E-R	3	4	1	1	0	1	0	0	0	4	4	0
				Through	37-E-T	1	0	1	0	0	0	0	0	0	1	0	1
				Left	37-E-L	44	14	6	7	0	4	0	0	0	51	14	6
		South	Herring Road	U - Turn	37-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	37-S-R	60	61	0	5	0	3	0	0	0	65	61	1
				Through	37-S-T	1,201	1,105	3	21	33	2	0	3	2	1,222	1,141	2
				Left	37-S-L	8	3	2	1	0	1	0	0	0	9	3	2
		West	Morling College Road	U - Turn	37-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	37-W-R	53	5	9	9	3	2	0	0	0	62	8	9
				Through	37-W-T	5	0	3	0	0	0	0	0	0	5	0	3
				Left	37-W-L	20	23	1	3	0	2	0	0	0	23	23	0

Intersection ID	Intersection Name	Approach	Road Name	Movement	AIMSUN Movement ID	2022-PM HR1 (16:15 – 17:15)											
						LV			Trucks			Heavy Trucks			Total		
						Observed	Modelled	GEH	Observed	Modelled	GEH	Observed	Modelled	GEH	Observed	Modelled	GEH
1	Epping & Culloden	North	Culloden Rd	U - Turn	1-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	1-N-R	0	0	0	0	0	0	0	0	0	0	0	0
				Through	1-N-T	1	0	1	0	0	0	0	0	0	1	0	1
				Left	1-N-L	194	195	0	4	7	1	0	0	0	198	202	0
		East	Epping Rd	U - Turn	1-E-U	1	0	1	0	0	0	0	0	0	1	0	1
				Right	1-E-R	182	136	4	4	6	1	0	0	0	186	142	3
				Through	1-E-T	1,150	1,145	0	49	37	2	0	0	0	1,199	1,182	0
				Left	1-E-L	30	35	1	1	0	1	0	0	0	31	35	1
		South	Culloden Rd	U - Turn	1-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	1-S-R	0	0	0	0	0	0	0	0	0	0	0	0
				Through	1-S-T	0	0	0	0	0	0	0	0	0	0	0	0
				Left	1-S-L	13	0	5	1	0	1	0	0	0	14	0	5
		West	Epping Rd	U - Turn	1-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	1-W-R	5	0	3	0	0	0	0	0	0	5	0	3
				Through	1-W-T	803	891	3	32	30	0	0	2	2	835	923	3
				Left	1-W-L	65	118	6	0	0	0	0	0	0	65	118	6
2	Epping & Balaclava	North	Balaclava Rd	U - Turn	2-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	2-N-R	120	77	4	17	5	4	0	0	0	137	82	5
				Through	2-N-T	226	150	6	6	4	1	0	0	0	232	154	6
				Left	2-N-L	147	200	4	3	1	1	0	0	0	150	201	4
		East	Epping Rd	U - Turn	2-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	2-E-R	39	54	2	1	1	0	0	0	0	40	55	2
				Through	2-E-T	1,160	1,198	1	36	37	0	0	0	0	1,196	1,235	1
				Left	2-E-L	666	764	4	20	14	1	0	0	0	686	778	3
		South	Balaclava Rd	U - Turn	2-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	2-S-R	291	340	3	6	4	1	0	0	0	297	344	3
				Through	2-S-T	79	59	2	8	2	3	0	0	0	87	61	3
				Left	2-S-L	83	64	2	1	1	0	0	0	0	84	65	2
		West	Epping Rd	U - Turn	2-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	2-W-R	109	116	1	1	0	1	0	0	0	110	116	1
				Through	2-W-T	831	868	1	20	29	2	0	2	2	851	899	2
				Left	2-W-L	58	73	2	15	8	2	0	0	0	73	81	1
3	Epping & Herring	North	Herring Rd	U - Turn	3-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	3-N-R	443	453	0	6	3	1	0	0	0	449	456	0

Intersection ID	Intersection Name	Approach	Road Name	Movement	AIMSUN Movement ID	2022-PM HR1 (16:15 – 17:15)											
						LV			Trucks			Heavy Trucks			Total		
				Through	3-N-T	470	553	4	25	22	1	0	0	0	495	575	3
				Left	3-N-L	212	290	5	13	10	1	0	0	0	225	300	5
		East	Epping Rd	U - Turn	3-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	3-E-R	274	275	0	5	1	2	0	0	0	279	276	0
				Through	3-E-T	1,490	1,511	1	53	46	1	0	0	0	1,543	1,557	0
				Left	3-E-L	297	337	2	3	10	3	0	0	0	300	347	3
		South	Herring Rd	U - Turn	3-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	3-S-R	126	169	4	2	8	3	0	0	0	128	177	4
				Through	3-S-T	245	293	3	12	18	2	0	0	0	257	311	3
				Left	3-S-L	57	36	3	0	3	2	0	0	0	57	39	3
		West	Epping Rd	U - Turn	3-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	3-W-R	104	131	2	1	0	1	0	0	0	105	131	2
				Through	3-W-T	891	989	3	19	31	2	1	2	1	911	1,022	4
				Left	3-W-L	271	237	2	7	3	2	0	0	0	278	240	2
4	Waterloo & Herring	North	Herring Rd	U - Turn	4-N-U	3	0	2	0	0	0	0	0	0	3	0	2
				Right	4-N-R	60	31	4	33	1	8	0	0	0	93	32	8
				Through	4-N-T	425	363	3	24	20	1	0	0	0	449	383	3
				Left	4-N-L	118	112	1	41	15	5	1	0	1	160	127	3
		East	Waterloo Rd	U - Turn	4-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	4-E-R	227	206	1	40	22	3	0	0	0	267	228	2
				Through	4-E-T	174	151	2	2	11	4	0	0	0	176	162	1
				Left	4-E-L	574	627	2	2	3	1	0	0	0	576	630	2
		South	Herring Rd	U - Turn	4-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	4-S-R	305	238	4	1	11	4	0	0	0	306	249	3
				Through	4-S-T	411	438	1	19	11	2	0	0	0	430	449	1
				Left	4-S-L	38	63	4	1	3	1	0	0	0	39	66	4
		West	Waterloo Rd	U - Turn	4-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	4-W-R	0	41	9	0	1	1	0	0	0	0	42	9
				Through	4-W-T	118	147	3	1	4	2	0	0	0	119	151	3
				Left	4-W-L	132	129	0	39	6	7	0	0	0	171	135	3
5	Waterloo & Macquarie	North	Macquarie Centre	U - Turn	5-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	5-N-R	130	120	1	0	0	0	0	0	0	130	120	1
				Through	5-N-T	1	1	0	0	0	0	0	0	0	1	1	0
				Left	5-N-L	158	151	1	0	0	0	0	0	0	158	151	1
		East	Waterloo Rd	U - Turn	5-E-U	4	0	3	0	0	0	0	0	0	4	0	3

Intersection ID	Intersection Name	Approach	Road Name	Movement	AIMSUN Movement ID	2022-PM HR1 (16:15 – 17:15)											
						LV			Trucks			Heavy Trucks			Total		
				Right	5-E-R	204	185	1	0	1	1	0	0	0	204	186	1
				Through	5-E-T	836	823	0	44	35	1	0	0	0	880	858	1
				Left	5-E-L	16	44	5	0	3	2	0	0	0	16	47	6
		South	Cottonwood Cres	U - Turn	5-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	5-S-R	0	0	0	0	0	0	0	0	0	0	0	0
				Through	5-S-T	0	0	0	0	0	0	0	0	0	0	0	0
				Left	5-S-L	16	42	5	0	0	0	0	0	0	16	42	5
		West	Waterloo Rd	U - Turn	5-W-U	1	0	1	0	0	0	0	0	0	1	0	1
				Right	5-W-R	0	0	0	0	0	0	0	0	0	0	0	0
				Through	5-W-T	308	300	0	42	22	4	1	0	1	351	322	2
				Left	5-W-L	103	60	5	1	0	1	0	0	0	104	60	5
6	Talavera & Herring	North	Herring Rd	U - Turn	6-N-U	1	0	1	0	0	0	0	0	0	1	0	1
				Right	6-N-R	70	83	1	2	3	1	0	0	0	72	86	2
				Through	6-N-T	0	0	0	0	0	0	0	0	0	0	0	0
				Left	6-N-L	85	93	1	2	2	0	0	0	0	87	95	1
		East	Talavera Rd	U - Turn	6-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	6-E-R	237	243	0	6	18	3	0	0	0	243	261	1
				Through	6-E-T	361	394	2	3	2	1	0	0	0	364	396	2
				Left	6-E-L	190	214	2	2	5	2	0	0	0	192	219	2
		South	Herring Rd	U - Turn	6-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	6-S-R	122	124	0	1	2	1	0	0	0	123	126	0
				Through	6-S-T	240	227	1	19	15	1	0	0	0	259	242	1
				Left	6-S-L	102	89	1	6	2	2	0	0	0	108	91	2
		West	Talavera Rd	U - Turn	6-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	6-W-R	0	0	0	13	0	5	0	0	0	13	0	5
				Through	6-W-T	343	312	2	5	4	0	0	0	0	348	316	2
				Left	6-W-L	68	73	1	2	2	0	0	0	0	70	75	1
7	Talavera & Christie	North	Christie Rd	U - Turn	7-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	7-N-R	96	122	2	1	1	0	0	0	0	97	123	2
				Through	7-N-T	0	0	0	0	0	0	0	0	0	0	0	0
				Left	7-N-L	104	86	2	14	2	4	0	0	0	118	88	3
		East	Talavera Rd	U - Turn	7-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	7-E-R	84	98	1	2	1	1	0	0	0	86	99	1
				Through	7-E-T	481	473	0	9	6	1	0	0	0	490	479	0
				Left	7-E-L	0	0	0	0	0	0	0	0	0	0	0	0

Intersection ID	Intersection Name	Approach	Road Name	Movement	AIMSUN Movement ID	2022-PM HR1 (16:15 – 17:15)											
						LV			Trucks			Heavy Trucks			Total		
		South	Technology Pl	U - Turn	7-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	7-S-R	0	0	0	0	0	0	0	0	0	0	0	0
				Through	7-S-T	0	0	0	0	0	0	0	0	0	0	0	0
				Left	7-S-L	0	0	0	0	0	0	0	0	0	0	0	0
		West	Talavera Rd	U - Turn	7-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	7-W-R	0	0	0	0	0	0	0	0	0	0	0	0
				Through	7-W-T	284	312	2	7	3	2	0	0	0	291	315	1
				Left	7-W-L	75	83	1	0	9	4	0	0	0	75	92	2
8	Epping & Lane Cove	North	Lane Cove Rd	U - Turn	8-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	8-N-R	291	309	1	13	6	2	0	0	0	304	315	1
				Through	8-N-T	1,514	1,625	3	57	46	2	6	2	2	1,577	1,673	2
				Left	8-N-L	461	456	0	11	18	2	0	1	1	472	475	0
		East	Epping Rd	U - Turn	8-E-U	11	37	5	0	1	1	0	0	0	11	38	5
				Right	8-E-R	674	624	2	15	7	2	0	1	1	689	632	2
				Through	8-E-T	9	52	8	2	5	2	0	0	0	11	57	8
				Left	8-E-L	229	263	2	7	2	2	3	0	2	239	265	2
		South	Lane Cove Rd	U - Turn	8-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	8-S-R	288	291	0	10	0	4	2	0	2	300	291	1
				Through	8-S-T	1,233	1,201	1	23	26	1	6	2	2	1,262	1,229	1
				Left	8-S-L	59	52	1	3	0	2	0	0	0	62	52	1
		West	Epping Rd	U - Turn	8-W-U	123	158	3	5	7	1	0	0	0	128	165	3
				Right	8-W-R	314	292	1	0	10	4	0	0	0	314	302	1
				Through	8-W-T	39	6	7	3	0	2	0	0	0	42	6	7
				Left	8-W-L	269	372	6	1	15	5	0	2	2	270	389	7
9	Waterloo & Lane Cove	North	Lane Cove Rd	U - Turn	9-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	9-N-R	130	163	3	6	7	0	0	0	0	136	170	3
				Through	9-N-T	1,665	1,849	4	71	42	4	5	2	2	1,741	1,893	4
				Left	9-N-L	121	114	1	15	4	4	1	0	1	137	118	2
		East	Waterloo Rd	U - Turn	9-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	9-E-R	218	210	1	4	7	1	1	1	0	223	218	0
				Through	9-E-T	85	110	3	29	8	5	0	0	0	114	118	0
				Left	9-E-L	99	33	8	0	7	4	0	1	1	99	41	7
		South	Lane Cove Rd	U - Turn	9-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	9-S-R	27	26	0	1	0	1	0	0	0	28	26	0
				Through	9-S-T	1,785	1,829	1	34	18	3	6	3	1	1,825	1,850	1

Intersection ID	Intersection Name	Approach	Road Name	Movement	AIMSUN Movement ID	2022-PM HR1 (16:15 – 17:15)											
						LV			Trucks			Heavy Trucks			Total		
				Left	9-S-L	276	342	4	4	29	6	0	1	1	280	372	5
		West	Waterloo Rd	U - Turn	9-W-U	1	0	1	0	0	0	0	0	0	1	0	1
				Right	9-W-R	438	422	1	12	15	1	0	0	0	450	437	1
				Through	9-W-T	103	54	6	17	0	6	0	0	0	120	54	7
				Left	9-W-L	291	314	1	6	11	2	0	0	0	297	325	2
10	M2 Motorway & Lane Cove	North	Lane Cove Rd	U - Turn	10-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	10-N-R	611	609	0	79	71	1	5	3	1	695	683	0
				Through	10-N-T	1,945	1,992	1	80	60	2	7	2	2	2,032	2,054	0
				Left	10-N-L	323	290	2	8	8	0	0	4	3	331	302	2
		East	M2 Motorway	U - Turn	10-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	10-E-R	0	0	0	0	0	0	0	0	0	0	0	0
				Through	10-E-T	0	0	0	0	0	0	0	0	0	0	0	0
				Left	10-E-L	0	0	0	0	0	0	0	0	0	0	0	0
		South	Lane Cove Rd	U - Turn	10-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	10-S-R	0	0	0	0	0	0	0	0	0	0	0	0
				Through	10-S-T	2,373	2,440	1	39	33	1	6	5	0	2,418	2,478	1
				Left	10-S-L	181	160	2	10	4	2	0	0	0	191	164	2
		West	M2 Motorway	U - Turn	10-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	10-W-R	84	103	2	17	4	4	0	0	0	101	107	1
				Through	10-W-T	0	0	0	0	0	0	0	0	0	0	0	0
				Left	10-W-L	461	468	0	10	11	0	2	3	1	473	482	0
11	Talavera & Lane Cove	North	Lane Cove Rd	U - Turn	11-N-U	1	0	1	0	0	0	0	0	0	1	0	1
				Right	11-N-R	377	386	0	13	15	1	0	0	0	390	401	1
				Through	11-N-T	1,641	1,659	0	84	47	5	7	2	2	1,732	1,708	1
				Left	11-N-L	10	9	0	0	0	0	0	0	0	10	9	0
		East	Talavera Rd	U - Turn	11-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	11-E-R	69	70	0	1	2	1	0	0	0	70	72	0
				Through	11-E-T	23	9	4	1	0	1	0	0	0	24	9	4
				Left	11-E-L	99	116	2	1	0	1	0	0	0	100	116	2
		South	Lane Cove Rd	U - Turn	11-S-U	1	0	1	0	0	0	0	0	0	1	0	1
				Right	11-S-R	50	50	0	2	0	2	1	0	1	53	50	0
				Through	11-S-T	2,192	2,153	1	41	33	1	6	5	0	2,239	2,191	1
				Left	11-S-L	105	117	1	4	4	0	0	0	0	109	121	1
		West	Talavera Rd	U - Turn	11-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	11-W-R	228	303	5	10	6	1	0	0	0	238	309	4

Intersection ID	Intersection Name	Approach	Road Name	Movement	AIMSUN Movement ID	2022-PM HR1 (16:15 – 17:15)											
						LV			Trucks			Heavy Trucks			Total		
				Through	11-W-T	6	1	3	1	0	1	0	0	0	7	1	3
				Left	11-W-L	292	363	4	7	2	2	0	0	0	299	365	4
12	Talavera & Khartoum	North	Khartoum Rd	U - Turn	12-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	12-N-R	55	35	3	3	5	1	0	0	0	58	40	3
				Through	12-N-T	69	55	2	4	0	3	0	0	0	73	55	2
				Left	12-N-L	11	19	2	0	0	0	0	0	0	11	19	2
		East	Talavera Rd	U - Turn	12-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	12-E-R	41	32	1	1	3	1	0	0	0	42	35	1
				Through	12-E-T	461	565	5	4	7	1	0	0	0	465	572	5
				Left	12-E-L	155	168	1	10	10	0	0	0	0	165	178	1
		South	Khartoum Rd	U - Turn	12-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	12-S-R	52	17	6	13	3	4	0	0	0	65	20	7
				Through	12-S-T	151	130	2	5	7	1	0	0	0	156	137	2
				Left	12-S-L	155	96	5	2	12	4	0	0	0	157	108	4
		West	Talavera Rd	U - Turn	12-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	12-W-R	172	204	2	5	7	1	0	0	0	177	211	2
				Through	12-W-T	250	259	1	5	4	0	0	0	0	255	263	0
				Left	12-W-L	293	313	1	1	6	3	0	0	0	294	319	1
13	Talavera & Unnamed	North	Unnamed Rd	U - Turn	13-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	13-N-R	0	0	0	0	0	0	0	0	0	0	0	0
				Through	13-N-T	0	0	0	0	0	0	0	0	0	0	0	0
				Left	13-N-L	30	74	6	0	3	2	0	0	0	30	77	6
		East	Talavera Rd	U - Turn	13-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	13-E-R	1	0	1	0	0	0	0	0	0	1	0	1
				Through	13-E-T	581	604	1	7	23	4	0	0	0	588	627	2
				Left	13-E-L	132	136	0	2	0	2	0	0	0	134	136	0
		South	Banda Rd	U - Turn	13-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	13-S-R	81	92	1	1	0	1	0	0	0	82	92	1
				Through	13-S-T	1	0	1	0	0	0	0	0	0	1	0	1
				Left	13-S-L	85	95	1	2	0	2	0	0	0	87	95	1
		West	Talavera Rd	U - Turn	13-W-U	1	0	1	0	0	0	0	0	0	1	0	1
				Right	13-W-R	75	45	4	0	0	0	0	0	0	75	45	4
				Through	13-W-T	534	542	0	11	12	0	0	0	0	545	554	0
				Left	13-W-L	1	8	3	0	0	0	0	0	0	1	8	3
14		North	Alma Rd	U - Turn	14-N-U	0	0	0	0	0	0	0	0	0	0	0	0

Intersection ID	Intersection Name	Approach	Road Name	Movement	AIMSUN Movement ID	2022-PM HR1 (16:15 – 17:15)											
						LV			Trucks			Heavy Trucks			Total		
	Talavera & Alma			Right	14-N-R	0	0	0	0	0	0	0	0	0	0	0	0
				Through	14-N-T	1	0	1	0	0	0	0	0	0	1	0	1
				Left	14-N-L	46	59	2	1	5	2	0	0	0	47	64	2
		East	Talavera Rd	U - Turn	14-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	14-E-R	0	0	0	0	0	0	0	0	0	0	0	0
				Through	14-E-T	631	665	1	9	22	3	0	0	0	640	687	2
				Left	14-E-L	68	58	1	0	1	1	0	0	0	68	59	1
		South	Macquarie Centre	U - Turn	14-S-U	1	0	1	0	0	0	0	0	0	1	0	1
				Right	14-S-R	146	137	1	1	1	0	0	0	0	147	138	1
				Through	14-S-T	0	0	0	0	0	0	0	0	0	0	0	0
				Left	14-S-L	175	184	1	2	2	0	0	0	0	177	186	1
		West	Talavera Rd	U - Turn	14-W-U	2	0	2	0	0	0	0	0	0	2	0	2
				Right	14-W-R	98	103	0	0	0	0	0	0	0	98	103	0
				Through	14-W-T	419	400	1	9	6	1	0	0	0	428	406	1
				Left	14-W-L	14	29	3	0	2	2	0	0	0	14	31	4
15	Fontenoy & Lane Cove	North	Lane Cove Rd	U - Turn	15-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	15-N-R	0	0	0	0	0	0	0	0	0	0	0	0
				Through	15-N-T	2,765	2,788	0	161	135	2	12	9	1	2,938	2,932	0
				Left	15-N-L	10	0	4	0	0	0	0	0	0	10	0	4
		East	Fontenoy Rd	U - Turn	15-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	15-E-R	3	0	2	0	0	0	0	0	0	3	0	2
				Through	15-E-T	16	6	3	0	0	0	0	0	0	16	6	3
				Left	15-E-L	16	11	1	0	0	0	0	0	0	16	11	1
		South	Lane Cove Rd	U - Turn	15-S-U	1	0	1	0	0	0	0	0	0	1	0	1
				Right	15-S-R	6	2	2	0	0	0	0	0	0	6	2	2
				Through	15-S-T	2,755	2,820	1	44	42	0	8	8	0	2,807	2,870	1
				Left	15-S-L	72	90	2	5	2	2	0	0	0	77	92	2
		West	Fontenoy Rd	U - Turn	15-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	15-W-R	97	85	1	6	4	1	0	0	0	103	89	1
				Through	15-W-T	0	0	0	0	0	0	0	0	0	0	0	0
				Left	15-W-L	278	222	4	0	8	4	0	0	0	278	230	3
16	Epping & Wicks	North	Wicks Rd	U - Turn	16-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	16-N-R	122	173	4	3	3	0	0	0	0	125	176	4
				Through	16-N-T	138	113	2	8	1	3	0	0	0	146	114	3
				Left	16-N-L	307	229	5	3	6	1	0	0	0	310	235	5

Intersection ID	Intersection Name	Approach	Road Name	Movement	AIMSUN Movement ID	2022-PM HR1 (16:15 – 17:15)											
						LV			Trucks			Heavy Trucks			Total		
		East	Epping Rd	U - Turn	16-E-U	2	0	2	0	0	0	0	0	0	2	0	2
				Right	16-E-R	169	141	2	6	5	0	0	1	1	175	147	2
				Through	16-E-T	2,230	2,264	1	56	47	1	3	1	1	2,289	2,312	0
				Left	16-E-L	894	908	0	20	26	1	1	0	1	915	934	1
		South	Wicks Rd	U - Turn	16-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	16-S-R	434	469	2	11	10	0	0	1	1	445	480	2
				Through	16-S-T	54	51	0	4	5	0	0	0	0	58	56	0
				Left	16-S-L	103	114	1	2	4	1	0	0	0	105	118	1
		West	Epping Rd	U - Turn	16-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	16-W-R	169	157	1	3	6	1	0	0	0	172	163	1
				Through	16-W-T	1,786	1,884	2	48	53	1	3	1	1	1,837	1,938	2
				Left	16-W-L	107	218	9	0	2	2	0	0	0	107	220	9
17	Halifax & Wicks	North	Wicks Rd	U - Turn	17-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	17-N-R	6	14	3	0	0	0	1	0	1	7	14	2
				Through	17-N-T	14	10	1	0	1	1	0	0	0	14	11	1
				Left	17-N-L	0	0	0	0	0	0	0	0	0	0	0	0
		East	Halifax St	U - Turn	17-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	17-E-R	0	0	0	0	0	0	0	0	0	0	0	0
				Through	17-E-T	39	67	4	9	0	4	0	0	0	48	67	3
				Left	17-E-L	101	101	0	5	2	2	0	0	0	106	103	0
		South	Wicks Rd	U - Turn	17-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	17-S-R	53	72	2	2	0	2	0	0	0	55	72	2
				Through	17-S-T	3	11	3	1	1	0	0	0	0	4	12	3
				Left	17-S-L	251	176	5	8	12	1	0	1	1	259	189	5
		West	Waterloo Rd	U - Turn	17-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	17-W-R	373	291	5	6	8	1	0	0	0	379	299	4
				Through	17-W-T	28	33	1	6	0	3	0	0	0	34	33	0
				Left	17-W-L	8	19	3	1	0	1	1	0	1	10	19	2
18	Epping & Delhi	North	Delhi Rd	U - Turn	18-N-U	1	0	1	0	0	0	0	0	0	1	0	1
				Right	18-N-R	1,054	1,053	0	31	28	1	2	0	2	1,087	1,081	0
				Left	18-N-L	646	680	1	11	12	0	0	0	0	657	692	1
		East	Epping Rd	U - Turn	18-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	18-E-R	532	501	1	26	17	2	1	0	1	559	518	2
				Through	18-E-T	2,393	2,287	2	61	48	2	2	2	0	2,456	2,337	2
		West	Epping Rd	U - Turn	18-W-U	0	0	0	0	0	0	0	0	0	0	0	0

Intersection ID	Intersection Name	Approach	Road Name	Movement	AIMSUN Movement ID	2022-PM HR1 (16:15 – 17:15)											
						LV			Trucks			Heavy Trucks			Total		
				Through	18-W-T	2,010	1,848	4	57	56	0	3	1	1	2,070	1,905	4
				Left	18-W-L	743	709	1	11	13	1	0	1	1	754	723	1
19	Epping & Pittwater	East	Epping Rd	U - Turn	19-E-U	1	0	1	0	0	0	0	0	0	1	0	1
				Through	19-E-T	2,565	2,544	0	79	54	3	3	2	1	2,647	2,600	1
				Left	19-E-L	760	703	2	24	21	1	0	2	2	784	726	2
		South	Pittwater Rd	U - Turn	19-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	19-S-R	276	249	2	17	12	1	0	0	0	293	261	2
				Left	19-S-L	360	277	5	8	11	1	0	0	0	368	288	4
		West	Epping Rd	U - Turn	19-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	19-W-R	830	726	4	10	10	0	0	0	0	840	736	4
				Through	19-W-T	1,826	1,841	0	58	58	0	3	1	1	1,887	1,900	0
20	Epping & M2 Motorway	North	M2 Motorway	U - Turn	20-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	20-N-R	364	387	1	6	7	0	0	0	0	370	394	1
				Left	20-N-L	224	226	0	8	3	2	0	0	0	232	229	0
		East	Epping Rd	U - Turn	20-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	20-E-R	355	331	1	20	21	0	0	0	0	375	352	1
				Through	20-E-T	1,337	1,330	0	36	32	1	2	0	2	1,375	1,362	0
		West	Epping Rd	U - Turn	20-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Through	20-W-T	866	787	3	14	15	0	1	1	0	881	803	3
				Left	20-W-L	410	429	1	23	15	2	0	0	0	433	444	1
21	Delhi & Rennie	East	Delhi Rd	U - Turn	21-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Through	21-E-T	1,595	1,544	1	53	50	0	2	0	2	1,650	1,594	1
				Left	21-E-L	20	11	2	0	0	0	0	0	0	20	11	2
		South	Rennie St	U - Turn	21-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	21-S-R	7	27	5	0	0	0	0	0	0	7	27	5
				Left	21-S-L	97	126	3	3	3	0	0	0	0	100	129	3
		West	Delhi Rd	U - Turn	21-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	21-W-R	123	137	1	1	0	1	0	0	0	124	137	1
				Through	21-W-T	967	870	3	21	18	1	1	1	0	989	889	3
22	Delhi & Plassey Entry	North	Plassey Entry Rd	U - Turn	22-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	22-N-R	67	51	2	2	3	1	0	0	0	69	54	2
				Through	22-N-T	11	3	3	0	0	0	0	0	0	11	3	3
				Left	22-N-L	23	8	4	1	0	1	0	0	0	24	8	4
		East	Delhi Rd	U - Turn	22-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	22-E-R	5	1	2	1	0	1	0	0	0	6	1	3

Intersection ID	Intersection Name	Approach	Road Name	Movement	AIMSUN Movement ID	2022-PM HR1 (16:15 – 17:15)											
						LV			Trucks			Heavy Trucks			Total		
				Through	22-E-T	1,279	1,179	3	48	42	1	2	0	2	1,329	1,221	3
				Left	22-E-L	58	51	1	1	0	1	0	0	0	59	51	1
		South	Julius Ave	U - Turn	22-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	22-S-R	63	87	3	0	0	0	0	0	0	63	87	3
				Through	22-S-T	1	0	1	0	0	0	0	0	0	1	0	1
				Left	22-S-L	269	319	3	3	4	1	0	0	0	272	323	3
		West	Delhi Rd	U - Turn	22-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	22-W-R	31	50	3	1	1	0	0	0	0	32	51	3
				Through	22-W-T	918	829	3	19	18	0	1	1	0	938	848	3
				Left	22-W-L	25	18	2	1	0	1	0	0	0	26	18	2
23	Delhi & Carpark	North	Carpark	U - Turn	23-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	23-N-R	25	36	2	0	0	0	0	0	0	25	36	2
				Through	23-N-T	5	0	3	0	0	0	0	0	0	5	0	3
				Left	23-N-L	5	0	3	0	0	0	0	0	0	5	0	3
		East	Delhi Rd	U - Turn	23-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	23-E-R	3	0	2	0	0	0	0	0	0	3	0	2
				Through	23-E-T	1,130	1,036	3	50	42	1	2	0	2	1,182	1,078	3
				Left	23-E-L	27	29	0	0	0	0	0	0	0	27	29	0
		South	Julius Ave	U - Turn	23-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	23-S-R	85	84	0	0	4	3	0	0	0	85	88	0
				Through	23-S-T	0	0	0	0	0	0	0	0	0	0	0	0
				Left	23-S-L	187	162	2	0	2	2	0	0	0	187	164	2
		West	Delhi Rd	U - Turn	23-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	23-W-R	36	41	1	1	0	1	0	0	0	37	41	1
				Through	23-W-T	946	879	2	18	18	0	1	1	0	965	898	2
				Left	23-W-L	5	3	1	0	0	0	0	0	0	5	3	1
24	Macquarie Walk & Uni	North	University Ave	U - Turn	24-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	24-N-R	0	0	0	0	0	0	0	0	0	0	0	0
				Through	24-N-T	25	9	4	0	0	0	0	0	0	25	9	4
				Left	24-N-L	16	7	3	0	0	0	0	0	0	16	7	3
		East	Macquarie Walk	U - Turn	24-E-U	4	0	3	6	0	3	0	0	0	10	0	4
				Right	24-E-R	7	1	3	0	0	0	0	0	0	7	1	3
				Through	24-E-T	0	0	0	0	0	0	0	0	0	0	0	0
				Left	24-E-L	379	310	4	33	5	6	0	0	0	412	315	5
		South	University Ave	U - Turn	24-S-U	0	0	0	0	0	0	0	0	0	0	0	0

Intersection ID	Intersection Name	Approach	Road Name	Movement	AIMSUN Movement ID	2022-PM HR1 (16:15 – 17:15)											
						LV			Trucks			Heavy Trucks			Total		
				Right	24-S-R	0	0	0	0	0	0	0	0	0	0	0	0
				Through	24-S-T	0	0	0	0	0	0	0	0	0	0	0	0
				Left	24-S-L	0	0	0	0	0	0	0	0	0	0	0	0
		West	Balaclava Rd	U - Turn	24-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	24-W-R	112	107	0	1	5	2	0	0	0	113	112	0
				Through	24-W-T	141	134	1	34	6	6	0	0	0	175	140	3
				Left	24-W-L	8	5	1	0	0	0	0	0	0	8	5	1
26	Waterloo & Carpark	North	Carpark	U - Turn	26-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	26-N-R	12	8	1	0	0	0	0	0	0	12	8	1
				Through	26-N-T	1	0	1	0	0	0	0	0	0	1	0	1
				Left	26-N-L	3	3	0	0	0	0	0	0	0	3	3	0
		East	Waterloo Rd	U - Turn	26-E-U	9	19	3	0	2	2	0	0	0	9	21	3
				Right	26-E-R	5	2	2	0	3	2	0	0	0	5	5	0
				Through	26-E-T	545	630	4	42	34	1	0	0	0	587	664	3
				Left	26-E-L	99	85	1	7	2	2	0	0	0	106	87	2
		South	Byfield St	U - Turn	26-S-U	1	0	1	0	0	0	0	0	0	1	0	1
				Right	26-S-R	150	160	1	3	12	3	0	0	0	153	172	1
				Through	26-S-T	2	0	2	0	0	0	0	0	0	2	0	2
				Left	26-S-L	345	289	3	2	1	1	0	0	0	347	290	3
		West	Waterloo Rd	U - Turn	26-W-U	158	108	4	0	4	3	0	0	0	158	112	4
				Right	26-W-R	118	65	6	4	0	3	0	0	0	122	65	6
				Through	26-W-T	450	356	5	43	16	5	0	0	0	493	372	6
				Left	26-W-L	10	0	4	0	0	0	0	0	0	10	0	4
27	Epping & Lyonpark	North	Lyonpark Rd	U - Turn	27-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	27-N-R	0	0	0	0	0	0	0	0	0	0	0	0
				Left	27-N-L	685	775	3	13	30	4	0	0	0	698	805	4
		East	Epping Rd	U - Turn	27-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	27-E-R	0	0	0	0	0	0	0	0	0	0	0	0
				Through	27-E-T	2,116	2,195	2	61	58	0	0	0	0	2,177	2,253	2
		West	Epping Rd	U - Turn	27-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Through	27-W-T	1,137	1,375	7	23	41	3	1	2	1	1,161	1,418	7
				Left	27-W-L	92	104	1	7	10	1	0	0	0	99	114	1
28	Harring & Macquarie	North	Harring Rd	U - Turn	28-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Through	28-N-T	190	214	2	15	5	3	0	0	0	205	219	1
				Left	28-N-L	0	0	0	0	0	0	0	0	0	0	0	0

Intersection ID	Intersection Name	Approach	Road Name	Movement	AIMSUN Movement ID	2022-PM HR1 (16:15 – 17:15)											
						LV			Trucks			Heavy Trucks			Total		
		East	Macquarie Centre	U - Turn	28-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	28-E-R	0	0	0	0	0	0	0	0	0	0	0	0
				Left	28-E-L	119	165	4	0	18	6	0	0	0	119	183	5
		South	Harring Rd	U - Turn	28-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	28-S-R	309	327	1	72	20	8	0	0	0	381	347	2
				Through	28-S-T	464	436	1	26	19	1	0	0	0	490	455	2
29	Waterloo & Macquarie	North	Macquarie Centre	U - Turn	29-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	29-N-R	0	0	0	0	0	0	0	0	0	0	0	0
				Left	29-N-L	1	0	1	1	0	1	0	0	0	2	0	2
		East	Waterloo Rd	U - Turn	29-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	29-E-R	8	0	4	0	0	0	0	0	0	8	0	4
				Through	29-E-T	975	985	0	44	35	1	0	0	0	1,019	1,020	0
		West	Waterloo Rd	U - Turn	29-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Through	29-W-T	411	362	2	42	23	3	1	0	1	454	385	3
				Left	29-W-L	130	134	0	1	7	3	0	0	0	131	141	1
30	Waterloo & Khartoum	North	Khartoum Rd	U - Turn	30-N-U	2	12	4	0	0	0	0	0	0	2	12	4
				Right	30-N-R	249	263	1	15	9	2	0	0	0	264	272	0
				Through	30-N-T	0	1	1	0	0	0	0	0	0	0	1	1
				Left	30-N-L	169	204	3	5	9	2	0	0	0	174	213	3
		East	Waterloo Rd	U - Turn	30-E-U	88	66	3	1	7	3	0	0	0	89	73	2
				Right	30-E-R	194	169	2	2	21	6	0	1	1	196	191	0
				Through	30-E-T	402	455	3	34	30	1	0	0	0	436	485	2
				Left	30-E-L	2	3	1	0	0	0	0	0	0	2	3	1
		South	Carpark	U - Turn	30-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	30-S-R	0	0	0	0	0	0	0	0	0	0	0	0
				Through	30-S-T	0	0	0	0	0	0	0	0	0	0	0	0
				Left	30-S-L	0	0	0	0	0	0	0	0	0	0	0	0
		West	Waterloo Rd	U - Turn	30-W-U	7	9	1	0	0	0	0	0	0	7	9	1
				Right	30-W-R	2	0	2	0	0	0	0	0	0	2	0	2
				Through	30-W-T	471	430	2	29	13	3	0	0	0	500	443	3
				Left	30-W-L	154	106	4	15	15	0	0	0	0	169	121	4
31	Optus & Lyonpark	North	Lyonpark Rd	U - Turn	31-N-U	5	0	3	0	0	0	0	0	0	5	0	3
				Right	31-N-R	22	2	6	0	0	0	0	0	0	22	2	6
				Through	31-N-T	521	596	3	13	23	2	0	0	0	534	619	4
				Left	31-N-L	14	8	2	4	0	3	0	0	0	18	8	3

Intersection ID	Intersection Name	Approach	Road Name	Movement	AIMSUN Movement ID	2022-PM HR1 (16:15 – 17:15)											
						LV			Trucks			Heavy Trucks			Total		
		East	Optus Dr	U - Turn	31-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	31-E-R	60	19	7	0	3	2	0	0	0	60	22	6
				Through	31-E-T	1	0	1	0	0	0	0	0	0	1	0	1
				Left	31-E-L	123	133	1	0	7	4	0	0	0	123	140	1
		South	Lyonpark Rd	U - Turn	31-S-U	2	0	2	0	0	0	0	0	0	2	0	2
				Right	31-S-R	6	5	0	7	0	4	0	0	0	13	5	3
				Through	31-S-T	75	94	2	0	10	4	0	0	0	75	104	3
				Left	31-S-L	9	5	2	0	0	0	0	0	0	9	5	2
		West	Carpark	U - Turn	31-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	31-W-R	39	43	1	0	0	0	0	0	0	39	43	1
				Through	31-W-T	1	0	1	0	0	0	0	0	0	1	0	1
				Left	31-W-L	26	17	2	0	0	0	0	0	0	26	17	2
32	Research Park & Talavera	West	Talavera Rd	U - Turn	32-W-U	4	7	1	0	0	0	0	0	0	4	7	1
				Right	32-W-R	24	14	2	0	1	1	0	0	0	24	15	2
				Through	32-W-T	239	279	2	6	9	1	0	0	0	245	288	3
		East	Talavera Rd	U - Turn	32-E-U	30	38	1	0	1	1	0	0	0	30	39	2
				Through	32-E-T	484	491	0	9	4	2	0	0	0	493	495	0
				Left	32-E-L	63	60	0	1	2	1	0	0	0	64	62	0
		South	Research Park Dr	U - Turn	32-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	32-S-R	90	81	1	1	2	1	0	0	0	91	83	1
				Left	32-S-L	73	77	0	1	0	1	0	0	0	74	77	0
33	Talavera & Culloden	North	Culloden Rd	U - Turn	33-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	33-N-R	0	0	0	0	0	0	0	0	0	0	0	0
				Through	33-N-T	6	18	3	0	1	1	0	0	0	6	19	4
				Left	33-N-L	8	13	2	0	1	1	0	0	0	8	14	2
		East	Talavera Rd	U - Turn	33-E-U	15	14	0	0	0	0	0	0	0	15	14	0
				Right	33-E-R	16	11	1	1	0	1	0	0	0	17	11	2
				Through	33-E-T	45	80	4	0	1	1	0	0	0	45	81	5
				Left	33-E-L	485	481	0	9	3	2	0	0	0	494	484	0
		South	Culloden Rd	U - Turn	33-S-U	4	0	3	1	0	1	0	0	0	5	0	3
				Right	33-S-R	210	229	1	6	9	1	0	0	0	216	238	1
				Through	33-S-T	18	41	4	0	0	0	0	0	0	18	41	4
				Left	33-S-L	51	65	2	7	1	3	0	0	0	58	66	1
		West	Talavera Rd	U - Turn	33-W-U	0	0	0	1	0	1	0	0	0	1	0	1
				Right	33-W-R	33	48	2	6	4	1	0	0	0	39	52	2

Intersection ID	Intersection Name	Approach	Road Name	Movement	AIMSUN Movement ID	2022-PM HR1 (16:15 – 17:15)											
						LV			Trucks			Heavy Trucks			Total		
				Through	33-W-T	34	36	0	0	0	0	0	0	0	34	36	0
				Left	33-W-L	0	0	0	0	0	0	0	0	0	0	0	0
34	Talavera & Macquarie	East	Talavera Rd	U - Turn	34-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Through	34-E-T	646	692	2	9	23	4	0	0	0	655	715	2
				Left	34-E-L	21	5	4	0	0	0	0	0	0	21	5	4
		South	Macquarie Centre	U - Turn	34-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	34-S-R	0	0	0	0	0	0	0	0	0	0	0	0
				Left	34-S-L	53	33	3	0	0	0	0	0	0	53	33	3
		West	Talavera Rd	U - Turn	34-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	34-W-R	0	0	0	0	0	0	0	0	0	0	0	0
				Through	34-W-T	611	597	1	11	12	0	0	0	0	622	609	1
35	Waterloo & Eden Park	North	Eden Park Dr	U - Turn	35-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	35-N-R	92	115	2	1	4	2	0	0	0	93	119	3
				Through	35-N-T	2	0	2	0	0	0	0	0	0	2	0	2
				Left	35-N-L	81	89	1	0	2	2	0	0	0	81	91	1
		East	Waterloo Rd	U - Turn	35-E-U	7	9	1	0	1	1	0	0	0	7	10	1
				Right	35-E-R	12	10	1	0	0	0	0	0	0	12	10	1
				Through	35-E-T	244	233	1	18	12	2	1	1	0	263	246	1
				Left	35-E-L	9	15	2	0	0	0	0	0	0	9	15	2
		South	Thomas Holt Dr	U - Turn	35-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	35-S-R	59	60	0	0	2	2	0	0	0	59	62	0
				Through	35-S-T	2	0	2	0	0	0	0	0	0	2	0	2
				Left	35-S-L	61	67	1	0	3	2	0	1	1	61	71	1
		West	Waterloo Rd	U - Turn	35-W-U	24	40	3	16	1	5	0	0	0	40	41	0
				Right	35-W-R	3	12	3	0	0	0	0	0	0	3	12	3
				Through	35-W-T	231	157	5	14	2	4	1	0	1	246	159	6
				Left	35-W-L	17	25	2	1	0	1	0	0	0	18	25	2
36	Gymnasium & Culloden	North	Culloden Rd	U - Turn	36-N-U	7	0	4	0	0	0	0	0	0	7	0	4
				Right	36-N-R	342	312	2	10	4	2	0	0	0	352	316	2
				Through	36-N-T	124	139	1	3	3	0	0	0	0	127	142	1
				Left	36-N-L	56	57	0	2	1	1	0	0	0	58	58	0
		East	Gymnasium Rd	U - Turn	36-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	36-E-R	38	23	3	0	1	1	0	0	0	38	24	3
				Through	36-E-T	48	35	2	2	0	2	0	0	0	50	35	2
				Left	36-E-L	40	41	0	0	0	0	0	0	0	40	41	0

Intersection ID	Intersection Name	Approach	Road Name	Movement	AIMSUN Movement ID	2022-PM HR1 (16:15 – 17:15)											
						LV			Trucks			Heavy Trucks			Total		
37	Herring Road & Ivanhoe Road	South	Culloden Rd	U - Turn	36-S-U	4	10	2	0	0	0	0	0	0	4	10	2
				Right	36-S-R	51	9	8	1	1	0	0	0	0	52	10	8
				Through	36-S-T	126	157	3	2	1	1	0	0	0	128	158	3
				Left	36-S-L	94	59	4	0	0	0	0	0	0	94	59	4
		West	Waterloo Rd	U - Turn	36-W-U	1	0	1	0	0	0	0	0	0	1	0	1
				Right	36-W-R	30	29	0	0	6	3	0	0	0	30	35	1
				Through	36-W-T	25	27	0	0	1	1	0	0	0	25	28	1
				Left	36-W-L	151	175	2	9	8	0	0	0	0	160	183	2
		North	Herring Road	U - Turn	37-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	37-N-R	31	27	1	3	1	1	0	0	0	34	28	1
				Through	37-N-T	1,034	1,144	3	28	32	1	0	0	0	1,062	1,176	3
				Left	37-N-L	13	24	3	2	0	2	0	0	0	15	24	2
		East	Ivanhoe Road	U - Turn	37-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	37-E-R	14	15	0	2	0	2	0	0	0	16	15	0
				Through	37-E-T	1	0	1	0	0	0	0	0	0	1	0	1
				Left	37-E-L	46	60	2	8	3	2	0	0	0	54	63	1
		South	Herring Road	U - Turn	37-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	37-S-R	32	20	2	3	0	2	0	0	0	35	20	3
				Through	37-S-T	746	711	1	37	24	2	0	0	0	783	735	2
				Left	37-S-L	7	24	4	1	0	1	0	0	0	8	24	4
		West	Morling College Road	U - Turn	37-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	37-W-R	45	82	5	8	0	4	0	0	0	53	82	4
				Through	37-W-T	6	2	2	1	0	1	0	0	0	7	2	2
				Left	37-W-L	22	8	4	4	0	3	0	0	0	26	8	4

Intersection ID	Intersection Name	Approach	Road Name	Movement	AIMSUN Movement ID	2022-PM HR2 (17:15 – 18:15)											
						LV			Trucks			Heavy Trucks			Total		
						Observed	Modelled	GEH	Observed	Modelled	GEH	Observed	Modelled	GEH	Observed	Modelled	GEH
1	Epping & Culloden	North	Culloden Rd	U - Turn	1-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	1-N-R	0	0	0	0	0	0	0	0	0	0	0	0
				Through	1-N-T	1	0	1	0	0	0	0	0	0	1	0	1
				Left	1-N-L	252	229	1	3	3	0	0	0	0	255	232	1
		East	Epping Rd	U - Turn	1-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	1-E-R	219	280	4	2	2	0	0	0	0	221	282	4
				Through	1-E-T	1,052	1,074	1	34	28	1	0	0	0	1,086	1,102	0
				Left	1-E-L	38	21	3	1	0	1	0	0	0	39	21	3
		South	Culloden Rd	U - Turn	1-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	1-S-R	0	0	0	0	0	0	0	0	0	0	0	0
				Through	1-S-T	0	0	0	0	0	0	0	0	0	0	0	0
				Left	1-S-L	10	0	4	1	0	1	0	0	0	11	0	5
		West	Epping Rd	U - Turn	1-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	1-W-R	5	0	3	1	0	1	0	0	0	6	0	3
				Through	1-W-T	816	952	5	26	24	0	0	3	2	842	979	5
				Left	1-W-L	89	173	7	1	0	1	0	0	0	90	173	7
2	Epping & Balaclava	North	Balaclava Rd	U - Turn	2-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	2-N-R	122	215	7	13	5	3	0	0	0	135	220	6
				Through	2-N-T	198	171	2	5	3	1	0	0	0	203	174	2
				Left	2-N-L	121	159	3	0	7	4	0	0	0	121	166	4
		East	Epping Rd	U - Turn	2-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	2-E-R	53	43	1	1	2	1	0	0	0	54	45	1
				Through	2-E-T	1,090	1,076	0	23	25	0	0	0	0	1,113	1,101	0
				Left	2-E-L	640	722	3	7	13	2	0	1	1	647	736	3
		South	Balaclava Rd	U - Turn	2-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	2-S-R	275	278	0	5	6	0	0	0	0	280	284	0
				Through	2-S-T	74	27	7	8	0	4	0	0	0	82	27	7
				Left	2-S-L	94	84	1	1	0	1	0	0	0	95	84	1
		West	Epping Rd	U - Turn	2-W-U	3	0	2	0	0	0	0	0	0	3	0	2
				Right	2-W-R	143	86	5	1	0	1	0	0	0	144	86	5
				Through	2-W-T	872	966	3	14	23	2	0	3	2	886	992	3
				Left	2-W-L	50	103	6	14	4	3	0	0	0	64	107	5
3	Epping & Herring	North	Herring Rd	U - Turn	3-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	3-N-R	454	379	4	4	11	3	0	0	0	458	390	3

Intersection ID	Intersection Name	Approach	Road Name	Movement	AIMSUN Movement ID	2022-PM HR2 (17:15 – 18:15)											
						LV			Trucks			Heavy Trucks			Total		
				Through	3-N-T	507	532	1	22	11	3	0	0	0	529	543	1
				Left	3-N-L	198	262	4	8	7	0	0	1	1	206	270	4
		East	Epping Rd	U - Turn	3-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	3-E-R	307	297	1	3	3	0	0	0	0	310	300	1
				Through	3-E-T	1,439	1,433	0	28	28	0	1	1	0	1,468	1,462	0
				Left	3-E-L	305	381	4	2	9	3	0	1	1	307	391	4
		South	Herring Rd	U - Turn	3-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	3-S-R	125	183	5	0	8	4	0	0	0	125	191	5
				Through	3-S-T	240	235	0	13	6	2	0	0	0	253	241	1
				Left	3-S-L	59	41	3	0	1	1	0	0	0	59	42	2
		West	Epping Rd	U - Turn	3-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	3-W-R	114	76	4	1	6	3	0	0	0	115	82	3
				Through	3-W-T	898	1,044	5	14	20	1	0	3	2	912	1,067	5
				Left	3-W-L	311	248	4	6	10	1	0	0	0	317	258	3
4	Waterloo & Herring	North	Herring Rd	U - Turn	4-N-U	1	0	1	0	0	0	0	0	0	1	0	1
				Right	4-N-R	66	48	2	32	5	6	0	0	0	98	53	5
				Through	4-N-T	469	402	3	17	15	1	0	0	0	486	417	3
				Left	4-N-L	124	108	1	41	11	6	0	0	0	165	119	4
		East	Waterloo Rd	U - Turn	4-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	4-E-R	259	248	1	55	16	7	1	0	1	315	264	3
				Through	4-E-T	145	239	7	3	12	3	0	0	0	148	251	7
				Left	4-E-L	618	583	1	1	15	5	0	1	1	619	599	1
		South	Herring Rd	U - Turn	4-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	4-S-R	310	285	1	3	10	3	0	0	0	313	295	1
				Through	4-S-T	420	417	0	19	7	3	0	0	0	439	424	1
				Left	4-S-L	38	93	7	0	1	1	0	0	0	38	94	7
		West	Waterloo Rd	U - Turn	4-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	4-W-R	0	35	8	0	0	0	0	0	0	0	35	8
				Through	4-W-T	133	99	3	1	2	1	0	0	0	134	101	3
				Left	4-W-L	103	92	1	38	8	6	0	0	0	141	100	4
5	Waterloo & Macquarie	North	Macquarie Centre	U - Turn	5-N-U	1	0	1	0	0	0	0	0	0	1	0	1
				Right	5-N-R	124	125	0	0	1	1	0	0	0	124	126	0
				Through	5-N-T	1	2	1	0	0	0	0	0	0	1	2	1
				Left	5-N-L	137	184	4	0	2	2	0	0	0	137	186	4
		East	Waterloo Rd	U - Turn	5-E-U	3	0	2	0	0	0	0	0	0	3	0	2

Intersection ID	Intersection Name	Approach	Road Name	Movement	AIMSUN Movement ID	2022-PM HR2 (17:15 – 18:15)											
						LV			Trucks			Heavy Trucks			Total		
				Right	5-E-R	174	108	6	1	0	1	0	0	0	175	108	6
				Through	5-E-T	890	913	1	59	45	2	1	1	0	950	959	0
				Left	5-E-L	28	47	3	0	3	2	0	0	0	28	50	4
		South	Cottonwood Cres	U - Turn	5-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	5-S-R	0	0	0	0	0	0	0	0	0	0	0	0
				Through	5-S-T	0	0	0	0	0	0	0	0	0	0	0	0
				Left	5-S-L	11	51	7	0	0	0	0	0	0	11	51	7
		West	Waterloo Rd	U - Turn	5-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	5-W-R	0	0	0	0	0	0	0	0	0	0	0	0
				Through	5-W-T	362	283	4	44	18	5	0	0	0	406	301	6
				Left	5-W-L	77	64	2	0	3	2	0	0	0	77	67	1
6	Talavera & Herring	North	Herring Rd	U - Turn	6-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	6-N-R	80	89	1	1	3	1	0	0	0	81	92	1
				Through	6-N-T	0	0	0	0	0	0	0	0	0	0	0	0
				Left	6-N-L	85	132	5	1	3	1	0	0	0	86	135	5
		East	Talavera Rd	U - Turn	6-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	6-E-R	261	264	0	3	12	3	0	0	0	264	276	1
				Through	6-E-T	407	341	3	3	5	1	0	0	0	410	346	3
				Left	6-E-L	235	183	4	1	7	3	0	0	0	236	190	3
		South	Herring Rd	U - Turn	6-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	6-S-R	117	107	1	1	3	1	0	0	0	118	110	1
				Through	6-S-T	274	248	2	35	13	4	1	0	1	310	261	3
				Left	6-S-L	80	64	2	6	5	0	0	0	0	86	69	2
		West	Talavera Rd	U - Turn	6-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	6-W-R	0	0	0	12	0	5	0	0	0	12	0	5
				Through	6-W-T	329	376	3	8	0	4	0	0	0	337	376	2
				Left	6-W-L	75	68	1	1	1	0	0	0	0	76	69	1
7	Talavera & Christie	North	Christie Rd	U - Turn	7-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	7-N-R	95	119	2	1	1	0	0	0	0	96	120	2
				Through	7-N-T	0	0	0	0	0	0	0	0	0	0	0	0
				Left	7-N-L	108	143	3	17	0	6	0	0	0	125	143	2
		East	Talavera Rd	U - Turn	7-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	7-E-R	74	77	0	2	4	1	0	0	0	76	81	1
				Through	7-E-T	530	416	5	8	9	0	0	0	0	538	425	5
				Left	7-E-L	0	0	0	0	0	0	0	0	0	0	0	0

Intersection ID	Intersection Name	Approach	Road Name	Movement	AIMSUN Movement ID	2022-PM HR2 (17:15 – 18:15)											
						LV			Trucks			Heavy Trucks			Total		
		South	Technology Pl	U - Turn	7-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	7-S-R	0	0	0	0	0	0	0	0	0	0	0	0
				Through	7-S-T	0	0	0	0	0	0	0	0	0	0	0	0
				Left	7-S-L	0	0	0	0	0	0	0	0	0	0	0	0
		West	Talavera Rd	U - Turn	7-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	7-W-R	0	0	0	0	0	0	0	0	0	0	0	0
				Through	7-W-T	276	313	2	5	2	2	0	0	0	281	315	2
				Left	7-W-L	66	66	0	0	3	2	0	0	0	66	69	0
8	Epping & Lane Cove	North	Lane Cove Rd	U - Turn	8-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	8-N-R	299	253	3	3	7	2	1	0	1	303	260	3
				Through	8-N-T	1,584	1,845	6	43	43	0	4	4	0	1,631	1,892	6
				Left	8-N-L	438	397	2	16	14	1	1	0	1	455	411	2
		East	Epping Rd	U - Turn	8-E-U	8	39	6	0	2	2	0	0	0	8	41	7
				Right	8-E-R	552	589	2	16	18	0	0	0	0	568	607	2
				Through	8-E-T	17	42	5	6	0	3	0	2	2	23	44	4
				Left	8-E-L	244	287	3	6	2	2	2	1	1	252	290	2
		South	Lane Cove Rd	U - Turn	8-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	8-S-R	284	285	0	5	0	3	0	0	0	289	285	0
				Through	8-S-T	1,111	1,166	2	17	15	1	7	0	4	1,135	1,181	1
				Left	8-S-L	74	69	1	1	2	1	0	0	0	75	71	0
		West	Epping Rd	U - Turn	8-W-U	122	164	4	5	0	3	0	0	0	127	164	3
				Right	8-W-R	338	297	2	1	13	5	0	1	1	339	311	2
				Through	8-W-T	37	6	7	3	0	2	0	0	0	40	6	7
				Left	8-W-L	291	326	2	1	11	4	0	1	1	292	338	3
9	Waterloo & Lane Cove	North	Lane Cove Rd	U - Turn	9-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	9-N-R	103	180	6	7	6	0	0	0	0	110	186	6
				Through	9-N-T	1,691	1,829	3	50	51	0	6	3	1	1,747	1,883	3
				Left	9-N-L	145	93	5	9	7	1	0	0	0	154	100	5
		East	Waterloo Rd	U - Turn	9-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	9-E-R	236	222	1	0	6	3	0	0	0	236	228	1
				Through	9-E-T	72	101	3	27	13	3	0	0	0	99	114	1
				Left	9-E-L	109	87	2	2	4	1	0	0	0	111	91	2
		South	Lane Cove Rd	U - Turn	9-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	9-S-R	25	42	3	1	0	1	0	0	0	26	42	3
				Through	9-S-T	1,706	1,762	1	30	33	1	6	2	2	1,742	1,797	1

Intersection ID	Intersection Name	Approach	Road Name	Movement	AIMSUN Movement ID	2022-PM HR2 (17:15 – 18:15)											
						LV			Trucks			Heavy Trucks			Total		
				Left	9-S-L	275	288	1	5	11	2	0	0	0	280	299	1
		West	Waterloo Rd	U - Turn	9-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	9-W-R	447	354	5	4	3	1	0	1	1	451	358	5
				Through	9-W-T	97	56	5	18	0	6	0	0	0	115	56	6
				Left	9-W-L	326	342	1	3	2	1	0	0	0	329	344	1
10	M2 Motorway & Lane Cove	North	Lane Cove Rd	U - Turn	10-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	10-N-R	478	524	2	56	71	2	2	2	0	536	597	3
				Through	10-N-T	1,982	2,036	1	50	66	2	5	3	1	2,037	2,105	1
				Left	10-N-L	343	314	2	4	17	4	1	0	1	348	331	1
		East	M2 Motorway	U - Turn	10-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	10-E-R	0	0	0	0	0	0	0	0	0	0	0	0
				Through	10-E-T	0	0	0	0	0	0	0	0	0	0	0	0
				Left	10-E-L	0	0	0	0	0	0	0	0	0	0	0	0
		South	Lane Cove Rd	U - Turn	10-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	10-S-R	0	0	0	0	0	0	0	0	0	0	0	0
				Through	10-S-T	2,428	2,481	1	34	42	1	2	2	0	2,464	2,525	1
				Left	10-S-L	163	174	1	4	3	1	4	0	3	171	177	0
		West	M2 Motorway	U - Turn	10-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	10-W-R	86	65	2	9	7	1	1	0	1	96	72	3
				Through	10-W-T	0	0	0	0	0	0	0	0	0	0	0	0
				Left	10-W-L	571	590	1	7	10	1	2	0	2	580	600	1
11	Talavera & Lane Cove	North	Lane Cove Rd	U - Turn	11-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	11-N-R	427	445	1	8	10	1	0	0	0	435	455	1
				Through	11-N-T	1,628	1,665	1	51	62	1	6	3	1	1,685	1,730	1
				Left	11-N-L	13	5	3	0	0	0	0	0	0	13	5	3
		East	Talavera Rd	U - Turn	11-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	11-E-R	79	76	0	0	3	2	0	0	0	79	79	0
				Through	11-E-T	35	6	6	0	0	0	0	0	0	35	6	6
				Left	11-E-L	118	116	0	3	0	2	1	0	1	122	116	1
		South	Lane Cove Rd	U - Turn	11-S-U	1	0	1	0	0	0	0	0	0	1	0	1
				Right	11-S-R	31	43	2	1	3	1	0	0	0	32	46	2
				Through	11-S-T	2,189	2,204	0	29	38	2	6	2	2	2,224	2,244	0
				Left	11-S-L	100	122	2	5	1	2	0	0	0	105	123	2
		West	Talavera Rd	U - Turn	11-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	11-W-R	220	304	5	6	2	2	0	0	0	226	306	5

Intersection ID	Intersection Name	Approach	Road Name	Movement	AIMSUN Movement ID	2022-PM HR2 (17:15 – 18:15)											
						LV			Trucks			Heavy Trucks			Total		
				Through	11-W-T	8	0	4	1	0	1	0	0	0	9	0	4
				Left	11-W-L	323	376	3	9	4	2	0	0	0	332	380	3
12	Talavera & Khartoum	North	Khartoum Rd	U - Turn	12-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	12-N-R	90	61	3	0	0	0	0	0	0	90	61	3
				Through	12-N-T	81	63	2	9	0	4	0	0	0	90	63	3
				Left	12-N-L	13	19	2	0	0	0	0	0	0	13	19	2
		East	Talavera Rd	U - Turn	12-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	12-E-R	96	106	1	0	3	2	0	0	0	96	109	1
				Through	12-E-T	436	490	3	1	6	3	2	0	2	439	496	3
				Left	12-E-L	183	128	4	12	5	2	0	0	0	195	133	5
		South	Khartoum Rd	U - Turn	12-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	12-S-R	62	25	6	12	2	4	0	0	0	74	27	7
				Through	12-S-T	204	198	0	5	3	1	0	0	0	209	201	1
				Left	12-S-L	164	135	2	0	14	5	0	0	0	164	149	1
		West	Talavera Rd	U - Turn	12-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	12-W-R	208	241	2	8	11	1	0	0	0	216	252	2
				Through	12-W-T	294	218	5	1	2	1	0	0	0	295	220	5
				Left	12-W-L	265	427	9	1	3	1	0	0	0	266	430	9
13	Talavera & Unnamed	North	Unnamed Rd	U - Turn	13-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	13-N-R	0	0	0	0	0	0	0	0	0	0	0	0
				Through	13-N-T	0	0	0	0	0	0	0	0	0	0	0	0
				Left	13-N-L	32	65	5	0	8	4	0	0	0	32	73	6
		East	Talavera Rd	U - Turn	13-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	13-E-R	0	0	0	0	0	0	0	0	0	0	0	0
				Through	13-E-T	611	605	0	7	21	4	0	0	0	618	626	0
				Left	13-E-L	107	90	2	0	0	0	0	0	0	107	90	2
		South	Banda Rd	U - Turn	13-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	13-S-R	112	132	2	0	0	0	0	0	0	112	132	2
				Through	13-S-T	1	0	1	0	0	0	0	0	0	1	0	1
				Left	13-S-L	115	62	6	2	0	2	0	0	0	117	62	6
		West	Talavera Rd	U - Turn	13-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	13-W-R	43	41	0	2	0	2	0	0	0	45	41	1
				Through	13-W-T	532	633	4	8	9	0	0	0	0	540	642	4
				Left	13-W-L	1	12	4	0	1	1	0	0	0	1	13	5
14		North	Alma Rd	U - Turn	14-N-U	0	0	0	0	0	0	0	0	0	0	0	0

Intersection ID	Intersection Name	Approach	Road Name	Movement	AIMSUN Movement ID	2022-PM HR2 (17:15 – 18:15)											
						LV			Trucks			Heavy Trucks			Total		
	Talavera & Alma			Right	14-N-R	0	0	0	0	0	0	0	0	0	0	0	0
				Through	14-N-T	0	0	0	0	0	0	0	0	0	0	0	0
				Left	14-N-L	41	74	4	1	4	2	0	0	0	42	78	5
		East	Talavera Rd	U - Turn	14-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	14-E-R	1	0	1	0	0	0	0	0	0	1	0	1
				Through	14-E-T	715	611	4	9	21	3	0	0	0	724	632	4
				Left	14-E-L	60	78	2	0	0	0	0	0	0	60	78	2
		South	Macquarie Centre	U - Turn	14-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	14-S-R	124	135	1	0	0	0	0	0	0	124	135	1
				Through	14-S-T	0	0	0	0	0	0	0	0	0	0	0	0
				Left	14-S-L	185	179	0	1	4	2	0	0	0	186	183	0
		West	Talavera Rd	U - Turn	14-W-U	7	0	4	0	0	0	0	0	0	7	0	4
				Right	14-W-R	69	96	3	0	0	0	0	0	0	69	96	3
				Through	14-W-T	411	482	3	9	6	1	0	0	0	420	488	3
				Left	14-W-L	28	36	1	1	0	1	0	0	0	29	36	1
15	Fontenoy & Lane Cove	North	Lane Cove Rd	U - Turn	15-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	15-N-R	4	0	3	0	0	0	0	0	0	4	0	3
				Through	15-N-T	2,701	2,752	1	101	150	4	8	5	1	2,810	2,907	2
				Left	15-N-L	0	0	0	0	0	0	0	0	0	0	0	0
		East	Fontenoy Rd	U - Turn	15-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	15-E-R	0	2	2	0	0	0	0	0	0	0	2	2
				Through	15-E-T	2	5	2	0	0	0	0	0	0	2	5	2
				Left	15-E-L	3	10	3	0	0	0	0	0	0	3	10	3
		South	Lane Cove Rd	U - Turn	15-S-U	1	0	1	0	0	0	0	0	0	1	0	1
				Right	15-S-R	2	6	2	0	0	0	0	0	0	2	6	2
				Through	15-S-T	2,899	2,962	1	34	49	2	4	2	1	2,937	3,013	1
				Left	15-S-L	97	94	0	7	3	2	0	0	0	104	97	1
		West	Fontenoy Rd	U - Turn	15-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	15-W-R	98	105	1	9	3	2	0	0	0	107	108	0
				Through	15-W-T	2	0	2	0	0	0	0	0	0	2	0	2
				Left	15-W-L	312	357	2	0	8	4	0	0	0	312	365	3
16	Epping & Wicks	North	Wicks Rd	U - Turn	16-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	16-N-R	130	230	7	0	1	1	0	0	0	130	231	8
				Through	16-N-T	165	143	2	3	4	1	0	0	0	168	147	2
				Left	16-N-L	295	274	1	4	6	1	0	0	0	299	280	1

Intersection ID	Intersection Name	Approach	Road Name	Movement	AIMSUN Movement ID	2022-PM HR2 (17:15 – 18:15)											
						LV			Trucks			Heavy Trucks			Total		
		East	Epping Rd	U - Turn	16-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	16-E-R	168	122	4	4	10	2	0	0	0	172	132	3
				Through	16-E-T	2,096	2,137	1	44	53	1	2	4	1	2,142	2,194	1
				Left	16-E-L	822	914	3	26	29	1	0	0	0	848	943	3
		South	Wicks Rd	U - Turn	16-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	16-S-R	512	510	0	7	12	2	0	1	1	519	523	0
				Through	16-S-T	40	44	1	0	3	2	0	0	0	40	47	1
				Left	16-S-L	111	101	1	0	3	2	0	0	0	111	104	1
		West	Epping Rd	U - Turn	16-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	16-W-R	176	173	0	0	7	4	0	0	0	176	180	0
				Through	16-W-T	1,809	1,812	0	41	41	0	0	2	2	1,850	1,855	0
				Left	16-W-L	107	143	3	0	0	0	0	0	0	107	143	3
17	Halifax & Wicks	North	Wicks Rd	U - Turn	17-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	17-N-R	3	6	1	0	0	0	0	0	0	3	6	1
				Through	17-N-T	4	15	4	1	0	1	0	0	0	5	15	3
				Left	17-N-L	3	0	2	0	0	0	0	0	0	3	0	2
		East	Halifax St	U - Turn	17-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	17-E-R	1	0	1	0	0	0	0	0	0	1	0	1
				Through	17-E-T	51	57	1	6	0	3	0	0	0	57	57	0
				Left	17-E-L	141	112	3	5	3	1	0	0	0	146	115	3
		South	Wicks Rd	U - Turn	17-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	17-S-R	61	28	5	1	0	1	0	0	0	62	28	5
				Through	17-S-T	4	7	1	0	0	0	0	0	0	4	7	1
				Left	17-S-L	207	186	1	0	13	5	0	0	0	207	199	1
		West	Waterloo Rd	U - Turn	17-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	17-W-R	364	443	4	3	6	1	0	0	0	367	449	4
				Through	17-W-T	42	34	1	4	2	1	0	0	0	46	36	2
				Left	17-W-L	13	5	3	1	2	1	0	0	0	14	7	2
18	Epping & Delhi	North	Delhi Rd	U - Turn	18-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	18-N-R	1,070	998	2	26	41	3	0	2	2	1,096	1,041	2
				Left	18-N-L	620	708	3	7	12	2	1	0	1	628	720	4
		East	Epping Rd	U - Turn	18-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	18-E-R	457	453	0	10	13	1	0	0	0	467	466	0
				Through	18-E-T	2,219	2,116	2	47	52	1	2	2	0	2,268	2,170	2
		West	Epping Rd	U - Turn	18-W-U	0	0	0	0	0	0	0	0	0	0	0	0

Intersection ID	Intersection Name	Approach	Road Name	Movement	AIMSUN Movement ID	2022-PM HR2 (17:15 – 18:15)											
						LV			Trucks			Heavy Trucks			Total		
				Through	18-W-T	1,830	1,805	1	37	45	1	0	2	2	1,867	1,852	0
				Left	18-W-L	797	757	1	16	15	0	0	1	1	813	773	1
19	Epping & Pittwater	East	Epping Rd	U - Turn	19-E-U	5	0	3	0	0	0	0	0	0	5	0	3
				Through	19-E-T	2,341	2,263	2	50	54	1	2	2	0	2,393	2,319	2
				Left	19-E-L	913	723	7	28	19	2	0	0	0	941	742	7
		South	Pittwater Rd	U - Turn	19-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	19-S-R	371	339	2	20	8	3	0	0	0	391	347	2
				Left	19-S-L	335	307	2	7	11	1	0	0	0	342	318	1
		West	Epping Rd	U - Turn	19-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	19-W-R	745	757	0	4	11	3	0	0	0	749	768	1
				Through	19-W-T	1,705	1,767	1	40	46	1	1	2	1	1,746	1,815	2
20	Epping & M2 Motorway	North	M2 Motorway	U - Turn	20-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	20-N-R	396	429	2	3	7	2	0	0	0	399	436	2
				Left	20-N-L	222	235	1	4	4	0	0	0	0	226	239	1
		East	Epping Rd	U - Turn	20-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	20-E-R	370	354	1	7	16	3	2	0	2	379	370	0
				Through	20-E-T	1,294	1,280	0	30	46	3	1	3	1	1,325	1,329	0
		West	Epping Rd	U - Turn	20-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Through	20-W-T	847	824	1	16	18	0	0	1	1	863	843	1
				Left	20-W-L	407	386	1	10	10	0	0	0	0	417	396	1
21	Delhi & Rennie	East	Delhi Rd	U - Turn	21-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Through	21-E-T	1,529	1,508	1	36	54	3	3	3	0	1,568	1,565	0
				Left	21-E-L	8	7	0	0	2	2	0	0	0	8	9	0
		South	Rennie St	U - Turn	21-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	21-S-R	21	28	1	0	4	3	0	0	0	21	32	2
				Left	21-S-L	135	127	1	1	7	3	0	0	0	136	134	0
		West	Delhi Rd	U - Turn	21-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	21-W-R	149	145	0	1	1	0	0	0	0	150	146	0
				Through	21-W-T	920	915	0	19	19	0	0	1	1	939	935	0
22	Delhi & Plassey Entry	North	Plassey Entry Rd	U - Turn	22-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	22-N-R	35	37	0	0	2	2	0	0	0	35	39	1
				Through	22-N-T	16	0	6	0	0	0	0	0	0	16	0	6
				Left	22-N-L	5	3	1	0	0	0	0	0	0	5	3	1
		East	Delhi Rd	U - Turn	22-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	22-E-R	3	2	1	0	0	0	0	0	0	3	2	1

Intersection ID	Intersection Name	Approach	Road Name	Movement	AIMSUN Movement ID	2022-PM HR2 (17:15 – 18:15)											
						LV			Trucks			Heavy Trucks			Total		
				Through	22-E-T	1,221	1,176	1	35	52	3	3	2	1	1,259	1,230	1
				Left	22-E-L	38	47	1	2	0	2	0	0	0	40	47	1
		South	Julius Ave	U - Turn	22-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	22-S-R	88	59	3	0	0	0	0	0	0	88	59	3
				Through	22-S-T	5	0	3	0	0	0	0	0	0	5	0	3
				Left	22-S-L	281	306	1	1	2	1	0	1	1	282	309	2
		West	Delhi Rd	U - Turn	22-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	22-W-R	28	62	5	0	6	3	0	0	0	28	68	6
				Through	22-W-T	892	867	1	19	17	0	0	1	1	911	885	1
				Left	22-W-L	21	15	1	0	0	0	0	0	0	21	15	1
23	Delhi & Carpark	North	Carpark	U - Turn	23-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	23-N-R	54	37	3	0	0	0	0	0	0	54	37	3
				Through	23-N-T	5	0	3	0	0	0	0	0	0	5	0	3
				Left	23-N-L	10	1	4	0	0	0	0	0	0	10	1	4
		East	Delhi Rd	U - Turn	23-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	23-E-R	4	0	3	0	0	0	0	0	0	4	0	3
				Through	23-E-T	1,069	1,017	2	37	45	1	3	1	1	1,109	1,063	1
				Left	23-E-L	78	25	7	1	0	1	0	0	0	79	25	7
		South	Julius Ave	U - Turn	23-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	23-S-R	77	91	2	0	5	3	0	0	0	77	96	2
				Through	23-S-T	1	0	1	0	0	0	0	0	0	1	0	1
				Left	23-S-L	139	161	2	0	5	3	0	1	1	139	167	2
		West	Delhi Rd	U - Turn	23-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	23-W-R	25	51	4	0	0	0	0	0	0	25	51	4
				Through	23-W-T	941	874	2	19	17	0	0	1	1	960	892	2
				Left	23-W-L	4	8	2	0	0	0	0	0	0	4	8	2
24	Macquarie Walk & Uni	North	University Ave	U - Turn	24-N-U	2	0	2	0	0	0	0	0	0	2	0	2
				Right	24-N-R	0	0	0	0	0	0	0	0	0	0	0	0
				Through	24-N-T	12	5	2	0	0	0	0	0	0	12	5	2
				Left	24-N-L	16	6	3	0	0	0	0	0	0	16	6	3
		East	Macquarie Walk	U - Turn	24-E-U	3	0	2	4	0	3	0	0	0	7	0	4
				Right	24-E-R	8	2	3	0	0	0	0	0	0	8	2	3
				Through	24-E-T	0	0	0	0	0	0	0	0	0	0	0	0
				Left	24-E-L	366	497	6	32	14	4	0	0	0	398	511	5
		South	University Ave	U - Turn	24-S-U	0	0	0	0	0	0	0	0	0	0	0	0

Intersection ID	Intersection Name	Approach	Road Name	Movement	AIMSUN Movement ID	2022-PM HR2 (17:15 – 18:15)											
						LV			Trucks			Heavy Trucks			Total		
				Right	24-S-R	0	0	0	0	0	0	0	0	0	0	0	0
				Through	24-S-T	0	0	0	0	0	0	0	0	0	0	0	0
				Left	24-S-L	0	0	0	0	0	0	0	0	0	0	0	0
		West	Balaclava Rd	U - Turn	24-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	24-W-R	95	37	7	1	2	1	0	0	0	96	39	7
				Through	24-W-T	139	151	1	37	3	8	0	0	0	176	154	2
				Left	24-W-L	8	6	1	0	0	0	0	0	0	8	6	1
26	Waterloo & Carpark	North	Carpark	U - Turn	26-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	26-N-R	20	16	1	0	0	0	0	0	0	20	16	1
				Through	26-N-T	2	0	2	0	0	0	0	0	0	2	0	2
				Left	26-N-L	10	9	0	0	0	0	0	0	0	10	9	0
		East	Waterloo Rd	U - Turn	26-E-U	2	16	5	0	0	0	0	0	0	2	16	5
				Right	26-E-R	3	3	0	0	0	0	0	0	0	3	3	0
				Through	26-E-T	538	602	3	60	39	3	1	0	1	599	641	2
				Left	26-E-L	102	81	2	2	0	2	0	0	0	104	81	2
		South	Byfield St	U - Turn	26-S-U	1	0	1	0	0	0	0	0	0	1	0	1
				Right	26-S-R	138	113	2	1	5	2	0	1	1	139	119	2
				Through	26-S-T	4	0	3	0	0	0	0	0	0	4	0	3
				Left	26-S-L	363	317	2	0	3	2	0	0	0	363	320	2
		West	Waterloo Rd	U - Turn	26-W-U	174	127	4	0	4	3	0	0	0	174	131	3
				Right	26-W-R	114	68	5	0	0	0	0	0	0	114	68	5
				Through	26-W-T	475	375	5	45	16	5	0	0	0	520	391	6
				Left	26-W-L	9	1	4	0	0	0	0	0	0	9	1	4
27	Epping & Lyonpark	North	Lyonpark Rd	U - Turn	27-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	27-N-R	0	0	0	0	0	0	0	0	0	0	0	0
				Left	27-N-L	750	754	0	13	27	3	0	0	0	763	781	1
		East	Epping Rd	U - Turn	27-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	27-E-R	0	0	0	0	0	0	0	0	0	0	0	0
				Through	27-E-T	2,147	2,069	2	32	42	2	1	3	1	2,180	2,114	1
		West	Epping Rd	U - Turn	27-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Through	27-W-T	1,134	1,331	6	15	30	3	0	4	3	1,149	1,365	6
				Left	27-W-L	87	164	7	7	5	1	0	0	0	94	169	7
28	Harring & Macquarie	North	Harring Rd	U - Turn	28-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Through	28-N-T	235	183	4	13	7	2	0	0	0	248	190	4
				Left	28-N-L	0	0	0	0	0	0	0	0	0	0	0	0

Intersection ID	Intersection Name	Approach	Road Name	Movement	AIMSUN Movement ID	2022-PM HR2 (17:15 – 18:15)											
						LV			Trucks			Heavy Trucks			Total		
		East	Macquarie Centre	U - Turn	28-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	28-E-R	0	0	0	0	0	0	0	0	0	0	0	0
				Left	28-E-L	99	125	2	0	20	6	0	0	0	99	145	4
		South	Harring Rd	U - Turn	28-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	28-S-R	312	331	1	70	10	9	0	0	0	382	341	2
				Through	28-S-T	471	417	3	42	20	4	1	0	1	514	437	4
29	Waterloo & Macquarie	North	Macquarie Centre	U - Turn	29-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	29-N-R	1	0	1	0	0	0	0	0	0	1	0	1
				Left	29-N-L	4	0	3	1	0	1	0	0	0	5	0	3
		East	Waterloo Rd	U - Turn	29-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	29-E-R	5	0	3	0	0	0	0	0	0	5	0	3
				Through	29-E-T	1,020	1,089	2	59	46	2	1	1	0	1,080	1,136	2
		West	Waterloo Rd	U - Turn	29-W-U	1	0	1	0	0	0	0	0	0	1	0	1
				Through	29-W-T	435	350	4	43	20	4	0	0	0	478	370	5
				Left	29-W-L	131	142	1	2	3	1	0	0	0	133	145	1
30	Waterloo & Khartoum	North	Khartoum Rd	U - Turn	30-N-U	0	13	5	0	2	2	0	0	0	0	15	5
				Right	30-N-R	280	337	3	22	9	3	0	0	0	302	346	2
				Through	30-N-T	0	0	0	0	0	0	0	0	0	0	0	0
				Left	30-N-L	193	199	0	4	3	1	0	0	0	197	202	0
		East	Waterloo Rd	U - Turn	30-E-U	101	51	6	0	5	3	0	0	0	101	56	5
				Right	30-E-R	208	296	6	1	11	4	0	0	0	209	307	6
				Through	30-E-T	364	347	1	40	30	2	1	0	1	405	377	1
				Left	30-E-L	3	2	1	0	0	0	0	0	0	3	2	1
		South	Carpark	U - Turn	30-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	30-S-R	1	0	1	0	0	0	0	0	0	1	0	1
				Through	30-S-T	0	0	0	0	0	0	0	0	0	0	0	0
				Left	30-S-L	0	0	0	0	0	0	0	0	0	0	0	0
		West	Waterloo Rd	U - Turn	30-W-U	1	9	4	0	0	0	0	0	0	1	9	4
				Right	30-W-R	2	0	2	0	0	0	0	0	0	2	0	2
				Through	30-W-T	471	390	4	23	9	4	0	1	1	494	400	4
				Left	30-W-L	159	119	3	22	12	2	0	0	0	181	131	4
31	Optus & Lyonpark	North	Lyonpark Rd	U - Turn	31-N-U	4	0	3	1	0	1	0	0	0	5	0	3
				Right	31-N-R	15	2	4	0	0	0	0	0	0	15	2	4
				Through	31-N-T	549	550	0	13	17	1	0	0	0	562	567	0
				Left	31-N-L	12	6	2	2	0	2	0	0	0	14	6	3

Intersection ID	Intersection Name	Approach	Road Name	Movement	AIMSUN Movement ID	2022-PM HR2 (17:15 – 18:15)											
						LV			Trucks			Heavy Trucks			Total		
		East	Optus Dr	U - Turn	31-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	31-E-R	68	13	9	0	3	2	0	0	0	68	16	8
				Through	31-E-T	0	0	0	0	0	0	0	0	0	0	0	0
				Left	31-E-L	158	154	0	0	9	4	0	0	0	158	163	0
		South	Lyonpark Rd	U - Turn	31-S-U	1	0	1	0	0	0	0	0	0	1	0	1
				Right	31-S-R	10	7	1	6	0	3	0	0	0	16	7	3
				Through	31-S-T	64	154	9	1	5	2	0	0	0	65	159	9
				Left	31-S-L	12	2	4	0	0	0	0	0	0	12	2	4
		West	Carpark	U - Turn	31-W-U	1	0	1	0	0	0	0	0	0	1	0	1
				Right	31-W-R	42	51	1	0	1	1	0	0	0	42	52	1
				Through	31-W-T	1	0	1	0	0	0	0	0	0	1	0	1
				Left	31-W-L	31	17	3	0	0	0	0	0	0	31	17	3
32	Research Park & Talavera	West	Talavera Rd	U - Turn	32-W-U	9	5	2	0	0	0	0	0	0	9	5	2
				Right	32-W-R	27	22	1	0	2	2	0	0	0	27	24	1
				Through	32-W-T	222	245	2	5	3	1	0	0	0	227	248	1
		East	Talavera Rd	U - Turn	32-E-U	30	24	1	0	1	1	0	0	0	30	25	1
				Through	32-E-T	531	470	3	9	9	0	0	0	0	540	479	3
				Left	32-E-L	64	50	2	0	0	0	0	0	0	64	50	2
		South	Research Park Dr	U - Turn	32-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	32-S-R	90	108	2	0	1	1	0	0	0	90	109	2
				Left	32-S-L	50	60	1	1	2	1	0	0	0	51	62	1
33	Talavera & Culloden	North	Culloden Rd	U - Turn	33-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	33-N-R	0	0	0	0	0	0	0	0	0	0	0	0
				Through	33-N-T	18	27	2	0	0	0	0	0	0	18	27	2
				Left	33-N-L	14	26	3	0	0	0	0	0	0	14	26	3
		East	Talavera Rd	U - Turn	33-E-U	2	7	2	0	0	0	0	0	0	2	7	2
				Right	33-E-R	40	23	3	0	0	0	0	0	0	40	23	3
				Through	33-E-T	69	70	0	0	6	3	0	0	0	69	76	1
				Left	33-E-L	479	445	2	10	5	2	0	0	0	489	450	2
		South	Culloden Rd	U - Turn	33-S-U	4	0	3	0	0	0	0	0	0	4	0	3
				Right	33-S-R	210	257	3	5	2	2	0	1	1	215	260	3
				Through	33-S-T	27	43	3	0	1	1	0	0	0	27	44	3
				Left	33-S-L	82	117	4	6	3	1	0	1	1	88	121	3
		West	Talavera Rd	U - Turn	33-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	33-W-R	51	64	2	5	5	0	0	0	0	56	69	2

Intersection ID	Intersection Name	Approach	Road Name	Movement	AIMSUN Movement ID	2022-PM HR2 (17:15 – 18:15)											
						LV			Trucks			Heavy Trucks			Total		
				Through	33-W-T	32	26	1	0	3	2	0	0	0	32	29	1
				Left	33-W-L	0	0	0	0	0	0	0	0	0	0	0	0
34	Talavera & Macquarie	East	Talavera Rd	U - Turn	34-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Through	34-E-T	709	664	2	9	21	3	0	0	0	718	685	1
				Left	34-E-L	17	5	4	0	0	0	0	0	0	17	5	4
		South	Macquarie Centre	U - Turn	34-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	34-S-R	0	0	0	0	0	0	0	0	0	0	0	0
				Left	34-S-L	67	23	7	0	0	0	0	0	0	67	23	7
		West	Talavera Rd	U - Turn	34-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	34-W-R	0	0	0	0	0	0	0	0	0	0	0	0
				Through	34-W-T	576	691	5	10	10	0	0	0	0	586	701	5
35	Waterloo & Eden Park	North	Eden Park Dr	U - Turn	35-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	35-N-R	62	73	1	0	3	2	0	0	0	62	76	2
				Through	35-N-T	0	0	0	0	0	0	0	0	0	0	0	0
				Left	35-N-L	73	121	5	0	0	0	0	0	0	73	121	5
		East	Waterloo Rd	U - Turn	35-E-U	9	10	0	0	0	0	0	0	0	9	10	0
				Right	35-E-R	12	18	2	0	0	0	0	0	0	12	18	2
				Through	35-E-T	231	230	0	7	13	2	0	0	0	238	243	0
				Left	35-E-L	4	19	4	0	0	0	0	0	0	4	19	4
		South	Thomas Holt Dr	U - Turn	35-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	35-S-R	64	100	4	0	4	3	0	0	0	64	104	4
				Through	35-S-T	0	0	0	0	0	0	0	0	0	0	0	0
				Left	35-S-L	35	65	4	0	0	0	0	0	0	35	65	4
		West	Waterloo Rd	U - Turn	35-W-U	26	16	2	20	3	5	0	0	0	46	19	5
				Right	35-W-R	3	17	4	0	0	0	0	0	0	3	17	4
				Through	35-W-T	261	221	3	8	6	1	0	0	0	269	227	3
				Left	35-W-L	12	21	2	1	0	1	0	0	0	13	21	2
36	Gymnasium & Culloden	North	Culloden Rd	U - Turn	36-N-U	3	0	2	0	0	0	0	0	0	3	0	2
				Right	36-N-R	351	311	2	12	4	3	0	0	0	363	315	3
				Through	36-N-T	156	165	1	3	2	1	0	0	0	159	167	1
				Left	36-N-L	45	49	1	2	3	1	0	0	0	47	52	1
		East	Gymnasium Rd	U - Turn	36-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	36-E-R	35	23	2	0	0	0	0	0	0	35	23	2
				Through	36-E-T	37	30	1	0	1	1	0	0	0	37	31	1
				Left	36-E-L	39	41	0	1	0	1	0	0	0	40	41	0

Intersection ID	Intersection Name	Approach	Road Name	Movement	AIMSUN Movement ID	2022-PM HR2 (17:15 – 18:15)											
						LV			Trucks			Heavy Trucks			Total		
		South	Culloden Rd	U - Turn	36-S-U	5	11	2	0	0	0	0	0	0	5	11	2
				Right	36-S-R	36	9	6	1	0	1	0	0	0	37	9	6
				Through	36-S-T	180	254	5	3	0	2	0	0	0	183	254	5
				Left	36-S-L	108	151	4	1	0	1	0	0	0	109	151	4
		West	Waterloo Rd	U - Turn	36-W-U	2	0	2	0	0	0	0	0	0	2	0	2
				Right	36-W-R	41	38	0	0	4	3	0	0	0	41	42	0
				Through	36-W-T	28	20	2	0	3	2	0	0	0	28	23	1
				Left	36-W-L	164	151	1	11	6	2	0	2	2	175	159	1
37	Herring Road & Ivanhoe Road	North	Herring Road	U - Turn	37-N-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	37-N-R	49	24	4	4	1	2	0	0	0	53	25	4
				Through	37-N-T	1,081	1,087	0	22	30	2	0	1	1	1,103	1,118	0
				Left	37-N-L	14	23	2	3	0	2	0	0	0	17	23	1
		East	Ivanhoe Road	U - Turn	37-E-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	37-E-R	7	23	4	1	2	1	0	0	0	8	25	4
				Through	37-E-T	1	1	0	0	0	0	0	0	0	1	1	0
				Left	37-E-L	35	30	1	5	0	3	0	0	0	40	30	2
		South	Herring Road	U - Turn	37-S-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	37-S-R	25	18	2	2	0	2	0	0	0	27	18	2
				Through	37-S-T	768	707	2	42	15	5	0	0	0	810	722	3
				Left	37-S-L	9	26	4	2	3	1	0	0	0	11	29	4
		West	Morling College Road	U - Turn	37-W-U	0	0	0	0	0	0	0	0	0	0	0	0
				Right	37-W-R	43	60	2	7	0	4	0	0	0	50	60	1
				Through	37-W-T	7	0	4	1	0	1	0	0	0	8	0	4
				Left	37-W-L	27	20	1	5	0	3	0	0	0	32	20	2

Appendix B – Travel Time Validation

Travel Time Validation – AM Peak

Epping Road EB																					
Survey Start Locations		Distances (km)	Cumulative Distance (km)	Hr1		Hr1 Cumulative		Cumulative Hr1 -15%	Cumulative Hr1 +15%	Hr 1 Min Cumulative	Hr 1 Max Cumulative	Check	Hr2		Hr2 Cumulative		Cumulative Hr2 -15%	Cumulative Hr2 +15%	Hr 2 Min Cumulative	Hr 2 Max Cumulative	Check
				Observed TT	Modelled TT	Observed TT	Modelled TT						Observed TT	Modelled TT	Observed TT	Modelled TT					
1	Culloden Rd	0.00	0.0	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00		00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	
2	Balaclava Rd	0.40	0.4	00:01:30	00:00:59	00:01:30	00:00:59	00:01:16	00:01:43	00:00:44	00:01:50	Pass	00:01:41	00:00:56	00:01:41	00:00:56	00:01:25	00:01:56	00:00:50	00:02:59	Pass
3	Herring Rd	0.62	1.0	00:01:43	00:02:08	00:03:13	00:03:07	00:02:44	00:03:42	00:02:10	00:04:32	Pass	00:01:51	00:02:08	00:03:32	00:03:04	00:03:00	00:04:04	00:02:09	00:07:34	Pass
4	Lane Cove Rd	1.31	2.3	00:02:10	00:02:48	00:05:24	00:05:55	00:04:35	00:06:12	00:03:34	00:06:50	Pass	00:02:19	00:02:34	00:05:51	00:05:38	00:04:59	00:06:44	00:03:22	00:09:03	Pass
5	Wicks Rd	0.55	2.9	00:01:31	00:01:13	00:06:54	00:07:08	00:05:52	00:07:57	00:04:54	00:08:37	Pass	00:01:23	00:01:12	00:07:14	00:06:51	00:06:09	00:08:19	00:04:37	00:10:42	Pass
6	Delhi Rd	0.47	3.4	00:01:10	00:01:21	00:08:05	00:08:29	00:06:52	00:09:17	00:06:12	00:10:30	Pass	00:01:15	00:01:51	00:08:29	00:08:42	00:07:13	00:09:46	00:05:19	00:12:22	Pass
7	Pittwater Rd	0.32	3.7	00:00:36	00:00:23	00:08:41	00:08:52	00:07:23	00:09:59	00:07:30	00:13:29	Pass	00:00:36	00:00:24	00:09:06	00:09:05	00:07:44	00:10:28	00:05:45	00:15:02	Pass
	Total	3.67		00:08:41	00:08:52							Pass	00:09:06	00:09:05							Pass

Epping Road WB																					
Survey Start Locations		Distances (km)	Cumulative Distance (km)	Hr1		Hr1 Cumulative		Cumulative Hr1 -15%	Cumulative Hr1 +15%	Hr 1 Min Cumulative	Hr 1 Max Cumulative	Check	Hr2		Hr2 Cumulative		Cumulative Hr2 -15%	Cumulative Hr2 +15%	Hr 2 Min Cumulative	Hr 2 Max Cumulative	Check
				Observed TT	Modelled TT	Observed TT	Modelled TT						Observed TT	Modelled TT	Observed TT	Modelled TT					
7	Pittwater Rd	0.00	0.0	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00		00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	
6	Delhi Rd	0.32	0.3	00:00:43	00:00:39	00:00:43	00:00:39	00:00:36	00:00:49	00:00:32	00:01:03	Pass	00:00:23	00:00:25	00:00:23	00:00:25	00:00:19	00:00:26	00:00:18	00:01:42	Pass
5	Wicks Rd	0.47	0.8	00:01:27	00:01:03	00:02:09	00:01:42	00:01:50	00:02:29	00:00:59	00:03:07	Pass	00:01:23	00:01:07	00:01:45	00:01:32	00:01:30	00:02:01	00:00:50	00:03:24	Pass
4	Lane Cove Rd	0.56	1.4	00:03:49	00:02:52	00:05:58	00:04:34	00:05:05	00:06:52	00:02:38	00:07:50	Pass	00:02:17	00:03:09	00:04:03	00:04:41	00:03:26	00:04:39	00:02:46	00:05:58	Pass
3	Herring Rd	1.31	2.7	00:01:57	00:02:17	00:07:56	00:06:51	00:06:44	00:09:07	00:03:49	00:10:26	Pass	00:01:50	00:02:17	00:05:52	00:06:58	00:05:00	00:06:45	00:04:23	00:08:03	Pass
2	Balaclava Rd	0.62	3.3	00:01:23	00:00:57	00:09:19	00:07:48	00:07:55	00:10:42	00:05:00	00:12:09	Pass	00:01:38	00:01:00	00:07:30	00:07:58	00:06:23	00:08:38	00:04:56	00:09:55	Pass
1	Culloden Rd	0.40	3.7	00:00:24	00:00:22	00:09:42	00:08:11	00:08:15	00:11:10	00:05:22	00:12:37	Pass	00:00:25	00:00:22	00:07:55	00:08:20	00:06:44	00:09:06	00:05:20	00:10:22	Pass
	Total	3.69		00:09:42	00:08:11							Fail	00:07:55	00:08:20							Pass

Talavera Road EB																					
Survey Start Locations		Distances (km)	Cumulative Distance (km)	Hr1		Hr1 Cumulative		Cumulative Hr1 -15%	Cumulative Hr1 +15%	Hr 1 Min Cumulative	Hr 1 Max Cumulative	Check	Hr2		Hr2 Cumulative		Cumulative Hr2 -15%	Cumulative Hr2 +15%	Hr 2 Min Cumulative	Hr 2 Max Cumulative	Check
				Observed TT	Modelled TT	Observed TT	Modelled TT						Observed TT	Modelled TT	Observed TT	Modelled TT					
1	Culloden Rd	0.00	0.0	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00		00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	
2	Research Park Pl	0.63	0.6	00:00:59	00:00:49	00:00:59	00:00:49	00:00:50	00:01:07	00:00:55	00:01:03	Pass	00:00:57	00:00:49	00:00:57	00:00:49	00:00:49	00:01:06	00:00:51	00:01:02	Pass
3	Christie Rd	0.15	0.8	00:00:37	00:00:22	00:01:35	00:01:11	00:01:21	00:01:49	00:01:24	00:01:45	Pass	00:00:42	00:00:25	00:01:39	00:01:14	00:01:25	00:01:54	00:01:12	00:02:08	Pass
4	Herring Rd	0.25	1.0	00:00:53	00:00:47	00:02:28	00:01:58	00:02:06	00:02:50	00:01:54	00:03:11	Pass	00:01:18	00:00:48	00:02:57	00:02:02	00:02:31	00:03:24	00:02:14	00:03:39	Pass
5	Alma Rd	0.16	1.2	00:00:14	00:00:19	00:02:42	00:02:17	00:02:18	00:03:07	00:02:06	00:03:38	Pass	00:00:17	00:00:17	00:03:15	00:02:19	00:02:45	00:03:44	00:02:27	00:04:08	Pass
6	Khartoum Rd	0.41	1.6	00:00:59	00:01:05	00:03:41	00:03:22	00:03:08	00:04:14	00:02:41	00:05:09	Pass	00:00:49	00:01:56	00:04:04	00:04:15	00:03:27	00:04:40	00:02:59	00:05:32	Fail
7	Lane Cove Rd	0.65	2.2	00:02:01	00:01:50	00:05:42	00:05:12	00:04:51	00:06:33	00:03:34	00:08:48	Pass	00:02:31	00:02:07	00:06:35	00:06:22	00:05:36	00:07:34	00:04:46	00:09:11	Pass
	Total	2.24		00:05:42	00:05:12							Pass	00:06:35	00:06:22							Pass

Talavera Road WB																					
Survey Start Locations		Distances (km)	Cumulative Distance (km)	Hr1		Hr1 Cumulative		Cumulative Hr1 -15%	Cumulative Hr1 +15%	Hr 1 Min Cumulative	Hr 1 Max Cumulative	Check	Hr2		Hr2 Cumulative		Cumulative Hr2 -15%	Cumulative Hr2 +15%	Hr 2 Min Cumulative	Hr 2 Max Cumulative	Check
				Observed TT	Modelled TT	Observed TT	Modelled TT						Observed TT	Modelled TT	Observed TT	Modelled TT					
7	Lane Cove Rd	0.00	0.0	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00		00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	
6	Khartoum Rd	0.65	0.6	00:01:26	00:01:52	00:01:26	00:01:52	00:01:13	00:01:39	00:00:53	00:02:03	Pass	00:01:51	00:02:27	00:01:51	00:02:27	00:01:34	00:02:08	00:01:20	00:02:12	Pass
5	Alma Rd	0.38	1.0	00:00:44	00:00:38	00:02:10	00:02:29	00:01:51	00:02:30	00:01:24	00:03:17	Pass	00:01:11	00:00:48	00:03:02	00:03:14	00:02:35	00:03:30	00:01:56	00:04:17	Pass
4	Herring Rd	0.17	1.2	00:00:27	00:00:34	00:02:37	00:03:03	00:02:13	00:03:00	00:01:38	00:04:14	Pass	00:00:54	00:00:34	00:03:56	00:03:48	00:03:21	00:04:31	00:02:20	00:05:31	Pass
3	Christie Rd	0.25	1.4	00:00:24	00:00:27	00:03:01	00:03:30	00:02:34	00:03:28	00:01:58	00:04:43	Pass	00:00:35	00:00:28	00:04:31	00:04:16	00:03:51	00:05:12	00:02:42	00:06:22	Pass
2	Research Park Pl	0.16	1.6	00:00:23	00:00:13	00:03:24	00:03:42	00:02:53	00:03:55	00:02:12	00:05:24	Pass	00:00:28	00:00:13	00:04:59	00:04:29	00:04:14	00:05:44	00:03:03	00:07:08	Pass
1	Culloden Rd	0.63	2.2	00:00:57	00:00:48	00:04:21	00:04:30	00:03:42	00:05:00	00:03:04	00:06:25	Pass	00:00:58	00:00:49	00:05:57	00:05:18	00:05:04	00:06:51	00:03:56	00:08:12	Pass
	Total	2.23		00:04:21	00:04:30							Pass	00:05:57	00:05:18							Pass

Lanecove Road NB																					
Survey Start Locations		Distances (km)	Cumulative Distance (km)	Hr1		Hr1 Cumulative		Cumulative Hr1 -15%	Cumulative Hr1 +15%	Hr 1 Min Cumulative	Hr 1 Max Cumulative	Check	Hr2		Hr2 Cumulative		Cumulative Hr2 -15%	Cumulative Hr2 +15%	Hr 2 Min Cumulative	Hr 2 Max Cumulative	Check
				Observed TT	Modelled TT	Observed TT	Modelled TT						Observed TT	Modelled TT	Observed TT	Modelled TT					
1	Epping Rd	0.00	0.0	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00		00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	
2	Waterloo Rd	0.33	0.3	00:01:08	00:01:03	00:01:08	00:01:03	00:00:58	00:01:18	00:00:27	00:01:30	Pass	00:01:23	00:01:16	00:01:23	00:01:16	00:01:11	00:01:36	00:00:23	00:03:34	Pass
3	Lanecove Rd	0.36	0.7	00:01:08	00:01:03	00:02:16	00:02:06	00:01:55	00:02:36	00:00:51	00:03:12	Pass	00:01:45	00:02:11	00:03:08	00:03:27	00:02:40	00:03:36	00:01:22	00:05:45	Pass
	Total	0.69		00:02:16	00:02:06							Pass	00:03:08	00:03:27							Pass

Lanecove Road SB																					
Survey Start Locations		Distances (km)	Cumulative Distance (km)	Hr1		Hr1 Cumulative		Cumulative Hr1 -15%	Cumulative Hr1 +15%	Hr 1 Min Cumulative	Hr 1 Max Cumulative	Check	Hr2		Hr2 Cumulative		Cumulative Hr2 -15%	Cumulative Hr2 +15%	Hr 2 Min Cumulative	Hr 2 Max Cumulative	Check
				Observed TT	Modelled TT	Observed TT	Modelled TT						Observed TT	Modelled TT	Observed TT	Modelled TT					
3	Lanecove Rd	0.00	0.0	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00		00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	
2	Waterloo Rd	0.36	0.4	00:01:20	00:01:32	00:01:20	00:01:32	00:01:08	00:01:32	00:01:10	00:01:45	Pass	00:01:30	00:01:48	00:01:30	00:01:48	00:01:16	00:01:43	00:01:16	00:01:46	Pass
1	Epping Rd	0.33	0.7	00:01:03	00:01:00	00:02:23	00:02:32	00:02:02	00:02:44	00:01:29	00:04:26	Pass	00:01:22	00:00:47	00:02:52	00:02:35	00:02:26	00:03:18	00:01:40	00:04:27	Pass
	Total	0.69		00:02:23	00:02:32							Pass	00:02:52	00:02:35							Pass

Herring Road NB																					
Survey Start Locations		Distances (km)	Cumulative Distance (km)	Hr1		Hr1 Cumulative		Cumulative Hr1 -15%	Cumulative Hr1 +15%	Hr 1 Min Cumulative	Hr 1 Max Cumulative	Check	Hr2		Hr2 Cumulative		Cumulative Hr2 -15%	Cumulative Hr2 +15%	Hr 2 Min Cumulative	Hr 2 Max Cumulative	Check
				Observed TT	Modelled TT	Observed TT	Modelled TT						Observed TT	Modelled TT	Observed TT	Modelled TT					
1	Epping Rd	0.00	0.0	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00		00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	
2	Ivanhoe Pl	0.19	0.2	00:00:18	00:00:25	00:00:18	00:00:25	00:00:15	00:00:21	00:00:13	00:00:26	Pass	00:00:17	00:00:24	00:00:17	00:00:24	00:00:14	00:00:19	00:00:13	00:00:25	Pass
3	Windsor Dr	0.12	0.3	00:00:08	00:00:09	00:00:26	00:00:34	00:00:22	00:00:30	00:00:21	00:00:35	Pass	00:00:08	00:00:09	00:00:25	00:00:33	00:00:21	00:00:29	00:00:20	00:00:34	Pass
4	Waterloo Rd	0.24	0.5	00:00:59	00:00:57	00:01:26	00:01:31	00:01:13	00:01:38	00:00:40	00:02:16	Pass	00:00:57	00:01:14	00:01:22	00:01:46	00:01:09	00:01:34	00:00:39	00:02:39	Pass
5	Talavera Rd	0.34	0.9	00:01:04	00:01:05	00:02:30	00:02:36	00:02:07	00:02:52	00:01:09	00:03:54	Pass	00:01:30	00:01:02	00:02:52	00:02:48	00:02:26	00:03:18	00:01:08	00:05:25	Pass
	Total	0.89		00:02:30	00:02:36							Pass	00:02:52	00:02:48							Pass

Herring Road SB																					
Survey Start Locations		Distances (km)	Cumulative Distance (km)	Hr1		Hr1 Cumulative		Cumulative Hr1 -15%	Cumulative Hr1 +15%	Hr 1 Min Cumulative	Hr 1 Max Cumulative	Check	Hr2		Hr2 Cumulative		Cumulative Hr2 -15%	Cumulative Hr2 +15%	Hr 2 Min Cumulative	Hr 2 Max Cumulative	Check
				Observed TT	Modelled TT	Observed TT	Modelled TT						Observed TT	Modelled TT	Observed TT	Modelled TT					
5	Talavera Rd	0.00	0.0	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00		00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	
4	Waterloo Rd	0.32	0.3	00:01:23	00:01:08	00:01:23	00:01:08	00:01:11	00:01:36	00:00:33	00:02:09	Pass	00:01:11	00:01:18	00:01:11	00:01:18	00:01:00	00:01:21	00:00:31	00:02:16	Pass
3	Windsor Dr	0.24	0.6	00:00:17	00:00:17	00:01:40	00:01:26	00:01:25	00:01:55	00:00:47	00:02:29	Pass	00:00:17	00:00:18	00:01:27	00:01:36	00:01:14	00:01:41	00:00:46	00:02:34	Pass
2	Ivanhoe Pl	0.11	0.7	00:00:18	00:00:18	00:01:58	00:01:44	00:01:40	00:02:16	00:00:58	00:02:58	Pass	00:00:10	00:00:17	00:01:38	00:01:53	00:01:23	00:01:52	00:00:53	00:02:50	Pass
1	Epping Rd	0.19	0.9	00:00:52	00:01:05	00:02:51	00:02:49	00:02:25	00:03:16	00:01:10	00:04:31	Pass	00:00:40	00:00:57	00:02:18	00:02:50	00:01:57	00:02:38	00:01:06	00:04:11	Pass
	Total	0.86		00:02:51	00:02:49							Pass	00:02:18	00:02:50							Pass

Travel Time Validation – PM Peak

Epping Road EB																					
Survey Start Locations		Distances (km)	Cumulative Distance (km)	Hr1		Hr1 Cumulative		Cumulative Hr1 -15%	Cumulative Hr1 +15%	Hr 1 Min Cumulative	Hr 1 Max Cumulative	Check	Hr2		Hr2 Cumulative		Cumulative Hr2 -15%	Cumulative Hr2 +15%	Hr 2 Min Cumulative	Hr 2 Max Cumulative	Check
				Observed TT	Modelled TT	Observed TT	Modelled TT						Observed TT	Modelled TT	Observed TT	Modelled TT					
1	Culloden Rd	0.00	0.0	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00		00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	
2	Balaclava Rd	0.40	0.4	00:00:44	00:00:52	00:00:44	00:00:52	00:00:37	00:00:50	00:00:26	00:01:28	Pass	00:00:41	00:00:47	00:00:41	00:00:47	00:00:35	00:00:48	00:00:25	00:01:48	Pass
3	Herring Rd	0.62	1.0	00:01:36	00:01:07	00:02:19	00:01:59	00:01:58	00:02:40	00:01:54	00:03:18	Pass	00:01:10	00:01:03	00:01:52	00:01:50	00:01:35	00:02:08	00:01:28	00:03:09	Pass
4	Lane Cove Rd	1.31	2.3	00:02:54	00:02:25	00:05:13	00:04:25	00:04:26	00:06:00	00:03:12	00:07:36	Pass	00:03:18	00:03:30	00:05:10	00:05:20	00:04:23	00:05:56	00:02:53	00:06:42	Pass
5	Wicks Rd	0.55	2.9	00:01:23	00:01:33	00:06:36	00:05:58	00:05:36	00:07:35	00:04:53	00:11:21	Pass	00:02:10	00:01:33	00:07:20	00:06:53	00:06:14	00:08:26	00:04:40	00:09:22	Pass
6	Delhi Rd	0.47	3.4	00:00:49	00:00:51	00:07:25	00:06:48	00:06:18	00:08:32	00:05:26	00:13:47	Pass	00:02:01	00:02:26	00:09:21	00:09:19	00:07:57	00:10:45	00:06:01	00:11:51	Pass
7	Pittwater Rd	0.32	3.7	00:00:41	00:00:26	00:08:06	00:07:14	00:06:53	00:09:19	00:05:47	00:15:32	Pass	00:01:08	00:00:26	00:10:29	00:09:45	00:08:55	00:12:04	00:06:23	00:13:41	Pass
	Total	3.67		00:08:06	00:07:14							Pass	00:10:29	00:09:45							Pass

Epping Road WB																					
Survey Start Locations		Distances (km)	Cumulative Distance (km)	Hr1		Hr1 Cumulative		Cumulative Hr1 -15%	Cumulative Hr1 +15%	Hr 1 Min Cumulative	Hr 1 Max Cumulative	Check	Hr2		Hr2 Cumulative		Cumulative Hr2 -15%	Cumulative Hr2 +15%	Hr 2 Min Cumulative	Hr 2 Max Cumulative	Check
				Observed TT	Modelled TT	Observed TT	Modelled TT						Observed TT	Modelled TT	Observed TT	Modelled TT					
7	Pittwater Rd	0.00	0.0	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00		00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	
6	Delhi Rd	0.32	0.3	00:01:02	00:00:37	00:01:02	00:00:37	00:00:52	00:01:11	00:00:59	00:01:15	Pass	00:00:51	00:00:32	00:00:51	00:00:32	00:00:43	00:00:59	00:00:21	00:01:16	Pass
5	Wicks Rd	0.47	0.8	00:01:49	00:01:53	00:02:50	00:02:30	00:02:25	00:03:16	00:01:47	00:04:04	Pass	00:00:34	00:01:31	00:01:25	00:02:02	00:01:12	00:01:37	00:00:52	00:02:04	Pass
4	Lane Cove Rd	0.56	1.4	00:01:51	00:01:42	00:04:42	00:04:13	00:03:59	00:05:24	00:02:21	00:06:45	Pass	00:02:13	00:01:45	00:03:37	00:03:47	00:03:05	00:04:10	00:02:03	00:05:00	Pass
3	Herring Rd	1.31	2.7	00:02:08	00:02:50	00:06:50	00:07:03	00:05:48	00:07:51	00:03:33	00:09:17	Pass	00:03:58	00:02:16	00:07:36	00:06:02	00:06:27	00:08:44	00:04:28	00:10:15	Fail
2	Balaclava Rd	0.62	3.3	00:00:41	00:01:30	00:07:31	00:08:33	00:06:24	00:08:39	00:04:52	00:10:15	Pass	00:00:39	00:01:27	00:08:15	00:07:30	00:07:01	00:09:29	00:05:04	00:11:03	Pass
1	Culloden Rd	0.40	3.7	00:00:35	00:00:23	00:08:06	00:08:55	00:06:53	00:09:19	00:05:19	00:11:21	Pass	00:00:45	00:00:26	00:09:00	00:07:55	00:07:39	00:10:21	00:05:30	00:12:24	Pass
	Total	3.69		00:08:06	00:08:55							Pass	00:09:00	00:07:55							Pass

Talavera Road EB																					
	Survey Start Locations	Distances (km)	Cumulative Distance (km)	Hr1		Hr1 Cumulative		Cumulative Hr1 -15%	Cumulative Hr1 +15%	Hr 1 Min Cumulative	Hr 1 Max Cumulative	Check	Hr2		Hr2 Cumulative		Cumulative Hr2 -15%	Cumulative Hr2 +15%	Hr 2 Min Cumulative	Hr 2 Max Cumulative	Check
				Observed TT	Modelled TT	Observed TT	Modelled TT						Observed TT	Modelled TT	Observed TT	Modelled TT					
1	Culloden Rd	0.00	0.0	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00		00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	
2	Research Park Pl	0.63	0.6	00:00:58	00:00:47	00:00:58	00:00:47	00:00:49	00:01:07	00:00:52	00:01:01	Pass	00:01:00	00:00:47	00:01:00	00:00:47	00:00:51	00:01:09	00:00:54	00:01:06	Pass
3	Christie Rd	0.15	0.8	00:00:26	00:00:23	00:01:24	00:01:10	00:01:12	00:01:37	00:01:12	00:01:38	Pass	00:00:16	00:00:23	00:01:16	00:01:10	00:01:05	00:01:28	00:01:09	00:01:29	Pass
4	Herring Rd	0.25	1.0	00:00:52	00:00:48	00:02:16	00:01:58	00:01:55	00:02:36	00:01:40	00:02:54	Pass	00:00:47	00:00:47	00:02:03	00:01:57	00:01:45	00:02:22	00:01:43	00:02:32	Pass
5	Alma Rd	0.16	1.2	00:00:21	00:00:13	00:02:37	00:02:10	00:02:14	00:03:01	00:01:52	00:03:28	Pass	00:00:25	00:00:12	00:02:28	00:02:10	00:02:06	00:02:50	00:01:55	00:03:04	Pass
6	Khartoum Rd	0.41	1.6	00:01:07	00:01:07	00:03:44	00:03:17	00:03:11	00:04:18	00:02:51	00:04:52	Pass	00:01:23	00:01:20	00:03:51	00:03:30	00:03:16	00:04:25	00:03:10	00:04:33	Pass
7	Lane Cove Rd	0.65	2.2	00:01:55	00:02:21	00:05:40	00:05:38	00:04:49	00:06:31	00:03:51	00:07:46	Pass	00:01:57	00:01:47	00:05:48	00:05:17	00:04:56	00:06:40	00:04:24	00:07:09	Pass
	Total	2.24		00:05:40	00:05:38							Pass	00:05:48	00:05:17							Pass

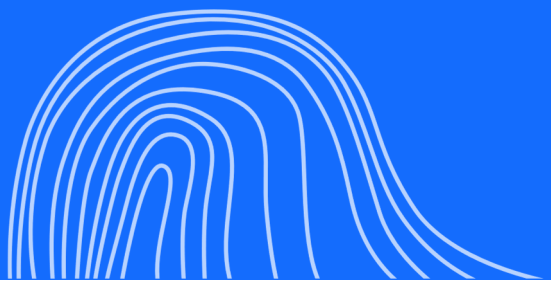
Talavera Road WB																					
	Survey Start Locations	Distances (km)	Cumulative Distance (km)	Hr1		Hr1 Cumulative		Cumulative Hr1 -15%	Cumulative Hr1 +15%	Hr 1 Min Cumulative	Hr 1 Max Cumulative	Check	Hr2		Hr2 Cumulative		Cumulative Hr2 -15%	Cumulative Hr2 +15%	Hr 2 Min Cumulative	Hr 2 Max Cumulative	Check
				Observed TT	Modelled TT	Observed TT	Modelled TT						Observed TT	Modelled TT	Observed TT	Modelled TT					
7	Lane Cove Rd	0.00	0.0	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00		00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	
6	Khartoum Rd	0.65	0.6	00:01:57	00:01:50	00:01:57	00:01:50	00:01:39	00:02:14	00:01:32	00:02:31	Pass	00:02:03	00:02:07	00:02:03	00:02:07	00:01:45	00:02:22	00:01:33	00:02:38	Pass
5	Alma Rd	0.38	1.0	00:01:50	00:00:55	00:03:46	00:02:45	00:03:12	00:04:20	00:02:09	00:05:37	Pass	00:01:03	00:00:59	00:03:07	00:03:06	00:02:39	00:03:35	00:02:18	00:04:56	Pass
4	Herring Rd	0.17	1.2	00:00:29	00:00:24	00:04:16	00:03:09	00:03:37	00:04:54	00:02:22	00:06:23	Pass	00:00:22	00:00:26	00:03:29	00:03:31	00:02:57	00:04:00	00:02:38	00:05:43	Pass
3	Christie Rd	0.25	1.4	00:00:21	00:00:28	00:04:36	00:03:37	00:03:55	00:05:18	00:02:41	00:06:45	Pass	00:00:21	00:00:27	00:03:50	00:03:58	00:03:15	00:04:24	00:02:56	00:06:10	Pass
2	Research Park Pl	0.16	1.6	00:00:22	00:00:14	00:04:59	00:03:51	00:04:14	00:05:43	00:03:00	00:07:11	Pass	00:00:18	00:00:13	00:04:07	00:04:11	00:03:30	00:04:44	00:03:09	00:06:33	Pass
1	Culloden Rd	0.63	2.2	00:01:00	00:00:50	00:05:58	00:04:40	00:05:05	00:06:52	00:03:54	00:08:16	Pass	00:01:00	00:00:50	00:05:07	00:05:01	00:04:21	00:05:53	00:04:00	00:07:38	Pass
	Total	2.23		00:05:58	00:04:40							Fail	00:05:07	00:05:01							Pass

Lanecove Road NB																					
	Survey Start Locations	Distances (km)	Cumulative Distance (km)	Hr1		Hr1 Cumulative		Cumulative Hr1 -15%	Cumulative Hr1 +15%	Hr 1 Min Cumulative	Hr 1 Max Cumulative	Check	Hr2		Hr2 Cumulative		Cumulative Hr2 -15%	Cumulative Hr2 +15%	Hr 2 Min Cumulative	Hr 2 Max Cumulative	Check
				Observed TT	Modelled TT	Observed TT	Modelled TT						Observed TT	Modelled TT	Observed TT	Modelled TT					
1	Epping Rd	0.00	0.0	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00		00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	
2	Waterloo Rd	0.33	0.3	00:00:47	00:01:02	00:00:47	00:01:02	00:00:40	00:00:54	00:00:25	00:02:01	Pass	00:01:42	00:01:04	00:01:42	00:01:04	00:01:27	00:01:57	00:00:41	00:02:27	Pass
3	Lanecove Rd	0.36	0.7	00:01:16	00:01:20	00:02:03	00:02:22	00:01:44	00:02:21	00:00:50	00:04:22	Pass	00:01:47	00:02:16	00:03:29	00:03:20	00:02:58	00:04:00	00:01:46	00:04:57	Pass
	Total	0.69		00:02:03	00:02:22							Pass	00:03:29	00:03:20							Pass

Lanecove Road SB																					
Survey Start Locations		Distances (km)	Cumulative Distance (km)	Hr1		Hr1 Cumulative		Cumulative Hr1 -15%	Cumulative Hr1 +15%	Hr 1 Min Cumulative	Hr 1 Max Cumulative	Check	Hr2		Hr2 Cumulative		Cumulative Hr2 -15%	Cumulative Hr2 +15%	Hr 2 Min Cumulative	Hr 2 Max Cumulative	Check
				Observed TT	Modelled TT	Observed TT	Modelled TT						Observed TT	Modelled TT	Observed TT	Modelled TT					
3	Lanecove Rd	0.00	0.0	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00		00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	
2	Waterloo Rd	0.36	0.4	00:01:08	00:01:13	00:01:08	00:01:13	00:00:58	00:01:18	00:01:00	00:01:24	Pass	00:02:05	00:01:22	00:02:05	00:01:22	00:01:46	00:02:23	00:01:00	00:02:48	Pass
1	Epping Rd	0.33	0.7	00:01:49	00:01:08	00:02:57	00:02:21	00:02:30	00:03:23	00:02:31	00:03:50	Pass	00:01:22	00:01:58	00:03:27	00:03:20	00:02:56	00:03:58	00:01:26	00:04:43	Pass
	Total	0.69		00:02:57	00:02:21							Pass	00:03:27	00:03:20							Pass

Herring Road NB																					
Survey Start Locations		Distances (km)	Cumulative Distance (km)	Hr1		Hr1 Cumulative		Cumulative Hr1 -15%	Cumulative Hr1 +15%	Hr 1 Min Cumulative	Hr 1 Max Cumulative	Check	Hr2		Hr2 Cumulative		Cumulative Hr2 -15%	Cumulative Hr2 +15%	Hr 2 Min Cumulative	Hr 2 Max Cumulative	Check
				Observed TT	Modelled TT	Observed TT	Modelled TT						Observed TT	Modelled TT	Observed TT	Modelled TT					
1	Epping Rd	0.00	0.0	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00		00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	
2	Ivanhoe Pl	0.19	0.2	00:00:19	00:00:29	00:00:19	00:00:29	00:00:16	00:00:22	00:00:13	00:00:33	Pass	00:00:23	00:00:32	00:00:23	00:00:32	00:00:20	00:00:26	00:00:15	00:00:37	Pass
3	Windsor Dr	0.12	0.3	00:00:08	00:00:10	00:00:27	00:00:38	00:00:23	00:00:31	00:00:21	00:00:45	Pass	00:00:09	00:00:10	00:00:32	00:00:42	00:00:27	00:00:36	00:00:22	00:00:47	Pass
4	Waterloo Rd	0.24	0.5	00:01:11	00:01:15	00:01:38	00:01:54	00:01:24	00:01:53	00:00:40	00:02:58	Pass	00:00:52	00:01:12	00:01:23	00:01:54	00:01:11	00:01:36	00:00:41	00:03:02	Pass
5	Talavera Rd	0.34	0.9	00:01:01	00:01:12	00:02:40	00:03:05	00:02:16	00:03:04	00:01:10	00:04:22	Pass	00:01:15	00:01:05	00:02:39	00:02:59	00:02:15	00:03:02	00:01:27	00:04:47	Pass
	Total	0.89		00:02:40	00:03:05							Pass	00:02:39	00:02:59							Pass

Herring Road SB																					
Survey Start Locations		Distances (km)	Cumulative Distance (km)	Hr1		Hr1 Cumulative		Cumulative Hr1 -15%	Cumulative Hr1 +15%	Hr 1 Min Cumulative	Hr 1 Max Cumulative	Check	Hr2		Hr2 Cumulative		Cumulative Hr2 -15%	Cumulative Hr2 +15%	Hr 2 Min Cumulative	Hr 2 Max Cumulative	Check
				Observed TT	Modelled TT	Observed TT	Modelled TT						Observed TT	Modelled TT	Observed TT	Modelled TT					
5	Talavera Rd	0.00	0.0	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00		00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	
4	Waterloo Rd	0.32	0.3	00:02:08	00:01:21	00:02:08	00:01:21	00:01:48	00:02:27	00:01:13	00:03:23	Pass	00:01:41	00:01:16	00:01:41	00:01:16	00:01:26	00:01:56	00:01:11	00:02:16	Pass
3	Windsor Dr	0.24	0.6	00:00:19	00:00:18	00:02:27	00:01:39	00:02:05	00:02:49	00:01:29	00:03:46	Pass	00:00:21	00:00:18	00:02:02	00:01:34	00:01:44	00:02:21	00:01:29	00:02:38	Pass
2	Ivanhoe Pl	0.11	0.7	00:00:18	00:00:24	00:02:45	00:02:03	00:02:20	00:03:10	00:01:36	00:04:18	Pass	00:00:26	00:00:28	00:02:29	00:02:02	00:02:06	00:02:51	00:01:36	00:03:10	Pass
1	Epping Rd	0.19	0.9	00:01:04	00:01:32	00:03:49	00:03:35	00:03:15	00:04:24	00:01:52	00:05:55	Pass	00:00:49	00:01:28	00:03:18	00:03:30	00:02:48	00:03:47	00:01:50	00:04:32	Pass
	Total	0.86		00:03:49	00:03:35							Pass	00:03:18	00:03:30							Pass



NSW GOVERNMENT