MELROSE PARK

TRANSPORT MANAGEMENT AND ACCESSIBILITY PLAN

Final Report

24 JANUARY 2019

CONTENTS

Jacobs Group (Australia) Pty Limited
ABN 37 001 024 095
Level 7, 177 Pacific Highway
North Sydney NSW 2060 Australia

PO Box 632 North Sydney
NSW 2059 Australia

T +61 2 9928 2100
F +61 2 9928 2500

www.jacobs.com

JACOBS

CONTENTS

Figures

Tables

REVISION	DATE	DESCRIPTION	BY	REVIEW	APPROVED
A	09/05/2018	Draft submittal	C. Arkell	S. Konstas	S. Konstas
B	31/10/2018	Updated based on govt agency comments	C. Arkell	I. Smith	I. Smith
C	07/12/2018	Final report	C. Arkell	I. Smith	I. Smith
D	24/01/2019	Updated based on additional TfNSW comments	C. Arkell	I. Smith	I. Smith

EXECUTIVE SUMMARY

JACOBS

EXECUTIVE SUMMARY

Background

Jacobs Group (Australia) Pty Ltd has been engaged to prepare a Transport Management Accessibility Plan (TMAP) for the Melrose Park north and south precincts. This report addresses the traffic and transport implications of the proposed development of approximately 11,000 dwellings and has been tailored specifically to address stakeholder comments through the Project Coordination Group (PCG) made up by City of Parramatta (CoP), Department of Planning & Environment (DPE), Transport for NSW, Roads and Maritime (RMS), Parramatta Light Rail (PLR), mProjects, and City plan.

The TMAP has recognised the transport planning initiatives described in the *Greater Sydney Regional Plan* and *Future Transport Strategy 2056* developed by DPE and TfNSW respectively. The purpose of the TMAP is to provide a framework for the implementation of a range of measures designed to achieve a sustainable transport outcome for the Melrose Park structure plan.

The assessment process has included analysis focused around achieving the targets defined with the PCG of encouraging more people to use public transport (40%-50%) over the next 20 years. Initiatives to increase public transport use have guided the planning process for the Melrose Park structure plan and are fundamental to the development of the precinct.

Proposed Delivery Melrose Park Structure Plans

The aspiration of the Melrose Park structure plans is to develop a smart precinct minimising natural resource, energy and transport demands. Transport demand and infrastructure requirements are to be minimised through an appropriate balance of business, housing and employment uses within the precinct and wider Greater Parramatta and Olympic Peninsula (GPOP) targeting of strategic mass transit, intermediate transit and local transit connections proposed through the core of the development.

The land use mix will support an appropriate balance of residential, social and business opportunities. This is to support Melrose Park's role as a self-sufficient smart precinct with high levels of connectivity to its regional and wider contexts.

A multi-decade development framework has been proposed to enable development flexibility and to complement future transport initiatives planned within the study area. For the purposes of assessing the transport infrastructure and service requirements the following staging elements have been examined:

- 3,200 dwellings to be developed by 2024
  - Commercial 7,900 m² GFA
  - Retail 6,000 m² GFA
- 6,700 dwellings to developed by 2028
  - Commercial 13,500 m² GFA
  - Retail 10,200 m² GFA
- 11,000 dwellings full build-out by 2036
  - Commercial 19,400 m² GFA
  - Retail 15,600 m² GFA

The Melrose Park structure plans for the north and south precincts ensures that public transport and active transport will be fully integrated into the precinct.

Key Issues Examined

The TMAP assessment has used a set of transport modelling tools (Public Transport Project Model and Aimsun Model) developed to assist decision making on key issues such as:

- The nature and scale of the development and the ability of the road and public transport network to accommodate forecast additional demands
- The cumulative impacts of future developments and forecast background growth in travel demand within the study area
- Changes in transport infrastructure and services that will satisfy the target objectives of increasing travel by alternative modes other than car
- The level of investment required in public transport initiatives to achieve the targets and visions of *Future Transport Strategy 2056*
- The relationship between parking provision and the achievement of higher mode share to public transport, cycling and walking
- The overall staging and trigger points for proposed mitigation measures attributed to Melrose Park.

Key Findings

The key findings of the investigations undertaken as part of TMAP are as follows:

- Based on the nominated service levels for the surrounding road network, the upgrade of Victoria Road intersections (Wharf Road and Kissing Point Road) will be required in order to efficiently service the Melrose Park precinct
- The road network analysis has identified that the remainder of the existing surrounding road network is able to cater for traffic generated by the proposed development, with no significant impacts when compared to a future 'do minimum' scenario
- Increased bus service frequencies on Victoria Road are required to support development and achieve mode share targets. Investigations have confirmed the required bus service levels are feasible
- A new bridge crossing (public and active transport only) across the Parramatta River linking Melrose Park to Wentworth Point is required by 2028 (approximately 6,700 dwellings) to enable connections between residential and employment areas to key public transport nodes including the planned Sydney Metro West station at Sydney Olympic Park.
- New bus services between Top Ryde and Concord Hospital via Melrose Park are proposed to operate via the new bridge
- Shuttle services between Melrose Park and Meadowbank station are proposed to operate prior to the implementation of the new bridge. Proposed operations can be implemented without signifcant works or impacts
- Ferry user patronage demand from Melrose Park is likely to be small. A new bridge across the Parramatta River will provide access to the newly-upgraded Sydney Olympic Park and proposed new ferry wharf at Rhodes East
- As development progresses and activity increases, a light rail corridor is being proposed by TfNSW established through the core of the development. This would bring light rail services through the heart of Melrose Park with direct access to the proposed Sydney Metro West station at Olympic Park
- The introduction of PLR Stage 2 leads to a number of access implications along Boronia Street, Hope Street and Waratah Street which will need to be carefully managed
- The public transport network for Melrose Park has been planned to cater for the full development (11,000 dwellings) without the need for light rail but has been planned to accommodate light rail through the precinct
- The northern precinct structure plan maintains a corridor on Hope Street between Hughes Avenue and Waratah Street to enable the implementation of light rail. The southern precinct allows for light rail along Waratah Street.
- Key elements of Stage 1 - Prior to bridge (up to 6,700 dwellings:
  - Stage 1A, Stage 1B and Stage 1C Victoria Road upgrades
  - Enhanced Victoria Road bus services to serve both background growth and Melrose Park demand
  - Shuttle services to Meadowbank Station
- Key elements of Stage 2 - After new bridge (more than 6,700 dwellings)
  - New high frequency services (bus or light rail) over the bridge
  - Continued enhancement of Victoria Road bus services

Conclusions

The key conclusions of the Melrose Park TMAP are:

- The scale of development envisaged for Melrose Park presents significant but manageable challenges for transport infrastructure and services for both the road and public transport network
- The additional traffic demands as a result of Melrose Park development on the surrounding local road network fall within acceptable capacity thresholds
- Sydney Metro West will deliver significant benefits for residents from Melrose Park with high-capacity and more frequent services between Parramatta CBD, Sydney Olympic Park and Sydney CBD
- A new active and public transport bridge across Parramatta River will provide substantial connectivity improvements between Melrose Park, Rhodes and Sydney Olympic Park before light rail is implemented
- The increased frequency of the T1 Northern Line (to 8 services per hour) will provide capacity to support the development and will continue once Sydney Metro North West opens in 2019
- Parramatta Light Rail Stage 2 would provide a direct link to the Parramatta CBD, and connect to Sydney CBD via the broader rail and metro networks
- The new bridge across Parramatta River will provide fast, direct, high frequency services linking Melrose Park to Rhodes Station and future metro station at Sydney Olympic Park. The full development (11,000 dwellings) can be supported by either bus or light rail services across the bridge.
- Substantial resources will need to be devoted to improving the public transport servicing and infrastructure in the study area, with significant support and funding contributions from the various agencies, proponents and authorities
- An integrated package of measures needs to be implemented as the development progresses, with the package containing a mix of policy, infrastructure and transport services measures
- The measures presented within the TMAP need to be integrated comprehensively and consistently over the life of the development if the mode split targets as outlined in the TMAP are to be achieved.
- The TMAP recommends a total off-street parking supply of 9,441. A total on-street parking supply of approximately 700 and 500 spaces is being proposed for the northern and southern precincts respectively. It is proposed to initially provide levels of parking in accordance with CoP DCP, and gradually decrease parking provision as the public transport initiatives are implemented.

1. INTRODUCTION

JACOBS

1. INTRODUCTION

1.1 Background

Melrose Park is located along the northern banks of the Parramatta River, 6km east of the Parramatta CBD and north east of the Greater Parramatta and Olympic Peninsula Urban Renewal Area (GPOP). The existing industrial area in Melrose Park has been proposed to be rezoned to enable large scale urban renewable and create a mixed use development featuring housing, commercial offices, retail space and community facilities. Melrose Park will include approximately 11,000 dwellings in a high density residential environment interspersed with retail, community and child care uses, and a mixed use Town Centre providing retail, commercial, community, a child care centre, affordable housing and plaza spaces.

In order to assist in the planning and rezoning of this precinct, this Transport Management and Accessibility Plan (TMAP) has been prepared. The recommendations of the TMAP will inform both the rezoning and the voluntary planning agreement process for Melrose Park to determine the ability of the transport network to cope with additional growth, and the improvements required to realise the development potential of Melrose Park.

An analysis of the regional context of the site has identified the following key considerations:

- The site at Melrose Park is located on and adjacent to the Global Economic Corridors to Parramatta and Sydney Olympic Park
- The eastern edge of the site forms the boundary between the Parramatta LGA and the Ryde LGA (Wharf Road)
- The site is located directly on the proposed corridor of Parramatta Light Rail Stage 2, which will provide a direct connection to Parramatta CBD. PLR Stage 2 will also connect to Sydney Olympic Park where significant development is planned along with a station for the future Sydney Metro West
- Surrounding remnant industrial sites at Camellia, Carter Street and Wentworth Point have been identified by the State Government as Priority Precincts for Urban Renewal and Urban Transformation
- The region contains an excellent network of Regional Parks and open spaces that traverse the banks of the Parramatta River.

The site at Melrose Park presents:

- A close proximity to Parramatta CBD a major economic centre, with strong commercial, living and cultural precincts with the single biggest concentration of jobs outside of Sydney CBD and North Sydney CBD
- A range of complementary land uses and community services that will be provided from the beginning of the development
- A mix of land uses will be created for Melrose Park to become an emerging, vibrant and attractive place to live, work, play and stay
- An integrated transport system comprising an interconnected, legible and urban scale grid street pattern providing a pedestrian and cycling friendly environment to provide optimal opportunities for bus, future light rail and connections to existing heavy railway transport interchanges and future metro through the core of the development
- A significant opportunity for urban renewal that has excellent access to the amenity of the Parramatta River and its associated network of regional parks and open space.

1.2 Purpose of this TMAP

The overall objective of the TMAP is to identify the local and regional impacts to the transport network as a result of approximately 11,000 dwellings at Melrose Park and to outline strategies and mitigations to ameliorate these impacts. The TMAP also aims to:

- Address movement to, from and within Melrose Park in a sustainable manner
- Ensure the provision of infrastructure and services will satisfy the forecast growth in travel demand generated by Melrose Park and is consistent with those planned for the wider region, taking into consideration potential development staging
- Present an integrated transport system that integrates all travel modes with a focus on encouraging the use of public transport, walking and cycling
- Ensure the development integrates seamlessly with the surrounding street environment
- Determine the changes in transport infrastructure that will satisfy the target objectives of more travel by alternative non car modes
- Examine the relationship between parking provision and the achievement of higher mode share to public transport, cycling and working
- Prepare a multi-modal transport network and services action plan including staging and trigger points of infrastructure upgrades.

The TMAP has recognised the land use and transport planning initiatives described in recently released NSW Government policies and strategies such as the *Greater Sydney Regional Plan* and *Future Transport Strategy 2056*. The purpose of the TMAP is to provide a framework for the implementation of a range of measures designed to achieve a sustainable transport outcome for Melrose Park.

The assessment process has included analysis built around achieving the targets defined and agreed during the TMAP process in getting more people on public transport (40%-50%) over the next 20 years. These initiatives and their influence on Melrose Park have been assessed and refined in the planning process for the TMAP.

1.3 Melrose Park TMAP objectives

The main objective of the Melrose Park structure plans is to achieve new standards of integration between land uses and public transport. Improved integration will be achieved by allowing higher development densities and clusters of different land uses together around public transport nodes and corridors, such as around existing Victoria Road bus corridor and future high-quality light rail corridor along Hope Street as part of PLR Stage 2. By allowing higher densities and a greater mix of land uses, including local employment, destinations are closer together, reducing travel distances. Higher densities in residential areas would also reduce land consumption, promote walking, support public transport services and reduce car use.

Transport infrastructure and services to support the development will need to be carefully planned and implemented to ensure an optimal outcome is achieved for future residents and the wider community. Potential issues that could arise as a result of poor planning and implementation have been identified and specific objectives formulated in response. These key objectives as determined with the Melrose Park Project Coordination Group (PCG) have guided the development of the TMAP and can also be used to measure the overall success of the northern and southern precincts in the future.

The potential issues and objectives set out in Table 1.1 highlight the requirements for regional transport improvements that could be made in GPOP and the surrounding area. The recently released *Greater Sydney Regional Plan* and *Future Transport Strategy 2056* are a number of NSW Government policies and strategies also identify and promote public transport improvements in and around GPOP that could deliver a number of benefits to Melrose Park. The relationship between these policies and Melrose Park is discussed further in Section 2 of this report.

Table 1.1 : Melrose Park Objectives

Potential issue	Objective	Indicator
A lack of feasible non-car access to/from the precinct leading to high car use and congestion	Encourage access by public transport, walking and cycling to reduce car dependence	Non-car mode share for peak trips to and from Melrose Park of 50% by 2036.
Limited options for travel between Melrose Park and strategic destinations, reducing the resilience and reliability of the transport network	Provide multiple transport options connecting to a variety of local and strategic destinations	30 minute travel time access by public and active transport to key metropolitan and strategic centres to and from Melrose Park by 2036.
A large number of residents being forced to travel long distances by car to access jobs and services.	Support a walkable urban environment with opportunities to work and play close to home	All new residents in Melrose Park are within a safe walking distance of open space, social infrastructure and retail facilities.
Excessive levels of car parking encouraging car use and ownership and inducing large volumes of car trips.	Support public and active transport through reducing private car parking and ownership	A reduction in residential parking provision from current parking requirements by 2036.
Trips generated by the development negatively impacting on regionally significant corridors adjacent to the precinct.	Minimise impacts to productive regional movement corridors	Travel times along Victoria Road (within model area) do not increase by greater than 5% compared to a 2036 base case scenario. Key precinct signalised intersections perform at LOS E or better in highest impact peak hour.
Insufficient new capacity is supplied to allow for and encourage non car travel.	Provide capacity to support a sustainable level of transport demand and cater for local access needs	Volume/capacity ratios on key public transport corridors directly impacted by the development are not detrimentally increased compared to a 2036 base case scenario.

1.4 Melrose Park TMAP study area

Figure 1.1 shows the Study Area adopted for this TMAP. The Study Area includes the Melrose Park northern and southern precincts and the area bordered by Stewart Street and Rutledge Street to the north; Church Street/Devlin Street to the east; Silverwater Road to the west and Parramatta River to the south. Consideration of physical issues such as interfaces with land use and the surrounding transport system are contained within the Study Area whereas considerations such as travel desire lines, trip distribution, demand and network capacity are considered beyond the Study Area.

1.5 Scope and limitations

As is normal in such studies, the scope of this work entails a number of assumptions and limitations. The TMAP does not aim to describe every aspect as the majority of the precinct is still in the planning proposal stage. Further detail will need to be provided as part of the development application and voluntary planning agreement process. The main assumptions and limitations include:

- Limits in the certainty of many key inputs to the public transport planning process such as the delivery of PLR Stage 2, Sydney Metro West and upgrades along T1 Northern Line
- The assumptions of rate and timing of development were provided by proponents for the northern and southern precincts and are understood to represent the current plans for Melrose Park
- In assessing the transport infrastructure needs, it has been assumed that access to Melrose Park will be facilitated in 2020, 2026 and 2036 to allow the requisite levels of transport infrastructure and services to match development and transport demands
- The interface between light rail and traffic in general requires significant further investigation and detailed traffic modelling. This is currently being investigated by TfNSW's PLR Stage 2 team
- The TMAP does not consider the detailed traffic and transport impacts associated with the operation of PLR Stage 2. The modelling has assessed the elimination of non-signalised right turns across the light rail alignment. Left-in/left-out movements have been assumed at remaining minor intersections
- Planned modifications to bus services as a result of PLR Stage 2 has been cursory and requires further work to understand and plan for the effective integration between bus and light rail across GPOP
- Indicative light rail layouts and stop locations for Hope Street (between Hughes Avenue and Waratah Street) have not been developed as part of the TMAP. This is currently being investigated by TfNSW's PLR Stage 2 team
- The impact of services and utilities on all the proposed mitigation measures may require further and more detailed examination
- Improvements to intersections at Devlin Street, Blaxland Road and Parkes Street were announced after the finalisation of future network assumptions for the project and have not been included in this modelling. Observed congestion in future traffic modelling at this location is likely to be significantly improved by these works.

1.6 Stakeholder engagement – process and key input

As part of this TMAP, regular consultation was undertaken with the City of Parramatta, and with other key stakeholders such as Department of Planning & Environment, Transport for NSW (TfNSW) and Roads and Maritime Services (RMS) through a series of meetings and workshops.

During the TMAP process a formal Project Coordination Group (PCG) consisting of representatives listed below was established to oversee the key project assumptions, strategic land use and transport outcomes, planning timeframes, assess available evidence and model development. The members of the PCG met at least once a month to monitor the progress and provide technical expertise, advice, support and direction as necessary to the TMAP process. The PCG comprised the following key stakeholders:

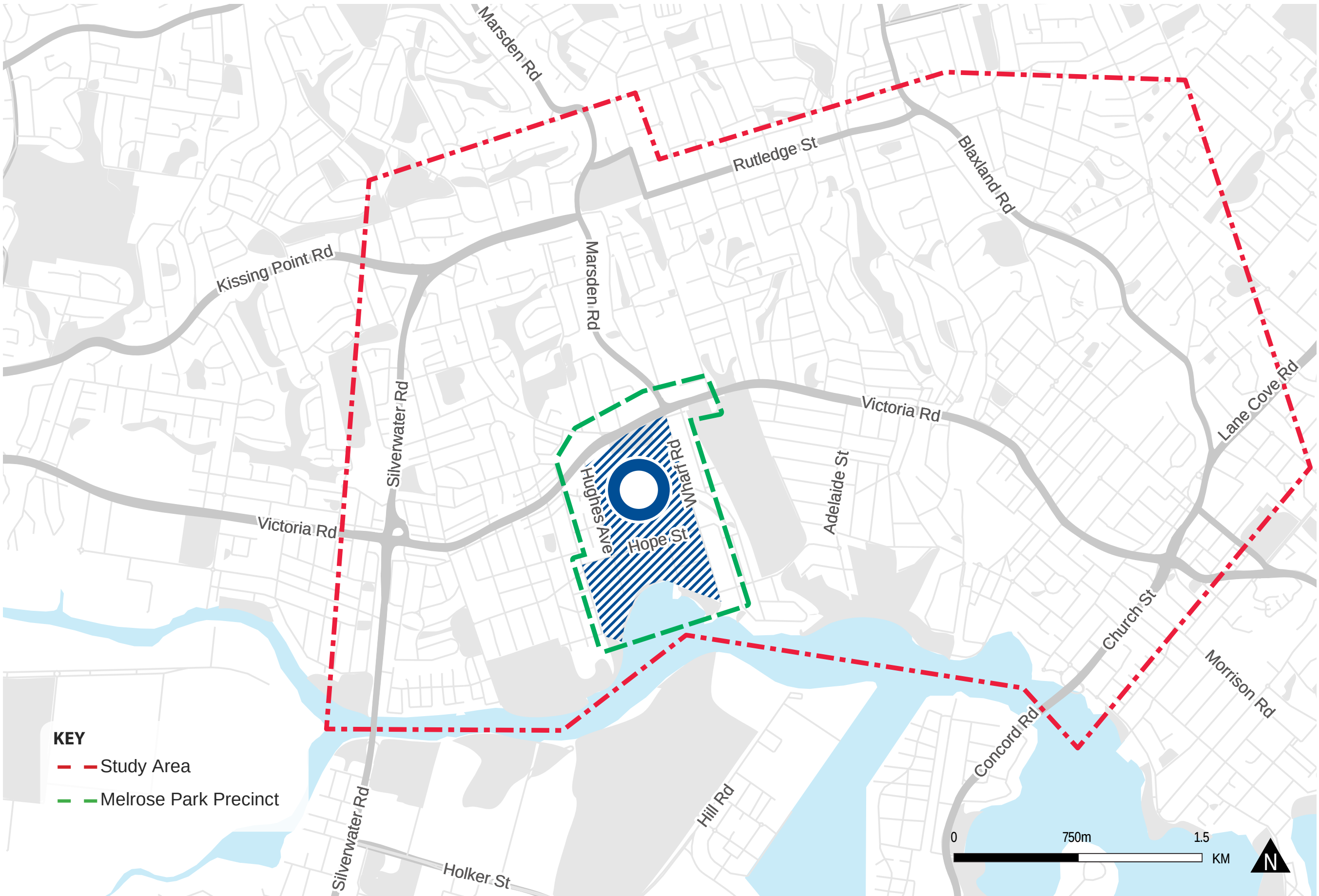
- Department of Planning & Environment (Chair)
- Greater Sydney Commission
- Transport for NSW
- Roads and Maritime Services
- Parramatta Light Rail Stage 1 and 2
- City of Parramatta
- mProjects (on behalf of Payce)
- Keyplan
- City Plan (on behalf of Holdmark and Goodman)

1.7 Report structure

This report is structured as follows:

- **Section 2: Strategic Context:** this brings together and summarises the background information and defines the physical context and transportation task affecting the study area
- **Section 3: Transport Context**: summarises the existing conditions of the study area and the future background conditions that will influence Melrose Park
- **Section 4: Melrose Park Structure Plans:** documents the planned land use proposed for Melrose Park and staging of the development
- **Section 5: Transport Modelling:** describes the transport modelling process as agreed with Transport for NSW, Roads and Maritime Services, Department of Planning and Environment and City of Parramatta
- **Section 6: Appraisal of the Melrose Park Structure Plans:** outlines the performance of the functional elements of the multi-modal transport network identified in the Melrose Park structure plans, and identifies infrastructure and service requirements to meet the desired standards of service
- **Section 7: Implementation Plan**: documents an integrated package of measures recommended to be implemented for Melrose Park.
- **Section 8: Conclusion and recommendations**: Summarises the key findings and outcomes of the TMAP.

Figure 1.1 : Melrose Park TMAP study area



2. STRATEGIC CONTEXT

JACOBS

2. STRATEGIC CONTEXT

2.1 Overview

This section reviews key NSW state and local government strategies and policies for land use and transport in and around Greater Parramatta Olympic Peninsula including Melrose Park. It provides a snapshot of the spatial planning and policy elements that may influence land use and transport outcomes for Melrose Park. This section presents an overview of the strategic land use and transport context and documents current and future land use and transport trends and projections.

2.1.1 Metropolitan and district context

Melrose Park is located 6km east of the Parramatta CBD which is in the geographic centre of the Sydney Metropolitan Region. With Parramatta identified as Sydney's second CBD, the region has an integral part to play in the provision of housing and jobs to Sydney.

The *Central District Plan* projects an additional 207,500 new dwellings and 210,000 new jobs by 2036. In the longer term, the district is projected to be home to up to over 2 million people and contain almost 1 million jobs by 2056. These projections are shown in Figure 2.1

The *Future Transport Strategy 2056* released in 2018 commits the NSW Government to a number of actions for improving transport to and within Parramatta CBD and Greater Parramatta Olympic Peninsula (GPOP). It is recognised that in its role as a CBD, the GPOP transport system must balance the need of all customers as well as align with current and future land use.

Melrose Park is surrounded by some of Greater Sydney's fastest growing strategic centres, presenting residents with significant employment options within close commute of home. The recently announced Sydney Metro West and Parramatta Light Rail Stage 2 project provides a unique opportunity to deliver a world-class transit system which can have a catalytic role in transforming Parramatta CBD and GPOP into a series of interconnected, sustainable and livable precincts. These public transport improvements provide an integrated transport and land use solution that is able to fully realise the benefits of the Parramatta CBD's multiple activity generators.

Melrose Park is strategically located to create strong synergies between the proposed light rail and future metro network and the economic activity centres of Parramatta CBD, Sydney CBD, Olympic Park, Macquarie Park, and Norwest. Current NSW Government policies and strategic directions will help shape a transport vision for Melrose Park which will include strengthened regional transport links, improved connectivity and sustainability.

Figure 2.2 presents Sydney's metropolitan transport network and its relationship with Melrose Park. The location of Melrose Park to GPOP presents a significant opportunity to deliver a strategy that will harness the multiple benefits of a sustainable regional transport system and a highly accessible urban form. The Melrose Park TMAP will assist in achieving a key aspect of the Metropolitan Strategy by strategically identifying a connected network of places that allow residents, workers and visitors to safely and efficiently access public transport improvements and surrounding land uses and amenities.

Figure 2.1 : Central District population and job growth

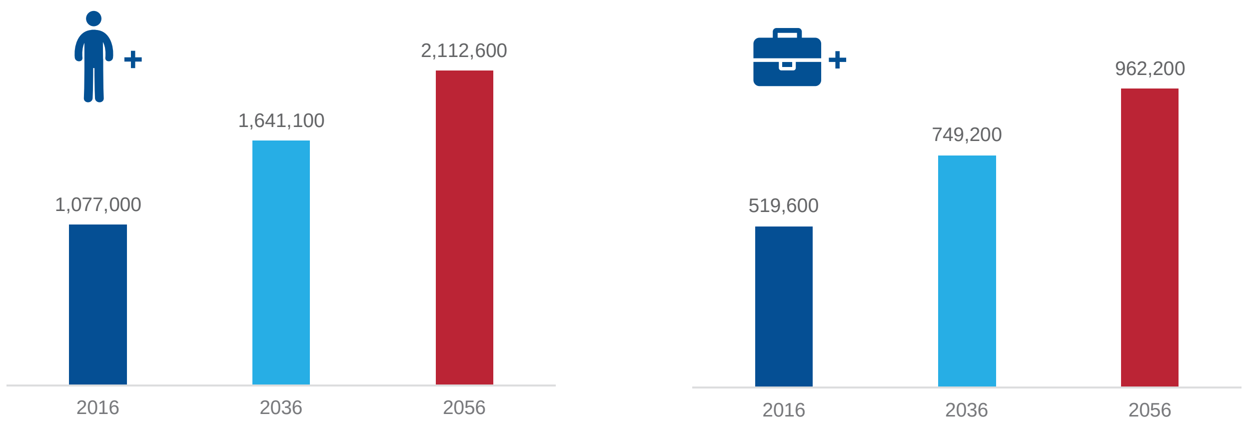
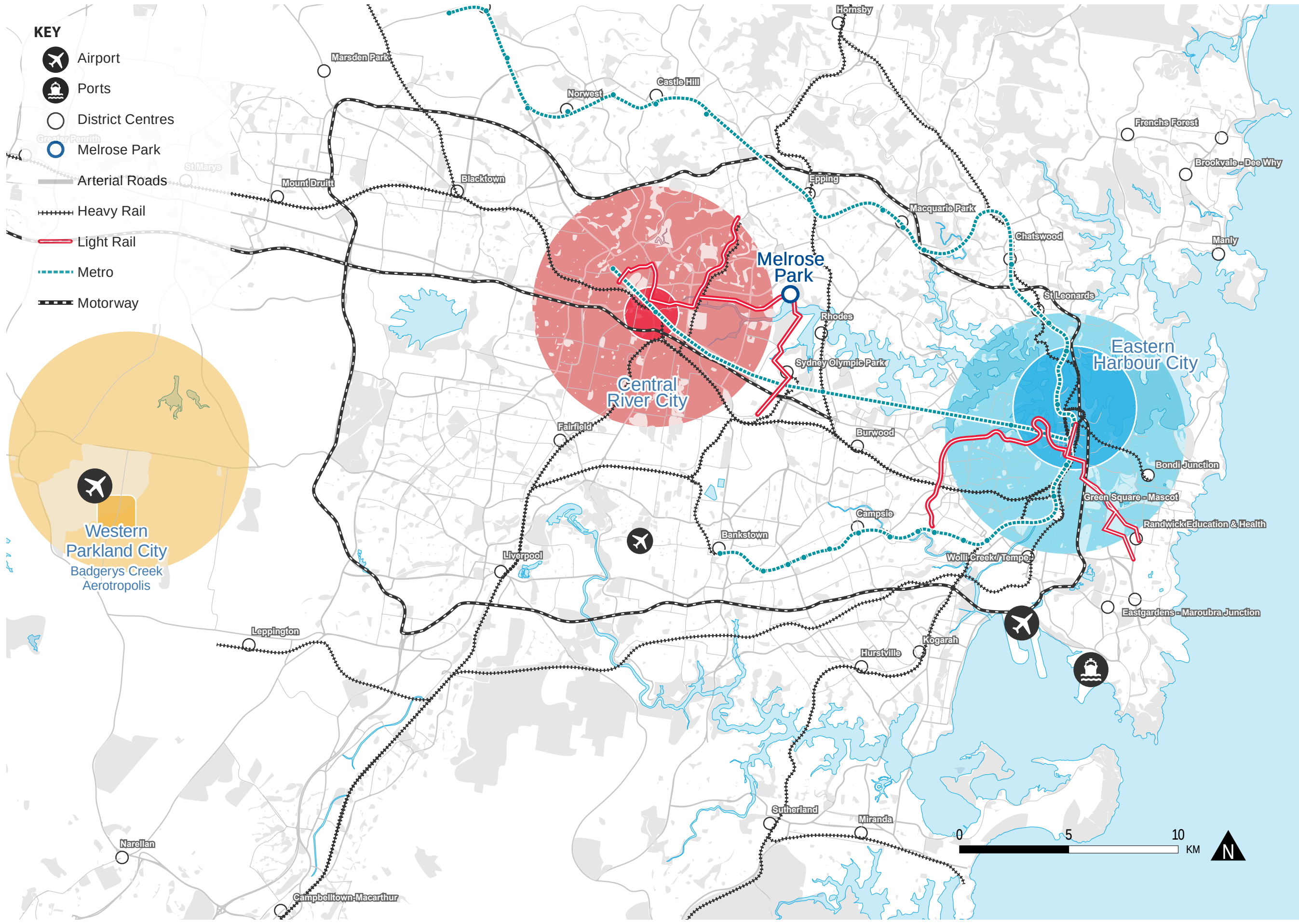


Figure 2.2 : Metropolitan and district context



2. STRATEGIC CONTEXT

2.2 GPOP context

Greater Parramatta Olympic Peninsula (GPOP) is comprised of the Parramatta CBD and several other distinct components including North Parramatta, Westmead, Rosehill Racecourse, Carter Street Activation Precinct, UWS Rydalmere, Sydney Olympic Park, Parramatta Road Urban Transformation, Rydalmere and Camellia industrial precincts. The Greater Sydney Commission has also recently included Melrose Park within the GPOP boundary. Many of these areas have been identified for potential redevelopment incorporating mixed use centres, which is expected to lead to increasing public and private sector investment in GPOP.

GPOP is at the heart of a second 'central' city, supported by a network of strategic centres including areas such as Melrose Park will become increasingly important as they work to help deliver the 30-minute city. Melrose Park sits within GPOP, and is surrounded by strategic and secondary employment and residential centres with significant public and private sector investment already underway.

Population and employment in GPOP are set to grow dramatically, putting more pressure on existing transport services and requiring major public transport improvements to the network. By 2056 there are planned to be an extra 370,000 residents and 200,000 jobs in GPOP. Forecast residential and employment growth for GPOP is shown in Figure 2.3.

The recently released *Future Transport Strategy 2056* shows that major investment such as Sydney Metro West and PLR Stage 2 via a new bridge across the Parramatta River will transform the surrounding area and GPOP including Melrose Park. Such transformation manifests itself as opportunities for best practice higher density developments that will attract residents looking for affordable housing in a centralised location with strong public transport links to Parramatta CBD and Sydney CBD within 30 minutes.

PLR Stage 1 will be introduced through the Parramatta CBD connecting the major educational and health facilities of Westmead and Rydalmere with provide faster and more frequent services. The recent announcement of PLR Stage 2 (refer to Figure 2.4) connecting Rydalmere to Melrose Park and Sydney Olympic Park will also make an important contribution to enhancing the sustainability of GPOP and improving its livability. PLR Stage 2 will play a positive role in stimulating urban renewal at Melrose Park connected by an integrated transport network to provide both housing and access to employment by connecting people and places.

JACOBS

Figure 2.3 : GPOP population and employment growth

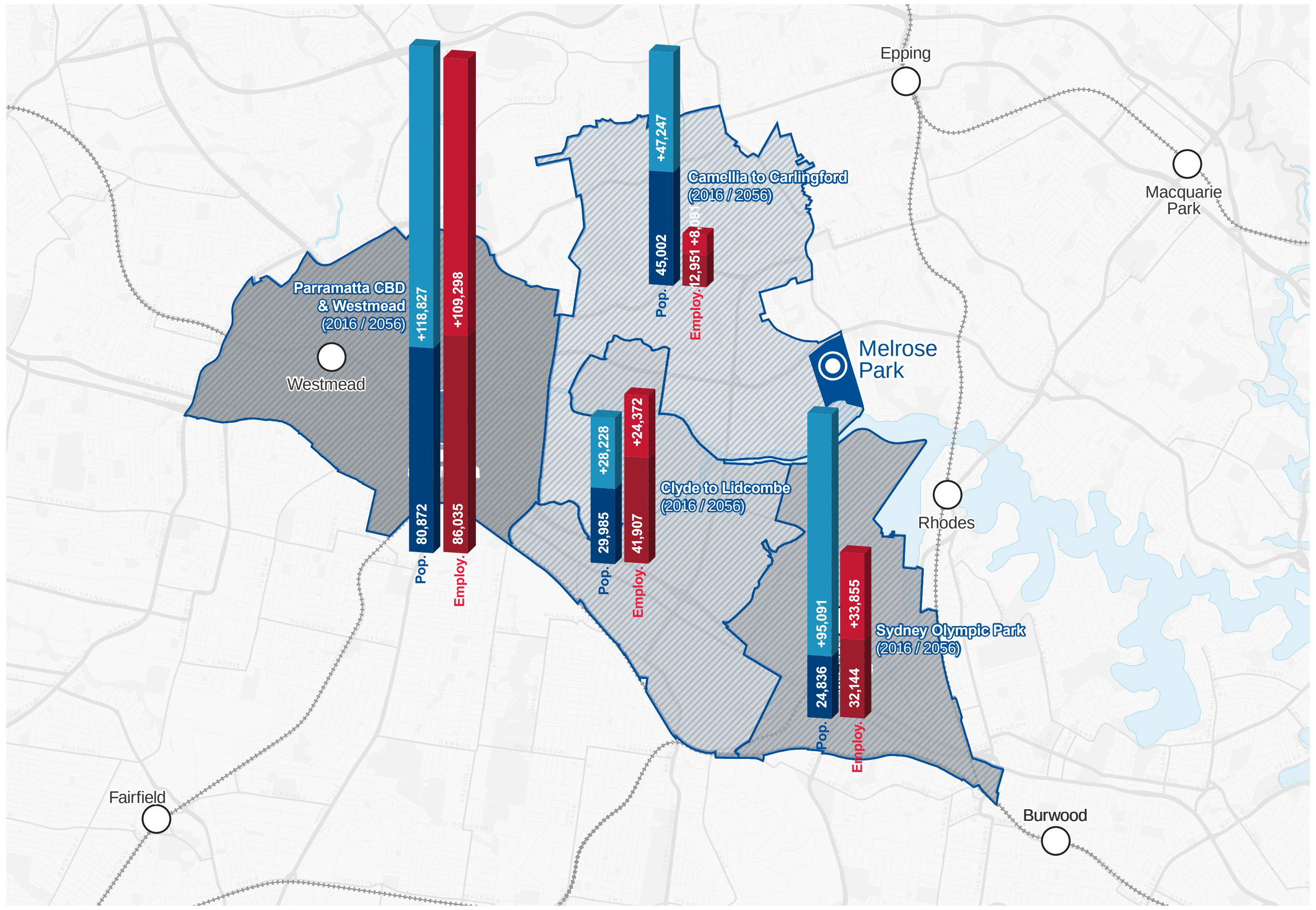
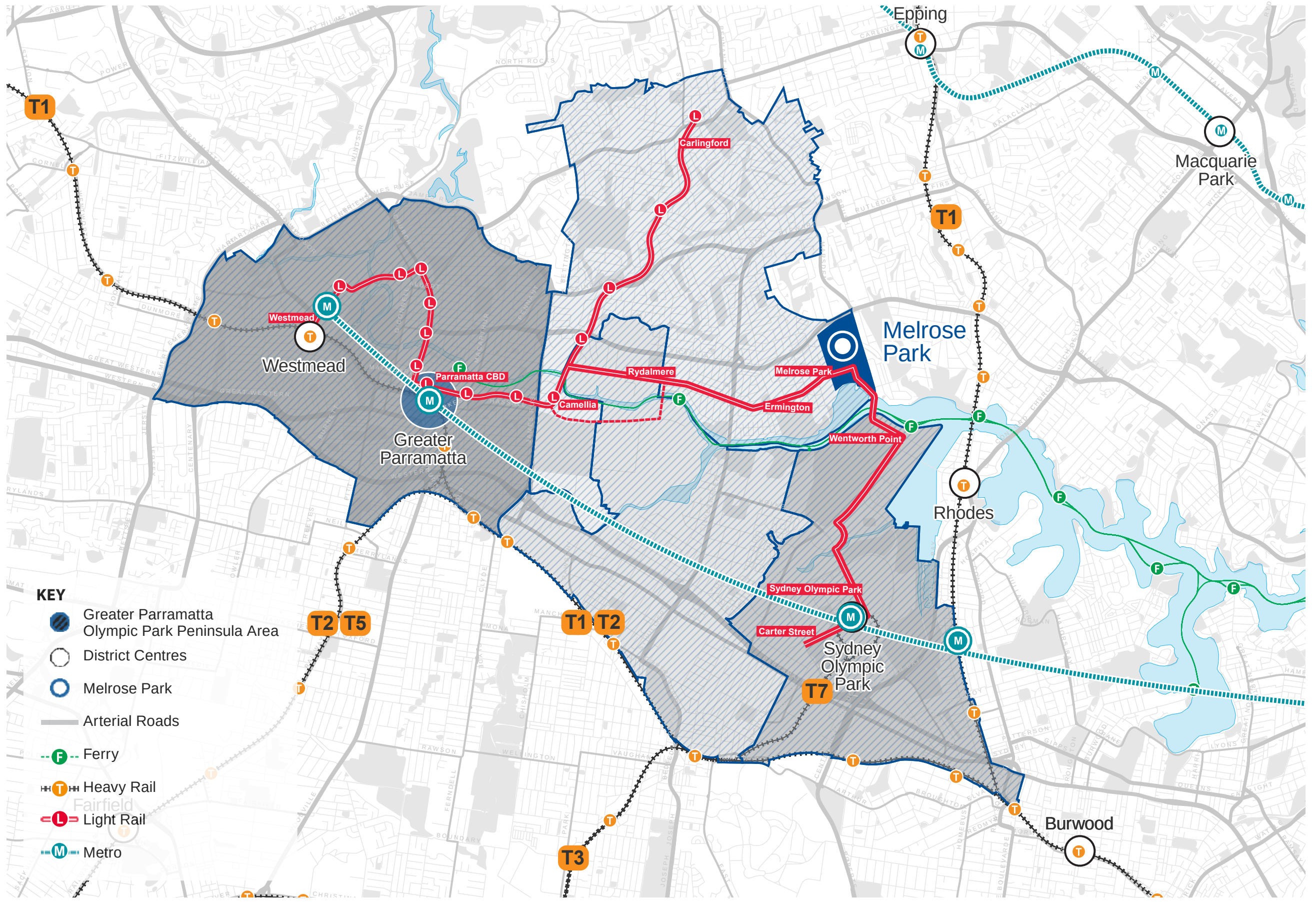


Figure 2.4 : GPOP context



2.3 Precinct and local context

Both the northern and southern Melrose Park precincts are located in an industrial site within an existing suburban area. The current block size (defined by the street network) is significantly larger than the block size commonly found in higher density urban areas. These large existing blocks present the opportunity for the street network layout proposed for the Melrose Park structure plan to connect well to the surrounding streets and offer good connectivity and permeability for the site. The blocks within the development are of a finer scale than the surrounding street areas and is further discussed in Section 4.

The Melrose Park precinct is well located in relation to several of Sydney's key strategic centres. The precinct incorporates effective connections to the transport system and provides good access to the Sydney CBD and key centres of economic activity across Sydney. A number of future public transport connections that would serve Melrose Park are planned or under investigation. The overall structure plan has been developed to facilitate and integrate with these opportunities if or when they are implemented. Some of these strategic corridors connecting the site include:

- Victoria Road
- Concord Road linking Ryde Bridge
- Connections to John Whitton Bridge
- Parramatta Light Rail Stage 2 connecting to Sydney Park via Melrose Park
- New bridge crossing across Parramatta River via Wharf Road (under investigation)

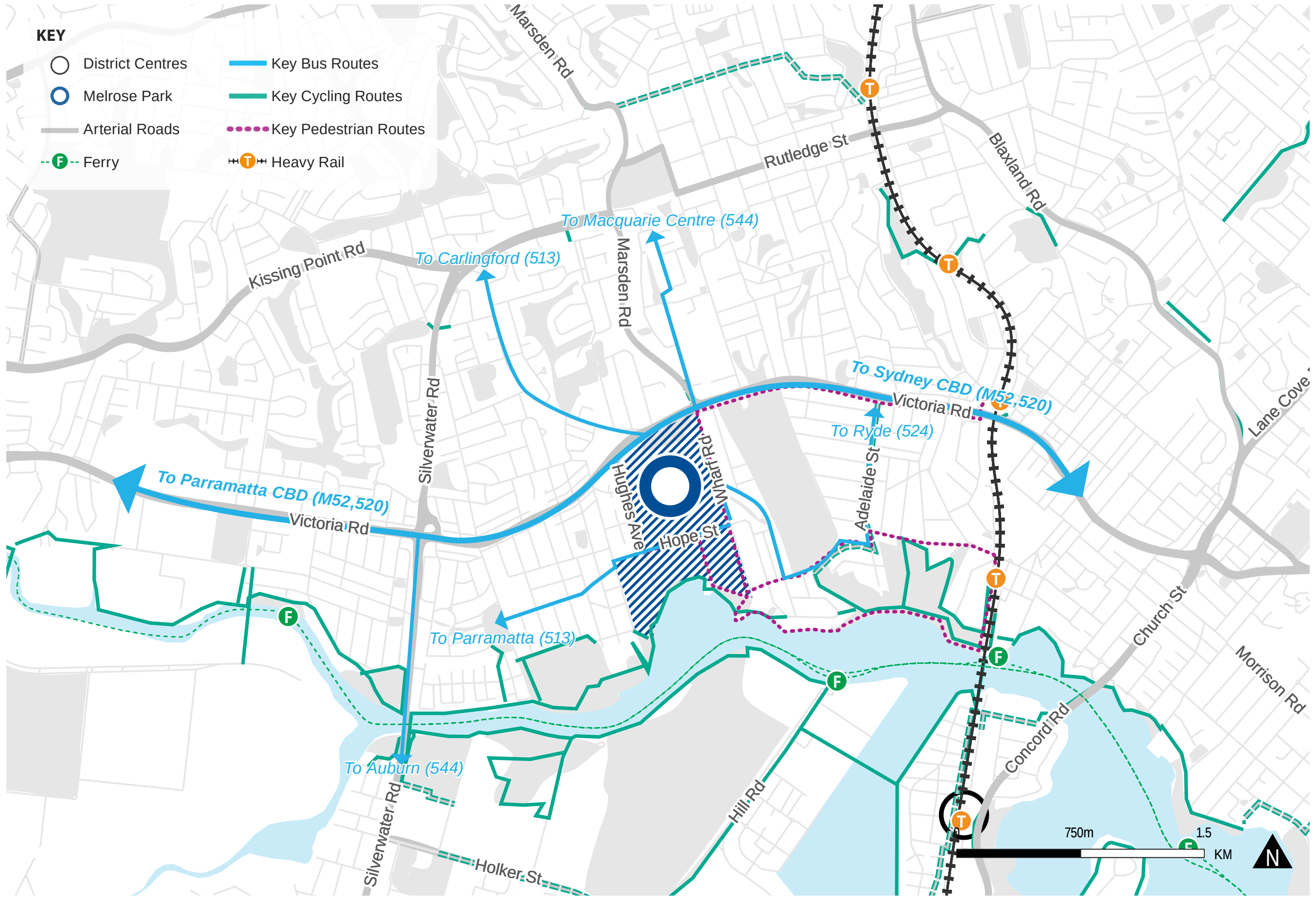
Major elements of the existing integrated transport network for the Melrose Park are shown in Figure 2.5. Key features of the network are outlined below:

- Trunk bus services between Parramatta CBD and Sydney CBD via Victoria Road are provided by the Route M52 and Route 520
- Key walking connections serving Melrose Park include Victoria Road, Hope Street, Adelaide Street, Hughes Avenue, Constitution Road West and Parramatta River Foreshore
- Key cycling routes serving Melrose Park include Parramatta River Foreshore, Andrew and Adelaide Streets, and bridges across Parramatta River (at Silverwater Road, Concord Road Street and John Whitton Bridge)
- Four key access corridors for general traffic serving destinations within Melrose Park include Victoria Road, Wharf Road, Hughes Avenue and Hope Street.

Melrose Park has a significant opportunity to raise the quality of sustainable transport as well as the built environment along and near the identified PLR Stage 2 corridor along Hope Street and Waratah Road, with a new bridge across Parramatta River connecting to a proposed new metro station at Sydney Olympic Park. The key to successfully implementing this city transformation project for the Melrose Park precinct is capitalising on opportunities created through carefully considered planning and urban design strategies along the Hope Street corridor in order to create a series of interconnected, sustainable and liveable precincts.

The enhanced public transport service with proximity to light rail stops and a potential new bridge across Parramatta River will encourage 'transit-oriented development', where the Melrose Park precinct urban design and built form can benefit from active transport links to public transport, whilst reducing the reliance on car access and parking in the medium to longer term.

Figure 2.5 : Major elements of existing network



2.4 Planning and policy context

The Commonwealth, State and Local Governments have recognised the importance of maintaining the economic growth and liveability within cities and urban areas, and have introduced a number of strategic plans to support future development within the Greater Sydney Metropolitan Area and GPOP. This section focuses on the most significant plans which shape the land use and transport context for Melrose Park. A summary of the key planning documents relevant to the Melrose Park, both regional and local, is provided in Table 2.1. They key output of TfNSW's *Future Transport Strategy 2056,* the proposed city-shaping and city-serving network, is shown in Figure 2.6.

Figure 2.6 : Future Transport 2056

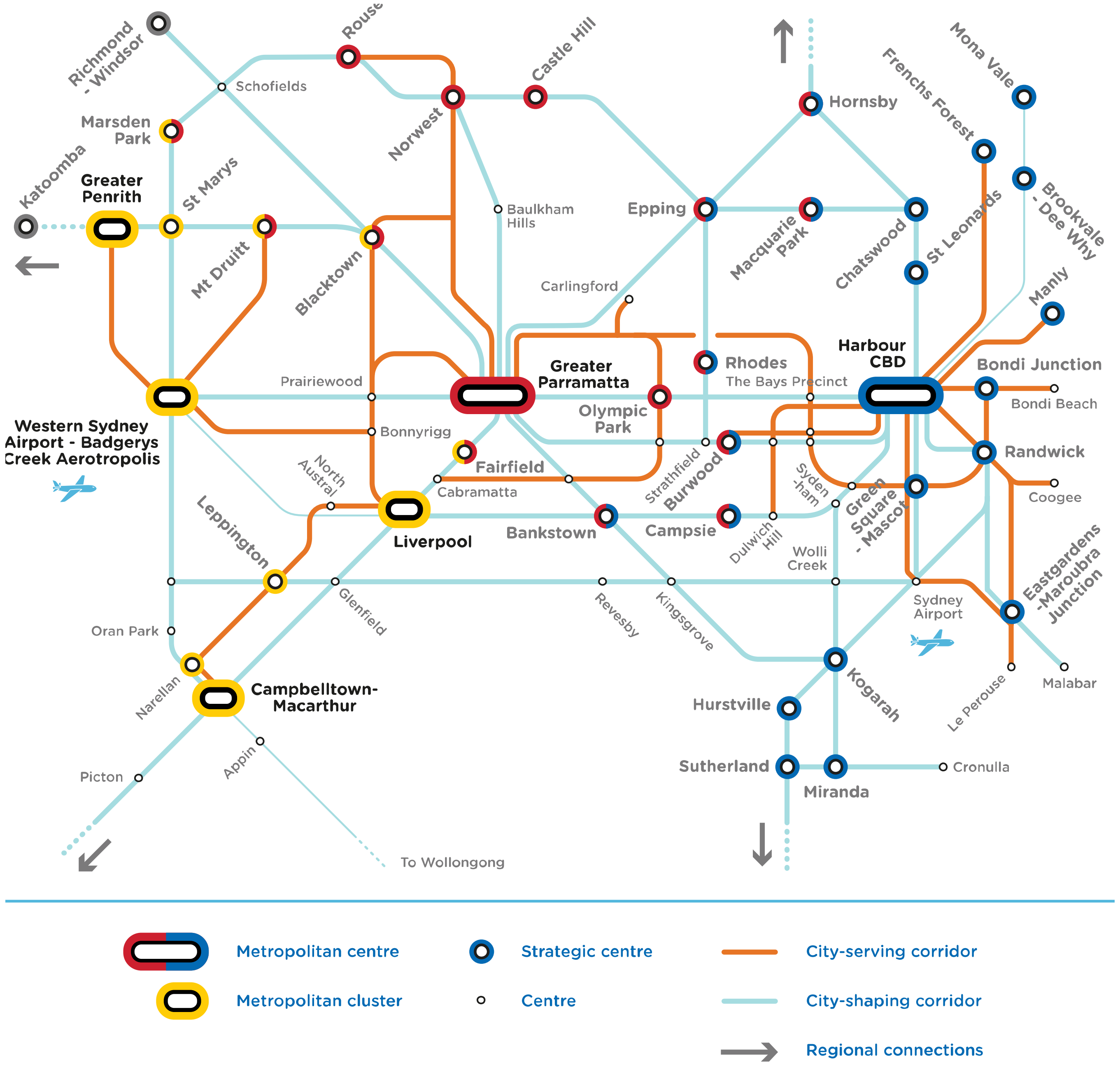


Table 2.1 : Planning and policy context

Document	Overview	Implications for Melrose Park
Greater Sydney Regional Plan	The Greater Sydney Region Plan, *A Metropolis of Three Cities* is built on a vision of three cities where most residents live within 30 minutes of their jobs, education and health facilities, services and great places.	It is noted that Melrose Park: • Is strategically located in close proximity to both the Eastern and Central cities • Is well placed to provide 30-minute access to both of these cities as well as a significant number of strategic centres via active and public transport
Central West District Plan	The final district plans released in 2017 set out a strategic vision for each of the districts, having regard to economic, social and environmental objectives, and identifying priority growth areas.	The key implications to the Melrose Park precinct includes the following priorities: • Support the Greater Parramatta and the Olympic Peninsula (GPOP) vision • Encourage employment growth • Create a more connected District • Improve housing design and diversity • Improve access and health of waterways The proposed development of Melrose Park is strongly aligned with all of the above priorities. It presents a unique opportunity to be an exemplar development for the vision of the West Central District.
Greater Parramatta Olympic Peninsula	GPOP refers to Greater Parramatta and Olympic Peninsula. GPOP is set to undergo a significant rate and scale of growth over the next 20 years. Greater Sydney Commission has delivered a strategic vision for the area and has also designed Growth Infrastructure Compacts which will match housing and jobs growth with timely and cost- effective delivery of infrastructure.	Melrose Park is included in the GPOP area and the proposed development is strategically well placed to provide housing, jobs and services which will support the growth of the peninsula.
Future Transport Strategy 2056	The strategy provides plans and initiatives for the next 40 years of how people will live, work and move across the state A key component of the strategy is the Greater Sydney Services and Infrastructure Plan which shows significantly improved connections from Melrose Park to Parramatta via Parramatta Light Rail and to the Eastern City via Sydney Metro West.	Both the Central and Eastern city centres will be able to be reached within approximately 30 minutes from Melrose Park via active and public transport, a key metric identified in Future Transport 2056. This connectivity will make the Melrose Park site an ideal location for urban renewal and best practice higher density development.
State Infrastructure Strategy	The State Infrastructure Strategy (SIS) sets out the government's priorities for the next 20 years, and combined with the Future Transport Strategy 2056, the Greater Sydney Region Plan and the Regional Development Framework, brings together infrastructure investment and land-use planning for our cities and regions..	Key directions specific to Melrose Park and the Central City include: • Improve intercity and intracity transport connections. • Improve north-south transport connections, for example Greater Parramatta to Epping and Greater Parramatta to Kogarah via Bankstown. • Support growth in population and housing, including social and affordable housing options

3. TRANSPORT CONTEXT

3. TRANSPORT CONTEXT

3.1 Overview

This section reviews the existing, planned and proposed transport and land use conditions that will influence the development of the Melrose Park precinct. For the purposes of this of the Melrose Park TMAP it is important to understand the operation of the existing and future transport systems serving the current precinct within the study context.

3.2 Existing transport network

The existing network contains the primary access routes for Melrose Park, including:

- Public Transport – The major existing bus, ferry and rail corridors providing access to, through and within Melrose Park.
- Private vehicles– The major routes for private vehicles, service and delivery vehicles, freight and taxis/ride-share vehicles providing access to, through and within Melrose Park.
- Active Transport – The major walking and cycling routes providing access to, through and within Melrose Park.

An overview of the existing transport network is shown in Figure 3.1. Accessibility to and from Melrose Park within 30 minutes by public and active transport is shown in Figure 3.2. Approximately 45,000 residents and 28,000 jobs are currently located within a 30-minute public transport journey of Melrose Park (Figure 3.2).

Figure 3.1 : Strategic transport network serving Melrose Park

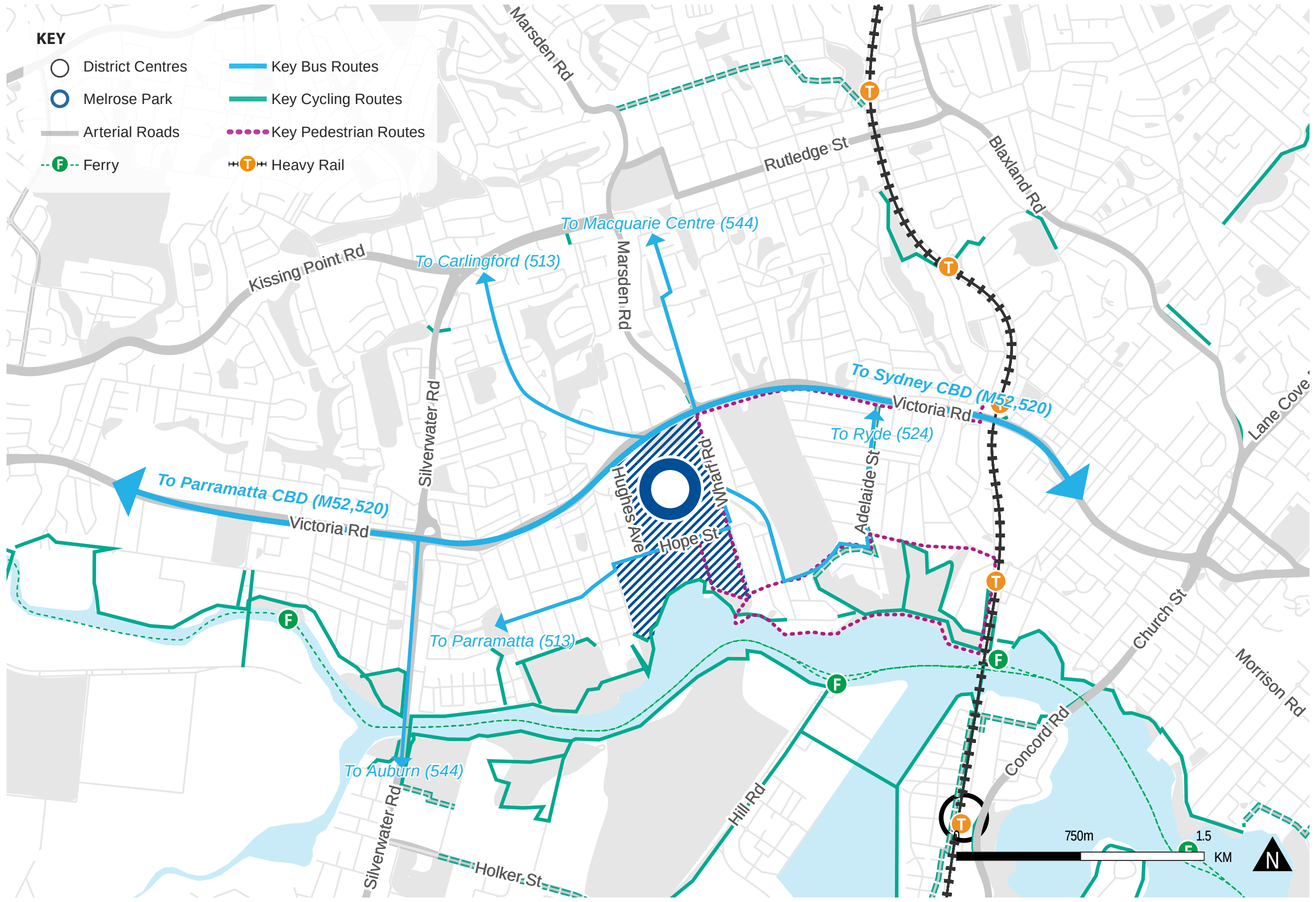
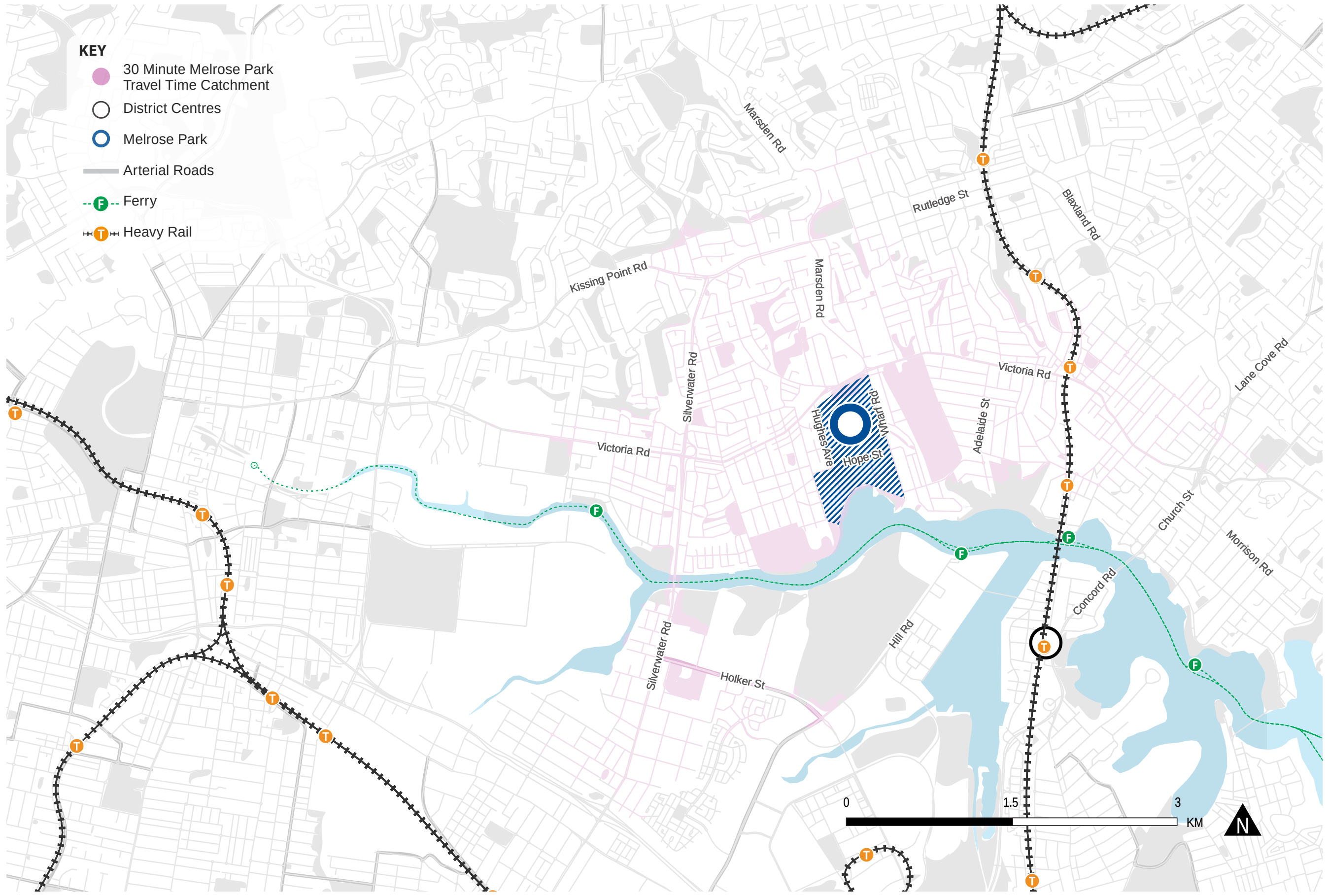


Figure 3.2 : Existing 30-minute public transport catchment from Melrose Park



3.3 Public transport network

3.3.1 Bus

Trunk bus services between Parramatta CBD and Sydney CBD via Victoria Road are provided by the Route M52 (6/hr in peak) and Route 520 (2/hr in peak). Bus services between Top Ryde and the Sydney CBD are more frequent but do not service the site directly.

These routes provide a direct and frequent service between Melrose Park and the Sydney CBD and Parramatta CBD. While travel times are relatively slow and unreliable (especially on Victoria Road east of Melrose Park), they are somewhat competitive with driving times. While there is generally spare passenger capacity on these services in the vicinity of Melrose Park, as bus routes get closer to the Sydney CBD, bus congestion on Victoria Road and in the Sydney CBD start to constrain passenger capacity on these routes.

Other bus routes serving Melrose Park include:

- Route 513 – Carlingford to Meadowbank Wharf (2/hr in peak)
- Route 523 – Parramatta – West Ryde (2/hr in peak)
- Route 524 – Parramatta – West Ryde (2/hr in peak)
- Route 544 – Auburn – Macquarie Centre (2/hr in peak).

These routes are relatively indirect and infrequent, offering a poor quality of service. The travel times for these north-south bus routes serving strategic centres are uncompetitive with driving times. As a result, there is generally spare capacity on these services.

Bus passenger loading data from Opal counts at locations near Melrose Park in both the inbound and outbound directions in May 2017 are summarised in Figure 3.3 and Figure 3.4 below. A summary of the data shows:

- Significant spare capacity on services traveling to Parramatta with spare seats available on all services. It is expected that a significant number of Melrose Park residents will travel to Greater Parramatta as jobs and services in the area increase over time.
- Several bus services are operating close to capacity in the eastbound direction through Melrose Park. It is expected that additional capacity will be required to allow Melrose Park residents to access destinations in the Eastern City.

Figure 3.3 : M52 bus loading - to Parramatta

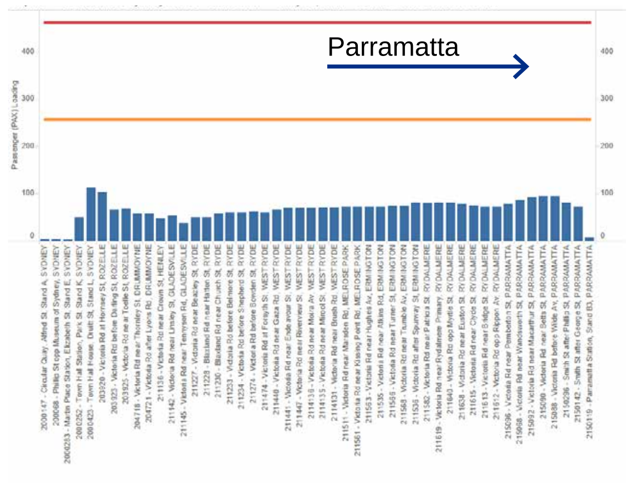
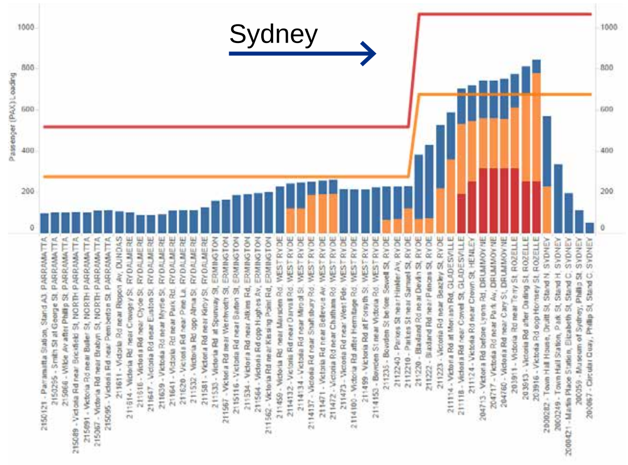


Figure 3.4 : M52 bus loading - to Sydney



Planned Bus Improvement – Victoria Road

TfNSW is currently planning bus priority improvements along Victoria Road. This project will improve travel times for public transport services in the Victoria Road Corridor between Sydney CBD and Parramatta CBD. Services will be faster and more frequent, with improved bus priority, wider stop spacing and high quality interchanges with consistent wayfinding and signage. These improvements will also enable local bus networks to be streamlined to connect with Victoria Road services and take advantage of faster travel speeds.

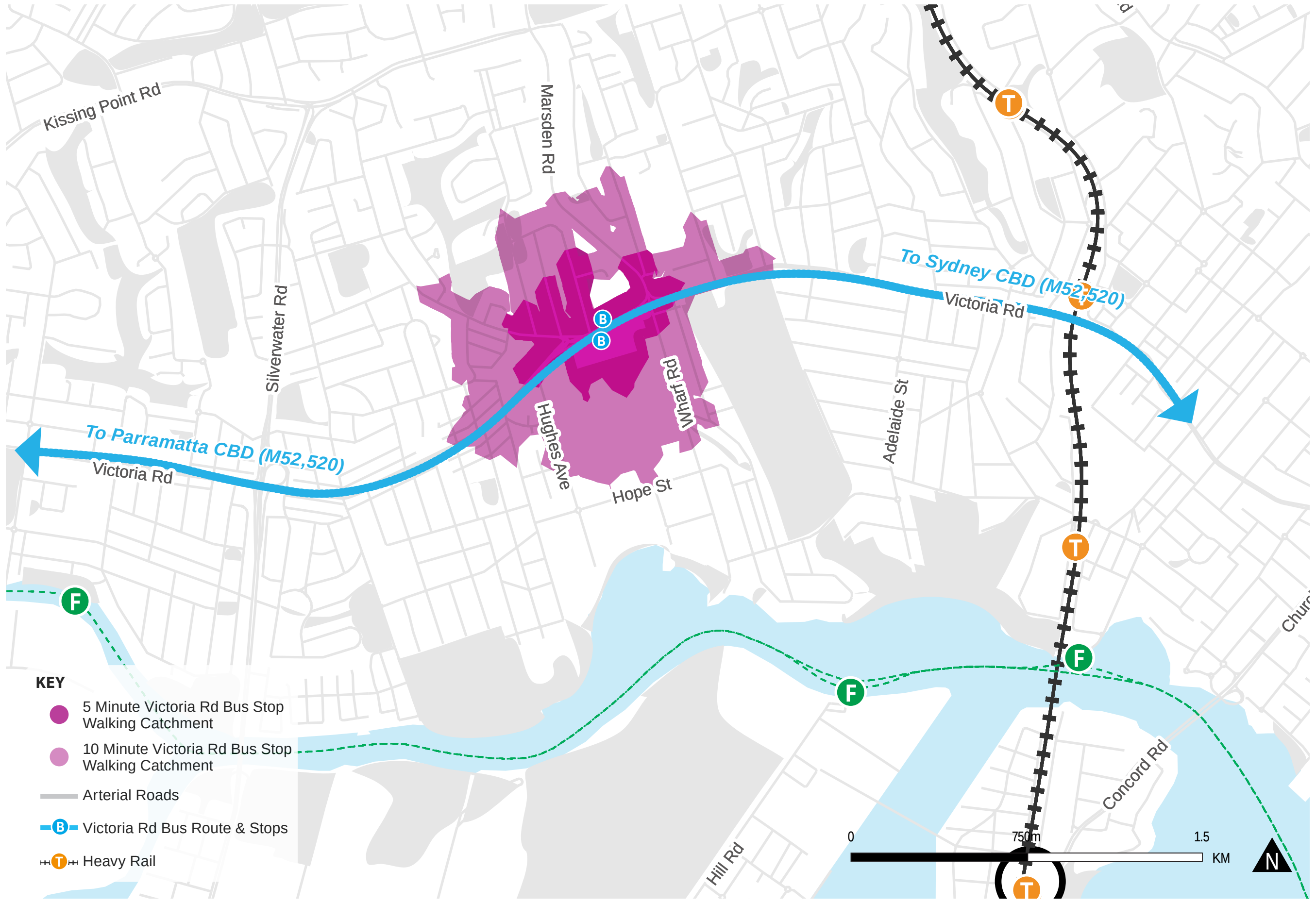
This offers an excellent public transport opportunity for Melrose Park because:

- It provides a high-frequency bus connection to destinations along the Victoria Road corridor, connecting to both the Sydney CBD and Parramatta CBD.
- It would deliver improved levels of reliability and capacity (the existing bus services currently experience significant delays due to traffic congestion).
- It can be designed to facilitate integration of bus services with Parramatta Light Rail (PLR) Stage 2, in terms of their services patterns and their respective operation within the street network.

Bus Stop Catchment

An analysis of the walk-up catchment for the existing bus stops on Victoria Road demonstrates that approximately half of the Melrose Park development site is within a 10-minute walk of bus services. This journey also involves an uphill grade from the site to Victoria Road. This catchment is shown in Figure 3.5.

Figure 3.5 : Victoria Road bus stops - 5 and 10-minute walking catchments



3.3.2 Rail

The north-eastern corner of the proposed Melrose Park precinct is approximately a 1.9 km walk from West Ryde Station and the south-eastern corner of the proposed Melrose Park precinct is approximately a 2.1 km walk from Meadowbank Station. Melrose Park is outside the generally accepted walk-up catchment of nearby rail stations, meaning that access to the rail network needs to be provided by linked trips involving kiss and ride, bus access, shuttle services, on-demand services or access by bicycle.

The Northern Line (T1) serving West Ryde and Meadowbank (the two closest stations to Melrose Park) are served by 5 trains per hour in the AM peak (7:00-9:00am) and 4 trains per hour over the rest of the day. The travel time between West Ryde and Town Hall is around 32 minutes. Bus services currently offer a faster public transport option between Melrose Park and Parramatta than train.

TfNSW's travel statistics for 2016 report peak hour loadings and passengers as a percentage of seat capacity on T1 North Shore rail services (refer to Figure 3.6). Rail loadings are higher on services towards the city in the AM peak an approaching capacity at North Strathfield.

Planned rail improvement – Sydney Metro West

TfNSW is currently planning Sydney Metro West, a new metro line connecting Parramatta and Sydney central business districts. This project will be located on a corridor between the Parramatta River and existing T1 Western Line. The currently proposed rail alignment (see Figure 3.7) envisages new railway stations at Westmead, Parramatta, Sydney Olympic Park, the T1 Northern Line, the Bays Precinct and at Sydney CBD and is expected to be able to move up to 40,000 passengers an hour in each direction.

This offers an excellent public transport opportunity for Melrose Park by:

- Providing a high frequency, fast rail connection to both the Sydney CBD and Parramatta CBD. Trains departing as frequently as every 2 minutes.
- Providing significant additional rail capacity which will relieve the currently constrained heavy rail network. The new line will be able to carry up to 40,000 people per hour in each direction.

For Melrose Park to benefit from the new east-west connectivity that Sydney Metro West will provide, a fast, direct, high frequency intermediate service linking Melrose Park to the future metro station at Sydney Olympic Park will be required. This is planned to be provided by Stage 2 of Parramatta Light Rail (PLR2) but will be required for Melrose Park even if PLR 2 does not proceed. If well connected to the proposed metro, the Melrose Park development could be a valuable source of patronage for Sydney Metro West.

Planned rail improvement – T1 Northern Line

The need for rail capacity enhancements for the T1 Northern Line was identified in the *Rhodes East Investigation Area Traffic and Transport Report - 2017*. This report also considered the quadruplication of the T1 Northern Line through Rhodes and north over the Parramatta River rail bridge, allowing more services to stop at West Ryde, Meadowbank and Rhodes Stations.

The future introduction of Sydney Metro City & Southwest timetable adjustments will cater for increased capacity via additional services and less crowded services at West Ryde, Meadowbank and Rhodes (with T1 Northern Line customers diverting on to the Metro at Epping, prior to reaching Rhodes) are also being investigated.

The Northern Sydney Freight Corridor Stage 2 will also improve the performance of the T1 Northern Line by improving separation of freight and passenger services on the corridor.

It is noted that the recently commenced Epping-Chatswood shutdown has coincided with increased services on the T1 Northern Line, now 8 per hour in the peak. These services will continue following the implementation of Sydney Metro North West and provide a 60% capacity increase compared to the previous 5 services per hour.

These improvements offers an excellent public transport opportunity for Melrose Park by:

- Providing increased capacity for Northern Line services at West Ryde, Meadowbank and Rhodes Stations
- Supporting mode shift towards increased public transport trips
- Supporting the proposed shuttle services between Melrose Park and Meadowbank.

Figure 3.6 : T1 Northern Line loadings

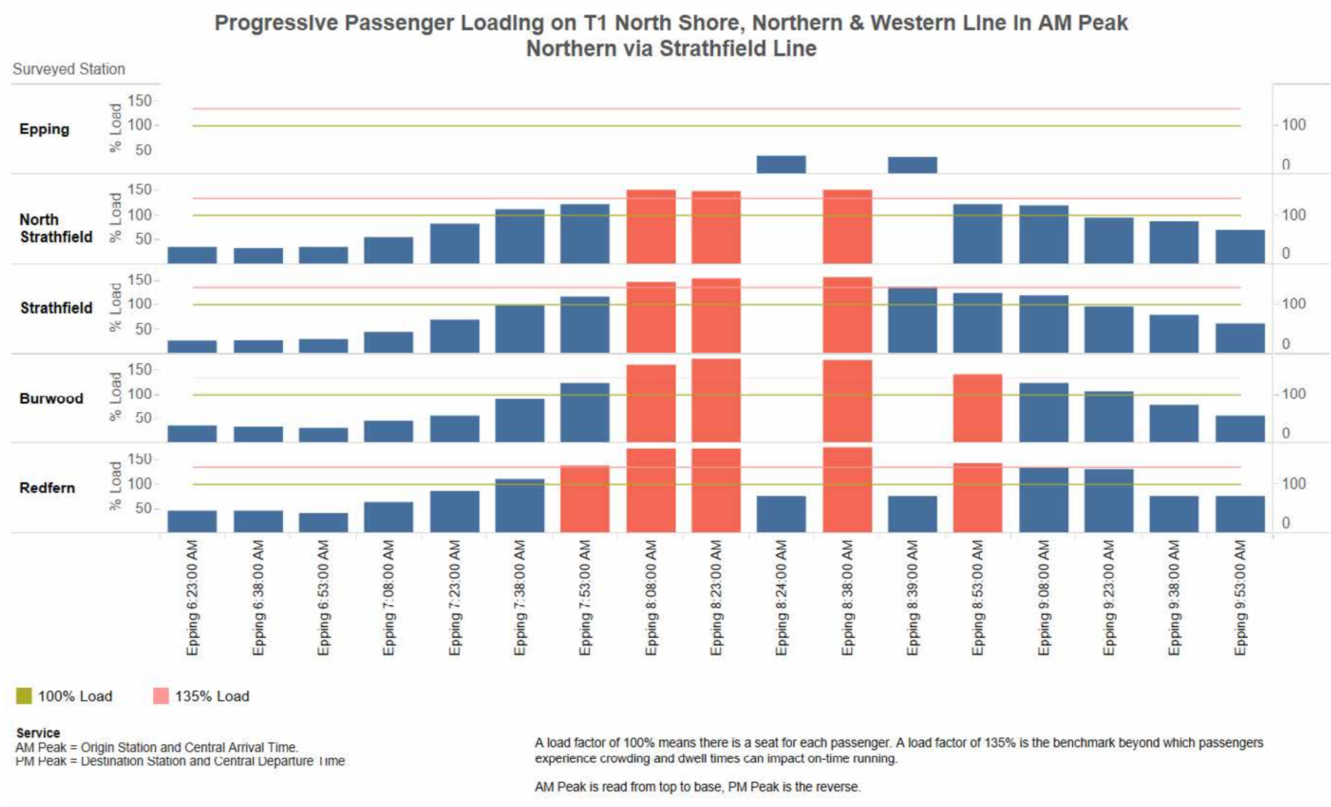
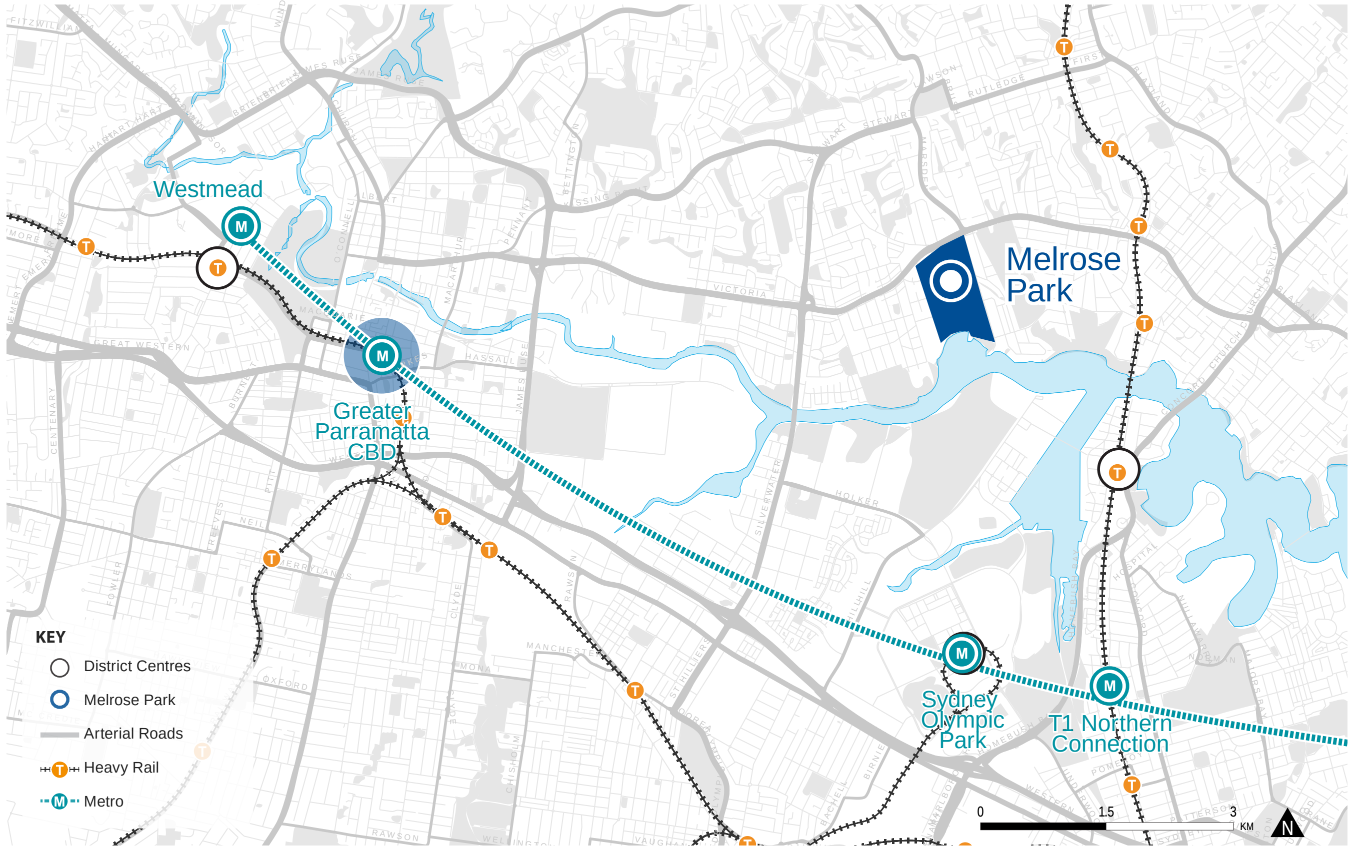


Figure 3.7 : Sydney Metro West (source: TfNSW)



3.3.3 Light rail

There is currently no light rail access in the vicinity of Melrose Park. Parramatta Light Rail Stage 1 will be introduced through the Parramatta CBD connecting the major educational and health facilities of Westmead and Rydalmere.

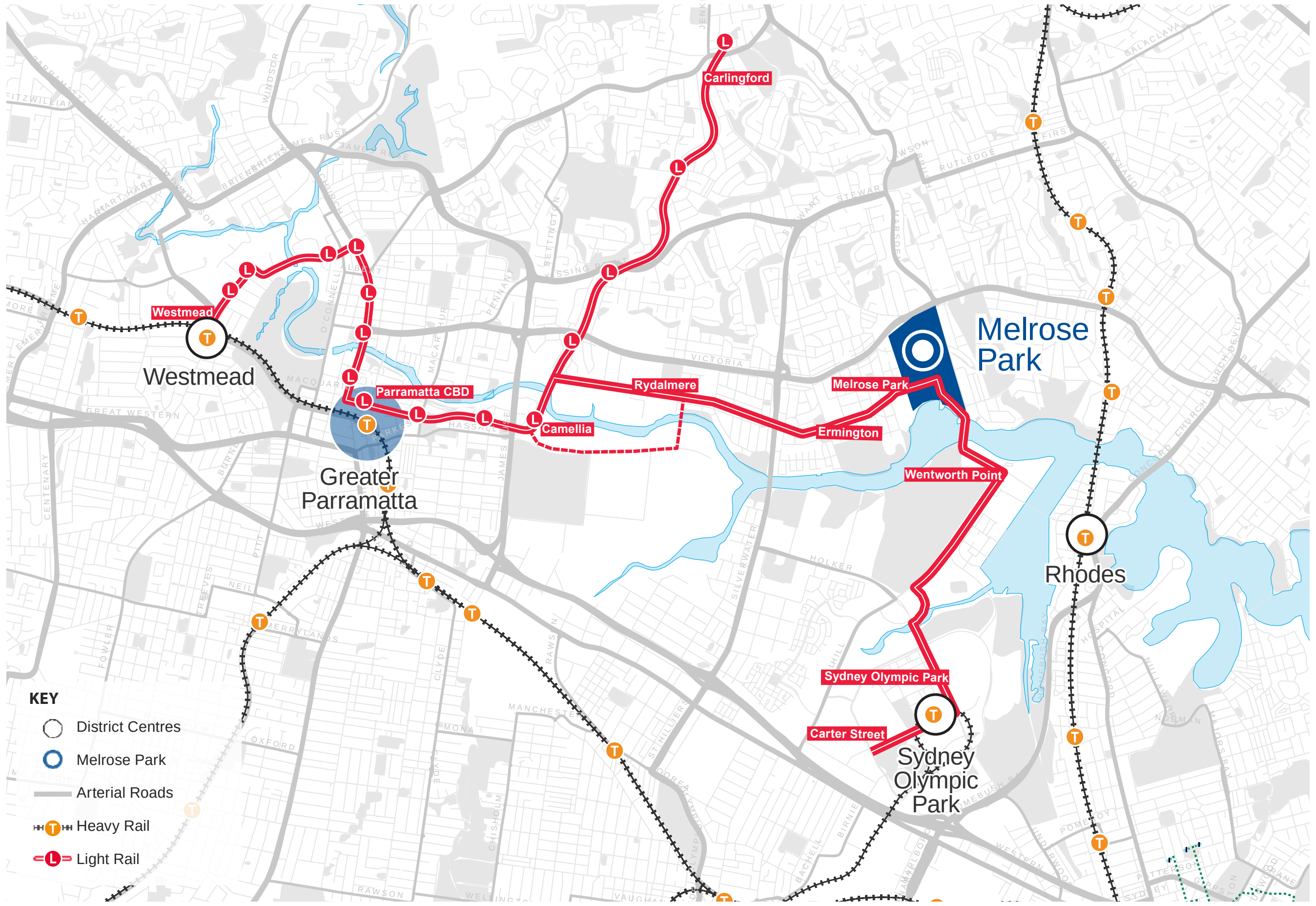
Planned light rail improvement – Parramatta Light Rail Stage 2

Parramatta Light Rail (PLR) Stage 2 is currently at the planning stage. The corridor under investigation connects Parramatta CBD with Sydney Olympic Park via Melrose Park using South Street, Boronia Street, Hope Street, Waratah Street, new bridge across Parramatta River, Hill Road, Australia Avenue and Carter Street. TfNSW is currently undertaking a final business case for PLR Stage 2 which is due to be completed by December 2018. Figure 3.8 shows the proposed alignment

This offers an excellent public transport opportunity for Melrose Park by:

- Better integrating Parramatta CBD with Rydalmere, Melrose Park, Wentworth Point and Sydney Olympic Park
- Providing an attractive and accessible service and the potential to reduce the need for car trips and car-parking use at Melrose Park
- Facilitating the development of higher density housing through better urban design and urban form at future light rail stops on Hope Street and Wharf Road.

Figure 3.8 : Proposed Parramatta Light Rail alignment (source: TfNSW)



3.3.4 Ferry

The existing ferry network is shown in Figure 3.9. Ferries currently run between Meadowbank Ferry Wharf and Circular Quay around twice per hour during the day. The trip takes approximately 50 minutes. Ferries currently run between Meadowbank Ferry Wharf and Parramatta once per hour and the trip takes 33 minutes.

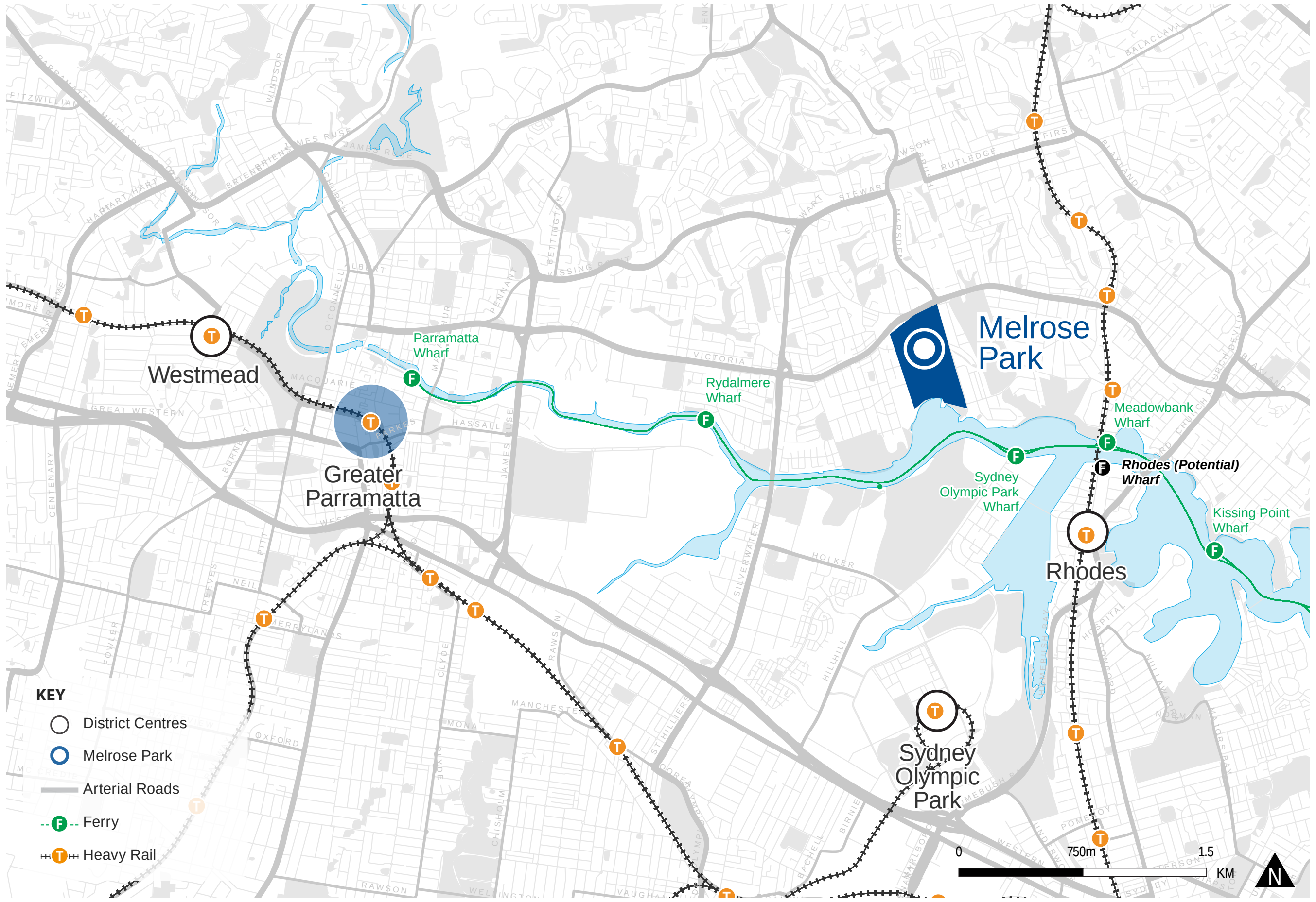
Parramatta River services have a higher proportion of travel for recreation than all Sydney ferry services, with a longer access trip, a longer ferry trip and a higher proportion of older passengers than the Sydney average. The current services are relatively slow and experience low patronage during the working week and overcrowding during the weekends.

Current commuter ferry services have capacity to accommodate future growth projected along the Parramatta River to the Parramatta CBD. Parramatta customers will continue to transfer to the Rivercat service at Rydalmere. Services will continue to operate directly to Parramatta in off-peak times and on weekends, reflecting demand.

Planned ferry improvement – Rhodes East Wharf

Roads and Maritime and TfNSW are investigating ferry wharf options at Rhodes East including between the John Whitton Rail Bridge and Ryde Bridge. The future wharf location will ultimately be decided based on operational and navigational design parameters for Sydney Ferries to run between Rhodes East and Meadowbank. Roads and Maritime has advised that the new Rhodes wharf will be delivered within the next three to five years. Further community consultation in relation to the proposed wharf will be undertaken by Roads and Maritime.

Figure 3.9 : Existing ferry network



3.4 Road network

3.4.1 Existing strategic road network

The key features of the road network in the vicinity of the Melrose Park site are summarised below:

Victoria Road

Victoria Road is a State Road providing access between Parramatta and the western end of Anzac Bridge. It is currently carrying approximately 60,000 veh/day and there are approximately 2,000 bus services provided along Victoria Road on a weekly basis in the vicinity of the site. Whilst serving as a primary arterial road and movement corridor, there is still a significant amount of direct access to properties on both sides of the road in the vicinity of the development site.

There is significant traffic congestion at nearby intersections on Victoria Road during peak hours. There are delays and queues eastbound in the AM peak at both signalised intersections with Wharf Road / Marsden Road and Kissing Point Road. Similar delays and queues exist in the PM peak at the Wharf Road / Marsden Road intersection.

Wharf Road

Wharf Road is a local road which provides direct access to properties on both sides of the road. Its main function is to facilitate the convenient and safe movement of local traffic to and from Victoria Road. This road generally provides two traffic lanes with parking on both sides. The road has a posted speed limit of 50km/h.

Hope Street

Hope Street is a local road which provides direct access to properties on both sides of the road. The Boronia Street-Hope Street-Andrews Road corridor distributes traffic within residential and industrial areas. These roads form a link between the local and higher order road network. This road generally provides two traffic lanes with parking on both sides. The road has a posted speed limit of 50km/h.

Hughes Avenue

Hughes Avenue is a local road which provides direct access to properties on both sides of the road. This road generally provides two traffic lanes with parking on both sides. The road has a posted speed limit of 50km/h.

Key issues and opportunities of the existing road network are summarised in Table 3.1 below.

A summary of the function of key roads in and around the Melrose Park precinct is summarised in Figure 3.10. This is based on observations pertaining to existing traffic volumes and the type of trips currently facilitated by particular corridors. The presented hierarchy is not intended to strictly correlate with the classification and governance structure of these assets i.e. some sub-arterial corridors are state roads whilst others are local roads.

Planned road improvement – Devlin Street

RMS are currently investigating improvements to intersections at Devlin Street, Blaxland Road and Parkes Street. These works were announced after the finalisation of future network assumptions for the project and have not been included in this modelling. Observed congestion in future traffic modelling at this location is likely to be significantly improved by these works.

Figure 3.10 : Indicative road hierarchy

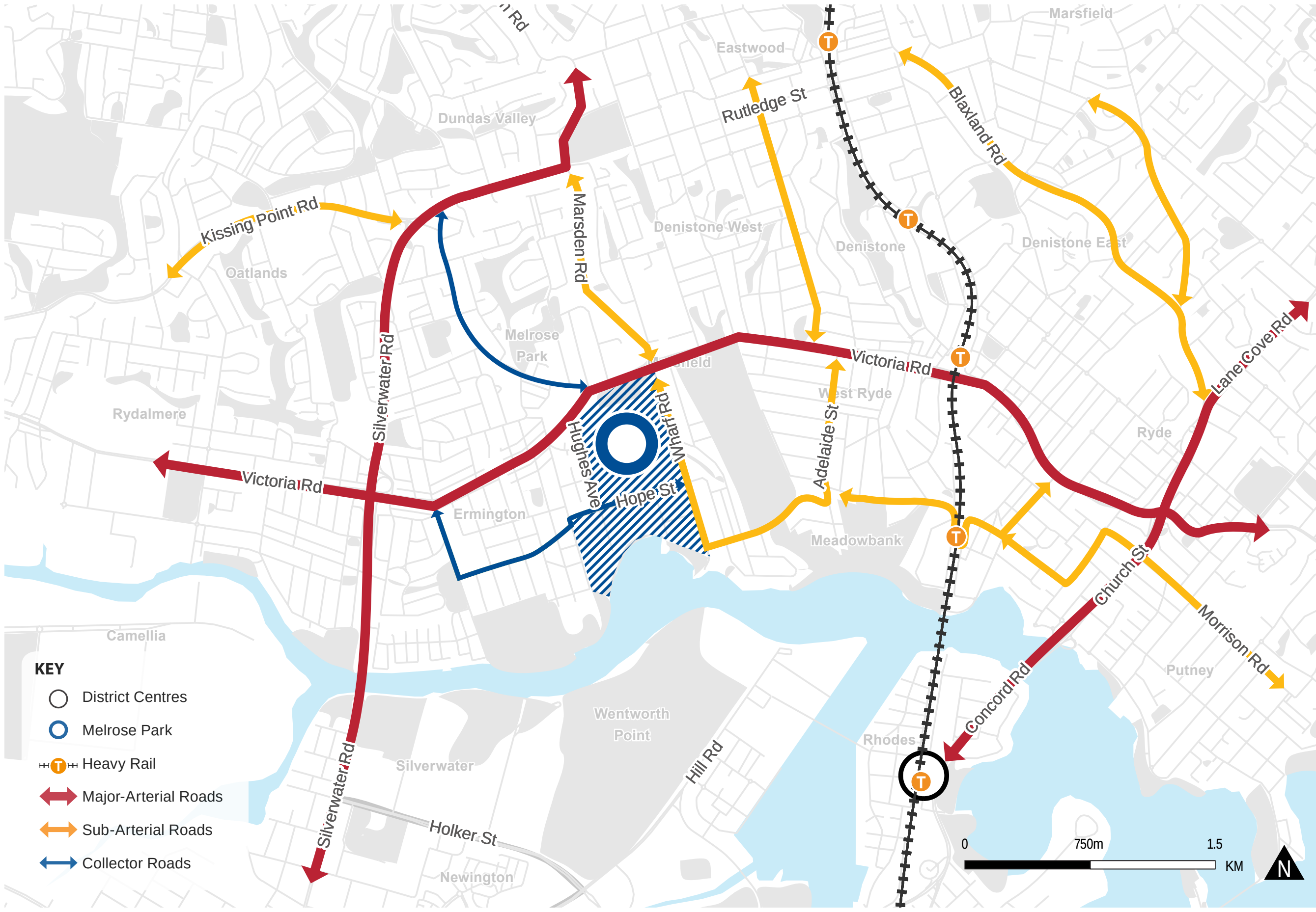


Table 3.1 : Key road access corridors serving Melrose Park

General Traffic Corridor	Role / Function	Opportunities
Victoria Road (A40)	Regional route and predominant movement corridor fronting Melrose Park and providing the most direct access for the development	Direct access from major arterial roads is generally discouraged as it may reduce efficiency of the corridor. Possible opportunities for left in left out access to relieve congestion on local roads
Wharf Road	Local access route along eastern edge of Melrose Park, providing alternative route into the development	Restricted by capacity to access by intersection on to Victoria Road. Opportunity to distribute traffic to reduce congestion.
Hughes Avenue	Local access route along western, edge of Melrose Park, providing alternative route into the development	Restricted to left in left out at priority intersection. Additional access to west and Parramatta.
Hope Street	Local access route along southern, edge of Melrose Park, serving as a local 'back route' and providing alternative route into the development.	Circuitous alternative route already in use to Meadowbank Station and Concord Road that avoids Victoria Road. Forms part of planned route for PLR Stage 2.

3.4.2 Existing traffic volumes

Peak hourly traffic volumes on selected roads in the study area, available from Aimsun Model, are summarised in the figure below depicting the traffic survey data collected in 2017. The key points from the traffic volumes include:

- Victoria Road, Silverwater Road and Church St/ Devlin Street carry significant traffic volumes of between 2,000 – 3,000 vehicles per hour in the peak direction.
- The section of Victoria Road east of Wharf Road carries the most traffic along this movement corridor.
- The Andrew Street/Constitution Road corridor performs a sub-arterial function and serves as an alternative east-west corridor to Victoria Road, with flows of up to 1,000 vehicles per hour.

These volumes are shown in Figure 3.11 and Figure 3.12.

Figure 3.11 : Existing traffic volumes AM peak hour

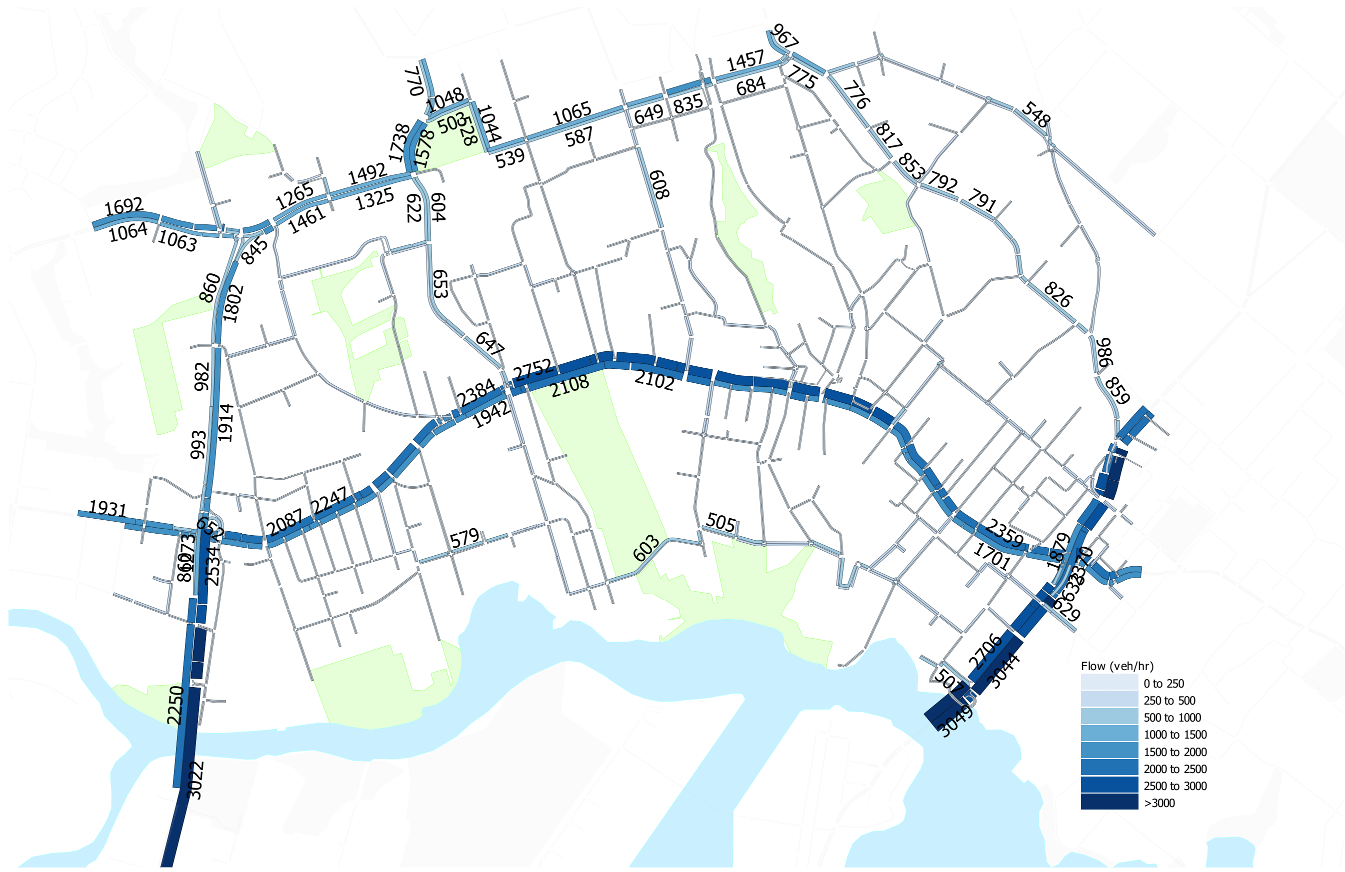
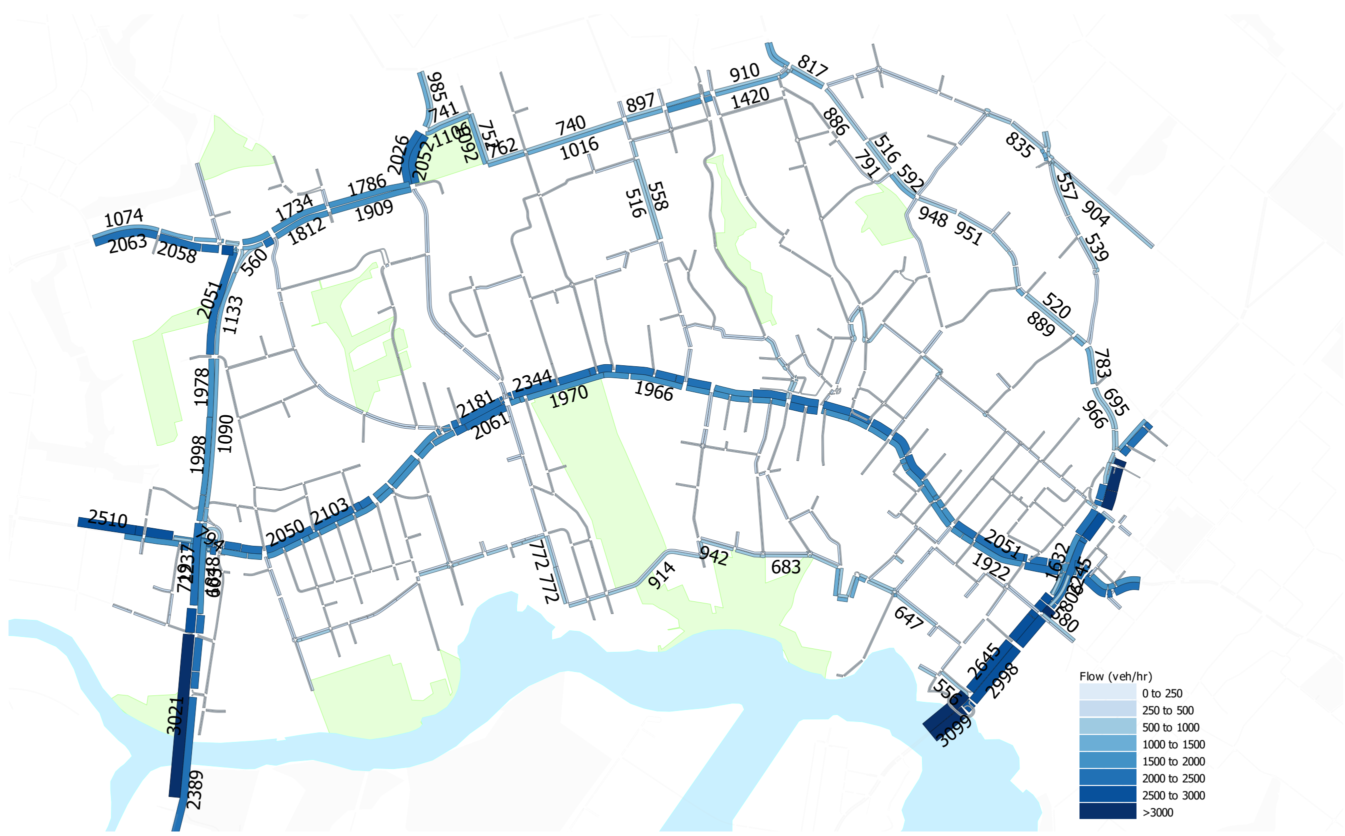


Figure 3.12 : Existing traffic volumes PM peak hour



3.4.3 Intersection Performance

The existing intersection performance of the Melrose Park study area was analysed using the Aimsun model for peak conditions (AM and PM peak) for 2017. The results of the analysis are presented in Figure 3.13 and Figure 3.14. The key points from the intersection performance include:

- Significant delays are observed along Victoria Road near Melrose Park at Wharf Road. The remaining intersections on Victoria Road perform satisfactorily with the exception of Church Street intersection in both peak periods and the West Parade intersection in the PM peak.
- Significant eastbound delays are observed on the Kissing Point Road/Stewart Street corridor in the AM peak, particularly at the Stewart Street/Marsden Road intersection.

Figure 3.13 : Existing intersection level of service AM peak hour

Figure 3.14 : Existing intersection level of service PM peak hour

3.4.4 Network Performance

A summary of the key existing performance indicators for general traffic, namely travel time and average vehicle speed, have been summarised in Table 3.2 and Table 3.3. The key points from the network performance include:

- Average speeds of approximately 33km/h in both the AM and PM periods indicates that the overall network performs relatively well, considering the modelled network is in an urban environment and does not include any motorways
- There is more demand for travel in the PM period with approximately 25,000 more km traveled across the four hours compared to the AM period
- All of the modelled traffic is able to enter the network in both modelled periods i.e. there is no unreleased traffic .

Table 3.2 : Travel time (2017)

		6:00am – 10:00am	3:00pm – 7:00pm
Victoria Road (between Silverwater Road and Devlin Street)	EB	12:14	11:23
	WB	9:02	12:16
Silverwater Road/Stewart Street (between South Street and Marsden Road)	NB	10:10	7:10
	SB	5:37	4:43
Wharf Road/Marsden Road (between Andrew Street and Stewart Street)	NB	5:40	7:54
	SB	4:05	4:19

Table 3.3 : Network statistics (2017)

	6:00am – 10:00am	3:00pm – 7:00pm
Vehicle kilometres travelled (VKT)	332,582	356,925
Vehicle hours travelled (VHT)	9,982	10,985
Average network speed (km/h)	33.3	32.5
Unreleased traffic (veh)	0	0

3.5 Pedestrian and cycling network

Figure 3.15 shows the current walking and cycling catchment from Melrose Park. The catchment analysis is indicative only and does not take into account locations in the road network which may be difficult for pedestrians and cyclists to traverse, such as major grade separated intersections. It does however provide a useful strategic assessment of active transport accessibility.

The catchments show that:

- Limited public transport services are within the existing walking catchment of Melrose Park
- Significant services and centres are within a 20 minute cycle of Melrose Park. These include:
  - T1 Northern Line
  - Rydalmere industrial area and future PLR stage 1
  - Sydney Olympic Park
  - Rhodes
  - Top Ryde.

Figure 3.15 : Walking and cycling catchments from Melrose Park

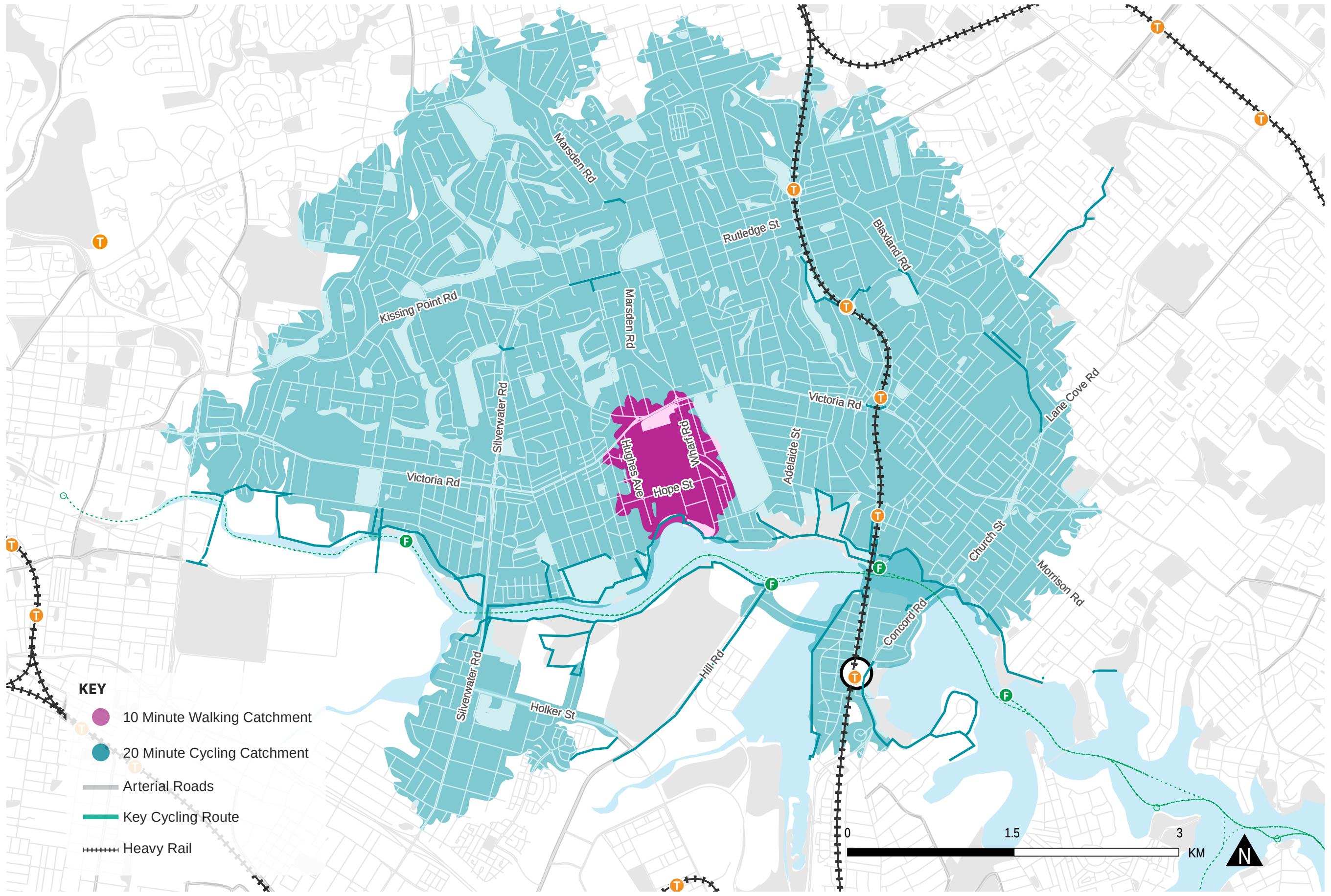
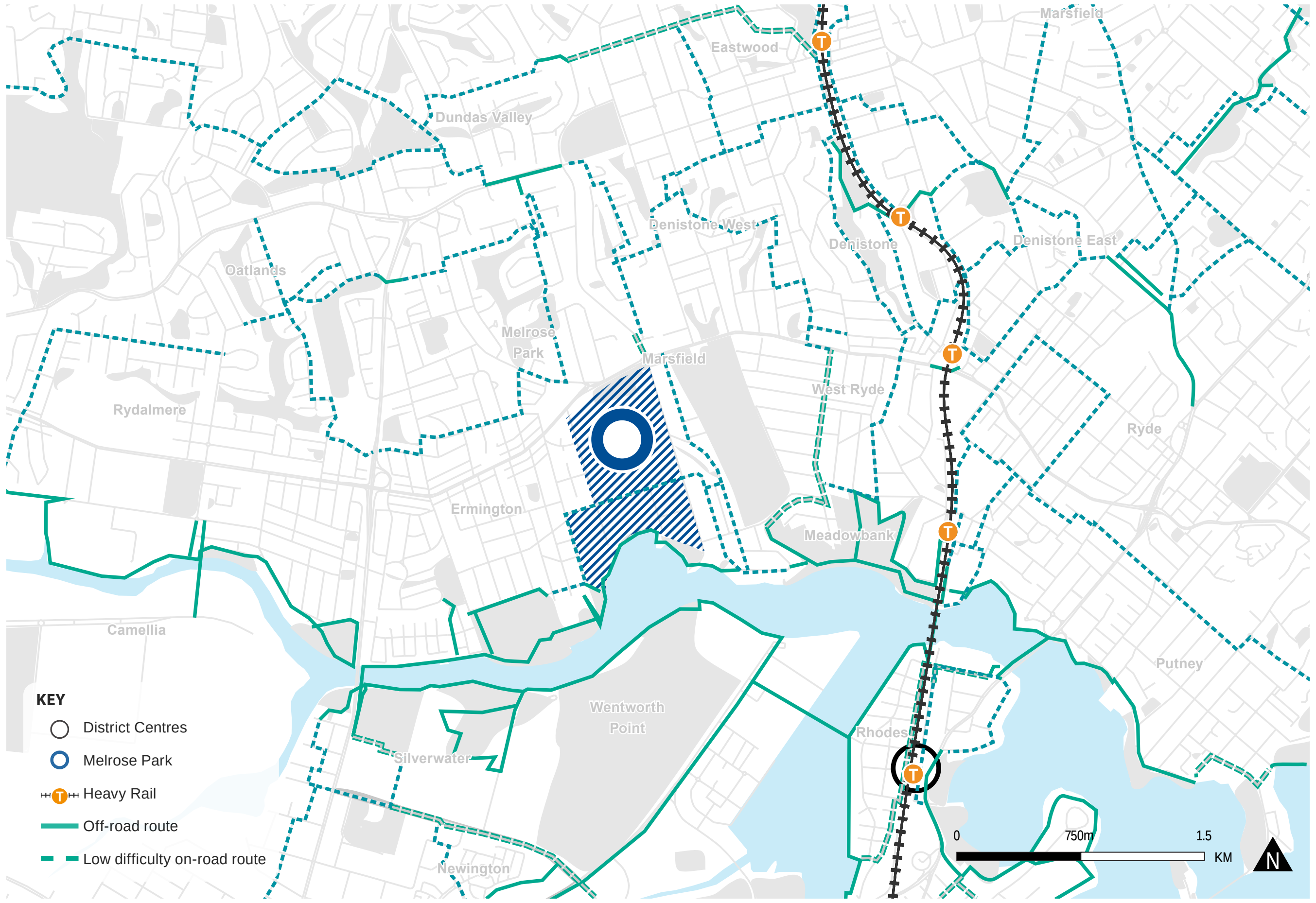


Figure 3.16 : Cycling routes



Existing off-road and low difficulty on-road cycling routes are shown in Figure 3.16 and are summarised in Table 3.4, below.

Table 3.4 : Key cycling connections serving Melrose Park

Connection	Role / Function	Route
Parramatta River Foreshore Pathway active transport shared path	Recreational and commuter cyclist connection to Meadowbank ferry wharf (and potentially station)	Parramatta River Foreshore Pathway east of the Melrose Park development (includes short section of Lancaster Avenue)
Southern precinct of Melrose Park to Victoria Road (West Ryde)	Local cycle connection	Andrew Street, Adelaide Street
Active transport shared path connections to southern side of Parramatta River and to Foreshore Pathway on southern side of river	Recreational and commuter cyclist connection to southern side of Parramatta River	Bridges across Parramatta River (Silverwater Road, Concord Road)

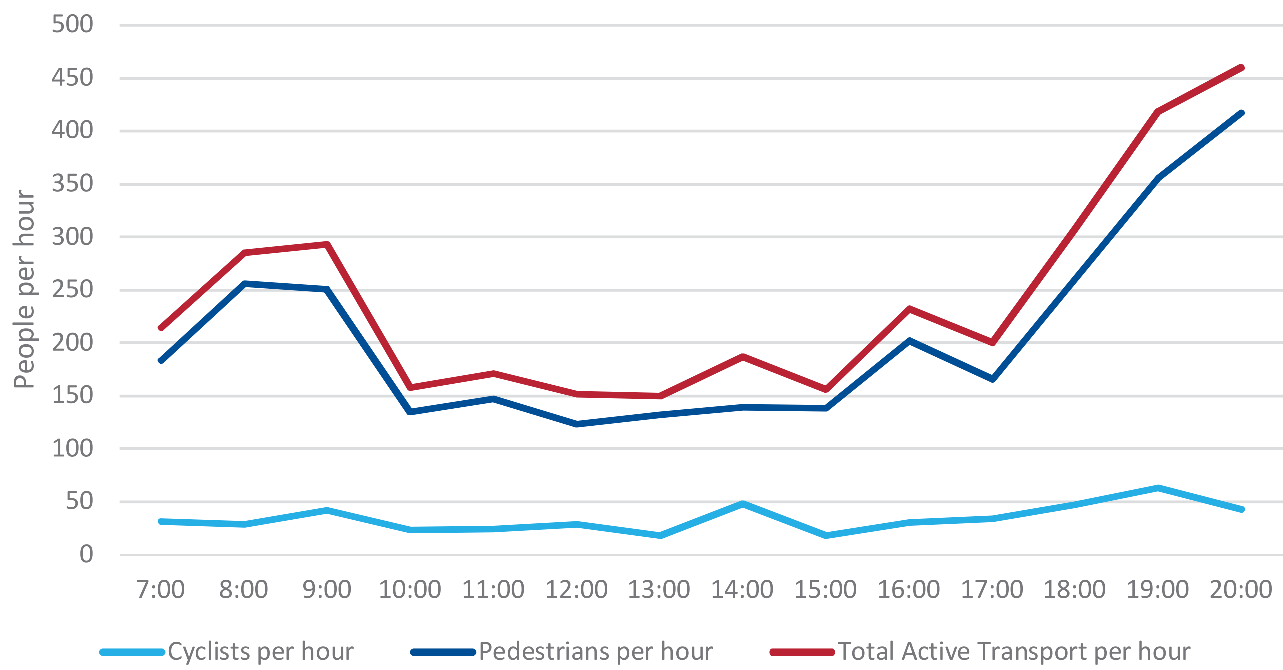
Bennelong Bridge active transport use

Surveys have been undertaken of active transport use on the Bennelong Bridge, connecting Wentworth Point and Rhodes. These surveys give an indication of the willingness of residents in the areas surrounding Melrose Park to use active transport if given safe and direct access to key centres.

Figure 3.17 outlines the results of the survey undertaken in November 2017. It is observed that:

- There is significant all-day use of the bridge by both pedestrians and cyclists.
- In the PM peak hour, over 50 cyclists and over 400 pedestrians utilise the bridge.
- Approximately 3,500 active transport trips are made across the bridge between 7:00am and 8:00pm.

Figure 3.17: Bennelong Bridge active transport use



JACOBS

3.6 Existing travel behaviour

Travel patterns to, from, through and within Melrose Park and GPOP have been analysed using data extracted from a range of sources including the Australian Bureau of Statistics (ABS) 2016 Census journey-to-work (JTW), Household Travel Survey (HTS) and TfNSW Strategic Travel Model (STM).

3.6.1 Existing mode share

The current site's function and urban character without renewal is predominately industrial which influences the existing travel patterns and purpose of trips to and from the study area. A number of trips are generated by workers commuting to employment opportunities provided by established commercial and industrial businesses within the study area.

Considering the predominantly residential nature of the proposed development, travel zones with existing residential characteristics adjacent to Melrose Park have been chosen to provide a more robust assessment of existing and future travel behaviour.

The travel zones shown in Figure 3.18 have been used to examine current JTW travel patterns and behaviour within and in proximity to Melrose Park.

Figure 3.19 and 3.20 show that trips to and from Melrose Park are predominantly undertaken by private vehicle, particularly for trips to the study area. Of more relevance to the future residential development, non-car mode share for commuting trips from the study area is currently 23%.

Figure 3.19 : Mode share for residents commuting from Melrose Park

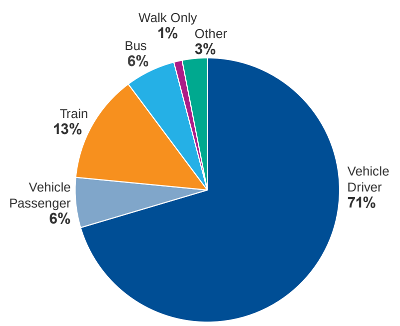


Figure 3.20 : Mode share for workers commuting to Melrose Park

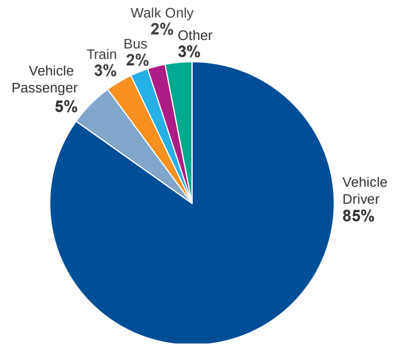
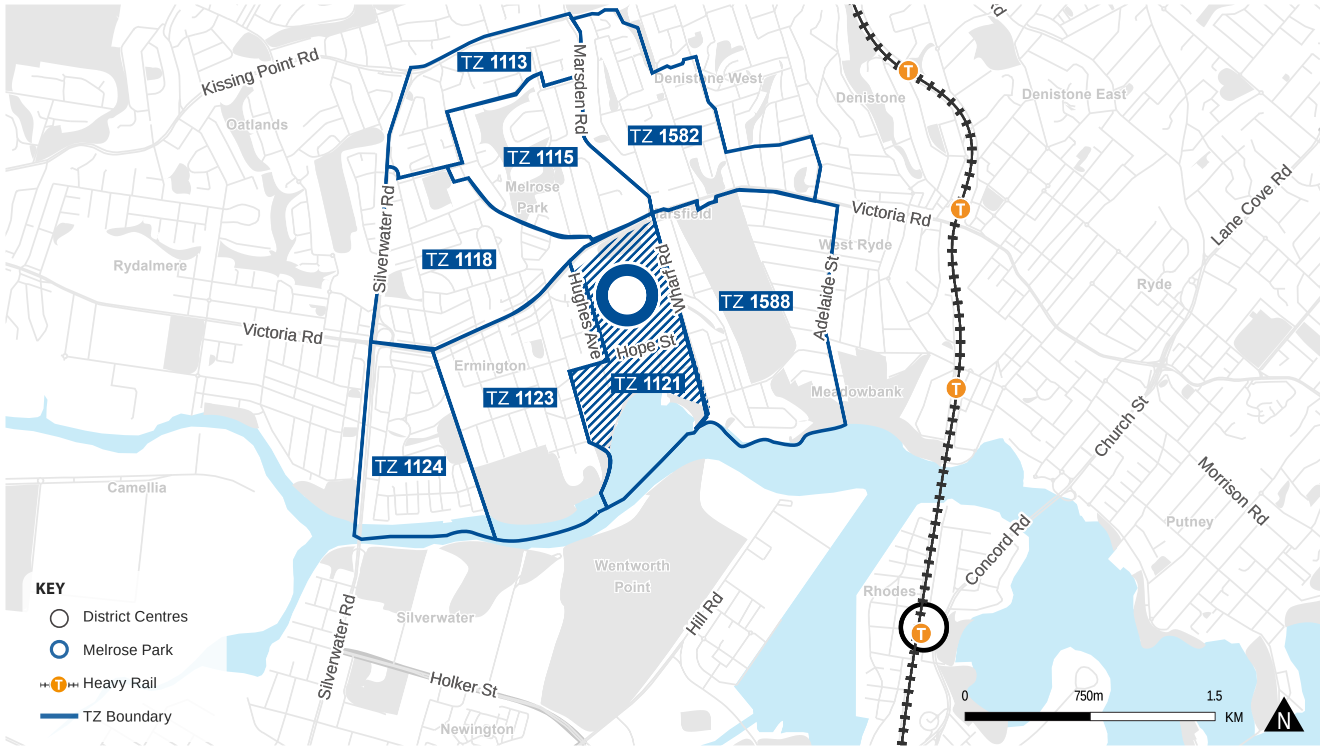


Figure 3.18 : Travel Zones - Melrose Park and surrounds



3.6.2 Existing trip purpose

A summary trip purpose is shown in Figure 3.21. This data is obtained from the Household Travel Survey (HTS). The Melrose Park data has been compared to the average trip purpose breakdown for the entire Sydney region. HTS data is available at the SA3 level so for the propose of this assessment the Melrose Park data has been derived from the Carlingford SA3 data. It is observed that:

- Commuter trips from Melrose Park make up a slightly higher proportion than the Sydney average.
- Trips for work related business, education, shopping and social/recreation from Melrose Park make up a slightly lower proportion than the Sydney average.

3.6.3 Existing trip lengths

Figure 3.22 shows the trip length distribution for all trips in the GPOP area. It is observed that:

- Average weekday trip distances have slightly shortened, with more trips in 0-5km category.
- On weekends, that trend is reversed, with more people taking longer trips (greater than 10km). This is indicative of a trend towards more car use for longer trips on weekends. This could particularly be the case if GPOP residents are traveling outside GPOP for discretionary weekend trips.
- Figure 3.23 shows that the breakdown of trips across the major weekday time periods has stayed relatively constant. There does not seem to have been any shift towards undertaking more off-peak travel in GPOP.

Figure 3.21 : Trip purpose

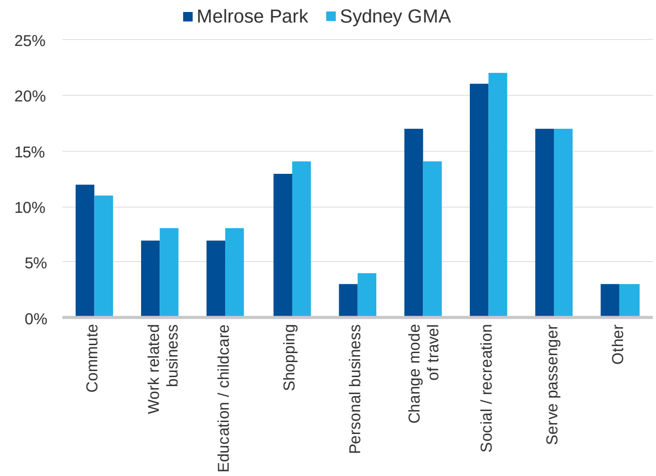


Figure 3.22 : Trip length distribution GPOP

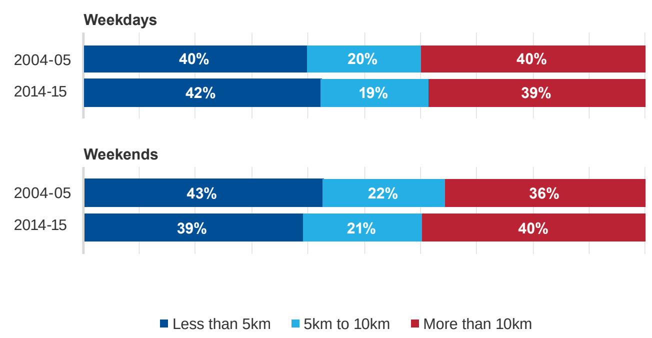
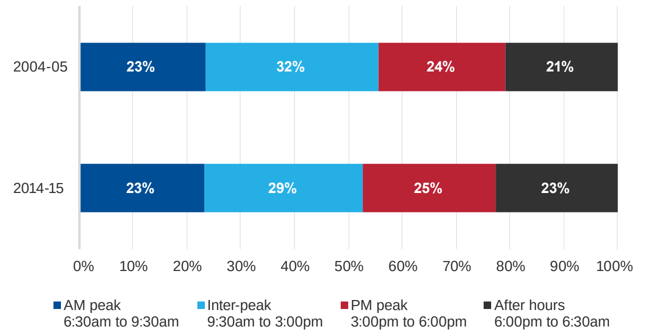


Figure 3.23 : Percentage of trips by time period



3.6.4 Existing trip distribution

The existing distribution of all trips leaving Melrose Park in the AM Peak has been analysed using TfNSW's Public Transport Project Model (PTPM), which is being used for planning of PLR Stage 1 and 2. Figure 3.24 shows the key 12 destinations – at the SA3 level – of these trips.

Figure 3.25 shows the destinations of all trips leaving Melrose Park at a '3 cities' level, with trips either remaining in the Central City or heading to the Eastern or Western Cities.

Both figures represent all modes of travel.

Several key observations can be made:

- A significant number of trips are relatively short and either remain in the Carlingford SA3 or travel to the adjacent Ryde-Hunters Hill SA3
- There is a strong desire line to the east of Melrose Park – due to the current imbalance of jobs and services in the Eastern City. 62% of trips originating around the Melrose Park precinct have destinations in the Eastern City.
- As the Parramatta CBD and wider Central City continues to grow it is expected that future residents of Melrose Park will be less reliant on the Eastern City. The existing 36% of trips which remain in the Central City is expected to increase.
- The balance of employment in Sydney has been shifting west, moving beyond the traditional employment hubs in the Eastern City

Figure 3.24 : Distribution of AM peak hour trips from Melrose Park - SA3 level (all modes)

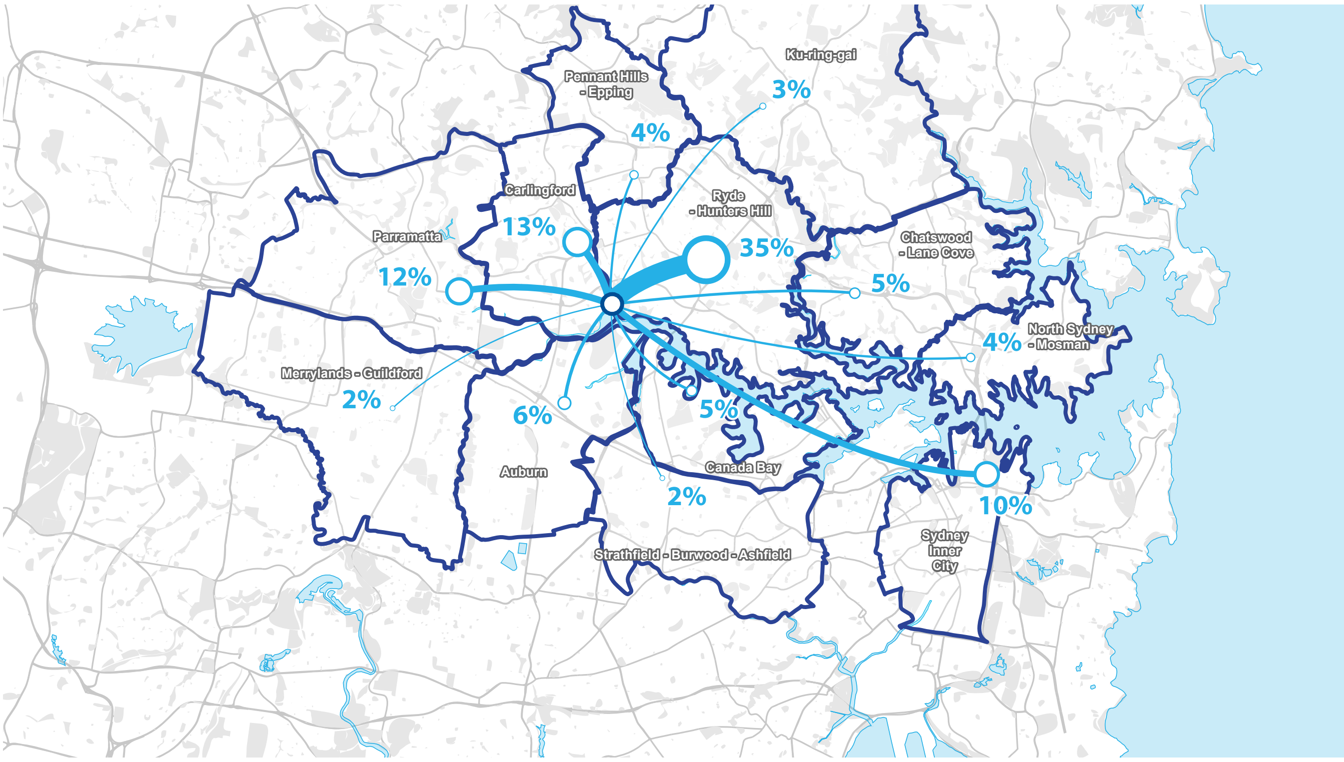
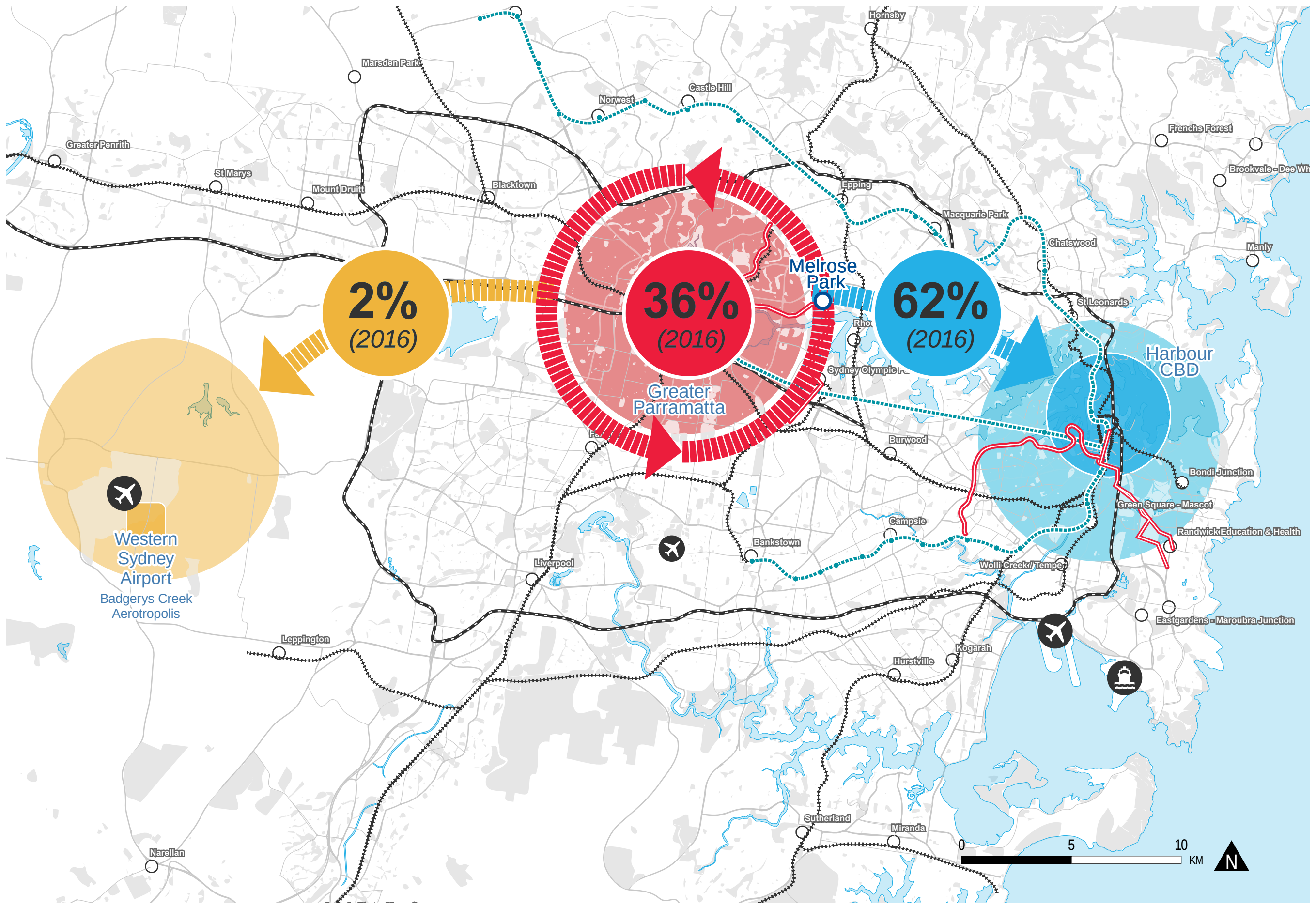


Figure 3.25 : Distribution of AM peak hour trips from Melrose Park - 3 cities (all modes)



4. MELROSE PARK STRUCTURE PLANS

JACOBS

4. MELROSE PARK STRUCTURE PLANS

4.1 Overview

The land uses within the Melrose Park northern and southern precincts will generate activity that will result in demand for travel. This section provides a guide to the location of the proposed land uses and activities generated by the planned development. This section describes the transport planning vision and objectives for Melrose Park to ensure that planning and investment in the transport network will result in positive outcomes, address the areas of highest priority, and cater for increased future transport demands resulting from the planning proposal.

4.2 The structure plans

The overall structure plans will provide public space that will connect Victoria Road to Parramatta River Foreshore with Melrose Park. The structure plans will also have a rich land-use mix, including housing, offices, town centre, retail, and amenities, connected by public landscape elements. Throughout the day, different happenings in the public domain, including daily work and leisure activities, and urban intersections will enable encounters between different users on site.

The structure plan has been developed in two parts, a northern and southern precinct separated by Hope Street. The structure plans have been developed by the respective proponents of the sites however they have been done so in a collaborative and consistent manner.

The TMAP process has considered the development as an entire combined precinct as agreed by the Project Coordination Group (PCG) in order to develop a consistent and coherent plan for transport and accessibility throughout the whole site, and its connection with the wider GPOP.

4.2.1 Northern structure plan

The northern structure plan has been adopted by City of Parramatta and is shown in Figure 4.1. It has been developed based on the following guiding principles:

- Urban Renewal in the Right Location
- Creating New Employment Opportunities
- Creating New Communities
- Connected Urban Renewal
- Well-Mannered and Environmentally Conscious

The land use plan has higher densities at key locations, increasing the potential for public transport share at key transit nodes. The major activities of Melrose Park are concentrated along the Victoria Road rapid bus corridor and planned light rail corridor along Hope Street. This improves access and provides the opportunity to increase walking and cycling, with the aim of reducing car dependency and overall parking requirements.

The former Bartlett Park site located on Victoria Road forms part of the northern precinct and has been re-zoned with DA approval for 1,200 dwellings.

A new town centre located on Hope Street will provide the focal point for the mixed use development and will contain the major commercial and retail uses. All this will be supported by a series of high quality public spaces which are to be dedicated to he City of Parramatta. The proposed development will create at least 1,500 full-time jobs within the town centre.

As part of the northern structure plan, upgrades on Victoria Road have been proposed as outlined in Figure 4.2. These upgrades have been planned in order to:

- Increase the accessibility of Melrose Park for all road users. Increased capacity at the Wharf Road intersection and new access via a southern leg at Kissing Point Road will allow vehicle demand to be efficiently dispersed across the network
- Improve the efficiency of the Victoria Road corridor. Additional stopline capacity on Kissing Point Road, Wharf Road and Marsden Road as well as for turning movement into these roads will ensure that regionally significant trips on Victoria Road are not adversely impacted by the development.
- Reinforce bus priorty by filling in gaps in existing bus lanes along Victoria Road and facilitating increased public transport use along the corridor.

Further investigations will be required in order determine the final layout of these upgrades. It is noted that all traffic modelling presented in this TMAP assumes full one-stage pedestrian crossings on all legs of Victoria Road intersections with Kissing Point Road and Wharf Road.

The proposed land use programme for the northern precinct is shown in Table 4.1

Table 4.1 : Land use summary (northern precinct)

Land use	GFA/dwellings
Residential	
Dwellings	6,850 dwellings
Non-residential	
Commercial	15,000m²
Retail	12,500m²

Figure 4.1 : Northern structure plan (adopted by CoP)

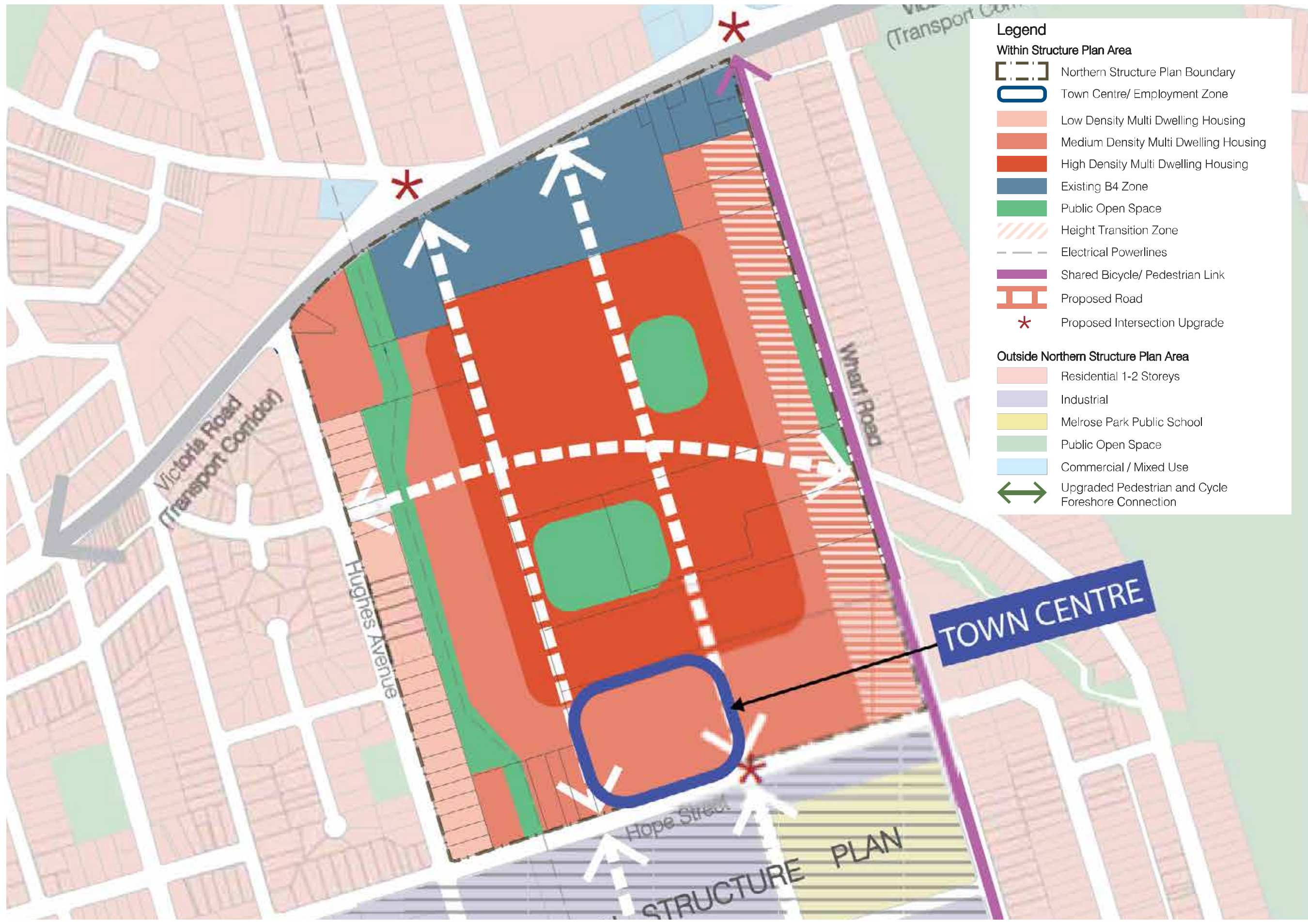


Figure 4.2 : Proposed Victoria Road Upgrades (Northrop)

4.2.2 Southern draft structure plan

The southern draft structure plan is shown in Figure 4.3 and has been developed based on the following guiding principles:

- A New Waterfront Community
- A Connected Precinct
- An Appropriately Scaled Precinct
- A Sustainable Precinct.

Built form in the Southern Precinct will be consistent with the scale of new development along Parramatta River and shall relate to the height of new development in the Northern Precinct.

- Built form will reduce in scale at the east and west edges of the precinct to affect a good transition in height to protect the amenity of adjoining low-rise neighborhoods.
- Along the riverfront park, scale will be limited to ensure a reasonable scale is achieved behind the mangrove line.
- There is to be no overshadowing of endangered Coastal Salt Marsh between 9am and 3pm at mid-winter, and no overshadowing of existing and new open space.

Higher density development is to be located at the heart of the precinct to facilitate a built form response that manages transitions adjoining low-rise residential. Densities will be reduced along the waterfront park edge.

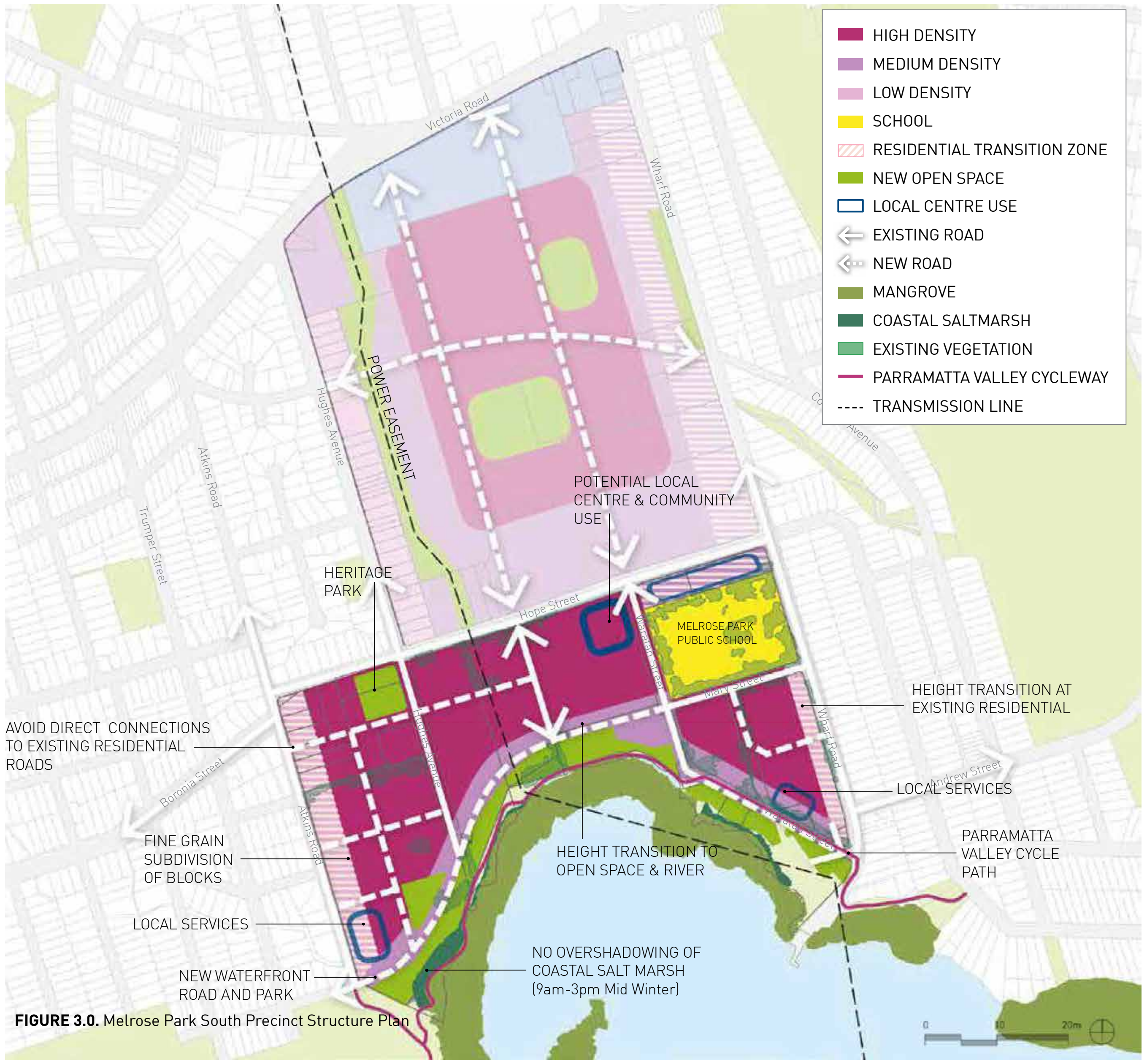
At least 15% of the precinct and 15% of privately owned land has been identified as new open space.

The proposed land use programme for the northern precinct is shown in Table 4.2

Table 4.2 : Land use summary (southern precinct)

Land use	GFA/dwellings
Residential	
Dwellings	4,238 dwellings
Non-residential	
Commercial	4,400m²
Retail	3,100m²

Figure 4.3 : Southern draft structure plan



4.3 Transport planning objectives and indicators

The Melrose Park precinct has been planned with the goal of delivering balanced, integrated and sustainable outcomes that will potentially achieve the proposed transport targets of:

- Walking and cycling mode share - 5%.
- Public transport mode share - 45%.
- Car mode share - 50%.

These targets are shown in Figure 4.4. It is noted that these mode shares are for peak hour trips external to the development. It is anticipated that trips within the development will be primarily undertaken by active transport.

The Melrose Park TMAP leverages off and facilitates existing, planned and potential future transport options and accommodates the staged implementation of these proposals. Table 4.3 shows the overall, integrated transport strategy for the Melrose Park TMAP. Specific transport objectives and indicators in the integrated network are discussed below to support the overall Melrose Park vision and respond to the constraints outlined in Section 3.0.

Figure 4.4 : Melrose Park peak hour mode share targets - excluding trips internal to development

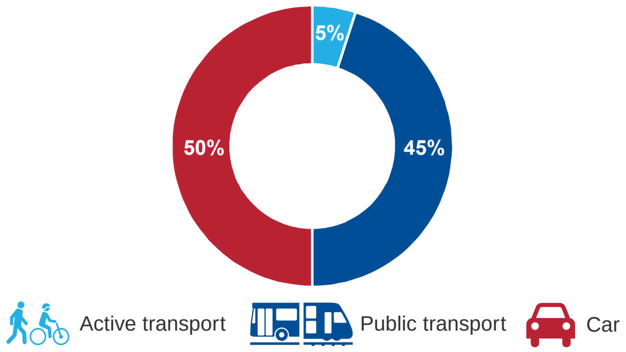


Table 4.3 : Melrose Park integrated transport objectives and indicators

Objective	Melrose Park indicators
1. Contribute to a general mode shift to public and active transport and reduce non-car mode share for peak trips to / from Melrose Park	Reducing the reliance on private car travel will provide significant benefits for future residents of Melrose Park whilst also minimising the impacts of the proposed developments on existing users of the road network. A non-car mode share of 50% represents a sizeable shift from the existing travel characteristics of the area. The delivery of significant new infrastructure – PLR Stage 2 and Sydney Metro West – will enable this step change in travel behaviour. These new public transport options will directly connect Melrose Park to the cores of the Eastern and Central CBD's, enhancing accessibility and reducing travel times to jobs and services.
2. Ensure that the transport network and services reflects the future growth and importance of key activity centres to / from Melrose Park	Melrose Park is perfectly located to provide 30-minute access to both the Eastern and Central CBD by public transport. Other nearby strategic centres include Sydney Olympic Park, Rhodes Business Park. This goal of 30-minute access to centres has been a key driver throughout the TMAP process and will be a key indicator for the overall success of the precinct.
3. Ensure all new residents in Melrose Park are within a safe walking distance of open space, social infrastructure and retail facilities.	The proposed development will deliver important non-residential facilities with retail, commercial and community uses as well as public open space. In order to maximise the benefits from these uses it will be imperative that a convenient, comfortable and safe walking environment is provided.
4. Minimise travel times along key public transport and movement corridors	Victoria Road is a regionally significant movement corridor. The efficiency and productivity of the corridor will need to be protected and the Melrose Park development will need to be implemented in a way that does not lead to travel time increases of more than 5% through the study area. This TMAP shall seek to meet this performance indicator through the provision of appropriate infrastructure upgrades and the minimisation of car use for trips to and from Melrose Park.
5. Ensure that the future transport network and services are attractive to the trip patterns of future residents	Melrose Park will be well served by existing and planned public transport services but there is a need to ensure patronage from the development does not exceed the planned future capacity of the network. The TMAP process will ensure that the staged development of the precinct occurs in lock-step with the provision of public transport infrastructure and services. The development will seek to focus highest intensity land uses around the primary public transport network such that 90% of the potential passenger catchment is within a 800 metre radius of a stop on the intermediate public transport system and/or within 400 metres of a local and suburban public transport route.
6. Ensure the key road network performs at acceptable levels of service during the highest impact peak hour.	The two key access points for the precinct will be on Victoria Road at Kissing Point Road and Wharf Road. Maintaining intersection level of service at LOS E or better will ensure that Victoria Road through traffic is not adversely impacted by the development whilst also allowing efficient access into and out of the precinct. It is noted that Victoria Road/Wharf Road currently performs at LOS F.
7. Prioritise active and public transport, and demand management measures to support sustainable travel behaviour and encourage reduced car use	Maximising the use of active and public transport will have significant benefits for the future residents and visitors of Melrose Park and will reduce the impacts of the development on the wider transport network. A key driver of active and public transport use will be the prioritisation of these modes throughout the precinct. This can primarily be done through best-practice urban and public realm design and by designing the precinct with pedestrians and cyclists as a primary consideration.

JACOBS

4.4 Movement and place framework

In recognition of these various functions, TfNSW has prepared new guidelines for street planning in NSW. The NSW Road Planning Framework (2017) proposes five different road types, as shown and described in Figure 4.5. Ultimately the classification of a road corridor to one of these types is based on a corridor's Movement needs and Place function.

The proposed road network within the Melrose Park precinct and hierarchy is shown in Figure 4.6. The hierarchy of the road has many functions on which the future precinct will rely on, including:

- Connecting communities through the movement of people and goods
- Supporting places and public spaces in urban areas and regional centres
- Facilitate economic growth and prosperity
- Facilitating social activities such as events and celebrations.

The Melrose Park structure plan is based on an interconnected, legible, urban-scale grid street pattern that will provide a pedestrian-friendly environment and provide optimal opportunities for bus servicing and access. The road network has been planned and dimensioned in conjunction with the spatial and land use planning of the precinct. This has ensured that the design of each street and its position in the movement and place hierarchy is appropriate to its role and the traffic demands placed upon it.

The internal road network has been conceived as a 'grid-like' system. Beginning from the higher order road network, each road type in the hierarchy branches into a smaller road with reduced speed environment. The hierarchy has been designed so that as individual blocks and access are approached, the level of speed of traffic decreases. The road network comprises three major elements:

1. The road hierarchy and street pattern

2. Road widths

3. Intersections

Figure 4.5 : Movement and Place

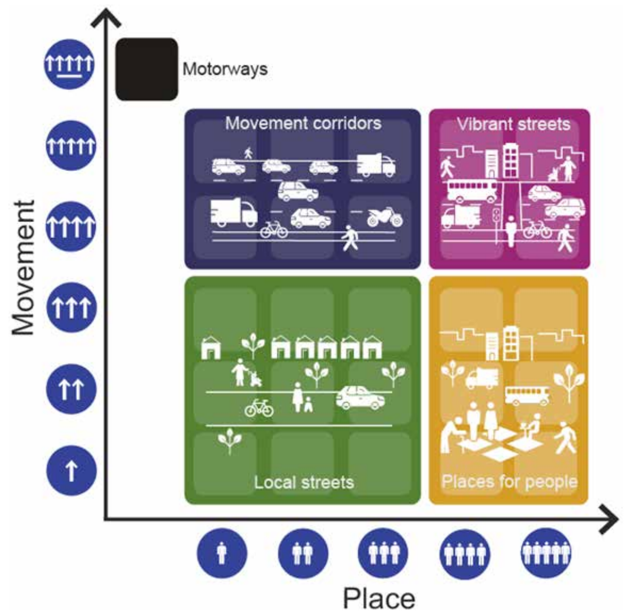


Figure 4.6 : Indicative internal street hierarchy

These elements have been integrated with a firm view of the broader aims of the structure plan to ensure the following outcomes:

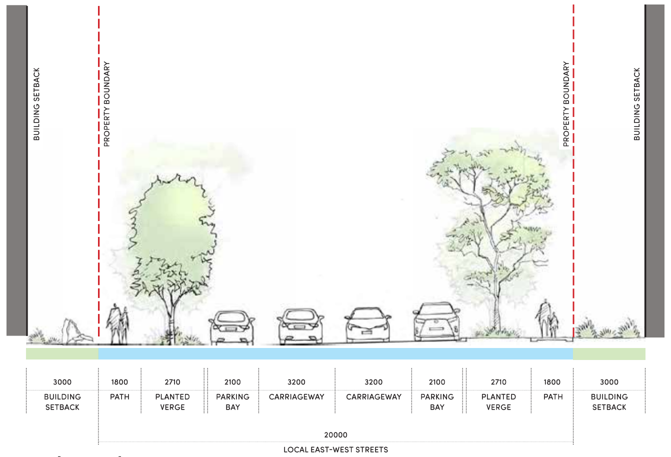
- An interconnected, legible, urban-scale grid street pattern that will provide a pedestrian-friendly environment and optimal opportunities for bus servicing and access
- The proposed Town Centre at the south east corner of Hope Street and Wharf Road is developed on the basis of promoting local access rather than regional traffic
- The road hierarchy is compatible with the land use and range of roles that each street serves. This incorporates a grid of local collector roads to distribute traffic within the Centre and to provide access into parking areas
- The alignment of roads and intersections support the urban structure and form. The structure plan includes proposed upgrades to Victoria Road in order to provide a new access into the precinct via the Victoria Road/Kissing Point Road intersection. Minor capacity upgrades to the Wharf Road/Victoria Road intersection are also proposed

Carriageways have been dimensioned to support the aims of the structure plan:

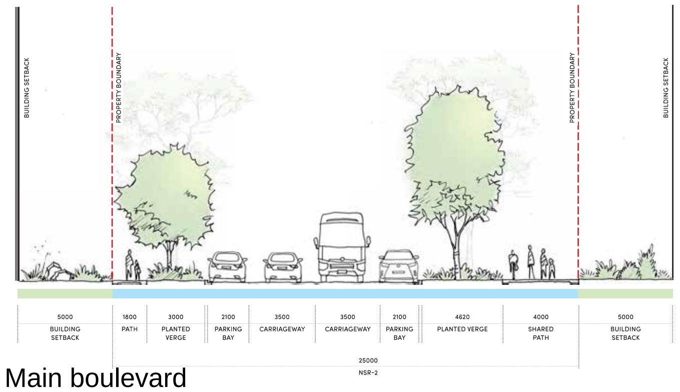
- Main roads in the core are proposed to each have a width capable of providing either four travel lanes or two travel lanes and two parking lanes
- Appropriate setbacks provided along the northern side of Hope Street (between Hughes Avenue and Waratah Street), future proofing the land to enable implementation of PLR Stage 2
- Some of the lesser roads are proposed to have 8.5m wide carriageways which would be capable of providing two travel lanes plus a parking lane on one side
- Roads in the residential areas are proposed to have carriageways typically 8m wide. These allow parking on each side plus a single travel lane between or parking on one side plus room for two vehicles to pass in opposing directions
- On-street parking (indented parallel parking bays) to be provided within the internal road network to provide for overspill of resident and visitor vehicles
- Comprehensive pedestrian and bicycle network providing sufficient footpath width that will provide permeability and a high degree of convenience for walkers and cyclists.

The right-of-way and typical cross sections associated with the northern and southern structure plans are shown in Figure 4.7 and Figure 4.8. It is noted these figures are indicative only and will be subject to refinement during detailed design and precinct delivery.

Figure 4.7 : Internal road sections - northern precinct

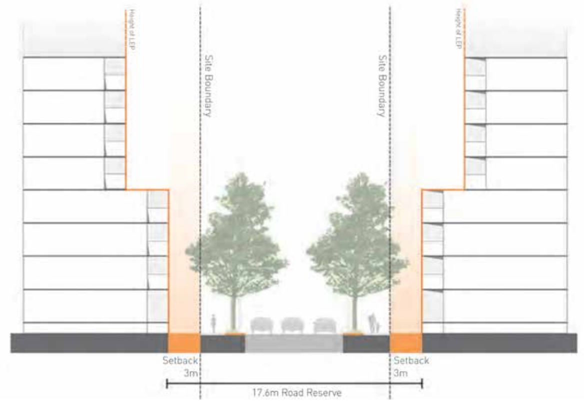


Local road



Main boulevard

Figure 4.8 : Internal road sections - southern precinct



5. TRANSPORT MODELLING

JACOBS

5. TRANSPORT MODELLING

5.1 Overview

Transport modelling is a core part of the Melrose Park TMAP. The modelling process forecasts the traffic and transport impacts of the overall Melrose Park precinct. This section outlines the various platforms and processes used throughout the modelling components of the TMAP.

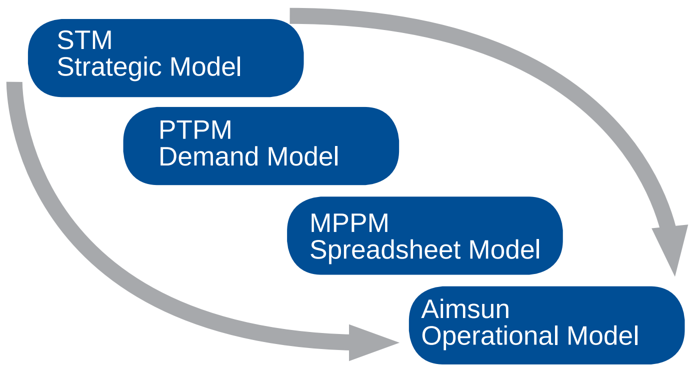
5.2 Modelling framework

The transport modelling approach was tailored to the needs of the Melrose Park TMAP included the use of three (3) separate models with linkages, as outlined in Figure 5.1. Transport modelling has been undertaken using a multi-tiered modelling approach using a combination of strategic, mesoscopic and microscopic modelling. Strategic modelling has been used for demand forecasting and mode split, while mesoscopic modelling has been undertaken to determine key performance indicators for general traffic, buses and light rail for the base and future scenarios.

The transport modelling approach and included the use of three (3) models with linkages as follows:

- **Public Transport Project Model (PTPM)** - used to determine future travel patterns based on population and employment forecasts from STM and estimate public transport patronage.
- **Melrose Park Precinct Model (MPPM)** - bespoke precinct wide spreadsheet modelling tool to derive high level patronage forecasts, and potential mode shares to assist in understanding the initial feasibility of various transport scenarios
- **Aimsun mesoscopic traffic model** - developed to assess transport impacts on the road network of the proposed land use changes and to ascertain the requirements for transport infrastructure and services to support this growth.

Figure 5.1 : Modelling process



5.2.1 Public Transport Project Model (PTPM)

PTPM (Public Transport Project Model), currently being used for PLR Stage 1 and 2, is an incremental multi-modal demand model developed for and operated by the Transport Performance Analytics (TPA) within TfNSW to assist in the evaluation of major public transport projects. It is closely related to the Strategic Travel Model (STM) which provides the overall growth factors before PTPM undertakes the mode choice and assignment functions using generalised costs. A key strength is the underlying observed demand, which provides a solid platform to forecast patronage and demand related impacts of public transport projects and policies.

In this context, the Melrose Park TMAP Project Coordination Group advised the use of PTPM to investigate the following for a 2026 and 2036 forecast year:

- Determine regional trip distribution across the Sydney Metropolitan Area
- Determine potential future travel patterns based on population and employment forecasts
- Estimate public transport patronage and future services through the study area.

5.2.2 Melrose Park Precinct Model (MPPM)

As part of the Melrose Park TMAP, Jacobs developed a bespoke precinct wide spreadsheet modelling tool (MPPM) in conjunction with Dr Neil Prosser to derive high level patronage forecasts, and potential mode shares to assist in understanding the initial feasibility of various transport scenarios. The MPPM is a combination of mode choice modelling with tailored assumptions trip generation, trip distribution, and travel attributes based on background data. The MPPM is a finer grain precinct wide model based on benchmarking future demand based on proposed developments near the vicinity of Melrose Park such as Meadowbank, Wentworth Point, Rhodes and Liberty Grove etc.

A summary of the development and operation of the model is provided below:

- A combination of mode choice modelling with assumptions about trip generation, distribution and travel attributes based on an analysis of JTW (2011) and HTS (2015/16) data
- Coarse representation of zones outside the study area – modelling of key origins and destinations
- No modelling of the road and traffic network – car travel times are obtained from STM
- Public transport – travel attributes, including travel time, walk time, wait time, transfers and fares, are estimated within the PT model based on specified public transport routes and services
- Walking and cycling – walk and cycle travel times are estimated based on specified average speeds and distance factors.

The MPPM has benefits associated with the modelling approach undertaken for the Melrose Park TMAP including:

- More accurate modelling of higher density land use at a block by block level near transit nodes
- Finer disaggregation of travel zones within the precinct when compared to PTPM
- Detailed modelling of bus, light rail and future rail services with 'walking up' components incorporated in mode choice
- Estimation of trip generation for work and non-work trips
- Modelling of public transport travel and mode share to and from Melrose Park during the AM and PM peak hours.

Detailed documentation of MPPM background and model development is provided in Appendix A.

5.2.3 Mesoscopic and microscopic modelling

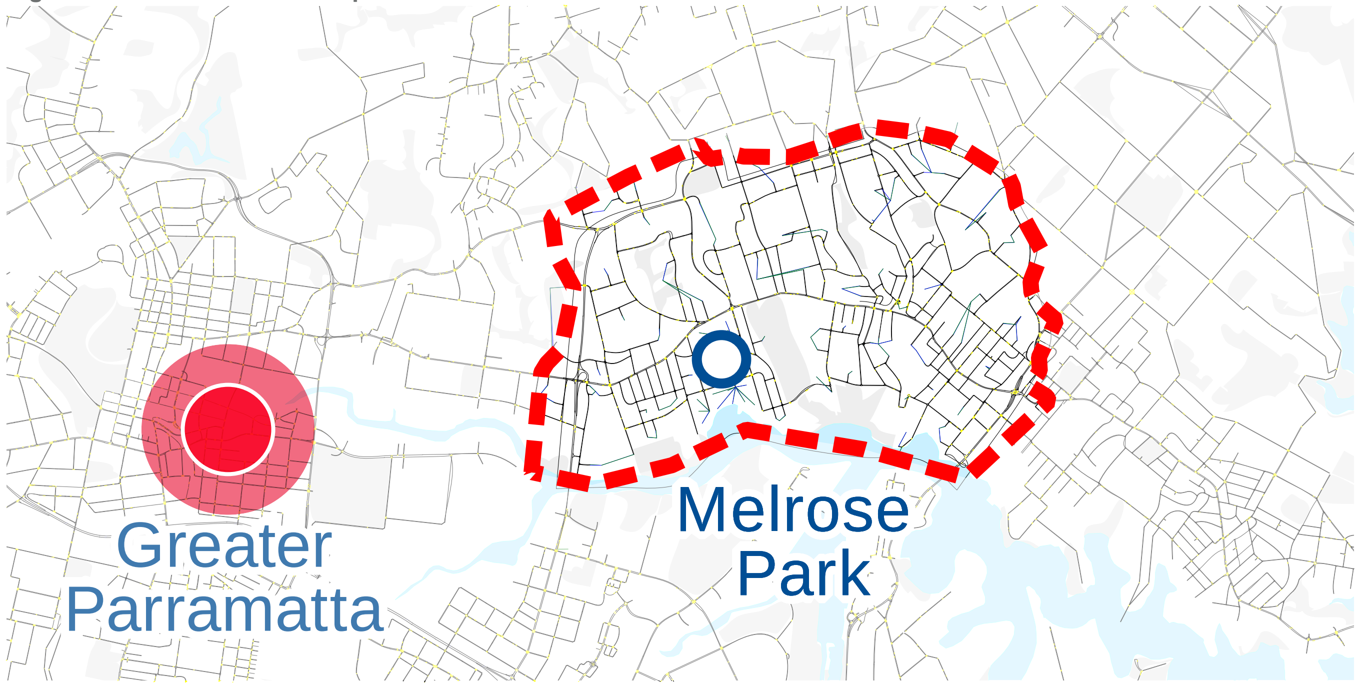
A mesoscopic model is a mid-level modelling tool which uses features from both strategic modelling and micro-simulation modelling to forecast the future transport demand on the road network by considering the predicted land use changes (population and employment). Operational modelling of the study area has been undertaken using the Aimsun modelling platform using a hybrid combination of mesoscopic and microscopic modelling. The extent of the model area is shown in Figure 5.2.

Mesoscopic modelling allows for simulation to be undertaken using dynamic assignment that takes into account the effects of congestion on the network and allows for the identification of network constraints at the arterial and sub-arterial level. Microscopic level modelling allows for more detailed examination of specific locations using microsimulation for selected areas. This hybrid configuration of mesoscopic/ microscopic modelling has been undertaken for the TMAP, with microsimulation at the immediate development interface and mesoscopic modelling for the wider network.

The adopted hybrid modelling configuration provides sufficient detail to determine the performance of the network under proposed future land use demands and provides guidance on the need for further road infrastructure improvements. In addition, the hybrid simulation allows for true dynamic equilibrium assignment, where vehicles can select their optimum travel routes based on their previous travel experiences. This provides confidence that the modelled pattern of traffic represents a realistic response to all of the delays and capacity constraints that would be experienced on the network.

The Aimsun model calibration report is provided in Appendix B.

Figure 5.2 : Aimsun mesoscopic model area



5.3 Mesoscopic Modelling – Calibration and validation

The Melrose Park Traffic Model has been calibrated and validated according to the principles outlined in the RMS Traffic Modelling Guidelines, 2013. Calibration and validation of models is essential to ensure that they are an accurate reflection of observed traffic conditions.

Further detail on the calibration and validation process is provided in the *Melrose Park Mesoscopic Model Calibration and Validation Report* (Jacobs, 2018).

5.3.1 Data sources

The model has been calibrated using turning movement counts collected across the study area in August 2017. Travel time surveys were undertaken along key corridors in order to provide a basis for model validation. Travel times were collected for:

- Victoria Road
- Silverwater Road
- Wharf Road/Marsden Road.

5.3.2 Model coverage

The Melrose Park mesoscopic model is a sub-area model derived from the Sydney GMA model. The Melrose Park sub-area extends from Silverwater Road in the west to Church Street/Devlin Street in the east. The Parramatta river forms the southern boundary and the model extends to Stewart Street and Rutledge Street in the north.

The model is comprised of:

- Over 1,267 individual road sections
- Over 100 traffic generating centroids
- Over 40 signalised intersections.

5.3.3 Calibration

Through a process of demand adjustment and refinement of traffic signal settings and route attractiveness, the models were calibrated to the observed counts. The Melrose Park model has been calibrated according to the following criteria:

- R^2 of greater than 0.95
- Regression slope between 0.95 and 1.05

Whole model:

- At least 80% of flow comparisons with GEH less than 5
- At least 95% of flow comparisons with GEH less than 10

Core/microsimulation area:

- At least 85% of flow comparisons with GEH less than 5
- 100% of flow comparisons with GEH less than 10

The GEH statistic is used in the calibration of traffic models to compare the differences between modelled and observed traffic flows

The R^2 value generally represents the closeness of fit of the observed data points with the modelled data points and the slope of the trendline provides an indication of whether the model is generally over assigning (slope greater than 1) or under assigning (slope less than 1) traffic across the network.

Review of the GEH and regression statistics, see Table 5.1, Table 5.2 and Figure 5.3 shows that the model is sufficiently well-calibrated on the basis of turning movement flows, for both peak periods in aggregate and for each hour within those peak periods.

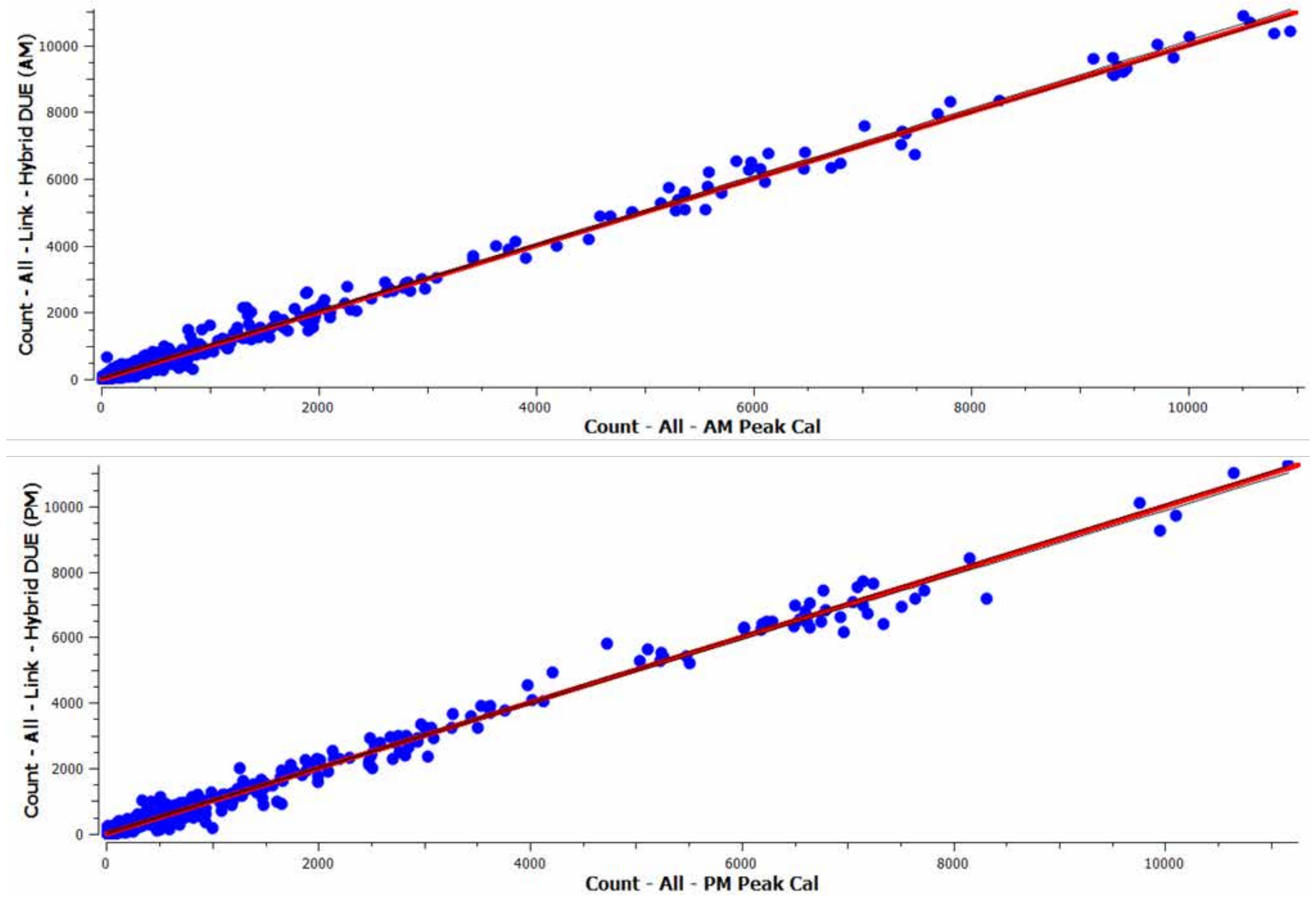
Table 5.1 : GEH statistics

Measure	Target	Hour starting				
		All hours	6:00am	7:00am	8:00am	9:00am
Whole model						
GEH<5	80%	85%	78%	80%	78%	80%
GEH<10	95%	98%	98%	99%	95%	98%
Core area						
GEH<5	85%	91%	82%	88%	86%	85%
GEH<10	100%	100%	100%	100%	100%	100%

Table 5.2 : Regression statistics

AM Peak	R^2	Slope
6:00 - 10:00 (Aggregate)	**0.992**	**0.989**
6:00 - 7:00	0.988	0.974
7:00 - 8:00	0.990	0.981
8:00 - 9:00	0.981	0.975
9:00 - 10:00	0.982	1.014
PM Peak	**R^2**	**Slope**
15:00 - 19:00 (Aggregate)	**0.987**	**0.979**
15:00 - 16:00	0.973	0.950
16:00 - 17:00	0.986	0.986
17:00 - 18:00	0.986	0.989
18:00 - 19:00	0.977	0.982

Figure 5.3 : Regression graphs



5.3.4 Validation

In order to determine the suitability of the Melrose Park model in forecasting future traffic conditions, it was necessary to validate the model against a set of data that is independent from that used in the demand estimation and calibration process. Validation of the Melrose Park model has been undertaken using travel time surveys outlined above and results for Victoria Road are shown in Figure 5.4 and Figure 5.5. Results indicated that the model was sufficiently validated in accordance with RMS Traffic Modelling Guidelines.

Figure 5.4 : Victoria Road travel time validation (AM peak hour)

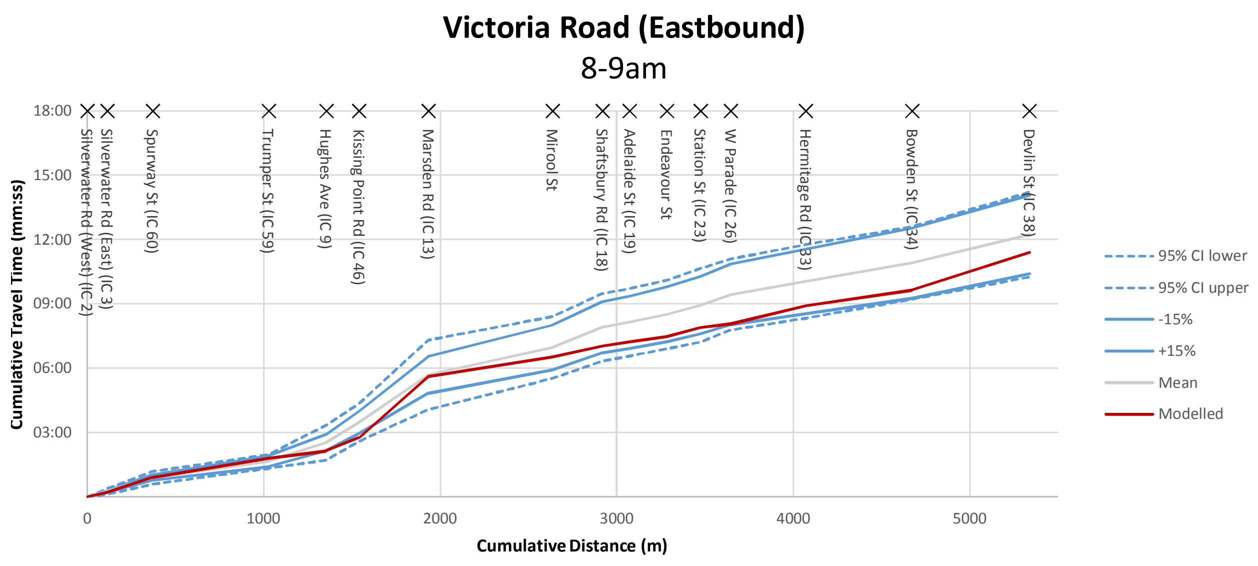
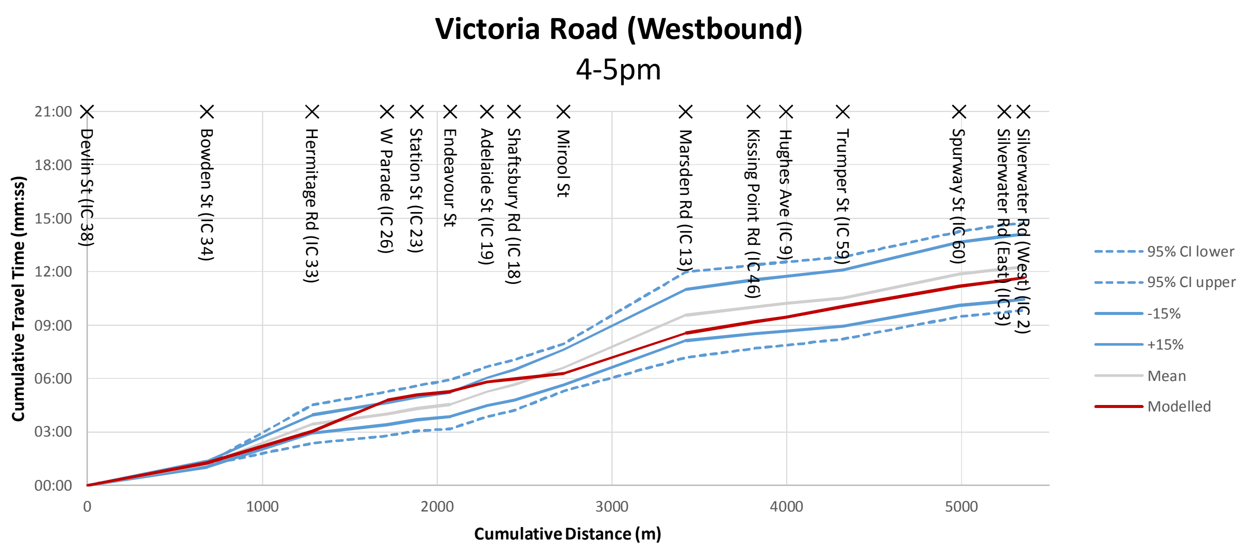


Figure 5.5 : Victoria Road travel time validation (PM peak hour)



5.4 Model inputs and assumptions

The transport models developed for the Melrose Park TMAP required a number inputs and assumptions, including population/employment forecasts, wider network changes, road network configurations and public transport service provision. Key assumptions in the immediate area impacting the Melrose Park TMAP included:

- Population and employment across Sydney GMA consistent with LU16 forecasts
- Major public transport projects – Parramatta Light Rail Stages 1 and 2 connecting Rydalmere and Sydney Olympic Park via Melrose Park (via new bridge across Parramatta River (in 2026), and Sydney Metro West connecting Parramatta CBD, Sydney Olympic Park and Sydney CBD in 2036
- Major motorway road projects – WestConnex Stages 1&2 by 2026 and WestConnex Stage 3 and Western Harbour Tunnel by 2036.
- Major arterial road projects – proposed structure plan incorporates widening of Victoria Road (from Wharf Road to Hughes Avenue), upgrades to Victoria Road signalised intersections at Wharf Road and Kissing Point Road in 2026
- Local road network changes – all intersections along Boronia Street-Hope Street between Spurway Street and Wharf Road along the PLR Stage 2 corridor have been assumed to be signalised with other intersections 'left-in' and 'left-out' in 2026

5.5 Trip generation

5.5.1 Approach

As agreed with the Melrose Park PCG, two methods were used to estimate the overall trip generation of the overall Aimsun model study area. The first method involved the application of the STM/PTPM, and the second method was based on the RMS Guide to Traffic Generating Developments (2002) and High Density Residential Car Based – Trip Generation Surveys Analysis Report (2017) undertaken on behalf of RMS.

5.5.2 Traffic generation calculations

The estimation of future traffic volumes to be used in the Aimsun model has been developed using a combination of both the STM/PTPM and RMS guidelines as follows:

- PTPM has been used to generate 'external trips' only with neither originating or ending in the study area
- RMS guidelines have been used to generate 'internal trips' into and out of Melrose Park precinct based on a combination of RMS updated surveys (TDT 2013/04a) and more recent surveys undertaken in 2017 on behalf of RMS.
- Commercial vehicle trip rates are based on rates from RMS updated surveys (TDT 2013/04a)
- Retail rates are based on surveys undertaken at East Village Shopping centre as outlined in the *Melrose Park Planning Proposal Traffic and Transport Study (2016)*.

An analysis of the above data along with an extensive benchmarking process led to the following rates being proposed and agreed with the PCG:

- The traffic generation rate for the former Bartlett Park site incorporating 1,200 dwellings has based on an AM and PM rate of 0.19 and 0.15 trips per dwelling per hour respectively as part of previously approved rezoning proposal
- The traffic generation rate for the remaining 9,855 dwellings for Melrose Park has been based on a rate of 0.25 trips per dwelling per hour for both the AM and PM periods.
- Retail rates includes a 20% reduction to account for linked trips already captured by the residential generation rates, as is appropriate for a high density mixed use development.

The expected generated trips for the AM and PM peak hours for the 'ultimate build-out' (2036) is shown in Table 5.3.

Table 5.3 : Melrose Park traffic generation (ultimate build-out)

		AM PEAK HOUR		PM PEAK HOUR	
		Trip generation rate	Vehicle trips	Trip generation rate	Vehicle trips
Dwellings (Bartlett site)	1,200	0.19 per dwelling	228	0.15 per dwelling	180
Dwellings	9,886	0.25 per dwelling	2,471	0.25 per dwelling	2,471
Commercial GFA	19,400m^2	1.6 per 100m^2	310	1.2 per 100m^2	233
Retail GFA	15,600m^2	2.5 per 100m^2	390	5.0 per 100m^2	780
Total			**3,399**		**3,664**

5.6 Trip distribution

The distribution of all trips in the network has been based on the outputs of PTPM. Overall trip distribution for the Melrose Park Traffic Model has been undertaken on the basis of revealed travel patterns from the PTPM, and by extension the STM. Trip distribution in STM is an iterative process that distributes trips based on the proximity of jobs and population for the whole Sydney metropolitan area.

The PTPM trip matrices provide the most appropriate source of future trip distribution for all trips within and through the study area. The future land use projections for the entire Sydney metropolitan area are included in the PTPM hence the distribution of trips within PTPM takes into account the location of future jobs, dwellings and services likely to generate and attract trips which interact with the Melrose Park study area.

Figure 5.6 and Figure 5.7 show the distribution of trips leaving Melrose Park in the 2036 AM peak periods. There remains a relatively strong desire line to Sydney CBD, however there is a noticeable shift away from the Eastern City as a whole. More trips from Melrose Park remain in the Central City where a significant number of new jobs and services are expected to be provided within the next 20 years. Less than half of all trips originating from Melrose Park are expected to have destinations in the Eastern City, compared with almost 60% in 2016.

This change in trip distribution patterns will lead to shorter trips and will help to relieve the existing pressure on existing transport infrastructure which is currently constrained by the significant number of eastbound trips towards the Eastern City in the AM peak period.

Figure 5.6 : Distribution of trips departing Melrose Park - SA3 level (2036 AM)

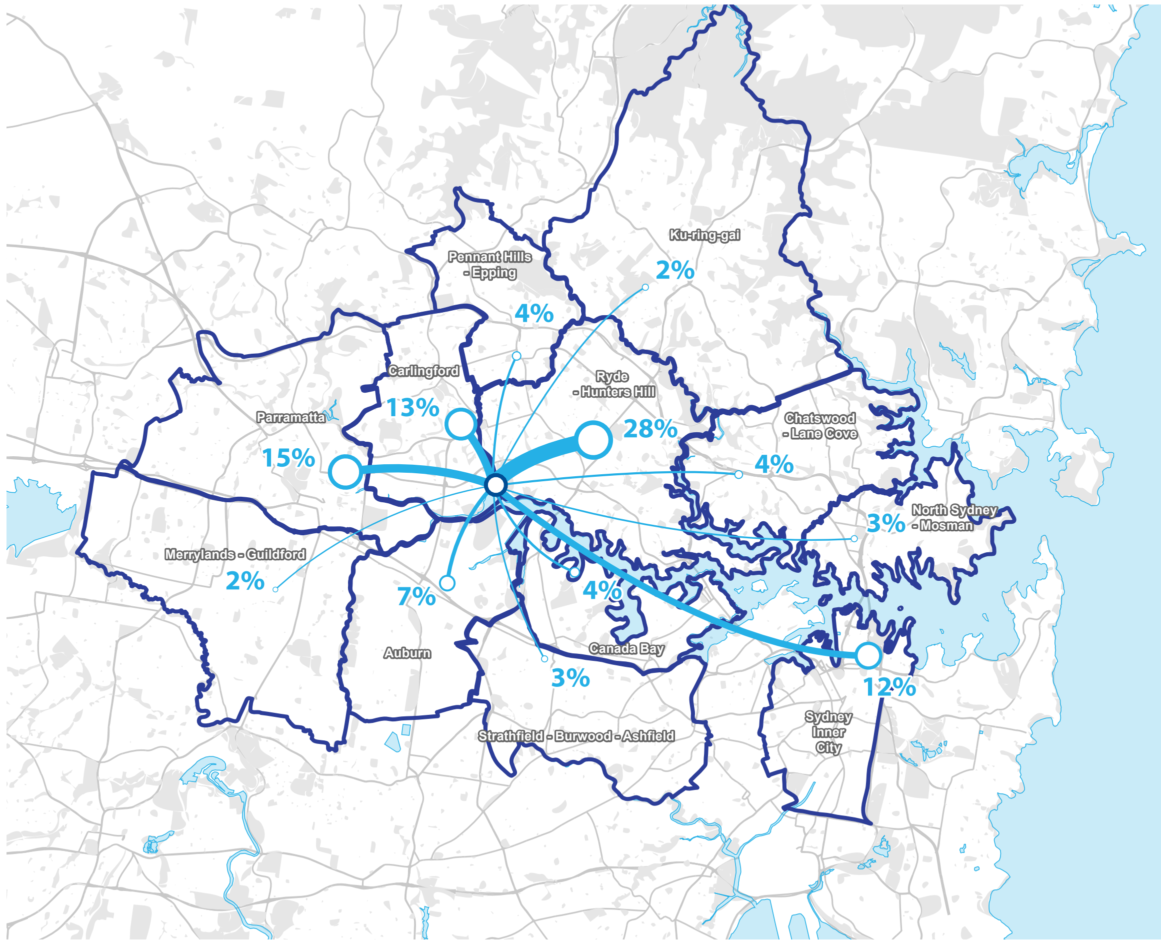
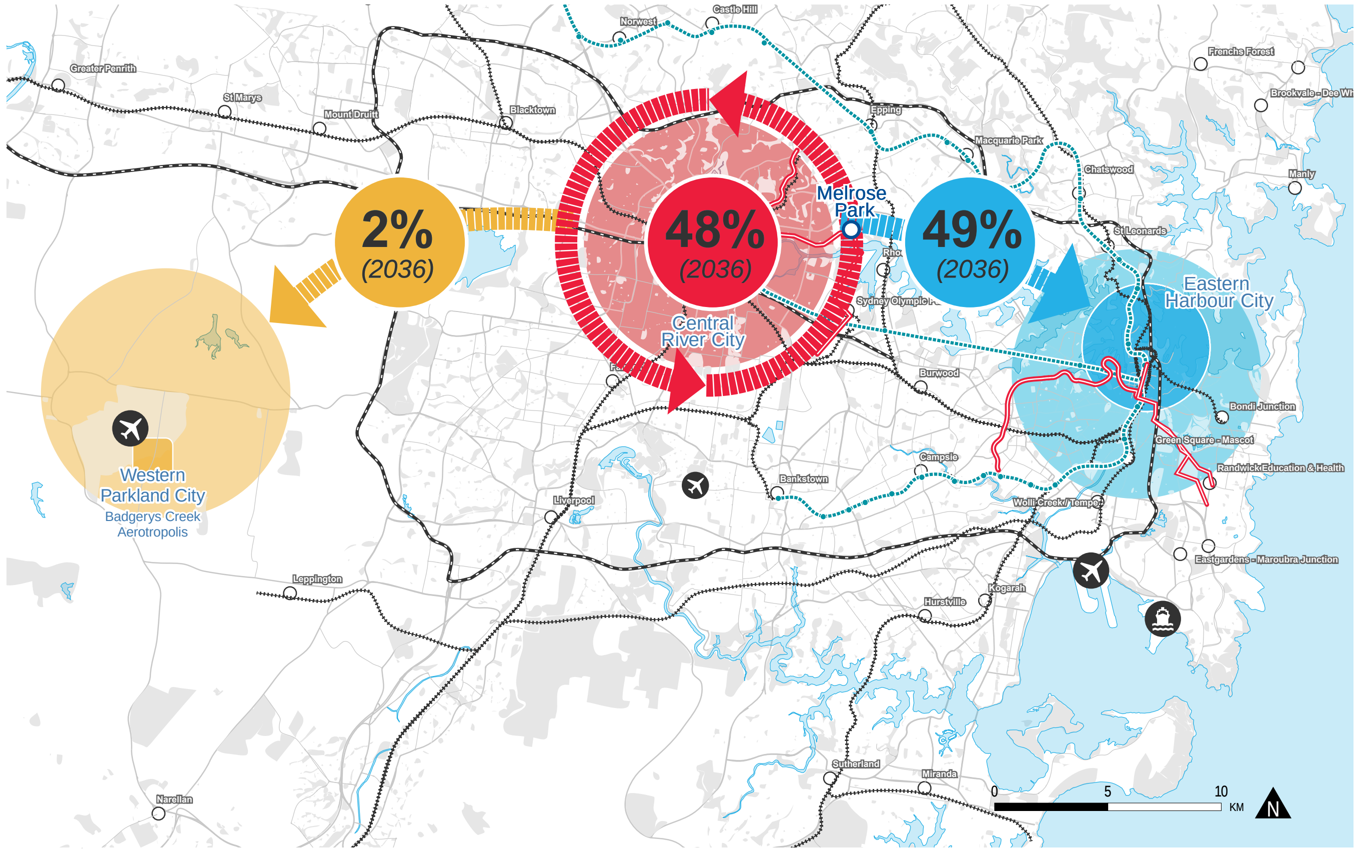


Figure 5.7 : Distribution of trips departing Melrose Park - 3 cities level (2036 AM)



5.7 Mode choice

Potential future mode shares for Melrose Park have been assessed using a combination of the PTPM and MPPM models. Both models use an assessment of the generalised cost of travel time to forecast mode choices for a particular journey.

The potential for reduction in car dependency by implementing the public transport initiatives (see Section 6.0) for Melrose Park is considerable, and preferable to the alternative of the traditional car-based solution. As discussed earlier, the Melrose Park site represents a major opportunity to influence travel through initiatives that encourage transport alternatives that will reduce car dependency.

The proposed PLR Stage 2 and its connection to Sydney Metro West via a new bridge across the Parramatta River represents a major commitment to promoting public transport, as a competitive and preferable mode to private vehicle use, which will be demonstrated later in this report.

The mode share for trips from Melrose Park derived from both the PTPM and MPPM is provided in Figure 5.8. It is noted that PTPM is forecasting higher car mode shares for all future horizon years compared to the MPPM results. Several points are noted regarding this difference:

- PTPM 'pivots' off the existing base conditions using a combination of incremental and absolute forecasting methods. The existing land use in Melrose Park is industrial and non-residential and existing car mode shares for trips from Melrose Park are therefore very high. The incremental forecasting component of PTPM is potentially unable to fully quantify the change in mode share that will result from the delivery of a highly accessible mixed use precinct and major public transport infrastructure.
- The MPPM results are based on an assessment of generalised costs for all mode options in the network. They are also founded on benchmarking of travel patterns from existing centres and developments similar in composition to the proposed Melrose Park precinct.

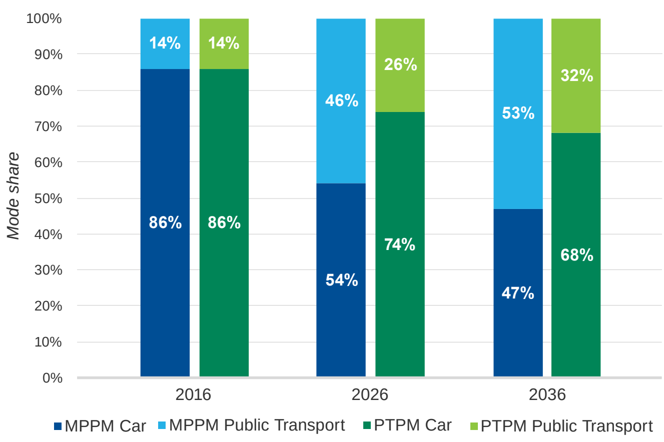
5.8 Trip assignment

The assignment of vehicle trips has been undertaken in two stages:

- Stage 1: Static traffic assignment in PTPM to determine sub-area traffic demand based on a traversal matrix from STM
- Stage 2: Dynamic user equilibrium assignment in Aimsun mesoscopic model

This assignment methodology is detailed below.

Figure 5.8 : Melrose Park mode share



5.8.1 Static assignment

The static assignment step has been undertaken to generate a sub-area traversal of the whole Sydney Greater Metropolitan Area model, suitable to be used as an input for future traffic demand within the smaller Melrose Park traffic model.

5.8.2 Dynamic user equilibrium assignment

Traffic generation as previously described was assigned to the Melrose Park traffic model Aimsun model using a Dynamic User Equilibrium (DUE) assignment method. DUE is an extension of the concept of static equilibrium however vehicle simulation is used to generate route costs, rather than a theoretical speed/flow curve. This has the advantage of taking into account the capacity constraints of the network in greater detail including traffic signals and intersections, merging and weaving on freeways and the accumulation of traffic in queues.

5.8.3 Assignment of Melrose Park trips

Figure 5.9 and 5.10 shows the assignment of trips in the 1-hour AM and PM peak periods generated by the Melrose Park development only. The origin and destination of trips has been defined by the PTPM strategic model whilst the route taken through the model is a result of DUE assignment. It is noted that:

- The majority of Melrose Park trips travel in an east-west direction, either via Victoria Road or the Andrews Street/Constitution Road corridor
- The Hope Street and Marsden Road corridors also serve as a key access for the Melrose Park precinct
- These volumes are not purely in addition to volumes in the do minimum scenario. It is noted that the development will replace existing traffic generating land uses and so the net increase in traffic would be lower than the total trip generation volumes in these figures.

Figure 5.9 : Traffic volume - 2036 AM peak hour (only trips generated by development)

Figure 5.10 Traffic volume - 2036 PM peak hour (only trips generated by development)

5.9 Development of future traffic forecasts

5.9.1 Future background traffic growth

Initial testing and analysis of the future year 2036 forecast travel demands – without Melrose Park development - showed that there was insufficient capacity on the network to accommodate forecast traffic growth. Demand capping was undertaken using simulation of the forecast traffic demand on the mesoscopic network and comparing forecast demand with model throughput across the network to:

- Identify network constraints where proposed demand exceeded capacity and resulted in either excessively low average speeds or vehicles being unable to enter the network
- Cap the growth in trips for any origin-destination pairs that must pass through identified capacity constraints
- Allow trips to change their departure time to avoid capacity constraints and maximise available traffic network capacity.

The process accounts for the fact that strategic model outputs from PTPM, are likely to overestimate the growth in peak hour trips. Historic traffic counts demonstrate that peak period vehicle trips have experienced limited growth despite significant population growth. PTPM forecasts significant growth (1-2% per annum) on Victoria Road and Silverwater Road which have experienced flat or negative growth since 2009 (-2% and -4% per annum respectively.) To account for this, traffic growth was capped to the modelled network capacity under the Do-Minimum scenario (without Melrose Park development).

The quantum of capped trips assumed to not depart during the modelled 4-hour period is shown in Figure 5.11 and equates to less than 2% of the total uncapped future demand from PTPM.

The primary result of the demand capping process has been to shift trips from the peak hour to the shoulder periods. This is consistent with the observed pattern of growth along Victoria Road and Silverwater Road, where peak hour volumes have remained relatively constant, but the peak period has expanded to cover a longer time period.

A difference plot comparing capped and uncapped static assignment hourly volumes is shown in Figure 5.12. It is noted that the majority of capped trips are those that use the Church Street/Devlin Street corridor in the far south east of the model area. The number of capped trips is also observed to be very low through the study area.

5.10 Trip generation summary

A summary of the AM peak 1-hour trip generation of Melrose Park for all modes is presented in Table 5.4. Trips are shown for the two major proposed staging scenarios i.e. 'No-bridge' representing the period prior to the implementation of the new bridge over Parramatta River and 'Post-bridge' representing the ultimate 11,000 dwelling scenario with the bridge in place. (See section 6.4.3 for a more detailed description of staging)

Table 5.4: All modes trip generation (AM peak hour person trips)

	No-bridge (approx 6,700 dwellings)	Post-bridge (approx 11,000 dwellings)
Private Vehicle[1]	2,525	4,080
Bus only	150	30
Bus/Train	1,590	450
Light Rail only	-	280
Light Rail/ Train	-	2,390

[1] Assuming vehicle occupancy of 1.2 people per vehicle

Figure 5.11 : Demand capping results (AM 4-hour period)

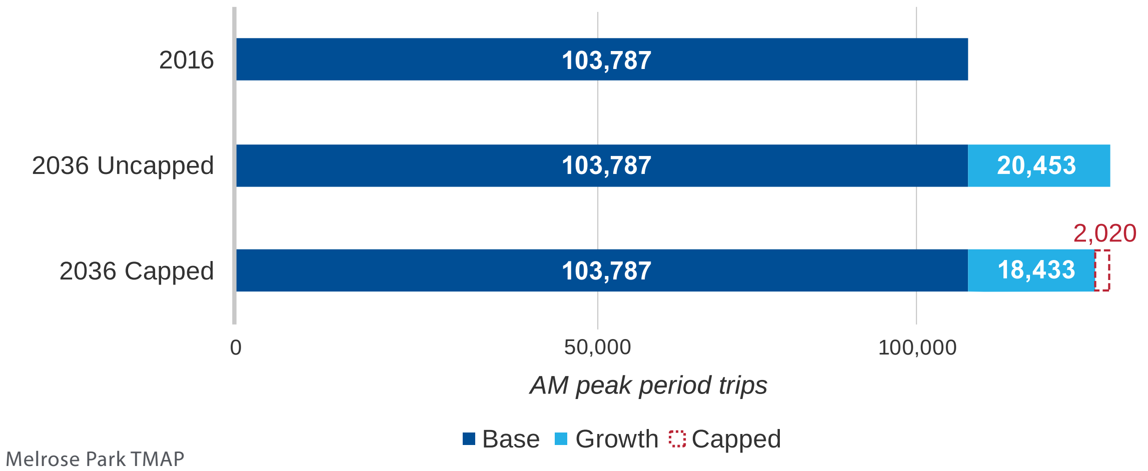


Figure 5.12 Difference plot comparing capped and uncapped 2036 AM demand (average hourly flows over 4-hour modelled period)

6. APPRAISAL OF MELROSE PARK STRUCTURE PLANS

JACOBS

6. APPRAISAL OF MELROSE PARK STRUCTURE PLANS

6.1 Overview

Transport modelling has been used as the basis for assessing the surface transportation network presented in the Melrose Park structure plans. This section examines the overall road network performance based on the land use estimates of 11,000 residential dwellings proposed for overall Melrose Park precinct and assesses future infrastructure enhancements for 2026 and 2036. In assessing the adequacy of the Melrose Park road network to meet the proposed future land-based demands, a desired assessment criteria for strategic road network planning and intersection performance has been developed.

This section addresses the potential impacts of the public transport system in the study area in the context of the mode shift objectives. This section also recognises the role walking and cycling replaces car-based trips within Melrose Park, and how the provision of improved transport facilities and opportunities can help drive positive mode change in the future.

6.2 Approach to appraisal

The appraisal of the Melrose Park structure plans was tested using the PTPM, MPPM and the Melrose Park Traffic Model (using Aimsun) to examine the potential impacts on transport infrastructure and services on the local and regional road network, public transport and walking and cycling. The key stages of the Melrose Park TMAP approach were as follows:

- Land use development scenario of 11,000 dwellings for the combined northern and southern precincts
- Update the TfNSW PTPM model to forecast travel demand and mode share
- Traffic forecasts and assessments for the road network produced by the Melrose Park traffic model based on:
  - 'Do Minimum' (without Melrose Park development)
  - 'With Project' (with Melrose Park development)
- Identify future system problems and user needs for the public transport network
- Develop appropriate transport network infrastructure and services
- Define appropriate travel demand management measures.
- Iteratively test staging scenarios to develop a strategy that ensures adequate capacity for both road and public transport networks at all stages of development.

6.3 Road network performance

6.3.1 Introduction

The Melrose Park Aimsun traffic model has been used as the basis for assessing the surface transportation road network presented in the structure plan. This section examines the overall road network performance based on the land use estimate of 11,000 dwellings proposed for Melrose Park and assesses future road infrastructure enhancements 2036. The following key performance indicators were used to assess the strategic merits of the structure plans and proposed road infrastructure enhancements:

- Midblock flow and density (measures of congestion in mesoscopic models)
- Intersection Level of Service (based on average delay)
- Travel times on key movement corridors (i.e. Victoria Road).

The above performance indicators have been extracted from the Melrose Park traffic model for the highest impact peak hour, under a future 'do minimum' (no development) and a future 'with project' (with development) scenario for 2036.

6.3.2 Desired service criteria

Midblock traffic density

The Melrose Park traffic model has traffic flows constrained by capacity whether due to saturation flows in midblock sections or due to capacity limitations at intersections. When traffic demand exceeds capacity, traffic queues form and these are depicted within the mesoscopic model as increases in traffic density. Traffic density is the average number of vehicles per kilometre on each section of road.

In this context, the road network traffic density was used to examine key capacity constraints within the road network developed for the structure plan. Higher densities indicate vehicles are closer together and therefore traveling more slowly and spending more time queuing (i.e. higher densities indicate more congestion). The assessment of network performance on the basis of traffic density was used to resolve capacity constraints (if any). Road network infrastructure improvements identified on the basis of traffic density were assessed according to whether they increased the volume of traffic that could be assigned to the network.

Intersection level of service

The performance of an urban road network is largely dependent on the operating performance of key intersections, which are critical capacity control points on the road network. It is therefore appropriate to consider intersection operation as a measure of the capacity of the road network.

The criteria for evaluating the operational performance of intersections is provided by the RTA Guide to Traffic Generating Development (2002); these criteria are shown in Table 6.1. The criteria for evaluating the operational performance of intersections is based on a qualitative measure (the level of service) which is applied to each band on the basis of average delay. This average vehicle delay is equated to a corresponding level of service from A (best) to F (worst).

Based on the performance measures shown in Table 6.1 a target maximum level of service threshold for new intersections of level of service E (as agreed with PCG) has been adopted for peak period conditions for future signalised intersection performance where practicable.

Table 6.1 : Intersection level of service criteria

Level of Service	Average delay (sec/veh)	Signalised intersections and roundabouts	Give way and stop signs
A	<14	Good operation	Good operation
B	15 – 28	Good with acceptable delays and spare capacity	Acceptable delays and spare capacity
C	29-42	Satisfactory	Satisfactory but accident study required
D	43-56	Operating near capacity	Near capacity and accident study required
E	56-70	At capacity; incidents will cause excessive delays	At capacity, requires other control mode
F	>70	Over capacity, unstable operation, excessive queuing	Over capacity. Unstable operation

Travel times

Victoria Road is a regionally significant movement corridor which carries more than 60,000 vehicles per day through the study area. It is also a key east-west bus corridor with up to 30 services per hour projected by 2026. The efficiency and productivity of the corridor will need to be protected and the Melrose Park development will need to be implemented in a way that does not lead to private vehicle travel time increases of more than 5% through the study area.

6.3.3 Future road link and segment performance

Future traffic volumes

The traffic volume plots in Figure 6.1 to Figure 6.4 show the 2036 forecast volume of traffic in the model area for Melrose Park. They provide a useful indication of the volume of traffic using a road and helps to understand the demand for access to the road network. This demonstrates the areas on the road network expected to experience an increase in traffic volumes as a result of the development. More detailed plots showing only traffic generated by the development are presented in Figure 5.9 and Figure 5.10.

The future traffic volume plots show:

- In the 'with development' scenario, Victoria Road is forecast to carry over 3,000 vehicles per hour in the peak direction (eastbound in AM and westbound in PM) an increase of approximately 300 vehicles per hour in the morning peak and 900 in the evening peak, compared to the do minimum scenario
- The largest increase in traffic volumes occurs in the westbound direction on Victoria Road in the morning peak. This is due to the fact that trips towards the Eastern City in the morning peak are more likely to use proposed public transport options (further discussed in Section 6.4)
- The Andrews Street-Constitution Road corridor carries between 800 and 1,000 vehicles per hour in the peak direction. This is an increase of approximately 300 vehicles per hour in the morning peak and 100 in the evening peak
- Increases in volumes on the local road network would not lead to adverse impacts to the performance or amenity of the network.

It is noted that some links would experience a reduction in volume in the 'with development' scenario. This is generally a result of the upgraded road network leading to a change in traffic assignment. Some morning peak southbound trips on Marsden Road and Kissing Point Road traveling from the north-west of the model to the east, for example, are observed to re-direct to Silverwater Road due to the improved performance and hence attractiveness of Victoria Road eastbound.

Figure 6.1 : Traffic volume - 2036 AM do minimum - no development

Figure 6.2 : Traffic volume - 2036 AM with development

Figure 6.3 : Traffic volume - 2036 PM do minimum - no development

Figure 6.4 : Traffic volume - 2036 PM with development

Future midblock traffic density

An assessment of midblock traffic density (vehicles per km) has been calculated for all road sections within the Melrose Park model area. When traffic demand exceeds capacity, traffic queues form and these are depicted within the mesoscopic model as increases in flow density. Traffic density is the average number of vehicles per kilometre on each section of road. Density plots are shown in Figure 6.5 to Figure 6.8, for 2036.

It is noted that the plots represent the results of the hour in which the highest vehicle flows occur throughout the entire modelled period. Performance before and after these time periods (i.e. in the 'shoulder' of the peak) is generally better to that presented below.

The plots show:

- Significant congestion is observed at north-western and south-eastern extents of the modelled area in all scenarios. This is not a direct result of the Melrose Park development but rather an indication that minor network improvements may be needed to accommodate regional traffic growth. Vehicles entering the model at these locations are not able to change their route to avoid congestion in the same way trips through the central part of the model are able to. In reality it is likely that some of these trips may use a different route and congestion would not be as severe as shown in these results.
- Modelled congestion on Devlin Street northbound on approach to Blaxland Road is likely to be relieved by proposed widening works along Devlin Street in this location. These works were announced after the finalisation of future network assumptions for the project and have not been included in this modelling.
- Upgrades on Victoria Road proposed as part of the Melrose Park structure plans would result in reduced congestion at Kissing Point Road and Wharf Road intersections in the 'with development' scenario during both of the peak periods.
- Minor increases in density are observed on Victoria Road eastbound near Shaftsbury Road in the AM peak. This is partly due to the increased throughput at Kissing Point Road and Wharf Road intersections allowing higher vehicle flows to reach the Shaftsbury Road intersection, rather than solely due to traffic generated by the Melrose Park development.
- Increases in density are observed on Victoria Road westbound near Hermitage Road in the PM peak but are considered within acceptable thresholds
- Increased flows on the Andrews Street-Constitution Road corridor lead to minor increases in density however no significant delays or adverse impacts are observed.

Figure 6.5 : Density - 2036 AM do minimum - no development

Figure 6.6 : Density - 2036 AM with development

Figure 6.7 : Density - 2036 PM do minimum - no development

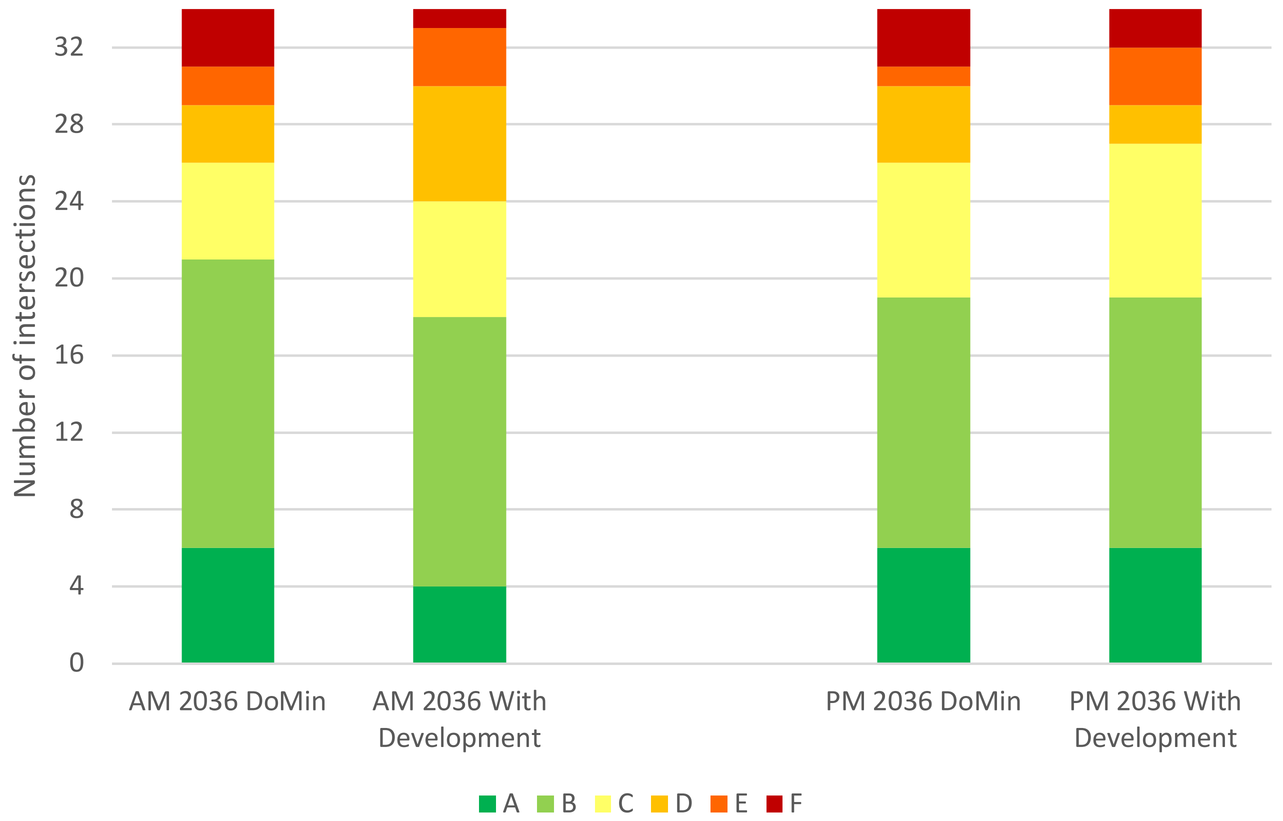
Figure 6.8 : Density - 2036 PM with development

6.3.4 Intersection level of service

Future intersection performance metrics are provided in Figure 6.10 to Figure 6.13 for key intersections in the study area. It is noted that the results represent only the busiest one-hour period on the road network. Results from the Melrose Park traffic model show that:

- Upgrades on Victoria Road - outlined in detail in section 4.2 and section 7.2 - proposed as part of the Melrose Park structure plan would reduce congestion at Kissing Point Road and Wharf Road in the 'with development' scenario
- Delays Victoria Road intersections with Shaftsbury Road in the AM peak and Hermitage Road in the PM peak would increase with the additional development traffic would still be within acceptable limits.
- All intersections along Hope Street through the precinct operate satisfactorily with the introduction of PLR Stage 2 and associated intersection changes. It is noted that the intersection of Hope Street and Wharf Road is proposed to be maintained as a priority controlled intersection. Modelling demonstrates that the intersection is forecast to operate satisfactorily without signalisation. This location has been identified as a key route for pedestrians accessing Melrose Park Public School. As such, investigation of a midblock crossing on Hope Street between Wharf Road and Waratah Street is recommended. This crossing would align with the key desire line between the new town centre and the school.

Figure 6.9 : Intersection level of service comparison



Further intersection performance metrics are provided in Figure 6.9 below. This analysis shows:

- Several key intersections in the study area are forecast to operate above capacity in a 'do minimum' scenario by 2036
- The 'with development' scenario reduces the number of intersections operating above capacity in both the AM and PM peak periods, mainly due to proposed improvements on Victoria Road.

Figure 6.10 : Intersection level of service - 2036 AM do minimum - no development

Figure 6.11 : Intersection level of service - 2036 AM with development

Figure 6.12 : Intersection level of service - 2036 PM do minimum - no development

Figure 6.13 : Intersection level of service - 2036 PM with development

6.3.5 Travel times along key routes

This section presents forecast travel times along Victoria Road through the model area, between Silverwater Road and Church Street/Devlin Street. Victoria Road is the key movement corridor in the study area and the efficiency and productivity of trips through the area needs to be maintained.

Figure 6.14 to Figure 6.15 shows a comparison of car travel times along Victoria Road between Silverwater Road and Church Street-Devlin Street for the 2036 AM and PM peak hour for both the 'do minimum' and 'with development' scenarios.

The results of the 'with development' scenarios indicate:

- Travel time through the upgraded intersections at Kissing Point Road and Wharf Road would significantly improve compared to the 2036 do minimum scenario
- Travel time through the remaining sections of the corridor would be slightly higher compared to the 2036 do minimum scenario
- Overall travel time along the corridor would improve in the AM peak and remain comparable in the PM peak

Figure 6.14 : Victoria Road travel time - Eastbound AM

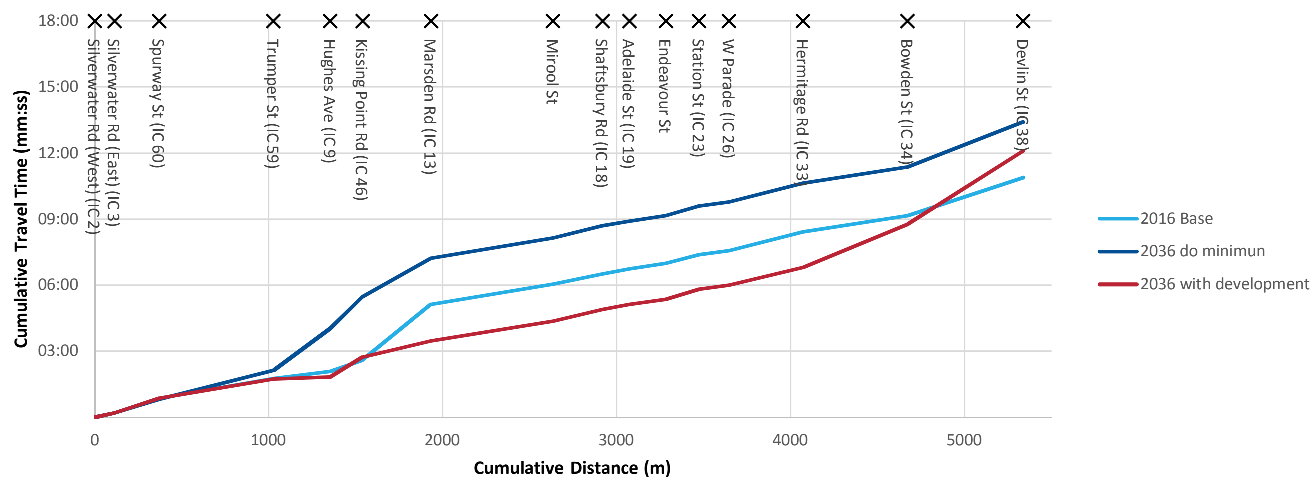
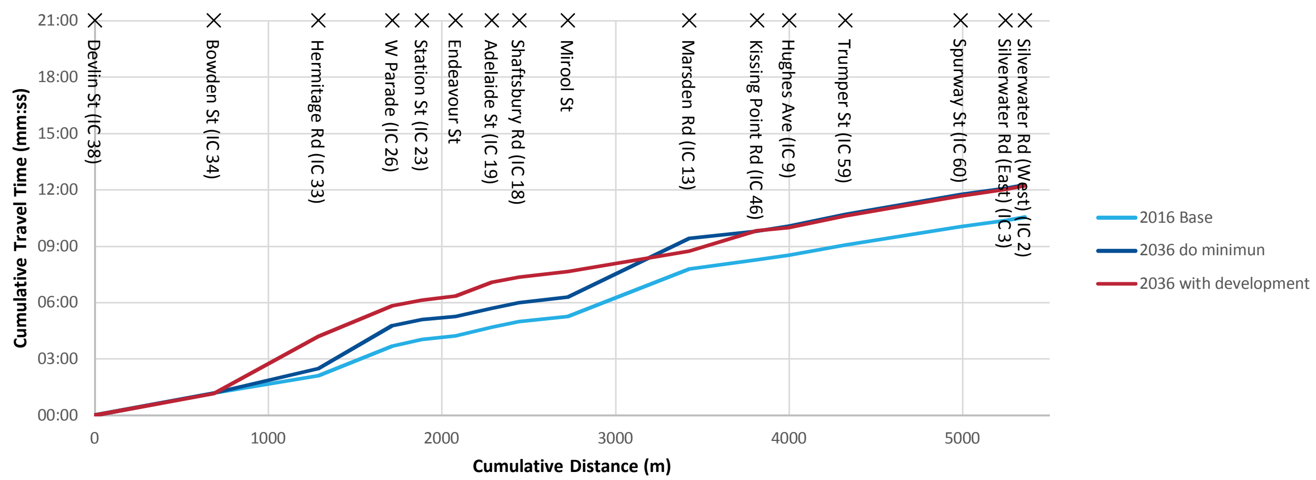


Figure 6.15 : Victoria Road travel time - Westbound PM



6.3.6 Implications of new bridge across Parramatta River open to vehicular traffic

The provision of a new active and public transport bridge across the Parramatta River has been identified as a key piece of infrastructure which will have a transformative impact for both Melrose Park and the wider GPOP area. Investigations using PTPM were undertaken to assess the impacts of also allowing general traffic on the bridge to understand the wider implications.

Figure 6.16 presents the difference in traffic volumes between a scenario with the bridge open to general traffic and a scenario where the bridge is used by public and active transport only. Whilst the reduction in traffic on Silverwater Road and Church Street may provide some localised benefits, the increases on Wharf Road (almost 400 additional vehicles per hour) and Hope Street would have significant amenity and efficiency impacts on the local road network, affecting both Melrose Park and Wentworth Point. This TMAP has therefore proceeded on the basis that the new bridge across Parramatta River would be open only to public and active transport, as agreed with the PCG.

Figure 6.16 : General traffic use of new bridge - change in peak 1-hour traffic volumes

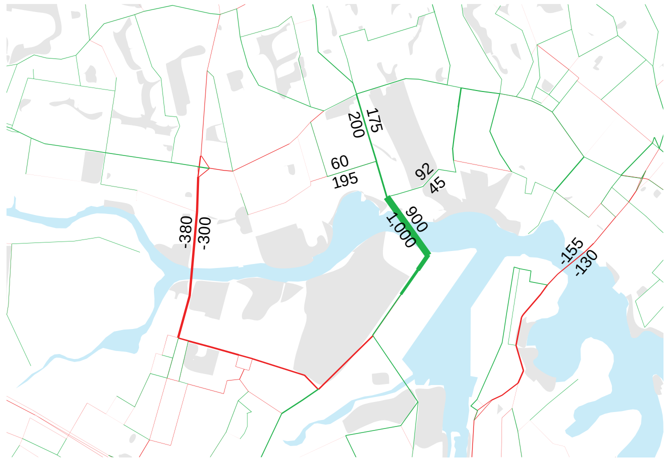


Table 6.2 : Network statistics - 6:00am - 10:00am

	2017 AM	2036 Do Min AM	2036 With Project AM
Vehicle km travelled (km)	332,582	378,030	422,657
Vehicle hours travelled (hours)	9,982	14,884	15,375
Average speed (km/hr)	33	25	27

Table 6.3 : Network statistics - 3:00pm - 7:00pm

	2017 PM	2036 Do Min PM	2036 With Project PM
Vehicle km travelled (km)	356,925	413,341	442,792
Vehicle hours travelled (hours)	10,985	16,402	18,095
Average speed (km/hr)	32	25	25

6.3.7 Overall network statistics

Table 6.2 and Table 6.3 provides a summary of the 'Do-Minimum' and 'With Project' scenario network statistics for the Melrose Park precinct. The results demonstrate the increased travel time and distance expected in all of the future scenarios. The 'With Project' scenario results show that increased travel is expected on the network due to the Melrose Park development. The AM average speed in the network is expected to increase, and the PM remain constant, compared to the Do Minimum scenario, demonstrating the benefits of the infrastructure improvements proposed as part of the Melrose Park structure plans.

6.3.8 Network staging

The full package of road upgrade works as presented in Figure 4.2 would be delivered in stages, in line with the delivery of dwellings. The staging has been developed through iterative traffic modelling of development yields in conjunction with proposed road network upgrades. The performance measures presented in this section have been applied to the various staging scenarios to ensure the road network performs satisfactorily for all stages.

Detailed road network staging is presented in Section 7.2. In general, a new access at Kissing Point Road will be provided followed by Victoria Road intersection upgrades at Wharf Road and Kissing Point Road. The ultimate layout will include a continuous bus lane in each direction on Victoria Road. The staging development process has also remained cognisant of the public transport network stages presented in Section 6.4. The entirety of the road works are proposed to be delivered prior to the implementation of the new bridge over the Parramatta River. This plan ensures that infrastructure is in place as early as possible to support the delivery of dwellings and minimise wider network impacts in the earlier stages of the project before delivery of critical public transport.

6.4 Public transport

6.4.1 Introduction

The public transport network for Melrose Park has been developed based on a series of key planning principles. These principles will ensure that the network provides the level of service and connectivity demanded of development of this scale and density. The network will provide connectivity to a range of key employment centres within the local and regional area thereby providing a range of choices for the future residents of Melrose Park.

6.4.2 Principles

The public transport principles have been developed to support the key TMAP objectives and physical planning process. These include:

- **Provide a staged network** that supports a high level of accessibility and connectivity from day one of the development, eventually realising its full potential upon full build-out
- **Take advantage** of areas of the existing bus and rail network with spare capacity and leverage additional capacity provided by future new infrastructure investment e.g. Sydney Metro City and South West
- **Connect to destinations and interchanges** within the local and regional area and aim to provide 30-minute public transport access to strategic centres within and outside GPOP
- **Provide accessibility** across the Melrose Park precinct recognising that the precinct itself covers a large area and that multiple access locations to the public transport network will be required
- **Support Melrose Park as a community** that provides for a variety of residents with a variety of economic and social needs

6.4.3 Staging approach

The public transport network for Melrose Park has been split into two key stages based on the development progression and the planned completion of relevant major infrastructure projects such as Parramatta Light Rail Stage 2 and Sydney Metro West. As established throughout the analysis in the TMAP, the bridge across Parramatta River is a key component of the development which will provide a transformative increase in accessibility for the future residents, workers and visitors of Melrose Park. The staging of the network has therefore been based on pre-bridge and post-bridge scenarios.

6.4.4 Stage 1 – Accessible and connected bus network

Stage 1 assumes the following parameters:

- PTPM forecast year is 2026
- Approximately 6,700 dwellings are developed
- Sydney Metro Northwest and City and Southwest are complete providing some relief to the T1 Northern rail line
- Parramatta Light Rail Stage 1 is complete.
- Stage 1 road network infrastructure is delivered as per section 7.2

The Stage 1 public transport network is shown in Figure 6.18 The network builds on the existing bus network to provide the following key improvements.

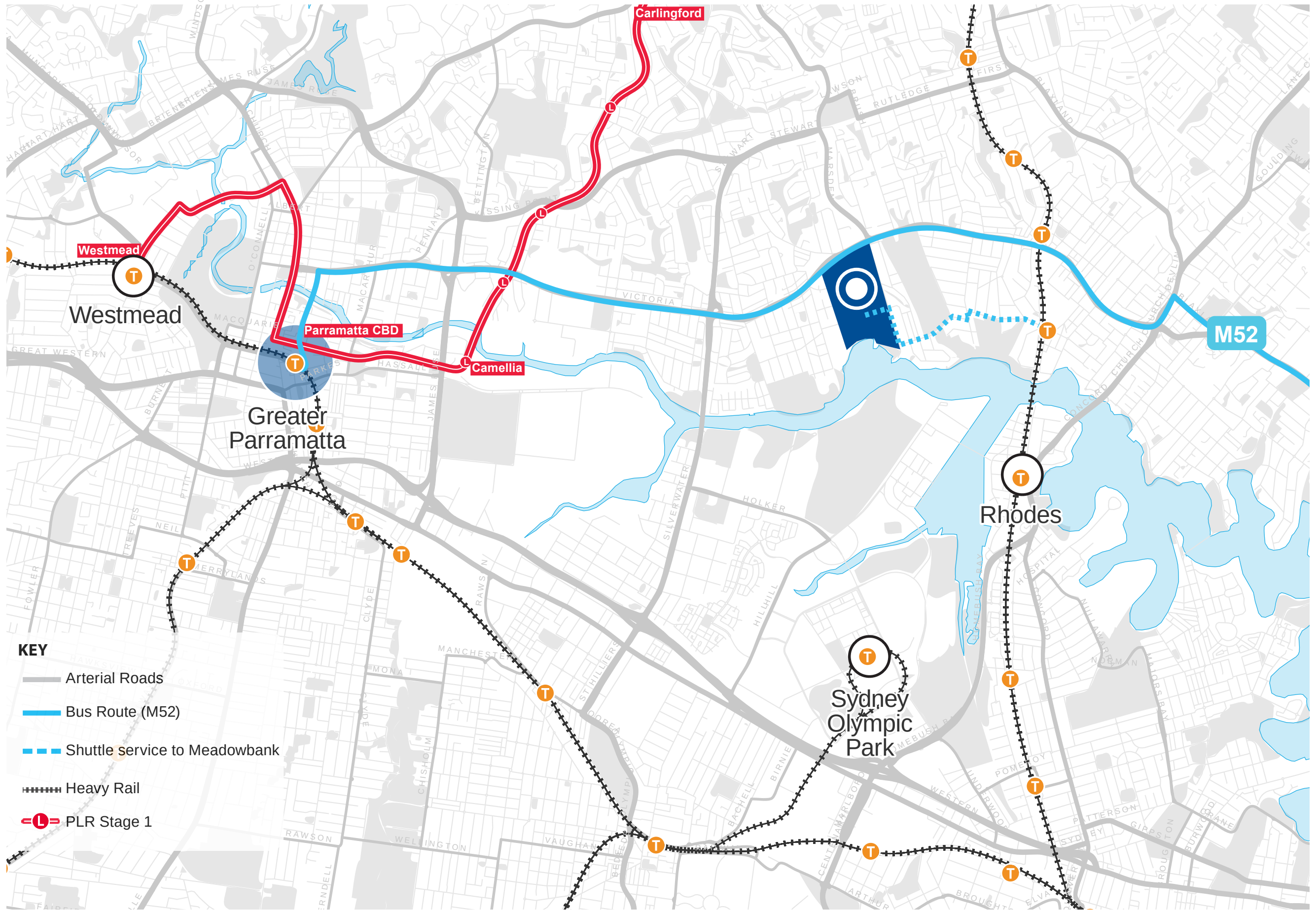
- **M52 bus route:** The AM peak service frequency along Victoria Road will be gradually improved to 20 per hour eastbound and 14 per hour westbound to provide direct connectivity from the northern portion of the precinct to Parramatta CBD and to West Ryde (rail connections to Sydney CBD and Macquarie Park) and Top Ryde. It is noted that service increases to 13 per hour eastbound and 9 per hour westbound would be required even without Melrose Park development based on PTPM demand forecasts.
- **Shuttle bus services to Meadowbank:** The proponent proposes to provide a shuttle bus service between Melrose Park and Meadowbank station to provide a direct connection to the T1 Northern Line. Provision of this service would begin with 1 bus providing 3 services per hour. More buses would be provided in line with the delivery of dwellings to provide an ultimate service headway of 5 minutes.
- **T1 Northern rail line:** Existing congestion on this line will be relieved by the completion of Sydney Metro City and Southwest. The removal of trains operating via the Epping to Chatswood rail link will provide some capacity for providing improved frequency. Connections to West Ryde via improved M52 services and Meadowbank via shuttle bus services will both be available for future Melrose Park residents workers and visitors. Figure 6.17 shows that there will be sufficient spare capacity on the T1 Northern Line in Stage 1. It is noted that 8 suburban services an hour are proposed to run in this stage.

As discussed, Stage 1 assumes that a new bridge across the river is not complete. As such, any development should be focused to the north of the precinct as the M52 bus route along Victoria Road will provide the highest level of accessibility until the bridge is complete.

It is also noted that MPPM public transport demand forecasts exceeds those provided by PTPM outputs. As such, MPPM demands have been used to assess the service requirements for Melrose Park, ensuring the assessment is conservative.

Figure 6.17 : Stage 1 2026 public transport demand (PTPM)

Figure 6.18 : Stage 1 public transport network



6.4.5 Stage 2 – Integrated network with new bridge over Parramatta River

Stage 2 assumes the following parameters:

- PTPM forecast year is 2036
- Development of the precinct is 100% complete (11,000 dwellings)
- Parramatta Light Rail Stage 2 is complete
- Sydney Metro West is complete

The Stage 2 network is shown in Figure 6.20. The network builds on committed infrastructure to provide the following key improvements:

- **Parramatta Light Rail Stage 2:** A new light rail line will be provided connecting Melrose Park with Parramatta CBD and Olympic Park. Additionally, there will be a major interchange point from the light rail to the new Sydney Metro West at Olympic Park. At least two stops will be provided within Melrose Park to cater for central / northern and southern precinct access to the line.
- **Sydney Metro West:** A new metro rail line is provided connecting Westmead, Parramatta CBD, Olympic Park, the T1 Northern rail line, Bays Precinct and Sydney CBD. There will be a major interchange point from the light rail at Olympic Park. This will be a key connection for Melrose Park residents, particularly connecting to Parramatta CBD and Westmead as this is likely to be the fastest route.
- **M52 bus route:** The AM peak service frequency along Victoria Road will be remain at 18 per hour eastbound and increase to 14 per hour westbound to provide direct connectivity from the northern portion of the precinct to Parramatta CBD and to West Ryde (rail connections to Sydney CBD and Macquarie Park) and Top Ryde.
- **New bus route (Top Ryde to Concord Hospital via Rhodes):** This new route will utilise the bridge and provide connectivity from Melrose Park, including the southern portion, to West Ryde in the north and to Wentworth Point, Rhodes and Concord Hospital in the south. The extension to Concord Hospital is proposed to provide a direct connection from new housing in Melrose Park to a major health precinct. This can support Melrose Park providing for a variety of different workers, rather than a sole focus on knowledge based workers based in centres. Notwithstanding this, an extension of the route to Macquarie Park may be viable and help to improve accessibility to this centre. Final route alignment will be at the discretion of TfNSW.
- **T1 Northern rail line:** Some customers traveling to the Sydney CBD and Macquarie Park would continue to interchange to rail at West Ryde rather than at Olympic Park. Sydney Metro West is likely to provide some relief to the Northern line as some customers on the Northern line may choose to interchange to Sydney Metro West at Concord West / North Strathfield. Capacity should be available on the T1 Northern line to cater for additional demand at West Ryde. Figure 6.19 shows that there will be sufficient spare capacity on the T1 Northern Line in Stage 2. It is noted that 8 suburban services an hour are proposed to run in this stage.

Figure 6.19 : Stage 2 2036 public transport demand (PTPM)

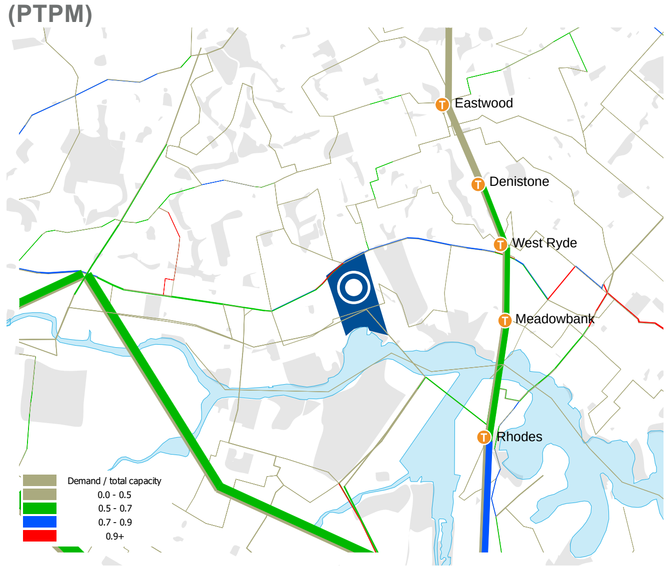
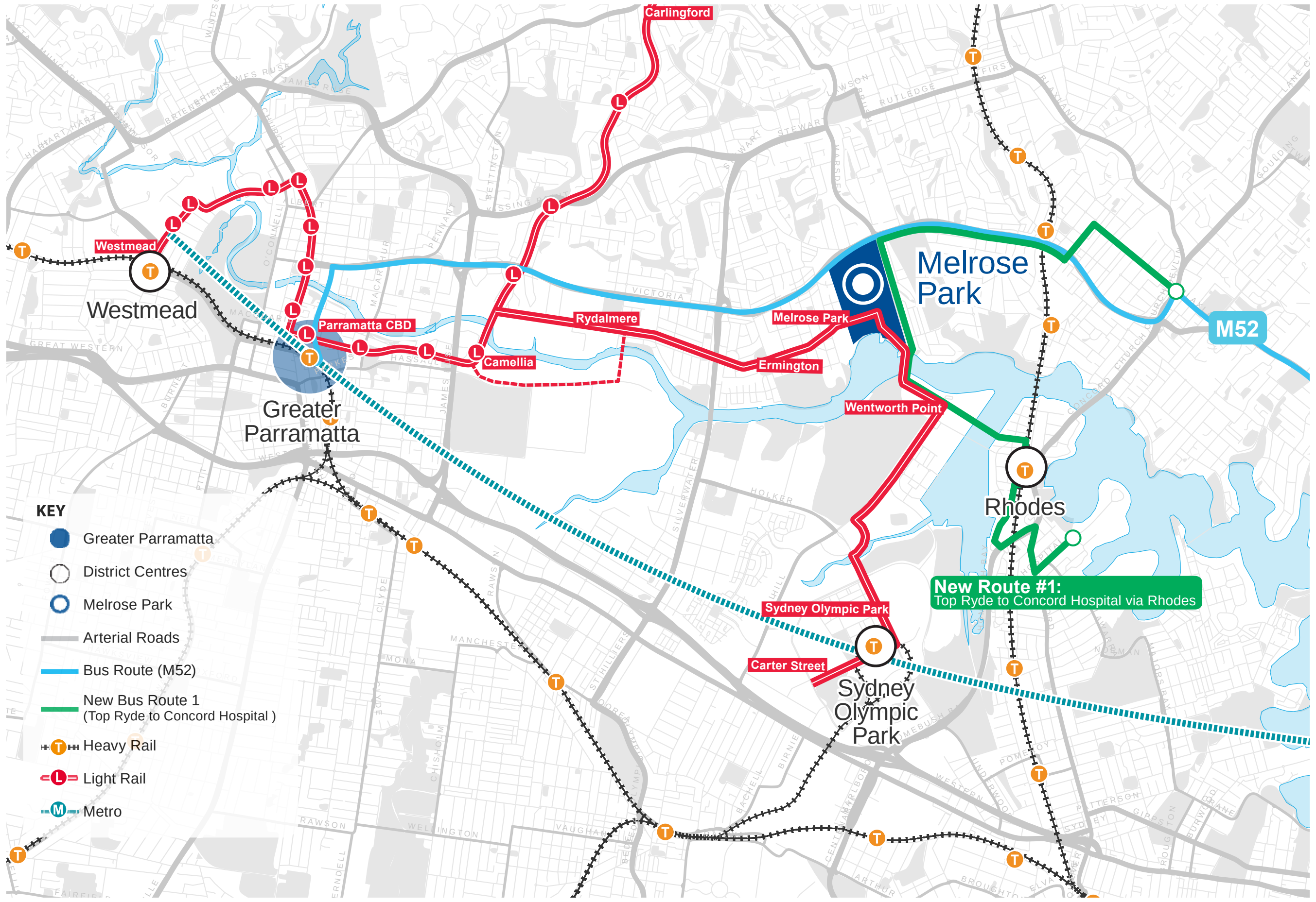


Figure 6.20 : Stage 2 public transport network



6.4.6 Future public transport performance

The success of the public transport network serving Melrose Park will be measured against the key metrics outlined in Section 4.4. In particular; mode share, 30-minute access, and capacity of key routes will be targeted. An analysis of peak direction demand with and without Melrose Park and required service provision is provided in Table 6.4 and Table 6.5 below. This analysis covers the two key stages.

Some key findings to note include:

- Consideration should be given to the fleet mix of the M52 service, including whether all services will be articulated or whether double deck services would be appropriate. Our capacity assumption of 80 people per bus is based on a mixed fleet with the majority of peak services operating articulated buses with a capacity of 100 people per service.
- Significant bus frequency improvements are required to serve background growth regardless of the Melrose Park development, as shown in Table 6.4 and 6.5.
- Consistency with previous analysis and agreed mode share targets has been achieved by replacing the PTPM Melrose Park boardings with MPPM public transport demands.
- PLR Stage 2 demands are within acceptable LRT capacity thresholds.

The demand and required service capacity represents the ultimate scenario of both stages. It is anticipated that staged service capacity increases will be delivered in line with the development of dwellings.

Table 6.4 : Stage 1 public transport performance (6,700 dwellings - demand from PTPM 2026)

AM Peak 1-hour	M52 – To City	M52 – To Parra	Shuttle to Meadowbank	Other local services
Existing service	6/hr	6/hr	-	
Vehicle capacity (pax)	80	80	30	50
Peak line load without Melrose Park	980	650	-	
Required services without Melrose Park	13/hr	9/hr	-	
Melrose Park boardings[1] (outbound only)	**500[2]**	**370**	**330**	**150**
Peak line load with Melrose Park	1480	1020	330	
Required services with Melrose Park	20/hr	14/hr	12/hr	~3 additional/hr

[1] Melrose Park demand derived from MPPM

[2] Shuttle to Meadowbank not modelled in MPPM. Actual demand of 830 reduced by 330 to reflect redistribution to shuttle bus.

Table 6.5 : Stage 2 public transport performance (11,000 dwellings - demand from PTPM 2036)

AM Peak 1-hour	M52 – To City	M52 – To Parra	PLR S2 – to SOP	PLR S2 – to Parra
Existing services	6/hr	6/hr	-	-
Vehicle capacity (pax)	80	80	300	300
Peak line load without Melrose Park	1170	1150	1330	540
Required services without Melrose Park	16/hr	15/hr	4/hr	1/hr
Melrose Park boardings[1] (outbound only)	**220**	**80**	**1670**	**470**
Peak line load with Melrose Park	1390	1250	3000	1010
Required services with Melrose Park	20/hr	17/hr	10/hr	3/hr

[1] Melrose Park demand derived from MPPM

Bus interchange capacity

Consideration has also been given to the functional performance of bus routes at major interchanges along their respective routes. In particular at the interchange facilities at Parramatta and West Ryde.

At Parramatta, some spare capacity may be available due to service changes to support the introduction of PLR Stage 1. The PLR Stage 1 EIS states that supporting changes may include:

- Modifying services that access the Parramatta CBD
- Truncating some services to better integrate with the project and the broader transport network
- Discontinuing some routes with alternate travel options in place

All of the above may increase available capacity at Parramatta interchange. There is also potential to truncate some Victoria Road services if required to reduce pressure on the interchange whilst maintaining the required frequency through Melrose Park.

At West Ryde, M52 services stop on Victoria Road and do not use the bus interchange facility. The impact of a significant number of interchanging passengers on bus stop requirements has been considered. The westbound stop at Gaza Road in the PM period is considered the critical location due to the large number of boarding passengers interchanging from rail to bus at this location. On-site observations were used to derive a function to relate boardings to dwell time. The maximum forecast boardings of approximately 500 passengers per hour (2026 Stage 1 public transport network) would lead to average dwell times of approximately 60 seconds. The State Transit Bus Infrastructure Guide and TCRP Report 16 provide guidance on bus stop requirements based on bus frequency and average dwell times. Noting the expected service frequency of approximately 25 buses per hour, this leads to the requirement for 2 bus stop bays.

It is noted that the existing bus stop arrangement on Victoria Road at Gaza Road allows for 2 articulated buses and is therefore likely to be sufficient. If dwell times and/or the number of bus services are higher than forecast in the above analysis there is a risk of operational impacts to bus services, general traffic and pedestrians crossing Victoria Road at this location.

Roads and Maritime Services is currently undertaking a corridor study of Victoria Road, which includes examination of bus stop facilities and bus priority measures along the corridor. Should capacity issues arise at this location, the TMAP action plan allows for the provision of additional shuttle buses to intercept rail-to-bus travel demand at Meadowbank Station, reducing demand at West Ryde. Any capacity enhancements at the westbound West Ryde Bus stop should be considered as part of the overall Roads and Maritime Corridor Strategy, as this bus facility is outside of the sphere of influence of Melrose Park and passenger demand from Melrose Park at this stop will peak in 2026, after which time the proposed bridge across Parramatta River would be constructed.

JACOBS

Parramatta Light Rail Stage 2

The PTPM model was used to determine peak line loads along the planned PLR Stage 2 route between Parramatta and Sydney Olympic Park (via Melrose Park) as shown in Figure 6.22 and Figure 6.23.

Passenger volumes are highest at the Sydney Olympic Park end of the corridor where it connects to the proposed Sydney Metro West station. The forecast peak line loading into Sydney Olympic Park has spare capacity of approximately 400 passengers per hour. Loadings on services to Parramatta are much lower than in the southbound direction with spare capacity of approximately 1,700 passengers per hour.

Shuttle service to Meadowbank

The shuttle bus proposed under the Stage 1 network is planned to operate between Melrose Park and the western entry to Meadowbank station. This location is preferred as it avoids conflicts with the main bus interchange on the eastern side of the station.

Two stop location options have been identified (see Figure 6.21). Both stop locations have sufficient capacity to cater for the proposed 12 services per hour. It is noted that:

- Option 1 at the current 'kiss and ride' location provides the most direct access to the station.
- Option 2 would require the removal of 1-2 parking spaces and a potential installation of a marked pedestrian crossing across Bank Street.
- Option 1 is the preferred option as it utilities the existing kiss and ride facility and provides the most direct access to the station.
- Swept path analysis and indicative arrangement plans are shown in Appendix C and confirms the shuttle bus can safety negotiate the roundabout at Bank Street and Meadow Crescent.

Figure 6.22 : PLR Stage 2 line load - to Parramatta (2036 AM PTPM)

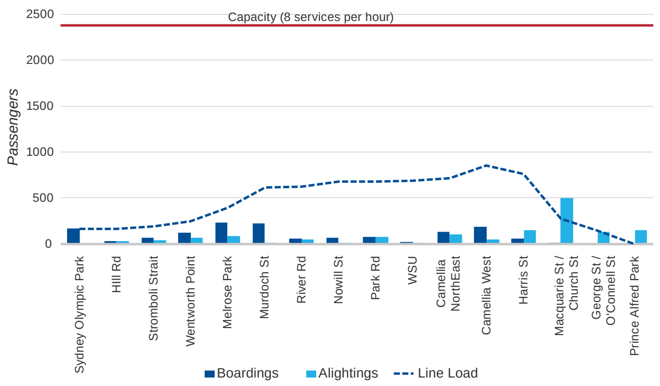


Figure 6.23 : PLR Stage 2 line load - to Sydney Olympic Park (2036 AM PTPM)

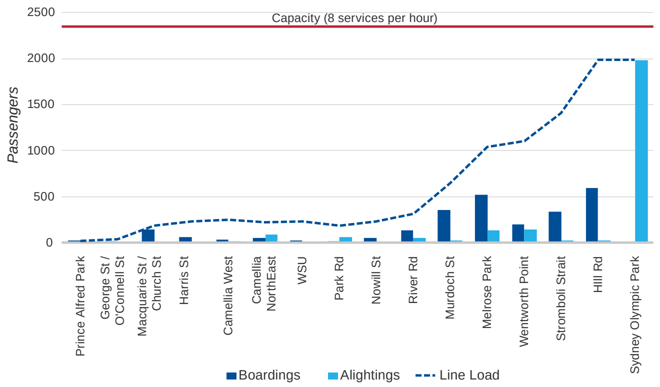
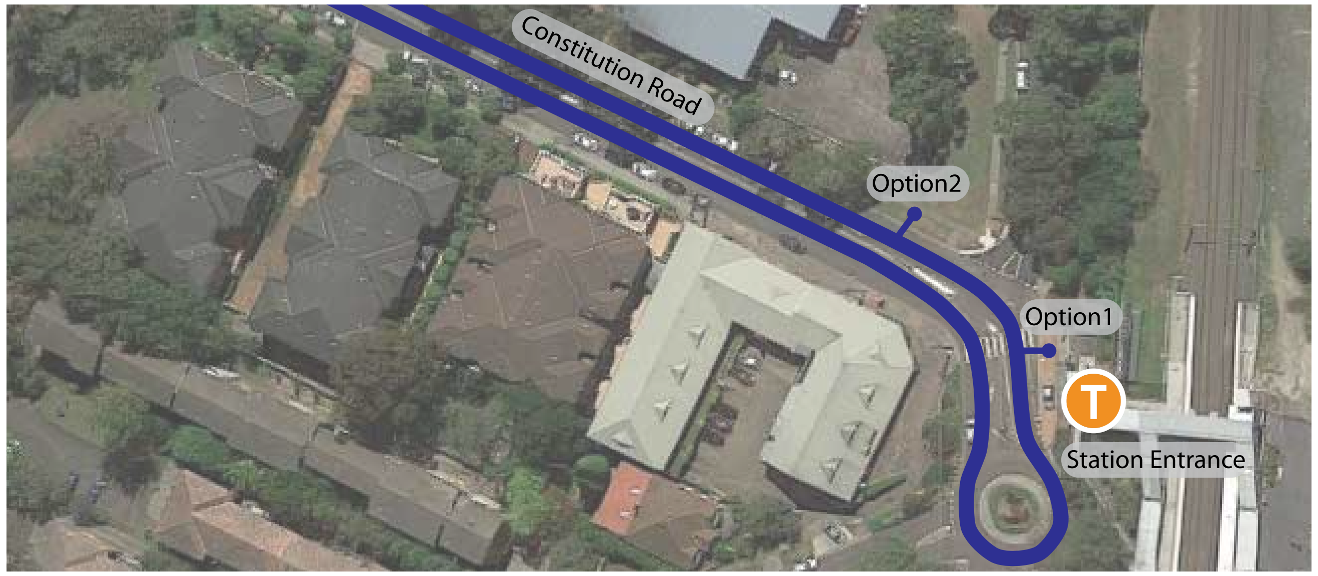


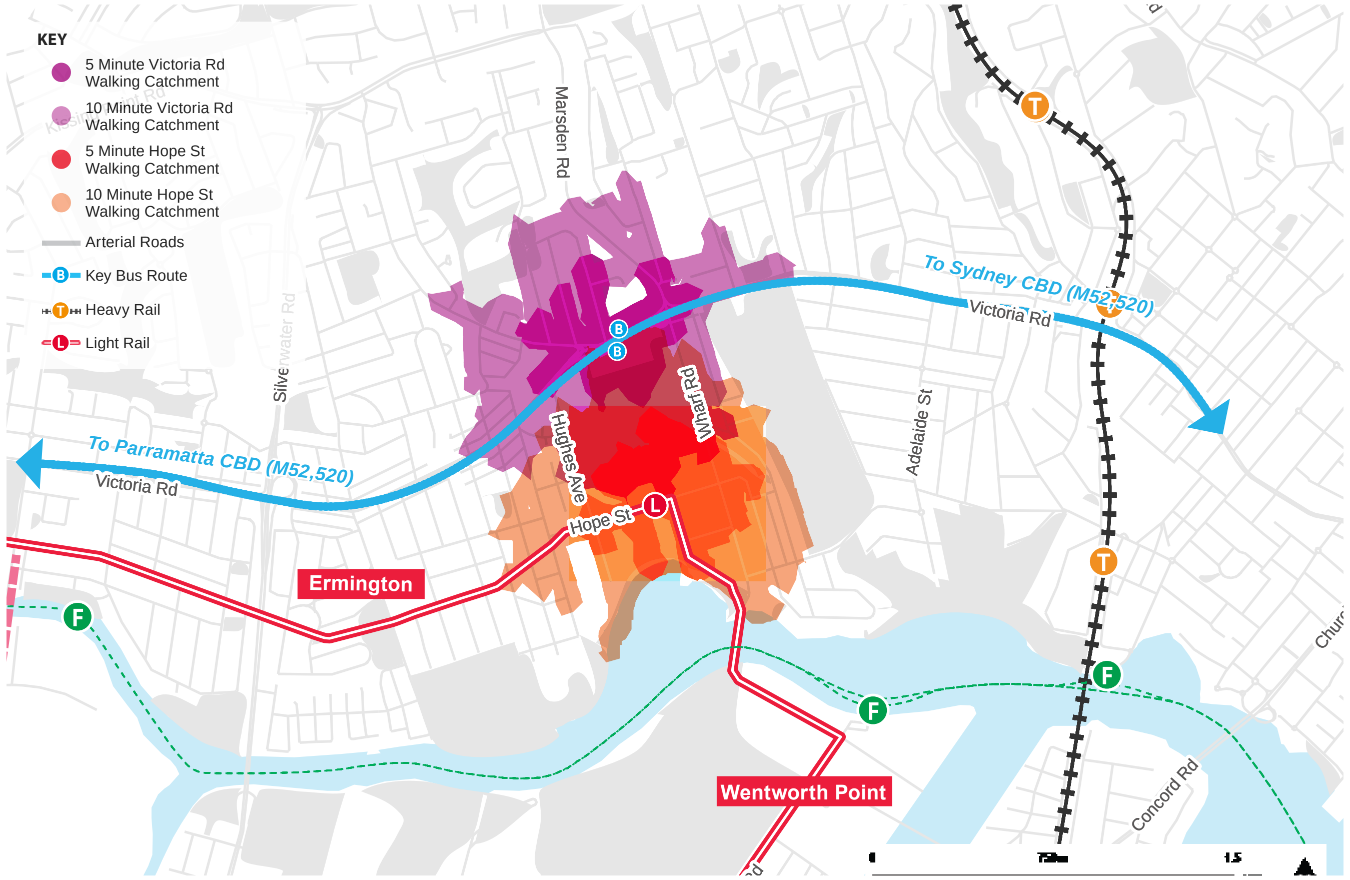
Figure 6.21: Shuttle bus stop location options at Meadowbank



Walking catchment to Public Transport

Another indicator of the function of the public transport network for Melrose Park is the walking catchment to bus and light rail stops of areas within 400 m of a bus stop and 800 m of a light rail station that meet minimum service frequencies. Figure 6.24 below shows that the majority of the Melrose Park precinct meets the minimum coverage area based on the proposed public transport network.

Figure 6.24 : Walking catchments for Victoria Road and Hope Street



6.4.7 Implications of new bridge across Parramatta River to public transport

The Melrose Park precinct proposes to create a new connection between Melrose Park and Wentworth Point via a new bridge suitable for active transport trips and public transport (bus and/or light rail) services. This is a key transport infrastructure component to create a direct, grade-separated link between the Parramatta River foreshore the southern end of the Melrose Park precinct.

A new bridge across Parramatta River offers a significant future opportunity for a local and regional transport connection between Melrose Park and Sydney Olympic Park / the Sydney CBD. Being separate from local and regional traffic would offer a major improvement in directness and amenity to people walking and cycling. The potential to establish a light rail service through PLR Stage 2 along this line is being considered, but there is also an opportunity to establish an active transport connection which also connects to the Parramatta River and Wentworth Point foreshore shared paths.

The key benefits of a new bridge across Parramatta River include:

- Significantly improved public transport access between Melrose Park and the following key centres:
  - Sydney Olympic Park – including the proposed Sydney Metro West station
  - Carter Street precinct
  - Rhodes business park
- The enabling of key new bus routes between:
  - Top Ryde and Concord Hospital via Wentworth Point and Rhodes
  - Top Ryde and Lidcombe via Sydney Olympic Park
- Improved active transport connections to the southern foreshore of the Parramatta River including the shared path.

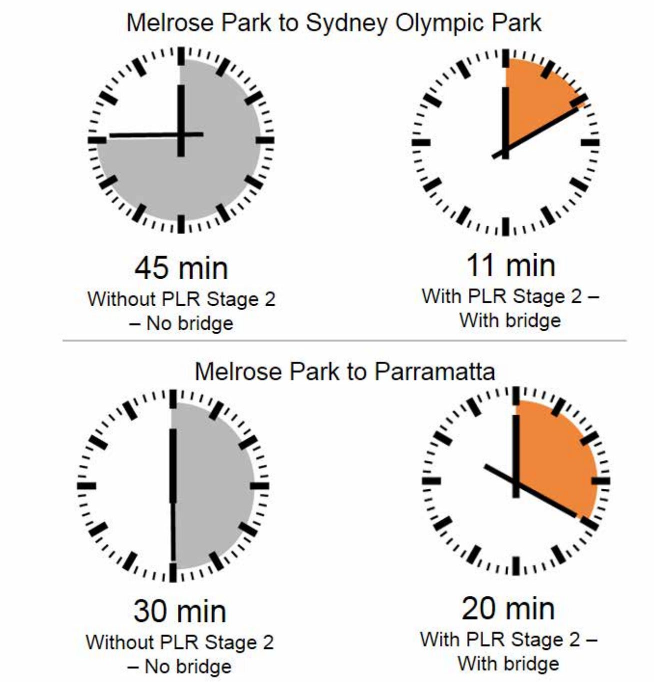
The provision of the new bridge will enable a light rail river crossing as part of Parramatta Light Rail Stage 2. This will lead to significant travel time savings for public transport trips between Melrose Park and both Sydney Olympic Park and Parramatta.

As shown in Figure 6.25, trips to Sydney Olympic Park would reduce from 45 minutes to 11 minutes. Trips to Parramatta would reduce from 30 minutes to 20 minutes. These are significant savings which will:

- Enhance the attractiveness of public transport trips between Melrose Park and these key centres.
- Reduce car reliance for future residents of Melrose Park and surrounding suburbs.
- Minimise the impact of the proposed development on the surrounding transport network.

It is noted that the delivery of PLR Stage 2 is yet to be confirmed and a business case is still to be finalised. If PLR Stage 2 was not to proceed, the Melrose Park development could be adequately supported by the provision of high frequency buses over the bridge connecting to Sydney Olympic Park.

Figure 6.25 : Public transport travel time savings resulting from new bridge



Public transport accessibility from Melrose Park

The future accessibility of Melrose Park is highlighted in Figure 6.26, which shows the catchment reachable from Melrose Park within 30 minutes by public transport. Accessibility is greatest in the north-south direction along the proposed PLR Stage 2 route with a new bridge across Parramatta River, reflecting the higher speeds of light rail which is also connected to Sydney Metro West (at Sydney Olympic Park) providing frequency services to Parramatta CBD and Sydney CBD. Accessibility is also enhanced considerably in the east-west direction with key connection opportunities provided with PLR Stage 2 to Parramatta via Rydalmere. The Melrose Park accessibility reflects coverage of the future network design, frequency, and speed of public transport services.

Figure 6.27 shows that approximately 175,000 jobs will be accessible within a 30-minute public transport journey from Melrose Park by 2036. Further, more than 200,000 people will live within a 30-minute public transport journey. This indicates that the proposed public transport network combined with a new bridge over the Parramatta River will ensure that Melrose Park is a highly accessible precinct for both residents and visitors. The delivery of regionally significant infrastructure in conjunction with the Melrose Park development will also have wide reaching benefits for surrounding communities.

Figure 6.27 : 30 minute job and population catchments

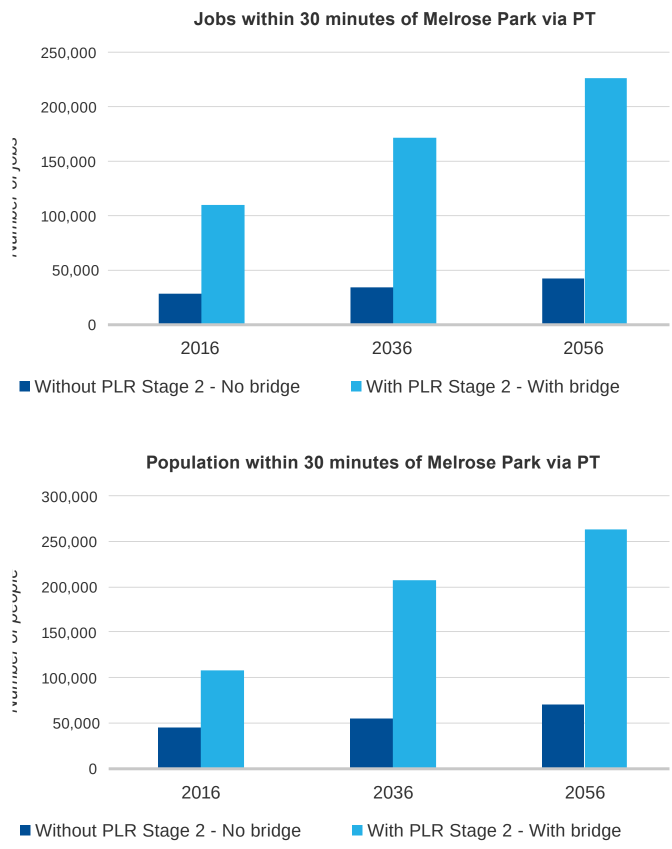
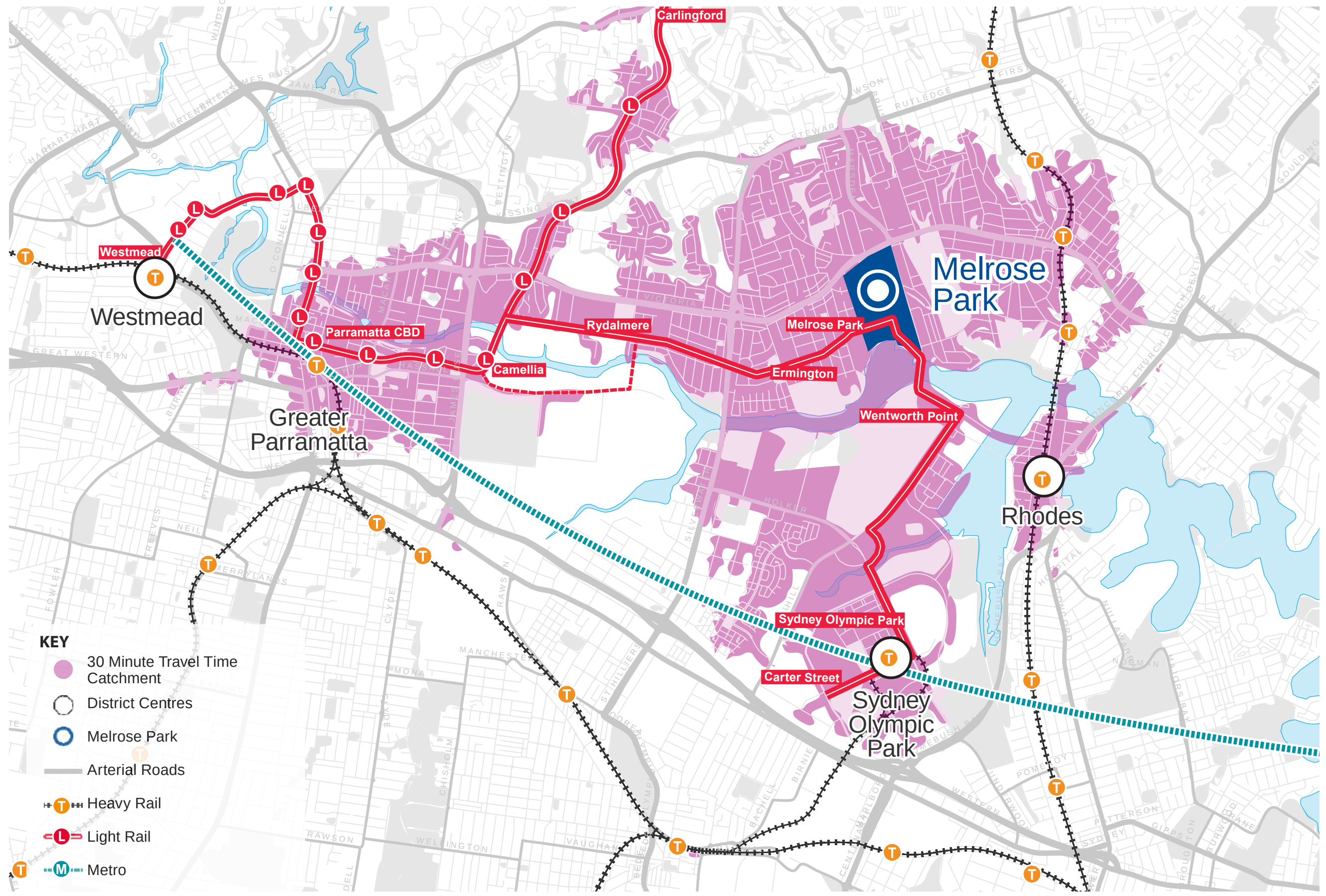


Figure 6.26 : Melrose Park 30 minute PT catchment (2036)



6.4.8 Ferry services

The current F3 Parramatta River Services provides all-stop services from Parramatta to Circular Quay and Darling Harbour/Barangaroo. The current peak hour frequency is three (3) services per hour. All-stop services to/from Parramatta suffer speed and reliability issues due to tidal and river conditions. The Melrose Park public transport network is set to include bus, light rail and connections to existing heavy railway and the future Sydney Metro system.

In this context, ferry services are not an essential component of Melrose Park transport network. Any new ferry services (private or public) at Melrose Park must stand on its own merits to determine whether new infrastructure and services are viable. The requirements for future ferry services and potential upgrade to the existing wharf at the end of Wharf Road are influenced by a number of considerations including:

- Forecast patronage
- Service frequency and vessel characteristics
- Navigation and safety considerations
- Operational considerations both maritime and land side
- Design parameters and site conditions.

Patronage forecasts

Patronage modelling was undertaken to produce a broad, strategic estimate of potential ferry demand at Melrose Park. Patronage modelling is based on the current service plan and the available information provided by TfNSW during the course of the TMAP. For the purpose of this modelling a new wharf was assumed at Melrose Park. This patronage modelling indicates that:

- Ferry mode share for trips from Melrose Park is projected to be approximately 1%
- Projected patronage in the AM peak hour at Melrose Park in 2036 would be less than 100 people.

The preliminary modelling results indicate fairly low patronage demand at Melrose Park. This suggests that travelling by ferry is generally less attractive when compared with competing land based public transport network on bus/light rail/metro.

Summary

The introduction of a ferry service will have minimal appreciable effect on both future public transport patronage and mode share targets for Melrose Park. For ferry services to provide a viable alternative to private vehicles and to complement the surface public transport network proposed, it must be based on infrastructure needed to enable efficient ferry service operation suitable to the conditions and requirements of its particular location. The location of new ferry wharf on the northern side of Parramatta River (near Wharf Road) to cater for relatively large vessels (i.e. Rivercat), will need to be further examined.

The Melrose Park public transport network has been developed to reflect the demand and growth potential of the precinct without the need for ferry services. Ferry users on the Parramatta River will have access to the newly-upgraded Sydney Olympic Park and Meadowbank wharves, as well as the new proposed ferry wharf proposed at Rhodes East. The proposed new bridge across Parramatta River (at the end of Wharf Road) will also provide the ability for Melrose Park residents to conveniently and comfortably access transport and ferry facilities on the southern side of Parramatta River and, when necessary, transfer between different transport modes.

Table 6.6: Ferry opportunity and constraints

Criterion	Advantages	Disadvantages
Land use	• Integrated with high density mixed use development • Land available for a potential park and ride function at existing wharf.	• New ferry wharf location will be located in sensitive mangroves and coastal salt march • Land acquisition may be required for a new ferry wharf.
Public transport integration	• Strategic opportunity to develop a sustainable transport option • Future light rail stop on Wharf Road (yet to be confirmed) may be within walking distance • Potential to expanding public transport services to address other customer markets (visitors and tourists) • Provides long-term growth and operational flexibility in response to demand.	• Low public transport market share and patronage for commuters • New ferry wharf must provide high level of access between future light rail stops on Wharf Road and ferry wharf • Ferry services are generally very slow and therefore not attractive to commuters who are time sensitive.
Pedestrian access	• Good access via Parramatta River foreshore shared path • Opportunity to integrated with existing Parramatta River foreshore shared path.	• Existing wharf location pedestrian access constrained and through an existing car park.
Road access	• Land available for potential park and ride site to be integrated with the ferry system • Land available to provide a coherent and legible road network.	• Existing car parking and boat ramps is likely to cause potential conflicts • New bridge proposed across Parramatta River (end of Wharf Road) will impact on circulation roadways to/from ferry terminal.
Maritime operations	• Protected from open water • Adjacent to F3 Parramatta River Services and the opportunity to join the broader ferry network for longer trips • Potential to operate on demand services via a private operator.	• Speed and tidal restrictions along Parramatta River may cause disruption to ferry operations particularly towards Parramatta • New bridge proposed across Parramatta River (end of Wharf Road) will impact on location of ferry wharf and vertical clearance requirements • Potential maritime operations issues relating to navigation safety considerations, turning and maneuvering space • Existing boat ramp activities closely spaced with existing wharf location • Water depth along foreshore near existing wharf and may need to be dredged • Significant subsidies required for both the initial investment and operational costs.

6.5 Walking and cycling

6.5.1 Introduction

There are numerous opportunities for walking and cycling in and around the Melrose Park precinct, particularly for short trips to nearby strategic centres. This is in line with one of the customer outcomes of *Future Transport 2056*, which aims to make walking and cycling the most convenient choice for short trips.

6.5.2 Active transport planning principles

Active transport planning for Melrose Park has been informed by a guiding set of planning principles. These aim to ensure that residents of and visitors to Melrose Park have the opportunity to walk and cycle as part of their everyday travel, especially for short trips and as part of multi-modal public transport trips. These include:

- **Encourage walking and cycling for short trips** by providing high quality, comfortable and safe facilities for walking and cycling, encouraging residents, visitors and in particular Melrose Park Primary School students to use active transport.
- **Integrate walking and cycling with public transport access** by providing adequate walking and cycling access and facilities at key public transport nodes, such as light rail stops, heavy rail stations and metro stations, promoting active transport as part of multi-modal public transport trips.
- **Provide connected and permeable walking and cycling networks** by ensuring that the walking and cycling networks are complete, closing existing gaps and improving connections where required. Provide connections to key local destinations such as Melrose Park Primary School and the new town centre. Pedestrian and cycle paths to be separated where feasible.

6.5.3 Walking and cycling network

The street network surrounding Melrose Park is relatively permeable for walking. The Melrose Park precinct will improve permeability by providing new links connecting through the precinct to Victoria Road, Hughes Avenue, Wharf Road and Hope Street. Travel to the north is somewhat constrained by uphill grades.

Major east-west cycling access is currently available along the Parramatta Valley Cycleway, which follows the Parramatta River. This is identified in *Sydney's Cycling Future and Future Transport 2056* as a key strategic cycling corridor, providing access to Parramatta CBD, Western Sydney University at Rydalmere, Meadowbank and Rhodes. Apart from this corridor there are presently limited cycling facilities provided in and around Melrose Park.

A number of new and upgraded active transport facilities are proposed in the precinct:

- *Parramatta Bike Plan 2017* proposes a fully separated cycleway is proposed for Hope Street, providing a new high quality east-west cycle connection through Melrose Park to Rydalmere
- A separated shared path on the western side of Wharf Road, connecting the Hope Street cycleway to the existing Parramatta Valley Cycleway
- Safe and adequate connections to Melrose Park Primary School as identified in the Southern Precinct Structure Plan

A new public and active transport bridge across Parramatta River is proposed which will provide significantly greater walking and cycling access to Sydney Olympic Park and beyond.

Figure 6.28 shows walking and cycling catchments from Melrose Park. The catchment analysis is indicative only and does not take into account locations in the road network which may be difficult for pedestrians and cyclists to traverse, such as major grade separated intersections. It does however provide a useful strategic assessment of active transport accessibility.

The catchment analysis shows:

- **10 minute walking catchment,** with new through-site links through the Melrose Park precinct. This shows that major bus routes on Victoria Road would be accessible within a 10 minute walk from the centre of the Melrose Park site, as well as future light rail services as part of Parramatta Light Rail (PLR) Stage 2. Melrose Park Primary School is within a comfortable walking distance for the entire site and immediate surrounding areas.
- **20 minute cycling catchment,** with a new bridge crossing Parramatta River. The area shaded yellow shows the expanded cycling catchment resulting directly from the new bridge. Stations on the T1 Northern Line would be easily within a 15 – 20 minute ride, as would light rail stops on PLR Stage 1. The new bridge would provide access to Sydney Olympic Park and access to the future Sydney Metro West station in this location.

Active transport connections to key nearby public transport services are shown in Figure 6.29. Meadowbank is able to be accessed by a predominantly off-road route utilising the Parramatta Valley shared path. An on-road/footpath route is also available via Andrews Street. Connections to Rhodes will be possible via the new bridge over Parramatta River and the Bennelong Bridge. The majority of this route is via separated paths or local streets.

Figure 6.28 : Walking and cycling catchments

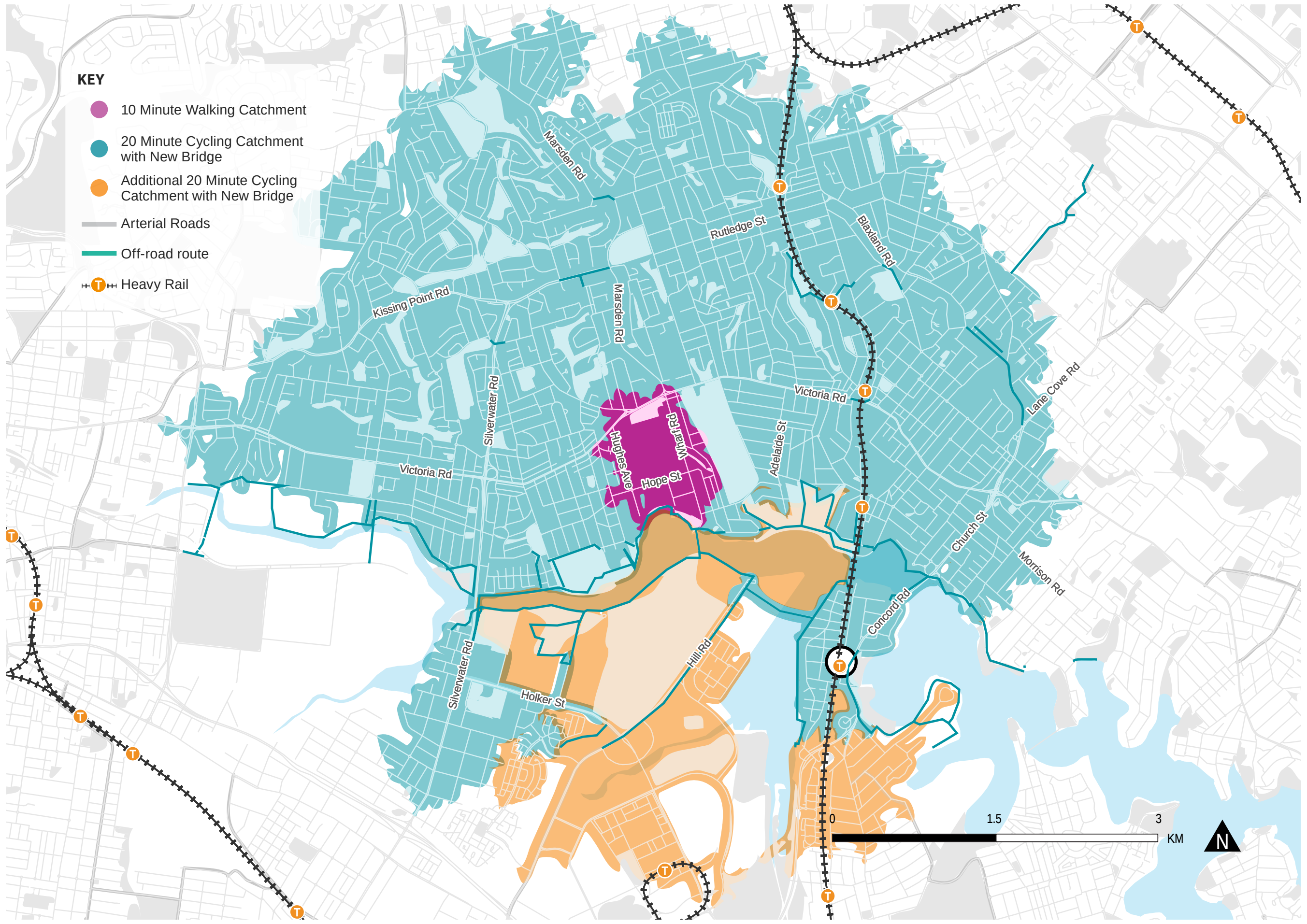
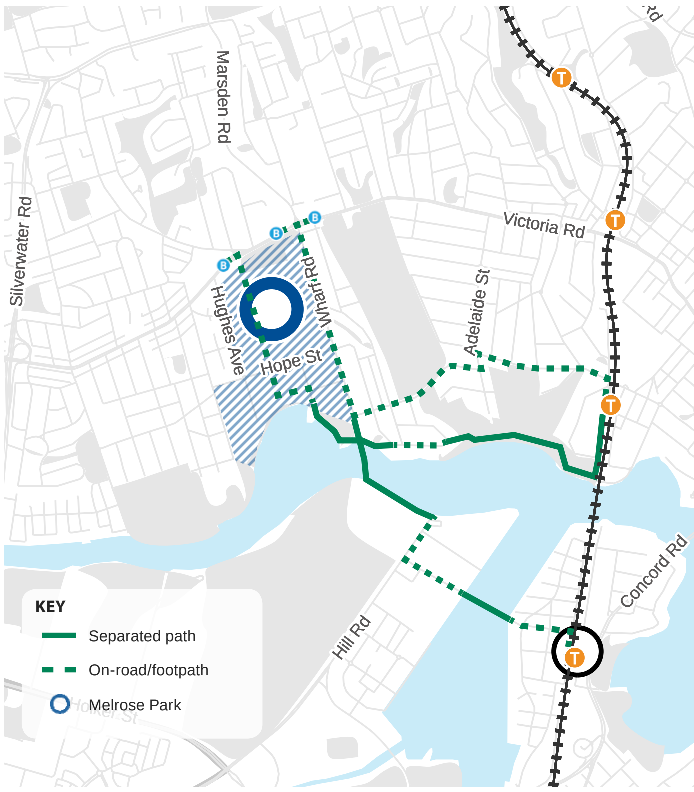


Figure 6.29 : Walking and cycling routes to public transport



6.5.4 Integration with other modes

There are several opportunities for multi-modal travel commencing with a walk or cycle trip from Melrose Park. Nearby public transport nodes should be provided with good active transport integration, including:

- Suitable pedestrian treatments at and around bus stops, light rail stops, heavy rail and metro stations. This includes traffic calming treatments to provide safe and easy pedestrian access.
- Provision of adequate bicycle parking facilities at or nearby bus and light rail stops, and bike cages or lockers at heavy rail and metro stations.
- Provision of adequate weather protection at stops and stations for waiting customers.
- Appropriate wayfinding signage in the Melrose Park precinct and at public transport stops and stations, advising customers on location and access points.

6.5.5 Promotion of walking and cycling within Melrose Park

A range of measures are proposed to promote walking and cycling within Melrose Park, including:

- Provide sufficient bicycle parking provision for residents, employees and visitors, including secure bicycle parking for residents
- Provide end of trip facilities for employees and primary school students
- Ensure residents and employees have access to sufficient travel information, including:
  - Maps of the walking and cycling network in and around Melrose Park precinct
  - Recommended walking and cycling routes
  - Average travel times to key destinations.
- Provide wayfinding and signage within the precinct to facilitate walking and cycling trips, and access to bicycle parking facilities
- Provide basic bicycle repair support, such as flat tyre repairs and tyre inflation.

All active transport infrastructure will be designed and implemented in accordance with the Disability Discrimination Act (1992)

Figure 6.30 : Example of supporting facilities for walking and cycling integration with public transport

6.5.6 Bicycle parking provision

An appropriate level of bicycle parking should be provided to support cycling to and from the Melrose Park precinct. The *Parramatta DCP 2011* has been used to develop a set of recommended minimum bicycle parking rates.

Table 6.7 outlines the bicycle parking provision for Melrose Park based on the *Parramatta DCP 2011* rates.

Table 6.7: Recommended minimum bicycle parking provision for Melrose Park (Parramatta DCP 2011)

Melrose Park land use		Minimum bicycle parking provision
Development type	**Dwellings / GFA**	
Residential	11,086 dwellings	**5,543 spaces** (0.5 per dwelling)
Commercial	19,400m^2 GFA	**97 spaces** (1 per 200m^2 GFA)
Retail	15,600m^2 GFA	**78 spaces** (1 per 200m^2 GFA)

6.6 Parking

6.6.1 Introduction

The Melrose Park structure plan recognises that there is a very strong link between parking provision and travel behaviour, and that it is a critical element of the integrated transport strategy. At the same time, it is necessary to develop a staged approach to parking that will balance the short term needs with the long term objectives for sustainable parking management within Melrose Park. Parking provision in the early stages at Melrose Park will need to balance the imperative of achieving development as early as possible, while parking provision in the later stages (beyond 2020) will need to constrain parking supply as a means of reducing travel by private car and to encourage public transport use. It is proposed to achieve the objectives relating to parking through physical planning, parking design, future trends in mobility as well as parking provision rates that reflect the site's accessibility.

6.6.2 Benchmarking and trends

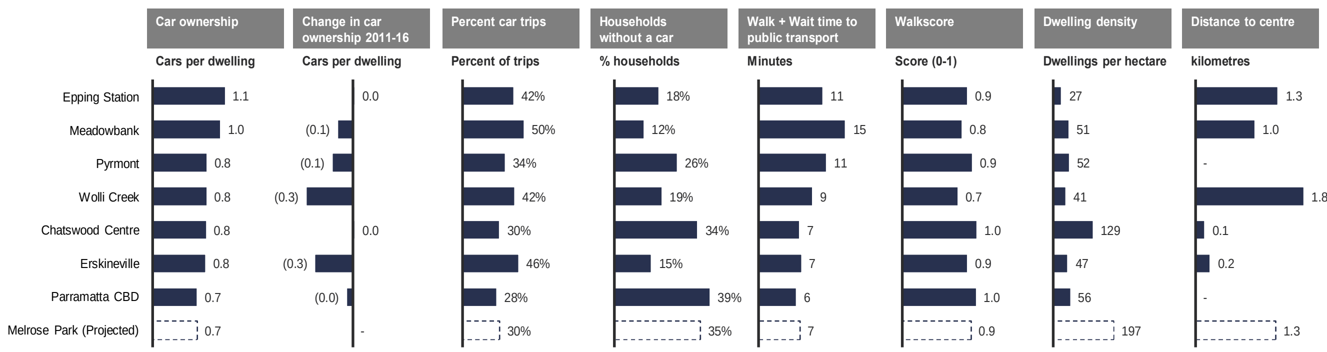
Car ownership patterns

In developing a parking strategy for Melrose Park a benchmarking exercise was undertaken by Kinesis *"An Evidence Base Parking Strategy for Melrose Park"* (06 March 2018) of car ownership and car use patterns for similar high density developments within the Sydney context (refer Figure 6.31).

The results show:

- Car ownership in the selected locations is between 0.7 and 1.1 vehicles per household
- Most areas have seen a decrease in car ownership in the last 5 years.
- 50% of all trips are generally made by car
- Areas with high access to public transport contain a large number of households (30-40%) that don't own a car.

Figure 6.31 : Benchmarking and trends (Kinesis)



Comparison of Parking Provision

Some examples of existing parking rates in selected Sydney councils are shown in Figure 6.30 for residential car parking controls. These councils have been selected as part of the TMAP for the following reasons:

- To reflect different areas or parking policy approaches to parking
- To highlight different parking provision approaches to implementing parking strategies
- To identify and compare a wide spectrum of parking policy from other local government areas within the Sydney Metropolitan spectrum
- To identify parking policy approaches in areas with similar urban and transport environments.

Parking controls across Sydney vary widely by council areas, with some council's providing a more 'best practice' model than others. Generally, adoption of maximum parking rates is considered to be desirable to ensure that there is not an oversupply of parking. Minimum parking rates effectively force proponents and developers to provide a certain number of car spaces and provide no restriction on the overall number.

Parking provision

Parking provision rates specified by the City of Parramatta DCP, Epping Town Centre DCP and the RMS Guidelines have been compared to assess various scenarios the total number of parking spaces required for the Melrose park structure plan and these calculations are provided in Table 6.8 below. It is noted that the RMS rates are recommended only for high density centres with a significantly higher jobs to dwellings ratio than is proposed at Melrose Park. It has however been included in this analysis to demonstrate the variance in total parking requirements as a result of different available rates.

Parking Provision for High Density Developments

Figure 6.32 shows the parking rates for high density residential dwellings from recent survey data provided by TfNSW and RMS. It is observed that the majority of these sites provide between 1.0 and 1.5 spaces per dwelling. The average across all sites is 1.3 spaces per dwelling. The majority of these sites do not have immediate access to mass transit comparable to the access that will be available to future residents of Melrose Park i.e. Parramatta Light Rail Stage 2. Furthermore, unlike Melrose Park, several of these sites are not located within 30 minutes of both the Eastern and Central cities. There is a clear opportunity for Melrose Park to provide parking spaces at a rate towards the lower end of the range presented in these surveys.

Figure 6.32 : Parking provision benchmarking

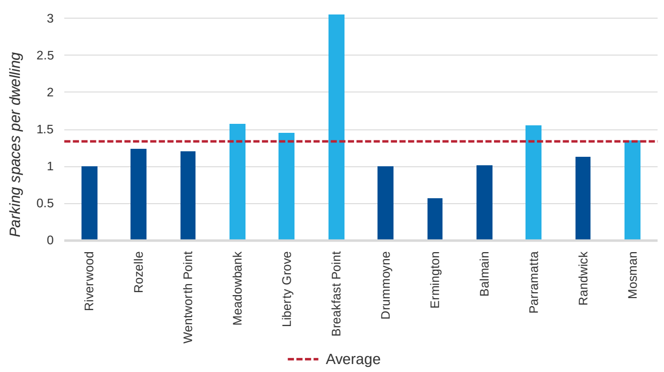


Table 6.8 : Comparison of parking requirements

		City of Parramatta DCP		Epping Town Centre		RMS (High density centre)	
Land use	GFA/ Dwellings	Parking Rate	Spaces	Parking Rate	Spaces	Parking Rate	Spaces
Commercial	19,400m²	1 per 50m²	388	1 per 70m²	277	1 per 40m²	485
Retail	15,600m²	1 per 30m²	520	1 per 60m²	260	1 per 20m²	780
Residential: 1 bed	2,910	1.0	2,910	0.75	2,182	0.6	1,746
2 bed	6,781	1.0	6,781	1	6,781	0.9	6,103
3 bed	1,190	1.2	1,428	1.5	1,785	1.4	1,666
4 bed	205	2	409	1.5	307	1.4	286
Total			12,436		11,592		11,066

It is clear that the application of existing parking controls would result in the provision of a significant amount of on-site parking. This would require significant construction and excavation costs, reducing the affordability of homes whilst also facilitating excessive car use and reducing the livability, vibrancy and sustainability of the precinct.

The current approach to parking provision does not represent industry best practice for an integrated transport network which entails innovative measures to achieve more sustainable access. There are several factors that would warrant a revised approach to parking policy for Melrose Park:

- Proposed future improvements to public transport as proposed by TfNSW, through the implementation of PLR Stage 1/2 and Sydney Metro West services improving connectivity and accessibility to public transport and major strategic centres
- The constraints of the higher order road network surrounding the site to accept a marked increase in traffic projected from other developments, even with improvements to capacity over time
- Planning trends show that residents living in areas of high dwelling density have lower car use and as such, lower car ownership relative to the Sydney Metro average
- Residents living in areas proximate to major centres areas exhibit lower car use relative to the Sydney Metro average. Melrose Park is located:
  - 5km from Rhodes Business Park
  - 8km from Sydney Olympic Park
  - 6km from Parramatta CBD
  - 7km from Macquarie Park
  - 15km from Sydney CBD.
- Melrose Park development includes a town centre with retail shopping, childcare centres and community facilities limiting the need for residents to make short car trips.

6.6.3 Parking provision considerations

Parking provision to public transport facilities

As development densities and public transport options increase at Melrose Park, the rate of parking demand is likely to decline. Public transport infrastructure such as Sydney Metro West, Parramatta Light Rail Stage 2 and new bridge across Parramatta River (suitable for active transport and public transport trips only) will constitute significant elements in the urban structure of the Melrose Park structure plan. Parking levels can be decreased as the public transport system improves and development momentum increases. In this context, the estimated reduction in the number of parking spaces required in major dense urban centres close to public transport facilities is provided in Table 6.9 (Professor Hans Westerman, *Cities for Tomorrow*).

By having development close to public transport infrastructure and services (such as Victoria Road and Hope Street) and by sharing and consolidating parking, overall parking requirements can be realistically reduced by 20%-30% for 'ultimate' build-out of Melrose Park. These parking reductions would need to be rolled out incrementally over time as higher mass, intermediate and active transport options are delivered to Melrose Park and GPOP.

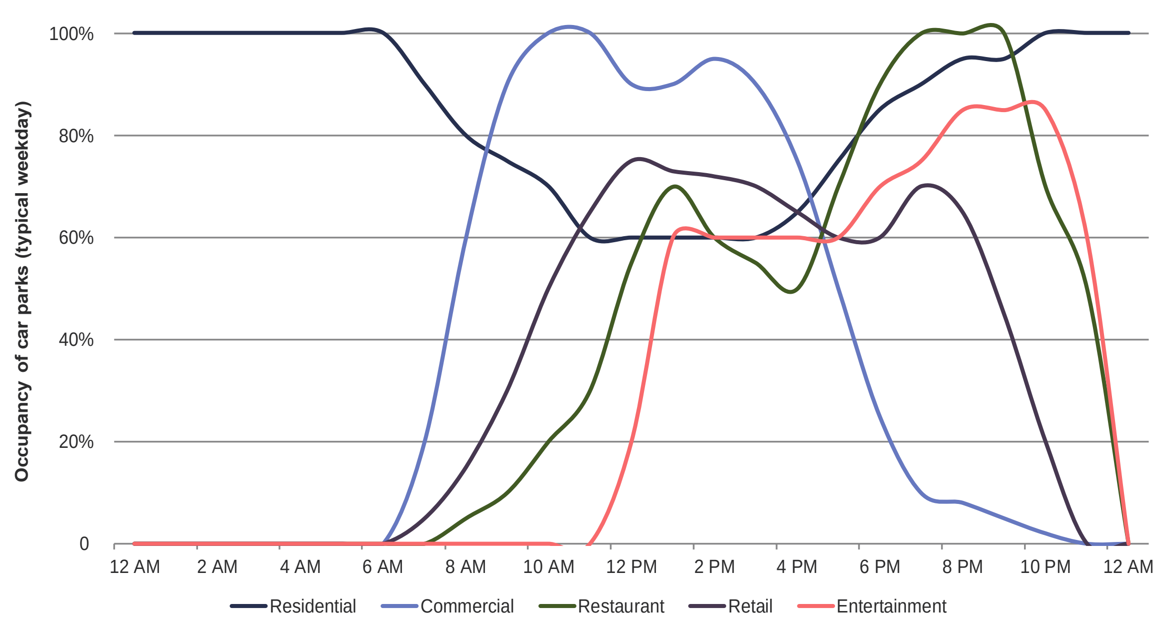
Table 6.9 : Parking reductions near public transport facilities

Location of development	Reduction (estimate)
Transit corridor	5%-10%
Station influence area	15%-20%
Transit interchange	25%-30%
Multi-modal transit hub	60%

Shared and complementary use of parking

By providing common parking facilities in locations where they can be used for a range of surrounding land uses, it will be possible to reduce the net parking provision as development progresses. Shared parking is parking shared by more than one user, which allows parking facilities to be used more efficiently. This arrangement reduces the potential for over-provision of parking spaces since complementary land uses can effectively use the same spaces. For example, the use of commercial parking for retail activities, since their times of peak demand do not coincide. These relationships are illustrated graphically in Figure 6.32 with parking assigned by type of activity based on time of day variations as reported in Urban Land Institute.

Figure 6.33 : Shared parking opportunities (Urban Land Institute)



Innovation to promote sustainable travel behaviour

Innovative parking solution for Melrose Park needs to respond to the site's level of accessibility but also to future trends in mobility. To complement the innovation incorporated into the structure plan elements of Melrose Park, we have developed a range of innovative approaches aimed at promoting more sustainable travel these include:

1. Unbundled Parking

Unbundled parking is parking that is separated from the cost or rent of a dwelling or building. In this case, residents have the choice to purchase/lease parking rather than it being bundled in the cost of housing. This can also reduce the total amount of parking required for the building. For buildings with unbundled parking, an overall parking rate reduction of 10-30% may be feasible.

2. Decoupled Parking

Decoupled parking is parking that is spatially separated from the building to which the parking services. It is also generally unbundled from the sale or rental of an apartment or building. The benefits of decoupled parking are significant, enabling transition to a low car dependent future and reduce parking rates by up to 10%. Decoupled parking has the potential to deliver the significant and mutually reinforcing benefits of parking. The shift towards lower car ownership rates and emergence of the autonomous vehicle will reduce the need for parking and investment in underground parking. In particular, parking stations/basement parking may lose value as vehicles may no longer need to be parked or housed at origin or destination locations.

3. Car Share and Planning for Reduced Car Ownership

Melrose Park is a multi-decade development and will be built out over the next 10 to 20 years. Encouraging residents to use car share schemes is one approach that can be used to reduce car dependence and ownership levels. A reduction in parking to reflect recent reductions and trends in car ownership could be expected to continue with the emergence and growth of car share, Mobility as a Service (MaaS) and connected autonomous vehicles. This will be initially supported through the delivery of car share spaces across the development and can potentially reduce parking rates by up to 10%.

4. Physical planning and design

Melrose Park will allow for common parking facilities in locations where they can be used for a range of surrounding land uses, it will be possible to reduce the nett parking provision as development progresses. The physical planning and design will incorporate:

- Dedicate parking space for car share programs and electric vehicles
- Parking location, design and access will enable better sharing of spaces and active management of supply. This will improve productivity of parking spaces and assist in achieving transport targets.
- Share mobility pods. Space will be provided within the Melrose Park for car and bike share, as well as emerging forms of share mobility such as e-mobility (electric mopeds etc).
- End of trip facilities for active transport (e.g. a bike hub providing showers, lockers and maintenance equipment).

Recommended parking provision

The overall transport objective of Melrose Park is to reduce the impact of the private car and promote alternative modes of transportation. Whilst there is a need to ensure that adequate access can be provided before public transport measures are introduced, in the medium and long term it is a core objective to reduce car parking and promote alternatives modes. This objective is supported by the demand management measures that are discussed above.

It is observed that all areas of the precinct will be within walking distance on high frequency buses and future light rail services on Victoria Road and Hope Street respectively. An 800 metre walking catchment was adopted on the basis that it is a readily accepted land use planning assumption that can be comfortably walked in 10-15 minutes. This also means the location is within close proximity to local services currently existing or planned within the Melrose Park precinct. The combination of the above strategies is expected to enable parking provision for Melrose Park as outlined below.

All parking rates are proposed to be maximum rates consistent with best practice to ensure there is not an oversupply of parking and that developers are not forced to provide additional costly parking that is not required, and which contributes to increased living costs.

It may be appropriate for earlier stages of the development to apply slightly higher rates if deemed appropriate and lower rates applied in the longer term. For this reason, proposed parking rates in Table 6.10 use the existing Parramatta Council DCP rates for short term development with medium to longer term rates representing the overall parking vision for the precinct.

Table 6.10 : Proposed maximum parking rates

	Residential (spaces per dwelling)						Non-residential (GFA per space)	
	Studio	1 bed	2 bed	3 bed +	Visitor	**Total[1]**	Commercial	Retail
Short term	1	1	1	1.2	0.25	**1.27**	$50m^2$	$30m^2$
Med-long term	0	0.3	0.7	1	0.1	**0.73**	$50m^2$	$30m^2$

1. Total residential rate per dwelling based on dwelling mix specified by Melrose Park proponents

Off-street

The parking provision rates set out in the Table 6.11 reflect suggested rates adopted for above which will have good public transport provision when the overall development is completed. The parking rates shown for the Barlett Park site have already been approved. The number of spaces proposed for ‘full build-out’ (2036) is below the levels required by the City of Parramatta standard parking standards. An overall objective of the Melrose Park development is to reduce the impact of the private car and promote alternative modes of transportation. Whilst there is a need to ensure that adequate access can be provided before public transport measures are introduced, in the medium and long term it is a core objective to reduce car parking and promote alternatives modes. In line with the objectives to reduce the level of car dependency it is recommended that the level of car parking provided on the site is reduced to a total of 9,441 spaces comprising 6,161 and 3,280 spaces for northern and southern precincts respectively.

Table 6.11 : Recommended off-street parking provision for Melrose Park (full build-out)

Land use	Parking Rate	GFA/Dwellings	Spaces
Northern Precinct			
Office/Commercial	1 space per $50m^2$	$15,000m^2$	300
Retail	1 space per $30m^2$	$12,500m^2$	417
Residential	0.73 spaces per dwelling	5,650 dwellings	4,125
Residential (Bartlett Park)[1]	1 space per dwelling + 0.1 visitor spaces per dwelling	1,200 dwellings	1,320
Sub-total			**6,161**
Southern Precinct			
Office/Commercial	1 space per $50m^2$	$4,400m^2$	88
Retail	1 space per $30m^2$	$3,000m^2$	100
Residential	0.73 spaces per dwelling	4,236 dwellings	3,092
Sub-total			**3,280**
TOTAL			**9,441**

1. Parking rate as previously approved

On-street parking (within Melrose Park)

The amount of on-street parking within the Melrose Park has been raised as an issue by the City of Parramatta (CoP). The majority of residential parking for the Melrose Park precinct will be provided off-street including visitor parking. To cater for greater variability in parking demand for on-street parking in the future, CoP would like to see on-street parking on both sides for all internal streets where possible within the Melrose Park precinct.

The amount of on-street parking within Melrose Park should be time restricted as far as possible to ensure parking spaces are allocated efficiently around key transit nodes and the proposed town centre. This will prevent long term parking for residents and commuters within Melrose Park, in particular when light rail is implemented On-street parking within the internal street network will incorporate parallel kerbside parking either on-carriageway parallel bays and/or indented parallel parking bays. Car share parking spaces are also planned to be on-street that would highlight the presence of these share cars and encourage residents to take up car share instead of purchasing private vehicles. An estimate of the number of on-streets spaces proposed for Melrose Park is summarised below:

- Northern Precinct – approximately 700 spaces
- Southern Precinct – approximately 500 spaces
- Total – 1,200 spaces.

Car share on-street parking (within Melrose Park)

City of Sydney and Leichhardt DCPs have been used in the development of car share rates as these are considered best practice and applicable to the future vision of the precinct (1 space per 40 dwellings). Car sharing rates have been developed using the parking categories outlined above. Car share schemes are generally more successful in higher density areas with limited off-street parking availability and high quality public transport, and this aligns well with the parking categories.

The Melrose Park Parking Strategy (Kinesis 2018) suggests that car share spaces can be provided in lieu of standard car parking spaces. Each car share space can replace up to 5 standard spaces.

Car share spaces will be located in publically accessibility parking spaces and located in strategic sites across the development to enable short walking distances.

6.7 Travel demand management

6.7.1 Introduction

The success of the overall TMAP requires the identification of demand management options that could potentially address future congestion problems that could be experienced on the transportation system within and around Melrose Park. In order to enable the desired changes to travel behaviour, a number of headline demand management options are discussed in the sections below. All of these support the overall transport network approach outlined in the TMAP.

6.7.2 Approach

The provision of demand management measures has been undertaken based on the following principles:

- Reduce car dependency, improve and maximise the share of travel by public transport, pedestrians and cyclists.
- Support a modal shift from private vehicles to public transport.
- Recognise the competing demands for car parking and set out parking management measures.
- Provide environmental protection through the reductions in total travel and the congestion levels in the transportation system.
- Apply an approach consistent with 'Travel Choices' method adopted by Transport for NSW focusing on re-mode, re-time, re-route or reducing journeys.

6.7.3 Demand Management Measures

There are a broad range of travel demand management options outlined in Table 6.12 that could be applied to Melrose Park. These range from "hard measures", such as parking charges and workplace parking levies through to "soft measures" such as car sharing, car clubs, public transport information, tele-working, etc.

Parking Management and Control

There are a number of ways in which parking management and control can be used to influence demand. These primarily include:

- Parking charges – for all or certain road user categories (i.e. time based pricing, vehicle occupancy pricing).
- Reducing or limiting available parking space for all or certain road user categories (i.e. vehicle size parking to encourage the use of smaller and more environmentally friendly vehicles).
- Variable parking pricing programs during congested hours of the day.
- Improving enforcement and control of available parking.
- De-coupling and/or unbundling of off-street car parking from being 'locked into' specific building structures or rent / ownership arrangements

Table 6.12: Suite of demand management measures

SOFT →				HARD
Providing Information	Encouraging behaviour change	Enabling behaviour change	Discouraging unsustainable behaviour	Preventing unsustainable behaviour
Awareness campaigns	Workplace and school travel plans	Prioritising public transport	Parking charges	Access control
Cycling and walking information	Flexible working hours	Car share schemes	Parking management	Pedestrianisation
Advanced traveller information	Personalised travel planning	Car pooling scheme		
	Opal card with pre-loaded value provided upon occupation	Smart work hubs		

Car-sharing

Car-sharing is an effective approach for encouraging reduced levels of car ownership. Car-sharing is best suited to high density, mixed use environments that provide a range of alternative transport options. Many car share providers provide a membership car share service that enables efficient online car booking and rental for registered users.

The service allows users to book, and have on-demand access to, a shared car or vehicle as their needs require. Cars are accessed through smart card technology with cars located in designated reserved spaces in established strategic locations. For example, GoGet has partnered with Parramatta City and City of Ryde councils to facilitate car share schemes within its boundaries with policy dedicated to promoting car share use including actions orientated towards management of kerbs and off-street car share parking.

Travel Choices

Travel Choices is a simple framework designed to help reduce peak hour travel, allow people to move around more efficiently and improve business productivity.

- *Remode*: use public transport as driving may no longer be your best option.
- *Retime*: avoid travel during the peak, especially between 8-9am and 5-6pm.
- *Reduce*: minimise the number of times you have to travel, especially by car.
- *Reroute*: use the city's preferred driving routes where possible.

Retiming and reducing are effective ways for people to avoid driving in the AM and PM peak. A number of approaches within the Travel Choices framework could be applicable to managing demand for private vehicles in Melrose Park.

Flexible working arrangements

Flexible working arrangements can include:

- *Flexible hours*: changing start or finish times.
- *Flexible patterns*: working longer days to provide for a shorter working week.
- *Flexible rostering*: split shifts.

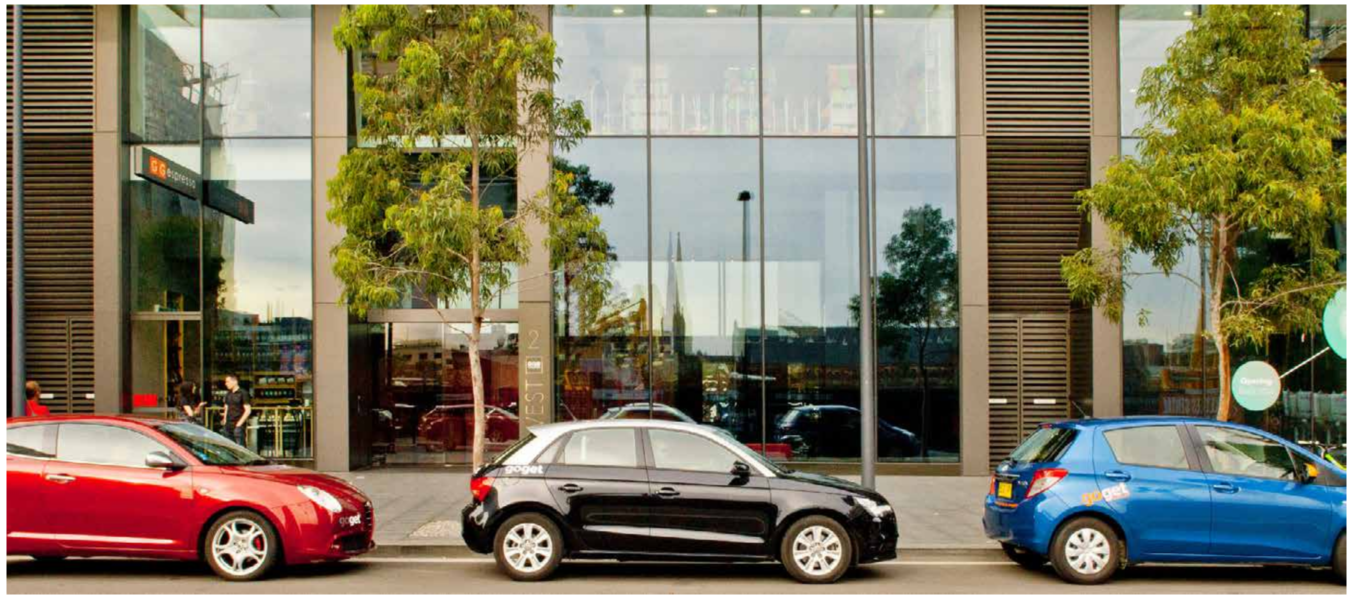
All of these arrangements would require significant support from employers in employment locations of Melrose Park workers e.g. Sydney CBD, Parramatta CBD, Rhodes and Olympic Park.

A 'smart work hub' could be considered in Melrose Park due to the significant commuter population it is likely to contain. A Smart Work Hub offers all the conveniences of a modern office – high speed internet, meeting rooms, videoconferencing facilities, informal lounges and quiet booths – but in close proximity to home. It is a shared workspace with others from small businesses, government and corporate organisations utilising the facilities. Telecommuting allows worker to either eliminate a commute trip altogether by working from home or to reduce trip length by working from a satellite office, such as a smart work hub.

End-User Facilities

The decision to travel to work via walk or cycle tends to be driven in large part by the availability of enduser facilities. These may include showers for cyclists, bike cages or other bicycle parking facilities that ensure safe and secure storage of bicycles, changing rooms and drinking water facilities. These facilities should be incorporated within all employment locations within Melrose Park.

Figure 6.34 : Car-share opportunities (GoGet)



Transport Management Association

The implementation of the Melrose Park TMAP could be supported by the establishment of a Transport Management Association (TMA) charged with managing the delivery and monitoring of the plan's outcomes. The TMA's responsibilities in terms of travel demand management may include, but not be limited to:

- *Personalised Travel Planning*: Personalised travel planning involves the provision of tailored information and incentives directly to households with the aim of influencing travel behaviour and reducing car usage.
- *Travel Information:* Working with transport service providers to provide road users with information about congestion in the surrounding network so the trip characteristics can be altered to avoid congestion.
- *Public Transport Information*: Establishing a marketing campaign and developing a strong, overarching, brand image for public transport has the potential to perform a key role in supporting other demand management options and encouraging modal shift from the private car to public transport alternatives. It is imperative that a good level of public transport service be in place before the promotion and marketing of a route or service can be considered as an effective tool. This could also be supported by a commitment to the early provision of Opal cards by proponents.

Workplace and Green Travel Plans

Workplace travel plans and green travel plans are generally a set of practical initiatives that are put in place by employers or building managers before occupying a new of existing development that encourages staff and residents to choose alternatives to driving that are healthier and more sustainable. For travel plans to be successful in reducing vehicular travel demand, they should be developed in a tailored manner that respects the specific needs to each particular location / organisation.

Elements of such travel plans can include many of the initiatives mentioned above, as well as information programs for sustainable transport, active transport initiatives, flexible work hours, proactive cooperation with transport agencies to tailor public transport facilities to the site and employer initiated parking policy that support public transport use.

A TMA would be charged with supporting the development, delivery and monitoring of all travel plans within the precinct. Expected outcomes of the plans (e.g. mode share targets) will be monitored by the TMA

Recommendations

A summary of the demand management measures recommended as a part of this study area are outlined below

- Implement comprehensive parking management and control approach for Melrose Park including consideration of de-coupling and unbundling off-street parking
- Develop car sharing approach for Melrose Park including parking rates to be delivered for specific developments
- Investigate the provision of a 'smart work hub' within Melrose Park to reduce commuter peak demand
- Provide high quality end-user facilities for all new developments in Melrose Park
- Measures be considered for inclusion in relevent site specific control plans for Melrose Park.

7. IMPLEMENTATION PLAN

JACOBS

7. IMPLEMENTATION PLAN

7.1 Overview

The development of an integrated package of measures and strategies for the Melrose Park TMAP has evolved over an ongoing process based upon close consultation with City of Parramatta, Department of Planning & Environment, Transport for NSW, Roads and Maritime Services and key stakeholders.

The implementation plan provides a framework to ensure an integrated and coordinated approach to achieve the objectives set out in the TMAP.

Whilst a number of the specific measures and strategies of this TMAP will be pursued jointly by both local and NSW Government, there will also be a number of measures and that will be taken forward by Melrose Park proponents separately. In implementing the processes outlined in this TMAP, the outcomes across the precinct and wider region will be consistent and coordinated.

7.2 Staging and trigger points for major infrastructure and services

Melrose Park precinct is a multi-decade development and will be developed in stages. The initial staging will be based on land ownership, market demand, cash flow, constructibility, community needs and design considerations.

Melrose Park precinct needs to build in flexibility to accommodate future changes and to ensure land use strategies are closely coordinated with infrastructure delivery. It is important to understand the short, medium and long term changes in demand and service level requirements as the development progress. Although a particular capacity or service level is required for ultimate development, infrastructure will usually be provided in stages to match demand and lower levels of service can be tolerated in the short term.

A key aspect in the timely and cost-effective provision of infrastructure and services is the integration of land release strategies with the delivery of infrastructure. This is to ensure that the use of existing assets and any spare capacity is maximised early in the process to ensure efficient delivery of future infrastructure.

The key aspects of the Melrose Park staging approach include:

- Assessing infrastructure demand over the proposed development period and identifying critical short term, medium and long term demands
- Ensuring public transport services are provided in line with development to encourage sustainable behaviour and reduce car reliance
- Investigation of existing and future infrastructure capacity to identify "trigger" thresholds and timeframes for contribution and implementation
- Preparing an infrastructure staging plan which moderates the development staging plan as required taking advantage of infrastructure capacity.

The detailed staging and sequencing for Melrose Park will be further refined after the planning proposal with development contingent on the delivery of transport infrastructure. The following staging scenarios have been considered:

- An extension of the existing development front from Victoria Road following development occurring at the former Bartlett Park site (Figure 7.1)
- Development occurring on two fronts (i) an extension of the existing Bartlett Park site, and (ii) the proposed new town centre at the south-east corner of the northern precinct (Figure 7.2)

The indicative staging described below has been formulated in conjunction with the establishment of the road network and public transport facilities to ensure that Melrose Park evolves in a coherent and efficient manner.

Dwelling yields for each stage reflect the trigger point for the associated infrastructure. e.g. Stage 1A works are required in order to support a yield of more than 1,100 dwellings. Years shown are indicative only.

Stage 1A: Delivered at approx 1,100 total dwellings (2021)

- Widening of Wharf Road south of Victoria Road
- Left in/left out access from Victoria Road to NSR-2 (i.e. at Kissing Point Road)

Stage 1B: Delivered at approx 1,800 total dwellings (2022)

- Upgrade of Victoria Road/Wharf Road intersection to provide:
  - Additional dedicated left turn lane on eastern Victoria Road approach
  - 4 lanes at the stopline on Wharf Road approach - 1 left, 1 through, 2 right
  - Removal of slip lane on western Victoria Road approach and realignment of stopline to allow for more efficient 'diamond' signal phasing
  - Additional through lane on Marsden Road approach

Stage 1C: Delivered at approx 3,200 total dwellings (2024)

- Upgrade of the Victoria Road/Kissing Point Road intersection to provide:
  - Fully signalised intersection allowing all turning movements.
  - Dual right turn lanes on the eastern and western Victoria Road approach
  - Dual right turn lanes and a shared left/through lane on the southern Kissing Point Road approach
  - 4 lanes at the stopline on the northern Kissing Point Road approach - 1 right, 2 through, 1 left.
  - New signalised pedestrian crossings on the northern, southern and western intersection legs
- Widening of Victoria Road between Kissing Point Road and Wharf Road to allow for a continuous bus lane in each direction

There is potential to provide an indented bus bay for eastbound Victoria Road services directly east of the upgraded Kissing Point Road intersection. It is recommended that the provision of this facility be further investigated at the detailed design stage to ensure that relevant design standards can be met at this location.

Throughout Stage 1

- Provide shuttle buses to service the public transport demand from Melrose Park to Meadowbank Station. Provision of this service will commence with one shuttle bus, with further shuttles to be brought into service in line with delivery of dwellings with a total of 4 buses providing an ultimate Stage 1 frequency of 12 shuttles per hour in the peak periods.
- Staged improvements to frequency of M52 bus services on Victoria Road as described in section 6.4.6 to provide ultimate frequency of 18 per hour in peak direction. (Noting that Melrose Park demand accounts for 5 of the additional 12 hourly services)
- Staged delivery of internal road network and associated pedestrian and cycling infrastructure to provide access to development.

Stage 2: Delivered at approx 6,700 total dwellings (2028)

- New public transport and active transport bridge over the Parramatta River between Melrose Park and Wentworth Point. The bridge will be designed to cater for both bus and light rail vehicles.
- Public transport services as described in section 6.4.6 including maintaining Stage 1 M52 service improvements and also providing services over the new bridge either via Parramatta Light Rail Stage 2 or high frequency bus connections.
- Staged delivery of internal road network and associated pedestrian and cycling infrastructure to provide access to development.

Figure 7.1: Single front staging scenario

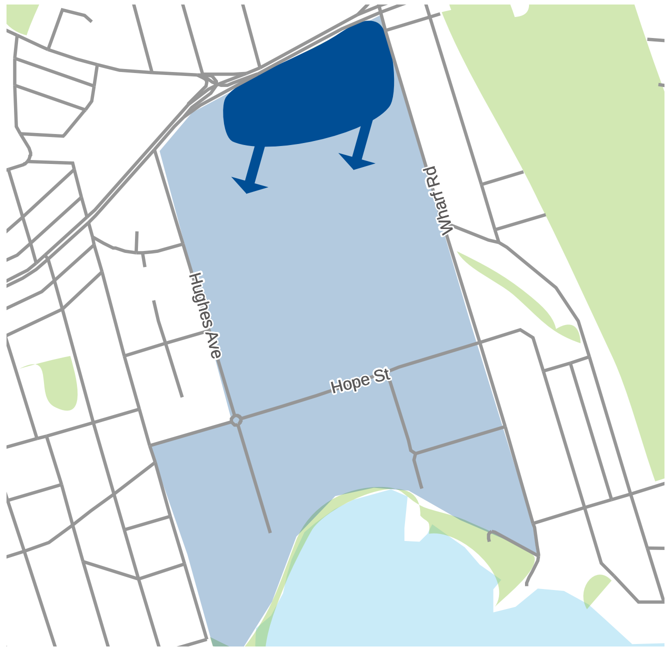
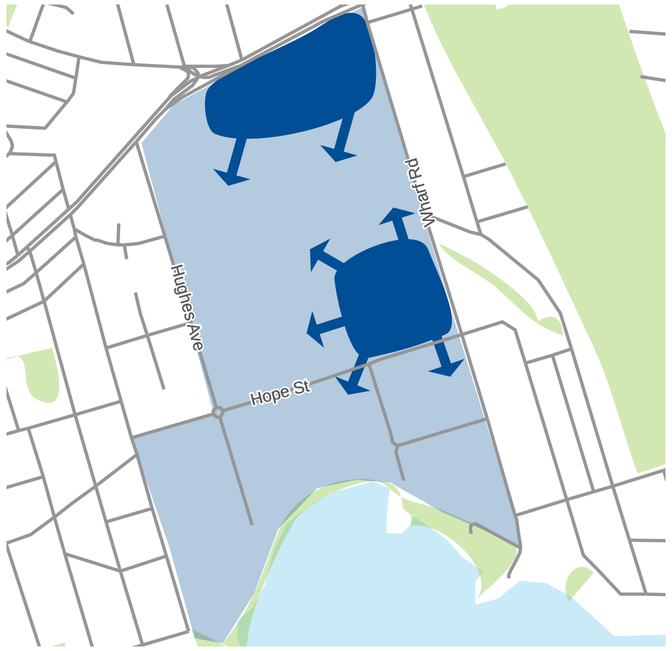


Figure 7.2: Two front staging scenario



A summary of the proposed staging and the total dwelling yield able to be supported by each stage is shown in Table 7.1

Table 7.1: Staging summary

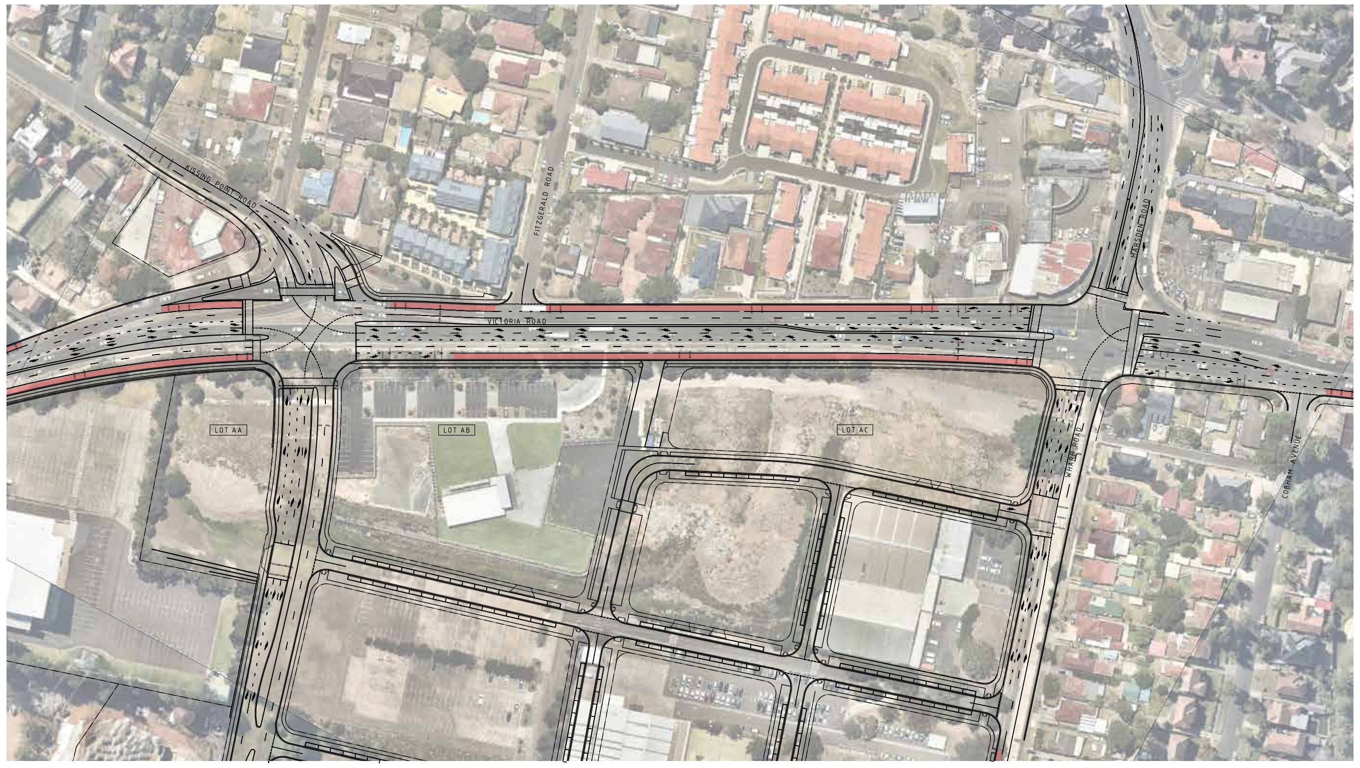
Stage	Delivered at (dwellings)	Yield supported (dwellings)
Existing network	N/A	1,100
Stage 1A	1,100	1,800
Stage 1B	1,800	3,200
Stage 1C	3,200	6,700
Stage 2	6,700	11,000

Figure 7.3 to 7.5 set out the staging of identified road infrastructure recommendations for the Melrose Park precinct. Intersection designs and pedestrian crossing facilities will be subject to further refinement at the detailed desgn stage. It is noted that all traffic modelling presented in this TMAP assumes full one-stage pedestrian crossings on all legs of Victoria Road intersections with Kissing Point Road and Wharf Road.

Figure 7.3 : Victoria Road Stage 1A upgrades (Northrop) - Required at approx 1,100 dwellings

Figure 7.4 : Victoria Road Stage 1B upgrades (Northrop) - Required at approx 1,800 dwellings

Figure 7.5 :Victoria Road Stage 1C upgrades (Northrop) - Required at approx 3,200 dwellings



7.3 Implementation plan

The table below sets out a summary of the proposed transport infrastructure and services required to support the Melrose Park development. Detailed staging of these items is outlined in section 7.2

ID	Description	Responsibility	Background	Objective	Timing
Road network					
1	Internal road network	Proponents	The internal road network will be delivered in lockstep with the staged development of Melrose Park. It is proposed to develop internal roads progressively to provide access to core development areas as they come online.	2,5,6	Ongoing
2	Wharf Road intersection upgrade at Victoria Road	Proponents/ RMS	Proposed upgrade to the Victoria Road/Wharf Road intersection will improve access to and from Melrose Park whilst also improving efficiency for buses, freight and general traffic on Victoria Road.	2,4,5,6	Short term
3	Kissing Point Road - new access at Victoria Road	Proponents/ RMS	New left-in/left-out access into the precinct via the Victoria Road/Kissing Point Road intersection. This will be required in the initial stages of the development to allow for local access.	2,4,5,6	Short term
4	Intersection upgrades - As part of PLR Stage 2	TfNSW	Intersections along Hope Street will require adjustments as PLR stage 2 is delivered. This will result in newly signalised intersections at Hughes Avenue, NSR-2 and NSR-3/Waratah Street.	2,4,5,6	Medium term
5	Kissing Point Road - intersection upgrade at Victoria Road	Proponents/ RMS	Full upgrade of the Victoria Road/Kissing Point Road intersection. This will provide full access into and out of the Melrose Park precinct whilst also improving efficiency for buses, freight and general traffic on Victoria Road.	2,4,5,6	Medium term
6	Victoria Road upgrade between Wharf Road and Kissing Point Road	Proponents/ RMS	Widening of Victoria Road between Kissing Point Road and Wharf Road to allow for extended turning lanes and a continuous bus lane in each direction.	2,4,5,6	Medium term
Public transport network					
7	On-demand services	TfNSW	On-demand services to Macquarie Park are currently being trialled in the Melrose Park area. The possible expansion of these services to other hubs will reduce car reliance for Melrose Park residents and workers.	1,2,5,7	Short term
8	Local bus shuttle services	Proponents	The provision of bus shuttle services to promote integration with local bus and rail services at Meadowbank. Staged provision of buses to allow an ultimate Stage 1 (pre-bridge) headway of 5 minutes in the weekday peak period. 4 buses required to support up to 6,700 dwellings. Potential minor works and pedestrian crossing on Bank Street or at kiss and ride facility to support shuttle operations at Meadowbank station.	1,2,5,7	Short term
9	Bus service enhancements	TfNSW	The following improvements will provide efficient and sustainable travel options for residents and visitors of Melrose Park in the short to medium term: • Increased frequency on M52 to cater for both background growth and Melrose Park demand along Victoria Road to Parramatta and the Eastern City • Potential new service Top Ryde to Concord Hospital via a new bridge over Parramatta River • New and upgraded bus stops on Wharf Road to ensure a maximum 400m spacing and to provide increased waiting areas and passenger amenity	1,2,5,7	Short to medium term
10	Ferry services	TfNSW	Investigations into the following ferry service improvements are recommended: • Service improvements for F3 Parramatta River services to cater for future commuter ferry and tourist patronage demand • Investigate and consult with TfNSW and RMS on ferry shuttles between Olympic Park and Parramatta and a potential new wharf at Melrose Park	1,2,5,7	Short to medium term
11	New bridge across Parramatta River	Proponents/ TfNSW	A new bridge connecting Melrose Park and Wentworth Point will have a transformative impact on Melrose Park and the wider region. Rapid transport connections via bus or light rail will directly connect Melrose Park with jobs, services and key transport corridors at Rhodes and Sydney Olympic Park.	1,2,3,4,5, 7	Medium term
12	PLR Stage 2	TfNSW	A new light rail line will be provided connecting Melrose Park with Parramatta CBD and Olympic Park. At least two stops will be provided within Melrose Park to cater for central / northern and southern precinct access to the light rail corridor. The structure plans makes provision for a LRT corridor along Hope Street.	1,2,4,5,7	Medium term
13	Sydney Metro West	TfNSW	New metro line connecting Westmead, Parramatta CBD, Olympic Park, the T1 Northern rail line, Bays Precinct and Sydney CBD. This will be a key connection for Melrose Park residents who can access the line at Sydney Olympic Park via PLR Stage 2.	1,2,4,5,7	Medium term
14	Victoria Road bus improvements	TfNSW	As outlined in Future Transport 2056 - Improvements will include upgrading bus services and infrastructure on the Victoria Road corridor. Improvements will transform the Victoria Road Corridor into a more attractive place to live and work. Improvements would enhance access for Melrose Park residents traveling to Parramatta or the Eastern City. A potential indented bus bay to be investigated eastbound on Victoria Road east of Kissing Point Road.	1,2,4,5,7	Medium term
15	T1 Northern Line improvements	TfNSW	Investigations into capacity improvements for the T1 Northern Line are currently underway. TfNSW has indicated improvements will be necessary within the next 10 years. Improved services would enhance access for Melrose Park residents who could reach West Ryde/Meadowbank via bus or on-demand services before transferring to the T1 Northern Line	1,2,4,5,7	Medium term
16	T1 Western Line improvements	TfNSW	The T1 Western Line Rail Upgrade Program is recommended to be implemented in order to provide more capacity for Northern Line services	1,2,4,5,7	Medium term

JACOBS

ID	Description	Responsibility	Background	Objective	Timing
Active transport network					
17	Walking and cycling infrastructure on internal network	Proponents	The internal road network within the Melrose Park precinct will include provision for safe, efficient and attractive walking and cycling trips, particularly to/from Melrose Park Primary School. A midblock crossing on Hope Street between Wharf Road and Waratah Street is recommended to be investigated to facilitate safe connections between the northern precinct and the school. This will encourage local trips to be undertaken via active modes whilst also enhancing access to nearby public transport services. A shared path will be provided on the western side of Wharf Road.	1,2,3,7	Ongoing
18	Enhanced local connections	Proponents/ CoP	Enhancements to active transport infrastructure linking Melrose Park Precinct to the surrounding activity areas through new connections via the internal road network to the Parramatta River foreshore shared path and to George Kendall Reserve	1,2,3,7	Short term
19	Cycle parking and end of trip facilities	Proponents	End of trips facilities and secure and visible cycle parking should be provided at all commercial centres and other major trip generators Adopt bicycle parking provision of: • 1 per dwelling + 1 visitor space per 10 dwellings • 1 per 150m^2 commercial GFA + 1 visitor space per 450m^2 commercial GFA • 1 per 250m^{2}retail GFA + 1 visitor space per 100m^2 retail GFA	1,2,5,7	Short term
20	Implement and refine Parramatta Bike Plan 2017	Proponents/ CoP	• Fully separated cycleway for Hope Street providing a new high quality east-west connection between Melrose Park and Rydalmere • Painted lanes on Wharf Road connecting Hope Street cycleway to existing Parramatta Valley cycleway • New shared path connecting north-south through the Melrose Park precinct and connecting with the Parramatta Valley cycleway	1,2,3,7	Short to medium term
21	Shared mobility facilities	Proponents	Shared mobility pods to be provided within Melrose Park for bike share, as well as emerging forms of shared mobility such as electric mopeds.	1,5,7	Medium term
22	New bridge across Parramatta River	Proponents/ TfNSW	A new bridge connecting Melrose Park and Wentworth Point will include dedicated walking and cycling infrastructure. This will provide direct active transport connections between Melrose Park and key centres such as Rhodes and Sydney Olympic Park.	1,2,3,4,5, 7	Medium term
23	Walking and cycling facilities to be delivered as part of PLR Stage 2	TfNSW	Improved cycling and pedestrian facilities should be investigated during planning and delivery of PLR Stage 2 along the Hope Street and Waratah Street corridors.	1,2,3,7	Medium term
Policy					

24	Parking policy	CoP/ Proponents	• Consider maximum parking rates for Melrose Park in the long term with parking provision of:
			  • 0.73 spaces per dwelling (average based on currently assumed dwelling mix)
			  • 1 space per 30m^2 commercial GFA
			  • 1 space per 50m^2 retail GFA
			• Prioritise on-street car share within Melrose Park at a residential car share rate of 1 space per 40 dwellings
			• On-street parking to be provided within the internal road network and be designed to support the function for the street.
			• Provide real-time parking information along key access streets and the proposed town centre
			• Unbundling /decoupling parking from the sale of apartments, to deliver housing choice and efficient allocation of parking across the development.
			• Monitor on-street parking activity on the surrounding street network at Wharf Road, Hope Street and Hughes Avenue to minimise over flow parking from Melrose Park
				1,6,7	Ongoing

25	Demand management	Proponents	• Ensure that transport information is up to date and liaise with the local residential and business communities on transport issues • Aligning information at stops and streets with digital transport information provided through websites, apps and electronic information displays • Liaise with transport providers to resolve any impediments to their efficient service and promote regular improvements • Enabling significant investment in car share, providing accessible mobility choice to households without parking or who choose not to own a car • Introduce parking management and control measures e.g. parking charges, constraining parking supply, unbundled/decoupled off-street parking • Facilitate car-sharing to reduce the need for private car ownership • Provide shared work spaces and ‘smart hubs’ to facilitate flexible working arrangements and minimise the need for peak hour commute trips • Provide opal cards to initial residents of the precinct	1,2,6,7	Ongoing

8. KEY FINDINGS AND CONCLUSIONS

8. CONCLUSIONS AND RECOMMENDATIONS

8.1 Overview

The Melrose Park TMAP has examined a wide range of issues in a complex land use and transport planning environment given the strategic location of the precinct within Greater Parramatta Olympic Peninsula (GPOP). The TMAP has sought to address the following key issues:

- The need to achieve a high level of public transport use, cycling and walking in order to achieve the *Future Transport Strategy 2056* broad strategic planning objectives of improved integration of land use and transport planning
- A strong commitment to bring light rail into the precinct as part of PLR Stage 2 and anchored by future connections to PLR Stage 1 and Sydney Metro West at Sydney Olympic Park
- The need to balance transport and access expectations in an environment where the road network, particularly at key intersections surrounding the site, is already close to capacity
- A staged approach to parking provision that will balance the short term needs with the long term objectives for sustainable parking management within the precinct
- To cluster residential, commercial and retail development in such a way that a 'critical mass' of trip generation is established within public transport catchments from the earliest stages of development.

8.2 Key findings

The key findings of the Melrose Park Precinct incorporating 11,000 dwellings in terms of transport infrastructure and services requirements are:

- Based on the nominated service levels for the road network, upgrades to Victoria Road intersections (Wharf Road and Kissing Point Road) will be required in order to efficiently service the Melrose Park precinct
- The road network analysis has identified that the remainder of the existing road network is able to cater for traffic generated by the proposed development, with no significant impacts compared to a future 'do minimum' scenario
- The public transport network for Melrose Park has been planned to cater for the full development without the need for light rail.
- Increased bus service frequencies on Victoria Road are required to support development and achieve mode share targets. Investigations have confirmed the required bus service levels are feasible
- A new bridge crossing (public and active transport only) across the Parramatta River linking Melrose Park to Wentworth Point is required by 2028 (approximately 6,700 dwellings) to enable connections from residential and employment areas to key public transport nodes
- New bus services between Top Ryde and Concord Hospital via Melrose Park are proposed to operate via the new bridge
- Shuttle services between Melrose Park and Meadowbank station are proposed to operate prior to the implementation of the new bridge. Proposed operations can be implemented without signifcant works or impacts
- Ferry user patronage demand from Melrose Park is likely to be small but may play an important role for discretionary trips. A new bridge across the Parramatta River will provide access to Sydney Olympic Park and proposed new ferry wharf at Rhodes East
- A light rail corridor is being proposed by TfNSW established through the core of the development. This would bring light rail services through the heart of Melrose Park with direct access to the proposed Sydney Metro West station at Olympic Park
- The introduction of PLR Stage 2 leads to a number of access implications along Boronia Street, Hope Street and Waratah Street which will need to be carefully managed
- The northern precinct structure plan maintains a corridor on Hope Street between Hughes Avenue and Waratah Street to enable the implementation of light rail. The southern precinct allows for light rail along Waratah Street.
- The entirety of the road works shall be delivered early with all upgrades delivered prior to the implementation of the new bridge over the Parramatta River. This plan ensures that infrastructure is in place to support the development and minimise wider network impacts.
- Key elements of Stage 1 - Prior to bridge (up to 6,700 dwellings:
  - Stage 1A, Stage 1B and Stage 1C road upgrades
  - Enhanced Victoria Road bus services to cater for background growth and Melrose Park demand
  - Shuttle services to Meadowbank Station
- Key elements of Stage 2 - After new bridge (more than 6,700 dwellings)
  - New high frequency services (bus or light rail) over the bridge
  - Continued enhanced Victoria Road bus services to cater for background growth and Melrose Park demand

8.3 Key conclusions

The key conclusions of the Melrose Park TMAP are:

- The scale of development envisaged for Melrose Park (11,000 dwellings) presents very significant, but manageable challenges for road and public transport infrastructure and services
- The package of transport infrastructure and services proposed and assessed in the TMAP is capable of accommodating the Melrose Park development yields (11,000 dwellings) and regional transport requirements as defined in *Future Transport Strategy 2056*
- Sydney Metro West will deliver significant benefits across the entire rail network for residents from Melrose Park with high capacity and more frequent services between Parramatta CBD, Sydney Olympic Park and Sydney CBD
- A new bridge crossing (public and active transport only) across the Parramatta River linking Melrose Park to Wentworth Point is required by 2028 (approximately 6,700 dwellings) to enable connections between multiple trip origins and destinations linking residential and employment areas to key public transport nodes
- Parramatta Light Rail Stage 2 will provide a direct link to and through the Parramatta CBD, and to the broader rail network, for the growing areas of Melrose Park, Wentworth Point, Sydney Olympic Park, North Parramatta and Westmead
- The public transport network needs for Melrose Park Precinct has been planned to match the type and scale of development without the need for light rail. The new bridge across Parramatta River linking Melrose Park and Wentworth Point will provide a key connection and will provide, a fast, direct, high frequency feeder bus services linking Melrose Park to Rhodes Station and future metro station at Sydney Olympic Park
- The signalised intersections within the study area are adequate and will operate at acceptable level of service with the improvements recommended. The TMAP analysis has shown LOS E or better for all the signalised intersections within the study area during the peak hours
- The additional traffic demands as a result of Melrose Park development on the surrounding local road network fall within acceptable capacity thresholds
- Parking provision in the early stages will need to balance the imperative of achieving as much development as early as possible (to contain travel within the area), while parking provision in the later stages will need to constrain parking supply as a means of reducing travel by private car
- The proposed 9,441 off-street parking spaces provided within Melrose Park is considered adequate to cater for the likely parking demand generated from the site at full build-out by 2036, which will be complemented by the public transport initiatives identified in the TMAP
- An integrated package of measures is required to be implemented over the next five to ten years as the development progresses, with the package containing a mix of policy and infrastructure and transport services measures
- The staging of the development will not cause any noticeable degradation of performance on the surrounding road network with the proposed integrated package of mitigation measures
- The staging of infrastructure and services is focused on ensuring high levels of accessibility in the short term. Road network upgrades and significant public transport service improvements are proposed in the early stages of the development.
- The measures presented within the TMAP need to be integrated comprehensively and consistently over the short, medium and long term if the mode split targets are to be achieved, and if the surrounding road network is to continue to function at an acceptable level of service.

APPENDIX A - MELROSE PARK PRECINCT MODEL (MPPM)

JACOBS

Memorandum

Level 7, 177 Pacific Highway
North Sydney NSW 2060 Australia
PO Box 632 North Sydney
NSW 2059 Australia
T +61 2 9928 2100
F +61 2 9928 2444
www.jacobs.com

Subject	**MPPM Spreadsheet model**	**Project Name**	Melrose Park TMAP
Date	12 October 2018	**Project No.**	IA130100

1. Introduction

The purpose of the Melrose Park Precinct Model (MPPM) is to assist in understanding the impacts of proposed developments and the potential travel behaviour for trips to and from the precinct. The model provides forecasts for trip generation, trip distribution, mode choice and trip assignment to and from a development. This memorandum details the process of generating forecasts using the MPPM.

2. Step 1 – Zoning System

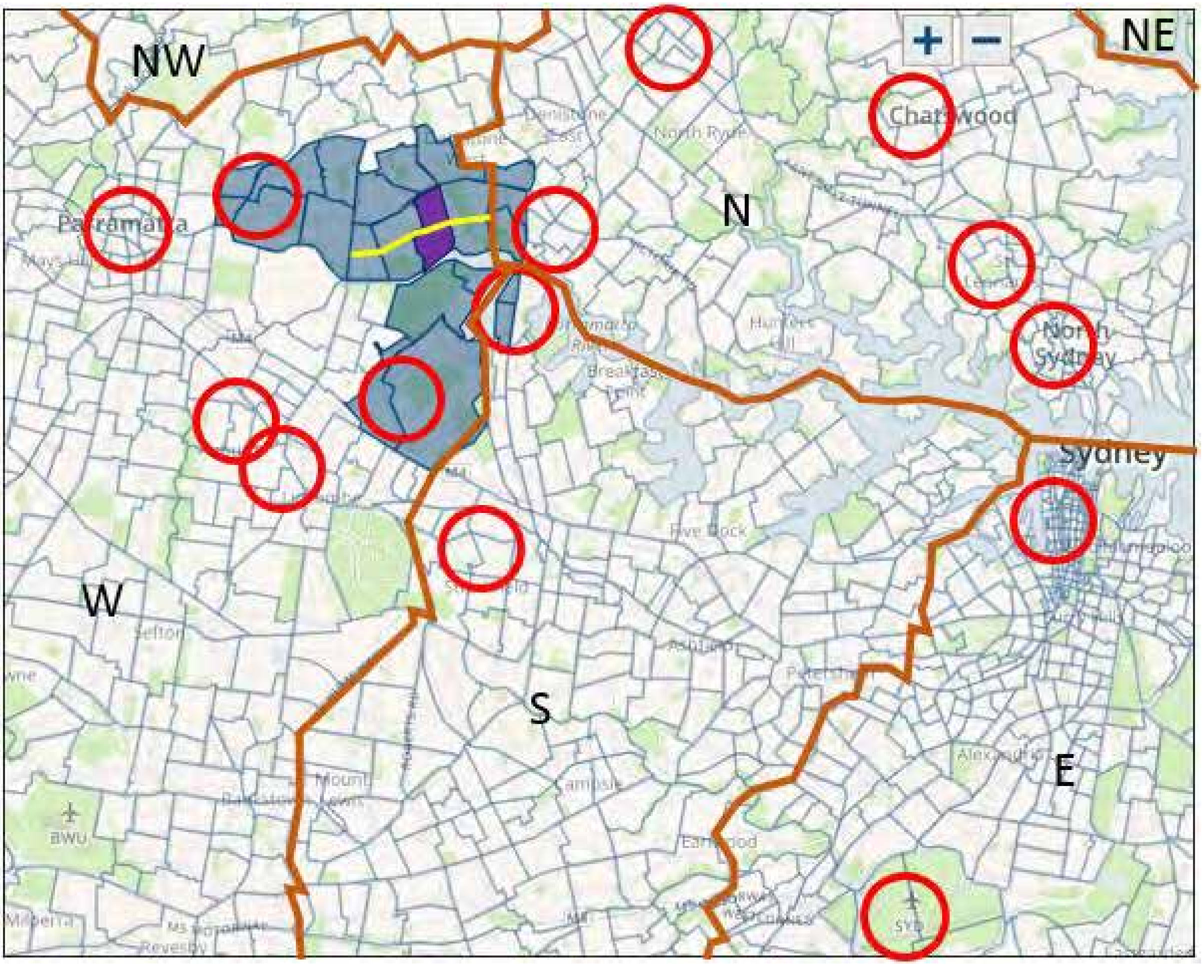
The first step is to define the zoning system. The zoning system forms the basis of the four-step analysis that is undertaken in the MPPM. MPPM uses Journey To Work (JTW) data from the 2011 census (the latest available at time of model development) for forecasting demand. As a result, JTW zones are used to define the geography of the model.

All JTW zones are defined into two types: internal and external. Internal zones comprise of the zone containing the development and its surrounding zones (the study area). If necessary, these zones can be further disaggregated to better reflect their public transit network connectivity. In the case of Melrose Park, travel zones between Victoria Road and the Paramatta River are all split into a North and a South zone because the North-South distance between Victoria Road and the Paramatta River is 2km. Therefore, residents in the Southern parts of these zones fall outside of the catchment of bus services running along Victoria Road.

External zones are divided into two types: employment centres, and wider external zones. These zones are created through the amalgamation of appropriate JTW travel zones. Employment centres represent the main places of employment for the residents of the internal zones (e.g. the CBD, Paramatta, Macquarie Park etc.). Employment centres are chosen to capture the majority of work trips which are made by the residents of the internal zones.

The figure above shows the zoning system used in the model. Internal zones are shaded blue, employment centre zones are indicatively shown by the red circles. Wider external zone boundaries are marked by the brown lines, which extend to cover the rest of Sydney (not shown above). Melrose Park is shaded purple. The yellow line marks the location of the split for the zones between Victoria Road and the Paramatta River, including the Melrose Park zone.

Figure 2.1: MPPM zoning system



All remaining travel zones are amalgamated into wider external zones. These zones represent large geographic areas (e.g. North West) and are comprised of many zones to which there are a low number of trips from the internal zones.

3. Step 2 – Demand development

Once the zoning system is developed, an origin-destination demand matrix (OD matrix) is created. JTW data provides the number of work trips which take place between every travel zone disaggregated by mode. MPPM uses the sum of all car and public transit trips; modes 1-5 in the JTW. Trips which report modes such as 'other' and 'mode not stated' (modes 6-9 in the JTW) are excluded from the analysis.

The sum of all car and public transit trips is amalgamated to provide OD demand for each OD pair using the zoning system defined in Step 1; with the exclusion of external to external zone pairs, as these do not influence the study area. This provides the base OD matrix for the year 2011.

Census projections are used to factor the base 2011 OD matrix in order to create the base study year matrix (2016) as well as future study year matrices (2026, 2036). The census provides population and employment projections for every JTW travel zone. These projections are split or amalgamated in the same manner as the JTW data to convert them into the MPPM zoning system. Using the reported

2011 employment and population, and the projected future population and employment in each zone, growth factors are derived. These are applied to the 2011 OD matrix to create the base and future year OD matrices.

Each OD pair is factored by two growth factors to arrive at the future OD value.

The population growth factor is simply the percentage by which the population in the origin zone has grown over time. Every origin zone has a growth factor which is applied to all trips originating from that zone.

The employment shift growth factor takes into consideration the fact that not all destination zones will grow at the same pace. First a distribution of trips from each origin zone is created using the 2011 OD matrix. This distribution is then factored by the relative growth in projected employment in each destination zone. This way, the fact that certain destinations, such as Paramatta, grow at a faster rate than others, such as the CBD, and will attract more trips in the future is accounted for. This new distribution of trips is then applied to the trips factored by the population growth factor to arrive at the future year number of trips for each OD pair.

4. Step 3 – Benchmarking

The growth factors used in Step 2 cannot be applied to the development zone as the land use will be completely different than it currently is. Benchmarking is needed to develop an accurate representation for trip generation and trip distribution for this zone. Additionally, any other internal zones where significant change in land use has occurred or is planned to be happen must also be benchmarked.

In the MPPM benchmarking was applied to the development zones in Melrose Park, and the fast-growing zones at Olympic Park and Wentworth Point South.

Firstly, benchmark zones are specified. Benchmark zones of similar location, development level and public transit connectivity are chosen as they will provide the most accurate estimates for the trip generation and distribution for the zones which require benchmarking.

Benchmarking is used to provide an estimate for trip generation and trip distribution. Population and employment projections for other internal benchmark zones can be obtained from the census projections used in Step 2. For the development zones, projections for population and employment are extracted from the development documents.

A weighted average number of JTW trips out per population for the appropriate benchmark zones is calculated and applied to the projected population to obtain the projected total number of trips from the zone. These are then distributed by the weighted average distribution for the appropriate benchmark zones.

Once benchmarking is completed, final OD matrices for the base and future year are created. This completes the process of trip generation and distribution.

5. Step 4 – Public Transit Generalised Cost

The next step in the MPPM is to assign the trips from the final OD matrix. The MPPM uses a generalised cost binomial logit model to assign all trips for each OD pair to one of two modes: public transit (PT) or car.

To carry out the assignment, generalised cost for each OD pair for PT and car trips are computed. The generalised cost represents a representative average trip for each OD pair.

PT trips are divided into three types: Local to External (LE), External to Local (EL), and Local to Local (LL). LE trips take place between internal and external zones; EL trips the opposite, and LL trips occur between two internal zones. A representative average PT trip is then computed for each PT trip type.

LE trips are broken down into 3 legs. Leg 1 represents the walk to a local bus stop (or local light rail stop in light future light rail scenarios). Each internal zone is served by a local bus stop. All bus services which go through an internal zone stop at the local bus stop. Using GIS, a centroid is estimated for each travel zone based on its land use; i.e. accounting for dwelling density and green spaces. The centroid is taken as the origin of all trips from each zone to represent the average trip.

The distance from the centroid to the local bus stop via the road network is calculated using a GIS network of the area. The generalised cost is expressed in minutes. The formula for calculating Leg 1 costs is shown below:

$$Cost = Walk\ Distance\ x\ Walk\ Speed\ x\ Walk\ Factor$$

The cost of Leg 1 is computed by converting the distance to a walking time using an assumed average walking speed, and applying a factor reflecting the relative desirability of walking as a means of commute. The factor used in the MPPM is 1.5 reflecting the fact that walking is seen as a relatively undesirable means of commute.

Leg 2 represents the trip on a local bus to a gateway. A gateway is a train/ferry/metro/light rail stations inside or near the study area. A representation of bus services running through the study area is created. Each bus service is modelled to stop in each zone and at each gateway through which it passes. The travel times and frequencies are taken from the Transport for New South Wales (TfNSW) timetable for each local bus service. The cost for Leg 2 of the trip is calculated using the formula below:

$$Cost = Wait\ Factor\ x\ 0.5\ x\ \frac{60}{Frequency} + IVT\ Factor\ x\ IVT + Fare\ Factor\ x\ Fare + Mode\ Transfer\ Penalty$$

Where;

- Wait factor represents the disutility of waiting for a local bus service to arrive
- Frequency is the number of busses per hour
- In vehicle time (IVT) is the time taken for the trip
- IVT Factor represents the relative attractiveness of each mode of travel. It is different for busses, trains, light rai, ferry etc.

- Fare is calculated using Opal distance bands
- Fare factor converts the monetary value of the fare to a perceived minute cost
- Mode transfer penalty represents the perceived inconvenience in minutes of changing modes of travel at the end of Leg 2

Where zones are served by multiple overlapping services the frequency is the sum of all overlapping services per hour, since travellers would board the first available service.

The centroid of certain zones falls within 1km of a gateway. For these zones, Legs 1 and 2 are replaced by a single walking trip from the zone centroid to a gateway. The cost of the trip is calculated using the same methodology used in Leg 1.

Leg 3 refers to the trip from the gateway to the destination. It is divided in two parts. First, travellers use the rail/light rail/ferry/metro network to travel to a destination station. A destination station is the station which acts as the proxy for an external zone. Each external zone, both employment centre and wider external zone, is represented by a destination station. A representation of the rail/ferry network is created for Leg 3 using the TfNSW General Transit Feed Specification (GTFS). The formula for computing costs in Leg 3 is the same one used in Leg 2; with the exception of the mode transfer penalty, as it was already applied in Leg 2.

The second part of the Leg 3 trip is the trip from the destination station to the destination. Again, an average trip is created to represent the trips from the destination station to the final destination. For employment centres, this trip is a walking trip of various durations to account for the differing sizes of the employment centres. The cost of this part of the trip is computed using the same formula as in Leg 1. For wider external zones, another local bus trip is assumed to take place from the destination station to the destination. The costs of this trip are computed using the same formula as in Leg 2.

The final cost of a local to external public transit trip is calculated by the summation of the costs from all components of the three legs.

External to local trips are equivalent to LE trips but take place in the opposite direction. Since the only change is the order in which the trip is made, their costs are identical for equivalent EL-LE pairs.

Local to local trips also consist of three legs. Leg 1 is the walk to the local bus stop and is the same as in EL trips. Leg 2 consists of taking the local bus to a destination zone. The formula used is the same one as in Leg 2 of EL trips, with the only difference being that the trip is taken to another internal zone instead of a gateway. Finally, Leg 3 is another walking trip from the local bus in the destination zone to the centroid of the destination zone. The cost of this leg is calculated the same as Leg 1. If two zone centroids are within 1km of each other, or if two zones share the same local bus stop, a walking trip from one zone centroid to the other replaces Legs 1-3 of a LL trip.

The final cost of a local to local public transit trip is calculated by the summation of the costs from all components of the three legs.

An important note is that most zones are connected to multiple gateways via multiple local bus services. Each of these alternatives has a different generalised cost. For the purposes of public transit vs car mode choice, the generalised cost of a public transit trip is considered to be the lowest generalised cost of any of the possible public transit trips. Later, when the trips are assigned, they are assigned through a logit model so that trips are distributed via different gateways and via different local bus services.

6. Step 5 - Car Generalised Cost

Car generalised cost for each OD pair is computed via the following formula:

- $Cost = IVT + Fare\ Factor\ x\ \frac{(Distance\ x\ Car\ Operating\ Cost\ Per\ Km + Toll + Parking\ Cost)}{Car\ Occupancy}$

Where;

- IVT is in-vehicle time (travel time)
- Fare factor is used to convert monetary costs to perceived minute cost. It is the same factor used to convert fares into a perceived minute cost for public transit fares in Step 4

Car travel time, distances and tolls are all obtained from the Sydney Strategic Traffic Model (STM).

Car occupancy cost per km and car occupancy are globally assumed parameters. Parking costs are different for each external zone. Parking costs are chosen to reflect the scarcity of parking at each destination.

7. Step 6 – Mode Choice

A simple binomial choice model is used in the MPPM to calculate mode choice. Specifically, the following formula is sued to calculate the proportion of public transit trips:

$$PT\ Proportion = \frac{e^{-\beta\ x\ GC_{PT}}}{e^{-\beta\ x\ GC_{PT}} + e^{-\beta\ x\ (GC_{car} + ASC_{car})}}$$

Where;

- PT Proportion is public transit mode share
- GCpt is the public transit generalised cost calculated in step 4
- GCcar is the car generalised cost calculated in step 5
- ASCcar is the alternative specific constant for car
- β is the sensitivity parameter

The two parameters used in calibrating the model; the β and the ASCcar, are varied for different trip types. All trips are divided to fall into one of eight trip types. All origin zones are divided into two types – rail walk and rail non-walk, depending on whether the zone falls within the walking distance of a gateway station. Destination zones are divided into 4 types: CBD, other centre, rail walk and rail non-walk, where;

- CBD is the CBD
- Other centre refers to employment centres outside of the CBD
- Rail walk refers to destination zones which are within a walking catchment of a gateway station but are not employment centres

- Rail non-walk refers to destination zones which are not within a walking catchment of a gateway station

Trip types are the combinations of the origin and the destination types and are;

- Rail walk to CBD
- Rail walk to Other Centre
- Rail walk to Rail walk
- Rail walk to Rail non-walk
- Rail non-walk to CBD
- Rail non-walk to Other Centre
- Rail non-walk to Rail walk
- Rail non-walk to Rail non-walk

To ensure the most accurate representation of traveller's behaviour, a unique sensitivity and alternative specific constant for each of the eight trip types because the difference in costs is perceived differently depending on the trip type.

For example, the ASCcar for rail non-walk to rail non-walk trips is negative, indicating a preference for making these trips by car. This occurs because making such trips via public transit requires a minimum of two mode changes. While a mode transfer penalty is applied to each when computing generalised cost, the additional perceived inconvenience of having to change modes twice is not accounted for until the ASCcar parameter is applied. Conversely, the ASCcar for trips to the CBD is positive indicating a preference for public transit on such trips due to the additional perceived cost of spending additional time in congestion and difficulty finding parking at the destination.

The sensitivity parameter is also varied to reflect how strong some of these preferences are. It is lower for trip types where there is a clear preference for one mode over the other, such as the preference for public transit to the CBD or the car for non-walk to non-walk trips, and higher for trip types where there isn't a clear preference and the difference in general costs is the most important factor in mode choice.

Variation of the two parameters based on trip type allows for a better calibration of the model. The model is calibrated based on the 2011 JTW data. The shape of the logit curve represents a limitation for zone pairs where mode share is significantly skewed to either mode. While it would be very easy to replicate the 2011 mode choice using very high parameters, these parameters would not be realistic. Thus, the 2011 JTW mode shares are used a guide rather calibration targets.

The logit model is applied to each zone pair in the model to determine mode share to and from each individual zone. Demand values refer to JTW trips across the 24-hour period. These are converted into all trip purposes over a 3.5 Hr AM peak and then a 1 Hr AM peak using appropriate factors. The factors are derived by comparing the number of JTW trips assigning to the rail network to the total observed 3.5 Hr rail station entries. The 3.5 Hr rail station entries are sourced from the Rail Station Barrier Counts 2013 report authored for the Bureau of Transport Statistics and TfNSW.

8. Step 7 – Trip Assignment

The mode choice model provides forecasts for public transit trips between each zone pair. Multiple alternative paths exist for public transit trips, as they can be made via multiple gateways. Also, most gateways can be accessed via multiple local bus services. In the trip assignment stage, these trips are assigned to alternative paths through the modelled transit network.

First, the demand for each OD zone pair is distributed to all the possible gateways which can be used to complete each trip. This is done using a simplified version of the binomial choice used in determining mode choice. There is only one parameter in this model – the sensitivity parameter. The alternative specific cost parameter is not used as all of the trips are made using the same mode. The sensitivity parameter used here differs from the one used in the mode choice model. It is calibrated to create a reasonable distribution of trips to each gateway depending on their relative costs for each zone pair. The costs used in this assignment are the cost of making the entire trip via each gateway, not just the cost of leg 3, as the decision of which gateway to use is made at the beginning of the trip and not at the beginning of leg 3.

Next, the demand from each zone to a gateway (or to another internal zone for LL trips) is assigned to the appropriate bus services. Again, a simple binomial choice model is used, with the sensitivity parameter being the only factor. This is another internally calibrated factor based on a reasonable distribution in regards to relative costs of alternative routes which differs from sensitivity parameters used previously. Again, the costs used are for the whole trip made via each service, not just leg 2.

An allowance for park and ride is included at this stage. It is recognised that a certain proportion of public transit trips will be made via park and ride or kiss and ride instead of the local bus network, especially at gateways where significant parking provisions or on-street parking facilities exist such as Meadowbank or West Ryde. The park and ride factor reduces the demand on the local bus services leading to these gateways, while leaving the demand at the gateway unaffected.

Once the trips are assigned to each local bus service, statistics such as demand at gateways or bus on/off diagrams can be reported.

APPENDIX B - AIMSUN CALIBRATION REPORT

JACOBS

Melrose Park Transport Management and Accessibility Plan (TMAP)

Payce Property

Calibration and Validation Report

Rev B - Final

10 May 2018

Melrose Park Transport Management and Accessibility Plan (TMAP)

Project No:	IA130100
Document Title:	Calibration and Validation Report
Revision:	Rev B - Final
Date:	10 May 2018
Client Name:	Payce Property
Project Manager:	Iwan Smith
Author:	Christian Arkell
File Name:	\\jacobs.com\anz\IE\Projects\04_Eastern\IA130100\21 Deliverables\Calibration and Validation Report\Melrose Park Calibration and Validation Report_R1.0.docx

Jacobs Australia Pty Limited

Level 7, 177 Pacific Highway
North Sydney NSW 2060 Australia
PO Box 632 North Sydney
NSW 2059 Australia
T +61 2 9928 2100
F +61 2 9928 2500
www.jacobs.com

Document history and status

Revision	Date	Description	By	Review	Approved
Rev A	8/1/2018	Draft	C Arkell/A Minic	I Smith	I Smith
Rev B	10/5/2018	Final	C Arkell/A Minic	I Smith	I Smith

Contents

1. Introduction

1.1 The project

Jacobs have been commissioned by Payce Property to develop a Transport Management and Accessibility Plan (TMAP) for proposed development at Melrose Park. Currently comprised of primarily industrial development, the Melrose Park site presents significant opportunities for redevelopment and rezoning to increase population density.

The Melrose Park TMAP will be informed by operational traffic modelling undertaken using a hybrid mesoscopic and microscopic traffic model using the Aimsun software package. The *Melrose Park Hybrid Traffic Model* will provide a tool for the assessment the impacts of new proposed mixed-use development on travel times and traffic performance through the study area.

Hybrid mesoscopic and microscopic traffic modelling provides the ideal tool to assess the requirements of the surface transportation network, effects of congestion and identification of network constraints.

1.2 Model purpose

The purpose of the model is to provide a strategic assessment of the road-based transport infrastructure requirements to support proposed development at Melrose Park. The wider mesoscopic areas of the model are not for the purposes of detailed road design. The microsimulation area directly impacted by the proposed development will be more detailed in nature and may be used to inform road design activities.

1.3 Modelling process

The Sydney Strategic Travel Model (STM) has been used to provide initial travel demand and will also be used for future demand development.

The *Melrose Park Hybrid Model* has been developed using the Aimsun modelling platform (version 8.2.1) and has been calibrated and validated based on the principles outlined in the *Roads and Maritime Traffic Modelling Guidelines, 2013*, modified for the specific purposes of the model and specified in the *Melrose Park Traffic Model Scoping Report* (23 October 2017) prepared by Jacobs.

Mesoscopic modelling provides sufficient detail to determine the performance of the road network under proposed future land use scenarios and provides guidance on the need for further road infrastructure requirements. In addition, mesoscopic simulation allows for true dynamic equilibrium assignment where vehicles can select their optimal travel routes based on their previous travel experiences. This provides a confidence that the modelled pattern of traffic represents a realistic response to the delays and capacity constraints that would be experienced by traffic on a day-to-day basis.

Additionally, the model includes a microscopic simulation area in the immediate vicinity of the development site in order to better reflect detailed behaviour such as lane-changing and weaving which is best modelled using microscopic simulation.

1.4 Purpose of this report

This report is intended to document the development, calibration and validation of the *Melrose Park Hybrid Model*. It details the process undertaken to calibrate and validate the model and specifies the conformance of the model to relevant modelling guidelines for calibration and validation.

1.5 Assumptions and limitations

1.5.1 Assumptions

The calibration and validation of the *Melrose Park Hybrid Traffic Model* is based on a number of assumptions:

- Peak period private vehicle travel demands supplied from STM are representative of peak period travel demand
- Traffic count data is a true and accurate representation of existing traffic conditions
- Public transport data supplied by Transport for NSW is a true and accurate representation of existing services
- Signal timing data supplied by Roads and Maritime Services from 2017 is a true and accurate representation of existing traffic signal operation
- Travel time data is an acceptable representation of existing delays across the network.

1.5.2 Limitations

The calibration and validation of the *Melrose Park Hybrid Model* documented in this technical report is subject to the following limitations:

- Traffic analysis has been limited to the morning (6-10am) and evening peak (3-7pm) four-hour periods for a typical weekday
- The traffic model development has been limited to mesoscopic modelling of the study area, except for the specified area surrounding the Melrose Park proposed development which was simulated using microscopic modelling
- The zoning system within the model is limited to some subdivision of the Sydney Strategic Travel Model (STM) zone system (TZ11). This subdivision includes detailed zone disaggregation down to the level of local or collector roads.
- Traffic data, including counts, signal timings and travel time surveys were gathered from a number of sources. While every effort has been made to ensure continuity in these sources, some inconsistency in count data is expected which may have an impact on the calibration and validation process.

1.6 Report structure

This report is structured as follows:

- Section 2: *Model development* – Outlines the methodology used in the development of the model and illustrates all supplied transport data
- Section 3: *Demand matrix development* – Details the sources and development of traffic demand
- Section 4: *Model calibration* – Details the calibration procedures and results
- Section 5: *Model validation* – Details validation procedures and results
- Section 6: *Conclusions* – Outlines the conclusions of the calibration and validation process.

2. Model development

2.1 Overview

The *Melrose Park Hybrid Model* has been developed using the Aimsun (version 8.2.1) traffic modelling platform. Aimsun allows for the development of static and dynamic traffic models within a unified platform, performing traditional static macroscopic modelling using volume delay functions as well as more detailed dynamic mesoscopic and microscopic simulation modelling. Dynamic traffic models are useful in modelling congested or capacity-constrained conditions where traffic demand exceeds available capacity and traffic diverts to seek less congested alternative routes. These conditions result in queuing that builds up and dissipates over time and dynamic routing of traffic that is responsive to this build-up of delays.

The model is based on an initial road network and traffic demand supplied by Transport for NSW, converted from the Roads and Maritime Strategic Highway Assignment Model and refined for the study area. This model has been built within the Greater Metropolitan Sydney network as a sub-model.

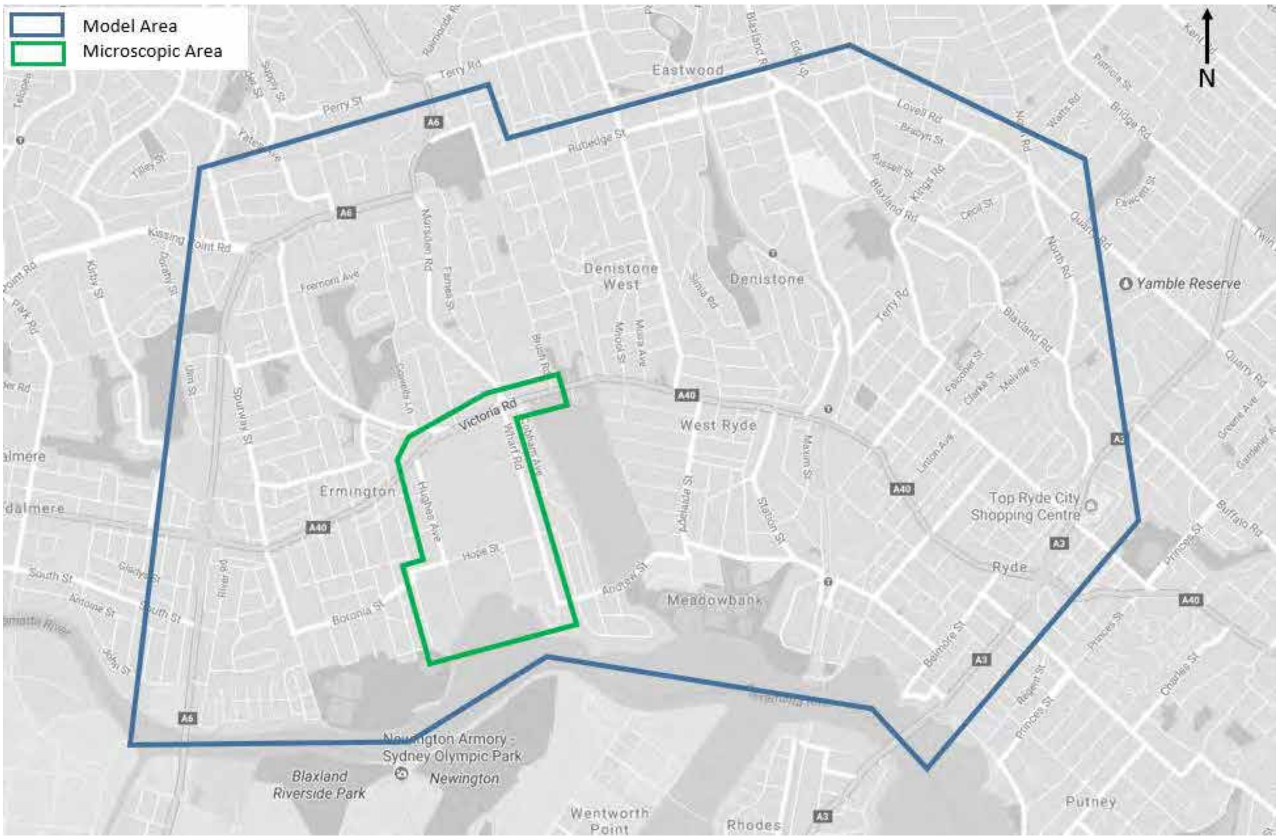
2.2 Model scope

2.2.1 Geographical coverage

A map of the model extents is provided in Figure 2.1. The model extends beyond the immediate area surrounding the proposed development to ensure that all traffic movements potentially related to development at Melrose Park are captured by the model.

Located in Sydney's North-West, Melrose Park is bounded by Victoria Road to the North, Archer's Creek to the East, the Parramatta River to the South and Hughes Avenue to the West.

Figure 2.1 : Aimsun model extents



2.2.2 Temporal coverage

The model covers the morning and evening peak periods from 6:00am to 10:00am and from 3:00pm to 7:00pm respectively. In addition to these simulation periods, a “warm-up” period of an additional 30 minutes has been specified to sufficiently load the network at the start of each analysis period. Results from the warm-up period are not included in the reported model statistics.

Traffic demand has been defined in 15-minute matrices, while signal control plans have been defined per-hour. Signal times were averaged per-hour as minimal phase time variance within the hour was observed for the majority of intersections within the modelled area. The accuracy that would be provided by the use of separate 15-minute signal plans would be minimal, particularly when considering traffic count data and traffic signal data are not from the same day. The profiles of 15-minute traffic counts would not correspond directly to the 15-minute profile of green time; furthermore, under future scenarios, fine-tuning of traffic signal settings at the 15-minute level is not practical.

2.2.3 Vehicle classes

The following four vehicle classes have been explicitly modelled:

- *Cars*: comprised of cars, taxis and light vans (all modelled as the same vehicle class), Austroads classes 1 and 2
- *Trucks*: comprised of small and large rigid trucks, Austroads classes 3, 4 and 5
- *Heavy trucks*: comprised of articulated semi-trailers and B-doubles, Austroads classes 6 and above
- *Buses*: modelled using fixed routes and timetables rather than demand matrices.

2.3 Road network

Key components of the existing road network in the study area are detailed in this section.

2.3.1 Victoria Road

Victoria Road is a state arterial road that provides access between Parramatta and the Anzac Bridge. Near the study area, the Victoria Road experiences moderate to high delays during the morning and evening peak periods, particularly near Kissing Point Road and Marsden Road. Clearways and bus lanes are in effect in both directions during peak periods. Several bus routes run along Victoria Road, including the M52 bus route. Parking is not permitted along Victoria Road, except near the West Ryde.

2.3.2 Silverwater Road

Silverwater Road is an arterial road that connects Dundas Valley to Lidcombe in a north-south direction. Some delays occur during the peak periods at Silverwater Road, south of Victoria Road. Near the study area, the posted speed limit is 80 km/hr and no parking is permitted along Silverwater Road.

2.3.3 Marsden Road

Marsden Road is a sub-arterial road that provides access between Carlingford and West Ryde. The posted speed limit is 60 km/hr and on-street parking is available on both sides of the road. The road generally operates with spare capacity, but experiences moderate delays near Victoria Road and between Morris Street and Stewart Street.

2.3.4 Wharf Road

Wharf Road is a collector road that connects Ermington to Melrose Park. The road experiences minor congestion at the intersection with Victoria Road. The posted speed limit is 50 km/hr and on-street parking is available along some sections of the road.

2.4 Zoning system

The model has a base centroid configuration corresponding with Transport for NSW's Transport Performance and Analytics (TPA) Travel Zones 2011 (TZ11). The TZ11Travel Zones cover large areas and hence have been disaggregated in order to provide sufficient detail and resolution in future scenarios. This disaggregation has been based on observed dwelling within each travel zone.

A summary of disaggregated centroids is shown in Table 2.1.

Table 2.1: Summary of centroid disaggregation

Travel Zone	Name	No. of disaggregated centroids
1113	Lottie Stewart Hospital	2
1118	Ermington	3
1121	Reckitt Benckiser	27
1123	George Kendall Riverside Reserve	4
1124	Ermington_River Rd and Lindsay Ave	2
1582	Marsden High School	2
1583	West Ryde Station_West	2
1585	West Ryde	2
1588	Melrose Park	4

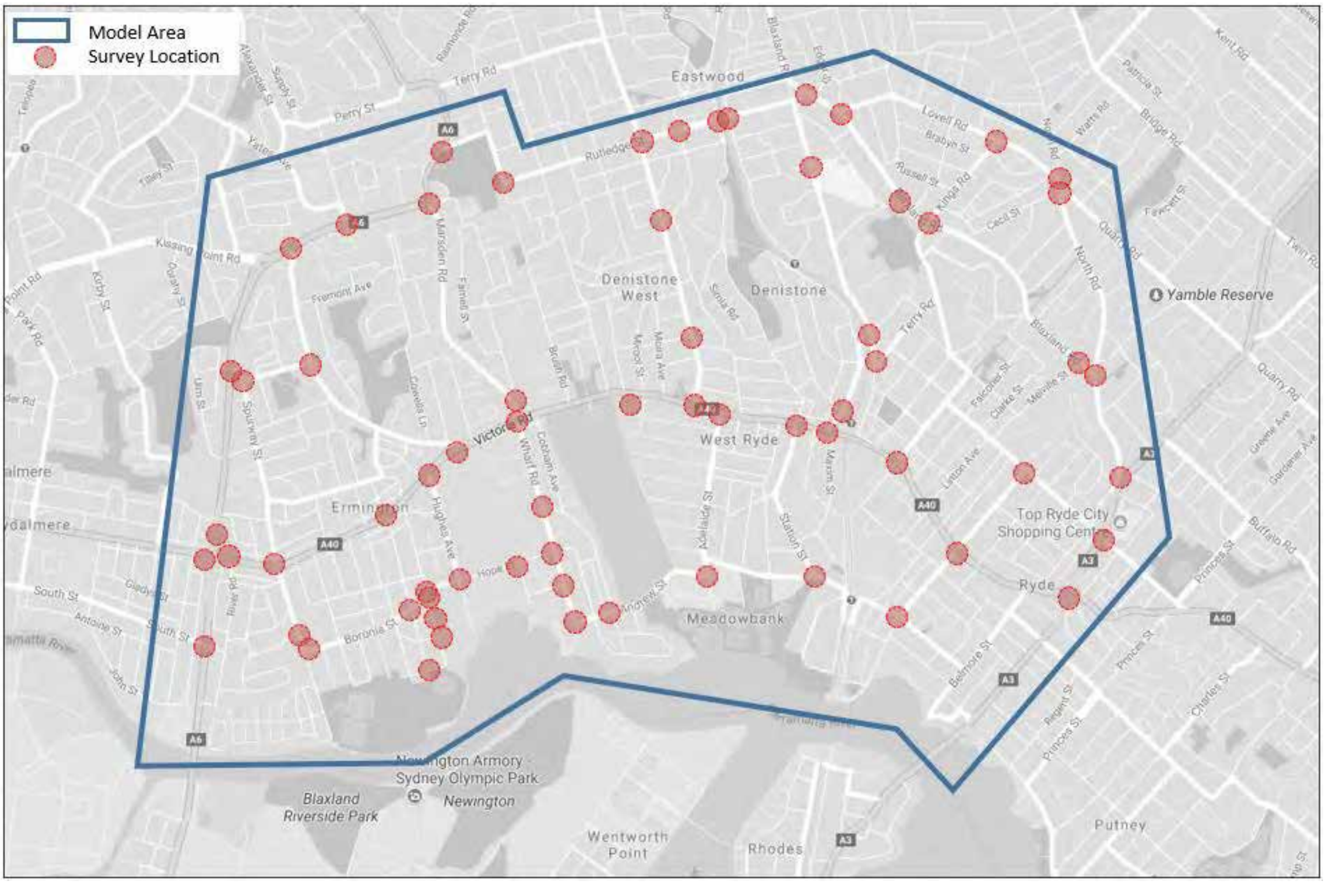
2.5 Model data

Traffic data used in the development of the model was collected from various sources. This section details the collection and analysis of this data.

2.5.1 Turning movement counts

Classified turning movement surveys for 64 intersections were collected at 15 minute intervals during the morning and evening peak and do not identify rigid and articulated heavy vehicles separately. A summary of intersection turning movement counts within the study model area is shown in Figure 2.2. The intersection movements were collected on 1 August 2017.

Figure 2.2 : Intersection survey locations



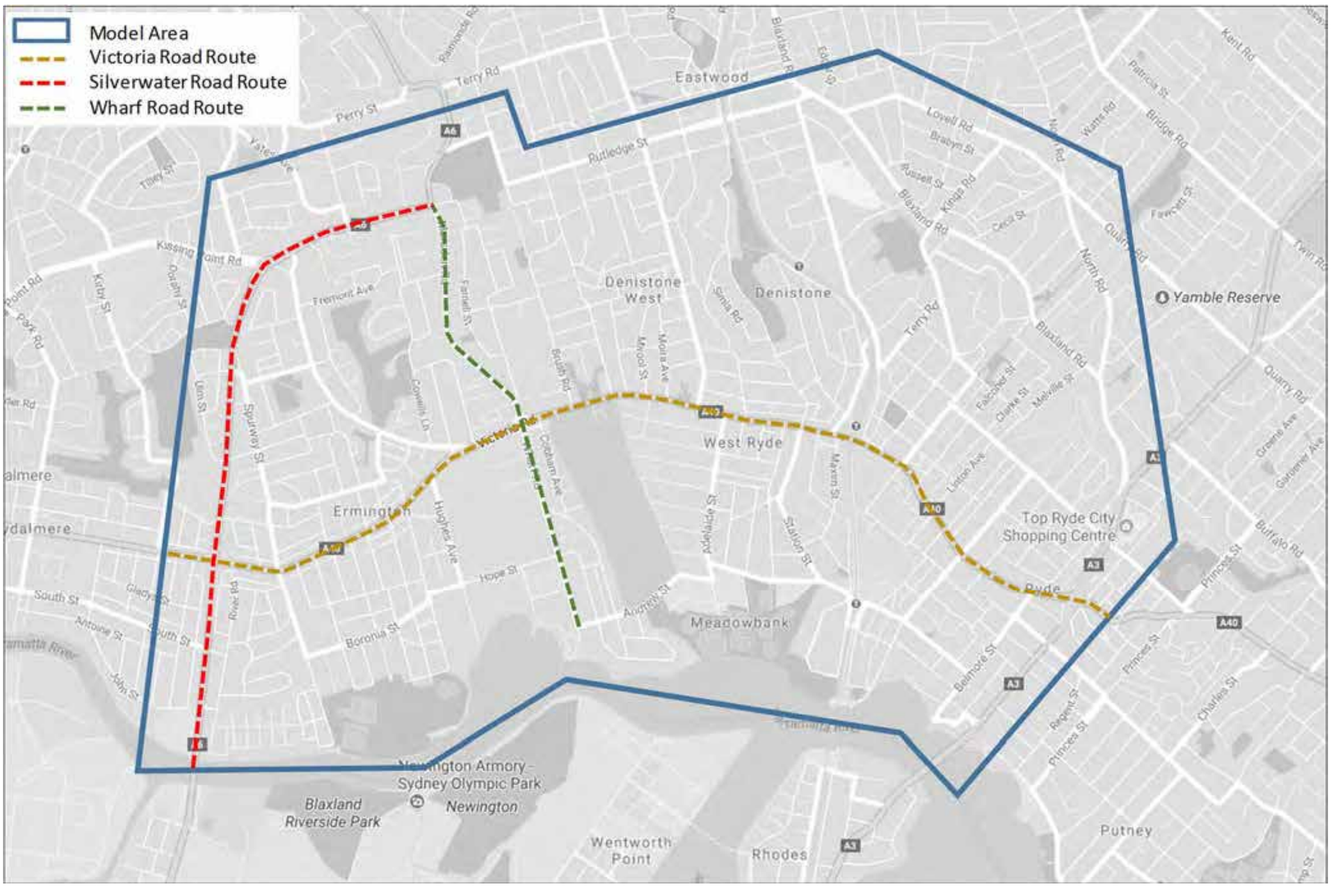
2.5.2 General traffic travel time data

General traffic travel time data was collected in August 2017 for three key routes in the study area using floating car travel time surveys:

- Victoria Road (between Silverwater Road and Devlin Street)
- Marsden Road (between Andrew Street and Silverwater Road)
- Silverwater Road (between Silverwater Bridge and Marsden Road)

These routes are shown in Figure 2.3.

Figure 2.3 : Travel time survey routes



2.6 Development of Real Data Sets

Real Data Sets (RDS) of target volumes were prepared for two purposes:

1) Target volumes against which model calibration is measured
2) Target volumes to guide the matrix adjustment processes

The RDS covers the full four hours of the morning and evening peak model periods. The RDS contains a total of 432 count movements for each hour.

2.6.1 Consistency checks and balancing

To provide a sound basis for calibration and demand adjustment, especially in view of the range of types and dates covered by the surveys, the counts have been checked and adjusted for consistency. This also provides an additional check that the counts have been processed and imported into the model correctly.

For each time interval, the counts have been propagated through the network to identify section volumes based on both upstream and downstream sources, and the turn or midblock counts which contribute to each.

Where a discrepancy is found between the propagated upstream and downstream sources, the contributing counts are adjusted accordingly.

Discrepancies have been adjusted for in cases where the GEH is greater than 2.0 or 50 vehicles per hour (whichever is larger) between adjacent intersections. As quoted in the *Roads and Maritime Traffic Modelling Guidelines version 1.0*, Transport for London (TfL) suggests that the accuracy of observed counts must be within +/- 50 pcu/hr or within a GEH of two. Adopting this method ensures that the larger counts remain within this range while providing good consistency between the lower volume counts.

2.7 Road network coding

2.7.1 Initial network coding

Coding of the road network was undertaken on the basis of updating Transport for NSW's latest Sydney GMA Aimsun network. In-filling of detail within the study area was undertaken on the basis of site observations, aerial photography and Google Streetview.

Additional time-dependent traffic management policies were coded in the network to reflect features such as school speed zones.

In locations where parking in a traffic lane is allowed across both peak periods, and aerial photographs indicate demand for this parking, the affected lane is not included as a trafficable lane in the model.

2.8 Public transport network coding

Coding of the public transport network was undertaken based on bus stop, bus route and bus timetable data from the Transport for NSW Operational Spatial Database (OSD). This database provides the location of bus stops, bus routes and stopping patterns as well as timetabled arrival times at each stop along each route.

A subset of the OSD was extracted that detailed the stops and routes for all public and school buses passing through the study area during the morning and evening peak periods. These bus stops were imported and bus routes created based on linking stops according to the shortest path between stops. Review and correction of imported routes was also undertaken to ensure that stops were imported in the correct locations and that routes operated along the correct paths.

2.9 Traffic signal settings

The traffic signal times have been derived from SCATS History file data which records the times for individual phases across the peak period. These phase times have been aggregated and imported into the models and manually adjusted to reflect a realistic representation of phase and cycle timings.

A limitation of the SCATS History files is that they do not record gap-out behaviour for diamond overlap phases. This behaviour occurs when there is an imbalance in right turns during a diamond phase, causing SCATS to call a short alternative phase to allow a leading right turn and through movement to run before the main through movement phase. The model flows and operation were observed and where it was determined that this gap-out feature was required to meet observed flows, a leading right turn phase was coded taking time from the recorded diamond phase.

Midblock pedestrian crossing in the study area also showed some variability in operation, with many being called inconsistently during the peak periods. A conservative assumption was made to model these pedestrian crossings as being called every cycle for the purposes of simplicity.

2.10 Behavioural settings

The following behavioural settings were used in the development of the model:

- Look-ahead distance variability: 40%
- Simulation step: 0.8 seconds
- Mesoscopic reaction time (all vehicles): 1.2 seconds
- Mesoscopic reaction time at traffic lights (all vehicles): 1.6 seconds
- Microscopic reaction time (all vehicles): 0.8 seconds
- Microscopic reaction time at traffic lights (all vehicles): 1.1 seconds
- Global arrivals: exponential distribution

The global jam density was set to 180 veh/km, which is the value used in the Sydney Aimsun model and suggested by the developers of Aimsun (TSS). Jam density is measured as number vehicles allowed per kilometre of road. Vehicles under mesoscopic simulation are modelled with instantaneous acceleration and deceleration; to better account for the impact of this behaviour in mesoscopic simulation, the jam density of road sections has been adjusted to more accurately represent delays in areas where driver merge and diverge behaviour is critical to the network, for example Victoria Road before Hermitage Road. The global jam density parameter has been retained for the majority of sections within the network, with the following exceptions:

  - Sections of Victoria Road westbound between Mellor Street and West Parade, where jam density is less than 180 veh/km due to a ‘lane-drop’ from 3 to 2 and a narrowing of the road corridor as vehicles travel under the rail bridge.
  - Sections of Victoria Road westbound on approach to Wharf Road/Marsden Road due to observed lane changing/weaving associated with the ending of the bus lane and vehicles preparing to turn right at Kissing Point Road.
  - The southernmost section of Church Street where downstream constraints on Concord Road outside of the model area reduce the southbound capacity of the section.

These changes to jam density closer replication of the observed capacity reductions through these parts of the road network.

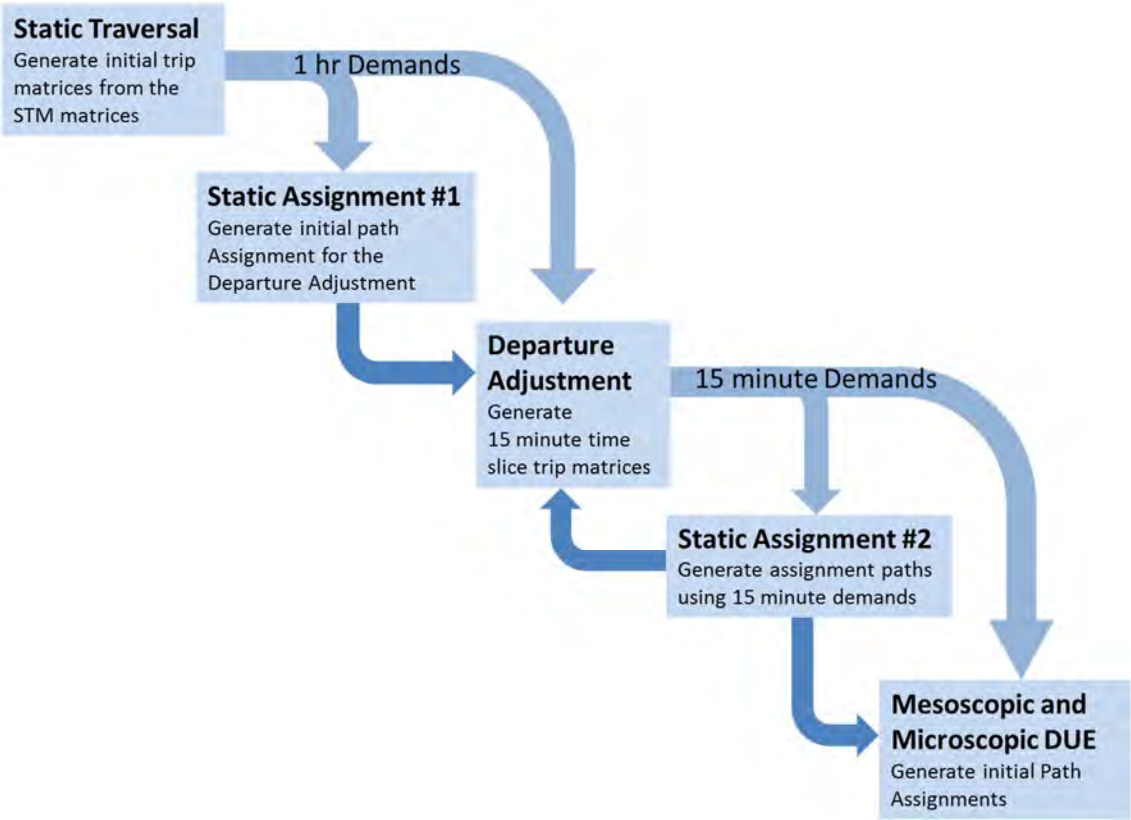
2.11 Traffic assignment and trip demand development

Aimsun allows for a combination of assignment types in combination with different vehicle simulation methods. The Melrose Park model has been developed using the following combinations of assignment and simulation techniques:

1) Static equilibrium assignment using static traffic model
2) Dynamic User Equilibrium (DUE) assignment using mesoscopic simulator
3) Dynamic User Equilibrium (DUE) assignment using hybrid mesoscopic/microscopic simulator

The process for assignment and trip demand is summarised in Figure 2.4.

Figure 2.4 : Assignment and trip demand process



The traffic demands were imported from the STM into Aimsun where it was assigned to the Greater Sydney Aimsun model using static assignment. A static traversal was undertaken to obtain the subarea trip matrices for the study area which were then disaggregated to a finer-grained centroid configuration to allow for modelling of the detailed road network.

The subarea matrices were then assigned to the study area road network as part of the first pass of the static assignment. The assignment results were reviewed to make sure that path assignment through the network was reasonable. The assignment paths were then used to undertake the departure adjustment.

The result of the departure adjustment was then reassigned using the static assignment. This was used to calibrate the initial flat traffic demand across the entire network and provide a starting point for mesoscopic simulation. Mesoscopic Dynamic User Equilibrium (DUE) was then used to fine-tune demand and generate the capacity constrained assignment for input to more detailed hybrid DUE simulation which contains the microsimulation area.

The following settings were used in the final DUE assignment parameters:

- Assignment cycle: 15 minutes
- Number of intervals: 1
- Maximum iterations: 30
- Stopping relative gap: 2%
- Attractiveness weight: 1.0
- User defined cost weight: 1.0
- Maximum paths from path assignment: 3 (the maximum number of assignment paths between any origin and destination pair taken from the static assignment input)
- Maximum paths per interval: 4 (the maximum number of assignment paths used by the DUE between any origin and destination pair)
- Assignment model: Gradient-based
- Path cost: Experienced

3. Demand matrix development

3.1 Traffic demand estimation methodology

Traffic demand estimation was undertaken using the Departure Adjustment method available in Aimsun. The following stages were used in the development of base traffic demand:

- Assignment of the Sydney GMA model and generation of morning and evening peak hour sub-area traversal matrices using static assignment
- Expansion of the single hour traversal matrices in the strategic model zone system to four hour total matrices in the higher-resolution Melrose Park zone system

Manual adjustment of 15-minute matrices to account for differences in static and dynamic assignment

Each of these stages is described in further detail below.

3.1.1 Static demand adjustment

The four-hour flat traffic demand for the sub-area traversal was adjusted to meet observed traffic flows throughout the network according to the hourly counts for each period using static departure adjustment. The departure adjustment procedure is an iterative matrix adjustment procedure that uses the paths and modelled travel time results from a static assignment to adjust the demand matrix and distribute trips in time so that their arrival profiles match observed flow profiles at count locations across the network. The demand adjustment was undertaken on the basis of turning movement counts outlined in Section 2.5.1.

3.1.2 Departure adjustment and slicing

The aim of this process is to adjust and time-slice an origin-destination matrix that considers static assignment travel times to allocate trips to the correct departure matrix in order to reach the desired location at the observed time under dynamic simulations. This resolves the time shift of long trips by considering static travel times in the adjustment. It should be emphasised that this process uses static modelled travel time, and hence dynamic factors such as congestion at signalised intersections are not considered.

The following are the parameters used in this project:

- Interval duration: 900 seconds (15 minutes)
- Matrix weight: 1

The interval duration is the general time duration used for the slicing calculation. The matrix weight provides a limit on the degree to which the original demand matrices can be adjusted, with 1 corresponding to no allowed change and 0 corresponding to complete liberty to change the original matrices.

The 15-minute traffic demands were then manually adjusted as needed for the finer tuning of the calibration in the mesoscopic model to match observed turn flows.

4. Model calibration

4.1 Overview

The calibration of the *Melrose Park Hybrid Model* has been undertaken with a view to meeting the targets for calibration provided in the *Roads and Maritime Traffic Modelling Guideline (2013)*. The calibration has been undertaken based on hourly turning movement counts over the four-hour AM and PM peak periods.

4.2 Calibration targets

The GEH statistic is used in the calibration of traffic models to compare the differences between modelled and observed traffic flows. The GEH statistic is defined as follows:

$$GEH = \sqrt{\frac{(V_{observed} - V_{modelled})^2}{(0.5 \times (V_{observed} + V_{modelled}))}}$$

Based on the calibration and validation guidelines presented in the *Roads and Maritime Traffic Modelling Guidelines, 2013* and the *Melrose Park Model Scoping Report* (23 October 2017) prepared by Jacobs, the following criteria has been adopted:

Whole model

- At least 80% of flow comparisons with GEH less than 5
- At least 95% of flow comparisons with GEH less than 10

Core/microsimulation area

- At least 85% of flow comparisons with GEH less than 5
- 100% of flow comparisons with GEH less than 10

In addition to GEH comparisons, regression analysis of observed versus modelled flows was also undertaken. The following criteria for regression analysis were adopted:

- R^2 greater than 0.95
- Slope between 0.95 and 1.05

The R^2 generally represents the closeness of fit of the observed data points to modelled data points and the slope of the trend line gives an indication of whether the model is general over-assigning (greater than 1) or under-assigning (less than 1) traffic across the network. A total of 432 individual turns were included in this analysis for each one-hour time period.

4.3 Model convergence

The *Melrose Park Hybrid Model* has been developed using dynamic user equilibrium (DUE) assignment. As the dynamic user equilibrium assignment is an iterative process, the relative gap between iterations is a measure of how close the assignment to the “optimal” network equilibrium.

Unlike static models, Aimsun’s dynamic user equilibrium measures the relative gap in the path costs for each path assignment cycle period (in this case 15 minutes) in the simulation. As later periods are dependent on the convergence of earlier time periods, later time periods require more iterations to converge. The relative gap reported for the convergence of the model is the mean relative gap for all time periods.

The hybrid DUE assignment was run using initial paths derived from both an initial static equilibrium assignment and a mesoscopic DUE assignment. A summary of the AM and PM peak hybrid DUE convergence for the model is shown in Figure 4.1 and Figure 4.2.

The hybrid DUE convergence shows that the models terminated at a mean relative gap of 2% after 19 and 23 iterations for the AM and PM peaks respectively. This relatively low variation in relative gap over the last 5 iterations gives confidence that the process has identified a stable equilibrium for the particular input parameters.

Figure 4.1: AM peak hybrid DUE convergence

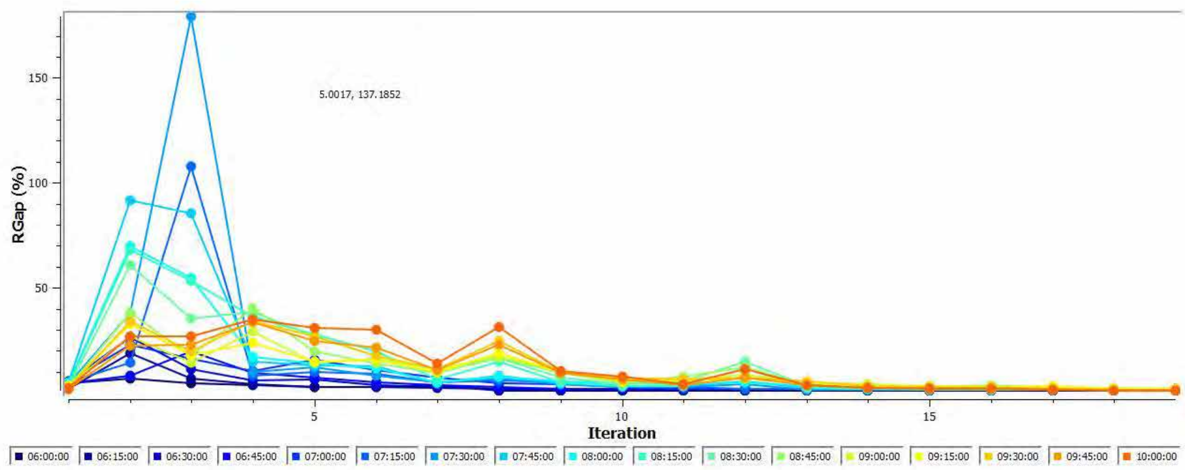
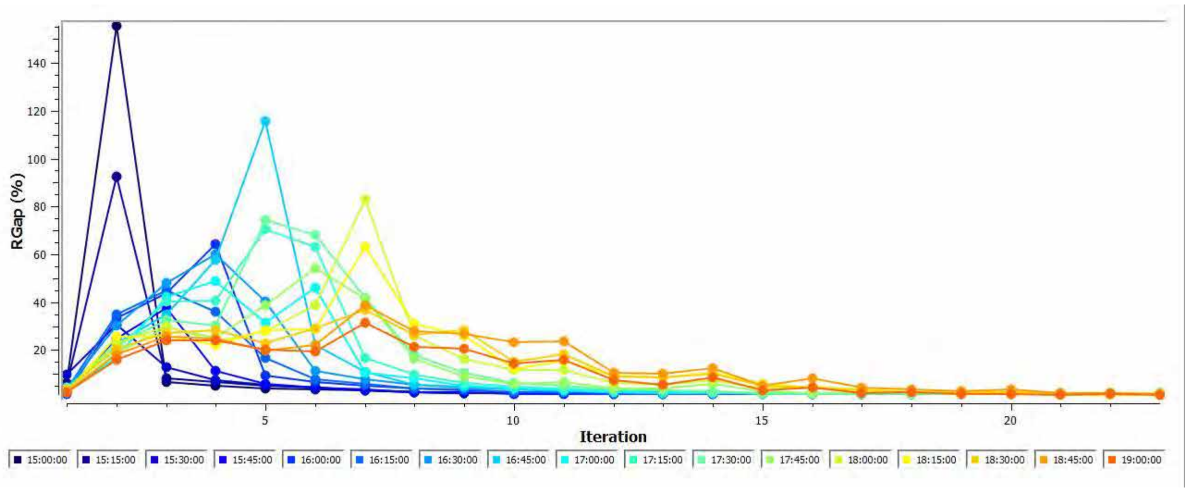


Figure 4.2: PM peak hybrid DUE convergence



4.4 Calibration results

4.4.1 Total traffic volume calibration statistics

A summary of the target count comparison statistics for the DUE assignment is provided in the following section.

Regression analysis

The following section summarises the regression analysis. Figure 4.3 and Figure 4.4 plot the observed traffic flows to the modelled traffic flows, while Table 4.1 provides a summary of the regression analysis statistics for the morning and evening peak by hour.

Figure 4.3: Morning peak modelled vs observed flows 6 – 10am

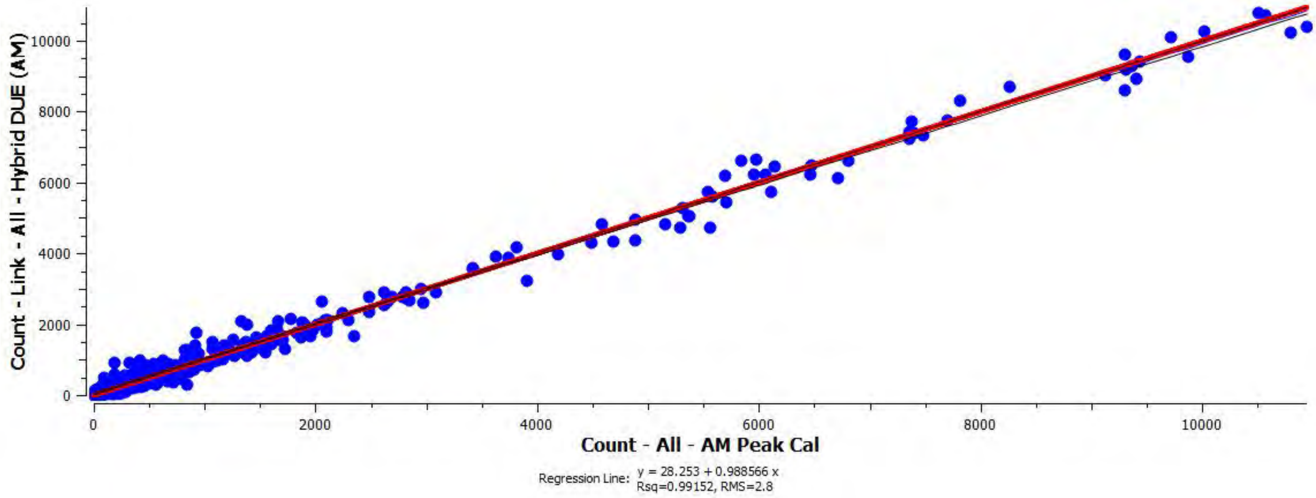


Figure 4.4: Evening peak modelled vs observed flows 3 – 7pm

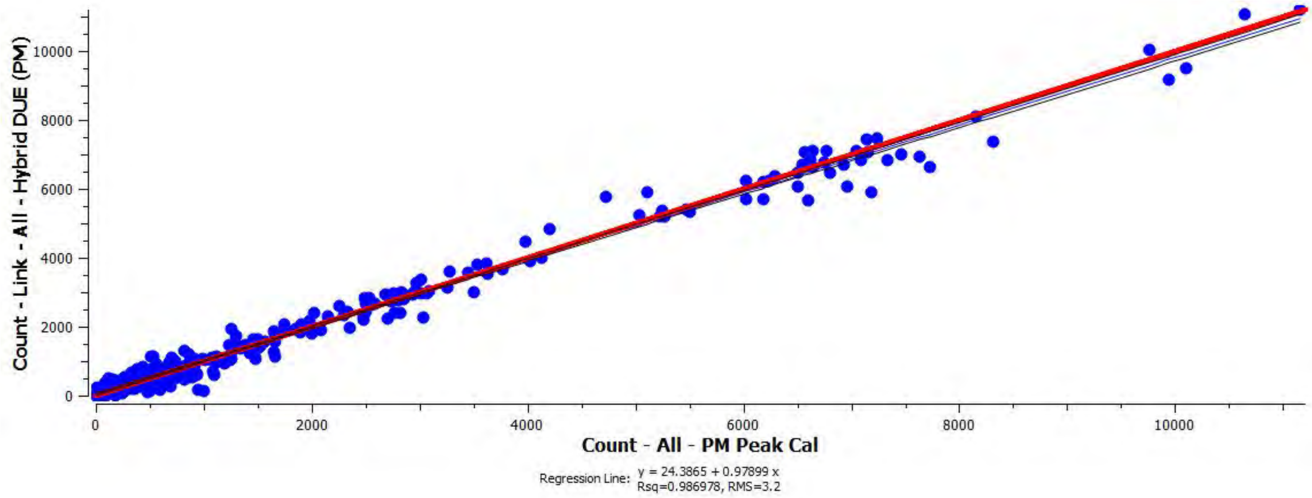


Table 4.1: Summary of model calibration – Regression analysis

Time period	R^2	Slope
6:00 AM to 7:00 AM	0.988	0.974
7:00 AM to 8:00 AM	0.990	0.981
8:00 AM to 9:00 AM	0.981	0.975
9:00 AM to 10:00 AM	0.982	1.014
Total morning peak – all hourly volumes	**0.992**	**0.989**
3:00 PM to 4:00 PM	0.973	0.950
4:00 PM to 5:00 PM	0.986	0.986
5:00 PM to 6:00 PM	0.986	0.989
6:00 PM to 7:00 PM	0.977	0.982
Total evening peak – all hourly volumes	**0.987**	**0.979**

Analysis of the regression parameters show that the targets of R^2 greater than 0.95 and slope between 0.95 and 1.05 are met in each hour.

Based on regression analysis, the model adequately meets the calibration criteria and is a good fit to the observed traffic volumes.

GEH statistics

Table 4.2 and Table 4.3 present a summary of the turn comparison between observed and modelled by GEH statistic. The results indicate the model achieves the adopted GEH criteria for the combined 4 hour periods in both the morning and evening peak periods. On an hour by hour basis, the whole model generally achieves the criteria. Some hourly periods achieve less than 80% for the GEH<5 criteria however no period is lower than 78%.

Similarly, for the core area, all periods achieve the required criteria with the exception of the first hour in both the AM and PM periods. This is not anticipated to affect the findings of the model considering the peak traffic flows occur in the middle 2 hours of the modelled period.

Table 4.2: Summary of turning movement comparisons (morning peak)

Measure	Target	Hour starting				
		All hours	6:00am	7:00am	8:00am	9:00am
Whole model						
GEH<5	80%	84%	78%	80%	78%	80%
GEH<10	95%	99%	99%	98%	95%	98%
Core area						
GEH<5	85%	91%	82%	88%	85%	85%
GEH<10	100%	100%	100%	100%	100%	99%

Table 4.3: Summary of turning movement comparisons (evening peak)

Measure	Target	Hour starting				
		All hours	3:00pm	4:00pm	5:00pm	6:00pm
Whole model						
GEH<5	80%	85%	80%	81%	80%	79%
GEH<10	95%	97%	97%	97%	98%	97%
Core area						
GEH<5	85%	91%	83%	85%	89%	85%
GEH<10	100%	100%	100%	100%	100%	100%

Locations where the GEH comparison statistics exceed 10 are summarised in Table 4.4

Table 4.4: Summary of turn locations exceeding GEH 10

	Location	Comment
AM	Right turn from West Parade into Rutledge Street eastbound	This is at the far north-eastern section of the model and is due to the inability of mesoscopic modelling to depict the delays of this priority turn caused by poor road geometry and sight lines. This causes the turn to be too attractive and hence the modelled volume exceeds the observed counts. This turn will not influence the findings of the modelling.
	Left turn from Bartlett Street into Kissing Point Road northbound	This turn is located in the far north-western section of the model. Some local roads in this area are not included in the model so turning movements are more concentrated at the Silverwater Road/Bartlett Street intersection. The discrepancies at this location are required in order for strategically important upstream and downstream flows on Silverwater Road to match observed counts.
	Left turn from Park Street into Devlin Street northbound	This turn is located at the far eastern section of the model. The zonal system and road networking coding in this area is fairly course and so this turn is used by trips which in reality would be accessing Devlin Street via the Top Ryde car-park exit ramp. Turn flows cannot be accurately met without detrimental impacts to calibration at the downstream Devlin Street/Blaxland Street intersection.
PM	Right turn from West Parade into Anthony Road westbound	These turns are out of/ into a local road in the West Ryde shopping village, 2km from the study area. The zonal system and road networking coding in this area is fairly course and turn flows cannot be accurately met without detrimental impacts to calibration at the nearby Victoria Road intersection.
	Left turn from Anthony Road into West Parade northbound	
	Right turn from Kings Road into Blaxland Road westbound	This turn is located in the far north-eastern section of the model. The zonal system and road networking coding in this area is fairly course and turn flows cannot be met without unrealistic fixed route choice constraints.

4.5 Calibration summary

Based on the model results, the model is considered to be satisfactorily calibrated for the purpose of the Melrose Park TMAP assessment.

5. Model validation

5.1 Overview

Validation of the *Melrose Park Hybrid Model* has been undertaken on the basis of general traffic travel times for routes identified in Sections 2.5.2. As recommended by the *Roads and Maritime Traffic Modelling Guide (2013)*, the target for validation of each route in each hour is for the modelled average travel time for the route to be within 15% or one minute of observed (whichever is larger).

5.2 Validation statistics

5.2.1 General traffic travel time validation results

The travel time validation for general traffic during the morning and evening peak periods are presented in Figure 5.1 to 5.24.

The majority of the travel time observations fall within the 15% upper and lower limits. Some of the modelled times sit outside of the 15% limits, but are still within one minute of the observed travel time.

The delays and travel times at the key areas of project influence along Victoria Road closely match the observed data. The main location where modelled travel times diverge from observed data is on Victoria Road, east of the study area and outside the key areas of influence of the Melrose Park development. At these locations some time periods in the model demonstrate travel times lower than observed data. This is generally due to delays from lane-changing, weaving and merging which cannot be fully captured by mesoscopic modelling. It is also noted that the observed data is highly variable at these locations, with significant differences between the upper and lower 95% confidence intervals.

In summary, these differences between modelled and observed travel times are expected based on the model assumptions and limitations, particularly in the mesoscopic model areas, and do not substantially affect the suitability of the model for assessing impacts of large scale land use changes.

Figure 5.1 : Travel time validation - Victoria Road eastbound 7am-8am

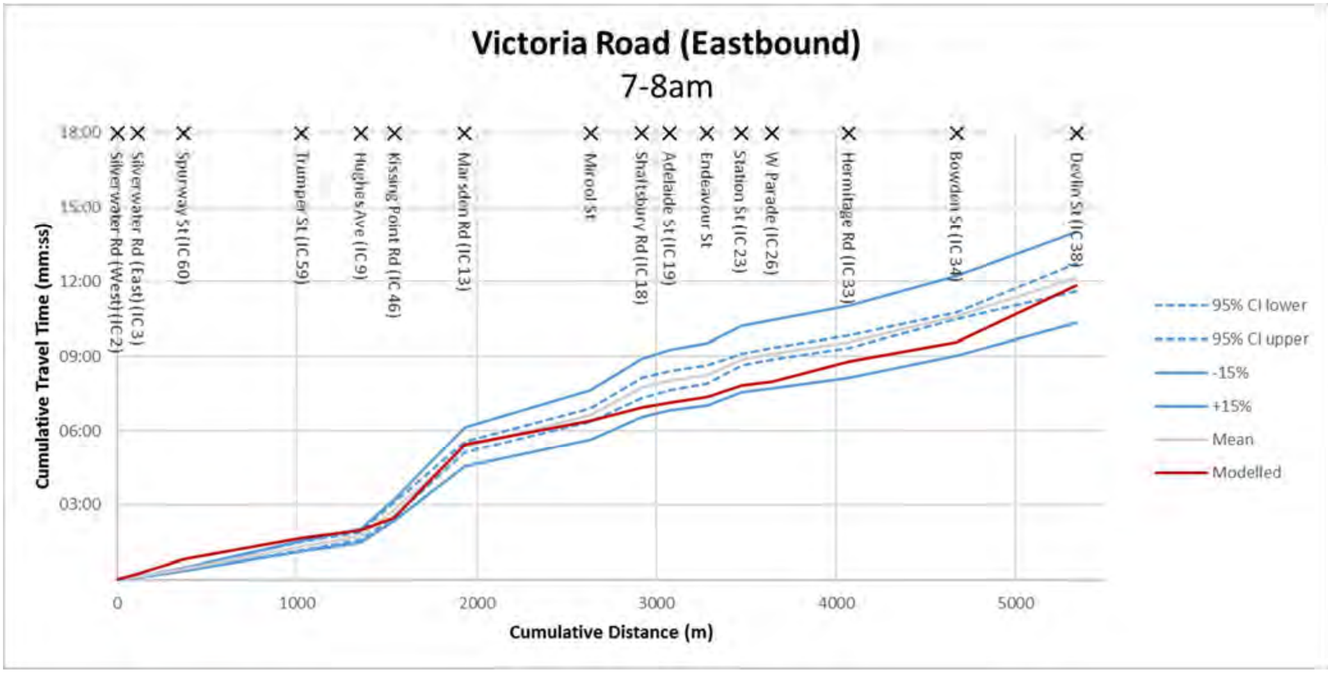


Figure 5.2 : Travel time validation - Victoria Road eastbound 8am-9am

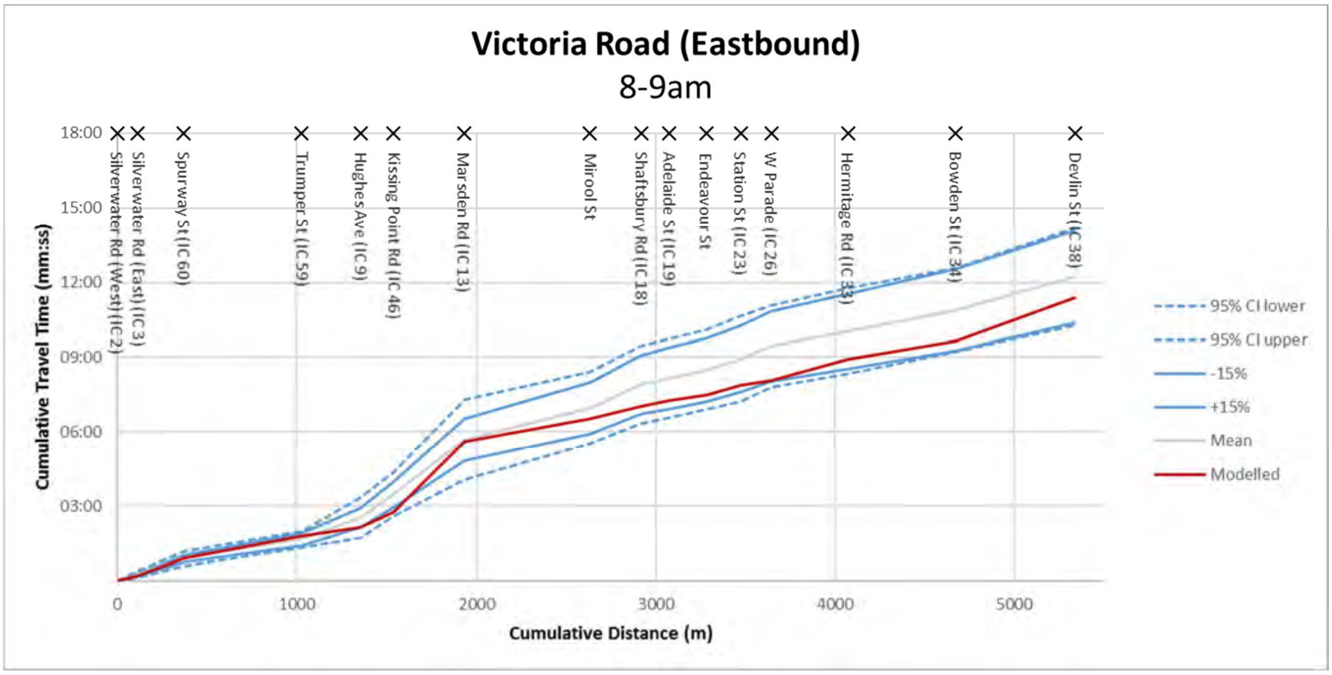


Figure 5.3 : Travel time validation - Victoria Road westbound 7am-8am

Figure 5.4 : Travel time validation - Victoria Road westbound 8am-9am

Figure 5.5 : Travel time validation - Victoria Road eastbound 4-5pm

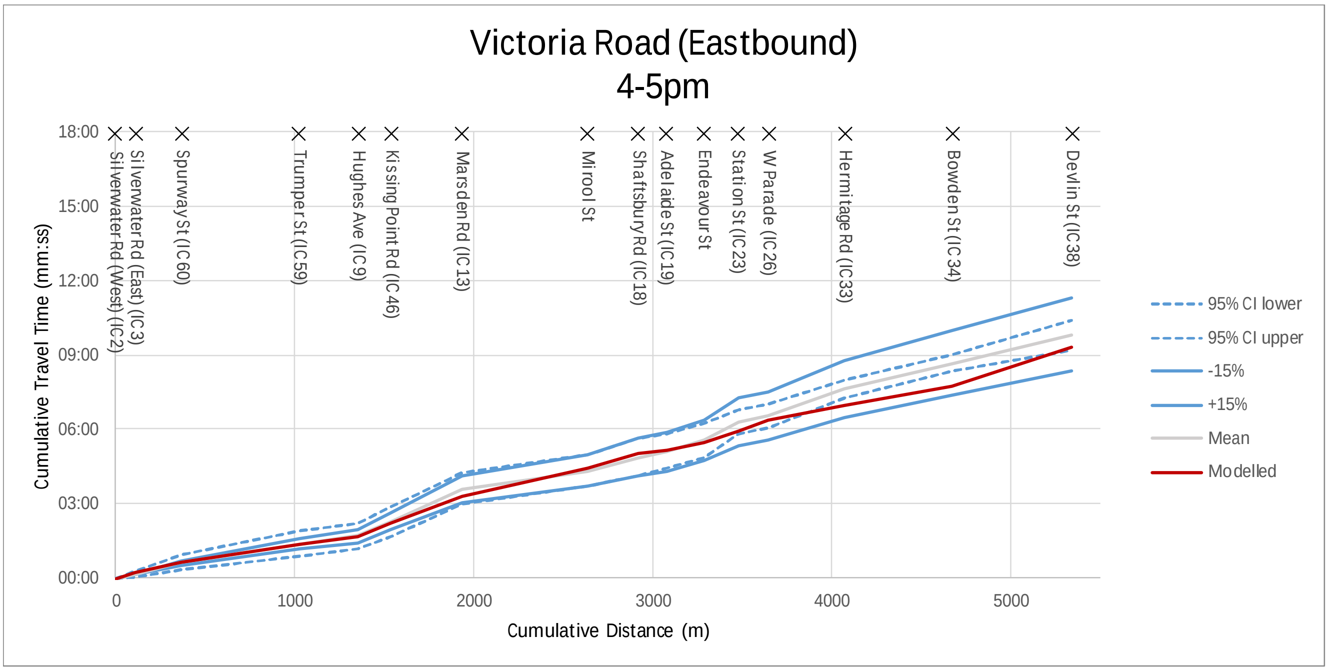


Figure 5.6 : Travel time validation - Victoria Road eastbound 5-6pm

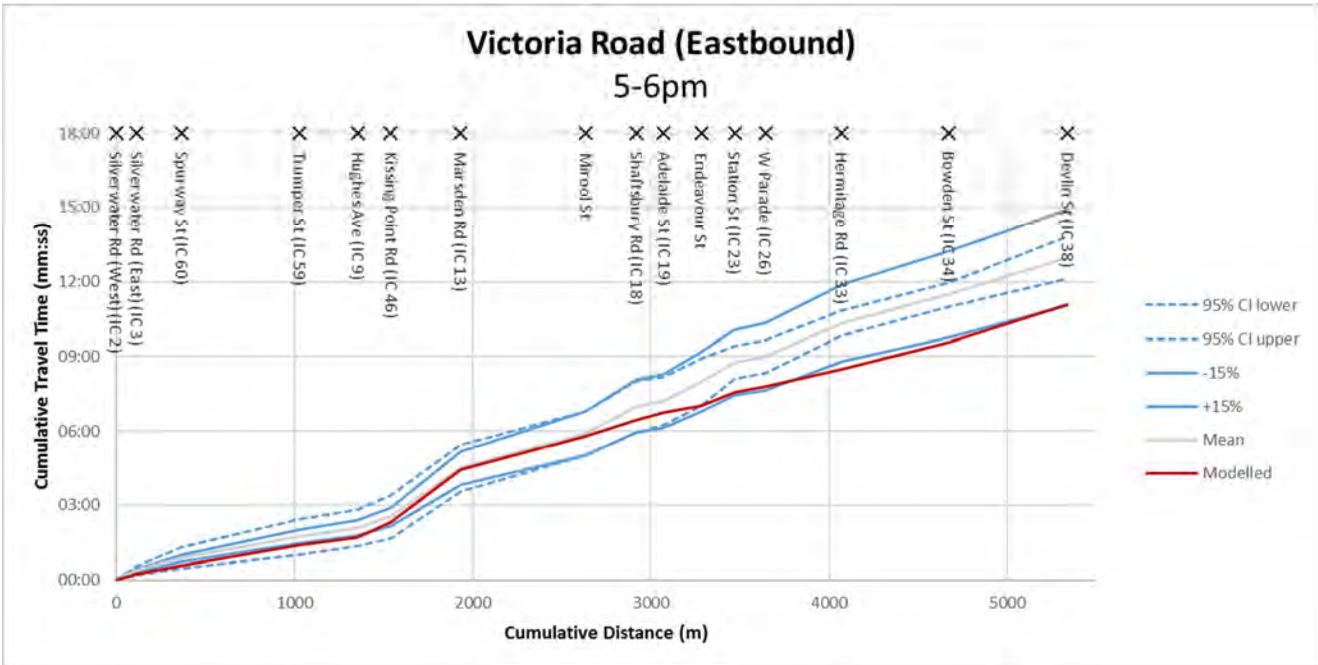


Figure 5.7 : Travel time validation - Victoria Road westbound 4-5pm

Figure 5.8 : Travel time validation - Victoria Road westbound 5-6pm

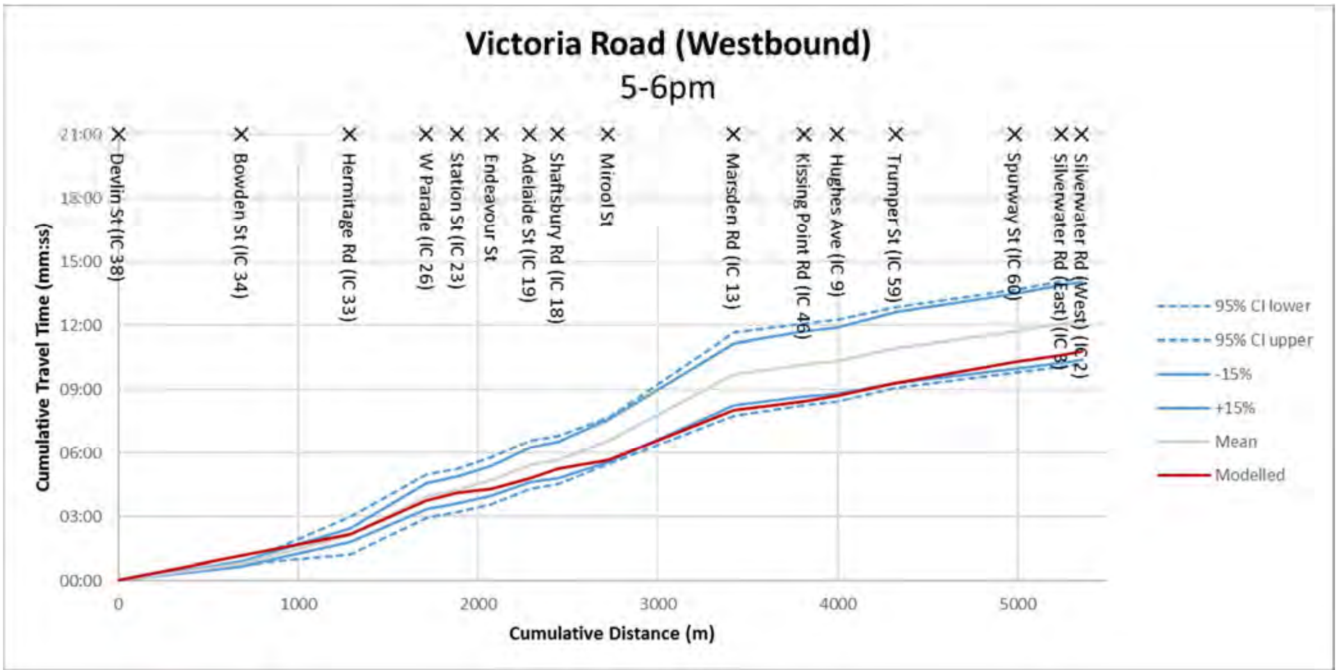


Figure 5.9 : Travel time validation - Silverwater Road northbound 7-8am

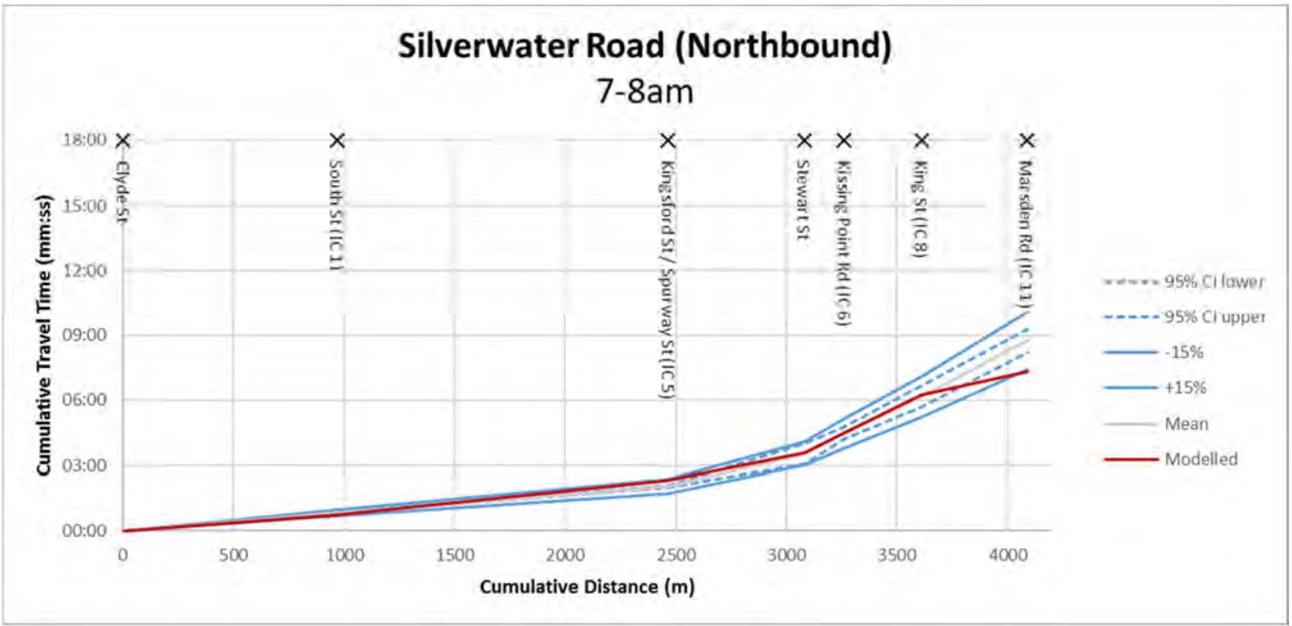


Figure 5.10 : Travel time validation - Silverwater Road northbound 8-9am

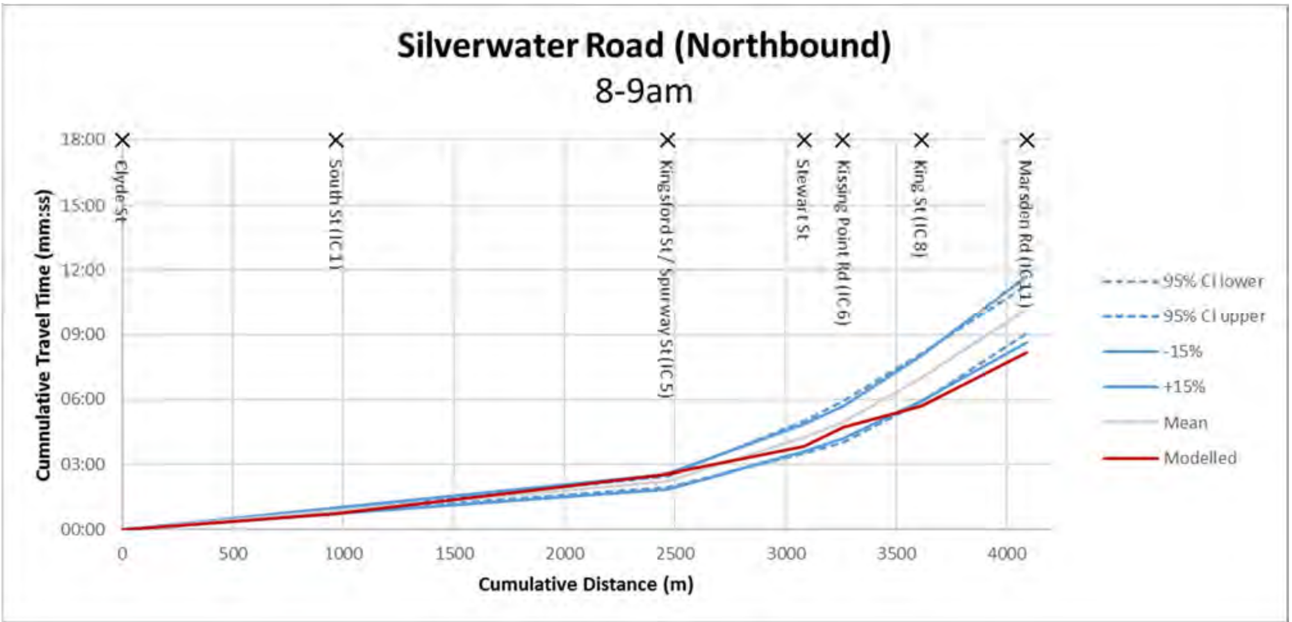


Figure 5.11 : Travel time validation - Silverwater Road southbound 7-8am

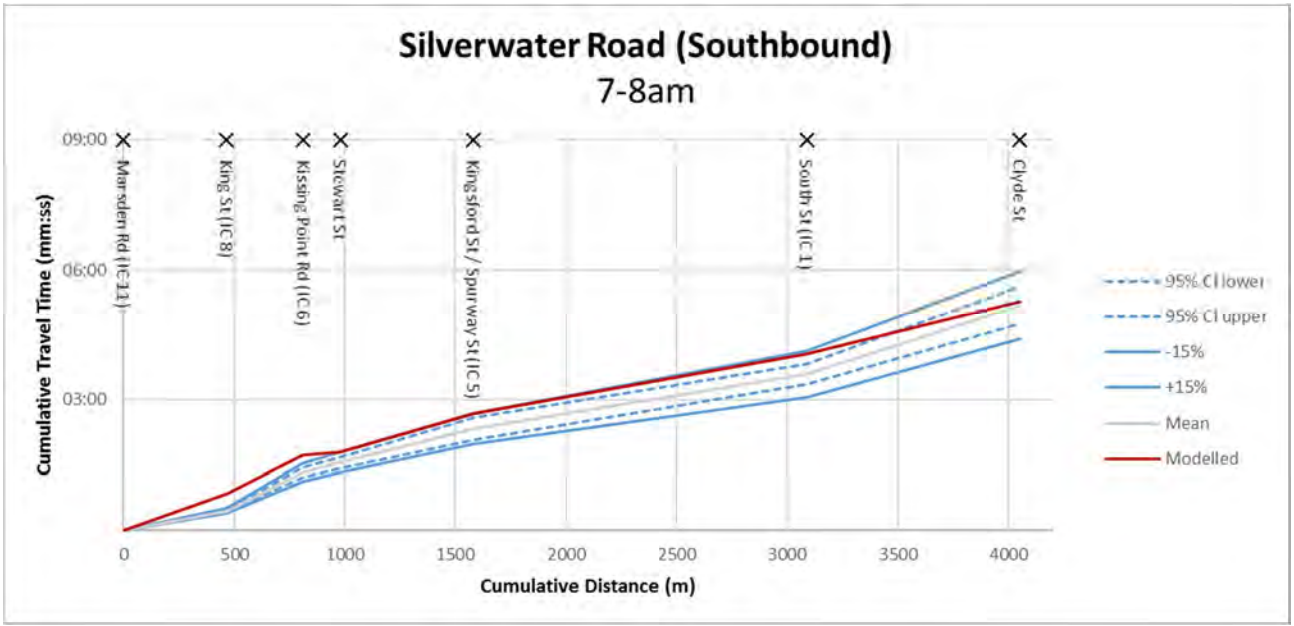


Figure 5.12 : Travel time validation - Silverwater Road southbound 8-9am

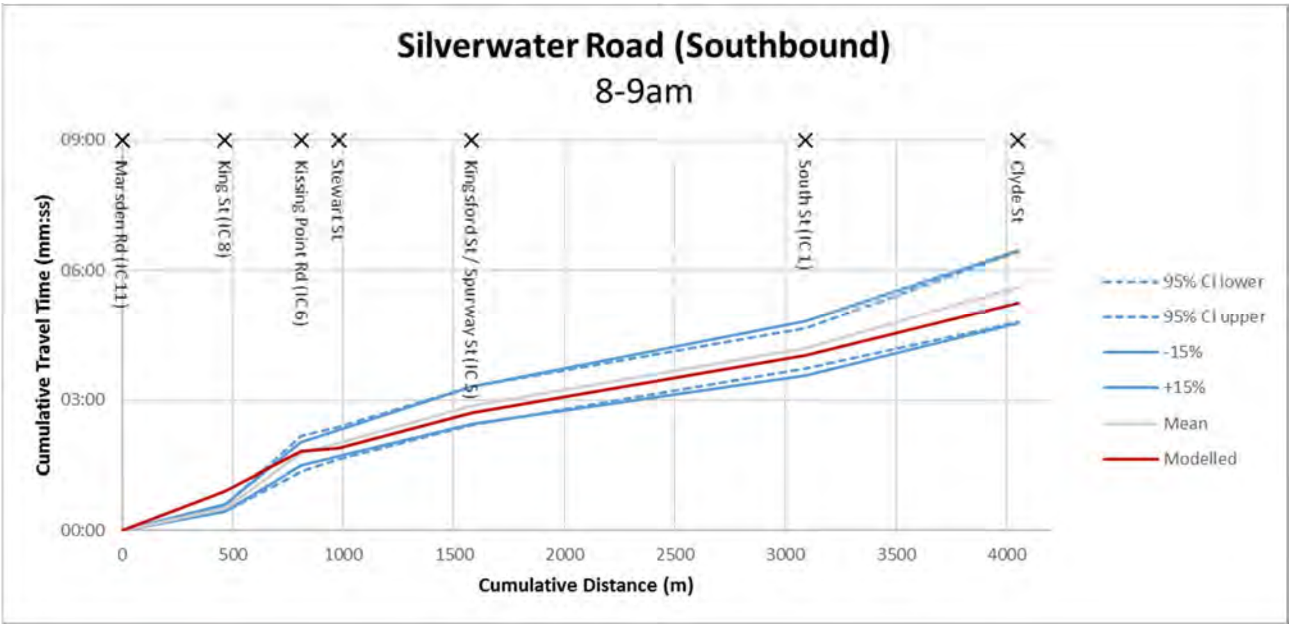


Figure 5.13 : Travel time validation - Silverwater Road northbound 4-5pm

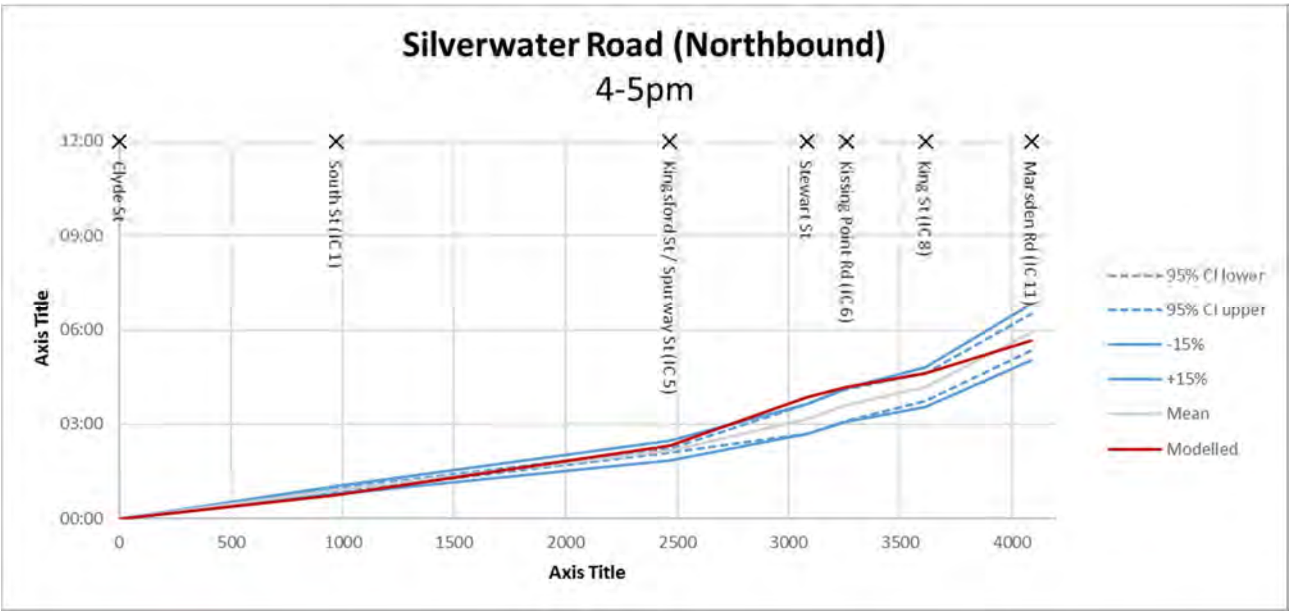


Figure 5.14 : Travel time validation - Silverwater Road northbound 5-6pm

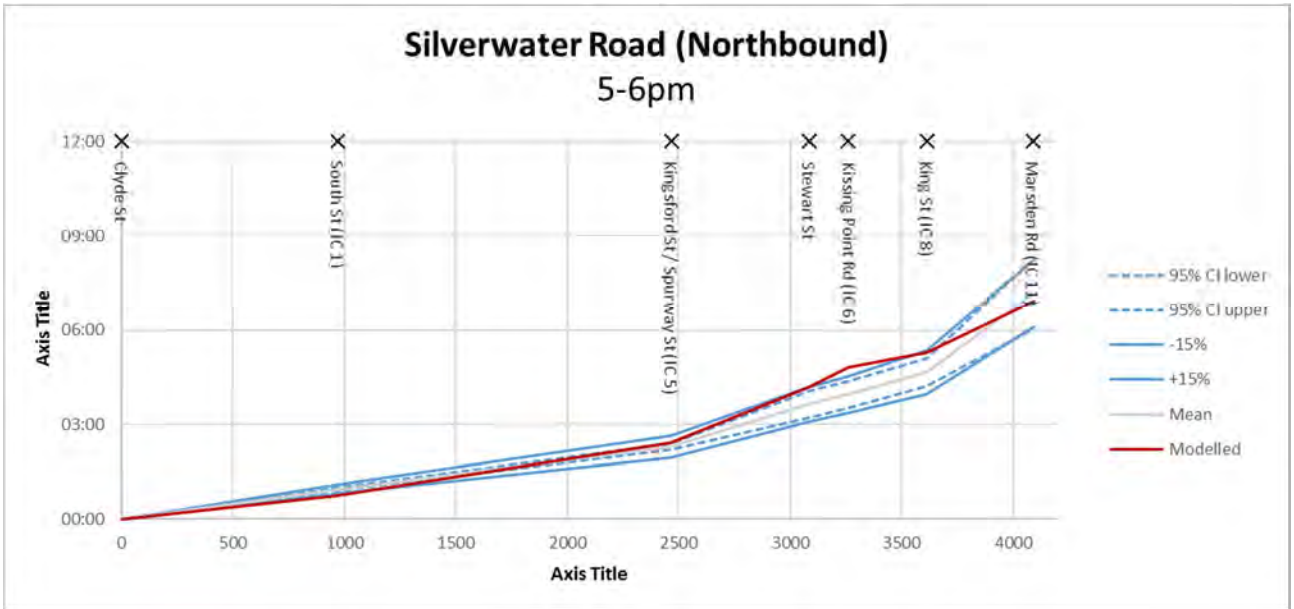


Figure 5.15 : Travel time validation - Silverwater Road southbound 4-5pm

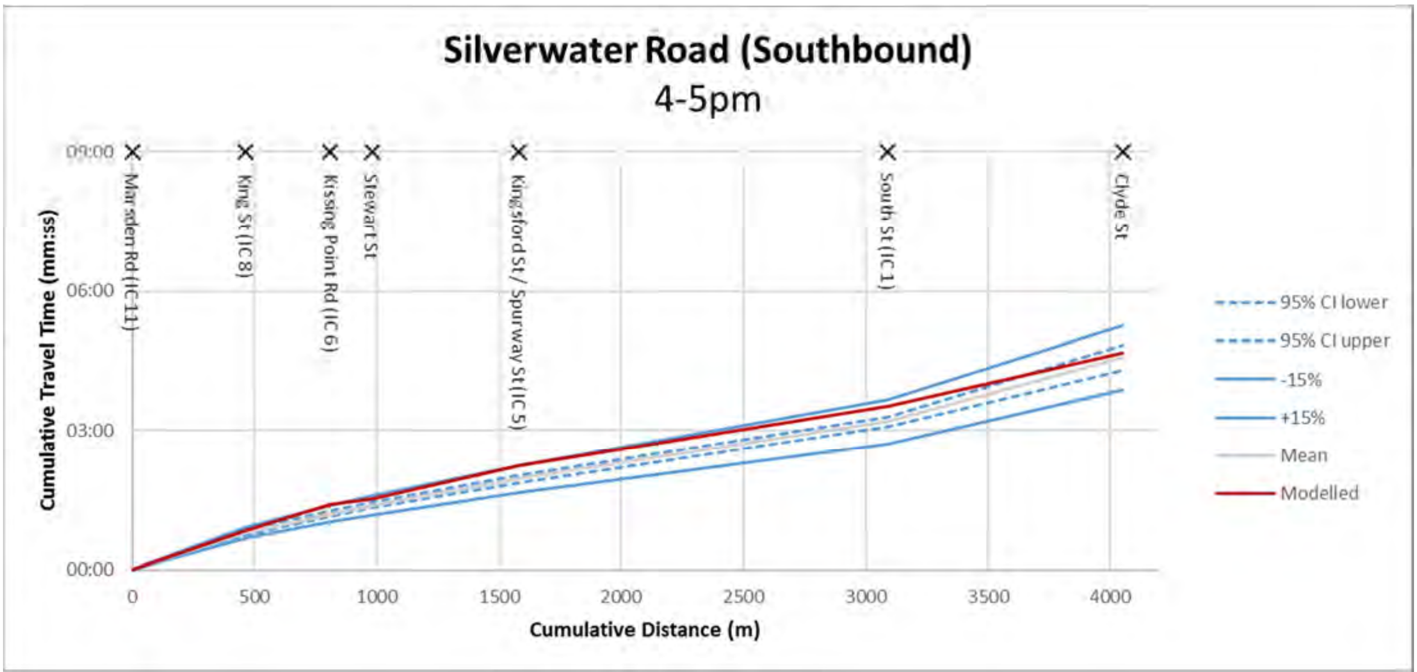


Figure 5.16 : Travel time validation - Silverwater Road southbound 5-6pm

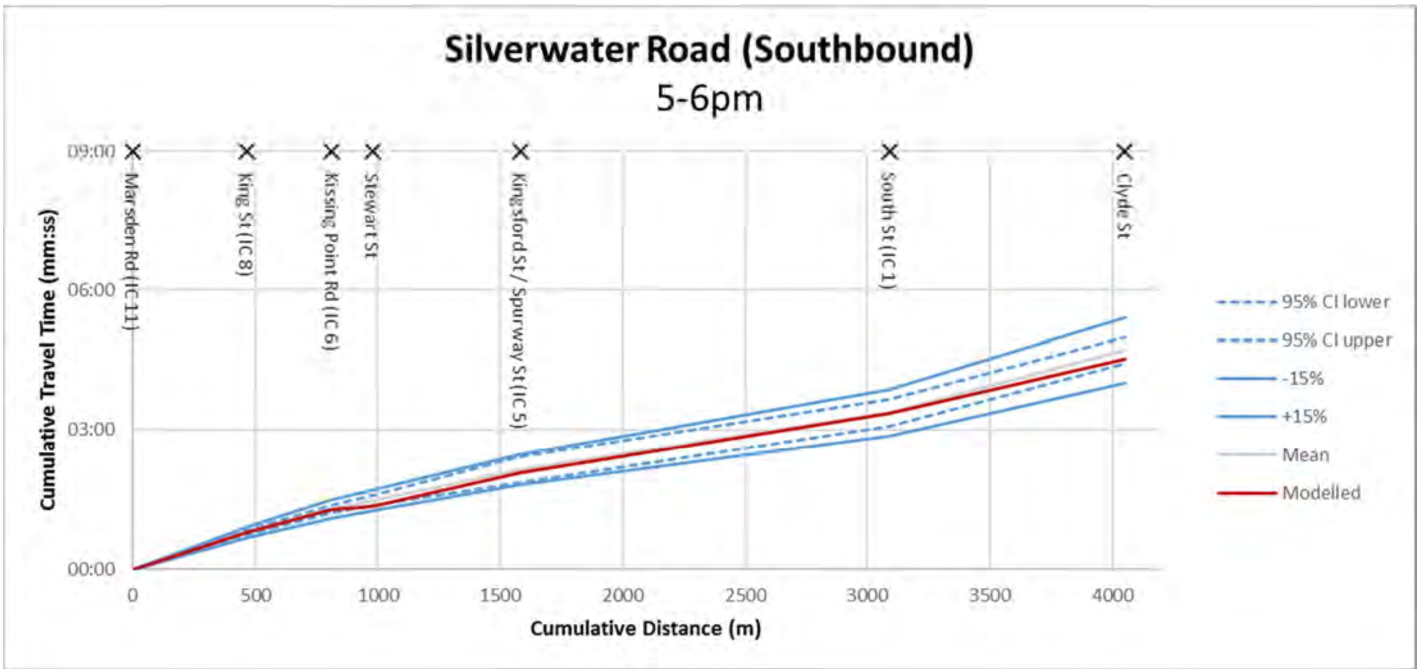


Figure 5.17 : Travel time validation - Wharf Road northbound 7-8am

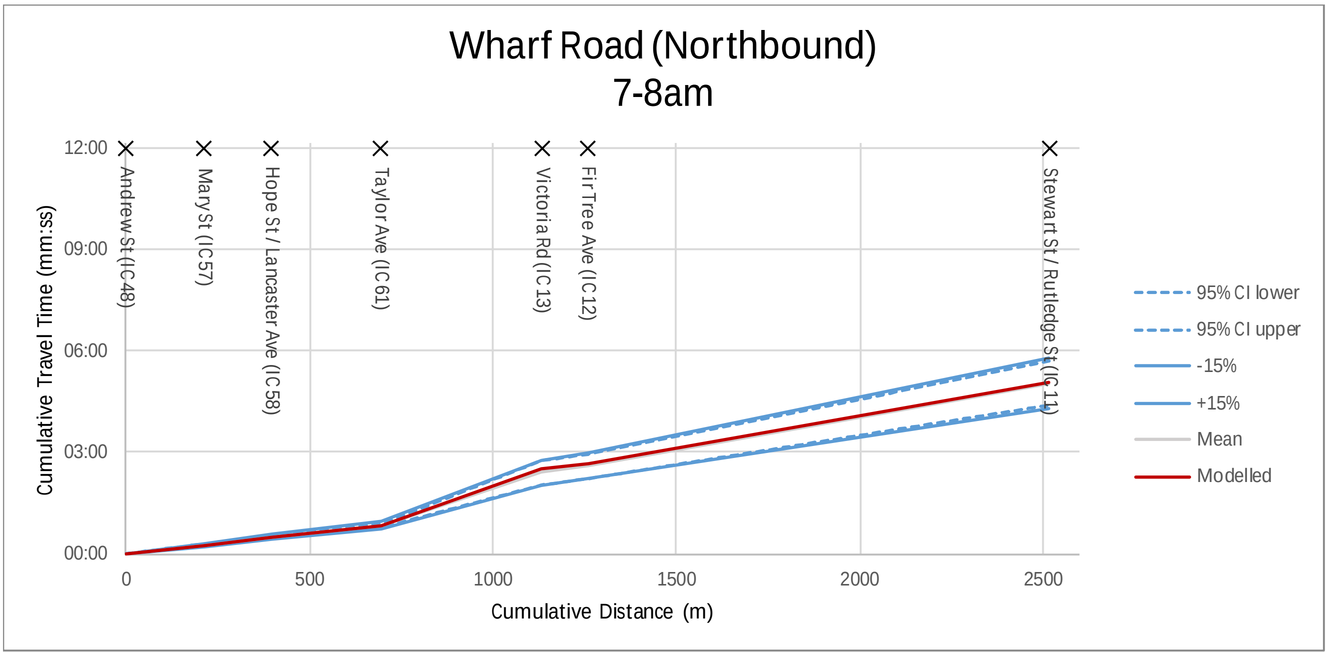


Figure 5.18 : Travel time validation - Wharf Road northbound 8-9am

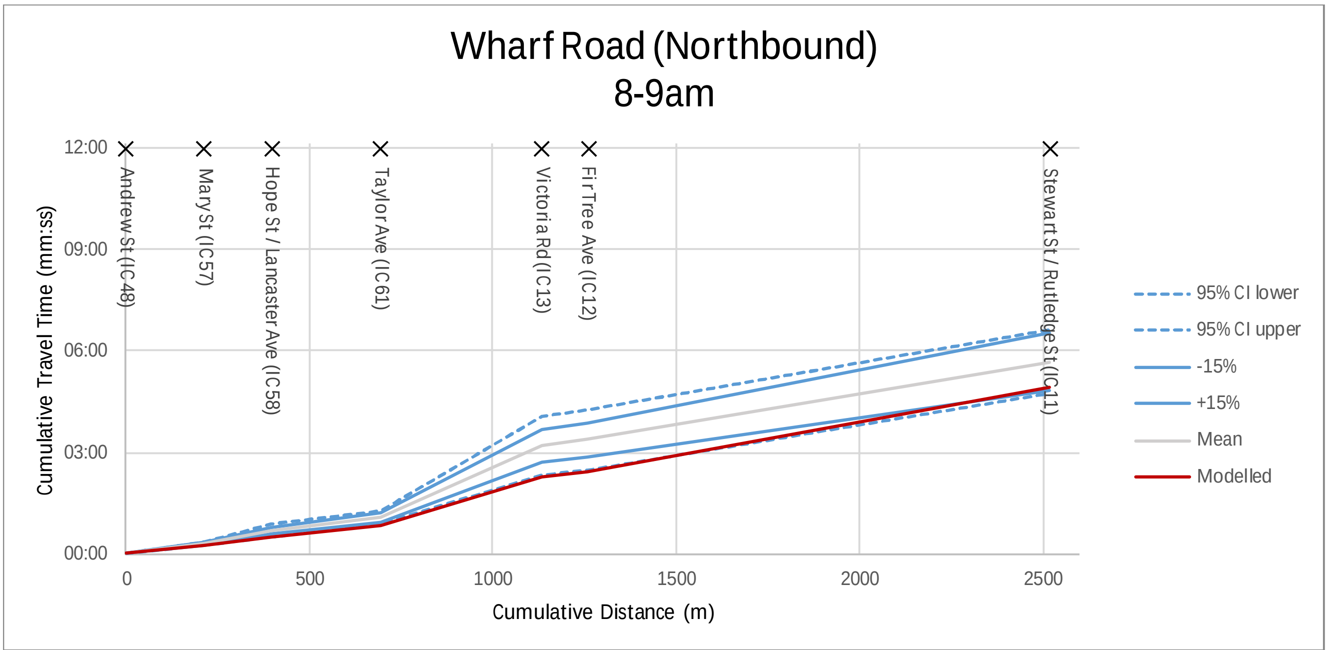


Figure 5.19 : Travel time validation - Wharf Road southbound 7-8am

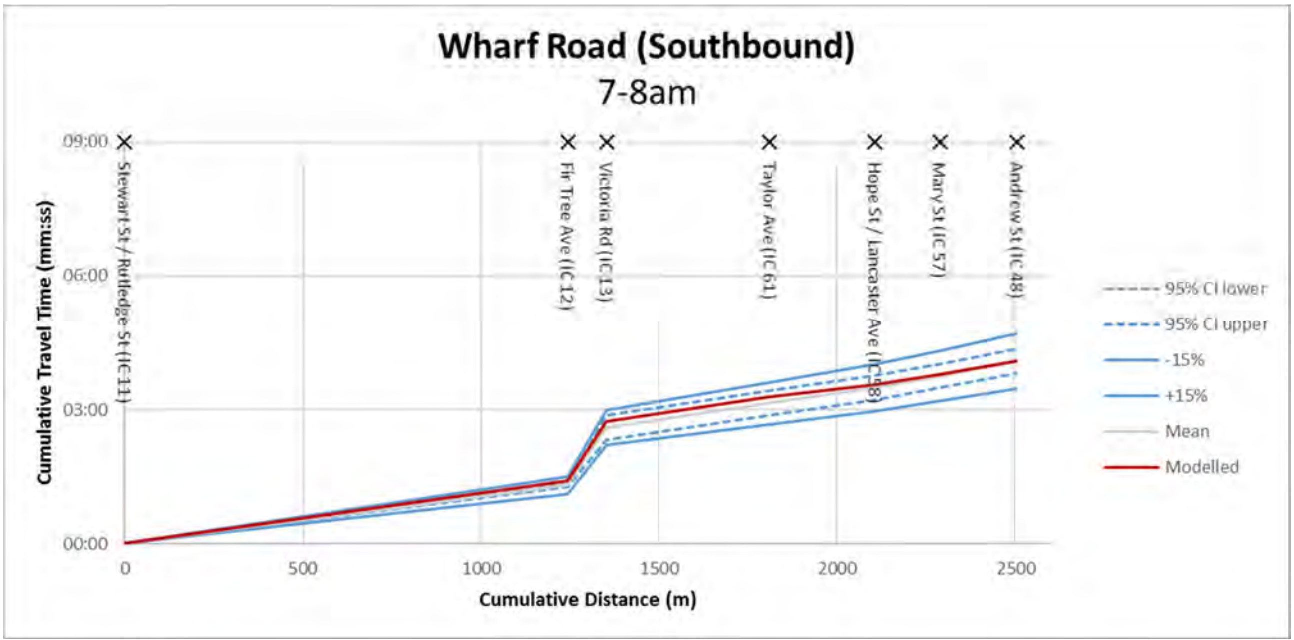


Figure 5.20 : Travel time validation - Wharf Road southbound 8-9am

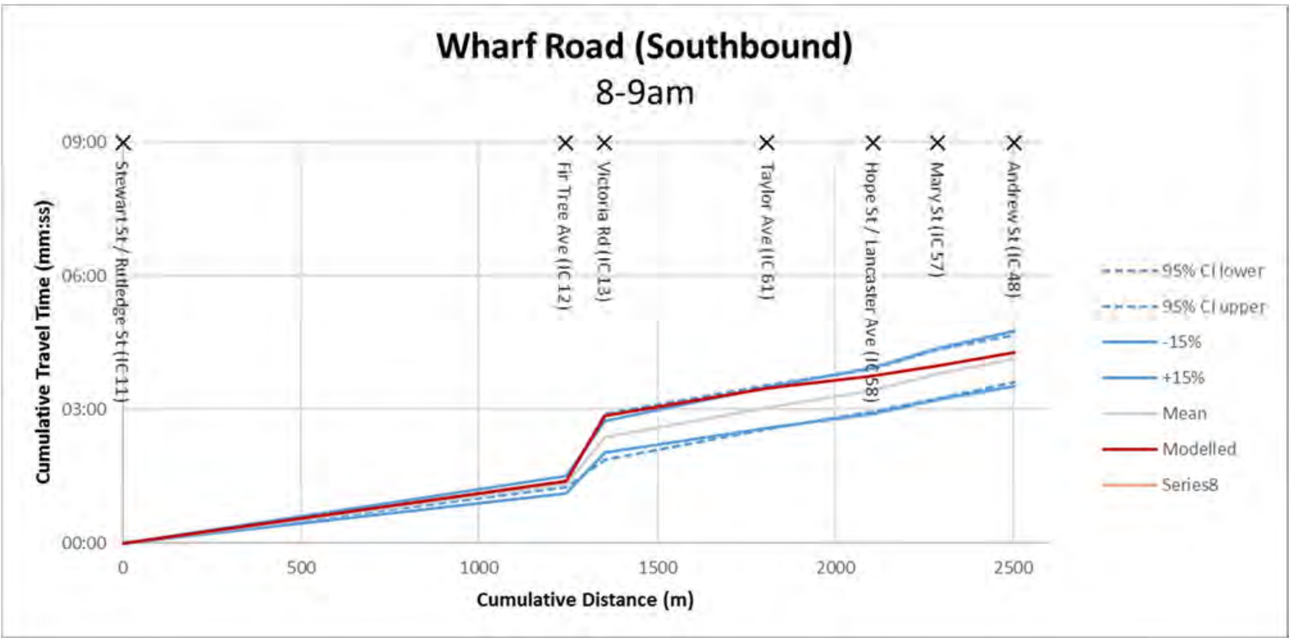


Figure 5.21 : Travel time validation - Wharf Road northbound 4-5pm

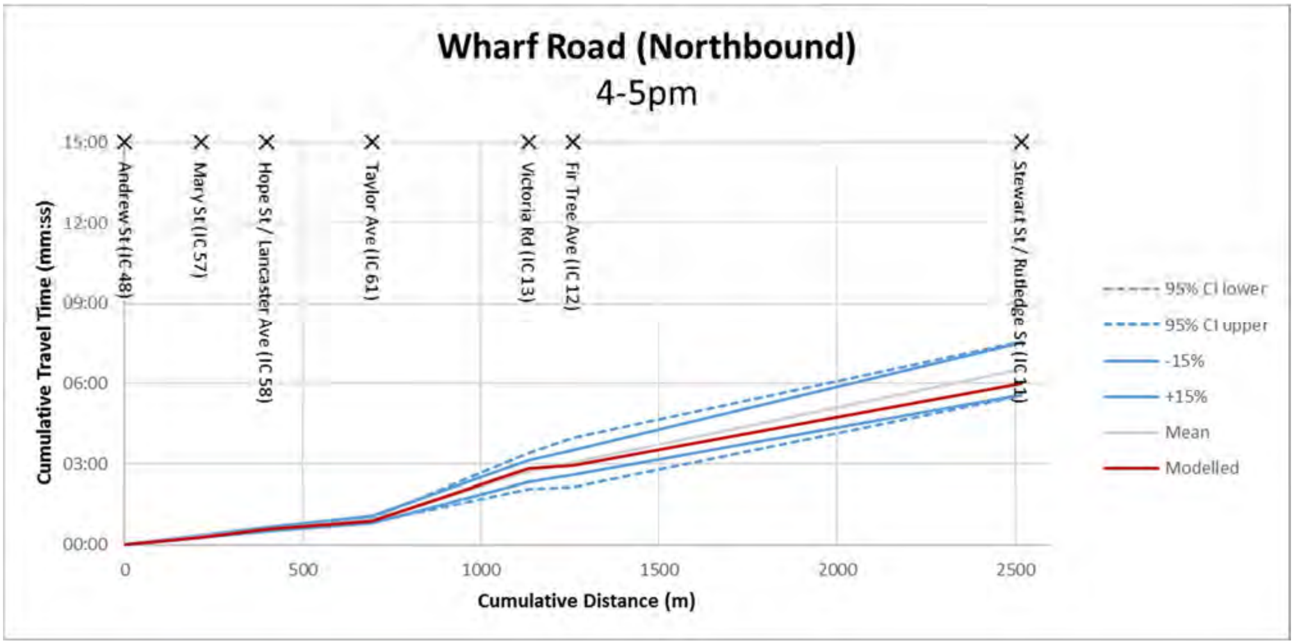


Figure 5.22 : Travel time validation - Wharf Road northbound 5-6pm

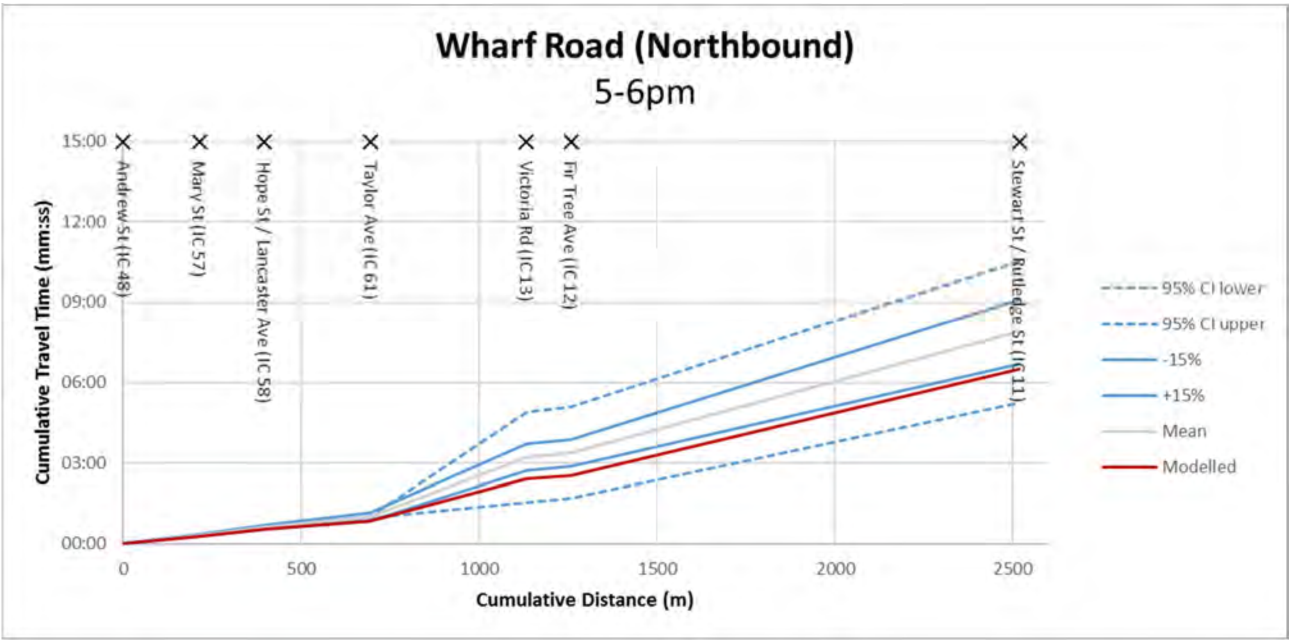


Figure 5.23 : Travel time validation - Wharf Road southbound 4-5pm

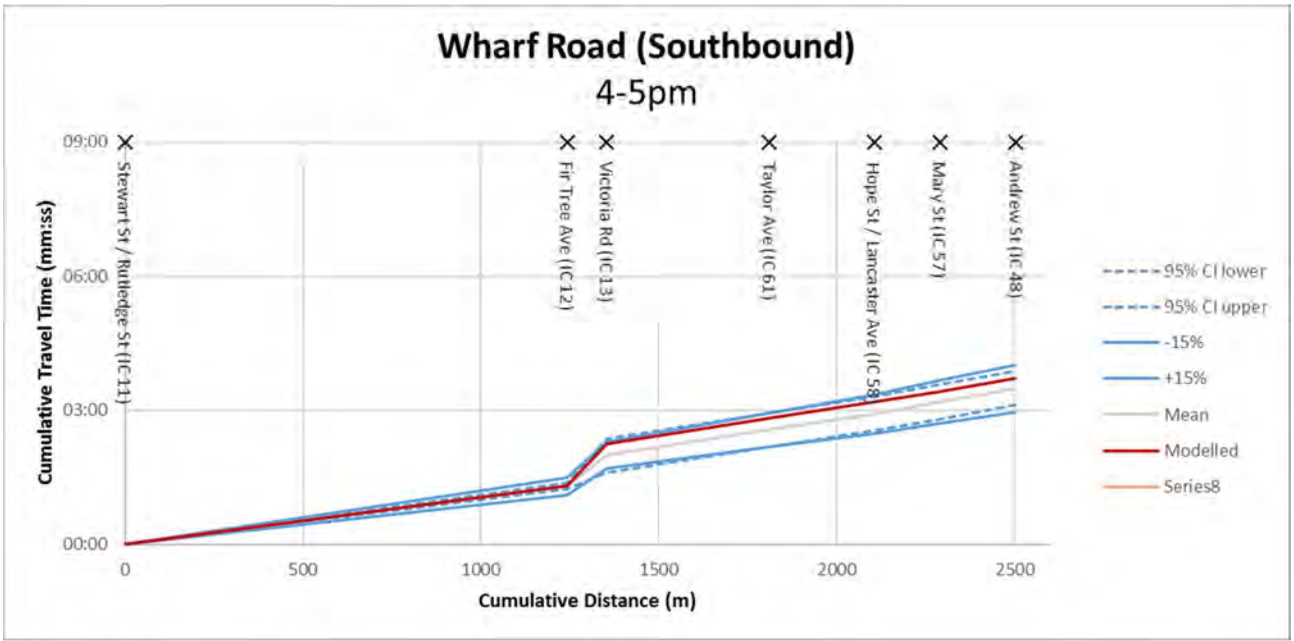
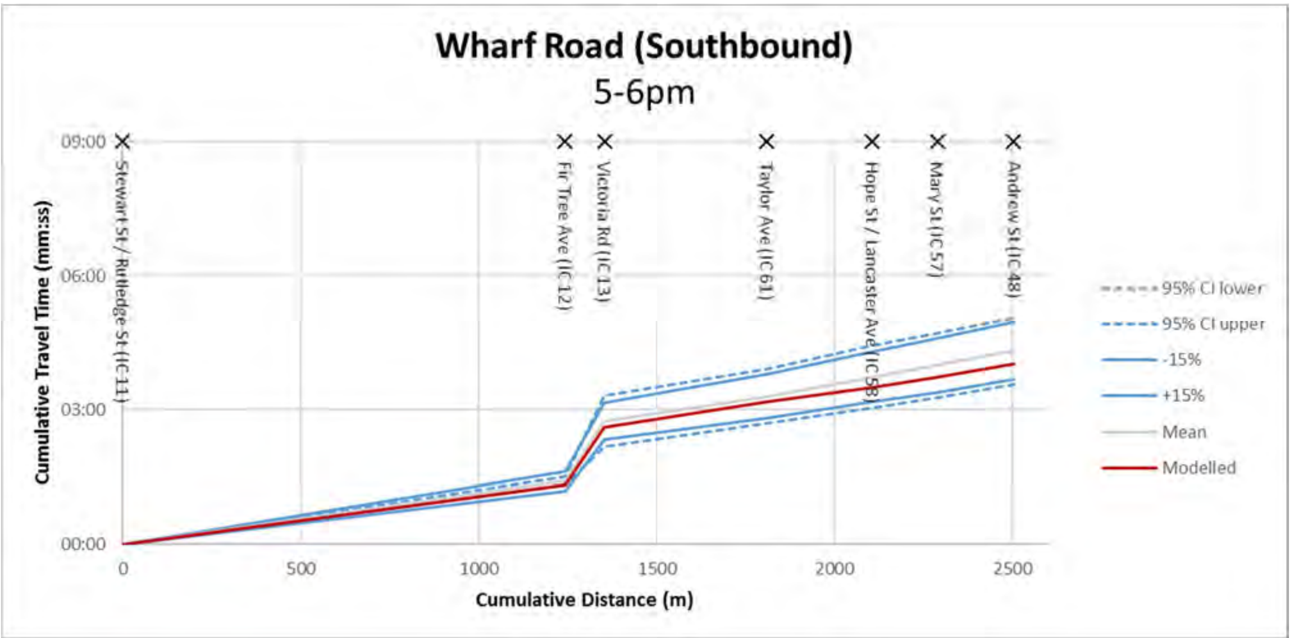


Figure 5.24 : Travel time validation - Wharf Road southbound 5-6pm



5.3 Validation summary

Comparison of the general traffic travel times with observed data shows that the model is generally replicating the pattern of delays and observed cumulative travel times during the peak periods. Minor divergences from the observed data occurs on Victoria Road, east of the study area and outside the key areas of influence of the Melrose Park development. This is generally due to delays which cannot be fully captured by mesoscopic modelling. These differences between modelled and observed travel times are expected based on the model assumptions and limitations, particularly in the mesoscopic model areas, and do not substantially affect the suitability of the model for assessing impacts of large scale land use changes.

6. Summary and conclusions

6.1 Overview

This report covers the calibration and validation results of the base *Melrose Park Hybrid Model*. The base model has been developed to inform the Melrose Park traffic and transport assessment.

The Sydney Strategic Travel Model (STM) has been used to provide initial travel demand and will also be used for future demand development.

Data for the model calibration was obtained from Transport for NSW and consisted of:

- Classified intersection counts
- Travel time surveys
- SCATS history files

6.2 Calibration findings

The model has been developed using the Aimsun modelling platform (version 8.2.1) and has been calibrated and validated based on the criteria adopted in Section 4.2.

The model has targeted regression parameters of R^2 greater than 0.95 and slope between 0.95 and 1.05 and 80% of turning movements with GEH less than 5.

All periods achieve the adopted regression targets. The results indicate the model achieves the adopted GEH criteria for the combined 4 hour periods in both the morning and evening peak periods. On an hour by hour basis, the model generally achieves the criteria. Some hourly periods achieve less than 80% for the GEH<5 criteria however no period is lower than 78%.

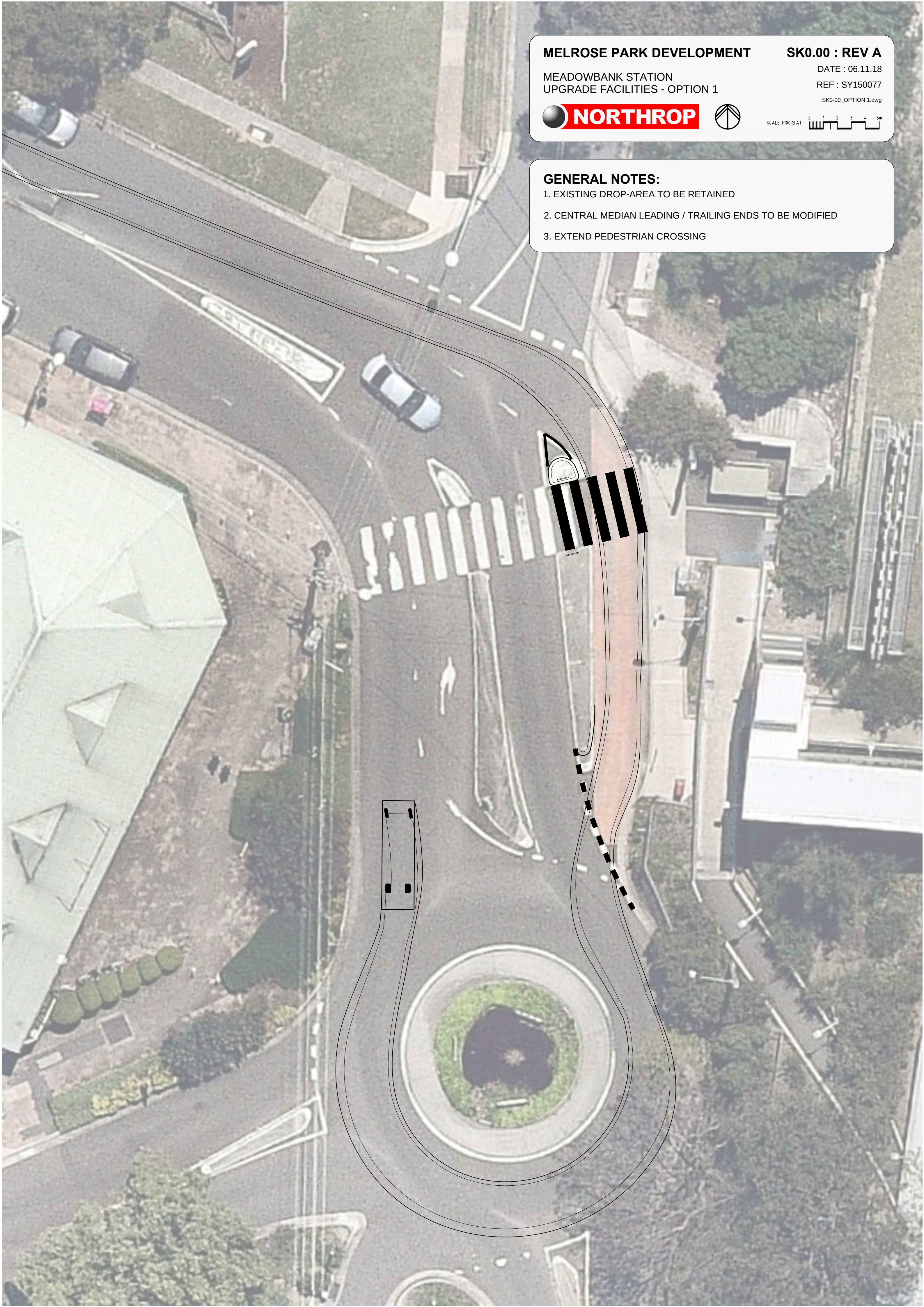
6.3 Validation findings

Validation of the model has been undertaken based on general traffic travel times. The travel time validation targets are for modelled times to be within 15% of the average observed travel times.

Comparison of modelled general traffic travel times with observed data shows that the model is replicating the pattern of delays and observed cumulative travel times during the peak period.

APPENDIX C - SWEPT PATH ANALYSIS

JACOBS



MELROSE PARK DEVELOPMENT

SK0.00 : REV A

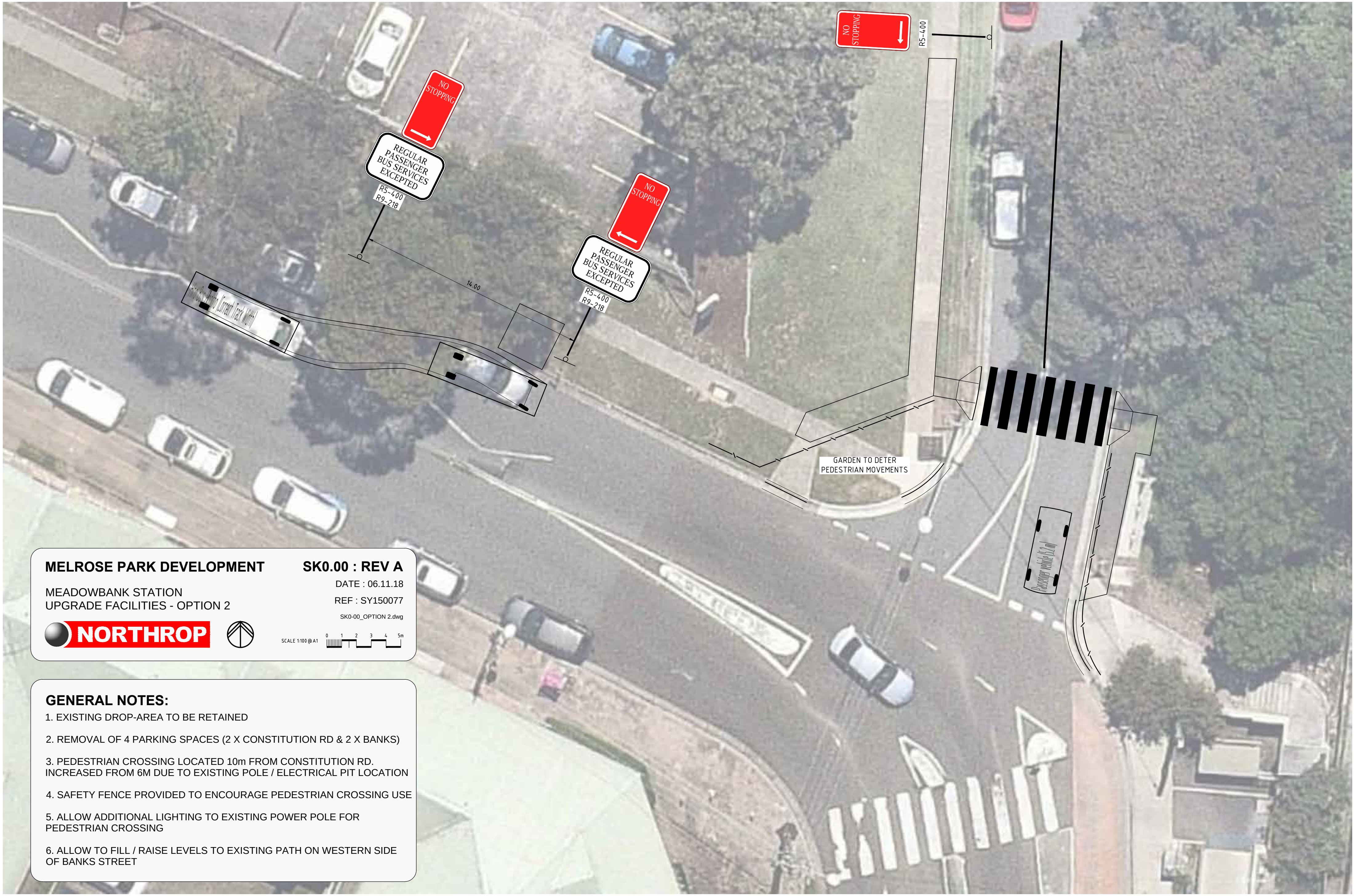
MEADOWBANK STATION
UPGRADE FACILITIES - OPTION 1

DATE : 06.11.18
REF : SY150077
SK0-00_OPTION 1.dwg

NORTHROP

GENERAL NOTES:

1. EXISTING DROP-AREA TO BE RETAINED
2. CENTRAL MEDIAN LEADING / TRAILING ENDS TO BE MODIFIED
3. EXTEND PEDESTRIAN CROSSING



MELROSE PARK DEVELOPMENT **SK0.00 : REV A**

DATE : 06.11.18

MEADOWBANK STATION
UPGRADE FACILITIES - OPTION 2

REF : SY150077

SK0-00_OPTION 2.dwg

NORTHROP

SCALE 1:100 @ A1 0 1 2 3 4 5m

GENERAL NOTES:

1. EXISTING DROP-AREA TO BE RETAINED
2. REMOVAL OF 4 PARKING SPACES (2 X CONSTITUTION RD & 2 X BANKS)
3. PEDESTRIAN CROSSING LOCATED 10m FROM CONSTITUTION RD. INCREASED FROM 6M DUE TO EXISTING POLE / ELECTRICAL PIT LOCATION
4. SAFETY FENCE PROVIDED TO ENCOURAGE PEDESTRIAN CROSSING USE
5. ALLOW ADDITIONAL LIGHTING TO EXISTING POWER POLE FOR PEDESTRIAN CROSSING
6. ALLOW TO FILL / RAISE LEVELS TO EXISTING PATH ON WESTERN SIDE OF BANKS STREET

Jacobs Group (Australia) Pty Limited
ABN 37 001 024 095
Level 7, 177 Pacific Highway
North Sydney NSW 2060 Australia

PO Box 632 North Sydney
NSW 2059 Australia

T +61 2 9928 2100
F +61 2 9928 2500

www.jacobs.com

JACOBS®