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SMEC INTERNAL REF. 30013460

Transport Assessment Report

Housing the Hunter: a plan for renewal at Broadmeadow

Prepared for: Department of Planning, Housing and Infrastructure
16 May 2024

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1. Introduction

1.1 Background

SMEC has been engaged by Department of Planning, Housing and Infrastructure (DPHI) to carry out a transport assessment for the Broadmeadow regionally significant growth area to support the Broadmeadow Place Strategy, Structure Plan and first-move state-led rezoning. Broadmeadow is an inner city suburb within the Newcastle Local Government Area (LGA) and is located a short distance to the west of the CBD.

In December 2022, the former Minister for Planning and Minister for Homes announced Broadmeadow as part of the Planning for Growth New Planning Proposal (NPP) Program. Broadmeadow forms part of the NPP Program initiative "Rezone and Build". This initiative aims to unlock 70,000 sites in priority locations across metropolitan and regional NSW over the next two years. The community will benefit, with more homes to own or rent in places with access to transport, services, and open space.

Housing the Hunter: a plan for renewal at Broadmeadow is focused on the efficient use of land, with the ability to deliver residential and employment benefits in a location with established services and infrastructure. There is the potential for Broadmeadow to become an employment and residential centre that capitalises on public investment in transport, potential future light rail connections, Hunter Park (Broadmeadow Sports Precinct), advanced manufacturing, and supporting sports medicine business and creative industries.

It is proposed to rezone four sites under the first-move state-led rezoning. The four sites have been identified to strategically catalyse development within the precinct. The first-move state-led rezoning will see the rezoning of Government-owned land at the Go Karts and Stadium Forecourt, Newcastle Showground, the Newcastle Basketball Stadium and Newcastle Police Citizens Youth Club (PCYC), as well as at the Locomotive Depot.

Figure 1–1 shows Broadmeadow and its location within Greater Newcastle, with the extent of the study area delineated in red.

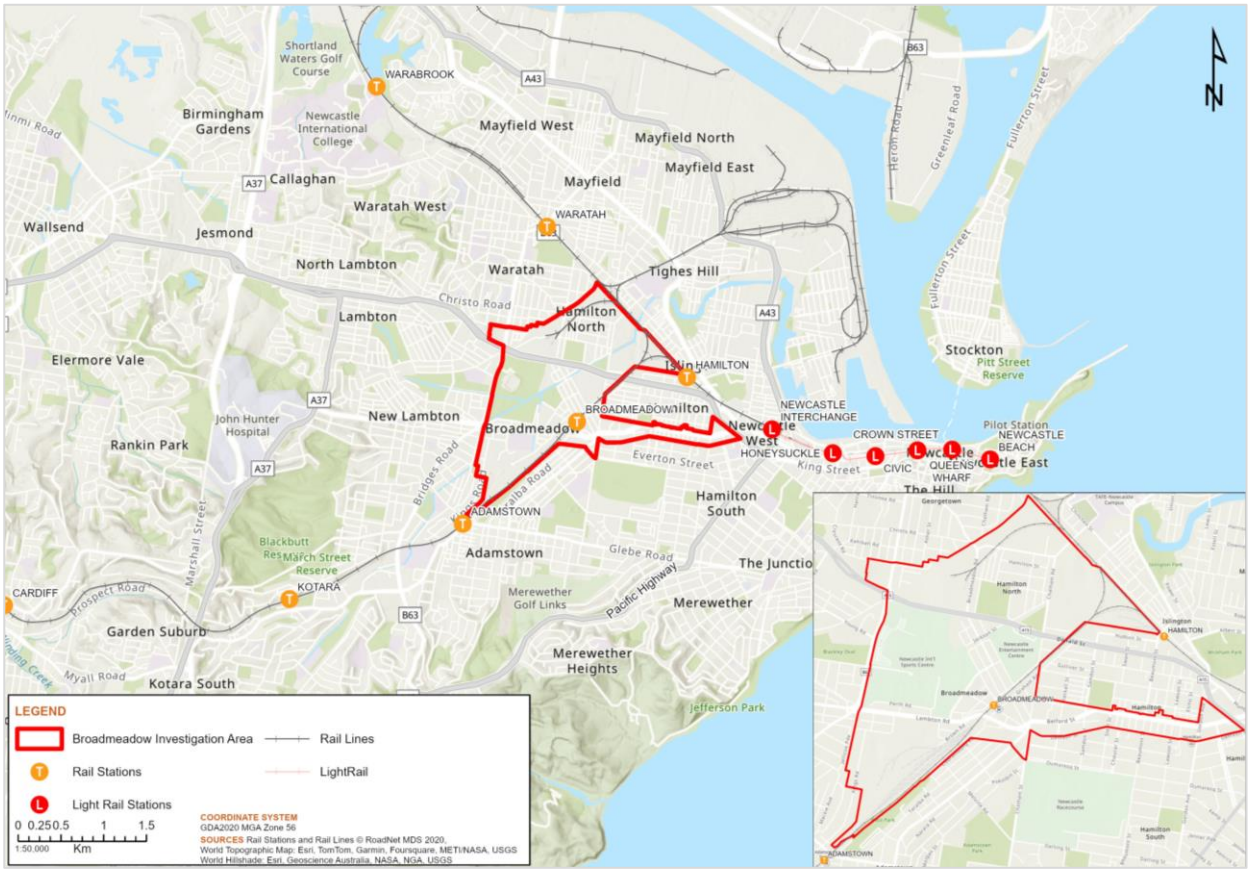


Figure 1–1: Study Location Plan

1.2 Study Objectives

The study objectives are:

- Provide traffic advice to inform development of the Broadmeadow Place Strategy, Structure Plan and first-move state-led rezonings
- Define short-term enabling infrastructure and service requirements to allow development to proceed in the Broadmeadow regionally significant growth area
- Identify longer-term transport infrastructure and service requirements to support future development in the Broadmeadow regionally significant growth area
- Prepare a Technical Report that responds to the outcomes of the identified Structure Plan scenario
- Prepare a Transport Implementation Plan to provide staging of infrastructure and service interventions in the short and longer term to support the planning of the Broadmeadow regionally significant growth area.

1.3 Scope of Work

The scope of work includes:

- Stage 1 – Studies and Investigations
  - Inception Workshop and Site Visit
  - Transport and Traffic Existing Context
- Stage 2 – Preliminary Enquiry by Design (EbD)
  - Preliminary EbD Workshop
  - Scenario Testing
  - Traffic and Transport – Future Context
- Stage 3 – Draft Structure Plan
  - Final EbD Workshop
  - Final Technical Report
  - Transport and Traffic – Implementation Plan

1.4 Purpose of Report

Key tasks undertaken as part of this transport assessment are as follows:

- Review strategic transport plans and policies, as well as traffic and transport studies commissioned by Transport for New South Wales (TfNSW) in relation to the proposal, as well as other reports prepared by agencies and Council relevant to the study
- Review historic traffic volumes, traffic survey data, crash data, as well as strategic transport model outputs for the precinct area
- Examine existing transport conditions, including pedestrians, cyclists, public transport and the surrounding road network
- Investigate and assess future transport conditions, including pedestrians, cyclists, public transport and the surrounding road network
- Determine the impacts of the proposal for all users of the transport network
- Undertake operational traffic modelling to assess current and future years' road network performance, including key intersections within and surrounding the precinct
- Identify and manage transport impacts on the road network, including identification of short and longer term infrastructure upgrades and service enhancements, where required

- Provide a delivery framework including prioritisation of proposed infrastructure upgrades and service interventions.

1.5 Report Structure

The structure of this report is outlined below:

- Section 1 – Introduces the study, including background, study objectives, scope of work, purpose of report and report structure
- Section 2 – Provides strategic context, including an overview of State, regional and local policy documents, as well as relevant guidelines
- Section 3 – Presents the existing traffic and transport context of the study area
- Section 4 – Explains development scenario testing and SWOT analysis undertaken to arrive at the preferred emerging development scenario
- Section 5 – Outlines project vision, principles and proposed Structure Plan
- Section 6 – Outlines transport vision, transport objectives and transport planning tools that could be employed for the Broadmeadow Precinct
- Section 7 – Provides qualitative commentary relating to the Broadmeadow transport network
- Section 8 – Describes traffic modelling undertaken, including methodology, assumptions, performance analysis, summary of results and road network improvement package to mitigate impact of the proposed Structure Plan
- Section 9 – Outlines proposed infrastructure, including staging/ timing and possible delivery strategy
- Section 10 – Provides next steps including additional assessment required.

2. Strategic Context

This section provides a review of relevant policies and strategies that will guide future land use and transport outcomes for the precinct. State, regional and local policy documents have been reviewed, as well as supplementary guidelines and documents in order to provide a detailed contextual overview relevant to the proposal.

2.1 Policies and Guidelines

2.1.1 NSW State Policy

Future Transport Strategy

Transport for New South Wales (TfNSW) released the Future Transport Strategy in 2018, which superseded the previous Future Transport 2056 and NSW Long Term Transport Master Plan. The Future Transport Strategy sets the vision for safe, healthy, sustainable, accessible and integrated passenger and freight journeys in NSW. The Future Transport Strategy includes ground-breaking ideas to bring the NSW Government's Six Cities vision to life, connect regional communities, encourage thriving local neighbourhoods and strengthen NSW's economy.

The strategy outlines a comprehensive vision for the future of transport in the state, with a strategic focus on:

- **Connecting customers' whole lives** with multimodal customer journeys that are seamless, personalised and enabled by data and technology
- **Successful places for communities** where transport enhances amenity, liveability and economic success
- **Enabling economic activity** by powering NSW's future $1.4 trillion economy and enabling economic activity across the state.

Figure 2–1 below illustrates further details relating to the strategic outcomes of the Future Transport Strategy.

Figure 2–1: Future Transport Strategy – Strategic Outcomes

NSW 2021 – State Plan

NSW 2021 is a 10-year plan to rebuild the economy, provide quality services, renovate infrastructure, restore government accountability, and strengthen local environment and communities. It replaces the State Plan as the NSW government's strategic business plan, setting priorities for action and guiding resource allocation.

NSW 2021 is a plan for change with ambitious goals and challenging targets. These targets will be hard to meet and there will be many factors outside the control of the NSW Government. NSW 2021 is based on five strategies:

- Rebuild the Economy – restore economic growth and establish NSW as the 'first place in Australia to do business'
- Return Quality Services – provide the best transport, health, education, policing, justice and family services, with a focus on the customer
- Renovate Infrastructure – build infrastructure that makes a difference to both our economy and people's lives
- Strengthen our Local Environment and Communities – improve people's lives by protecting natural environments and building a strong sense of community
- Restore Accountability to Government – talk honestly with the community, return planning powers to the community and give people a say on decisions that affect them.

The 32 goals of NSW 2021 are shown in Figure 2–2.

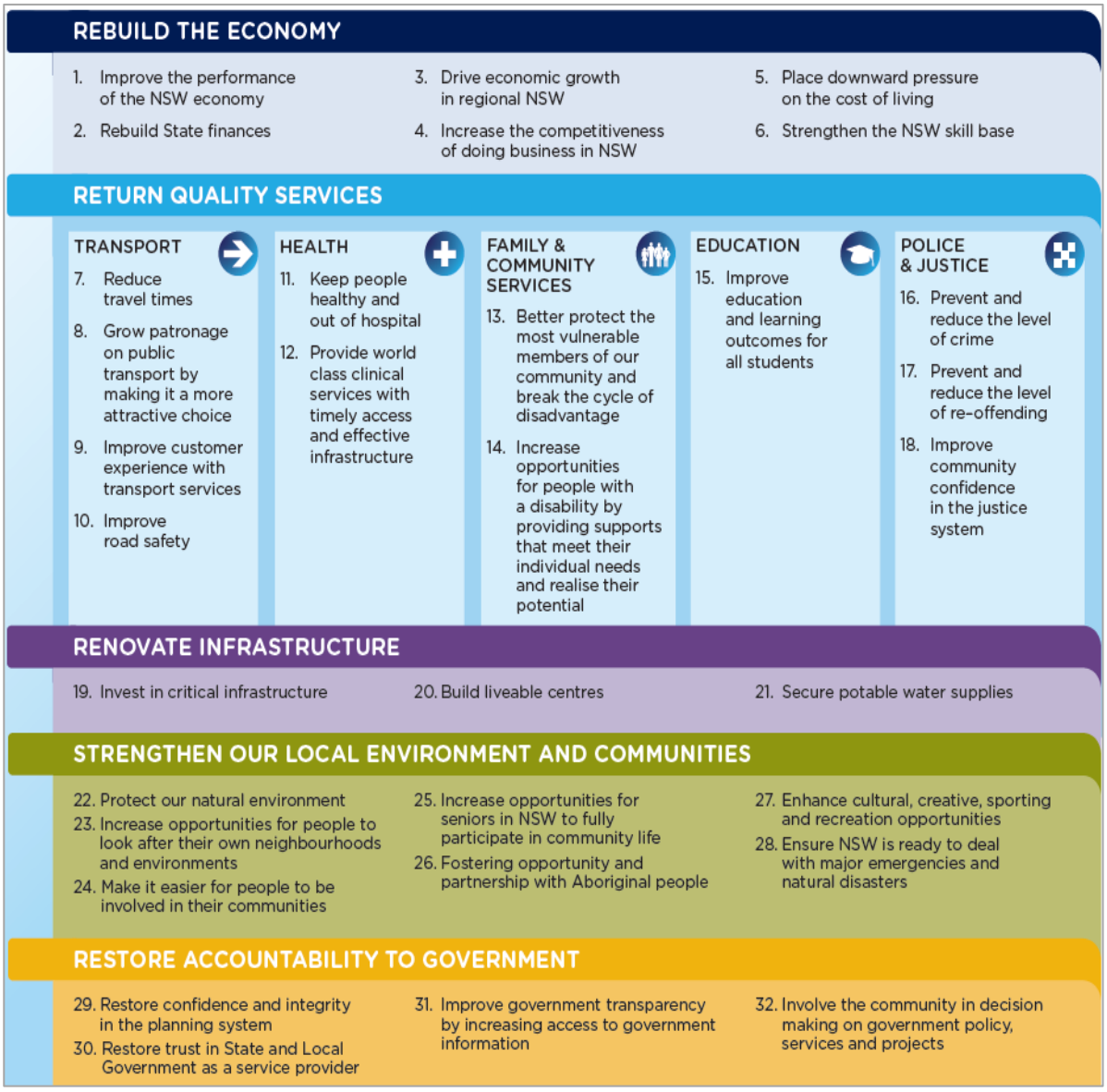


Figure 2–2: 32 Goals of NSW 2021

Staying Ahead: State Infrastructure Strategy 2022-2042

Staying Ahead: State Infrastructure Strategy 2022-2042 is a document published by Infrastructure NSW, which outlines the state's long-term infrastructure strategy for the next 20 years. The strategy aims to ensure that NSW remains globally competitive by investing in infrastructure that supports economic growth, enhances liveability, and protects the environment.

The document identifies six key priorities for infrastructure investment:

- Building a stronger economy through infrastructure investment that supports growth in key sectors, such as health, education, and tourism
- Investing in sustainable transport infrastructure to reduce congestion and improve connectivity, including new metro lines and upgrades to regional rail services
- Enhancing regional connectivity by investing in regional airports, ports, and roads
- Investing in critical social infrastructure, including schools, hospitals, and social housing
- Ensuring the state's resilience to natural disasters, including the development of a state-wide flood strategy
- Leveraging technology to improve service delivery and enhance the efficiency of infrastructure networks.

The strategy also outlines a series of initiatives to support these priorities, including the establishment of a Major Infrastructure Assessment Unit to ensure the delivery of major projects, and the development of a 30-year infrastructure pipeline to provide certainty for investors and industry.

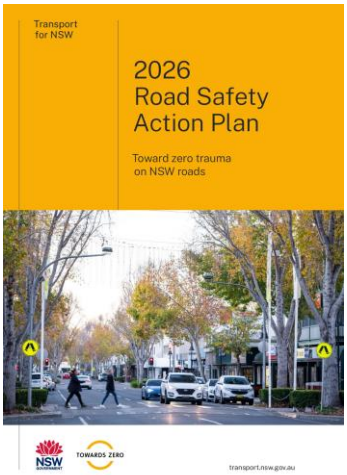
Overall, the strategy aims to position NSW as a world leader in infrastructure and ensure that the state remains prosperous and liveable for all residents. The recommendations in NSW State Infrastructure Strategy relate both to the Premier's stated strategic priorities and to other investments and initiatives which Infrastructure NSW considers will grow the State's economy and enhance its productivity.

2026 Road Safety Action Plan

The NSW Road Safety Action Plan 2026:

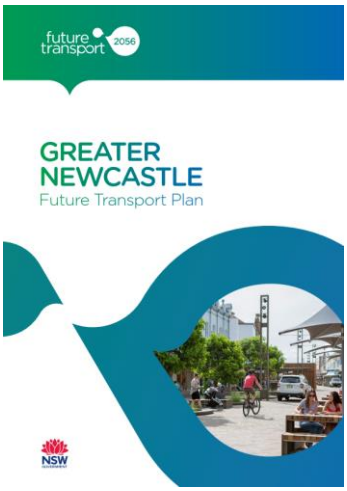
- Sets key objectives and initiatives to aim towards by 2030
- Is aiming towards its 2050 vision of zero fatalities by 2050
- Focuses equally on lowering fatalities and serious injuries
- Encourages shared responsibility for road safety outcomes
- Supports the delivery of the National Road Safety Strategy 2021-2030.

The Strategy is set in the context of the current and future policy operating environments of Transport for NSW. Transport for NSW is the lead agency for road safety in NSW, and therefore will lead and coordinate road safety interventions across State Government, Local Government, stakeholders and the community.



2.1.2 Regional Policy

Greater Newcastle Future Transport Plan



The Greater Newcastle Future Transport Plan is a document that outlines the NSW government's vision and strategy for the transport system in the Greater Newcastle area. The plan aims to provide a safe, efficient, and sustainable transport network that meets the needs of residents, businesses, and visitors in the region.

The plan identifies four key objectives for the transport system in the Greater Newcastle area:

- Improving accessibility: This involves making it easier for people to move around the region, including better connections between different modes of transport, such as buses, trains, and ferries.
- Enhancing safety: This involves reducing the number of accidents and improving safety for all road users, including pedestrians, cyclists, and motorists.
- Supporting economic growth: This involves ensuring that the transport system supports the region's economic growth by improving access to employment centres and key industries.
- Reducing environmental impact: This involves promoting sustainable transport options, such as public transport and active transport, to reduce the region's carbon footprint and improve air quality.

The plan outlines a series of initiatives and projects to achieve these objectives, including improvements to the road network, upgrades to public transport infrastructure, and investment in active transport options, such as cycling and walking paths. The plan also includes a range of measures to monitor and evaluate progress towards these objectives, including regular reporting on key performance indicators and consultation with the community.

The plan refers to Broadmeadow as an emerging catalyst growth area, and specifically makes reference to a number of priority corridors within the study area. Key place attractors identified include Newcastle Airport, University of Newcastle, John Hunter Hospital, Broadmeadow, Kotara, as well as other key destinations. The potential priority corridors across Greater Newcastle and its strategic centres have been identified and investigated for investment in priority public transport over the next 10 years.

The following are two key projects referenced in the plan, which are relevant to the study area:

Newcastle Inner City Bypass

The Newcastle Inner City Bypass is part of Transport for NSW's long-term strategy to provide an orbital road within Newcastle’s road network to connect the Pacific Highway at Bennetts Green with the Pacific Highway at Sandgate. The 3.4 kilometre bypass will be built between Rankin Park and Jesmond, to the west of John Hunter Hospital. Major construction started in March 2023, targeting completion in mid-2025.

The bypass will provide improved traffic flows across the western suburbs of Newcastle and connectivity to Bennetts Green, Charlestown and Jesmond shopping centres, the John Hunter Hospital precinct at New Lambton Heights and the University of Newcastle at Callahan with connections to the Pacific Highway.

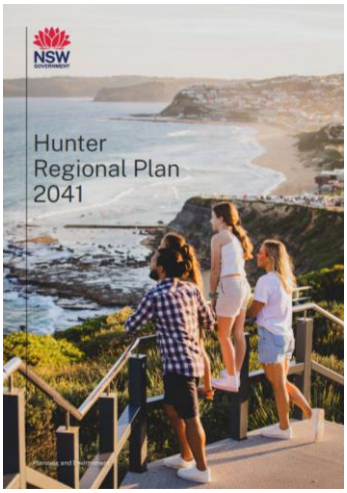
Lower Hunter Freight Corridor

The Lower Hunter Freight Corridor will provide for a future dedicated freight rail line between Fassifern and Hexham, bypassing the Newcastle urban area and improving regional and interstate links. Separating rail freight from passenger rail lines is a NSW Government initiative to reduce network congestion and improve travel times and reliability for both rail freight and passenger rail services.

The corridor will also support growing demand as freight and passenger rail services in Northern Sydney, Newcastle, and the Sydney-Newcastle corridor continue to grow. Additionally, the corridor will also relieve congestion and journey delays to road and active transport users around level crossings at St James Road, Adamstown and Clyde Street, Islington.

Removing freight services along the passenger rail line will allow for additional passenger rail services to connect communities with jobs and services. Most importantly, it will improve amenity for local communities.

Hunter Regional Plan 2041



The Hunter Regional Plan 2041 is a document published by DPHI in NSW, which sets out a long-term vision and strategy for the Hunter region. The plan aims to guide sustainable growth and development in the region, while also preserving its unique natural and cultural heritage. The plan identifies five key goals for the region:

- A strong and diverse economy that supports job creation and growth in key industries, such as health, education, tourism, and advanced manufacturing
- Sustainable and connected communities that are supported by high-quality infrastructure, such as public transport, schools, and health facilities
- A healthy and diverse environment that is protected and enhanced through sustainable land use practices, biodiversity conservation, and natural resource management
- Efficient and effective governance that promotes collaboration and coordination between different levels of government, industry, and the community
- Innovation and excellence in urban design and planning that creates vibrant, liveable, and resilient places.

The plan outlines a series of initiatives and strategies to achieve these goals, including targeted infrastructure investments, planning controls and guidelines, and partnerships between government, industry, and community organisations. The plan also includes a range of measures to monitor and evaluate progress towards these goals, including the development of key performance indicators and regular reporting on outcomes.

Like other policy documents, the Hunter Regional Plan 2041 recognises Broadmeadow as a regionally significant growth area. The NSW Government aims to establish “Hunter Park” as the premier destination for sports, leisure, and entertainment, while also developing it into a vital area for new residences and job opportunities in close proximity to Broadmeadow Station. The Hunter Park Urban Regeneration Program seeks to revitalise underutilised lands owned by the government and transform them into a nationally renowned sports and entertainment hub within a new urban district.

The Hunter Regional Plan 2041 includes a number of key objectives, the following two relating specifically to transport:

- Objective 3: Create 15-minute neighbourhoods to support mixed, multi-modal, inclusive and vibrant communities
- Objective 4: An inter-connected and globally-focused Hunter without car dependent communities.

The plan also includes the following place strategy outcomes relating to Broadmeadow:

- Broadmeadow’s connectivity and access to transport infrastructure will drive opportunities for optimal density and diversity in housing types
- Revitalise Styx Creek to enable a well-connected green and blue heart at the centre of Broadmeadow
- Establish a hierarchy of open spaces for legibility and wayfinding
- Improve walking and cycling connections across Styx Creek, the rail line and Griffiths, Lambton and Turton Roads
- Improve public transport, including potential light rail connections
- Create accessible spaces for all members of the community
- Protect and secure land for transport upgrades, including potential light rail and fast rail.

Draft Hunter Regional Transport Plan 2041

The Draft Hunter Regional Transport Plan 2041 sets out a 20-year transport vision for the Hunter, coordinating the key infrastructure, services and policy interventions to achieve the vision at a regional level.

Specifically related to Broadmeadow, a key objective is to support and improve local connectivity to and within centres, including the investigation of the potential future extension of Newcastle light rail, and improving and protecting key freight corridors.

This draft plan also identifies future Fast Rail, which is currently being investigated between Sydney and Newcastle. Fast Rail will provide Newcastle greater connectivity to other regional centres in addition to Sydney.

Greater Newcastle Metropolitan Plan

The Greater Newcastle Metropolitan Plan 2036 is the first-ever Metropolitan Plan prepared for the Greater Newcastle area and will drive sustainable growth over the next 20 years across the five Greater Newcastle Council areas.

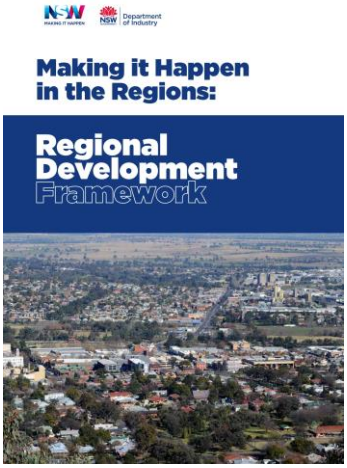
In alignment with the aforementioned Greater Newcastle Future Transport Plan, The Metropolitan Plan sets a vision for Greater Newcastle to be Australia's newest and emerging economic and lifestyle city, taking its place on a global stage. Additionally, the plan aims to guide sustainable growth and development in the region, whilst also preserving its natural and cultural heritage.

The plan identifies four outcomes that deliver the vision for Greater Newcastle:

- Create a workforce skilled and ready for the new economy
- Enhance environment, amenity and resilience for quality of life
- Deliver housing, close to jobs and services
- Improve connections to jobs, services and recreation.

The plan seeks to create a more vibrant, liveable, and connected region that provides opportunities for all residents and visitors to participate in and benefit from the region's growth and development.

Making it Happen in the Regions: Regional Development Framework



Making it Happen in the Regions: Regional Development Framework is a document published by the NSW Department of Industry, which outlines the state's approach to regional development. The framework aims to drive economic growth and support regional communities by identifying the unique strengths and challenges of each region and implementing tailored strategies to address them.

The document sets out four key pillars for regional development:

- Strong and Competitive Regional Economies: This involves supporting the growth of regional industries, attracting new businesses, and developing regional supply chains to increase local economic activity and create jobs
- Vibrant and Cohesive Regional Communities: This involves improving social infrastructure, such as schools and hospitals, and supporting community events and initiatives to promote social cohesion and a sense of belonging
- Improved Connectivity and Access: This involves investing in transport infrastructure, including roads, rail, and airports, to improve connectivity between regions and metropolitan areas
- Strong and Sustainable Natural Resource Management: This involves supporting sustainable use of natural resources, such as land, water, and energy, to promote environmental sustainability and reduce the impact of climate change.

The framework emphasises the importance of collaboration between government, industry, and communities to achieve these goals. It also outlines a range of programs and initiatives to support regional development, including funding opportunities, skills and training programs, and industry partnerships.

2.1.3 Local Policy

Newcastle 2040 (Community Strategic Plan)

Newcastle 2040 is a shared community vision, developed as a guide to inform policies and actions throughout the city for the next 20+ years. The document outlines its vision to be a liveable, sustainable and inclusive global city by 2040, through building trust and collaborative relationships.

To target their goal of a liveable Newcastle, the City of Newcastle (CN) focuses enriched neighbourhoods and places, connected and fair communities, safe, active and linked movement across the city and an innovative and connected city. CN is addressing all modes of transport, including:

- Connected cycleways and pedestrian networks – making active movement a convenient, accessible way of getting around
- Road networks – managing and maintaining road networks to connect people and places comfortably across the city
- Managing parking – supporting the amenity of streets, supporting access to centres and local businesses and encouraging a shift to active and public transport
- Effective public transport – support the implementation of regional transport strategies and plans and public transport improvements to allow easy movement across the city.

Local Strategic Planning Statement

The Local Strategic Planning Statement (LSPS) is CN's plan to guide land use planning over the next 20 years. The LSPS implements priorities from the aforementioned Newcastle 2040 (Community Strategic Plan) and brings together land use planning actions in other CN adopted strategies. The LSPS also gives effect to the State Government strategic directions for the Hunter region, outlined in the Hunter Regional Plan 2041 and the Greater Newcastle Metropolitan Plan 2036.

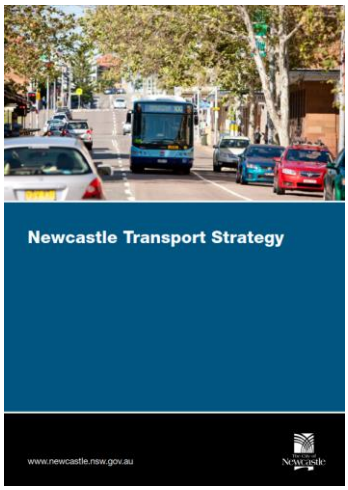
This document also highlights Broadmeadow as an area of change, and more specifically as a catalyst growth area. CN highlights that its growth will be centred around the future development of a world class sport and entertainment precinct, developing on the existing Newcastle Entertainment Centre and Showground, McDonald Jones Stadium and other sports facilities.

Broadmeadow also includes areas of former industrial land which provide potential growth in jobs, visitor accommodation and housing. This will require the transport system of Broadmeadow to be improved in order to cater for such growth.

Figure 2–3 highlights City of Newcastle's vision for the growth of Broadmeadow and its land use, whilst also highlighting priority multimodal corridors westbound from the city via Lambton Road towards John Hunter Hospital, as well as via A15 Griffiths Road. The document also talks specifically of extending the light rail system to McDonald Jones Stadium, the hospital and the University of Newcastle.

Figure 2–3: Catalyst Area: Broadmeadow (Source: Local Strategic Planning Statement, City of Newcastle)

Newcastle Transport Strategy



The Newcastle Transport Strategy (2016) is a strategic plan created by CN to improve the city's transportation system. The plan aims to create a sustainable and efficient transport network that connects the city's residents, businesses, and visitors, while also reducing traffic congestion and carbon emissions.

To achieve this, the plan sets out a range of strategies and actions, including:

- Investing in public transport: The plan aims to increase the use of public transport by improving services, expanding routes, and creating new transport hubs
- Promoting active transport: The plan encourages walking and cycling by creating safe and accessible pedestrian and cycle paths and improving infrastructure such as bike parking facilities
- Managing traffic congestion: The plan aims to reduce traffic congestion by improving traffic flow, promoting the use of public transport, and implementing smart technology solutions, such as intelligent transport systems
- Improving accessibility: The plan ensures that the city's transport system is accessible for everyone, including people with disabilities, by improving infrastructure, such as footpaths, crossings, and bus stops
- Investing in infrastructure: The plan involves investing in infrastructure, such as new roads, bridges, and public transport facilities to support the city's growth and development.

There is continuing support to complete the missing links in the cycling network between Broadmeadow and Newcastle City Centre.

On our bikes – CN Cycling Plan 2021-2030

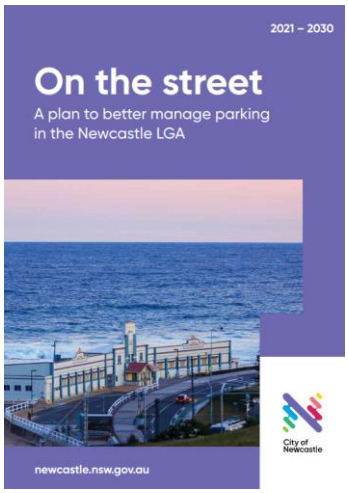
On Our Bikes is a cycling plan by City of Newcastle that outlines a vision for cycling in Newcastle over the next decade. The plan aims to make cycling a safe, convenient, and an enjoyable mode of transport for people of all ages and abilities. It includes a range of initiatives, such as building new cycleways, upgrading existing ones, providing better wayfinding and route maps, and promoting cycling as a healthy and sustainable mode of transport.

Regional cycle routes that feature throughout Broadmeadow include:

- R1 (NSW Coastline Cycleway) Swansea to Newcastle City (via Fernleigh Track) and Newcastle City to Fern Bay
- R4 (Mayfield to Warners Bay)
- R5 (Newcastle City Centre to Speers Point)

In addition to infrastructure improvements, the document also outlines plans for promoting cycling culture and behavioural change. The city plans to offer cycling education and training programs, as well as incentives for businesses to become bike-friendly. The document also mentions the importance of community engagement and consultation to ensure that cycling infrastructure meets the needs of all members of the community.

On the street – CN Parking Plan 2021-2030



On the Street is the City of Newcastle's parking plan for 2021-2030. The plan outlines strategies for managing parking in a sustainable and equitable way that supports CN's economic, social, and environmental goals.

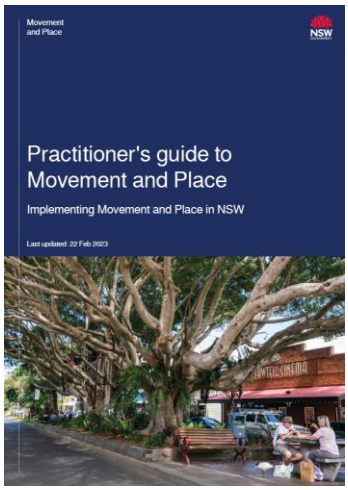
The plan includes several key initiatives, including:

- Better management of parking in the Newcastle LGA
- Developing a parking management strategy that prioritises active transport, such as walking, cycling, and public transportation, to reduce reliance on cars
- Improving parking availability in areas where demand is high, such as near transport hubs and commercial areas
- Working with developers and businesses to reduce the need for parking by promoting sustainable transportation options and encouraging carpooling and ride-sharing
- Ensuring that parking infrastructure is designed to be safe, accessible, and environmentally sustainable.

The plan also identifies several areas of the city where parking management will be a particular focus, including the Broadmeadow catalyst area. In this area, the city plans to work with businesses and residents to develop a parking strategy that supports economic growth and improves liveability for local residents. This may include the introduction of parking permits or the implementation of time-limited parking in certain areas to encourage turnover and increase availability.

2.1.4 Supplementary Guidelines and Documents

Practitioner's Guide to Movement and Place



A Movement and Place Framework has been developed in New South Wales as a collaboration between Government Architect NSW (GANSW) and TfNSW. It is a multi-disciplinary, place-based approach to the planning, design, delivery and operation of transport networks. It recognises and seeks to optimise the network of public spaces formed by roads and streets and the spaces they adjoin and impact.

The NSW Framework is a tool that integrates with the existing planning process. It may be used by planners and engineers at a local/ project level to assess individual roads and intersections.

The NSW Framework adopts a six-part structure, which is a guide for planners and designers to assess a road segment and develop a future vision for that area.

Figure 2–4 illustrates the recommended structure of movement and place decision making in NSW.

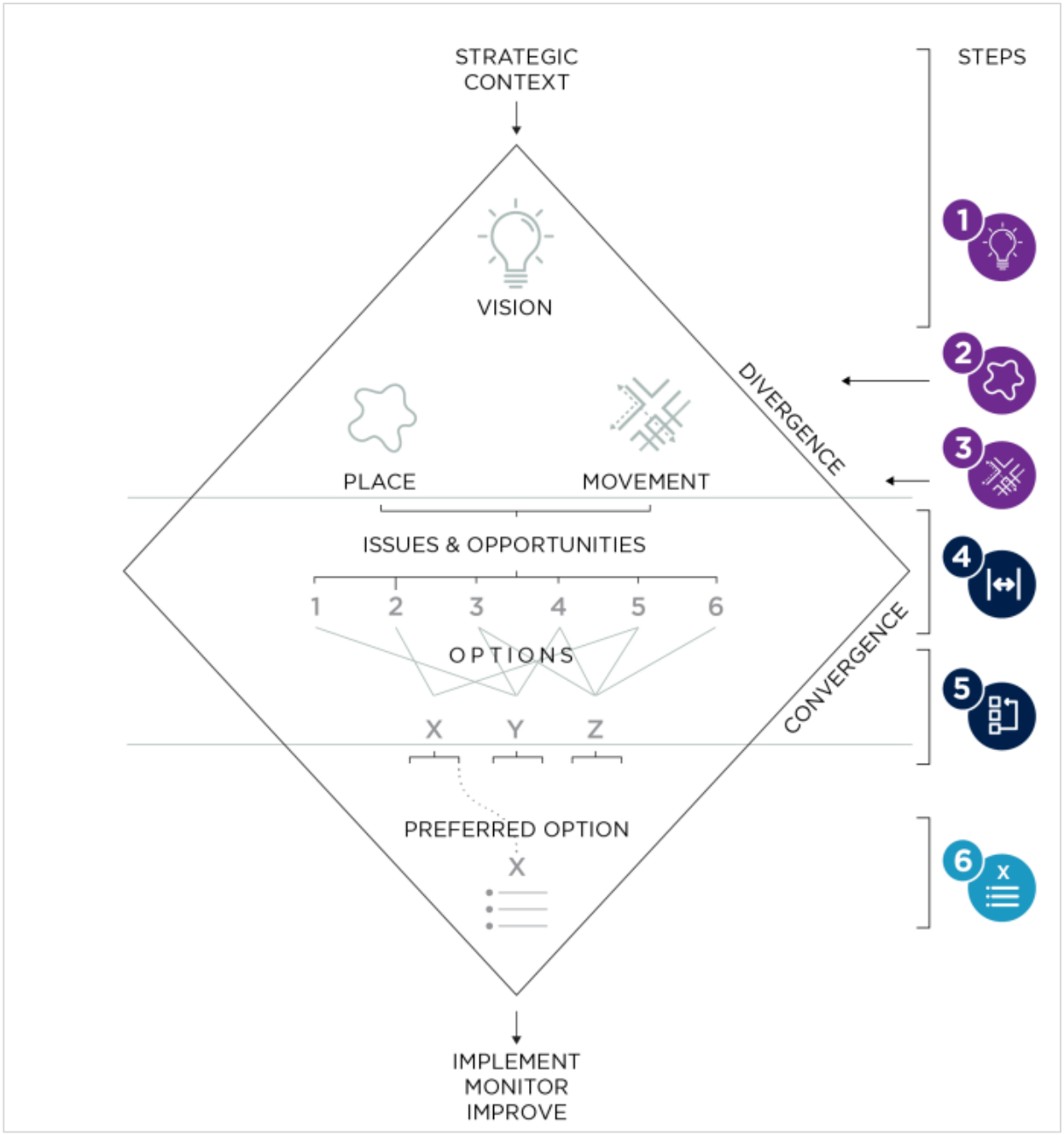
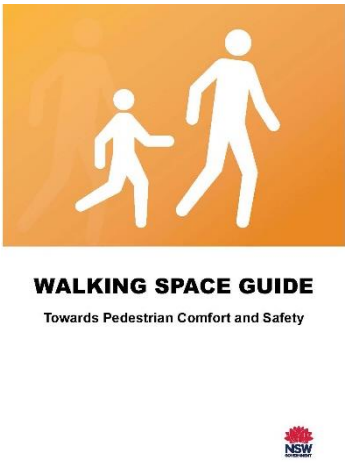


Figure 2–4: Movement and Place Process Diagram (Source: NSW Practitioner's Guide to Movement and Place)

Walking Space Guide: Towards Pedestrian Comfort and Safety



The Walking Space Guide developed by Transport for NSW provides a set of standards and tools to assist those responsible for walking spaces on streets to ensure that sufficient space is provided to achieve comfortable environments which encourage people to walk.

The guide is based on research into Australian walking comfort norms. It sets standards that will ensure that a comfortable amount of walking space is provided on streets which will encourage people to walk.

The guide provides step by step instructions and comes with a spreadsheet for calculating results. This guide works with the Movement and Place framework referred to above by helping to understand the effects of balancing competing space allocation priorities on pedestrian comfort. This is for use on streets, but not transport interchanges, or where walking is highly managed.

The required amount of space is determined relative to the number of people using or predicted to use the footpath. The standards are set at levels that ensure enough space is provided for everyone including (but not limited to): people with disability, older people whose mobility may be impacted as a result of ageing, people who sustain a temporary injury that limits their mobility, families with young children and people using prams and people walking dogs.

Healthy Streets Qualitative Assessment

The Healthy Streets approach is a human-centred framework for embedding public health in transport, public realm and planning and is gradually becoming incorporated into more and more local government policies and spreading to other states.

The approach is based on ten evidence-based Healthy Streets indicators, each describing an aspect of the human experience of being on streets. The ten indicators must be prioritised and balanced to improve social, economic and environmental sustainability through how streets are designed and managed.

The approach can be applied to any streets, anywhere in the world. It builds improvements on existing conditions rather than seeking a fixed end goal. Taking this approach requires incremental changes in all aspects of the decision-making processes related to streets and transport.

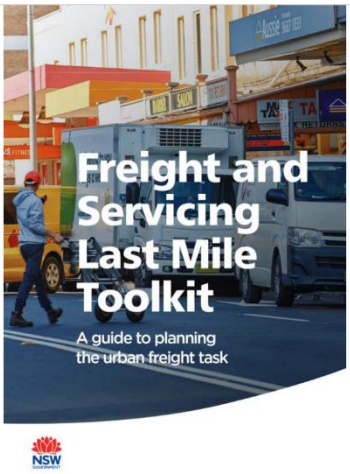
Cycleway Design Toolbox

The Cycleway Design Toolbox provides guidance for practitioners on desired outcomes for cycling and other forms of micromobility in NSW in the context of New South Wales and Greater Sydney. Based on an integrated approach to planning, the design principles and recommendations outlined in the Toolbox aim to address both the movement function and place intensity of the location.

This Toolbox provides practitioners with a range of design tools, being a comprehensive suite of best practice designs across a range of typical on- and off-road environments that can be tailored to their specific environment. It can be used to justify the planning, design and delivery of high-quality cycling infrastructure by demonstrating the positive impact on level of service for people cycling.

There are five internationally recognised design principles that cycling-friendly infrastructure needs to meet: safe, connected, direct, attractive, and comfortable.

Freight and Servicing Last Mile Toolkit

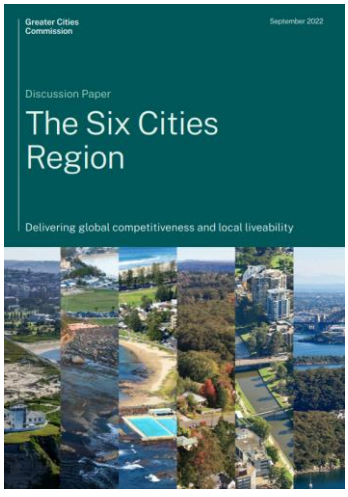


The Last Mile Toolkit has been developed by Transport for NSW to support the NSW Freight and Ports Plan 2018–2023 and to assist urban planners, developers and government to give greater consideration to freight and servicing demands for new buildings and precincts as part of the planning process. It also promotes better management of freight and servicing for existing buildings.

The toolkit includes guiding principles, measurement and forecasting tools, design and management solutions and future approaches.

The Toolkit sets out five key guiding principles for planning freight and servicing activity in urban centres with high-density land uses, including 1) Promoting self-sufficient buildings and precincts 2) Enabling place-making objectives 3) Balancing amenity, transport and building efficiency 4) Delivering economic, social and environmental benefits and 5) Commercial activity and derived demands.

The Six Cities Region



The Six Cities Region Discussion Paper was released in September 2022 by the Greater Cities Commission. The paper aims to stimulate conversation about the best way to plan a Six Cities Region that benefits people and captures global economic opportunities as they develop the Six Cities Region Plan. The discussion paper is not government policy, but started conversations with many stakeholders including First Nations peoples and community.

The paper explores the idea of creating a six-city region in the south eastern part of the country, consisting of the largest cities in that region. The six cities are shown in Figure 2–5 and are designated as 1) Lower Hunter and Greater Newcastle City 2) Central Coast City 3) Illawarra-Shoalhaven City 4) Western Parkland City 5) Central River City and 6) Eastern Harbour City.

The paper outlines several potential benefits of a six-city region, including increased economic opportunities, improved access to services and amenities, and reduced environmental impacts. The paper also identifies several potential challenges, including the need for strong regional leadership, effective communication, and equitable distribution of resources.

To address these challenges, the paper proposes several policy recommendations, such as the establishment of a regional governing body, the development of a regional transportation plan, and the creation of a regional economic development strategy. The paper also suggests engaging stakeholders from all sectors to ensure that the policies are inclusive and equitable.

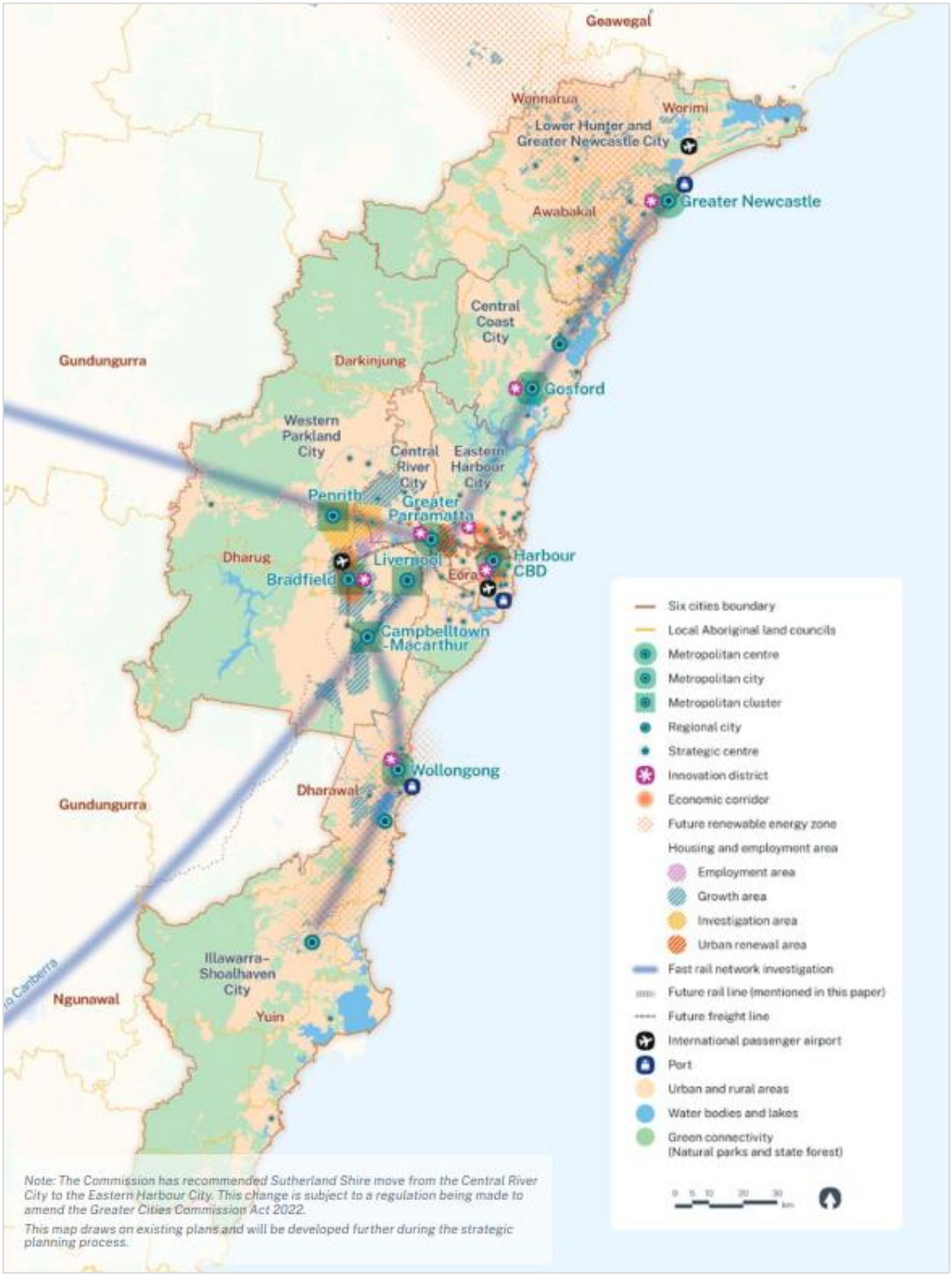


Figure 2–5: The Six Cities Region (Source: Greater Cities Commission)

3. Existing Transport Context

3.1 Study area

The Broadmeadow investigation area covers approximately 313ha of land within the Newcastle local government area. It is centred around Newcastle's sports and entertainment precinct as a primary focus. Broadmeadow is essential in developing Newcastle into a nationally significant residential, sports, and entertainment precinct. Broadmeadow can accommodate various uses, including affordable and diverse housing options, and support the region's growth.

Figure 3–1 below illustrates the Study Area, which forms the subject of traffic and transport analysis undertaken for purposes of this study.

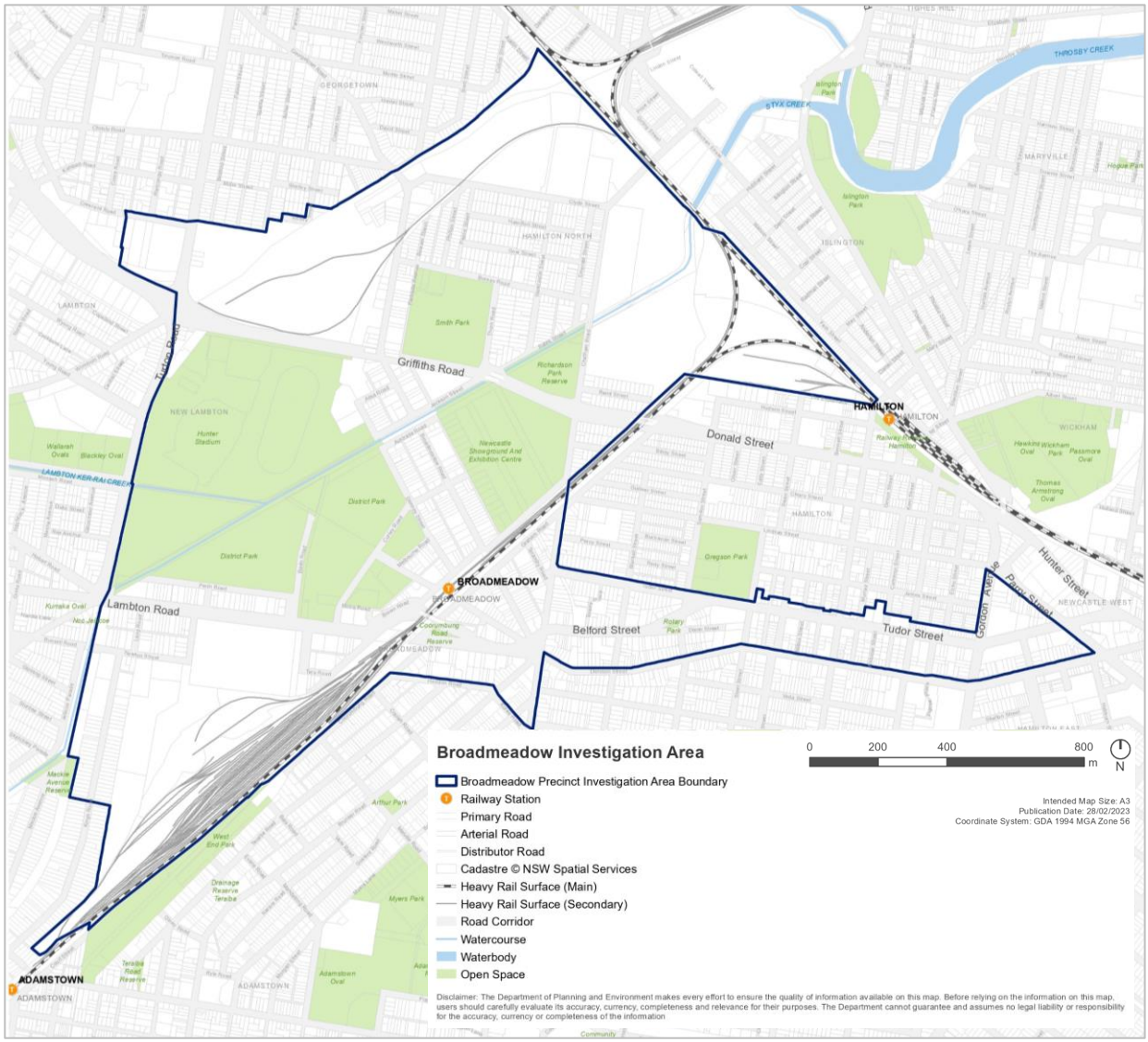


Figure 3–1: Study Area (Source: DPHI)

3.2 Understanding Place

There are a number of key places within the precinct, which will be further discussed throughout the report, including:

- Broadmeadow Train Station – a major transport interchange in NSW for regional rail and inter-city services and a key connection to Newcastle CBD.
- Hunter Park – the Broadmeadow Sports Precinct, including McDonald Jones Stadium, Newcastle Showground and Exhibition Centre.
- Styx Creek – although not a wide or large running body of water, it still poses itself as a transportation obstacle for future potential works.
- Locomotive Depot – a large government owned site in the southwest of the study area.

3.2.1 Demographics and Land Use

Population and Employment

SMEC analysed land use data within the relevant Bureau of Transport Statistics (BTS) travel zone system in the study area catchment.

The study area includes the following eight Travel Zones, which are illustrated in Figure 3–2.

- 6313 – Hamilton North
- 6314 – Broadmeadow Station West
- 6389 – Waratah
- 6388 – Georgetown
- 6325 – New Lambton
- 6316 – Broadmeadow Station East
- 6315 – Hamilton Station South
- 6317 – Hamilton East

Figure 3–2: Travel Zones in Vicinity of Study Area (Source: TfNSW Travel Zone Explorer Website)

Table 3–1 shows the population and employment forecasts in the study area catchment between the years 2016 and 2041, based on the above travel zones (Travel Zone Projections 2022 – TZP22), while Table 3–2 shows the percentage growth in population and employment.

Table 3–1: Population and Employment Forecasts for Travel Zones within Study Area (Source: TfNSW)

Year	Population	Employment
2016	17,988	17,605
2021	18,214	19,121
2026	18,195	22,081
2031	18,388	22,809
2036	18,583	24,842
2041	18,784	26,807

Table 3–2: Population and Employment Annual Growth Rates

Period	Annual growth rates (linear method)	
	Population	Employment
2016 to 2021	1.3%	8.6%
2021 to 2026	-0.1%	15.5%
2026 to 2031	1.1%	3.3%
2031 to 2036	1.1%	8.9%
2036 to 2041	1.1%	7.9%

The annual growth rates suggest that population will reduce marginally by 0.1% per annum between 2021 and 2026, after which there will be slow, but steady growth of around 1.1% per annum till 2041. Employment on the other hand is forecast to grow significantly at 15.5% per annum between 2021 and 2026 and will continue to grow at between 3.3% - 8.9% per annum thereafter.

Retail and Commercial

Broadmeadow precinct boasts a diverse mix of retail and commercial spaces. Over 30,000 square meters of retail space caters to various needs, with the Broadmeadow Shopping Centre being the largest single entity. Tudor Street and Nine Ways offer a concentrated selection of shops, while the nearby Beaumont Street is a popular retail destination. Notably, the retail vacancy rate throughout Broadmeadow is very low.

On the commercial side, the precinct offers approximately 40,000 square meters of floor space. The area features high-rise office buildings, like the Greater Bank building, along Tudor Street, complemented by low-rise buildings with larger floorplates found along Lambton Road. The commercial sector attracts businesses serving the local population, such as real estate agencies and medical practices, as well as those seeking more affordable options compared to the city centre's pricing, which is typically 50% higher.

Outside the Broadmeadow precinct, there is the Westfield Kotara Shopping Centre, located approximately 5km to the southwest. The Westfield Kotara is the largest shopping centre in the region and has over 230 stores.

Industrial

The Broadmeadow precinct offers a significant industrial presence, encompassing 106 hectares of land dedicated to this purpose. While approximately 16ha are currently vacant (with an 8ha site recently purchased) the area still has around 144,000 square meters of industrial floor space. The existing buildings are primarily older-style facilities, including warehouses and custom-built structures. Notably, the UGL site contributes a substantial 14ha to the industrial land in the area.

Historically, the Broadmeadow industrial market has enjoyed strong performance. Several long-term factors continue to drive demand from both businesses and investors. These factors include the central location, proximity to a dense population base, and good accessibility. The demand is primarily driven by light industrial and urban service businesses, while larger format users typically seek locations with larger buffer zones.

Education

There are a number of primary and secondary schools in and around the Broadmeadow precinct, which are detailed in Table 3–3 below.

Table 3–3: Primary and Secondary Schools within Broadmeadow Precinct and Surrounding Area

Primary Schools		
Adamstown Public School	Hamilton Public School[1]	Hamilton North Public School[1]
Hamilton South Public School	New Lambton South Public School	Waratah Public School
St Therese's Primary School	St Columba's Primary School	
Secondary Schools		
Callaghan College – Waratah campus	Lambton High School	Kotara High School
Newcastle High School	Mereweather High School	St Laurence Flexible Learning Centre[1]
Hunter School of the Performing Arts[12]	St Francis Xavier's College	St Philip's Christian School
St Pius X High School	Callaghan College – Braye Park Campus	Callaghan College – Jesmond Campus

1 School is within the study area boundary
2 Hunter School of the Performing Arts is K-12

Greater Newcastle also has a variety of tertiary education options, including The University of Newcastle and TAFE NSW.

Recreation

The Broadmeadow precinct and its nearby suburbs are home to a range of parklands, including Lambton Park and Blackbutt Reserve. Lambton Park is a large, well-maintained park located adjacent to Broadmeadow. The park features a playground, swimming pool, picnic areas, barbecue facilities, walking paths, and a variety of sporting facilities, including tennis courts, basketball courts, and a skate park. Similarly, Blackbutt Reserve is a parkland which features walking trails, picnic areas and barbecue facilities.

Inside the precinct, there are a range of parks and recreational spaces, including Richardson Park, Smith Park and most prominently Hunter Park. The parks offer a variety of amenities, including playgrounds, picnic areas, barbecue facilities and walking paths. Hunter Park is home to the McDonald Jones Stadium, the Newcastle Entertainment Centre and Newcastle Showground, while also including other surrounding facilities such as the Newcastle International Paceway, Newcastle Indoor Basketball Centre, Newcastle District Tennis Centre, and Newcastle International Hockey Centre.

The stadium can accommodate up to 33,000 spectators and features state-of-the-art facilities, including corporate hospitality suites. Likewise, the Newcastle Entertainment Centre hosts a range of concerts, sporting events and shows throughout the year, while the Newcastle Showground hosts the Newcastle City Farmers Markets and the Newcastle Show attracting visitors from across the region. This sport and recreation hub is a major catalyst for Newcastle to prove itself on the world stage in terms of becoming a leader in hosting major international sports and recreational events.

Figure 3–3 below illustrates the key place attractors within and surrounding the Broadmeadow precinct. These key attractors and places influence existing travel patterns to/ from and within the study area, which are discussed further in Section 3.2.2 below.

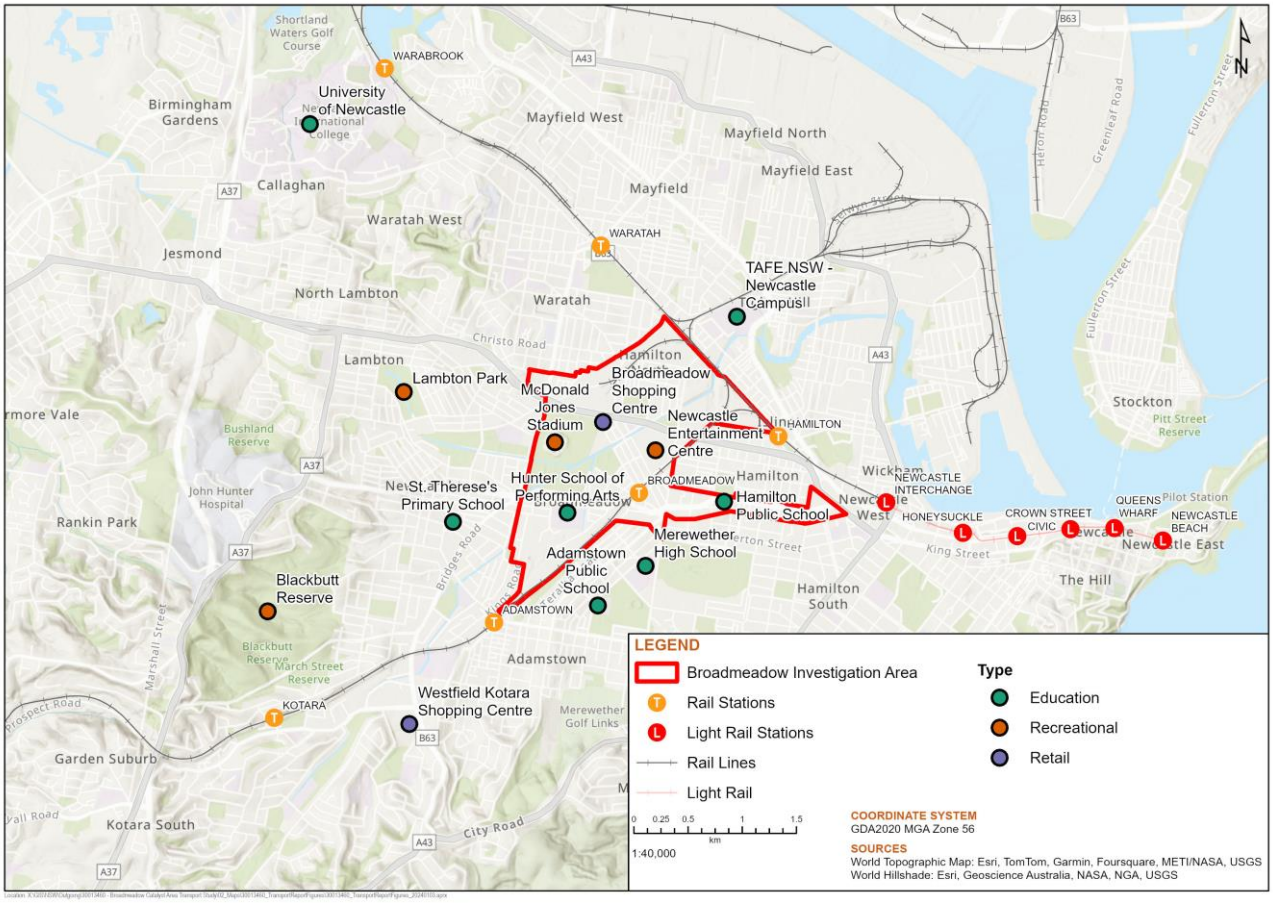


Figure 3–3: Key Place Attractors within and Surrounding Study Area

3.2.2 Existing Travel Patterns

To understand existing travel patterns around and within Broadmeadow Precinct, assessment was carried out using information from the Sydney Strategic Travel Model (STM) provided by Transport for New South Wales (TfNSW), which includes Newcastle and Illawarra. The STM outputs allow analysis to be undertaken to understand where trips are travelling to and from the Broadmeadow Precinct. The STM information also provides insights into the distance travelled by people making trips to and from the Broadmeadow Precinct.

STM outputs received cover a 24-hour period for car demand in vehicle trips. The 24-hour period is split into four separate periods: AM peak period (7am-9am), Interpeak period (9am-3pm), PM peak period (3pm-6pm) and the evening period (6pm-7am). Other than car demand, public transport demand (bus and rail) were also provided for the AM peak period (2 hours). It is understood that active transport and walk only trips are currently unavailable from the STM.

Trip Distribution

Trip information from the STM was aggregated and categorised into directions of travel for both inbound and outbound trips. Trips travelling inbound to the Broadmeadow Precinct from different directions are shown in Figure 3–4, while trips travelling out of the Broadmeadow Precinct in different directions are shown in Figure 3–5. Outputs from the STM were analysed for car demand for the AM peak, PM peak and daily periods, while analysis was undertaken for public transport trips during the AM peak period only, as STM outputs are unavailable for other periods.

Based on the information presented in Figure 3–4 and Figure 3–5, car trips travelling into and out of the Broadmeadow Precinct during peak periods mainly originate from and travel to the southern and eastern areas, ranging from between 24% and 36%. This is consistent with the level of development within the Greater Newcastle region, where the majority of developed areas are currently located south of Broadmeadow and in the Newcastle CBD. This is followed by areas to the west, contributing approximately 25% of car trips into and out of Broadmeadow,

and to the north with approximately 14% of car trips. Similar travel distribution patterns can also be observed in the total number of car trips for a typical day.

For public transport trips, the highest number of trips travelling into the Broadmeadow Precinct during the AM peak originate from the western areas, reflecting existing population centres in the west. In regard to public transport trips travelling out of the Broadmeadow Precinct, 42% of trips head towards areas south of Broadmeadow, which is likely to be a reflection of people using the train to travel to employment centres located in the south.

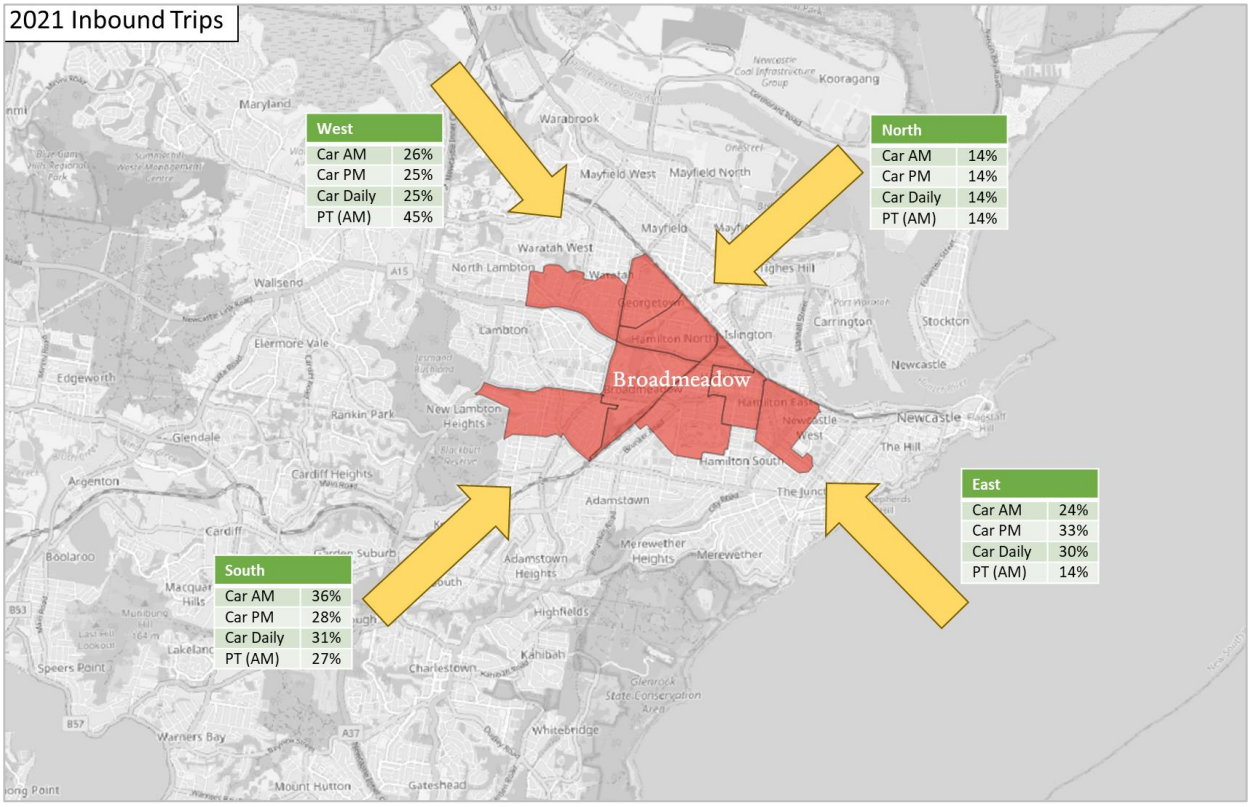


Figure 3–4: Percentage of trips travelling to Broadmeadow Precinct from different directions

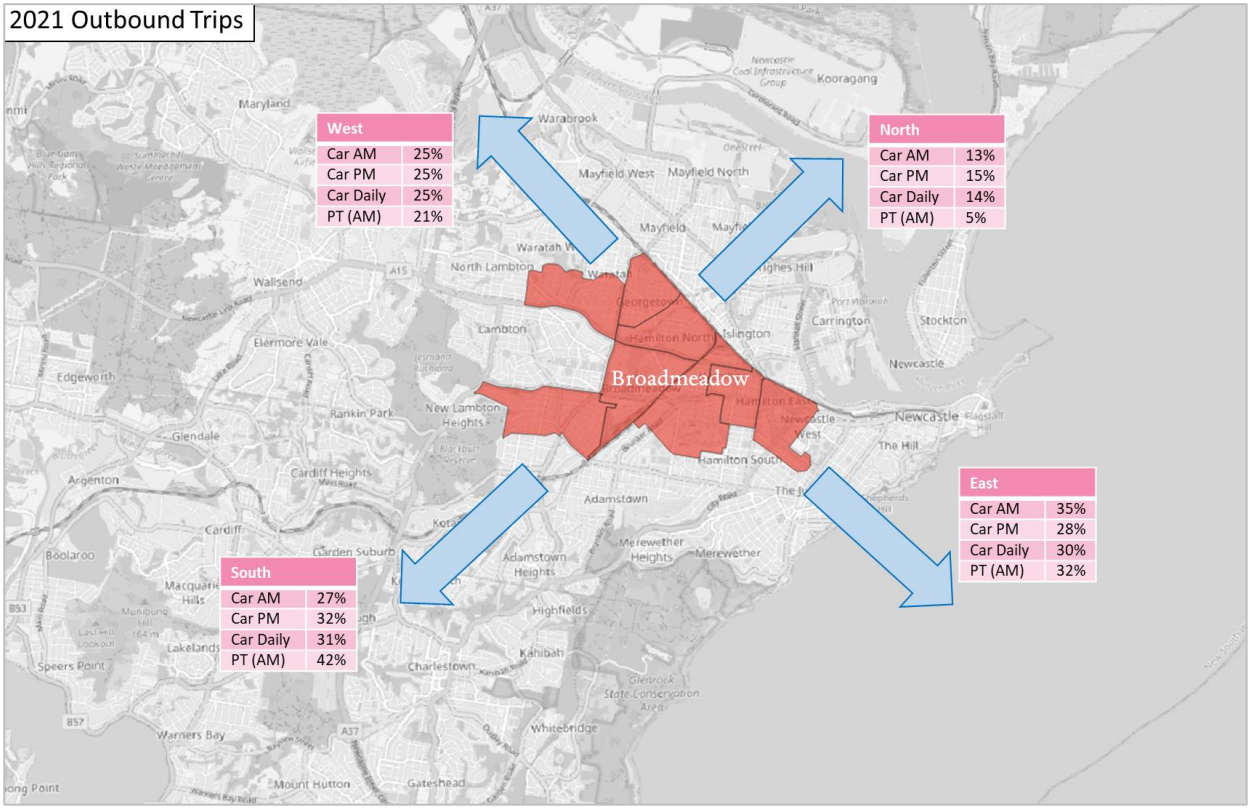


Figure 3–5: Percentage of trips travelling from Broadmeadow Precinct to surrounding areas

Analysis was also carried out to understand the percentage of trips that are local to the Broadmeadow Precinct, i.e. trips that originate and end within the Broadmeadow Precinct. Figure 3–6 summarises the percentages of internal-internal trips and external-internal trips. The analysis shows that for car trips, the AM peak, PM peak and daily percentages are very similar, with approximately 10% of trips being local to the Broadmeadow Precinct. It should be noted that the trips included in the analysis exclude those that only pass through the Broadmeadow Precinct, which are trips that neither originate nor end in Broadmeadow.

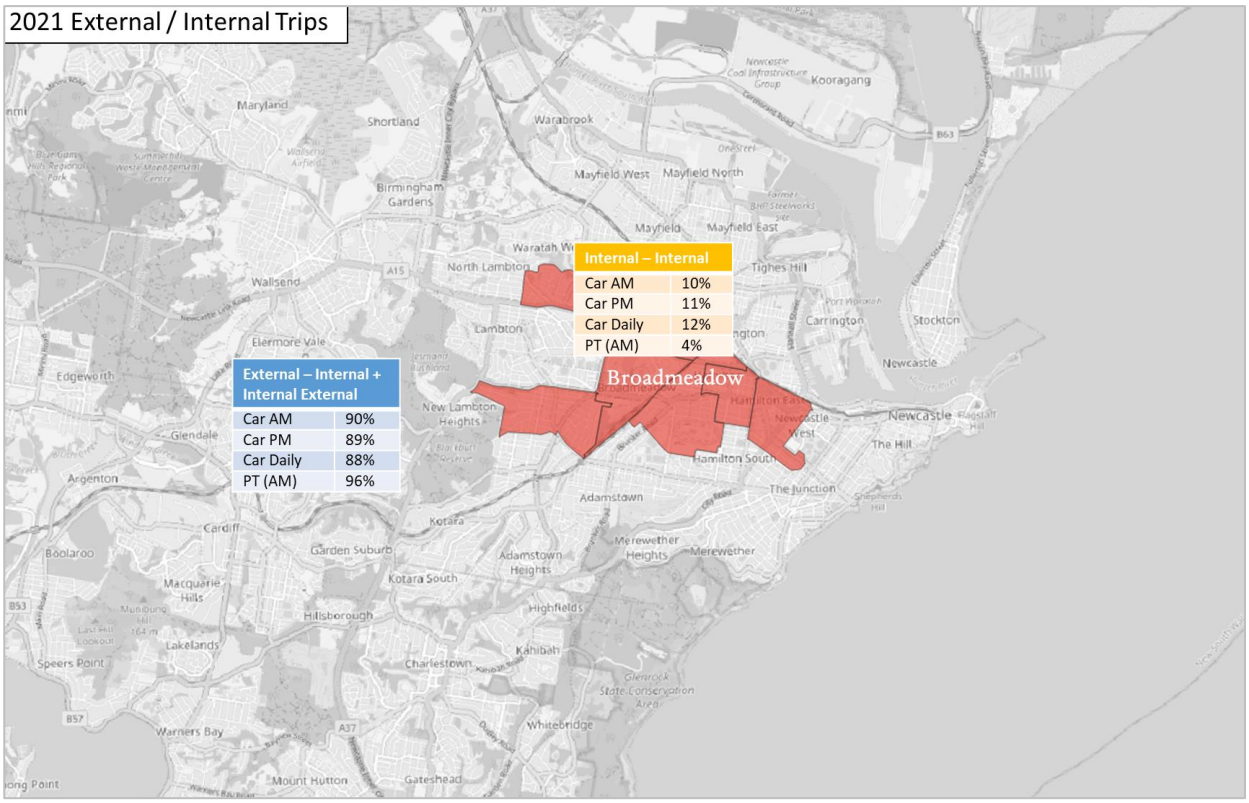


Figure 3–6: Percentage of trips travelling within Broadmeadow Precinct versus percentage of trips travelling to and from outside Broadmea dow Precinct

Trip Lengths

The STM outputs were analysed to understand the range of distances travelled to and from Broadmeadow, which are shown in Figure 3–7 and Figure 3–8 respectively. It can be seen that the majority of car trips originate and end within 10 km of Broadmeadow. Approximately 40% to 50% of car trips originate within 5 km of Broadmeadow with approximately 31% originating within 5 km to 10 km of Broadmeadow. For outbound trips, approximately 55% of trips will end within 5 km of Broadmeadow during the AM peak with a further 30% of trips ending between 5 km to 10 km from Broadmeadow. During the PM peak, approximately 46% of car trips end 5 km from Broadmeadow with a further 29% ending within 5 km to 10 km.

For public transport trips, there are high percentages of trips originating from and ending 100 km away from Broadmeadow – approximately 27% for inbound trips and 28% for outbound trips. This is a reflection of travel by train on the Central Coast and Newcastle (CCN) line, as well as due to the small number of total public transport trips travelling to (738 person trips) and from (368 person trips) Broadmeadow, which results in a high percentage, even though the number of trips is relatively low (203 person trips travelling inbound and 105 person trips travelling outbound).

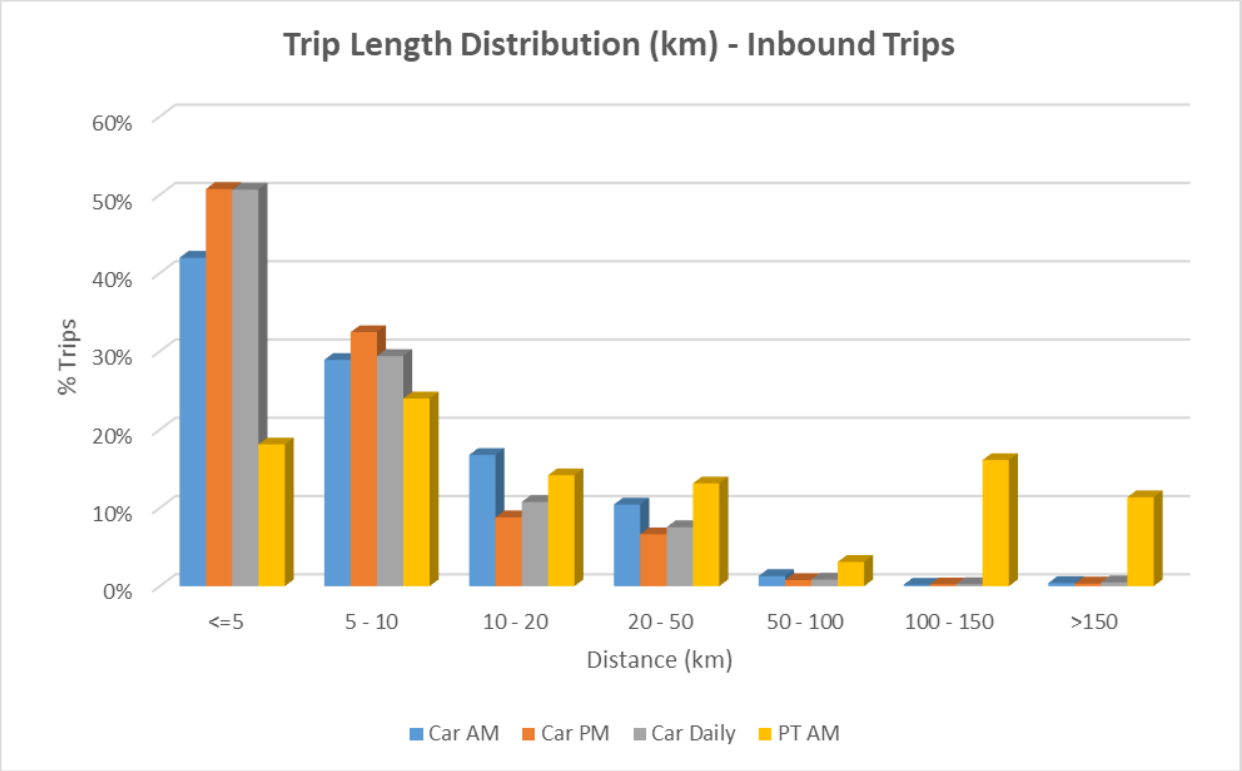


Figure 3–7: Percentage of trips travelling to Broadmeadow Precinct from surrounding areas

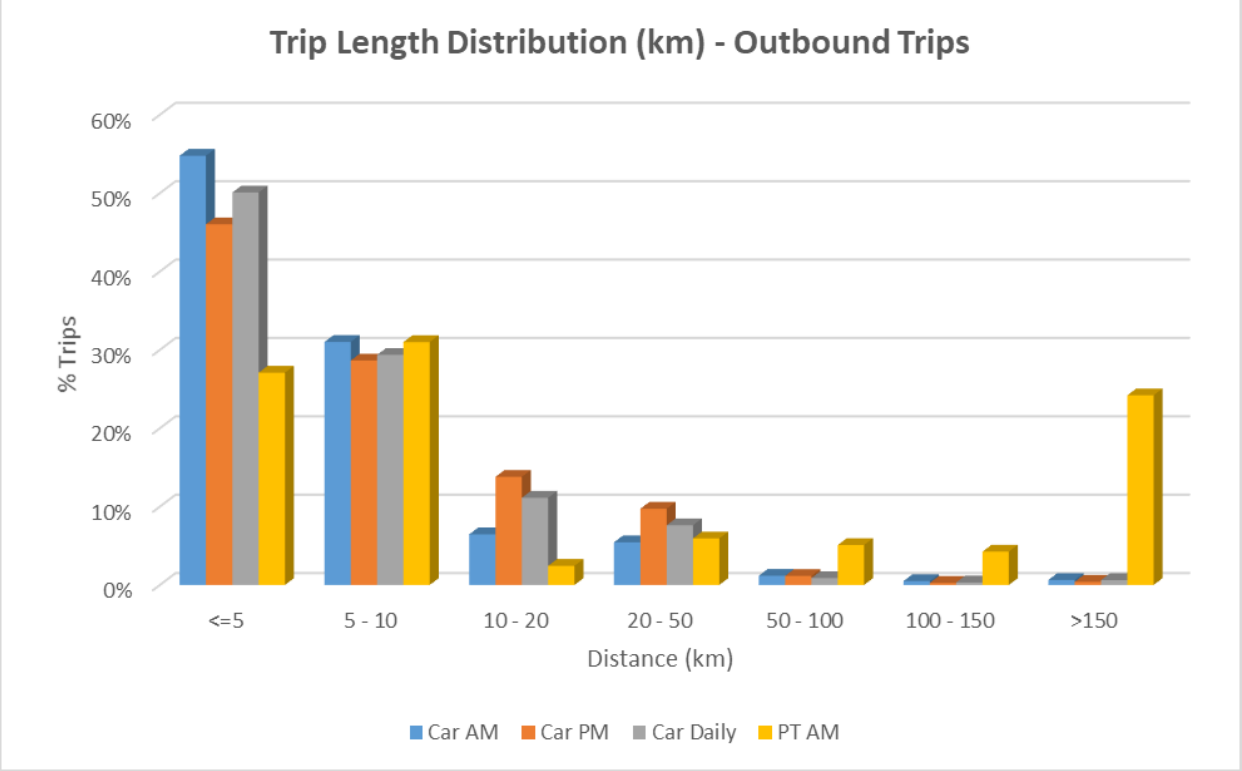


Figure 3–8: Percentage of trips travelling from Broadmeadow Precinct to surrounding areas

3.2.3 Mode Share

The BTS provides Journey to Work (JTW) data collected during the 2016 and 2021 Census' for travel zones relevant to the study area. Table 3–4 provides the number and proportion of trips for each mode traveling to and from the travel zones assessed for both 2016 and 2021, while Figure 3–9 and Figure 3–10 present the 2021 census information graphically for workers travelling to and from the study area, respectively.

Table 3–4: Daily Travel Mode Split in Study Area (Journey to Work Data)

Travel mode	2016 Census				2021 Census			
	Study area[1] as a place of residence		Study area[1] as a place of work		Study area[1] as a place of residence		Study area[1] as a place of work	
	Number of Trips	%	Number of Trips	%	Number of Trips	%	Number of Trips	%
Bicycle	102	3%	193	2%	98	2%	167	1%
Bus	237	4%	222	2%	99	2%	142	1%
Car, as driver	3,527	63%	8,711	74%	2912	46%	6,837	49%
Car, as passenger	260	5%	466	4%	167	3%	326	2%
Did not go to work	622	11%	1,255	11%	949	15%	1,945	14%
Motorbike/ scooter	57	1%	104	<1%	38	1%	69	<1%
Other	18	<1%	25	<1%	27	<1%	28	<1%
Train	102	2%	169	<1%	29	<1%	73	<1%
Walked only	326	6%	341	3%	257	4%	280	2%
Worked at home	256	5%	266	2%	1,733	27%	4,194	30%
Total	**5,586**		**11,755**		**6,309**		**14,069**	

[1] SA2 Zone "Hamilton – Broadmeadow" used for purposes of analysis

According to the 2016 and 2021 journey to work census data, there have been significant changes in the mode split of people travelling to work during this time.

The 2016 census data suggests that the most common mode of transport for commuting to/ from the study area was by car, with 78% of trips to the study area being by car (as driver, or passenger), while 68% of trips from the study area were by car (as driver, or passenger). This is followed by active transport (walked only and bicycle) representing 5% of trips to the study area, with 9% of trips by active transport from the study area. Trips by public transport (bus and train) represent around 3% of trips to the study area, while 6% of trips were by public transport from the study area.

The 2021 census data however indicates a noticeable shift in commuting patterns. The percentage of workers travelling by car (as driver, or passenger) to the study area decreased to just 51%, while the percentage of workers travelling by car (as driver, or passenger) from the study area decreased to 49%. The use of active and public transport also fell.

The 2021 census data indicates a significant increase in people working from home ranging from a maximum of 5% in 2016 compared to a maximum of 30% in 2021. While car remains the most common mode of transport, the rise of remote work and slight decreases in other modes of transport suggests a shift towards more flexible and sustainable work and transportation practices.

COVID-19 undoubtedly played a key role in these changes, as many companies were forced to adopt remote work policies to prevent the spread of the virus. The census data suggests that these changes may have a lasting impact on commuting patterns, however a degree of caution is required when drawing conclusions from the 2021 census data.

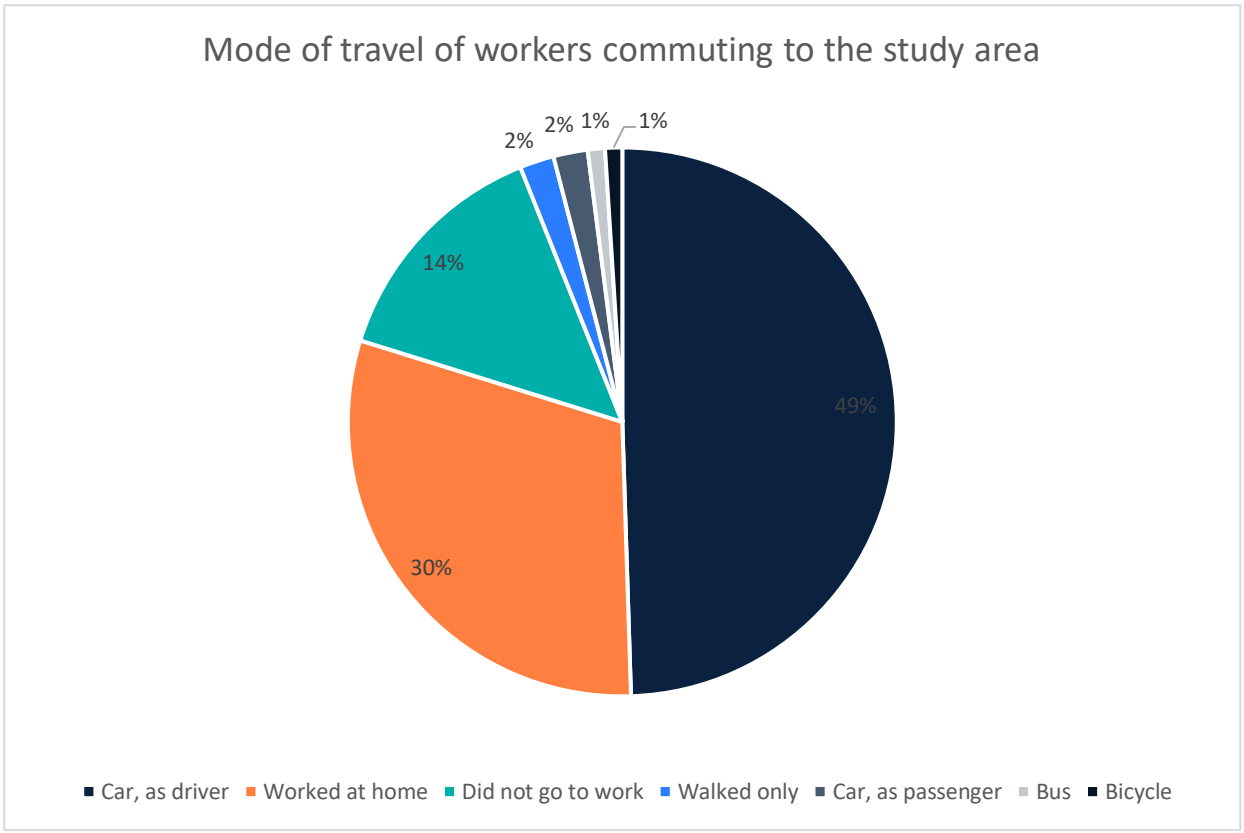


Figure 3–9: Mode of Travel for Zones as a Destination

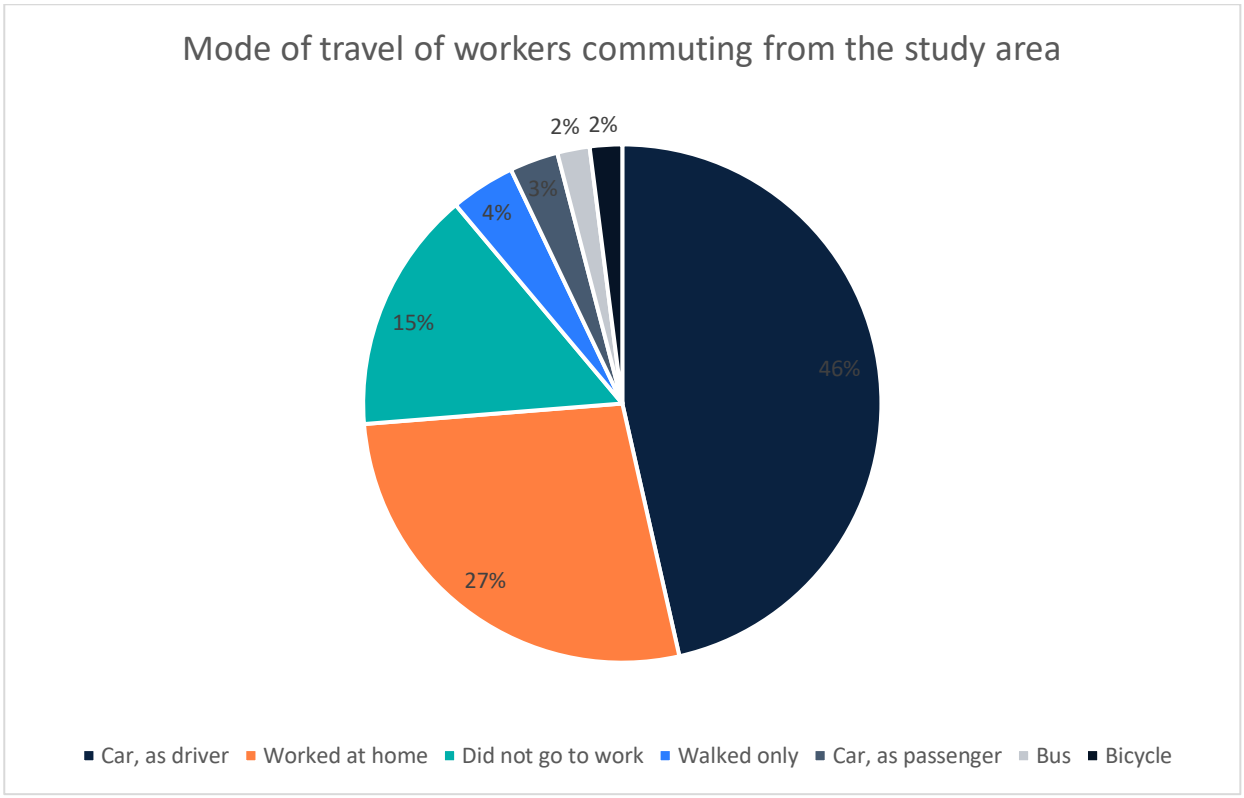


Figure 3–10: Mode of Travel for Zones as an Origin

In summary, the census data indicates that private vehicle trips are the dominant mode of transport to and from the study area with travel by others modes being fairly limited and having recently reduced further perhaps due to COVID-19, which may have resulted in a reluctance to use public transport.

3.3 Understanding Movement

This section of the report focusses on understanding movement relating to the transport network within the study area, including the road network, public transport network, as well as active transport networks, while Section 1 provides an understanding of the current performance of the transport network.

3.3.1 Road Network

The existing road network in the vicinity of Broadmeadow features the key road corridors of Griffiths Road, Turton Road and Lambton Road. Figure 3–11 below shows the road hierarchy of the aforementioned key road corridors in the study area and their locality to Broadmeadow Station.

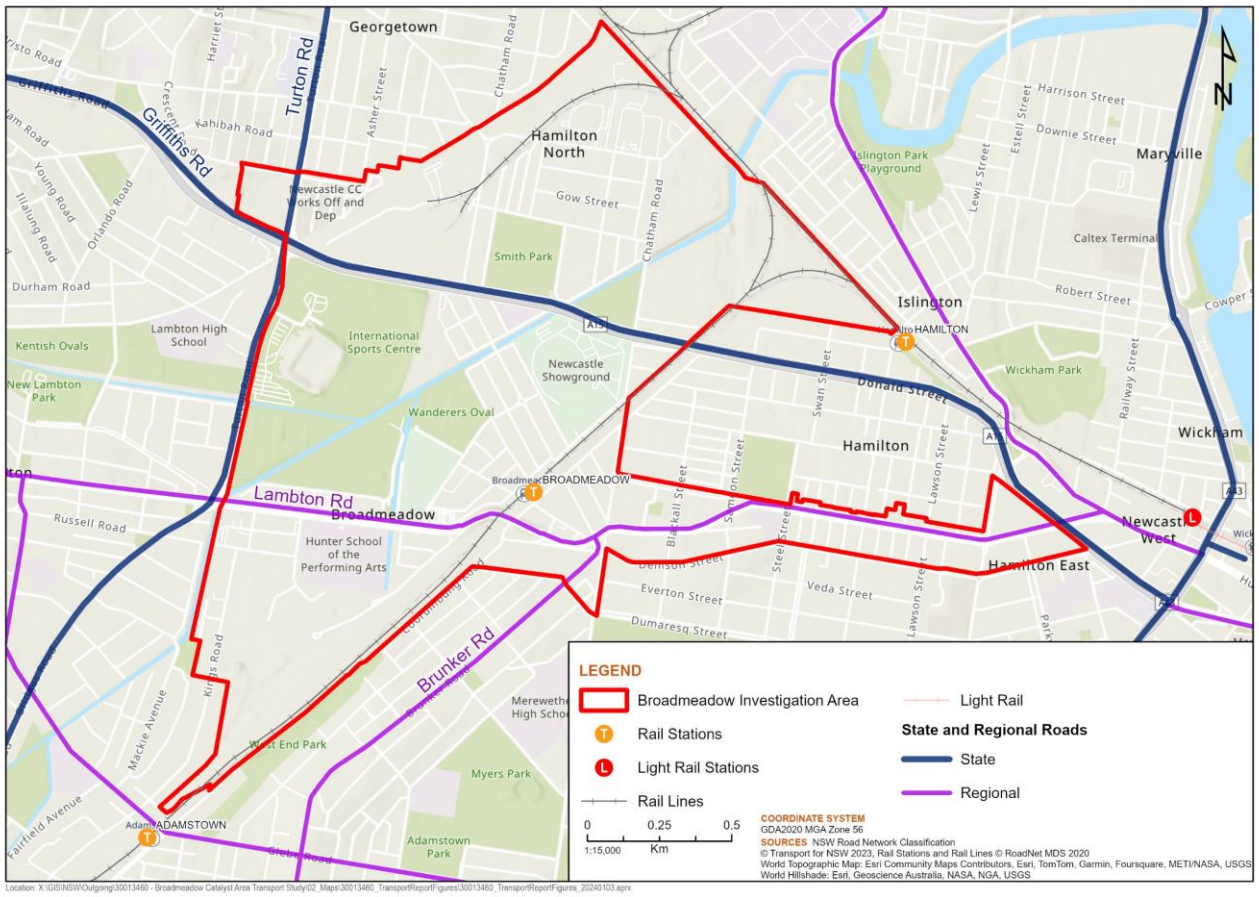


Figure 3–11: Key Road Corridors

Griffiths Road

Griffiths Road is a State classified Road, which serves as a crucial link between Newcastle CBD and major suburbs, such as Hamilton and Jesmond, as well as to the inner-city bypass. It connects to the motorway network, namely the M1 Motorway, and beyond to the M15/ A15 to Tamworth.

Griffiths Road caters to various types of traffic, including private and commercial vehicles, public transport services and B-doubles (official route). The road features multiple lanes in each direction and dedicated turning lanes, however it is important to note that not all intersections have dedicated turning lanes. While pedestrian access is provided by footpaths along the corridor, there are multiple sections without pedestrian facilities. Similarly, cycleways have a limited presence, mainly starting to the east of the Showground along Griffiths Road.

Within the precinct, major intersections include Griffiths Road/ Turton Road and Griffiths Road/ Broadmeadow Road, allowing commuters to travel North/ South.

Turton Road

Turton Road is a State road that provides a key link between Griffiths Road and Lambton Road in a north/ south direction. Turton Road connects several surrounding suburbs, including Kotara (road changes to Bridges Road) and Georgetown. Turton Road allows commuters to access McDonald Jones Stadium as a major place attractor, whilst also intersecting with Griffiths, Young and Lambton Roads.

Turton Road features two to three traffic lanes in each direction, and turning lanes are provided at major intersections to improve traffic flow. The R4 off-road shared cycle path runs along the east side of Turton Road, while a pedestrian footpath is provided on the west side of the road. Pedestrian crossings are provided at signalised intersections and a cycle/ pedestrian crossing is provided a short distance north of the Turton Road/ Monash Road intersection where the R4 and R5 cycle routes intersect (refer to).

Turton Road also hosts three bus routes, often used by commuters travelling to Hunter Park, including the 27, 138 and 266, highlighting the multimodal nature of Turton Road, which also features active transport facilities as referred above.

Lambton Road

Lambton Road is a Regional road, which is an important arterial road that connects the Newcastle CBD with several surrounding suburbs, including Lambton and Jesmond, as well as with the John Hunter Hospital. It is a major thoroughfare for both private vehicles, commercial vehicles, as well as for public transport, notably being a high-frequency bus route.

Lambton Road is also the main connector to Broadmeadow Station for multimodal commuters. Within the vicinity of Broadmeadow Station is Nine Ways, where Lambton Road intersects with (among others) Young Road and Belford Street, allowing for commuters to reach the Station or head North, South, East or West (noting that not all directions have right-turning options).

Footpaths are provided on both sides of Lambton Road, while pedestrian crossings are provided at major intersections, as well as outside the Hunter School of Performing Arts.

3.3.2 Public Transport Network

Rail Network

Broadmeadow Station is located in the centre of the study area and is served by the Central Coast and Newcastle (CCN) line, North Coast NSW line and the North Western line. Broadmeadow acts as a major interchange for regional rail services, specifically for trips to/ from Brisbane, Casino, Grafton and Armidale.

Table 3–5 provides route description and service frequency information, while Figure 3–12 shows the rail network including train stations in the vicinity of the study area.

Table 3–5: Rail Services Serving Broadmeadow Station

Rail Line	Route Description	Peak Weekday	Midday Trips (Weekday)	Midday Trips (Weekend)
CCN	Newcastle to Central via Strathfield or Gordon	Hourly (Express) Hourly (All Stopping)	Hourly (Express) Hourly (All Stopping)	Two Hourly (Express) Two Hourly (All Stopping)
	Central to Newcastle via Strathfield or Gordon	Hourly (Express) Hourly (All Stopping)	Hourly (Express) Hourly (All Stopping)	Two Hourly (Express) Two Hourly (All Stopping)
North Coast NSW	Central to Brisbane via Casino and Grafton	Once Daily		
	Brisbane to Central via Casino and Grafton	Once Daily		
North Western NSW	Central to Armidale via Tamworth	Once Daily		
	Armidale to Central via Tamworth	Once Daily		

There are bus stands located on Graham Road on the east side of the station allowing transfer between rail and intercity coaches, as well as local bus services.

Broadmeadow Station facilities include a commuter car park, wheelchair accessible car spaces, kiss and ride stopping area, taxi rank, bike racks, wheelchair accessible toilets, information point, departure indicator screen, and opal card top up or single trip ticket machine (Cash or Card Payment).

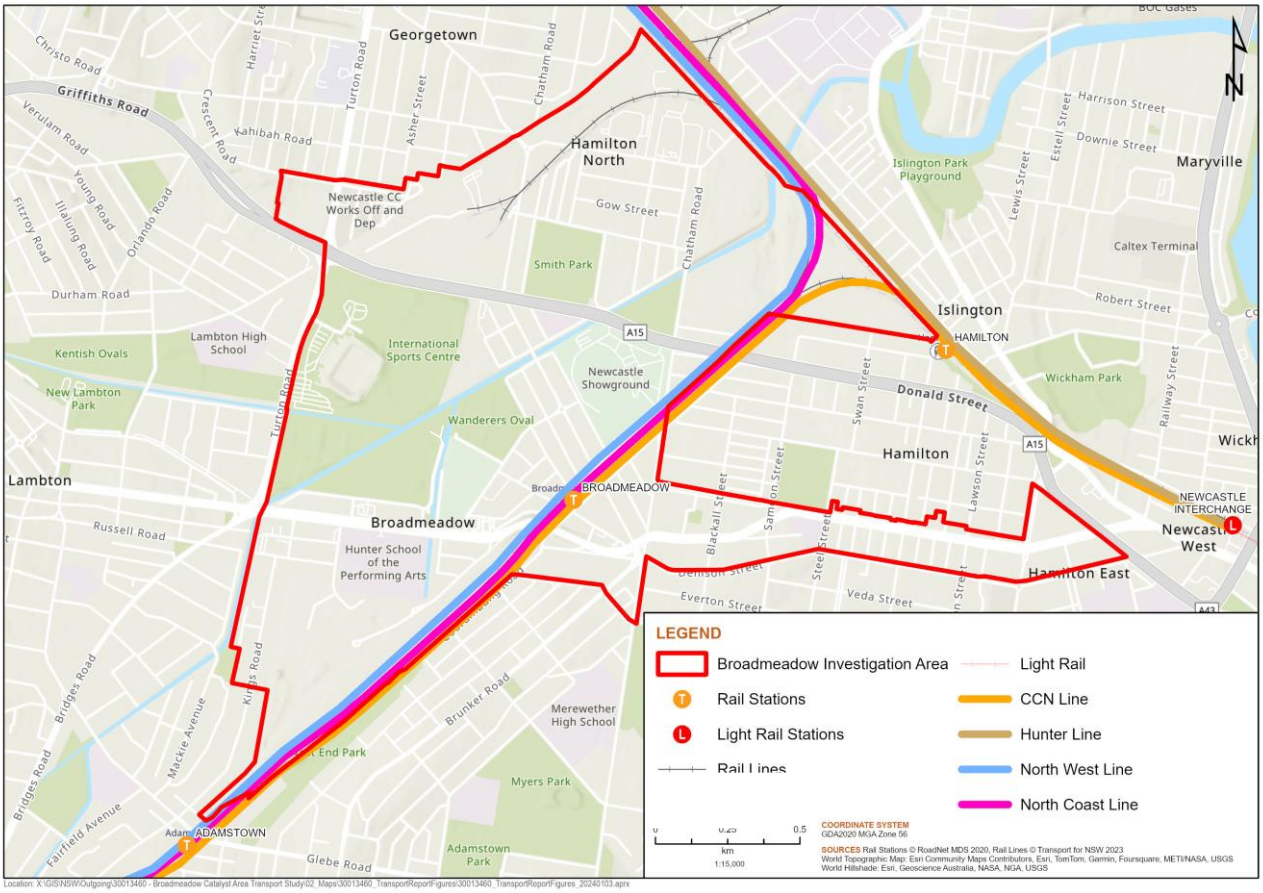


Figure 3–12: Rail Network and Stations in Vicinity of Study Area

Bus Network

A review of public bus services indicates that the study area is well connected by bus, although the majority of services are fairly infrequent. The most frequent services operate from Maryland to Merewether Beach via Wallsend and Newcastle Interchange (Route No. 12), as well as Glendale to Newcastle via Cardiff and John Hunter Hospital (Route No. 13). Table 3–6 provides a summary of bus services within the study area, including route number, route description and number of trips.

Table 3–6: Bus Routes and Services

Route No.	Route Description [1]	Peak Trips (Weekday)	Midday Trips (Weekday)	Midday Trips (Weekend)
12	Maryland to Merewether Beach via Wallsend and Newcastle Interchange	4 trips	4 trips/hr	2 trips/hr
13	Glendale to Newcastle via Cardiff & John Hunter Hospital	4 trips	4 trips/hr	2 trips/hr
21	Broadmeadow to Newcastle via Merewether	2 trips	1 trip/hr	1 trip/hr
23	Wallsend to Newcastle East via Lambton & Newcastle Interchange	2 trips	1 trip/hr	1 trip/hr
25	Charlestown to Broadmeadow via Kotara	2 trips	1 trip/hr	1 trip/hr
26	Wallsend to Newcastle West via Kotara & Newcastle Interchange	2 trips	1 trip/hr	1 trip/hr

Route No.	Route Description [1]	Peak Trips (Weekday)	Midday Trips (Weekday)	Midday Trips (Weekend)
27	Wallsend to Broadmeadow via Newcastle University	2 trips	1 trip/hr	1 trip/hr
28	Mount Hutton to Newcastle West via Broadmeadow & Newcastle Interchange	2 trips	1 trip/hr	1 trip/hr
138	Newcastle Interchange to Lemon Tree Passage via Airport	1 trip	1 trip/hr	-
266	Newcastle to West Wallsend	1 trip	-	-

[1] All bus routes operate in both directions

Figure 3–13 shows existing bus routes in and around the study area, the thicker lines indicating routes with a higher service frequency. As previously discussed, Lambton Road and Griffiths Road are key corridors in the precinct, providing access to major place attractions throughout Greater Newcastle.

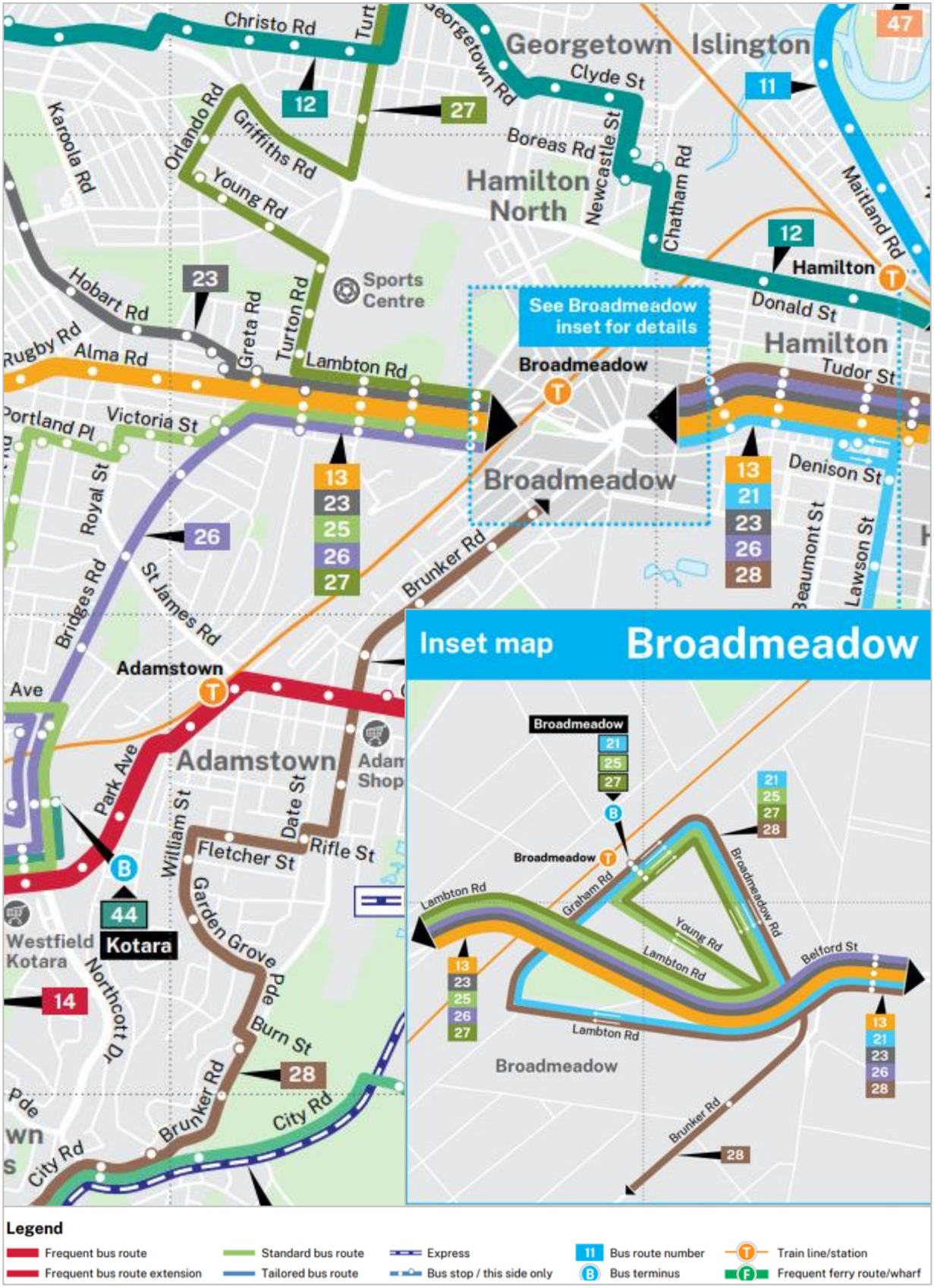


Figure 3–13: Existing Bus Routes in Vicinity of Study Area (Source: TfNSW)

3.3.3 Active Transport Network

Pedestrian Network

The Broadmeadow precinct has a network of footpaths, however there are a number of key constraints that hinder pedestrian accessibility:

- Hunter Park: This area encompasses large government owned sites, including McDonald Jones Stadium, the Exhibition Centre and Newcastle Showground, which creates a significant barrier for pedestrians, especially on event days when crowds and road closures can be expected. Crossing the busy Griffiths Road and Turton Road to access the precinct also present a challenge, due to limited crossing opportunities.
- Styx Creek: The creek runs diagonally through the precinct with limited pedestrian crossing opportunities. As such, it presents a barrier to pedestrians, impacting accessibility through increased journey distances and times.
- Road Corridors: Pedestrians face challenges in crossing key road corridors, including Griffiths Road, Lambton Road and Turton Road, as well as some local roads, including Clyde Street at Hamilton North due to high traffic volumes and limited crossing opportunities. This can make it difficult for pedestrians to move around the area safely and efficiently.
- Rail Corridors: A key feature of the precinct are the rail corridors that run along the eastern and northern perimeters. Pedestrian movements are inhibited within certain parts of the precinct, given the limited number of rail crossings, which include a rail overbridge at Lambton Road and Griffiths Road, an underpass at Broadmeadow Station, as well as a rail level crossing at Clyde Street.

There is currently no direct active transport connection between Broadmeadow Station and Hunter Park (notably McDonald Jones Stadium). The precinct would benefit from a direct connection to encourage travel to events using alternative modes, which should form a central feature of the precinct.

The Knights Centre of Excellence, Wanderers Oval, and the Newcastle International Paceway all restrict active transport connectivity between the above referred key place attractors, which will need to be addressed in the development of a comprehensive network of paths to enhance accessibility and permeability throughout the precinct.

A direct line of sight connection from Broadmeadow Station to the McDonald Jones Stadium, supplemented with a wide pedestrian footpath, lighting and wayfinding signage is required to facilitate smooth transition and increased safety for events. Envisaged is a wide pedestrian and cycle promenade from Broadmeadow Station to the Stadium with a new crossing of Styx Creek.

There are also a number of key roads in the precinct that have no footpaths, or only have footpaths on one side of the road. Examples include Griffiths Road, which has no footpaths along lengthy sections of the road, as well as Curly Road, which has no footpaths. This lack of a comprehensive network of footpaths restricts pedestrian movements and disincentives walking as a viable alternative mode of transport, particularly for short trips within the precinct.

Cycle Network

Figure 3–14 shows existing on-road and off-road cycleways, as well as proposed routes in and around the precinct, as indicated in the City of Newcastle Cycling Plan. Cycle routes vary from low to high difficulty of navigation and comfort/ levels of road safety, are fairly sparse, as well as being disjointed with limited connectivity between key attractors.

Figure 3–14 shows that while there are currently only a limited number of cycle routes in the precinct, many routes are proposed as part of Council's plan for safe and connected cycling in the Newcastle LGA. Council's goal is to have a safe, connected cycling network of principal routes and low stress streets, where riding and walking will be the natural choices for short trips for all members of our community.

A number of regional cycle routes, including the R1, R4 and R5 also run through the precinct, which provide connectivity to destinations beyond the precinct boundary. The R1 runs in an east-west direction immediately to the south of the precinct, the R4 runs in a north-south direction adjacent to Turton Road, while the R5 passes through the centre of the precinct in an east-west direction parallel to Styx Creek, as well as to the south of the Stadium, before crossing Turton Road at a dedicated cycle/ pedestrian crossing. A summary of regional cycle routes, including their route description is provided in Table 3–7.

Existing cycling amenities in the precinct are limited, such as secure cycle parking, bike charging, and other end of trip facilities, such as at Broadmeadow Station and other key attractors. As the precinct is developed, there will be a need

to enhance such facilities and for new development proposals to be supported by green travel plans to ensure appropriate provision of facilities within the precinct.

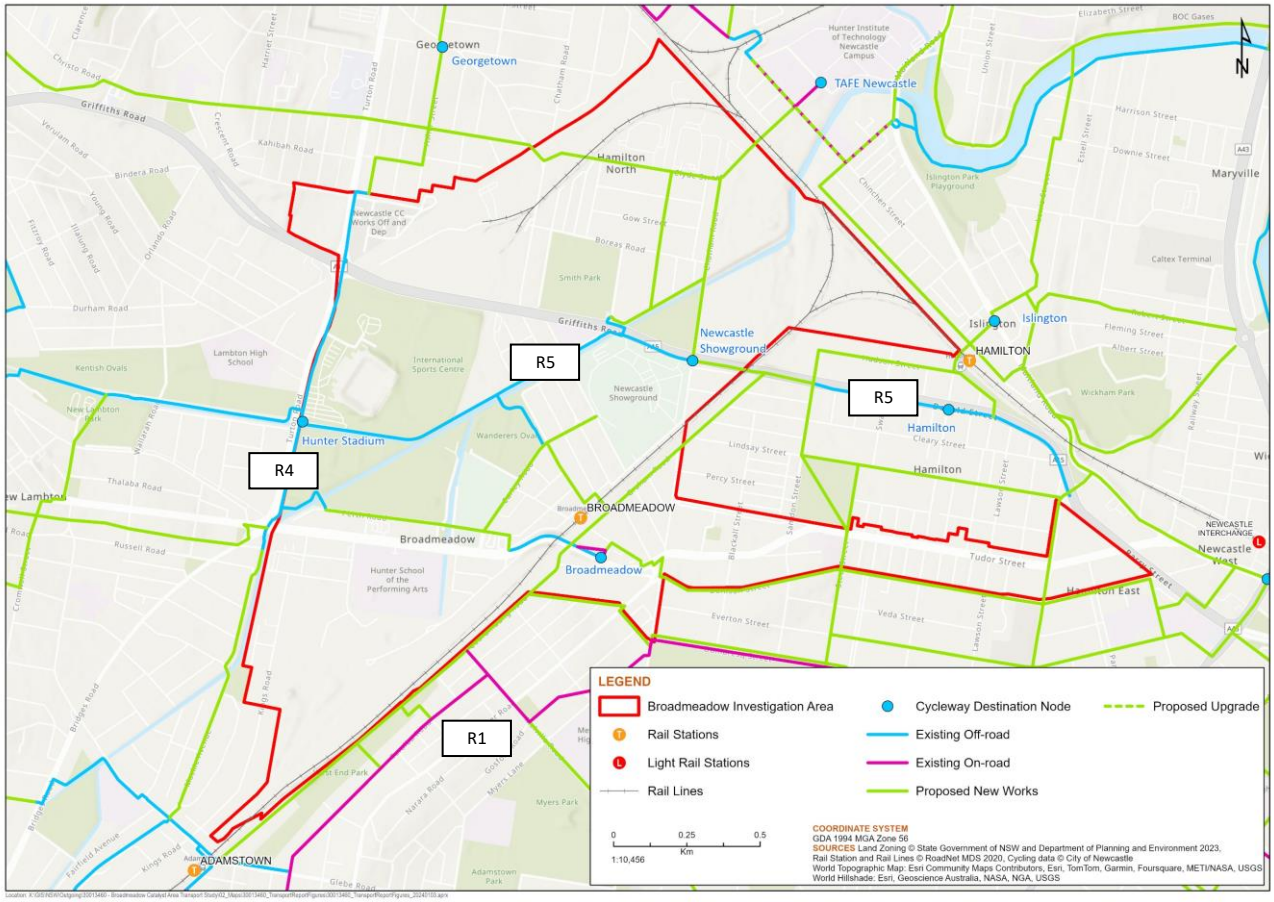


Figure 3–14: Existing and Proposed Cycle Paths (Source: On our bikes 2021-2030; City of Newcastle)

Table 3–7: Regional Cycle Routes

Route	Route Description
R1 – (NSW Coastline Cycleway)Swansea to Newcastle City (via Fernleigh Track) and Newcastle City to Fern Ba	The R1 route is part of the NSW Coastline Cycleway. It extends from the Lake Macquarie LGA, through Newcastle on the Fernleigh Track through Adamstown, Broadmeadow, Hamilton East to Newcastle. The route continues from Stockton through to Fern Bay. Most of the route north and east of Adamstown is on road. Improvements to sections are required. Bike boulevard treatment has been proposed for the section on Corlette Street.
R4 – Mayfield to Warners Bay	This route provides a direct and convenient connection between Lake Macquarie and Newcastle. In the Newcastle LGA, it largely comprises what was known as the North-South cycleway. It is off road on a former colliery railway from Kirkdale Drive in Lake Macquarie to St James Road in New Lambton near the Adamstown railway level crossing, then primarily on quiet streets and shared paths through to Mayfield. Improvements to several sections are required.
R5 – Newcastle City Centre to Speers Point	In Lake Macquarie, this route follows Winding Creek to Cockle Creek Station before running adjacent to Lake Road to reach the former Speers Point to Wallsend tram line. From Wallsend, the route is mainly off road on former tram routes through to Broadmeadow, then primarily via a shared path to Selma Street, Newcastle West. The proposed route from Newcastle West to the City Centre will be undertaken through implementation of the adopted West End Stage 2 Streetscape Plan.

3.3.4 Freight Network

Figure 3–15 shows the existing 19m B-Double routes in the study area, as well as on the wider surrounding road network, noting that Griffiths Road is shown as a 19m B-Double route.

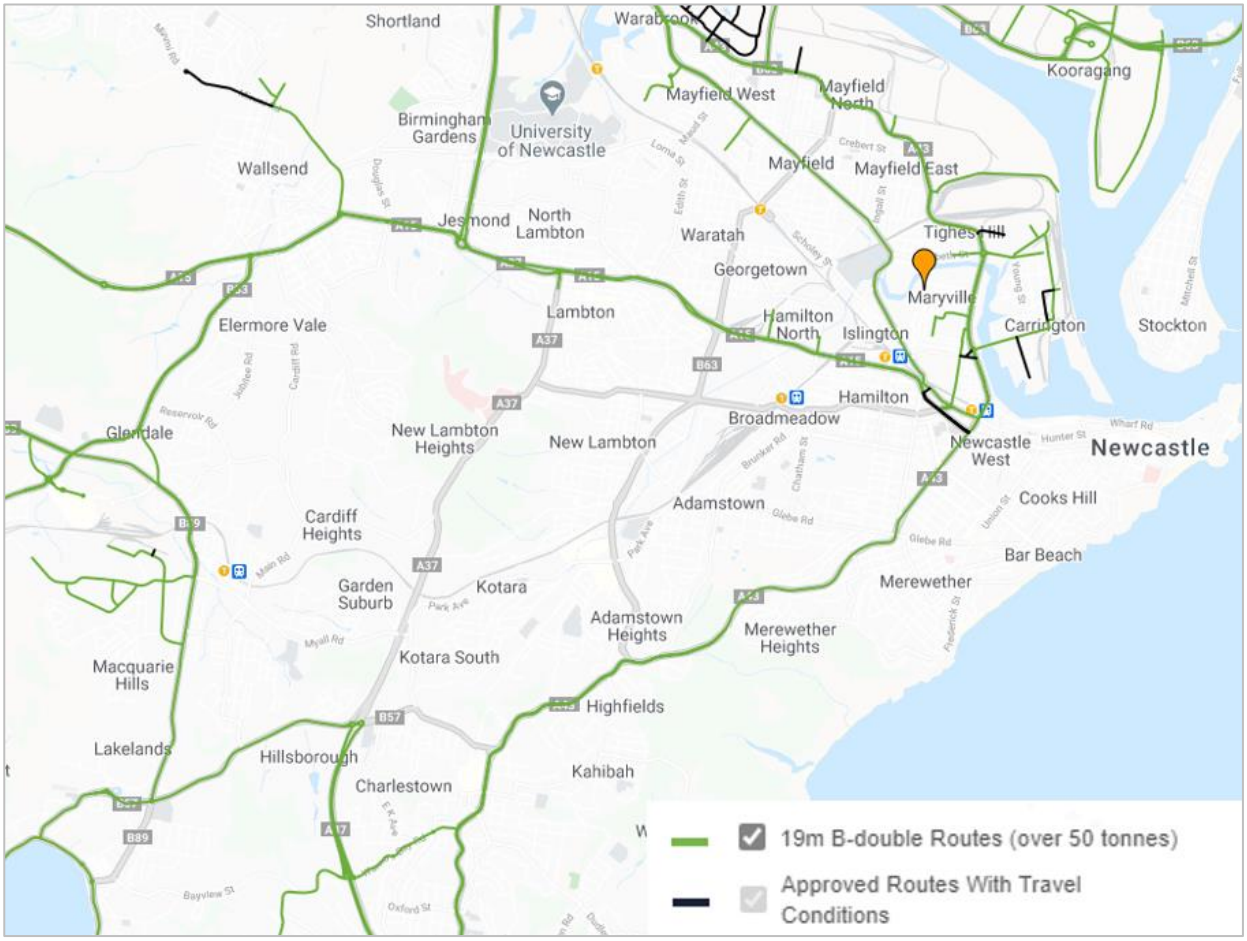


Figure 3–15: B-Double Vehicle Route Map (Source: TfNSW)

3.4 Network Performance

3.4.1 Road Network

A base year VISSIM microsimulation traffic model was developed and calibrated for 2020 conditions. Table 3–8 provides network statistics for the base year network traffic model, which shows that the PM peak period between 4pm and 6pm is the most heavily congested, with highest delay across the network, lowest speed and the highest number of stops.

The traffic assessment undertaken shows that a number of intersections on key road corridors in the study area are already operating close to, or at capacity.

Development of the precinct and associated uplift in traffic in the study area will therefore require road network infrastructure interventions to accommodate future traffic growth.

Table 3–8: 2020 Base Year Model Network Performance Results

Scenario	AM Peak Period (7am-9am)	PM Peak Period (4pm-6pm)	Weekend Peak Period (11am-1pm)
Speed (km/hr)	27	25	29
Delay (min)	104	118	82
Latent Demand (veh)	15 (0%)	711 (3%)	27 (0%)
VHT (hr)	1,097	1,184	921
VKT (Km)	29,924	29,922	27,085
Demands (veh)	19,686	20,683	19,084
Stops	48,465	62,360	42,115

3.4.2 Public Transport Network

In assessing the performance of the public transport network, connectivity and frequency of public transport services has been reviewed. Examining these two key parameters provides insight into the performance of the existing public transport system in and around Broadmeadow.

Connectivity

An effective public transport network should provide connectivity within Broadmeadow and beyond. It should offer easy access to other areas of the city or region and provide direct connections to major transport hubs, such as the airport, or train stations, as well as reliable connections to the aforementioned key place attractors, such as John Hunter Hospital, Newcastle CBD, Kotara Shopping Centre and University of Newcastle (Callaghan Campus).

Figure 3–16 highlights the location of existing bus stops in Broadmeadow, as well as the surrounding area, each with a 400m buffer zone. The figure illustrates that the bus stop coverage of the study area is generally good, with only a handful of small areas, or pockets not covered by services.

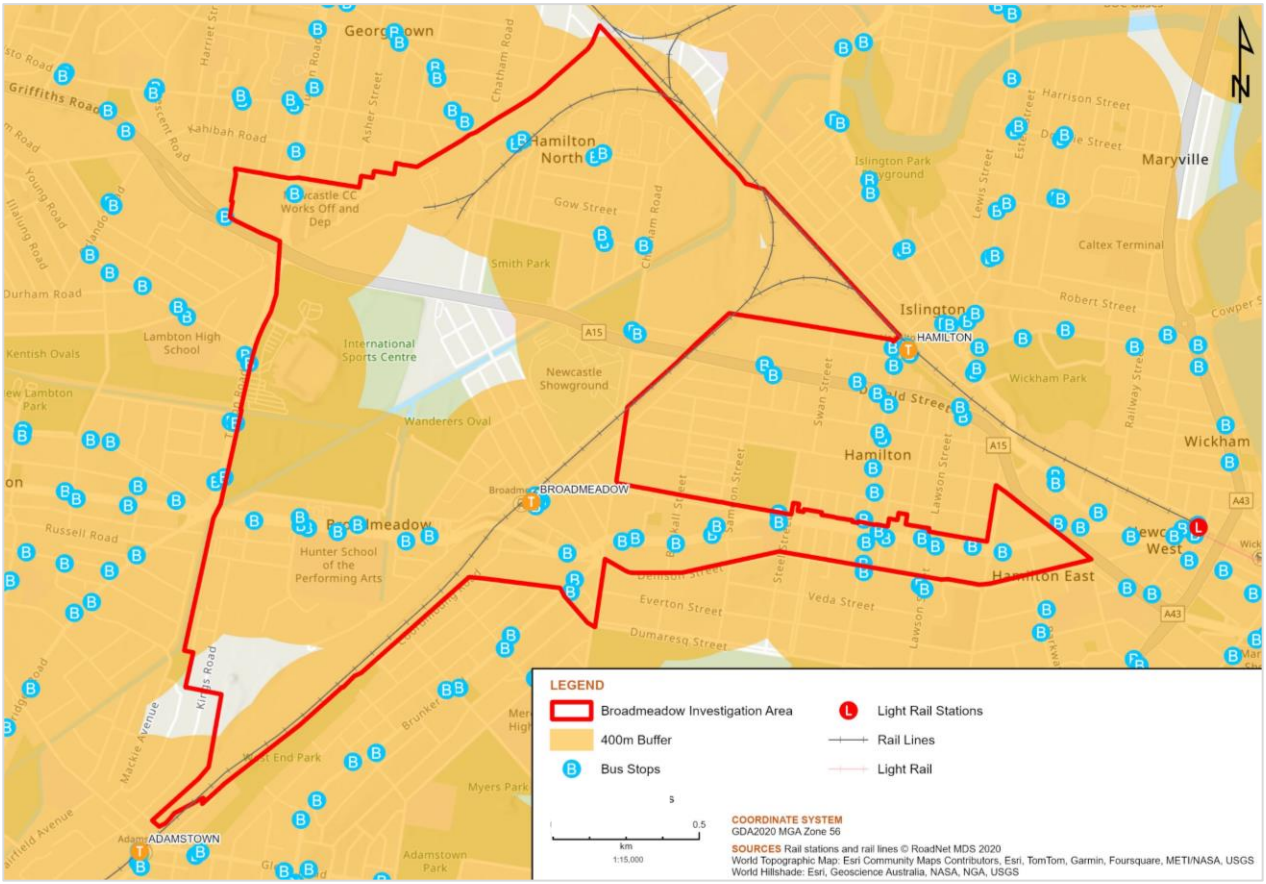


Figure 3–16: Bus Stop Catchments

Figure 3–17 to Figure 3–20 illustrate public transport coverage of the precinct and wider surrounding area, assuming Broadmeadow Station as a start and end point for journeys. The figures provide isochrone maps for travel to and from Broadmeadow, assuming 8am and 12pm travel times, respectively.

The maps illustrate accessibility of different parts of the precinct and surrounding area by public transport at the assumed travel times and show the distance that can be travelled from Broadmeadow Station within a 15, 30, 45 or 60 minute time allocation. The maps were developed using public transport schedules and timetables sourced from TfNSW.

The maps show that the majority of the precinct may be accessed within 15 minutes, while peripheral areas may be accessed within 30 minutes. Surrounding towns and regional centres are also accessible within 60 minutes travel time.

There is greater coverage at peak times due to additional bus services on some routes, as well as enhanced service provision and stopping patterns on the rail network, however service provision and accessibility outside of peak times during the week, as well as at the weekend is significantly reduced.

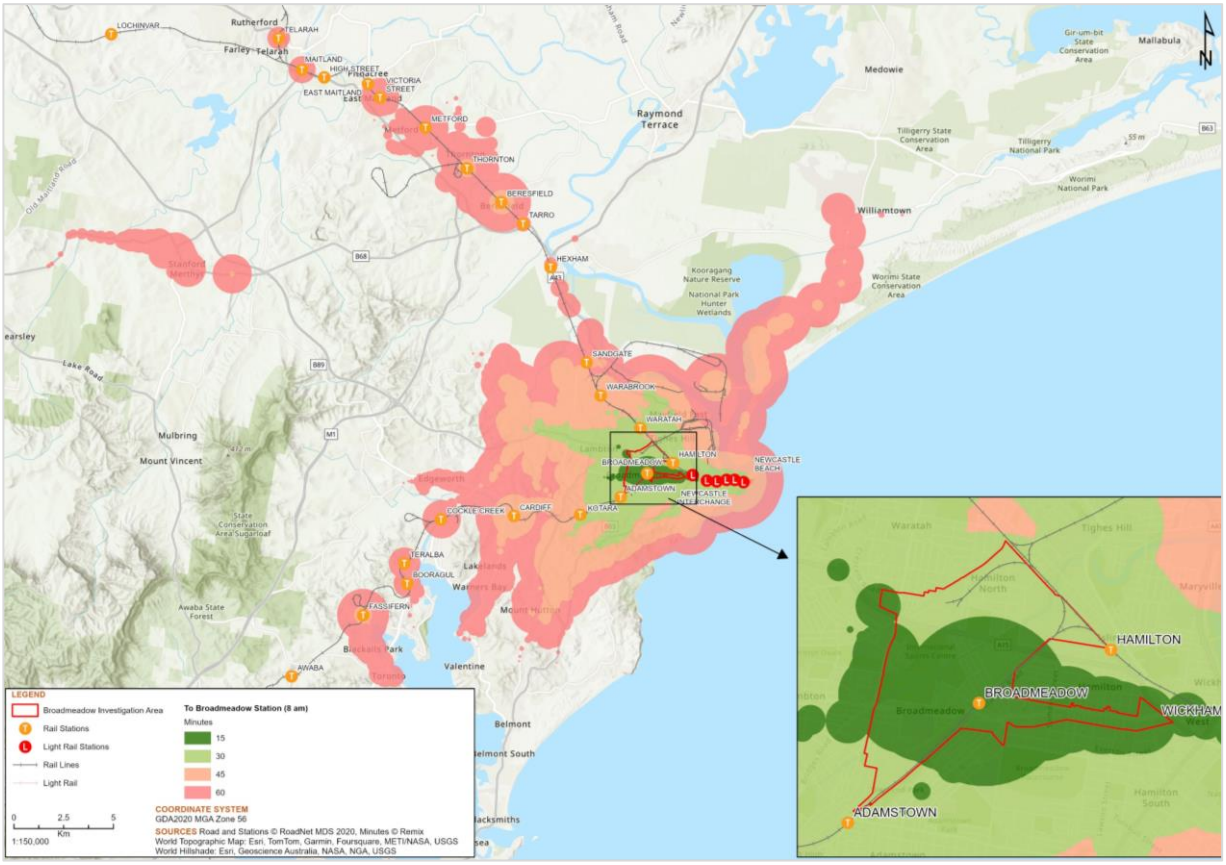


Figure 3–17: Public Transport Isochrone Map - To Broadmeadow Station at 8am

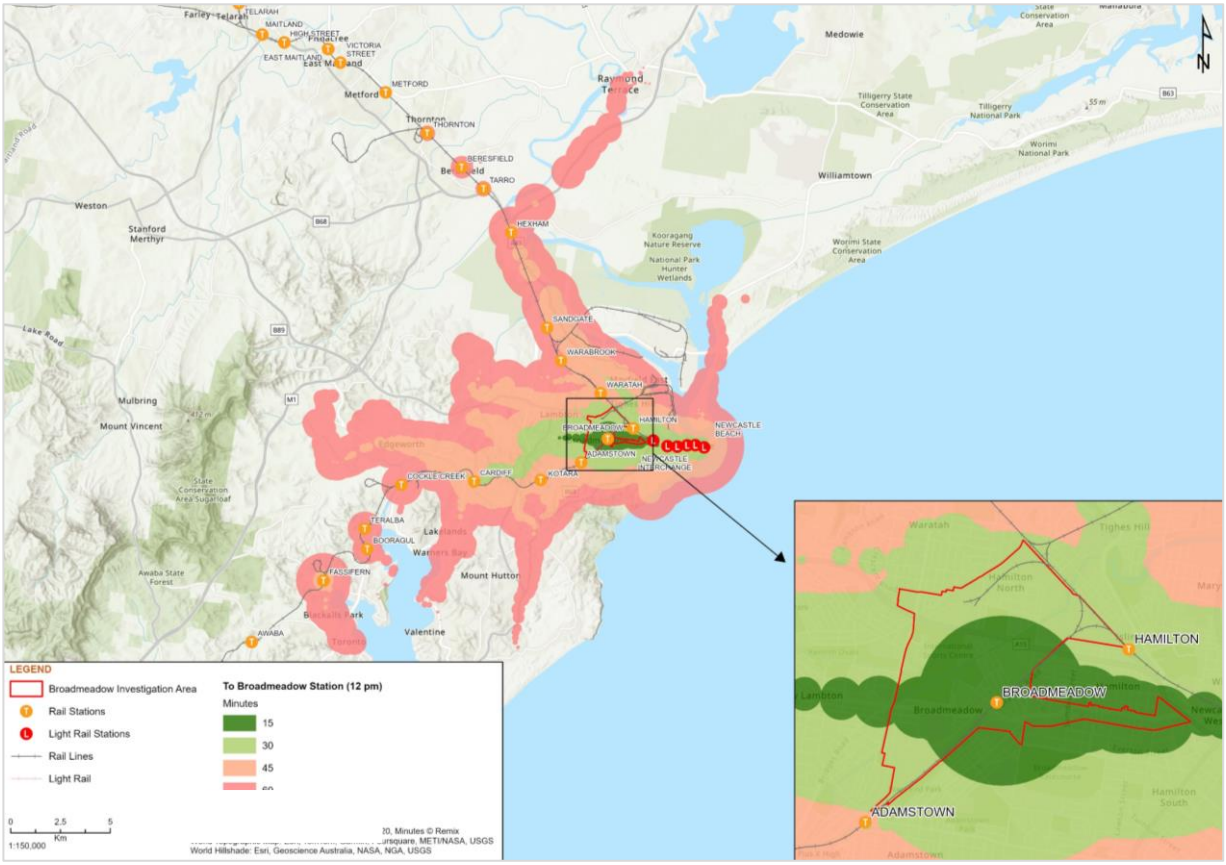


Figure 3–18: Public Transport Isochrone Map - To Broadmeadow Station at 12pm

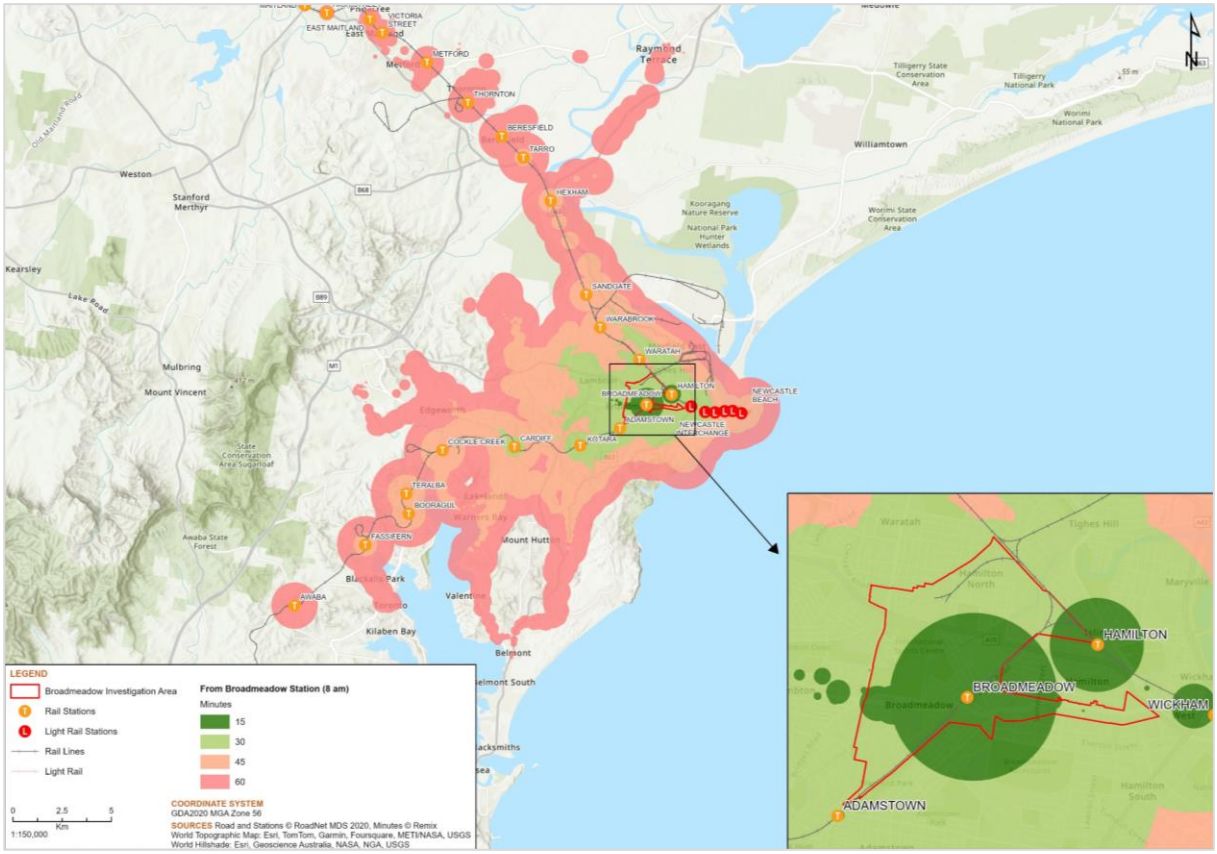


Figure 3–19: Public Transport Isochrone Map - From Broadmeadow Station at 8am

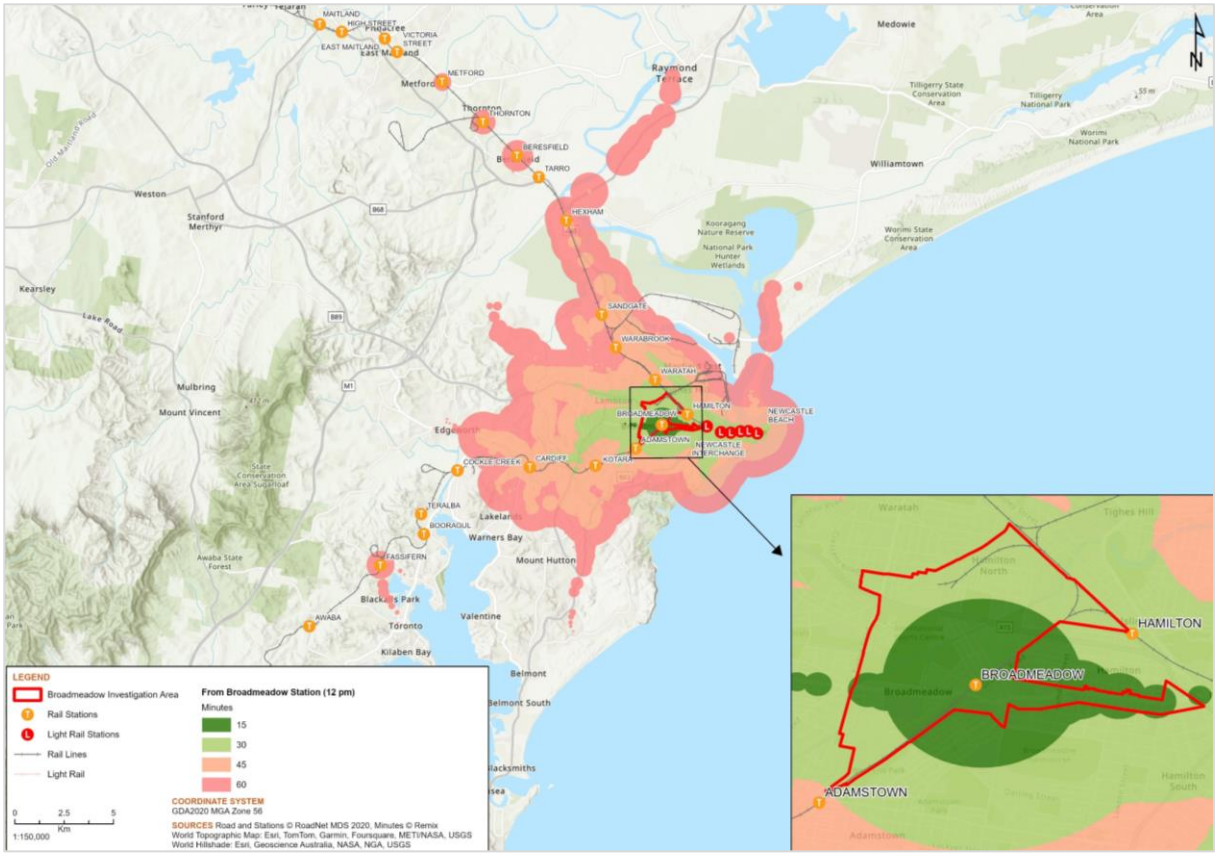


Figure 3–20: Public Transport Isochrone Map - From Broadmeadow Station at 12pm

Frequency

Frequency of public transport services has also been assessed within the precinct and surrounding area. By analysing the frequency of services, areas where service levels are insufficient may be identified and adjustments made to improve the public transport network.

Figure 3–21 highlights the public transport network frequency in the Broadmeadow and Greater Newcastle area at 8am on a weekday, which shows that the study area is generally well connected by public transport.

As previously noted, the most frequent services operating in the study area are bus service No. 12 that runs from Maryland to Merewether Beach via Wallsend and Newcastle Interchange, as well as bus service No. 13 from Glendale to Newcastle via Cardiff and John Hunter Hospital with a total of 4 trips during the weekday peak and midday period, which reduces to 2 trips at the weekend.

Off-peak services during the week, as well as at the weekend operate at significantly reduced timetables.

Figure 3–21: Public Transport Network Frequency Map (8am Weekdays)

3.4.3 Active Transport Network

Pedestrian Network

A walking catchment analysis has been undertaken to assess the pedestrian network in the study area. A walking catchment is an area that encompasses all the streets and walkways that may be reached within a given walking time, or distance from a specific location, in this instance Broadmeadow Station, which may be used to analyse the accessibility of the precinct by foot.

Figure 3–22 shows the difference between straight line walking distance (400m, 800m and 1200m concentric buffers) centred around Broadmeadow Station and pedestrian sheds that show the streets and walkways that may be reached using the pedestrian footpath network.

The assessment shows that there is reasonable straight line connectivity to the west via Lambton Road, however in other areas, such as to the north, connectivity is constrained due to limited opportunities for crossing over Styx Creek, as well as due to open areas with limited availability of pedestrian footpaths.

Figure 3–22 also highlights how active transport movement is constrained due to the number of large government owned sites that dominate the central part of the precinct, as well as the southwestern part of the precinct. These sites include Hunter Park, the Knights Centre of Excellence, Newcastle International Hockey Centre, Harness Racing Track and Newcastle Showgrounds (central), as well as the former Locomotive Depot (southwest), which are all NSW Government owned.

A co-ordinated approach is therefore possible to enhance active transport usability and amenity within the precinct, which is considered essential to encourage a greater number of trips by both walking and cycling, therefore reducing vehicular trips, particularly for short distances.

As discussed in Section 3.3.3, pedestrian accessibility within the precinct is challenged by a number of key constraints, including lack of footpaths on a number of major roads, lack of pedestrian crossings on key roads (and clear low prioritisation of them), as well as physical barriers caused by both Styx Creek, as well as the CCN railway line that runs through the precinct.

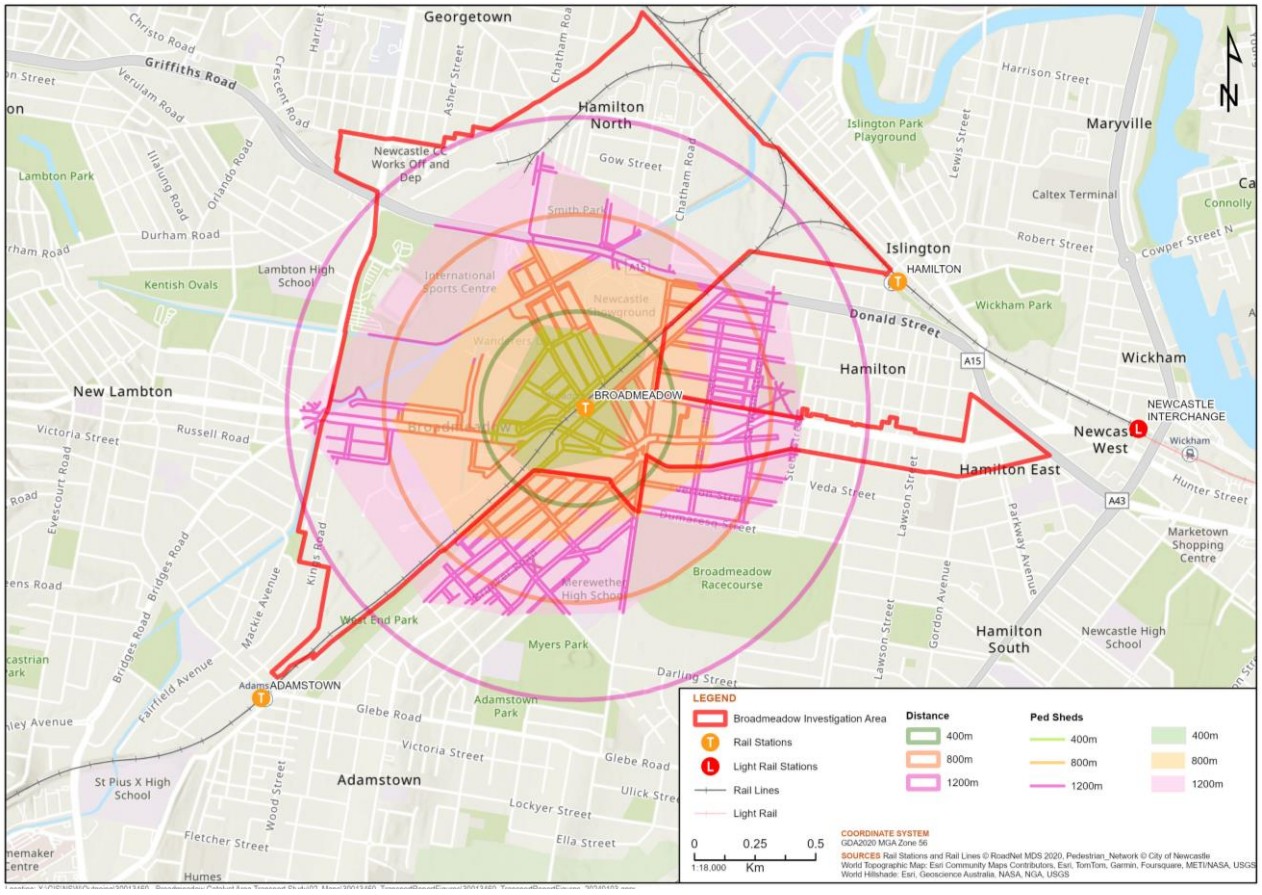


Figure 3–22: Walking Catchment Analysis

Cycle Network

A cycle catchment analysis has also been undertaken to assess the cycle network in the study area. A cycle catchment is an area that encompasses all the cycle routes that may be reached within a given time, or distance from a specific location, in this instance Broadmeadow Station.

Figure 3–23 reflects cycle routes in the greater Broadmeadow area, noting that cyclists often use the road network too. The figure clearly demonstrates that while there are some dedicated cycle facilities in the study area, including routes R1, R4 and R5, there is a need for additional cycle routes in order to provide a safe and comprehensive cycle network in the study area.

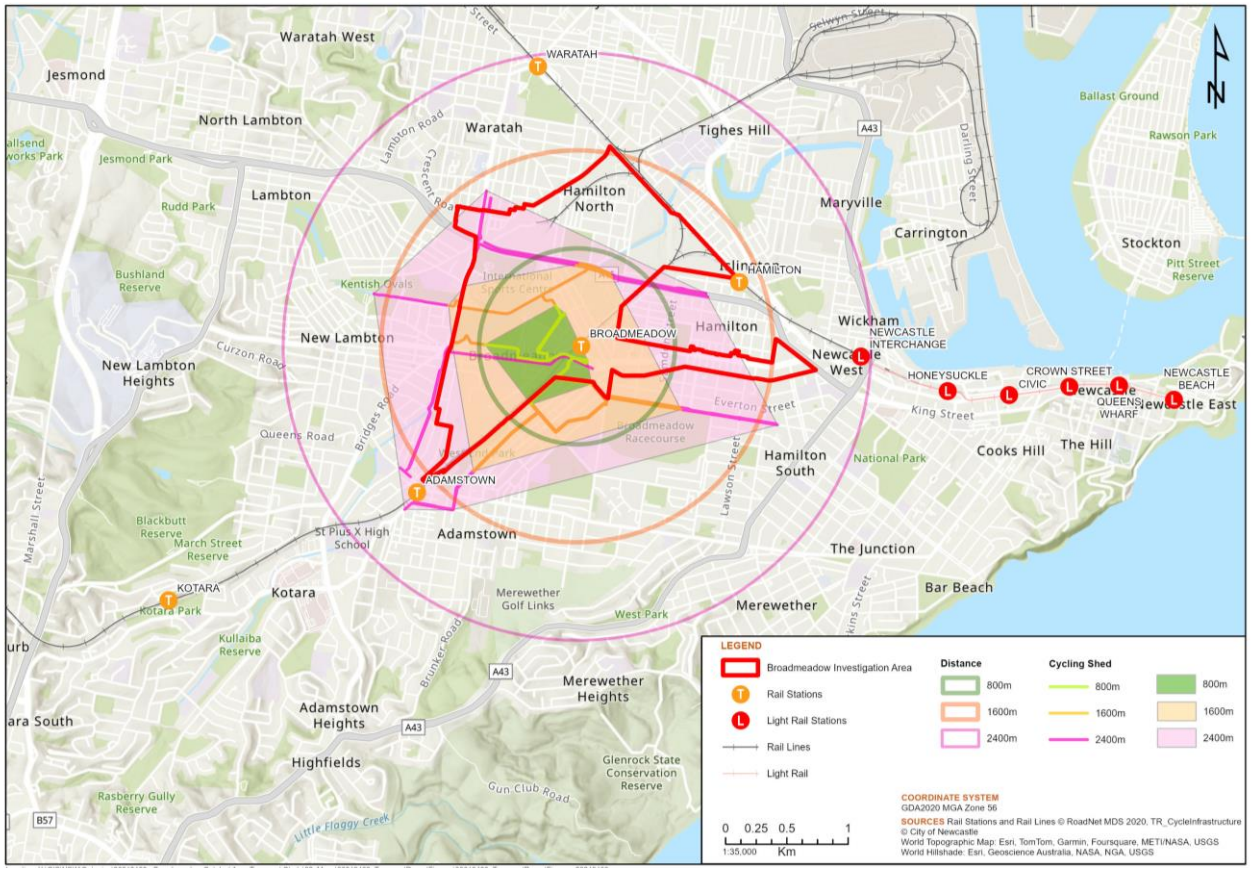


Figure 3–23: Cycling Catchment Analysis

3.4.4 Road Safety Assessment

Crash Analysis

Crash data was sourced from TfNSW for the period October 2014 to March 2020 (most recent crash reported). A total of 210 crashes were reported with an average of 42 crashes per year. A total of 144 of the crashes (69%) caused at least one injury with the remainder being non-casualty tow away crashes. There were no fatality crashes. Locations of crashes and severity of injuries is shown in Figure 3–24.

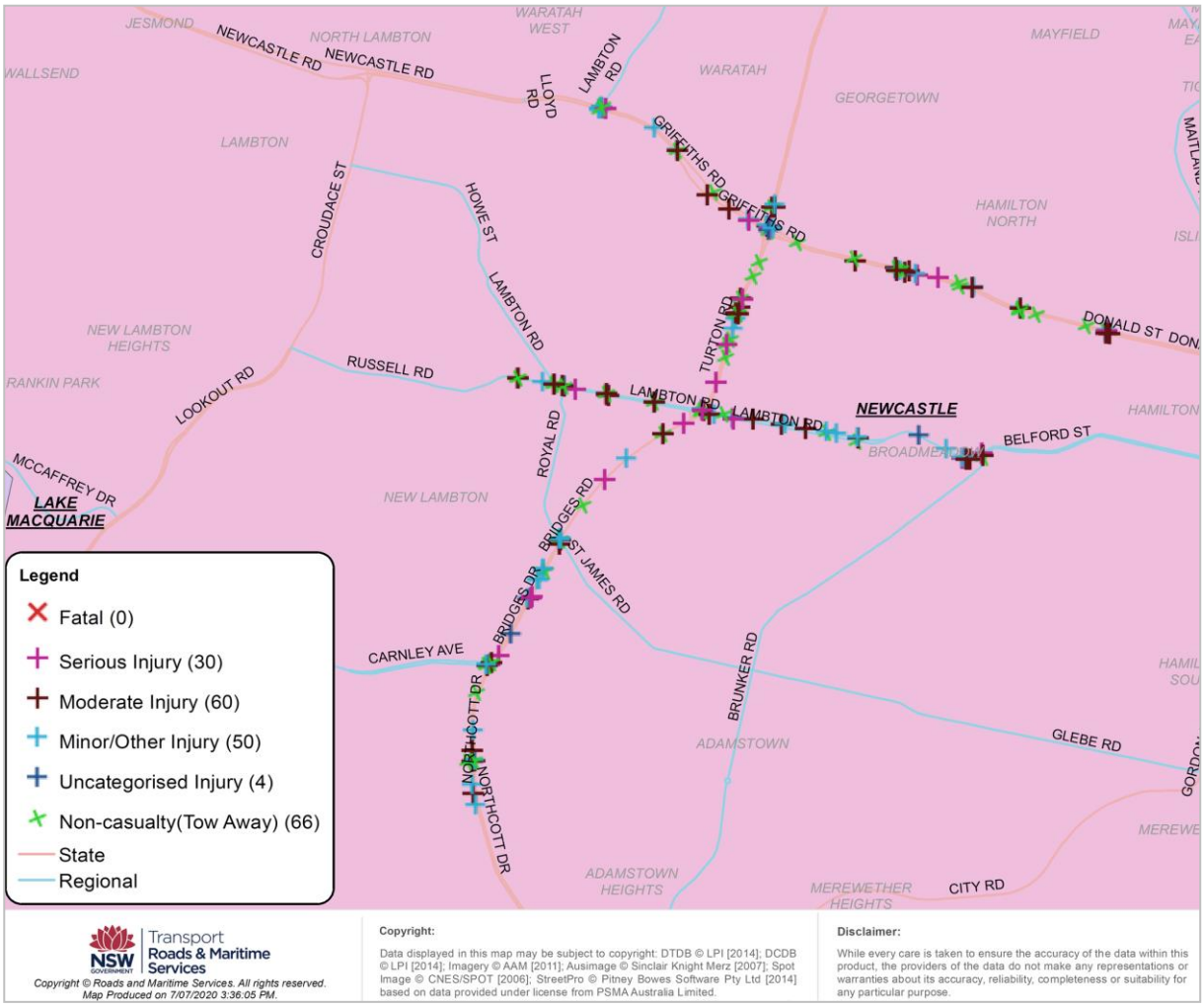


Figure 3–24: Crash Locations and Injury Severity

Table 3–9 provides the number and percentage of crashes by movement type.

Table 3–9: Study Area Crash Type

Crash Movement	Number of crashes	Percentage
Rear-end	87	41.4
Opposing vehicles; turning	34	16.2
Intersection, adjacent approaches	19	9.0
Other crash type	19	9.0
Lane change	11	5.2
Off road on straight, hit object	10	4.8
Vehicle leaving driveway	6	2.9
Off road on curve, hit object	5	2.4

Crash Movement	Number of crashes	Percentage
Hit pedestrian	4	1.9
Head-on (not overtaking)	3	1.4
Parallel lanes; turning	3	1.4
U-turn	2	1.0
Hit parked vehicle	2	1.0
Off road, on straight	2	1.0
Out of control on straight	2	1.0
Out of control on curve	1	0.5
Overtaking; same direction	0	0.0
Hit railway train	0	0.0
Permanent obstruction on road	0	0.0
Hit animal	0	0.0
Off road, on curve	0	0.0

The above data indicates the following:

- Rear end crashes are the most prevalent collision type, accounting for 41% of the total number of crashes
- Opposing vehicle turning crashes are the second most prevalent collision type, accounting for 16% of total crashes
- Light truck crashes accounted for 21% of total crashes, with heavy vehicle crashes accounting for 1% of total crashes
- Intersection crashes occurred throughout the area accounting for 64% of total crashes. A crash is considered to have occurred at an intersection if it occurred up to 10 metres from an intersection.

The large number of rear end crashes may indicate that congestion presents a safety issue. Fluctuations in average speed due to congestion, particularly during peak commute hours, can create a 'start and stop' driving environment for motorists. This increases the likelihood of rear end collisions during periods of congestion when there may be relatively little headway between vehicles, although crashes are likely to be less severe due to lower speeds.

Around 8% of crashes were categorised as 'off-road", which may be due to poor road surface condition, insufficient line marking, and delineation. An investigation of the roadway is required to gain a better understanding of issues contributing to these types of crashes.

Adjacent intersection crashes accounted for 9% of total crashes. Additionally, there were 43 crashes involving light trucks. The relatively large number of these crashes may warrant further investigation.

There were a total of five crashes involving pedestrians, and five crashes involving cyclists. No trends in active transport crashes were identified.

Crash Severity Index

Table 3–10 provides a summary of the number of crashes with fatalities and injuries that occurred, as well as a calculated crash severity index, which uses a weighted system to give an indication of the severity of crashes.

It should be noted that the crash data included four uncategorised injury crashes. These crashes have been excluded from the calculation, as the level of severity is unknown. Non-casualty crashes have also been excluded, as the data is unavailable for the Newcastle LGA and NSW state-wide. As such, the crash severity index has been calculated for a total 140 crashes.

The following weighting is given for the different crash types:

- Fatal crash (FC) weight: 2.5
- Serious Injury crash (SIC) weight: 2
- Moderate Injury crash (MIC) weight: 1.5
- Minor/Other Injury crash (MOIC) weight: 1

Crash severity index = ((FC x 2.5) + (SIC x 2) + (MIC x 1.5) + (MOIC x 1)) / (FC+ SIC+ MIC+ MOIC)

Table 3–10: Crash Severity Index

Description	Fatal Crashes	Serious injuries	Moderate injury crashes	Minor/Other Injury Crashes	Total	Crash Severity Index
Study Area	0	30	60	50	140	1.43
Newcastle LGA	29	489	792	508	1,818	1.51
NSW State-wide	1,688	23,903	32,456	23,525	81,572	1.52

Note: Newcastle and NSW state-wide data is based on crash data for the 5-year period between 2015 and 2019 and is sourced from TfNSW's Crash and Casualty Statistics Interactive Map

The analysis indicates that the area studied has a crash severity index of 1.43, which is lower than the crash severity index for both the Newcastle LGA and NSW as a whole, which have a crash severity index of 1.51 and 1.52, respectively. As noted, these indices do not consider non-casualty and uncategorised injury crashes, which may impact the conclusion.

3.5 Movement and Place Challenges and Opportunities

Desk based investigation of land use and existing transport conditions relating to the surrounding road network, public transport network, active transport networks and parking, supplemented with observations from a site visit, has enabled a range of challenges and opportunities relating to movement and place to be identified.

The challenges and opportunities, including challenge/ opportunity type, location and description are summarised in Table 3–11 and Table 3–12 respectively.

3.5.1 Challenges

Table 3–11: Movement and Place Challenges

Challenge Type	Issue	Description
Road Network	Key Road Corridors	A number of intersections on key road corridors in the study area are already operating close to, or at capacity. Development of the precinct and associated uplift in traffic in the study area will require road network infrastructure interventions to accommodate future traffic growth.
Public Transport Network	Bus Frequencies	While there is an established network of local bus services within the study area, service frequencies are generally low. There are only two services that operate with 4 trips/ hour in the peak and throughout the day, which reduce to 2 trips/ hour at the weekend. The majority of other services operate with only 2 trips/ hour in the peak with just one trip/ hour throughout the remainder of the day, as well as at the weekend.
	Bus travel time reliability	Congestion on certain parts of the road network resulting in bus travel time reliability issues, particularly on the Griffiths Road corridor between Lambton Road and Broadmeadow Road.
	Heavy Rail Network Connectivity	For those using regional rail services from Northern/Western NSW, issues arise for customers who wish to travel to Broadmeadow/ Hunter Park, as they are limited to one service per day. If Broadmeadow wishes to become a major place attractor and be home to an International level Entertainment Precinct, improved access to Broadmeadow Station is required.
Pedestrian Network	Key Road Corridors	Pedestrians face challenges in crossing key road corridors, including Lambton Road, Griffiths Road and Turton Road, as well as some local roads, including Clyde Street at Hamilton North due to high traffic volumes and limited crossing opportunities. This can make it difficult for pedestrians to move around the area safely and efficiently.
	Rail Corridors	A key feature of the precinct are the rail corridors that run along the eastern and northern perimeters. Pedestrian movements are inhibited within certain parts of the precinct, given the limited number of rail crossings, which include a rail overbridge at Lambton Road and Griffiths Road, an underpass at Broadmeadow Station, as well as a rail level crossing at Clyde Street.
	Broadmeadow Station to Stadium	There is currently no direct pedestrian route between Broadmeadow Station and the McDonald Jones Stadium, as well as to the wider Hunter Park area of the precinct, including the Entertainment Centre, a major place attractor within the study area.
	Styx Creek	Styx Creek runs through the centre of the study area and acts as a barrier to pedestrian movements. While there are a number of existing pedestrian crossings, pedestrian movements are inhibited due to the limited number of crossings.
Cycle Network	Extent of cycle network	While Broadmeadow has dedicated cycle routes, including regional routes R1, R4 and R5, cycling infrastructure is not as extensive as in other areas of Greater Newcastle, which can be challenging for cyclists during peak periods and can lead to safety issues and inhibit cyclists from moving around the area efficiently.
	Cycling Network Infrastructure	The current routes are primarily on shared paths, with pedestrians and cyclists sharing the path allocation. Additionally, the quality of the infrastructure varies significantly throughout the study area. There are numerous conflict points with vehicular traffic, reducing safety and useability for less experienced riders, disincentivising active travel.

Challenge Type	Issue	Description
		Also, existing on-road cycle lanes do not provide sufficient level of safety and comfort for cyclists of all ages and ability.
	Broadmeadow Station	There are only a limited number of bike racks and no secure cycle parking at the station.
Parking	Commuter Car Parking at Broadmeadow Station	While Broadmeadow has an at-grade commuter car park at the railway station, on-site observation suggests that the car park is often full leading to overspill car parking on surrounding residential streets.
Place Challenges	Green Space	The study area comprises significant areas of green space, however these are currently fragmented with limited connectivity between them.

3.5.2 Opportunities

Table 3–12: Movement and Place Opportunities

Opportunity Type	Issue	Description
Road Network	Key Road Corridors	There are limited opportunities to provide improvements to the road network to accommodate future growth in the study area. This includes upgrades to key road corridors and intersections to maintain satisfactory operational performance. The focus needs to be towards improving public and active transport, through methods such as bus priority measures, bus rapid transit, extension of light rail, additional, or enhanced cycling and pedestrian facilities, as well as travel demand management measures, including the introduction of maximum parking standards. Consideration should be given to an additional Lambton Road rail overbridge for traffic, with the existing bridge retained for light rail and active transport. Additional connections will be required to the arterial road network from proposed development sites.
	Pedestrian Friendly Road Network	An opportunity exists for the development of more pedestrian-friendly streets, including wider footpaths, raised crossings, reduced speed limits, and separated active transport facilities, making it easier and safer for residents to walk within the precinct. Barriers to pedestrian movement need to be addressed, including the ability to easily cross key arterial roads that run through the precinct, such as Griffith Road, as well as Styx Creek, and the rail corridor. This could be achieved through provision of grade-separated crossings, or additional at-grade crossings, where appropriate. The road network is currently tailored to private and commercial vehicle transit, which needs to be altered towards active transit, striving towards sustainability. The internal road network within proposed development sites will need to include active transport routes that connect to the wider active transport network within the precinct.
Public Transport Network	Light Rail	Extension of light rail from Newcastle Interchange to Broadmeadow Station and potentially to McDonald Jones Stadium would transform the public transport network within the study area and provide a direct connection between the precinct and Newcastle CBD. Opportunity to extend further west in later stages of development.
	Heavy Rail	To accommodate the push for Newcastle to host an international-level entertainment precinct, improved train services to Broadmeadow station are required, including enhanced connectivity for regional train services.
	Rapid Bus Network	A rapid bus corridor along Griffiths Road connecting to the Broadmeadow Interchange would provide an express connection between the western suburbs of Newcastle, including Wallsend, Maryland and Glendale, the Broadmeadow Interchange and further east towards Newcastle CBD. A rapid bus route along Lambton Road as a precursor to light rail should also be considered, as well as a route to the south-western suburbs via Bridges Road, including Kotara.

Opportunity Type	Issue	Description
	Bus frequencies	With the proposed future development of the precinct, there is an opportunity to review bus services and frequencies to ensure service provision adequately meets future demands.
	Bus travel time reliability	Provide bus priority measures on Bridges Road, Lambton Road and Griffiths Road to improve travel time reliability, reduce journey times and encourage greater use of public transport as a viable alternative mode of transport.
	Public Transport Amenity	Bus routes should be accommodated through and link new development sites and work in conjunction with proposed active transport routes. This will be vital to promote mode shift from private vehicles towards a more sustainable future. Bus waiting infrastructure, including shelters and real-time information should be provided at stops within new precincts.
Pedestrian Network	Key Road Corridors	Review crossing opportunities along key road corridors taking account of key place attractors and pedestrian desire lines to ensure pedestrians are able to move around the area safely and efficiently. An opportunity exists to provide seamless connectivity by provision of at-grade crossings, alternatively additional at-grade crossings, where appropriate.
	Rail Corridors	Opportunity to consider enhanced pedestrian connectivity across rail corridors, which currently inhibit pedestrian movements within certain parts of the precinct.
	Broadmeadow Station to Stadium	Improve pedestrian connectivity between Broadmeadow Station and nearby areas, including a direct line of sight connection from Broadmeadow Station to the McDonald Jones Stadium, supplemented with a wide pedestrian footpath, lighting and wayfinding signage to facilitate smooth transition and increased safety for events. Envisage a wide pedestrian and cycle promenade through venues site from Young Road to the stadium with a new crossing of Styx Creek.
	Styx Creek	Create more access points to Styx Creek, potentially including new pedestrian bridges and boardwalks, to improve connectivity and increase opportunities for recreation and leisure activities in the area.
		Develop a riverfront walkway (and/ or cycleway) along the Styx Creek, Throsby Creek and Hunter River, linking Broadmeadow with the Newcastle CBD and other surrounding suburbs.
Cycle network	Extent of Cycle Network	Provide additional cycle facilities to encourage more people to cycle to nearby destinations, including improved lighting on shared paths to increase the place perception with heightened safety. Cycle and pedestrian paths should extend along the length of creeks, existing and former railway corridors and traverse the centre of large government owned sites, such as at Hunter Park and elsewhere. There is a need to provide enhancement to through, internal and linking of cycleways throughout, as the location is a key node for intersecting cycleways. The precinct should be a hub for cycle connectivity.
	Broadmeadow Railway Station	While Broadmeadow station currently has a number of bike racks, additional bike racks and secure bike lockers should be provided to accommodate increased future demand.
	Styx Creek	Development of a shared pathway, or separate cycle and pedestrian pathways along Styx Creek from Lambton Road diagonally to Chatham Road. There is potential opportunity for cycle provision under the Griffiths Road Bridge within the stormwater channel easement.
Parking	Broadmeadow Railway Station	There is an opportunity to address overspill commuter car parking on surrounding residential streets as part of a wider parking management strategy for the precinct, however a more sustainable future is desired from a shift to active and public transport. In this regard, stations elsewhere on the rail network should be investigated as commuter hubs where those wishing to reach a station by car could park.

Opportunity Type	Issue	Description
Place Opportunities	Green Space	Create new parks and recreational areas to serve the residents of Broadmeadow. While Broadmeadow has a number of parks and green spaces, such as the Broadmeadow Lions Park and Gregson Park, they are relatively small and fragmented and are unlikely to provide sufficient space for residents to engage in outdoor recreation and relaxation.
	Integrated transport and land use	There is an opportunity to cluster high-density residential, mixed-use and employment land uses around the proposed Broadmeadow Transport Interchange and key transport nodes within the precinct to reduce travel distances and encourage travel by alternative modes.

4. Scenario Testing

4.1 Introduction

An Enquiry by Design (EbD) process was undertaken to inform the preparation of the Master Plan and Place Strategy. The EbD was an interactive process that explored a number of potential development scenarios for Broadmeadow that could deliver the vision for the precinct and result in a draft Master Plan.

The Preliminary EbD workshop for the Broadmeadow Place Strategy was held on the 3rd and 4th of May 2023. The Preliminary EbD was an iterative process that allowed for the testing of ideas, solutions and concepts by participants across all technical streams and a range of stakeholders, such as state agencies, local government and department representatives. This was informed by baseline investigation undertaken in advance of the workshop, consideration of opportunities and constraints, as well as non-negotiables and nice-to-haves identified within the workshop.

The workshop resulted in three scenarios being developed based on an overall vision for the Precinct, which were represented by way of spatial outcomes and growth scenarios to inform the next phase of refinement and testing.

4.2 Scenario Testing

A review of the three development scenarios identified at the Preliminary EbD was undertaken from a strategic transport planning and accessibility perspective focusing on key features, similarities and differentiators across modes.

The key elements that vary for each scenario are the location and configuration of:

- Mixed use centre and employment generating uses
- Housing density, diversity and tenure
- Multipurpose arena and leisure centre
- Transport and movement

While the key elements vary across the scenarios, the non-negotiables remain a constant.

The scenario testing involved a review of movement and access, land use, traffic generation, traffic distribution and network capacity to identify potential locations requiring infrastructure upgrades, or policy interventions to accommodate and manage additional traffic, as well as to allow comparison across the three scenarios.

A SWOT analysis was also undertaken to assess and compare the strengths, weaknesses, opportunities, and threats of each development scenario.

4.3 Preferred Emerging Scenario

The Final EbD workshop for the Broadmeadow Place Strategy was held on the 11th and 12th of October 2023. The workshop resulted in a preferred emerging scenario being developed to align with the Precinct objectives, collective vision statement and the findings of the technical assessment of the three scenarios that emerged from the Preliminary EbD workshop in May 2023.

The preferred emerging scenario provides a combination of the best elements of each of the options which was refined to produce the Draft Structure Plan. Opportunities for the public to help further refine and voice their opinion on the Draft Structure Plan will be provided during exhibition of The Draft Place Strategy in 2024.

5. Proposed Structure Plan

5.1 Project Vision

A draft vision for the Broadmeadow Place Strategy was prepared by City of Newcastle based on community feedback received during May and June 2023. The draft vision was prepared in collaboration with the desired place strategy outcomes established by DHPI in the Hunter Regional Plan 2041 to facilitate an integrated and holistic planning approach for the Broadmeadow regionally significant growth area.

The overarching project vision identified through this process is as noted below:

“Broadmeadow is a loveable place and vibrant destination with highly-connected and distinct neighbourhoods that balance the needs of a dynamic community and growing Newcastle.”.

5.2 Project Principles

A set of project principles was also developed as part of the Place Strategy, which are summarised below, while further details may be found in the Draft Integrated Master Plan report.

- Celebrate our culture and heritage in everyday life
- Deliver diverse and affordable housing
- Establish a welcoming and thriving sport, entertainment and lifestyle destination
- Create a highly connected place that prioritises sustainable travel
- Empower a resilient and sustainable future ready community
- Create a vibrant blue and green heart with high quality public spaces
- Boost opportunities in employment, education and innovation.

5.3 Structure Plan

The Broadmeadow precinct is a significant urban renewal opportunity. Its location just west of the Newcastle City Centre, existing public transport infrastructure and large NSW Government owned sites adds to its significance and ability to deliver more homes, jobs, quality places and infrastructure at the geographical centre of Greater Newcastle.

Movement patterns will transition away from the private vehicle and toward walking and cycling networks. The Styx Creek corridor, Belford/Tudor Streets and a proposed pedestrian-friendly boulevard from Broadmeadow Station to Hunter Park will become the organising elements of Broadmeadow, transforming existing roads and spaces into public places. Styx Creek can be characterised as a 'Green Connection,' and Belford/Tudor as an 'Urban Connection.'

The railway line through the centre of the precinct is a structural feature and significant movement barrier. Traversing this corridor with additional road and active transport connections is key to realising the Structure Plan’s vision of a cohesive and functional precinct.

The public domain links major movement corridors together with green and recreation spaces. Green spaces beyond the precinct boundary, like Gregson Park, Islington Park, the Lambton Ker-rai Creek corridor and Mackie Avenue Reserve, are integrated within the open space network to form regional-scale connections. Living Focus areas foster highly liveable communities with high accessibility to Employment and Activity Focus areas and the Newcastle CBD in the east.

Broadmeadow’s central location within the Newcastle metropolitan area creates significant opportunities for improvement in the transport network. Introducing clean, high-capacity public transport, enhanced active transport connectivity, combined with a demand management strategy, including maximum parking standards, will shift Newcastle away from the private vehicle and facilitate the projected increase in population and employment.

The proposed Structure Plan is shown in Figure 5–1, while the traffic and transport vision, implications and infrastructure requirements are expanded upon in Sections 6 - 9 of this report.

Qualitative commentary about transport planning considerations relating to the transport network is provided, while traffic analysis has been undertaken to consider the impact of the Structure Plan on the road network, as well as to identify infrastructure upgrades required to accommodate proposed development.

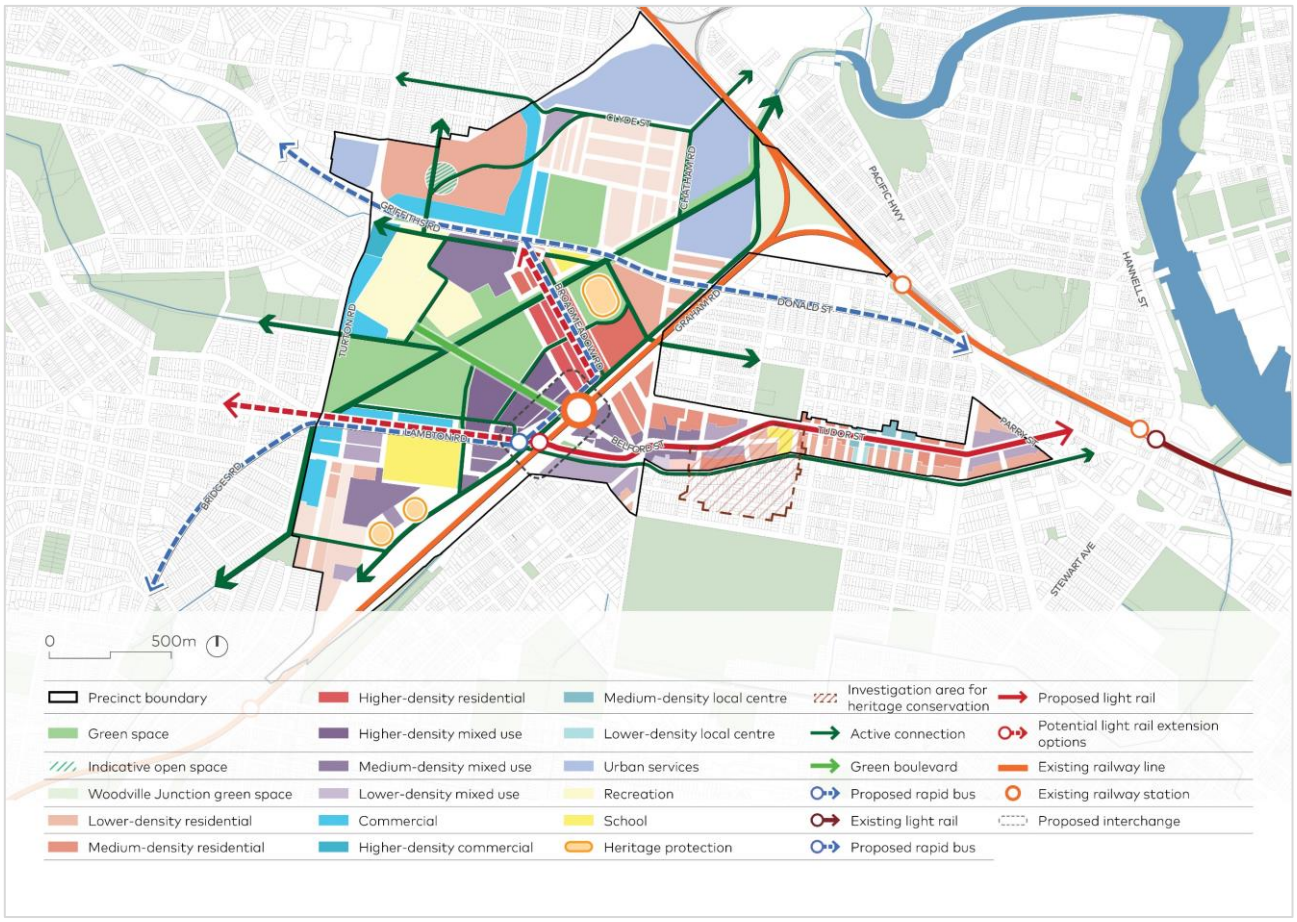


Figure 5–1: Proposed Structure Plan

6. Transport Vision and Objectives

6.1 Transport Vision

The review of government policies and plans in Section 2 shows the compatibility of proposed development in the Broadmeadow Precinct with the investigation of transport improvements currently being undertaken. The commitment to urban renewal at locations such as Broadmeadow responds to the need to accommodate population growth in the Greater Metropolitan Area.

The Structure Plan comprising a mix of complementary development and supporting transport infrastructure will have a positive transport outcome in that it will result in less need to travel and shorter trips, thereby increasing the potential for greater use of non-car modes, such as walking and cycling, which will assist in managing the transport task from proposed development.

Based on the overall vision for the Project, planning principles, the results of the study to date and community feedback, the following vision for transport is proposed for the Precinct:

“An integrated multi-modal transport network that promotes sustainable travel to and within the Broadmeadow Precinct, reducing reliance on the private motor vehicle, while improving the connectivity of people, places and businesses through enhanced provision of public transport infrastructure and services, active transport facilities and demand management initiatives”.

6.2 Transport Objectives

The strategic transport objectives have been developed to achieve the transport vision for the Broadmeadow Precinct. The strategic transport objectives align with NSW Government policy, support a range of desired transport outcomes and address customer needs. The strategic transport objectives are outlined in Table 6–1.

Table 6–1: Broadmeadow Transport Objectives

	Transport Objective	Precinct Outcome
Improve quality of transport services and facilities	Prioritise public and active transport modes	– More reliable public transport network – Connected, prioritised and direct active transport network – Reduce demand for private vehicle travel – Increase number of trips by alternative transport modes
	Support efficient interchange between transport modes	– Reduce the need for private vehicle trips whose reliability can be affected by arterial road congestion
	Improve bus services within the precinct and align them with rail services	
	Provide consistent and effective wayfinding to increase permeability through the precinct and encourage walking; also provide legible public transport access to increase usage.	– Moving around the precinct is easy encouraging use of active and public transport leading to enhanced sense and experience of place and opportunities for place making
Improve liveability	Make the precinct an attractive place to travel to, from and within	– Public transport and active transport offer a fast and reliable trip even if the road network is congested

	Transport Objective	Precinct Outcome
	Encourage healthy and active lifestyles through provision of safe, direct, and legible infrastructure for walking and cycling, including cycle parking and other end-of-trip facilities in public and private developments	– Take advantage of the extensive green spaces and recreational facilities in the Precinct
	Improve land use integration to increase trip containment, improve liveability and stimulate social/economic activity	– Reduce demand for trips by offering live and work opportunities through mixed land use
	Establish a street network with defined function, hierarchy, and modal priority	– A street network that balances transport and land used outcomes, movement and place
Support economic growth and productivity	Reduce traffic congestion through provision of real and convenient transport alternatives to private vehicles	– Preserve road space for high-value movement, including freight, by providing high-quality alternatives for residents and employees
	Increase use of smart technology to enhance mobility	– Ability to plan more easily, book, pay and track a wide range of services in real time, for better convenience and reliability. – Greater use of real time information, including electronic signage and real time information at bus stops, as well as for incident management – Use of smart data to prioritise public transport and inform place making decisions – Connected, Autonomous Vehicles (CAV's)
Improve safety and security	Make active commuting trips to the precinct safer for the workers who also live in the area	– Provide well-lit paths between employment and residences with passive surveillance
	Reduce pedestrian and vehicle conflict through design of infrastructure	– Consider pedestrian and cyclist safety in intersection design – Direct cycle and pedestrian crossing points to intersections or grade separate
	Reduce traffic accidents	– Provide clear intersection layout and signage at crossing points – Provide pavement type, colour, and vertical difference to guide pedestrians and cyclists when crossing – Design cycle and pedestrian paths to cross at perpendicular angle
	Improve personal security for active transport users and those waiting for public transport, particularly at night	– Design passive surveillance around the proposed Broadmeadow Interchange, active transport connections, bus stops and light rail, where possible

	Transport Objective	Precinct Outcome
		– Provide secure parking options and support green travel plans for all developments
Improve sustainability	Support sustainable modes of transport throughout the precinct	– Reduce road congestion and vehicle emissions by reducing demand for private vehicle trips
	Increase containment and reduce the need to travel by locating complementary land uses close to each other, e.g. residential close to essential shopping/other services, and to varied employment opportunities	– Reduce demand for trips by offering live and work opportunities through mixed land use
Strengthen transport planning processes	Work with businesses, Council, and transport operators to achieve an integrated transport network that addresses all customer needs	– Customer focussed transport network
	Support new developments to encourage an attractive and safe street environment for pedestrians, cyclists, and public transport customers with active street frontages	– Provide a street environment, which is conducive to walking and cycling trips
	Introduce maximum parking rates for all development types, as well as other demand management initiatives to align with transport objectives for the precinct	– Discourage private vehicle travel and encourage use of alternative modes through provision of enhanced infrastructure and services for public transport, walking and cycling.

6.3 Transport Planning Tools

Adopting sustainable transport planning principles for the proposed redevelopment of Broadmeadow assists in achieving the transport vision and minimises its impact on the surrounding road network. Table 6–2 outlines transport planning tools that could be employed for the Broadmeadow Precinct.

Table 6–2: Transport Planning Tools

Tool	Description
Road network hierarchy	– Link the role of the road to its required function in providing access and moveability – Encourage vehicles to use the appropriate connections between individual lots and the arterial road network by designing and providing streets that reflect their position in the road hierarchy – Protect amenity and improve road safety in residential areas and the town centre by discouraging traffic in high pedestrian areas – Reduce through trips when supported with appropriate directional signage – Ensure that vehicles are required to give way at certain points, i.e. no direct through paths

Tool	Description
Modal priority	– Provide enhanced public transport infrastructure and services, as well as active transport facilities within the precinct in order that priority may be given to alternative transport modes – Facilitate easy interchange between modes, including heavy rail, light rail, bus and active transport – Prioritise modes that relate to the surrounding land use – e.g. bus and light rail on public transport corridors, walking and cycling in residential areas, and traffic on key arterial routes – Plan space and paths for active transport to avoid conflicts and the need to retrofit facilities – Reduce the number of times active and public transport passengers are required to wait for general traffic
Early provision of bus services	– Influence travel behaviour of residents as they move in rather than trying to change it later – Establish demand for future light rail corridor – Allow new residents and workers to explore their travel choices before their travel patterns are set – Make residents aware of their travel choices before they invest in a car
Information about active and public transport	– Resident and workplace travel plans – Wayfinding signage throughout precinct – Facilitate real-time information for public transport services
DCP planning conditions to provide active transport infrastructure	– Provide end of trip facilities within each new development – Plan for permeable pedestrian and cycle network – Appropriate parking provision, balanced with active and public transport facilities.

7. Transport Network Assessment

7.1 Overview

Population and employment growth forecasts associated with the proposed Structure Plan and first-move state-led rezoning mean that trip numbers will increase, therefore in order for this growth to be achieved in an environmentally sustainable manner, a greater proportion of existing and future car trips will need to occur on foot, by bike, public transport, or by using car share schemes, which will have a direct impact on reducing traffic congestion.

An assessment of the transport network in the vicinity of Broadmeadow has been undertaken, focusing on active transport, bus, rail, on-demand services, as well as the surrounding road network.

Travel demand management will also play an important role in changing how, when and where people travel. In particular, it will act as a tool along with other strategies such as parking management to minimise demand on the future transport network.

Detailed discussion on traffic modelling is included in Section 8, while transport infrastructure required to facilitate proposed development, as well as potential staging is provided in Section 9.

7.2 Walking and Cycling

Walking and cycling trips are already being made within the Greater Newcastle area, as recognised in the Greater Newcastle Transport Plan, which states:

“Capitalising on the strong existing active transport use within Greater Newcastle, there is an opportunity for increased trips within centres, as well as trips less than 10km to be made by walking or cycling”.

A network of active transport links has therefore been identified to improve connections within the precinct and across the wider metropolitan area, building on existing on-road and off-road infrastructure and proposals by the City of Newcastle. A safe, legible and connected active transport system is vital to inducing modal shift and reducing reliance on the private vehicle.

The Styx Creek green corridor creates an excellent opportunity for a regionally significant active transport connection, linking together the series of district and regional parks along the central spine. It presents an opportunity to create a continuous walking and cycling connection along the creek interface and into the city centre via Throsby Creek.

A route along the west side of the Main North railway line within the precinct supplements Styx Creek, while a new pedestrian-oriented boulevard will extend from the proposed multi-modal interchange at Broadmeadow Station to the entertainment precinct.

Vital to the attractiveness of walking and cycling is a legible, consistent and direct active transport network. In response, locations for grade separation have been identified to increase safety and overcome barriers in the walking and cycling network formed by major roads and rail corridors within the precinct.

The existing rail corridor, Griffiths Road, and Lambton Road divide the precinct into three parcels. The improved cross-corridor connections will encourage the development of distinct but connected character areas throughout the precinct where people live closer to where they work and play, however the connections are not without their challenges, which will require more detailed investigation.

Where intersection upgrades are required to facilitate proposed development traffic, these will include improved active transport connectivity, where appropriate, aligning with nominated active transport routes.

Mobility devices like e-bikes offer alternatives for short trips to nearby centres and work locations. It is recommended that the Newcastle e-bike on demand service, which allows users to make short trips using a fleet of publically available power-assisted bicycles, be expanded to include Broadmeadow.

Proposed land use and active transport facilities, including connectivity between proposed land uses, is provided in Figure 5–1, while Figure 7–1 below shows the network of existing and proposed active transport links within the precinct and surrounding area. Street typologies, including cross sections of active transport facilities are included in the draft Master Plan.

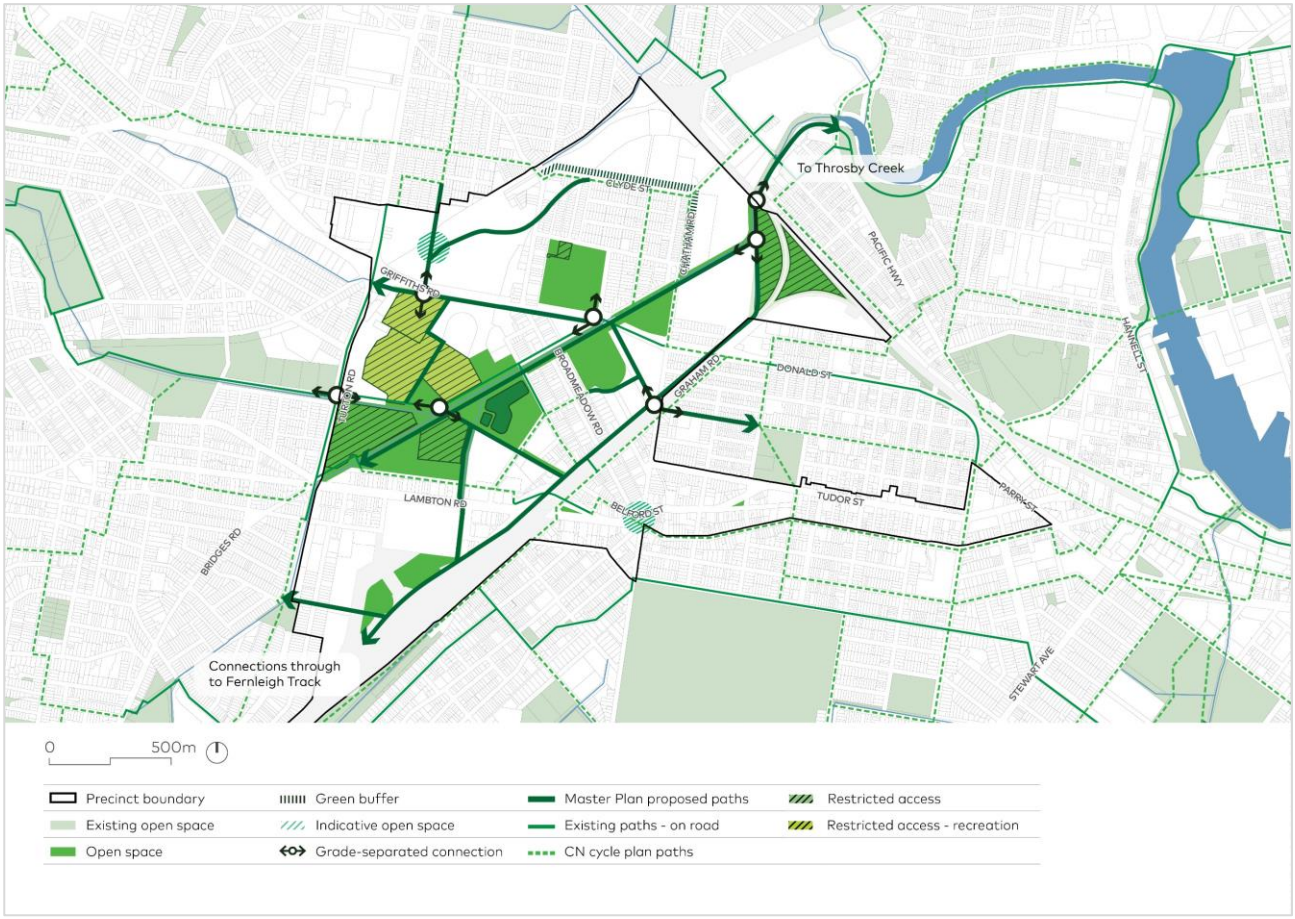


Figure 7–1: Proposed Active Transport Connectivity and Links

7.3 Bus

The review of public bus services undertaken in Section 3 indicates that the precinct is well connected by bus with all areas within 400m of an existing bus stop, however the majority of services are fairly infrequent. The most frequent services operate from Maryland to Merewether Beach via Wallsend and Newcastle Interchange, as well as from Glendale to Newcastle via Cardiff and John Hunter Hospital with 4 trips per hour on weekdays during peak and off-peak periods and 2 trips per hour at the weekend. The majority of other services operate with 2 trips/ hour during the weekday peak and 1 trip/ hour throughout the rest of the day, as well as at the weekend.

An opportunity therefore exists for increased frequencies to better service existing demands, as well as to service future demands generated by proposed development in the precinct. Additional/ improved service options should be investigated to 1) better serve weekday peak demands across the network and 2) cater for people who need to travel between the weekday peaks, as well as on weekends.

A review of Journey to Work (JTW) data undertaken in Section 1 indicates that the share of trips by public transport for travel zones relevant to the study area is currently low, however there is strong potential to increase the share of trips that people make by public transport through a range of measures. A gradual shift in travel patterns and land use will build the foundation for mode shift from car-based to public-transport based travel.

Introducing bus priority measures on key corridors in the short to medium term would increase journey speed and reliability delivering more rapid bus services. For customers, this will result in improved connectivity between key centres and increased accessibility to opportunities like jobs, health care, education and sports facilities.

Dedicated bus corridors have the potential to be converted to light rail corridors in the longer term, subject to demand. Such investment in public transport would deliver early community benefits and support planned growth. Bus routes should reflect customer's travel needs, with priority given to buses on key corridors to provide comparable, if not quicker, journey times compared to private vehicles. Service levels should match the travel demand, with turn up and go frequencies on key corridors.

The need for a rapid bus corridor has been identified along Griffiths Road with a connection to the proposed multi-modal interchange at Broadmeadow Station via Broadmeadow Road. These buses will feed commuters from the north of the precinct into the Newcastle City Centre, and patrons to events at Hunter Stadium and the future Newcastle Entertainment Centre.

The need for rapid bus has also been identified on the Bridges Road corridor connecting with the Lambton Road corridor and the proposed multi-modal interchange at Broadmeadow Station. Likewise along the Belford Street/ Tudor Street corridor between Newcastle Interchange and the proposed interchange at Broadmeadow as a precursor to light rail. The provision of dedicated bus priority lanes will reduce journey times and provide a viable alternative to the private car, thus encouraging mode shift in the precinct.

Integration of bus services with light and heavy rail at the proposed multi-modal interchange at Broadmeadow Station will be essential to provide a seamless journey experience for customers. The bus network will provide a support role to the extended light rail, connecting areas further away from the line to light rail stops. Further detail on light rail is contained in Section 7.4 below.

7.4 Light Rail

Newcastle Light Rail is a high capacity, frequent and reliable service that operates along a 2.7km route with 6 stops from Newcastle Interchange in Wickham to Newcastle Beach in the east end, connecting key activity precincts and facilitating urban renewal opportunities.

The focus of Newcastle light Rail on connecting and revitalising the Newcastle City Centre and waterfront has paved the way to extend the light rail system to encourage growth in surrounding precincts, such as Broadmeadow.

The extension of Newcastle Light Rail from Newcastle Interchange to Broadmeadow, or a bus rapid transit alternative, is considered essential to achieve the magnitude of mode shift change needed to reduce reliance on private car travel. Without this service, the proposed Broadmeadow town centre will effectively become isolated from the wider public transport network and road constraints will reduce the ability of the precinct to achieve the proposed Structure Plan.

The extension of the light rail would introduce a high frequency, high capacity service to Broadmeadow. In addition, it would be the primary connection to the heavy rail network, being part of a proposed new transport interchange with heavy rail services. The extension of the light rail to Broadmeadow (and potentially to destinations further west) will become a focus of transport for the town centre.

The proposed interchange will prioritise simple and quick connections between different modes, including light rail, heavy rail, bus, as well as active transport and will be integrated with surrounding land uses enabling adjoining development to respond through good urban design.

7.5 Heavy Rail

Improvement of the heavy rail service on the Central Coast and Newcastle Line, as well as on the Hunter Line would establish trains as a more viable alternative to the car for commuting to/ from Newcastle, Broadmeadow and beyond.

A review of existing rail services at Broadmeadow Station in Section 3 indicates that weekday service frequencies for both express and all stopping services are hourly, therefore consideration could be given to increased train frequencies in the short term.

An alternative longer term option is faster rail, or a high-speed rail corridor from Sydney to Newcastle, which would reduce travel times to give people more choice about where they live and work and would also provide a catalyst for regional growth by attracting investment, creating jobs and supporting growth in key industries.

It is understood that the federal government has recently committed around $80 million to an initial business case for a high-speed rail line from Sydney to Newcastle. The document will outline the proposed route for the rail line, station locations, the type of trains to be used and the cost and time frame for the project and is expected to be provided to the government by the end of this year.

The Lower Hunter Freight Corridor will provide for a future dedicated freight rail line between Fassifern and Hexham, bypassing the Newcastle urban area and improving regional and interstate links. Separating rail freight from passenger rail lines is a NSW Government initiative to reduce network congestion, improve travel times and reliability for both rail freight and passenger rail services, as well as to allow for additional passenger rail services to be provided.

The corridor will also support growing demand as freight and passenger rail services in Northern Sydney, Newcastle, and the Sydney-Newcastle corridor continue to grow. Additionally, the corridor will also relieve congestion and journey delays to road and active transport users around level crossings at St James Road, Adamstown and Clyde Street, Islington.

7.6 Road Network

The existing road network in the vicinity of Broadmeadow features the key road corridors of Griffiths Road, Turton Road and Lambton Road.

The A15 Griffiths Road is a State road that provides the main link from Newcastle to the M1 and continues on as the A/M15 to Tamworth. It connects several major suburbs in the Newcastle area, including Hamilton, Broadmeadow, and Jesmond. The road is a multi-functional priority corridor used by private vehicles, commercial vehicles, as well as by public transport and is also a designated B-double Route.

Turton Road is also a State road and provides a key link between A15 Newcastle Road and Lambton Road, running in a north/ south direction, while Lambton Road is a Regional road that connects the Newcastle CBD with several surrounding suburbs, including Lambton and Jesmond. It is a major thoroughfare for both private vehicles, commercial vehicles, as well as for public transport.

Operational traffic modelling undertaken by SMEC to support the Structure Plan has identified congestion on the arterial road network, including the key movement corridors referred to above.

Traffic modelling shows that a number of intersections on key road corridors are operating close to, or at capacity. Model statistics show that the current afternoon peak is the most heavily congested, with the highest delay across the network, lowest speed and the highest number of stops.

The proposed Structure Plan and resulting uplift in traffic will therefore require road network infrastructure interventions to accommodate both future background traffic growth, as well as traffic generated as a result of development associated with the Structure Plan.

Traffic modelling of the road network indicates that the precinct is forecast to experience increased congestion regardless of the proposed Structure Plan, thus travel demand management measures to encourage a reduction in private vehicle trips, an increased number of trips by alternative travel modes, as well as a change in travel behaviour will be important.

Travel demand management is discussed in Section 7.7 below, while discussion on traffic modelling undertaken is provided in Section 8, including methodology, assumptions, network performance and road network improvements to mitigate the impact of the proposed Structure Plan.

7.7 Travel Demand Management

7.7.1 Overview

Travel Demand Management (TDM) combines transport and land use planning in order to change how, when and where people travel. Its purpose is to minimise demand on existing and future transport networks, which will be essential in the case of Broadmeadow where a significant uplift in trips is expected associated with the proposed Structure Plan.

TDM seeks to reduce car trips and distances travelled by increasing travel options, by providing incentives and information to encourage and help individuals modify their travel behaviour, or by reducing the physical need to travel through transport-efficient land uses. The cumulative impact of a comprehensive set of TDM strategies can have a significant impact on travel behaviour, system efficiency and demands.

TDM can generally be categorised into ‘hard’ and ‘soft’ measures. Hard measures tend to be physical or cost based that seek to limit a particular travel behaviour, such as congestion charging, parking restrictions, or road access constraints, while soft measures seek to influence travel behaviour through education, information, incentives, or ride share schemes.

7.7.2 Importance of TDM

Encouraging and working with stakeholders to develop travel demand management policies (re-time, re-mode, re-route and reduce travel), such as promoting people working from home, or working with employers to promote sustainable working and organisational practices, travelling in off peak periods, or reallocation of road space to reduce the number of single occupant vehicle trips will be essential to reducing travel demands in Broadmeadow.

TDM is a key part of a sustainable transport system, delivering social, economic and environmental benefits, including:

- reduction in congestion
- efficient use of existing transport infrastructure and services
- reduction or deferral of transport infrastructure investment
- better access and more transport choices for socially and economically disadvantaged people
- increased physical activity and better public health
- improved liveability and amenity
- road safety benefits including reduced injuries and associated costs; and
- improved air quality and reduced emissions.

7.7.3 Travel Behaviour Change Strategies

Travel behaviour change strategies use a multi-prong approach to assist people to reduce their need to travel, reduce dependence on private cars and increase physical activity by making voluntary changes in their travel habits and patterns. Such changes include reducing car use and increasing the share of trips by alternative modes, such as walking, cycling, public transport or car-pooling.

A review of journey to work data in Section 3 shows that Broadmeadow is very much car dominated. Analysis indicates that the majority of people use a private vehicle to travel from the area to their work; also that the majority of workers use a private vehicle to travel to the area.

The Greater Newcastle Future Transport Plan has a public transport mode share target of 7.55% by 2056 from the 2011-16 average of 3.2% and an active transport mode share target of 17% by 2056 from the 2011-16 average of 7.5% (based on Household Travel Survey data). This represents a target of 25 per cent of total trips within Greater Newcastle to be made by public transport or walking and cycling by 2056.

Given the population and employment growth projections associated with the proposed Structure Plan, any increase in travel would also be accompanied by increased congestion, should current travel patterns and behaviours be sustained. Hence, if growth in Broadmeadow is to be achieved in an environmentally sustainable and uncongested manner, a greater proportion of existing and future car trips will need to occur on foot, by bike, public transport, or by using car share schemes, which will have a direct impact on reducing traffic congestion.

The 15-minute neighbourhood, which will be adopted in the development of the precinct, will also assist in achieving the above referred mode share targets, in that more people will live locally where their everyday needs can be reached within 15 minutes by using public transport, walking or cycling – rather than by taking trips by private car. The principle responds to the way people increasingly want to live and also encourages efficient and more sustainable forms of transport.

Sustainable travel can also enhance the lifestyle and wellbeing of the community and will increase by providing information, opportunities and encouragement to make and maintain sustainable travel changes, which will enable residents, workers and visitors to know when it is viable to walk, cycle or take public transport rather than use a private vehicle.

The travel behaviour change strategies and recommended actions below provide a way to maximise the use and efficiency of existing and proposed transport infrastructure:

- Develop and implement community travel behaviour programs for residents, business and schools
- Better promotion of sustainable transport options through events
- Better promotion of sustainable transport options through education and awareness campaigns

- Better information provision for sustainable transport options
- Further develop car share schemes for residents and business
- Better support for point-to-point transport within the area, including taxis
- Comprehensive parking management strategy.

7.8 Parking Management

7.8.1 Overview

Parking management can encourage more efficient use of existing parking facilities, reduce parking demand and shift travel to non-single occupancy vehicle modes. Managing parking helps to reduce the undesirable impacts of parking demand and the resulting impacts on community, liveability and design. At the same time, smart management of parking helps to ensure access to retail businesses and local services, as well as supports neighbourhood vitality.

The supply of free or inexpensive parking at the final destination is a key decision factor cited for choosing to drive a private vehicle rather than taking a bus, walk, bike, or carpool. When free or inexpensive parking is available, it leads to overuse, often by long-term, or all-day parkers who occupy valuable spaces at the expense of short-term parkers, limiting access to retail businesses and service industries catering to short-term users.

The most effective parking strategies are cost based, or pricing measures that link parking rates more directly to demand or provide financial incentives and/ or prime parking spaces to preferred markets, such as carpools, vanpools and short-term parkers. This reduces total parking demand, shifts travel to other modes, reduces vehicle kilometres travelled and ensures a minimum number of parking spots are always available.

A comprehensive parking strategy is required for Broadmeadow to reduce total parking demand, shift travel to other modes, reduce distances travelled and ensure parking spots are only available for those who most need them. While the City of Newcastle already has an adopted Parking Plan, this will require to be amended along with the Newcastle Development Control Plan (DCP) to introduce the required controls needed to achieve the desired outcomes for Broadmeadow.

7.8.2 Future Growth and Challenges

7.8.2.1 Future growth

Future employment and residential growth will generate significant travel demands to/ from Broadmeadow, placing greater demand on transport infrastructure and services. As noted above, parking management and policy measures are therefore required together with a range of other travel demand management measures to assist with the reduction of traffic on the road network.

Under a business-as-usual approach where car is the dominant mode of travel to/ from Broadmeadow, the additional trips would lead to significantly higher volumes of private vehicle traffic on the surrounding road network if effective parking measures, greater public transport infrastructure and active transport connectivity are not made available.

An increase in private vehicle volumes will lead to increased congestion, which in turn will:

- Impact on all road-based travel modes, including bus and commercial vehicles
- Decrease urban amenity and ‘place’ function in the Broadmeadow Town Centre
- Decrease economic productivity; and
- Impact on community health.

Forecast traffic volumes for the study area indicate that many travellers will continue to use private cars, which indicates that without intervention that provides alternatives, the road network will be severely congested. Car users value the comfort, flexibility and convenience of using their own vehicle, however if parking is made scarce and/ or expensive, car users will switch to public transport and other modes if it is readily available.

7.8.2.2 Challenges

The design and management of parking supply will affect the liveability and walkability of the precinct. Building additional parking without managing the existing supply will induce driving, which in turn will increase the demand for more parking. Conversely, managing the existing supply is a cost effective way to reduce demand or increase the use of underutilised spaces.

The most effective way to control demand is through pricing. However, other policies and practices can also be highly effective, such as the use of strictly enforced parking time restrictions. Factors affecting the impact of parking management include residential and employment densities, access to public transport, and critically availability of active transport infrastructure.

The following issues have been identified as impacting parking management:

- Parking fee provision
- Minimum rather than maximum parking rates
- Parking over-supply in residential development
- Parking over-supply in retail and office use buildings
- Accessibility to active transport facilities and public transport system; and
- Free kerbside parking provision and low parking turn over.

7.8.3 Parking Strategy Actions and Initiatives

As noted above, a comprehensive parking strategy is required to manage parking within the precinct over the short, medium and long term. The overarching objective of the parking strategy would be as follows:

- Short term action – Reduce parking availability to disincentivise ownership of cars within the precinct and use of cars to travel to the precinct through the introduction of maximum parking rates
- Medium term action – Provide parking and sustainable transport options to manage the parking demand of a growing precinct and town centre
- Long term action – Implement a comprehensive, integrated transport and parking system.

Table 7–1: Key Actions and Initiatives to Manage Parking Demand details the key actions and initiatives recommended to be undertaken over the short, medium and long term to manage parking demand, improve parking efficiency, and monitor the consequences of the strategy.

Table 7–1: Key Actions and Initiatives to Manage Parking Demand

No.	Strategy	Policy Action	Short term action	Medium term action	Long term action
1	Introduce more sustainable and efficient parking provision within Broadmeadow for different land uses and user groups	Identify parking requirements for different land use types and user groups in order to implement more sustainable and efficient parking provision	• Undertake detailed surveys and investigations to identify user needs in order to inform parking requirements for different land use types and user groups	• Undertake periodic consultation with key user groups to refine/ update parking management arrangements, as required	• Undertake periodic consultation with key user groups to refine/ update parking management arrangements, as required
		Amend Development Control Plan to introduce maximum car parking standards for all land use types to reduce supply of parking associated with future new development and encourage use of alternative transport modes to/ from and within Broadmeadow, reducing the demand for trips by private vehicle and lessening the impact on the surrounding road network.	• Identify and adopt appropriate maximum car parking rates within the Development Control Plan	• Implement and monitor revised parking rates within Broadmeadow	• Implement and monitor revised parking rates within Broadmeadow
2	Plan for improved more sustainable access to Broadmeadow	Identify appropriate short, medium, and long-term actions to improve access to Broadmeadow based on travel demand management principles	• Identify and prioritise travel demand management arrangements	• Implement and monitor demand management arrangements	• Implement and monitor demand management arrangements
		Undertake analysis of trip patterns and determine appropriate location and feasibility of park and ride facilities	• Identify park and ride sites in vicinity of mass transit corridors to reduce number of vehicular trips entering Broadmeadow	• Implement and monitor park and ride sites	• Monitor park and ride sites

No.	Strategy	Policy Action	Short term action	Medium term action	Long term action
		Prepare access and parking management plan for Broadmeadow	• Develop access and parking management plan	• Implement and monitor access and parking management plan	• Monitor access and parking management plan
3	Better manage existing and future car parking provision in Broadmeadow	Manage short and long stay car parking to promote turnover, achieve optimal utilisation and support mode shift to sustainable transport	• Undertake a comprehensive review of time restricted parking within Broadmeadow to understand issues, challenges, and opportunities to optimise utilisation, improve consistency of restrictions and implement changes as required • Develop an integrated strategy and approach to time restrictions across Broadmeadow • Implement revised time restricted parking aimed at establishing convenient and accessible (short stay) parking in the centre, radiating out to longer term parking on the periphery of the precinct • Study the need for paid parking to manage parking more efficiently within Broadmeadow, including flexible demand-based pricing structures	• Continue to implement and monitor revised time restricted parking in Broadmeadow • Implement paid parking in Broadmeadow town centre, if required, and monitor effectiveness	• Monitor revised time restricted parking in Broadmeadow • Monitor effectiveness of paid parking

No.	Strategy	Policy Action	Short term action	Medium term action	Long term action
			• Investigate feasibility of vehicle mounted licence plate recognition systems to complement current parking enforcement	• Continue effective parking enforcement across precinct, adopting new technology, where appropriate	• Continue effective parking enforcement across precinct, adopting new technology, where appropriate
		Identify opportunities for shared use of car parking by multiple users	• Investigate and implement opportunities to share parking areas for situations with varying peak demands • Investigate and implement opportunities to increase the number of spaces in existing on-road and off-road car park areas	• Investigate opportunities for car stackers and other technology to minimise demand for car parking areas	• Implement relevant technologies to improve parking efficiency in existing car parks
4	Ensure safe access for all user groups at car parks within Broadmeadow	Review and enhance safety at car parks within Broadmeadow	• Undertake review of safety and security at car parks	• Implement safety and security updates identified/ required	• Ongoing monitoring of safety and security in car parks
5	Improve customer experience through clear information about parking management	Undertake a communication and education campaign to inform residents and stakeholders of proposed parking management measures	• Develop communication and education campaign	• Implement and monitor communication and education campaign	• Monitor communication and education campaign

8. Traffic Modelling

Traffic modelling has been undertaken to determine the impact of the forecast increase in population and employment associated with the proposed Structure Plan.

To develop demands for modelling purposes, the Strategic Travel Model (STM) and Sydney Traffic Forecasting Model (STFM) were updated by Transport for New South Wales to reflect development associated with the proposed Structure Plan, which resulted in a significant increase in traffic in the vicinity of the Broadmeadow Precinct.

The demands were then used in a VISSIM microsimulation traffic model developed by SMEC to determine operational impacts on the road network associated with the proposed Structure Plan, as well as to identify appropriate road infrastructure upgrades that may be required.

8.1 Limitations of Modelling

Strategic Modelling

Initial strategic modelling was undertaken by Transport for New South Wales reflecting the demographics of the proposed Structure Plan, primarily large increases in both population and employment. No changes were made to household types, population types, or car ownership rates.

The modelling conducted was based on existing assumptions relating to the transport network, including future public transport infrastructure and services. No modelling has been undertaken of potential future mass transit options, including bus rapid transit, or the extension of light rail. It is recommended that further work be undertaken to assess potential future public transport projects, which is outside the scope of the current study.

Microsimulation Modelling

The microsimulation model used for purposes of assessment is a corridor model, therefore traffic is not able to dynamically choose its path along the network. Vehicle pathing is determined through the strategic modelling process and can only be shifted via manual adjustments to the demands.

The primary goal of the microsimulation modelling is to identify locations where road infrastructure upgrades will be required to accommodate traffic associated with the proposed Structure Plan. The proposed upgrades are preliminary only and subject to change during later stages of design development.

8.2 Assessment Years and Stages

The following future years were modelled, which align to the years for which strategic model outputs were provided by Transport for New South Wales, as well as to the following proposed stages of development:

- 2031 - First-move state-led rezoning sites comprising 1) Go Karts and Stadium Forecourt 2) Newcastle Showground 3) Basketball Stadium plus PCYC sites, and 4) the Locomotive Depot. The first-move state-led rezoning sites comprise up to 3,200 dwellings and 2,350 jobs. The Stage 1 development was also assessed in this year, which comprises 6,780 dwellings and 9,531 jobs.
- 2041 - Stage 3 (full development), which comprises up to 20,000 dwellings and 15,000 jobs.

The 2031 assessment will inform road infrastructure upgrades required for the first-move state-led rezoning sites and Stage 1 development, while the 2041 scenario will inform infrastructure upgrades required for Stage 2 and Stage 3 (full development). Modelling beyond 2041 has not been undertaken, as there is increasing uncertainty around land use assumptions upon which strategic models rely this far into the future.

Figure 8–1 shows the first-move state-led rezoning sites, while Figure 8–2 provides the overall staging for Stages 1-3 (full development). Proposed land use is shown on the Structure Plan in Figure 5–1.

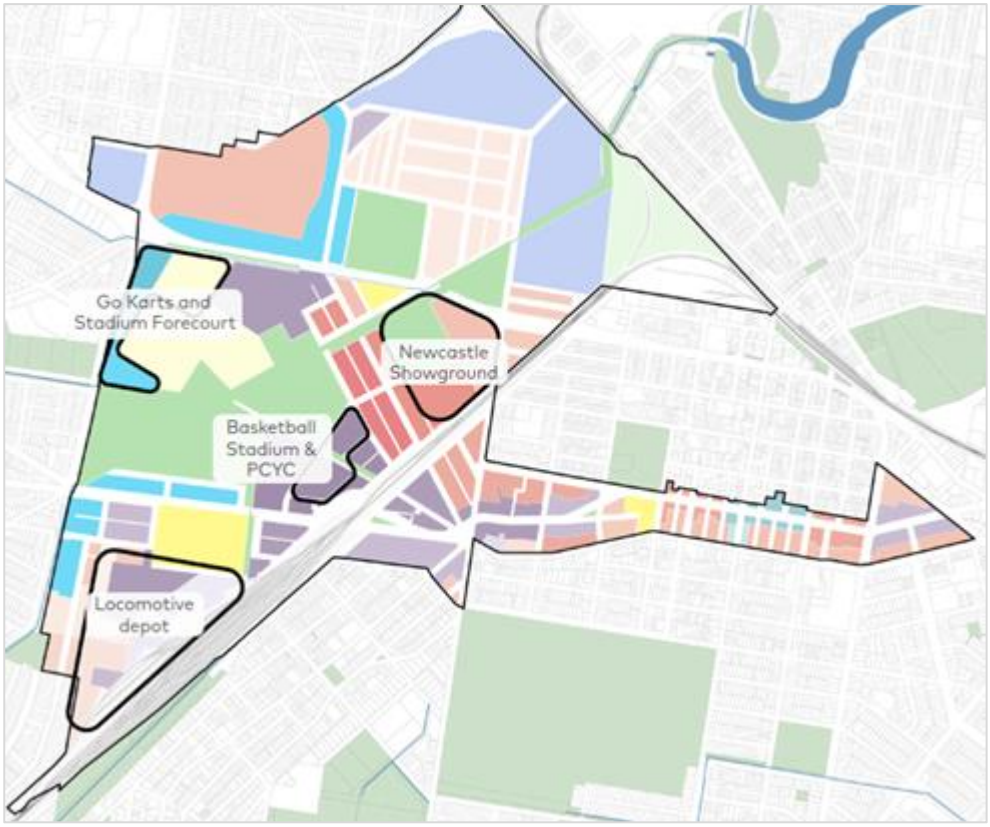


Figure 8–1: First-Move State-Led Rezoning Sites

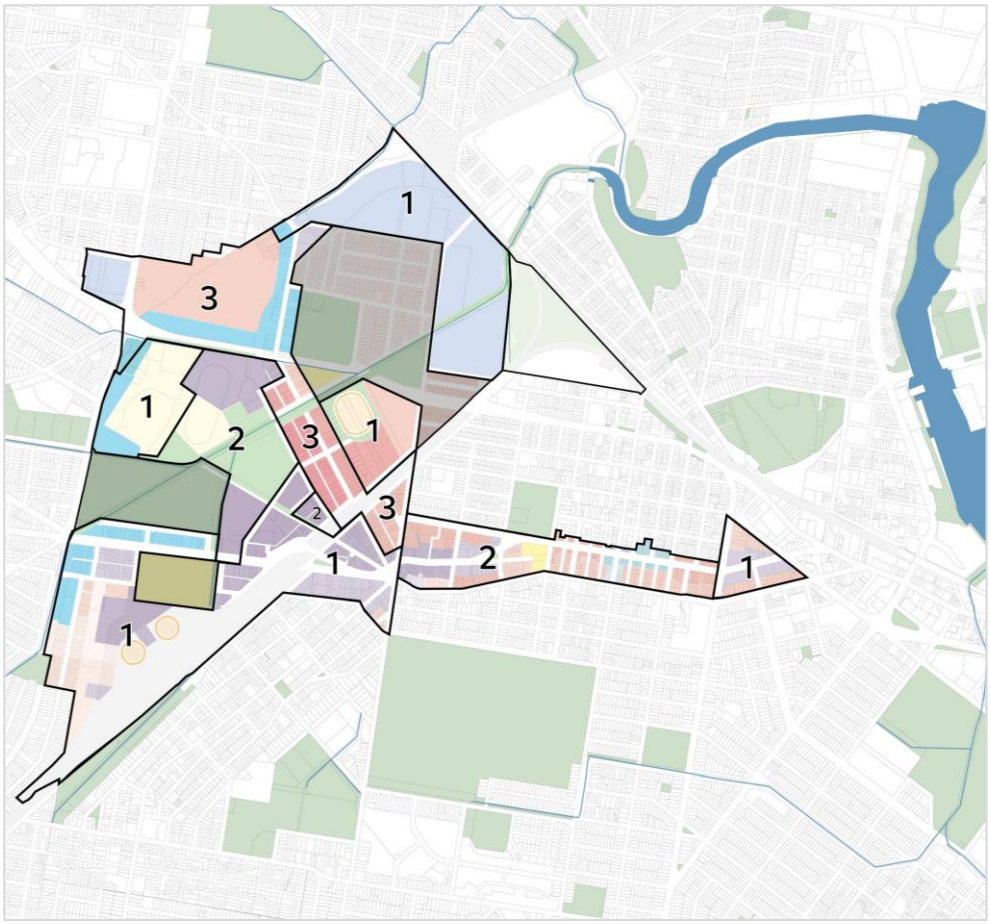


Figure 8–2: Staging Plan – Stages 1 to 3

8.3 STM and STFM Strategic Modelling

Forecasts of traffic demands and travel patterns in the project area were informed through the use of two strategic models developed and maintained by Transport for NSW, namely the Strategic Travel Model (STM) and the Sydney Traffic Forecasting Model (STFM).

As previously discussed, these strategic models were updated to incorporate the land use associated with the proposed Structure Plan and served as the foundation for valuable insights into the expected traffic volumes and travel behaviours specific to the precinct.

The traffic demand outputs from the strategic models were subsequently adopted into the VISSIM microsimulation modelling process to simulate and assess the performance of the road network under various scenarios to support informed decision-making relating to the project area, in particular to identify and recommend road upgrades required.

The strategic model area is divided into the travel zones shown in Figure 8–3. These travel zones represent the traffic origins and destinations for all trip generators and attractors, including housing and employment. The study area overlaps zones 6313, 6314, 6316 and 6325, with a significant proportion of proposed development located within zones 6314 and 6316.

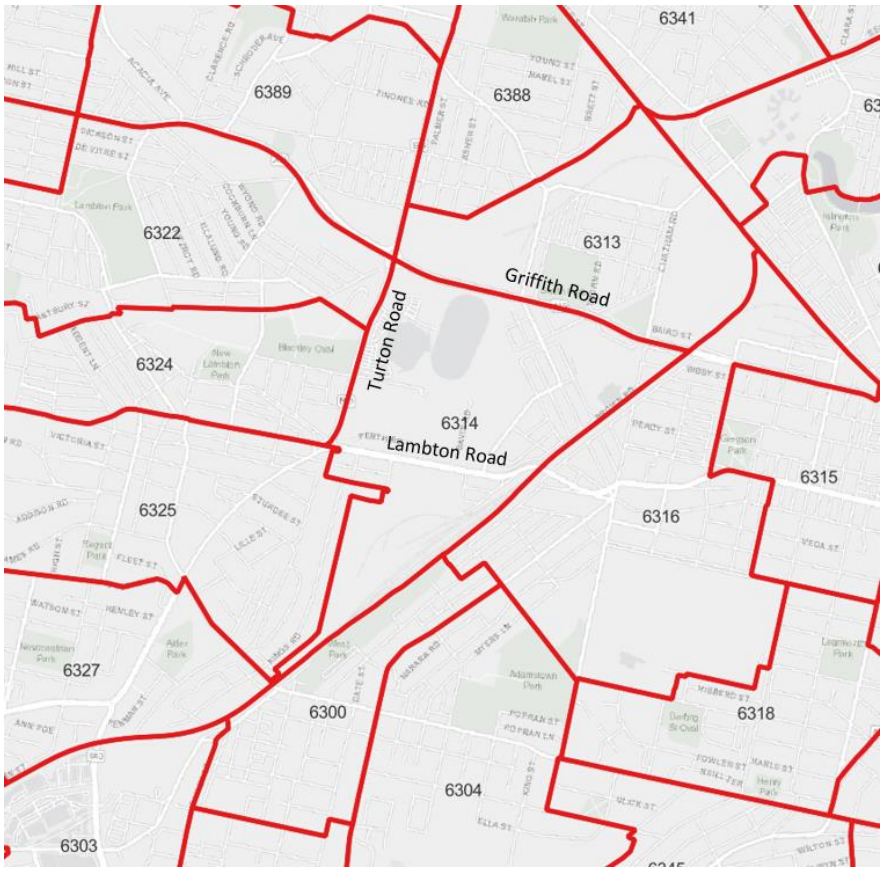


Figure 8–3: STFM Zonal Map

A cordon of the strategic model was cut based on the extents of the microsimulation model, which is shown in Figure 8-6. The cordon contains three main corridors, including Griffiths Road/ Donald Street, Lambton Road/ Belford Street and Bridges/ Turton Road.

An OD demand matrix of trips was generated for this cordon, which provides the overall number of trips in the study area. The demand matrix totals from the STFM are provided in Table 8–1, which are also graphically represented in Figure 8–4 and Figure 8–5 for the AM (7am-9am) and PM (4pm-6pm) periods respectively.

When comparing the Base Reference and With Structure Plan annual growth rates, analysis indicates that there is a 1.3% to 1.5% per annum higher annual growth rate for the cordon area.

Table 8–1: STFM Matrix Totals and Growth Rates

	Total Matrix (vehicle trips, 2 hours)		Compounding Growth rate from 2021	
AM	Base Reference	With Structure Plan	Base Reference	With Structure Plan
2021	28,661	N/A	N/A	N/A
2031	29,629	34,173	0.3%	1.8%
2041	30,599	41,034	0.3%	1.8%
PM	Base Reference	With Structure Plan	Base Reference	With Structure Plan
2021	35,139	N/A	N/A	N/A
2031	35,815	41,237	2.3%	3.7%
2041	38,145	48,838	1.4%	2.7%

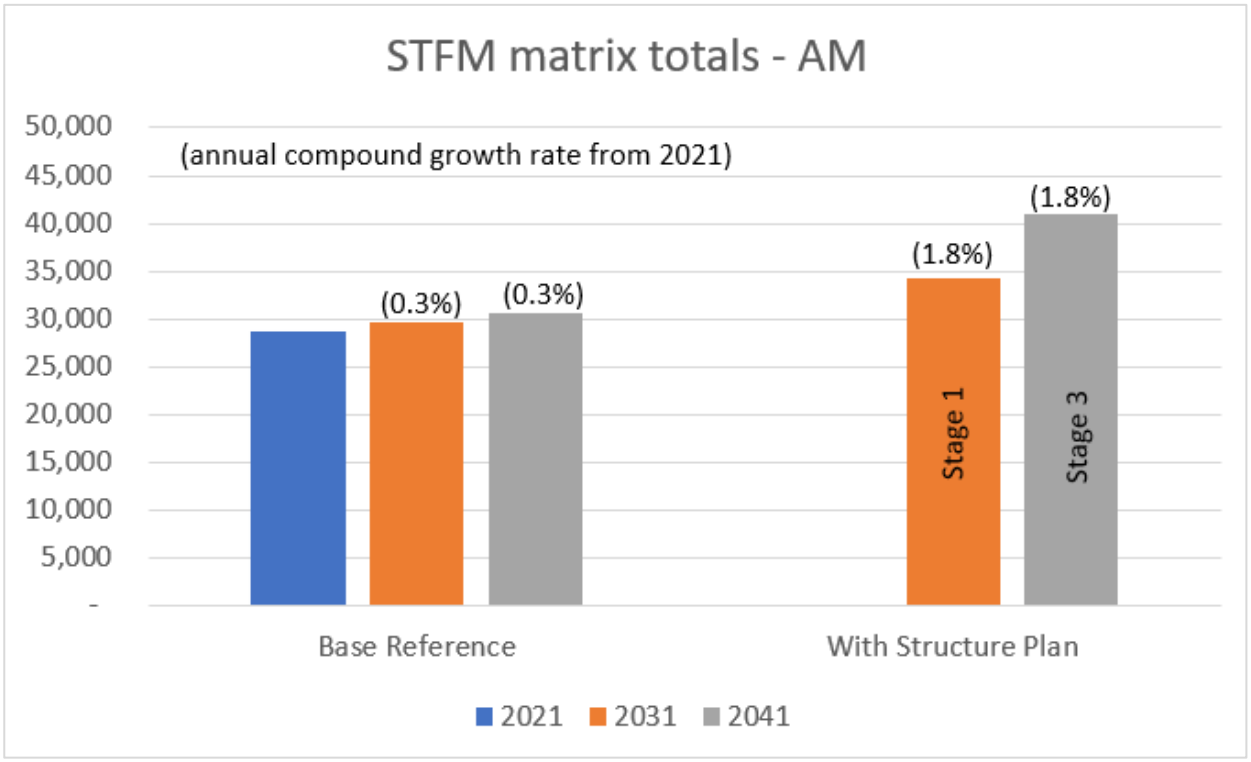


Figure 8–4: STFM Zonal Difference (top ten) 2 hours - AM

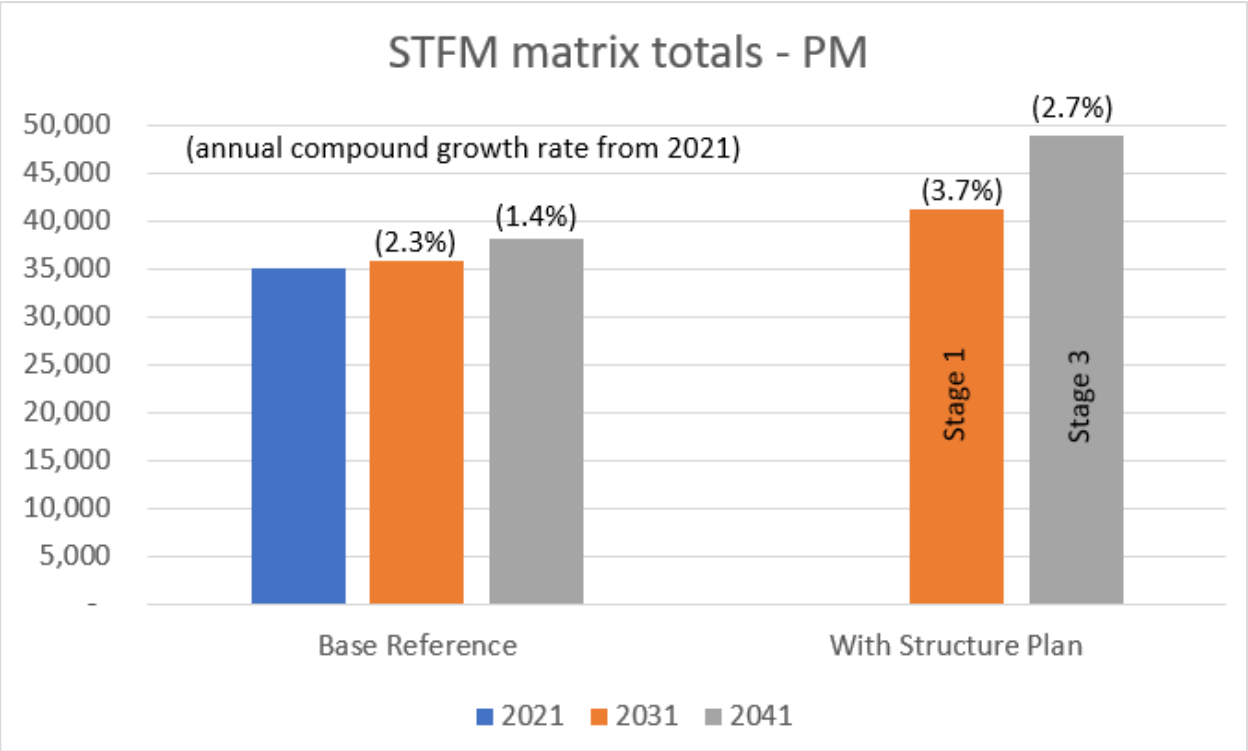


Figure 8–5: STFM Zonal Difference (top ten) 2 hours - PM

The following are key observations from the STM and STFM strategic traffic modelling:

- Traffic demands for the Broadmeadow precinct will increase due to the significant increase in population and employment associated with the proposed Structure Plan. The impact of proposed land use changes are significant and may have impacts beyond the study area.
- The proposed Structure Plan comprises significant mixed-use development, which results in up to 1,500 internal trips in 2041. These internalised trips represent short distance trips between origin and destination that are not assigned to the external network. For example, a commuter travelling less than five blocks to work. As these trips are not assigned to the network, it is assumed that these trips will be undertaken via active transport methods, such as walking and cycling.
- The STM has a public transport mode split for background traffic of approximately 2%. This is based on current assumptions within the model relating to existing and future public transport infrastructure and services.
- During peak periods the Structure Plan generates approximately 6,000 external trips and 1,500 internal trips, which account for around 20% of the total number of trips.
- As discussed in Section 8.1, no strategic model runs have been undertaken that include mass transit options, such as bus rapid transit, or extension of light rail to Broadmeadow. As such, no demand reductions have been made to reflect mode shift that would arise from mass transit options.

8.4 VISSIM Microsimulation Modelling

A microsimulation model was used to assess the impacts of the Structure Plan on the road network. The model extents are as shown in Figure 8-6.

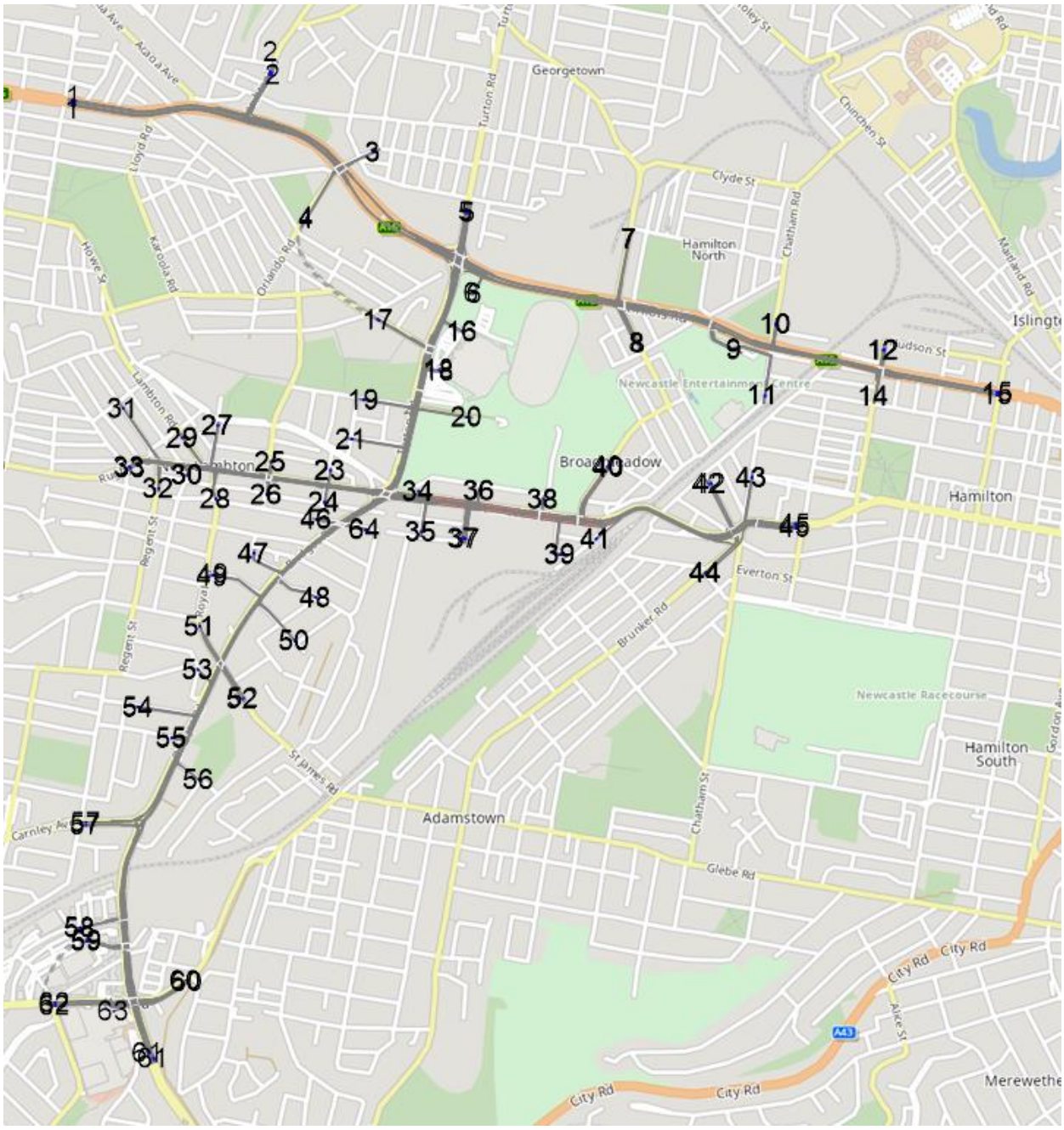


Figure 8-6: VISSIM Extents and Zonal Structure

The primary purpose of the VISSIM modelling was to identify road upgrades required to accommodate traffic generated by the proposed Structure Plan. The scenarios modelled are summarised in Table 8–2, the demands being the same for each scenario modelled in 2031, as well as for each scenario modelled in 2041.

Table 8–2: Modelled Scenarios

Modelling Scenario	2031		2041	
	AM	PM	AM	PM
Structure Plan Scenario (without mitigation)	✓	✓	✓	✓
Structure Plan Scenario (with mitigation)	✓	✓	✓	✓

8.4.1 Matrix Development

To determine the forecast increase in demands due to background growth, as well as traffic associated with the proposed Structure Plan, the following STFM forecast models were used:

- Base year model 2021 with existing conditions
- Future year models using Structure Plan demographics for both 2031 (Stage 1) and 2041 (Stage 3).

Delta matrices were then created representing the difference in trips between the 2021 model and the 2031 and 2041 models. The difference in trips was then added to the calibrated base year model to create calibrated future year models for 2031 and 2041.

The difference in trips between the zones shown in Figure 8-6 above are provided in Table 8–3, which highlights two major zones that did not have appropriate entrance points to the network and needed desegregation, namely zones 6314 and 6315.

Over a two-hour period, Zone 6314 shows an increase of approximately 3,400 vehicles and zone 6316 shows an increase of approximately 1,500 vehicles.

Table 8–3: STFM Zonal Difference (top ten) 2 hours

Zone ID	Location	AM (vehicles)			PM (Vehicles)			Difference '21 to '41	
		2021	2031	2041	2021	2031	2041	AM	PM
1	Griffith Road (West)	3,149	3,571	3,993	2,861	2,863	3,250	844	389
7	Meadowbrook @Griffiths (North)	855	1,086	1,465	1,078	1,116	1,484	610	406
8	Meadowbrook @Griffiths (South)	259	471	677	350	592	830	418	479
10	Chatham @Griffiths (North)	458	719	919	678	774	1,003	461	325
14	Samdon @Griffith (South)	563	804	1,130	728	934	1,077	566	349
15	Griffith Road (East)	1,881	2,165	2,564	2,755	3,374	4,069	683	1,314
33	Lambton Road (West)	1,167	1,353	1,537	1,032	1,559	1,844	371	813
40	Development Zone 6314	787	2,597	3,990	1,262	3,622	4,695	3,204	3,432
42-44	Development Zone 6316	1,022	1,684	2,612	2,023	2,609	3,592	1,589	1,569
45	Lambton Road (East)	955	1,301	1,396	1,491	1,815	2,251	441	760

To ensure that the STFM and microsimulation models had zones that correlated, the STFM traffic demands were proportioned to accesses based on the percentage of population and employment for each land parcel. The larger zones were disaggregated amongst identified access points onto the road network, as shown in Figure 8-7.

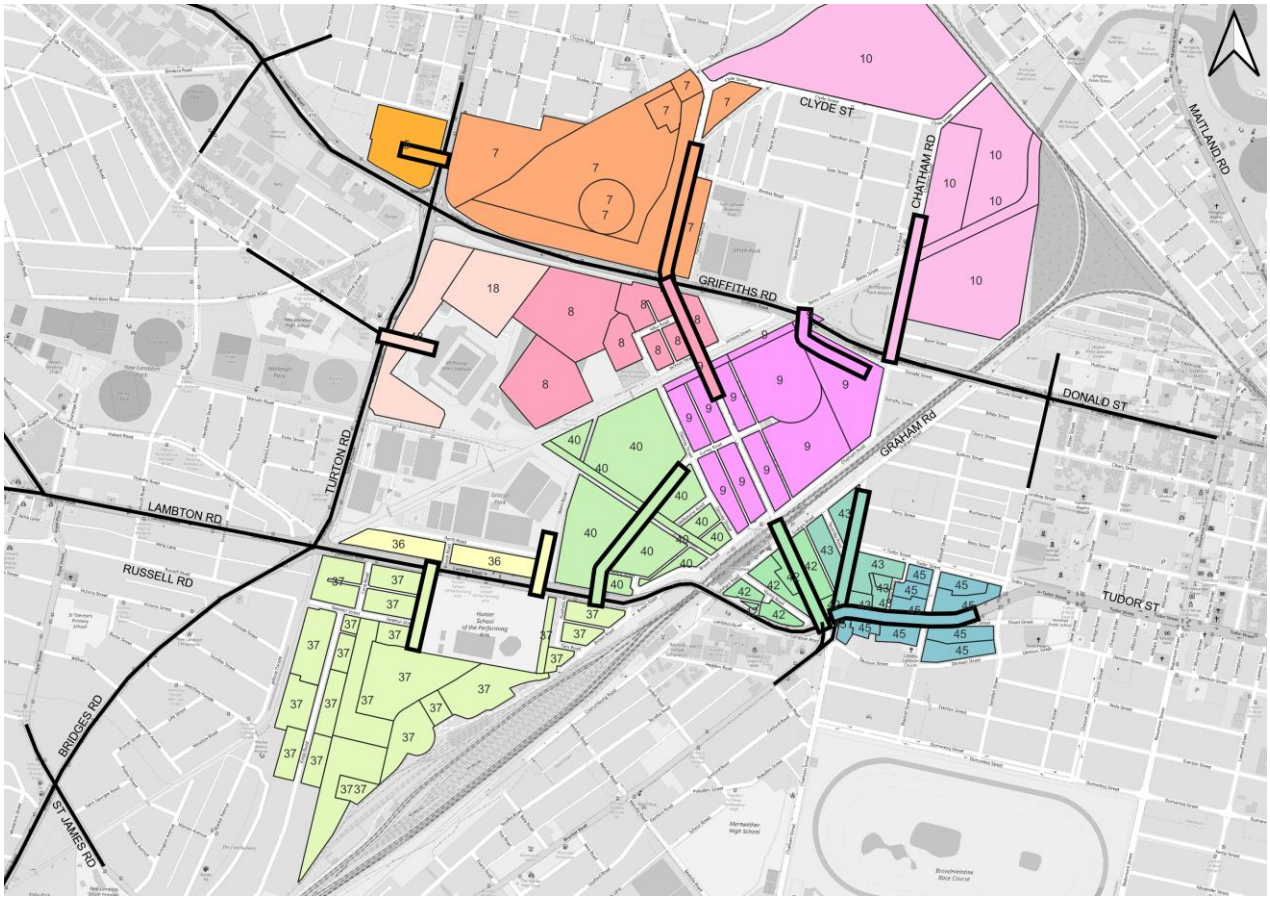


Figure 8-7: Desegregation of Traffic from Study Area

Following development and testing of the 2031 (Stage 1) and 2041 (Stage 3) matrices, a number of issues with illogical pathing were found. Primarily traffic from zone 6314 which had been proportioned to either Griffith Road or Lambton Road. For example, if the destination for traffic from zone 6314 was Griffith Road, it made sense for it to use the internal road network to exit via Griffith Road. The same approach was applied for traffic from zone 6314 travelling to Lambton Road.

Additional changes relating to illogical movements included the reallocation of right turning traffic from left-in left-outs, such as at the Lambton Road/ Chatham Road intersection, as well as closed roads, such as at the Griffiths Road/ Chatham Road intersection, where it is proposed to close the southern approach.

8.4.2 Peak Hour Factor

The STFM volumes are from a two-hour peak period model, however the VISSIM microsimulation model is a one-hour peak model. The Peak Hour Factor used to convert from two hours to one hour was 0.55 for both peak periods, which was based on peak hours profiling undertaken during calibration.

8.5 Key Access Points and Initial Upgrades

To accommodate the significant increase in traffic demand resulting from the proposed Structure Plan, a number of road infrastructure upgrades are required to address both latent demand and congestion on the road network to allow traffic to flow efficiently.

The key access points and initial upgrades are detailed in Table 8–4, noting that the upgrades do not cover the full extent of upgrade recommendations and were focused primarily on reducing latent demand.

Table 8–4: Key Access Points and Initial Network Upgrades

Key Access Points	Existing Configuration	Comments
Griffiths Road/ Chatham Road	Unsignalised	Convert to a signalised T-intersection and close southern approach.
Griffiths Road/ Showgrounds	Signalised	No change required.
Griffiths Road/ Broadmeadow Road	Signalised	Requires additional through capacity for through and turning movements.
Lambton Road/ Cameron Street	Unsignalised	Convert to traffic signals. Also, conversion of Griffith/ Bronte to left in/ left out priority intersection.
Lambton Road/ Curley Road	Signalised	Add dual right capacity westbound and southbound, as well as a left slip lane from Curley Road into Lambton Road eastbound.
Lambton Road/ Broadmeadow Road (Nine-Ways)	Signalised	Upgrade to the Broadmeadow Road approach with dual rights.

The next step of the analysis involved an iterative refinement of the model to determine the final recommendations for upgrades. A full list of recommended upgrades from the analysis is provided in Section 8.6, which was informed by assessment of network performance and model outputs discussed in Section 8.7.

8.6 Recommended Road Upgrades

Based on the road network performance assessment undertaken, as well as the need to consider improved accessibility and safety, the location of proposed road upgrades are shown in Figure 8–8, with further details provided in Table 8–5.

All intersection upgrades will include improved active transport connectivity, where appropriate, aligning with nominated active transport routes. The staging of proposed road upgrades is discussed in Section 9.

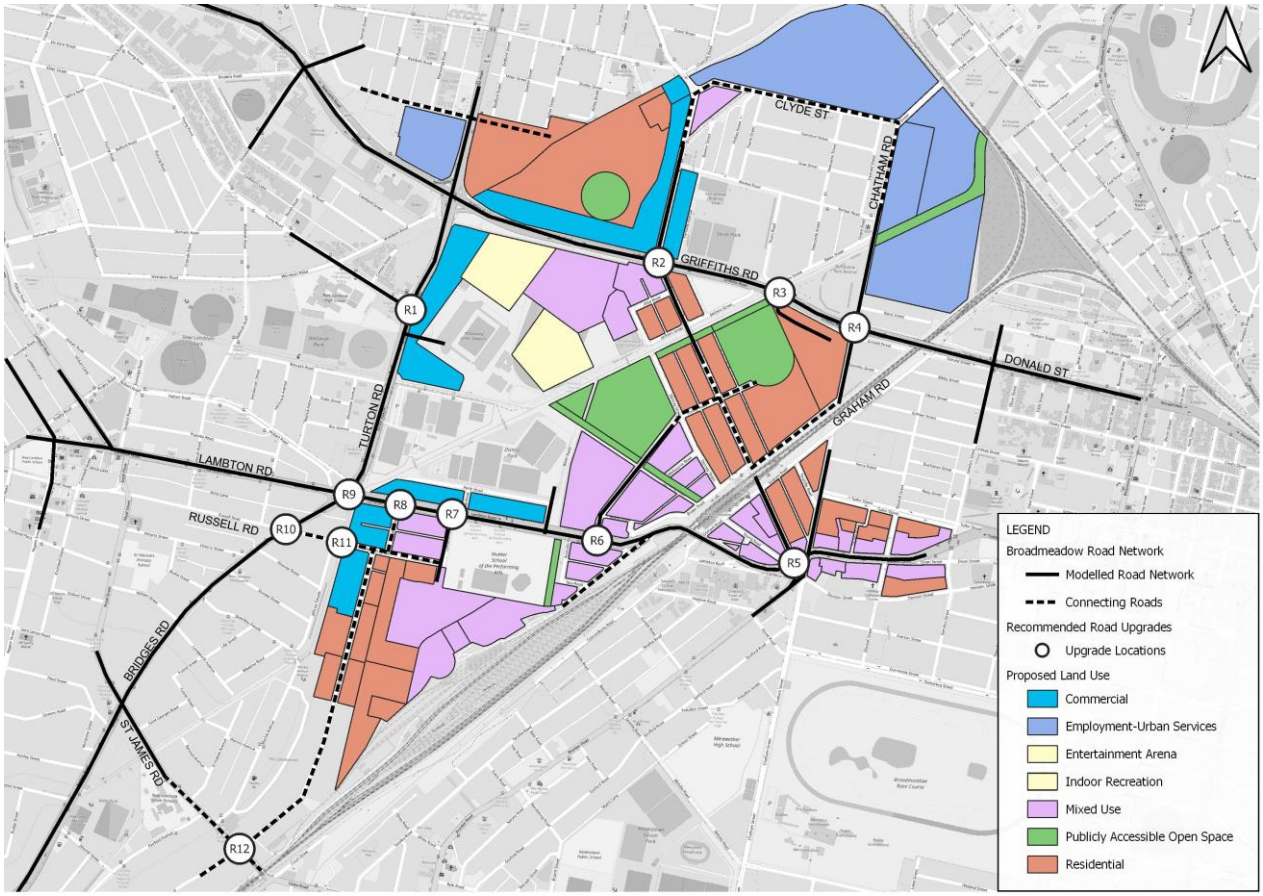


Figure 8–8: Location of Proposed Road Infrastructure Upgrades

Table 8–5: Proposed Road Infrastructure Upgrades

ID	Intersection Name	Issue	Upgrade details
R1	Turton Road/ Young Road	No capacity issue with existing priority intersection and 2041 demands, however upgrade proposed due to safety concerns relating to right turning traffic crossing three southbound lanes.	Access to Entertainment Precinct via new eastern leg at Turton Road/ Young Street signalised intersection
R2	Griffiths Road/ Broadmeadow Road	Capacity issue	Upgrade Griffith Road/ Broadmeadow Road to include dual rights on all approaches, except on the eastern approach, as well as to provide one additional stand-up lane on the east and west approaches
R3	Griffiths Road/ Showground	No capacity issue, however, realignment recommended to better facilitate right turn movements, particularly for large vehicles	Upgrade Griffith Road/ The Showground signalised intersection to realign southern leg perpendicular to Griffith Road

ID	Intersection Name	Issue	Upgrade details
R4	Griffiths Road/ Chatham Road	Capacity upgrade. Convert to T-intersection. Traffic from south to access Griffiths Road via the Showgrounds access.	Convert existing priority intersection to a signalised T-intersection and close southern approach
R5	Lambton Road/ Broadmeadow Road (Nine-Ways)	Capacity issue	Dual rights at Lambton Road/ Broadmeadow Road signalised intersection on the southbound approach (Nine-Ways)
R6	Lambton Road/ Curley Road	Capacity issue	Upgrade Lambton Road/ Curley Road signalised intersection to include dual right turns on the westbound and southbound approaches, as well as to include a left slip lane from Curley Road into Lambton Road eastbound
R7	Lambton Road/ Cameron Street	Primary access to TAHE site	Upgrade Lambton Road/ Cameron Street priority intersection to traffic signals, including dual right turn from eastbound Lambton Road into Cameron Street. Also, conversion of Griffith/ Bronte to left in/ left out priority intersection.
R8	Lambton Road/ Lang Road	Complements the Lambton Road/ Cameron Street upgrade.	Remove right turn at Lambton Road/ Lang Road priority intersection creating a left-in left-out
R9	Lambton Road/ Turton Road	Capacity issue	Upgrade Turton Road/ Bridges Road/ Lambton Road signalised intersection, including dual right turn lanes from westbound Lambton Road into Turton Road and extension of the northbound right turn bay from Bridges Road to Lambton Road eastbound
R10	Bridges Road/ Russell Road	Upgrade to provide secondary access to TAHE site and reduce right turning traffic at Turton Road/ Lambton Road signalised intersection	Upgrade Bridges Road/ Russell Road priority intersection to traffic signals, including right turn pockets and left turn slip lanes on both Bridges Road approaches
R11	Bridge over Styx Creek	Upgrade to provide secondary access to TAHE site	New bridge connecting Russell Road to Newton Street over Styx Creek
R12	St James Road/ Kings Road	Secondary access to TAHE site utilising Kings Road. Potential right turn issue out of Kings Road into St James Road. Note this intersection is outside the model area.	Upgrade St James Road/ Kings Road priority intersection to traffic signals to work in conjunction with the nearby rail level crossing.

8.7 Network Performance

A summary of road network performance for 2031 (Stage 1) and 2041 (Stage 3) is provided in Table 8–6 and Table 8–7 respectively.

Table 8–6: Network Performance – Structure Plan without Mitigation

Scenario	2031 (Stage 1)		2041 (Stage 3)	
	AM Peak Period (7am-9am)	PM Peak Period (4pm-6pm)	AM Peak Period (7am-9am)	PM Peak Period (4pm-6pm)
Speed (km/hr)	26	19	15	12
Delay (min)	118	181	246	300
Latent Demand (veh)	35 (0%)	1069 (5%)	1399 (7%)	4706 (19%)
VHT (hr)	1,026	1,641	1,770	2,331
VKT (Km)	26,244	30,913	25,789	27,335
Demands (veh)	15,640	20,883	19,035	24,756
Stops	55,715	98,713	119,536	157,910

Table 8–7: Network Performance – Structure Plan With Mitigation

Scenario	2031 (Stage 1)		2041 (Stage 3)	
	AM Peak Period (7am-9am)	PM Peak Period (4pm-6pm)	AM Peak Period (7am-9am)	PM Peak Period (4pm-6pm)
Speed (km/hr)	29	26	26	22
Delay (min)	106	115	122	147
Latent Demand (veh)	11 (0%)	150 (1%)	33 (0%)	355 (1%)
VHT (hr)	920	1,238	1,188	1,643
VKT (Km)	26,271	32,467	31,007	36,660
Demands (veh)	15,640	20,883	19,035	24,756
Stops	35,584	54,008	52,715	89,850

In the future 2031 and 2041 Structure Plan models without mitigation, the 2031 PM, 2041 AM and 2041 PM scenarios have significant latent demand (greater than 5%). They also show significantly lower speeds and high VHT, which are indicators of a network with large queuing and breakdown of flow. This is due to many of the key intersections along the corridors not having sufficient capacity.

The recommended upgrades on the network result in significantly improved average speeds, VHT and minimal latent demands in both 2031 and 2041.

8.8 Intersection Performance

This section details intersection performance for the Structure Plan scenarios modelled with and without mitigation.

As already indicated, there is significant latent demand and congestion in the majority of Structure Plan scenarios that were modelled without mitigation. In these scenarios, traffic volumes, delays and level of service are not reliable measures of performance, as an issue upstream or downstream can cause a flow on effect impacting the whole network.

As such, it is not recommended that the results for scenarios without mitigation be used to draw conclusions for individual intersection performance beyond acknowledging that several of the intersections are over capacity. Table 8–8 details network performance criteria for intersections from Transport for New South Wales modelling guidelines.

Table 8–8: Intersection Level of Service Performance Criteria

Level of Service	Average Delay per Vehicle (sec/vehicle)	Traffic Signal & Roundabout	Give Way & Stop Signs
A	<14	Good operation	Good operation
B	15 to 28	Good with acceptable delays & spare capacity	Acceptable delays & spare capacity
C	29 to 42	Satisfactory	Satisfactory, but accident study required
D	43 to 56	Operating near capacity	Near capacity & accident study required
E	57 to 70	At capacity; at signals, incidents will cause excessive delays. Roundabouts require other control mode	At capacity, requires other control mode
F	>70	Unsatisfactory with excessive queuing	Unsatisfactory with excessive queuing

Table 8–9 and Table 8–10 below provide intersection performance results for proposed Structure Plan demands without mitigation, while Table 8–11 and Table 8–12 provide intersection performance results for proposed Structure Plan demands with proposed mitigation to address performance issues identified.

A more detailed breakdown of performance for all movements at each of the intersections is provided in Appendix A for all of the scenarios tested.

Table 8–9: Intersection Performance – 2031 Structure Plan (No Mitigation)

Intersection	2031 (Stage 1)					
	AM			PM*		
	Volume	Delay	LOS	Volume*	Delay*	LOS*
Griffiths Road/ Lambton Road	3850	26	B	4319	27	B
Griffiths Road/ Turton Road	4870	33	C	5670	64	E
Griffiths Road/ Broadmeadow Road	3563	35	C	3920	61	E
Griffiths Road/ Showgrounds	2568	6	A	2585	14	A
Griffiths Road/ Chatham Road	2863	3	A	2889	32	C
Griffiths Road/ Samdon Road	2924	16	B	2930	61	E
Turton Road/ Young Road	2386	11	A	3196	12	A
Lambton Road/ Turton Road/ Bridges Road	4434	57	E	5249	62	E
Lambton Road/ Cameron Street	3005	3	A	3483	5	A
Lambton Road/ Bavin Road	2495	1	A	3020	1	A
Lambton Road/ Curley Road	2980	27	B	3507	32	C
Lambton Road/ Chatham Street	2163	26	B	2872	43	D
Bridges Road/ St James Road	2584	31	C	3339	25	B

*The 2031 PM network is over capacity and results in greater than 5% latent demands. This causes both recorded volumes, delay and levels of service to be unreliable.

Table 8–10: Intersection Performance – 2041 Structure Plan (No Mitigation)

Intersection	2041 (Stage 3)					
	AM*			PM*		
	Volume*	Delay*	LOS*	Volume*	Delay*	LOS*
Griffiths Road/ Lambton Road	3560	41	C	3453	70	E
Griffiths Road/ Kahibah Road/ Orlando Road	2788	33	C	2947	56	E
Griffiths Road/ Turton Road	4143	92	F	4347	123	F
Griffiths Road/ Broadmeadow Road	3268	81	F	3137	95	F

Intersection	2041 (Stage 3)					
	AM*			PM*		
	Volume*	Delay*	LOS*	Volume*	Delay*	LOS*
Griffiths Road/ Showgrounds	2307	32	C	1642	87	F
Griffiths Road/ Chatham Road	2811	15	B	1625	103	F
Griffiths Road/ Samdon Road	2960	24	B	1695	141	F
Turton Road/ Young Road	2223	19	B	2800	22	B
Alma Road/ Regent Street	1847	27	B	1672	138	F
Alma Road/ Lambton Road	1935	31	C	2298	53	D
Lambton Road/ Turton Road/ Bridges Road	4510	69	E	5016	83	F
Lambton Road/ Cameron Street	3264	5	A	3573	11	A
Lambton Road/ Bavin Road	2594	2	A	3038	3	A
Lambton Road/ Curley Road	3222	54	D	3619	50	D
Lambton Road/ Chatham Street	2586	35	C	3223	46	D
Bridges Road/ St James Road	2585	40	C	3116	41	C

*The 2041 AM and PM network is over capacity. This causes both recorded volumes, delay and levels of service to be unreliable.

Table 8–11: Intersection Performance – 2031 Structure Plan (With Mitigation)

Intersection	2031 (Stage 1)					
	AM			PM		
	Volume	Delay	LOS	Volume	Delay	LOS
Griffiths Road/ Lambton Road	3874	32	C	4539	27	B
Griffiths Road/ Turton Road	5020	39	C	6151	36	C
Griffiths Road/ Broadmeadow Road	3598	35	C	4284	60	E
Griffiths Road/ Showgrounds	2546	6	A	3108	7	A
Griffiths Road/ Chatham Road	2815	5	A	3624	11	A
Griffiths Road/ Samdon Road	2930	17	B	3773	26	B
Turton Road/ Young Road	2564	12	A	3303	15	B
Lambton Road/ Turton Road/ Bridges Road	4502	34	C	5177	40	C
Lambton Road/ Cameron Street	2921	13	A	3457	14	A
Lambton Road/ Bavin Road	2385	7	A	3032	13	A
Lambton Road/ Curley Road	2918	13	A	3707	14	B
Lambton Road/ Chatham Street	2093	25	B	2948	35	C
Bridges Road/ St James Road	2770	21	B	3334	28	B

Table 8–12: Intersection Performance – 2041 Structure Plan (With Mitigation)

Intersection	2041 (Stage 3)					
	AM			PM		
	Volume	Delay	LOS	Volume	Delay	LOS
Griffiths Road/ Lambton Road	4410	34	C	4965	36	C
Griffiths Road/ Turton Road	5745	64	E	6874	48	D
Griffiths Road/ Broadmeadow Road	4541	26	B	5068	44	D
Griffiths Road/ Showgrounds	3147	13	A	3372	11	A
Griffiths Road/ Chatham Road	3584	24	B	4051	26	B
Griffiths Road/ Samdon Road	3659	22	B	4158	69	E

Intersection	2041 (Stage 3)					
	AM			PM		
	Volume	Delay	LOS	Volume	Delay	LOS
Turton Road/ Young Road	2856	21	B	3775	18	B
Lambton Road/ Turton Road/ Bridges Road	5298	46	D	6008	57	E
Lambton Road/ Cameron Street	3597	15	B	4005	16	B
Lambton Road/ Bavin Road	2923	7	A	3448	19	B
Lambton Road/ Curley Road	3858	15	B	4473	27	B
Lambton Road/ Chatham Street	2824	29	C	3720	38	C
Bridges Road/ St James Road	3035	22	B	3829	36	C

8.8.1 Performance Summary – No Mitigation

Modelling indicates that the 2031 PM and 2041 AM and PM networks are over capacity with latent demand between 5% and 19%. This results in overall intersection performance being unreliable due to upstream and downstream congestion. Upstream congestion can hold back traffic improving intersection performance for all downstream intersections, while downstream congestion can create large queues that spill back into adjacent intersections decreasing performance.

It is not recommended that these results be used to draw conclusions for individual intersection performance beyond acknowledging that several intersections are over capacity.

8.8.2 Performance Summary – With Mitigation

In both 2031 (Stage 1) and 2041 (Stage 3), the overall performance of intersections is Level of Service D or better, with the exception of one intersection in 2031 and three intersections in 2041, which operate at Level of Service E. Further detail relating to performance of these intersections is included below:

- Griffiths Road/ Broadmeadow Road is over capacity in 2031 Stage 1. The primary pressure is from Griffith Road east-west traffic, rather than from an increase in traffic arising from the proposed Structure Plan, therefore no upgrades are proposed at this stage. Performance issues are however resolved in Stage 2, when upgrades are proposed.
- Griffiths Road/ Turton Road operates at LoS E by 2041. The opportunity to improve performance at this location is limited, as performance is already maximised. The primary traffic flow is along Griffiths Road, which serves both local traffic, as well as through traffic travelling to/ from Newcastle.
- While upgrades are recommended at Lambton Road/ Turton Road, the intersection would operate at LoS E by 2041, therefore alternative network solutions should be considered, including further investigation of an alternative access to the Locomotive Depot via King Street in the south and Russell Road in the west.
- Griffiths Road and Samdon Road is a four-way signalised intersection, which would operate at LoS E by 2041. Solutions for this intersection are limited by geometric engineering constraints due to its proximity to nearby bridge infrastructure.
- Intersections along Griffiths Road that provide direct access to the precinct, including Broadmeadow Road, Showgrounds and Chatham all experience a significant increase in demands:
  - Griffiths Road and Broadmeadow Road (a four-way signalised intersection) requires upgrades, including additional stand-up lanes on Griffiths Road.
  - The Showground access is a high quality access with two dual rights into the site. The current access will need to be realigned to better facilitate right turn movements out of the site, particularly for large vehicles
  - A signalised T-intersection at Griffiths and Chatham is recommended (north approach), as well as closure of the south approach with traffic diverted to the Showgrounds intersection.

- While traffic at the Turton Road priority access to the Stadium and Entertainment Precinct would increase, demands remain low. A signalised access is however recommended to improve traffic safety, as traffic accessing the site from the south is currently required to cross three lanes of southbound traffic. Consolidation of the access with the Young Street T-intersection would allow a signalised access without adding additional signals to the network.
- The intersections along Lambton Road, including Cameron Street, Curley Road and Nine-Ways all experience a significant increase in demands due to their proximity to proposed development:
  - Cameron Street would require to be signalised, while Curley Street, which is already signalised, would require to be upgraded to include dual right turns on the westbound and southbound approaches, as well as a left slip lane from Curley Road into Lambton Road eastbound.
  - The Nine-Ways intersection operates well, as the intersection removes the westbound right turn into Broadmeadow Road simplifying the overall operation of the signalised intersection. The right turn to access the precinct on the north side of Belford Road is via a left slip into Graham Road.
  - The layout of Nine-Ways currently relies on slip lanes. This layout could potentially be improved to address accessibility concerns relating to pedestrian movements and should be investigated further at the next stage of the project.

To conclude, there are still a number of intersections unable to meet LoS D or better in 2041 even with proposed road upgrades. Additional investigation is therefore recommended, including assessment of mass transit options, which are expected to significantly reduce vehicular demands on the road network and better align with the desired outcomes for the precinct.

9. Transport Implementation Plan

9.1 Overview

The transport assessment for this study has identified a range of infrastructure required across different transport modes, including active transport, buses and light rail, as well as upgrades to the road network to facilitate future development in the Broadmeadow Precinct.

9.2 Integrated Transport Network

Transport infrastructure required for the Broadmeadow Precinct has been compiled based on the assessment in Sections 6, 7 and 8. The list of proposed transport infrastructure does not include local infrastructure, such as internal roads, footpaths and internal intersection treatments, as these will be identified as part of individual development applications.

The Transport Implementation Plan comprising list of proposed transport infrastructure required is provided in Table 9–1, which also provides information on delivery responsibility and timing. Development will be progressed in three stages: Stage 1 (0-10 years), including the first-move state-led rezoning sites comprising Go Karts and Stadium Forecourt, Newcastle Showground, Basketball Stadium and PCYC sites, as well as the Locomotive Depot, Stage 2 (10-20 years) and Stage 3 (20-30 years). Further information on infrastructure staging is provided in Section 9.3.

Table 9–1: Transport Implementation Plan

Item	Measure	Asset Owner	Timing
Active Transport			
AT1	3,430 m active transport link parallel to Styx Creek between Chinchen Street and St James Road, including a grade separated crossing of the Hunter railway line	City of Newcastle Council/ TfNSW/ Hunter Water/ TAHE	First Moves (Newcastle Showground & Locomotive Depot) plus Stage 1
AT2	2,400 m active transport link parallel to the Main North railway line on its west side between Styx Creek in the vicinity of the Caltex site and St James Road, including a grade separated crossing of Styx Creek	City of Newcastle Council/ TfNSW/ TAHE	First Moves (Newcastle Showground, Basketball Stadium & PCYC Sites, Locomotive Depot) plus Stage 1
AT3	730 m active transport link between Broadmeadow Station and the Stadium Precinct via Young Street, including a new grade separated crossing at Styx Creek	City of Newcastle Council	First Moves (Basketball Stadium & PCYC Sites) plus Stage 1
AT4	360 m active transport link between Clyde Street and Styx Creek via Chatham Road	City of Newcastle Council/ Jemena Gas Networks (NSW) Ltd	Stage 1
AT5	1,600 m active transport link between Chinchen Street and Turton Road via Clyde Street and Christo Road	City of Newcastle Council	Stage 1
AT6	410 m active transport link from Styx Creek at the eastern end of Jackson Street through Newcastle Showground to Brown Road	City of Newcastle Council	First Moves (Newcastle Showground)
AT7	380 m active transport link between Styx Creek in the vicinity of the Mackay Avenue Reserve and the Main North railway line corridor (north west side)	City of Newcastle Council	First Moves (Locomotive Depot)
AT8	2,400 m active transport link along Denison Street parallel to the Lambton Road/ Belford Street/ Tudor Street corridor connecting to AT2 in the vicinity of the light rail stop at Broadmeadow	City of Newcastle Council/ TfNSW	Stage 2
AT9	750 m active transport link via Curley Road between Moira Road, Newcastle Showground and AT6	City of Newcastle Council	Stage 2
AT10	730 m active transport link between the proposed Broadmeadow Interchange and Styx Creek via Moira Road and Perth Road	City of Newcastle Council	Stage 2
AT11	570 m active transport link between Griffiths Road and Lambton Ker-rai Creek via McDonald Jones Stadium	City of Newcastle Council	Stage 2

Item	Measure	Asset Owner	Timing
AT12	900 m active transport link parallel to Griffith Road on its south side between Regional Cycle Route R4 on Turton Road and Regional Cycle Route R5 on Jackson Street, including a grade separated crossing of Griffiths Road leading to Bates Street	City of Newcastle Council/ TfNSW	Stage 3
AT13	340 m active transport link between AT12 on the south side of Griffiths Road, extending north through the UGL site to Asher Street, including a grade separated crossing at Griffiths Road	City of Newcastle Council/ TfNSW	Stage 3
AT14	695 m active transport link between AT5 at 115 Clyde Street through the UGL site to AT13.	City of Newcastle Council	Stage 3
AT15	Grade separated active transport crossing between the east and west sides of Turton Road on Regional Cycle Route R5	City of Newcastle Council/ TfNSW	Stage 3
AT16	440 m active transport link from the eastern end of Brown Road, including a grade separated crossing of the Main North railway line, extending along Lindsay Street to its intersection with Samdon Street.	City of Newcastle Council/ TfNSW	Stage 3
Buses			
B1	Rapid bus along the Belford Street/ Tudor Street Corridor between Newcastle Interchange and the proposed Broadmeadow Interchange	TfNSW	Stage 1
B2	Rapid bus corridor on Griffiths Road with a connection to Broadmeadow Station via Broadmeadow Road	TfNSW	Stage 2
B3	Rapid bus corridor on Bridges Road connecting with Lambton Road and the proposed multi-modal interchange at Broadmeadow Station	TfNSW	Stage 2
Light Rail			
L1	Extension of light rail including new track and stops between Newcastle Interchange and the proposed Broadmeadow Interchange along the Belford Street/ Tudor Street Corridor	TfNSW	Stage 2
L2	Potential extension of light rail including new track and stops to the north, or west of the proposed Broadmeadow Interchange	TfNSW	Stage 3
Road			

Item	Measure	Asset Owner	Timing
R1	Access to Entertainment Precinct via new eastern leg at Turton Road/ Young Street signalised intersection	TfNSW	First Moves (Go Karts and Stadium Forecourt)
R2	Upgrade Griffith Road/ Broadmeadow Road to include dual rights on all approaches, except on the eastern approach, as well as to provide one additional general traffic lane on the east and west approaches.	TfNSW	Stage 2
R3	Upgrade Griffith Road/ The Showground signalised intersection to realign southern leg perpendicular to Griffith Road	TfNSW	First Moves (Newcastle Showground)
R4	Convert existing Griffiths Road/ Chatham Road priority intersection to a signalised T-intersection and close southern approach	TfNSW	Stage 1
R5	Dual rights at Lambton Road/ Broadmeadow Road signalised intersection on the southbound approach (Nine-Ways)	TfNSW	Stage 3
R6	Upgrade Lambton Road/ Curley Road signalised intersection to include dual right turns on the westbound and southbound approaches, as well as to include a left slip lane from Curley Road into Lambton Road eastbound	TfNSW	First Moves (Basketball Stadium & PCYC Sites)
R7	Upgrade Lambton Road/ Cameron Street priority intersection to traffic signals, including dual right turn from eastbound Lambton Road into Cameron Street. Also, conversion of Griffith/ Bronte to left in/ left out priority intersection.	TfNSW	First Moves (Locomotive Depot)
R8	Remove right turn at Lambton Road/ Lang Road priority intersection creating left-in left-out	TfNSW	First Moves (Locomotive Depot)
R9	Upgrade Turton Road/ Bridges Road/ Lambton Road signalised intersection, including dual right turn lanes from westbound Lambton Road into Turton Road and extension of the northbound right turn bay from Bridges Road to Lambton Road eastbound	TfNSW	First Moves (Locomotive Depot)
R10	Upgrade Bridges Road/ Russell Road priority intersection to traffic signals, including right turn pockets and left turn slip lanes on both Bridges Road approaches	TfNSW	First Moves (Locomotive Depot)
R11	New bridge connecting Russell Road to Newton Street over Styx Creek	City of Newcastle Council/ Hunter Water	First Moves (Locomotive Depot)
R12	Upgrade St James Road/ Kings Road priority intersection to traffic signals to work in conjunction with the nearby rail level crossing.	City of Newcastle Council	First Moves (Locomotive Depot)

9.3 Infrastructure Staging

Potential staging of suggested active transport, bus and light rail transport infrastructure is shown in Figures 9-1 to 9-3 for Stages 1 – 3 respectively, noting that the timing of infrastructure associated with all stages, including first-move state-led rezoning sites is as provided in Table 9–1. The staging of proposed road infrastructure upgrades is provided in Figure 9-4.

The staging assessment considers the need for infrastructure based on indicative staging of proposed development provided in the draft Master Plan report.

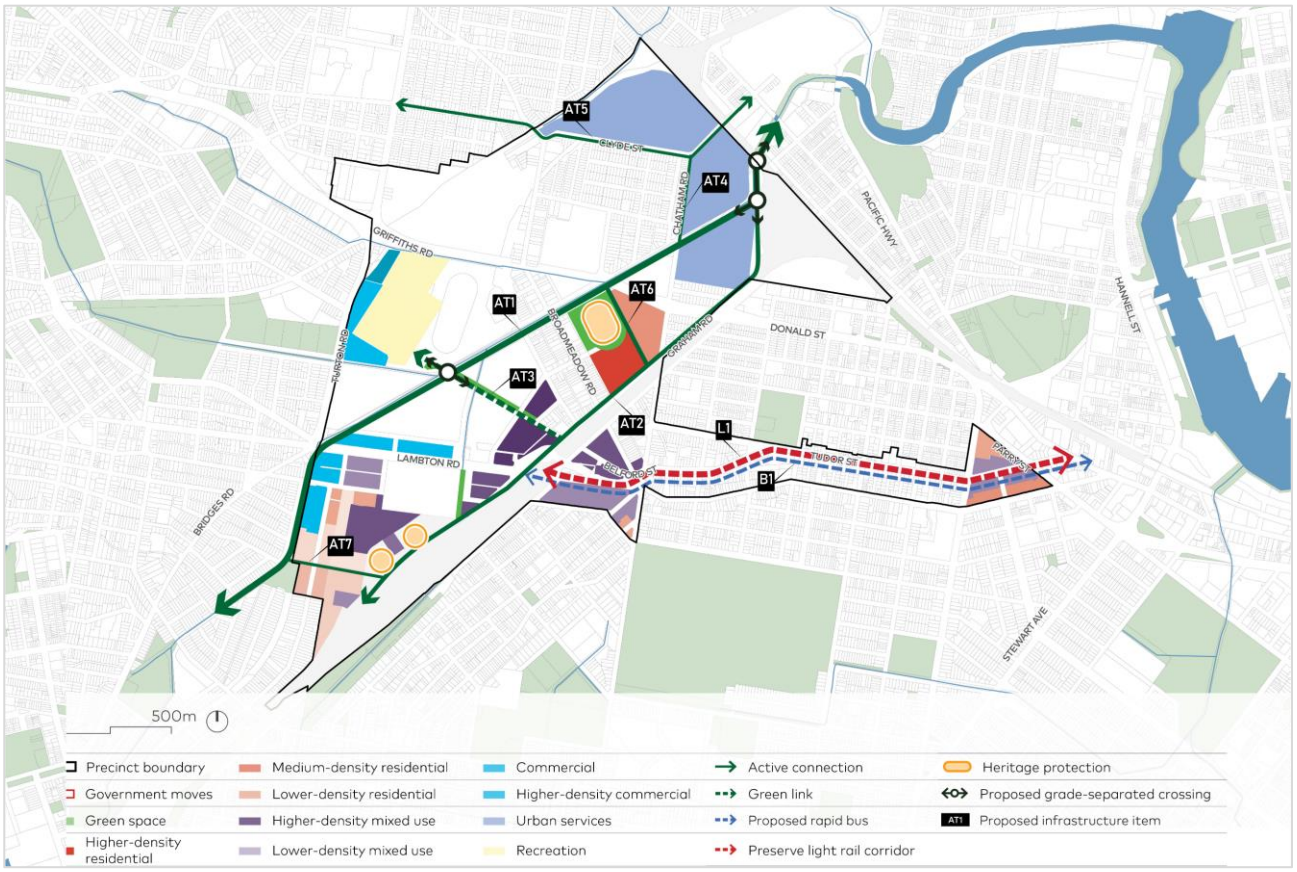


Figure 9–1: Active Transport, Bus and Light Rail Transport Infrastructure – Stage 1

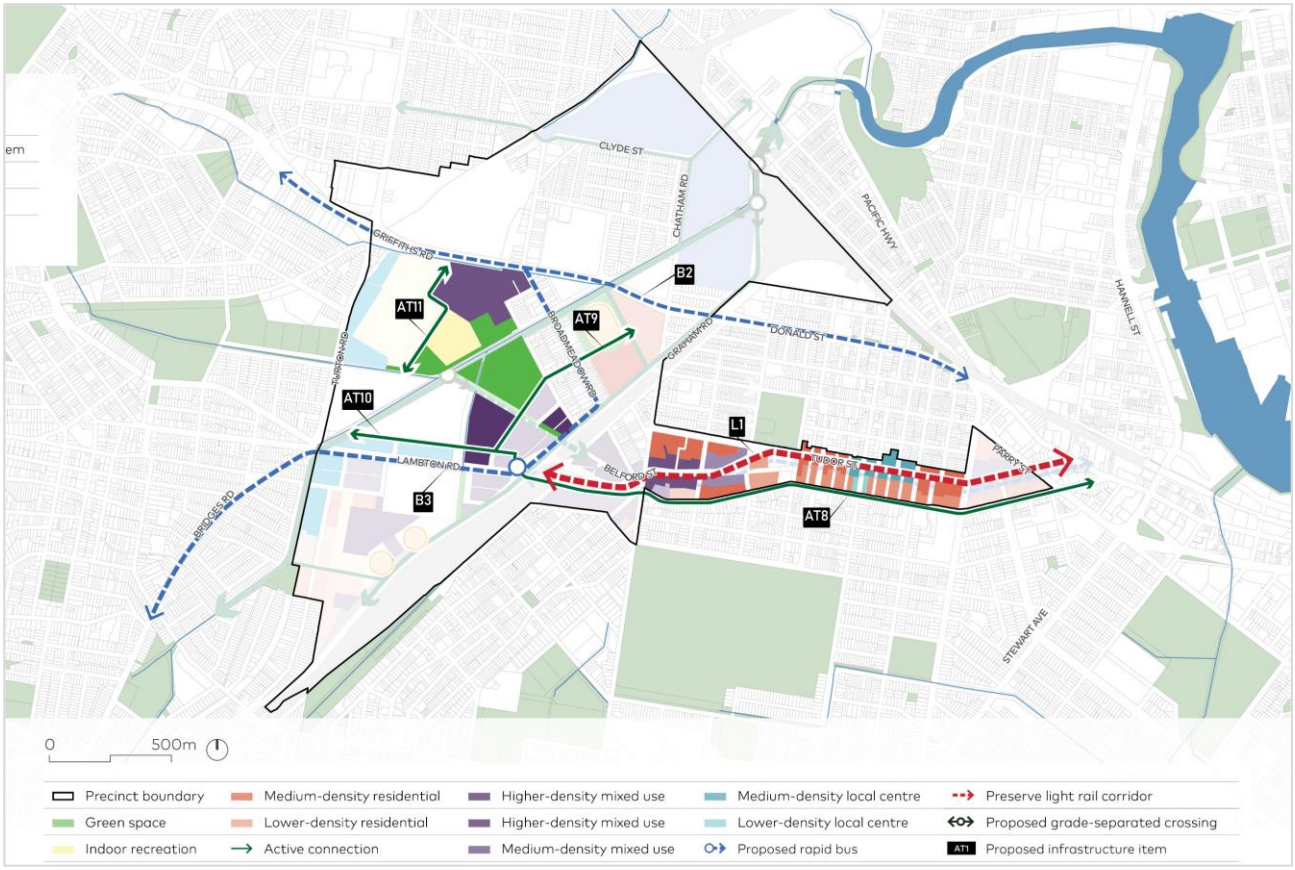


Figure 9–2: Active Transport, Bus and Light Rail Transport Infrastructure – Stage 2

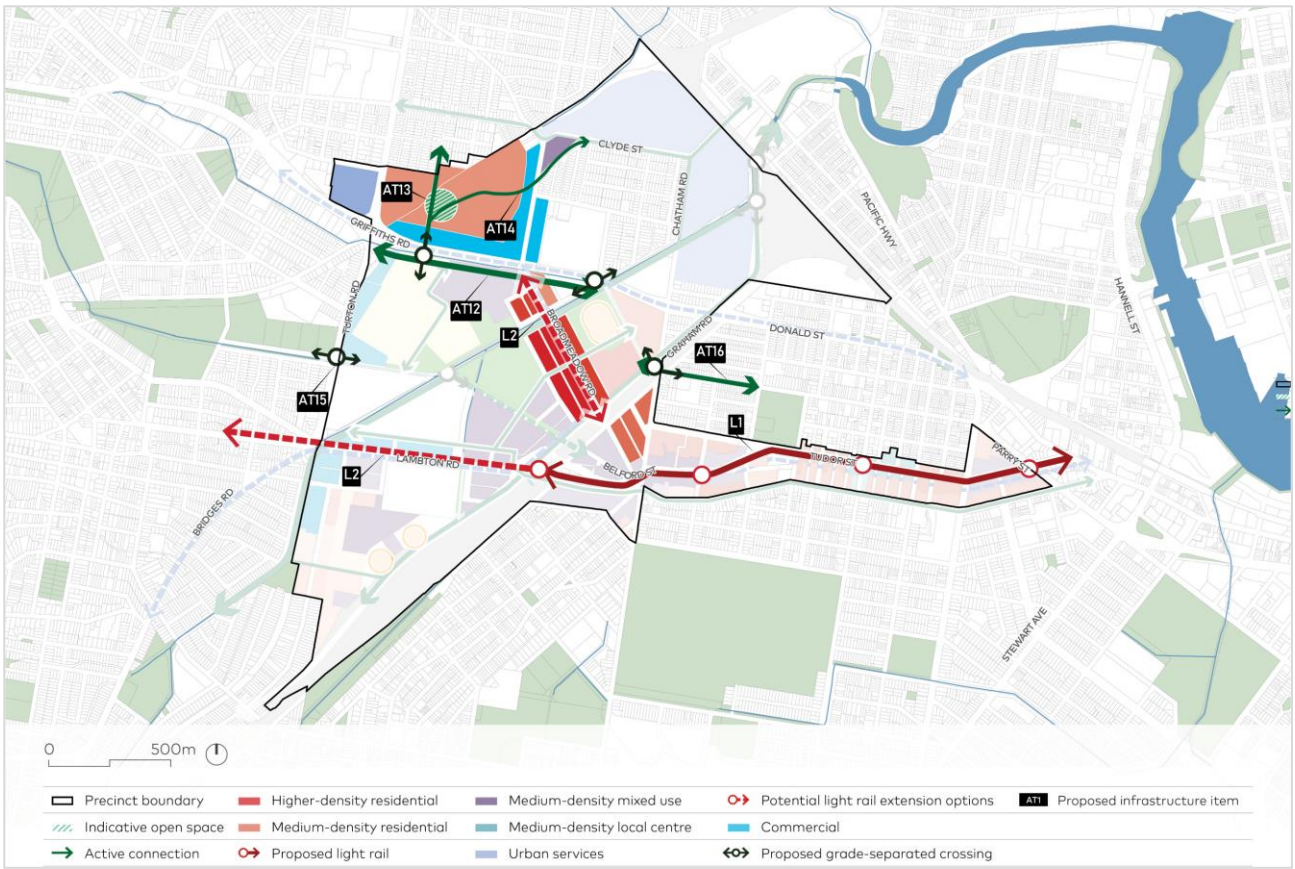


Figure 9–3: Active Transport, Bus and Light Rail Transport Infrastructure – Stage 3

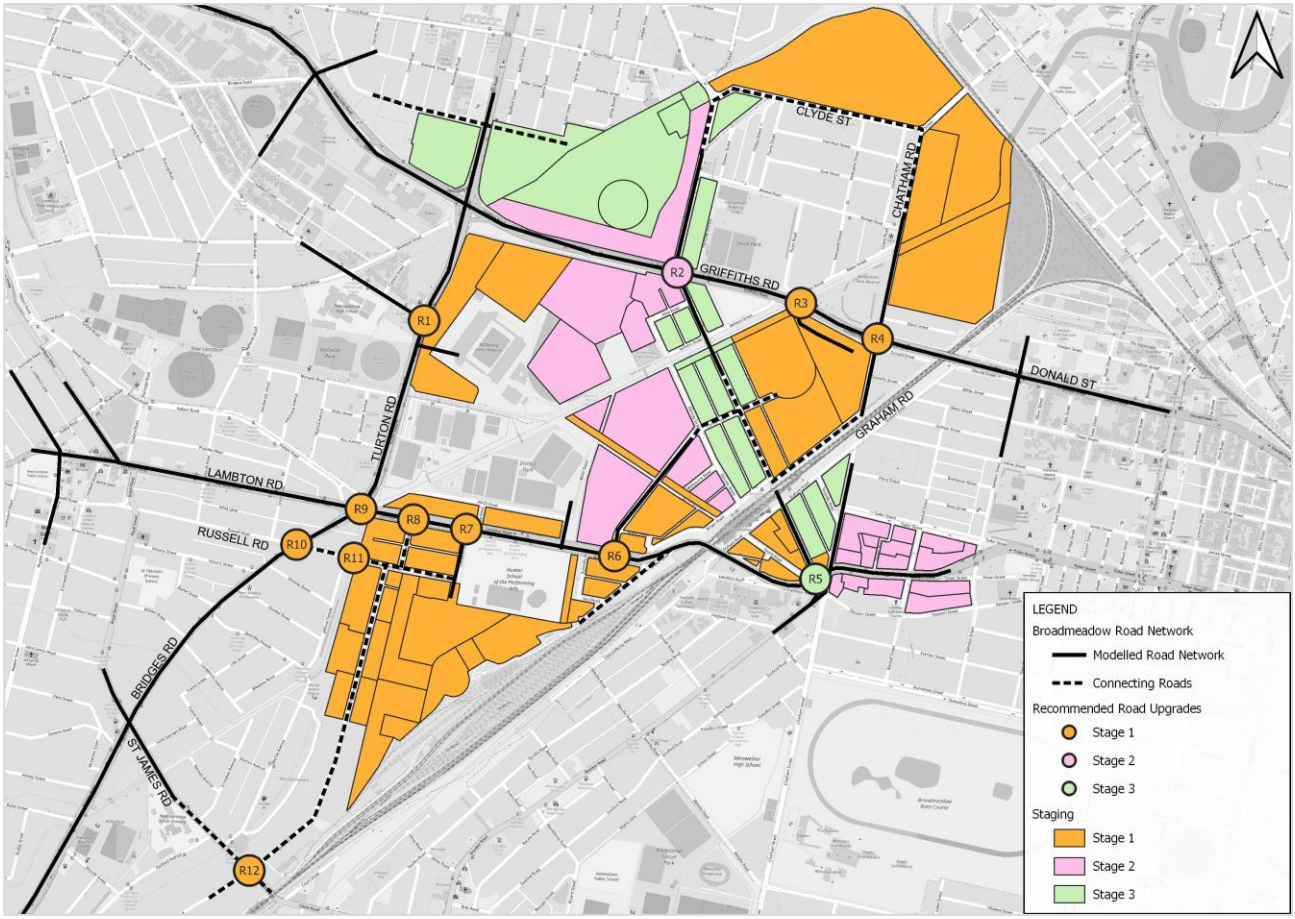


Figure 9–4: Staging of Proposed Road Infrastructure Upgrades

9.4 First-Move State-Led Rezoning Sites

The first-move state-led rezoning sites involve initial development that will be undertaken within Stage 1, which comprise four sites:

1) Go Karts and Stadium Forecourt;
2) Newcastle Showground;
3) Basketball Stadium and PCYC sites; and
4) Locomotive Depot.

The locations of the first-move state-led rezoning sites are shown in Figure 9–5 together with key road and active transport upgrades, details of which are provided in Table 9–1.

All other road upgrades, active transport infrastructure, as well as potential public transport upgrades would be provided as part of Stages 1 – 3 of the wider proposed development within the Broadmeadow precinct, as described in Section 9.3.

It should be noted that further more detailed investigations relating to traffic, transport and access will be required to support individual Development Applications (DA) for each of the first-move state-led rezoning sites at a later stage.

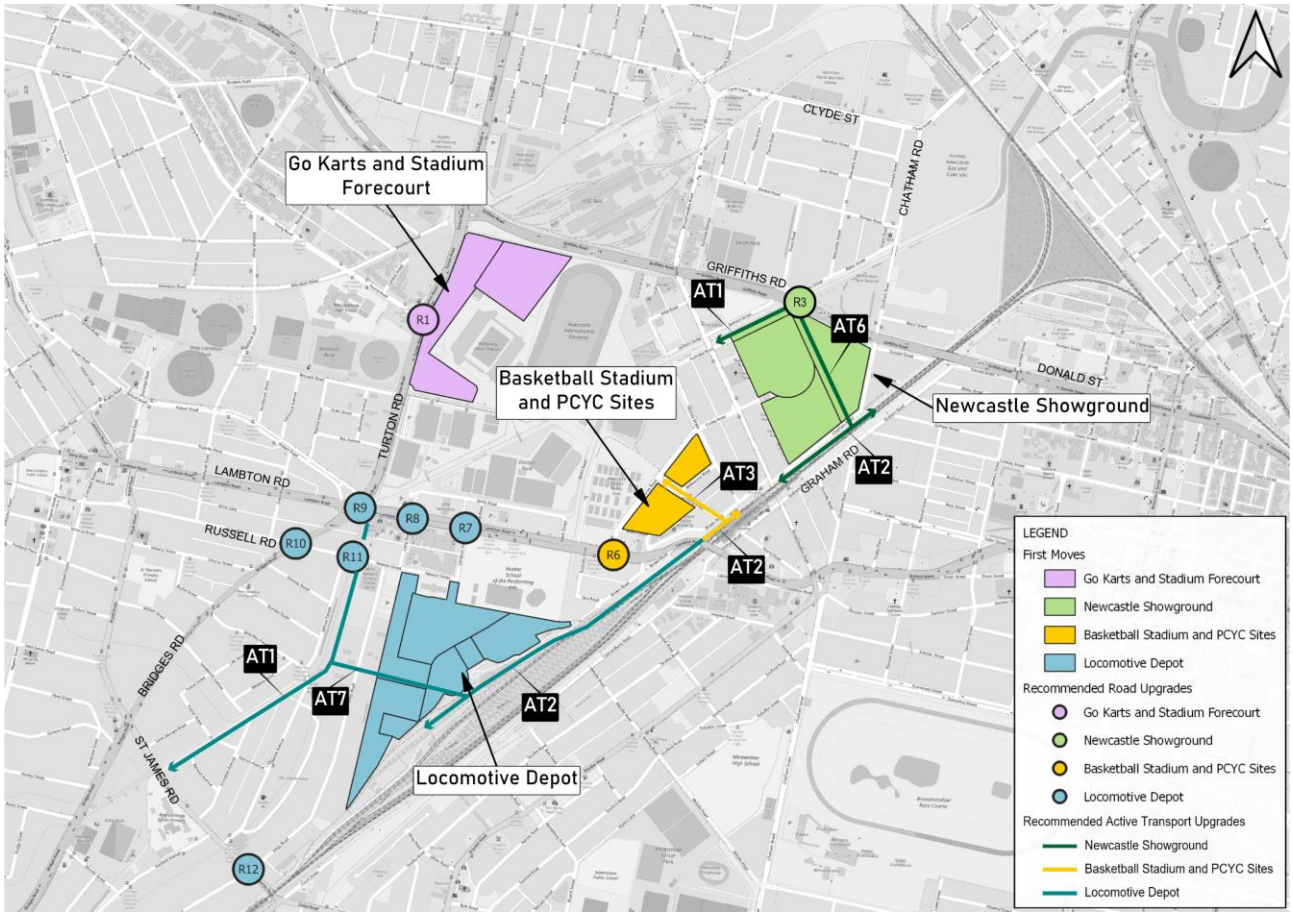


Figure 9–5: First-Move State-Led Rezoning Infrastructure Upgrades

9.5 Funding and Delivery

The delivery of infrastructure outlined in Table 9–1 and the above figures may require funding from a range of sources, including State Government, City of Newcastle Council, as well as contributions from developers.

10. Next Steps

Following the public exhibition of the Broadmeadow Place Strategy, DPHI will assess the matters raised in the submissions and prepare a package for the first-move state-led rezoning to be placed on exhibition. Once finalised, the planning proposal will be forwarded to the Minister for Planning and Public Spaces for determination.

Approval and publication of the first-move state-led rezoning would enable the lodgement of development applications for individual development proposals with Newcastle City Council for processing and assessment. During the development application process, when staging, delivery and detailed urban form are proposed, further transport modelling will be required to understand the impact and mitigation measures required on the local transport network.

As proposed development proceeds, Transport for NSW will continue to monitor the performance of the transport network and the timing of initiatives proposed in this report.

Recommendations for further assessments include:

- Strategic and operational traffic modelling to assess the impact of bus rapid transit on the performance of proposed routes
- Strategic and operational traffic modelling of light rail from Newcastle Interchange to Broadmeadow (and potentially further west) to assess the impact of light rail on performance of the corridor
- Detailed public transport modelling of bus rapid transit and light rail to Broadmeadow (and potentially further west) to ensure sufficient capacity to accommodate the anticipated number of passengers travelling to/ from Broadmeadow
- Traffic modelling associated with individual development applications, noting that the list of proposed transport infrastructure does not include local infrastructure, such as internal roads, footpaths and internal intersection treatments, as these will be identified post first-move state-led rezoning as part of individual development applications.

Appendix A

VISSIM Model Outputs

Broadmeadow 2031 (Stage 1) - without mitigation

Intersection	Approach	Movement	AM				PM			
			Vol.	Delay	LoS	Queue	Vol.	Delay	LoS	Queue
Griffiths Road and Lambton Road	E	T	905	5	A	118	1350	10	A	110
	E	R	326	44	D	118	276	46	D	110
	N	L	289	43	D	64	606	55	D	160
	N	R	143	4	A	30	332	22	B	127
	W	L	546	14	A	424	279	6	A	276
	W	T	1641	37	C	424	1476	33	C	276
Griffiths Road and Turton Road	S	L	293	7	A	18	401	11	A	27
	S	T	468	37	C	123	565	43	D	177
	S	R	357	78	F	121	284	111	F	175
	E	L	249	1	A	13	427	5	A	104
	E	T	924	32	C	95	1082	43	D	109
	E	R	127	73	F	97	88	435	F	111
	N	L	117	8	A	6	209	71	F	82
	N	T	504	48	D	70	802	54	D	140
	N	R	72	50	D	69	73	63	E	139
	W	L	269	27	B	146	386	49	D	572
	W	T	1408	27	B	144	1236	107	F	570
	W	R	82	4	A	9	117	23	B	6
Griffiths Road and Broadmeadow Road	S	L	169	46	D	74	203	81	F	152
	S	T	42	60	E	72	60	146	F	150
	S	R	112	54	D	74	240	93	F	152
	E	L	19	53	D	131	79	73	F	359
	E	T	920	26	B	130	1175	51	D	358
	E	R	59	21	B	130	35	33	C	357
	N	L	65	35	C	58	53	26	B	233
	N	T	119	41	C	58	214	41	C	233
	N	R	181	52	D	57	225	86	F	233
	W	L	191	12	A	540	238	25	B	647
	W	T	1449	29	C	540	1224	54	D	647
	W	R	237	87	F	540	174	134	F	646
Griffiths Road and Showgrounds	S	L	66	13	A	25	101	24	B	59
	S	R	13	39	C	25	4	34	C	59
	E	L	0	0	A	82	0	0	A	185
	E	T	946	8	A	82	1180	22	B	185
	W	T	1476	4	A	229	1260	4	A	199
	W	R	67	34	C	228	40	57	E	199
Griffiths Road and Chatham Road	S	L	4	5	A	7	8	21	B	20
	S	T	1	52	D	7	7	88	F	19
	S	R	0	0	A	0	0	0	A	19
	E	L	2	1	A	10	17	12	A	409
	E	T	903	0	A	10	1145	23	B	409
	E	R	203	13	A	31	306	70	F	430
	N	L	200	21	B	68	152	76	F	85
	N	T	8	36	C	69	9	131	F	85
	N	R	46	28	C	68	29	116	F	85
	W	L	48	1	A	0	58	20	B	220
	W	T	1438	0	A	0	1142	24	B	220
	W	R	10	3	A	6	16	6	A	252
Griffiths Road and Samdon Road	S	L	275	26	B	66	326	52	D	91
	S	T	29	32	C	65	4	34	C	90
	S	R	49	35	C	65	16	59	E	90
	E	L	70	11	A	68	77	34	C	449
	E	T	788	16	B	69	1207	45	D	450
	E	R	11	42	D	69	7	97	F	450
	W	L	6	16	B	336	3	18	B	451
	W	T	1482	10	A	336	969	40	C	451
	W	R	153	42	D	337	231	158	F	452
	N	L	8	28	B	25	28	185	F	70
	N	T	3	21	B	25	12	413	F	70
	N	R	50	45	D	26	50	338	F	71
Turton Road and Young Road	S	L	118	2	A	79	145	2	A	81
	S	T	1028	10	A	89	1139	9	A	91
	N	T	939	8	A	66	1497	10	A	108
	N	R	83	36	C	66	109	49	D	108
	W	L	73	13	A	44	135	21	B	49
	W	R	145	27	B	46	171	33	C	50
Lambton Road and Turton Road and Bridges Road	S	L	8	76	F	0	4	76	F	0
	S	T	702	72	F	215	777	72	F	215
	S	R	307	254	F	220	254	267	F	220
	E	L	0	0	A	0	0	0	A	0
	E	T	0	0	A	0	0	0	A	0
	E	R	0	0	A	0	0	0	A	0
	N	L	593	38	C	104	920	40	C	145
	N	T	109	83	F	106	107	119	F	147
	N	R	474	4	A	39	495	5	A	112
	W	L	173	9	A	12	124	4	A	18
	W	T	885	58	E	233	749	56	D	136
Lambton Road and Cameron Street	S	L	132	3	A	35	223	20	B	110
	S	R	100	9	A	43	133	28	C	118
	W	T	1448	4	A	83	1275	3	A	26
	W	R	188	9	A	91	181	14	B	47
	E	L	111	0	A	25	124	0	A	34
	E	T	1026	0	A	25	1547	2	A	34
Lambton Road and Bavin Road	E	T	1109	0	A	0	1519	0	A	0
	E	R	25	1	A	6	48	2	A	6
	N	L	1	0	A	0	78	5	A	31
	N	R	33	7	A	6	92	4	A	31
	W	L	40	1	A	21	63	2	A	60
	W	T	1287	1	A	21	1220	3	A	60
Lambton Road and Curley Road	W	L	324	12	A	93	269	13	A	93
	W	T	907	22	B	93	1024	20	B	93
	N	L	332	44	D	219	399	60	E	219
	N	R	0	0	A	0	0	0	A	0
	E	R	283	54	D	102	295	70	E	173
	E	T	0	0	A	0	0	0	A	0
Lambton Road and Broadmeadow Road (Nine-Ways)	S	T	12	51	D	25	32	63	E	64
	S	R	76	51	D	25	247	55	D	64
	E	T	625	33	C	107	933	38	C	138
	N	L	0	0	A	0	0	0	A	0
	N	T	0	0	A	0	0	0	A	0
	N	R	0	0	A	0	0	0	A	0
	W	L	201	10	A	144	195	18	B	116
	W	T	893	12	A	144	1058	15	B	116
	W	R	137	24	B	143	161	27	B	116
Bridges Road and St James Road	S	L	130	20	B	84	155	13	A	84
	S	T	1041	35	C	83	1017	16	B	83
	E	L	40	53	D	90	55	62	E	82
	E	T	266	53	D	90	348	48	D	82
	E	R	70	70	E	91	91	51	D	82
	N	L	46	5	A	88	129	13	A	225
	N	T	647	8	A	88	1141	18	B	224
	W	L	7	71	F	79	5	39	C	74
	W	T	240	42	D	79	326	45	D	74
	W	R	97	47	D	79	72	46	D	74

Broadmeadow 2041 (Stage 3) - without mitigation

Intersection	Approach	Movement	AM				PM			
			Vol.	Delay	LoS	Queue	Vol.	Delay	LoS	Queue
Griffiths Road and Lambton Road	E	T	850	5	A	108	854	9	A	125
	E	R	318	49	D	109	262	47	D	126
	N	L	410	93	F	185	550	159	F	185
	N	R	136	43	D	151	261	125	F	152
	W	L	502	19	B	663	251	8	A	663
	W	T	1344	54	D	663	1275	77	F	663
Griffiths Road and Turton Road	S	L	216	9	A	12	347	24	B	26
	S	T	401	44	D	248	502	72	F	248
	S	R	259	274	F	246	301	302	F	246
	E	L	293	2	A	104	384	4	A	104
	E	T	958	32	C	109	619	29	C	109
	E	R	158	314	F	110	143	209	F	111
	N	L	90	59	E	180	132	354	F	174
	N	T	514	62	E	175	535	119	F	169
	N	R	57	68	E	175	47	92	F	168
	W	L	187	47	D	577	278	37	C	573
	W	T	972	163	F	575	970	228	F	571
	W	R	38	30	C	0	89	43	D	6
Griffiths Road and Broadmeadow Road	S	L	216	75	F	152	225	146	F	152
	S	T	57	102	F	150	43	250	F	150
	S	R	207	82	F	152	279	157	F	152
	E	L	5	316	F	359	32	195	F	359
	E	T	1072	81	F	358	574	47	D	358
	E	R	59	24	B	358	17	54	D	357
	N	L	70	72	F	241	47	71	F	241
	N	T	159	74	F	241	268	47	D	241
	N	R	220	169	F	240	323	117	F	240
	W	L	163	20	B	647	230	27	B	647
	W	T	945	53	D	647	992	95	F	647
	W	R	95	316	F	646	107	206	F	646
Griffiths Road and Showgrounds	S	L	81	158	F	102	103	233	F	96
	S	R	13	115	F	102	5	446	F	96
	E	L	0	0	A	266	0	0	A	188
	E	T	1133	48	D	266	504	23	B	188
	W	T	1037	3	A	221	991	101	F	378
	W	R	43	55	D	221	39	141	F	378
Griffiths Road and Chatham Road	S	L	3	23	B	7	5	6	A	33
	S	T	1	72	F	7	3	18	B	33
	S	R	0	0	A	0	0	0	A	33
	E	L	1	1	A	354	8	112	F	409
	E	T	1114	18	B	354	484	89	F	409
	E	R	333	22	B	375	97	9	A	431
	N	L	248	44	D	85	66	139	F	84
	N	T	5	25	B	85	2	137	F	85
	N	R	50	58	E	85	10	60	E	85
	W	L	63	1	A	24	42	66	E	228
	W	T	990	1	A	24	897	122	F	228
	W	R	3	3	A	56	11	75	F	259
Griffiths Road and Samdon Road	S	L	449	28	B	91	138	192	F	91
	S	T	29	34	C	90	0	0	A	90
	S	R	45	37	C	90	28	225	F	90
	E	L	107	24	B	132	58	50	D	449
	E	T	1021	22	B	132	555	157	F	450
	E	R	11	40	C	132	3	27	B	450
	N	L	5	21	B	451	2	130	F	451
	N	T	1078	13	A	451	646	66	E	451
	N	R	154	67	E	451	206	221	F	451
	W	L	8	41	C	31	18	160	F	70
	W	T	2	92	F	31	9	572	F	70
	W	R	51	70	F	31	32	573	F	70
Turton Road and Young Road	S	L	111	1	A	81	178	2	A	81
	S	T	874	25	B	91	1049	26	B	91
	N	T	917	8	A	77	1121	8	A	116
	N	R	82	39	C	77	74	52	D	116
	W	L	98	40	C	58	165	58	E	148
	W	R	141	34	C	59	213	52	D	150
Lambton Road and Turton Road and Bridges Road	S	L	7	82	F	0	3	53	D	199
	S	T	635	82	F	215	758	72	F	215
	S	R	276	287	F	220	236	317	F	220
	E	L	0	0	A	0	0	0	A	0
	E	T	0	0	A	0	0	0	A	0
	E	R	0	0	A	0	0	0	A	0
	N	L	607	33	C	186	745	67	E	203
	N	T	106	89	F	187	112	171	F	204
	N	R	452	4	A	63	449	12	A	190
	W	L	185	28	B	17	144	33	C	19
	W	T	1005	100	F	294	822	115	F	291
Lambton Road and Cameron Street	S	L	205	11	A	97	264	51	D	110
	S	R	181	18	B	105	204	57	E	118
	W	T	1483	5	A	94	1329	3	A	21
	W	R	223	9	A	93	190	18	B	42
	E	L	137	0	A	25	145	0	A	34
	E	T	1035	0	A	25	1441	4	A	34
Lambton Road and Bavin Road	E	T	1132	0	A	0	1445	2	A	57
	E	R	21	3	A	6	42	5	A	80
	N	L	1	43	D	11	75	9	A	45
	N	R	35	5	A	11	93	8	A	45
	W	L	32	3	A	34	62	2	A	58
	W	T	1373	3	A	34	1321	3	A	58
Lambton Road and Curley Road	E	T	338	16	B	93	301	13	A	97
	E	R	995	21	B	93	1097	20	B	97
	N	L	383	65	E	219	420	66	E	219
	N	R	0	0	A	0	0	0	A	0
	W	L	361	124	F	697	364	123	F	637
	W	T	0	0	A	0	0	0	A	0
Lambton Road and Broadmeadow Road (Nine-Ways)	S	T	10	98	F	95	32	61	E	69
	S	R	73	50	D	95	255	60	E	69
	E	T	893	40	C	138	1182	51	D	233
	N	L	0	0	A	0	0	0	A	0
	N	T	0	0	A	0	0	0	A	0
	N	R	0	0	A	0	0	0	A	0
	W	L	272	14	B	89	239	15	B	209
	W	T	993	11	A	89	1136	15	B	209
	W	R	104	25	B	89	134	27	B	209
Bridges Road and St James Road	S	L	116	28	C	91	120	17	B	84
	S	T	991	43	D	91	888	38	C	83
	E	L	38	53	D	84	53	74	F	142
	E	T	318	61	E	84	333	83	F	142
	E	R	57	82	F	85	154	102	F	143
	N	L	92	19	B	188	130	21	B	225
	N	T	616	18	B	187	895	18	B	225
	W	L	6	80	F	65	6	91	F	90
	W	T	260	49	D	65	469	49	D	90
	W	R	91	49	D	65	68	53	D	90

Broadmeadow 2031 (Stage 1) - with mitigation

Intersection	Approach	Movement	AM				PM			
			Vol.	Delay	LoS	Queue	Vol.	Delay	LoS	Queue
Griffiths Road and Lambton Road	E	T	888	7	A	98	1493	12	A	129
	E	R	344	27	B	97	333	31	C	128
	N	L	295	38	C	62	596	41	C	133
	N	R	143	4	A	25	337	12	A	96
	W	L	548	22	B	376	275	11	A	201
	W	T	1656	52	D	375	1505	43	D	200
Griffiths Road and Turton Road	S	L	311	7	A	30	484	10	A	98
	S	T	567	50	D	244	612	60	E	246
	S	R	421	91	F	243	310	70	E	244
	E	L	246	1	A	20	473	5	A	103
	E	T	930	32	C	109	1242	32	C	110
	E	R	126	64	E	109	120	81	F	110
	N	L	117	4	A	12	218	5	A	11
	N	T	494	48	D	76	760	48	D	87
	N	R	71	56	E	76	70	64	E	87
	W	L	274	34	C	164	408	36	C	148
	W	T	1385	39	C	162	1330	35	C	146
	W	R	78	8	A	0	124	8	A	9
Griffiths Road and Broadmeadow Road	S	L	172	36	C	87	144	164	F	149
	S	T	42	50	D	85	52	103	F	147
	S	R	114	65	E	87	165	211	F	149
	E	L	18	88	F	162	98	71	F	331
	E	T	940	33	C	161	1464	49	D	330
	E	R	17	24	B	160	23	27	B	328
	N	L	63	50	D	138	57	55	D	195
	N	T	120	51	D	138	215	51	D	195
	N	R	174	56	E	138	226	84	F	195
	W	L	235	24	B	420	266	28	B	316
	W	T	1463	22	B	420	1385	40	C	316
	W	R	240	80	F	420	189	102	F	316
Griffiths Road and Showgrounds	S	L	62	18	B	25	113	35	C	44
	S	R	13	37	C	25	5	24	B	44
	E	L	0	0	A	69	0	0	A	138
	E	T	913	5	A	69	1504	7	A	138
	W	T	1479	5	A	218	1437	4	A	234
	W	R	79	30	C	217	49	68	E	234
Griffiths Road and Chatham Road	S	L	5	1	A	6	8	10	A	6
	S	T	0	0	A	0	0	0	A	0
	S	R	0	0	A	0	0	0	A	0
	E	L	2	4	A	96	34	6	A	212
	E	T	913	1	A	96	1501	5	A	212
	E	R	204	44	D	117	435	62	E	233
	N	L	201	17	B	46	203	18	B	54
	N	T	0	0	A	0	0	0	A	0
	N	R	0	0	A	0	0	0	A	0
	W	L	51	1	A	19	54	1	A	21
	W	T	1428	1	A	0	1373	1	A	0
	W	R	11	19	B	6	16	114	F	20
Griffiths Road and Samdon Road	S	L	275	26	B	58	414	39	C	92
	S	T	30	36	C	57	5	45	D	92
	S	R	47	34	C	57	22	56	D	91
	E	L	72	16	B	73	92	26	B	191
	E	T	794	16	B	73	1473	28	C	191
	E	R	11	45	D	73	9	48	D	191
	W	L	4	22	B	221	2	9	A	157
	W	T	1487	13	A	221	1276	14	A	157
	W	R	146	33	C	221	307	40	C	157
	N	L	9	17	B	14	50	35	C	27
	N	T	3	5	A	13	22	26	B	27
	N	R	52	25	B	13	101	38	C	27
Turton Road and Young Road	S	L	103	6	A	91	113	6	A	91
	S	T	1230	9	A	91	1295	10	A	91
	N	T	930	8	A	93	1509	10	A	108
	N	R	90	41	C	93	123	59	E	108
	W	L	74	24	B	44	133	33	C	139
	W	R	137	41	C	45	130	70	E	140
Lambton Road and Turton Road and Bridges Road	S	L	14	20	B	71	6	20	B	0
	S	T	929	36	C	211	833	39	C	206
	S	R	379	69	E	215	287	70	F	211
	E	L	181	4	A	52	383	11	A	129
	E	T	604	20	B	85	955	32	C	176
	E	R	305	50	D	83	378	58	E	174
	N	L	567	42	C	113	920	48	D	202
	N	T	110	67	E	114	113	85	F	204
	N	R	458	3	A	45	426	5	A	31
	W	L	171	8	A	101	171	8	A	22
	W	T	784	42	D	131	705	55	D	159
Lambton Road and Cameron Street	S	L	132	5	A	32	222	8	A	32
	S	R	101	48	D	32	128	43	D	32
	W	T	1397	14	B	151	1283	20	B	182
	W	R	209	46	D	151	181	57	E	182
	E	L	110	0	A	44	143	0	A	45
	E	T	972	3	A	44	1500	3	A	45
Lambton Road and Bavin Road	E	T	1057	5	A	75	1551	7	A	91
	E	R	28	43	D	75	50	49	D	91
	N	L	1	0	A	19	76	35	C	49
	N	R	34	33	C	19	90	34	C	49
	W	L	50	4	A	101	72	3	A	96
	W	T	1215	8	A	100	1193	16	B	95
Lambton Road and Curley Road	W	L	350	3	A	93	306	3	A	93
	W	T	863	17	B	93	964	17	B	93
	N	L	334	2	A	53	568	3	A	84
	N	R	277	30	C	46	427	35	C	77
	E	R	291	22	B	78	305	31	C	91
	E	T	803	7	A	78	1137	8	A	91
Lambton Road and Broadmeadow Road (Nine-Ways)	S	T	10	61	E	29	31	60	E	64
	S	R	73	50	D	29	247	56	E	64
	E	T	612	31	C	113	893	37	C	143
	N	L	12	50	D	83	22	62	E	67
	N	T	17	34	C	83	40	56	E	67
	N	R	175	42	C	83	201	47	D	66
	W	L	189	16	B	102	235	24	B	95
	W	T	870	15	B	101	1066	23	B	95
	W	R	135	33	C	101	213	59	E	95
Bridges Road and St James Road	S	L	146	15	B	84	146	19	B	89
	S	T	1141	15	B	84	914	18	B	89
	E	L	38	36	C	46	55	62	E	88
	E	T	270	42	C	45	357	59	E	87
	E	R	0	0	A	0	0	0	A	0
	N	L	42	20	B	112	132	19	B	191
	N	T	645	15	B	112	1153	21	B	191
	W	L	7	39	C	72	5	19	B	70
	W	T	242	39	C	71	319	46	D	70
	W	R	98	43	D	72	68	50	D	70

Broadmeadow 2041 (Stage 3) - with mitigation

Intersection	Approach	Movement	AM				PM			
			Vol.	Delay	LoS	Queue	Vol.	Delay	LoS	Queue
Griffiths Road and Lambton Road	E	T	965	7	A	80	1540	17	B	158
	E	R	366	31	C	79	353	33	C	157
	N	L	461	40	C	96	777	63	E	193
	N	R	160	5	A	59	365	38	C	157
	W	L	655	27	B	277	323	11	A	179
	W	T	1803	53	D	276	1607	46	D	178
Griffiths Road and Turton Road	S	L	288	26	B	253	517	16	B	170
	S	T	616	98	F	253	741	63	E	247
	S	R	439	218	F	251	420	102	F	245
	E	L	340	2	A	77	585	5	A	103
	E	T	1075	45	D	115	1221	51	D	114
	E	R	257	224	F	115	227	179	F	115
	N	L	154	4	A	13	261	12	A	48
	N	T	586	48	D	68	844	52	D	102
	N	R	74	62	E	67	72	65	E	102
	W	L	290	33	C	202	380	39	C	180
	W	T	1546	36	C	200	1492	41	C	178
	W	R	80	15	B	17	114	17	B	17
Griffiths Road and Broadmeadow Road	S	L	220	3	A	59	271	12	A	85
	S	T	56	61	E	75	64	77	F	101
	S	R	208	45	D	76	328	79	F	103
	E	L	3	65	E	150	19	806	F	288
	E	T	1263	27	B	149	1440	41	C	287
	E	R	67	27	B	148	74	30	C	286
	N	L	86	34	C	140	51	39	C	194
	N	T	199	38	C	140	290	44	D	194
	N	R	289	27	B	140	365	35	C	194
	W	L	295	19	B	148	368	35	C	154
	W	T	1640	23	B	231	1580	38	C	245
	W	R	215	29	C	231	218	48	D	245
Griffiths Road and Showgrounds	S	L	112	41	C	62	142	43	D	56
	S	R	14	46	D	62	12	59	E	56
	E	L	9	4	A	91	46	5	A	115
	E	T	1236	7	A	91	1463	8	A	115
	W	T	1682	13	A	222	1611	8	A	226
	W	R	94	53	D	221	98	61	E	226
Griffiths Road and Chatham Road	S	L	0	0	A	0	0	0	A	0
	S	T	0	0	A	0	0	0	A	0
	S	R	0	0	A	0	0	0	A	0
	E	L	0	0	A	0	0	0	A	0
	E	T	1182	11	A	135	1432	20	B	179
	E	R	332	35	C	135	530	43	D	179
	N	L	300	13	A	59	344	13	A	71
	N	T	0	0	A	0	0	0	A	0
	N	R	66	52	D	50	62	45	D	62
	W	L	64	26	B	254	71	18	B	249
	W	T	1622	32	C	254	1544	30	C	249
	W	R	0	0	A	0	0	0	A	0
Griffiths Road and Samdon Road	S	L	435	47	D	92	416	36	C	92
	S	T	28	61	E	92	4	38	C	91
	S	R	44	63	E	91	87	64	E	91
	E	L	109	17	B	128	130	144	F	450
	E	T	1031	20	B	128	1460	146	F	450
	E	R	11	37	C	128	5	133	F	450
	N	L	4	20	B	199	3	2	A	147
	N	T	1709	13	A	199	1395	7	A	147
	N	R	223	37	C	199	484	35	C	147
	W	L	9	23	B	13	50	43	D	39
	W	T	3	38	C	13	19	33	C	39
	W	R	53	30	C	13	105	45	D	39
Turton Road and Young Road	S	L	143	6	A	96	161	9	A	91
	S	T	1290	22	B	96	1508	8	A	91
	N	T	1124	7	A	82	1651	10	A	124
	N	R	98	53	D	82	129	76	F	124
	W	L	92	78	F	211	160	62	E	206
	W	R	109	97	F	212	166	95	F	207
Lambton Road and Turton Road and Bridges Road	S	L	13	44	D	194	6	42	D	187
	S	T	989	44	D	212	1008	44	D	207
	S	R	386	86	F	217	287	112	F	211
	E	L	220	8	A	71	415	12	A	153
	E	T	856	27	B	126	1088	38	C	176
	E	R	407	57	E	124	448	57	E	174
	N	L	714	34	C	124	1034	48	D	192
	N	T	115	87	F	126	154	149	F	194
	N	R	491	5	A	56	483	6	A	39
	W	L	184	24	B	6	198	57	E	248
	W	T	923	82	F	242	887	125	F	247
Lambton Road and Cameron Street	S	L	203	6	A	37	267	12	A	50
	S	R	178	35	C	37	204	30	C	50
	W	T	1530	18	B	188	1466	23	B	186
	W	R	255	42	D	188	249	41	C	186
	E	L	160	0	A	48	201	0	A	45
	E	T	1271	6	A	48	1618	6	A	45
Lambton Road and Bavin Road	E	T	1407	4	A	96	1771	17	B	91
	E	R	26	37	C	96	48	41	C	91
	N	L	1	34	C	20	76	34	C	49
	N	R	32	27	B	20	93	34	C	49
	W	L	46	5	A	127	68	9	A	169
	W	T	1411	10	A	126	1392	19	B	169
Lambton Road and Curley Road	E	T	410	5	A	101	373	3	A	94
	E	R	994	18	B	101	1090	16	B	94
	N	L	609	4	A	66	775	23	B	225
	N	R	450	30	C	59	502	80	F	218
	W	L	415	33	C	87	439	31	C	92
	W	T	980	8	A	87	1294	23	B	92
Lambton Road and Broadmeadow Road (Nine-Ways)	S	T	11	63	E	31	30	48	D	106
	S	R	75	51	D	31	243	50	D	105
	E	T	869	36	C	165	1157	37	C	169
	N	L	10	45	D	47	69	54	D	75
	N	T	17	33	C	47	42	46	D	75
	N	R	233	40	C	47	332	51	D	75
	W	L	381	23	B	143	348	32	C	245
	W	T	1087	20	B	142	1282	28	C	244
	W	R	141	39	C	142	217	65	E	244
Bridges Road and St James Road	S	L	132	14	B	85	129	21	B	89
	S	T	1211	15	B	84	983	18	B	89
	E	L	38	47	D	53	62	91	F	126
	E	T	319	48	D	52	365	80	F	126
	E	R	0	0	A	0	0	0	A	0
	N	L	109	14	B	124	179	33	C	184
	N	T	754	14	B	124	1220	32	C	184
	W	L	6	63	E	68	6	68	E	120
	W	T	260	42	D	68	472	52	D	120
	W	R	88	47	D	68	71	59	E	120

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