Henry Lawson Drive – Stage 1A

Traffic and transport impact assessment report

Executive summary

Background

Transport for NSW (Transport) is proposing to upgrade Henry Lawson Drive Upgrade between Keys Parade, Milperra, to Tower Road, Bankstown Aerodrome (known as the Henry Lawson Drive Upgrade Stage 1A) (the overall proposal). The overall proposal consists of upgrading a 1.3 kilometre length of Henry Lawson Drive including intersection upgrades. The upgrade would help ease existing traffic issues and increase traffic capacity at key intersections to help meet growing demand, with residential, commercial and industrial development in the surrounding area expected to increase in the coming years.

This Traffic and Transport Impact Assessment has been prepared to assess the potential traffic and transport impacts of the overall proposal. It will support a Review of Environmental Factors (REF) being prepared by Transport under Division 5.1 of *the Environmental Planning and Assessment Act 1979* (EP&A Act) and an Environmental Impact Statement (EIS) being prepared under Division 4.1 of the EP&A Act.

This assessment addresses both the REF proposal and the EIS proposal. The investigation of the existing environment and impacts have been developed in consideration of the overall proposal area (combined REF and EIS proposal area).

Proposal overview

REF proposal

Key features of the REF proposal would include:

- Widening Henry Lawson Drive from two to four lanes
- Upgrading the signalised intersection of Henry Lawson Drive and Tower Road including:
    - An additional right turn lane from Tower Road onto Henry Lawson Drive
    - A new channelised short left-turn lane from Henry Lawson Drive (southbound) onto Tower Road
    - An additional right turn lane from Henry Lawson Drive (northbound) onto Tower Road
    - Retaining the pedestrian crossing across Henry Lawson Drive on the southern side of the intersection
- Upgrading the signalised intersection of Henry Lawson Drive and Milperra Road/ Newbridge Road including:
    - An additional right turn lane on the Milperra Road and Newbridge Road approaches to Henry Lawson Drive
    - An additional through lane on the Henry Lawson Drive southbound approach
    - The removal of the bus only lane on Milperra Road to provide an additional right turn lane on the Henry Lawson Drive northbound approach

- Removing the dedicated left turn slip lane into the ALDI and fast-food area with access being retained via a standard property driveway
- Retaining the existing bus stop on Milperra Road (eastbound) and moving the westbound bus stop 20 metres to the west
- Altering access to Auld Avenue to a “left in/left out” only configuration
- Installing a new Henry Lawson Drive road bridge (over Milperra Drain) to the south of Auld Avenue (referred to as the Auld Avenue bridge) to carry northbound traffic and retaining the existing bridge for southbound traffic
- Constructing new footpaths on the eastern side of Henry Lawson Drive to connect Tower Road to the existing bus stop on the eastbound lanes of Milperra Road and a new footpath on the southern side between Henry Lawson Drive to the bus stop on the westbound lanes of Milperra Road
- Widening the shared user pathway between Flower Power (Keys Parade) and Newbridge Road to three metres and reconstructing footpaths along the western side of Henry Lawson Drive, where required
- Adjusting existing drainage, including lengthening culverts, installing new drainage infrastructure and water quality controls
- Relocating utilities (including electrical, gas, water and telecommunications)
- Final roadworks including pavement, kerb and gutters, signs, lighting and line marking
- Ancillary work for the proposal including road furniture, tie-in works, landscaping, earthworks and the like
- Temporary ancillary compounds, stockpile sites and associated facilities

EIS proposal

Key features of the EIS proposal are identified below for each EIS proposal area.

EIS proposal area 1 – Henry Lawson Drive opposite Tower Road

The key features of EIS proposal area 1 are:

- Widening of Henry Lawson Drive northbound lanes
- Installing of fill embankments along the edge of the new carriageway to meet existing ground levels
- Extending existing stormwater culvert and installing outlet scour protection measures
- Installing additional stormwater drainage infrastructure and water quality treatments
- Installing a vegetated swale along the toe of the new fill embankment
- Adjusting the existing shared path to suit the new re-alignment and to connect it back to the existing path
- Installing road furniture, including road safety barriers.

EIS proposal area 2 – Milperra Road opposite Bankstown Airport

The key features of the EIS proposal area 2 are:

- Installing a new bus stop relocated from its existing position on Milperra Road
- Installing a section of a new footpath to the bus stop (connecting to the remainder of the new path to Henry Lawson Drive – REF proposal)
- Installing fill embankments along the edge of the new carriageway to meet existing ground levels
- Extending existing stormwater culvert and installing outlet scour protection measures
- Installing additional stormwater drainage infrastructure connecting to the outlet of the extended culvert
- Installing road furniture, including road safety barriers

EIS proposal area 3 – Henry Lawson Drive opposite Auld Avenue

The key features of the EIS proposal area 3 are:

- Removing of existing ancillary structures
- Installing temporary fencing, flagging of exclusion boundaries and temporary erosion and sediment controls for use as an ancillary facility and construction area
- Installing fill embankments along the edge of the new carriageway to meet existing ground levels
- Stabilising the ground surface following the completion of construction to minimise erosion

Construction traffic impact assessment

Impact on network performance

The proposal would generate light and heavy vehicle movements on the road network surrounding the proposal. This would be associated with the delivery or removal of construction materials and equipment and construction worker movements to and from the construction footprint. A traffic modelling assessment using the SIDRA model was performed, comparing road performance in 2023 with and without construction vehicles. The assessment showed that due to the low overall volumes, construction vehicles had no material impact on the performance of key intersections within the study area and those further afield.

Impact on road access

The majority of construction works are being undertaken in the road reserve and on/ adjacent to the roads of Henry Lawson Drive, Milperra Road and Newbridge Road. Side roads such as Tower Road and Auld Avenue will also be affected by construction works. These roads will remain operational during construction. However, there may be a need for temporary lane closures at times during the construction period.

In addition, as sections of the upgrade are completed, traffic switches would be put in place to shift traffic onto new sections of the road to enable works on existing pavement to be completed. Traffic management controls such as speed limit reduction will also be enforced near worksites. All impacts to the road network would be undertaken in accordance with a Road Occupancy Licence (ROL) to be obtained from the Traffic Management Centre. Access for emergency vehicles would be maintained along these roads.

Impact on property access

Access to properties would be maintained during construction. However, access may need to be disturbed on a short-term basis. It is expected that the following property accesses may be affected by construction works:

- Access to commercial properties along the southbound carriageway of Henry Lawson Drive between Tower Road and Milperra Road (ALDI, BP Truckstop) may be temporarily affected as widening works encroach on existing access points. Alternate access routes are available along Starkie Drive.
- Access to residential properties along north carriageway of Henry Lawson Drive between Milperra Road and Auld Avenue maybe be temporarily affected as widening works encroaches on existing access points. Access to these properties will be maintained by the construction contractor, though it may involve detours and increase in travel times.
- Access to Flower Power from Henry Lawson Drive southbound may be minimally affected by widening works. Northbound access to Flower Power is not expected to be affected as it is outside the scope of works.

Landowners and occupiers will be consulted by the construction contractor about any potential impacts to access and methods to minimise these impacts. Consultation will be undertaken well in advance of property accesses being impacted.

Impact on public transport

Bus routes M90 operate along Newbridge Road/Milperra Road in both directions. Access for pedestrians and to public transport would be maintained around the construction site during construction. There are two bus stops within the construction area. These would be temporarily relocated to allow for safe access.

Impact on active transport

Detours for pedestrian/cyclist access would be implemented within the proposal area and alternative arrangements managed through signage and wayfinding. In particular, the following routes may be affected, as they lie within the zone of construction works:

- Existing shared path along northbound Henry Lawson Drive north of Keys Parade
- Existing shared path along northbound Henry Lawson Drive between Auld Avenue and Milperra Road
- Existing shared path along Georges River near Tower Road

Operational traffic impact assessment

Road network changes

The proposal would improve intersection capacity of the Henry Lawson Drive/Milperrra Road intersection by providing additional right turn lanes along Milperra Road, Newbridge Road and Henry Lawson Drive southbound. Existing dual right turn lanes on Henry Lawson Drive northbound would be extended to allow for more vehicle storage. An additional southbound through lane will be provided along Henry Lawson Drive to the north of the intersection. The existing bus jump lane along Milperra Road westbound will be removed as part of the upgrade to provide the space needed for the additional right turn lanes.

The proposal would include an additional right turn lane into Tower Road from Henry Lawson Drive northbound and a new channelised short left-turn lane from Henry Lawson Drive (southbound). On Tower Road, an additional right turn lane would be provided.

The proposal would convert the Henry Lawson Drive/Auld Avenue intersection from a priority T-intersection with all movements allowed to a left-in left-out only. This change would result in vehicles travelling southbound on Henry Lawson Drive needing to change their route to access Auld Avenue. Based on community feedback, further investigations on the layout of this intersection would be undertaken during detailed design. Further traffic monitoring and design options would be done to identify the most optimal layout for this intersection.

Impact on network performance

A microsimulation model of the study area was created to identify the operational impact of the proposed upgrades on intersections, travel times, and network statistics for the years 2026 and 2036, compared to a do-minimum scenario.

Modelling showed that at intersections within the study area all showed significant improvements in delay and volume throughput due to capacity improvements, even though the operating level of service sometimes remained the same.

Assessment of northbound and southbound travel times along Henry Lawson Drive between Bullecourt Avenue and Flinders Road all showed improvements when compared to the do-minimum scenario.

Overall network statistics showed an increase of total vehicle kilometres travelled (VKT) and decrease in total vehicle hours travelled (VHT) within the network compared to the do-minimum scenario. This translates to increase in traffic throughput and travel time saving, showing the proposal has a positive impact on network performance.

Impact on property access

The increased footprint of the road network in the proposal area is likely to impact local road and property access during operation. Landowners and occupiers would be consulted about any potential access impacts prior to the commencement of construction and/or operation.

Currently approximately 10 properties between Milperra Road and Auld Avenue have driveway frontage onto Henry Lawson Drive and have access to/from both north and southbound carriageways. The concept design proposes a raised concrete median along this section of Henry Lawson Drive, which will make driveway access left in left out only (from the northbound lanes). Property owners wishing to access their driveway from the southbound carriageway of Henry Lawson Drive will need to turn around at the Keys Parade intersection or detour elsewhere onto the network (possibly via Milperra Road, Ashford Avenue, Bullecourt Avenue then back onto Henry Lawson Drive northbound).

Additionally, widening of Henry Lawson Drive may cause some properties experiencing shrinking of setback space between their property and the road. Properties which previously relied on this space to perform vehicle turnarounds may be required to reverse into live traffic to access Henry Lawson Drive.

Commercial properties between Tower Road and Milperra Road would not have any impacts to access. Access to the fast food outlets and ALDI supermarket will change from a left slip lane arrangement to a driveway access, and access to BP Truckstop would change from left turn lane to driveway entry and exit. These changes would not have an adverse impact on patrons.

Impact on public transport

The westbound bus jump start lane along Milperra Road would be removed as part of the upgrade of the intersection. As a result, this would remove the bus signal phasing which would improve the efficiency of the intersection along all approaches.

The bus stop located on the Milperra Road westbound carriageway would be relocated out of the left turn lane about 20 metres from where it is currently located. This would require the bus to merge out of the left turn lane into Milperra Road. The operation of the proposal would not result in any changes to public bus services.

Impact on active transport

As a part of the upgrade, pedestrian accessibility and safety would be improved with the provision of a footpath on the eastern side Henry Lawson Drive between Tower Road and Milperra Road. This would support foot traffic to the new retail/ warehouse precinct proposed within the Bankstown Airport Development. A pedestrian foot path will also be provided on both sides along Milperra Road to provide a formal connection between the bus stops and pedestrian crossings at the Henry Lawson Drive intersection.

The existing footpath along the western side of Henry Lawson Drive between Keys Parade and Newbridge Road would be upgraded from narrow footpath to a 3.0 metre wide shared path (including provision of shared path facilities on the new bridge south of Auld Avenue).

Pedestrian and cyclist movements along the Georges River would be maintained with the existing pedestrian pathway along the Georges River north of Newbridge Road bridge slightly realigned to accommodate the larger footprint of the upgraded Henry Lawson Drive/Tower Road intersection. This pathway would still connect to the existing pedestrian crossing at Tower Road.

Impact on road safety

Whilst no dedicated road safety upgrades have been undertaken in the preferred option, the increased intersection capacity and smoother operation of the network in general is expected to significantly improve road safety. Additionally, the following intersection upgrades are expected to improve road safety:

- Henry Lawson Drive/Tower Road
    - Provision of additional right turn bays will increase turn storage capacity and reduce risk of road blockage and rear end collisions.
    - Conversion of left turn exit lane from Tower Road into slip lane will improve safety of that turn.
- Henry Lawson Drive/Milperra Road/Newbridge Road
    - Additional right turn bays and extension of existing right turn bays will increase storage capacity and reduce risk of road blockage and rear end collisions
    - High entry signalised left turn from Newbridge Road to reduce weaving impacts for vehicles merging right to enter the Bankstown Airport precinct on Tower Road.
- Henry Lawson Drive/Auld Avenue
    - Conversion of intersection into a left-in left-out reduces risk of vehicles turning into incoming traffic

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Date:	17 May 2021
Version:	Final draft. Revision 2
Reference:	P.0065812
Division:	Customer Strategy and Technology
Review date:	17 May 2021

1 Introduction

Transport for New South Wales (Transport) is proposing to upgrade Henry Lawson Drive between Keys Parade, Milperra, to Tower Road, Bankstown Aerodrome (known as the Henry Lawson Drive Upgrade Stage 1A) (the overall proposal). The proposal consists of upgrading a 1.3-kilometre length of Henry Lawson Drive and an additional 480 metres along Milperra Road, including intersection upgrades.

This Traffic and Transport Impact Assessment has been prepared to assess the potential traffic and transport impacts of the proposal. It will support a Review of Environmental Factors (REF) being prepared by Transport under Division 5.1 of *the Environmental Planning and Assessment Act 1979* (EP&A Act) and an Environmental Impact Statement (EIS) being prepared under Division 4.1 of the EP&A Act.

The REF has been prepared for the majority of the proposal, where Transport can approve works under the State Environmental Planning Policy (Infrastructure) 2008 (referred to as the 'REF proposal'). However, as part of the proposal is located within areas mapped as coastal wetlands under the State Environmental Planning Policy (Coastal Management) 2018, part of the proposal is deemed designated development and is subject to an EIS. The work within mapped coastal wetlands is referred to as the 'EIS proposal'.

An overview of the proposal and the REF and EIS proposal areas is presented in Figure 1-1.

1.1 Proposal background

The overall proposal forms the first stage of the progressive upgrade to 7.5 kilometres of Henry Lawson Drive between the intersections of Hume Highway, Villawood, and the M5 South Western Motorway, Milperra.

The upgrade would help ease existing traffic issues and increase traffic capacity at key intersections to help meet growing demand, with residential, commercial and industrial development in the surrounding area expected to increase in the coming years. The upgrade would be delivered in three stages.

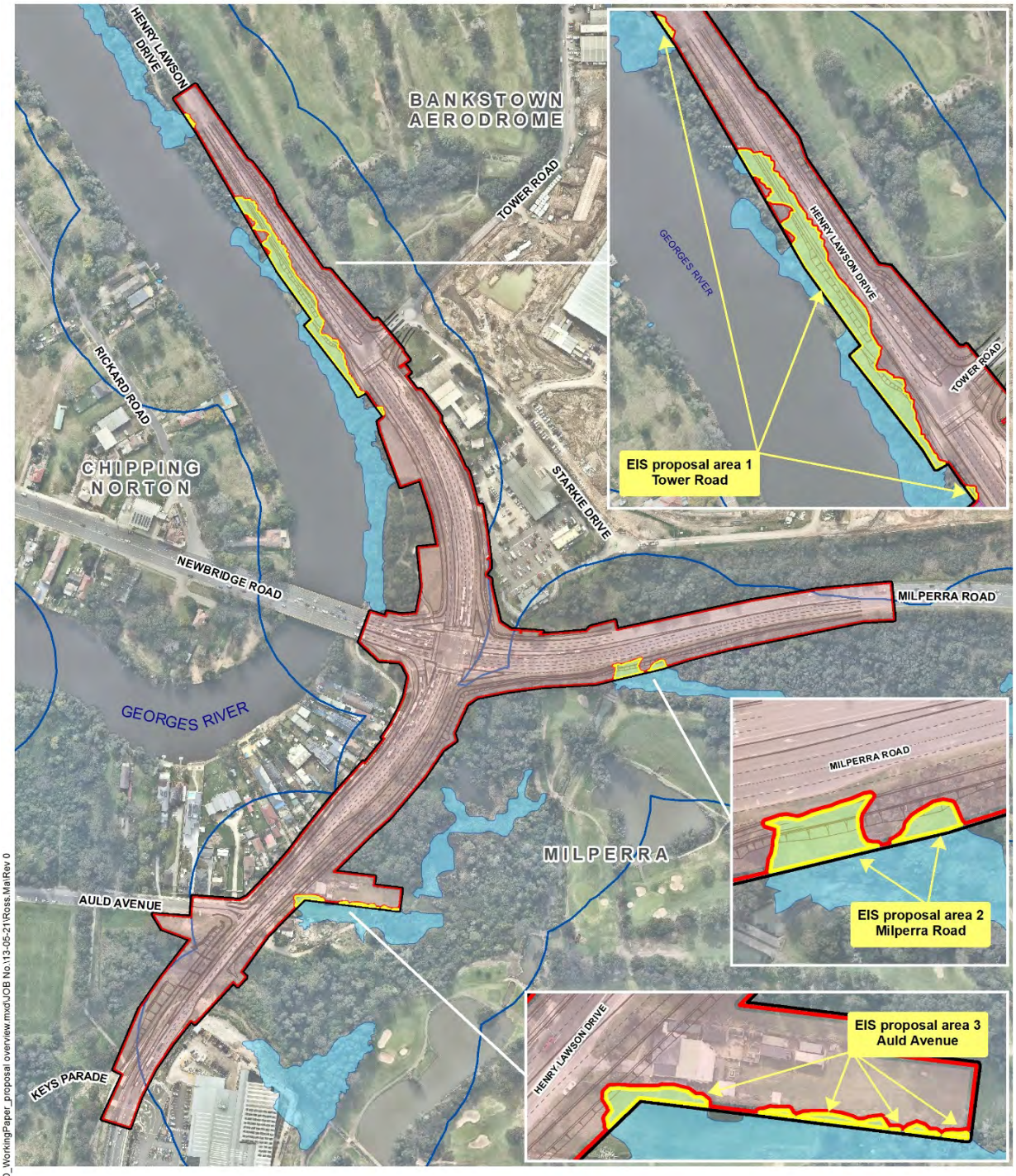
Subject to approval, construction of the Stage 1A proposal may commence in early 2023 and would take about two years to complete. Other stages of upgrading Henry Lawson Drive would be developed and assessed separately in the future.

1.2 Proposal location and setting

The overall proposal is located around 20 kilometres south west of the Sydney CBD in the City of Canterbury-Bankstown local government area (LGA). The proposal is mainly along Henry Lawson Drive and includes intersection upgrades at Tower Road, Newbridge/Milperra Road and Auld Avenue.

Henry Lawson Drive is a key connection for traffic moving between the Hume Highway, Milperra Road /Newbridge Road and the M5 Motorway. It is also used for local travel trips between residences and services. In terms of heavy vehicle access, Henry Lawson Drive is designated as a B-Double access route that connects surrounding large industrial areas of Milperra, Revesby, Chipping Norton and Moorebank.

The overall proposal is located to the east of the Georges River and surrounding recreational areas. There are a number of coastal wetlands within and surrounding the proposal associated with the Georges River.



Henry Lawson Drive Stage 1A

FIGURE 1-1: Proposal overview

Located to the south west of the overall proposal, is a residential area with detached housing and sporting fields and passive recreation areas. To the south east, is the Bankstown Golf Course and urban bushland areas. North of Milperra Road, land use comprises retail and commercial development that backs onto the Bankstown Airport, which is currently being redeveloped, all of which access Henry Lawson Drive via Tower Road. North of Tower Road is the Georges River Golf Course.

1.3 Scope of works

This report has been prepared to support the REF and EIS for the proposal and in with the Secretary's Environmental Assessment Requirements (SEARs) for the proposal.

The following scope of works was completed to prepare the Traffic and Transport Impact Assessment for both the REF and EIS proposal areas:

- Describe the existing conditions for all modes of transport in the study area
- Assess the potential traffic and transport impacts of constructing and operating the proposal
- Recommend measures to manage the identified potential traffic and transport impacts of the proposal

1.4 Secretary's Environmental Assessment Requirements

As sections of the proposal intersect with areas mapped as Coastal Wetlands, an EIS has been prepared to assess the proposal under Division 4.1 of the EP&A Act. For this EIS, SEARs have been issued by the Department of Planning, Industry and Environment, which describe assessment requirements. The requirements relevant to Traffic and Transport Impact Assessment is presented in Table 1-1.

Table 1-1 Henry Lawson Drive Stage 1A – Traffic and Transport SEARs

SEARs Requirement	Where addressed
Land use and development including: a) the assessment for impacts of construction and operation on and from surrounding land uses,	Section 5.1
b) an assessment of safety and access to intersections and properties during construction	Section 5.1.6

1.5 Strategic plans and policies

There are a number of strategic plans and strategies that are relevant to the proposal. These include:

- Bankstown Airport Master Plan
- Transport Road Network Plan – Henry Lawson Drive and Woodville Road
- Future Transport 2056
- Greater Sydney Region Plan
- NSW Freight and Ports Strategy
- NSW Road Safety Plan 2021
- Transport draft walking and cycling policy

1.5.1 Bankstown Airport Master Plan 2019

The Bankstown Airport Master Plan 2019 was approved by the Federal Minister for Infrastructure, Transport, and Regional Development in November 2019. Bankstown Airport Limited proposes to undertake development works to build large retail and leisure centres, factory outlets and restaurants to maximise opportunities to increase economic activity and jobs growth within the Bankstown to Liverpool Enterprise corridor.

As stated in the Bankstown Airport Master Plan 2019, the new non-aviation component of the development at the airport is expected to generate an additional 1,300 to 1,850 peak hour vehicle trips by 2024 (Bankstown Airport Limited, 2019). These vehicles would access the airport via Henry Lawson Drive, Newbridge Road and Milperra Road in the proposal area.

The traffic modelling for the proposal has considered the future increase in traffic on the road network as a result of the changes to the Bankstown Airport.

1.5.2 Transport Road Network Plan – Henry Lawson Drive and Woodville Road

The Henry Lawson Drive and Woodville Road network plan provides a framework for the development and management of Henry Lawson Drive/Woodville Road, based on the network's strategic movement and place function and customer needs. The plan outlines following objective statements:

- A safe road system for every customer supporting the Towards Zero vision of zero fatalities and serious injuries on NSW roads by 2056.
- Improve travel time and reliability for key customer group (freight and car users) along the corridor to support and enhance its function as a primary north-south link between M5 and Parramatta.
- Support access to safe crossing opportunities of the corridor for active modes, for both commuting and recreational uses, linking local centres, and transport interchanges on parallel rail lines.
- Facilitate the efficient, safe and reliable movement of goods along the corridor and beyond, supporting the growth of freight precincts such as Yennora, Villawood and Bankstown Airport, the metropolitan centre of Parramatta and strategic centres of Fairfield and Bankstown.
- Integrate current and future land use planning with road network development to ensure compatible and complementary uses and functions.

The overall proposal would help achieve the objectives of the road network plan through the increased capacity of the proposal improving travel times and efficiency for motorists and freight operators, as well as improved connectivity and safety for active transport users.

1.5.3 Future Transport 2056

The Future Transport 2056 (Future Transport Strategy) is an update of the NSW Government's NSW Long Term Transport Master Plan, providing an integrated vision for NSW through a suite of strategies and plans for transport developed alongside the SIS, Greater Sydney Region Plan and the Department of Planning, Industry and Environment's regional plans. The Future Transport Strategy outlines the 40-year vision, directions and outcomes framework for customer mobility in NSW, guiding investment over the longer term. The Future Transport Strategy outlines six state-wide outcomes to guide investment, policy and reform and service provision.

Within the Future Transport Strategy, a network issue to be addressed for the improvement, use and management of the network over the next 40 years is 'Optimising the network and better using existing infrastructure'. As part of this network issue, mitigating the costs and impacts of congestion is identified as a major focus for planning the future network. The proposal would help to alleviate congestion and improve travel time, aligning with the Future Transport Strategy's strategic objective to optimise the network and improve the use of existing infrastructure.

In addition, the Future Transport Strategy also discusses Transport's 'Movement and Place' framework. The framework is defined in the strategy as a tool to manage the road network in a way that supports safe, efficient and reliable journeys for people and freight whilst enhancing the liveability and amenity of places (Transport, 2018b). The proposal aligns with the framework through the objective to improve travel times and journey time reliability for all road users. The overall proposal would promote the Movement and Place framework through the provision of increased capacity at intersections and improved connectivity and safety for active transport users, contributing to the liveability of the community and local/regional road users.

1.5.4 Greater Sydney Region Plan

The *Greater Sydney Region Plan: A Metropolis of Three Cities* (GSRP) outlines the vision to transform Greater Sydney into a metropolis of three cities:

- The established Eastern Harbour City – building on its recognised economic strength and addressing liveability and sustainability.
- The developing Central River City – investing in a wide variety of infrastructure and services and improving amenity.
- The emerging Western Parkland City – establishing the framework for the development and success of an emerging new city.

The proposal is located within the developed Central River City. The GSRP highlights the importance of providing infrastructure to support cities, while also having the ability to adapt to meet the needs of future growth. The proposal would contribute to meeting these objectives through the upgrading of infrastructure on Henry Lawson Drive and its connecting roads. This would increase traffic efficiency for local road users and provide for future growth by allowing greater traffic capacity at key intersections.

One of the GSRP objectives also focuses on ensuring the freight and logistics network is competitive and efficient. It highlights the importance of locations surrounding key freight networks and ensuring they are not adversely impacted by traffic patterns and congestion. The upgrade of Henry Lawson Drive would contribute to achieving the GSRP objectives relating to freight and logistic networks through the provision of additional capacity in the direct study area. This would also benefit the community through decreasing traffic congestion on local roads, improving access within the neighbouring communities.

1.5.5 NSW Freight and Ports Plan 2018-2023

In September 2018, Transport released the *Freight and Ports Plan 2018-2023* (FPP) as a supporting plan to the Future Transport Strategy. The FPP was released to provide a guide for the freight industry over a five-year period to make the long-term investments required to benefit the freight industry as well as the State's future growth (Transport 2018c). The main aim of the FPP is for the industry and government to work together to achieve the following objectives:

- Objective 1: Economic growth

- Objective 2: Efficiency, connectivity and access
- Objective 3: Capacity
- Objective 4: Safety
- Objective 5: Sustainability

The proposal aligns closely with the objectives of the FPP through the upgrade of Henry Lawson Drive to increase capacity to address existing congestion issues and accommodate growth. In doing so, the proposal would improve efficiency and provide better connectivity and access for the community and all road users. The FPP discusses the contribution that congestion makes to the cost of moving freight, particularly around high-density urban areas (Transport 2018c). The overall proposal would aim to improve freight efficiency and reduce vehicle operating costs on the road network through the upgrade of the Henry Lawson Drive. In particular, the upgrade at signalised intersections and provision of increased through lanes and dedicated turning lanes would aim to improve efficiency and safety.

1.5.6 Road Safety Plan 2021

The *Road Safety Plan 2021* (Road Safety Plan) was established to guide the improvement of road safety in NSW. The plan is based on consultation with the NSW community to identify trends and key issues that can be responded to. The international 'Safe System Approach' is adopted in the plan to achieve the NSW target of 'zero fatalities and serious injuries on our roads by 2056' (Transport, 2018d).

The steps to achieving a safer system that align closely with the proposal include creating safer urban places and communities and building a safe future. Developing 'liveable and safe urban communities' is a priority area highlighted in the Road Safety Plan. Actions that are discussed to achieve this include exploring options to accelerate safety upgrades at intersections (Transport, 2018d). The overall proposal would upgrade Henry Lawson Drive including intersections to improve road safety outcomes for all road users. This includes motorists, pedestrians and cyclists. This would have benefits for current and future people living and travelling through the overall proposal area, contributing to the liveability of the community through the provision of safer infrastructure and connections.

1.5.7 Transport Draft Walking and Cycling Policy

The Draft Walking and Cycling Policy outlines Transport's recognition that walking and cycling are integral to the greater good of communities. This policy requires that every transport project funded by Transport includes provision for walking and cycling within the core scope of the project.

The proposal aligns with this policy, improving active transport connectivity through the construction of new footpaths to extend existing pedestrian paths to bus stops. It also improves safety outcomes for active transport users through intersection upgrades.

The proposal would reinstate the shared use path along the Georges River, and provide greater active transport linkage along Henry Lawson Drive, south of Auld Avenue, with the new bridge structure across Milperra Drain to include a three metre wide shared use path.

2 Methodology

2.1 Study process

The methodology for this traffic and transport assessment consisted of:

- Reviewing the existing and future conditions of the transport network within and surrounding the proposal using publicly available information as well as data that had been previously collected for the proposal
- Preparing a microsimulation traffic model for the concept design of the proposal using AIMSUN v8.4.1 software from TSS (Transport Simulation Systems)
- Modelling the traffic performance of the concept design for several scenarios within the study area
- Assessing the impacts of the proposal on traffic and transport performance during construction and operational stages
- Recommending mitigation measures to minimise potential traffic or transport impacts from the proposal

Further details on the methodology are provided in the following sections.

2.2 Study area

The study area for the traffic model considered a broader road network than the immediate area subject to the proposal (Henry Lawson Drive Stage 1A). The purpose of this is to:

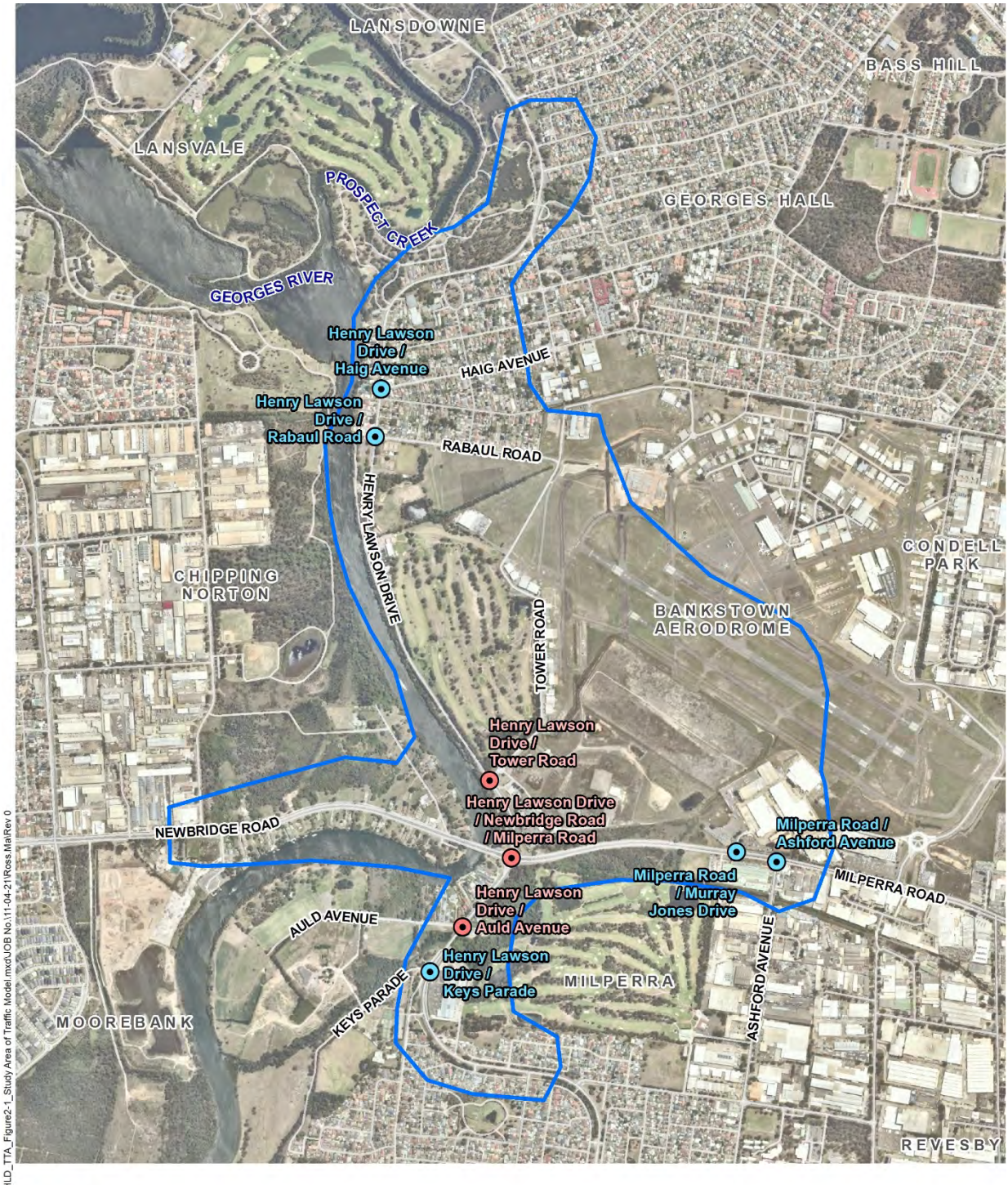
- Incorporate future projects in the area that would result in increased traffic volumes or changed traffic movements through the proposal area
- Assess the impacts of the proposal on the broader road network.

The modelling study area is shown in Figure 2-1. The traffic modelling assessed the impacts of the proposal on all intersections in the proposal area being:

- Henry Lawson Drive/Tower Road
- Henry Lawson Drive/Newbridge Road/Milperra Road
- Henry Lawson Drive/Auld Avenue

The modelling results for the following intersections in the broader road network were also analysed:

- Henry Lawson Drive/Keys Parade (to the south of the proposal)
- Henry Lawson Drive/Haig Avenue (to the north of the proposal)
- Henry Lawson Drive/Rabaul Road (to the north of the proposal)
- Milperra Road/Murray Jones Drive (to the east of the proposal)
- Milperra Road/Ashford Avenue (to the east of the proposal)



P:\GIS\Project-4\project\510003_HenryLawsonDrive\HLD_TTA_Figure2-1_Study Area of Traffic Model.mxd\JOB No.\11-04-21\Ross.Mai\Rev 0

Source: Aurecon, TfNSW, Spatial Services

1:20,000

0 250 500m

Henry Lawson Drive Stage 1A **Traffic and Transport Impact Assessment**

Projection: GDA 1994 MGA Zone 56

FIGURE 2-1: Study Area of Traffic Model

2.3 Detailed modelling method

AIMSUN microsimulation software was chosen as the modelling software which would allow analysis of the intersection performance, and key changes of the proposal. This software allows reporting of travel times, delays and queuing at signalised and non-signalised intersections and geometric conditions.

The traffic modelling required development of:

- A calibrated and validated base case traffic model that accurately represents traffic conditions observed within the study area and is suitable for analysing network performance and acting as a benchmark to evaluate performance of the future year scenarios.
- Future year traffic models that draw on the base case model and strategic traffic forecasting models to compare the expected traffic conditions with and without the proposal under forecast traffic volumes.
- Further details on the inputs, base case and assessment scenario development are detailed in the following sections.

It should be noted that the traffic model was based on the following considerations:

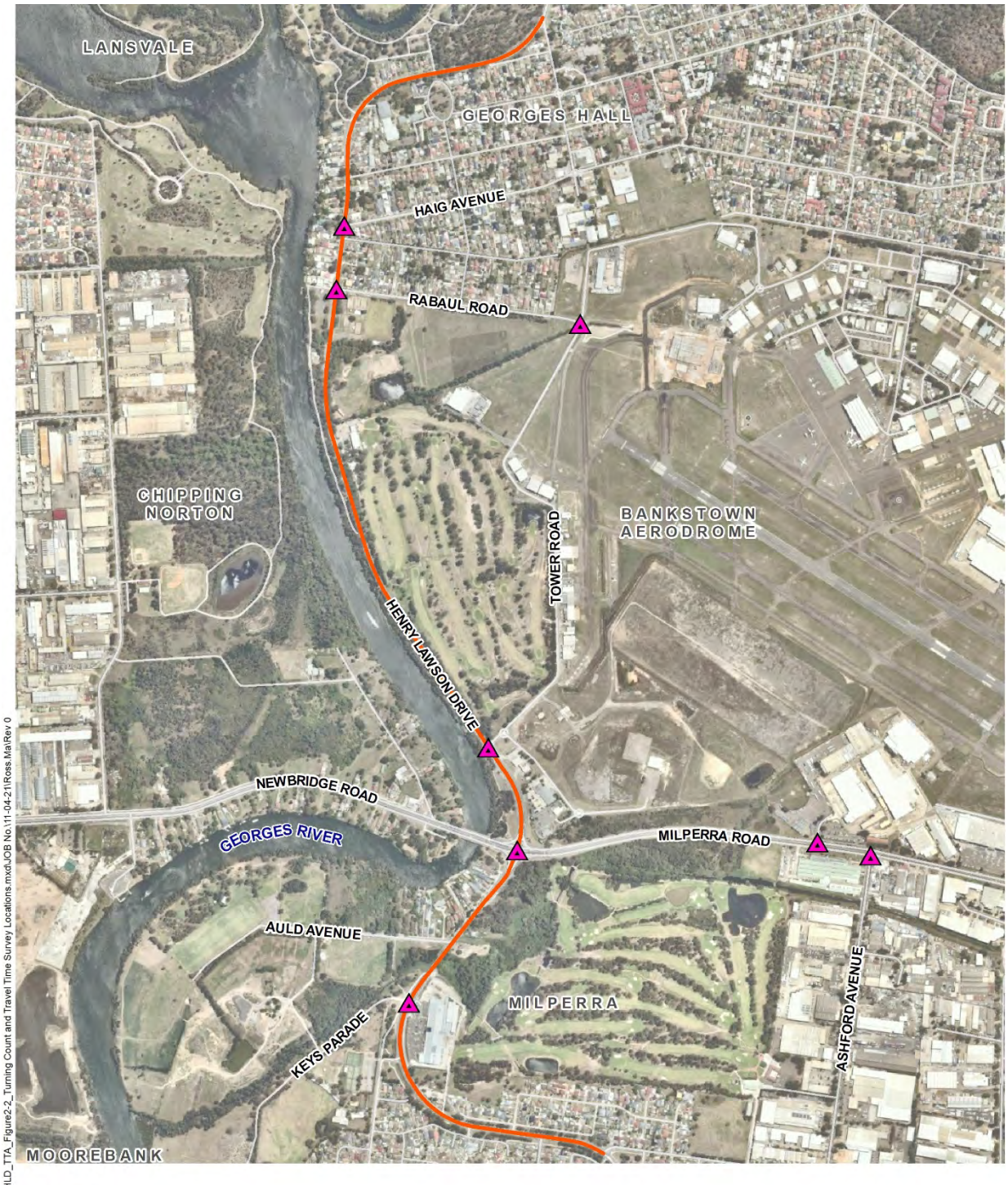
- Traffic surveys were undertaken in 2018 and 2019 (being pre-COVID19), as such reduced traffic levels during COVID-19 lockdown is not a concern.
- Future background growth assumptions are based from the latest land use information available. Any potential effects of COVID-19 on future population growth and employment are not reflected in the modelling results.
- Traffic count data collected from MATRIX and HERE are true and represent existing conditions.
- Did not consider any upstream or downstream congestion outside the model study area on Milperra Road and Henry Lawson Drive.

2.3.1 Traffic monitoring and existing data

The development of the base case model for the proposal was validated and calibrated against several key data inputs being:

- Classified intersection turning movement and midblock counts at multiple locations within the study area, which were carried out to identify the peak hours and calibrate the model. Locations and survey dates are summarised below, and shown in Figure 2-2:
    - Henry Lawson Drive/Keys Parade, collected 19 November 2019
    - Henry Lawson Drive/Milperra Road, collected 28 February 2018
    - Henry Lawson Drive/Tower Road, collected 28 February 2018
    - Henry Lawson Drive/Haig Avenue, collected 28 February 2018
    - Henry Lawson Drive/Rabaul Road, collected 28 February 2018
    - Henry Lawson Drive/Auld Avenue, collected 23 February 2021
    - Tower Road and Rabaul Road, collected 19 November 2019
    - Milperra Road/Murray Jones Drive, collected 23 May 2018
    - Milperra Road/Ashford Avenue 23 May 2018
    - Henry Lawson Drive between Newbridge Road and Haig Avenue midblock, collected 27 February to 5 March 2018.

- HERE travel time survey data for the month of November 2019, which was used to validate the model. Extent of travel time survey is shown in Figure 2-2.
- Origin destination survey conducted on 19 November 2019 to determine the number of vehicles performing a left turn from Newbridge Road (west approach) and then turning right into Tower Road, which was used to calibrate the model.
- SCATS signal history timing data for signalised intersections within the study area to understand and code the signal phases and timings.
- Bus route, stop and timetable information, obtained from Transport website.



Source: Aurecon, TfNSW, Spatial Services

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Henry Lawson Drive Stage 1A **Traffic and Transport Impact Assessment**

Projection: GDA 1994 MGA Zone 56 **FIGURE 2-2:** Turning Count and Travel Time Survey Locations

2.3.2 Development of the base case traffic model

This section presents a summary of the development of the base case traffic model. A full breakdown of the development process is provided in the Calibration and Validation Report, which has been included as Appendix A of this report.

The base case traffic model for the proposal was developed by Transport using AIMSUN v8.1.4 to replicate November 2019 base year traffic conditions for the two-hour AM (7:00am – 9:00am) and PM peak period (4:00pm – 6:00pm). This involved developing an AIMSUN network model to match existing lane configurations, intersections, gradients, lane/turn restrictions, turn lanes and reduced speed areas within the study area.

The Traffic Modelling Guideline, Version 1 (Roads and Maritime, 2013) was used as the main guideline for the base year model development, calibration and validation process. The calibration of the base model involved network verification, demand calibration and route choice calibration. This included development of accurate origin-destination (O-D) matrices calibrated against the intersection turn count data, origin destination data, aerial imagery and other background data collected for the proposal. The model was then validated against HERE travel time data, which confirmed the accuracy of the model.

The calibration and validation process determined that:

- The AM and PM models satisfy the network wide tolerance limits with the majority of light and heavy vehicle turning movements. Tolerance was measured by the GEH statistic, a chi-squared test measuring the variance in differences between surveyed and modelled turning movements. A GEH of <5 was achieved for the model, satisfying the requirements of the Traffic Modelling Guidelines.
- The modelled travel times, specifically in the critical direction (westbound), were within the acceptable 15 per cent tolerance band.
- Model stability is consistent across the five chosen seed runs.
- The base case model provides a realistic replication of the study area's traffic operations.

As a result, the base case model has been calibrated and validated to achieve an acceptable representation of the existing road network conditions in accordance with the Traffic Modelling Guideline (Roads and Maritime, 2013) and has been considered fit for purpose for use in the assessment of future year scenarios.

The base case scenario is identified as the 2019 existing traffic environment. In addition, the increase in traffic volumes from the recently completed development of Flower Power at Keys Parade has been included in the model as part of the base case.

2.3.3 Development of assessment scenarios for the proposal

Future year models were developed for the proposal for the following assessment scenarios:

- 2026 AM/PM peak period without works (Do-Minimum)
- 2036 AM/PM peak period with the proposal

The future year models for 2026 (opening year) and 2036 (ten years after opening) were developed for the future AM and PM peaks by adding the predicted traffic growth to the base case 2019 calibrated demand volumes. The traffic growth was derived using traffic volumes from the Sydney Strategic Traffic Forecasting Model.

It is noted that at the time of modelling, there were several key developments not included within the future land use assumptions within Land Use 2016. These developments include Bankstown Airport and Riverlands Golf Course Subdivision. Traffic generated by these developments have been based on the Bankstown Airport Masterplan and the Riverland's Golf Course Residential Subdivision Traffic Impact Assessment (TTPP, 2020) respectively and considered in future traffic volumes. Detailed breakdown of the generated traffic is shown in Appendix B.

In addition, the Georges Hall Pinch Point upgrade to be constructed north of the proposal on Henry Lawson Drive between Beale Street and Rabaul Road has been considered in all future year assessment scenarios. The changed traffic movements and improvements to the traffic on Henry Lawson Drive from that project has been modelled in these scenarios.

The assumed future infrastructure upgrades are shown in Table 2-1. These projects are common in all future do-minimum and option scenarios.

Table 2-1 Future year network upgrade assumptions

Upgrades	2026	2036
Henry Lawson Drive Upgrade, Stage 1B (to be developed and constructed as a separate project)	X	✔
Henry Lawson Drive Upgrade, Stages 2 & 3 (potential future projects)	X	X
Georges Hall Pinch Point Upgrade	✔	✔
Keys Parade Intersection Upgrade to a 4-leg intersection (as part of the Riverlands Development)	✔	✔
Murray Jones Drive Intersection Upgrade (as part of the Bankstown Airport redevelopment)	✔	✔

2.4 Traffic performance criteria

2.4.1 Level of service criteria for intersections

Intersection operational performance is evaluated by assessing the intersection turning volumes, vehicle delays and level of service (LOS). LoS is a measure used to determine the effectiveness of intersection operation and is commonly used to analyse intersections by categorising traffic flow conditions. For a signalised intersection, the LoS criteria is related to the average intersection delay measured in seconds per vehicle. Table 2-2 shows the Transport for NSW standard LoS criteria for intersection operation.

Table 2-2 Level of Service criteria for intersections

Level of Service	Average Delay per Vehicle (s/veh)	Traffic Signals, Roundabout
A	<14	Good operation
B	15 to 28	Good with acceptable delays & spare capacity
C	29 to 42	Satisfactory
D	43 to 56	Operating near capacity
E	57 to 70	At capacity; at signals, incidents will cause excessive delays Roundabouts requires other control mode
F	>70	Unsatisfactory with excessive queuing

3 Existing conditions

3.1 Study area characteristics

3.1.1 Surrounding land uses

The study area is located predominantly within the City of Canterbury-Bankstown local government area (LGA), though it is noted that a minor part of the area encompassing Newbridge Road extends into the Liverpool LGA. Local development within the City of Canterbury-Bankstown LGA is largely governed by the *Bankstown Local Environmental Plan 2015* (Bankstown LEP), which establishes land zonings that control the types of land uses that are permitted.

Figure 3-1 shows the existing land zoning within and surrounding the study area.

3.1.2 Economic profile

In 2015/2016, the median weekly disposable household income in Australia was $1,438 based on the Census of Population and Housing (ABS, 2016a). The median household income in Canterbury-Bankstown was lower than that of residents in the Liverpool LGA. Unemployment was highest in the City of Canterbury-Bankstown LGA, followed by the Liverpool LGA compared to the broader study area and Greater Sydney.

Employment in health care and social assistance, construction and retail trade comprised the highest proportion of the work force in the City of Canterbury-Bankstown and Liverpool LGAs.

The high proportion of people working in construction may be associated with the occurrence of industrial precincts and development within the broader study area and both LGAs. This may be similar for the higher levels of employment in health care and social assistance and retail trade. This may be associated with the proximity to the hospitals located just outside of the broader study area (Bankstown-Lidcombe Hospital and Liverpool Hospital) and the urban centres located throughout, which include commercial areas.

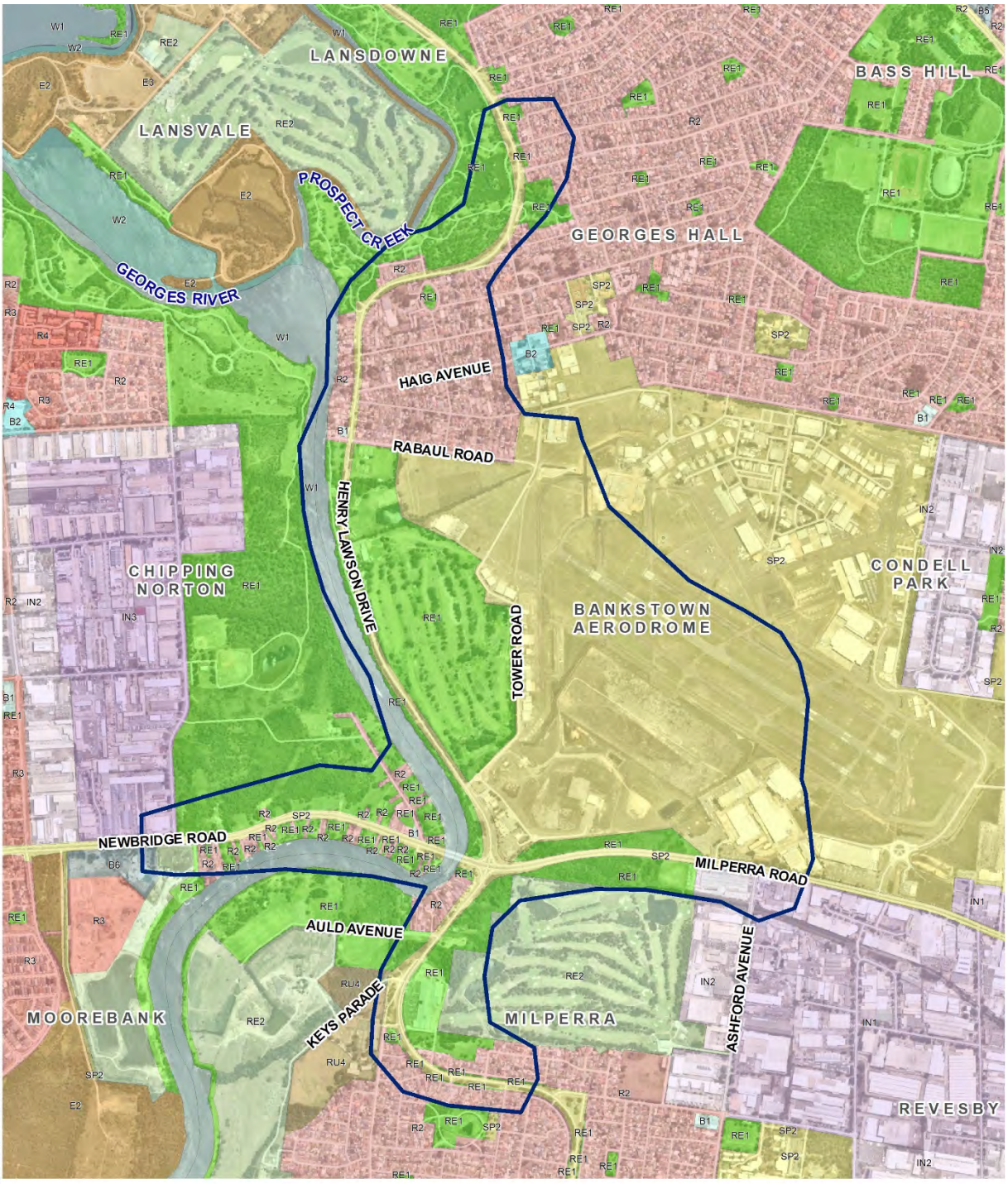
Table 3-1 provides a summary of the economic profile, with the top employment industries in the two LGAs provided in Table 3-2.

Table 3-1 Economic profile in 2016

	City of Canterbury-Bankstown LGA		Liverpool LGA	
	Number	%	Number	%
Labour force	150,613	-	90,669	-
Median weekly household Income	$1,298	-	$1,550	-
Unemployment	12,420	8.2%	6764	7.5%

Table 3-2 Top industries of employment in 2016

	Construction	Retail Trade	Health Care and Social Assistance
City of Canterbury-Bankstown LGA	9.50%	10.40%	10.80%
Liverpool City Council LGA	9.90%	10.10%	11.40%



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Study area

Land zoning

- B1 Neighbourhood Centre
- B2 Local Centre
- B5 Business Development
- B6 Enterprise Corridor
- E2 Environmental Conservation
- E3 Environmental Management
- IN1 General Industrial
- IN2 Light Industrial
- IN3 Heavy Industrial
- R2 Low Density Residential
- R3 Medium Density Residential
- R4 High Density Residential
- RE1 Public Recreation
- RE2 Private Recreation
- RU4 Primary Production Small Lots
- SP2 Infrastructure
- W1 Natural Waterways
- W2 Recreational Waterways

Source: Aurecon, TfNSW, Spatial Services

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Henry Lawson Drive Stage 1A **Traffic and Transport Impact Assessment**

Projection: GDA 1994 MGA Zone 56

FIGURE 3-1: Land Zoning within Study Area

3.1.3 Travel behaviour

Table 3-3 provides a summary of the vehicle ownership and Table 3-4 provides a list of other transport methods used in the City of Canterbury-Bankstown and Liverpool LGAs.

The following travel patterns were identified from the review of ABS data:

- The preferred method of travel to work in both LGAs was travel to work by car (as driver). Liverpool LGA had the highest portion of residents driving overall.
- City of Canterbury-Bankstown LGA had relatively high proportions of people commuting to work by train and the bus compared to Liverpool LGA.
- Travel to work by train was the second most used method of travel to work in the two LGAs. This is likely to be due to the additional public transport facilities located throughout both LGAs including train and bus services.

Table 3-3 Vehicle ownership in 2016

	City of Canterbury-Bankstown LGA		Liverpool LGA	
	Number	%	Number	%
Households with no vehicles	12,183	11.3%	4,542	7.7%
Average motor vehicles per dwelling	1.7	-	2	-

Table 3-4 Travel to work data in 2016

	City of Canterbury-Bankstown LGA		Liverpool LGA	
	Number	%	Number	%
Travel to work by train (one method)	19,504	14.1%	5,641	6.7%
Travel to work by bus (one method)	2,753	2.0%	1,314	1.6%
Travel to work by ferry (one method)	20	0.0%	6	0.0%
Travel to work by tram (one method)	91	0.1%	4	0.0%
Travel to work by taxi (one method)	400	0.3%	111	0.1%
Travel to work by car (as driver - one method)	79,112	57.2%	54,561	65.0%
Travel to work by car (as passenger - one method)	6,453	4.7%	4,157	5.0%
Travel to work by truck (one method)	1,555	1.1%	1,236	1.5%
Travel to work by Motorbike/scooter (one method)	528	0.4%	274	0.3%
Travel to work by bicycle (one method)	406	0.3%	166	0.2%
Other (one method)	806	0.6%	372	0.4%
Travel to work by walking only (one method)	2,787	2.0%	1,661	2.0%
Worked at home*	3,832	2.8%	2,530	3.0%

* *Notes about the data from the ABS 2016 Census of Population and Housing: The data does not consider the potential impact of COVID 19 on travel, including the number of public transport users and people working from home*

3.2 Road network

3.2.1 Key roads within the study area

3.2.1.1 Road hierarchy

There are three key road categories in NSW:

- State roads, which form the primary routes for the movement of people and goods within and between major urban centres and include roads classified as Freeways, State Highways and Main Roads under the Roads Act 1993. State Roads are managed by Transport for NSW
- Regional roads, which provide for travel between smaller towns and districts as well as perform a sub-arterial function within major urban centres. These roads are managed by local councils but often receive funding from the State Government due to their importance to the road network in NSW
- Local roads, which include collector and local access roads and are managed by local councils.

The study area for the traffic and transport assessment of the proposal includes several key roads, which are described in the sections below, including:

- State roads – Milperra Road, Henry Lawson Drive, Newbridge Road
- Regional roads – Haig Avenue, Ashford Avenue
- Local roads – Tower Road, Rabaul Road, Auld Avenue.

3.2.1.2 Milperra Road

Milperra Road is a State road that runs predominantly east-west from Newbridge Road in Milperra to Canterbury Road in Revesby. It is part of the A34 arterial route which connects Newtown and Liverpool.

Within the study area, Milperra Road intersects with Newbridge Road and Henry Lawson Drive at an at-grade signalised intersection. This section of Milperra Road has three lanes in each direction, with additional auxiliary turning lanes. It is sign posted at 70 kilometres per hour.

3.2.1.3 Henry Lawson Drive

Henry Lawson Drive is a 20 kilometre- long State road that runs predominantly north-south from Hume Highway in Villawood to Forest Road in Peakhurst.

Within the study area, Henry Lawson Drive intersects with Newbridge Road and Milperra Road at an at-grade signalised intersection. South of this intersection, Henry Lawson Drive has one-lane in each direction, with additional auxiliary turning lanes. North of this intersection, it has two lanes in each direction until Tower Road, where it reduces to one-lane in each direction. Both sections are sign posted at 60 kilometres per hour, increasing to 70 kilometres per hour north of Hazel Street.

3.2.1.4 Newbridge Road

Newbridge Road is a State road that runs predominantly east-west from Milperra Road in Milperra to Terminus Road/Hume Highway in Liverpool. It is part of the A34 arterial route which connects Newtown and Liverpool.

Within the study area, Newbridge Road intersects with Milperra Road and Henry Lawson Drive at an at-grade signalised intersection. This section of Milperra Road has three lanes in each direction, with additional auxiliary turning lanes. It is sign posted at 70 kilometres per hour.

3.2.1.5 Other key roads within the study area

Table 3-5 describes the other key roads within the study area.

Table 3-5 Description of key roads within and surrounding the proposal

Road	Construction
Haig Avenue	Haig Avenue is an east-west regional road that connects Henry Lawson Drive to Georges Crescent/Birdwood Road. It is generally a two-lane undivided road with residences and on-street parking on both sides.
Ashford Avenue	Ashford Avenue is a north-south regional road that connects Milperra Road to the Western Sydney University Bankstown campus and residential areas to the south. It is generally a two-lane undivided road with residential and on street parking on both sides.
Tower Road	Tower Road is a north-south local road that connects Henry Lawson Drive to Link Road and Bankstown Airport. It is generally a two-lane undivided road with aeronautical industry/golf course on both sides.
Endeavour Road	Endeavour Road is an east-west local road that connects Henry Lawson Drive residential areas and ends in a cul-de-sac. It is generally a two-lane undivided road with residences and on-street parking on both sides.
Rabaul Road	Rabaul Road is an east-west local road that connects Henry Lawson Drive to Tower Road. It is generally a two-lane undivided road with residences and on-street parking on both sides.
Auld Avenue	Auld Avenue is an east-west dead-end local road that connects Henry Lawson Drive to playing fields and cricket pitches to the west. It is generally a two-lane undivided road with on-street parking on both sides.
Riverside Road	Riverside Road is a north-west local road that connects Newbridge Road to Homestead Avenue. It is generally a two-lane undivided road with on-street parking on both sides. It is fronted on both sides by warehousing and industry.

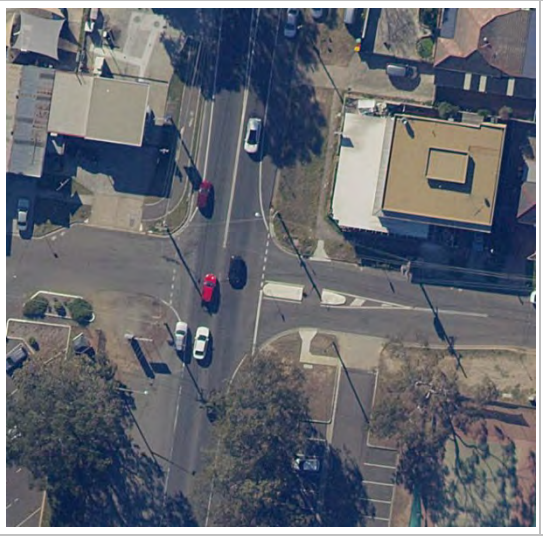
3.2.2 Key intersections within the study area

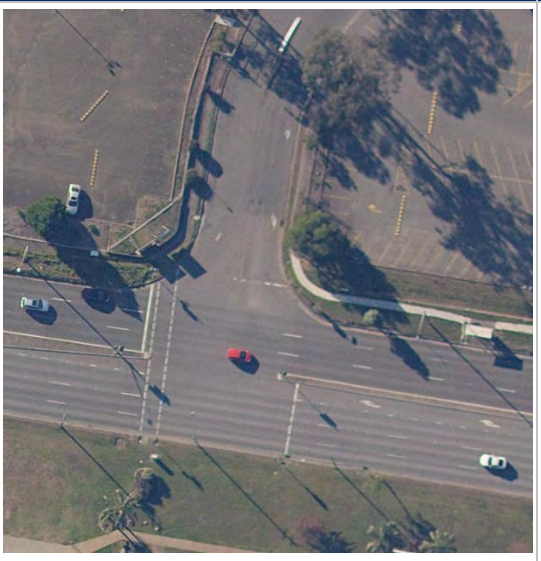
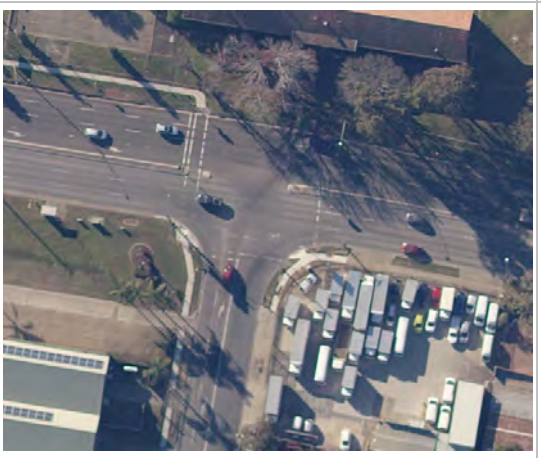
Table 3-6 summarises the existing key intersections and key features of the intersections.

Table 3-6 Summary of key intersections within the study area

Intersection	Image	Layout
Henry Lawson Drive/Tower Road		• Signalised T-Intersection. At the time of the assessment, Transport acknowledges that the airport redevelopment has removed the roundabout shown in the aerial 30 m east of the intersection. • Access to Tower Road from Henry Lawson Drive northbound carriageway via right turn short lane. Access from southbound carriageway via a through-left full-length lane.

Intersection	Image	Layout
		• Access from Tower Road to Henry Lawson Drive via full length (30m) dedicated left and right turn lanes.
Henry Lawson Drive/ Newbridge Road/Milperra Road		• Signalised 4-way intersection with all turning movements permitted. • Left turns on all approaches are single slip lanes protected by median islands. Two left turn slip lanes are provided on the southern approach of Henry Lawson Drive. • Right turns on all approaches are on single dedicated right turn short lanes. Two right turn lanes are provided on Henry Lawson Drive north approach.
Henry Lawson Drive/Auld Avenue		• Priority T-intersection with one lane approach/exit on all legs, except for Henry Lawson Drive northbound exit lane expanding to two lanes after the intersection. • All turning movements permitted. Auld Avenue eastbound onto Henry Lawson Drive controlled by Give Way sign.
Henry Lawson Drive/Keys Parade		• Signalised T intersection for access to/from Flower Power and Henry Lawson Drive • Access to Flower Power from Henry Lawson Drive northbound carriageway via a right turn short lane. Access from southbound carriageway via a protected short left turn slip lane, with left turn permitted on red.

Intersection	Image	Layout
		• Access from Flower Power to Henry Lawson Drive northbound via dedicated right turn lane. Access to southbound carriageway via a protected left turn slip lane.
Henry Lawson Drive/Haig Avenue		• Signalised T-Intersection • Access to Haig Avenue from Henry Lawson Drive northbound and southbound via right and left turn short lanes respectively. • Access from Haig Avenue to Henry Lawson Drive southbound carriageway via left-turn short lane. Access to northbound carriageway via right turn full length lane.
Henry Lawson Drive/Rabaul Road		• Priority 4-way intersection with one lane approach/exit on all legs. • All turning movements permitted. Rabaul Road westbound controlled by Stop sign, and eastbound controlled by Give Way sign.

Intersection	Image	Layout
Henry Lawson Drive/Murray Jones Drive		• Signalised T-Intersection • Access to Murray Jones Drive from Milperra Road westbound carriageway via a right turn short lane, and from eastbound carriageway via a through-left full-length lane. • Access from Murray Jones Drive to Milperra Road eastbound carriageway via left-turn lane with left turn on red permitted after stopping. Access to westbound carriageway via right turn with seagull treatment.
Henry Lawson Drive/Ashford Avenue		• Signalised T-Intersection • Access to Ashford Avenue from Milperra Road eastbound carriageway via a right turn short lane, and from westbound carriageway via a through-left full-length lane. • Access from Ashford Avenue to Milperra Road via dedicated left and right turn lanes for access onto eastbound and westbound carriageways respectively.

3.2.3 Road traffic volumes and intersection performance

Table 3-7 shows the traffic performance of key intersections within the study area as per the base case model results for the 2019 peak periods. Delays are shown as a time period of seconds.

Table 3-7 2019 Existing intersection traffic performance

Intersection	AM Peak 7–8			AM Peak 8–9			PM Peak 4–5			PM Peak 5–6		
	Vol	Delay	LOS	Vol	Delay	LOS	Vol	Delay	LOS	Vol	Delay	LOS
HLD/Milperra Rd/ Newbridge Rd	6,052	112	F	6,296	112	F	6,615	152	F	6,819	199	F
HLD/Tower Rd	2,935	18	B	3,046	26	B	2,984	70	E	3,142	49	D
HLD/Auld Avenue	1,880	11	A	2,056	13	A	2,119	25	B	2,192	29	C
HLD/Haig Ave	2,451	43	D	2,563	55	D	2,502	66	E	2,433	51	D
HLD/Rabaul Rd	2,403	40	C	2,491	57	E	2,580	95	F	2,488	361	F
HLD/Keys Pde	1,725	3	A	1,857	5	A	1,981	12	A	2,120	6	A
Milperra Rd/ Murray Jones Dr	3,156	5	A	3,134	10	A	3,383	4	A	3,387	6	A
Milperra Rd/ Ashford Ave	3,410	19	B	3,359	22	B	3,650	19	B	3,657	17	B

3.2.3.1 Henry Lawson Drive/Tower Road

Henry Lawson Drive/Tower Road performs at an overall LoS B during both AM peak hours and LoS E and D during the PM peak hours.

The poor performance in the PM peak can be attributed to a pinch point along the north approach exit which results in vehicles merging from two lanes to one. This extends into queues stretching beyond the Tower Road intersection. Additionally, the Tower Road approach provides access to retail shops, which generates more traffic during the PM.

3.2.3.2 Henry Lawson Drive/Milperra Road/Newbridge Road

Henry Lawson Drive/Milperra Road/Newbridge Road performs at an overall LoS F for both hours of the AM and PM peaks, though has noticeably worse delays during the PM.

Poor performance of the intersections can be partly attributed to the following observations:

- Right turn bay along the east approach is typically full during both peaks, with heavy vehicles filling up the bay space readily.
- During the PM peak, dual right turn along the north approach is typically full and queues back upstream along Henry Lawson Drive
- The left turn slip from Newbridge Road is heavily utilised during the AM peak and is constrained by the short storage length, which measures 60m from the stop line.

3.2.3.3 Henry Lawson Drive/Auld Avenue

Henry Lawson Drive/Auld Avenue performs at an overall LoS A during the AM Peak, and slightly worse during the PM peak at LoS B and C. The performance of this intersection is good overall due to the low demand from Auld Avenue during the peak times.

3.2.3.4 Other intersections in road network

Traffic performance is excellent at the intersections of Henry Lawson Drive/Keys Parade, Milperra Road/Murray Jones Drive and Milperra Road/Ashford Avenue, which all perform at an overall LoS A or B during the AM and PM Peaks.

Henry Lawson Drive/Haig Avenue performs at an overall LoS D in the AM peak and E/D in the PM Peak, likely due to the slow north and southbound movement caused by slow moving heavy vehicles in a single lane approach with lack of overtaking opportunities causing extended queues on busy days.

Henry Lawson Drive/Rabaul Road performs at a LoS C/E in the AM peak and overall F in the PM Peak. The majority of the delays is coming from the turning movements along Rabaul Road as they try to pick a gap to enter Henry Lawson Drive which is typically congested.

3.2.4 Freight

3.2.4.1 Heavy vehicle numbers

The majority of Sydney's freight is conveyed by road. Henry Lawson Drive is an important route for freight and industrial type business operations that connects surrounding large industrial areas of Milperra, Revesby, Chipping Norton and Moorebank, which are made up of warehouses, manufacturing, storage and logistics businesses. As a result, a range of vehicles including heavy vehicles travel throughout the local road network. Table 3-8 shows the heavy vehicle volumes along different sections of Henry Lawson Drive for a typical weekday for the AM and PM peaks, based on the base traffic model. The proportion of heavy vehicles during the peak periods along Henry Lawson Drive is high compared to the average of 4% across the Sydney Urban Network

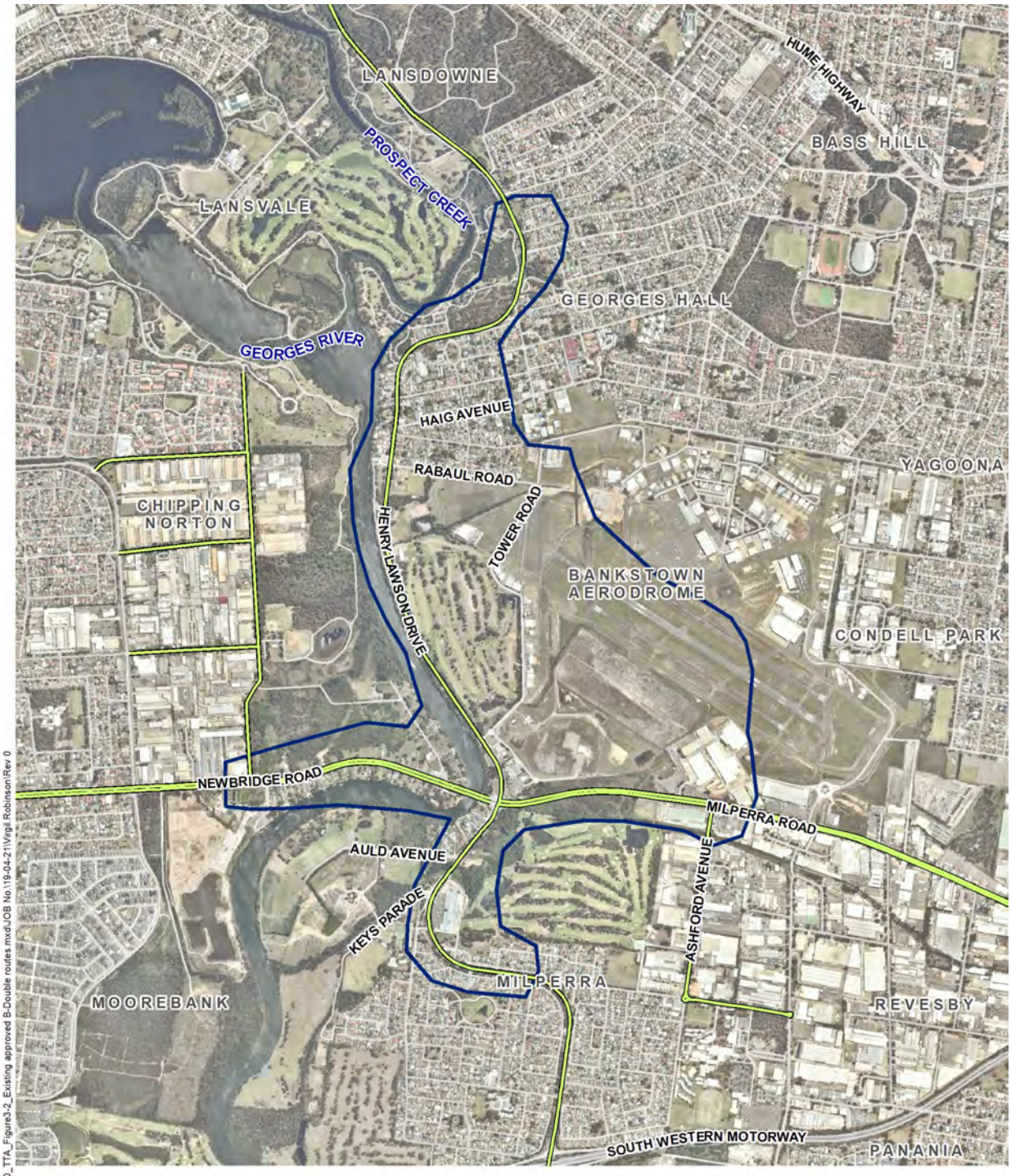
Table 3-8 Average weekday heavy vehicle volumes - combined directions

Midblock	7–9 AM		4–6 PM	
	Heavy	Heavy %	Heavy	Heavy %
Henry Lawson Drive between Haig Avenue and Newbridge Road	587	12%	412	8%
Henry Lawson Drive between Newbridge Road and Bullecourt Avenue	422	11%	303	8%

3.2.4.2 Access and routes

Figure 3-2 shows the approved B-Double routes for vehicles up to 26 metres in length on the road network surrounding the study area, based on the Transport Restricted Access Vehicles map. These are shown in green.

This shows that the study area is well serviced by roads suitable for heavy vehicles, including Henry Lawson Drive, Newbridge Road, Milperra Road, and Ashford Avenue.



Henry Lawson Drive Stage 1A **Traffic and Transport Impact Assessment**

Projection: GDA 1994 MGA Zone 56

FIGURE 3-2: Approved B-Double routes

3.2.4.3 Crash data analysis

Crash data was extracted from the past 10 years from the Transport Crash Link database for Henry Lawson Drive, Milperra Road and Newbridge Road across an area similar to the study area. The extraction area is shown in Figure 3-5.

The crash history is summarised in Figure 3-3 along with the crash types shown in Figure 3-4**.** Note that casualties include accidents involving fatalities, serious injury, moderate injury and minor injury.

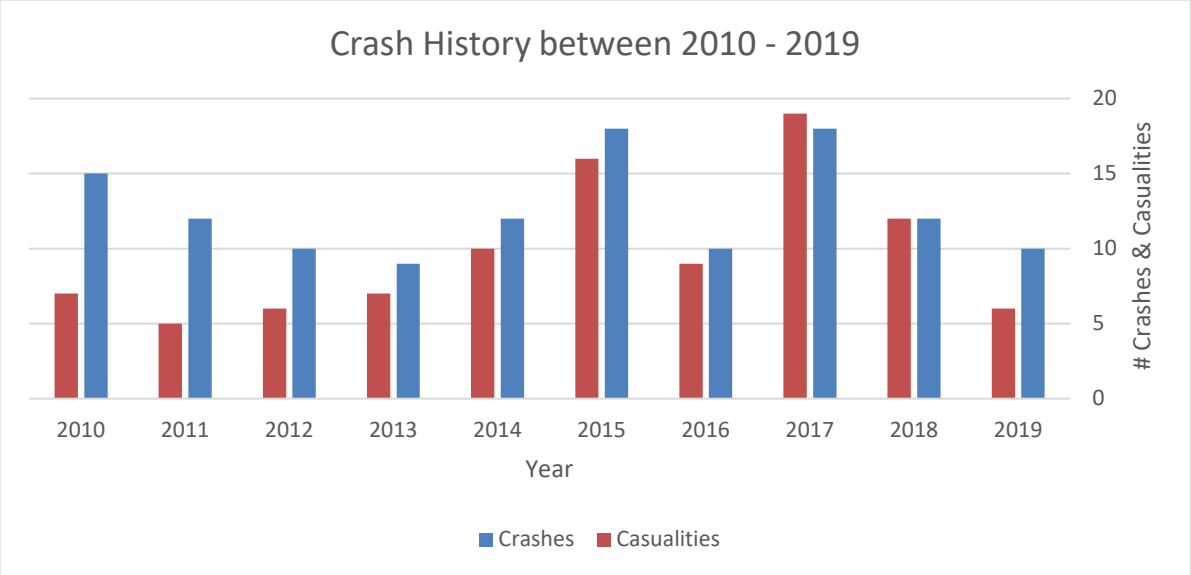


Figure 3-3 Crash history along Henry Lawson Drive and Milperra Road (2010 – 2019)

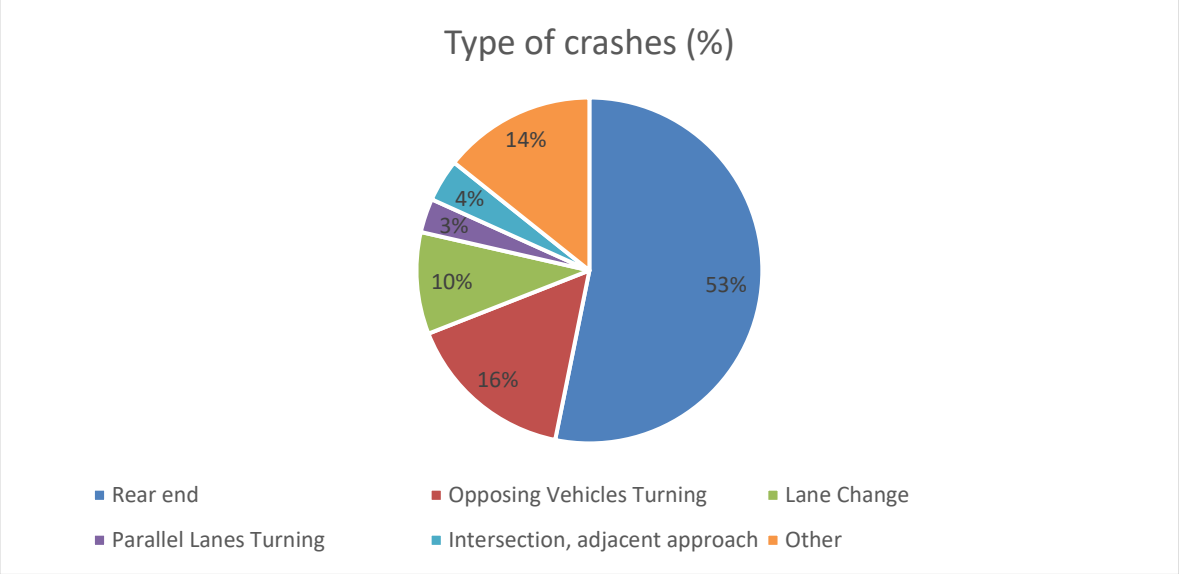


Figure 3-4 Crash by type along Henry Lawson Drive and Milperra Road (2010 – 2019)

The crash history data shows an average of 12.6 crashes and 9.7 casualties per year within the study area. Rear end crashes make up the majority of crashes (53.2 per cent) followed by opposing vehicles turning (15.9 per cent) and lane changing (9.5 per cent).

Most crashes occur within 10 metres of the intersection (65.9 per cent), during the AM and PM peak periods during the weekdays.

Crash area cordon

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Source: Aurecon, TfNSW, Spatial Services

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Projection: GDA 1994 MGA Zone 56

Henry Lawson Drive Stage 1A **Traffic and Transport Impact Assessment**

FIGURE 3-5: Cordon area extraction for crash data

3.3 Public transport

3.3.1 Rail network

There is no rail network within the study area. The nearest train stations are East Hills station, about four kilometres to the south, and Liverpool Station, about five kilometres to the west.

3.3.2 Bus network

The study area is serviced by a single bus route, the M90 which runs from Liverpool to Burwood. Bus stops are located along Milperra Road and Newbridge Road. Stops within the study area shown in Figure 3-6.

3.4 Active transport

3.4.1 Pedestrian infrastructure

Existing pedestrian footpaths and shared paths across the study area is substantial, including existing pathways for pedestrians along:

- Northbound carriageway of Henry Lawson Drive south of its intersection with Newbridge Road
- Either side of Newbridge Road
- Pedestrian pathway along Georges River to the north of the Newbridge Road Georges River Bridge
- Bridge crossing along Henry Lawson Drive south of Auld Avenue has a footpath along the northern carriageway that is of substandard width
- Local roads within the residential streets within the study area

3.4.2 Cyclist infrastructure

A map of cyclist infrastructure within the study area has been obtained from Transport Cycleway Finder and is provided in Figure 3-7. It shows that Henry Lawson Drive is well-serviced by cycling infrastructure, with an off-road shared path along its northbound carriageway. Likewise, Newbridge Road is serviced by an off-road shared path along its eastbound carriageway. Milperra Road, however, is not serviced by dedicated cyclist infrastructure.

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Source: Aurecon, TfNSW, Spatial Services

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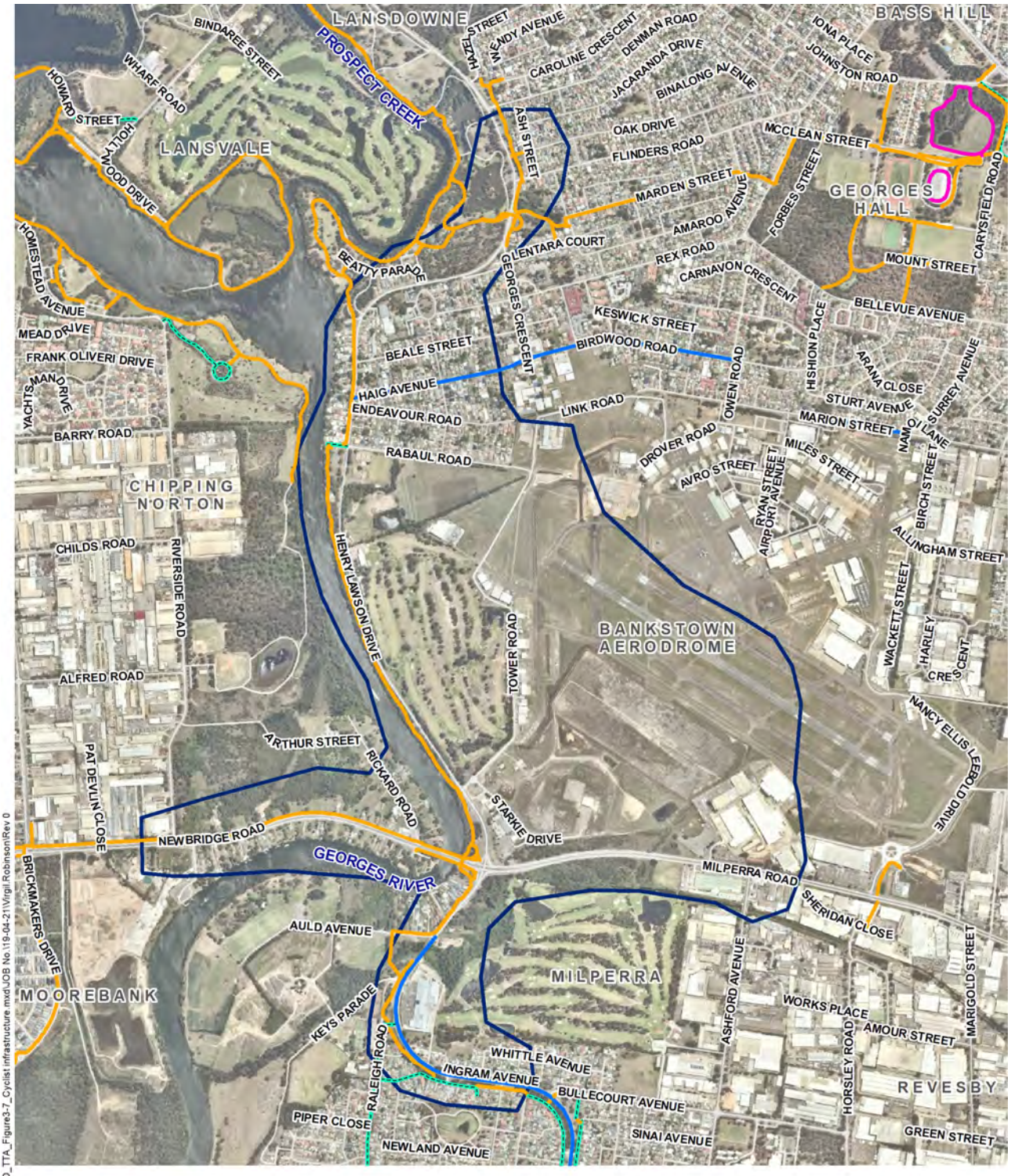
Henry Lawson Drive Stage 1A **Traffic and Transport Impact Assessment**

Projection: GDA 1994 MGA Zone 56

FIGURE 3-6: Bus Network in Study Area



Study area

Bicycle network

- Bicycle Path (Off road facility type – for bicycle use only)
- Shared Path (Off road facility type - shared with pedestrians)
- Road Shoulder (On road facility type - shared with parked vehicles)
- Mixed Traffic (On road facility type – shared with moving vehicles)

P:\GIS\Project-4\project\510003_HenryLawsonDriveHLD_TTA_Figure3-7_Cyclist infrastructure.mxd\JOB No.\19-04-21\Virgil Robinson\Rev 0

Source: Aurecon, TfNSW, Spatial Services

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0 250 500 m

Henry Lawson Drive Stage 1A **Traffic and Transport Impact Assessment**

Projection: GDA 1994 MGA Zone 56

FIGURE 3-7: Cyclist infrastructure

4 Proposal description

4.1 Overall proposal

4.1.1 Key features of the REF proposal

Key features of the REF proposal would include:

- Widening Henry Lawson Drive from two to four lanes
- Upgrading the signalised intersection of Henry Lawson Drive and Tower Road including:
    - An additional right turn lane from Tower Road onto Henry Lawson Drive
    - A new channelised short left-turn lane from Henry Lawson Drive (southbound) onto Tower Road
    - An additional right turn lane from Henry Lawson Drive (northbound) onto Tower Road
    - Retaining the pedestrian crossing across Henry Lawson Drive on the southern side of the intersection
- Upgrading the signalised intersection of Henry Lawson Drive and Milperra Road/Newbridge Road including:
    - An additional right turn lane on the Milperra Road and Newbridge Road approaches to Henry Lawson Drive
    - An additional through lane on the Henry Lawson Drive southbound approach
    - The removal of the bus only lane on Milperra Road to provide an additional right turn lane on the Henry Lawson Drive northbound approach
- Removing the dedicated left turn slip lane into the ALDI and fast-food area with access being retained via a standard property driveway
- Retaining the existing bus stop on Milperra Road (eastbound) and moving the westbound bus stop 20 metres to the west
- Altering access to Auld Avenue to a “left in/left out” only configuration
- Installing a new Henry Lawson Drive road bridge (over Milperra Drain) to the south of Auld Avenue (referred to as the Auld Avenue Bridge) to carry northbound traffic and retaining the existing bridge for southbound traffic
- Constructing new footpaths on the eastern side of Henry Lawson Drive to connect Tower Road to the existing bus stop on the eastbound lanes of Milperra Road and a new footpath on the southern side between Henry Lawson Drive to the bus stop on the westbound lanes of Milperra Road
- Widening the shared user pathway between Flower Power (Keys Parade) and Newbridge Road to three metres and reconstructing footpaths along the western side of Henry Lawson Drive, where required
- Adjusting existing drainage, including lengthening culverts, installing new drainage infrastructure and water quality controls
- Relocating utilities (including electrical, gas, water and telecommunications)

- Final roadworks including pavement, kerb and gutters, signs, lighting and line marking
- Ancillary work for the proposal including, but not limited to noise walls, road furniture, tie-in works, landscaping, earthworks and the like
- Temporary ancillary compounds, stockpile sites and associated facilities

4.1.2 Key features of the EIS proposal

Key features of the EIS proposal are identified below for each EIS proposal area.

4.1.2.1 EIS proposal area 1 – Henry Lawson Drive opposite Tower Road

The key features of EIS proposal area 1 are:

- Widening of Henry Lawson Drive northbound lanes
- Installing of fill embankments along the edge of the new carriageway to meet existing ground levels
- Extending existing stormwater culvert and installing outlet scour protection measures
- Installing additional stormwater drainage infrastructure and water quality treatments
- Installing a vegetated swale along the toe of the new fill embankment
- Adjusting the existing shared path to suit the new re-alignment and to connect it back to the existing path
- Installing road furniture, including road safety barriers

4.1.2.2 EIS proposal area 2 – Milperra Road opposite Bankstown Airport

The key features of the EIS proposal area 2 are:

- Installing a new bus stop relocated from its existing position on Milperra Road
- Installing a section of a new footpath to the bus stop (connecting to the remainder of the new path to Henry Lawson Drive – REF proposal)
- Installing fill embankments along the edge of the new carriageway to meet existing ground levels
- Extending existing stormwater culvert and installing outlet scour protection measures
- Installing additional stormwater drainage infrastructure connecting to the outlet of the extended culvert
- Installing road furniture, including road safety barriers

4.1.2.3 EIS proposal area 3 – Henry Lawson Drive opposite Auld Avenue

The key features of the EIS proposal area 3 are:

- Removing of existing ancillary structures
- Installing temporary fencing, flagging of exclusion boundaries and temporary erosion and sediment controls for use as an ancillary facility and construction area
- Installing fill embankments along the edge of the new carriageway to meet existing ground levels

- Stabilising the ground surface following the completion of construction to minimise erosion.

4.2 Operational technologies

Operational technologies have been assessed along the proposal in accordance with Transport's ITS provision protocols on arterial roads.

Operational technologies that are currently being used along the Stage 1A section include:

- Existing CCTV coverage at Henry Lawson Drive and Milperra Road providing 180 degree coverage across Henry Lawson Drive northbound, southbound, Newbridge Road and Milperra Road movements. The CCTV is mounted on the south east mast arm at the intersection.
- Traffic control signals as per the TCS design manual at both the Tower Road and Milperra Road intersections.
- Traffic detection systems at both the Tower Road and Milperra Road intersections at all stop lines.
- Red light speed camera at the north west corner of the major intersection of Henry Lawson Drive and Newbridge Road.

These four different operational technologies for road safety and traffic operations would be either maintained or upgraded as part of the proposal. Further investigations during detailed design may be undertaken to confirm location, position or level of coverage required.

In addition, another two operational technologies were considered for the proposal. These were variable message signs (VMS) and flood warning alerts. Neither were considered appropriate for the proposal as:

- There are existing VMSs to the south on approach to the M5 Motorway
- Flood warming alerts would increase cost but have limited benefit

4.3 Construction

4.3.1 Construction overview

Construction activities would be carried out in accordance with a construction environmental management plan (CEMP) to ensure work complies with Transport's commitments and legislative requirements. Detailed work methodologies would be identified by the construction contractor.

The proposal is expected to involve the following activities:

- Preliminary and utility works
- Earthworks
- Widening and pavement works
- Bridge and drainage works
- Pedestrian pathway, intersection crossing and shared path works
- Intersection configuration and traffic signals
- Landscaping and finishing works
- Removal of ancillary facilities and site rehabilitation

4.3.2 Construction footprint

A construction footprint has been developed for the proposal to cover all works and construction activities. This is represented by the overall proposal area in Figure 1-1.

In general, the construction footprint has assumed a five-metre buffer from the edge of design. The footprint also takes into account ancillary facilities and works areas for equipment and machinery. Where possible, the footprint has been developed to minimise environmental impacts.

4.3.3 Ancillary facilities

To support construction, a range of ancillary facilities would be required for the provision of site compounds, material delivery and storage, water capture, and stockpile locations. There are four sites that have been identified for use as ancillary facilities:

4.3.3.1 Georges River site

Located along Henry Lawson Drive opposite the service station, around 0.13 hectares in size. Access will likely be via Henry Lawson Drive northbound carriageway and be left in/ left out.

4.3.3.2 Newbridge Road site

Located on the corner of Newbridge Road and Henry Lawson Drive in the road reserve, around 0.24 hectares in size. Access will likely be via Henry Lawson Drive northbound carriageway and be left in/ left out.

4.3.3.3 Henry Lawson Drive site

Located on residential land, Lot16 DP18399, which will be acquired by Transport for the proposal as part of road widening. It is around 0.29 hectares in size. Access will likely be via Henry Lawson Drive southbound carriageway and be left in/ left out.

4.3.3.4 Auld Avenue site

Located on corner of Auld Avenue and Henry Lawson Drive, around 0.14 hectares. Access will likely be via Auld Avenue.

4.3.4 Construction workforce

The number and types of workers would vary throughout the different stages of construction but would include workers such as:

- Plant and machinery operators
- Traffic controllers
- Labourers
- Utilities servicers
- Project and site managers

A total of about 70 construction workforce staff is estimated to work on the proposal. Final details of the workforce would be identified at a later stage by the construction contractor.

4.3.5 Construction hours and duration

Construction is expected to commence in early 2023 and would take about 24 months to complete.

Construction works would be undertaken in both standard hours and out of works hours (OOHW) for the proposal. Standard construction hours as defined in the Interim Construction Noise Guideline (DECC 2009b) (ICNG) are:

- Monday to Friday: 7am – 6pm
- Saturday: 8am – 1pm
- Sunday and Public Holidays: No work.

Out of hours works would be required to minimise disruptions to the road network. The main works that would be required to occur out of hours would include:

- Intersection works at the Milperra Road/Henry Lawson Drive and Tower Road/ Henry Lawson Drive intersections
- Auld Avenue bridge upgrade works

Any OOHW would be undertaken in accordance with the *Construction Noise and Vibration Guidelines* (Roads and Maritime 2016).

4.3.6 Construction vehicle volumes

The proposal would generate light and heavy vehicle movements associated with delivery or removal of construction materials and equipment and construction worker movements to and from the construction area. The anticipated number of peak construction light and heavy vehicles involved with construction is provided in Table 4-1.

Table 4-1 Estimated construction traffic

Vehicle type	Total vehicle movements per day	Vehicle movements per day at peak construction period	AM peak movements	PM peak movements
Construction personnel (cars and private vehicles)	15	30	30	35
Light construction vehicles and utes	20	40	35	40
Heavy vehicles and trucks	30	60	70	90

4.3.7 Traffic management and staging

During construction of the proposal, traffic management controls and staging would be implemented to maintain safety and reduce impacts on the existing road network. The staging process would be confirmed by the construction contractor in a Traffic Management Plan (TMP) prepared for the proposal.

4.3.8 Construction haulage routes

The haulage routes to and from site would generally use existing routes approved for heavy vehicles surrounding the proposal. Use of local roads would be minimised, where possible. Figure 4-1 shows indicative construction haulage routes. Final haulage routes would be determined by the construction contractor.

Construction haulage routes

- Henry Lawson Drive - North
- Henry Lawson Drive - South
- Milperra Road - East and west
- Potential compound sites

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Source: Aurecon, TfNSW, Spatial Services

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Henry Lawson Drive Stage 1A **Traffic and Transport Impact Assessment**

Projection: GDA 1994 MGA Zone 56

FIGURE 4-1: Construction haulage routes

5 Impact assessment

5.1 Construction impacts

5.1.1 Construction traffic impacts

The proposal would generate light and heavy vehicle movements on the road network surrounding the proposal associated with delivery or removal of construction materials and equipment and construction worker movements to and from the construction footprint.

As outlined in Table 4-1, this would result in up to an additional 60 heavy vehicles and 70 light vehicles on the surrounding road network per day during peak construction. The construction traffic for delivery or removal of construction materials and equipment would generally be staged throughout the day. The construction workers would arrive and leave site at the start and end of each shift.

The construction footprint is well serviced by roads suitable for heavy vehicles. Therefore, impacts on local roads surrounding the proposal are expected to be limited to short sections of local roads required to access the construction zones. Of note, are two roundabouts which may be used by haulage trucks to facilitate turnaround movements:

- Roundabout at Nancy Ellis Leebold Drive
- Utilised by haulage vehicles along Milperra Road to perform turnaround
- While not part of the approved heavy vehicle network, both Nancy Ellis Leebold Drive and the roundabout are servicing Bankstown Airport and the industrial area to its north, and thus have sufficient pavement strength and road widths to support heavy vehicles.
- Minimal impact expected
- Roundabout at intersection of Ashford Avenue and Bullecourt Avenue.
- Utilised by haulage vehicles along Henry Lawson Drive south to perform turnaround
- The roundabout itself is part of the approved heavy vehicle network, along with Ashford Avenue
- Vehicles will access the roundabout from Henry Lawson Drive via Bullecourt Avenue, which is not part of the approved heavy vehicle network.
- Swept path analysis will need to be undertaken during detailed design to assess physical constraints along this route, as well as consideration for access and noise of residences fronting Bullecourt Avenue.

Overall, while the construction workforce traffic would likely be noticeable, the additional volume of vehicles would be relatively small compared to the existing traffic volumes of vehicles on the surrounding road network. Therefore, any impact on the surrounding road network performance associated with construction traffic from the proposal is expected to be minor. Nevertheless, to determine the operation of the road network within the proposal area during construction, the following scenarios have been developed in SIDRA modelling:

- Future year 2023 without construction vehicles
- Future year 2023 with construction vehicles for the peak construction stage

The results of the road performance within the proposal area are shown in Table 5-1 to Table 5-2.

Table 5-1 Future 2023 road performance without construction

Intersection	AM Peak				PM Peak			
	Delay (s)	LOS	DOS	Queue (m)	Delay (s)	LOS	DOS	Queue (m)
Henry Lawson Drive/ Milperra Rd	127	F	1.14	682	216	F	1.47	786
Henry Lawson Drive/ Tower Rd	80	F	1.06	776	127	F	1.21	1094
Henry Lawson Drive/ Auld Avenue	32	C	0.1	2	20	B	0.11	2
Henry Lawson Drive/ Keys Pde	13	A	0.74	231	21	B	0.91	364

Table 5-2 Future 2023 road performance with peak construction

Intersection	AM Peak				PM Peak			
	Delay (s)	LOS	DOS	Queue (m)	Delay (s)	LOS	DOS	Queue (m)
Henry Lawson Drive/ Milperra Rd	141	F	1.16	710	256	F	1.6	882
Henry Lawson Drive/ Tower Rd	90	F	1.1	853	146	F	1.26	1196
Henry Lawson Drive/ Auld Avenue	14	A	0.1	1	21	B	0.1	3
Henry Lawson Drive/ Keys Pde	15	A	0.83	260	48	D	1	758

The assessment shows that the construction traffic from the proposal has a negative but minor impact on the intersections within the proposal area.

- The Milperra Road/Henry Lawson Drive and Tower Road/Henry Lawson Drive intersection experience around 10 per cent more delay but remain at an operational level of service F for both peaks.
- Auld Avenue/Henry Lawson Drive intersection experiences an improvement in delay and level of service from C to B in the AM peak. This is due to the construction assessment assessing the removal of the right turn movement from Henry Lawson Drive southbound into Auld Avenue. Construction has no material impact on the intersection in the PM peak.
- Keys Parade/Henry Lawson Drive experiences a greater delay from 21 seconds to 48 seconds in the PM peak, but remains at an acceptable LoS D. Construction has no material impact on the intersection in the AM peak.
- Construction traffic is unlikely to have a material impact on intersections further afield of the study area due to the low generated traffic volumes, and are less likely to make turning movements as they are already on the arterial network.

5.1.2 Impacts associated with site access

The construction and all associated works would result in temporary changes in road and property access, as well as pedestrian and cyclist access across the local road network. The impacts of these changes are discussed in the following chapters.

5.1.2.1 Road access

The majority of construction works would be undertaken in the road reserve and on/ adjacent to the roads of Henry Lawson Drive, Milperra Road and Newbridge Road. These roads are important roads within the Sydney road network and would need to remain operational during construction. However, changes to traffic movements may result due to traffic management controls such as reduction in speed limits.

The construction site would be appropriately fenced and appropriate traffic deflection barriers to avoid vehicles accidentally accessing the construction site.

While the roads would remain open, there may be a need for temporary lane closures at times during the construction period. In addition, as sections of the upgrade are completed, traffic switches would be put in place to shift traffic onto new sections of the road to enable works on existing pavement to be completed. All impacts to the road network would be undertaken in accordance with a Road Occupancy Licence (ROL) to be obtained from the Traffic Management Centre. Access for emergency vehicles would be maintained along these roads.

Tower Road, Auld Avenue would experience some delays during construction. Tower Road would remain open during construction, however, could result in lane closures and traffic switches being introduced for short periods. This would allow the road to remain open, especially for emergency services which may need to access Bankstown Airport. However, should Tower Road/Henry Lawson Drive intersection need to be closed, access onto Henry Lawson Drive would be available from Tower Road via Rabaul Road.

Auld Avenue may be affected by access to a compound site as well as Henry Lawson Drive tie-in works. For most of the construction period, Auld Avenue would remain open to traffic, however, there may be short delays as vehicles access the compound site. There may be short periods of time where the road may need to be closed or opened only for residents. These periods would try, where possible, to be outside of peak traffic periods, especially on weekends where the playing fields are in use by community sports. The construction contractor would confirm the need and duration of any road closures in consultation with the community and in accordance with a Council Road Opening Permit.

5.1.2.2 Property access

Access to properties would be maintained during construction, though it may need to be disturbed on a short-term basis. It is expected that the following property accesses may be affected by construction works:

- Access to commercial properties along southbound carriageway of Henry Lawson Drive between Tower Road and Milperra Road (ALDI, BP Truckstop) maybe be temporarily affected as widening works encroaches on existing access points. Alternate access routes are available along Starkie Drive.
- Access to residential properties along the northbound carriageway of Henry Lawson Drive between Milperra Road and Auld Avenue may be temporarily affected as widening works encroaches on existing access points. Access to these properties will be maintained by the contractor, though it may involve detours and increase in travel times.

- Access to Flower Power from Henry Lawson Drive southbound may be minimally affected by widening works. Northbound access to Flower Power is not expected to be affected as it is outside of the scope of works.

Landowners and occupiers will be consulted by the construction contractor about any potential impacts to access and methods to minimise these impacts. Consultation will be undertaken well in advance of property accesses being impacted.

5.1.3 Impacts on public transport

Bus routes M90 operate along Newbridge Road/Milperra Road in both directions. Access for pedestrians and to public transport would be maintained around the construction site during construction. There are two bus stops within the construction area. These would be temporarily relocated to allow for safe access. During the construction of the overall proposal, the following impacts on buses and customers will be:

- Longer travel times when travelling through construction areas as a result of speed reduction and additional construction vehicles.
- Temporary relocation of bus stops away from construction zones. Passengers may be required to walk further to relocated bus stops.

Any change to the bus stops in the construction areas would be confirmed by the construction contractor and would be discussed with the bus operator.

5.1.4 Impacts on active transport

Detours for pedestrian/cyclist access would be implemented within the proposal area. In particular, the following routes may be affected:

- Existing shared path along northbound Henry Lawson Drive north of Keys Parade
- Existing shared path along northbound Henry Lawson Drive between Auld Avenue and Milperra Road
- Existing shared path along Georges River near Tower Road

The above routes lie within the zone of road widening works and will be temporarily removed as part of construction. Pedestrian and cyclist access will be detoured, and alternative arrangements managed through signage and wayfinding.

5.2 Operation impacts

This section provides an assessment of the operational impacts of the overall proposal on road network performance against the do-minimum scenario for the future years 2026 and 2036.

5.2.1 Road network changes

The proposal consists of the upgrade of the intersection of Milperra Road/Newbridge Road and Tower Road. Changes will also be made along Auld Avenue and Keys Parade to tie into the proposal. The details of the preferred upgrade are summarised in the following sections.

5.2.1.1 Henry Lawson Drive/Tower Road

The intersection of Tower Road is currently a signalised T-junction intersection providing access into Bankstown Airport and other retail facilities. Tower Road currently provides a single lane in and two lanes exiting, with dedicated left and right turn lanes onto Henry Lawson Drive. Henry Lawson Drive has a right turn lane (northbound) into Tower Road.

The proposal would include an additional right turn lane into Tower Road from Henry Lawson Drive northbound and a new channelised short left-turn lane from Henry Lawson Drive (southbound). On Tower Road, an additional right turn lane would be provided. These changes would increase capacity at the intersections improving travel times through the intersections and addressing anticipated future traffic growth from the Bankstown Airport redevelopment.

5.2.1.2 Henry Lawson Drive/Milperra Road/Newbridge Road

The Henry Lawson Drive/Milperra Road/Newbridge Road is a 4 way signalised intersection with pedestrian crossings on all legs. The proposal would improve intersection capacity by providing additional right turn lanes along Milperra Road, Newbridge Road and Henry Lawson Drive southbound. Existing dual right turn lanes on Henry Lawson Drive northbound would be extended to allow for more vehicle storage. An additional southbound through lane will be provided along Henry Lawson Drive to the north of the intersection. The existing bus jump lane along Milperra Road westbound will be removed as part of the upgrade to provide the space needed for the additional right turn lanes. This would increase the length of time for westbound vehicles to pass through the intersection.

5.2.1.3 Henry Lawson Drive/Auld Avenue

Auld Avenue is currently a priority T-intersection with all movements allowed.

The proposal would convert this intersection to left in and left out only. This change would result in vehicles travelling southbound on Henry Lawson Drive needing to change their route to access Auld Avenue. This may involve turning onto Milperra Road then Ashford Avenue and Bullecourt Avenue to access Henry Lawson Drive northbound into Auld Avenue (a detour of around four kilometres). Vehicles would also be able to turn around at the Flower Power intersection, further south of Auld Avenue (a detour of around 400 metres).

Based on community feedback, further investigations on the layout of this intersection would be undertaken during detailed design. Further traffic monitoring and design options would be undertaken to identify the most optimal layout for this intersection. Any change in the layout would be based on balancing a range of issues including road safety and road network performance, as well as considering any future opportunities for broader connectivity.

5.2.2 Intersection performance

The intersection performance (LoS) for the intersections within the study area are detailed in Table 5-3 to Table 5-6. Performance of the intersections to be upgraded by the proposal are discussed further in the section.

Table 5-3 Level of service results for Do Minimum 2026 scenarios

Intersection	AM Peak 7–8			AM Peak 8–9			PM Peak 4–5			PM Peak 5–6		
	Vol	Delay	LOS	Vol	Delay	LOS	Vol	Delay	LOS	Vol	Delay	LOS
HLD/Milperra Rd	6,341	240	F	6,104	509	F	6,789	215	F	6,997	255	F
HLD/Tower Rd	2,784	29	C	2,408	52	D	2,995	105	F	3,126	78	F
HLD/Auld Avenue	2,105	66	E	1,947	82	F	2,201	80	F	2,145	99	F
HLD/Haig Ave	2,558	33	C	2,325	74	F	2,722	147	F	2,738	97	F
HLD/Rabaul Rd	2,464	24	B	2,148	26	B	2,477	54	D	1,783	59	E
HLD/Keys Pde	2,086	34	C	1,884	179	F	2,163	130	F	2,416	106	F
Milperra Rd/ Murray Jones Dr	4,012	16	B	4,039	36	C	3,759	9	A	3,728	17	B
Milperra Rd/ Ashford Ave	4,045	23	B	3,774	28	B	3,956	20	B	3,906	31	C

Table 5-4 Level of service results for Do Minimum 2036 scenarios

Intersection	AM Peak 7–8			AM Peak 8–9			PM Peak 4–5			PM Peak 5–6		
	Vol	Delay	LOS	Vol	Delay	LOS	Vol	Delay	LOS	Vol	Delay	LOS
HLD/Milperra Rd	6,361	297	F	6,195	572	F	6,580	265	F	6,429	314	F
HLD/Tower Rd	2,892	56	E	2,543	105	F	3,019	121	F	2,890	134	F
HLD/Auld Avenue	2,146	54	D	1,941	76	F	2,201	80	F	2,145	99	F
HLD/Haig Ave	2,676	48	D	2,278	136	F	2,693	169	F	2,726	201	F
HLD/Rabaul Rd	2,555	37	C	2,246	76	F	2,688	84	F	2,568	81	F
HLD/Keys Pde	2,120	29	C	1,863	314	F	2,081	252	F	2,056	243	F
Milperra Rd/ Murray Jones Dr	3,873	10	B	3,997	37	C	3,591	11	A	3,452	25	B
Milperra Rd/ Ashford Ave	4,095	22	B	3,677	68	E	3,833	21	B	3,582	32	C

Table 5-5 Level of service results with the Proposal 2026 scenarios

Intersection	AM Peak 7–8			AM Peak 8–9			PM Peak 4–5			PM Peak 5–6		
	Vol	Delay	LOS	Vol	Delay	LOS	Vol	Delay	LOS	Vol	Delay	LOS
HLD/Milperra Rd	6,949	77	F	7,267	131	F	7,247	163	F	7,478	191	F
HLD/Tower Rd	3,214	26	B	3,452	39	C	3,530	81	F	3,514	88	F
HLD/Auld Avenue	2,219	17	B	2,415	32	C	2,421	47	D	2,515	30	C
HLD/Haig Ave	2,720	43	D	2,918	61	E	2,952	69	E	2,887	91	F
HLD/Rabaul Rd	2,662	46	D	2,842	67	E	2,938	74	F	2,887	90	F
HLD/Keys Pde	2,206	12	A	2,316	17	B	2,442	57	E	2,509	16	B
Milperra Rd/ Murray Jones Dr	4,000	14	B	4,039	30	C	3,819	8	A	3,782	10	A
Milperra Rd/ Ashford Ave	4,192	23	B	4,185	25	B	4,034	20	B	3,989	19	B

Table 5-6 Level of service results with the Proposal 2036 scenarios

Intersection	AM Peak 7–8			AM Peak 8–9			PM Peak 4–5			PM Peak 5–6		
	Vol	Delay	LOS	Vol	Delay	LOS	Vol	Delay	LOS	Vol	Delay	LOS
HLD/Milperra Rd	7,210	98	F	7,413	201	F	7,273	201	F	7,339	225	F
HLD/Tower Rd	3,235	26	B	3,392	54	D	3,571	87	F	3,586	81	F
HLD/Auld Avenue	2,341	26	B	2,499	65	E	2,567	66	E	2,498	70	F
HLD/Haig Ave	2,810	56	D	2,955	96	F	2,989	72	F	2,891	93	F
HLD/Rabaul Rd	2,704	43	D	2,835	55	D	3,000	73	F	2,993	86	F
HLD/Keys Pde	2,325	11	A	2,446	78	F	2,583	42	D	2,550	51	D
Milperra Rd/ Murray Jones Dr	4,160	14	A	4,156	19	B	3,636	8	A	3,588	9	A
Milperra Rd/ Ashford Ave	4,386	23	B	4,371	28	B	3,858	21	B	3,803	18	B

5.2.2.1 Henry Lawson Drive/Tower Road

The modelling results show the intersection remains at LoS B during the 7–8 AM and improves from LoS D to LoS C during 8–9 AM in 2026. In 2036, the 7–8 AM improves from LoS E to LoS B and the 8–9 AM improves from LoS F to LoS D. The PM peak shows the intersection performing at LoS F however with improvements in overall delay. In 2026, delay is reduced from 105s to 81s (4–5 PM) and remains at 88s during the 5–6 PM. In 2036, delay is further reduced from 121s to 87s (4–5 PM) and 134s to 81s (5–6 PM). Volume throughput of the intersection has also increased across all peak periods.

The improvements in delay and volume throughput of the intersection can be seen coming from the capacity improvements of the Tower Road leg with the addition of a dual right turn bay and a dedicated left turn slip which helps during the PM peak periods as more traffic exits from the development. In the AM peak the LoS and delay improves from the addition of a dual right turn bay from Henry Lawson Drive into Tower Road. The merge length, north of Tower Road, has also been extended to accommodate more traffic through the intersection however it is expected queue spillback from the single lane constraint to be a reoccurring issue affecting the intersections northbound movement. This also affects any right turn movement out of Tower Road onto Henry Lawson Drive.

5.2.2.2 Henry Lawson Drive/Milperra Road/Newbridge Road

The modelling shows that the intersection would still operate at LoS F under the operation scenario for both 2026 and 2036 during both peak periods. However, the difference can be seen in the reduction in delay and the volume capacity of the intersection. The 2026 7–8 AM peak, delay has reduced from 240s down to 77s. Volume throughput has also increased from 6341 to 6949 vehicles which shows the intersection is able to accommodate more traffic. Similarly, the 2026 8–9 AM shows delays improving from 509s to 131s and also volume throughput increases. In 2036, delays have improved from 297s to 98s in the 7–8 AM and from 572s to 201s in the 8–9 AM. Likewise, improvements in delay can also be seen during the PM peak periods.

The delay improvement of the intersection can be factored by the addition of a dual right turn along from Milperra Road into Henry Lawson Drive. Originally a single right turn, the dual right is able to store and release more right turn traffic thus improving the intersection performance overall as green time can be reallocated back onto other major movements. Other improvements such as the removal of the bus jump lane, turn bay extensions, the additional southbound through lane and short dual right from Newbridge Road into Henry Lawson Drive adds further capacity to the intersection thus improving its performance.

It can be noted, as the intersection accommodates more traffic, any northbound movement is likely to be constrained due to downstream congestion of the single lane north of Tower Road. During simulation runs, northbound queues can be seen extended back from Haig Avenue through to Tower Road and onto Milperra/Newbridge Road affecting some movement flows.

5.2.2.3 Henry Lawson Drive/Auld Avenue

The do minimum modelling shows by 2026, Henry Lawson Drive/Auld Avenue will operate at LoS E/F in the AM peak and LoS F during the PM peak. Similar LoS can be seen in 2036 do minimum. The poor performance is attributed to the high delays from traffic turning in and out of Auld Avenue as a result of congestion along Henry Lawson Drive.

Under the proposal scenario, the 2026 modelling shows the intersection performing at LoS B/C during the AM peak and LoS D/C during the PM peak. By 2036, the intersection performs at LoS B/E during the AM peak and LoS E/F during the PM peaks. The improvement in performance is a result of the intersection layout changes from a T junction with all movements to a left in left out arrangement.

5.2.2.4 Other intersections in the road network

For the other intersections included in the road model, the assessment found that overall the proposal would have a positive impact on the surrounding road network. Improvements during the AM and PM peaks would be anticipated at Henry Lawson Drive/Keys Parade as result of less queue spill back from Henry Lawson Drive/Milperra Road. Minor improvements in delay can be seen along Henry Lawson Drive/Haig Avenue and Henry Lawson Drive/Rabaul Road. Both of these intersections are located north of Tower Road where the midblock capacity remains at a single lane in each direction. The intersection performances along Milperra Road/Murray Jones Drive and Milperra Road/Ashford Ave remains relatively unchanged for future AM and PM peaks under both scenarios.

5.2.3 Travel time

Future travel times along Henry Lawson Drive for the proposal scenario has been assessed against the Do–Minimum option for the future years 2026 and 2036 for the AM and PM peaks. Results of the modelled travel times are summarised in Table 5-7 to Table 5-10 with details in Appendix C.

Table 5-7 Do Minimum cumulative travel time summary – Northbound (from Bullecourt Avenue)

Section	2026 Do Minimum				2036 Do Minimum			
	7–8 AM	8–9 AM	4–5 PM	5–6 PM	5–6 PM	8–9 AM	4–5 PM	5–6 PM
Keys Parade	01:42	08:07	05:25	04:22	01:33	14:25	10:13	10:50
Milperra/ Newbridge Road	05:05	14:40	10:38	09:06	04:44	21:07	16:08	17:27
Tower Road	05:36	15:13	11:33	10:02	05:17	21:40	17:14	18:51
Haig Avenue	08:03	17:14	16:18	14:16	07:58	23:47	21:50	24:06
Flinders Road	09:25	18:35	17:39	15:38	09:20	25:09	23:12	25:28

Table 5-8 Do Minimum cumulative travel time summary – Southbound (from Flinders Road)

Section	2026 Do Minimum				2036 Do Minimum			
	7–8 AM	8–9 AM	4–5 PM	5–6 PM	7–8 AM	8–9 AM	4–5 PM	5–6 PM
Haig Avenue	01:32	01:36	03:54	02:54	01:50	05:03	05:00	05:59
Tower Road	04:02	04:41	10:13	06:55	05:31	12:03	12:19	12:38
Milperra/ Newbridge Road	05:25	06:45	12:15	08:33	06:41	14:44	14:33	14:39
Keys Parade	06:18	07:49	13:12	09:29	07:34	15:47	15:34	15:39
Bullecourt Avenue	07:15	08:46	14:09	10:28	08:24	16:36	16:25	16:29

Table 5-9 Proposal travel time summary – Northbound (From Bullecourt Avenue)

Section	2026 Preferred Option				2036 Preferred Option			
	7–8 AM	8–9 AM	4–5 PM	5–6 PM	7–8 AM	8–9 AM	4–5 PM	5–6 PM
Keys Parade	00:59	01:01	02:32	01:03	00:57	02:58	01:59	02:16
Milperra/ Newbridge Road	02:48	04:35	07:31	03:13	02:50	08:09	05:48	07:26
Tower Road	03:24	05:27	09:29	05:19	03:28	09:34	07:50	09:02
Haig Avenue	06:32	09:37	14:38	10:22	06:52	14:56	13:06	13:51
Flinders Road	07:54	10:59	15:59	11:44	08:13	16:17	14:28	15:12

Table 5-10 Proposal travel time summary – Southbound (From Flinders Road)

Section	2026 Preferred Option				2036 Preferred Option			
	7–8 AM	8–9 AM	4–5 PM	5–6 PM	7–8 AM	8–9 AM	4–5 PM	5–6 PM
Haig Avenue	01:28	01:30	01:29	01:27	01:28	01:31	01:28	01:27
Tower Road	03:35	03:42	03:58	03:42	03:35	03:47	04:03	03:44
Milperra/ Newbridge Road	04:24	04:38	05:59	06:36	04:26	04:48	05:48	05:19
Keys Parade	05:18	05:37	06:50	07:24	05:20	05:49	06:39	06:14
Bullecourt Avenue	06:15	06:36	07:52	08:28	06:11	06:41	07:31	07:06

5.2.3.1 Northbound travel time

Analysis of the modelled northbound travel times shows:

- The 7–8 AM peak travel times along Henry Lawson Drive northbound improve between Bullecourt Avenue and Flinders Road. In 2026, there is a slight improvement of 1:31 and in 2036 improves by 1:06 compared with the do minimum travel times. The travel time between Tower Road and Haig Avenue is expected to increase as more northbound traffic flows through. Capacity constraints with the merge point and single lane are some key factors which would decrease the travel speeds in this section.
- In the 8–9 AM peak, the travel times along Henry Lawson Drive northbound improves by 7:36 minutes in 2026 and 8:52 in 2036 compared to do minimum scenario. The biggest difference can be seen between the section of Keys Parade and Milperra Road/Newbridge. The intersection upgrades (Keys Parade by others) reduce queueing and provides more green time for the through movement. As traffic approaches Tower Road and Haig Avenue the travel time performance begins to drop due to congestion.
- The 4–5 PM peak shows an improvement of 1:40 minutes for 2026 and an improvement of 8:44 minutes for 2036 along Henry Lawson Drive northbound. Similarly, in the AM peaks, travel times south of the Milperra Road/Newbridge Road shows improvement. North of this intersection the travel time performance deteriorates as a result of queue spill back.
- The 5–6 PM peak indicates an improvement of 3:54 minutes in 2026 and 10:16 minutes in 2036 along Henry Lawson Drive northbound in comparison with the do minimum scenario. The section between Tower Road and Haig Avenue remains a constraint for travel time improvements, with congestion resulting in deteriorating travel times.

5.2.3.2 Southbound travel time

Analysis of the modelled southbound travel times shows:

- During 7–8 AM peak, travel time along Henry Lawson Drive southbound improves by 59 seconds in 2026 and 2:14 minutes in 2036 compared with the do minimum scenario. Improvements can be seen on the approach to the Milperra Road/Newbridge Road intersection from the increased dual right storage and additional southbound lane. The increased lane diverge distance on approach to Tower Road southbound also helps improves travel time performance as traffic is able get into the left or through lanes sooner.

- The 8–9 AM peak travel time along Henry Lawson Drive southbound shows improvements of 2:10 minutes in 2026 and 9:56 minutes for 2036 when compared to do minimum travel times as a result of intersection improvements at Milperra Road/Newbridge Road.
- In the 4–5 PM peak, the travel time along Henry Lawson Drive southbound improves by 6:18 minutes in 2026 and 7:31 minutes in 2036. The travel time is expected to remain similar to the 2019 base case scenario. The improvements in travel time can be associated back to the intersection upgrade of Milperra Road/Newbridge Road.
- The 5–6 PM peak shows travel time along Henry Lawson Drive southbound improving by 2:00 minutes in 2026 and 9:23 minutes in 2036 in comparison to future do minimum scenarios. The travel time also shows a slight improvement from 2019 base conditions.

5.2.4 Overall network performance

Overall network performance can be quantified based on a number statistical outputs, which provide a level of understanding and comparison between different modelled scenarios. Some of these performance statistics include:

- **VKT (Vehicle Kilometres Travelled)** – Total kilometres travelled by all vehicles in the model. Complete VKT are trips completing a trip from origin to destination. Incomplete VKT are trips that have started but remain in the network after the simulation period has ended.
- **VHT (Vehicle Hours Travelled)** – Total travel hours by all vehicles in the model. Complete VHT include vehicles complete a trip from origin to destination. Incomplete VHT includes vehicles that have started but remain in the network after the simulation period has ended.
- **Total Number of Stops** – Total number of stops for all vehicles determined from the model
- **Average Speed** – Measures the average traffic speed during the simulation for all vehicles
- **Unreleased Trips** – Number of vehicles that were unable to enter the network due to queues extending beyond the network area.

Table 5-11 and Table 5-12 provides a summary output of the network performance statistics of the Do Minimum and the proposal scenarios respectively.

Table 5-11 Do Minimum model network performance statistics

Performance Statistics	2026 Do Minimum		2036 Do Minimum	
	AM Peak 7–9	PM Peak 4–6	AM Peak 7–9	PM Peak 4–6
Travel Demand	24585	26307	25608	26690
VKT Complete	58107	64035	58337	60847
VKT Incomplete	6630	6381	6806	7344
VKT Total	64736	70416	65143	68192
VHT Complete	2667	3062	3147	3551
VHT Incomplete	924	900	1184	1320
VHT Total	3591	3962	4330	4870
Total Number of Stops	22918	25215	27768	29178

Performance Statistics	2026 Do Minimum		2036 Do Minimum	
	AM Peak 7–9	PM Peak 4–6	AM Peak 7–9	PM Peak 4–6
Average Speed (km/h)	18	18	15	14
Unreleased Trips	859	822	1440	1482

Table 5-12 Proposal model network performance statistics

Performance Statistics	2026 Proposal		2036 Proposal	
	AM Peak 7–9	PM Peak 4–6	AM Peak 7–9	PM Peak 4–6
Travel Demand	24585	26307	25608	26690
VKT Complete	64583	67297	66137	67145
VKT Incomplete	4601	5272	5176	5471
VKT Total	69184	72569	71313	72616
VHT Complete	1892	2618	2207	2735
VHT Incomplete	192	358	369	440
VHT Total	2084	2976	2576	3175
Total Number of Stops	16297	21710	19604	22255
Average Speed (km/h)	33	24	28	23
Unreleased Trips	2	190	86	376

The performance statistics show an increase of total VKT for the proposal when compared to the Do–Minimum scenario. For 2026 AM peak, VKT is increased by around 4500 vehicles kilometres and for 2026 PM peak by around 2400 vehicle kilometres. In 2036 AM peak, VKT increases by around 6200 vehicle kilometres and for 2036 PM peak, 4400 vehicle kilometres. The increase in VKT is as a result of improved intersection capacity from the proposal which allows additional traffic demand to be accommodated.

There is a decrease in total VHT for the proposal scenario across the study area which indicates there is a travel time saving benefit. In 2026, there is a saving of 1508 hours in the AM peak and 1050 hours for the PM peak. Similarly, in 2036, 1754 hours travel time saving for the AM peak and 1695 hours in the PM peak.

In addition, there are a reduced number of vehicle stops for the proposal scenarios along with an improvement in average speed.

The latent demand or unleased trips for do minimum base scenarios indicates a high number of vehicles waiting outside the network due to high congestion. For the proposal scenario, there is a reduction in unreleased trips which shows the proposal results in travel time improvements across the whole modelled network.

5.2.5 Property access changes

The increased footprint of the road network in the proposal area is likely to impact local road and property access during operation. Landowners and occupiers would be consulted about any potential access impacts prior to the commencement of construction and/or operation.

Currently around 10 properties between Milperra Road and Auld Avenue have driveway frontage onto Henry Lawson Drive and have access to/from both north and southbound carriageways. The overall proposal proposes a raised concrete median along this section of Henry Lawson Drive, which will make driveway access left in left out only (from the northbound lanes). Property owners wishing to access their driveway from the southbound carriageway of Henry Lawson Drive will need to turn around at the Keys Parade intersection or detour elsewhere onto the network (possibly via Milperra Road, Ashford Avenue, Bullecourt Avenue then back onto Henry Lawson Drive northbound).

Additionally, widening of Henry Lawson Drive may cause some properties experiencing shrinking of setback space between their property and the road. Properties which previously relied on this space to perform vehicle turnarounds may be required to reverse into live traffic to access Henry Lawson Drive. Driveway access would be designed during detailed design and would consider safety requirements such as sight distances.

Access to the commercial properties between Tower Road and Milperra Road would not have any impacts to access. Access to the fast food and ALDI supermarket will change from a left slip lane arrangement to a driveway access, but this would not have an adverse impact on patrons. This driveway access has been developed in consideration of traffic efficiency and road safety requirements.

5.2.6 Impacts on public transport

The westbound bus jump start lane along Milperra Road will be removed as part of the upgrade of the intersection. As a result, this will remove the bus signal phasing which will improve the efficiency of the intersection along all approaches.

The existing bus stops located along Milperra Road east of the intersection with Henry Lawson Drive would be retained. The bus stop located on the Milperra Road westbound carriageway would be relocated out of the left turn lane about 20 metres from where it is currently located. This will require the bus to merge out of the left turn lane into Milperra Road. Buses stopping at these bus stops would be in the kerbside lane. This would result in no change to the existing situation for bus services stopping on Milperra Road.

Bus bays were considered, however, there are a number of constraints including Aboriginal land claim areas and coastal wetlands which meant that these were not appropriate for this location.

The operation of the proposal would not result in any changes to public bus services.

5.2.7 Impacts on active transport

As a part of the upgrade, pedestrian accessibility and safety will be improved with the provision of a concrete footpath on the eastern side Henry Lawson Drive between Tower Road and Milperra Road which will support foot traffic to the new retail proposed within the Bankstown Airport Development. A pedestrian concrete footpath will also be provided on both sides along Milperra Road to provide a formal connection between the bus stops and pedestrian crossings at the Henry Lawson Drive intersection.

The existing footpath along the western side of Henry Lawson Drive between Keys Parade and Newbridge Road would be upgraded from narrow footpath to a 3.0 wide concrete shared path (including provision of shared path facilities on the new bridge south of Auld Avenue).

Pedestrian and cyclist movements along the Georges River would be maintained with the existing pedestrian pathway along the Georges River north of Newbridge Road bridge slightly realigned to accommodate the larger footprint of the upgraded Henry Lawson Drive/Tower Road intersection. This concrete pathway would still connect to the existing pedestrian crossing at Tower Road.

5.2.8 Operational road safety

Whilst no dedicated road safety upgrades have been undertaken in the preferred option, the increased intersection capacity and smoother operation of the network in general is expected to significantly improve road safety. Additionally, the following intersection upgrades are expected to improve road safety:

- Henry Lawson Drive/Tower Road
- Provision of additional right turn bays will increase turn storage capacity and reduce risk of road blockage and rear end collision.
- Conversion of the left turn exit lane from Tower Road into a slip lane will improve safety of that turn.
- Henry Lawson Drive/Milperra Road/Newbridge Road
- Additional right turn bays and extension of existing right turn bays will increase storage capacity and reduce risk of road blockage and rear end collisions
- High entry signalised left turn from Newbridge Road to reduce weaving impacts for vehicles merging right to enter the Bankstown Airport precinct on Tower Road.
- Henry Lawson Drive/Auld Avenue
- Conversion of the intersection into a left-in left-out reduces risk of vehicles turning into incoming traffic.

6 Management measures

Table 6-1 provides a summary of the mitigation measures and environmental safeguards that are recommended for the proposal based on the assessment of potential traffic and transport impacts.

Table 6-1 Traffic impact mitigation measures

Impact	Environmental safeguard	Responsibility	Timing
Traffic and transport	A Traffic Management Plan (TMP) will be prepared and implemented as part of the CEMP. The TMP will be prepared in accordance with the Transport for NSW Traffic Control at Work Sites Manual (RMS, 2020) and QA Specification G10 Control of Traffic (Transport, 2020). The TMP will include: • Confirmation of haulage routes • Swept path analysis of haulage vehicles using the Ashford Avenue roundabout • Measures to maintain access to local roads and properties • Construction traffic control plans outlining site-specific traffic control measures (including signage) to manage and regulate traffic movement • Measures to maintain pedestrian and cyclist access • Requirements and methods to consult and inform the local community of impacts on the local road network • Access to construction sites including entry and exit locations and measures to prevent construction vehicles queuing on public roads • A response plan for any construction traffic incident • Consideration of other developments that may be under construction to minimise traffic conflict and congestion that may occur due to the cumulative increase in construction vehicle traffic • Monitoring, review and amendment mechanisms.	Contractor	Pre-construction/ construction
Construction site access	Construction site access will be designed and implemented in consideration of: • Road design guidelines and turning paths for heavy vehicles • Appropriate sight distances to allow traffic to safely enter and exit • Visibility of compliant warning and way finding signs • Use of accredited traffic controllers, where appropriate and/or other controls to separate, slow down or temporarily stop traffic for safe entry/exit • Minimising use of local roads, where practical	Contractor	Pre-construction/ construction

Impact	Environmental safeguard	Responsibility	Timing
	• Provision of deceleration lanes at accesses next to highly trafficked roads		
Traffic impacts	Further traffic modelling will be carried out during detailed design following confirmation of the construction methodology and traffic staging to confirm the potential for traffic impacts and identify whether any additional mitigation measures or traffic control measures would be required.	Contractor	Detailed design
Impact on bus stops or routes	Temporary and permanent bus stop relocation would be discussed with the relevant bus operator.	Transport for NSW/ Contractor	Detailed design/ Pre-construction
Temporary access changes	Detours during temporary access changes will be implemented with directional signage along alternate routes.	Contractor	Construction
Heavy Vehicle Movements	Heavy vehicle movements to be limited during peak traffic periods (i.e. between 7.15 and 8.15 am and 4.45 and 5.45 pm), where practical.	Contractor	Construction
Traffic management measures	Any temporary traffic diversions, clearways and road closures will be implemented in accordance with Transport Management Centre (TMC) and Canterbury Bankstown City Council requirements.	Contractor	Construction
Property access	Property access will be maintained where feasible and reasonable and property owners will be consulted well in advance of work starting that may temporarily restrict or control access.	Contractor	Construction
Local road or shared path closures	Relevant councils will be consulted with prior to any local road or shared path closures to identify suitable mitigation measures such as detour routes.	Contractor	Construction
Parking	Off-road parking for construction vehicles will be provided within the ancillary facility and construction areas.	Contractor	Construction
Damage to local roads	Any damage to the local road network identified to be caused by construction vehicles for the proposal will be remediated by the contractor to be similar to the existing road condition.	Contractor	Construction
Auld Avenue	Further investigations on the layout of this intersection would be undertaken during detailed design, including traffic monitoring and design options to identify the most optimal layout for this intersection. Any change in the layout would be based on balancing a range of issues including road safety and road network performance, as well as considering any future opportunities for broader connectivity.	Transport for NSW	Detailed design

7 Conclusion and justification

Transport for NSW proposes to upgrade Henry Lawson Drive between the M5 motorway, Milperra and Hume Highway, Lansdowne. The corridor is around 7.5 kilometres long and serves as a major north-south link for freight and general traffic. This section along Henry Lawson Drive is currently performing poorly with slow travel times and increases in delay as result of limited single lane road capacity and increase in traffic demand. The need for this proposal has been further accelerated through proposed upcoming developments including the Bankstown Airport redevelopment and Riverlands Golf Course (residential) subdivision.

This traffic and transport assessment focuses on Stage 1A of the Henry Lawson Drive upgrade between Keys Parade, Milperra, to Tower Road, Bankstown. The proposal consists of upgrading a 1.3-kilometre length of Henry Lawson Drive including intersection upgrades and an additional 480 metres along Milperra Road to the Newbridge Road Georges River Bridge tie in. It describes the existing conditions for all modes of transport in the study area, assesses the traffic and transport impacts of the proposal during construction and operation and recommends measures, to minimise impacts where required.

The operational traffic performance of the proposal has been assessed using AIMSUN traffic modelling for the preferred scenario against the do-minimum scenario in 2026 and 2036. The modelling results show the following:

- The level of service in the future is expected to remain at LoS F for the main intersection of Henry Lawson Drive/Milperra Road/Newbridge Road. However, modelling for the future scenarios with the proposal shows a notable reduction in average traffic delay when comparing with the do minimum case. The combination of dual right turns, turn bay length extensions and the removal of the bus jump lane also provides increased capacity and higher vehicular throughput at the intersection.
- The section north of Tower Road is expected to remain congested and minimise any improvements in travel time along Henry Lawson Drive. This section remains at one lane each way and shows significant queuing extending back onto Milperra Road/Newbridge Road. Movements heading northbound are likely to be affected. It should be noted that as part of the Henry Lawson Drive upgrade, this section falls within the extent of a future potential Stage 2 upgrade of Henry Lawson Drive. These conditions are expected to be alleviated following future upgrades.
- The network statistics shows an increase in VKT for future scenarios with the proposal as a result of increase traffic demand. The VHT shows a travel time saving for both AM and PM peak which indicates travel time benefit. Travel speeds across the network improve and greater traffic movement through the network would result from a reduction in congestion and queuing.

The overall proposal providing the aforementioned traffic intersection benefits, in conjunction with other stages of the Henry Lawson Drive upgrade program, would ease existing traffic congestion issues and improve freight access between the M5 Motorway and Hume Highway.

There is potential for temporary traffic impacts during construction associated with construction traffic generated by the proposal, construction vehicles accessing the construction zones and temporary access restrictions. Several mitigation measures and safeguards would be implemented to reduce the potential traffic and transport impacts, where possible, which would be outlined in a Construction Traffic Management Plan that would be prepared and approved prior to construction of the proposal. The CTMP would be implemented during construction and would detail the final traffic arrangements, construction boundaries, access points, heavy vehicle haulage routes and strategies to minimise any potential adverse traffic and transport impacts from construction of the proposal.

Appendix A Base Model Calibration and Validation Report

Henry Lawson Drive Stage 1A

Calibration and Validation Modelling Report

December 2020 | Version: 1

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Date: 1 December 2020

Version: 1

1 Introduction

1.1 Project background

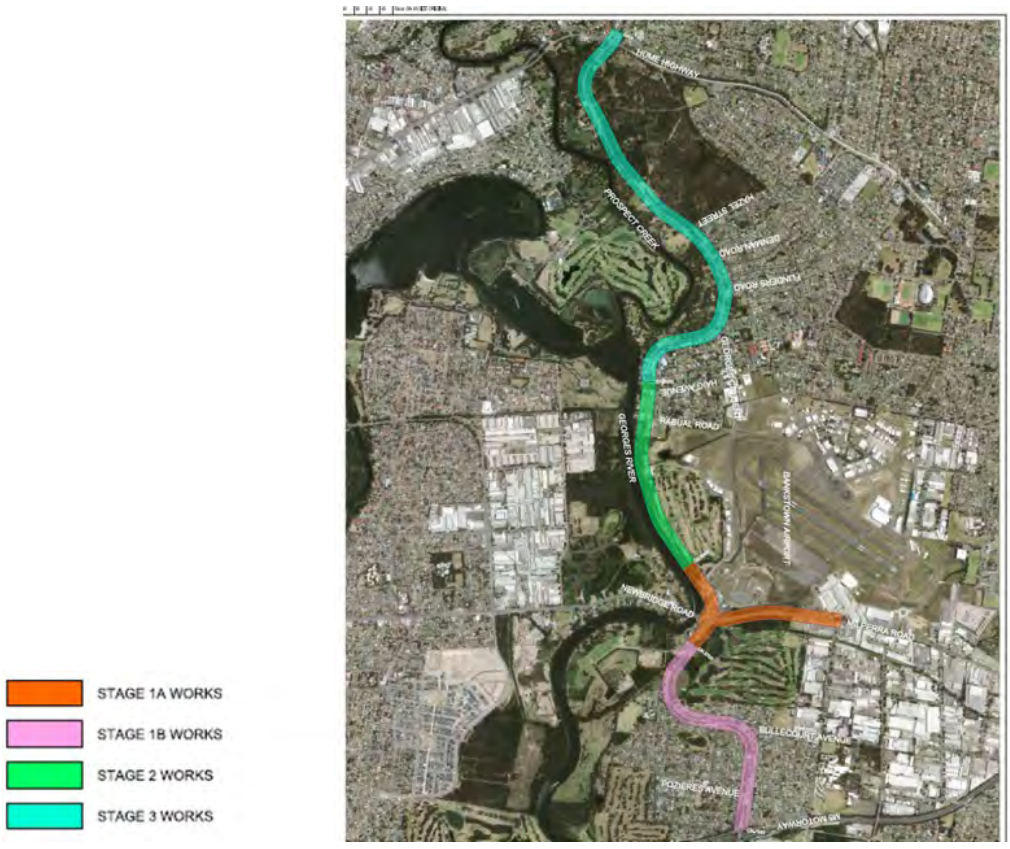
Transport for NSW is investigating the upgrade along Henry Lawson Drive between the M5 motorway, Milperra and Hume Highway, Lansdowne. The route corridor is approximately 7.5 km long and serves as a major north-south link for freight and general traffic. The land use surrounding the corridor includes a mix of residential, industrial, retail and airport facilities. Section along Henry Lawson Drive is currently performing poorly with slow travel times and increases in delay as result of limited single lane road capacity and increase in traffic demand. The need for this project has been further accelerated through proposed upcoming developments including the Bankstown Airport redevelopment and Riverland's Golf Course subdivision.

The project is divided into 4 stages:

- Stage 1A – Intersection upgrade between Milperra Road / Newbridge and Tower Road with Auld Avenue bridge widening.
- Stage 1B – Widening between M5 to Auld Avenue
- Stage 2 – Widening between Tower Road to Haig Avenue
- Stage 3 – Widening between Haig Avenue to Hume Highway

This report will focus on the Stage 1A works as shown in **Figure 1-1**. The assessment report will demonstrate a need of the proposal benefits and justification from a traffic and transport perspective.

Figure 1-1. Henry Lawson Drive staging works



1.2 Project objectives

The project objectives includes:

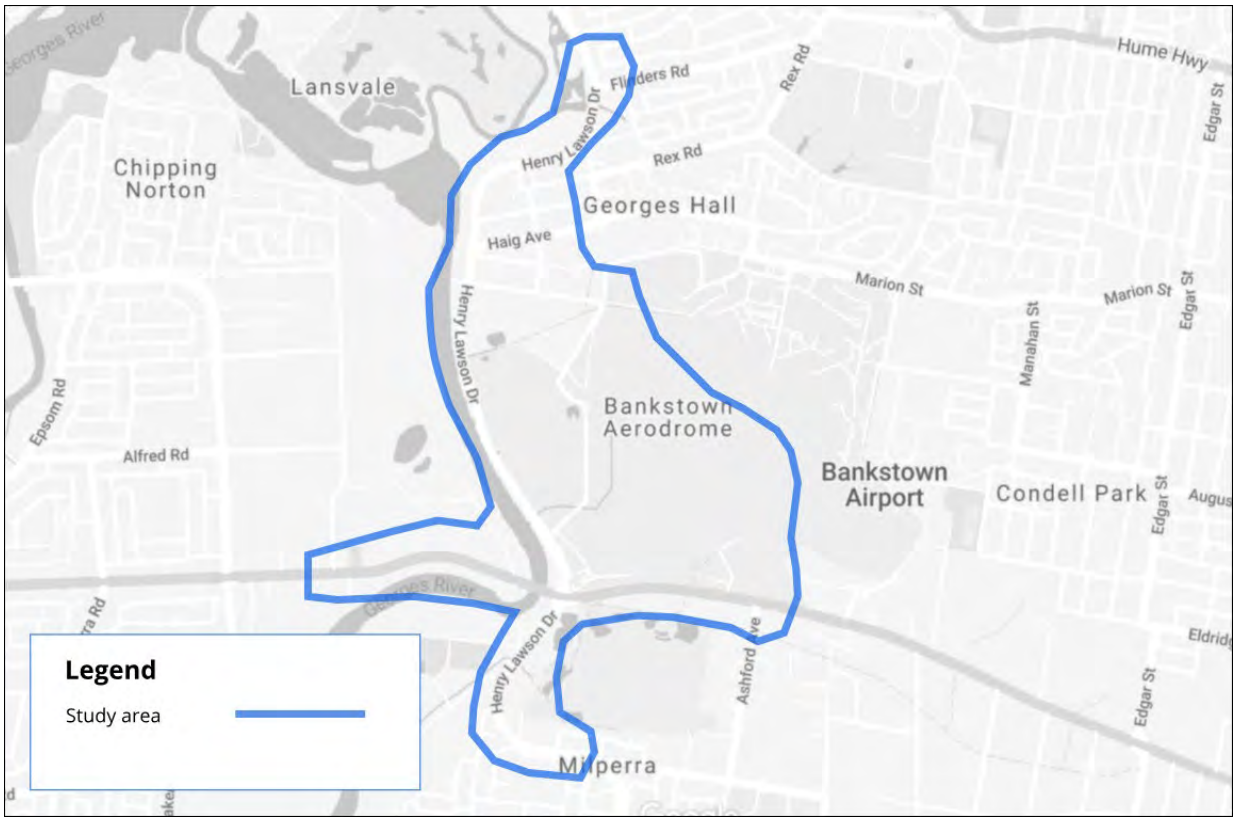
- Improve travel times, journey time reliability and road safety outcomes for all road users.
- Improve flood resilience to minimise road closures
- Improve freight efficiency and reduce vehicle operating costs on the road network.
- Support new development in the precinct by improving traffic flow and connectivity to Bankstown Airport, Milperra Industrial and residential area and the surrounding road network in the south west of Sydney
- Improve connectivity and safety for pedestrians and cyclists
- Provide the best value for money solution, whilst,
- Minimizing impacts to the environment
- Minimizing impacts to social amenity
- Providing value for money

1.3 Study area

The study area for Henry Lawson Drive Stage 1A is shown in Figure 1-2 and it includes the following key intersections along Henry Lawson Drive:

- Henry Lawson Drive / Keys Parade;
- Henry Lawson Drive / Newbridge Road / Milperra Road;
- Henry Lawson Drive / Tower Road
- Henry Lawson Drive / Haig Avenue

Figure 1-2. Study of area of the model



1.4 Assumptions and Limitations

The model has been specifically developed to achieve the objectives of this project. However, the model limitations is outlined below:

- The future background growth assumption are based from the latest land use information available. Note, the effect on COVID-19 on future population growth and employment is not reflected in the modelling results.
- Traffic count data collected from MATRIX and HERE are true and represent existing conditions.
- Any upstream or downstream congestion outside the model study area on Milperra Road and Henry Lawson Drive has not been considered.

1.5 Report structure

The report structure is as follows:

- **Section 1** – Introduction
- **Section 2** – Traffic Data and Existing Conditions
- **Section 3** – Base Model Development
- **Section 4** – Base Model Calibration and Validation
- **Appendix A** – Calibration Results

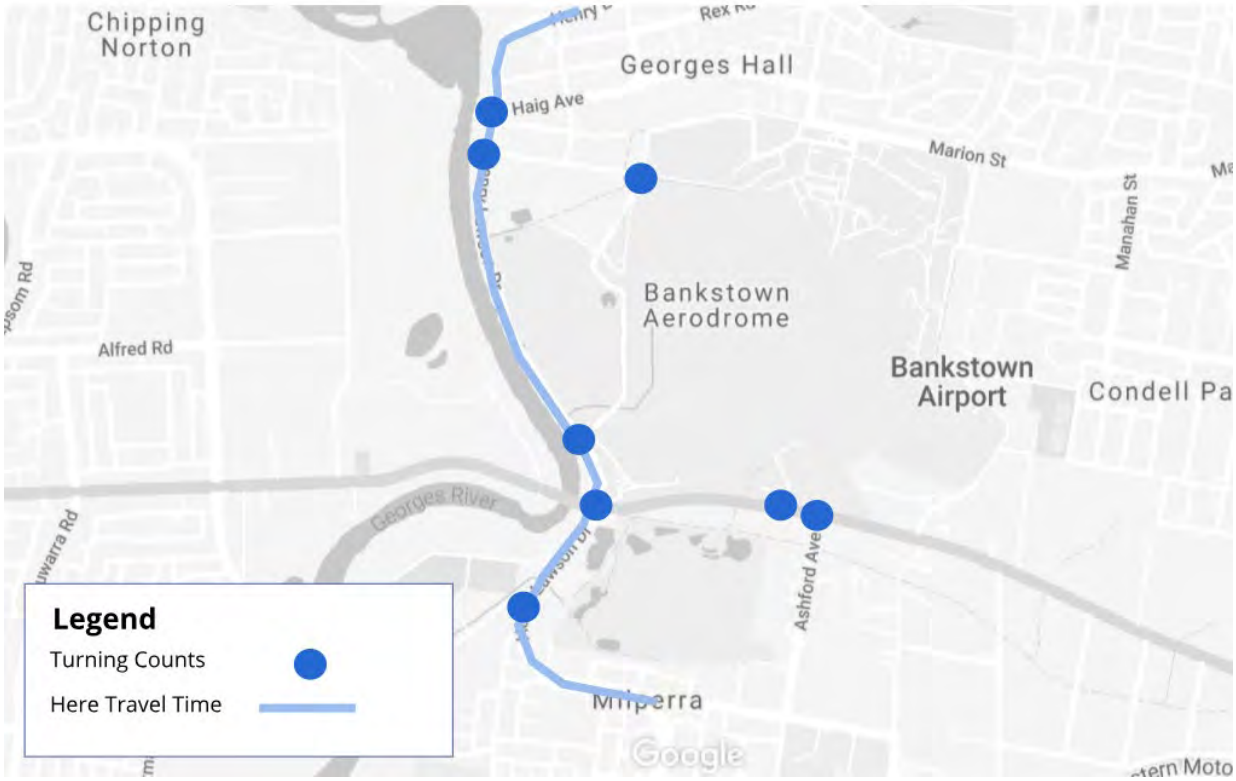
2 Traffic Data and Existing Conditions

2.1 Traffic data

Intersection survey counts along with midblock counts, queue surveys, SCATS history and HERE travel time data formed the inputs into the model.

Below in **Figure 2-1** is an overview of the data available on a map.

Figure 2-1. Traffic data inputs



2.1.1 Traffic count data

A summary of the traffic count data can be seen in **Table 2-1**. A mixture of intersection and midblock counts was collected in preparation for the calibration of the model. It was noted several of the intersection counts was collected during different years. These counts was reviewed to identify any changes and differences that might have changed traffic patterns. Following this a process was developed to align and balance the traffic volumes between the different intersection counts to ensure consistency of traffic volume during the calibration process.

Table 2-1. Traffic survey count data summary

Data	Location	Type	Collection Date	Vehicles Types
Turning Movements	Henry Lawson Drive & Keys Parade	Signalised	19-11-2019	Lights & Heavy vehicles
	Henry Lawson Drive & Newbridge Road & Milperra Road	Signalised	28-02-2018	Lights & Heavy vehicles
	Henry Lawson Drive & Tower Road	Signalised	28-02-2018	Lights & Heavy vehicles
	Henry Lawson Drive & Haig Avenue	Signalised	28-02-2018	Lights & Heavy vehicles
	Henry Lawson Drive & Rabaul Road	Priority	19-11-2019	Lights & Heavy vehicles
	Tower Road & Rabaul Road	Priority	19-11-2019	Lights & Heavy vehicles
	Milperra Road & Murray Jones Drive	Signalised	23-05-2018	Lights & Heavy vehicles
	Milperra Road & Ashford Avenue	Signalised	23-05-2018	Lights & Heavy vehicles
Midblock counts	Between Newbridge Road and Haig Avenue	n/a	27-02-2018 to 05-03-2018	12 Bin Classification

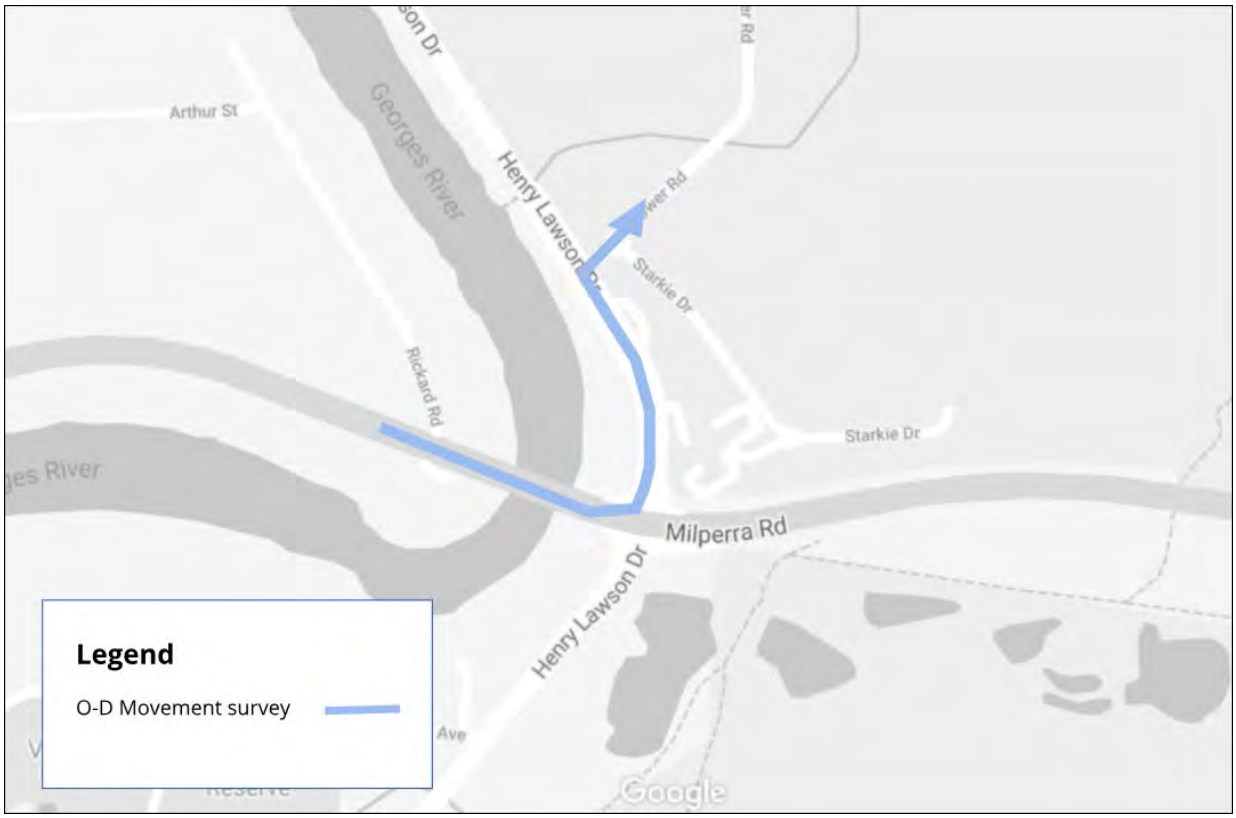
2.1.2 Traffic signal operations

All traffic signals operate using SCATS software. SCATS diagrams and phasing information was used to code up intersections within the model.

2.1.3 Origin-Destination data

Origin and destination data was also collected on the 19th of November 2019 to determine the number of vehicles performing a left turn along Newbridge Road (West approach) and then turning right into Tower Road as shown in **Figure 2-2**.

Figure 2-2. OD survey movements collected



This origin and design data is summarised below in **Table 2-2**.

Table 2-2. Origin Destination survey data summary during the peak periods

Period	Newbridge Road Left Turn into Henry Lawson Drive (veh)	Henry Lawson Drive right turn into Tower Road (veh)	Number of match (veh)	% of match
7-8 AM	818	345	195	24%
8-9 AM	756	457	241	32%
4-5 PM	534	224	114	21%
5-6 PM	624	225	125	20%

2.1.4 Travel time survey data

Travel time data was collected from HERE which collects GPS data points daily from vehicles over a 24 hour period. The data was extracted for the month of November in 2019 for weekdays for each AM and PM peak period. The data is summarised below in **Table 2-3** and **Figure 2-3**.

Figure 2-3. HERE travel time data sections along Henry Lawson Drive

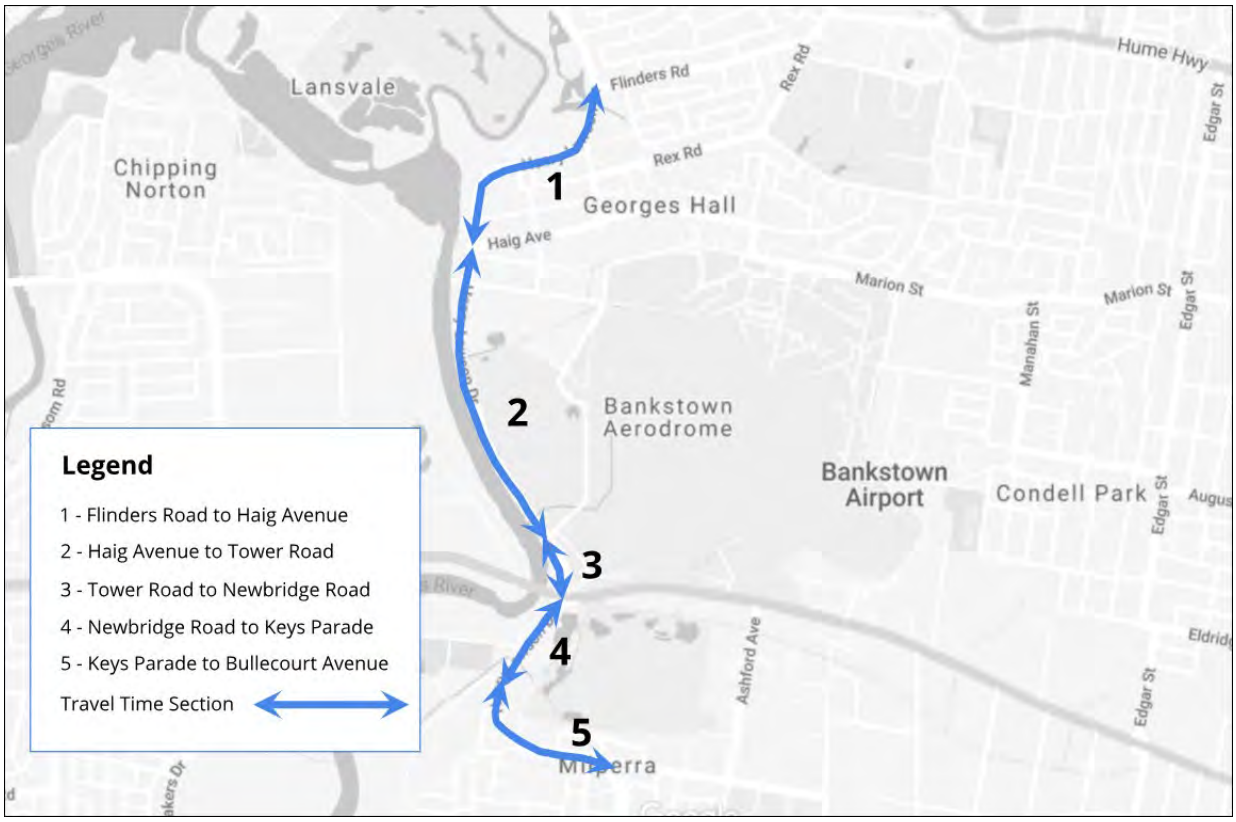


Table 2-3. HERE travel time data summary for November 2019

Direction	Time Period	HERE average travel time (min:sec)
Northbound (From 5 to 1)	7-8 AM	7:11
	8-9 AM	8:38
	4-5 PM	8:27
	5-6 PM	7:43
Southbound (From 1 to 5)	7-8 AM	5:55
	8-9 AM	7:08
	4-5 PM	9:20
	5-6 PM	8:17

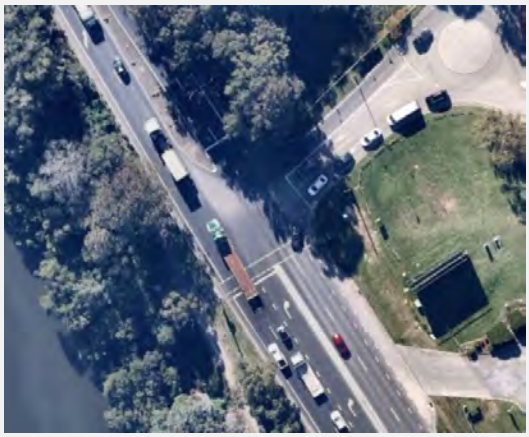
2.2 Existing traffic conditions

Table 2-4 is a summary of the existing traffic conditions based on a site inspection. The site visit looked at the following:

- Existing intersections layout and phasing operation
- Congestion and queueing from bottlenecks
- Types of heavy vehicles usage on the roads
- Surrounding land uses and industries
- Active and public transport infrastructure

Table 2-4 Site inspection observations

ID	Key intersections	Type	Notes
1	Keys Parade / Henry Lawson Drive 	Signalised	• A newly constructed intersection along Henry Lawson Drive which connects to the Flower Power development. • A fourth leg will be introduced in the future to cater for the Riverland's development. • AM & PM peak appears to be running smoothly without any issues or congestion.
2	Newbridge Road / Henry Lawson Drive 	Signalised	• The right turn bay along the east approach is typically full during both AM & PM peaks. Heavy vehicles fill up the bay space readily. • During the PM peak, the dual right turn along the north approach is full and queues back upstream along Henry Lawson Drive. • The left turn slip from Newbridge Road into Henry Lawson Drive is heavy during the AM peak and is constrained by the short entrance which measures 60m from the stop line.

ID	Key intersections	Type	Notes
3	Tower Road / Henry Lawson Drive 	Signalised	• There is a pinch point along the north approach exit which results in vehicles merging from 2 lanes to 1 lane. This extends into queues stretching beyond the Tower Rd intersection. • The Tower Road leg provides access to retail shops and as well as to Bankstown Airports buildings. Can be busy during PM peak.
4	Haig Avenue / Henry Lawson Drive 	Signalised	• During both AM and PM peaks the northbound movement is typically slow moving on approach to Haig Avenue. The single lane on approach in combination with slow moving heavy vehicles are factors contributing to this. • The southbound movement is typically slow moving during the PM peak. Queues can stretch as far back towards Hume Highway on busy days.

3 Base Model Development

3.1 Modelling software platform

The microsimulation model for Henry Lawson Drive Stage 1A was developed using AIMSUN v 8.4.1 software from TSS (Transport Simulation Systems).

3.2 Modelling time periods

The model time period covers the following:

- AM peak – 7 to 9AM with a 1 hour warmup period
- PM peak – 4 to 6PM with a 1 hour warmup period

The AM and PM traffic profiles can be in Figure 3-1 and Figure 3-2 respectively. The traffic profiles follow a consistent pattern with the 2 hour peak period for each case.

Figure 3-1. AM peak Traffic Profile from survey data

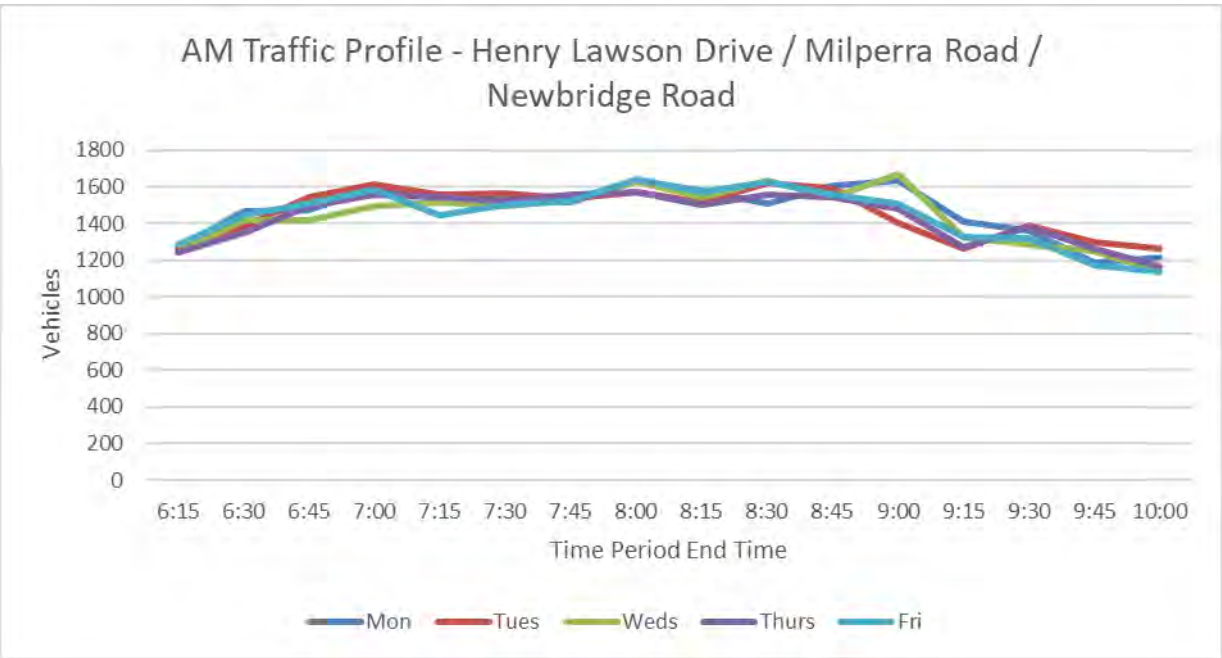
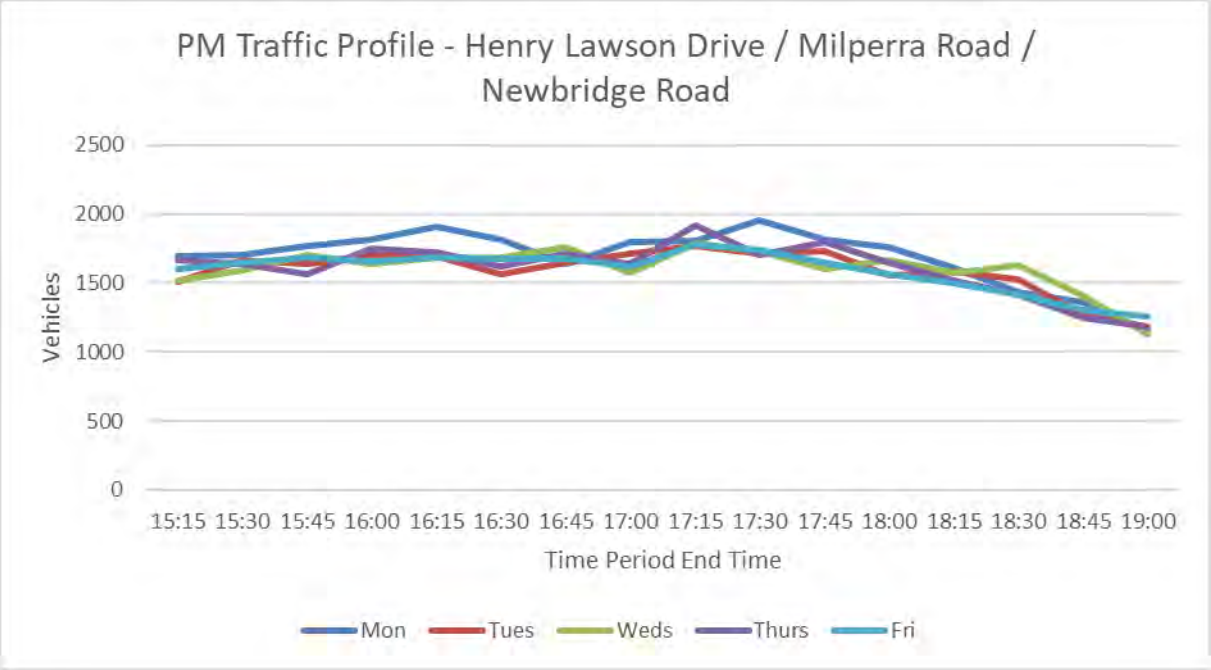


Figure 3-2. PM peak Traffic Profile from survey data

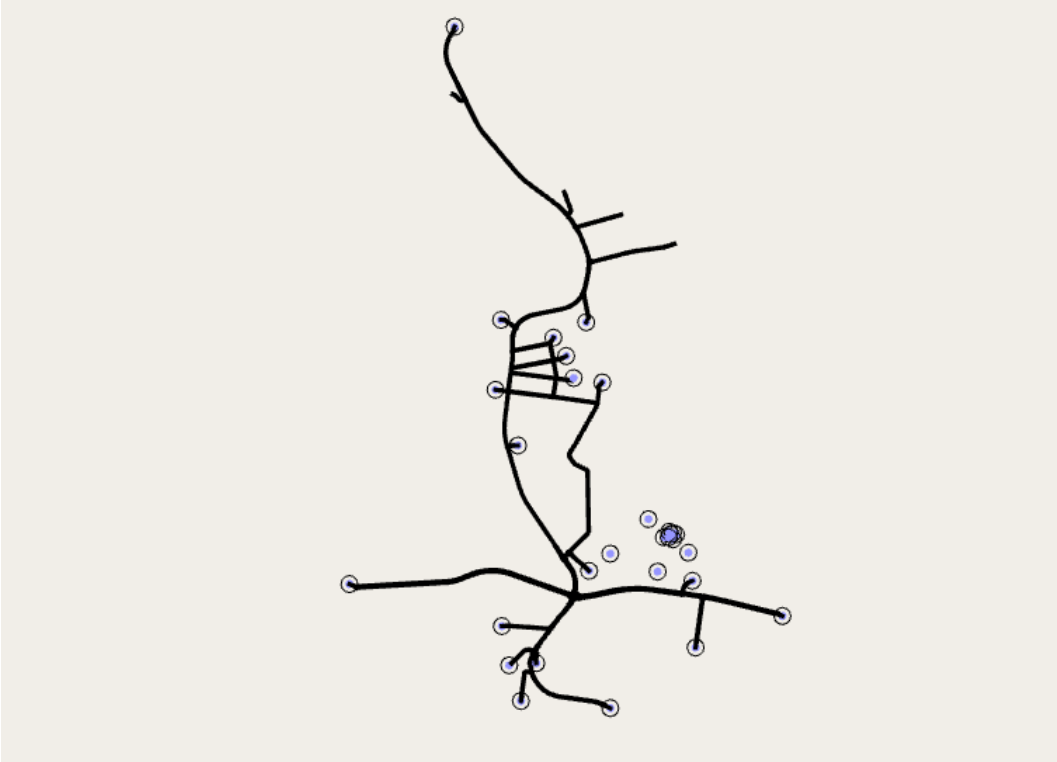


3.3 Network development

3.3.1 Road network

The extent of the model network can be seen in **Figure 3-3.** The northern extent of the model was extended further due to southbound queue spillback. From site observation the southbound queue can reach all the way up to the Hume Highway intersection during PM peak periods.

Figure 3-3. Road network model extent in AIMSUN



3.3.2 Speed limits

The following speed limits has been adopted in the model:

- Henry Lawson Drive - 60km/h
- Newbridge Road/ Milperra Rd – 70km/h
- Tower Road – 40km/h

3.3.3 School zones

There is no school zones within the study area.

3.3.4 On-street parking

There is generally no available street parking along Henry Lawson Drive and Newbridge Road / Milperra Road. There is an unsealed road shoulders available along some sections north of Tower Road which is reserved for emergency break downs.

3.3.5 Traffic signals

The network model consists of 6 signalised intersections with some coded as fixed time and actuated. See **Table 3-1** below.

Table 3-1. Model intersection coding

Intersection	Signal Coding	Max Cycle Time (s)
Keys Parade / Henry Lawson Drive	Actuated	140
Newbridge Road / Milperra Road / Henry Lawson Drive	Fixed	140
Tower Road / Henry Lawson Drive	Fixed	140
Haig Avenue / Henry Lawson Drive	Fixed	120
Milperra Road / Murray Jones Drive	Actuated	140
Milperra Road / Ashford Avenue	Actuated	140

3.3.6 Vehicle types

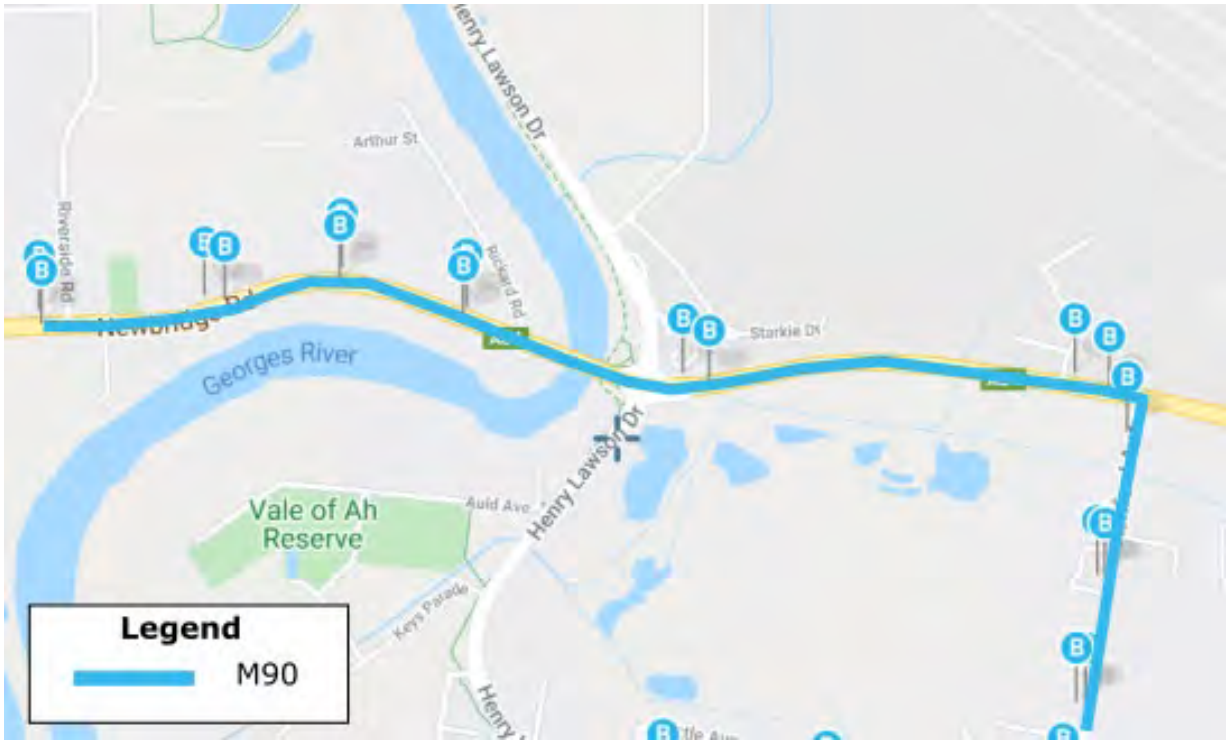
The following vehicles types have been included in the model

- Cars
- Buses
- Light Trucks
- Heavy Trucks

3.3.7 Public transport

There is no public bus services that run along Henry Lawson Drive north of Keys Parade. There is one public bus service (M90) that runs along Newbridge Rd, Milperra Rd and Ashford Avenue. The bus stops were coded into the model as shown Figure 3-4.

Figure 3-4. Overview of bus routes within the model area



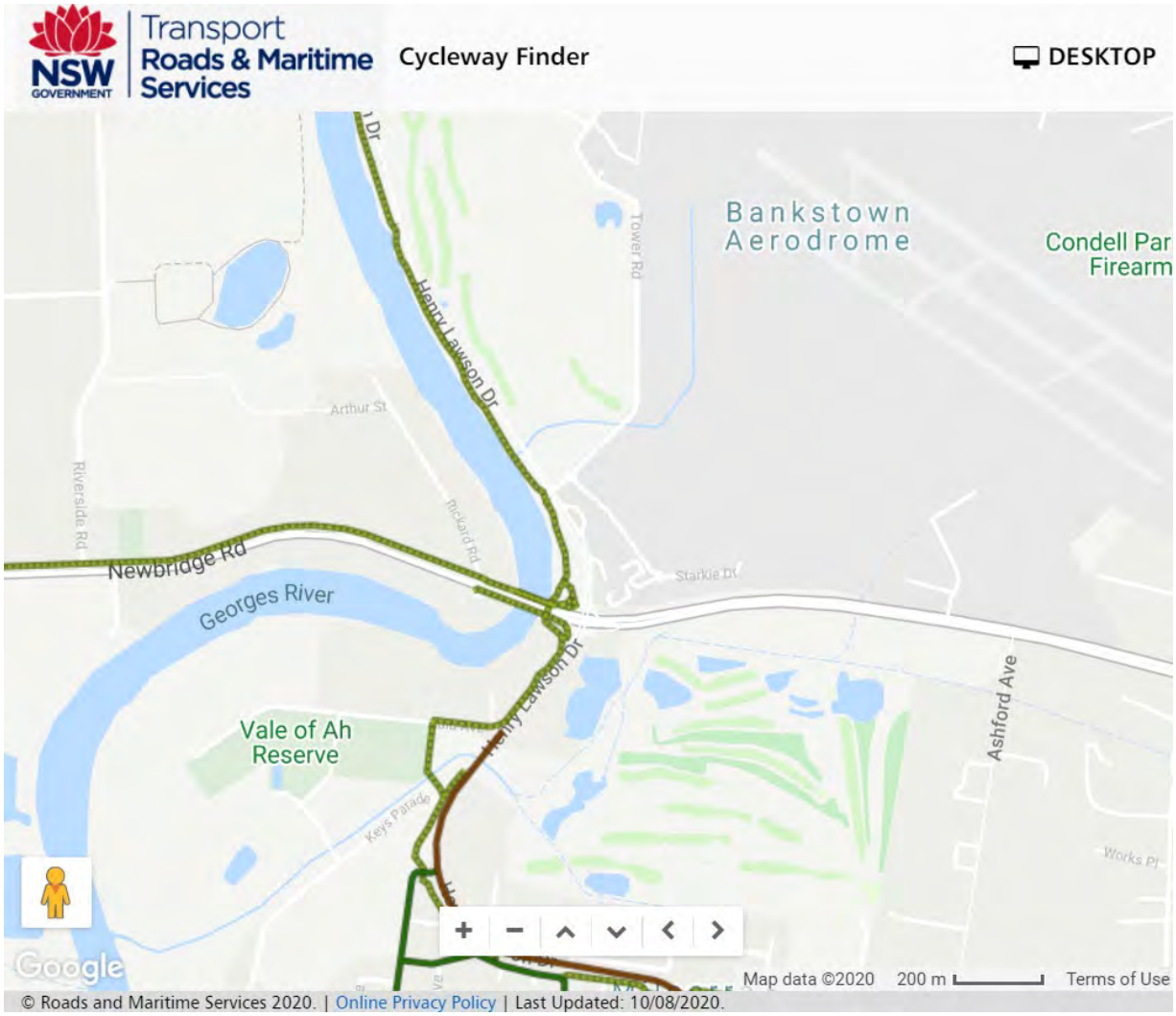
3.3.8 Heavy vehicle restrictions

Tower Rd has a heavy vehicle restriction for vehicles weighing over 4 tonnes.

3.3.9 Cycle ways

There is an existing cycle path that runs from south to north along Henry Lawson Drive on the western side. An underground crossing allows pedestrians and cyclist to cross the intersection without needing to wait at the signals. There is also a cycle path located on the northern side along Newbridge Road. **Figure 3-5** is details the cycle path location.

Figure 3-5. Cycleway locations



3.3.10 Gradients

Upon site observation and desktop analysis, the area was observed to be relatively flat thus no gradient was considered in the modelling.

3.4 Traffic demands

3.4.1 Zoning system

The zoning system for the network model can be seen in **Figure 3-6** and **Table 3-2**. Extra zones have been created around Bankstown Airport to cater for the new development demands.

Figure 3-6. AIMSUN zoning system

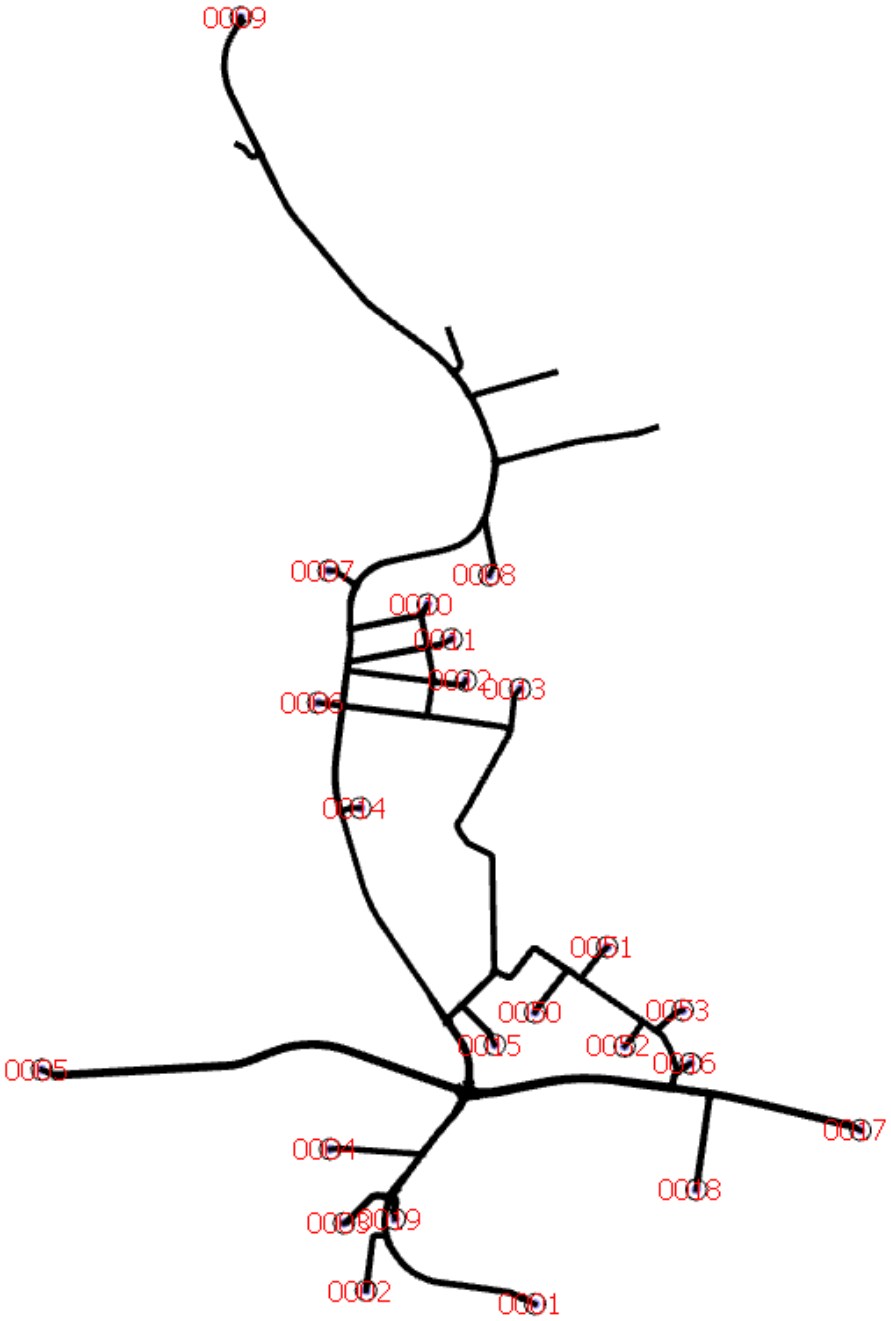


Table 3-2. AIMSUN zoning table

Zone ID	Name	Type
1	Henry Lawson Drive (South)	External
2	Raleigh Avenue	External
3	Keys Parade	External

Zone ID	Name	Type
4	Auld Avenue	External
5	Newbridge Road	External
6	Rabaul Road	External
7	Henry Lawson Reserve	External
8	Georges Crescent	External
9	Henry Lawson Drive (North)	External
10	Beale Street	External
11	Haig Avenue	External
12	Endeavour Road	External
13	Tower Road (North)	External
14	Georges River Golf Course	External
15	Starkie Drive	External
50	Bankstown Airport – Commercial Zone 1	Internal
51	Bankstown Airport – Commercial Zone 2	Internal
52	Bankstown Airport – Commercial Zone 3	Internal
53	Bankstown Airport – Commercial Zone 4	Internal

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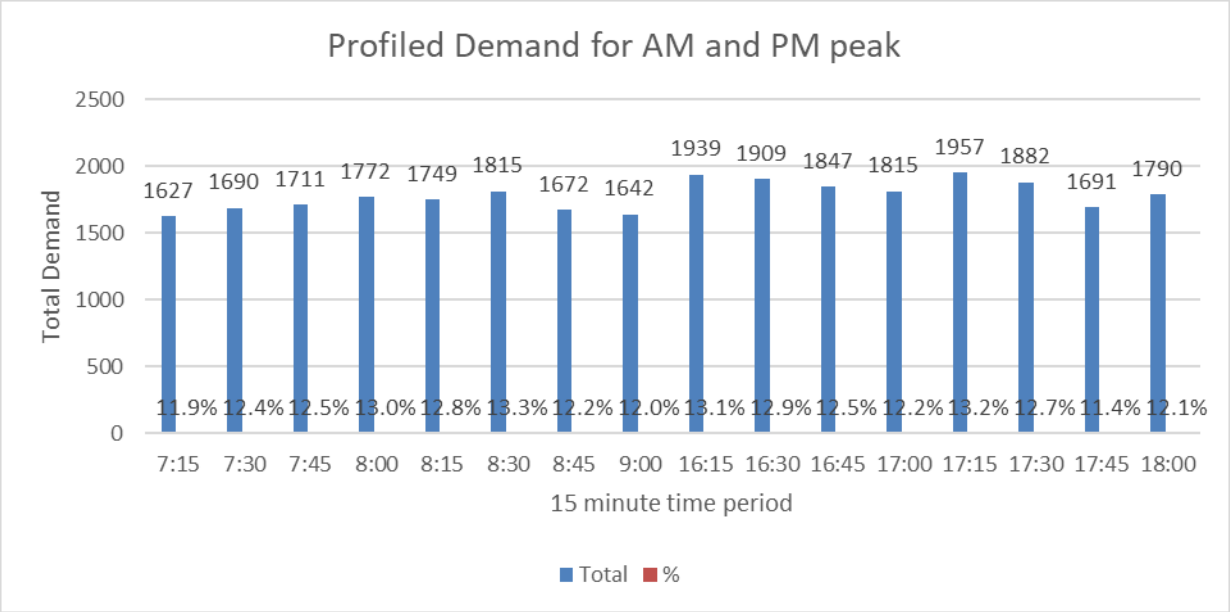
3.4.2 Matrix estimation process

The STFM cordon matrix was adjusted using the Static OD Adjustment procedure in AIMSUN which manipulates the starting matrix to fit the observed count data. Several local roads were not contained within the STFM thus was estimated along with the distribution using available survey data.

This demand was then profiled using the Static OD Departure Adjustment procedure to create the profiled traffic demand based on observed count data in 15-minute time intervals. The profiled demand was manually adjusted where necessary to meet calibration and validation targets and ensure consistency between the observed and modelled traffic volumes.
Figure 3-7 shows the profiled demand for AM and PM peak periods.

Figure 3-7. Profiled calibrated demand for AM and PM peak periods



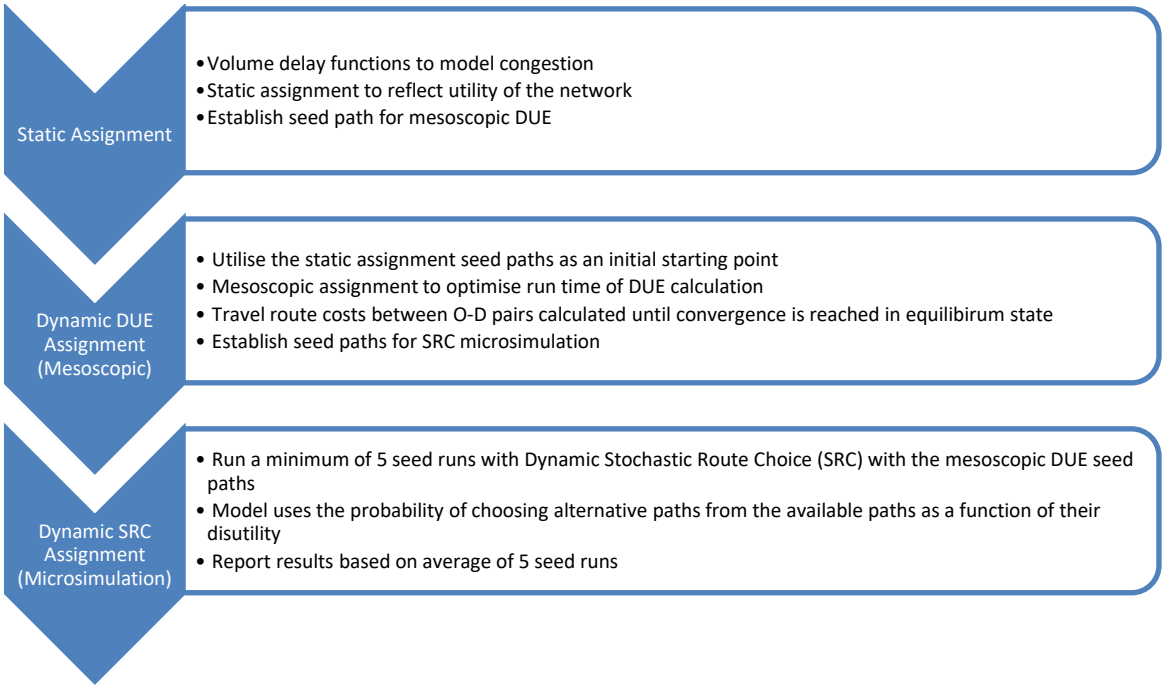
3.5 Traffic assignment method

The model incorporates the following traffic assignment methods:

- Static Assignment
- Dynamic DUE Assignment (mesoscopic)
- Dynamic SRC Assignment (microsimulation)

This assignment workflow is summarised in Figure 3-8.

Figure 3-8. Multi-tier traffic assignment for microsimulation in AIMSUN approach



4 Base Model Calibration and Validation

4.1 Overview

This section sets out the key calibration and validation statistics from the preparation of the base model. The calibration and validation of the model has been completed adhering to RMS Traffic Modelling Guidelines (2013).

4.2 Parameter changes

During the calibration and validation of the model several parameters was changed as a part of the process. This is detailed in Table 4-1.

Table 4-1. AIMSUN parameter changes

Parameter Changes	Values Changed	Justification
Acceleration factor between Tower Road and Haig Avenue was altered for calibration and validation	Factor changed from 0 to x0.5 decrease	During the microsimulation runs it was noted this section did not replicate the existing queue conditions as experienced on site. It was also noted large gaps between vehicles seen on traffic survey videos. To replicate this the acceleration factor was decreased.
Turn penalty factor for Rabaul Road altered for calibration.	TPF changed to 5000	To better match the turning volumes of Rabaul Road and Endeavour Road for static assignment and calibration.

4.3 Model stability

The stability of the model for both the AM and PM peak was checked by plotting the vehicle kilometres travelled (VKT) and vehicle hours travelled (VHT) across the 5 seed values. This can be seen in **Figure 4-1** and **Figure 4-2**.

Figure 4-1. VKT across 5 seed runs for AM and PM

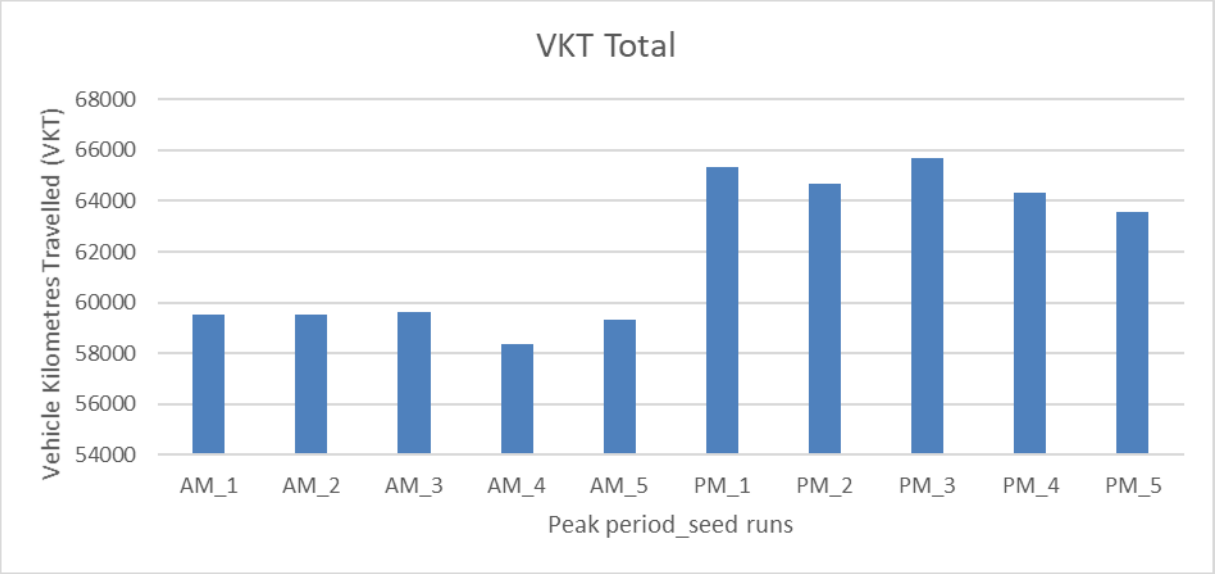
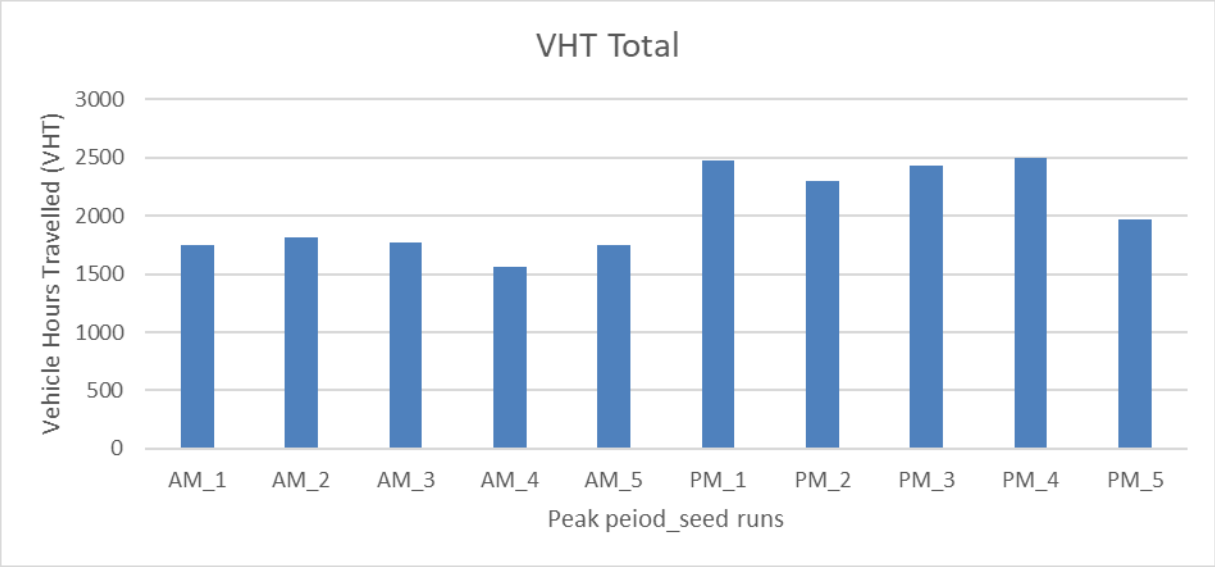


Figure 4-2. VHT across 5 seed runs for AM and PM



The number of vehicles in the network was also checked across the 5 seed runs as shown in **Figure 4-3** and **Figure 4-4**

Figure 4-3 – Number of vehicles in the network for AM peak

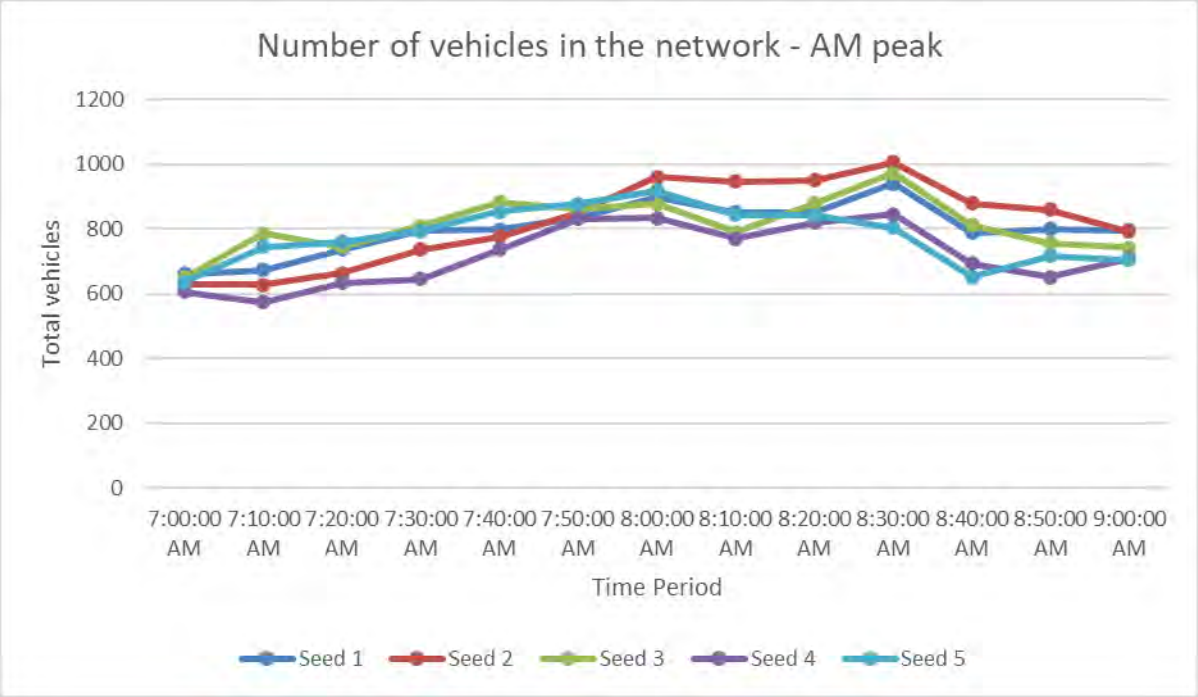
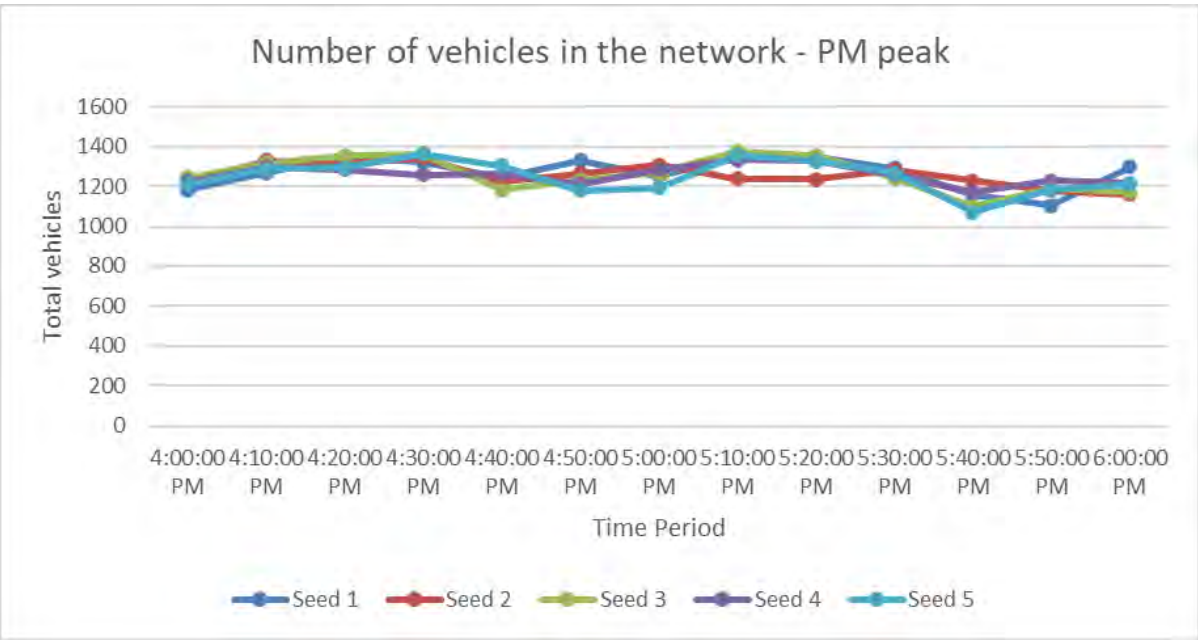


Figure 4-4 - Number of vehicles in the network for PM peak



As seen with the above figures, the model stability is consistent across the 5 seed runs. The peak hour models are therefore stable and demonstrate that the model is robust and remains stable under varying conditions.

4.4 Model calibration

A turning count calibration was used to compare observed on-site traffic volumes with the equivalent outputs from the model. Turning count calibration was undertaken for each of the surveyed intersections.

4.4.1 Random seeds and simulation criteria

The base model results was run using the average of 5 seed runs: 1000, 2000, 3000, 4000 & 5000. The seeds values was chosen outside of the Traffic Modelling Guidelines.

4.4.2 Model calibration criteria

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

$$GEH = \sqrt{\frac{(V_{Observed} - V_{Modelled})^2}{0.5 * (V_{Observed} + V_{Modelled})}}$$

These guidelines state that:

- GEH < 5 minimum 85% of observations to be with tolerance limits
- Turn or link flows with GEH > 10 require explanation in reporting
- Plots of observed vs modelled hourly flows required for all observations
- Plots to include lines showing GEH = 5 tolerance limits
- R^2 value to be included with plots and to be >0.9
- Slope equation to be included with plots

4.4.3 Traffic volume calibration summary results

The calibration of the model was based on the surveyed intersection turning volumes for each modelled peak period. **Table 4-1** & **Table 4-2** is a summary of the calibration results for the AM and PM peak respectively.

Detailed turning movement calibration can be seen in **Appendix 1**.

Table 4-1. AM turn calibration statistic results for light vehicles

Network Wide Calibration Criteria	7-8 AM	8-9 AM	Calibration
85% of observations must have GEH < 5	70 (100%)	66 (94%)	✓
100% of observation must have GEH < 10	70 (100%)	70 (100%)	✓
Total observations	70	70	✓

Table 4-2. AM turn calibration statistic results for heavy vehicles

Network Wide Calibration Criteria	7-8 AM	8-9 AM	Calibration
85% of observations must have GEH < 5	54 (96%)	54 (96%)	✓
100% of observation must have GEH < 10	56 (100%)	56 (100%)	✓
Total observations	56	56	✓

Figure 4-1 and **Figure 4-2** below plots the modelled and observed vehicle counts with the R squared statistic trend line.

Figure 4-1. 7-8 AM GEH plots for light vehicles

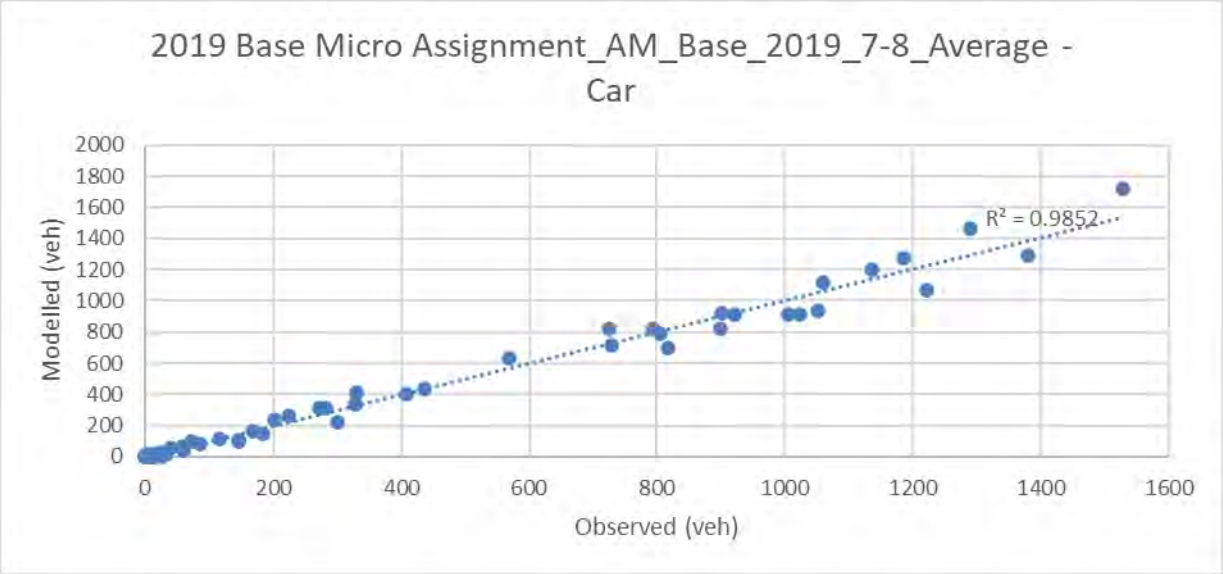


Figure 4-2. 8-9 AM GEH plots for light vehicles

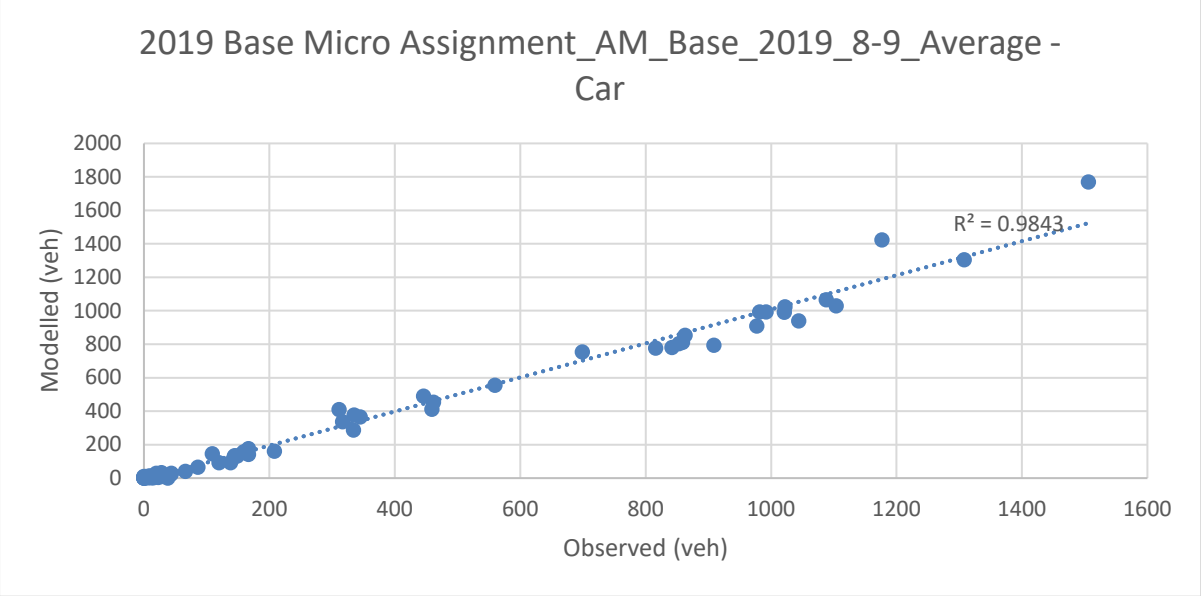


Table 4-3. PM turn calibration statistic results for light vehicles

Calibration Criteria	4-5 PM	5-6 PM	Calibration
85% of observations must have GEH < 5	63 (90%)	67 (95%)	✓
100% of observation must have GEH < 10	70 (100%)	70 (100%)	✓
Total observations	70	70	✓

Table 4-4. PM turn calibration statistic results for heavy vehicles

Calibration Criteria	4-5 PM	5-6 PM	Calibration
85% of observations must have GEH < 5	52 (93%)	49 (98%)	✓
100% of observation must have GEH < 10	56 (100%)	50 (100%)	✓
Total observations	56	50	✓

Figure 4-3. 4-5 PM GEH plots for light vehicles

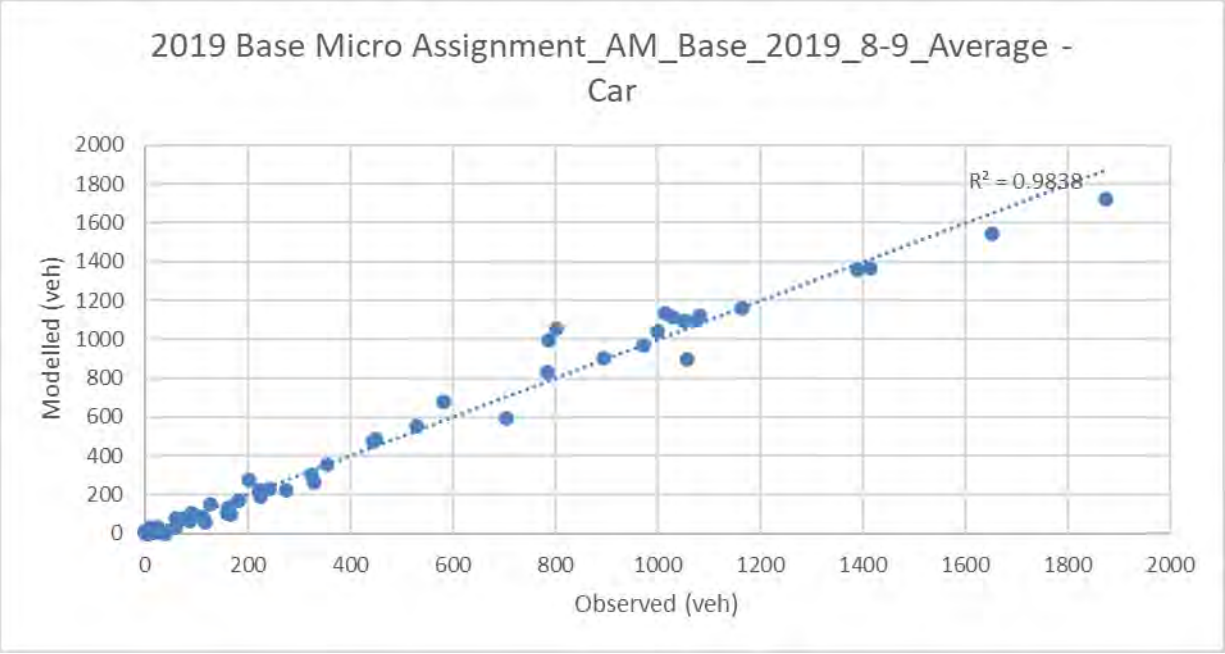
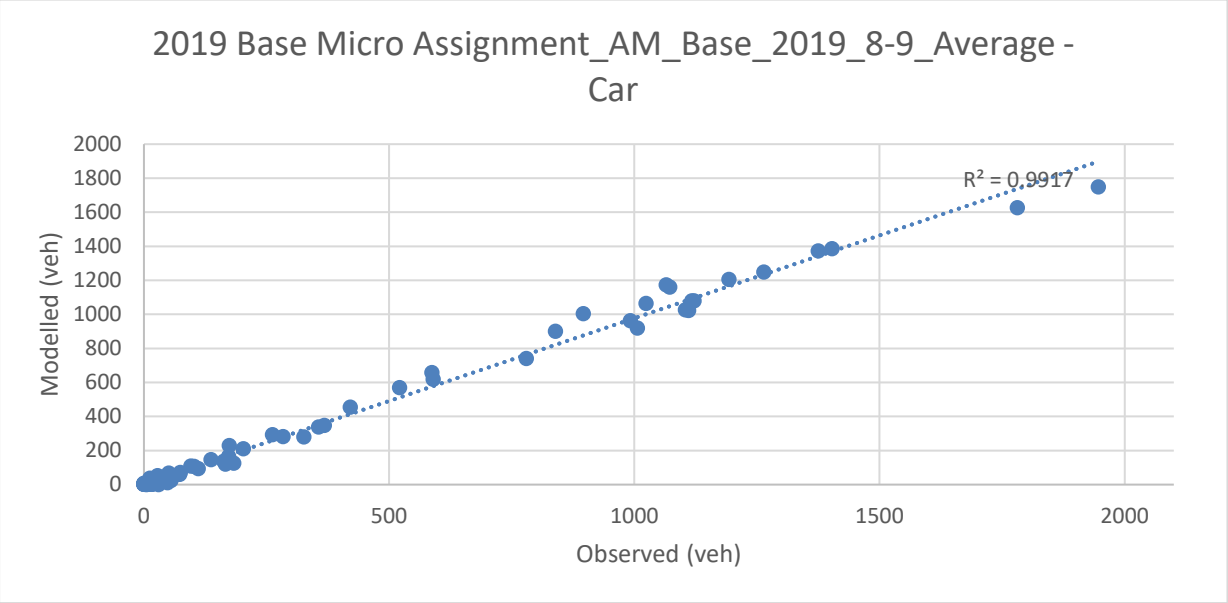


Figure 4-4. 5-6 PM GEH plots for light vehicles



In addition to the turning count calibration, the model was also calibrated with the origin and destination survey data collected for the left turn movement at Newbridge Road then turning right into Tower Road. This O-D movement is important for future option testing as this might lead to weaving and merging issues in particular the AM peak. Thus, the model AM peak was compared with the O-D survey and the results are summarised in **Table 4-5**.

Table 4-5. Origin Destination data comparison

Time	Model Average	O-D Survey	Absolute Difference	GEH
7:00 to 7:15	41	44	3	0.40
7:15 to 7:30	42	40	-2	0.34
7:30 to 7:45	43	52	9	1.37
7:45 to 8:00	63	59	-4	0.46
8:00 to 8:15	75	70	-5	0.61
8:15 to 8:30	70	68	-2	0.24
8:30 to 8:45	61	45	-16	2.22
8:45 to 9:00	68	58	-10	1.21
Total	463	436	-27	1.26

In summary the calibration results shows the model is satisfactory calibrated in terms of GEH and R^2 criteria for both AM and PM peak.

4.5 Model validation

4.5.1 Travel time validation

Travel time has been validated with HERE travel time data for the month of November 2019. HERE's real travel time data is aggregated and analysed from sophisticated sources, including high quality vehicle sensor data, government sources and historical traffic records. The data is available on all TFNSW's classified road network at 15 minute intervals with historical data available to be accessed readily.

The travel time for the month of November was analysed along Henry Lawson Drive with results showing significant amount of variability between different days in each peak hour and direction as a result of congestion. Thus several days of data was collected to ensure the modelled travel time fits within the observed travel times.

HERE travel time was collected and analysed for the following sections in both directions:

- Section 1 – Flinders Road to Haig Avenue
- Section 2 – Haig Avenue to Tower Road
- Section 3 – Tower Road to Milperra / Newbridge Road
- Section 4 – Milperra / Newbridge Road to Keys Parade
- Section 5 – Keys Parade to Bullecourt Avenue

Table 4-6 provides a summary of the travel time validation results.

Table 4-6. Travel time validation summary

Direction	Time Period	Model average travel time (min:sec)	HERE average travel time (min:sec)	Absolute difference (min:sec)	Percentage difference (%)	Validation
Northbound	7-8 AM	7:21	7:11	-0:10	-2%	✓
	8-9 AM	8:33	8:38	0:05	1%	✓
	4-5 PM	8:37	8:27	-0:10	-2%	✓
	5-6 PM	7:01	7:43	0:42	10%	✓
Southbound	7-8 AM	6:06	5:55	-0:11	3%	✓
	8-9 AM	6:29	7:08	0:39	10%	✓
	4-5 PM	8:58	9:20	0:22	4%	✓
	5-6 PM	8:28	8:17	-0:11	-2%	✓

For the model to be validated the modelling guidelines states:

- Average modelled journey time to be within 15 percent or one minute (whichever is greater) of average observed journey time for full length of route. Each route should be cumulatively graphed by section.

Overall, the modelled and HERE travel time data shows a good correlation and fits within range of 15% which satisfies the validation criteria. **Figures 4-5** to **Figure 4-12** shows the travel time validation graphed across each section for each peak and direction along Henry Lawson Drive.

Figure 4-5. Travel time validation northbound 7-8AM

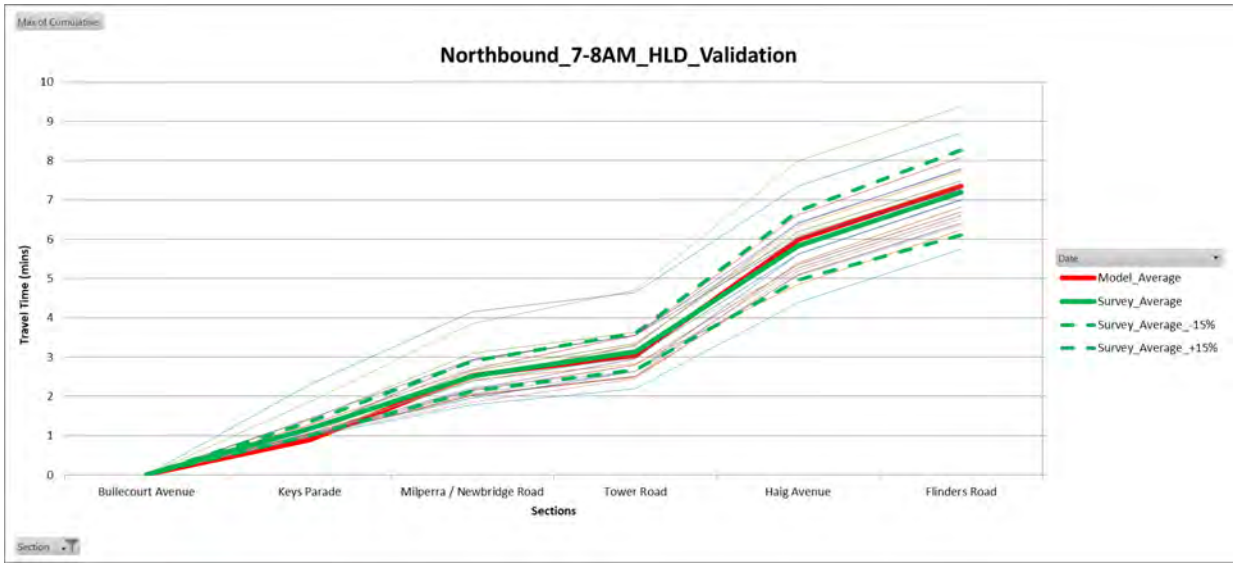


Figure 4-6. Travel time validation northbound 8-9AM

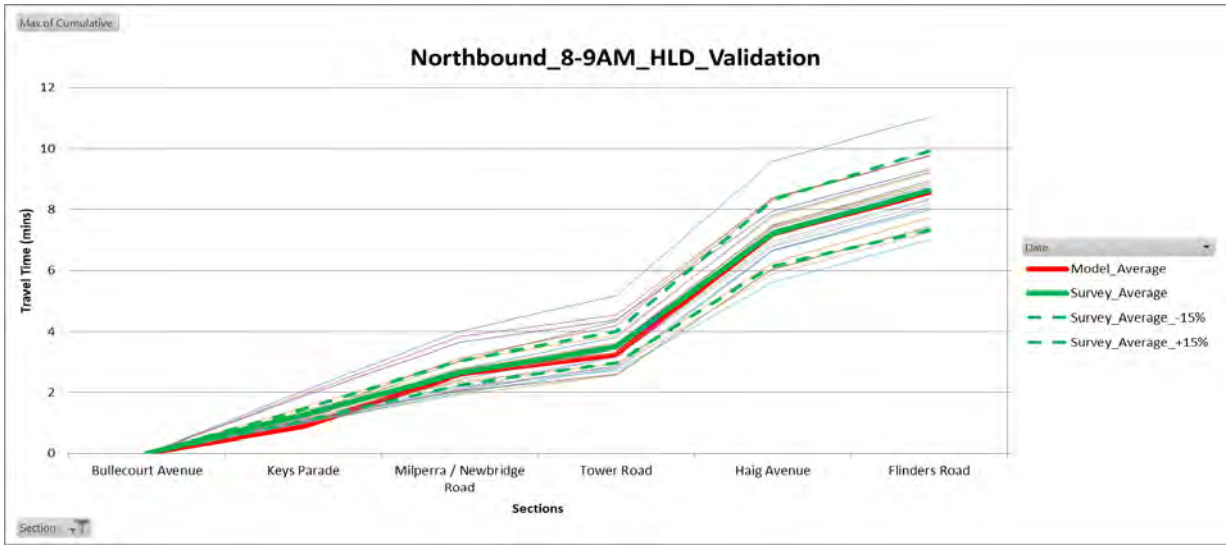


Figure 4-7. Travel time validation northbound 4-5PM

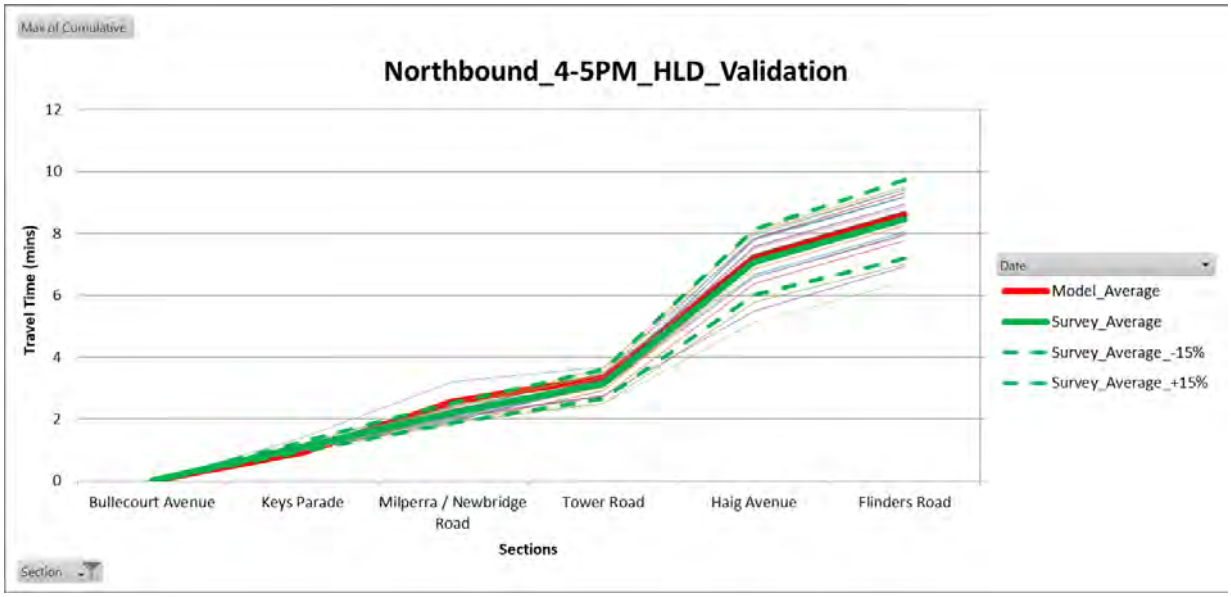


Figure 4-8. Travel time validation northbound 5-6PM

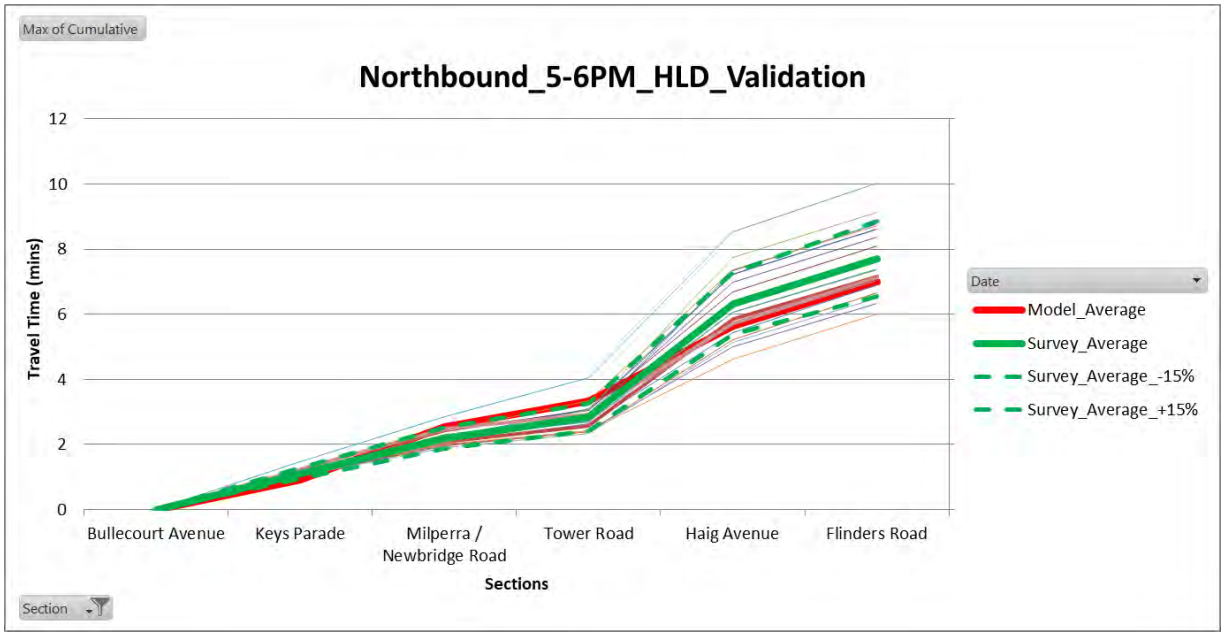


Figure 4-9. Travel time validation southbound 7-8AM

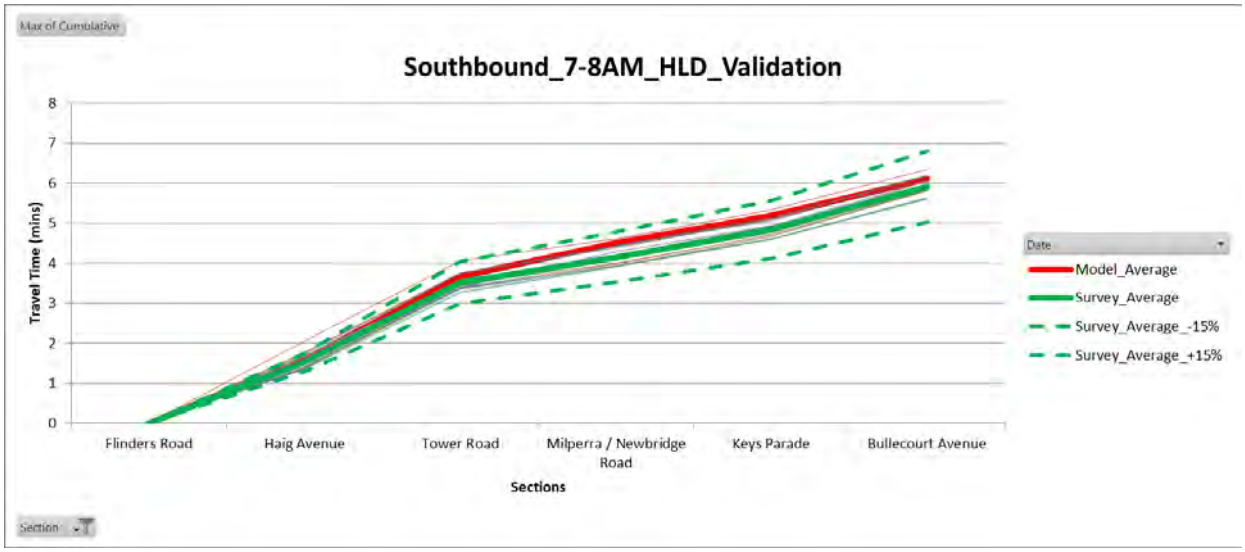


Figure 4-10. Travel time validation southbound 8-9AM

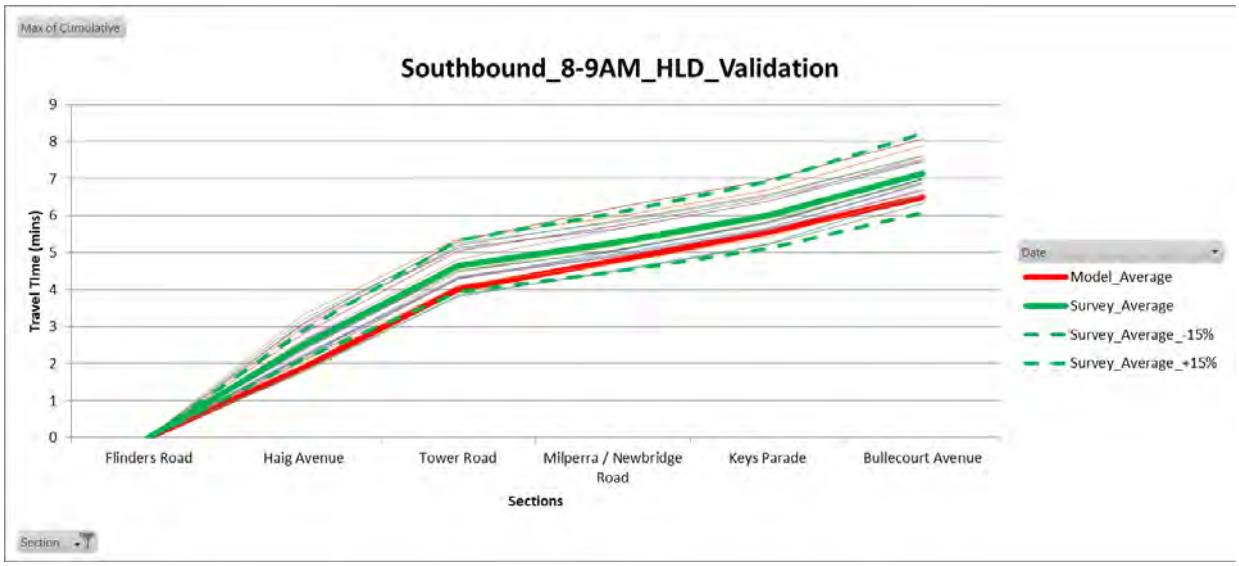


Figure 4-11. Travel time validation southbound 4-5PM

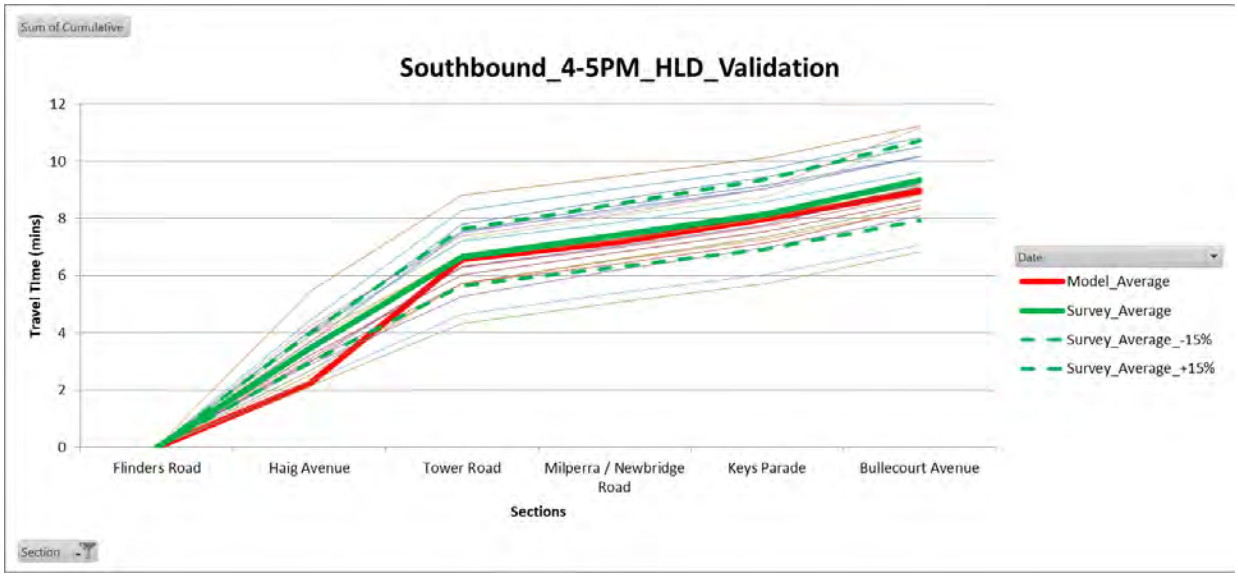
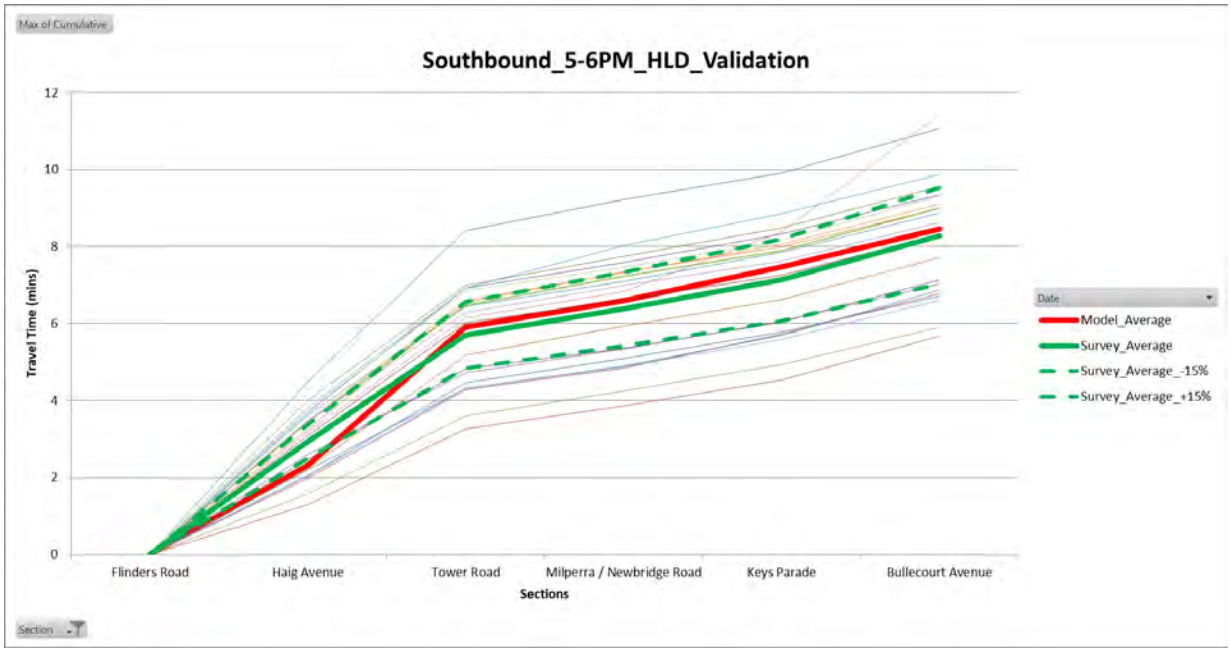


Figure 4-12. Travel time validation southbound 5-6PM



4.6 Summary of calibration and validation

In summary the AM and PM base models passes all the Traffic Modelling Guidelines (Roads and Maritime, 2013) criteria for calibration and validation. The model stability is consistent across all chosen 5 seed runs and modelled queue lengths replicates site observations. Thus, the model is suitable and fit for purpose for future options testing.

5 Appendix A - Model Calibration Results

Time period: 7-8AM

Vehicle Type: Light Vehicles

Intersection	Approach	Turn	Object ID	Observed	Modelled	Absolute Difference	Relative Difference	GEH
Ashford Ave / Newbridge Rd	Ashford Ave SOUTH	L	3768	184	149.8	34.2	18.58696	2.647268
Ashford Ave / Newbridge Rd	Ashford Ave SOUTH	R	3767	169	161.4	7.6	4.497041	0.591301
Ashford Ave / Newbridge Rd	Newbridge Rd EAST	L	3685	147	97.2	49.8	33.87755	4.506833
Ashford Ave / Newbridge Rd	Newbridge Rd EAST	T	3684	1051	937	114	10.84681	3.61586
Ashford Ave / Newbridge Rd	Newbridge Rd WEST	R	5442	225	265.2	-40.2	-17.8667	2.56776
Ashford Ave / Newbridge Rd	Newbridge Rd WEST	T	5441	1290	1461.6	-171.6	-13.3023	4.626362
Endeavour Rd / HLD	Endeavour Rd EAST	L	5409	26	1.2	24.8	95.38462	6.724844
Endeavour Rd / HLD	Henry Lawson Dr NORTH	L	2770	1	3.4	-2.4	-240	1.61808
Endeavour Rd / HLD	Henry Lawson Dr NORTH	T	5410	922	911.8	10.2	1.106291	0.336852
Haig Ave / HLD	Haig Ave EAST	R	2626	115	111.2	3.8	3.304348	0.357316
Haig Ave / HLD	Haig Ave EAST	L	2625	72	96.4	-24.4	-33.8889	2.659095
Haig Ave / HLD	Henry Lawson Dr NORTH	L	2721	10	7.4	2.6	26	0.881483
Haig Ave / HLD	Henry Lawson Dr NORTH	T	2720	899	819	80	8.898776	2.729565
Haig Ave / HLD	Henry Lawson Dr SOUTH	R	5855	85	82	3	3.529412	0.328305
Haig Ave / HLD	Henry Lawson Dr SOUTH	T	5854	1060	1117.8	-57.8	-5.45283	1.751596
Henry Lawson Dr / Newbridge Rd	Henry Lawson Dr NORTH	R	5434	301	224.6	76.4	25.38206	4.712818
Henry Lawson Dr / Newbridge Rd	Henry Lawson Dr NORTH	T	2765	283	313.8	-30.8	-10.8834	1.783
Henry Lawson Dr / Newbridge Rd	Henry Lawson Dr NORTH	L	5468	437	435.6	1.4	0.320366	0.067025
Henry Lawson Dr / Newbridge Rd	Henry Lawson Dr SOUTH	T	1587	568	636.8	-68.8	-12.1127	2.803148
Henry Lawson Dr / Newbridge Rd	Henry Lawson Dr SOUTH	R	1588	19	7	12	63.15789	3.328201
Henry Lawson Dr / Newbridge Rd	Henry Lawson Dr SOUTH	L	5457	329	336	-7	-2.12766	0.383886
Henry Lawson Dr / Newbridge Rd	Newbridge Rd EAST	R	5709	202	240.2	-38.2	-18.9109	2.569029
Henry Lawson Dr / Newbridge Rd	Newbridge Rd EAST	L	5461	28	23.8	4.2	15	0.825276
Henry Lawson Dr / Newbridge Rd	Newbridge Rd EAST	T	1845	805	792.8	12.2	1.515528	0.431632
Henry Lawson Dr / Newbridge Rd	Newbridge Rd WEST	T	2185	1381	1295	86	6.227371	2.351096
Henry Lawson Dr / Newbridge Rd	Newbridge Rd WEST	R	5433	409	400.4	8.6	2.102689	0.427496
Henry Lawson Dr / Newbridge Rd	Newbridge Rd WEST	L	5454	794	818.8	-24.8	-3.12343	0.873326
HLD / Keys Pde	Henry Lawson Dr NORTH	T	5518	730	716.8	13.2	1.808219	0.490778
HLD / Keys Pde	Henry Lawson Dr NORTH	L	5512	7	16.6	-9.6	-137.143	2.794668
HLD / Keys Pde	Henry Lawson Dr SOUTH	R	5508	7	1.4	5.6	80	2.73252
HLD / Keys Pde	Henry Lawson Dr SOUTH	T	5506	902	922.4	-20.4	-2.26164	0.675437
HLD / Keys Pde	Henry Lawson Dr SOUTH	L	5850	0	1.4	-1.4	#DIV/0!	1.67332
HLD / Keys Pde	Keys Pde EAST	L	5505	4	2.6	1.4	35	0.770675
HLD / Keys Pde	Keys Pde EAST	R	5507	3	4.8	-1.8	-60	0.911465
HLD / Tower Rd	Henry Lawson Dr NORTH	T	5444	1005	915.8	89.2	8.875622	2.878318
HLD / Tower Rd	Henry Lawson Dr NORTH	L	1437	4	8.6	-4.6	-115	1.832684
HLD / Tower Rd	Henry Lawson Dr SOUTH	R	5446	330	408.2	-78.2	-23.697	4.070378
HLD / Tower Rd	Henry Lawson Dr SOUTH	T	5443	1185	1275.8	-90.8	-7.66245	2.588587
HLD / Tower Rd	Tower Rd EAST	R	2768	4	2.2	1.8	45	1.022331
HLD / Tower Rd	Tower Rd EAST	L	5445	39	60.4	-21.4	-54.8718	3.035537
Murray Jones Dr / Newbridge Rd	Murray Jones Dr NORTH	R	4118	3	5.4	-2.4	-80	1.17108

Intersection	Approach	Turn	Object ID	Observed	Modelled	Absolute Difference	Relative Difference	GEH
Murray Jones Dr / Newbridge Rd	Murray Jones Dr NORTH	L	4117	1	1.8	-0.8	-80	0.676123
Murray Jones Dr / Newbridge Rd	Newbridge Rd EAST	T	5439	1222	1071.8	150.2	12.29133	4.435138
Murray Jones Dr / Newbridge Rd	Newbridge Rd EAST	R	5440	12	14.8	-2.8	-23.3333	0.764902
Murray Jones Dr / Newbridge Rd	Newbridge Rd WEST	T	1972	1528	1717.6	-189.6	-12.4084	4.706584
Murray Jones Dr / Newbridge Rd	Newbridge Rd WEST	L	1973	20	23.4	-3.4	-17	0.729876
Rabaul Rd / HLD	Henry Lawson Dr NORTH	T	2779	1024	909	115	11.23047	3.699107
Rabaul Rd / HLD	Henry Lawson Dr NORTH	L	2780	9	1.6	7.4	82.22222	3.214355
Rabaul Rd / HLD	Henry Lawson Dr NORTH	R	2781	2	2.8	-0.8	-40	0.516398
Rabaul Rd / HLD	Henry Lawson Dr SOUTH	T	5010	1136	1197.4	-61.4	-5.40493	1.797582
Rabaul Rd / HLD	Henry Lawson Dr SOUTH	R	5011	20	4.6	15.4	77	4.391048
Rabaul Rd / HLD	Henry Lawson Dr SOUTH	L	5012	5	12	-7	-140	2.40098
Rabaul Rd / HLD	Rabaul Rd EAST	T	4299	0	1.6	-1.6	#DIV/0!	1.788854
Rabaul Rd / HLD	Rabaul Rd EAST	L	4357	29	19.8	9.2	31.72414	1.862486
Rabaul Rd / HLD	Rabaul Rd EAST	R	4359	2	2.4	-0.4	-20	0.26968
Rabaul Rd / HLD	Rabaul Rd WEST	L	4298	4	8.6	-4.6	-115	1.832684
Rabaul Rd / HLD	Rabaul Rd WEST	T	4358	0	2.6	-2.6	#DIV/0!	2.280351
Rabaul Rd / HLD	Rabual Rd WEST	R	4300	0	6	-6	#DIV/0!	3.464102
Rabaul Rd / Tower Rd	Rabaul Rd WEST	R	5721	13	1.2	11.8	90.76923	4.428461
Rabaul Rd / Tower Rd	Rabaul Rd WEST	L	5722	24	6.4	17.6	73.33333	4.514305
Rabaul Rd / Tower Rd	Tower Rd NORTH	R	5720	10	10.4	-0.4	-4	0.125245
Rabaul Rd / Tower Rd	Tower Rd NORTH	T	5718	57	63.6	-6.6	-11.5789	0.849934
Rabaul Rd / Tower Rd	Tower Rd SOUTH	T	5723	273	311.8	-38.8	-14.2125	2.269045
Rabaul Rd / Tower Rd	Tower Rd SOUTH	L	6530	59	37.2	21.8	36.94915	3.143286
Raleigh Rd / HLD	Henry Lawson Dr NORTH	T	3159	817	700.8	116.2	14.22277	4.218071
Raleigh Rd / HLD	Henry Lawson Dr NORTH	R	3160	32	15	17	53.125	3.506832
Raleigh Rd / HLD	Henry Lawson Dr SOUTH	T	5421	725	819.4	-94.4	-13.0207	3.39709
Raleigh Rd / HLD	Henry Lawson Dr SOUTH	L	3139	0	0.8	-0.8	#DIV/0!	1.264911
Raleigh Rd / HLD	Raleigh Rd WEST	L	5422	147	107.8	39.2	26.66667	3.472973
Raleigh Rd / HLD	Raleigh Rd WEST	R	3132	6	2.2	3.8	63.33333	1.876686

Time period: 8-9 AM

Vehicle Type: Light Vehicles

Intersection	Approach	Turn	Object ID	Observed	Modelled	Absolute Difference	Relative Difference	GEH
Ashford Ave / Newbridge Rd	Ashford Ave SOUTH	L	3768	208	161.2	-46.8	-22.5	3.44453
Ashford Ave / Newbridge Rd	Ashford Ave SOUTH	R	3767	149	133.4	-15.6	-10.4698	1.31283
Ashford Ave / Newbridge Rd	Newbridge Rd EAST	L	3685	138	92.6	-45.4	-32.8986	4.22806
Ashford Ave / Newbridge Rd	Newbridge Rd EAST	T	3684	853	804.6	-48.4	-5.67409	1.6812
Ashford Ave / Newbridge Rd	Newbridge Rd WEST	R	5442	317	337	20	6.30915	1.106
Ashford Ave / Newbridge Rd	Newbridge Rd WEST	T	5441	1177	1424.4	247.4	21.0195	6.85979
Endeavour Rd / HLD	Endeavour Rd EAST	L	5409	23	5	-18	-78.2609	4.8107
Endeavour Rd / HLD	Henry Lawson Dr NORTH	L	2770	0	5	5	inf	3.16228
Endeavour Rd / HLD	Henry Lawson Dr NORTH	T	5410	982	993.6	11.6	1.18126	0.369083
Haig Ave / HLD	Haig Ave EAST	L	2625	109	145	36	33.0275	3.19448
Haig Ave / HLD	Haig Ave EAST	R	2626	167	142.8	-24.2	-14.491	1.94442
Haig Ave / HLD	Henry Lawson Dr NORTH	L	2721	13	10	-3	-23.0769	0.884652
Haig Ave / HLD	Henry Lawson Dr NORTH	T	2720	863	853.4	-9.6	-1.1124	0.3277
Haig Ave / HLD	Henry Lawson Dr SOUTH	R	5855	120	92.4	-27.6	-23	2.67822
Haig Ave / HLD	Henry Lawson Dr SOUTH	T	5854	992	992.4	0.4	0.040323	0.012699
Henry Lawson Dr / Newbridge Rd	Henry Lawson Dr NORTH	L	5468	462	454.4	-7.6	-1.64502	0.355047
Henry Lawson Dr / Newbridge Rd	Henry Lawson Dr NORTH	R	5434	334	288.2	-45.8	-13.7126	2.59666
Henry Lawson Dr / Newbridge Rd	Henry Lawson Dr NORTH	T	2765	311	409.8	98.8	31.7685	5.20433
Henry Lawson Dr / Newbridge Rd	Henry Lawson Dr SOUTH	L	5457	335	378	43	12.8358	2.2774
Henry Lawson Dr / Newbridge Rd	Henry Lawson Dr SOUTH	R	1588	28	32.8	4.8	17.1429	0.870572
Henry Lawson Dr / Newbridge Rd	Henry Lawson Dr SOUTH	T	1587	560	555.4	-4.6	-0.82143	0.194786
Henry Lawson Dr / Newbridge Rd	Newbridge Rd EAST	L	5461	44	29.4	-14.6	-33.1818	2.41002
Henry Lawson Dr / Newbridge Rd	Newbridge Rd EAST	R	5709	167	176	9	5.38922	0.687243
Henry Lawson Dr / Newbridge Rd	Newbridge Rd EAST	T	1845	816	776.4	-39.6	-4.85294	1.40341
Henry Lawson Dr / Newbridge Rd	Newbridge Rd WEST	L	5454	842	780	-62	-7.36342	2.17711
Henry Lawson Dr / Newbridge Rd	Newbridge Rd WEST	R	5433	459	411.4	-47.6	-10.3704	2.28172
Henry Lawson Dr / Newbridge Rd	Newbridge Rd WEST	T	2185	1308	1305.8	-2.2	-0.1682	0.060856
HLD / Keys Pde	Henry Lawson Dr NORTH	L	5512	26	24.8	-1.2	-4.61538	0.238103
HLD / Keys Pde	Henry Lawson Dr NORTH	T	5518	859	812	-47	-5.47148	1.62602
HLD / Keys Pde	Henry Lawson Dr SOUTH	L	5850	0	2	2	inf	2
HLD / Keys Pde	Henry Lawson Dr SOUTH	R	5508	15	2.4	-12.6	-84	4.2718
HLD / Keys Pde	Henry Lawson Dr SOUTH	T	5506	977	909.4	-67.6	-6.91914	2.20113
HLD / Keys Pde	Keys Pde EAST	L	5505	8	4	-4	-50	1.63299
HLD / Keys Pde	Keys Pde EAST	R	5507	6	6.2	0.2	3.33333	0.080978
HLD / Tower Rd	Henry Lawson Dr NORTH	L	1437	12	8.6	-3.4	-28.3333	1.0594
HLD / Tower Rd	Henry Lawson Dr NORTH	T	5444	1022	1024	2	0.195695	0.062531
HLD / Tower Rd	Henry Lawson Dr SOUTH	R	5446	446	490	44	9.86547	2.0339
HLD / Tower Rd	Henry Lawson Dr SOUTH	T	5443	1104	1028.8	-75.2	-6.81159	2.30281
HLD / Tower Rd	Tower Rd EAST	L	5445	145	135.2	-9.8	-6.75862	0.827956
HLD / Tower Rd	Tower Rd EAST	R	2768	12	3	-9	-75	3.28634
Murray Jones Dr / Newbridge Rd	Murray Jones Dr NORTH	L	4117	0	0	0	0	0
Murray Jones Dr / Newbridge Rd	Murray Jones Dr NORTH	R	4118	3	8.2	5.2	173.333	2.1974
Murray Jones Dr / Newbridge Rd	Newbridge Rd EAST	R	5440	20	29	9	45	1.81827

Intersection	Approach	Turn	Object ID	Observed	Modelled	Absolute Difference	Relative Difference	GEH
Murray Jones Dr / Newbridge Rd	Newbridge Rd EAST	T	5439	1044	939	-105	-10.0575	3.33459
Murray Jones Dr / Newbridge Rd	Newbridge Rd WEST	L	1973	9	13	4	44.4444	1.20605
Murray Jones Dr / Newbridge Rd	Newbridge Rd WEST	T	1972	1506	1769.2	263.2	17.4768	6.50402
Rabaul Rd / HLD	Henry Lawson Dr NORTH	L	2780	7	2.4	-4.6	-65.7143	2.12182
Rabaul Rd / HLD	Henry Lawson Dr NORTH	R	2781	2	5.6	3.6	180	1.84676
Rabaul Rd / HLD	Henry Lawson Dr NORTH	T	2779	1021	990.8	-30.2	-2.95788	0.952203
Rabaul Rd / HLD	Henry Lawson Dr SOUTH	L	5012	3	10.4	7.4	246.667	2.85887
Rabaul Rd / HLD	Henry Lawson Dr SOUTH	R	5011	28	10	-18	-64.2857	4.12948
Rabaul Rd / HLD	Henry Lawson Dr SOUTH	T	5010	1088	1066.4	-21.6	-1.98529	0.658121
Rabaul Rd / HLD	Rabaul Rd EAST	L	4357	66	39.8	-26.2	-39.697	3.60225
Rabaul Rd / HLD	Rabaul Rd EAST	R	4359	1	0.6	-0.4	-40	0.447214
Rabaul Rd / HLD	Rabaul Rd EAST	T	4299	0	4.2	4.2	inf	2.89828
Rabaul Rd / HLD	Rabaul Rd WEST	L	4298	1	7.8	6.8	680	3.24177
Rabaul Rd / HLD	Rabaul Rd WEST	T	4358	0	3.8	3.8	inf	2.75681
Rabaul Rd / HLD	Rabual Rd WEST	R	4300	0	9.8	9.8	inf	4.42719
Rabaul Rd / Tower Rd	Rabaul Rd WEST	L	5722	27	11.4	-15.6	-57.7778	3.5602
Rabaul Rd / Tower Rd	Rabaul Rd WEST	R	5721	38	1.4	-36.6	-96.3158	8.24609
Rabaul Rd / Tower Rd	Tower Rd NORTH	R	5720	21	12.2	-8.8	-41.9048	2.15988
Rabaul Rd / Tower Rd	Tower Rd NORTH	T	5718	144	127.6	-16.4	-11.3889	1.40732
Rabaul Rd / Tower Rd	Tower Rd SOUTH	L	6530	86	65.6	-20.4	-23.7209	2.34313
Rabaul Rd / Tower Rd	Tower Rd SOUTH	T	5723	345	365.6	20.6	5.97101	1.09287
Raleigh Rd / HLD	Henry Lawson Dr NORTH	R	3160	43	23.8	-19.2	-44.6512	3.32222
Raleigh Rd / HLD	Henry Lawson Dr NORTH	T	3159	909	795.2	-113.8	-12.5193	3.89849
Raleigh Rd / HLD	Henry Lawson Dr SOUTH	L	3139	0	1	1	inf	1.41421
Raleigh Rd / HLD	Henry Lawson Dr SOUTH	T	5421	699	755	56	8.01144	2.07693
Raleigh Rd / HLD	Raleigh Rd WEST	L	5422	159	157.4	-1.6	-1.00629	0.127209
Raleigh Rd / HLD	Raleigh Rd WEST	R	3132	3	2	-1	-33.3333	0.632456

Time period: 4-5 PM

Vehicle Type: Light Vehicles

Intersection	Approach	Turn	Object ID	Observed	Modelled	Absolute Difference	Relative Difference	GEH
Ashford Ave / Newbridge Rd	Ashford Ave SOUTH	L	3768	224	189.6	-34.4	-15.3571	2.39212
Ashford Ave / Newbridge Rd	Ashford Ave SOUTH	R	3767	183	166.2	-16.8	-9.18033	1.27141
Ashford Ave / Newbridge Rd	Newbridge Rd EAST	L	3685	159	105.2	-53.8	-33.8365	4.68092
Ashford Ave / Newbridge Rd	Newbridge Rd EAST	T	3684	1653	1540.2	-112.8	-6.82396	2.823
Ashford Ave / Newbridge Rd	Newbridge Rd WEST	R	5442	242	229.6	-12.4	-5.12397	0.807513
Ashford Ave / Newbridge Rd	Newbridge Rd WEST	T	5441	1164	1160.6	-3.4	-0.2921	0.099729
Endeavour Rd / HLD	Endeavour Rd EAST	L	5409	60	79	19	31.6667	2.27909
Endeavour Rd / HLD	Henry Lawson Dr NORTH	L	2770	0	1.8	1.8	inf	1.89737
Endeavour Rd / HLD	Henry Lawson Dr NORTH	T	5410	803	1051.4	248.4	30.934	8.15765
Haig Ave / HLD	Haig Ave EAST	L	2625	116	57.8	-58.2	-50.1724	6.24328
Haig Ave / HLD	Haig Ave EAST	R	2626	162	130.4	-31.6	-19.5062	2.61345
Haig Ave / HLD	Henry Lawson Dr NORTH	L	2721	11	6	-5	-45.4545	1.71499
Haig Ave / HLD	Henry Lawson Dr NORTH	T	2720	787	995.6	208.6	26.5057	6.98719
Haig Ave / HLD	Henry Lawson Dr SOUTH	R	5855	111	85.6	-25.4	-22.8829	2.56187
Haig Ave / HLD	Henry Lawson Dr SOUTH	T	5854	999	1038.8	39.8	3.98398	1.24686
Henry Lawson Dr / Newbridge Rd	Henry Lawson Dr NORTH	L	5468	275	220.6	-54.4	-19.7818	3.4558
Henry Lawson Dr / Newbridge Rd	Henry Lawson Dr NORTH	R	5434	706	593.6	-112.4	-15.9207	4.40937
Henry Lawson Dr / Newbridge Rd	Henry Lawson Dr NORTH	T	2765	529	550.8	21.8	4.12098	0.93821
Henry Lawson Dr / Newbridge Rd	Henry Lawson Dr SOUTH	L	5457	451	487.4	36.4	8.07095	1.68044
Henry Lawson Dr / Newbridge Rd	Henry Lawson Dr SOUTH	R	1588	25	29	4	16	0.7698
Henry Lawson Dr / Newbridge Rd	Henry Lawson Dr SOUTH	T	1587	446	476.4	30.4	6.81614	1.41556
Henry Lawson Dr / Newbridge Rd	Newbridge Rd EAST	L	5461	90	104.8	14.8	16.4444	1.49962
Henry Lawson Dr / Newbridge Rd	Newbridge Rd EAST	R	5709	222	222	0	0	0
Henry Lawson Dr / Newbridge Rd	Newbridge Rd EAST	T	1845	1414	1365.4	-48.6	-3.43706	1.30369
Henry Lawson Dr / Newbridge Rd	Newbridge Rd WEST	L	5454	583	676.2	93.2	15.9863	3.71436
Henry Lawson Dr / Newbridge Rd	Newbridge Rd WEST	R	5433	356	356.8	0.8	0.224719	0.042376
Henry Lawson Dr / Newbridge Rd	Newbridge Rd WEST	T	2185	1077	1104	27	2.50696	0.817619
HLD / Keys Pde	Henry Lawson Dr NORTH	L	5512	16	24	8	50	1.78885
HLD / Keys Pde	Henry Lawson Dr NORTH	T	5518	973	971.8	-1.2	-0.12333	0.038482
HLD / Keys Pde	Henry Lawson Dr SOUTH	L	5850	0	2.2	2.2	inf	2.09762
HLD / Keys Pde	Henry Lawson Dr SOUTH	R	5508	8	3.8	-4.2	-52.5	1.72911
HLD / Keys Pde	Henry Lawson Dr SOUTH	T	5506	1058	897.4	-160.6	-15.1796	5.13621
HLD / Keys Pde	Keys Pde EAST	L	5505	13	2.2	-10.8	-83.0769	3.91757
HLD / Keys Pde	Keys Pde EAST	R	5507	21	13.6	-7.4	-35.2381	1.77913
HLD / Tower Rd	Henry Lawson Dr NORTH	L	1437	19	9	-10	-52.6316	2.67261
HLD / Tower Rd	Henry Lawson Dr NORTH	T	5444	1015	1132.4	117.4	11.5665	3.58283
HLD / Tower Rd	Henry Lawson Dr SOUTH	R	5446	202	276.2	74.2	36.7327	4.7986
HLD / Tower Rd	Henry Lawson Dr SOUTH	T	5443	1053	1096.4	43.4	4.12156	1.32387
HLD / Tower Rd	Tower Rd EAST	L	5445	331	259.4	-71.6	-21.6314	4.1673
HLD / Tower Rd	Tower Rd EAST	R	2768	24	3.8	-20.2	-84.1667	5.41806
Murray Jones Dr / Newbridge Rd	Murray Jones Dr NORTH	L	4117	19	21.2	2.2	11.5789	0.49071
Murray Jones Dr / Newbridge Rd	Murray Jones Dr NORTH	R	4118	10	29.4	19.4	194	4.37088

Intersection	Approach	Turn	Object ID	Observed	Modelled	Absolute Difference	Relative Difference	GEH
Murray Jones Dr / Newbridge Rd	Newbridge Rd EAST	R	5440	4	10.4	6.4	160	2.38514
Murray Jones Dr / Newbridge Rd	Newbridge Rd EAST	T	5439	1874	1720	-154	-8.21772	3.63284
Murray Jones Dr / Newbridge Rd	Newbridge Rd WEST	L	1973	0	1.8	1.8	inf	1.89737
Murray Jones Dr / Newbridge Rd	Newbridge Rd WEST	T	1972	1390	1359.6	-30.4	-2.18705	0.819887
Rabaul Rd / HLD	Henry Lawson Dr NORTH	L	2780	1	1	0	0	0
Rabaul Rd / HLD	Henry Lawson Dr NORTH	R	2781	6	5.6	-0.4	-6.66667	0.166091
Rabaul Rd / HLD	Henry Lawson Dr NORTH	T	2779	1083	1122.6	39.6	3.65651	1.19247
Rabaul Rd / HLD	Henry Lawson Dr SOUTH	L	5012	2	5.4	3.4	170	1.76758
Rabaul Rd / HLD	Henry Lawson Dr SOUTH	R	5011	17	2.8	-14.2	-83.5294	4.51306
Rabaul Rd / HLD	Henry Lawson Dr SOUTH	T	5010	1029	1114.4	85.4	8.29932	2.60868
Rabaul Rd / HLD	Rabaul Rd EAST	L	4357	166	94.2	-71.8	-43.253	6.29486
Rabaul Rd / HLD	Rabaul Rd EAST	R	4359	6	0.6	-5.4	-90	2.9726
Rabaul Rd / HLD	Rabaul Rd EAST	T	4299	0	2.8	2.8	inf	2.36643
Rabaul Rd / HLD	Rabaul Rd WEST	L	4298	9	5.6	-3.4	-37.7778	1.2584
Rabaul Rd / HLD	Rabaul Rd WEST	T	4358	1	3.2	2.2	220	1.51814
Rabaul Rd / HLD	Rabual Rd WEST	R	4300	0	8.4	8.4	inf	4.09878
Rabaul Rd / Tower Rd	Rabaul Rd WEST	L	5722	9	5.8	-3.2	-35.5556	1.17634
Rabaul Rd / Tower Rd	Rabaul Rd WEST	R	5721	39	0.2	-38.8	-99.4872	8.76403
Rabaul Rd / Tower Rd	Tower Rd NORTH	R	5720	59	31	-28	-47.4576	4.17399
Rabaul Rd / Tower Rd	Tower Rd NORTH	T	5718	326	300.8	-25.2	-7.73006	1.42348
Rabaul Rd / Tower Rd	Tower Rd SOUTH	L	6530	94	96.4	2.4	2.55319	0.245976
Rabaul Rd / Tower Rd	Tower Rd SOUTH	T	5723	126	149.4	23.4	18.5714	1.99411
Raleigh Rd / HLD	Henry Lawson Dr NORTH	R	3160	86	66.8	-19.2	-22.3256	2.19662
Raleigh Rd / HLD	Henry Lawson Dr NORTH	T	3159	896	902.4	6.4	0.714286	0.213428
Raleigh Rd / HLD	Henry Lawson Dr SOUTH	L	3139	3	1.4	-1.6	-53.3333	1.07872
Raleigh Rd / HLD	Henry Lawson Dr SOUTH	T	5421	785	826.8	41.8	5.32484	1.47243
Raleigh Rd / HLD	Raleigh Rd WEST	L	5422	76	75.8	-0.2	-0.26316	0.022957
Raleigh Rd / HLD	Raleigh Rd WEST	R	3132	3	0.6	-2.4	-80	1.78885

Time period: 5-6 PM

Vehicle Type: Light Vehicles

Intersection	Approach	Turn	Object ID	Observed	Modelled	Absolute Difference	Relative Difference	GEH
Ashford Ave / Newbridge Rd	Ashford Ave SOUTH	L	3768	163	136.8	-26.2	-16.0736	2.13993
Ashford Ave / Newbridge Rd	Ashford Ave SOUTH	R	3767	173	166.2	-6.8	-3.93064	0.522151
Ashford Ave / Newbridge Rd	Newbridge Rd EAST	L	3685	183	125.4	-57.6	-31.4754	4.63853
Ashford Ave / Newbridge Rd	Newbridge Rd EAST	T	3684	1781	1627.2	-153.8	-8.6356	3.72571
Ashford Ave / Newbridge Rd	Newbridge Rd WEST	R	5442	203	210.8	7.8	3.84236	0.542268
Ashford Ave / Newbridge Rd	Newbridge Rd WEST	T	5441	1193	1206	13	1.08969	0.375356
Endeavour Rd / HLD	Endeavour Rd EAST	L	5409	73	60.8	-12.2	-16.7123	1.49158
Endeavour Rd / HLD	Henry Lawson Dr NORTH	L	2770	0	2.8	2.8	inf	2.36643
Endeavour Rd / HLD	Henry Lawson Dr NORTH	T	5410	1104	1026.2	-77.8	-7.0471	2.38388
Haig Ave / HLD	Haig Ave EAST	L	2625	96	109.6	13.6	14.1667	1.34135
Haig Ave / HLD	Haig Ave EAST	R	2626	166	121.4	-44.6	-26.8675	3.72054
Haig Ave / HLD	Henry Lawson Dr NORTH	L	2721	14	3	-11	-78.5714	3.77297
Haig Ave / HLD	Henry Lawson Dr NORTH	T	2720	1006	919.2	-86.8	-8.62823	2.79767
Haig Ave / HLD	Henry Lawson Dr SOUTH	R	5855	102	108	6	5.88235	0.58554
Haig Ave / HLD	Henry Lawson Dr SOUTH	T	5854	1024	1065.2	41.2	4.02344	1.27474
Henry Lawson Dr / Newbridge Rd	Henry Lawson Dr NORTH	L	5468	326	281	-45	-13.8037	2.58305
Henry Lawson Dr / Newbridge Rd	Henry Lawson Dr NORTH	R	5434	780	741.6	-38.4	-4.92308	1.39218
Henry Lawson Dr / Newbridge Rd	Henry Lawson Dr NORTH	T	2765	590	619	29	4.91525	1.17951
Henry Lawson Dr / Newbridge Rd	Henry Lawson Dr SOUTH	L	5457	521	569.6	48.6	9.32821	2.08122
Henry Lawson Dr / Newbridge Rd	Henry Lawson Dr SOUTH	R	1588	20	20	0	0	0
Henry Lawson Dr / Newbridge Rd	Henry Lawson Dr SOUTH	T	1587	421	456	35	8.31354	1.67141
Henry Lawson Dr / Newbridge Rd	Newbridge Rd EAST	L	5461	56	37.2	-18.8	-33.5714	2.75401
Henry Lawson Dr / Newbridge Rd	Newbridge Rd EAST	R	5709	262	294	32	12.2137	1.91923
Henry Lawson Dr / Newbridge Rd	Newbridge Rd EAST	T	1845	1403	1386.6	-16.4	-1.16892	0.439125
Henry Lawson Dr / Newbridge Rd	Newbridge Rd WEST	L	5454	587	658	71	12.0954	2.8457
Henry Lawson Dr / Newbridge Rd	Newbridge Rd WEST	R	5433	368	348.8	-19.2	-5.21739	1.01419
Henry Lawson Dr / Newbridge Rd	Newbridge Rd WEST	T	2185	1117	1079.4	-37.6	-3.36616	1.13461
HLD / Keys Pde	Henry Lawson Dr NORTH	L	5512	12	37.4	25.4	211.667	5.11076
HLD / Keys Pde	Henry Lawson Dr NORTH	T	5518	992	962.2	-29.8	-3.00403	0.953338
HLD / Keys Pde	Henry Lawson Dr SOUTH	L	5850	0	3.8	3.8	inf	2.75681
HLD / Keys Pde	Henry Lawson Dr SOUTH	R	5508	10	1.8	-8.2	-82	3.37589
HLD / Keys Pde	Henry Lawson Dr SOUTH	T	5506	1111	1024.2	-86.8	-7.81278	2.65653
HLD / Keys Pde	Keys Pde EAST	L	5505	16	1.4	-14.6	-91.25	4.94986
HLD / Keys Pde	Keys Pde EAST	R	5507	20	10.8	-9.2	-46	2.34438
HLD / Tower Rd	Henry Lawson Dr NORTH	L	1437	13	7.8	-5.2	-40	1.61245
HLD / Tower Rd	Henry Lawson Dr NORTH	T	5444	1264	1249	-15	-1.18671	0.423165
HLD / Tower Rd	Henry Lawson Dr SOUTH	R	5446	174	229.6	55.6	31.954	3.91394
HLD / Tower Rd	Henry Lawson Dr SOUTH	T	5443	1065	1174.6	109.6	10.2911	3.27522
HLD / Tower Rd	Tower Rd EAST	L	5445	356	338.4	-17.6	-4.94382	0.944545
HLD / Tower Rd	Tower Rd EAST	R	2768	18	4	-14	-77.7778	4.22116
Murray Jones Dr / Newbridge Rd	Murray Jones Dr NORTH	L	4117	28	52	24	85.7143	3.79473
Murray Jones Dr / Newbridge Rd	Murray Jones Dr NORTH	R	4118	13	18.8	5.8	44.6154	1.45455

Intersection	Approach	Turn	Object ID	Observed	Modelled	Absolute Difference	Relative Difference	GEH
Murray Jones Dr / Newbridge Rd	Newbridge Rd EAST	R	5440	10	17.6	7.6	76	2.04585
Murray Jones Dr / Newbridge Rd	Newbridge Rd EAST	T	5439	1946	1749.8	-196.2	-10.0822	4.56415
Murray Jones Dr / Newbridge Rd	Newbridge Rd WEST	L	1973	2	2	0	0	0
Murray Jones Dr / Newbridge Rd	Newbridge Rd WEST	T	1972	1375	1372.8	-2.2	-0.16	0.059353
Rabaul Rd / HLD	Henry Lawson Dr NORTH	L	2780	3	1.2	-1.8	-60	1.24212
Rabaul Rd / HLD	Henry Lawson Dr NORTH	R	2781	11	6.4	-4.6	-41.8182	1.55955
Rabaul Rd / HLD	Henry Lawson Dr NORTH	T	2779	1122	1080	-42	-3.74332	1.26577
Rabaul Rd / HLD	Henry Lawson Dr SOUTH	L	5012	0	4	4	inf	2.82843
Rabaul Rd / HLD	Henry Lawson Dr SOUTH	R	5011	16	3.4	-12.6	-78.75	4.04562
Rabaul Rd / HLD	Henry Lawson Dr SOUTH	T	5010	1072	1160.6	88.6	8.26493	2.65182
Rabaul Rd / HLD	Rabaul Rd EAST	L	4357	111	95	-16	-14.4144	1.57653
Rabaul Rd / HLD	Rabaul Rd EAST	R	4359	5	0	-5	-100	3.16228
Rabaul Rd / HLD	Rabaul Rd EAST	T	4299	2	7	5	250	2.35702
Rabaul Rd / HLD	Rabaul Rd WEST	L	4298	3	8.6	5.6	186.667	2.32527
Rabaul Rd / HLD	Rabaul Rd WEST	T	4358	0	2.8	2.8	inf	2.36643
Rabaul Rd / HLD	Rabual Rd WEST	R	4300	0	7.8	7.8	inf	3.94968
Rabaul Rd / Tower Rd	Rabaul Rd WEST	L	5722	11	7.2	-3.8	-34.5455	1.25969
Rabaul Rd / Tower Rd	Rabaul Rd WEST	R	5721	30	0.4	-29.6	-98.6667	7.59224
Rabaul Rd / Tower Rd	Tower Rd NORTH	R	5720	48	11	-37	-77.0833	6.81225
Rabaul Rd / Tower Rd	Tower Rd NORTH	T	5718	284	283	-1	-0.35211	0.059391
Rabaul Rd / Tower Rd	Tower Rd SOUTH	L	6530	51	68	17	33.3333	2.20389
Rabaul Rd / Tower Rd	Tower Rd SOUTH	T	5723	137	147.8	10.8	7.88321	0.905042
Raleigh Rd / HLD	Henry Lawson Dr NORTH	R	3160	74	71.6	-2.4	-3.24324	0.281284
Raleigh Rd / HLD	Henry Lawson Dr NORTH	T	3159	839	900.8	61.8	7.36591	2.09534
Raleigh Rd / HLD	Henry Lawson Dr SOUTH	L	3139	10	1.8	-8.2	-82	3.37589
Raleigh Rd / HLD	Henry Lawson Dr SOUTH	T	5421	896	1003.6	107.6	12.0089	3.49137
Raleigh Rd / HLD	Raleigh Rd WEST	L	5422	55	24.6	-30.4	-55.2727	4.81872
Raleigh Rd / HLD	Raleigh Rd WEST	R	3132	4	1.4	-2.6	-65	1.58231

Time period: 7-8 AM

Vehicle Type: Heavy Vehicles

Intersection	Approach	Turn	Object ID	Observed	Modelled	Absolute Difference	Relative Difference	GEH
Ashford Ave / Newbridge Rd	Ashford Ave SOUTH	L	3768	19	9.4	8.2	17.6	0.327267
Ashford Ave / Newbridge Rd	Ashford Ave SOUTH	R	3767	6	14.6	3.4	18	3.464102
Ashford Ave / Newbridge Rd	Newbridge Rd EAST	L	3685	9	6.8	1.8	8.6	0.13484
Ashford Ave / Newbridge Rd	Newbridge Rd EAST	T	3684	81	89.4	36.6	126	4.423259
Ashford Ave / Newbridge Rd	Newbridge Rd WEST	R	5442	19	26.2	8.6	34.8	3.046358
Ashford Ave / Newbridge Rd	Newbridge Rd WEST	T	5441	80	101.4	29.8	131.2	4.982393
Endeavour Rd / HLD	Endeavour Rd EAST	L	5409	2	0	0	0	2
Endeavour Rd / HLD	Henry Lawson Dr NORTH	L	2770	0	0	0	0	#DIV/0!
Endeavour Rd / HLD	Henry Lawson Dr NORTH	T	5410	144	100.6	24.8	125.4	1.602615
Haig Ave / HLD	Haig Ave EAST	L	2625	9	0	0	0	4.242641
Haig Ave / HLD	Haig Ave EAST	R	2626	14	0	0	0	5.291503
Haig Ave / HLD	Henry Lawson Dr NORTH	L	2721	6	0	0	0	3.464102
Haig Ave / HLD	Henry Lawson Dr NORTH	T	2720	167	100.6	24.8	125.4	3.440485
Haig Ave / HLD	Henry Lawson Dr SOUTH	R	5855	3	0	0	0	2.44949
Haig Ave / HLD	Henry Lawson Dr SOUTH	T	5854	119	92	35.2	127.2	0.739069
Henry Lawson Dr / Newbridge Rd	Henry Lawson Dr NORTH	L	5468	81	49.2	14.2	63.4	2.071305
Henry Lawson Dr / Newbridge Rd	Henry Lawson Dr NORTH	R	5434	39	16.6	4.2	20.8	3.328402
Henry Lawson Dr / Newbridge Rd	Henry Lawson Dr NORTH	T	2765	61	35.8	6.6	42.4	2.586829
Henry Lawson Dr / Newbridge Rd	Henry Lawson Dr SOUTH	L	5457	48	19.4	5.2	24.6	3.883851
Henry Lawson Dr / Newbridge Rd	Henry Lawson Dr SOUTH	R	1588	5	0.6	0.4	1	2.309401
Henry Lawson Dr / Newbridge Rd	Henry Lawson Dr SOUTH	T	1587	46	49.8	4.6	54.4	1.185571
Henry Lawson Dr / Newbridge Rd	Newbridge Rd EAST	L	5461	5	0	0	0	3.162278
Henry Lawson Dr / Newbridge Rd	Newbridge Rd EAST	R	5709	50	20.6	22.2	42.8	1.056996
Henry Lawson Dr / Newbridge Rd	Newbridge Rd EAST	T	1845	92	75.6	21.4	97	0.514344
Henry Lawson Dr / Newbridge Rd	Newbridge Rd WEST	L	5454	32	25.8	10.2	36	0.685994
Henry Lawson Dr / Newbridge Rd	Newbridge Rd WEST	R	5433	45	28.4	12.6	41	0.609994
Henry Lawson Dr / Newbridge Rd	Newbridge Rd WEST	T	2185	115	76.2	23	99.2	1.52673
HLD / Keys Pde	Henry Lawson Dr NORTH	L	5512	3	0	0	0	2.44949
HLD / Keys Pde	Henry Lawson Dr NORTH	T	5518	102	64.4	19	83.4	1.931849
HLD / Keys Pde	Henry Lawson Dr SOUTH	L	5850	0	0	0	0	#DIV/0!
HLD / Keys Pde	Henry Lawson Dr SOUTH	R	5508	3	0	0	0	2.44949
HLD / Keys Pde	Henry Lawson Dr SOUTH	T	5506	67	69.6	9.6	79.2	1.426925
HLD / Keys Pde	Keys Pde EAST	L	5505	1	0	0	0	1.414214
HLD / Keys Pde	Keys Pde EAST	R	5507	0	0	0	0	#DIV/0!
HLD / Tower Rd	Henry Lawson Dr NORTH	L	1437	2	0	0	0	2
HLD / Tower Rd	Henry Lawson Dr NORTH	T	5444	179	101	24.4	125.4	4.344677
HLD / Tower Rd	Henry Lawson Dr SOUTH	R	5446	9	0	0	0	4.242641
HLD / Tower Rd	Henry Lawson Dr SOUTH	T	5443	117	95.6	36.6	132.2	1.36171
HLD / Tower Rd	Tower Rd EAST	L	5445	9	0	0	0	4.242641
HLD / Tower Rd	Tower Rd EAST	R	2768	1	0	0	0	1.414214
Murray Jones Dr / Newbridge Rd	Murray Jones Dr NORTH	L	4117	0	0	0	0	#DIV/0!
Murray Jones Dr / Newbridge Rd	Murray Jones Dr NORTH	R	4118	2	0	0	0	2

Intersection	Approach	Turn	Object ID	Observed	Modelled	Absolute Difference	Relative Difference	GEH
Murray Jones Dr / Newbridge Rd	Newbridge Rd EAST	R	5440	5	0	0	0	3.162278
Murray Jones Dr / Newbridge Rd	Newbridge Rd EAST	T	5439	92	99	45.2	144.2	4.803365
Murray Jones Dr / Newbridge Rd	Newbridge Rd WEST	L	1973	4	0	0	0	2.828427
Murray Jones Dr / Newbridge Rd	Newbridge Rd WEST	T	1972	101	127	38.4	165.4	5.579994
Rabaul Rd / HLD	Henry Lawson Dr NORTH	L	2780	1	0	0	0	1.414214
Rabaul Rd / HLD	Henry Lawson Dr NORTH	R	2781	0	0	0	0	#DIV/0!
Rabaul Rd / HLD	Henry Lawson Dr NORTH	T	2779	106	100.6	24.8	125.4	1.803579
Rabaul Rd / HLD	Henry Lawson Dr SOUTH	L	5012	1	0	0	0	1.414214
Rabaul Rd / HLD	Henry Lawson Dr SOUTH	R	5011	0	0	0	0	#DIV/0!
Rabaul Rd / HLD	Henry Lawson Dr SOUTH	T	5010	99	92.2	35.6	127.8	2.704494
Rabaul Rd / HLD	Rabaul Rd EAST	L	4357	3	0	0	0	2.44949
Rabaul Rd / HLD	Rabaul Rd EAST	R	4359	0	0	0	0	#DIV/0!
Rabaul Rd / HLD	Rabaul Rd EAST	T	4299	0	0	0	0	#DIV/0!
Rabaul Rd / HLD	Rabaul Rd WEST	L	4298	4	0	0	0	2.828427
Rabaul Rd / HLD	Rabaul Rd WEST	T	4358	1	0	0	0	1.414214
Rabaul Rd / HLD	Rabual Rd WEST	R	4300	0	0	0	0	#DIV/0!
Rabaul Rd / Tower Rd	Rabaul Rd WEST	L	5722	2	0	0	0	2
Rabaul Rd / Tower Rd	Rabaul Rd WEST	R	5721	0	0	0	0	#DIV/0!
Rabaul Rd / Tower Rd	Tower Rd NORTH	R	5720	7	0	0	0	3.741657
Rabaul Rd / Tower Rd	Tower Rd NORTH	T	5718	6	0	0	0	3.464102
Rabaul Rd / Tower Rd	Tower Rd SOUTH	L	6530	0	0	0	0	#DIV/0!
Rabaul Rd / Tower Rd	Tower Rd SOUTH	T	5723	6	0	0	0	3.464102
Raleigh Rd / HLD	Henry Lawson Dr NORTH	R	3160	0	0	0	0	#DIV/0!
Raleigh Rd / HLD	Henry Lawson Dr NORTH	T	3159	57	64	18.6	82.6	3.064166
Raleigh Rd / HLD	Henry Lawson Dr SOUTH	L	3139	0	0	0	0	#DIV/0!
Raleigh Rd / HLD	Henry Lawson Dr SOUTH	T	5421	42	69.4	9.4	78.8	4.735102
Raleigh Rd / HLD	Raleigh Rd WEST	L	5422	0	0	0	0	#DIV/0!
Raleigh Rd / HLD	Raleigh Rd WEST	R	3132	1	0	0	0	1.414214

Time period: 8-9 AM

Vehicle Type: Heavy Vehicles

Intersection	Approach	Turn	Object ID	Observed	Modelled	Absolute Difference	Relative Difference	GEH
Ashford Ave / Newbridge Rd	Ashford Ave SOUTH	L	3768	23	9.4	9.4	18.8	0.918705
Ashford Ave / Newbridge Rd	Ashford Ave SOUTH	R	3767	3	12	4.4	16.4	4.302481
Ashford Ave / Newbridge Rd	Newbridge Rd EAST	L	3685	16	4.8	1.4	6.2	2.941471
Ashford Ave / Newbridge Rd	Newbridge Rd EAST	T	3684	95	108	42.4	150.4	5.001353
Ashford Ave / Newbridge Rd	Newbridge Rd WEST	R	5442	17	32.4	8.8	41.2	4.486099
Ashford Ave / Newbridge Rd	Newbridge Rd WEST	T	5441	77	113.8	37.4	151.2	6.946421
Endeavour Rd / HLD	Endeavour Rd EAST	L	5409	1	0	0	0	1.414214
Endeavour Rd / HLD	Henry Lawson Dr NORTH	L	2770	0	0	0	0	#DIV/0!
Endeavour Rd / HLD	Henry Lawson Dr NORTH	T	5410	171	181.8	35.8	217.6	3.343101
Haig Ave / HLD	Haig Ave EAST	L	2625	12	0	0	0	4.898979
Haig Ave / HLD	Haig Ave EAST	R	2626	7	0	0	0	3.741657
Haig Ave / HLD	Henry Lawson Dr NORTH	L	2721	3	0	0	0	2.44949
Haig Ave / HLD	Henry Lawson Dr NORTH	T	2720	160	181.8	35.8	217.6	4.192002
Haig Ave / HLD	Henry Lawson Dr SOUTH	R	5855	14	0	0	0	5.291503
Haig Ave / HLD	Henry Lawson Dr SOUTH	T	5854	132	107.2	44.2	151.4	1.629734
Henry Lawson Dr / Newbridge Rd	Henry Lawson Dr NORTH	L	5468	79	56.2	15.8	72	0.805609
Henry Lawson Dr / Newbridge Rd	Henry Lawson Dr NORTH	R	5434	38	14.6	5.8	20.4	3.257026
Henry Lawson Dr / Newbridge Rd	Henry Lawson Dr NORTH	T	2765	57	107.8	12	119.8	6.679339
Henry Lawson Dr / Newbridge Rd	Henry Lawson Dr SOUTH	L	5457	43	29.8	6.6	36.4	1.047487
Henry Lawson Dr / Newbridge Rd	Henry Lawson Dr SOUTH	R	1588	8	0.8	1.2	2	2.683282
Henry Lawson Dr / Newbridge Rd	Henry Lawson Dr SOUTH	T	1587	69	43.6	9.2	52.8	2.0759
Henry Lawson Dr / Newbridge Rd	Newbridge Rd EAST	L	5461	12	0	0	0	4.898979
Henry Lawson Dr / Newbridge Rd	Newbridge Rd EAST	R	5709	56	22.6	22.6	45.2	1.518268
Henry Lawson Dr / Newbridge Rd	Newbridge Rd EAST	T	1845	113	97.8	30.6	128.4	1.401739
Henry Lawson Dr / Newbridge Rd	Newbridge Rd WEST	L	5454	41	36.2	11.4	47.6	0.991613
Henry Lawson Dr / Newbridge Rd	Newbridge Rd WEST	R	5433	43	29	9.6	38.6	0.688847
Henry Lawson Dr / Newbridge Rd	Newbridge Rd WEST	T	2185	164	95.6	29.8	125.4	3.208877
HLD / Keys Pde	Henry Lawson Dr NORTH	L	5512	2	0	0	0	2
HLD / Keys Pde	Henry Lawson Dr NORTH	T	5518	126	137.2	21.8	159	2.764436
HLD / Keys Pde	Henry Lawson Dr SOUTH	L	5850	0	0	0	0	#DIV/0!
HLD / Keys Pde	Henry Lawson Dr SOUTH	R	5508	1	0	0	0	1.414214
HLD / Keys Pde	Henry Lawson Dr SOUTH	T	5506	123	74.4	17.8	92.2	2.969235
HLD / Keys Pde	Keys Pde EAST	L	5505	2	0	0	0	2
HLD / Keys Pde	Keys Pde EAST	R	5507	0	0	0	0	#DIV/0!
HLD / Tower Rd	Henry Lawson Dr NORTH	L	1437	0	0	0	0	#DIV/0!
HLD / Tower Rd	Henry Lawson Dr NORTH	T	5444	171	180.8	36	216.8	3.289096
HLD / Tower Rd	Henry Lawson Dr SOUTH	R	5446	12	0	0	0	4.898979
HLD / Tower Rd	Henry Lawson Dr SOUTH	T	5443	151	102.6	43.4	146	0.410305
HLD / Tower Rd	Tower Rd EAST	L	5445	12	0	0	0	4.898979
HLD / Tower Rd	Tower Rd EAST	R	2768	2	0	0	0	2
Murray Jones Dr / Newbridge Rd	Murray Jones Dr NORTH	L	4117	3	0	0	0	2.44949
Murray Jones Dr / Newbridge Rd	Murray Jones Dr NORTH	R	4118	5	0	0	0	3.162278

Intersection	Approach	Turn	Object ID	Observed	Modelled	Absolute Difference	Relative Difference	GEH
Murray Jones Dr / Newbridge Rd	Newbridge Rd EAST	R	5440	2	0	0	0	2
Murray Jones Dr / Newbridge Rd	Newbridge Rd EAST	T	5439	113	117	51.8	168.8	4.700875
Murray Jones Dr / Newbridge Rd	Newbridge Rd WEST	L	1973	0	0	0	0	#DIV/0!
Murray Jones Dr / Newbridge Rd	Newbridge Rd WEST	T	1972	93	146.6	46.2	192.8	8.348615
Rabaul Rd / HLD	Henry Lawson Dr NORTH	L	2780	0	0	0	0	#DIV/0!
Rabaul Rd / HLD	Henry Lawson Dr NORTH	R	2781	1	0	0	0	1.414214
Rabaul Rd / HLD	Henry Lawson Dr NORTH	T	2779	135	181.8	35.8	217.6	6.22091
Rabaul Rd / HLD	Henry Lawson Dr SOUTH	L	5012	0	0	0	0	#DIV/0!
Rabaul Rd / HLD	Henry Lawson Dr SOUTH	R	5011	0	0	0	0	#DIV/0!
Rabaul Rd / HLD	Henry Lawson Dr SOUTH	T	5010	126	106.6	43.8	150.4	2.075562
Rabaul Rd / HLD	Rabaul Rd EAST	L	4357	1	0	0	0	1.414214
Rabaul Rd / HLD	Rabaul Rd EAST	R	4359	1	0	0	0	1.414214
Rabaul Rd / HLD	Rabaul Rd EAST	T	4299	0	0	0	0	#DIV/0!
Rabaul Rd / HLD	Rabaul Rd WEST	L	4298	1	0	0	0	1.414214
Rabaul Rd / HLD	Rabaul Rd WEST	T	4358	0	0	0	0	#DIV/0!
Rabaul Rd / HLD	Rabual Rd WEST	R	4300	0	0	0	0	#DIV/0!
Rabaul Rd / Tower Rd	Rabaul Rd WEST	L	5722	0	0	0	0	#DIV/0!
Rabaul Rd / Tower Rd	Rabaul Rd WEST	R	5721	1	0	0	0	1.414214
Rabaul Rd / Tower Rd	Tower Rd NORTH	R	5720	1	0	0	0	1.414214
Rabaul Rd / Tower Rd	Tower Rd NORTH	T	5718	4	0	0	0	2.828427
Rabaul Rd / Tower Rd	Tower Rd SOUTH	L	6530	2	0	0	0	2
Rabaul Rd / Tower Rd	Tower Rd SOUTH	T	5723	10	0	0	0	4.472136
Raleigh Rd / HLD	Henry Lawson Dr NORTH	R	3160	0	0	0	0	#DIV/0!
Raleigh Rd / HLD	Henry Lawson Dr NORTH	T	3159	68	137.6	22.2	159.8	8.601631
Raleigh Rd / HLD	Henry Lawson Dr SOUTH	L	3139	0	0	0	0	#DIV/0!
Raleigh Rd / HLD	Henry Lawson Dr SOUTH	T	5421	51	74.6	18	92.6	4.90943
Raleigh Rd / HLD	Raleigh Rd WEST	L	5422	1	0	0	0	1.414214
Raleigh Rd / HLD	Raleigh Rd WEST	R	3132	0	0	0	0	#DIV/0!

Time period: 4-5 PM

Vehicle Type: Heavy Vehicles

Intersection	Approach	Turn	Object ID	Observed	Modelled	Absolute Difference	Relative Difference	GEH
Ashford Ave / Newbridge Rd	Ashford Ave SOUTH	L	3768	11	21.2	6.2	27.4	3.742771
Ashford Ave / Newbridge Rd	Ashford Ave SOUTH	R	3767	6	8.8	3.2	12	2
Ashford Ave / Newbridge Rd	Newbridge Rd EAST	L	3685	7	5	1	6	0.392232
Ashford Ave / Newbridge Rd	Newbridge Rd EAST	T	3684	53	80.8	25.4	106.2	5.962867
Ashford Ave / Newbridge Rd	Newbridge Rd WEST	R	5442	21	7.4	1.8	9.2	3.036642
Ashford Ave / Newbridge Rd	Newbridge Rd WEST	T	5441	33	72.8	15.6	88.4	7.11075
Endeavour Rd / HLD	Endeavour Rd EAST	L	5409	0	0	0	0	#DIV/0!
Endeavour Rd / HLD	Henry Lawson Dr NORTH	L	2770	0	0	0	0	#DIV/0!
Endeavour Rd / HLD	Henry Lawson Dr NORTH	T	5410	73	71.6	13.6	85.2	1.371739
Haig Ave / HLD	Haig Ave EAST	L	2625	9	0	0	0	4.242641
Haig Ave / HLD	Haig Ave EAST	R	2626	7	0	0	0	3.741657
Haig Ave / HLD	Henry Lawson Dr NORTH	L	2721	3	0	0	0	2.44949
Haig Ave / HLD	Henry Lawson Dr NORTH	T	2720	89	71.6	13.6	85.2	0.407169
Haig Ave / HLD	Henry Lawson Dr SOUTH	R	5855	7	0	0	0	3.741657
Haig Ave / HLD	Henry Lawson Dr SOUTH	T	5854	137	99.4	40.6	140	0.254916
Henry Lawson Dr / Newbridge Rd	Henry Lawson Dr NORTH	L	5468	38	16.8	2.8	19.6	3.428638
Henry Lawson Dr / Newbridge Rd	Henry Lawson Dr NORTH	R	5434	32	16	3.2	19.2	2.529822
Henry Lawson Dr / Newbridge Rd	Henry Lawson Dr NORTH	T	2765	53	38.8	7.4	46.2	0.965535
Henry Lawson Dr / Newbridge Rd	Henry Lawson Dr SOUTH	L	5457	44	33.8	6.2	40	0.617213
Henry Lawson Dr / Newbridge Rd	Henry Lawson Dr SOUTH	R	1588	5	0.2	0	0.2	2.976834
Henry Lawson Dr / Newbridge Rd	Henry Lawson Dr SOUTH	T	1587	73	34	12.8	46.8	3.385228
Henry Lawson Dr / Newbridge Rd	Newbridge Rd EAST	L	5461	14	0	0	0	5.291503
Henry Lawson Dr / Newbridge Rd	Newbridge Rd EAST	R	5709	44	32.4	9.4	41.8	0.335888
Henry Lawson Dr / Newbridge Rd	Newbridge Rd EAST	T	1845	107	74.8	20.6	95.4	1.153102
Henry Lawson Dr / Newbridge Rd	Newbridge Rd WEST	L	5454	37	25.8	17.2	43	0.948683
Henry Lawson Dr / Newbridge Rd	Newbridge Rd WEST	R	5433	20	11.4	3	14.4	1.35028
Henry Lawson Dr / Newbridge Rd	Newbridge Rd WEST	T	2185	62	58.2	15	73.2	1.362212
HLD / Keys Pde	Henry Lawson Dr NORTH	L	5512	3	0	0	0	2.44949
HLD / Keys Pde	Henry Lawson Dr NORTH	T	5518	65	50.2	10.4	60.6	0.55523
HLD / Keys Pde	Henry Lawson Dr SOUTH	L	5850	0	0	0	0	#DIV/0!
HLD / Keys Pde	Henry Lawson Dr SOUTH	R	5508	1	0	0	0	1.414214
HLD / Keys Pde	Henry Lawson Dr SOUTH	T	5506	101	64.6	18	82.6	1.920421
HLD / Keys Pde	Keys Pde EAST	L	5505	1	0	0	0	1.414214
HLD / Keys Pde	Keys Pde EAST	R	5507	1	0	0	0	1.414214
HLD / Tower Rd	Henry Lawson Dr NORTH	L	1437	2	0	0	0	2
HLD / Tower Rd	Henry Lawson Dr NORTH	T	5444	112	70.2	12.8	83	2.936944
HLD / Tower Rd	Henry Lawson Dr SOUTH	R	5446	12	0	0	0	4.898979
HLD / Tower Rd	Henry Lawson Dr SOUTH	T	5443	133	92.2	39.4	131.6	0.121716
HLD / Tower Rd	Tower Rd EAST	L	5445	8	0	0	0	4
HLD / Tower Rd	Tower Rd EAST	R	2768	4	0	0	0	2.828427
Murray Jones Dr / Newbridge Rd	Murray Jones Dr NORTH	L	4117	3	0	0	0	2.44949
Murray Jones Dr / Newbridge Rd	Murray Jones Dr NORTH	R	4118	1	0	0	0	1.414214

Intersection	Approach	Turn	Object ID	Observed	Modelled	Absolute Difference	Relative Difference	GEH
Murray Jones Dr / Newbridge Rd	Newbridge Rd EAST	R	5440	1	0	0	0	1.414214
Murray Jones Dr / Newbridge Rd	Newbridge Rd EAST	T	5439	64	102.8	31.2	134	7.035265
Murray Jones Dr / Newbridge Rd	Newbridge Rd WEST	L	1973	0	0	0	0	#DIV/0!
Murray Jones Dr / Newbridge Rd	Newbridge Rd WEST	T	1972	54	79.6	17.2	96.8	4.928992
Rabaul Rd / HLD	Henry Lawson Dr NORTH	L	2780	0	0	0	0	#DIV/0!
Rabaul Rd / HLD	Henry Lawson Dr NORTH	R	2781	0	0	0	0	#DIV/0!
Rabaul Rd / HLD	Henry Lawson Dr NORTH	T	2779	73	71.6	13.4	85	1.350105
Rabaul Rd / HLD	Henry Lawson Dr SOUTH	L	5012	0	0	0	0	#DIV/0!
Rabaul Rd / HLD	Henry Lawson Dr SOUTH	R	5011	0	0	0	0	#DIV/0!
Rabaul Rd / HLD	Henry Lawson Dr SOUTH	T	5010	94	100	40.4	140.4	4.28602
Rabaul Rd / HLD	Rabaul Rd EAST	L	4357	0	0	0	0	#DIV/0!
Rabaul Rd / HLD	Rabaul Rd EAST	R	4359	1	0	0	0	1.414214
Rabaul Rd / HLD	Rabaul Rd EAST	T	4299	0	0	0	0	#DIV/0!
Rabaul Rd / HLD	Rabaul Rd WEST	L	4298	0	0	0	0	#DIV/0!
Rabaul Rd / HLD	Rabaul Rd WEST	T	4358	0	0	0	0	#DIV/0!
Rabaul Rd / HLD	Rabual Rd WEST	R	4300	0	0	0	0	#DIV/0!
Rabaul Rd / Tower Rd	Rabaul Rd WEST	L	5722	2	0	0	0	2
Rabaul Rd / Tower Rd	Rabaul Rd WEST	R	5721	1	0	0	0	1.414214
Rabaul Rd / Tower Rd	Tower Rd NORTH	R	5720	1	0	0	0	1.414214
Rabaul Rd / Tower Rd	Tower Rd NORTH	T	5718	3	0	0	0	2.44949
Rabaul Rd / Tower Rd	Tower Rd SOUTH	L	6530	2	0	0	0	2
Rabaul Rd / Tower Rd	Tower Rd SOUTH	T	5723	9	0	0	0	4.242641
Raleigh Rd / HLD	Henry Lawson Dr NORTH	R	3160	1	0	0	0	1.414214
Raleigh Rd / HLD	Henry Lawson Dr NORTH	T	3159	42	49.4	10.2	59.6	2.46934
Raleigh Rd / HLD	Henry Lawson Dr SOUTH	L	3139	0	0	0	0	#DIV/0!
Raleigh Rd / HLD	Henry Lawson Dr SOUTH	T	5421	65	64.2	18.2	82.4	2.026822
Raleigh Rd / HLD	Raleigh Rd WEST	L	5422	1	0	0	0	1.414214
Raleigh Rd / HLD	Raleigh Rd WEST	R	3132	1	0	0	0	1.414214

Time period: 5-6 PM

Vehicle Type: Heavy Vehicles

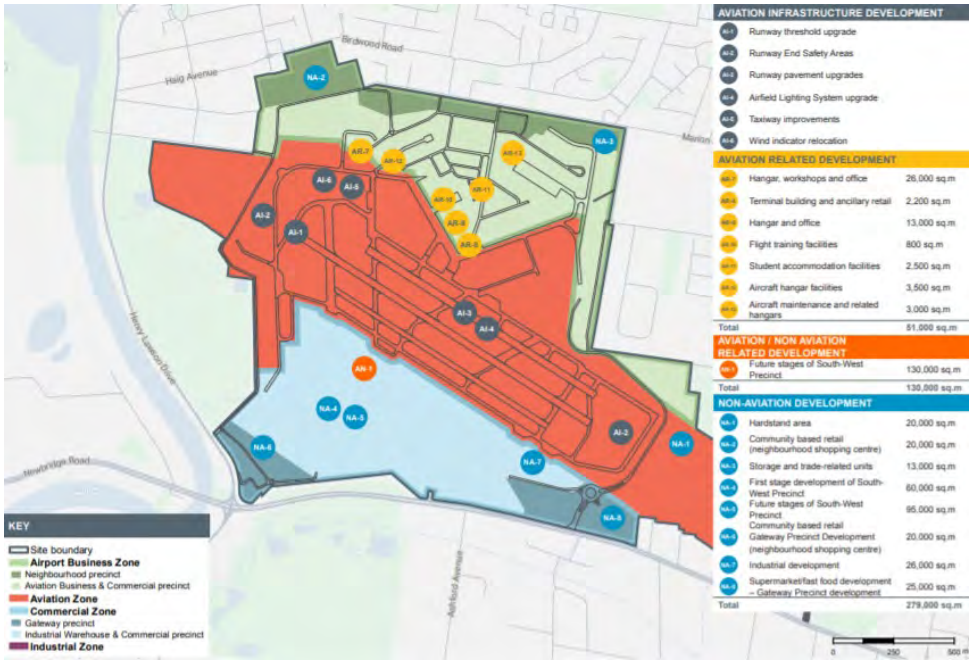
Intersection	Approach	Turn	Object ID	Observed	Modelled	Absolute Difference	Relative Difference	GEH
Ashford Ave / Newbridge Rd	Ashford Ave SOUTH	L	3768	12	11.8	2.2	14	0.5547
Ashford Ave / Newbridge Rd	Ashford Ave SOUTH	R	3767	3	4.6	1.8	6.4	1.568303
Ashford Ave / Newbridge Rd	Newbridge Rd EAST	L	3685	6	5.2	1	6.2	0.080978
Ashford Ave / Newbridge Rd	Newbridge Rd EAST	T	3684	46	52.6	13.2	65.8	2.648252
Ashford Ave / Newbridge Rd	Newbridge Rd WEST	R	5442	12	5	0	5	2.40098
Ashford Ave / Newbridge Rd	Newbridge Rd WEST	T	5441	30	56.8	17.4	74.2	6.123552
Endeavour Rd / HLD	Endeavour Rd EAST	L	5409	0	0	0	0	#DIV/0!
Endeavour Rd / HLD	Henry Lawson Dr NORTH	L	2770	0	0	0	0	#DIV/0!
Endeavour Rd / HLD	Henry Lawson Dr NORTH	T	5410	40	35.2	6.2	41.4	0.219448
Haig Ave / HLD	Haig Ave EAST	L	2625	5	0	0	0	3.162278
Haig Ave / HLD	Haig Ave EAST	R	2626	7	0	0	0	3.741657
Haig Ave / HLD	Henry Lawson Dr NORTH	L	2721	2	0	0	0	2
Haig Ave / HLD	Henry Lawson Dr NORTH	T	2720	58	35.2	6.2	41.4	2.354669
Haig Ave / HLD	Henry Lawson Dr SOUTH	R	5855	4	0	0	0	2.828427
Haig Ave / HLD	Henry Lawson Dr SOUTH	T	5854	101	60.6	27.6	88.2	1.316026
Henry Lawson Dr / Newbridge Rd	Henry Lawson Dr NORTH	L	5468	23	7.6	1.4	9	3.5
Henry Lawson Dr / Newbridge Rd	Henry Lawson Dr NORTH	R	5434	17	10.2	2.6	12.8	1.088068
Henry Lawson Dr / Newbridge Rd	Henry Lawson Dr NORTH	T	2765	28	23.8	3.2	27	0.190693
Henry Lawson Dr / Newbridge Rd	Henry Lawson Dr SOUTH	L	5457	29	26.2	4.2	30.4	0.256892
Henry Lawson Dr / Newbridge Rd	Henry Lawson Dr SOUTH	R	1588	4	0	0	0	2.828427
Henry Lawson Dr / Newbridge Rd	Henry Lawson Dr SOUTH	T	1587	40	22.2	2.8	25	2.631174
Henry Lawson Dr / Newbridge Rd	Newbridge Rd EAST	L	5461	7	0	0	0	3.741657
Henry Lawson Dr / Newbridge Rd	Newbridge Rd EAST	R	5709	31	15.6	6.2	21.8	1.790548
Henry Lawson Dr / Newbridge Rd	Newbridge Rd EAST	T	1845	73	48.8	11.2	60	1.594162
Henry Lawson Dr / Newbridge Rd	Newbridge Rd WEST	L	5454	31	18.8	17.2	36	0.863868
Henry Lawson Dr / Newbridge Rd	Newbridge Rd WEST	R	5433	13	10	5	15	0.534522
Henry Lawson Dr / Newbridge Rd	Newbridge Rd WEST	T	2185	47	57.2	16	73.2	3.37959
HLD / Keys Pde	Henry Lawson Dr NORTH	L	5512	3	0	0	0	2.44949
HLD / Keys Pde	Henry Lawson Dr NORTH	T	5518	39	33.8	8.2	42	0.471405
HLD / Keys Pde	Henry Lawson Dr SOUTH	L	5850	0	0	0	0	#DIV/0!
HLD / Keys Pde	Henry Lawson Dr SOUTH	R	5508	0	0	0	0	#DIV/0!
HLD / Keys Pde	Henry Lawson Dr SOUTH	T	5506	96	47.4	7	54.4	4.797162
HLD / Keys Pde	Keys Pde EAST	L	5505	1	0	0	0	1.414214
HLD / Keys Pde	Keys Pde EAST	R	5507	0	0	0	0	#DIV/0!
HLD / Tower Rd	Henry Lawson Dr NORTH	L	1437	0	0	0	0	#DIV/0!
HLD / Tower Rd	Henry Lawson Dr NORTH	T	5444	62	40.4	7.4	47.8	1.916471
HLD / Tower Rd	Henry Lawson Dr SOUTH	R	5446	10	0	0	0	4.472136
HLD / Tower Rd	Henry Lawson Dr SOUTH	T	5443	101	56.4	26	82.4	1.942354
HLD / Tower Rd	Tower Rd EAST	L	5445	6	0	0	0	3.464102
HLD / Tower Rd	Tower Rd EAST	R	2768	1	0	0	0	1.414214
Murray Jones Dr / Newbridge Rd	Murray Jones Dr NORTH	L	4117	1	0	0	0	1.414214
Murray Jones Dr / Newbridge Rd	Murray Jones Dr NORTH	R	4118	1	0	0	0	1.414214

Intersection	Approach	Turn	Object ID	Observed	Modelled	Absolute Difference	Relative Difference	GEH
Murray Jones Dr / Newbridge Rd	Newbridge Rd EAST	R	5440	0	0	0	0	#DIV/0!
Murray Jones Dr / Newbridge Rd	Newbridge Rd EAST	T	5439	59	64.6	15.2	79.8	2.496799
Murray Jones Dr / Newbridge Rd	Newbridge Rd WEST	L	1973	0	0	0	0	#DIV/0!
Murray Jones Dr / Newbridge Rd	Newbridge Rd WEST	T	1972	45	62.6	17.4	80	4.427189
Rabaul Rd / HLD	Henry Lawson Dr NORTH	L	2780	2	0	0	0	2
Rabaul Rd / HLD	Henry Lawson Dr NORTH	R	2781	0	0	0	0	#DIV/0!
Rabaul Rd / HLD	Henry Lawson Dr NORTH	T	2779	28	35.2	6.4	41.6	2.305416
Rabaul Rd / HLD	Henry Lawson Dr SOUTH	L	5012	1	0	0	0	1.414214
Rabaul Rd / HLD	Henry Lawson Dr SOUTH	R	5011	1	0	0	0	1.414214
Rabaul Rd / HLD	Henry Lawson Dr SOUTH	T	5010	71	58.8	27.2	86	1.692998
Rabaul Rd / HLD	Rabaul Rd EAST	L	4357	2	0	0	0	2
Rabaul Rd / HLD	Rabaul Rd EAST	R	4359	0	0	0	0	#DIV/0!
Rabaul Rd / HLD	Rabaul Rd EAST	T	4299	0	0	0	0	#DIV/0!
Rabaul Rd / HLD	Rabaul Rd WEST	L	4298	0	0	0	0	#DIV/0!
Rabaul Rd / HLD	Rabaul Rd WEST	T	4358	0	0	0	0	#DIV/0!
Rabaul Rd / HLD	Rabual Rd WEST	R	4300	0	0	0	0	#DIV/0!
Rabaul Rd / Tower Rd	Rabaul Rd WEST	L	5722	1	0	0	0	1.414214
Rabaul Rd / Tower Rd	Rabaul Rd WEST	R	5721	0	0	0	0	#DIV/0!
Rabaul Rd / Tower Rd	Tower Rd NORTH	R	5720	0	0	0	0	#DIV/0!
Rabaul Rd / Tower Rd	Tower Rd NORTH	T	5718	1	0	0	0	1.414214
Rabaul Rd / Tower Rd	Tower Rd SOUTH	L	6530	0	0	0	0	#DIV/0!
Rabaul Rd / Tower Rd	Tower Rd SOUTH	T	5723	5	0	0	0	3.162278
Raleigh Rd / HLD	Henry Lawson Dr NORTH	R	3160	0	0	0	0	#DIV/0!
Raleigh Rd / HLD	Henry Lawson Dr NORTH	T	3159	30	34.6	8.4	43	2.151775
Raleigh Rd / HLD	Henry Lawson Dr SOUTH	L	3139	0	0	0	0	#DIV/0!
Raleigh Rd / HLD	Henry Lawson Dr SOUTH	T	5421	50	47.2	6.8	54	0.5547
Raleigh Rd / HLD	Raleigh Rd WEST	L	5422	1	0	0	0	1.414214
Raleigh Rd / HLD	Raleigh Rd WEST	R	3132	0	0	0	0	#DIV/0!

Appendix B Future Land Use Assumptions

B-1 Bankstown Airport Development

Under the Bankstown Airport masterplan, the development is expected to be comprised of four main land use zones including the Airport Business zone, Aviation zone, Commercial Zone and Industrial Zone as seen below in Appendix B Figure 1:



Appendix B Figure 1 Bankstown Airport development proposal

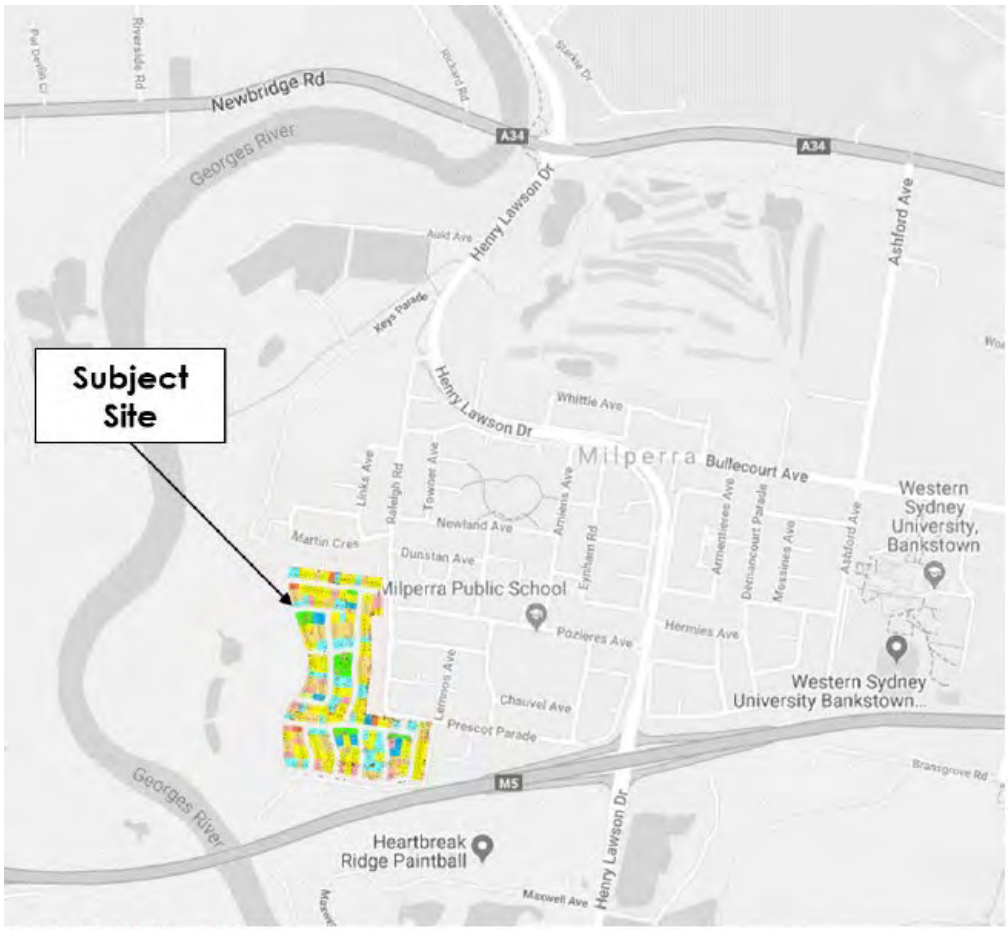
Details of the traffic generation is provided in the Bankstown Airport's Masterplan in table 10.3 on page 172. Following discussions between Transport and Bitzios the traffic generation was revised and updated in Appendix B Table 1

				Previous version		With RMS Changes	
Zone	Description	Land Use	Area (m2)	Trips generated		Trips generated	
				AM	PM	AM	PM
-	Office, Hangar, Workshops	Already constructed	3857	0	0	0	0
Zone 4	Storage and Trade Units	Warehouse	8000	27	27	27	27
-	Hardstand	Hardstand	20000	0	0	0	0
Zone 10	Industrial	Warehouse	12000	41	41	41	41
Zone 10	Kaufland Supermarket	Supermarket	6600	118	347	118	347
Zone 10	Ancillary Retail including a Café	Retail	500	9	26	74	105
Zone 44	Lot 1	Warehouse	37,000	126	126	126	126
Zone 39	Lot 4A,4B	warehouse	40,400	137	137	137	137
Zone 40	Lot 4C	warehouse	15,770	54	54	54	54
Zone 41	Lot 3C	warehouse	13,810	47	47	47	47
Zone 42	Lot 2	warehouse	28,720	98	98	98	98
Zone 43	Lot 3A,3B	warehouse	27,620	94	94	94	94
Zone 55	Shopping centre	Shopping centre	3000	88	252	185	369
Zone 55	Childrens play centre	Childrens play centre	2000	0	56	0	56
Zone 37	Mixed Use Retail	Bulky Retail	4000	10	11	38	75
Zone 37	Mixed Use Retail	Retail	3000	84	168	153	337
Zone 37	Mixed Use Retail	Fast food	1000	321	218	321	218
Zone 37	Mixed Use Retail	Hotel	2000	11	12	11	12
Zone 4	Flight Training Facilities (Employees)	Education (Employees)	30	33	26	22	26
Zone 4	Flight Training Facilities (Students)	Education (Students)	90	19	19	19	19
Zone 4	Student Accomodation (Employees)	Student Accomodation (Employees)	20	18	15	18	15
Zone 4	Student Accomodation (Students)	Student Accomodation (Students)	35	16	19	16	19
Zone 4	Office, Hangar, Workshops	Warehouse	10000	34	34	34	34
Zone 4	Hangar Facilities	Warehouse	1300	4	4	4	4
Zone 4	Aircraft Maintenance / Hangar	Warehouse	1500	5	5	5	5
			TOTALS	1,351	1,825	1,640	2,264

Appendix B Table 1 Bankstown Airport development traffic generation

B-2 Riverland's Golf Course Subdivision Development

The development is located on the former Riverland's golf course site as shown in Appendix B Figure 2 Riverland's development location. The plan involves residential dwellings for single and dual occupancies which will house a maximum total of 340 dwellings.

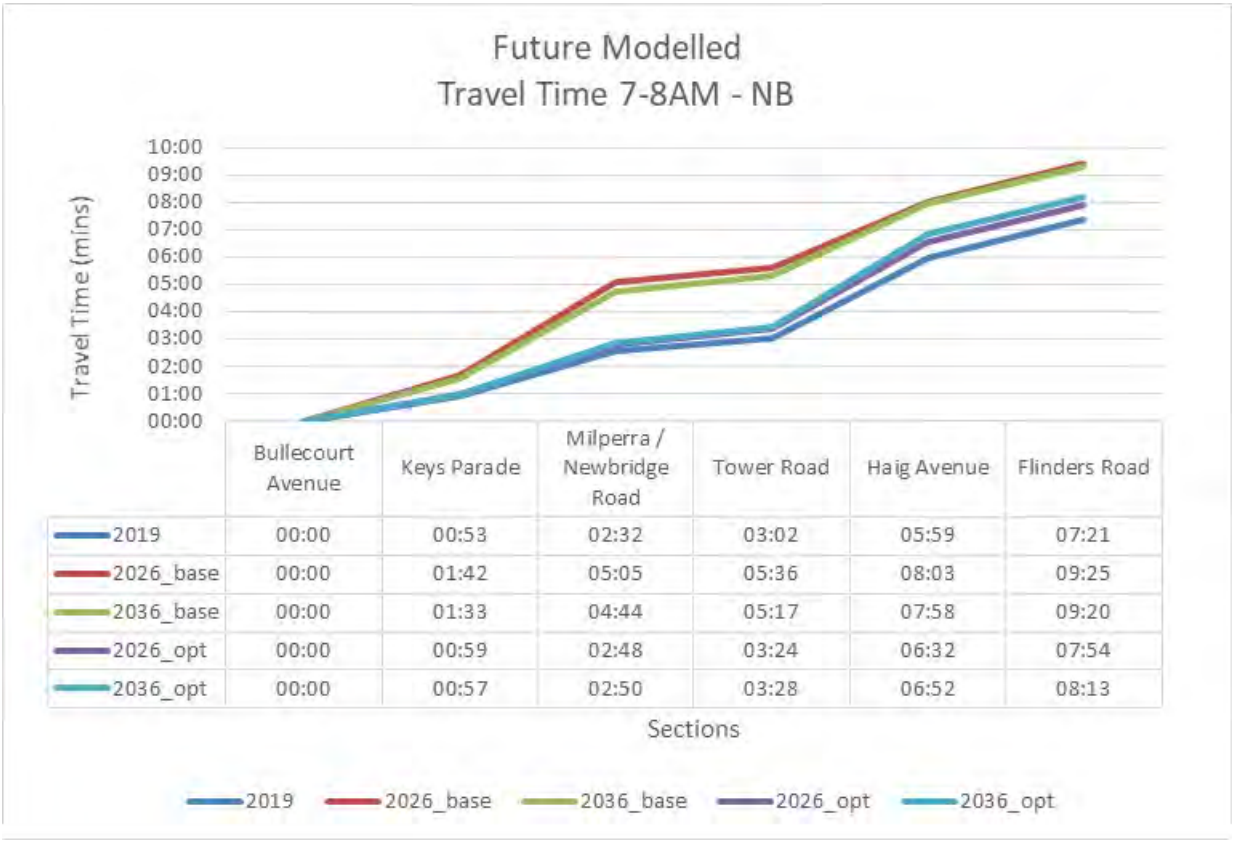


Source: Google Maps Australia

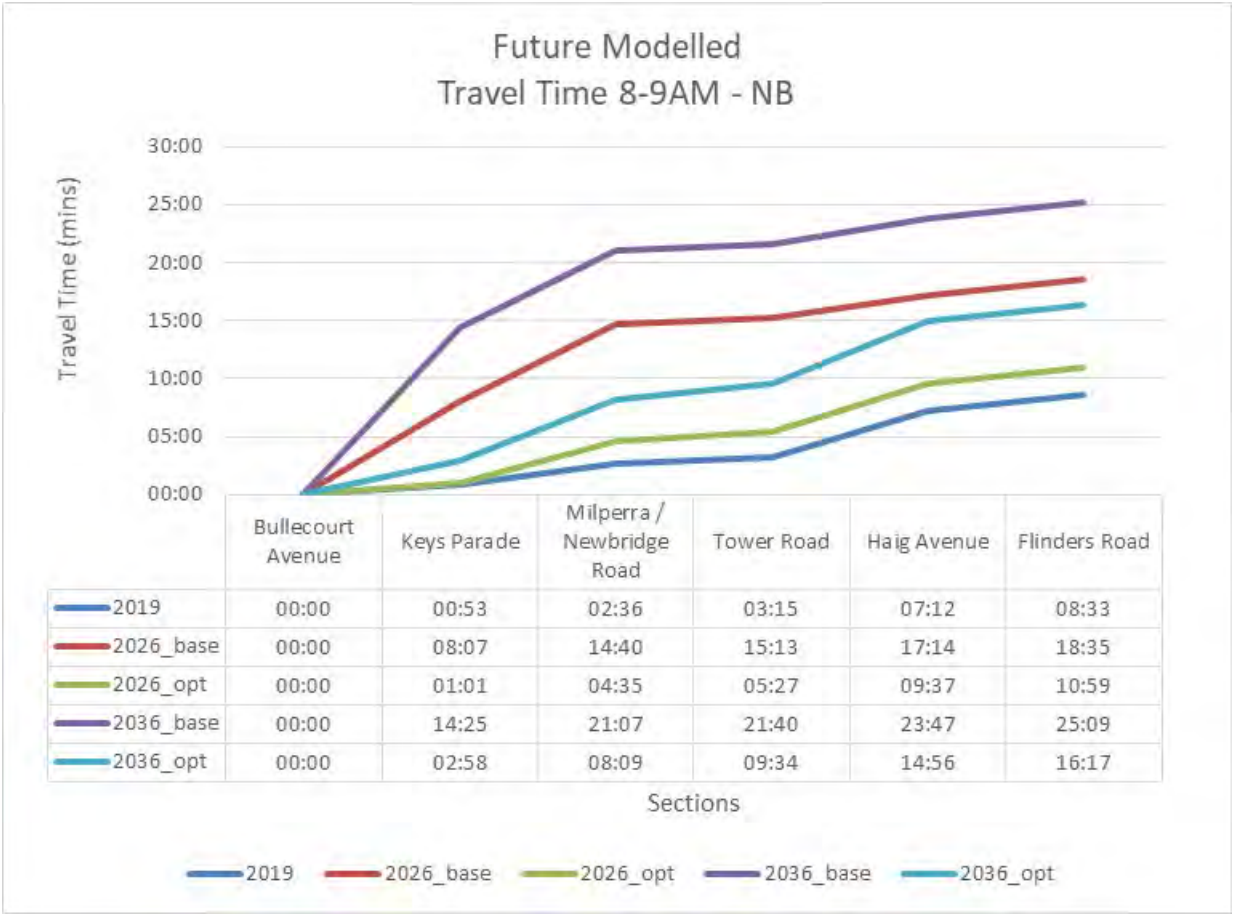
Appendix B Figure 2 Riverland's development location

A report from TTPP (Riverland's Golf Course Residential Subdivision Traffic Impact Assessment, 2020) details the traffic generation of the site to generate 294 veh/hour in the AM peak and 296 veh/hour during the PM peak.

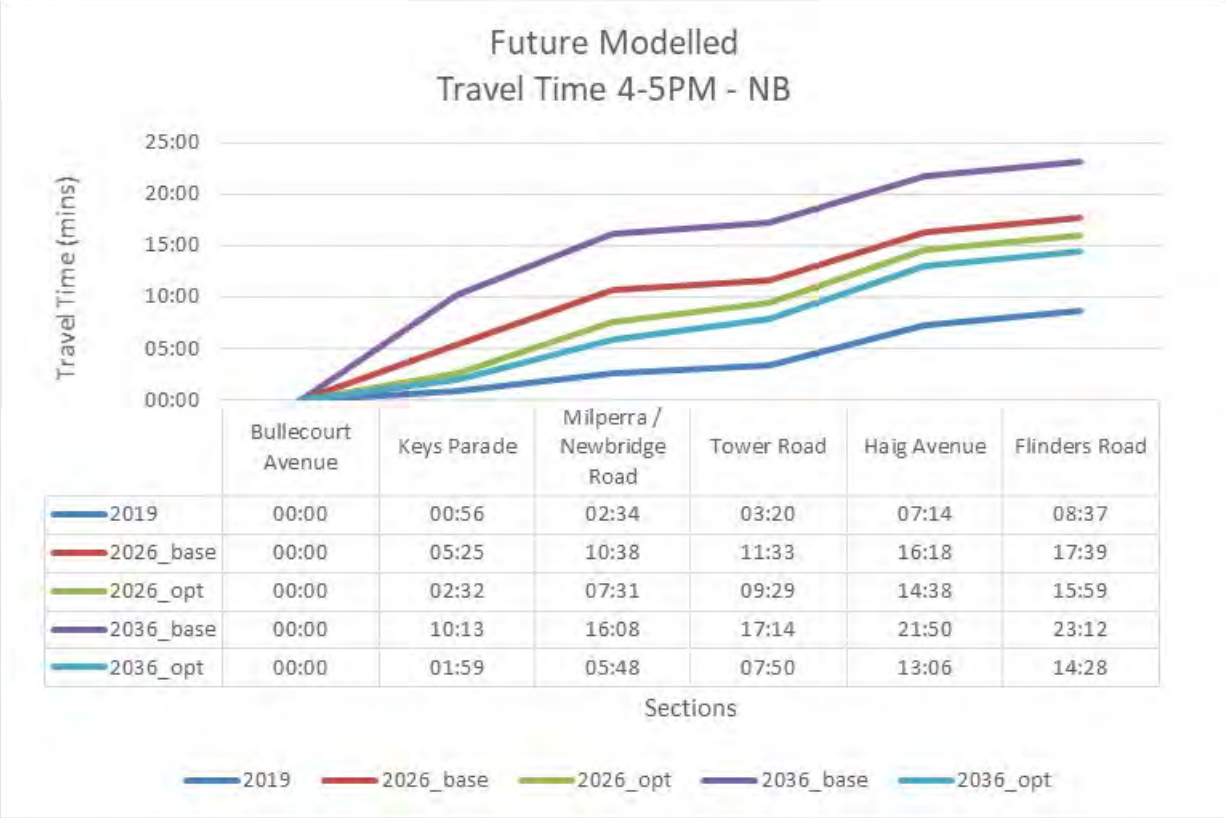
Appendix C Travel Time Results



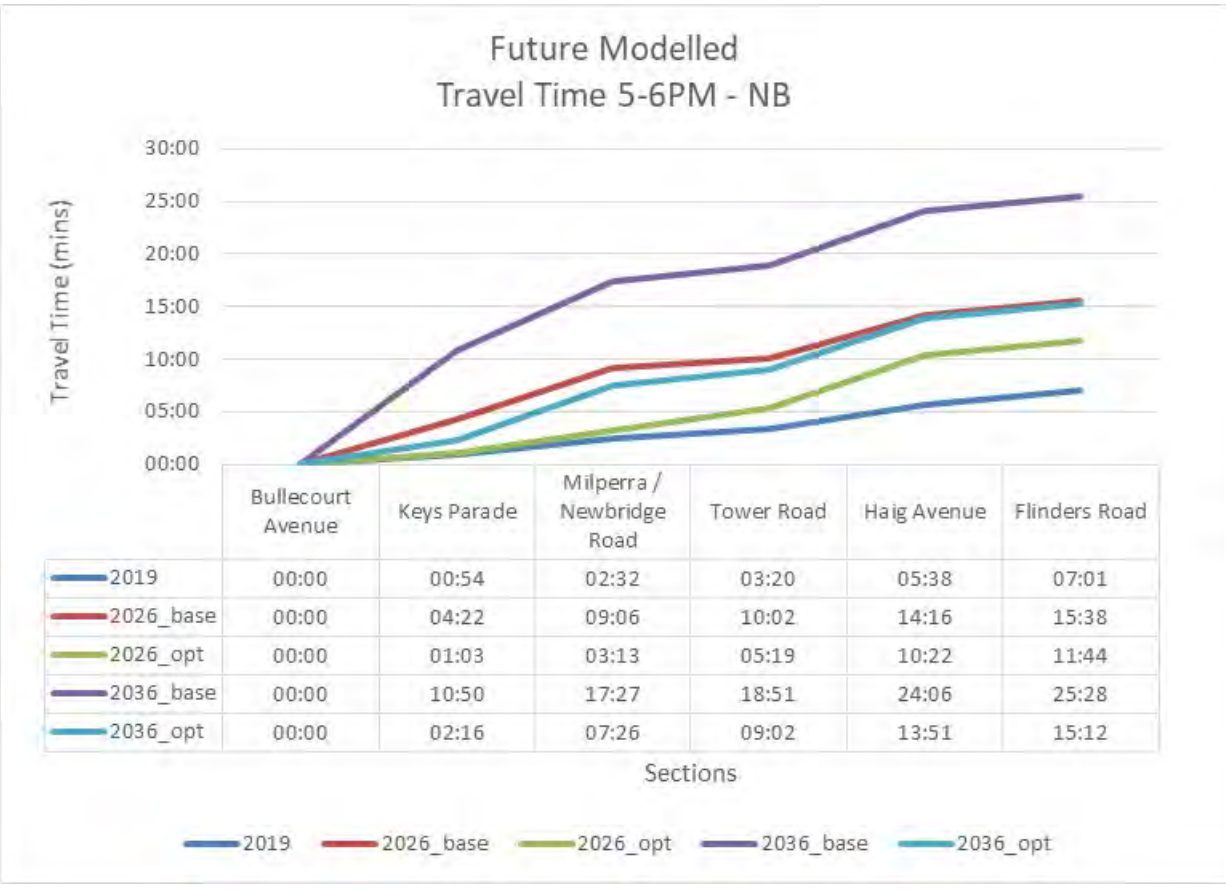
	Bullecourt Avenue	Keys Parade	Milperra / Newbridge Road	Tower Road	Haig Avenue	Flinders Road
2019	00:00	00:53	02:32	03:02	05:59	07:21
2026_base	00:00	01:42	05:05	05:36	08:03	09:25
2036_base	00:00	01:33	04:44	05:17	07:58	09:20
2026_opt	00:00	00:59	02:48	03:24	06:32	07:54
2036_opt	00:00	00:57	02:50	03:28	06:52	08:13



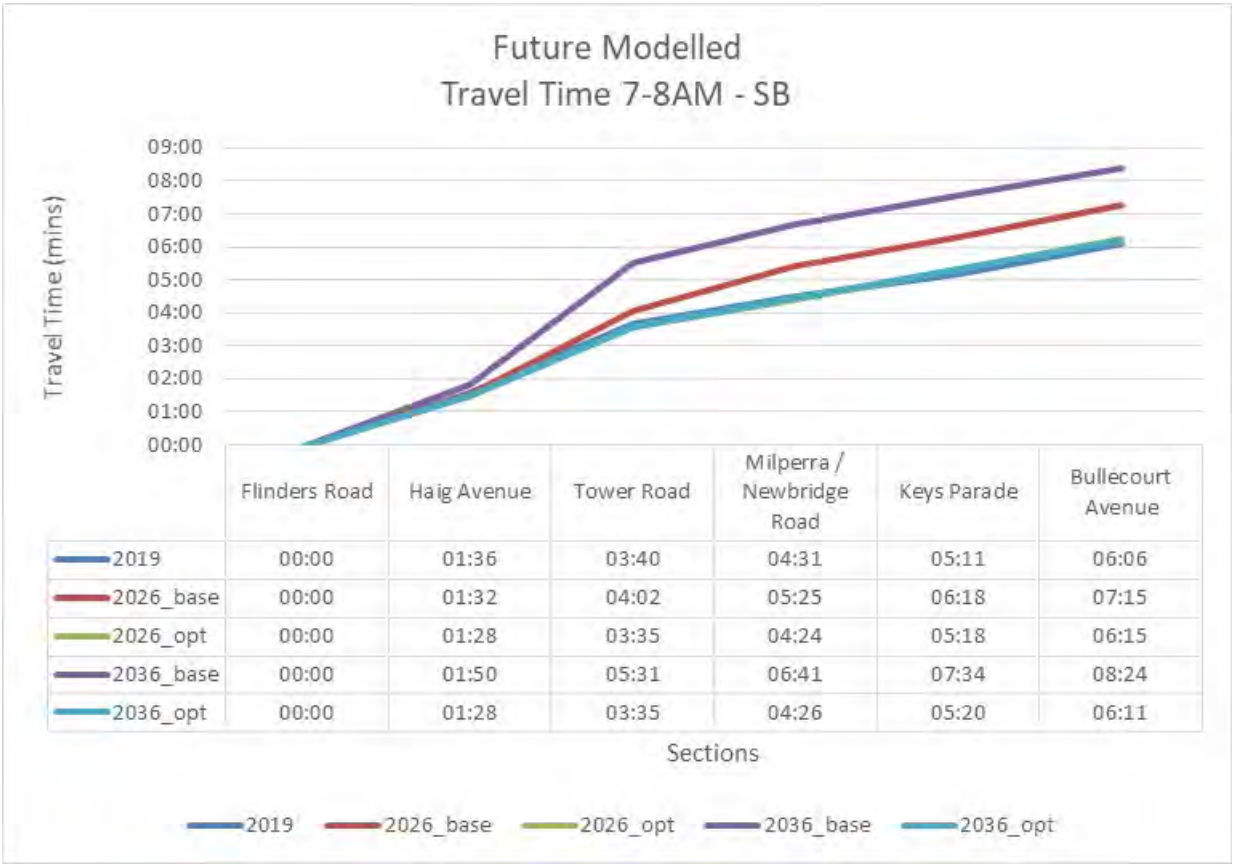
	Bullecourt Avenue	Keys Parade	Milperra / Newbridge Road	Tower Road	Haig Avenue	Flinders Road
2019	00:00	00:53	02:36	03:15	07:12	08:33
2026_base	00:00	08:07	14:40	15:13	17:14	18:35
2026_opt	00:00	01:01	04:35	05:27	09:37	10:59
2036_base	00:00	14:25	21:07	21:40	23:47	25:09
2036_opt	00:00	02:58	08:09	09:34	14:56	16:17

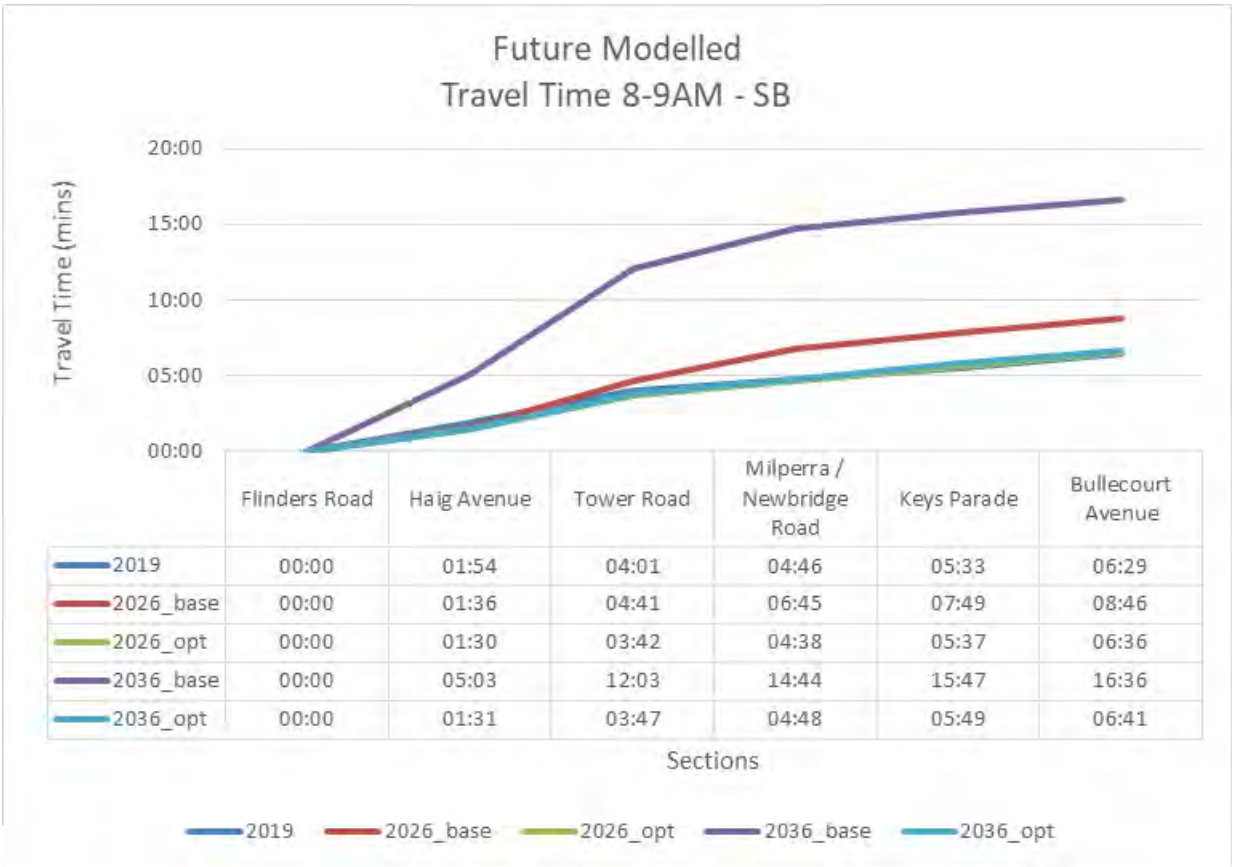


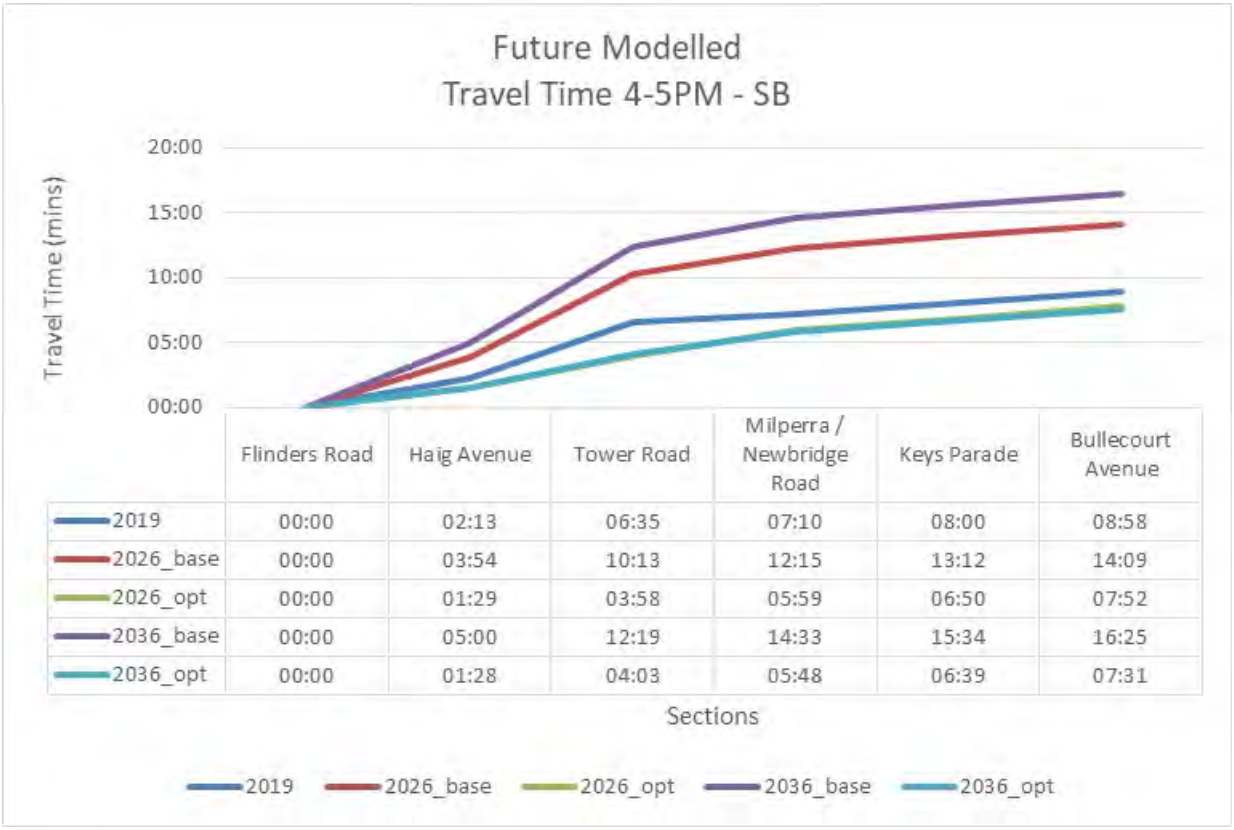
	Bullecourt Avenue	Keys Parade	Milperra / Newbridge Road	Tower Road	Haig Avenue	Flinders Road
2019	00:00	00:56	02:34	03:20	07:14	08:37
2026_base	00:00	05:25	10:38	11:33	16:18	17:39
2026_opt	00:00	02:32	07:31	09:29	14:38	15:59
2036_base	00:00	10:13	16:08	17:14	21:50	23:12
2036_opt	00:00	01:59	05:48	07:50	13:06	14:28



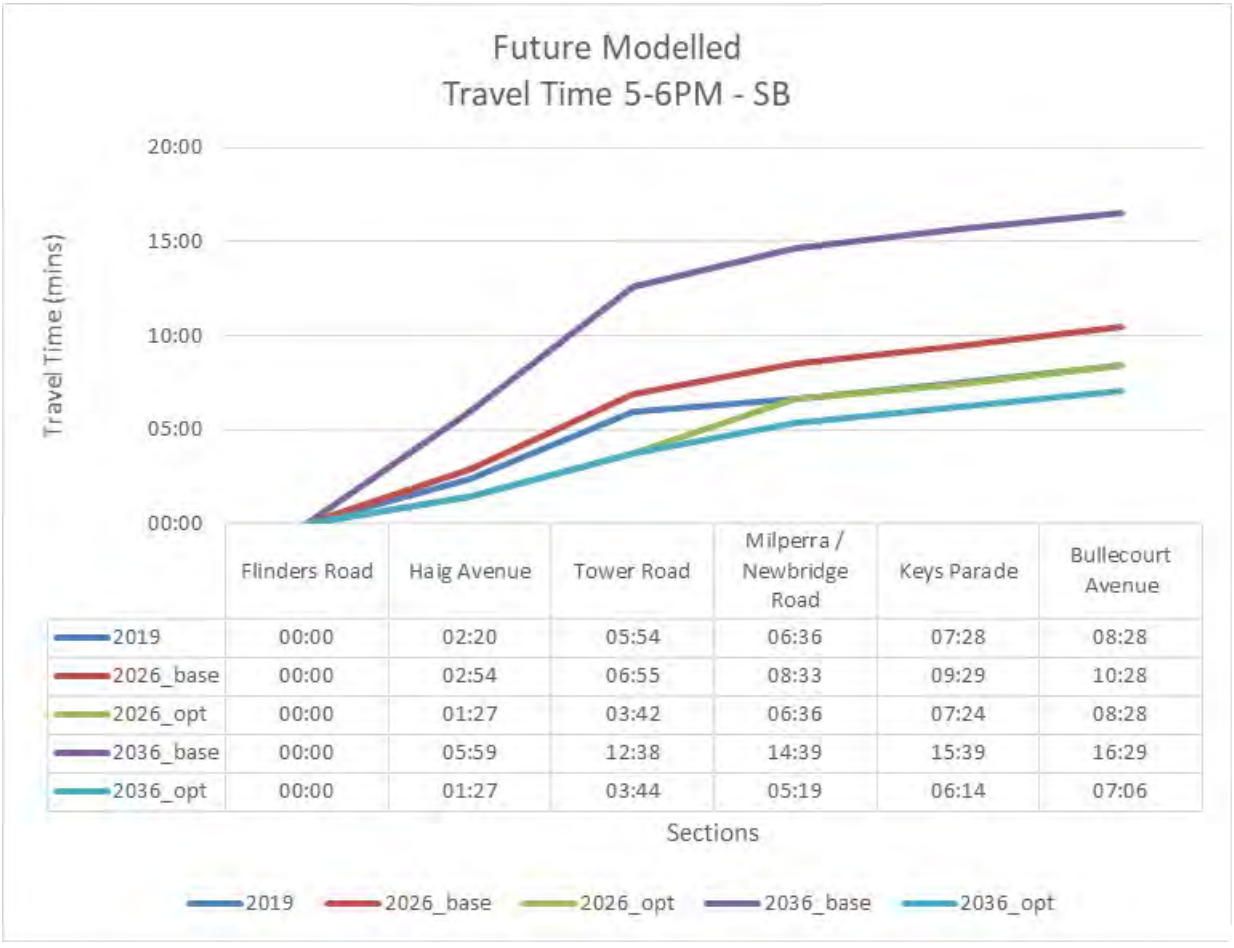
	Bullecourt Avenue	Keys Parade	Milperra / Newbridge Road	Tower Road	Haig Avenue	Flinders Road
2019	00:00	00:54	02:32	03:20	05:38	07:01
2026_base	00:00	04:22	09:06	10:02	14:16	15:38
2026_opt	00:00	01:03	03:13	05:19	10:22	11:44
2036_base	00:00	10:50	17:27	18:51	24:06	25:28
2036_opt	00:00	02:16	07:26	09:02	13:51	15:12


Future Modelled
Travel Time 7-8AM - SB
Travel Time (mins)
09:00
08:00
07:00
06:00
05:00
04:00
03:00
02:00
01:00
00:00
Flinders Road
Haig Avenue
Tower Road
Milperra / Newbridge Road
Keys Parade
Bullecourt Avenue
2019 00:00 01:36 03:40 04:31 05:11 06:06
2026_base 00:00 01:32 04:02 05:25 06:18 07:15
2026_opt 00:00 01:28 03:35 04:24 05:18 06:15
2036_base 00:00 01:50 05:31 06:41 07:34 08:24
2036_opt 00:00 01:28 03:35 04:26 05:20 06:11
Sections
2019
2026_base
2026_opt
2036_base
2036_opt


Future Modelled
Travel Time 8-9AM - SB
Travel Time (mins)
20:00
15:00
10:00
05:00
00:00
Flinders Road
Haig Avenue
Tower Road
Milperra / Newbridge Road
Keys Parade
Bullecourt Avenue
2019 00:00 01:54 04:01 04:46 05:33 06:29
2026_base 00:00 01:36 04:41 06:45 07:49 08:46
2026_opt 00:00 01:30 03:42 04:38 05:37 06:36
2036_base 00:00 05:03 12:03 14:44 15:47 16:36
2036_opt 00:00 01:31 03:47 04:48 05:49 06:41
Sections
2019
2026_base
2026_opt
2036_base
2036_opt



	Flinders Road	Haig Avenue	Tower Road	Milperra / Newbridge Road	Keys Parade	Bullecourt Avenue
2019	00:00	02:13	06:35	07:10	08:00	08:58
2026_base	00:00	03:54	10:13	12:15	13:12	14:09
2026_opt	00:00	01:29	03:58	05:59	06:50	07:52
2036_base	00:00	05:00	12:19	14:33	15:34	16:25
2036_opt	00:00	01:28	04:03	05:48	06:39	07:31



	Flinders Road	Haig Avenue	Tower Road	Milperra / Newbridge Road	Keys Parade	Bullecourt Avenue
2019	00:00	02:20	05:54	06:36	07:28	08:28
2026_base	00:00	02:54	06:55	08:33	09:29	10:28
2026_opt	00:00	01:27	03:42	06:36	07:24	08:28
2036_base	00:00	05:59	12:38	14:39	15:39	16:29
2036_opt	00:00	01:27	03:44	05:19	06:14	07:06