Appendix E

Traffic and transport impact assessment

Transport for NSW

Townson Road Upgrade between Richmond Road and Jersey Road – Stage 1

Traffic and transport impact assessment

December 2020

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Appendix A – STFM Modelling Plots (supplied by TfNSW)

Appendix B – Future land use and proposed development information (supplied by TfNSW)

1. Introduction

1.1 Overview

Transport for NSW (TfNSW) is proposing to construct a four-lane divided road along Townson Road/Burdekin Road corridor linking Richmond Road, Marsden Park in the west and Burdekin Road, Schofields in the east. The length of the overall program of work is about 3.6 kilometres.

The overall program of work consists of two stages:

- Stage 1 (the proposal) involves an upgrade of about 1.6 kilometres of road extending from Richmond Road to south of Jersey Road (see Figure 1-1).
- Stage 2 is about two kilometres in length involving the construction of a new road between the Stage 1 tie-in and Burdekin Road.

Stage 2 is subject to a separate planning approval.

Staged delivery of the proposal would involve:

- Interim phase – two lanes plus earthworks (see Figure 1-2)
- Ultimate phase – completion of remainder of the works for a four-lane dual carriageway.

The proposal is located within the Marsden Park Industrial and West Schofields precincts of the North West Growth Area, about 37 kilometres north-west of the Sydney central business district and three kilometres west of Schofields

TfNSW is the proponent of the proposal, and an environmental assessment in the form of a review of environmental factors (REF) is being prepared in accordance with the requirements of Division 5.1 of the *NSW Environmental Planning and Assessment Act 1979* (EP&A Act).

This report assesses and documents the potential Traffic and Transport impacts of the proposal.

1.2 Proposal outline

The key features of the proposal are shown in Figure 1-1 and include:

- Widening and upgrading about 1.6 kilometres of Townson Road, between Richmond Road and Durham Road/Jersey Road, to provide:
  - Two traffic lanes, about 3.5 metres wide in each direction
  - A new section of Townson Road about 250 metres long, to the east of the existing alignment, between Meadow Road and Durham Road/Jersey Road
  - A temporary connection road extending from the stub to Durham Road/Jersey Road to maintain access and connectivity until Stage 2 is operational
  - A new southbound slip lane at Richmond Road intersection from Townson Road
- Constructing two bridges, each about 36 metres long, to reduce flooding afflux with one bridge over Bells Creek and another bridge about 50 metres east of Bells Creek
- Providing two new signalised intersections allowing all turning movements to and from Townson Road/Victory Road/A New Road, and formalised pedestrian crossings at each leg of the signalised intersections
- Constructing stubs for Victory Road north and the new road to the north and south of the Townson Road intersection, with a traffic lane in each direction about 3.5 metres wide and a footway on either side, about 1.2 metres wide

- Providing a shared path about three metres wide for pedestrians and cyclists on the southern side of Townson Road along the length of the proposal, and a pedestrian crossing across the new southbound slip lane from Townson Road to Richmond Road
- Providing a footpath about 1.2 metres wide on the northern side of Townson Road along the length of the proposal and at the intersections.

This interim phase allows the surrounding developments to progress and allows utilities to be relocated to their ultimate location. It is anticipated that construction of the interim phase would commence in early 2022 and would be open to traffic in 2023. Completion of the ultimate phase of the proposal would take place around five years after completion of the interim phase.

1.3 Scope of this assessment

The purpose of this report is to document the results of the assessment of the potential traffic and transport impacts of the operation and construction of the proposal. This report supports the REF for the proposal. The scope of assessment included:

- Review of the current situation and forecast land use changes in the NWGA as envisaged in the North West Growth Centre Structure Plan
- Develop suitable traffic models to assess the proposal under future network conditions assuming the connection of Townson Road to Burdekin Road in 2026 and 2036
- Use the microscopic traffic model and intersection model to inform the concept and detailed road design for the proposal
- Determine key infrastructure requirements for vehicles, public and active transport.

GHD's traffic modelling methodology was agreed with TfNSW in August 2019, that a microscopic model of the Townson Road and Burdekin Road corridor should be developed in AIMSUN, capturing the future land uses directly served by this corridor. The primary function of this microscopic model is to test the intersection layouts and lane configurations that form part of proposal only.

The ultimate phase of the proposal

The principle of the design requires the proposed intersections in the proposal corridor to accommodate the future traffic growth when the connection to Burdekin Road is implemented (completion of Stage 2), forming an east-west corridor south of Schofields Road.

Therefore, the traffic modelling assessment has been undertaken to account for the impact of the completion of both the proposal and Stage 2 of the project, as a worst-case option from a traffic growth perspective.

The interim phase of the proposal

proposal was also assessed to account for the interim phase 2-lane Townson Road and localised land use associated with property accesses.

Only the intersections that form part of the proposal will be discussed in this report.

- Identification of the existing traffic impacts in the proposal area
- Assess the potential operational traffic impacts of the proposal including approved project opening and 10 years after opening
- Assess the potential construction traffic impacts of the proposal based on the approved project description

- Determine suitable mitigation measures in order to meet a satisfactory level of service criteria
- Prepare a report summarising the findings of the study.

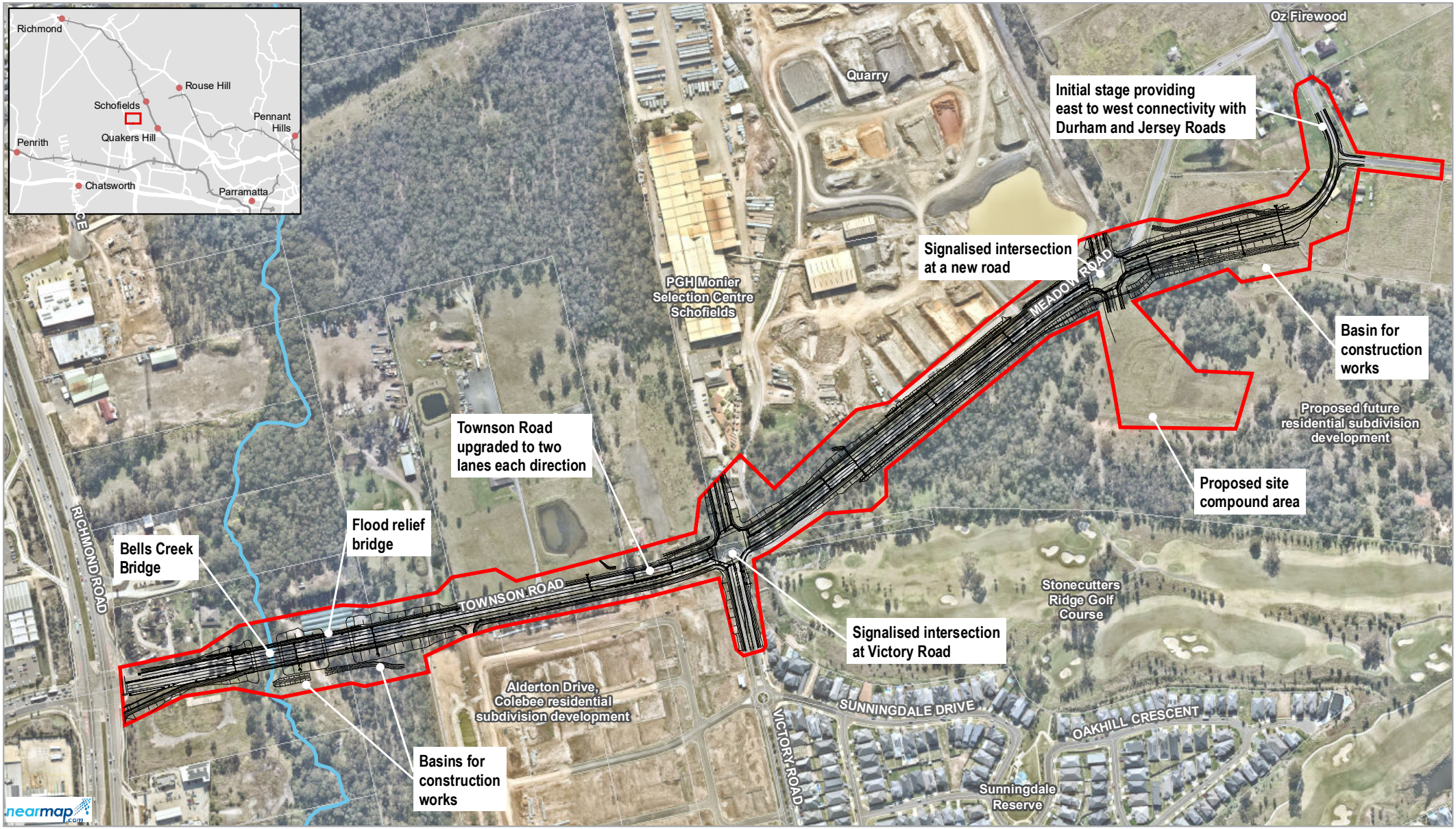
1.4 Report structure

This report is structured into the following sections:

- **Section 2 – Methodology,** discusses the steps and methods undertaken to assess the existing and future traffic and transport conditions of the proposal.
- **Section 3 – Existing traffic condition**, supplemented by the microsimulation traffic model results documented in the *Townson Road and Burdekin Road Design and EA Base Traffic Model Report* (GHD, November 2019). Hereafter this is referred to be *Existing Condition Report*.
- **Section 4 – Operational traffic impact assessment** discusses the operation of future traffic growth within the study area, according to the Sydney Traffic Forecasting Model (STFM) and outputs provided by TfNSW for horizon years 2026 and 2036 on:
  - Conceptual design layout and the proposed improvement to the road network and intersection layouts of the interim and ultimate phase of the proposal
- **Section 5 – Construction traffic impact assessment** discusses the construction traffic and transport impacts of the proposal on the surrounding road network.
- **Section 6 – Cumulative impacts:** discusses the operational impacts of the proposal and results of the traffic and transport assessment.
- **Section 7 – Mitigation and management measures:** provides recommendations of proposed mitigation options for the construction and operational impacts of the proposal.
- **Section 8 – Conclusion and recommendations:** presents a summary of the traffic and transport assessment findings and sets out the principal conclusions for the study.

1.5 Scope and limitations

All source data employed in the preparation of the traffic and transport assessment has been diligently collated and checked by GHD. However, given that Townson Road will be a new road link in the future, a number of unknowns arise from the level of traffic growth predicted by the STFM model. The magnitude of future traffic volumes generated by the STFM model has been relied on to inform the analysis.



LEGEND

The proposal *Subject to detailed design

Construction

Cadastre

Paper Size ISO A4

0 25 50 75 100

Metres

N

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

GHD

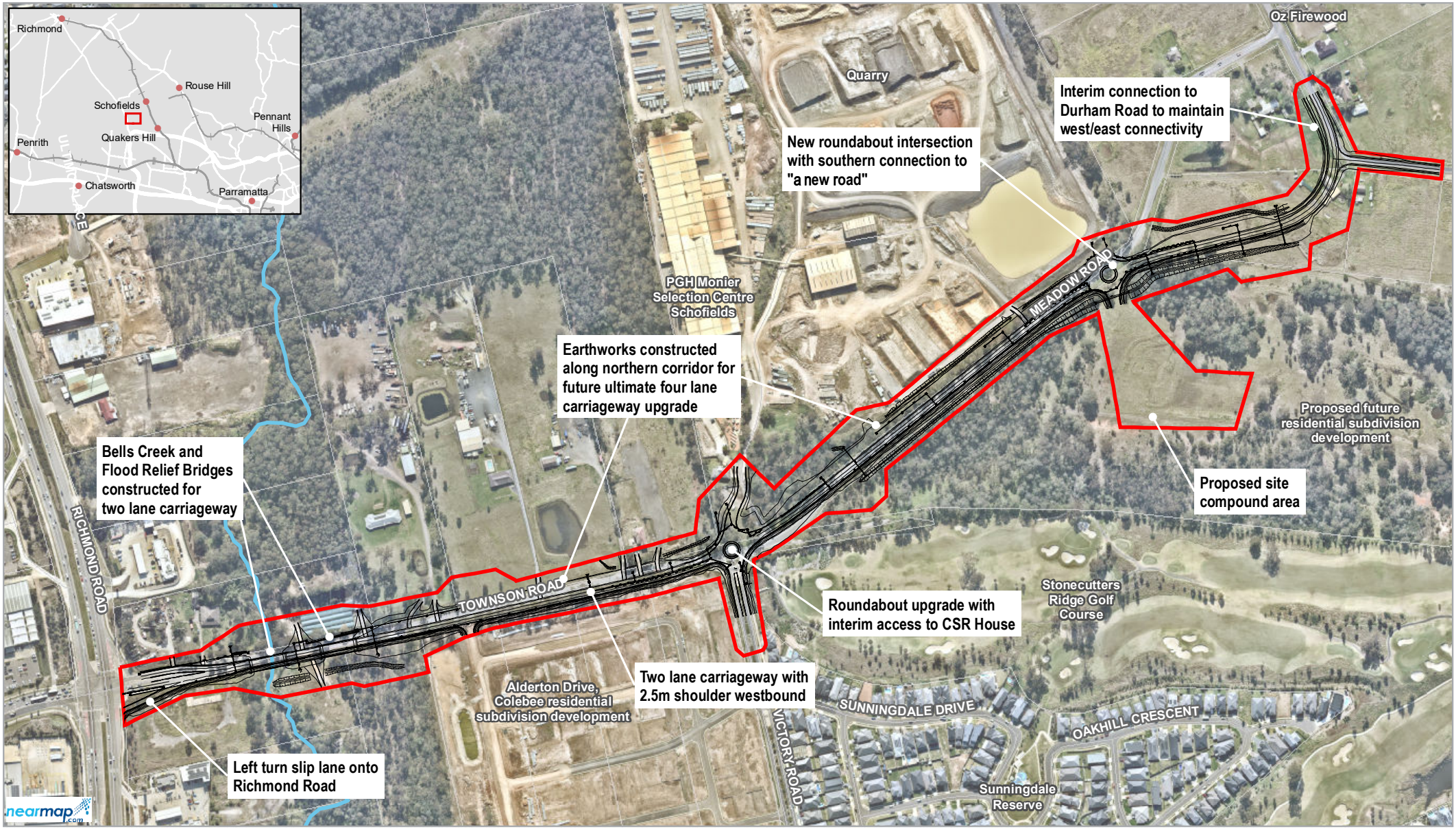
Transport for NSW
Townson Road Upgrade Stage 1
Between Richmond Road and Jersey Road

The Ultimate Phase of the Proposal

Project No. **21-12511195**
Revision No. **-**
Date **6/11/2020**

FIGURE 1-1

Data source: Aerial Imagery - Nearmap 2019 (image date 12/09/2019, image extracted 21/09/2019) and NSW Six Maps, 2019 . Created by: eibbertson



LEGEND

- The proposal **Subject to detailed design*
- Construction footprint
- Cadastre

Paper Size ISO A4

0 25 50 75 100

Metres

N

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

GHD

Transport for NSW
Townson Road Upgrade Stage 1
Between Richmond Road and Jersey Road

Interim phase of the proposal

Project No. **21-12511195**
Revision No. **-**
Date **4/12/2020**

FIGURE 1-2

Data source: Aerial Imagery - Nearmap 2020 (image date 03/08/2020, image extracted 28/09/2020) and NSW Six Maps, 2020 . Created by: eibbertson

2. Methodology

Review and summarise the existing conditions

- This includes operations of major intersections that are assumed to be subject to traffic during construction and operation. The study area for the assessment includes all local and state roads that would be affected by the proposal. These include Richmond Road, Victory Road, Meadow Road and Durham Road which act as road links that provide access/egress to local roads adjacent to the proposal.
- The purpose of the existing conditions assessment is to document the current operations within the study area as a point of reference for comparison to the construction and operational stages. Information gathered for the assessment includes:
  - Existing traffic turn counts for major intersections along the Townson Road corridor
  - Crash history on the proposed routes within proximity of the proposal
  - Existing public transport services in the study area (bus and train services).
- A base year traffic model has been developed that represents the AM and PM peak periods for a standard school term weekday. A base microsimulation traffic modelling using AIMSUN has been undertaken.
- Similar to our approach for recent TfNSW studies, the models have been developed to represent a two-hour peak centred in both the AM and PM peak periods. The signal timings are based on fix time setting using trial and error method to optimise delay and queueing. The models have been calibrated against the Roads and Maritime Traffic Modelling Guidelines (2013).
- This report contains the Base Model Development Report that describes, in detail and according to the Roads and Maritime Traffic Modelling Guidelines (2013), the traffic calibration and validation process and results for the 2019 traffic model. The report documents the existing traffic operations within the study area, provides a network wide line diagram showing turning movement volumes for each of the AM and PM peak hour periods and lists all agreed assumptions.
- See section 3 for existing traffic and transport conditions.

Carry out a construction traffic impact assessment as follows:

- Desktop review of proposed construction routes for suitability for use by construction vehicles
- Estimate peak hour construction traffic generated by the proposal based on the number of workers and on information provided by TfNSW
- Assess impacts on vulnerable transport users due to construction based on a desktop review
- Assess likely impacts on road performance as a result of the peak construction activities
- See section 6 of this report.

Carry out an operational traffic impact assessment:

- Roads and Maritime Services have developed the Strategic Transport Forecast Model (STFM), using the EMME software platform. This model encompasses the whole of the Greater Metropolitan Area and forecasts traffic volumes into the future at 5-year increments. The model produces results at a strategic level only, so information from the strategic model will be used to feed into microsimulation modelling to investigate the detailed traffic impact.
- The microsimulation modelling will cover the scope identified as high-level project influence area as shown below in Figure 2-1.

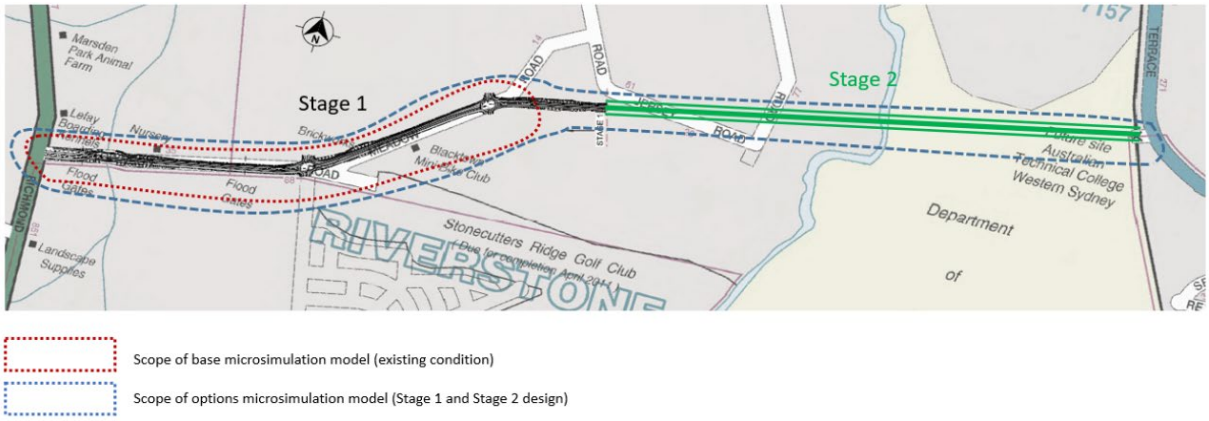


Figure 2-1 Scope for microsimulation model

- Following the review by TfNSW on the base model, a future year demand estimation has been carried out based upon:
  - Traffic forecast and project lists from the latest STFM model
  - Approved traffic generating developments within the study area.
- An assessment has been carried out on the proposed Townson Road conceptual design for both the interim and ultimate phases of the proposal for future traffic options in 2026 and 2036.
- For the interim phase, the future traffic options do not consider the completion of Stage 2 of the design, which assumes future traffic growth associated with the connection of Townson Road to Burdekin Road and the proposed developments east of New Road. From this assessment the average delay and overall level of service at each intersection along the proposal corridor has been determined.
- For the ultimate phase, the future traffic options have considered the completion of Stage 2 such that the future traffic growth associated with the connection of Townson Road to Burdekin Road can be assessed.
- The initial assessment on the conceptual design highlights areas of capacity constraint (if any). For locations on the corridor with capacity constraint, potential for road and intersection improvements are investigated and recommended based on the traffic assessment in this report.
- An unconstrained case has also been modelled which assumes that Richmond Road has been upgraded to six lanes (from the existing four lanes). The unconstrained case has the potential to allow more traffic from Richmond Road to travel through the Townson Road corridor during peak periods. This option tests the worst case traffic that could be expected in the study area.
- See section 5 for the operational traffic impact assessment.

3. Existing road and traffic conditions

This chapter outlines the existing traffic and transport environment within the proposal area. The data presented in this chapter represents the base or existing conditions and is based on information that was specifically sourced for the proposal.

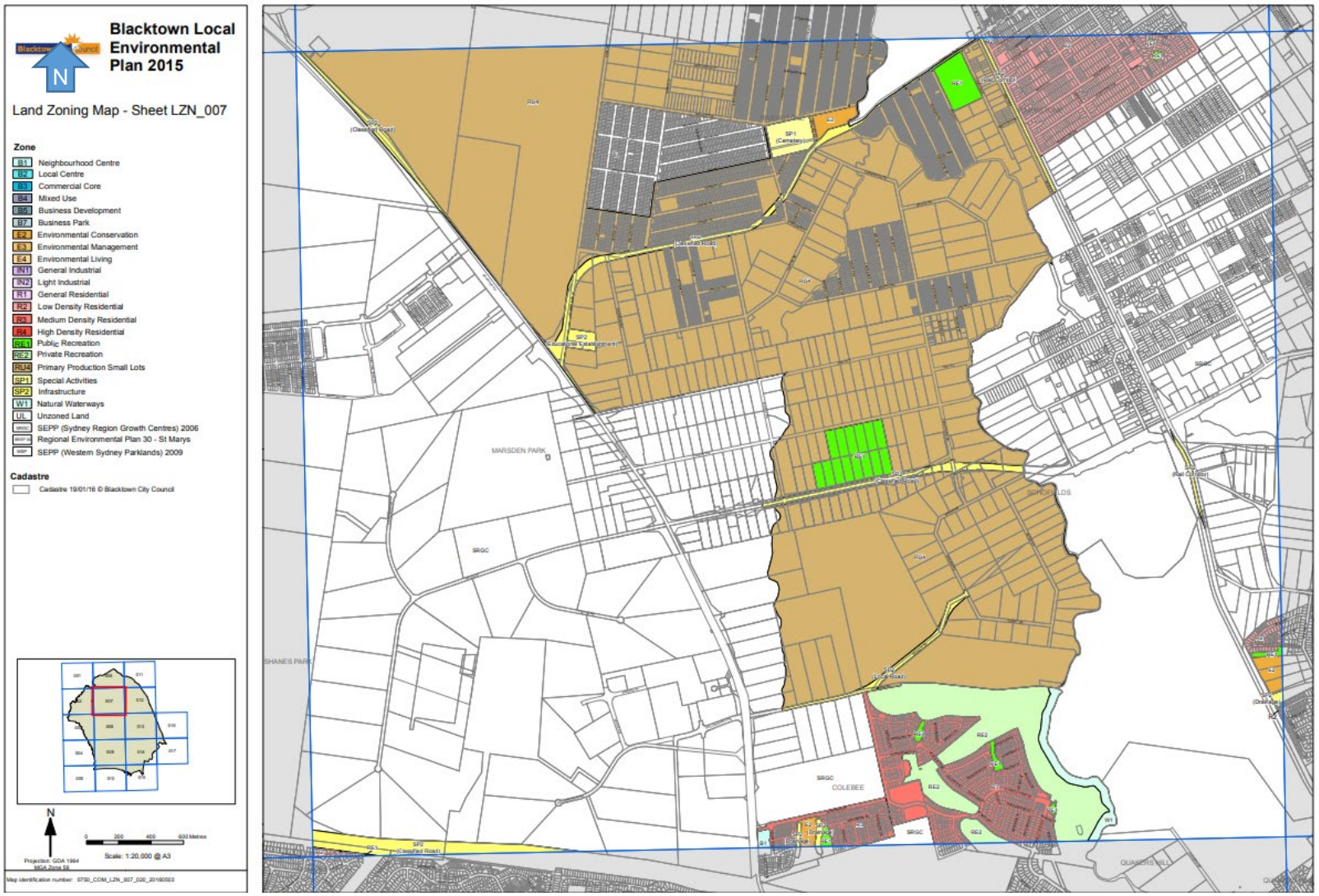
3.1 Existing land uses

The land uses in the vicinity of the subject corridor will influence the type and volume of traffic that access the corridor. The general land zoning within the study area is provided within the *Blacktown Local Environment Plan (LEP) 2015*.

Key features of land use surrounding the proposal include:

- To the north-west of the Townson Road to Burdekin Road corridor, the land is zoned as Primary Production (RU4)
- Towards the south, the land is zoned as medium density residential (R3) and private recreation (RE2)
- The area south of Burdekin Road is zoned as Low Density Residential (R2), Environmental Conservation (E2) and Public Recreation (RE1).

An extract of the land zoning map for areas within the vicinity of the proposal is shown in Figure 3-1.



Source: Blacktown Local Environmental Plan 2015

Figure 3-1 Land zoning within the Townson Road to Burdekin Road Corridor

3.2 Existing road network characteristics

This section provides an understanding of the existing road network surrounding the proposal.

3.2.1 Road hierarchy

Roads within NSW are categorised in the following two ways:

- By Classification (ownership)
- By the function that they perform.

3.2.1.1 Road classification

Roads are classified (as defined by the *Roads Act 1993*) based on their importance to the movement of people and goods within NSW (as a primary means of communication).

The classification of a road allows TfNSW to exercise authority of all or part of the road. Classified roads include Main Roads, State Highways, Tourist Roads, Secondary Roads, Tollways, Freeways and Transitways.

For management purposes, TfNSW has three administrative classes of roads. These are:

- **State roads** – Major arterial links through NSW and within major urban areas. They are the principle traffic carrying roads and fully controlled by TfNSW with maintenance fully funded by TfNSW. State Roads include all Tollways, Freeways and Transitways; and all or part of a Main Road, Tourist Road or State Highway.
- **Regional roads** – Roads of secondary importance between State Roads and Local Roads which, with State Roads provide the main connections to and between smaller towns and perform a sub arterial function in major urban areas. Regional roads are the responsibility of councils for maintenance funding, though TfNSW funds some maintenance based on traffic and infrastructure. Traffic management on Regional Roads is controlled under the delegations to local government from TfNSW. Regional Roads may own all or part of a Main Road, Secondary Road, Tourist Road or State Highway; or other roads as determined by TfNSW.
- **Local roads** – The remainder of the council controlled roads. Local Roads are the responsibility of councils for maintenance funding. TfNSW may fund some maintenance and improvements based on specific programs (eg urban bus routes, road safety programs). Traffic management on Local Roads is controlled under the delegations to local government from TfNSW.

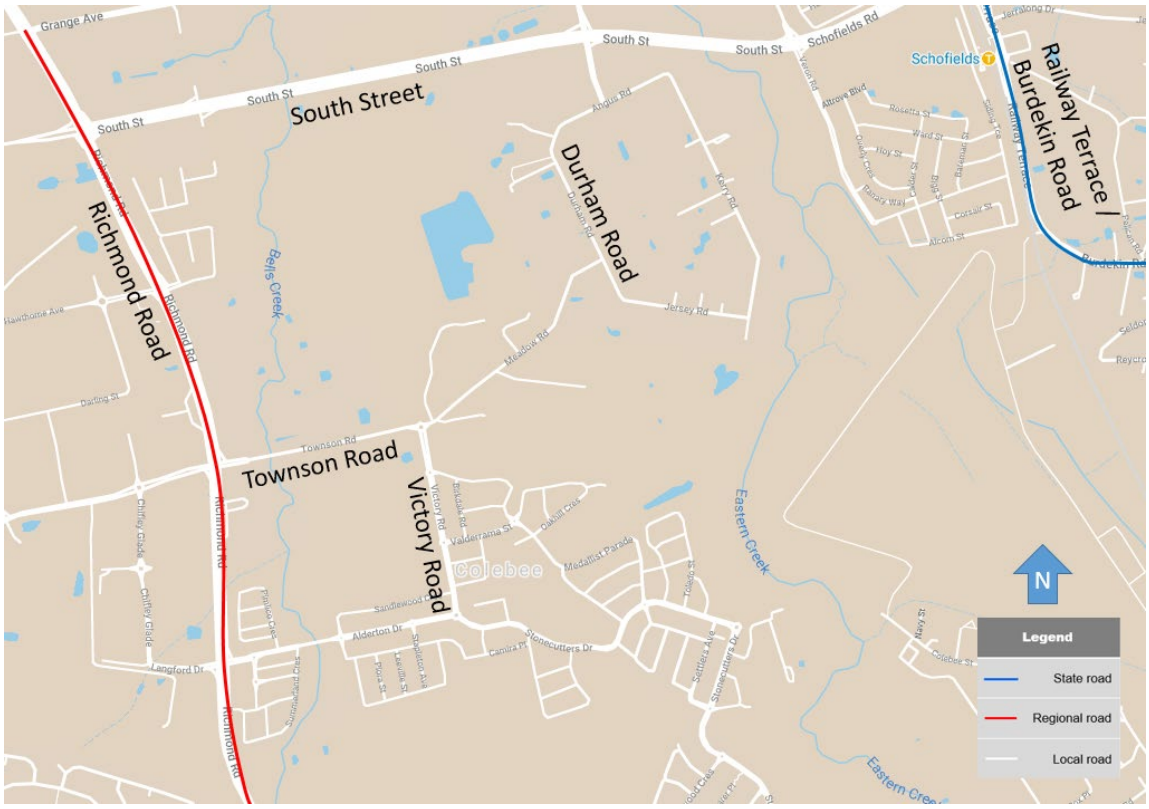
Functional hierarchy

Functional road classification involves the relative balance of the mobility and access functions. TfNSW define four levels in a typical functional road hierarchy, ranking from high mobility and low accessibility, to high accessibility and low mobility. These road classes are:

- **Arterial roads** – generally controlled by TfNSW, typically no limit in flow and designed to carry vehicles long distance between regional centres.
- **Sub-arterial roads** – can be managed by either TfNSW or local council. Typically, their operating capacity ranges between 10,000 and 20,000 vehicles per day, and their aim is to carry through traffic between specific areas in a sub-region, or provide connectivity from arterial road routes (regional links).

- **Collector roads** – provide connectivity between local roads and the arterial road network and typically carry between 2,000 and 10,000 vehicles per day.
- **Local roads** – provide direct access to properties and the collector road system and typically carry between 500 and 4,000 vehicles per day.

The surrounding road network is shown in Figure 3-2.



Source: TfNSW State and Regional Roads

Figure 3-2 Surrounding road network

3.2.2 Route description

Townson Road functions as a local road and is located between Richmond Road and Victory Road. Townson Road has the following key features as outlined in Table 3-1 and Figure 3-3.

Table 3-1 Townson Road key features

Feature	Description
Carriageway	Undivided carriageway with one lane in each direction. Line marking is only available on the approaches to the intersections.
Parking	Restricted parking on either side of the road
Speed Limit	60 km/h
Pedestrian Facilities	No dedicated pedestrian facilities
Bicycle Facilities	No dedicated bicycle facilities
Public Transport	No dedicated public transport facilities

Source: Google Maps

Figure 3-3 Townson Road viewed east

3.2.3 Speed limits

The signposted speed environments of the key roads of the surrounding road network are illustrated in Figure 3-4.

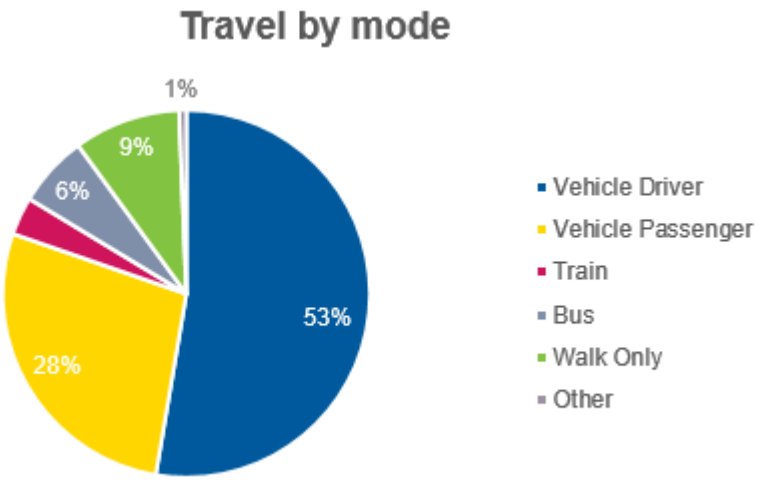
Source: Google Maps – modified by GHD

Figure 3-4 Signposted speed limits

3.2.4 Travel modes

Mode of travel

In the Blacktown – North SA3 region, a total of 397,968 trips were made according to census data for 2017/2018. This equated to 3,952,652 kilometres travelled in total. Of these, 53 percent of the trips were made by private vehicle as a driver. This is followed by travelling in a vehicle as a passenger (28 percent). The next most common mode was by walking, which made up 9 percent of the total trips. The modal splits for the Blacktown – North SA3 region are shown Figure 3-5.

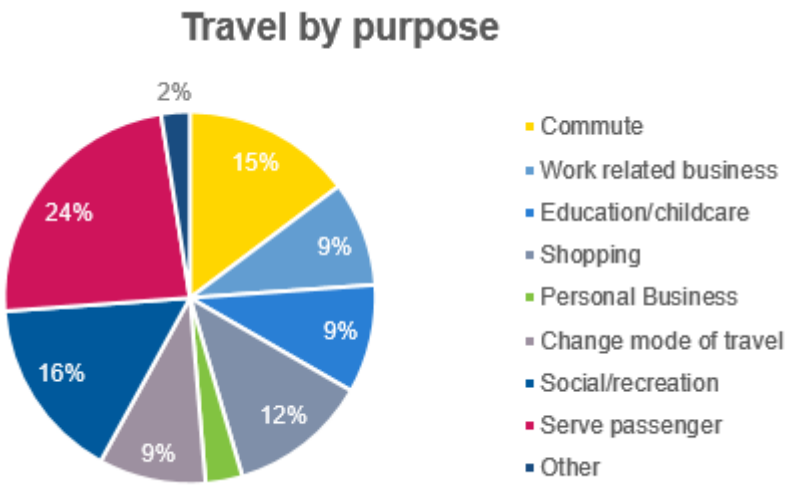


Source: Household Travel Survey (HTS)

Figure 3-5 Modal split (2017/18)

Purpose of travel

The proportion of trips made in the Blacktown – North SA3 region is shown in Figure 3-6. The greatest proportion of trips is by passengers, which makes up 24 percent of the total. This is followed by social/recreation purposes at 16 percent of the total trips. Work and educational trips both constituted nine percent of the total trips.



Source: Household Travel Survey (HTS)

Figure 3-6 Travel by purpose split (2017/18)

3.2.5 Public and active transport

Accessibility to public transport is important for reducing the reliance on private vehicles. For new developments, a walkable distance of 400 metres to 800 metres to public transport is recommended or a 1.5 kilometre bicycle riding distance to encourage public transport use (NSW Planning, 2004).

Details of the accessibility to public transport, walking and bicycle riding is provided in the following sub-sections.

Bus services

A bus interchange is located outside of Schofields Station. The bus services accessing this interchange, their associated coverage and the number of services per day are outlined in Table 3-2.

Note that bus route 742 is the main service that operates along Townson Road.

Table 3-2 Bus services at Schofield Station

Route	Coverage	Frequency
734	Riverstone to Blacktown via Schofields	**Weekday** 37 services **Weekend** 17 services
	Blacktown to Riverstone via Schofields	**Weekday** 37 services **Weekend** 17 services
751	Blacktown to Rouse Hill Town Centre	**Weekday** 39 services **Weekend** 16 services
	Rouse Hill Town Centre to Blacktown	**Weekday** 47 services **Weekend** 27 services
742	Marsden Park to Rouse Hill	**Weekday** 15 **Weekend** 6
	Rouse Hill to Marsden Park	**Weekday** 15 **Weekend** 6
N71	Richmond to City Town Hall	**Weekday 5** services **Weekend 5** services
	City Town Hall to Richmond	**Weekday 5** services **Weekend 5** services

Source: TfNSW

Rail services

Schofields Station and Quakers Hill Station are the two railway stations which are closest to the Townson Road to Burdekin Road Corridor.

The stations are serviced by the T1 Western Line and the T5 Cumberland Line, providing trains to the City and Leppington respectively, via Blacktown and Parramatta.

Schofields Station also features a bus interchange on the eastern side, allowing passengers to change between local bus routes and train services.

Cycling

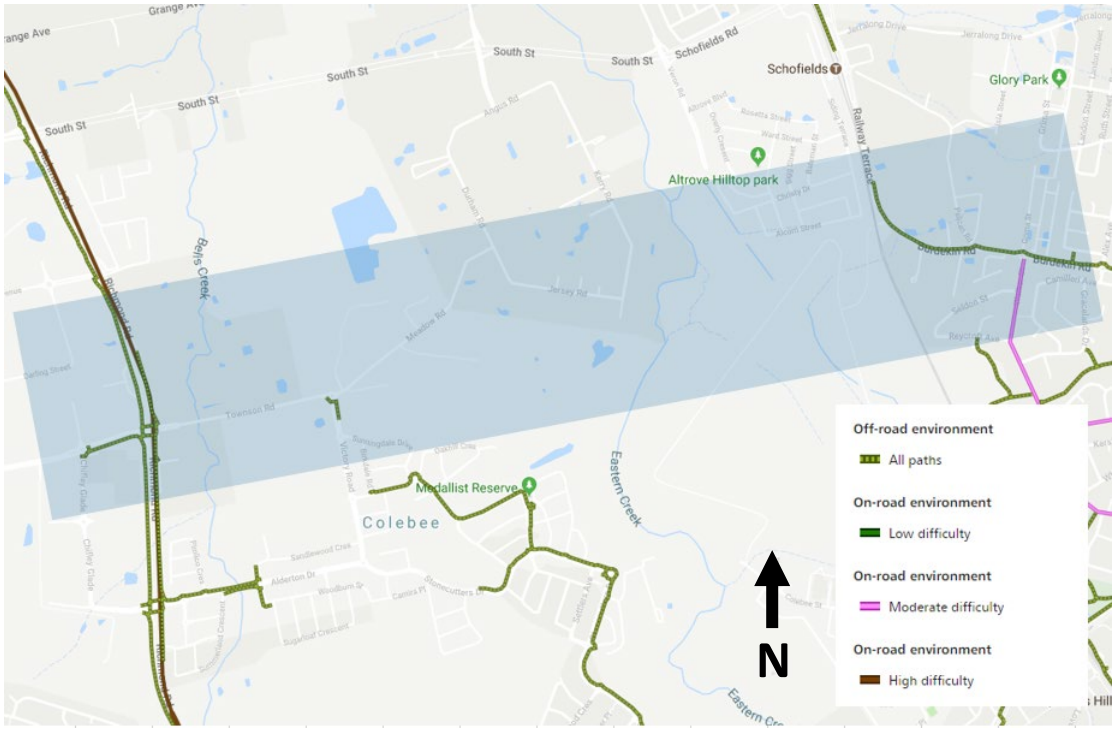
TfNSW Cycleway Finder has been used to identify the bicycle paths in the vicinity of the proposal, as shown in Figure 3-7.

The figure indicates that along Townson Road there are no existing cycle track provisions. There is one section however, which is located at the Townson Road/Victory Road roundabout south approach that provides a cycle crossing and connects to an off-road shared path. This shared path continues for approximately 75 metres along the eastern side of Victory Road, where it terminates.

Along Richmond Road, off-road shared paths are available on both sides of the road. These shared paths are connected by signalised cycle lantern crossings at the intersection of Townson Road/Richmond Road/Hollinsworth Road on all four approaches.

Towards the east of the proposal, an off-road shared path is available on the northern side of Burdekin Road. The shared path begins at the end of Railway Terrace to the south of Schofields Station and continues for the length of Burdekin Road.

A bicycle rack is provided on the western side of Schofields Station.



Source: TfNSW Cycleway Finder

Figure 3-7 Existing cycle routes

Walking

There are no provisions for pedestrian infrastructure along Townson Road. However, a pedestrian footpath is provided at the Townson Road/Victory Road roundabout southern approach. This footpath extends along the length of Victory Road on the western side.

Towards the east of the study area, pedestrian infrastructure in the form of the shared path is provided on the northern side of Burdekin Road.

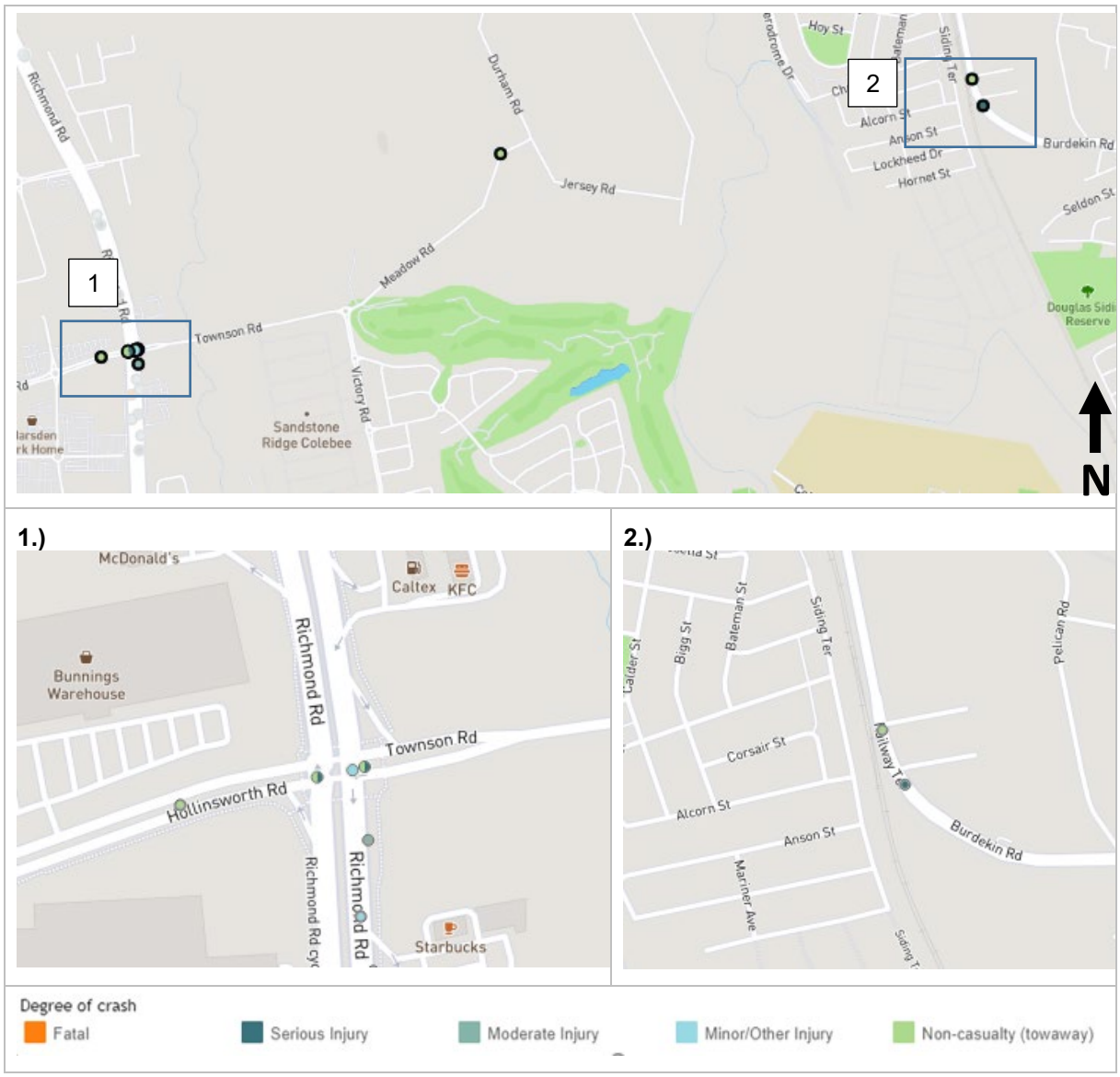
3.2.6 Crash analysis

A review of crash data in proximity to the proposal from the *Transport for NSW Centre for Road Safety* website has been undertaken for a five-year period (2013 - 2017).

A summary of the five-year crash data resulting in injuries is summarised in Table 3-3, with the crash locations shown in Figure 3-8.

A total of 11 crashes were recorded:

- Three resulted in serious injuries
- Three resulted in minor/moderate injuries
- Five were “non-injury” crashes
- No fatalities occurred.



Source: Transport for NSW Centre for Road Safety website (modified by GHD)

Figure 3-8 Crash map (2014 – 2018)

Table 3-3 Crash summary

Location	Number of injuries			
	Fatal	Serious	Moderate/ Minor	No injury
Townson Road to Burdekin Road	0	4	3	6
Predominate Crash Type	RUM Code	Number of Crashes		
Cross traffic	10	1		
Head on	20	2		
Object on road	66	1		
Off road left into object	71	2		
Off road to right	72	1		
Other same direction	39	1		
Right rear	32	2		
Struck animal	67	1		
	TOTAL	**11**		

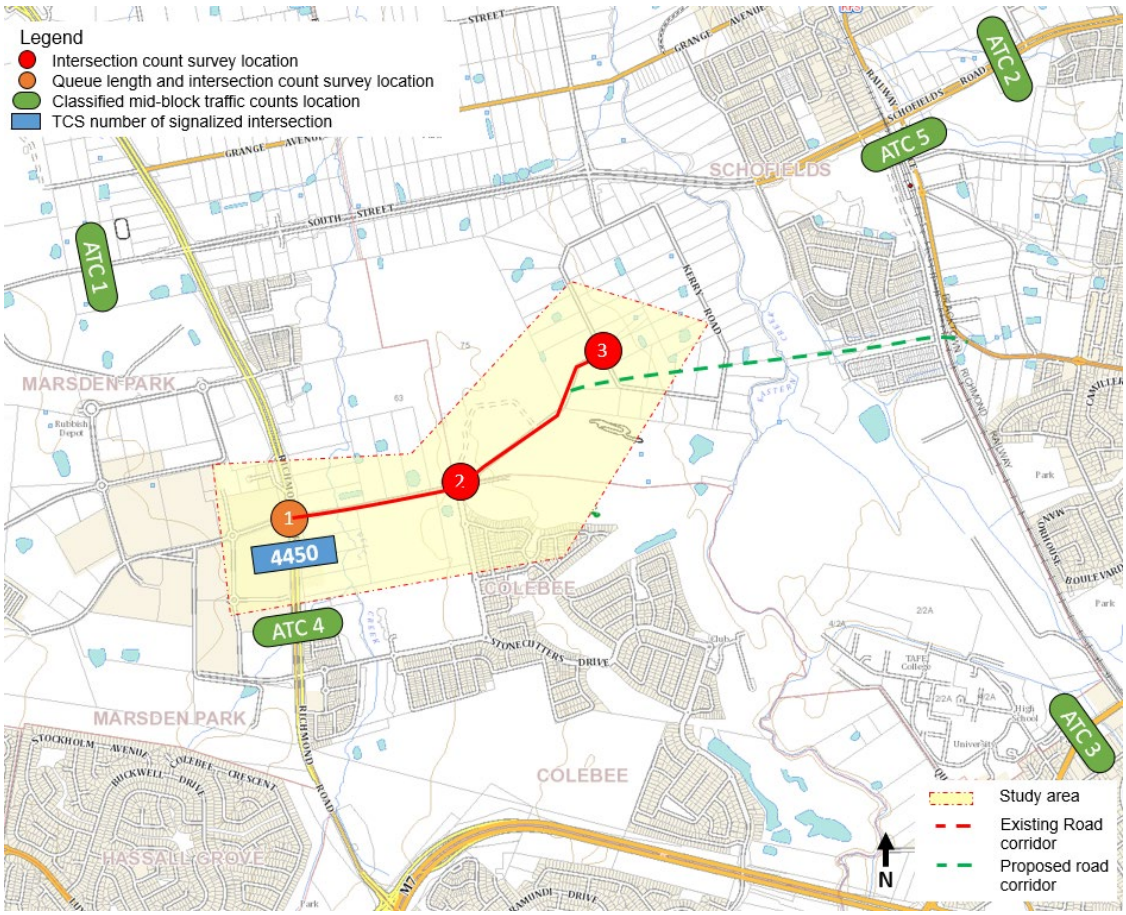
3.3 Existing traffic volumes

3.3.1 Data collection

Traffic data collection was conducted by Matrix and Transport Data (Matrix) on Tuesday 3 September 2019. The surveys included:

- Classified Intersection counts – three locations
- Queue length surveys – one location
- Seven days classified mid-block traffic counts – five locations
- Travel time surveys – two routes.

Survey locations are shown in Figure 3-9.



Source: Matrix

Figure 3-9 Traffic data collection locations

A summary of the traffic counts is provided in the traffic movements diagrams in *Existing Condition Report (GHD. 2019).*

3.3.2 Classified intersection counts

Turning movement surveys were undertaken at the following three (3) intersections:

1. Richmond Road and Townson Road
2. Townson Road and Victory Road
3. Meadow Road and Durham Road.

The surveys captured light vehicles, heavy vehicles and pedestrian activity. The surveys were undertaken in 15-minute increments on a weekday between the following times in order to identify the peak periods:

- 6 am – 9 am
- 3 pm – 6 pm.

The network AM peak hour was identified as 7.15 am to 8.15 am and the PM peak hour was identified as 4.45 pm to 5.45 pm. Peak hour volumes for each intersection are shown in Figure 3-10 and Figure 3-11.

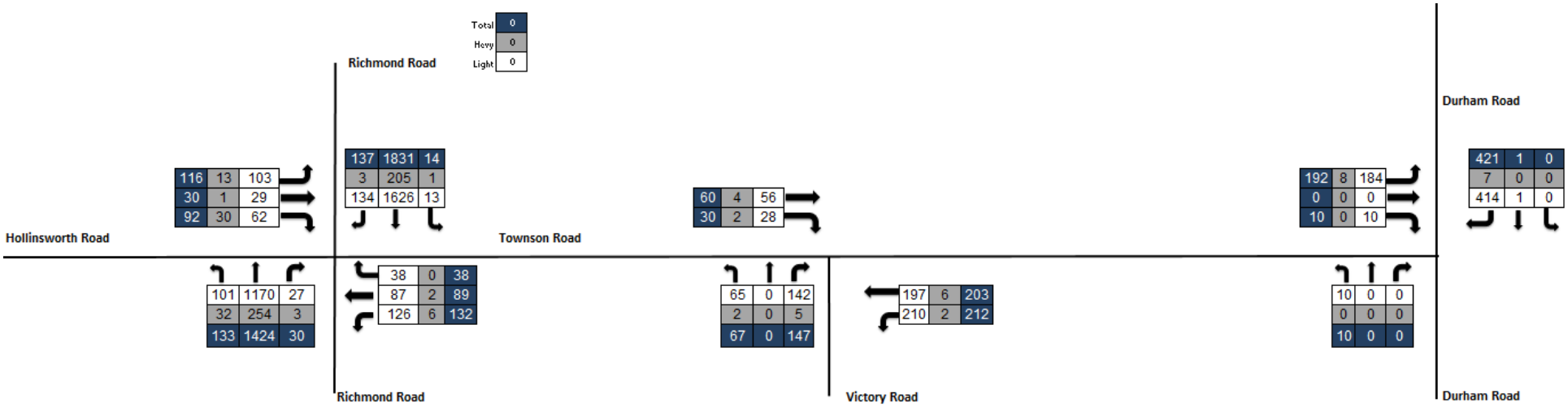


Figure 3-10 AM peak hour 7.15 – 8.15

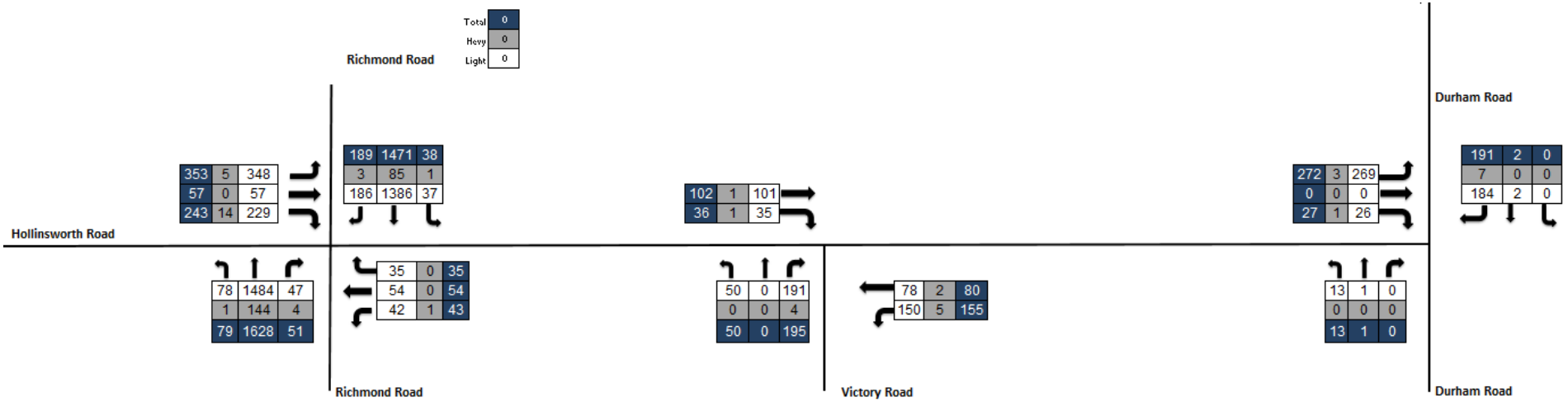


Figure 3-11 PM peak hour 4.45 to 5.45

3.3.3 Queue length surveys

Queue length surveys were undertaken on at the Richmond Road and Townson Road intersection between 7 am - 9 am and 3 pm - 6 pm.

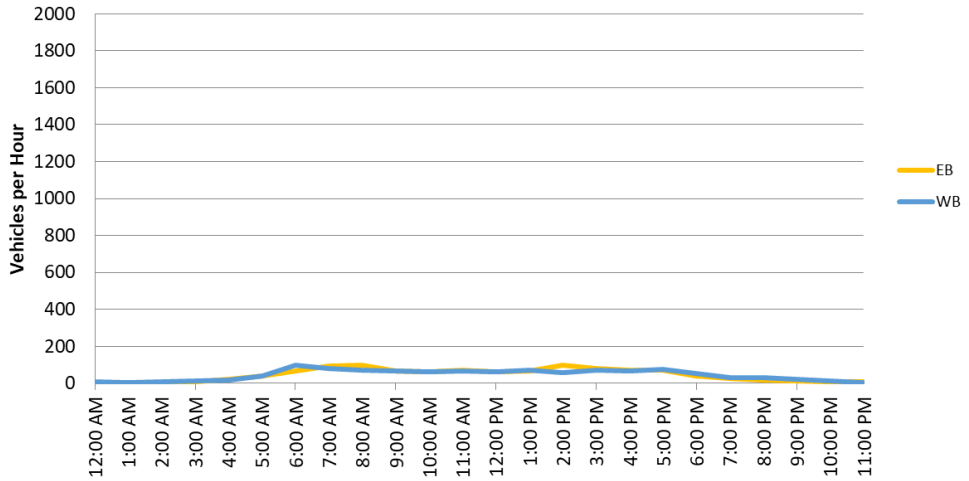
A summary of the traffic queue length surveys are provided in *Existing Condition Report (GHD. 2019).*

3.3.4 Midblock traffic counts

Seven-day automatic tube traffic counts (ATC) were undertaken at the following locations between Wednesday 4 September 2019 and Tuesday 10 September 2019, for 7 days and 24 hours per day:

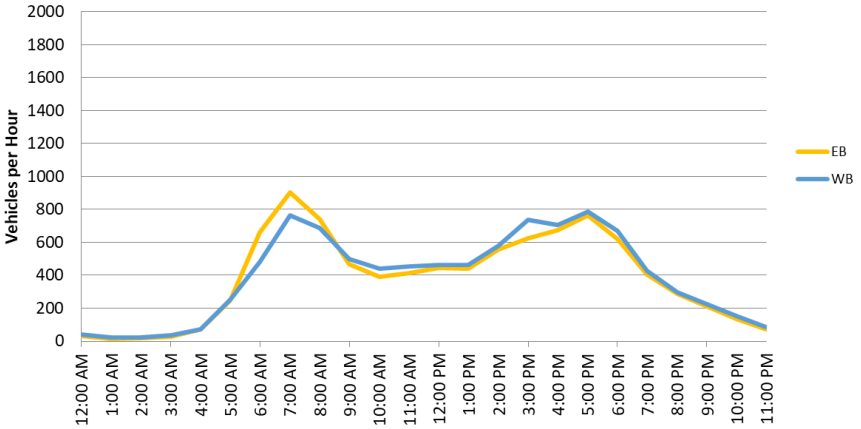
- ATC 1 – South Street between Richmond Road and Fulton Road
- ATC 2 – Schofields Road between Railway Terrace and Junction Road
- ATC 3 – Quakers Hill Parkway between Eastern Road and Nirimba Drive
- ATC 4 –Richmond Road between Alderton Drive and Hollinsworth Road
- ATC 5 – Railway Terrace between Jerralong Drive and Woolworths Schofields Access.

The midblock traffic volumes are summarised in Figure 3-12 to Figure 3-16.



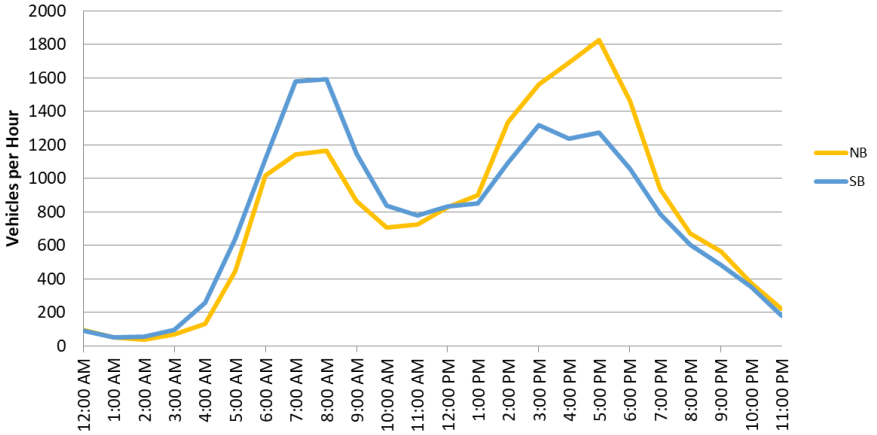
Source: Matrix

Figure 3-12 Weekday average traffic profile at South Street (between Richmond Road and Fulton Road)



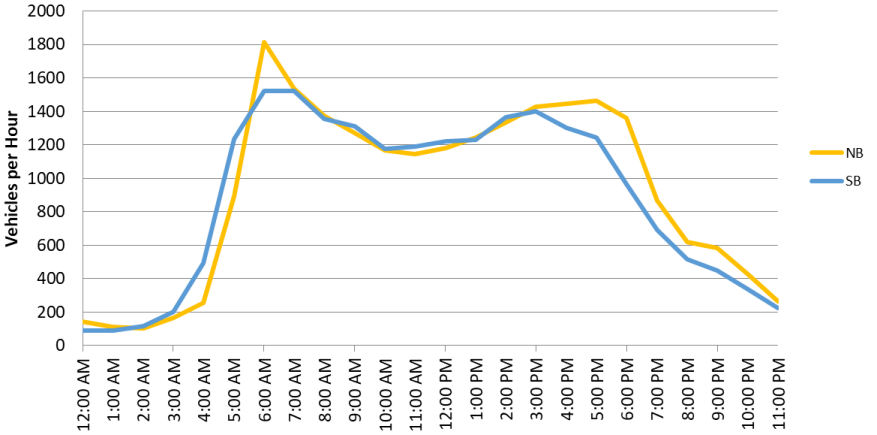
Source: Matrix

Figure 3-13 Weekday average traffic profile at Schofields Road (between Railway Terrace and Junction Road)



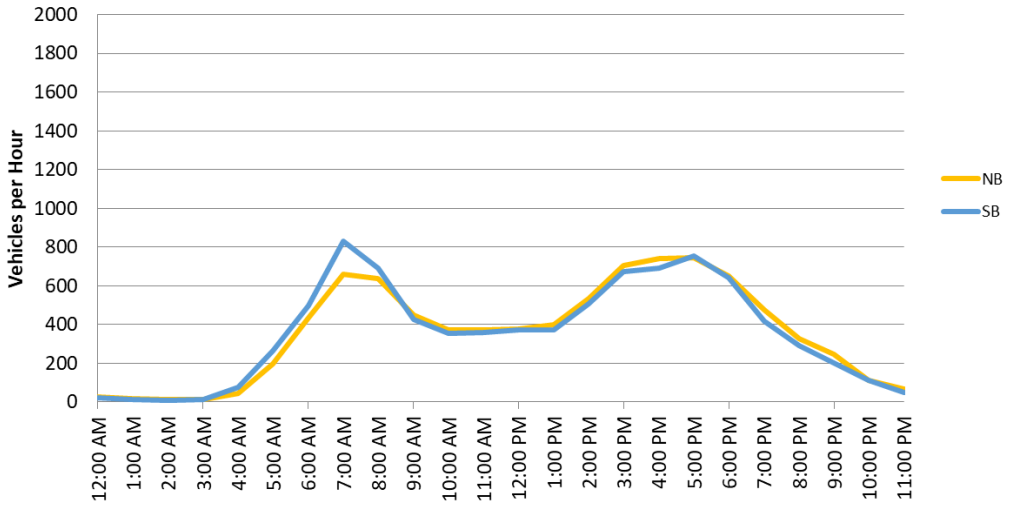
Source: Matrix

Figure 3-14 Weekday average traffic profile at Quakers Hill Parkway (between Eastern Road and Nirimba Drive)



Source: Matrix

Figure 3-15 Weekday average traffic profile at Richmond Road (between Alderton Drive and Hollinsworth Road)



Source: Matrix

Figure 3-16 Weekday average traffic profile at Railway Terrace (between Jerralong Drive and Woolworths Schofields Access)

The data indicates that:

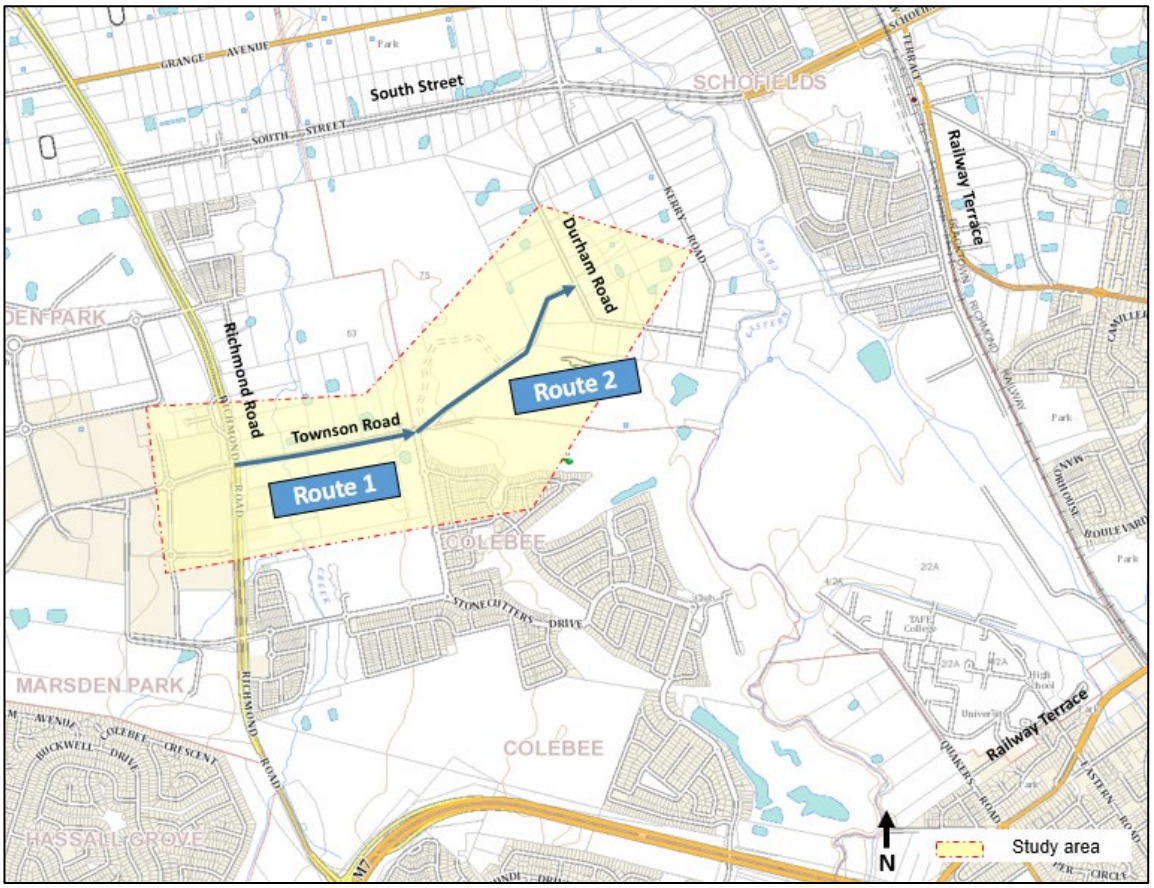
- The graphical representations of the daily traffic profiles in Figure 3-12 to Figure 3-16 show the peak traffic flow, with a clear “spike” in traffic volumes during their respective morning and afternoon peak periods.
- For Richmond Road, the peak traffic flow occurs during the AM peak period with the majority of traffic flow heading northbound. During this period, the traffic flows peak at approximately 1,800 vehicles per hour in the northbound direction and 1,500 vehicles per hour in the southbound direction.
- For South Street (west of the Richmond Road), traffic flow is negligible, less than 100 vehicles per hour.
- Higher traffic volumes head eastbound bound in the AM peak on Schofields Road (between Railway Terrace and Junction Road) compared to the westbound direction.
- Quakers Hill Parkway (between Eastern Road and Nirimba Drive) shows significantly higher southbound traffic volumes in the AM compared to the PM peak period.
- Higher traffic volumes head southbound in the AM peak on Railway Terrace (between Jerralong Drive and Woolworths Schofields Access) compared to the northbound direction.

3.3.5 Travel time surveys

Travel time surveys (using GPS technology) as shown in Figure 3-17 were undertaken on the following routes on Tuesday 3 September 2019, between 7 am – 9 am and 4 pm – 6 pm.

- Route 1: Townson Road between Richmond Road and Victory Road (0.73 kilometres)
- Route 2: Townson Road between Victory Road and Durham Road (0.92 kilometres).

The delays at the signalised intersections along each route were recorded separately.



Source: Matrix

Figure 3-17 Travel time routes

Recorded travel time surveys were used for validation and compared against modelled travel time to validate the base microsimulation model. The average travel speed survey results demonstrated that:

- The recorded average speed on Townson Road between Richmond Road and Victory Road is:
  - 52 kilometres per hour in eastbound direction in AM peak
  - 49 kilometres per hour in westbound direction in AM peak
  - 54 kilometres per hour in eastbound direction in PM peak
  - Ranges between 49 and 53 kilometres per hour in westbound direction in PM peak.
- The recorded average speed on Townson Road between Victory Road and Durham Road ranges between:
  - 50 kilometres per hour in the eastbound direction in the AM peak
  - Ranges between 28 and 37 kilometres per hour in westbound direction in the AM peak
  - Ranges between 51 and 52 kilometres per hour in eastbound direction in the PM peak
  - Ranges between 35 and 41 kilometres per hour in westbound direction in the PM peak.

The westbound vehicles on Townson Road approaching Richmond Road experience delays at the intersection. This reduces the overall average speed heading west across the intersection at Richmond Road, resulting in lower speed than the posted speed limit (60 kilometres per hour).

3.3.6 Traffic signal information

SCATS Intersection Diagnostic Monitor (IDM) data for the signalised intersection of Richmond Road and Townson Road, within the microscopic model study area, was collected on 3 September 2019 from TfNSW, the same date as the site visit and traffic surveys for the classified intersection counts.

3.4 Traffic modelling of existing conditions

3.4.1 Introduction

The existing Townson Road microsimulation model was developed using AIMSUN (version 8.3.0). The *Roads and Maritime Traffic Modelling Guidelines* (2013) served as a reference in developing the microsimulation model. Model development and key output metrics are detailed in the *Base Model Report* (GHD, 2019). The remainder of this section summarises the key performance indices achieved.

3.4.2 Model calibration

The key output metrics employed to evaluate the model's accuracy in replicating the observed traffic conditions and driver behaviour were:

- Percentage Root Mean Square Error (RMSE) of total modelled flows and observed counts
- Scatter plot of modelled flows and observed counts, with regression statistics (R^2 values)
- GEH-statistic, a form of the Chi-squared statistic, that incorporates relative and absolute differences between modelled flows and observed counts.

GHD adopted the calibration criteria and acceptability guidelines for the link and turning movement flows from the *Roads and Maritime Traffic Modelling Guidelines* (2013). Both of the AM and PM peak base models (2019) were calibrated according to the RMSE, R^2 values, GEH metrics and criteria set out in Table 3-4.

Table 3-4 Weekday Peak Hour Calibration Summary – Base Model (2019)

Period	Metric	Target	Status
AM Peak Hour	RMSE	Less than or equal to 30%	Calibrated
	Scatter Plot (R^2)	Greater than 90%	Calibrated
	GEH < 5	Greater than or equal to 85%	Calibrated
PM Peak Hour	RMSE	Less than or equal to 30%	Calibrated
	Scatter Plot (R^2)	Greater than 90%	Calibrated
	GEH < 5	Greater than or equal to 95%	Calibrated

Source: 'Traffic Modelling Guidelines', Roads and Maritime Services, NSW, 2013

The *Base Model Report* (GHD, 2019) contains detailed statistics of the AM and PM Base Year (2019) model calibrations.

3.4.3 Model stability

In order to ensure the stability of modelling results and to address the impact of random seed variations on simulation results, five simulation runs with different random seeds (28, 560, 2849, 7771, 86524) were performed for the respective AM and PM base year (2019) models. The average of five simulation runs was used to evaluate the accuracy of model calibration and processing of modelling results.

3.4.4 Model validation

The *Roads and Maritime Traffic Modelling Guidelines* recommend the measure for travel time validation as the percentage difference between modelled and observed travel times, subject to an absolute maximum difference. Table 3-5 defines the travel time validation criterion.

Table 3-5 Calibration Criteria and Acceptability Guidelines

Criteria	Acceptability Guidelines
Modelled times along routes should be within 15% of surveyed times (or 60 seconds, if higher)	≥ 95% of routes

Source: 'Traffic Modelling Guidelines', Roads and Maritime Services, NSW, 2013

GHD validated the accuracy of the modelling results against an independent set of travel time measurements on Richmond Road and Rooty Hill Road North. The results confirmed that the calibrated Base model (2019) was validated for both AM and PM peak hours.

3.4.5 Fit for purpose

The results demonstrated that the AM and PM Base Year (2019) models are acceptably calibrated based on the industry-approved standards using observed intersection counts and travel time surveys. These validations confirmed the ability of the models to replicate travel times.

Following the review by TfNSW on the base model and the Base Model Report, it was agreed that the base model could be carried forward to the assessment of 2026 and 2036 horizon year options.

4. Future Traffic Growth on Townson Road

This section outlines the traffic growth implications after the completion of both the interim phase works (two lanes two-way) and the ultimate phase (four lanes two-way).

4.1 Introduction

Future traffic estimates were carried out to determine 2026 and 2036 future traffic growth within the Townson Road Corridor. This traffic growth is attributed to new developments that are planned,

- Within the study area for interim phase
- Within the study area for both the proposal and Stage 2 for the ultimate phase.

It was envisaged the future traffic growth within the study is comprised of the following:

- Background traffic growth projected in the wider strategic planning tools, such as the land use information in STFM provided by the TfNSW
- Traffic generated from the committed and potential developments within the study area, based on the submitted/approved planning documents provided by TfNSW.

4.2 Background traffic growth

The background traffic growth was primarily determined from the land use information in the STFM provided by the TfNSW. Background traffic growth was estimated by calculating the absolute difference in traffic volumes between the existing STFM model links and the future 2026 and 2036 model links, as shown in Figure 4-1.

Source: Sydney Strategic Travel Forecast Model TfNSW 2019

Figure 4-1 Background traffic zones from STFM

It can be seen in Figure 4-1 that zones 3 and 4 were removed from the cordon matrix of the Townson Road model. Zone 3 was attributed to future development that is not planned to access Townson Road directly. Zone 4 is attributed to trips generated by the future CSR limited development, which was more accurately estimated by proposed land use provided by TfNSW. Matrices from the STFM model are shown in Appendix A

Interim phase background growth

The interim phase background traffic were based on STFM zones as shown in Figure 4-1 with zones east of the New Road omitted from the traffic demands (ie zones 6 to 10). This assumes that the interim stage does not consider future background traffic associated with the Stage 2 connection of Townson Road, such as the Altove Development and Private Properties east of the New Road link.

Ultimate phase background growth

Background traffic growth for the ultimate phase of the proposal uses the same STFM zones as shown in Figure 4-1, and assumes that the Stage 2 traffic zones are included in the assessment (ie zones 6 to 10). It is worth noting that there are instances of negative background traffic growth shown for both light and heavy vehicles. This could be explained by future changes in route choice favouring Townson Road over less favourable existing route choices, the results are summarised in Table 4-1.

2019 AM peak and PM peak volumes are based on calibrated microsimulation base models. The traffic growths between 2019 and 2026 and between 2019 and 2036 horizon years are based on STFM outputs. Background traffic growth is predominantly determined by:

- The increase of traffic volumes on the Richmond Road Corridor
- The increase of traffic volumes on Townson Road and Burdekin Road corridor, after the completion of Stage 2 upgrade, including:
  - Between Burdekin Road and Richmond Road via Townson Road
  - Between Burdekin Road and New Veron Road north (connecting to Schofields Road)
  - Between New Veron Road north (Schofields Road) and Townson Road.

Table 4-1 Estimated future background traffic growth

Year	AM peak (veh/hr)		PM peak (veh/hr)	
	Light vehicle	Heavy vehicle	Light vehicle	Heavy vehicle
2019	3874	472	4330	256
2019 to 2026 background growth	1939	-12	2077	-9
	7.2% pa	-0.4% pa	6.9% pa	-0.5% pa
2019 to 2036 background growth	3694	169	3690	163
	5.6% pa	2.1% pa	5.0% pa	3.7% pa

4.3 Future development traffic

4.3.1 Proposed developments and land use

The following information was available to GHD regarding the proposed developments, provided by TfNSW, as attached as Appendix B and summarised below:

- Property ownership Map (Transport for NSW, 2019), shown in Figure 4-2
- Altove Development: anticipated number of lots and releasing timing provided by email on 8 November 2019

- Luxeland Property (68 Townson Road): provided by email on 1 November 2019
- CSR limited West Schofields Proposed Lot Yield and Delivery provided by email 27 August 2019
- Marsden Park Industrial Area, Stonecutters Ridge and the Private Dwellings estimation provided by email 14 November 2019.

GHD have made the assumptions of both dwelling numbers and completion date for the following developments as detailed in Table 4-2.

- Stonecutters Ridge Golf Club
- Kennards (no longer assessed)
- Multiple Private Properties.

The size and location of assessed developments along the Townson Burdekin Road corridor and property ownership are shown in Figure 4-2. A summary of each development, including lot yield and land use, is provided in Table 4-2, as advised by TfNSW. It is worth noting the completion year was benchmarked with the future horizon years to be used in traffic modelling (eg 2026 referring to prior to 2026).

Table 4-2 Development land use and size considered during the interim phase of the proposal

Development name	Land Use	Development size	Completion by	Source
Interim phase				
CSR	Low Density Residential	1376 Dwellings	2026	TfNSW
	Medium Density Residential	160 Dwelling	2028, assumed as 2026	TfNSW
Luxeland	Low Density Residential	240 Dwellings	2026	Luxeland
Stonecutters Ridge Golf Club	Recreational	No further developments	N/A	Stonecutters Ridge Golf Club
Private Properties (West of New Road link)	Low Density Residential	432 Dwellings (note 1)	2026	GHD assumption
	Medium Density Residential	108 Dwellings (note 1)	2026	GHD assumption
Ultimate phase				
All the developments considered in interim phase				
Altove Development	Medium Density Residential	164 Dwellings	2026	TfNSW
	High Density Residential	1500 Units	2036	TfNSW
Private Properties (east of New Road link)	Low Density Residential	216 Dwellings (note 1)	2026	GHD assumption

Note 1: estimated dwelling numbers and completion date

The information provided to date was used to develop the above dwelling yields. The assumptions made GHD to summarise land use information are as follows:

- Where residential lot yield is provided, it has been assumed that one dwelling will occupy each lot.
- As residential developments are predominantly low-density (R2) within the assessment area, this assumption is deemed reasonable.
- All private properties have been assumed to be completed by 2026.
- Lot yield of private properties has been estimated based on total proposal area, with the assumption of 80 percent being low density residential and 20 percent being medium density residential. More specifically:
  - The total proposal area of all private properties has been approximated to be 45 hectares, of which 36 hectares are low density residential
  - Build capacities are 20 lots per hectare for low density residential and 25 lots per hectare for medium density residential as indicated in West Schofields Draft ILP, which generates 720 low density and 225 medium density dwellings.

4.3.2 Development traffic generation

Based on land use information, traffic generation for each development has been estimated by applying appropriate trip generation rates from the following guidelines:

- Guide to Traffic Generating Developments (Version 2.2), RTA, October 2002 (referred to henceforth as “Guide”)
- Roads and Maritime Guide to Traffic Generating Developments Technical Direction (TDT 2013/04a) – Updated traffic surveys, TfNSW, August 2013 (referred to henceforth as “Technical Direction”).

4.3.3 Trip generation rates

Based on development land uses, applicable trip generation rates have been extracted from the aforementioned guidelines and summarised in Table 4-3.

Table 4-3 Summary of applicable trip generation rates

Land use	Rate type	Unit	Trip rate[1] (veh/day or /hr)			Source
			Daily	AM	PM	
Low density residential	Average	dwelling	10.7	0.95	0.99	Technical Direction (TfNSW, 2013)
	Maximum	dwelling	10.7	1.32	1.39	Technical Direction (TfNSW, 2013)
Medium density residential	Average	dwelling	5.8	0.58	0.58	Guide (RTA, 2002)
	Maximum	dwelling	6.5	0.65	0.65	Guide (RTA, 2002)
High density residential	Average	unit	1.52	0.19	0.15	Technical Direction (TfNSW, 2013)
	Maximum	unit	3.14	0.32	0.41	Technical Direction (TfNSW, 2013)
	Maximum	outlet	N/A	N/A	120*	Guide (RTA, 2002)

Note: 1. Total trip numbers

The following assumption was made for above residential trip rates:

- All medium density residential developments assessed have been assumed to be larger units or townhouses.
- A range of trip rates is provided for daily and peak-hourly traffic respectively. The average trip rate has therefore been calculated as the average of maximum and minimum value within each range.

The following assumption was made for above fast food trip rates:

- Daily trip generation rate has been assumed to be seven times the PM peak traffic generation
- AM peak trip generation rate has been assumed to be 10 percent that of PM peak traffic generation.

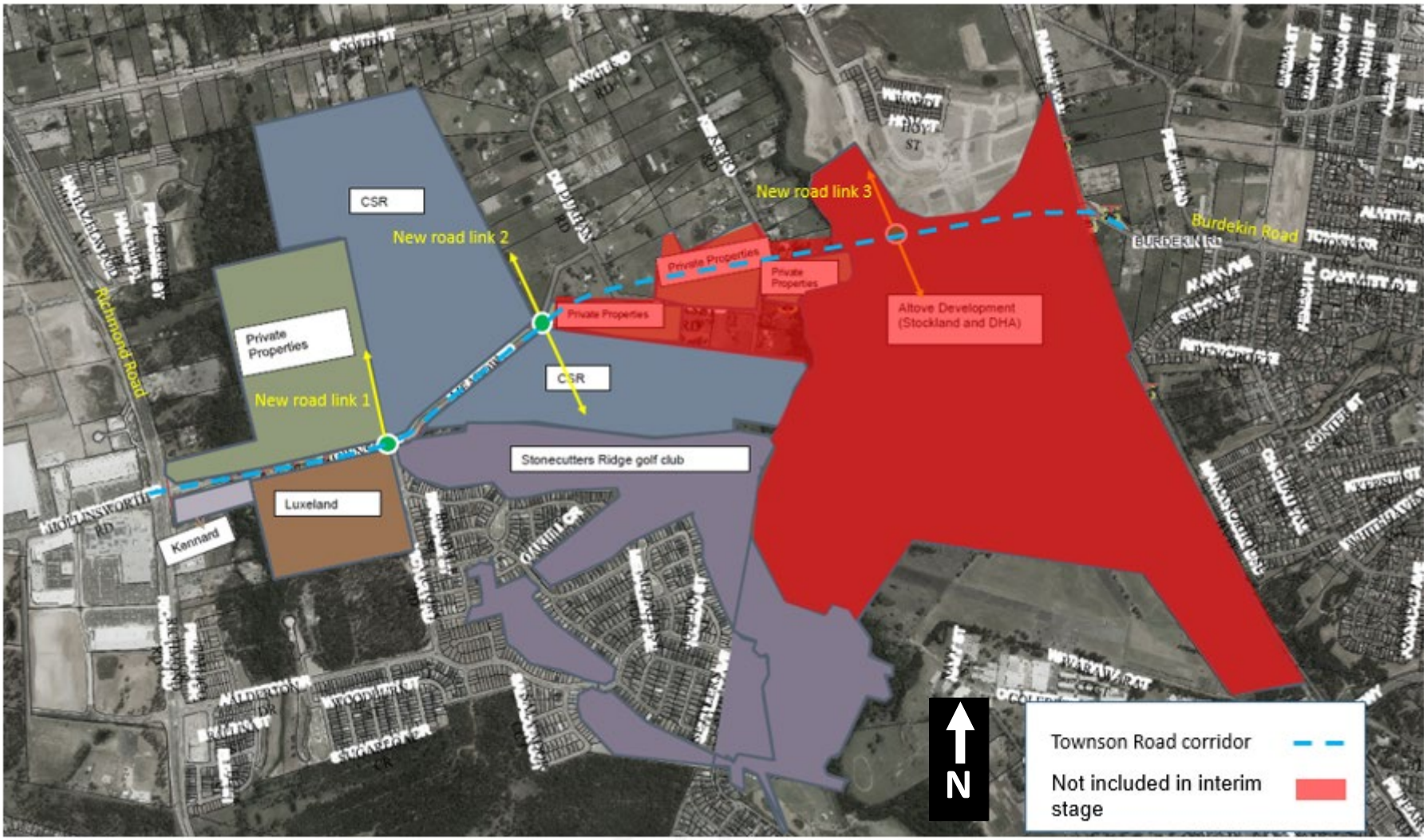
Traffic generation for each development has been obtained by applying the appropriate trip generation rate listed in Table 4-3 to development size in Table 4-2. Assumptions made in conducting this assessment include:

- The developments are considered to have an average trip generating profile. Therefore, the average trip generation rates were used.

The results are summarised in Table 4-4 for both horizon year 2026 and 2036. With the available information to GHD, for traffic modelling, it was assumed that all the proposed developments would be completed by 2026. The results are also presented in Figure 4-3, Figure 4-4 and Figure 4-5.

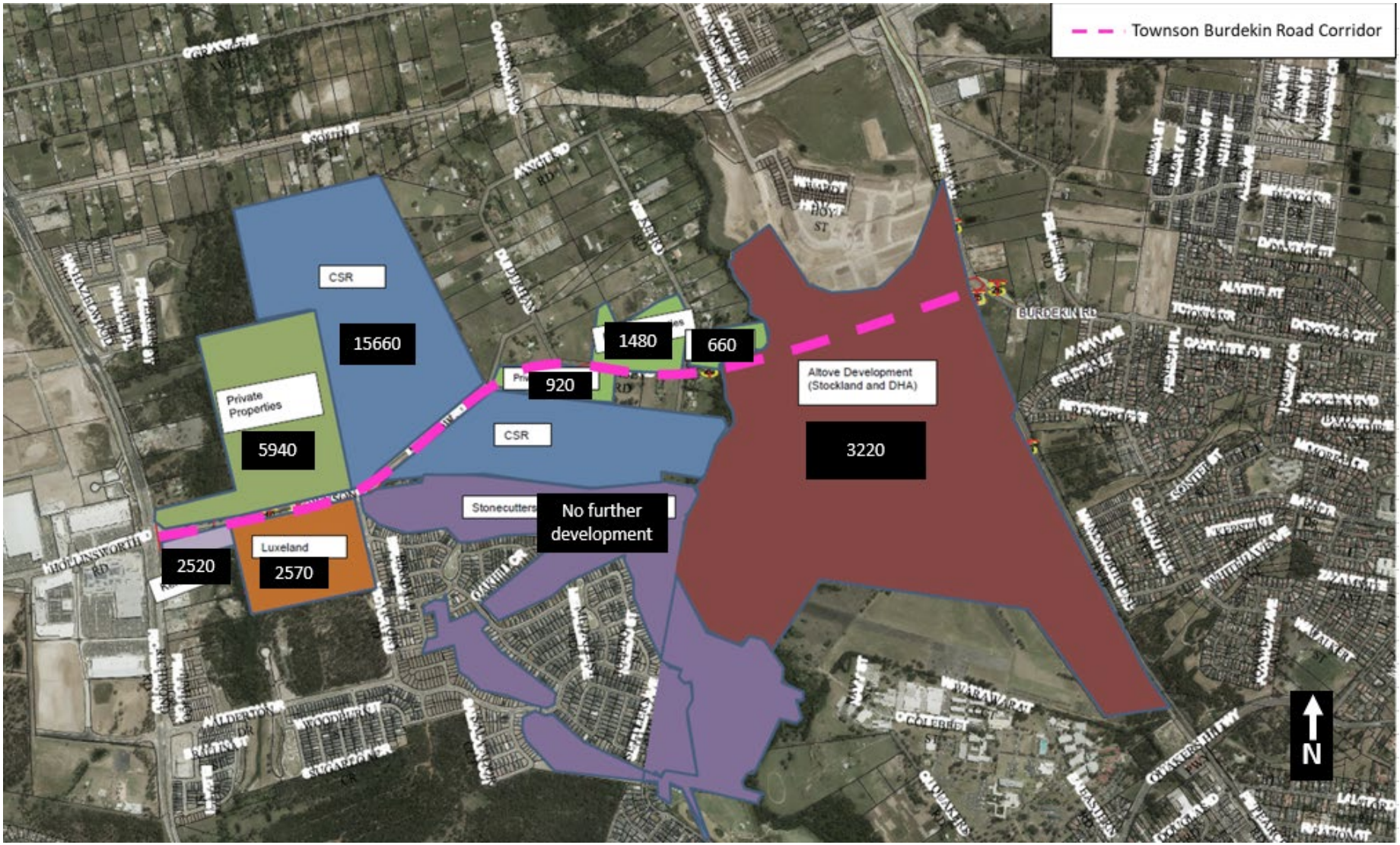
Table 4-4 Development trip generation by 2026 and 2036

Development name	Land Use	Daily		AM Peak (per hour)		PM Peak (per hour)	
		Rate per unit	No. of Trips	Rate per unit	No. of Trips	Rate per unit	No. of Trips
CSR	Low Density Residential	10.7	14720	0.95	1310	0.99	1360
	Medium Density Residential	5.75	940	0.575	90	0.575	90
Altove Development	Medium Density Residential	5.75	940	0.575	90	0.575	90
	High Density Residential	1.52	2280	0.19	290	0.15	230
Luxeland	Low Density Residential	10.7	2570	0.95	230	0.99	240
Stonecutters Ridge	Recreational	No further development					
Private Properties	Low Density Residential	10.7	7700	0.95	680	0.99	710
	Medium Density Residential	5.75	1290	0.575	130	0.575	130



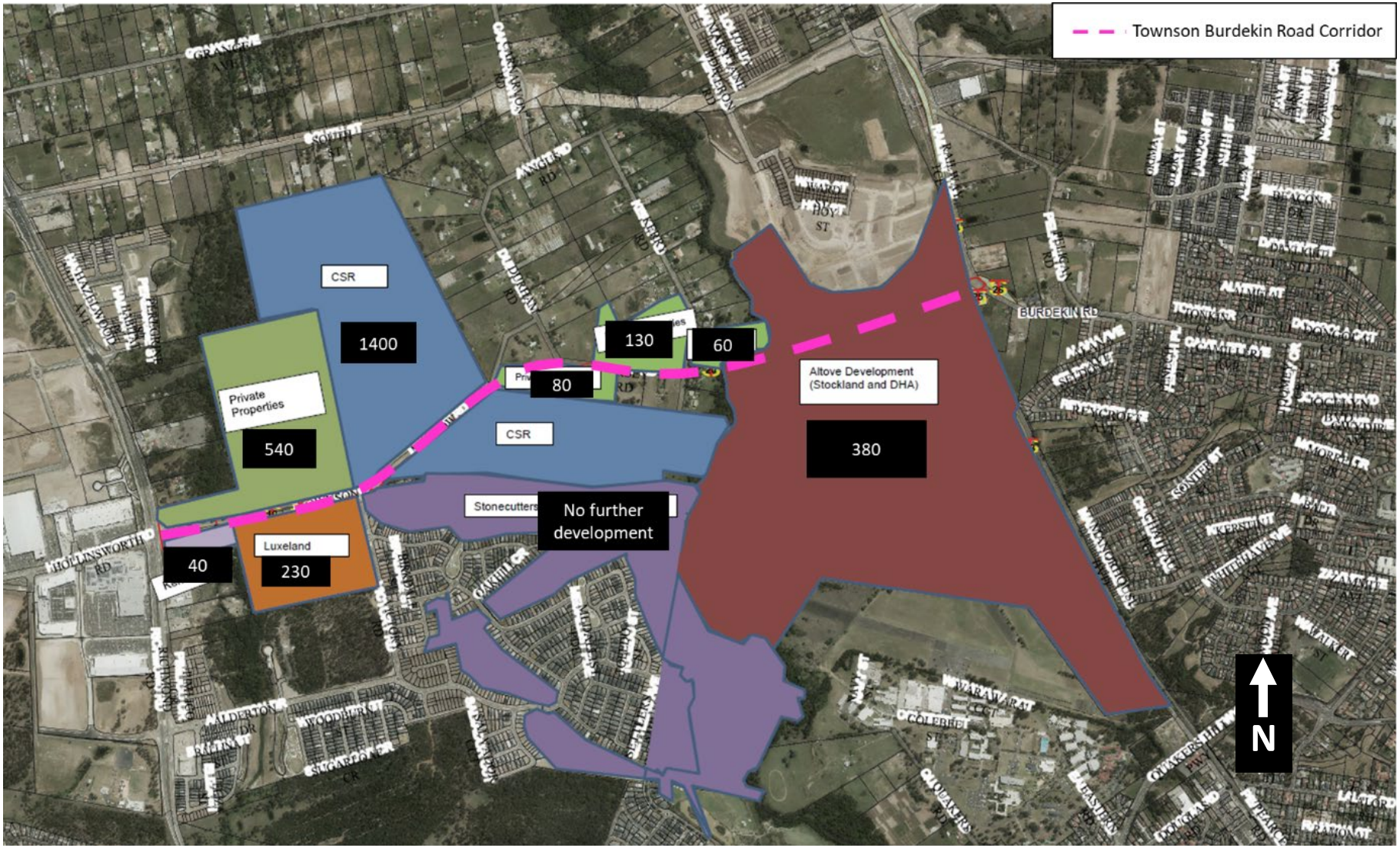
Source: TfNSW

Figure 4-2 Proposed developments assessed for the interim phase along Townson Burdekin Road corridor



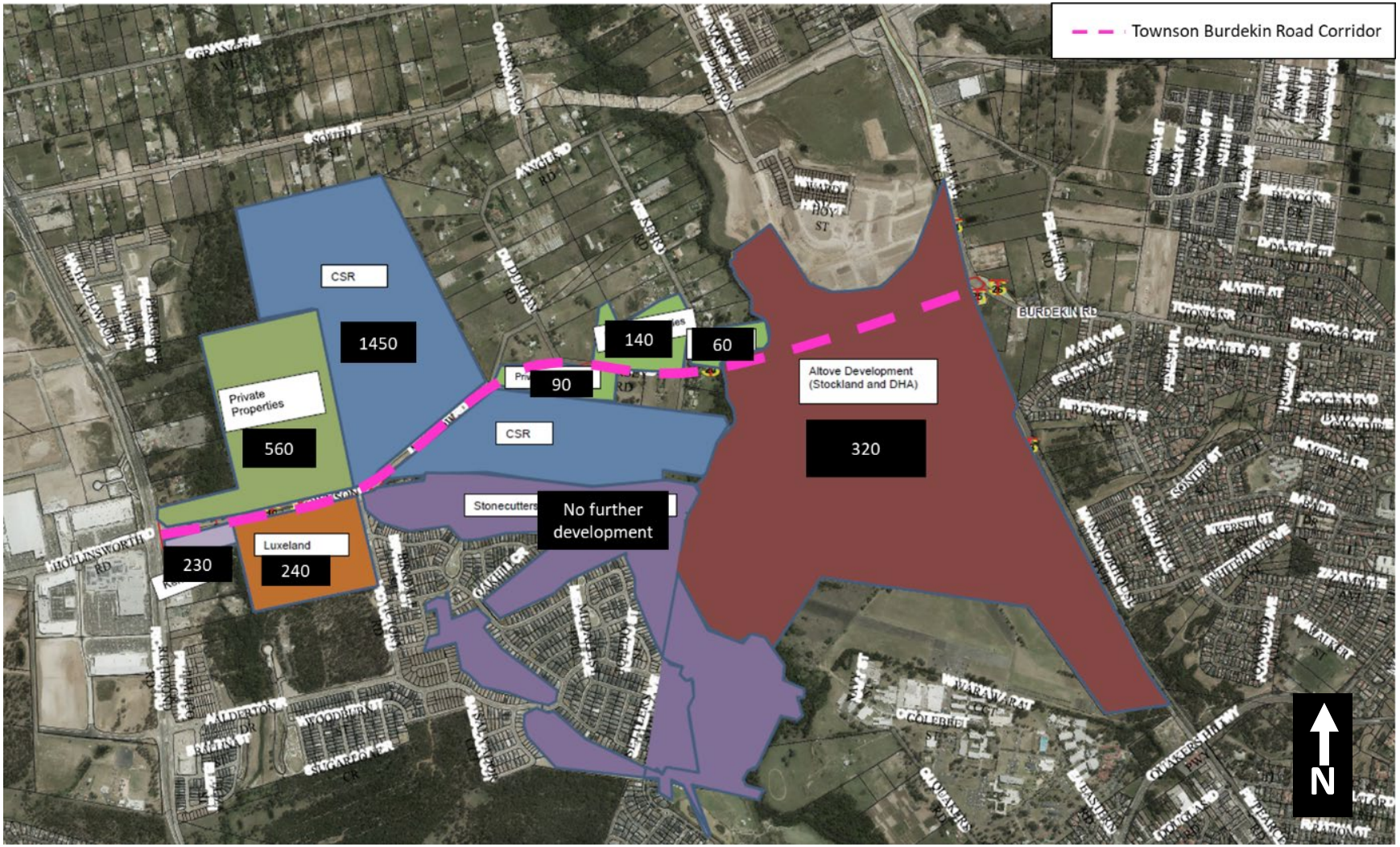
Source: TfNSW

Figure 4-3 Daily Traffic Generation (2026 and 2036)



Source: TfNSW

Figure 4-4 AM Peak Hour Traffic Generation (2026 and 2036)

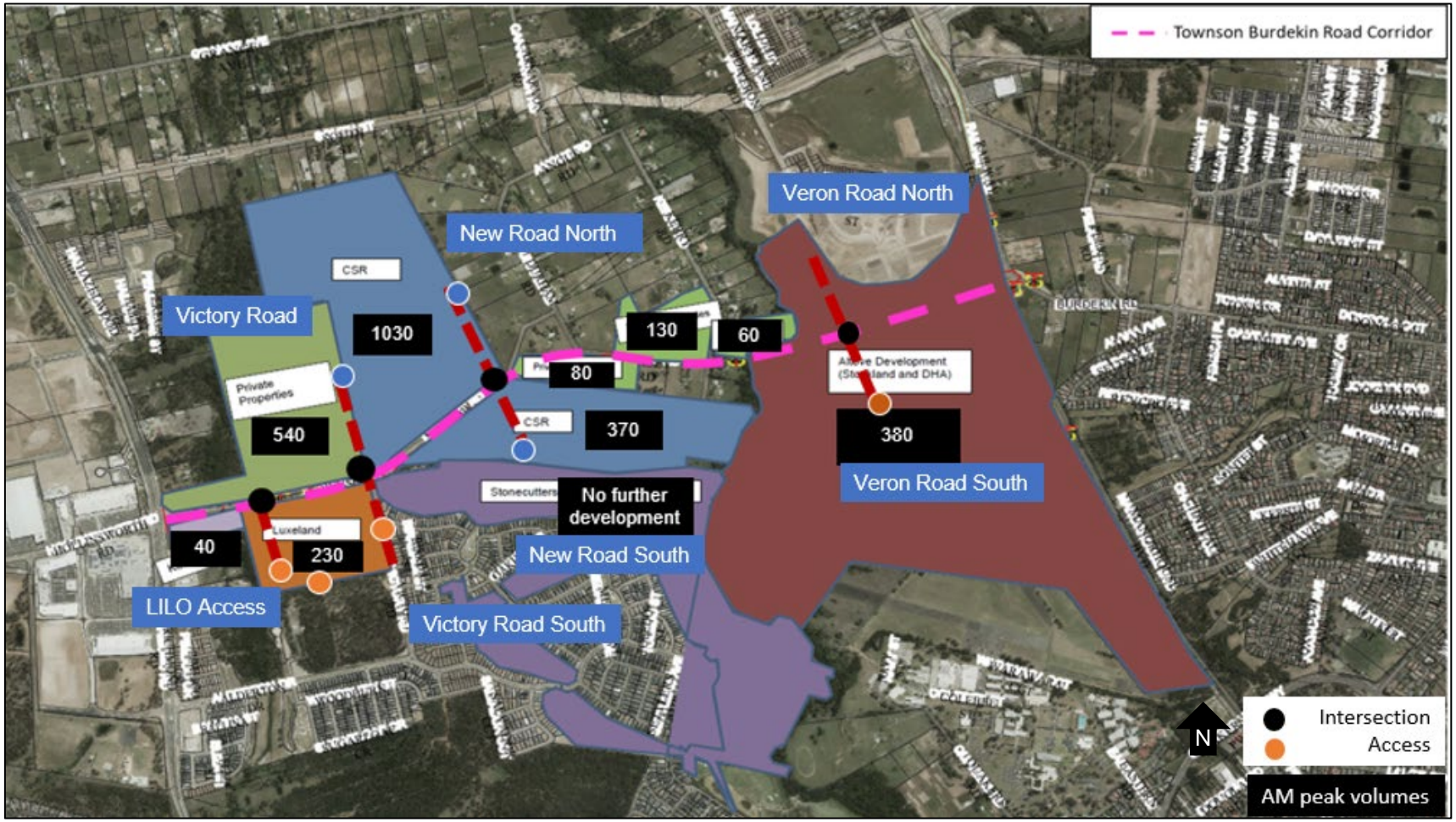


Source: TfNSW

Figure 4-5 PM Peak Hour Traffic Generation (2026 and 2036)

4.4 Future traffic accesses

The future traffic accesses from new developments are summarised in Figure 4-6 and Table 4-5, based on the assumptions agreed by TfNSW.



Source: TfNSW

Figure 4-6 Future traffic accesses from the proposed developments

Table 4-5 Assumed access of proposed developments

Development name	Land Use	Proposed Access	
		Road Name	% of Trips
CSR North	Low Density Residential	Victory Road North	30
		New Road North	30
		Schofields Road (Note 1)	40
CSR South	Low Density Residential	New Road South	100
Luxeland	Low Density Residential	LILO access	14
		Victory Road South	56
		Alderton Drive (Note 1)	30
Private property 1	Low Density Residential Medium Density Residential	Victory Road North	100
Private property 2		New Road South	100
Private property 3 & 4		New Road North	50
		Veron Road North	50
Altove Development	Medium Density Residential	Veron Road South	80
		Internal local street to Schofields Road (Note 1)	20

Note 1: Accesses are outside Townson Road corridor

Table 4-6 to Table 4-9 summarise the estimated hourly development traffic using each access road on the Towson Road and Burdekin Road Corridor. It is worth noting the traffic volumes presented in the tables below do not include (in addition to) the background traffic growth from STFM discussed in section 3.2.

Table 4-6 Development traffic by proposed access roads –interim phase- AM peak

Summary of Access Roads Volumes to Townson Road (veh/hr)			AM IN	AM OUT
Road Name	Zone	Total	20%	80%
Luxeland LILO	15	32	6	26
Victory Road North	13	801	160	641
Victory Road South	11	129	26	103
New Road North	5	257	51	206
New Road South	14	370	74	296
Veron Road North	6	0	0	0
Veron Road South	10	0	0	0
Total		***1590***	***318***	***1272***

Table 4-7 Development traffic by proposed access roads –interim phase– PM peak

Summary of Access Roads Volumes to Townson Road (veh/hr)			PM IN	PM OUT
Road Name	Zone	Total	80%	20%
Luxeland LILO	15	34	27	7
Victory Road North	13	835	668	167
Victory Road South	11	134	108	27
New Road North	5	267	213	53
New Road South	14	383	307	77
Veron Road North	6	0	0	0
Veron Road South	10	0	0	0
Total		***1653***	***1322***	***331***

Table 4-8 Development traffic by proposed access roads – ultimate phase – AM peak

Summary of Access Roads Volumes to Townson Road (veh/hr)			AM IN	AM OUT
Road Name	Zone	Total	20%	80%
Luxeland LILO	15	32	6	26
Victory Road North	13	849	170	679
Victory Road South	11	129	26	103
New Road North	5	404	81	323
New Road South	14	450	90	360
Veron Road North	6	95	19	76
Veron Road South	10	304	61	243
Total		***2263***	***453***	***1810***

Table 4-9 Development traffic by proposed access roads – ultimate – PM peak

Summary of Access Roads Volumes to Townson Road (veh/hr)			PM IN	PM OUT
Road Name	Zone	Total	80%	20%
Luxeland LILO	15	34	27	7
Victory Road North	13	880	704	176
Victory Road South	11	134	108	27
New Road North	5	420	336	84
New Road South	14	473	379	95
Veron Road North	6	100	80	20
Veron Road South	10	256	205	51
Total		***2297***	***1838***	***459***

4.5 Summary and conclusion

Figure 4-7 to Figure 4-10 present future traffic movements for the interim phase on the Townson Road Corridor, including both background traffic growth and future development traffic. Similarly, Figure 4-11 to Figure 4-14 present the future traffic movements for the ultimate phase.

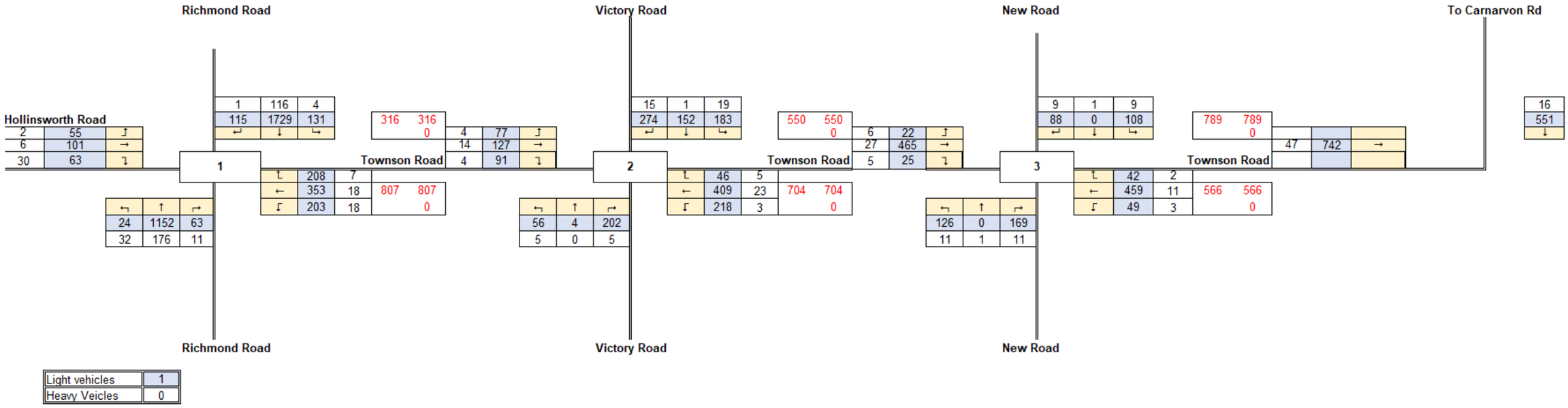


Figure 4-7 Interim phase 2026 AM peak traffic movement diagram

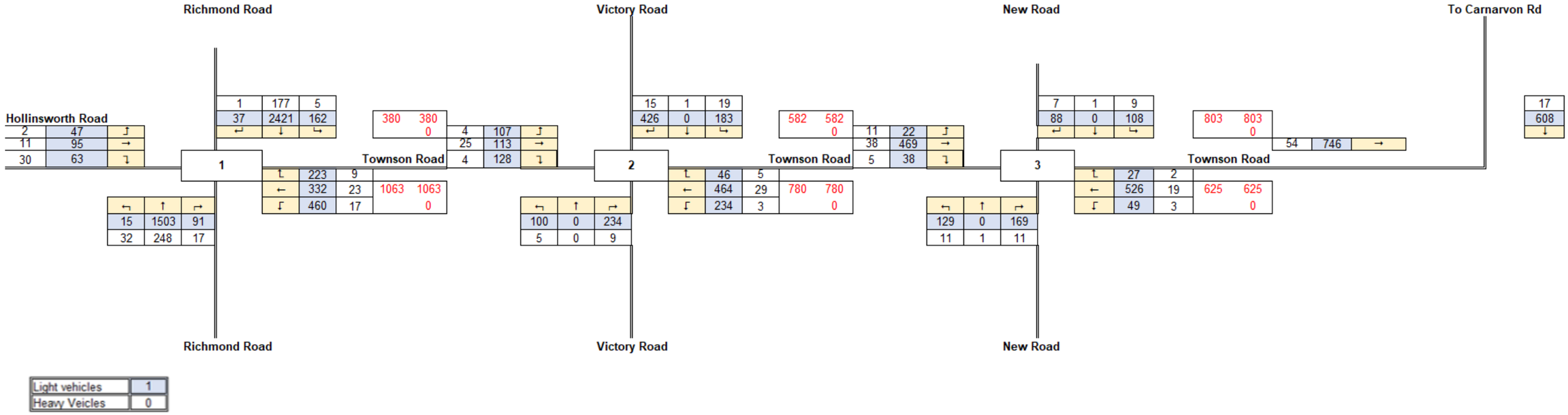


Figure 4-8 Interim phase 2036 AM peak traffic movement diagram

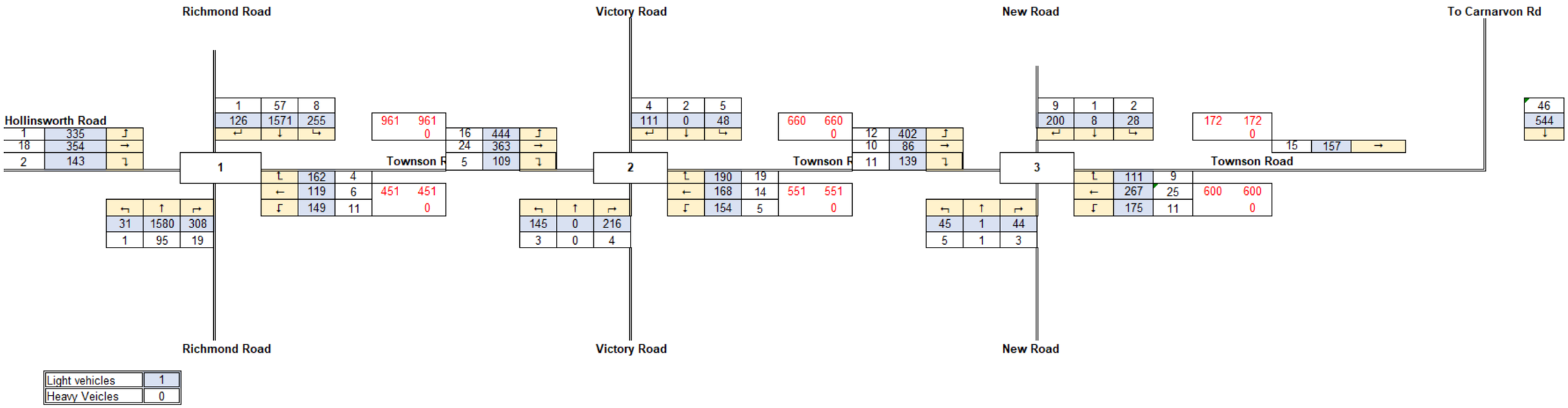


Figure 4-9 Interim phase 2026 PM traffic movement diagram

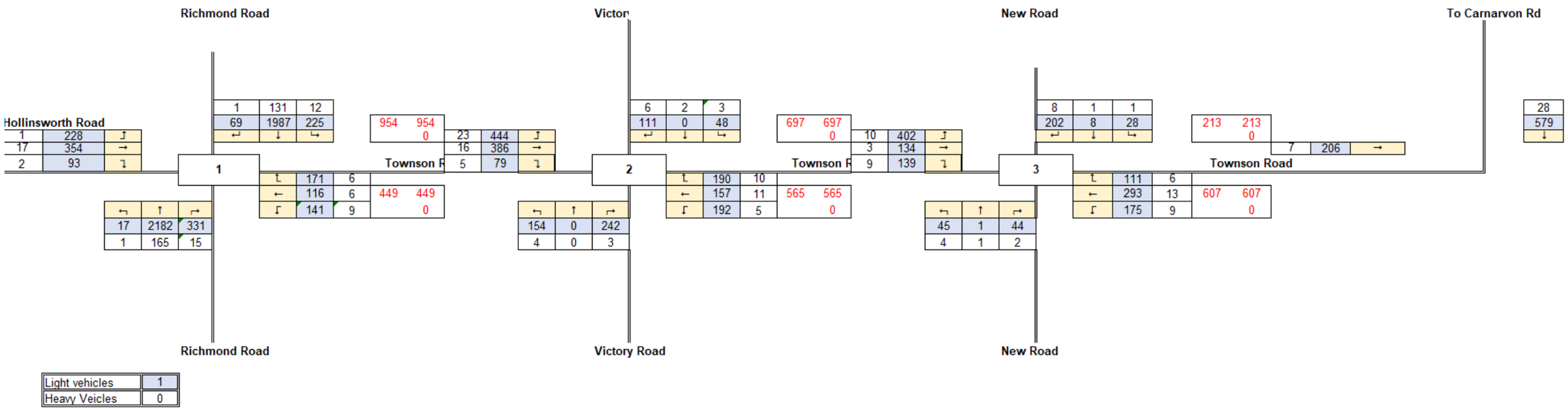


Figure 4-10 Interim phase 2036 PM traffic movement diagram

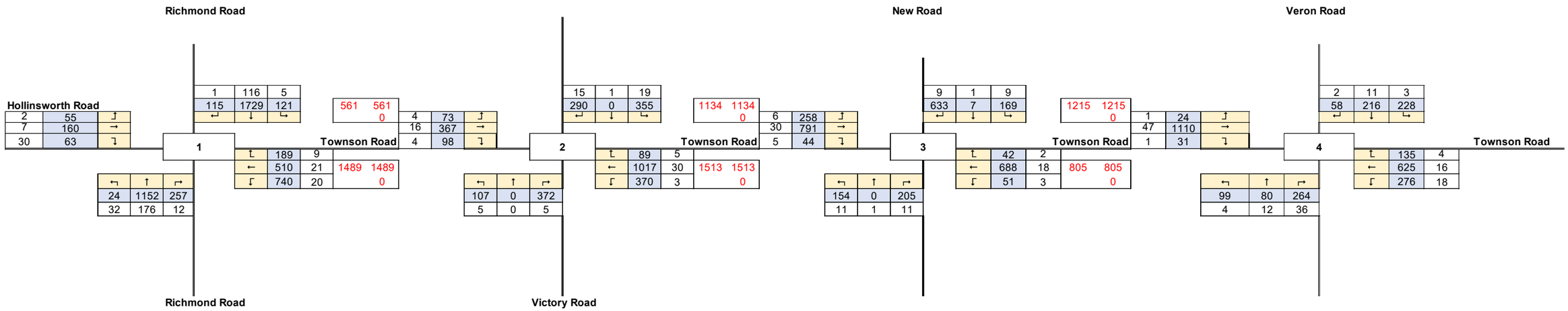


Figure 4-11 Ultimate phase 2026 AM peak Traffic volumes (vehicles per hour)

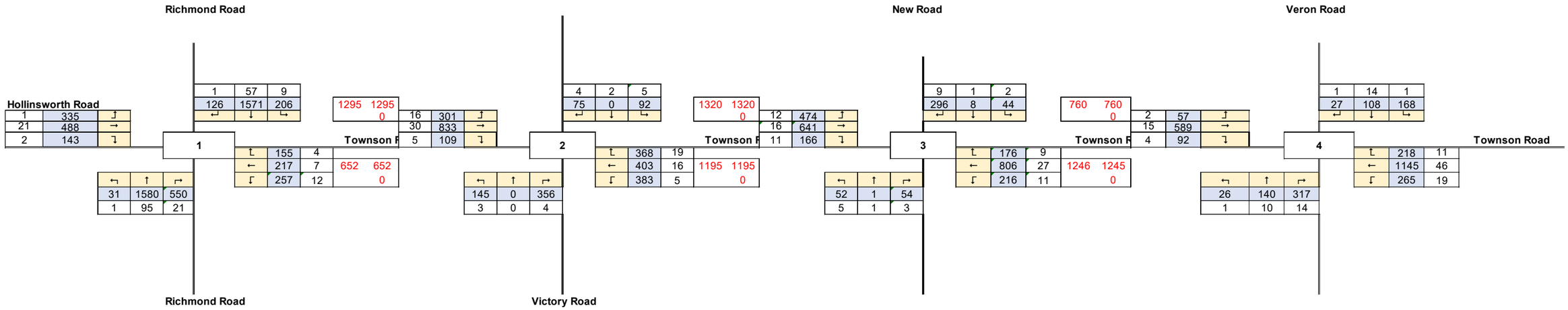


Figure 4-12 Ultimate phase 2026 PM peak Traffic volumes (vehicles per hour)

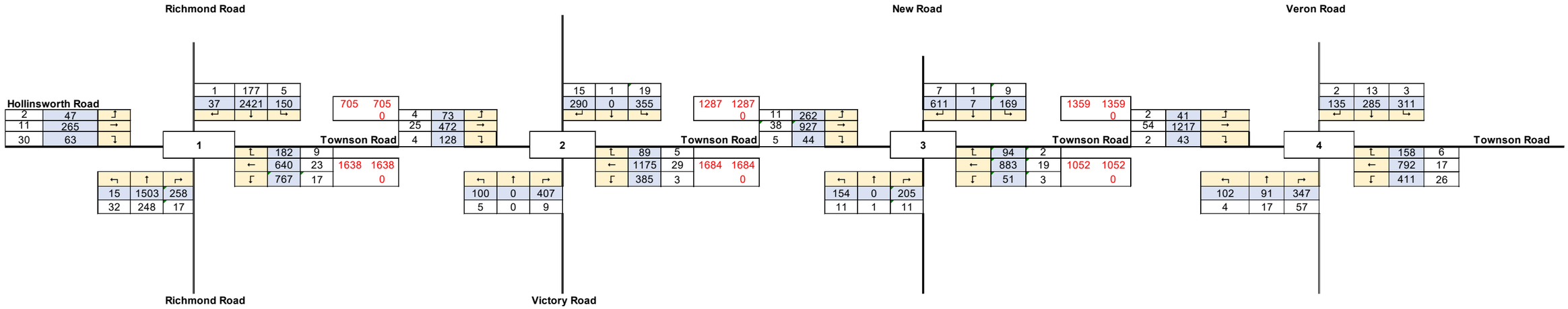


Figure 4-13 Ultimate phase 2036 AM peak Traffic volumes (vehicles per hour)

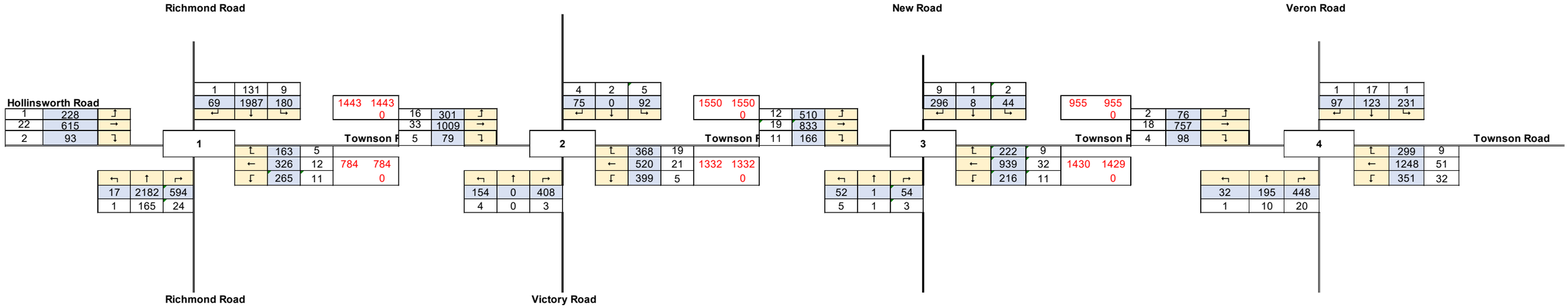


Figure 4-14 Ultimate phase 2036 PM peak Traffic volumes (vehicles per hour)

5. Future Traffic Performance on Townson Road

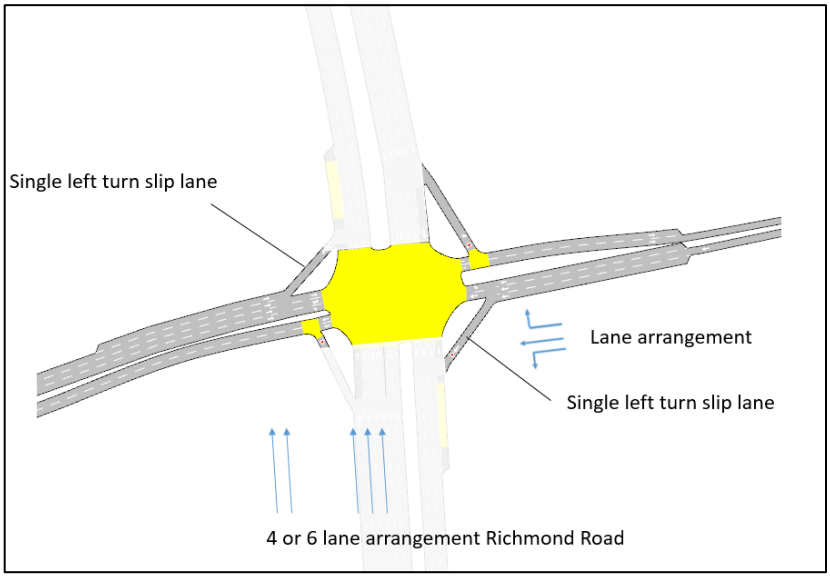
This section summarises the future traffic, transport and access impacts on Townson Road.

5.1 Interim phase

Assessment of the interim phase aimed to provide a 2-lane alignment on Townson Road, with sufficient capacity at the intersections, prior to the upgrades to 4-lane at later stage.

A number of variations of the interim layout were assessed, consisting of:

- Townson Road two-lane alignment, single carriageway in each direction (as shown previously in Figure 1-2).
- Roundabouts and traffic signals were assessed at Townson Road/Victory Road intersection, respectively.
- To the west, Richmond Road was assessed with 4 lanes and 6 lanes, respectively, between Alderton Drive and north of Townson Road. Left turn slip lanes at the Townson Road and Hollinsworth Road approaches were included. This is presented in Figure 5-1.
- To the east, the interim phase finishes with connection to Carnarvon Road/South Street. The Carnarvon Road/South Street was not assessed in this exercise and it was assumed that the northbound approach at Carnarvon Road would accommodate up to 700 vehicles per hour by 2026.



Note: the single left turn slip lane has been included in the modelling however not included as part of the Townson Road Stage 1 road design package

Figure 5-1 Richmond Road and Townson Road lane configuration option

Level of Service (LoS) is a basic performance parameter used to describe the operation of an intersection. The LoS range from A to F based on the operational performance primarily determined by the average traffic delay at the signalised intersection. The Roads and Maritime Guide to Traffic Generating Developments (Roads and Maritime, 2012) provides a guideline for the Level of Service (LoS) assessment for different intersection control types. The outputs produced by AIMSUN were used to assess intersection performance summarised in Table 5-1.

Table 5-1 Level of Service Criteria (TfNSW)

Level of Service	Average Delay (seconds)	Control types	
		Traffic signal	Priority control
A	< 14	Good operation	Good operation
B	15 – 28	Good with acceptable delays and spare capacity	Acceptable delays and spare capacity
C	29 – 42	Satisfactory operation	Satisfactory, but accident study required
D	43 – 56	Near capacity	Near capacity and accident study required
E	57 – 70	At capacity, at signals incidents will cause excessive delays.	At capacity, require other control model
F	> 70	Unsatisfactory with excessive queuing	Unsatisfactory with excessive queuing; requires other control model

Table 5-2 provides a summary of the modelled options for the interim phase.

Table 5-2 Interim phase options

Interim phase	Townson Road/ Victory Road	Townson Road/ New Road	Richmond Road	2026	2036[2]
Option 1A	Roundabout	Roundabout	4 lanes	✓	x
Option 1B	Roundabout		6 lanes	✓	x
Option 2A	Signal		4 lanes	✓	x
Option 2B	Signal		6 lanes	✓	x
Option 2C	Signal with short turn lanes from Townson Road[1]		6 lanes	✓	✓

Note 1: An additional 100 metre short left turn lane on the east approach and an 80 metre left turn lane on the west approach to Victory Road.

Note 2: Options not assessed for 2036 wherein it failed in 2026.

5.1.1 Interim phase modelling results summary

Option 1A and 1B: Roundabout at Townson Road/Victory Road

Traffic delays are expected to be significant at Victory Road northbound approach and Townson Road westbound approach in the AM peak at the proposed roundabout, resulting in LOS F (Figure 5-2). This is primarily due to the inadequate gaps in the traffic stream on Townson Road to accommodate traffic entering from Victory Road. In addition, the westbound approach to Richmond Road would have high delays, due to the capacity constraint of the upstream single lane and the arrival pattern of uninterrupted flows. Further discussed in the queue length comparison in section 5.1.2.

Similarly, the PM peak results (Figure 5-2) also demonstrated that the delays would be significant at the eastbound approach to Victory Road/Townson Road intersection. Queues are likely to propagate back to Richmond Road/Townson Road intersection at the eastbound merge lane, as a result, of the downstream congestion.

With Richmond Road widened to six lanes (Option 1B), the results indicated improved intersection performance at Richmond Road/Townson Road intersection. However, this widening would increase the traffic throughputs from Richmond Road (eg northbound right turn to Townson Road) consequently, increasing the eastbound delays on Townson Road/Victory Road intersection.

Option 2A and 2B: Traffic Signal at Townson Road/Victory Road

With the proposed traffic signal layout (with minimum lane configuration), it would be unable to improve the performance along Townson Road corridor, due to the limited capacity provided by the single lane in each direction.

The AM peak results (Figure 5-3) show that some improvements would be provided, compared to Options 1A and 1B, the performance of westbound and northbound approach are still unsatisfactory (LOS F). Similarly, in the PM peak, eastbound movements on Townson Road towards Victory Road depict significant delay and queue back to Richmond Road.

Option 2C: Traffic Signal with increased lane configuration at Victory Road

Increased layout was further assessed at Townson Road/Victory Road intersection.

Option 2C results (Figure 5-4) depict that by implementing short left turn lanes on the eastbound and westbound approaches on Townson Road, there is an overall intersection performance improvement to a satisfactory level (LOS D or better) in 2026.

A summary table of Level of Service results at each intersection recorded in Table 5-3.

Table 5-3 Interim phase: intersection Level of Service results

Intersections	AM Peak			PM Peak		
	Richmond Road	Victory Road	New Road	Richmond Road	Victory Road	New Road
Option 1A	D	F	B	E	F	A
Option 1B	C	F	C	E	F	A
Option 2A	D	F	B	F	F	A
Option 2B	C	F	B	E	F	A
Option 2C	C	D	B	C	D	A
Option 2C (2036)	D	D	B	C	E	A

Traffic Delay: Option 1A 2026 (AM peak – top; PM peak – bottom)

Figure 5-2 Option 1A AM and PM peak delay time results

Traffic Delay: Option 2B 2026 (AM peak – top; PM peak – bottom)

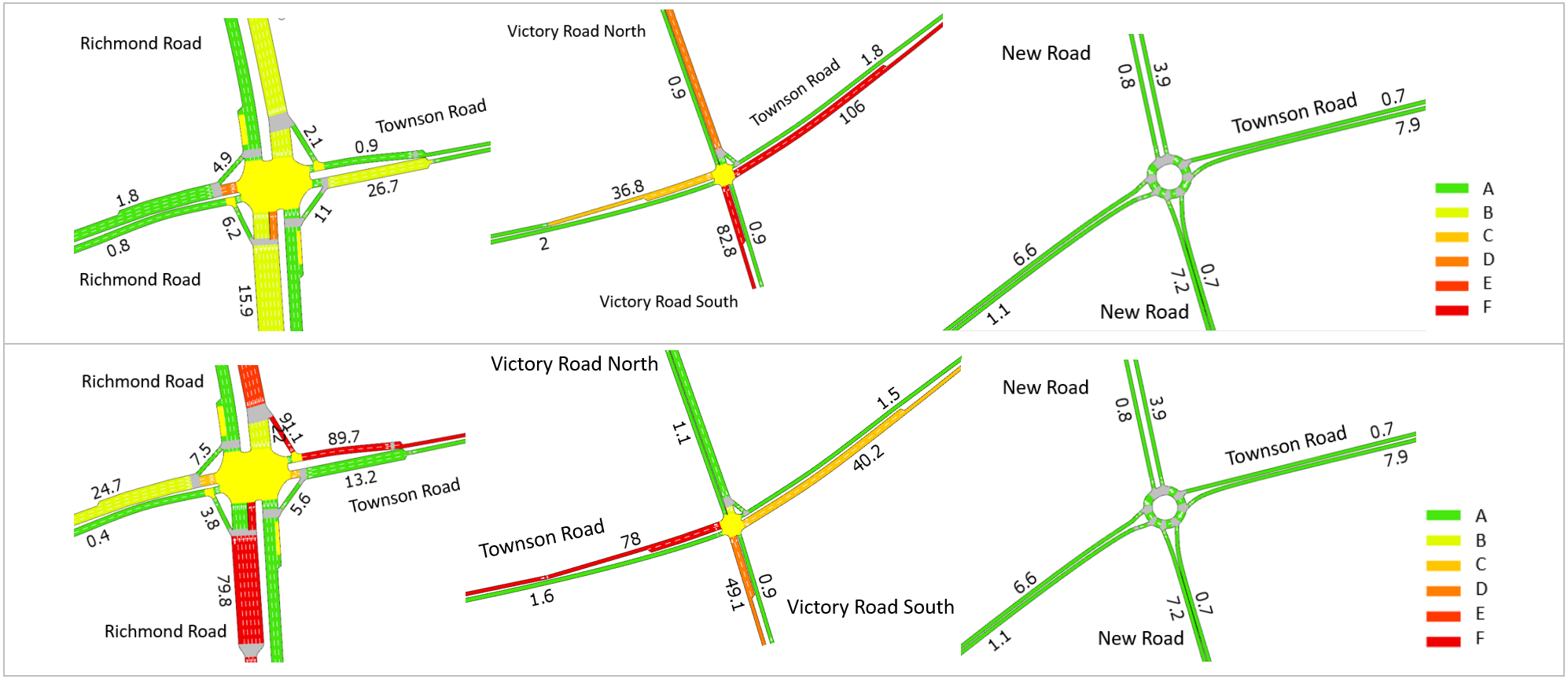


Figure 5-3 Option 2B AM and PM peak delay time results

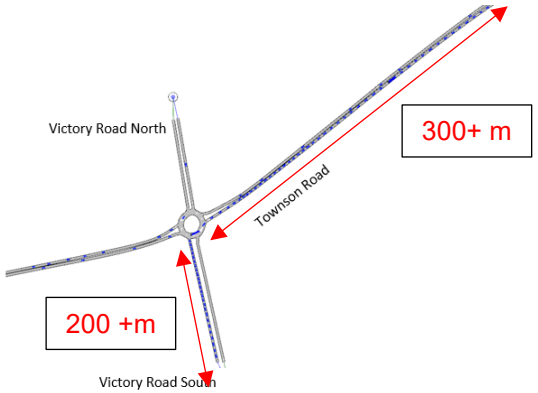
Traffic Delay: Option 2C 2026 (AM peak – top; PM peak – bottom)

Figure 5-4 Option 2C AM and PM peak delay time results

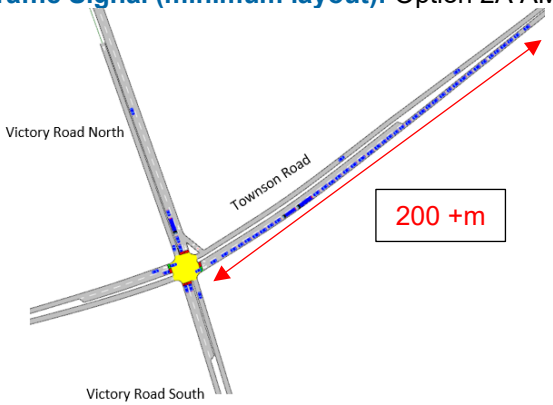
5.1.2 Interim phase queue length comparison

The 95th percentile queue length on the Townson Road corridor was also compared (Figure 5-5 to Figure 5-7) to further demonstrate the benefits provided by the signalisation and the improved layout at Townson Road/Victory Road intersection.

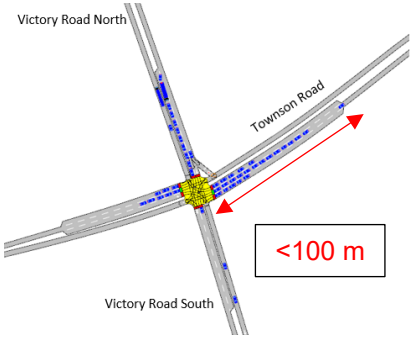
Roundabout: Option 1A AM peak



Traffic Signal (minimum layout): Option 2A AM peak:



Traffic signal with left turn lanes: Option 2C AM peak



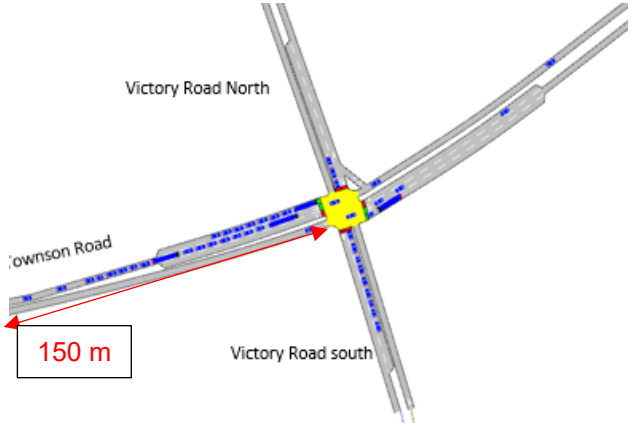
The provision of additional turn lanes at Townson Road/ Victory Road intersection would significantly reduce the queuing, compared to the roundabout control and the minimum traffic signal layout.

Figure 5-5 2026 AM peak Queuing conditions at Victory Road and Townson Road

Roundabout: Option 1B PM peak

Traffic Signal (minimum layout): Option 2A PM peak

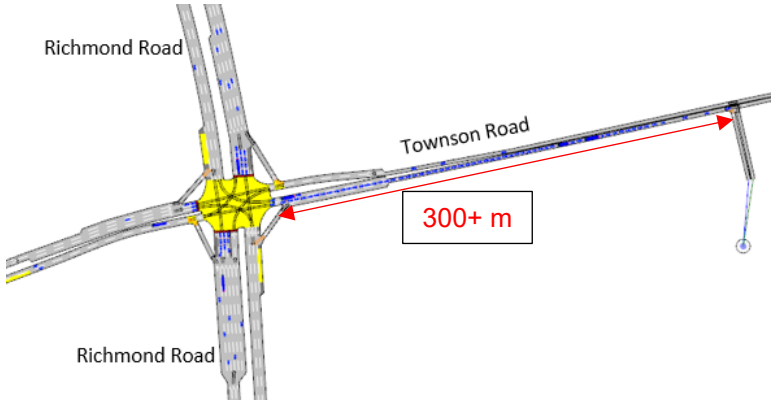
Traffic signal with left turn lanes Option 2C PM peak



Similar benefits were predicted in PM peak. The provision of an additional turn lane at Townson Road/Victory Road intersection would significantly reduce the queue length in peak (eastbound) direction, from over 500m to approximately 150m.

Figure 5-6 2026 PM Peak queuing conditions comparison

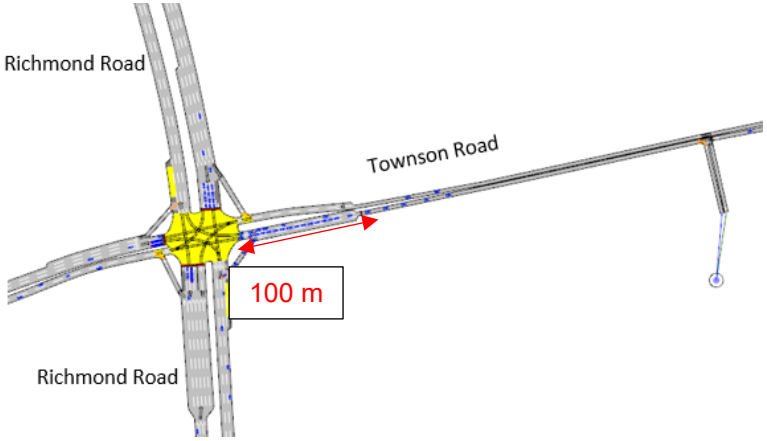
Option 1A
AM peak



Roundabout at Towson Road/Victory Road

The westbound through movements would have priority (‘right of way’) along entire Townson Road corridor, until Richmond Road. Hence, there will be excessive queuing at Richmond Road intersection (signal controlled) due to no traffic interruptions along Townson Road prior to Richmond Road approach.

Option 2C
AM peak



Traffic signal with left turn lanes at Townson Road/Victory Road

The traffic signal control at Victory Road would enable the vehicles to arrive at Townson Road/Richmond Road in a platooned pattern. This in turn would reduce the queuing as presented in the graph.

Figure 5-7 Control type at Victory Road and the impact on Richmond Road

5.1.3 Interim phase design recommendation

Following the assessment of interim phase (Townson Road two lanes between Richmond Road and New Road), the results demonstrated that the roundabout control at Townson Road/Victory Road would be inadequate in 2026 during peak hours.

Upgrading the Townson Road/Victory Road intersection to a traffic signal would provide benefits, noting an appropriate geometric layout needs provided (ie dedicated left and right turn lanes). The signalised Townson Road/Victory Road intersection would perform as LOS D in 2026, and the predicted queue length would be reduced to an acceptable distance. It would continue to operate at capacity (LOS E) by 2036.

In addition, the initial roundabout concept design for the New Road was shown to operate satisfactorily in 2026 without any need for additional lane capacity improvements.

Upgrading Townson Road to a 4 lane road corridor should be considered beyond 2026.

5.2 Utlimate phase of the proposal

This section outlines the traffic implications of the ultimate phase of works (four lane two-way).

Note: The results of ultimate phase was originally documented *in Townson Road Traffic Modelling and Assessment Report (April 2020).*

The principle of the ultimate phase requires the proposed intersections on this corridor to accommodate the future traffic growth when the connection to Burdekin Road is implemented (completion of Stage 2), forming an east-west corridor south of Schofields Road.

The modelled layouts for the ultimate phase are based on the design drawings provided by the project team. The design includes predominantly two through lanes and designated turning lanes in each direction along Townson Road, with side streets providing access to future developments or other major roads. Following modelling options were assessed in the ultimate phase, as presented in Table 5-4.

Table 5-4 Ultimate phase options

Ultimate phase	Townson Road approach (westbound)	Hollinsworth Road	Richmond Road	Victory Road	New Road	2026	2036
Option 3A	Through and left turn shared lane.	Existing lane configuration	4 lanes	Signalised	Signalised	✓	✓
Option 3B	Single dedicated left turn slip lane	Left turn slip lane onto Richmond Road north[2]	4 lanes in 2026 and 6 lanes in 2036			✓	✓1

Note 1: though not explicitly assessed, the results for Option A informed that this intersection would not operate within capacity at LOS D with Richmond Road retained as 4 lanes in 2036, regardless of the lane configuration at Townson Road approach. Therefore, 6 lanes on Richmond Road were assessed in 2036.

Note 2: while this was included in the modelling assessment for Option B/B2,an additional left turn slip lane at Hollinsworth Road is not included in the proposed scope of works for the proposal.

5.2.1 Richmond Road and Townson Road

5.2.1.1 Six lanes on Richmond Road in 2036

As a key east-west link in the NWGA, Richmond Road is expected to undergo significant changes in providing access to land use and associated infrastructure. The wide central median for future widening of the road to six lanes (if needed) is reserved on this corridor.

As already discussed, the current four-lane capacity on Richmond Road would not accommodate the future growth predicted at both northern and southern approaches, resulting in latent demands (vehicles unable to enter the road network due to congestion). This in turn would impact the throughputs for the turning vehicles onto Townson Road corridor, being propagated outside the network.

Therefore, an 'unconstrained case' is investigated to widen the Richmond Road to six lanes approaching this intersection as shown in Figure 5-8. The objective of this preliminary assessment is to discern the impact on the intersection performance at Townson Road/Victory Road and Townson Road/New Road, with the unconstrained capacity at Richmond road, resulting in higher vehicle throughputs on Townson Road corridor.

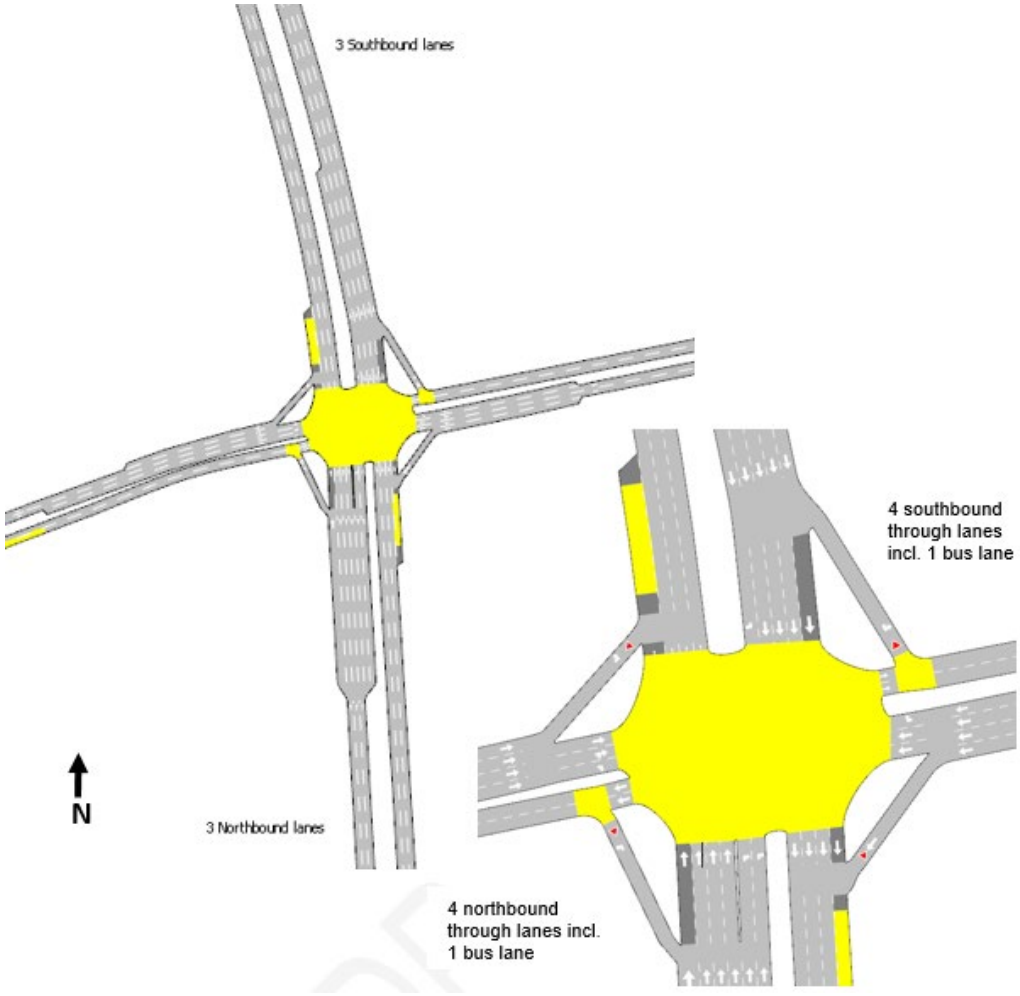


Figure 5-8 Assumed upgrades at Richmond Road and Townson Road (2036)

5.2.1.2 Intersection layout: Option 3A and Option 3B

To accommodate the additional westbound left turn volumes at the Richmond Road and Townson Road intersection, particularly in the future year 2036, the lane configuration at the eastern approach was investigated. Two lane configuration options were investigated and are described in the following sections. An initial Option 3A was investigated with the geometric layout shown in Figure 5-9, which converts one through lane to a through and left turn shared lane.

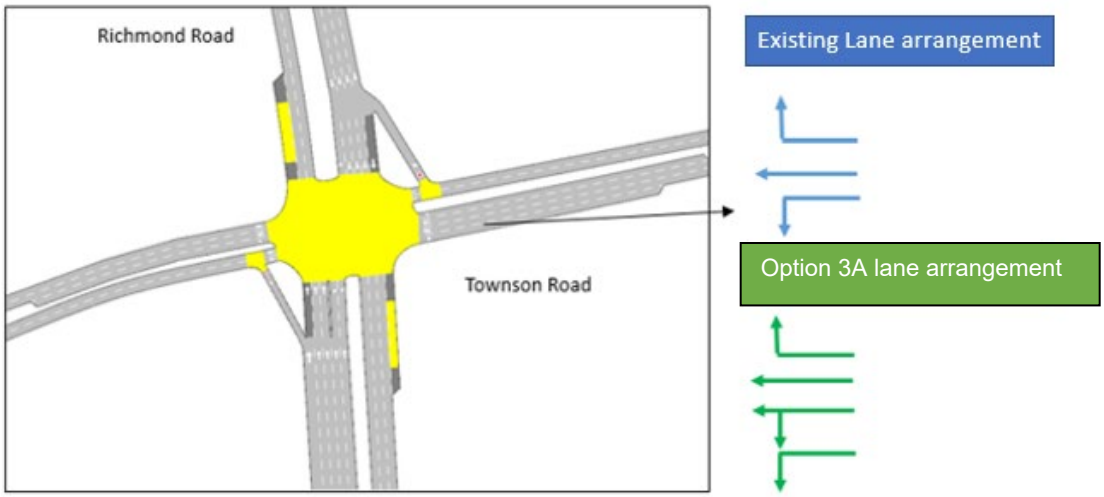


Figure 5-9 Option 3A lane arrangement at the eastern approach

An alternate layout (Option 3B) was also assessed, which investigates the impact of a left turn slip lane at the eastern approach of Townson Road to Richmond Road as shown in Figure 5-10. The eastern approach consists of two dedicated through lanes and one left turn slip lane with short 90 metres storage. In addition, it was assumed that the Hollinsworth Road also has a slip lane at the western approach to Richmond Road. Apart from this change, the existing layout of Richmond Road and Townson Road intersection was retained in the assessment.

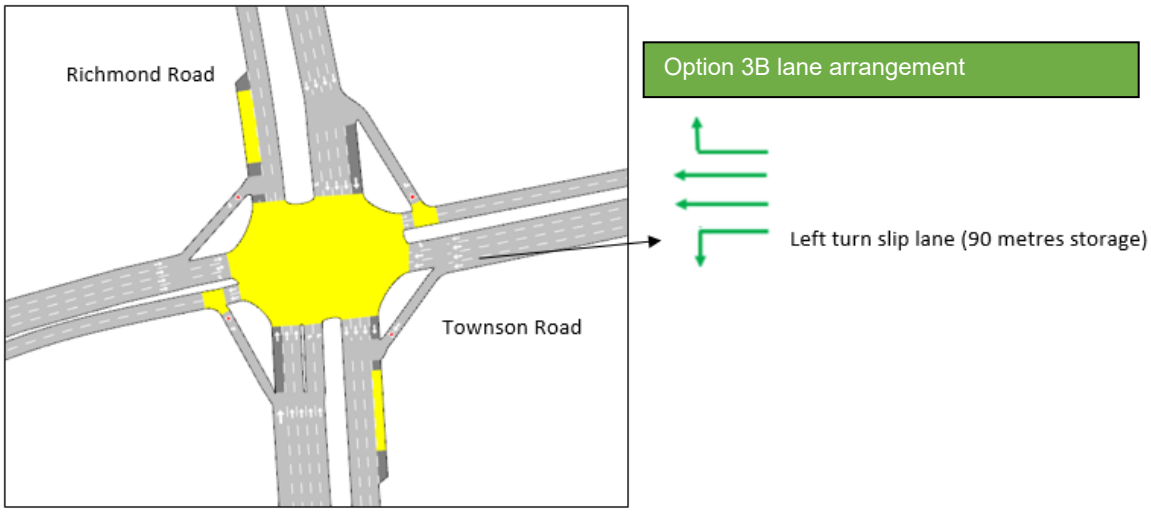


Figure 5-10 Option 3B lane arrangement- left turn slip lane at eastern approach

Note: the Hollinsworth left turn slip lane was assumed in the future modelling but is not part of the proposal

The zebra pedestrian crossing at the slip lane as shown by the indicative street view in Figure 5-11 is not explicitly modelled. It is anticipated that limited delay to the left turn vehicles would be encountered, in addition to the estimated delay of yielding to through movements on Richmond Road. A signalised pedestrian crossing would be provided however only activated upon a pedestrian call. It is anticipated that this likely not to occur every cycle.

Figure 5-11 Indicative single slip lane configuration

5.2.1.3 Option 3A (without left turn slip lane) results

The intersection performance outputs for Option 3A (without left turn slip lane) 2026 are displayed in Table 5-5 and for 2036 in Table 5-6.

Table 5-5 Option 3A Intersection performance of Richmond Road and Townson Road intersection –2026

Richmond Road and Townson Road	2026 - AM				2026 – PM			
	6:15 - 7:15 am		7:15 - 8:15 am		3:45 - 4:45 pm		4:45 - 5:45 pm	
	Delay	LoS	Delay	LoS	Delay	LoS	Delay	LoS
Southbound	40	C	38	C	51	D	50	D
Eastbound	41	C	53	D	58	E	91	F
Northbound	37	C	44	D	50	D	43	D
Westbound	33	C	106	F	69	E	68	E
Total	37	C	59	E	54	D	56	D

Table 5-6 Option 3A Intersection performance of Richmond Road and Townson Road intersection – 2036

Richmond Road and Townson Road	2036 - AM				2036 – PM			
	6:15 - 7:15 am		7:15 - 8:15 am		3:45 - 4:45 pm		4:45 - 5:45 pm	
	Delay	LoS	Delay	LoS	Delay	LoS	Delay	LoS
Southbound	47	D	65	E	141	F	163	F
Eastbound	41	C	64	E	97	F	148	F
Northbound	59	E	68	E	49	D	46	D
Westbound	33	C	76	F	74	F	125	F
Total	47	D	68	E	93	F	112	F

Based on the results in Table 5-5 and Table 5-6, the following outcomes were identified:

- The 2026 AM peak operates satisfactorily, however, the overall performance in 2036 AM peak approaches an unsatisfactory performance (LOS F).
- The PM peak performs significantly worse in comparison to the AM peak. Both the 2026 and 2036 options operate at LOS F.

5.2.1.4 Option 3B (single left turn slip lane) results

The intersection performance outputs for Option 3B (with left turn slip lane) are displayed in Table 5-7, with 4 lanes on Richmond Road.

Table 5-7 2026 Option 3B – Single westbound left turn slip lane

Approach	2026 - AM				2026 - PM			
	6:15 am-7:15 am		7:15 am-8:15 am		3:45 pm-4:45 pm		4:45 pm-5:45 pm	
	Delay	LoS	Delay	LoS	Delay	LoS	Delay	LoS
Southbound	39	C	43	D	48	D	53	D
Eastbound	51	D	50	D	41	C	46	D
Northbound	46	D	53	D	49	D	58	E
Westbound	27	B	35	C	37	C	41	C
Total	39	C	44	D	46	D	53	D

With the single westbound left turn slip lane from Townson Road in 2026 (Option B, Table 5-7):

- The level of service and delays are at a satisfactory level (LOS D) overall for the Richmond Road/Townson Road intersection in 2026, with Richmond Road retained as 4 lanes.
- Approach delays at the Townson Road approach (westbound) was predicted to be at Los C or better. The left turn slip lane would result in a delay reduction of approximately 50 seconds compared to Option A.
- The left turn slip lane at Hollinsworth Road contributed to the delay reduction at the eastbound approach, by over 60 seconds compared to the results in Option A.

The performance of Option 3B in 2036 was also assessed, with Richmond Road widened to six lanes. The results demonstrated that this intersection would still operate within capacity in 2036. Table 5-8 shows by 2036 that overall the intersection performs satisfactorily with the single westbound left turn slip lane on Townson Road, however both eastbound (Hollinsworth Road) and westbound approaches are likely to have increased delays and operate at capacity, particularly in the PM peak.

Table 5-8 2036 Option 4B – with left turn slip lane

Approach	2036 - AM				2036 - PM			
	6:15 am-7:15 am		7:15 am-8:15 am		3:45 pm-4:45 pm		4:45 pm-5:45 pm	
	Delay	LoS	Delay	LoS	Delay	LoS	Delay	LoS
Southbound	41	C	42	C	48	D	52	D
Eastbound	54	D	57	E	54	D	56	D
Northbound	46	D	49	D	46	D	47	D
Westbound	31	C	39	C	64	E	52	D
Total	**41**	**C**	**44**	**D**	**50**	**D**	**50**	**D**

5.2.2 Ultimate phase: Townson Road and Victory Road

The modelled layout of Townson Road and Victory Road, shown in Table 5-9, was based on the concept design (DS2018/001093, December 2019) with minor changes to the length of short lane.

Table 5-9 Modelled layout of Townson Road and Victory Road

Approach	Original design	Recommended design	Comment
North	One full-length through and left turn lane and one short 60 metre right-turn lane.	One full-length through and left turn lane with slip and one short 80 metre right-turn lane	The right turn lane increased in the recommended design to allow for additional queue storage. An additional left turn slip lane was proposed on the southbound approach, following the traffic volume estimation which indicated high southbound left turn movements.
South	One full-length through and left-turn lane and one short right turn lane length is 60 metres.	One Full-length through and left-turn lane and one short 70 metre right-turn lane.	The right turn lane increased in the recommended design to allow for additional queue storage.
East	Two full-length through lanes, (the inside lane is a shared through and left turn), and a short 140 metre right-turn lane.	Two full-length through lanes, (the inside lane is a shared through and left turn), and a short 160 metre right-turn lane.	The right turn lane increased in the recommended design to allow for additional queue storage.
West	Two full-length through lanes, (the inside lane is a shared through and left turn), and a short 140 metre right-turn lane.	Two full-length through lanes, (the inside lane is a shared through and left turn), and a short 140 metre right-turn lane.	Original design layout retained.

Pedestrian crossings were included on all approaches. A minimum of four seconds of left turn protection was modelled in each relevant phase, reflecting the frequency of the pedestrian phase to be called (eg called two times every three cycles with six seconds left turn protection).

The original design layout is shown in Figure 5-12, modelled layout was presented in Figure 5-13 and the traffic signal phasing and timing are presented in Table 5-10. Note that the additional slip lane provided at the north approach of Victory Road with Townson Road is not included within the proposed road design. This slip lane was included in the modelling to demonstrate future capacity benefits if it were to be included.

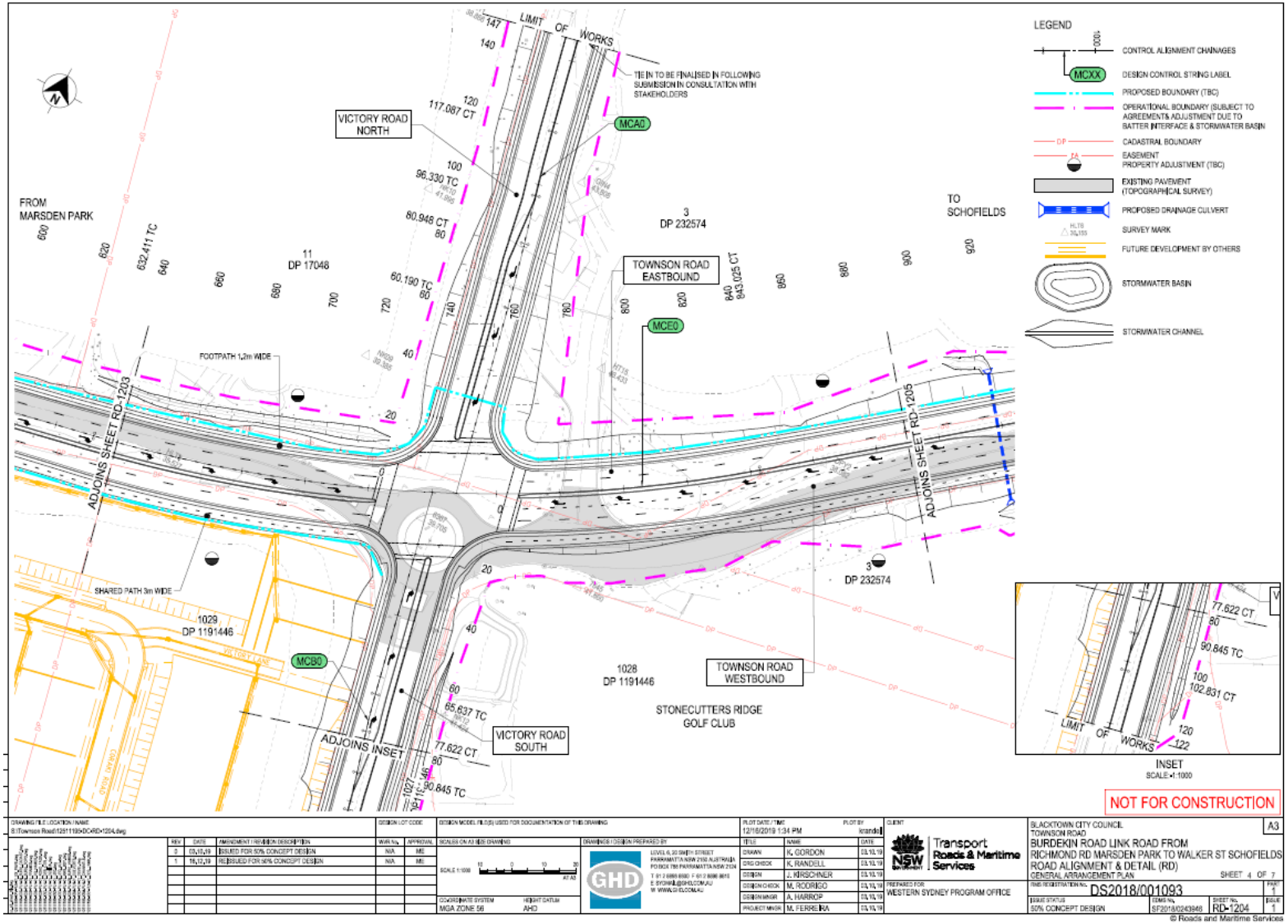


Figure 5-12 Original design layout at Victory Road and Townson Road

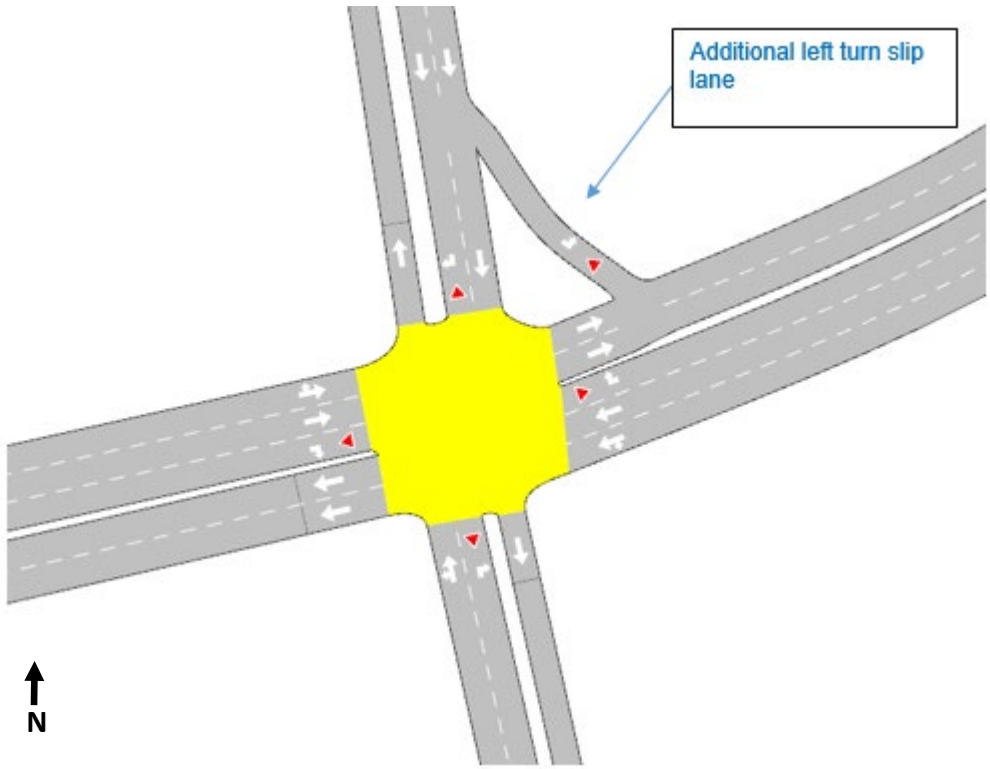
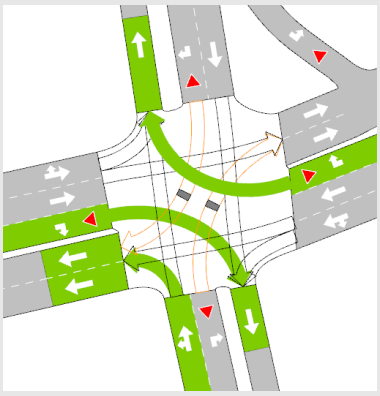
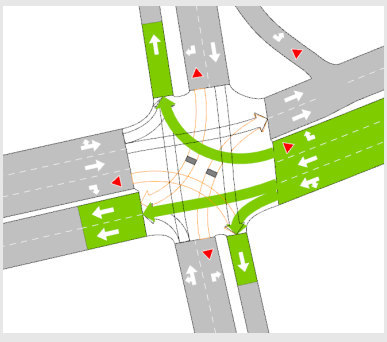
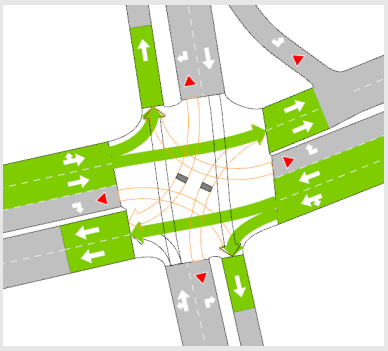
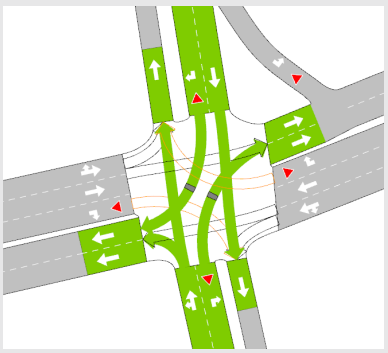
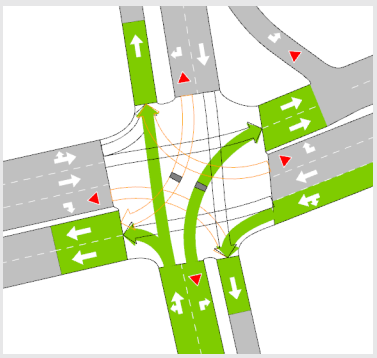


Figure 5-13 Modelled intersection layout at Townson Road and Victory Road

Table 5-10 Modelled signal settings at Townson Road and Victory Road

Proposed Signal Phasing/ Phase Time	2026 AM peak	2026 PM peak	2036 AM peak	2036 PM peak
	19 seconds	39 seconds	15 seconds	16 seconds
	-	-	20 seconds	26 seconds

Proposed Signal Phasing/ Phase Time	2026 AM peak	2026 PM peak	2036 AM peak	2036 PM peak
	58 seconds	54 seconds	42 seconds	54 seconds
	44 seconds	33 seconds	45 seconds	32 seconds
	19 seconds	14 seconds	18 seconds	12 seconds
Cycle time	140 seconds	140 seconds	140 seconds	140 seconds

Note: AM peak: 7:15 – 8:15 am. PM peak: 4:45 – 5:45 pm

The intersection performance results are provided in Table 5-11 (2026) and Table 5-12 (2036).

Table 5-11 Intersection performance of Townson Road and Victory Road intersection –2026

Townson Road and Victory Road	2026 - AM				2026 - PM			
	6:15-7:15 am		7:15-8:15 am		3:45-4:45 pm		4:45-5:45 pm	
	Delay	LoS	Delay	LoS	Delay	LoS	Delay	LoS
Southbound	26	B	48	D	39	C	31	C
Eastbound	45	D	37	C	39	C	50	D
Northbound	28	B	33	C	39	C	41	C
Westbound	43	C	56	D	25	B	29	B
Total	38	C	48	D	34	C	40	C

Table 5-12 Intersection performance of Townson Road and Victory Road intersection – 2036

Townson Road and Victory Road	2036 - AM				2036 - PM			
	6:15-7:15 am		7:15-8:15 am		3:45-4:45 pm		4:45-5:45 pm	
	Delay	LoS	Delay	LoS	Delay	LoS	Delay	LoS
Southbound	34	C	49	D	47	D	46	D
Eastbound	59	E	52	D	49	D	52	D
Northbound	33	C	32	C	50	D	50	D
Westbound	34	C	60	E	22	B	31	C
Total	39	C	52	D	39	C	43	D

Based on the results in Table 5-11 and Table 5-12, the key findings are:

- Intersection performance was observed to be satisfactory in the 2026 AM and PM peaks (less than 60 seconds delay or better than LOS D)
- Intersection performance was observed to be satisfactory in the 2036 AM and PM peaks (less than 60 seconds delay or better than LOS D) The eastbound movement was predicted to the worst performing movement, with LoS E in AM peak.

5.2.3 Ultimate phase: Townson Road and "New Road"

The modelled layout of Townson Road and a "New Road" was based on the concept design (DS2018/001093, December 2019) with minor changes to the length of a short lane:

Approach	Original design	Recommended design	Comment
North	One full-length through and left turn lane and one short 60 metre right-turn lane.	One full-length through and left turn lane with slip and one short 80 metre right-turn lane.	The right turn lane increased in the recommended design to allow for additional queue storage.
South	One full-length through and left-turn lane and one short right turn lane length is 30 metres.	Original layout retained	Original layout retained
East	Two full-length through lanes (with the inside lane a through and left-turn lane) and a short 130 metre right-turn lane.	Original layout retained	Original layout retained
West	Two full-length through lanes, (the inside lane is a shared through and left turn), and a short 160 metre right-turn lane.	Original design layout retained.	Original design layout retained.

Pedestrian crossings were included on all approaches. A minimum of four seconds of left turn protection was modelled in each relevant phase, reflecting the frequency of the pedestrian phase to be called (eg called two times every three cycles with six seconds left turn protection). The original design layout is shown in Figure 5-14 and the modelled layout is shown in Figure 5-15. The signal phasing and timing is shown in Table 5-13.

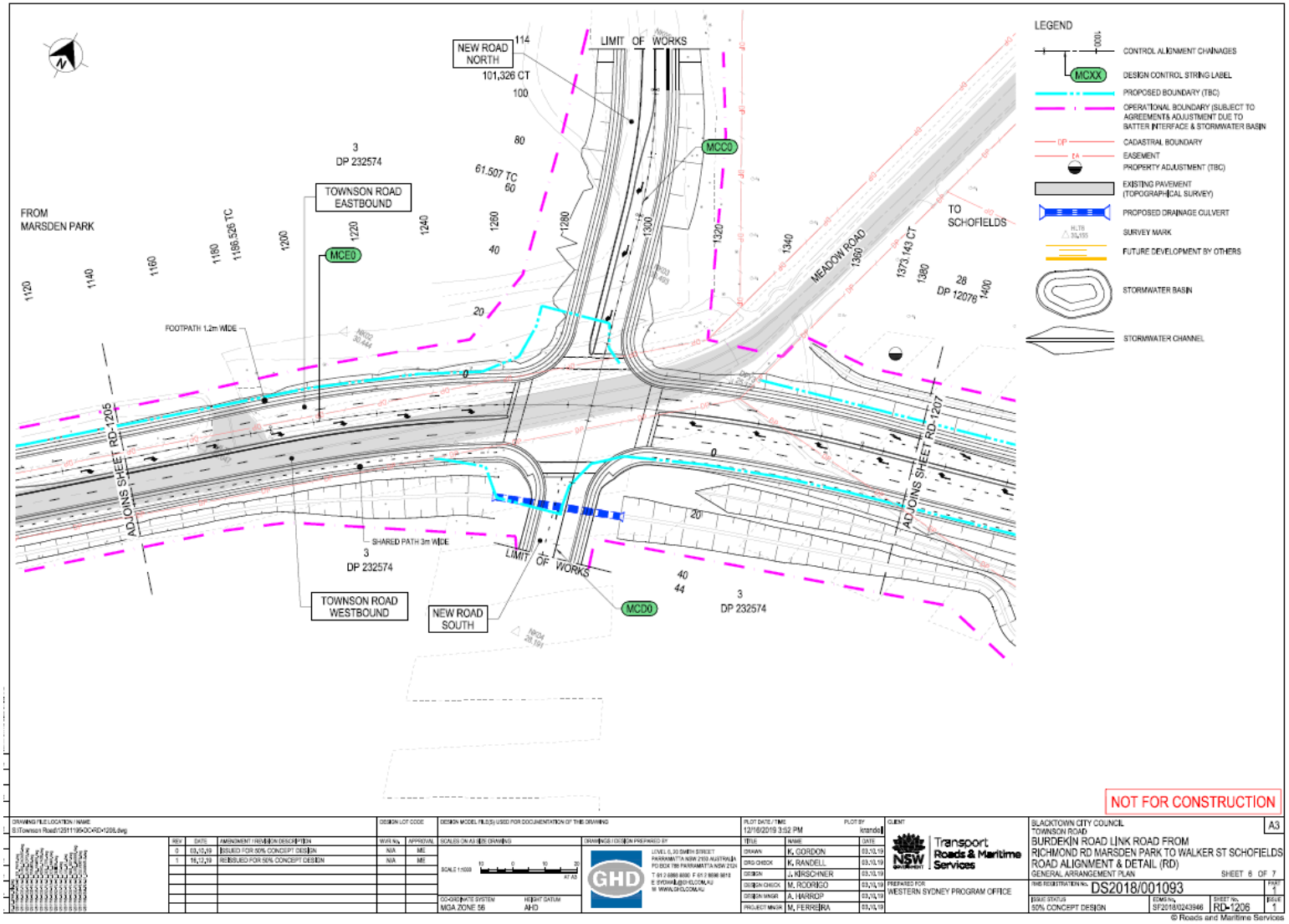


Figure 5-14 Original design layout of New Road and Townson Road

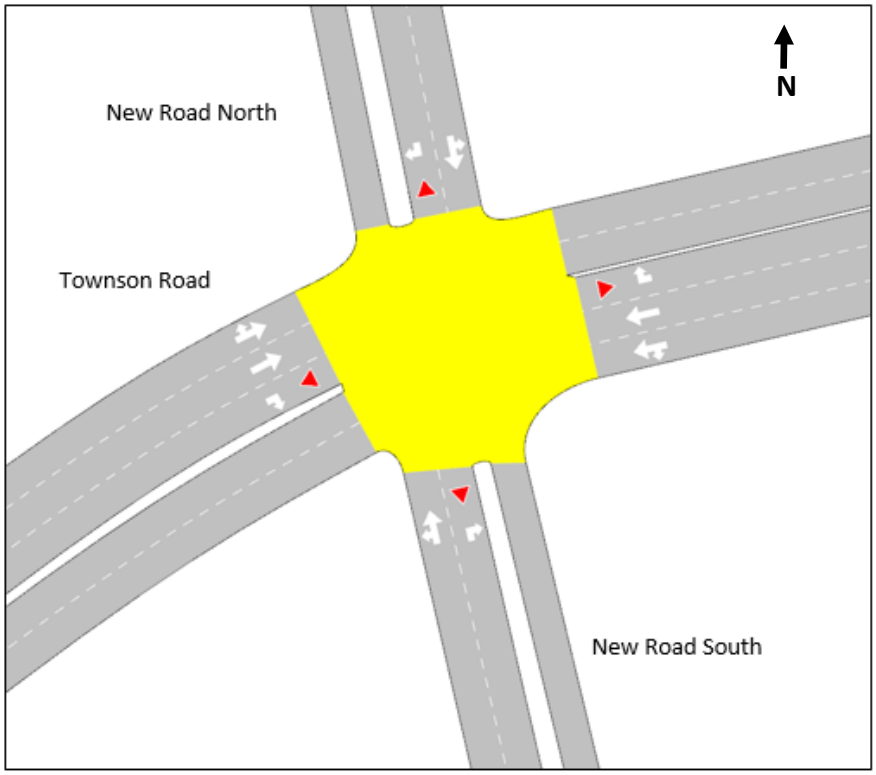
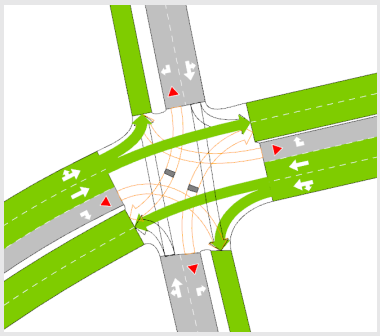
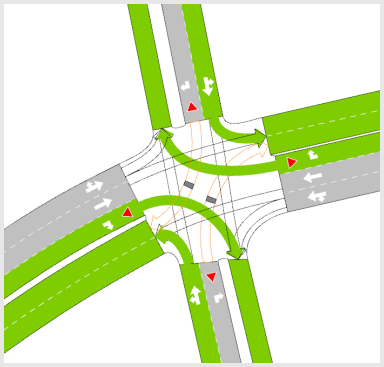
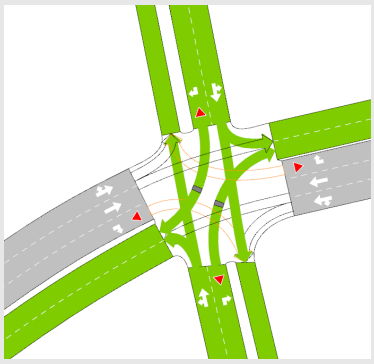
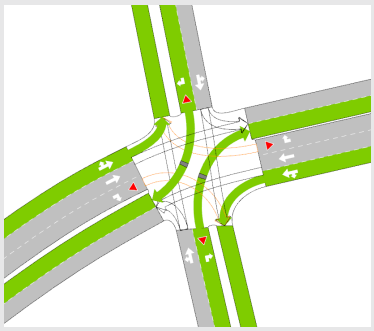


Figure 5-15 Modelled intersection layout at Townson Road and New Road

Table 5-13 Modelled signal settings at Townson Road and New Road

Proposed Signal Phasing/ Phase Time	2026 AM peak	2026 PM peak	2036 AM peak	2036 PM peak
	54 seconds	63 seconds	54 seconds	63 seconds
	16 seconds	32 seconds	16 seconds	31 seconds

Proposed Signal Phasing/ Phase Time	2026 AM peak	2026 PM peak	2036 AM peak	2036 PM peak
	36 seconds	28 seconds	36 seconds	29 seconds
	34 seconds	17 seconds	34 seconds	17 seconds
Cycle time	140 seconds	140 seconds	140 seconds	140 seconds

Note: AM peak: 7:15 – 8:15 am. PM peak: 4:45 – 5:45 pm

The intersection performance results were provided in Table 5-14 (2026) and Table 5-15 (2036).

Table 5-14 Intersection performance of Townson Road and New Road intersection –2026

Townson Road and New Road	2036 - AM				2036 - PM			
	6:15-7:15 am		7:15-8:15 am		3:45-4:45 pm		4:45-5:45 pm	
	Delay	LoS	Delay	LoS	Delay	LoS	Delay	LoS
Southbound	41	C	47	D	48	D	49	D
Eastbound	48	D	52	D	35	C	34	C
Northbound	36	C	38	C	37	C	36	C
Westbound	38	C	40	C	33	C	33	C
Total	42	C	46	D	36	C	35	C

Table 5-15 Intersection performance of Townson Road and New Road intersection – 2036

Townson Road and New Road	2036 - AM				2036 - PM			
	6:15-7:15 am		7:15-8:15 am		3:45-4:45 pm		4:45-5:45 pm	
	Delay	LoS	Delay	LoS	Delay	LoS	Delay	LoS
Southbound	38	C	46	D	50	D	54	D
Eastbound	42	C	50	D	43	D	41	C
Northbound	35	C	37	C	36	C	37	C
Westbound	32	C	39	C	52	D	48	D
Total	37	C	45	D	47	D	45	D

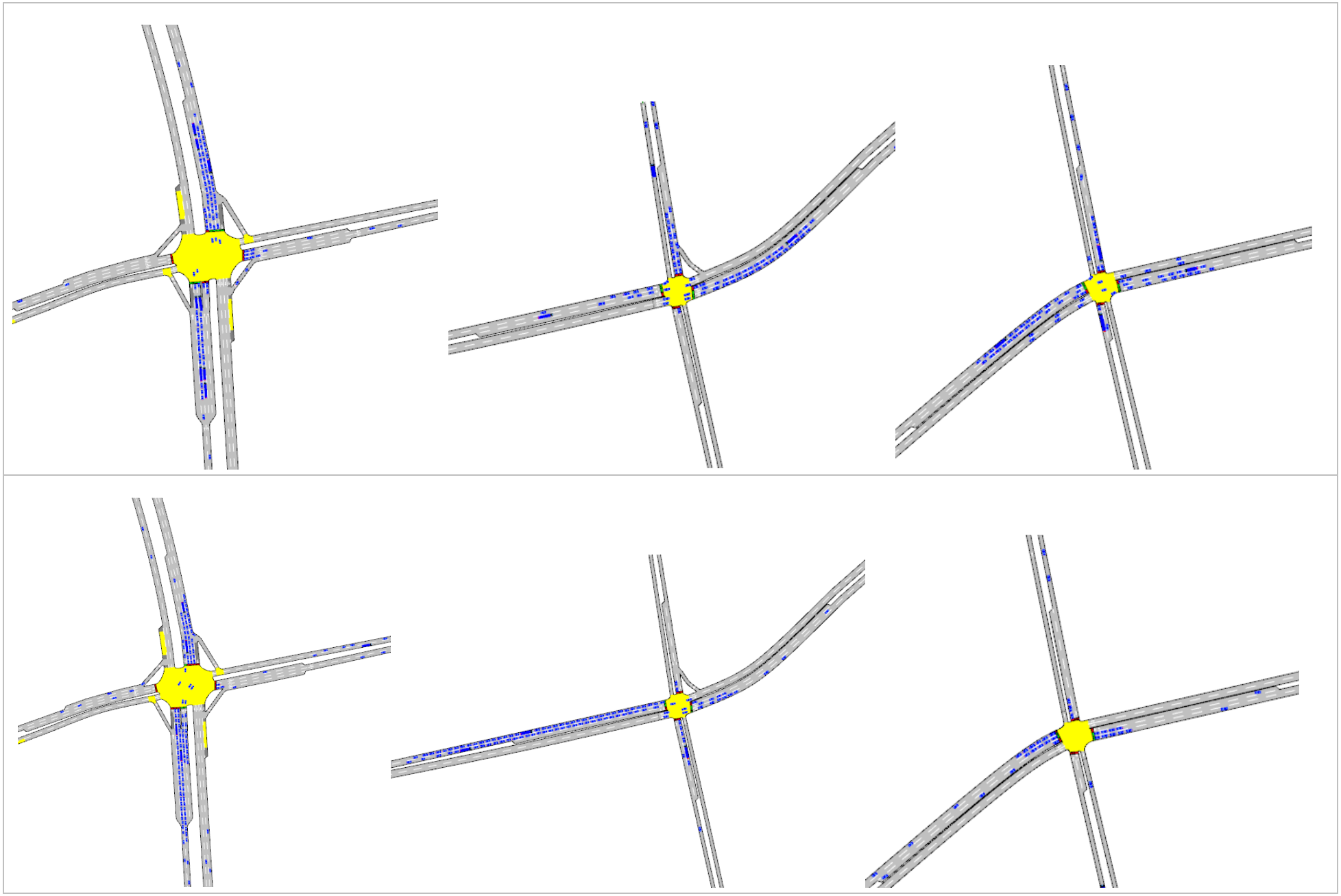
As shown in Table 5-14 and Table 5-15, the following outcomes were found at the Townson Road and New Road, with the modelled intersection layout:

- Intersection performance was observed to be satisfactory in the 2026 AM and PM peaks (better than LOS D)
- Intersection performance was observed to be satisfactory in the 2036 AM and PM peaks (better than LOS D)
- All the movements were predicted to operate within capacity.

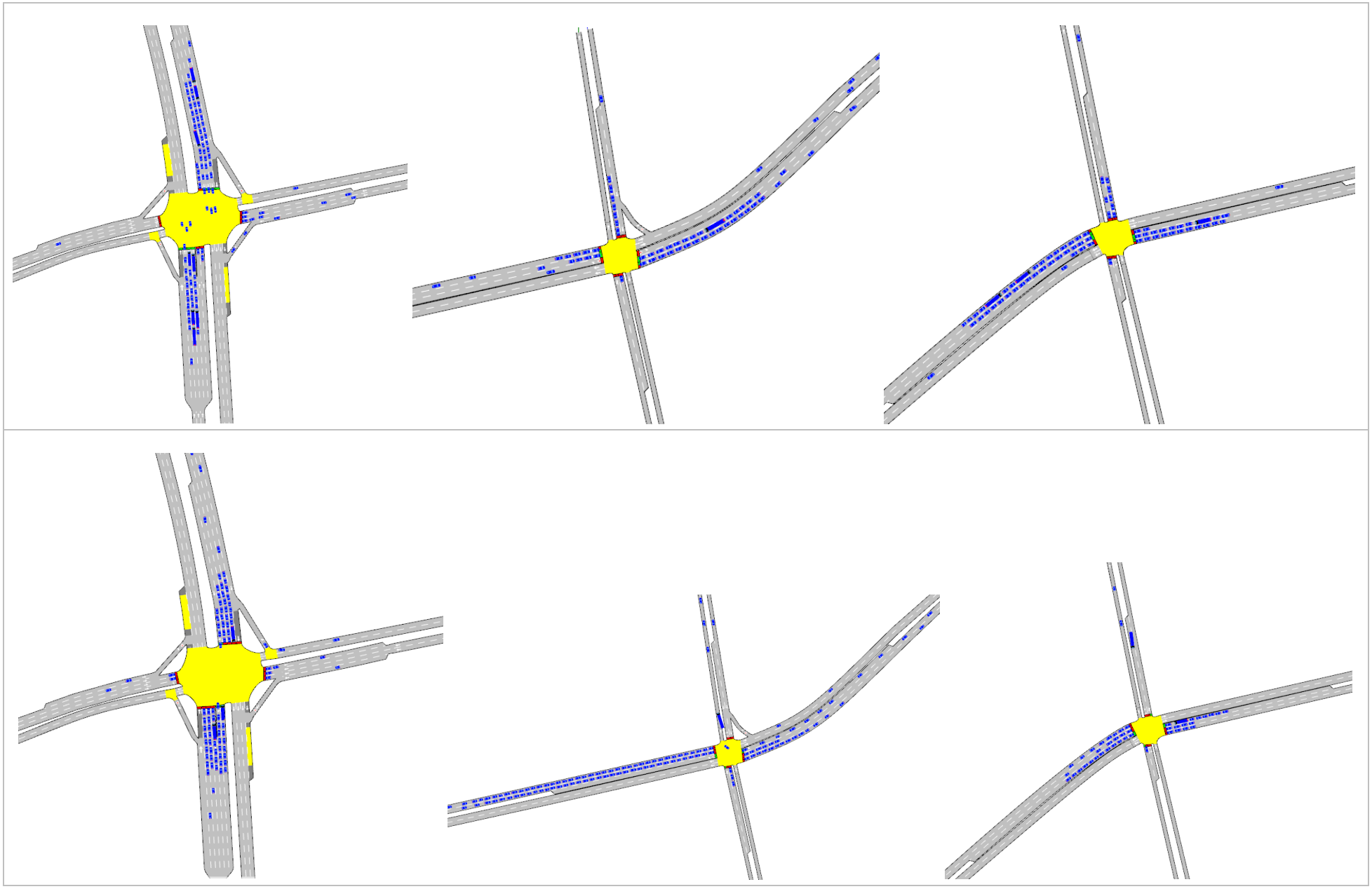
5.2.4 Ultimate phase: Queue length comparison

95th percentile queue length on the Townson Road corridor was also compared (Figure 5-5 to Figure 5-7) to demonstrate the capacity benefits provided by upgrading Townson Road from a two lane, two way, road, to a four lane, two way, road signalised network.

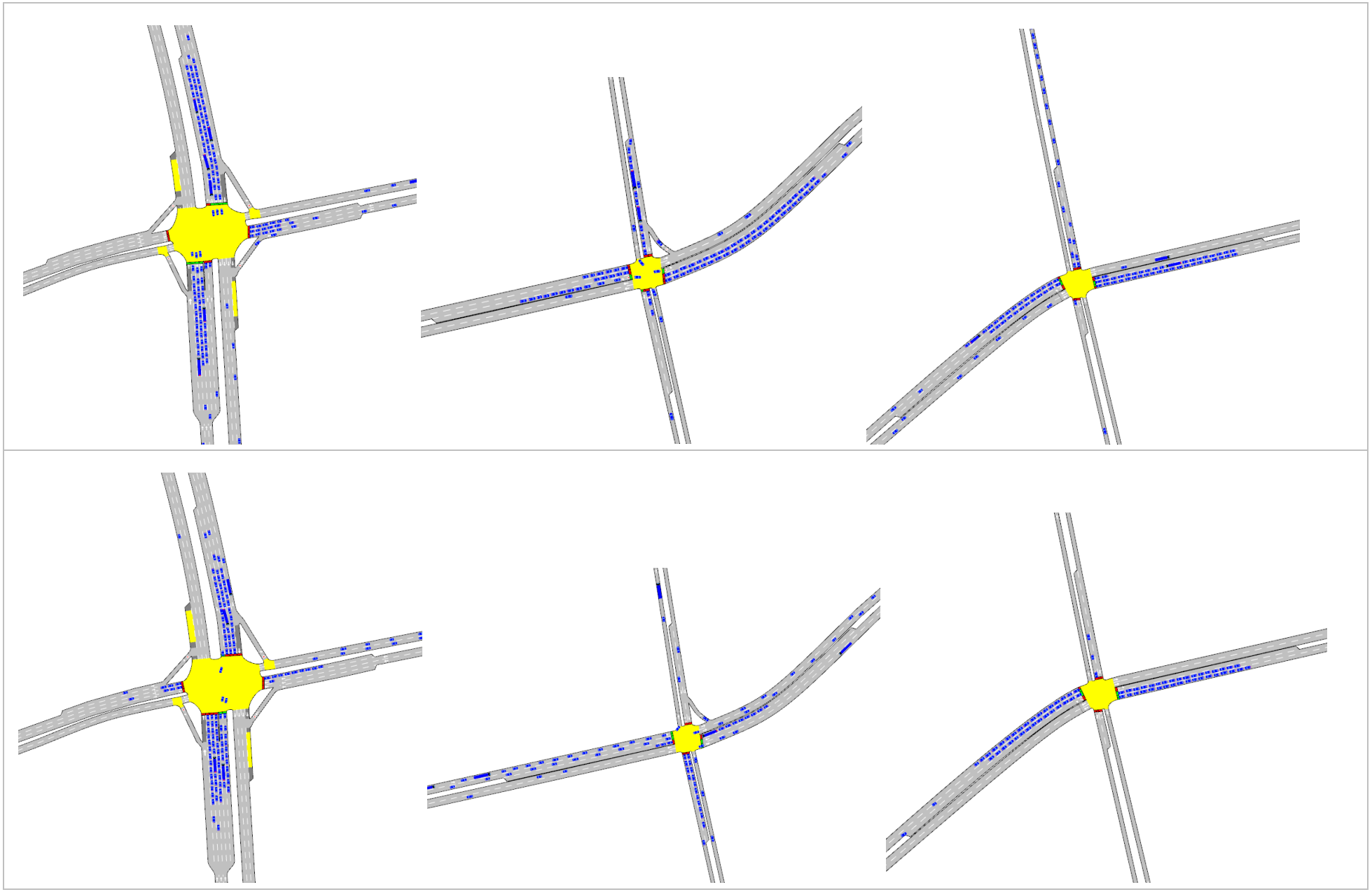
Traffic Queues: Option 3B 2026 (AM peak – top; PM peak – bottom)



Traffic Queues: Option 4B 2026 (AM peak – top; PM peak – bottom)



Traffic Queues: Option 4B 2036 (AM peak – top; PM peak – bottom)



5.2.5 Ultimate phase Recommendation

A summary of the traffic modelling results is shown in Table 5-16.

The modelling results show that by providing an additional left turn slip lane at the eastern approach of Townson Road to Richmond Road, that this would likely provide sufficient capacity to cater for future traffic growth on the Townson Road Corridor.

The proposed layouts for ultimate phase at Victory Road and Townson Road intersection and Victory Road and New Road intersection were assessed to be sufficient to accommodate the future traffic growth in 2036.

Note additional traffic throughputs on Townson Road corridor were predicted as a result of the potential widening of Richmond Road to six lanes. The Townson Road and Victory Road intersection and Townson Road and New Road intersection would still operate within capacity with the additional throughputs of up to 130 vehicles per hour in 2036.

Table 5-16 Level of Service results summary (2026)

Level of Service	AM Peak			PM Peak		
Intersections	Richmond Road and Townson Road	Townson Road and Victory Road	Townson Road and New Road	Richmond Road and Townson Road	Townson Road and Victory Road	Townson Road and New Road
Level of Service in 2026	D	C	D	D	C	C
Level of Service in 2036	D	D	D	D	D	D

6. Construction traffic impact assessment

6.1 Potential construction traffic generation

It is expected that construction traffic impacts associated with the proposal would be generated by construction vehicles, namely workers and heavy vehicles, accessing and egressing the proposal.

6.2 Work activities

The proposal will include the following key work activities:

- Clearing and grubbing, topsoil removal
- Site access establishment for local traffic
- Existing asset and property demolitions
- Bridge construction
- Permanent kerb and pavement shared path and stormwater system on Townson Road
- Intersection construction at Victory Road and a New Road (name still to be determined)
- Creek protection works.

6.2.1 Construction timeframe

Construction of the interim phase is anticipated to start in early 2022, opening to traffic in 2023. It is anticipated that the interim phase would be operational for a period of up to five years before the ultimate phase work is completed.

Both phases of construction work are anticipated to take around 18 months each to complete.

6.2.2 Proposed work hours

The working hours for the construction sites would be as follows:

- Monday to Friday (7.00 am to 6.00 pm)
- Saturday (8.00 am to 1.00 pm)
- Sunday and public holidays (no work)
- Limited night time works for Victory Road south reconstruction which would involve minimal vehicle movements.

6.3 Construction activity traffic generation

6.3.1 Staff movements

During the proposed works, it is anticipated that up to a maximum of 80 personnel per day (Construction Staging Report, Ranbury 2019) would be likely to access the proposal. This is dependent on the construction staging and the construction contractor.

6.3.2 Light vehicle traffic generation

It is estimated that light vehicle movements to the proposal are in the order of 12 to 50 vehicles daily across the proposal (Construction Staging Report, Ranbury 2019). It is assumed that there will be some level of car sharing. These volumes equate to, on average less than two to five vehicles every hour over the peak hour arrival and departure periods.

The expected volume of construction worker trips are low and would fall within typical daily fluctuations with no expected adverse impacts to the operation of the adjoining road network. Construction workers would be expected to access the site works area in the morning and exit in the afternoon/evening.

Due to the low construction traffic generated by the proposal, no traffic modelling has been carried out.

6.3.3 Heavy vehicle traffic generation

The traffic generation associated with heavy vehicles has been based on the concept design and it is assumed that heavy vehicle truck movements are in the order of five to 10 vehicles per hour (access and egress) at each construction. Trucks are expected to deliver material and to remove spoil.

These increases in traffic movements are low and would fall within typical daily fluctuations with no expected adverse impacts to the operation of the adjoining road network.

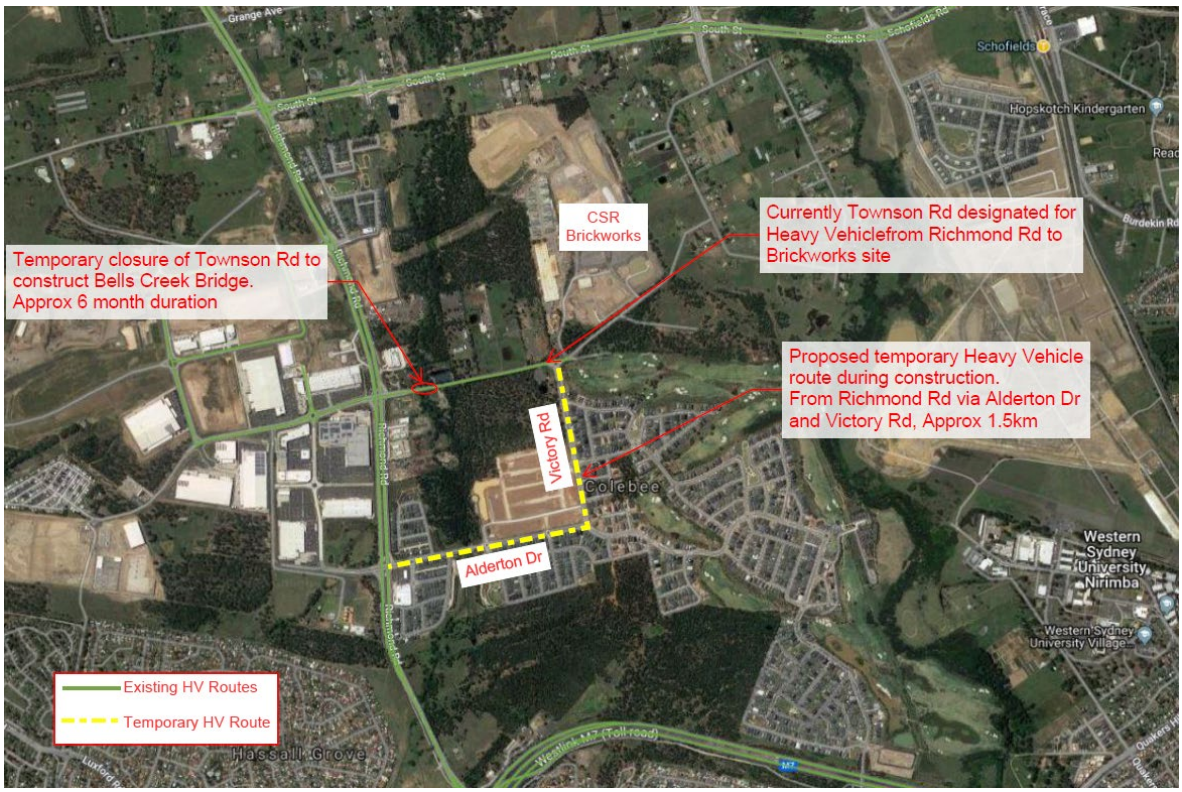
Due to the low construction traffic generated by the proposal, no traffic modelling has been carried out.

6.4 Construction traffic access and trip distribution

It is expected that for the works would include a temporary closure of Townson Road at the approach to Richmond Road, in order to construction the proposed bridges. This will divert existing traffic and construction traffic via Alderton Drive and Victory Road as an alternate route.

The construction traffic movements are expected to occur:

- To/from Townson Road via the south side – Richmond Road, Alderton Drive and Victory Road
- To/from Townson Road via the north side – South Street, Richmond Road, Alderton Drive and Victory Road. Figure 6-1 shows illustratively the proposed temporary and existing heavy vehicle routes for construction vehicles.



Source: Google maps modified by GHD

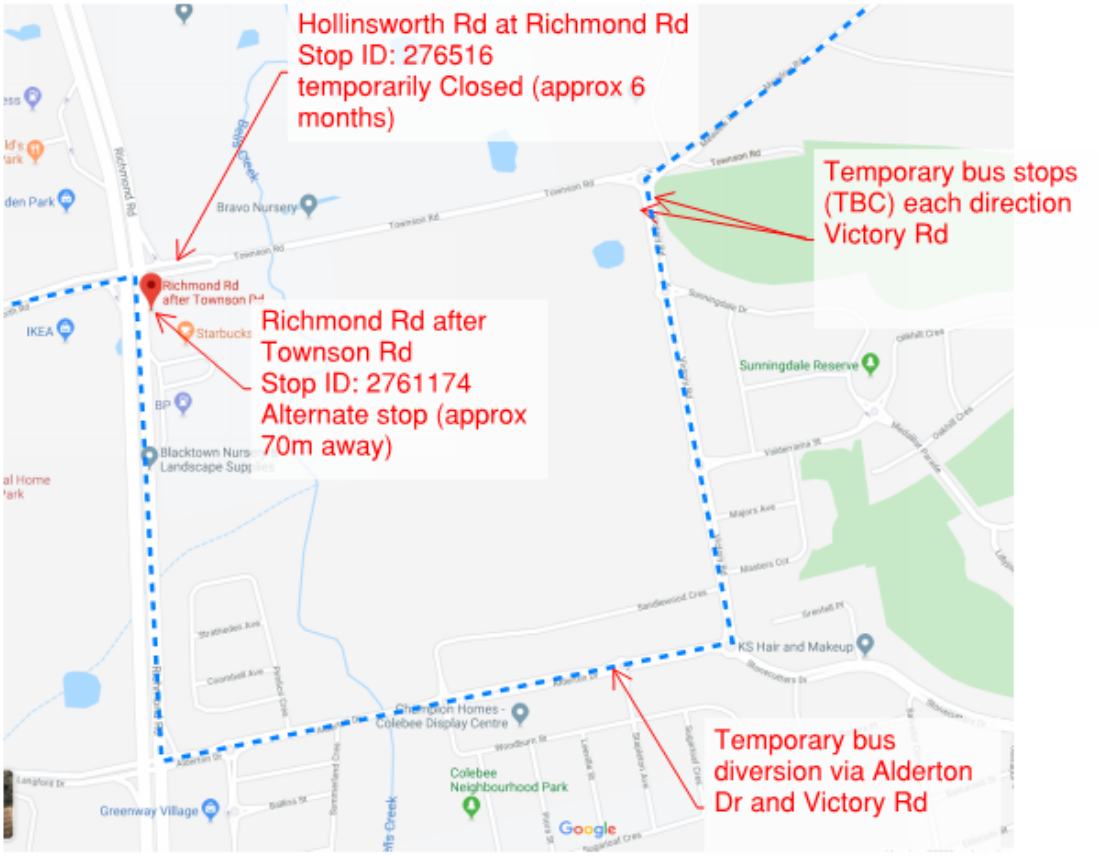
Figure 6-1 Construction traffic routes

6.5 Parking for construction workers

It is anticipated that parking for construction workers will be restricted to designated compounds and areas for construction workers only. As such, there should be minimal impact to on-street parking and traffic flow on the existing road network. The proposed location for the compound proposal is shown in section 8.1.10.

6.6 Public transport

During construction of Townson Road, there will be impacts to bus services that use Townson Road (bus route 742). During this time, bus services will be required to use the temporary diverted route via Alderton Drive and Victory Road to access Townson Road. Existing bus stops would also be temporarily relocated to accommodate the diverted bus route as shown in Figure 6-2.



Source Google Maps modified by GHD

Figure 6-2 Temporary bus route and bus stop changes

7. Cumulative traffic impacts

The following developments within close proximity of the proposal have the potential to occur at the same time as the construction of the proposal, and therefore have the potential to contribute to cumulative traffic impacts within the study area:

- Luxeland development
- Altove development
- CSR development.

The potential for cumulative impacts at the operation stage has been assessed as set out in section 4.3 traffic generation estimates for 2026 and 2036. Future traffic impacts and road network performance in the study area arising as a result of cumulative development shown in Table 4-2 have been modelled in section 5. Section 5 also describes proposed intersection improvements to mitigate against lower levels of intersection performance on Townson Road.

Cumulative impacts arising from construction traffic from developments listed in section 4.3 will be managed with the implementation of the preliminary construction traffic management plan and mitigation measures proposed in section 8. To further minimise the potential for cumulative impacts coordination would be undertaken with other stakeholders associated with those projects prior to construction to ensure construction activities are appropriately scheduled and undertaken to minimise impacts.

8. Mitigation measures

8.1 Preliminary construction traffic management plan

8.1.1 Objectives

The Preliminary Construction Traffic Management Plan (CTMP) aims to facilitate the safety of all workers and road users within the vicinity of the construction site. The following outlines the primary objectives:

- To minimise the impact of the construction vehicle traffic on the operation of the adjoining road network
- To facilitate the continuous, safe and efficient movement of traffic for both the general public and construction workers
- To identify appropriate advance warning signs to inform users of changed traffic conditions
- To facilitate the establishment of a safe pedestrian environment in the vicinity of the proposal
- To provide a description of the types of vehicles and estimated vehicle volumes during each stage of construction
- To provide information regarding the access arrangement and a description of the proposed routes for vehicles accessing and egressing the construction sites.

8.1.2 Construction vehicle access route

Consideration needs to be given to vehicle types expected to access Alderton Drive and Victory Road to the proposal as this is a local street with residential frontage and sections of parallel parking. A number of roundabouts exist on this route also which may restrict manoeuvrability of longer vehicles, however they have been designed with mountable kerbs to allow for heavy vehicle movements.

The contractor will be responsible for assessing the maximum vehicle type to be used for accessing the proposal via Alderton Drive and Victory Road.

Heavy vehicles

Arrival of heavy vehicles for construction work will require coordination to minimise queuing of vehicles, notably during peak truck movement, such as the main works. Vehicles are not to double park or queue to adversely impact traffic and pedestrian thoroughfare and property access.

Although not anticipated to be required for the proposed construction works and is not proposed due to the low volume of construction vehicles, application of a Works Zone can minimise the likelihood of impacts to traffic movement on the surrounding road network in the designated queue areas.

Such traffic management should be considered if road network operation becomes restricted during constructions works.

Light vehicles

During the proposed works, it is expected that there would be a total construction workforce of up to 80 personnel accessing the site daily.

It is anticipated primarily the worker vehicle parking will be within on-site compound, where some parking could be made available adjacent to the proposal.

The designated area will need to be addressed in greater detail between the Contractor, TfNSW and the Council, prior to commencement of construction and incorporated within the detailed CTMP.

It is recommended that workers be made aware of alternative transport options and where possible encouraged to use alternate transport options such as public transport to access the proposal or carpool with fellow workers. Detailing the available transport and carpooling options should form part of the site induction process.

8.1.3 Traffic management

Public access to the proposal is expected to be maintained on the surrounding road network. Vehicles will be permitted to travel past the worksite with traffic signage in accordance with a Traffic Control Plan (TCP) to be developed in accordance with Roads and Maritime *Traffic Control at Works Sites* manual (2018) and AS1742.3 – T*raffic Control for Works on Roads*.

TCPs will need to be developed as part of the detailed CTMP before the commencing of construction activity on the proposal.

8.1.4 Road closures

Full road closures

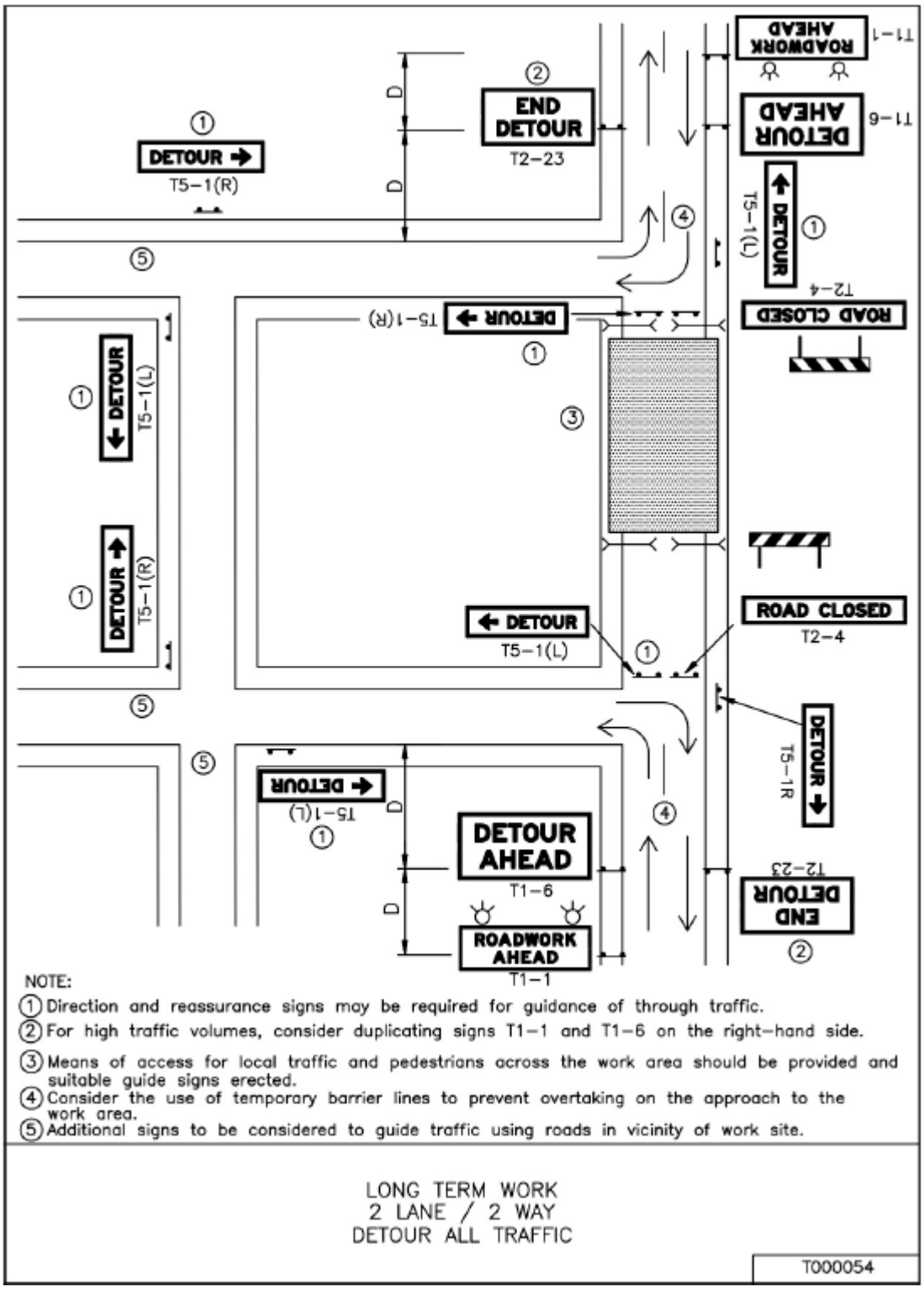
Although details of full road closure are not available at this stage, it is likely that Townson Road near the intersection of Richmond Road would require a full closure to allow for the construction activities associated with the Bells Creek Bridge.

Residential properties along Townson Road between Richmond Road and Victory Road that require to travel west will be temporarily diverted to Victory Road, and Alderton Drive.

TCPs are to be developed in accordance with Roads and Maritime *Traffic Control at Works Sites* manual (2018) and AS1742.3 – T*raffic Control for Works on Roads*.

Residential and business in the local area shall be notified on any road closures (refer to section 8.1.13).

An example of a traffic control plan for a road closure and detour that would be expected on Townson Road is shown in Figure 8-1.



Source: Traffic Control at Work Sites Technical Manual Transport for NSW 2018

Figure 8-1 Example traffic control plan for road closures and detours

8.1.5 Oversize vehicles

Section 8.1.2 outlines the proposed access routes for heavy vehicles.

The Constructor is to review the suitability of the maximum size vehicle that can negotiate the road network. It is anticipated that cranes for bridge construction will be used (subject to Contractor review).

No oversized vehicles are anticipated to be used for the construction works.

8.1.6 Pedestrian and bicycle management

This section outlines the management of impacts on pedestrians, cyclists and paths and the maximisation of their safety. The prime objectives of a pedestrian and cyclist management framework are strategical to:

- Ensure the safety and protection of pedestrians and cyclists
- Minimise disruption to pedestrian and cycle movements
- Management of pedestrian and cycle flows around the construction sites and haulage routes. This addresses all traffic control actions such as traffic control personnel, redirection of pedestrians, cyclists, signposting, line-marking, Variable Message Sign (VMS), lane closures etc
- Identify mitigation measures to improve the efficiency for pedestrian utilisation of pathways and movements.

Site access will be restricted to authorised personnel only. It is anticipated that the pedestrian, and to a lesser extent, cyclist activity, within proximity to the proposal will be low due to the residential nature of the site locations.

Potential interactions between construction traffic and pedestrians and bicycle riders include:

- Impact to pedestrian and bicycle rider movements due to the movement of material to and from the proposal
- Increased vehicle movements may reduce safety.

Pedestrians are to be clearly directed to utilise formed paths where possible or temporary paths as a short term measure.

Clear visibility at the site egress along the road network and the pedestrian pathway is to be maintained. This can be achieved by the removal of vegetation, where required or convex mirrors upon site egress.

8.1.7 Works zone

Works Zone are not anticipated on the road network for the duration of works. However, such traffic management should be considered if road network operation becomes restricted during constructions works.

Works Zone's, if required, are to be positioned near the worksites and can assist in short term parking of heavy vehicles during loading and unloading activity or parking for site workers.

Should a Work Zone be required, the contractor is to apply through the council for approval.

8.1.8 Roadwork speed zone

Temporary roadwork speed limits are one of many traffic controls that can be implemented to manage the speed of traffic approaching and passing through work sites. However, they can, over long distances, have a significant impact on road user delay.

Roadwork speed zones must be logical and credible, as well as enforceable. When considering the use of roadwork speed zones, they will:

- Only be used where they are self-enforcing or will be enforced
- Not be used alone but with other traffic control signs and devices
- Not be used in place of more effective traffic controls
- Only be used while road works are in progress or the lower speed road conditions exist.

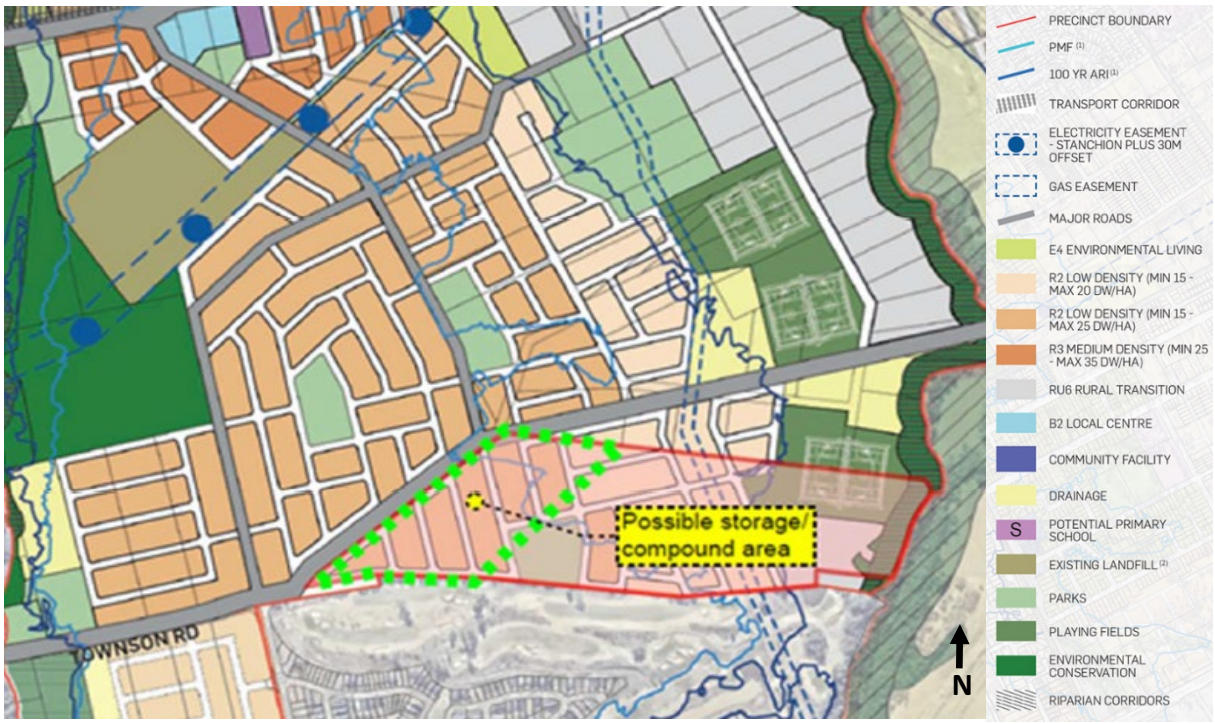
Where works are anticipated to be contained within the boundary of the sites, with vehicle access via local roads (Victory Road, Alderton Drive) where vehicle speeds are relatively low due to the existing urban environment, no Roadwork Speed Zones are proposed adjacent to the sites.

8.1.9 Access to adjoining properties

Access to all adjoining properties and lots will be maintained for the duration of works. Notification and communication to affected properties during lane or road closures are to be provided as outlined in section 8.1.13.

8.1.10 Storage of materials

All construction storage containment is to be located within the proposal. The road networks is not to be used for storage of material and equipment. A potential site compound for the storage of materials is shown in Figure 8-2.



Source: Ranbury Management Group Pty Ltd (Ranbury)

Figure 8-2 Potential site compound

8.1.11 Road hazards

The proposed works adjacent to the road network brings hazards to workers and the public and can impact the surrounding facilities. The CTMP should identify specific road hazards associated with the works area including but not limited to:

- Environmental:
  - Fog
  - Wet weather
  - Frost
- Transport infrastructure:
  - Bus infrastructure: Richmond Road and Townson Road
  - Bicycle facilities: Generally on-road environment
  - General traffic
  - Pedestrian activity and infrastructure: Parsley Bay Reserve play equipment
- Public facilities
  - No existing public facilities.

8.1.12 Environmental control

Notwithstanding the environmental requirements specified in other project documents, the following environmental requirements are to be adhered to:

- All vehicles transporting loose materials will have the entire load covered and/or secured to prevent any large items, excess dust or debris depositing onto the roadway during travel to and from the site with additional dust tracking control implemented, including, but not limited to, construction rumble strips/wheels wash at the site egress location.
- The lead contractors will monitor the roads leading to and from the site and take all necessary steps to rectify any road deposits caused by site vehicles, to maintain the safety of all road users.
- Vehicles operating to, from and within the site shall do so in a manner, which does not create unreasonable or unnecessary noise or vibration.
- Metal-tracked vehicles will not be permitted on paved roads.
- Public roads and access points will not be obstructed by any materials, vehicles, refuse skips or the like, under any circumstances.
- All subcontractors must be inducted by the lead contractor to encourage that all the relevant procedures are met.

8.1.13 Method of communicating traffic changes

Advance notification of upcoming works is paramount to safety and efficient delivery of the proposal. The following outlines communication measure to be considered in the detailed CTMP.

On-road communication

TCPs are to be developed in accordance with Australian Standards AS 1742.3 – Traffic Control Devices for Works on Roads (Australian Standards, 2009) and Roads and Maritime Traffic Control at Worksites manual (Roads and Maritime, 2018) to identify appropriate signage (and location) to advise motorists of upcoming changes in the road network.

Signs and Devices

Signs and other safety devices such as safety barriers, containment fences, temporary kerbing and longitudinal channelizing barricades should be provided in accordance with the Australian Standards (AS 1743.2 – Traffic Control Devices for Works on Roads) to:

- Warn, guide and instruct road users, workers and pedestrians
- Control the speed or passage of traffic within and adjacent to work areas
- Indicate travel diversions.

Other alternatives to consider include vehicle-mounted warning devices, illuminating arrow signs, and painting vehicles and machinery distinctive colours. Installations and operations of the traffic control devices must abide by the regulations in section 4 of AS 1743.2.

Variable Message Signs

The use of VMS provides benefit to the local community and visitors to convey messages of upcoming impacts to the road network as the result of construction activity. Although not anticipated for this proposal, VMS should be installed in locations and used in accordance with relevant guidelines and Australian Standard practices (AS 4852.1 and/or AS4852.2) with the necessary approvals from governing authorities.

Night Works

Due to limited night work being conducted, temporary traffic route lighting through a worksite may be required to supplement existing lighting particularly on areas where the path through the site could be difficult to follow.

Advance notification of works

Prior to the commencement of works on site, neighbouring properties must be informed by the contractor of the impacts and site contact information. Notification can be provided by various mean including, but not limited to:

- Letterbox distribution
- Local newspaper
- Council website.

8.1.14 Monitoring of Traffic Control Plans (TCP)

During construction the contractor shall each morning, prior to commencing work, ensure all signage is erected in accordance with the TCP and is clearly visible to motorists. Each evening, upon completion of work, the contractor is to ensure signage is either covered or removed as required.

A review of the TCPs can be undertaken as required in order to determine any potential need for future amendments. Any variation to the layout of the TCP on site is to be recorded and certified by accredited TfNSW personnel.

8.1.15 Work health and safety

Any workers required to undertake works or traffic control shall be suitably trained and hold the required accreditation to carry out works on-site and will also be site inducted. All traffic control personnel will be required to hold TfNSW accreditation in accordance with section 2.4 of the Roads and Maritimes Traffic Control at Worksites manual (Roads and Maritime, 2018).

8.1.16 Certificates and approvals

Approval is to be obtained from TfNSW, Blacktown City Council and other relevant authorities as required. Approvals that may need to be obtained for items such as but not limited to:

- Council Road opening permits
- Road occupancy approvals/licences
- Hoarding/fencing approvals.

8.1.17 Staff induction

All staff and subcontractors engaged on-site will be required to undergo a site induction. The induction will outline the requirements on the CTMP including site access routes, environmental and occupational health and safety responsibilities, emergency procedures, potential carpooling opportunities, etc. Additionally, the Site Manager will discuss CTMP requirements regularly as a part of toolbox talks.

8.1.18 Contact for emergency services

In the event of an emergency related construction traffic incident on the public road network, it will be the responsibility of the Site Manager to ensure that emergency services are notified. The emergency services include but are not limited to:

- Fire
- Ambulance
- Police.

Phone “000” in cases of emergency. Furthermore, it is the responsibility of the Site Manager to advise the emergency services of any restriction of vehicular access to the public and private areas one week prior to its implementation.

8.2 Operational mitigation measure

To provide necessary road capacity to sustain future development in the study area, the proposed Townson Road concept design was assessed against the future traffic growth in section 4. Proposed mitigation measures were recommended to include improvements to the original concept layout at Richmond Road/Townson Road and the Victory Road/Townson Road intersections. These improvements include:

- Providing additional northbound and southbound through lanes on Richmond Road
- Providing slip lane to the north approach of Victory Road/Townson Road.

The performance of these revised intersection concept layouts are discussed in more detail in section 5.

9. Conclusion and recommendations

This report details the traffic and transport impacts during the construction and operation of the proposed Townson Road conceptual design. In addition, a preliminary CTMP is provided for future contractors when developing a detailed CTMP prior to construction.

9.1 Operational impacts

9.1.1 Interim phase

Following the assessment of the interim phase (Townson Road two lanes between Richmond Road and New Road), the results demonstrated that the roundabout control at Townson Road/Victory Road would be inadequate in 2026 during peak hours.

Upgrading the Townson Road/Victory Road intersection to a traffic signal would provide benefits, noting an appropriate geometric layout needs provided (ie dedicated left and right turn lanes). The signalised Townson Road/Victory Road intersection would perform as LOS D in 2026, and the predicted queue length would be reduced to an acceptable distance. It would continue to operate at capacity (LOS E) by 2036.

In addition, the initial roundabout concept design for the New Road was shown to operate satisfactorily in 2026 without any need for additional lane capacity improvements.

Upgrading Townson Road to a four lane road corridor should be considered beyond 2026.

9.1.2 Ultimate phase

The modelling results show that by providing an additional left turn slip lane at the eastern approach of Townson Road to Richmond Road, that this would likely provide sufficient capacity to cater for future traffic growth on the Townson Road Corridor.

The proposed layouts for at the ultimate phase of the proposal at Victory Road and Townson Road intersection and Victory Road and New Road intersection were assessed to be sufficient to accommodate the future traffic growth in 2036.

Note additional traffic throughputs on Townson Road corridor were predicted as a result of the potential widening of Richmond Road to six lanes. The Townson Road and Victory Road intersection and Townson Road and New Road intersection would still operate within capacity with the additional throughputs of up to 130 vehicles per hour in 2036.

9.2 Construction impacts

A review of the expected construction impacts identified the following:

- There are minor impacts to the road network performance associated with construction as the traffic generated is expected to be approximately two to five light vehicles per hour and 10 heavy vehicles per hour. Due to the low construction traffic generated, it is anticipated this would fall within daily traffic fluctuations, and road network performance impacts are expected to be minor.
- During bridge construction of the Bells Creek Bridge, only residential and commercial access is permitted to Townson Road during construction. Remaining vehicles that require access would be diverted via Alderton Drive and Victory Street, which would result in minor increases in travel time.

9.3 Mitigation measures

9.3.1 Operational measures

Recommendations for mitigation to the future Townson Road intersection layouts are as follows:

- The provision of additional turn lanes at Townson Road/Victory Road intersection (Sceanrio 2C) would significantly reduce delays and queueing to satisfactory level for the interim stage.
- Provide additional through lanes on the north and south approaches of Richmond Road/ Townson Road intersection. While this was shown not to improve intersection performance substantially, it is likely to improve travel times and increase the number of vehicles arriving on Townson Road from Richmond Road during peak periods.
- Provide an additional left turn slip lane to the southbound approach of Townson Road and Victory Road.
- Seek to upgrade Townson Road from a two lane two way road to a four lane two way Road from 2026 onwards.

9.3.2 Construction measures

A detailed CTMP is required to be prepared before the start of works, with site induction for construction personnel being undertaken to outline the requirements of the CTMP. The aim of the CTMP is to maintain the safety of all workers and road users within the vicinity site and outline mitigation measures of construction traffic impacts. The plan is to include such items as:

- Vehicle approach routes
- Traffic management and TCP
- Workers transportation and on-site parking provisions
- Pedestrian and bicycle rider management
- Oversize vehicle permit requirements
- Road hazards (including environmental, transportation infrastructure, emergency services and public facilities etc)
- Methods of communicating traffic changes to the local community and visitors to the area.

The CTMP will be developed in consultation with Blacktown City Council and TfNSW.

10. References

Australian Standards, 2009, AS 1742.3 – Manual of uniform traffic control devices-Traffic control for works on roads

NSW Department for Planning, Industry and Environment, 2004, Guidelines for Walking and Cycling

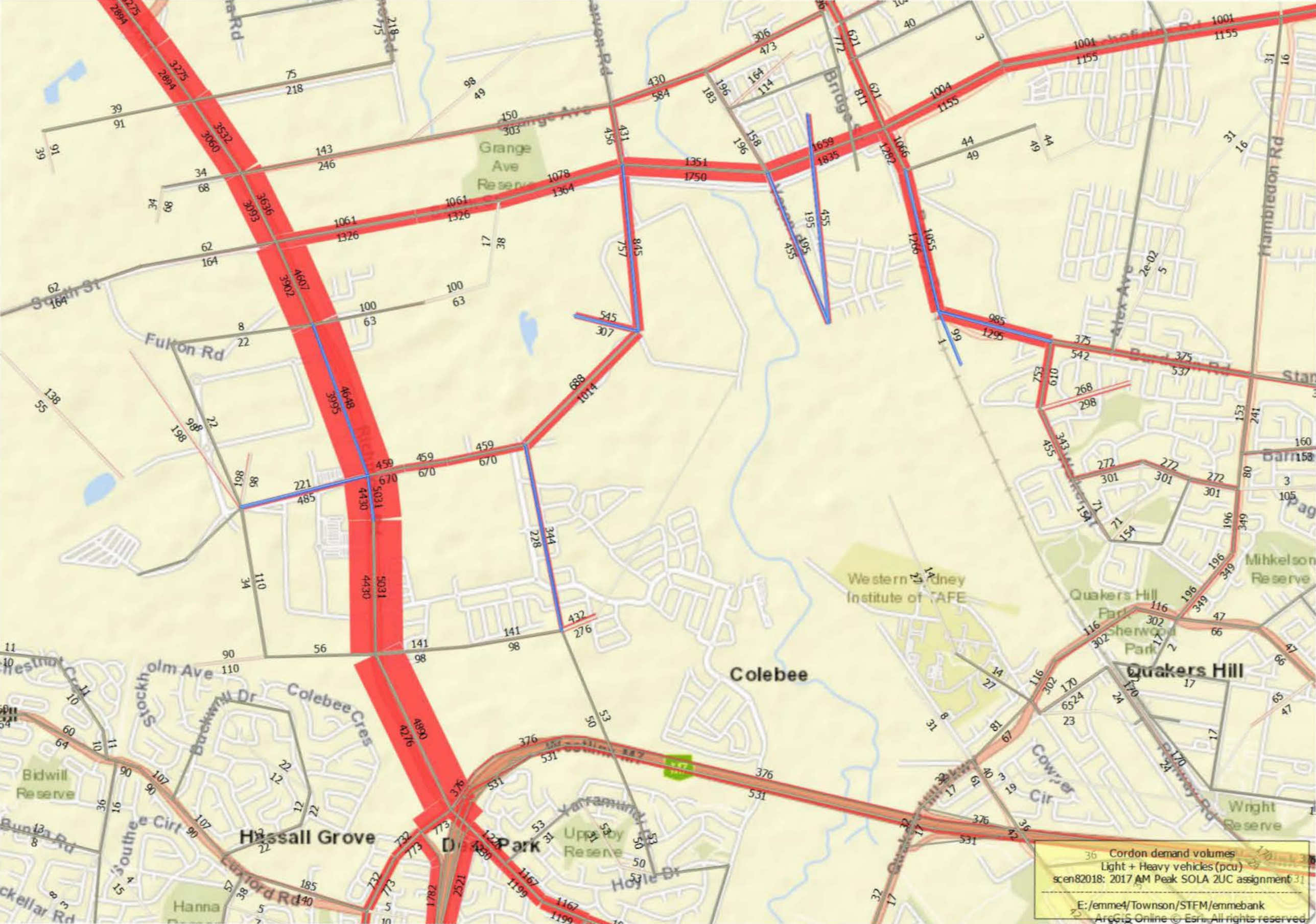
Roads and Maritime Services 2013, Traffic Modelling Guidelines.

Roads and Maritime Services 2012, Guide to Traffic Generating Developments.

Roads and Maritime Services 2018 Version 5, Traffic Control at Worksites Technical Manual

Appendices

Appendix A – STFM Modelling Plots (supplied by TfNSW)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Grange Ave Reserve
Bridge St
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South St
Stockholm Ave
Buckwell Dr
Colebee Cres
Colebee
Hassall Grove
Quakers Hill
Quakers Hill Park
Sherwood Park
Western Sydney Institute of TAFE
Mihkelson Reserve
Wright Reserve
Upper Roby Reserve
Bidwill Reserve
Hanna
Hoyle Dr
Southee Cirt
Clanford Rd
Cowper Cir
Alex Ave
Hambledon Rd
Cordon demand volumes
Light + Heavy vehicles (pcu)
scen82018: 2017 AM Peak SOLA 2UC assignment
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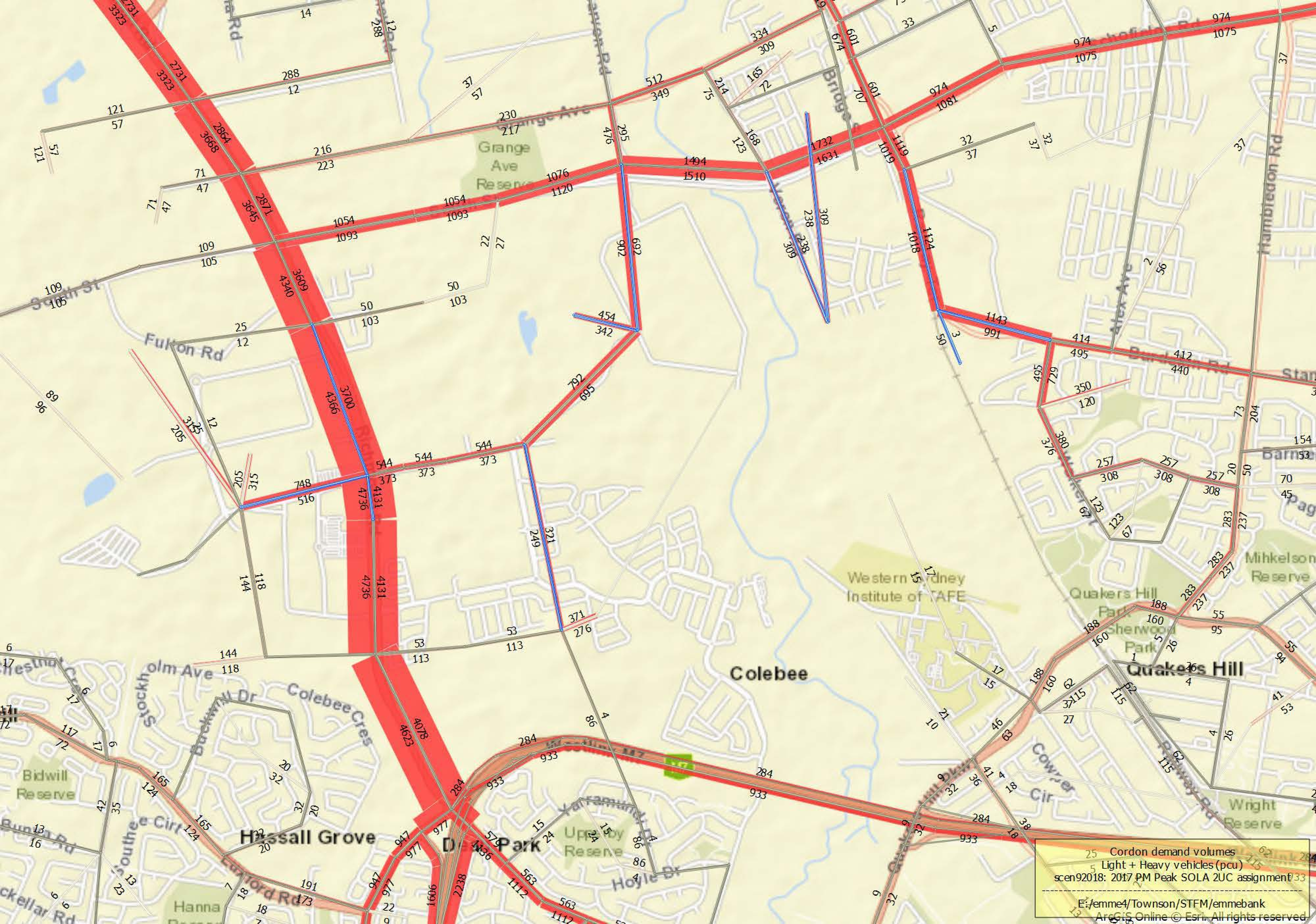

Grange Ave Reserve
Fulton Rd
South St
Colebee
Western Sydney Institute of TAFE
Quakers Hill Park
Sherwood Park
Quakers Hill
Mihkelson Reserve
Hambledon Rd
Alex Ave
Burdekin Rd
Bridge St
Stockholm Ave
Colebee Cres
Bidwill Reserve
Hassall Grove
Dean Park
Upper... Reserve
Hoyle Dr
Luxford Rd
Hanna Reserve
Cowper Cir
Railway Rd
Wright Reserve
Westlink M7
Cordon demand volumes
Light + Heavy vehicles (pcu)
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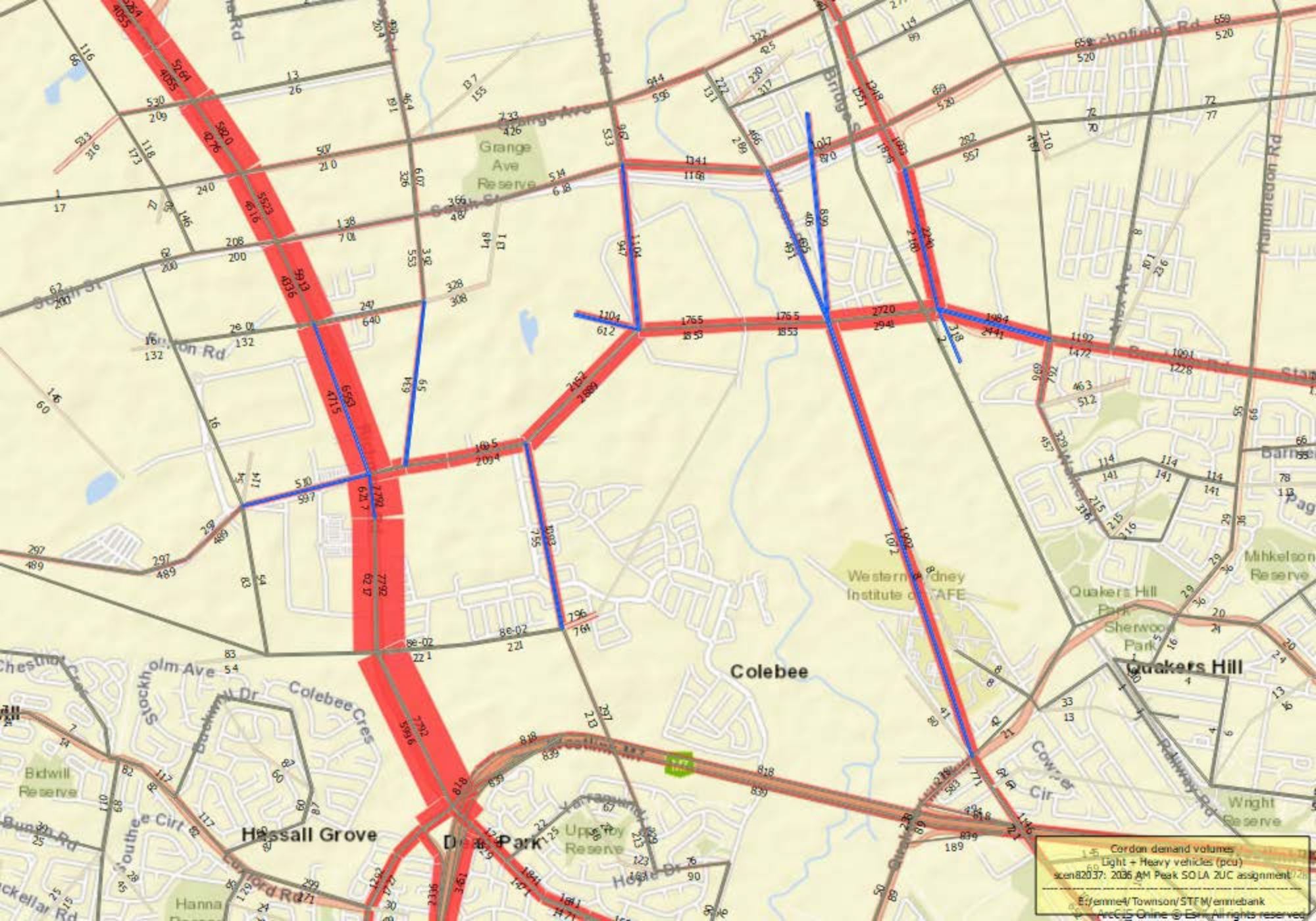
Colebee
Hassall Grove
Quakers Hill
Grange Ave Reserve
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scen82037: 2036 AM Peak SOLA 2UC assignment
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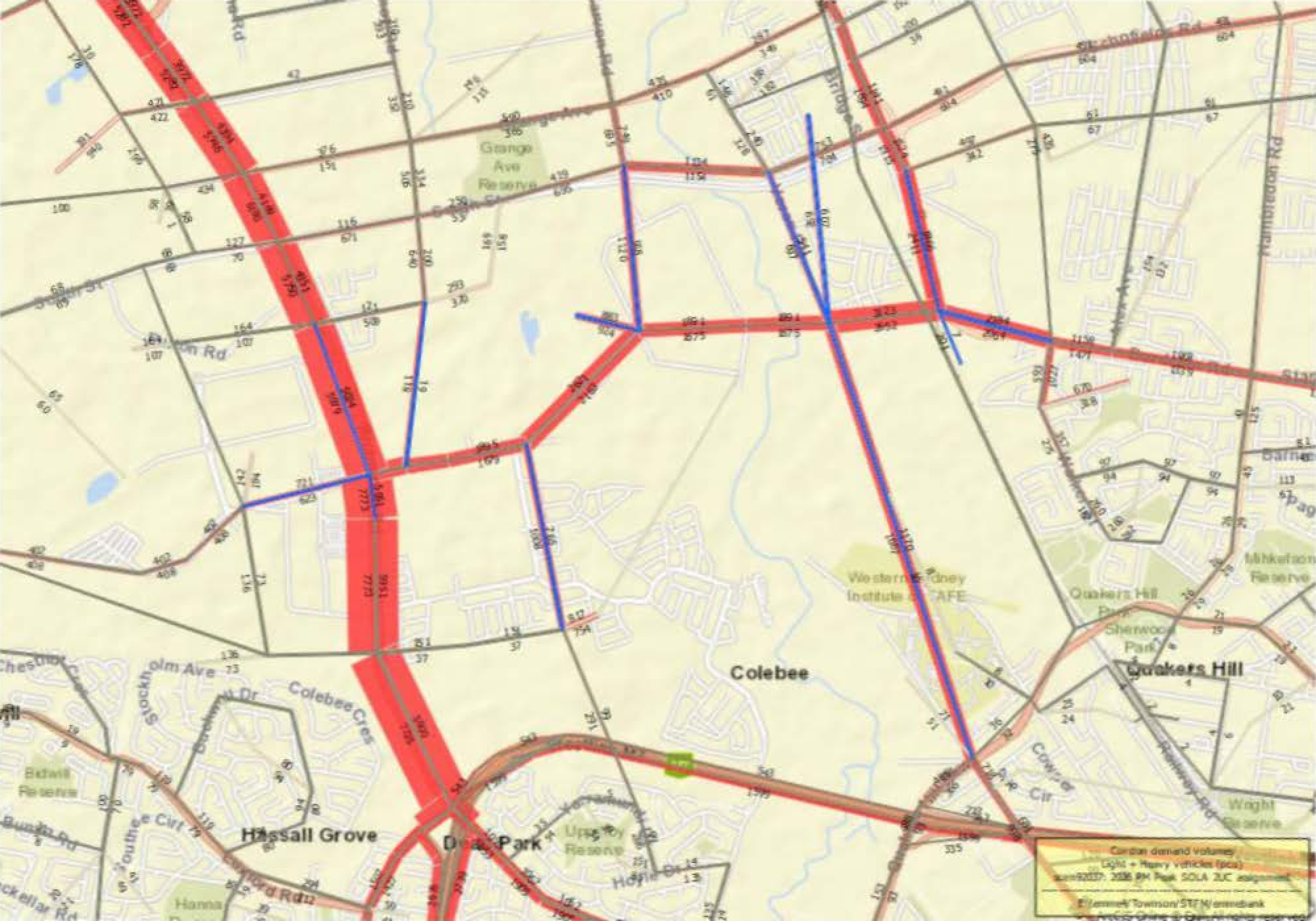
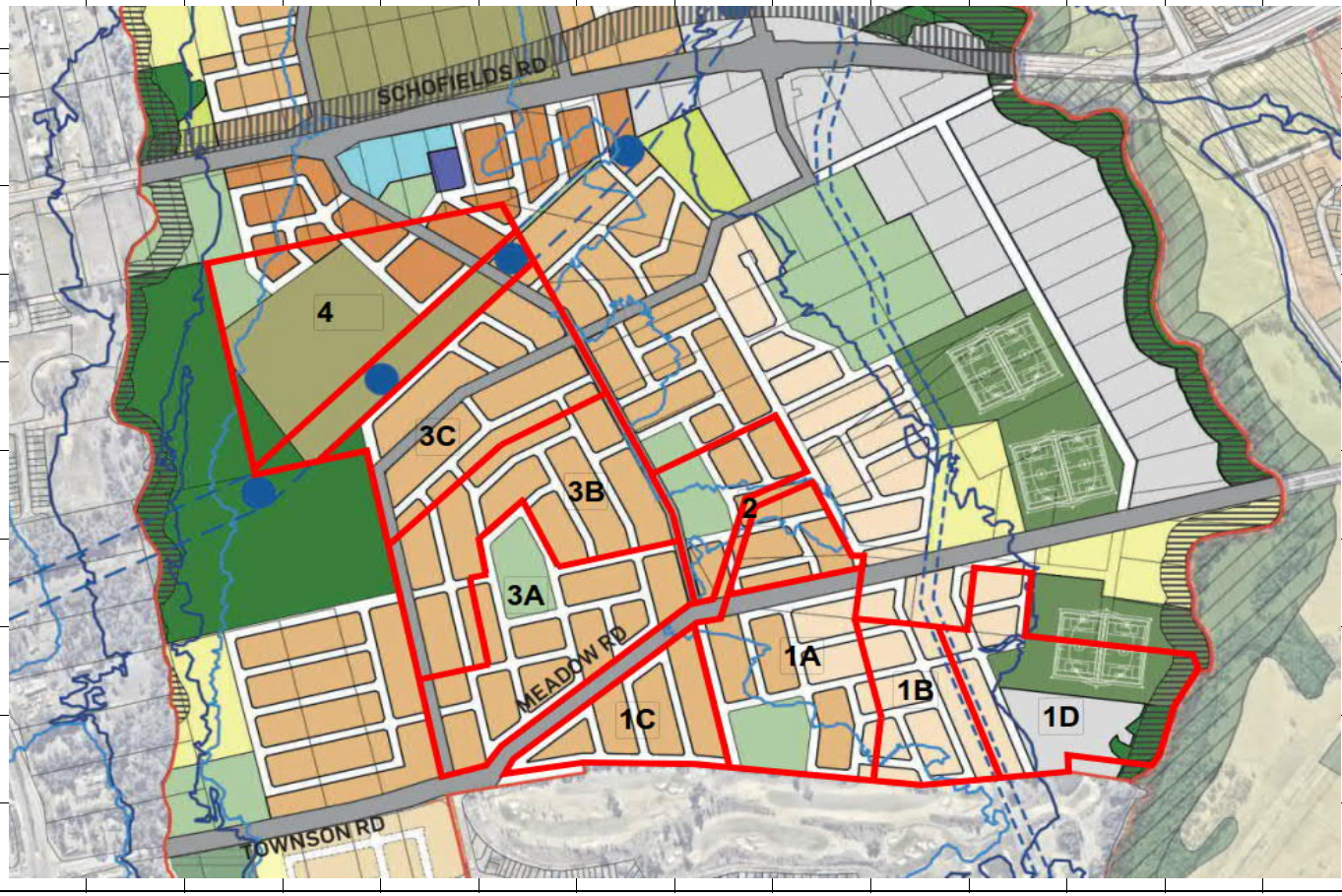

Grange Ave Reserve
Colebee
Quakers Hill
Hassall Grove
Colebee Cres
Stockholm Ave
Hambledon Rd
Bidwill Reserve
Wright Reserve
Mihkelson Reserve
Cordon demand volumes
Light + Heavy vehicles (pcu)

Appendix B – Future land use and proposed development information (supplied by TfNSW)

CSR - West Schofields
Proposed Lot Yield and Delivery

Stage	Lots	Cumulative Lots	Settlement Date
1A	126	126	Mar-22
1B	108	234	Aug-22
1C	124	358	Jan-23
1D	48	406	Oct-23
2	160	566	Jul-24
3A	270	836	Nov-24
3B	270	1,106	Dec-25
3C	270	1,376	Dec-26
4	160	1,536	May-28



27/08/2019

PLAN SHOWING OWNERSHIP SCHEDULE
FOR BURDEKIN TOWNSON ROAD CORRIDOR

Reduction Ratio 1:13000

Lengths are in metres

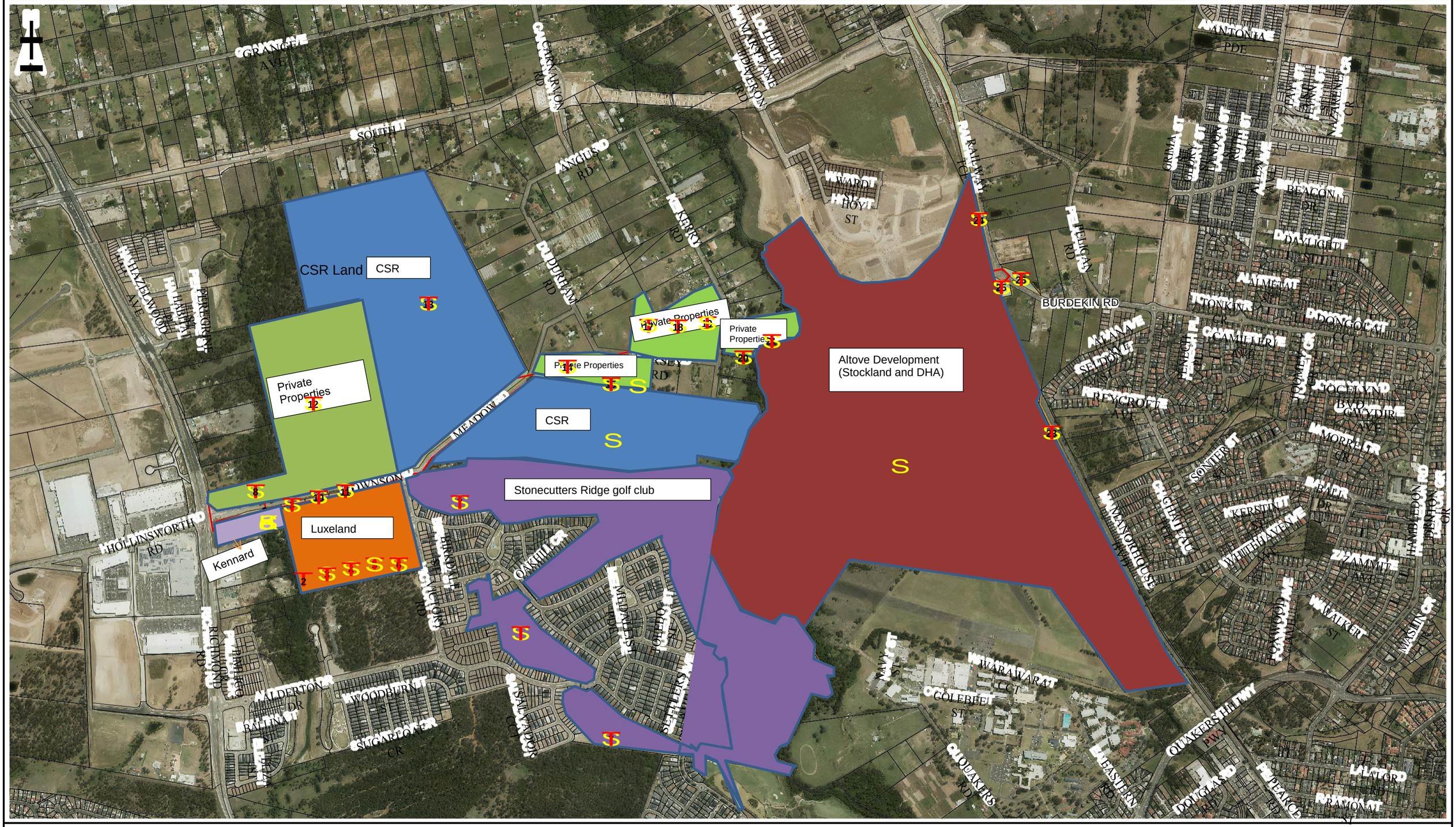
ROADS & MARITIME SERVICES
STAKEHOLDER AND COMMUNITY ENGAGEMENT

LGA: BLACKTOWN **Locality:** MARSDEN PARK COLEBEE
Parish: GIDLEY **County:** CUMBERLAND SCHOFIELDS QUAKERS HILL

SKETCH

SR5193 - OVERVIEW

DRAWN 17/08/2018



Transport Roads & Maritime Services

Project No: #

Dimensions and positions of improvements in relation to the boundaries are subject to final survey
Offsets are 90° to property boundaries

0 250 500 1,000 Metres

BURDEKIN TOWNSON ROAD CORRIDOR

AFFECTED PROPERTIES

Altove Development site	Number
House – current yield	381
Townhouses– current yield	142
Townhouses – future yield, year 2022	90
Townhouses – future yield, year 2026	74
Apartments – future yield, year 2027 to 2035	Around 1500
Total - approximately	2200

Development	Summary of development status
Marsden Park development – source: https://www.planning.nsw.gov.au/marsdenparkindustrial	"The most likely future development of the precinct is now primarily employment/industrial land including significant commercial/business park areas for a future total workforce of up to 10,000 persons, together with a number of smaller areas of residential development (1,100 additional dwellings in total) which are to be mainly located at the northern end of the precinct where they will be close to the future Marsden Park Town Centre."
Stonecutters Ridge – source: **Western Sydney Project Office | Infrastructure and Place**	Stonecutters Ridge will not experience any further growth, it is fully developed. As for the private dwellings, the ones that are developable along the corridor are all low density (20 dwellings/HA), although there are a few medium density (up to 25/HA).

GHD

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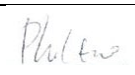
12511195-40381-493/\\Ghdnet\ghd\AU\Sydney\Projects\21\12511195\Technical\Environmental\Stage 1 REF\Specialist management\FINAL REVIEW\App E Traffic\210921473-REP-Traffic__clean.docx

Document Status

Revision	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
A	Shane Quinn	Phil Guo Mark Lucas	On File On File			4/02/2020
B	Shane Quinn	Phil Guo	On File			11/03/2020
C	Shane Quinn	Phil Guo	On File			21/07/2020
D	Shane Quinn	Phil Guo		Matthew Ferreira		4/12/2020

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