Department of Planning and Environment

West Schofields Precinct

Traffic and Transport Study

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1 Introduction

1.1 Study Background

The West Schofields Release precinct is a major future urban release area which is proposed to be developed as part of Sydney's North West Growth Area (NWGA). Arup has been appointed by CSR and Department of Planning and Environment (DPE) to undertake a transport assessment, part of a set of specialist studies that will inform the development of the draft Indicative Layout Plan (ILP) for the West Schofields Precinct.

1.2 Study Objectives

The purpose of this study is to provide an assessment of the West Schofields Precinct by all modes of transport including walking, cycling, public transport, and passenger vehicles. This study will need to consider the development of adjacent precincts within the NWGA, as well as upcoming infrastructure works such as the Sydney Metro Northwest. The transport assessment will identify suitable facilities for future West Schofields residents and employees to walk, cycle, use private cars and access public transport.

Specific objectives of the study will be to:

- Provide a strategic overview of the existing and future transport network in the NWGA
- Assess and test the transport impacts of the proposed development of the study area as reflected in the Indicative Layout Plan (ILP), taking into consideration potential development staging
- Recommend infrastructure upgrades and other measures to address those impacts within the vicinity of West Schofields
- Prepare an agreed implementation framework, in negotiation with the NSW Government Transport Agencies, Blacktown Council, and the Department of Planning and Environment, for the key infrastructure components, and
- Ensure all modes of transport, including private vehicles, public transport (bus and rail), walking and cycling are considered in the planning and development of the whole precinct.

1.3 Summary of Key Findings

The key findings of the existing transport conditions desktop study are:

- For both work and all-purpose trips private vehicle is the most common form of travel, with single occupancy vehicles being substantially more popular than carpooling.
- Train travel accounts for 11% of work trips, however this is expected to increase following the completion of the Sydney Metro Northwest in 2019. Cudgegong Road Station in Rouse Hill located adjacent to the Precinct will be equipped with commuter car parking facilities, bicycle parking, walking and bus connections and is expected to draw commuters from West Schofields.
- Due to the current nature of West Schofields walking and cycling is limited. However, with the changing urban form and the close proximity of high quality facilities such as the M7 cycle path, this can be expected to change.
- There is currently only one infrequent bus service through West Schofields. *The North West Sector Bus Servicing Plan* however identifies five regional and twelve district routes that service the NWGA area five of which will service West Schofields. It will be important to maintain provision for bus movements along the identified routes.
- The West Schofields Precinct is currently supported by three main roads (Schofields Road, Richmond Road and Garfield Road) all of which are currently being upgraded or being investigated for upgrades.
- Current traffic constraints occur on the periphery of the network at the two rail crossings as well as the intersection of Garfield Road West and Richmond Road. Both these issues are being addressed with the upgrade of Richmond Road and with the *NWGA Structure Plan* identifying the need for and laying out the plans for grade separation of the two rail crossings.

The key findings of the future road network assessment are:

- Schofields Road and Townson Road/Burdekin Link Road have the heaviest volumes in the area performing the sub-arterial function.
- Vine St West and Grange Avenue will still see modest use as both roads will have signalised connections to Richmond Road.
- Carnarvon Road although listed as an existing local road will perform more of a collector function as a primary north-south connection to Garfield Road.
- A Quakers Road extension will serve as an alternative access point to the M7 from Richmond Road and as such is liable to carry sub-arterial levels of traffic.
- Shared paths will need to be provided along all collector and sub-arterial roads allowing for greater permeability and accessibility for active transport.
- The intersection analysis found that the intersection layouts proposed as part of the ILP will operate satisfactorily in the year 2036 during both AM and PM peak periods and did not require additional intersection upgrades at all intersections investigated.

The key findings of the future public and active transport network assessments are:

- The West Schofields precinct will be serviced by 2 district routes and 1 regional route running directly through the precinct while 2 more district routes and 2 more regional routes will run adjacent to it as part of the proposed North West Sector Bus Servicing Plan.
- Bus stops and amenities are recommended to be provided on key regional routes such as Garfield Road West, Schofields Road and Townson Road.
- A number of dedicated bicycle routes have been identified in this study and shared paths are recommended on Carnarvon Road, Angus Road, Victory Road and Kerry Road. There is also opportunity to connect Townson Road with Stonecutters Drive to provide direct access to the M7 cycle path from the precinct.

1.4 Report Structure

This Traffic and Transport Study for the West Schofields Precinct is structured as follows:

Section 1: Introduction

Section 2: Summary of Proposed Development

Overview of the future development of the NWGA and West Schofields Precinct.

Section 3: Existing Transport Conditions

Summary of existing transport services in the NWGA, including roads, public transport, walking and cycling.

Section 4: Precinct Planning Principles

Identification of key criteria and objectives when planning for the development of the West Schofields Precinct.

Section 5: Road Network Assessment

Analysis of future road network conditions following the development of the West Schofields Precinct, including link flows and intersection controls.

Section 6: Public Transport, Walking and Cycling Networks

Assessment of the future transport provision for non-car modes of travel, supporting the project objective of reducing car dependency for residents and employees of the West Schofields Precinct.

Section 7: Summary and Conclusions

Summary of the key findings of this document.

2 Summary of Proposed Development

2.1 North West Growth Area Precinct

The NWGA comprises of 16 precincts. It is approximately 10,000 hectares and is expected to contain around 90,000 new dwellings for 250,000 people over the next 25-30 years. 11 of the 16 precincts have been rezoned for development, those being:

- North Kellyville
- Alex Avenue
- Riverstone
- Riverstone West
- Colebee
- Area 20
- Marsden Park Industrial
- Schofields
- Box Hill
- Box Hill Industrial
- Marsden Park

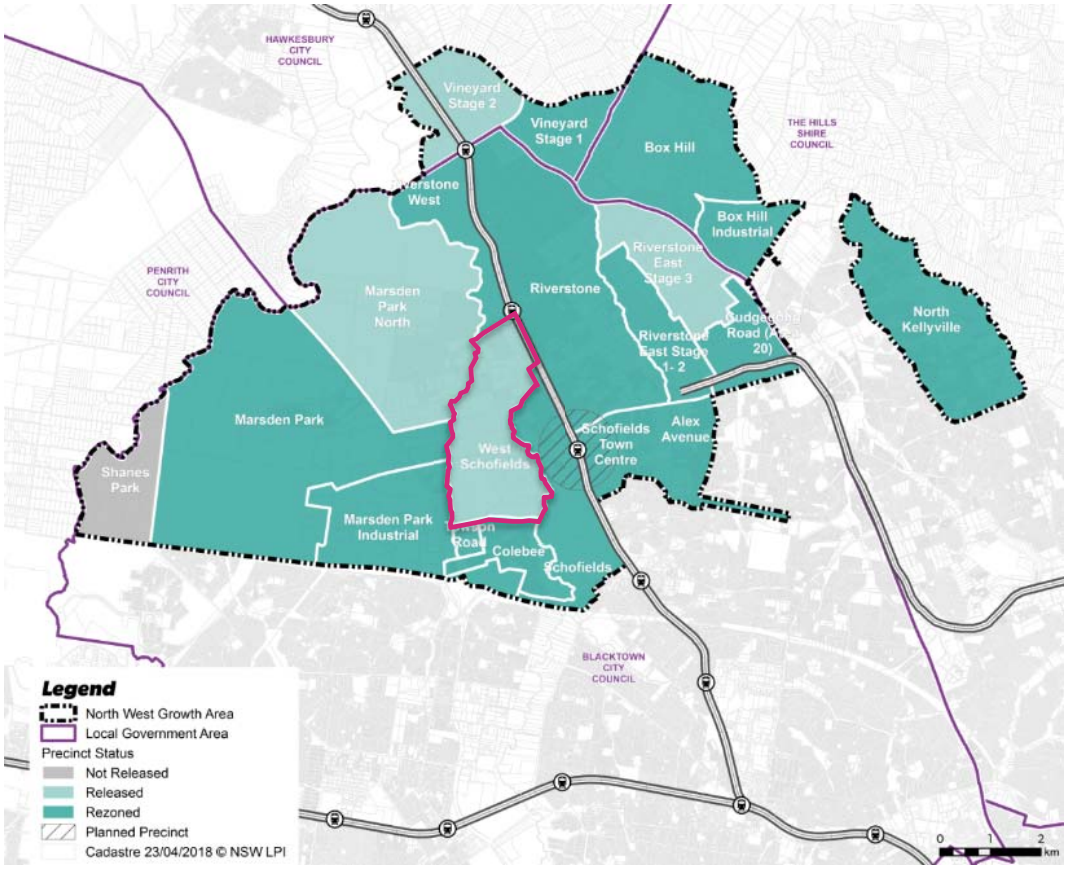


Figure 1 North West Growth Area

The NWGA spans three local government areas (LGA) – Blacktown, Hawkesbury and The Hills Shire. The NWGA is undergoing a streamlined planning process to enable land to be rezoned in a shorter period. Figure 2 illustrates the current North West Land Use and Infrastructure Implementation Plan (LUIIP).

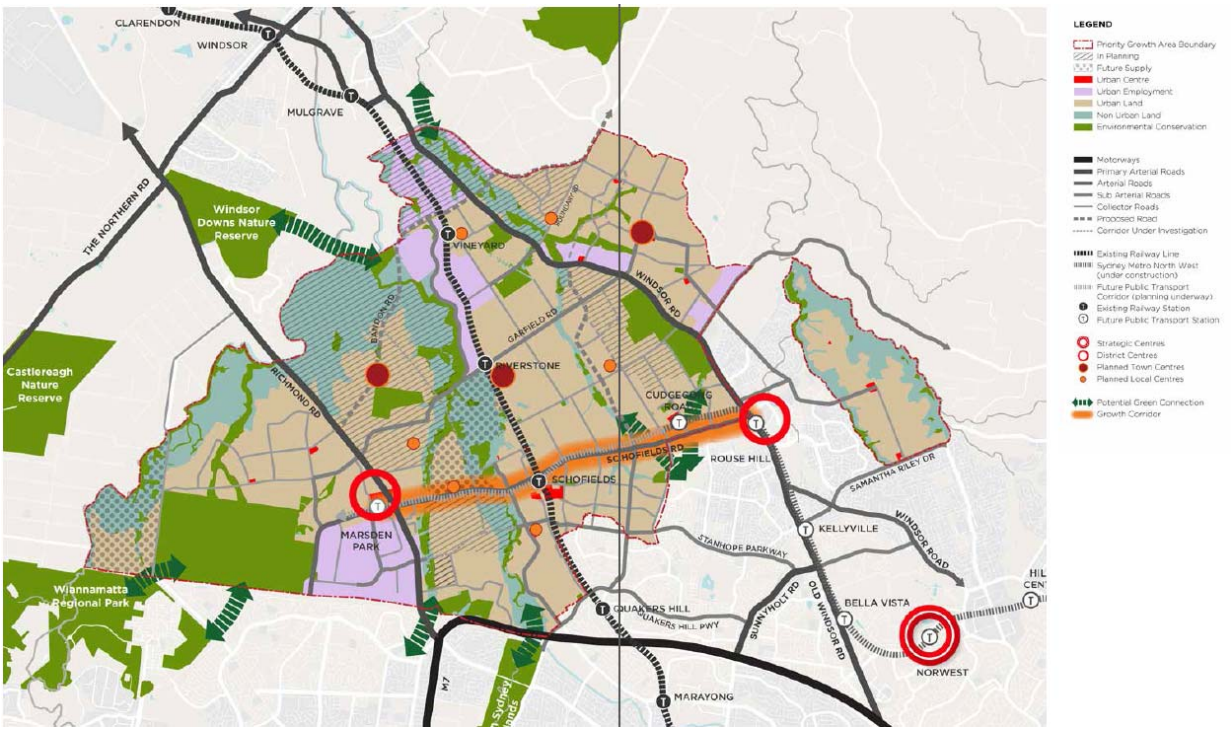


Figure 2 North West Land Use and Infrastructure Implementation Plan (LUIIP)

2.2 West Schofields Precinct

The West Schofields Precinct is located in the central portion of the NWGA, wholly within the Blacktown Local Government Area (LGA). It is currently zoned "RU4 – Primary Production Small Lots" under the Blacktown Local Environment Plan.

The precinct comprised of 542 hectares in total and is bounded by Eastern Creek to the east, Colebee Release Area to the south, Bells Creek to the west, and Garfield Road to the north. In the wider area, the precinct is located approximately 50km from the Sydney CBD, 9km northwest of Blacktown and 5km west of Rouse Hill.

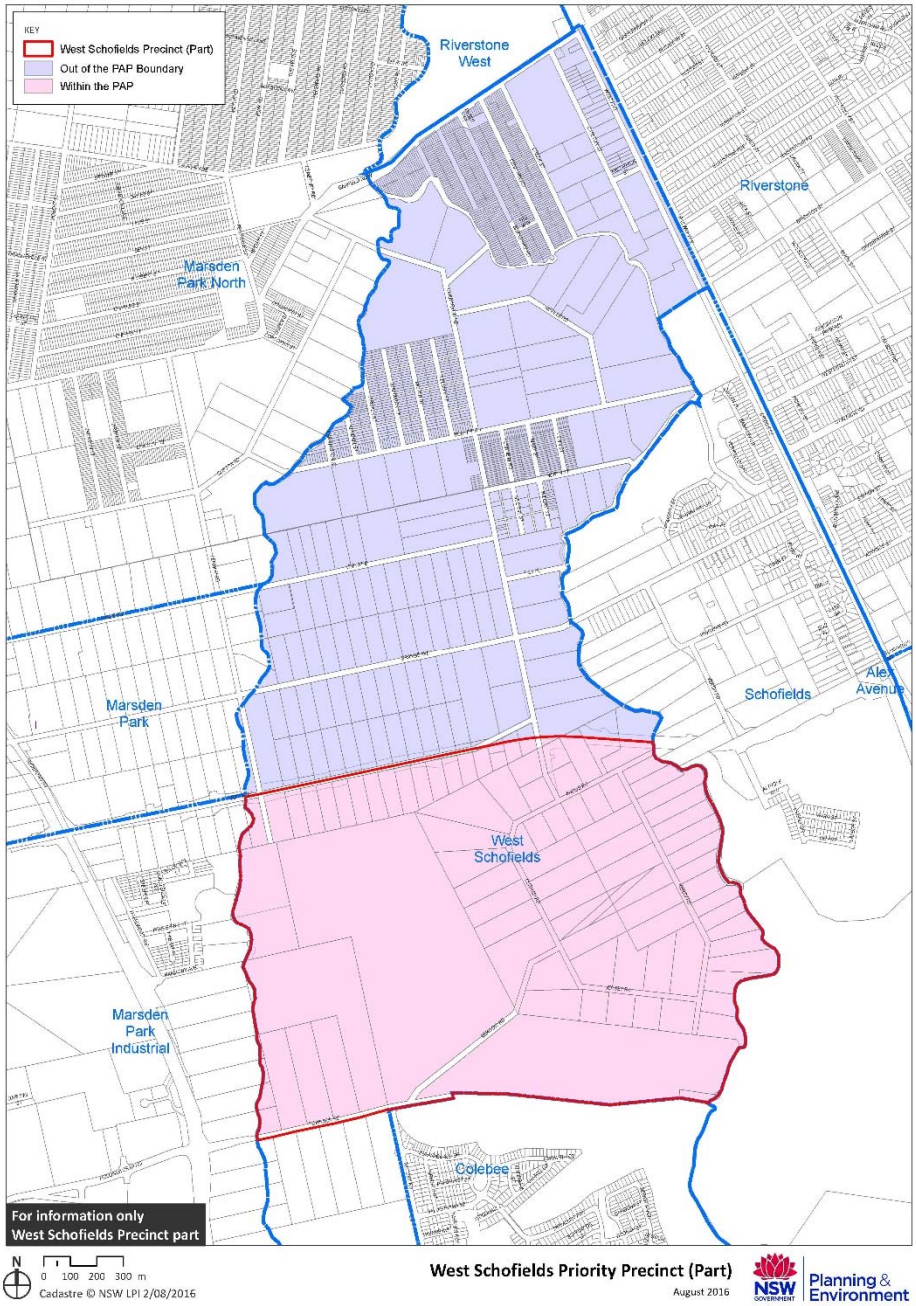


Figure 3 West Schofields Priority Precinct

2.3 Draft Indicative Layout Plan

The draft indicative layout plan (ILP) developed for the West Schofields Precinct is presented in Figure 4.

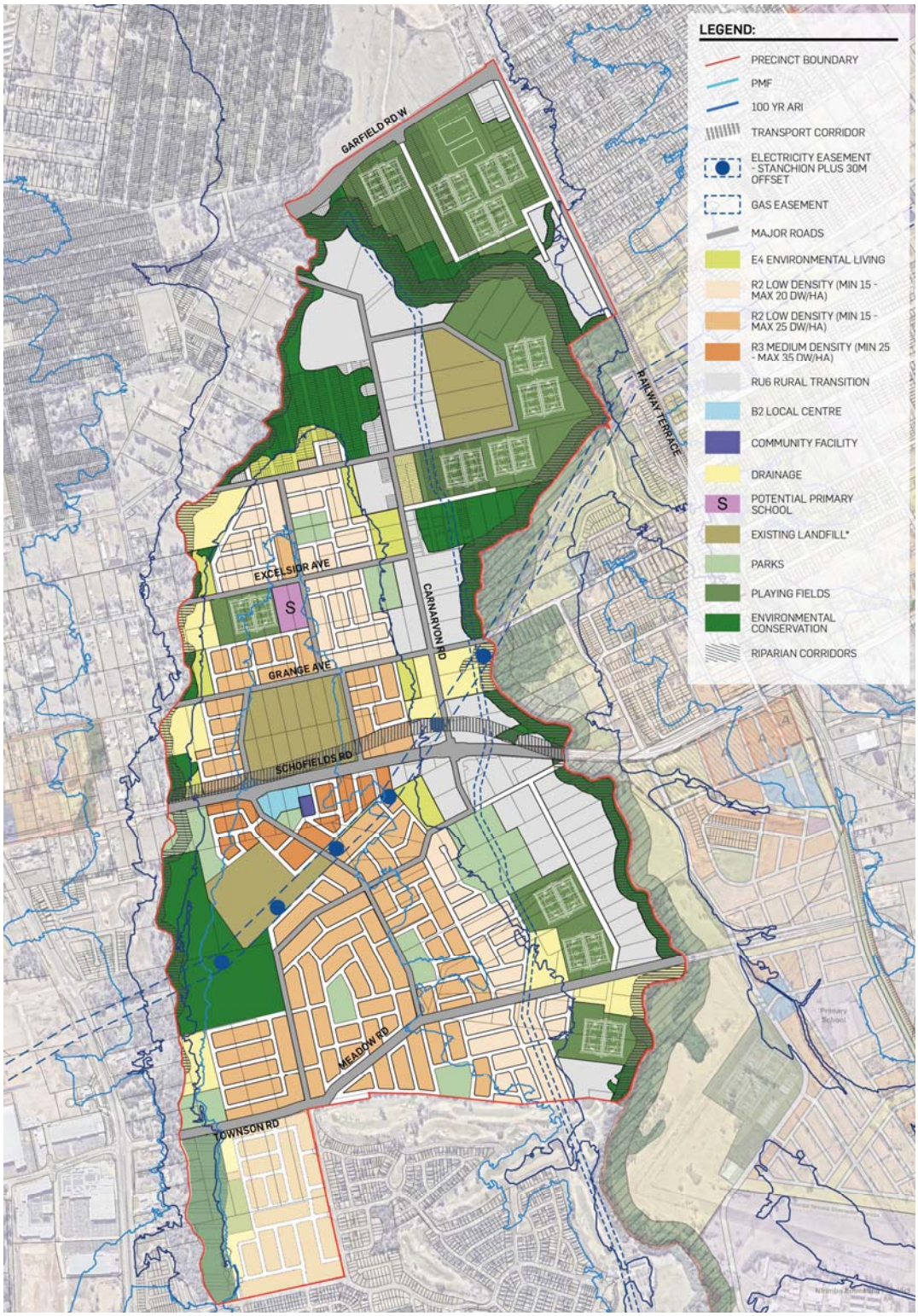


Figure 4 Draft Indicative Layout Plan (ILP)

The yields of the different types of residential development within the West Schofields precinct are summarised in Table 1.

Table 1: Summary of residential yields within the West Schofields precinct

Land Type	**Area (ha)**	**Yield**
Existing Dwellings Remaining	100.88	82
E4 Environmental Living Lots	13.22	135
Low Density dwellings	173.71	3,857
Medium Density	11.98	419
Residential within the Town Centre	1.46	67
Total	**301.25**	**4,560**

3 Existing Transport Conditions

3.1 Travel Patterns

Existing travel characteristics of residents in the NWGA have been identified based on 2011 Journey to Work Census data[1] and 2012 Household Travel Survey Information[2]. The existing mode share of residents is illustrated in Figure 5.

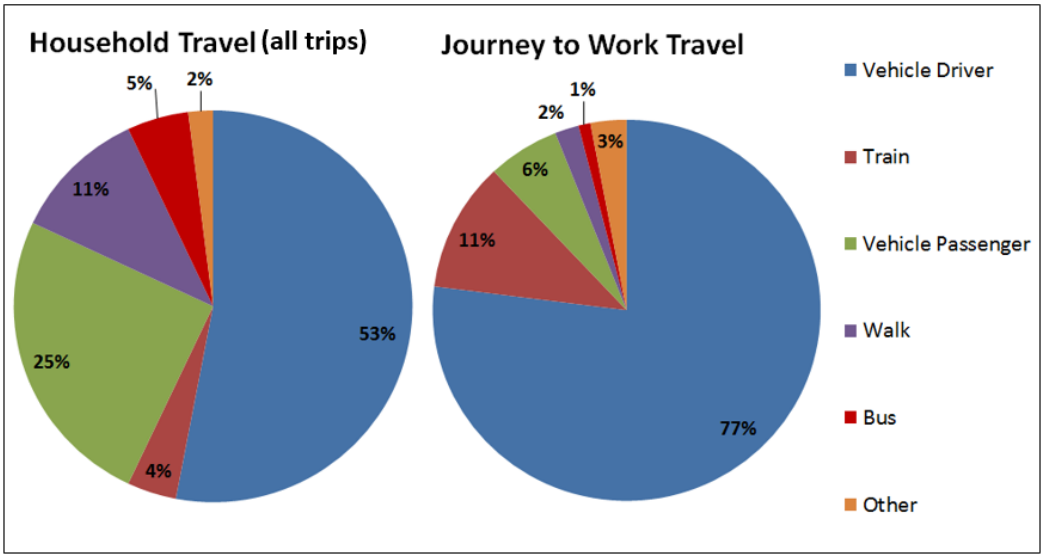


Figure 5 Existing travel patterns, North West Growth Area

(Source: Bureau of Transport Statistics, 2014, other includes motorcycle, bicycle and mode not stated)

The results indicate that for both work trips and all-purpose trips private vehicle is the most common form of travel. For journey to work trips, the incidence of vehicle driver is higher, and vehicle passenger is lower, suggesting that these trips will see more single occupancy use of private vehicles. Train travel accounts for 11% of work trips, however this is expected to increase following the completion of the Sydney Metro Northwest in 2019.

Walking accounts for a low proportion of work related trips, however, the household travel survey data indicates that this mode accounts for a higher proportion of all trips.

[1] Based on travel zones within the North West Priority Growth Area
[2] Based on travel information for residents in the Blacktown LGA

3.2 Road Network

Details of key roads serving the precinct and future proposed roads are described below. The existing road hierarchy consists of two sub-arterial roads (Richmond Road and Garfield Road West) and one collector road (Grange Avenue), see Figure 6.

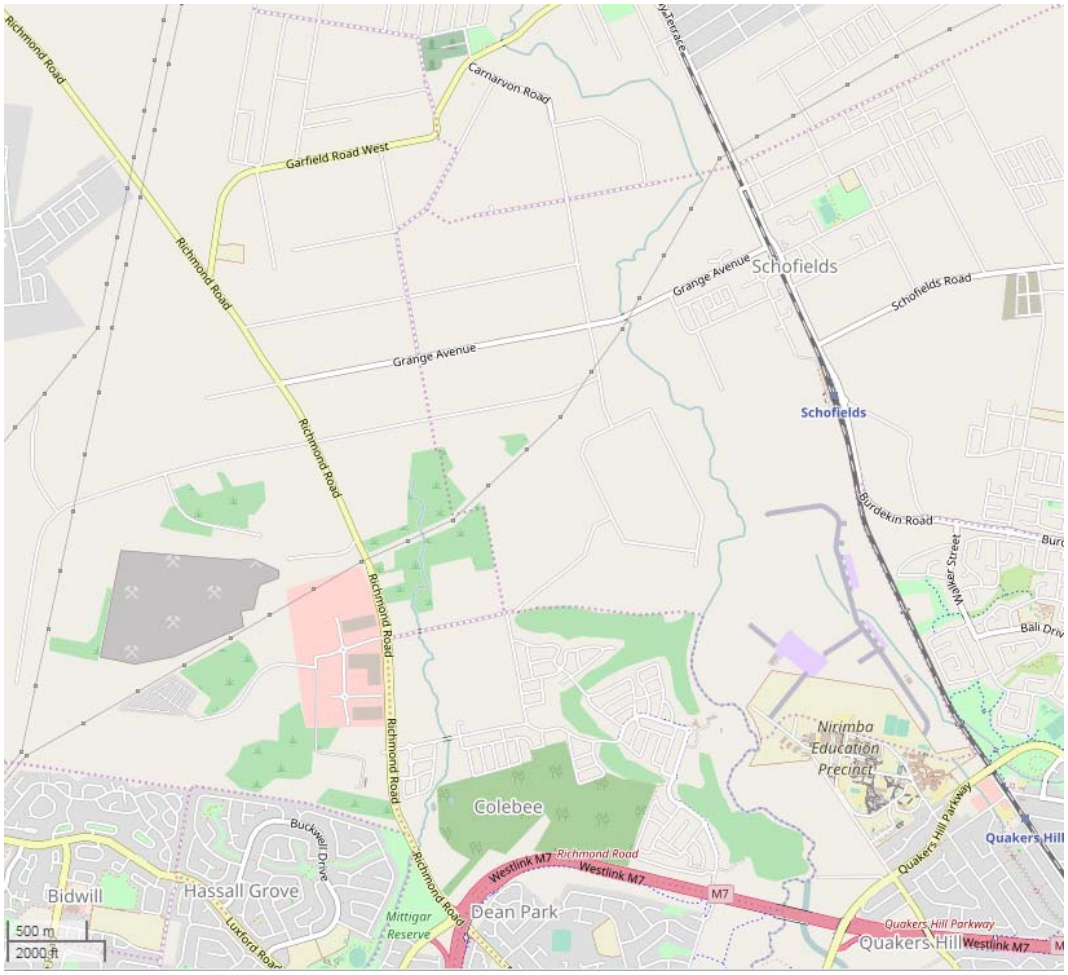


Figure 6 Existing road hierarchy *(Source: Open Street Map)*

3.2.1 Richmond Road

Richmond Road currently lies to the west of the Precinct and is being upgraded in three separate stages. Richmond Road serves as a principle arterial road for the NWGA and is being upgraded in accordance with this function.

Stage one was completed mid-2014 and involved upgrading Richmond Road to a four-land divided road with traffic signals at Townson Road and two new intersections at Colebee and the Sydney Business Park.

Stage two was completed at the end of 2016 and involved extending the four lane section of Richmond Road up to Garfield Road. Further work along this road corridor is to be carried out in the coming years which will provide for a four lane divided road corridor up to the intersection of Richmond Road and Elara Boulevard.

As shown in Figure 7, Stage 3 will involve upgrading Richmond Road between Elara Boulevard and the South Creek floodplain at Marsden Park.

The upgrade of Richmond Road will provide continued service as a "principal arterial" providing access to pedestrians, cyclists and buses within the NWGA and to surrounding areas. A wide central median will be provided to allow for a six lane corridor in the future should demand necessitate. This will meet the future transport needs of the NWGA.

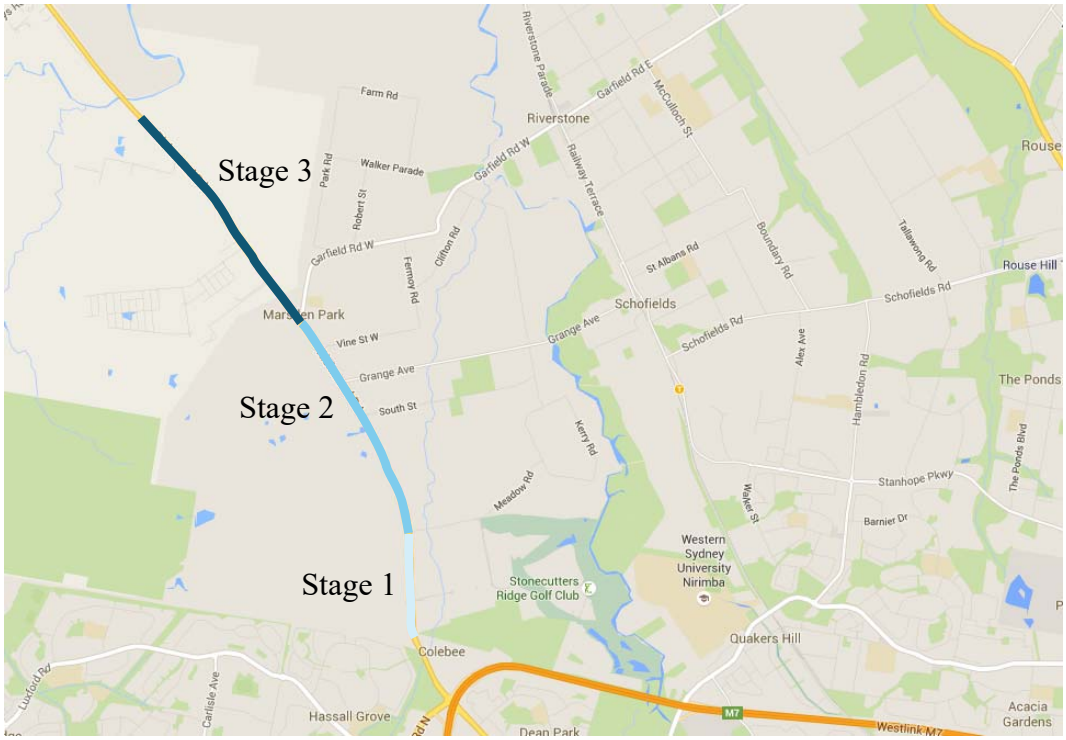


Figure 7 Richmond Road Upgrade

3.2.2 Garfield Road

Garfield Road currently provides an east-west road connection at the northern boundary of the West Schofields Precinct. It provides a link between Richmond Road and Riverstone Parade (to Riverstone Station), extending east to Windsor Road. It is currently an undivided two lane sealed road, with a mixture of 60km/hr and 80km/hr speed limits.

The Garfield Road corridor comprises one of the key road corridors that have been identified in the NWGA Structure Plan for future upgrades over the next 25-30 years. The upgrade would expand its capacity to four lanes. In 2013, the NSW State Budget allocated $1 million for planning of the Garfield Road upgrade between Windsor Road and Richmond Road in West Schofields.

Roads and Maritime Services are currently investigating the provision of a grade separated crossing of the Richmond Rail Line at Riverstone Station along the existing Garfield Road alignment.

Figure 8 Garfield Road East

3.2.3 Schofields Road

Schofields Road currently lies to the east of the Precinct and is currently being upgraded in three separate stages. Upon the completion of stage three Schofields Road will connect to South Street forming one of the main transit boulevards running east west through the centre of the Precinct.

Stage one was completed mid-2014 and involved upgrading Schofields Road to a four-land divided road with traffic signals at the intersections of Cudgegong Road, Tallawong Road/Ridgeline Drive and the Ponds Boulevard/Terry Road.

Stage two involved constructing an underpass crossing of the Richmond Rail Line. Further work along this road corridor is to be carried out in the coming years which will provide for a four lane divided road corridor along the full length of Schofields Road between Windsor Road and Richmond Road, giving the opportunity to further upgrade to a six lane road in the future. Additionally, the upgrade will place more emphasis on active and public transport.

Work on Stage 3, the final section of the Schofields Road Upgrade, between Veron Road and Richmond Road, started in March 2016 and is scheduled for completion in mid-2018.

The NSW Government is funding the $340 million upgrade of Schofields Road between Windsor Road and Richmond Road. The upgrade includes extending Schofields Road across Eastern Creek to Carnarvon Road and widening South Street. When complete it will link the Rouse Hill and Marsden Park town centres and help to better meet the future transport needs of the North West Priority Growth Area.

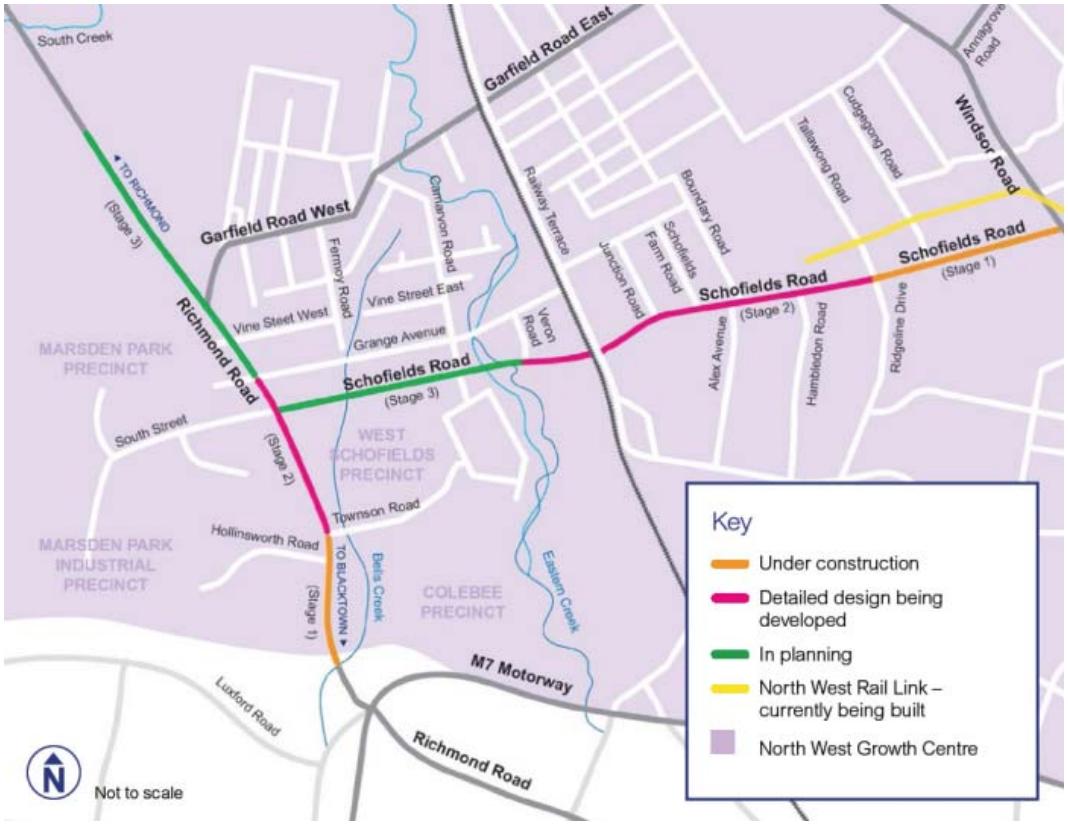


Figure 9 Schofields Road upgrade

(Source: RMS, Schofields Road upgrade location map)

3.2.4 Townson Road

Townson Road currently connects Colebee to Richmond Road and the southern portion of West Schofields via Meadow Road. As per the proposed North West Growth Centre Structure Plan, Townson Road is to be upgraded and connected to Burdekin Road via a new rail crossing. Once completed Townson Road will form a vital east west link through the southern portion of the precinct.

3.2.5 Bandon Road

The Bandon Road extension is a new proposed road north of the precinct connecting Richmond Road to Windsor Road, via the existing Bandon Road. Providing an alternative east west connection in the north to Garfield Road.

3.2.6 Grange Avenue

Grange Avenue currently forms a secondary east west connection to Garfield Road West running directly through the site. Grange Avenue currently connects Richmond Road to Railway Terrace via Bridge Street. This connection is however not direct and does require a deviation of 380m at the eastern end to make use of a railway bridge. Because of this deviation Grange Avenue will not be a strong east west connection in the future with Schofields Road providing a higher capacity alternative.

3.2.7 Crossing of Richmond Rail Line

RMS has developed a strategy for the provision of grade-separated road crossings of the Richmond Rail Line as part of the NWGA Road Network Strategy, 2015. The strategy identifies the need for five grade-separated crossings of the Richmond Rail line:

- Westminster Street bridge, Schofields (existing with limited capacity)
- Schofields Road, Schofields (in progress as part of the Schofields Road upgrade project)
- Garfield Road, Riverstone (currently a level-crossing of the rail line)
- Bandon Road, Vineyard (currently a level-crossing of the rail line)
- Burdekin Road, Quakers Hill

The components of the road network strategy that RMS has committed to have been divided into short, medium and long term works as described in detail below and shown in Figure 10.

Short term works

The planned short term works (to be completed within the next four years) will directly influence traffic conditions within the Riverstone town centre. These works include:

- Work with Blacktown City Council to develop local strategies to improve traffic flow within Riverstone town centre to boost capacity and minimise delays, with the existing level crossing retained. The specific location and extent of these works are currently being developed.
- Link Westminster Street with Garfield Road West to provide an alternative route for local traffic away from the Garfield Road level crossing.
- Work with the Department of Planning and Environment and Blacktown City Council to reserve a road corridor along Garfield Road between Richmond Road and Windsor Road for future widening

Medium term works

The strategy has recommended an upgrade of Bandon Road to function as a transit boulevard (including an underpass of the Richmond Rail Line) which would provide a high quality road connection between Windsor Road and Richmond Road. This upgrade would be completed by the time the NWGA reaches approximately 25% of its population and employment development. Works include the construction of an underpass and creation a new road connection between Richmond Road and Windsor Road. The existing level crossings at Bandon Road and Level Crossing Road would be closed at this time.

Long term works

The road network strategy has recommended the construction of a grade separated crossing at Garfield Road, replacing the existing level crossing. This infrastructure would be delivered by the time the NWGA reaches approximately 75% of its population and employment development. Based on current projections, this could occur between 2031 and 2036. Works would also include an upgrade Garfield Road between Richmond Road and Windsor Road.

In addition to these scheduled works by RMS, Blacktown City Council has proposed a connection between Townson Road and Burdekin Road (one of the grade-separated crossings identified as part of the NWGA Road Network Strategy). Further information regarding timing and delivery of this project is to be advised by Blacktown City Council.

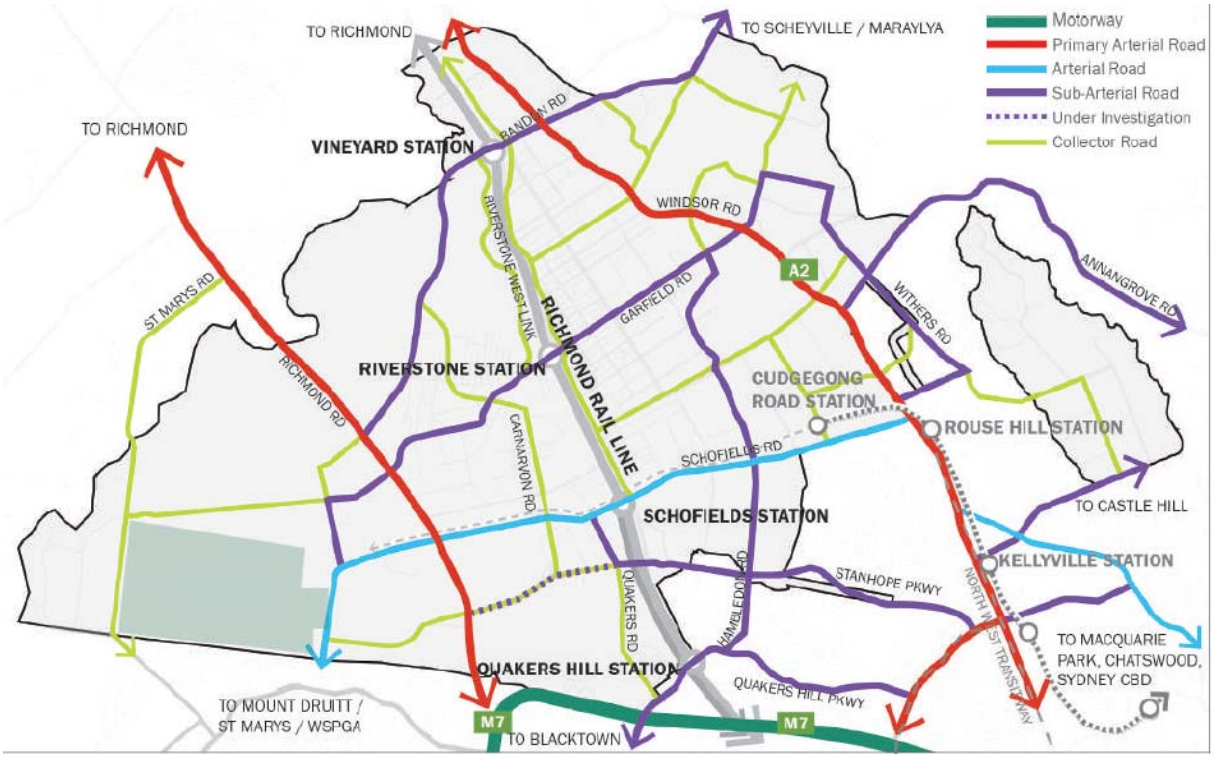


Figure 10 Road hierarchy and rail crossing alignments

Source: North West Growth Area structure plan review (Jacobs, 2017)

3.3 Traffic Conditions

3.3.1 Summary

A desktop study has been undertaken to establish current traffic constraints within and surrounding the West Schofield Precinct. Using information obtained from google maps travel data verified by surrounding precinct and RMS infrastructure reports it was established that existing traffic constraints occur on the periphery of the network and at the two rail crossings. Overall, however, as the precinct is currently rural the severity of the traffic constraints are minimal. Under more intensive land uses the constraints will have the potential to cause more substantial traffic issues.

The current constraints of the rail crossings reflect a pinch-point within the network caused by the limited opportunity for east-west movements. This issue has been identified by RMS and has been the focus of studies into providing additional rail crossings of the Richmond Rail Line outlined in section 3.2.7.

The intersection of Richmond Road / Garfield Road West experiences delays as this intersection is the primary access point to the wider road network with Richmond Road linking West Schofield to the M7 and the wider Sydney network. Garfield Road can also experience delays being the primary east-west connection for West Schofields. Grange Avenue provides the only other east-west connection.

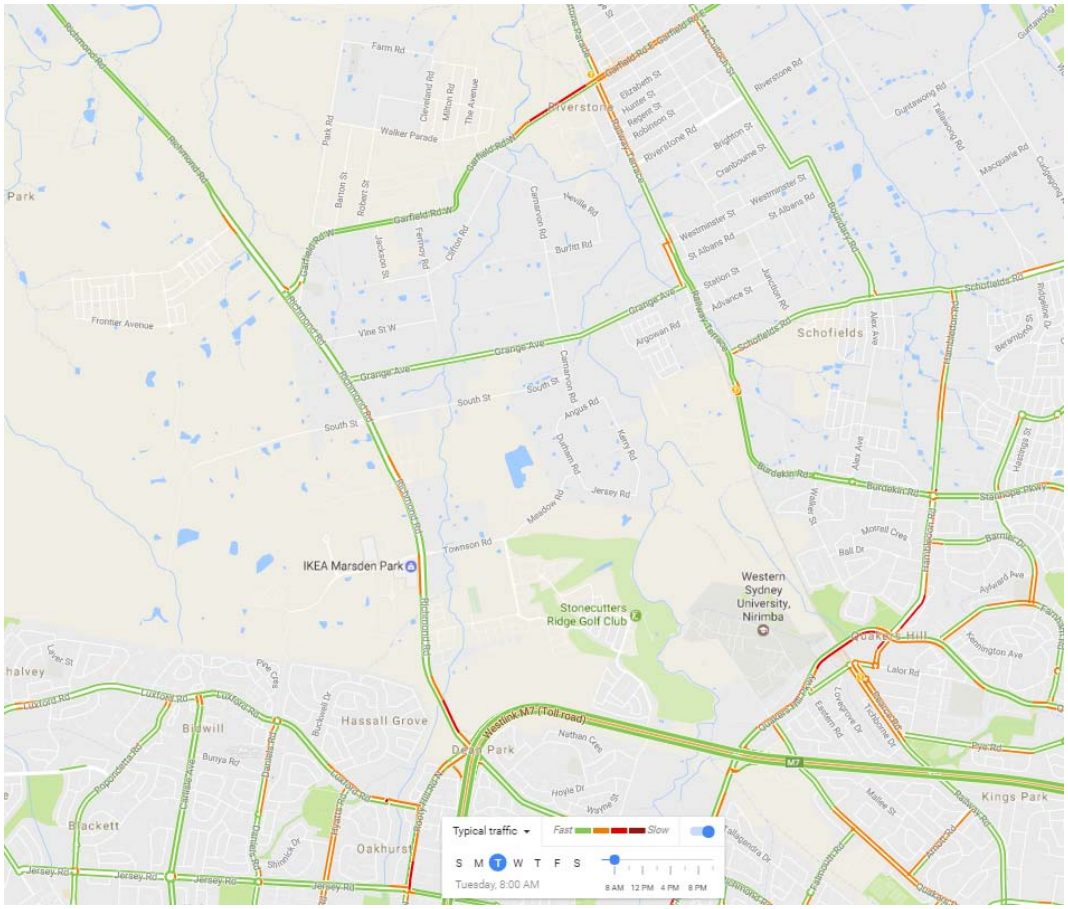


Figure 11 Typical AM traffic conditions in West Schofields

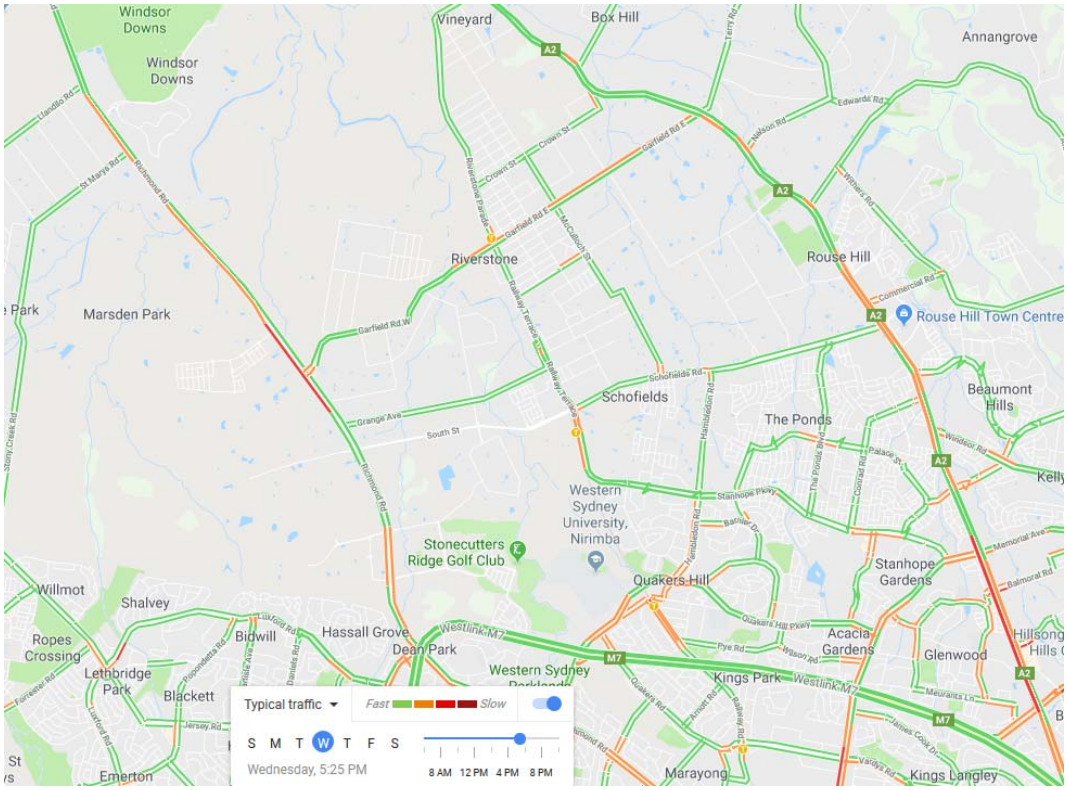


Figure 12 Typical PM traffic conditions in West Schofields

3.3.2 Existing Traffic Flows

The existing traffic flows were extracted for the AM and PM peak from the base Aimsun traffic model. The modelled traffic flows highlight how the periphery roads Richmond Road and Garfield Road West are used to carry all the through trips and act primarily as the collector roads as well. All the internal roads carry less than 300 vehicles per hour in the peak exhibiting a local rural road function.

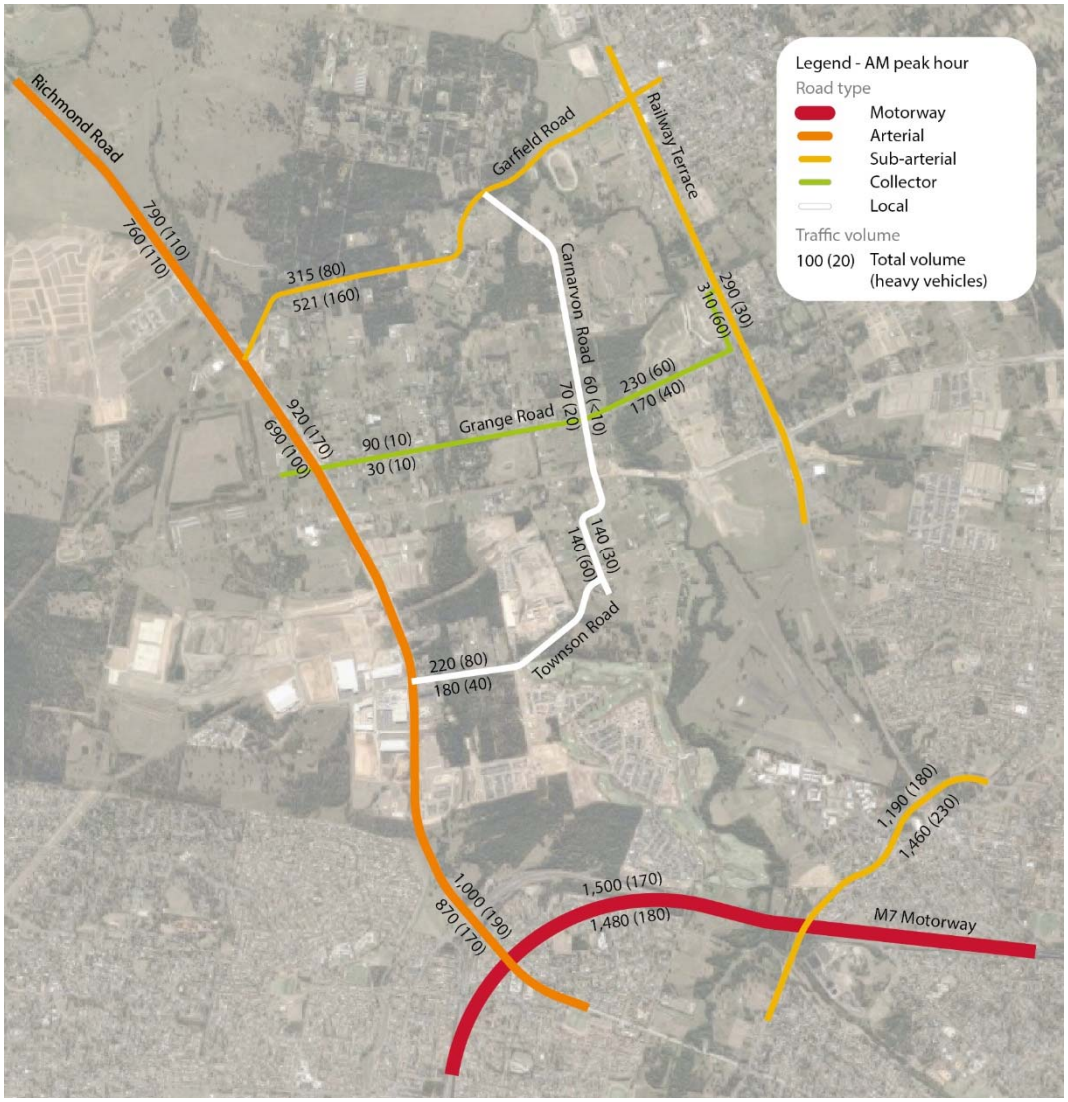


Figure 13 AM Peak existing traffic flows

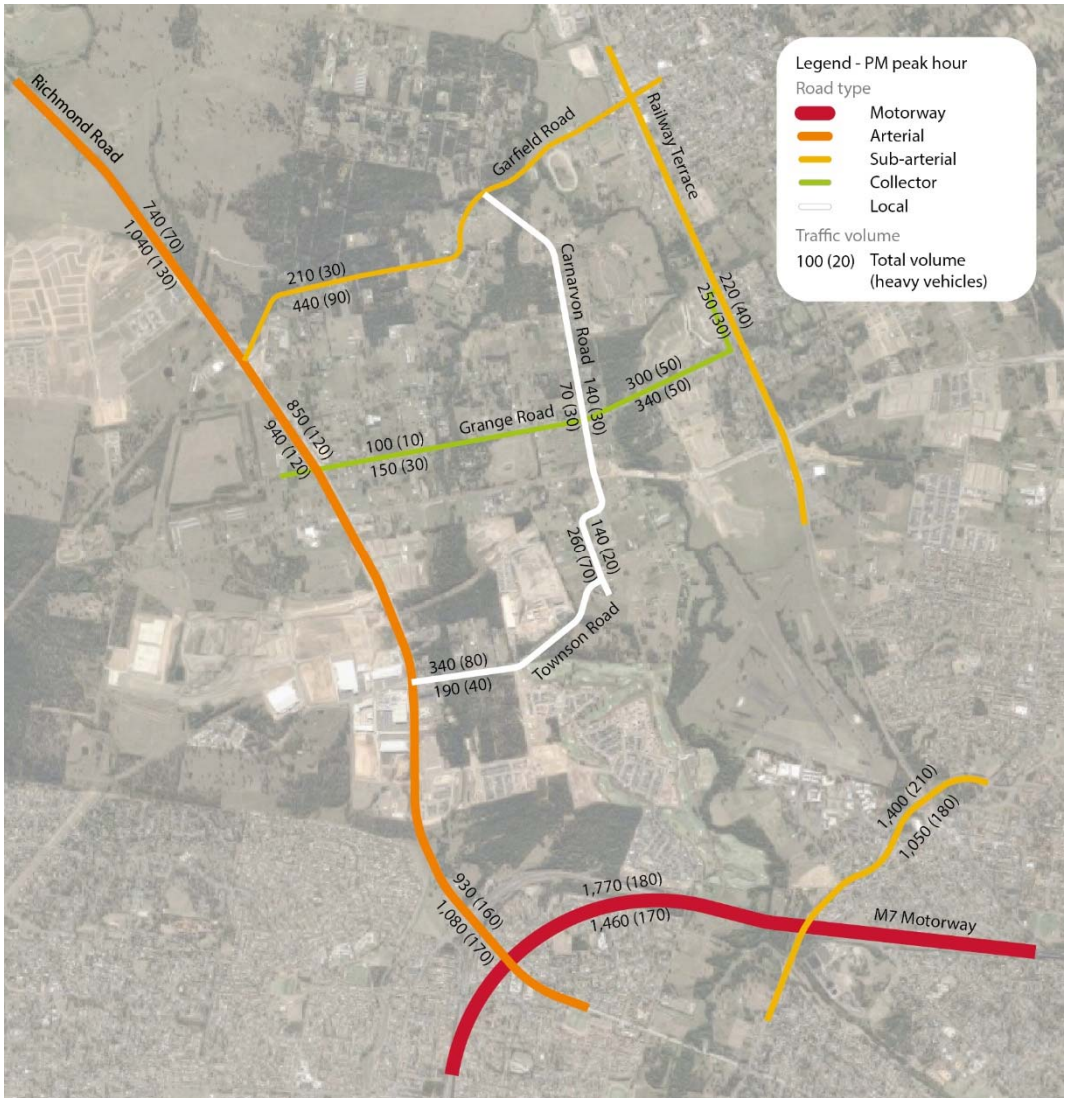


Figure 14 PM Peak existing traffic flows

3.4 Rail Services

3.4.1 Richmond Rail Line

The West Schofields Precinct is currently served by the Richmond Rail Line, a branch of the Western Line. The Richmond Line currently provides access to key centres located throughout Sydney via direct links to Blacktown, Parramatta, Granville, Strathfield, Redfern, Central and the City. A summary of the existing services along the Richmond Line is shown in Table 2.

Table 2 Existing services along the Richmond Rail Line

Departing Station	**Direction**	**Average Frequency of Services (Weekday)**		
		AM Peak (7am – 9am)	PM Peak (4pm – 6pm	Off Peak (10am – 3pm)
Vineyard	Northbound	30 minutes	30 minutes	30 minutes
	Southbound	30 minutes	30 minutes	30 minutes
Schofields	Northbound	20 minutes	15 minutes	15 minutes
	Southbound	12 minutes	15 minutes	15 minutes

In 2011 a duplication of the rail line was completed between Quakers Hill and Schofields, including the opening of the new Schofields Station. This duplication has allowed for more frequent train services travelling to and from Schofields. The new station at Schofields includes 230 park and ride spaces and a new bus interchange servicing residents of the NWGA.

3.4.2 Sydney Metro Northwest

Sydney Metro Northwest is currently under constructions and scheduled for completion in 2019. The new metro will deliver eight new stations, 23km of new track and provide 4,000 commuter parking spaces in Sydney's North West. Strengthening connections between the NWGA and major destinations such as Norwest, Castle Hill, Macquarie Park, Chatswood, North Sydney and the Sydney CBD.

Future residents of the West Schofields Precinct will be provided with a high quality rail interchange via a new station at Cudgegong Road. Located between Tallawong Road and Cudgegong Road. The new station will provide for 1,000 commuter car parking spaces, bike parking and storage for up to 45 bicycles, 15 kiss and ride spaces, 6 bus spaces and 6 taxi space. The station is located just north of Schofields road within the "Area 20 Precinct", the station layout is shown in Figure 15.

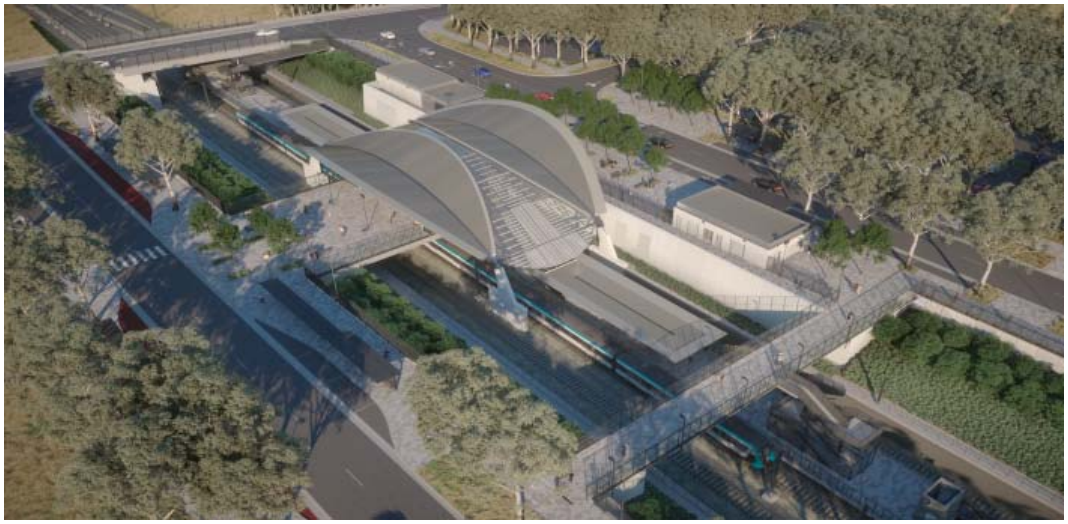


Figure 15 Cudgegong Road Station artist's impression
(Source: Sydney Metro, 2017)

An overview of the proposed rail link is shown in Figure 16 below.

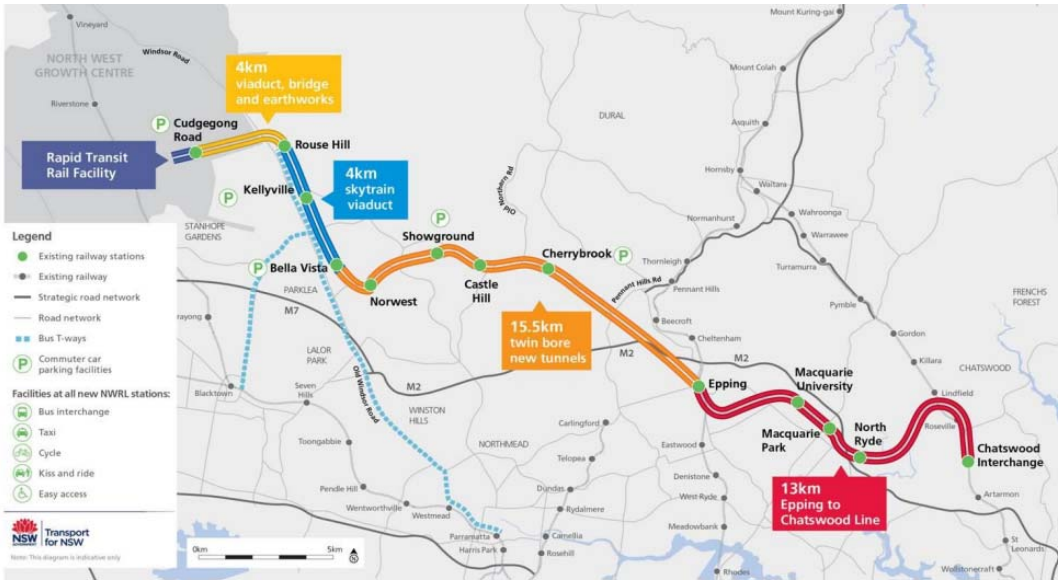


Figure 16 Sydney Metro North West
(Source: Transport for NSW, 2014)

3.5 Bus Services

Currently there is one bus service that operates within the vicinity of the West Schofields Precinct: Route 757 from Mt Druitt to Riverstone via Rooty Hill Road North & Marsden Park (via Richmond Road to Riverstone Station). This service only runs 4 times a day at uneven headways.

A map of the existing bus route serving the West Schofield's Precinct is illustrated below in Figure 17.

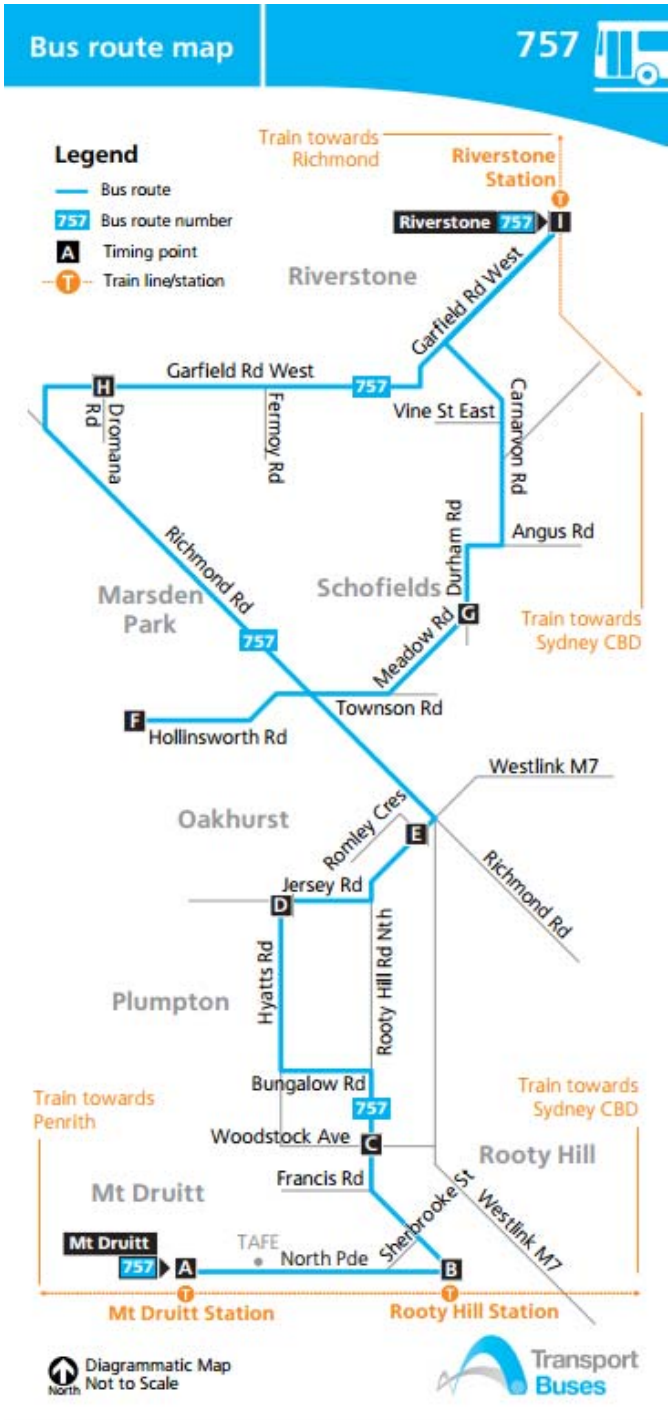


Figure 17 Existing bus services

3.6 Walking and Cycling

Due to the current rural nature of the West Schofields Precinct, existing pedestrian and cycling routes and facilities within and surrounding the precinct are limited with the Precinct primarily consisting of rural roads.

With the upgrade to Richmond Road a shared pathway will be provided along Richmond Road adjacent to the western boundary of the Precinct. This facility however ends just north of the Bells Creek Bridge.

Regional cycling links are also provided on the surrounding network with the M7 Motorway cycle path located just to the south of the Precinct, access to which is provided off Richmond Road. The Blacktown bike plan can be seen in Figure 18. It shows that there are only a handful of cycleways near the West Schofields precinct.

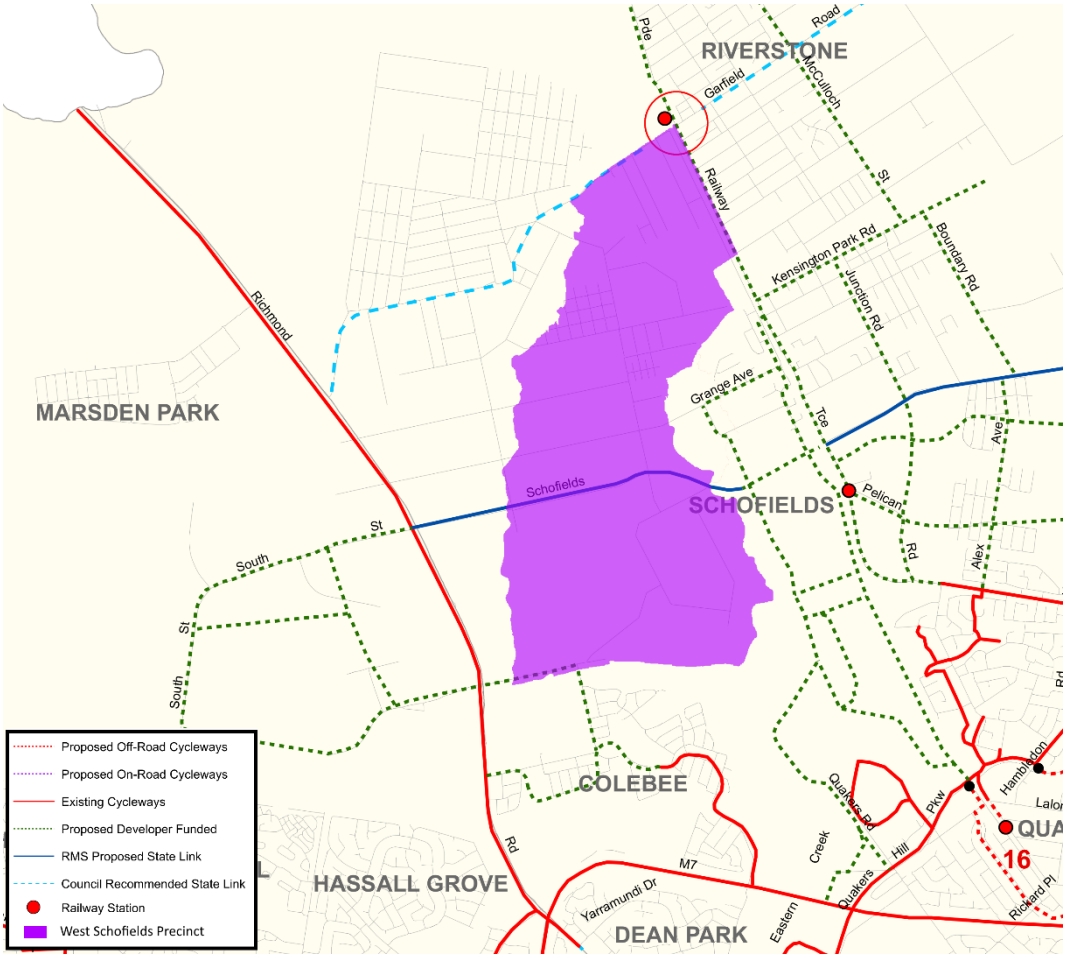


Figure 18 Blacktown City Council bike plan

4 Precinct Planning Principles

4.1 Transport Planning Objectives

In developing the preferred transport network, in conjunction with the precinct master planners, the following key transport objectives have been considered. These aim to provide for a coherent, legible transport network that supports movement to, from, and within the West Schofields Precinct.

- Provide a strategic overview of the existing and future transport network in the NWGA.
- Assess and test the transport impacts of the proposed development of the study area as reflected in the Indicative Layout Plan (ILP), taking into consideration potential development staging including from adjacent precincts in the NWGA.
- Recommend infrastructure upgrades and other measures to address those impacts within the vicinity of West Schofields.
- Prepare and agreed implementation framework, in negotiation with the NSW Government transport agencies, Blacktown Council, and DP&E, for the key infrastructure components.
- Ensure all modes of transport, including private vehicle, public transport (bus and rail), walking and cycling are considered in the planning and development of each Precinct.

4.2 Road Classification and Capacity

Guidelines for road network design can be allocated into three main categories:

- Road classification (road hierarchy) – how will traffic move through the precincts and are roads designed to accommodate particular function in mind?
- Road capacity – are adequate lanes provided on the streets to accommodate traffic without significant congestion?
- Intersection performance – are delays at intersections acceptable?

The Growth Centres Development Code (Growth Centres Commission, 2006) classifies the hierarchy based on anticipated levels of daily traffic as summarised in Table 3. The classification of each road will dictate its physical form (i.e. number of lanes, road reserve width), function (what types of vehicles utilise the road) and the speed limit.

Table 3 Functional classification of roads

Road Type	AADT*	Functions and Connections	Speed Limit
Arterial/ Freeway	>35,000	Connects large urban areas	80km/hr +
Sub-Arterial	10,000 – 35,000	Arterial roads to town centres Carries major bus routes	Up to 70km/hr
Collector	3,000 – 10,000	Connects neighbourhoods Can accommodate public transport	Up to 60km/hr
Local	1,000 – 3,000	Priority to pedestrians and cyclists Designed to slow residential traffic	Up to 50km/hr

* Annual Average Daily Traffic

4.3 Road Cross Sections

Typical road corridor cross sectional design requirements for future urban development have been determined as a standard to be adopted throughout the NWGA. They are summarised in Table 4.

Table 4 GCC Standard Road Types and Road Corridor Widths

Road Type	Traffic Load (Vehicles/Day)	Road Corridor Width	Road Carriageway Lanes, Number and Width
Arterial Road	35,000 +	To be determined by the RMS	To be determined by the RMS
Sub Arterial Road	10,000-35,000	35 metres	4 Lanes divided, 1*2.5m shared path and 1*1.5m footpath
Collector Road	3,000-10,000	20.8 metres	4 traffic lanes (13 metres carriageway)
Local Road	1,000-3,000	16 metres	9 metres

In general all future road cross sections, as summarised in Table 4, should be reviewed at the precinct master planning Development Control Plan (DCP) stage to minimise any un-necessary “land take” requirement.

4.4 Heavy Vehicles

Heavy vehicles presently comprise a significant proportion (close to 50% in some locations) of total traffic through the precinct. The ILP for West Schofields should aim to minimise heavy vehicle intrusion to enhance the amenity of the area. Measures to achieve this objective include:

- Introducing load limits on certain roads within the precinct (buses excepted)
- Restricting certain turn movements from Richmond Road into the precinct for vehicles over nine metres, and
- Providing advisory signposting that requires that heavy vehicles use major arterial routes such as Richmond Road and Garfield Road West.

4.5 Public Transport Provision

For new precincts within the NWGA, where private vehicle has historically dominated the transport landscape, it is vital that strong public transport linkages are provided at an early stage in the development process, prior to new residents establishing their travel habits. As illustrated in Figure 5, private vehicle is the dominant mode of travel in the NWGA. Reducing the dependence on private vehicles must form one of the key objectives of this transport study.

Local bus routes should be planned so that they run through the core of the precinct, as opposed to along arterial roads with poor pedestrian connectivity. This provides a higher level of public transport accessibility to future residents of West Schofields. Regional bus routes should be provided which allow more direct, time efficient services to key regional centres such as Rouse Hill and Blacktown. A number of local bus services would also service stations on the Sydney Metro Northwest to encourage multi-modal public transport trips.

Adequate facilities will need to be provided for public transport users to encourage a mode shift away from private vehicles. This includes infrastructure items such as bus shelters, waiting areas and other bus priority measures. The provision of a good quality, permeable footpath network will be critical in ensuring users are able to easily access public transport stops.

Land use planning will also play a vital role in facilitating increased use of public transport. High density developments should be located close to public transport nodes as these will be the areas where the highest mode shares to public transport will be achieved. Consideration should also be given to major pedestrian attractors such as schools and their proximity to the public transport network. Streets and roads containing public transport stops should be activated wherever possible to enhance the amenity and attractiveness for pedestrians waiting for services.

4.6 Walking and Cycling

Walking and cycling will play an important role in meeting the future transport needs of the West Schofields Precinct. Providing good connections within the precinct and close proximity to the village centres and public transport connections will promote the use of sustainable travel modes.

Footpaths should be provided on both sides of the road carriageway in accordance with the standard road cross sections described in Section 4.3. Appropriate pedestrian crossing facilities should be incorporated at intersections and along key desire lines to ensure safe and efficient pedestrian movements. Signalised intersections should provide crossing legs on all approaches, while pedestrian refuges should be integrated in the design of any roundabout within the precinct.

Bus stops should be located to allow for good pedestrian accessibility. Where possible, stops should be positioned close to traffic signals or alternative safe pedestrian crossing facilities (e.g. pedestrian refuges, zebra crossings). Adequate shelter and seating should be provided, particularly to service less mobile users.

It is important walking and cycling routes are integrated with those provided in adjacent growth centre precincts and regional cycle routes such as the Windsor Road shared path and Westlink M7 cycleway. Linkages to major land uses such as

schools, retail and public transport nodes should also form a key consideration when planning pedestrian and cycle routes.

Blacktown City Council prefer to have cycleways on all new roads provided off street by means of either a combined 2.5 or 3 metre wide pedestrian-cycle path on one side of the road for local roads or similar paths on both sides of the road for the sub arterial and arterial roads.

The NSW Bicycle Guidelines (Roads and Traffic Authority, 2003) summarises the needs and requirements of bicycle users by the following five design principles:

- **Safety**: A good quality route enhances the safety of all users, including cyclists, pedestrians and motorists. Streets and intersections along key bicycle routes should be designed to a standard which incorporates cyclist movements.
- **Coherence**: The bicycle network should link popular destinations with local residential streets via a mix of both local and regional routes. The network should be continuous and easily identifiable to both novice and experienced cyclists.
- **Directness**: Bicycle routes should be as direct as possible, having consideration for major barriers such as road intersections and steep topography. The rider should ideally be able to maintain a safe and comfortable consistent riding speed throughout their journey.
- **Attractiveness**: The bicycle network must be designed so that it complements and enhances its environment in such a way that cycling is attractive. Clear and strategically placed wayfinding information should indicate distances and times to major destinations.
- **Comfort**: Bicycle routes must be comfortable and easy to use for all cyclists. Depending on the road environment and topography, some level of separation (e.g. clearly marked bicycle lanes, painted green) may be required.

Bicycle parking facilities should be provided at key destinations (e.g. train stations, village centres and major developments) to accommodate the needs of both short and long term cyclists. Parking for short stay cyclists should be provided in areas with passive surveillance - if the parking is visible it will be perceived as more secure and achieve greater utilisation. Parking for long stay cyclists should be in secure, lockable facilities which provides weather protection and conveys a sense of high priority for the treatment of riders.

5 Road Network Assessment

This section provides an assessment of the future road network that will support the development of the West Schofields Precinct and meet future traffic demands. It also evaluates the performance of key intersections within the precinct during the critical commuter peak hours. This assessment has informed the master planning team in the development of the draft ILP for the precinct.

5.1 Assessment Criteria

5.1.1 Road Capacity

Mid-block capacity requirements (for interrupted flow conditions) for roads supporting the West Schofields precinct have been based on Austroads Guide to Traffic Management[3]. These are outlined in Table 5.

Table 5 Mid-Block capacities of urban roads

Lane Type (interrupted flow conditions)		One-way mid-block capacity (veh/hour)
Median or inner lane	Divided road	1,000
	Undivided road	900
Middle lane	Divided road	1,000
	Undivided road	900
Kerbside lane	Adjacent to parking lane	900
	Occasional parked vehicles	600
	Clearway conditions	900

Based on the mid-block capacities outlined above, in conjunction with future traffic volumes, roadway levels of service can be determined. This is summarised in Table 6 (as outlined in Austroads Guide to Traffic Management[4]).

Table 6 Roadway levels of service definition

Level of Service	Volume / Capacity Ratio	Description (interrupted flow conditions)
A	0.00 to 0.34	Primarily free flow operations at average travel speeds
B	0.35 to 0.50	Reasonably unimpeded operations at average travel speeds
C	0.51 to 0.74	Stable operations; however, ability to manoeuvre and change lanes in mid-block locations may be more restricted
D	0.75 to 0.89	Small increases in flow may cause substantial increases in delay and decreases in travel speed.
E	0.90 to 0.99	Significant delays and average travel speeds of 33% of the free flow speed or less
F	> 1.00	Characterised bu urban street flow at extremely low speeds. Intersection congestion is likely at critical signalised locations.

[3] Part 3: Traffic Studies and Analysis, section 5.21, Table 5.1
[4] Part 2: Roadway Capacity

5.1.2 Intersection Capacity

The performance of intersections in an urban environment is measured in terms of its Level of Service (LoS). Level of service ranges from A (very good) to F (over capacity with significant delays). This is described in the RTA Guide to traffic Generating Developments as summarised in Table 7. In peak hours at intersections controlled by traffic signals on key regional and arterial routes, a LoS D is generally acceptable.

Table 7 Intersection level of service

Level of Service	Average Vehicle Delay (seconds)	Traffic Signals and Roundabouts	Priority Intersections ('Stop' and "Give Way')
A	< 14	Good operation	Good operation
B	15 to 28	Good with acceptable delays and spare capacity	Acceptable delays and spare capacity
C	29 to 42	Satisfactory	Satisfactory, but accident study required
D	43 to 56	Operating near capacity	Near capacity and accident study required
E	57 to 70	At capacity. At signals, incidents will cause excessive delay. Roundabouts require other control mode	At capacity, requires other control mode
F	> 71	Unsatisfactory with excessive queuing	Unsatisfactory with excessive queuing;

5.2 Strategic Network Modelling

A strategic transport network model has been developed for the West Schofields precinct. This model has been constructed in Aimsun as a "Static Assignment Model" and was used to assess the proposed Indicative Layout Plan testing varying levels of traffic on the proposed road network.

The model was developed from the 2014 RMS model that was used to undertake investigations into potential rail crossings alignments and corresponding road network options. The base model (originally a mesoscopic model) was re-calibrated using turn counts collected in 2014 to ensure the adequacy of the network coding before the future model was developed.

Future modelling involved the development of the ILP road network within the model as well as making some network improvements on the periphery to ensure no bias on loading points (the assumption being that the surrounding roads currently being upgraded will be functional upon development of the site). The road hierarchy was represented using the geometry of the roads (number of lanes, turning bays, etc) and volume delay functions that describe the delay created by different traffic flows, representing the presence of street friction.

The Aimsun model utilises defined travel demand matrices cut from a cordon within the Sydney Strategic Travel Model. These demand matrices were then imported into the model and traffic was assigned to the network using the "Frank and Wolfe" Assignment. The Frank and Wolfe traffic assignment method uses an

algorithm based off Wardrop's principle in that no user can improve their travel time by changing routes as the network is at equilibrium.

To be consistent with transport modelling undertaken for a number of key planning studies and documents, the year 2036 was taken as the design year for assessing network performance, with 2014 as the base year.

5.3 Traffic Generation

Traffic generation estimates have been sourced from the Sydney Strategic Model with output being supplied by the Bureau of Statistics and Analytics (BTS). The traffic generation numbers were then cross checked against values estimated using the RMS *Guide to Traffic Generating Developments*. Table 8 below summarise the rates used in the analysis. Although the draft ILP proposes a number of open space areas, these were not included in the trip generation process as they were unlikely to generate significant traffic during peak hours.

Table 8 Traffic generation rates

Land Use	**Traffic Generation Rate (vehicles / hour)**	
	AM Rate (8am – 9am)	**PM Rate (5pm – 6pm)**
Large lot residential	0.99 / dwelling	0.95 / dwelling
Low density residential	0.99 / dwelling	0.95 / dwelling
Medium density residential	0.50 / dwelling	0.50 / dwelling
High density residential	0.32 / dwelling	0.32 / dwelling
Commercial (office)	1.6 / 100m^2 GFA	1.2 / 100m^2 GFA
Retail	1.94 / 100m^2 GFA	9.84 / 100m^2 GFA
Business Park / Light Industrial	0.52 / 100m2 GFA	0.56 / 100m2 GFA

5.4 Future Traffic Volumes

Trip generation assumption used for the traffic modelling were informed by the economic feasibility study undertaken by the wider project team for West Schofields. These population and employment forecasts were then sent to BTS to be incorporated into the wider forecasts for the NWGA.

A summary of the forecasted traffic volumes for the future year for 2036 is provided below in Figure 19 and Figure 20. The total vehicle flows are shown in black and the light vehicle only flows are shown in grey.

Figure 19 AM Peak flows (veh/hr)

Figure 20 PM Peak flows (veh/hr)

- Figure 19 and Figure 20 show that the two newly constructed east west links of Schofields Road and Townson Road/Burdekin Link Road have the heaviest volumes in the area performing the sub-arterial function.
- Vine St West and Grange Avenue still see modest use as both roads will have signalised connections to the Richmond Road.
- Carnarvon Road although listed as an existing local road is performing more of a collector function as a primary North South connection to Garfield Road.
- A potential Quakers Road extension serves as an alternative access point to the M7 from Richmond Road and as such is liable to carry sub-arterial levels of traffic.

5.5 Traffic Distribution

The future year demand matrices, produced by the BTS have been developed from a 4 step travel model based on forecast population, employment and the transport network. The traffic distribution is retained within Aimsun and only minor edits were introduced to include school traffic and town centre traffic. While developing school and town centre traffic it was deduced that there will be a number of linked trips (i.e. school drop off before continuing onto work) and pass by trips reducing the overall trip generation.

Route selection is determined on the basis of the shortest travel time or cost considering the inherent route delays incurred along a possible link.

5.6 Preferred Road Network Hierarchy

The road network hierarchy supporting the West Schofields precinct is described in this section and shown in Figure 21. This hierarchy is consistent with the transport planning objectives outlined in Section 4.1.

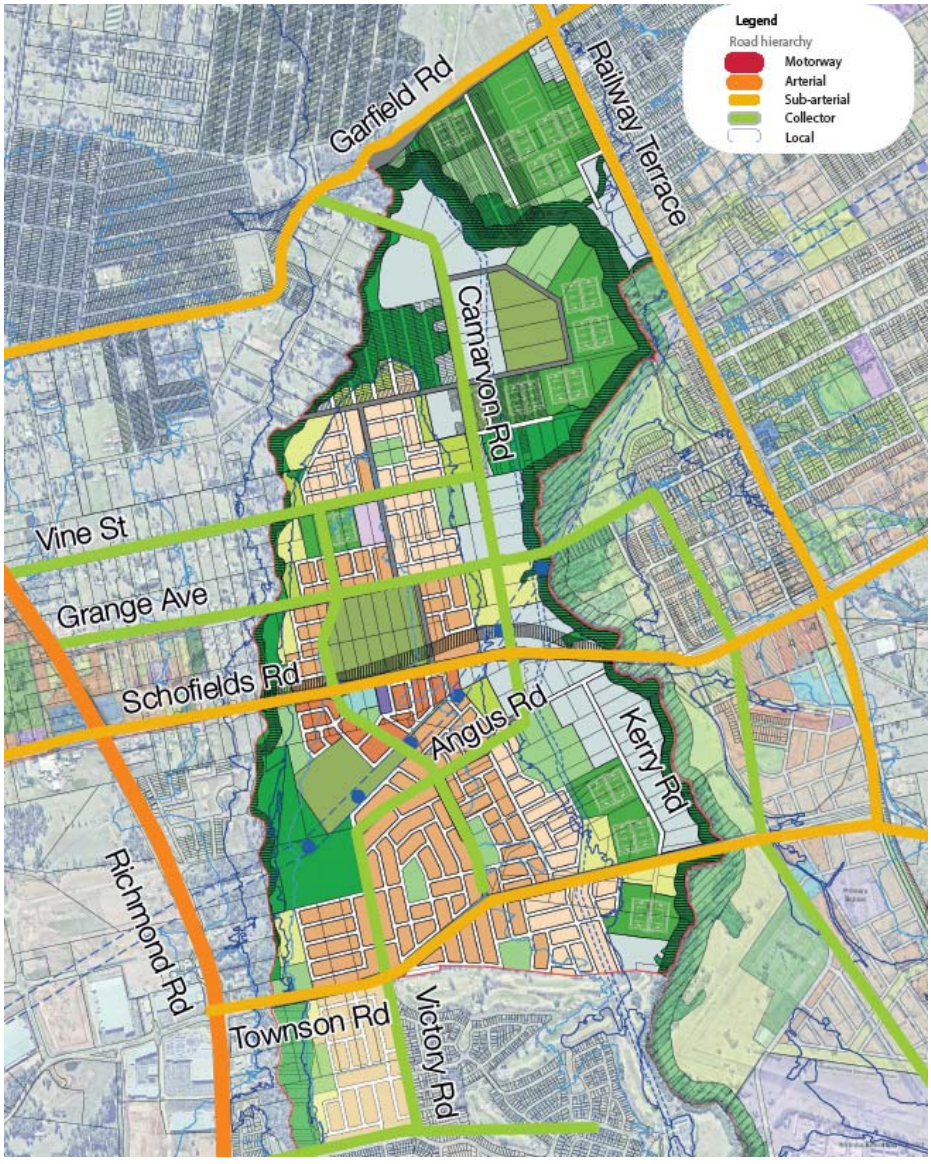


Figure 21 Future road network hierarchy

5.6.1 Richmond Road

Richmond Road is a key arterial road in Sydney's north-west that links the suburbs of Colebee and Marsden Park. Richmond Road has recently undergone an upgrade allowing it to provide capacity for four lanes with the opportunity to upgrade to six lanes in the future.

5.6.2 Schofields Road

Schofields Road is currently being upgraded in 3 stages to link the Rouse Hill and Marsden Park town centres as well as helping to meet the transport needs of the North West Priority Land Release Areas (including the West Schofields development investigated in this study).

Schofields Road has been identified as a sub arterial road within the study network, continuing from South Street running east-west throughout the West Schofields development. As Schofields Road runs parallel to Townson Road, Garfield Road West and Grange Avenue, it will also connect Richmond Road in the west to Windsor Road in the east.

5.6.3 Townson Road

Similar to Schofields Road, Townson Road has been identified as a sub arterial road within the study area based on high traffic volumes observed from the strategic transport model during both peak hour periods.

5.6.4 Internal Roads

A number of existing internal roads within the precinct have also been identified for improvement to form the framework for the higher order road network. These include Vine St West, Grange Avenue, Canarvon Road and potentially the Quakers Road extension.

5.7 Intersection Capacity Analysis

Traffic modelling of key intersections in the West Schofields development study area has been undertaken to determine the required layout and configuration to support the future population. The analysis has considered the ultimate development of the entire development as summarised in Section 5.4.

At key intersections (i.e. the junction of collector / sub-arterial roads), traffic signals are generally required to manage the high traffic movements expected following the development of the area. Signalised intersections provide benefit not only with respect to traffic capacity but also to support pedestrian and bicycle movements across major roads.

Intersection analysis has been undertaken for the following sites:

- Schofields Road / Carnarvon Road
- Carnarvon Road / Grange Avenue
- Schofields Road / Internal Road 1
- Richmond Road / South Street

- Richmond Road / Townson Road
- Townson Road / Victory Road
- Townson Road / Internal Road 2
- Grange Avenue / Internal Road 1

The locations of these intersections are shown on an overlay of the ILP and aerial imagery in Figure 22.

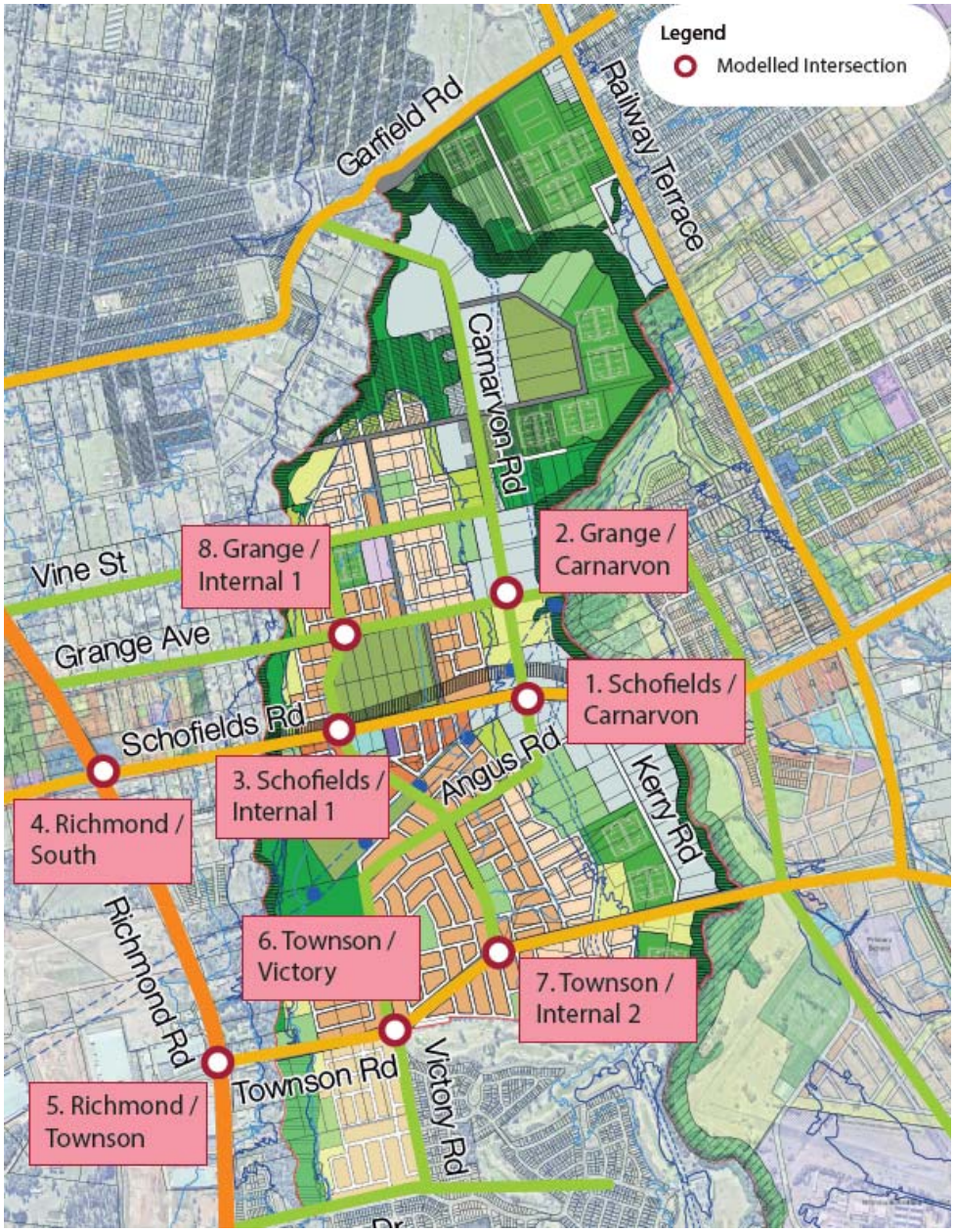


Figure 22 Traffic modelling locations

As described previously, volumes from the strategic Aimsun model were used and imported into SIDRA Intersection Version 7.0 to quantify the 2036 future peak-hour performance of each study intersection. The intersections within the precinct have all been found to operate at Level of Service D or better – in line with the criteria for evaluating the operational performance of intersections in the *RMS Guide to Traffic Generating Developments*.

The recommended future intersection controls are summarised in Table 9 and Figure 23 below.

Table 9 Proposed intersection controls

Intersection	Future Intersection Control*
1 Schofields Road / Carnarvon Road	Signals
2 Carnarvon Road / Grange Avenue	Roundabout
3 Schofields Road / Internal Road 1	Signals
4 Richmond Road / South Street	Signals
5 Richmond Road / Townson Road	Signals
6 Townson Road / Victory Road	Signals
7 Townson Road / Internal Road 2	Signals
8 Grange Avenue / Internal Road 1	Roundabout

* To be confirmed at later stages of planning for the precinct, in consultation with Roads and Maritime

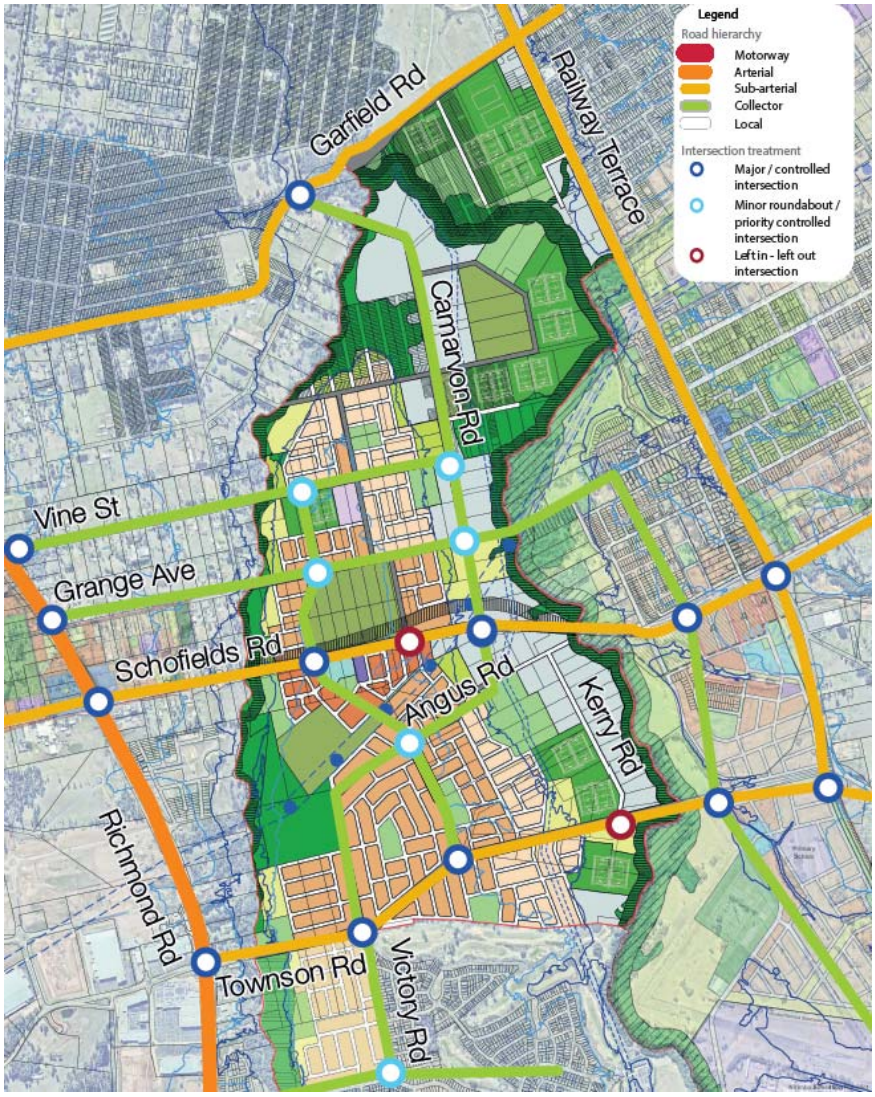


Figure 23 Proposed intersection controls

Traffic signals are recommended at four new locations in the precinct based on the traffic modelling undertaken for this study. The RMS has specific requirements relating to vehicular and pedestrian volumes where it will consider the installation of traffic signals at an intersection. These are commonly referred to as signal warrants. Section 2 of the RMS Traffic Signal Design Manual outlines five different warrants for the installation of traffic signals at intersections. These are summarised in Table 10.

Table 10 Warrants for Traffic Signals at Intersections

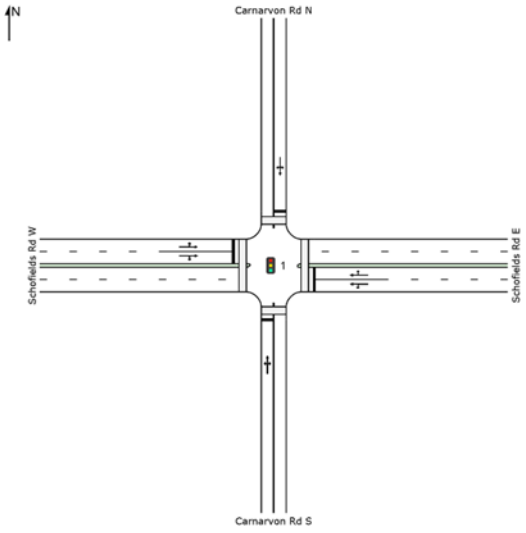
Warrant	Requirements
Traffic Demand	For each of the four one-hour periods of an average day: (i) The major road exceeds 600 vehicles/hour in each direction; and (ii) The minor road exceeds 200 vehicles/hour in one direction
Continuous Traffic	For each of the four one-hour periods of an average day: (i) The major road flow exceeds 900 vehicles/hour in each direction; and (ii) The minor road exceeds 100 vehicles/hour in one direction; and (iii) The speed of traffic on the major road or limited sight distance from the minor road causes undue delay/hazards to the minor road vehicles; and (iv) There is no other nearby traffic signal site easily accessible to the minor road vehicles
Pedestrian Safety	For each of the four one-hour periods of an average day: (i) The pedestrian flow crossing the major road exceeds 150 persons/hour; and (ii) The major road exceeds 600 vehicles/hour in each direction or, where there is a central median at least 1.2m wide, 1000 vehicles/hour in each direction
Pedestrian Safety – high speed road	For each of the four one-hour periods of an average day: (i) The pedestrian flow crossing the major road exceeds 150 persons/hour; and (ii) The major road exceeds 450 vehicles/hour in each direction or, where there is a central median at least 1.2m wide, 750 vehicles/hour in each direction; and (iii) The 85th percentile speed on the major road exceeds 75km/hr
Crashes	(i) The intersection has been the site of an average three or more reported tow-away or casualty traffic accidents per year over a three year period, where traffic signals could have prevented the accidents; and (ii) The traffic flows are at least 80% of the appropriate flow warrants

Source: Roads and Maritime Services

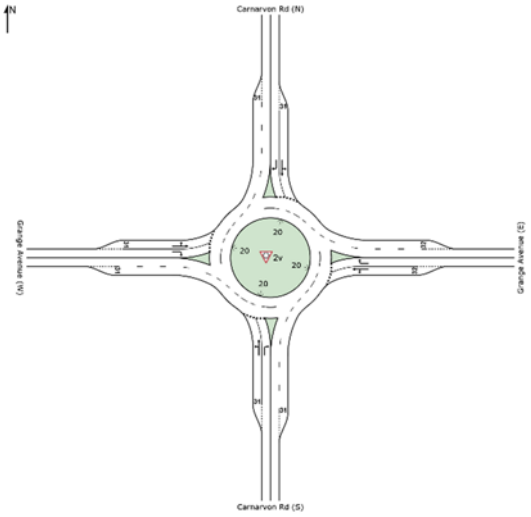
The installation of traffic signals will be delivered based on the development of the precinct and following demonstration that the above warrants may be met. This will be considered during detailed planning for the precinct as the land uses are further defined. The layout for the new or upgrade signalised intersections in the precinct will be developed (in consultation with Roads and Maritime) as planning for the West Schofields precinct progresses.

Blacktown City Council will continue to be consulted with regard to the proposed intersection and pedestrian treatments on local roads.

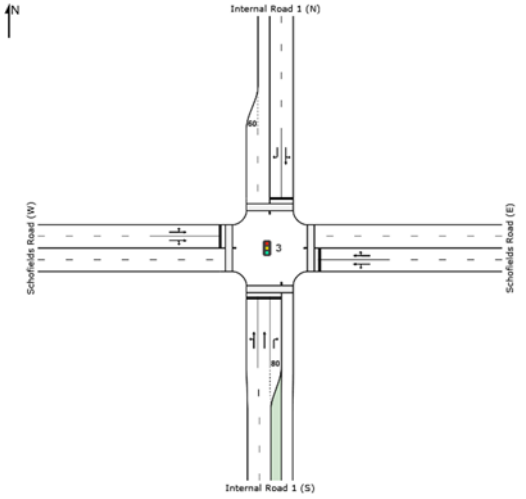
Intersection configurations were developed based on the outputs of the traffic model and future turning movements. These proposed layouts are illustrated in the figures below.



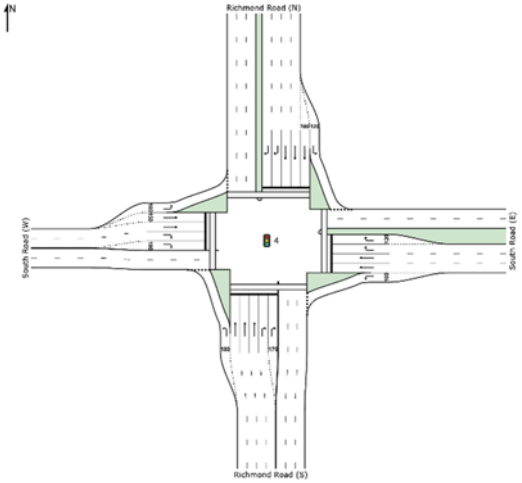
Schofields Road / Carnarvon Road



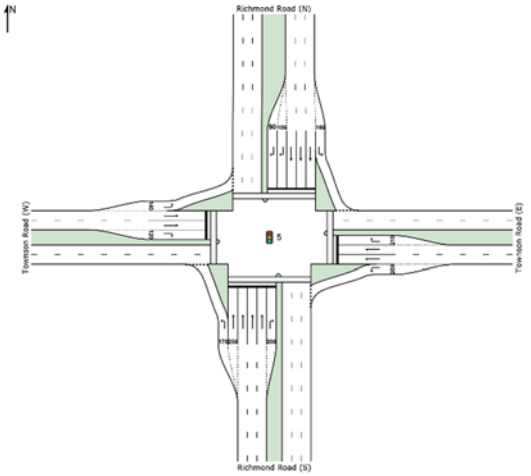
Carnarvon Road / Grange Avenue



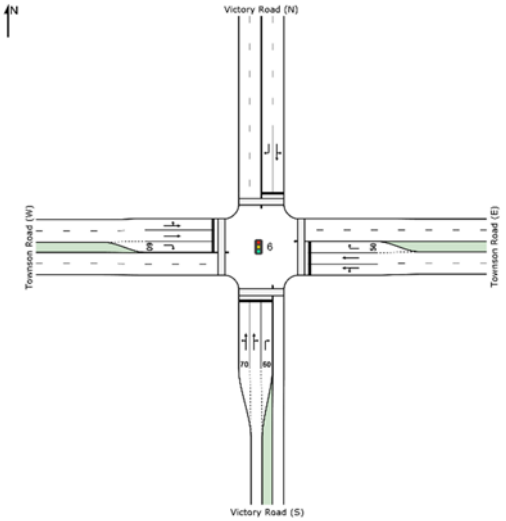
Schofields Road / Internal Road 1



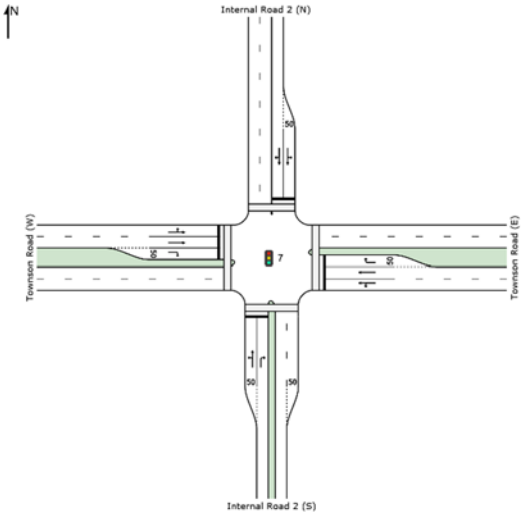
Richmond Road / South Street



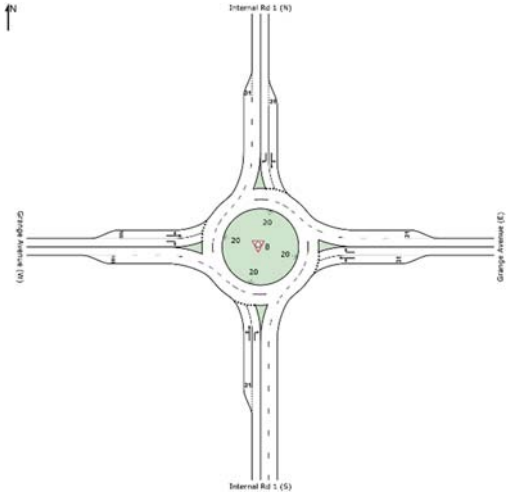
Richmond Road / Townson Road



Townson Road / Victory Road



Townson Road / Internal Road 2



Grange Avenue / Internal Road 1

The results of the traffic modelling based on the criteria previously described in Section 5.1 of this report are summarised in Table 11. As mentioned, these results demonstrate that the intersections will operate satisfactorily in the year 2036 during both AM and PM peak periods. It should be noted that each peak period consisted of 2 peak hours (7-9AM and 4-6PM).

Table 11: 2036 Modelled intersection performance

Intersection	Peak Period	LoS	Av Delay (s)	DoS
Schofields Road / Carnarvon Road	AM	B	22	0.31
	PM	B	23	0.33
Carnarvon Road / Grange Avenue	AM	A	6	0.24
	PM	A	6	0.22
Schofields Road / Internal Road 1	AM	C	37	0.37
	PM	C	35	0.32
Richmond Road / South Street	AM	C	32	0.68
	PM	C	29	0.72
Richmond Road / Townson Road	AM	D	54	0.95
	PM	D	44	0.93
Townson Road / Victory Road	AM	B	25	0.47
	PM	B	25	0.39
Townson Road / Internal Road 2	AM	A	11	0.27
	PM	A	5	0.21
Grange Avenue / Internal Road 1	AM	A	6	0.26
	PM	A	6	0.17

DoS – Degree of Saturation, Av Delay – Average vehicle delay, LoS – Level of Service

Detailed traffic modelling outputs are provided in Appendix A.

5.8 Heavy Vehicle Movements

As the draft ILP does not include any significant industrial/commercial areas, future developments within the West Schofields Precinct are not expected to generate significant heavy vehicle movements. However, the sections of road listed above, especially for the entirety of Garfield Road West, should have sufficient spacing to allow heavy vehicles through once the upgrades have been constructed. Heavy vehicles will travel on the higher order road network (Richmond Road and Garfield Road W) to reach their destination.

Amenity issues may arise if heavy vehicle movements were to increase within the West Schofields precinct and as such, measures to ameliorate this will need to be considered. This may include (but is not limited to):

- Implementation of heavy vehicle load limits of certain roads
- Positioning the frontage of residential lots away from roads which are expected to carry heavy vehicle traffic
- Providing noise attenuation devices on local roads to reduce the noise impacts arising from heavy vehicles
- Introducing local area traffic management (LATM) devices, e.g. raised speed tables, to discourage heavy vehicle intrusion into the precinct

6 Public Transport, Walking and Cycling

6.1 Bus Network

6.1.1 Proposed Network of Routes

The *North West Sector Bus Servicing Plan* consists of five regional and twelve district routes that service the NWGA area. This plan provides a network which links major centres of each of the 16 precincts across the NWGA. Regional routes are intended to connect town and regional centres, with district routes providing further accessibility to village centres and extending bus service provision to the widest area practically possible.

The proposed bus network plan to service the West Schofields Precinct builds upon the principles of the *North West Sector Bus Servicing Plan*. This has been modified based on the proposed road network layout, maximising the potential patronage and coverage. The bus network proposes one regional and two district routes which run directly within the West Schofields Precinct, as described below and illustrated in Figure 24:

- Route D4: Marsden Park to Blacktown

Starting at Marsden Park, route D4 cuts through the West Schofields precinct via a new road running north-south perpendicular to Grange Avenue and Schofields Road. The route then follows Townson Road towards the south west.

- Route D5: Emerton – Marden Park – Schofields – Rouse Hill

This bus route commences at Emerton, south west of the West Schofields precinct, then heads into heads into Marsden Park before running through the precinct via Townson Road followed by Meadow Road.

- Route R3: Mount Druitt – Marsden Park – Schofields – Rouse Hill

Within the study area, this bus route runs primarily along Schofields Road between Rouse Hill and Marsden Park and therefore provides east-west connectivity to those within the West Schofields precinct.

The following proposed bus routes will pass alongside the precinct.

- Route D1: Rouse Hill to Schofields

Bus route D1 runs along the eastern border of the West Schofields Precinct, providing a direct service into the Box Hill and Rouse Hill town centres as well as to the Riverstone and Vineyard train stations.

- Route D3: Rouse Hill to Box Hill

Bus route D3 travels between the Riverstone train station and the Rouse Hill town centre via Box Hill.

- Route R2: Parramatta – Rouse Hill – Riverstone East – Vineyard

Starting from Parramatta in the south east, bus route R2 travels to the Rouse Hill town centre followed by the Riverstone station and finally Vineyard station.

- Route R4: Blacktown – Marsden Park – Riverstone East

Bus route R4 connects Blacktown to the Riverstone railway station via Marsden Park.

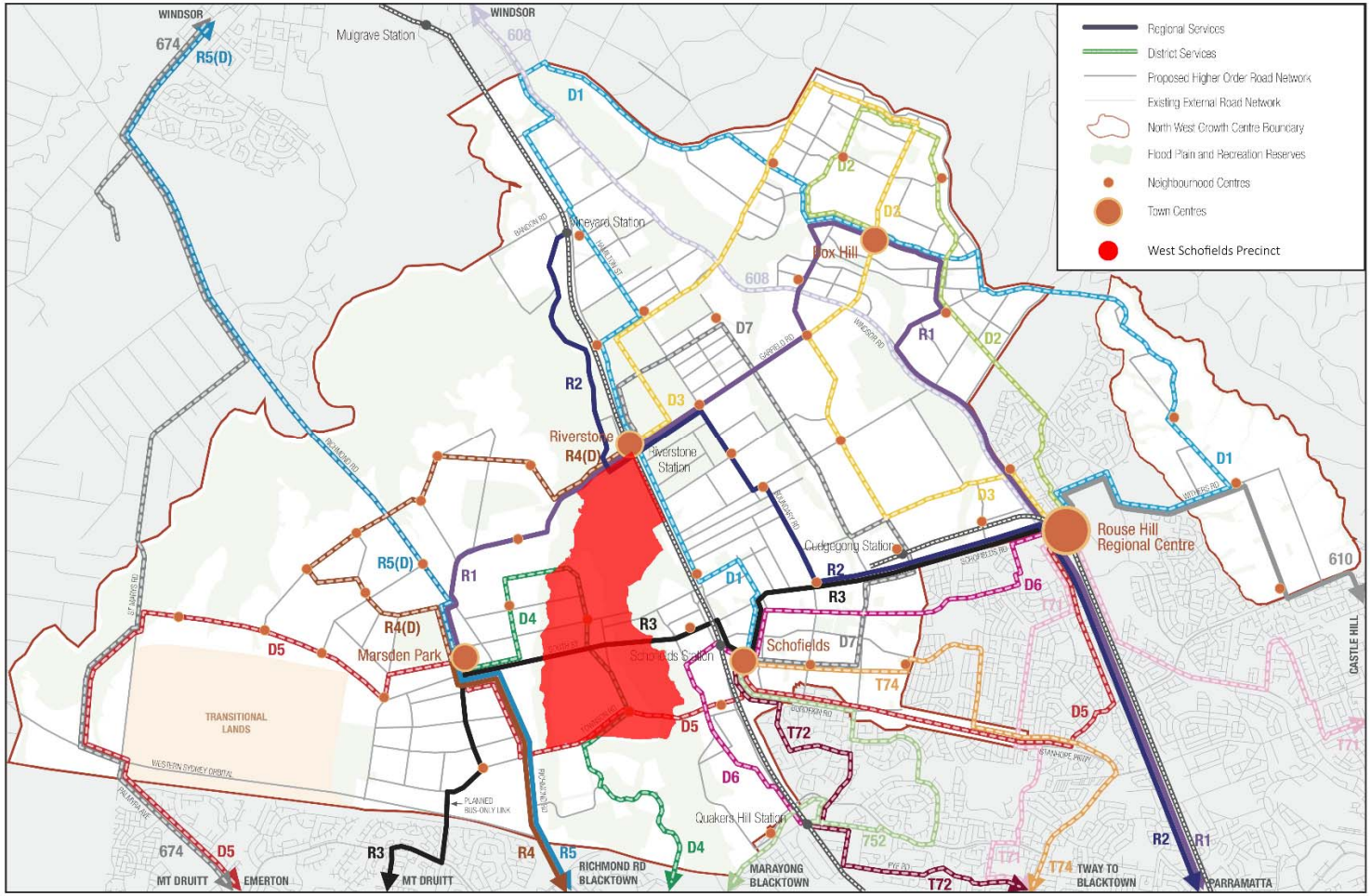


Figure 24 North West Sector Bus Servicing Plan (Source: MRCagney, 2012)

In addition to the servicing plan described above, *Sydney's Bus Future* was a long term plan published by the NSW Government in 2013 dedicated to improving the bus network to meet current and future needs. The relevant section pertaining to the West Schofields precinct can be seen in Figure 25 and indicates potential to enhance connectivity to Penrith to the west as well as Mount Druitt to the south.

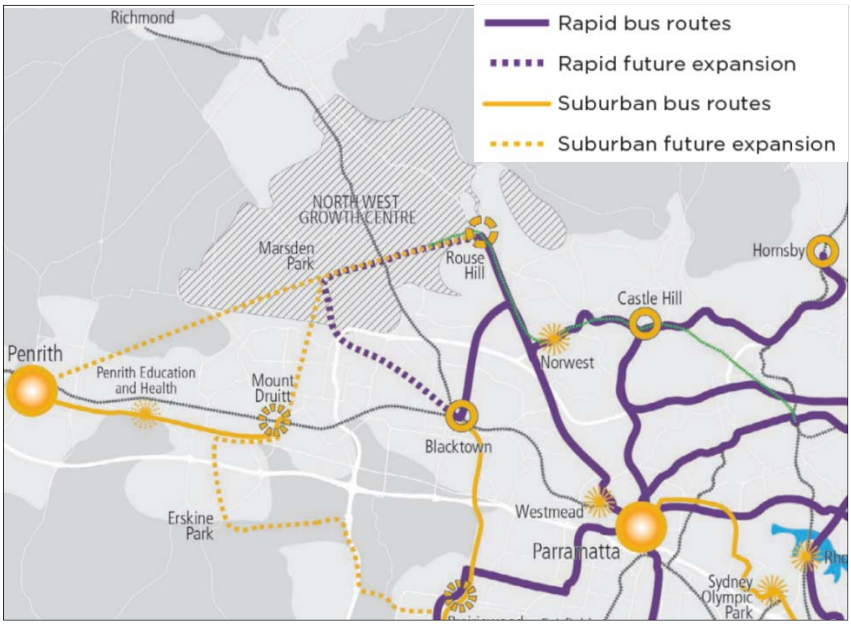


Figure 25 Sydney's Future Bus Network *(Source: Transport for NSW, 2013)*

6.1.2 Bus Servicing

All routes identified as bus corridors would be required to provide a road reserve of sufficient width to accommodate bus stops, including shelters where appropriate. Lane widths for bus routes would need to be a minimum of 3.5m. Roads which accommodate bus routes are required to have two lanes in each direction so stopping buses will not adversely impact general traffic. Should it not be feasible to provide two traffic lanes, indented bus bays may be considered – although this option limits flexibility should bus stops need to be moved in the future.

Schofields Road and Townson Road have been identified as sub arterial roads and therefore critical links to support the regional bus network. Bus priority facilities (including bus lanes and bus jumps) may be required at all signalised intersections to enable buses to maintain journey times and improve the attractiveness of public transport.

Bus stops should be provided with a minimum spacing of 400m to provide good accessibility to workers and residents of the West Schofields Precinct. This bus stop spacing will maintain route speeds and minimise the impact of stopping buses on general traffic flows. The exact locations of bus stops within West Schofields will be identified during detailed planning for the precinct as the land uses are more accurately defined.

Bus stop locations will be identified and approved through Local Traffic Committee at the earliest opportunity during the precinct planning phase. As a

general principle, bus stops should be located to provide good access to key land uses including Cudgegong Road, Schofields and Riverstone Railway station, West Schofields town centre, Rouse Hill regional Park and town centre as well as local Schools.

Amenities for waiting passengers, including shading, seating and shelters, is recommended at bus stops located on key regional routes such as Garfield Road West, Schofields Road and Townson Road.

6.2 Rail Services

The West Schofields Precinct is well served by the Sydney Trains network via Schofields Station on the Richmond Line and the Cudgegong Road Station on the future Sydney Metro Northwest. Providing strong access to these rail stations through bus connections and a permeable road network with plenty of pedestrian and cycling links will be a key component in facilitating a mode shift away from private vehicle onto public transport.

In December 2012, the NSW Government announced a public transport corridor had been preserved in the NWGA for future generations, known as the Marsden Park Transport Corridor. The route runs from the end of the Sydney Metro Northwest corridor at Cudgegong Road Station, west to Schofields Station and then further on to Marsden Park, a distance of approximately 6.8km. This Corridor runs through the middle of the West Schofields Precinct. The indicative alignment of the corridor is shown in Figure 26.

Figure 26 Marsden Park transport corridor
(Source: Transport for NSW, 2013)

Transport for NSW is currently undertaking detailed planning to define the alignment of the corridor – including the interface with existing and planned roads. A suitable transport mode has not yet been determined, however the route of the corridor will be designed to accommodate a range of feasible modes including heavy rail, bus or light rail. The decision of the selected transport mode will be based on detailed analysis to ensure the most appropriate mode is selected that best serves the corridor and the region in the longer term.

6.3 Pedestrian and Cycling Network

The future design objectives of the local area pedestrian and cyclist network for the West Schofields precinct should be to encourage residents, wherever possible to walk or cycle in preference to using motor vehicles for locally based travel and for access to public transport.

A number of intersection upgrades have been recommended in this strategy which will provide controlled pedestrian crossing across major roads and more formalised opportunities to cross – improving accessibility. The southern portion of the site is proposed to contain the town centre and consist mainly of medium to high density dwellings. Additional pedestrian facilities such as zebra crossings and/or widened footpaths may be required to support the higher levels of pedestrian activity anticipated in this area.

The bicycle network serving the West Schofields precinct should be designed in accordance with the design principles and objectives outlined in Austroads and NSW Bicycle Guidelines (refer to section 4.6 and Appendix A of this document). In particular, the precinct should provide a network of safe and connected bicycle paths which, where possible and appropriate, provide physical separation from vehicles and pedestrians.

A shared path has recently been constructed along Richmond Road. Schofields Road and Townson Road have been identified as sub-arterial roads and therefore should include shared pedestrian / cycle paths on both sides of the street. This will provide excellent east west permeability providing direct access to a rail station and the Burdekin Road shared path.

In addition, the following roads in West Schofields have been identified as suitable corridors for the introduction of shared paths to improve the cycling network:

- Carnarvon Road
- Angus Road
- Victory Road
- Kerry Road

There is also opportunity for a formal off road facility to be constructed to connect Townson Road with Stonecutters Dr around the back of the golf course via Eastern Creek. This would provide direct access from the site to the M7 cycle path, one of the most heavily utilised recreational facilities in Sydney.

The West Schofields precinct will need to have shared paths along one side of collector roads for pedestrian and cyclists. The collector road reserve width is to be increased to 20.8m to accommodate this plus a 13m carriageway for buses. Separate bike paths within the road reserve will make the collector road widths too wide.

Within any medium and high density residential development within the precinct, the provision of secure bicycle parking is recommended. Bicycle parking should be provided at rates consistent with those outlined in the *NSW Planning Guidelines for Walking and Cycling.*

Visitor bicycle parking should be provided in the public domain with the town centre to support local bicycle trips. The proposed open space plan allows for some off-street cycling facilities but this will most likely be supported by on-street provisions.

7 Summary and Conclusions

This report has assessed the existing and future traffic and transport requirements associated with the development of the West Schofields Precinct located in the North West Growth Area within the Blacktown Local Government Area. This precinct has the capacity to accommodate approximately 4,500 residential dwellings, as well as a school, a town centre, and green space.

This report has provided an assessment of the transport infrastructure components necessary to support the development of the precinct and suggests a series of key objectives as summarised below:

- Provide a road network that allows for easy access to all modes of transport
- Design a physical site layout which encourages walking and cycling
- Ensure the road network provides suitable connections to adjacent development precincts
- Integrate transport and land use planning
- Provide high quality access to public transport stops to reduce the dependence on private vehicles
- Develop an appropriate road hierarchy to provide adequate carrying capacity
- Protect residential areas from through traffic intrusion, particularly from heavy vehicles

Road Network

A strategic transport model was developed to forecast future year (2036) as a Static Assignment Model in Aimsun and was used to assess the proposed Indicative Layout Plan testing various levels of traffic on the proposed road network. Schofields Road and Townson Road exhibit the heaviest volumes in the study area performing the roles of sub-arterial roads. There is a large amount of route choice within the model, and in order to limit route choice and to maintain a certain degree of consistency between the random seeds for the model run, a proportion of trips (30%) have been assigned using static routing, with the remainder by dynamic assignment.

A number of existing internal roads within the precinct have been identified for improvement to form the framework for the higher order road network. These roads will accommodate internal traffic, bicycle and pedestrian movements.

Traffic modelling of key intersections in the West Schofields development study area has been undertaken to determine the required layout and configuration to support the future population. Intersection analysis has been undertaken for the following sites:

- Schofields Road / Carnarvon Road
- Carnarvon Road / Grange Avenue
- Schofields Road / Internal Road 1
- Richmond Road / South Street
- Richmond Road / Townson Road
- Townson Road / Victory Road

- Townson Road / Internal Road 2
- Grange Avenue / Internal Road 1

Outcomes from the assessment shows that the proposed measures for each intersection is sufficient for the future year of 2036 performing to Level of Service C or better with the proposed intersection layouts.

Public Transport, Walking and Cycling

Private vehicle has historically dominated the transport landscape within the North West Growth Centre and so it is vital that strong public transport, walking and cycling linkages are provided at an early stage when residents establish their travel habits in a new precinct.

The West Schofields precinct will be served by a number of new bus routes proposed as part of the North West Sector Bus Servicing Plan. 2 district routes and 1 regional route have been proposed to run directly through the precinct while 2 more district routes and 2 more regional routes will run adjacent to it.

Bus stops are recommended to be provided with a minimum spacing of 400m to provide accessibility to those using public transport. Amenities for passengers waiting for the bus include shading, seating and shelters and are recommended at bus stops located on key regional routes such as Garfield Road West, Schofields Road and Townson Road.

A number of dedicated bicycle routes have been identified in this study. Shared pedestrian/cyclist paths are recommended for Carnarvon Road, Angus Road, Victory Road and Kerry Road. There is also opportunity to connect Townson Road with Stonecutters Drive behind the golf course via Eastern Creek which would provide direct access from the precinct to the M7 cycle path.

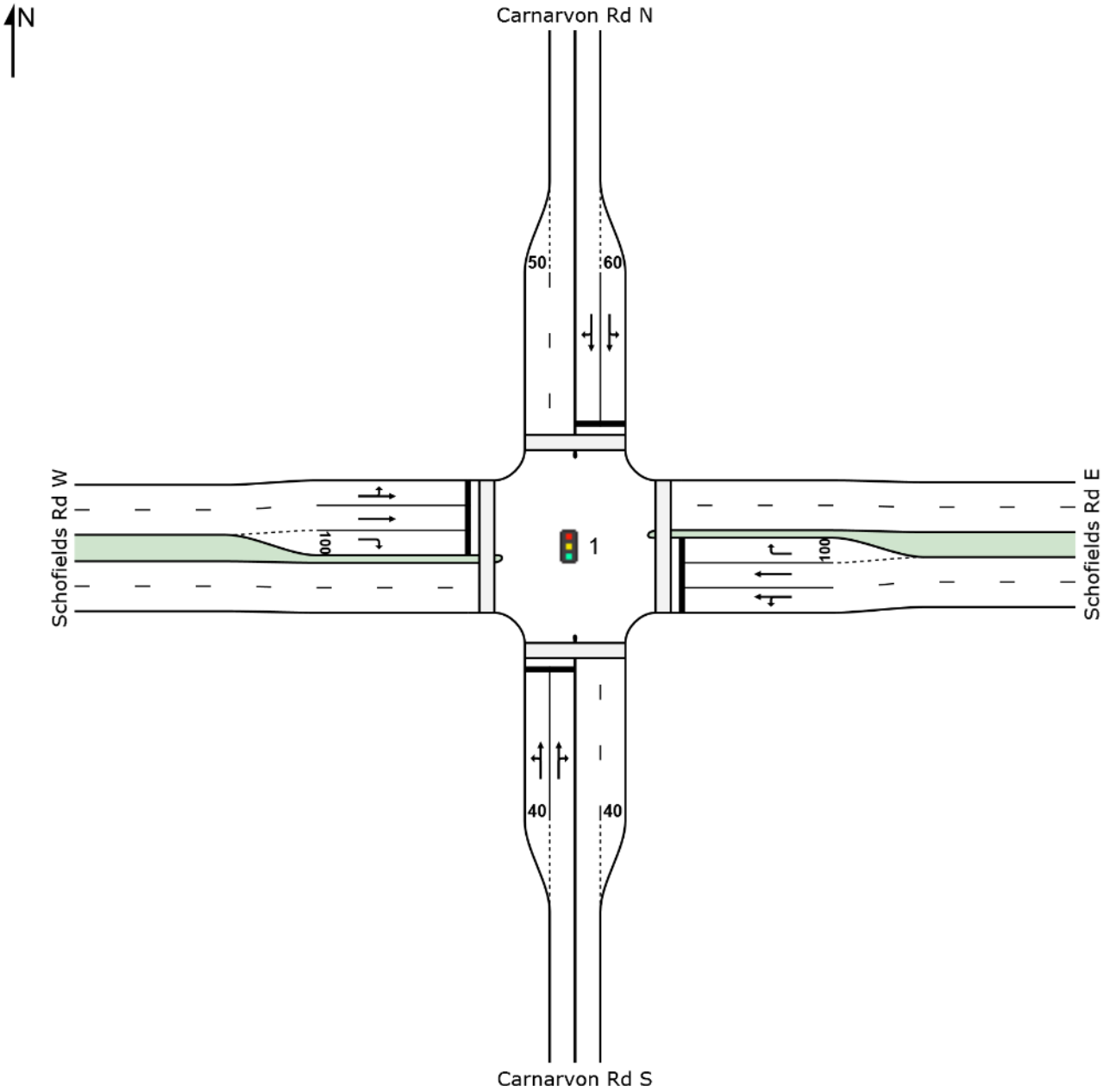
Appendix A

Traffic modelling outputs

SITE LAYOUT

Site: 1 [1_Schofields Road / Carnarvon Road AM]

Schofields Road / Carnarvon Road
Signals - Fixed Time Isolated



MOVEMENT SUMMARY

Site: 1 [1_Schofields Road / Carnarvon Road AM]

Schofields Road / Carnarvon Road
Signals - Fixed Time Isolated Cycle Time = 120 seconds (User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Carnarvon Rd S											
1	L2	1	0.0	0.095	31.3	LOS C	2.6	18.1	0.68	0.54	41.4
2	T1	69	0.0	0.095	25.7	LOS B	2.6	18.1	0.68	0.54	42.2
3	R2	117	0.0	0.310	39.4	LOS C	5.3	36.9	0.80	0.77	36.0
Approach		187	0.0	0.310	34.3	LOS C	5.3	36.9	0.76	0.68	38.1
East: Schofields Rd E											
4	L2	144	0.0	0.310	22.7	LOS B	10.0	69.9	0.61	0.63	44.4
5	T1	479	0.0	0.310	17.1	LOS B	10.4	72.5	0.61	0.56	46.3
6	R2	75	0.0	0.144	24.0	LOS B	2.4	17.0	0.59	0.71	42.2
Approach		698	0.0	0.310	19.0	LOS B	10.4	72.5	0.60	0.59	45.4
North: Carnarvon Rd N											
7	L2	127	0.0	0.191	33.8	LOS C	5.1	35.4	0.73	0.75	37.9
8	T1	125	0.0	0.201	27.0	LOS B	5.5	38.2	0.71	0.60	41.4
9	R2	14	0.0	0.201	32.6	LOS C	5.5	38.2	0.71	0.60	40.7
Approach		266	0.0	0.201	30.5	LOS C	5.5	38.2	0.72	0.67	39.6
West: Schofields Rd W											
10	L2	1	0.0	0.167	21.2	LOS B	5.1	35.7	0.55	0.46	46.7
11	T1	341	0.0	0.167	15.6	LOS B	5.1	35.7	0.55	0.46	47.8
12	R2	1	0.0	0.001	25.9	LOS B	0.0	0.1	0.58	0.59	41.3
Approach		342	0.0	0.167	15.7	LOS B	5.1	35.7	0.55	0.46	47.7
All Vehicles		1493	0.0	0.310	22.2	LOS B	10.4	72.5	0.63	0.59	43.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	26	18.7	LOS B	0.1	0.1	0.56	0.56
P2	East Full Crossing	26	33.0	LOS D	0.1	0.1	0.74	0.74
P3	North Full Crossing	26	18.7	LOS B	0.1	0.1	0.56	0.56
P4	West Full Crossing	26	33.0	LOS D	0.1	0.1	0.74	0.74
All Pedestrians		105	25.9	LOS C			0.65	0.65

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

PHASING SUMMARY

Site: 1 [1_Schofields Road / Carnarvon Road AM]

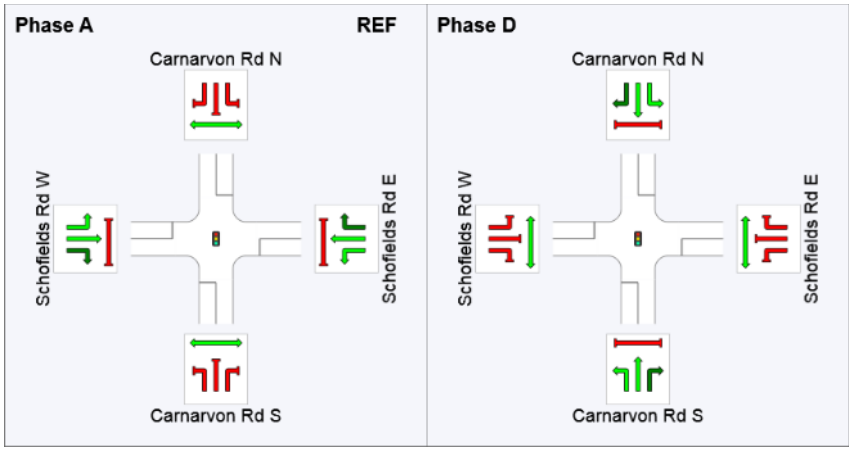
Schofields Road / Carnarvon Road
Signals - Fixed Time Isolated Cycle Time = 120 seconds (User-Given Cycle Time)

Phase Times determined by the program
Phase Sequence: Variable Phasing
Reference Phase: Phase A
Input Phase Sequence: A, D
Output Phase Sequence: A, D

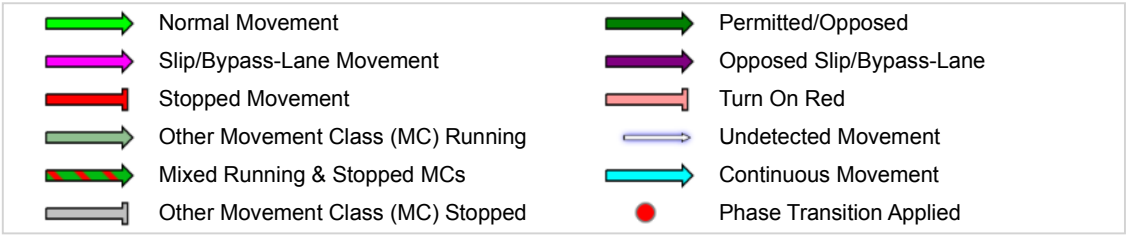
Phase Timing Results

Phase	A	D
Phase Change Time (sec)	0	69
Green Time (sec)	63	45
Phase Time (sec)	69	51
Phase Split	58 %	43 %

See the Phase Information section in the Detailed Output report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.



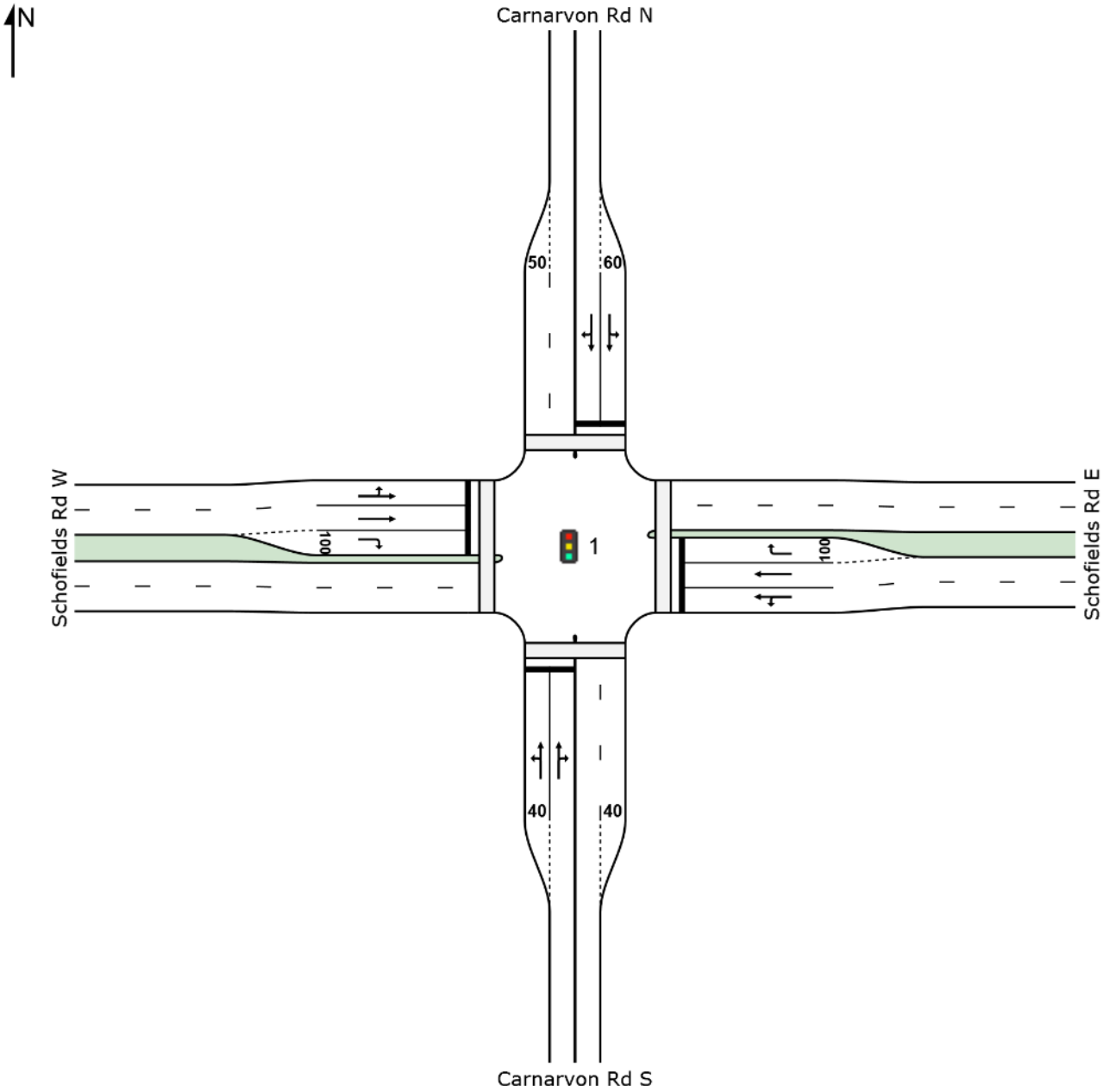
REF: Reference Phase
VAR: Variable Phase



SITE LAYOUT

Site: 1 [1_Schofields Road / Carnarvon Road PM]

Schofields Road / Carnarvon Road
Signals - Fixed Time Isolated



MOVEMENT SUMMARY

Site: 1 [1_Schofields Road / Carnarvon Road PM]

Schofields Road / Carnarvon Road
Signals - Fixed Time Isolated Cycle Time = 120 seconds (User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Carnarvon Rd S											
1	L2	1	0.0	0.093	29.2	LOS C	2.6	18.1	0.65	0.52	42.4
2	T1	72	0.0	0.093	23.7	LOS B	2.6	18.1	0.65	0.52	43.2
3	R2	136	0.0	0.331	38.1	LOS C	6.0	42.1	0.79	0.78	36.4
Approach		208	0.0	0.331	33.1	LOS C	6.0	42.1	0.74	0.69	38.5
East: Schofields Rd E											
4	L2	165	0.0	0.328	25.1	LOS B	10.7	74.7	0.65	0.67	42.9
5	T1	460	0.0	0.328	19.2	LOS B	11.0	77.1	0.64	0.59	45.1
6	R2	94	0.0	0.185	26.2	LOS B	3.3	22.8	0.63	0.73	41.1
Approach		719	0.0	0.328	21.5	LOS B	11.0	77.1	0.64	0.63	44.0
North: Carnarvon Rd N											
7	L2	148	0.0	0.208	31.9	LOS C	5.7	40.1	0.71	0.75	38.7
8	T1	67	0.0	0.087	23.6	LOS B	2.4	16.8	0.65	0.51	43.3
9	R2	1	0.0	0.087	29.2	LOS C	2.4	16.8	0.65	0.51	42.6
Approach		215	0.0	0.208	29.3	LOS C	5.7	40.1	0.69	0.68	40.0
West: Schofields Rd W											
10	L2	1	0.0	0.158	22.7	LOS B	4.8	33.7	0.58	0.48	45.8
11	T1	308	0.0	0.158	17.2	LOS B	4.8	33.7	0.58	0.48	46.8
12	R2	1	0.0	0.002	28.4	LOS B	0.0	0.1	0.61	0.60	40.2
Approach		309	0.0	0.158	17.2	LOS B	4.8	33.7	0.58	0.48	46.8
All Vehicles		1452	0.0	0.331	23.4	LOS B	11.0	77.1	0.65	0.61	43.1

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	26	20.4	LOS C	0.1	0.1	0.58	0.58
P2	East Full Crossing	26	30.9	LOS D	0.1	0.1	0.72	0.72
P3	North Full Crossing	26	20.4	LOS C	0.1	0.1	0.58	0.58
P4	West Full Crossing	26	30.9	LOS D	0.1	0.1	0.72	0.72
All Pedestrians		105	25.6	LOS C			0.65	0.65

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

PHASING SUMMARY

Site: 1 [1_Schofields Road / Carnarvon Road PM]

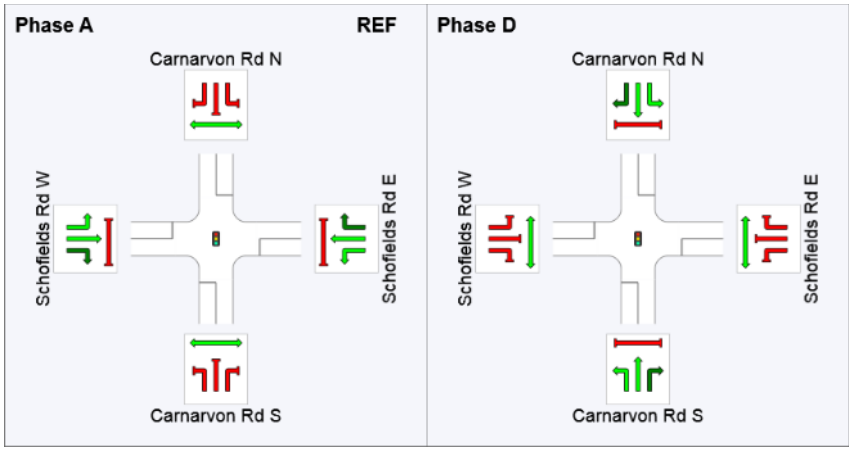
Schofields Road / Carnarvon Road
Signals - Fixed Time Isolated Cycle Time = 120 seconds (User-Given Cycle Time)

Phase Times determined by the program
Phase Sequence: Variable Phasing
Reference Phase: Phase A
Input Phase Sequence: A, D
Output Phase Sequence: A, D

Phase Timing Results

Phase	A	D
Phase Change Time (sec)	0	66
Green Time (sec)	60	48
Phase Time (sec)	66	54
Phase Split	55 %	45 %

See the Phase Information section in the Detailed Output report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.



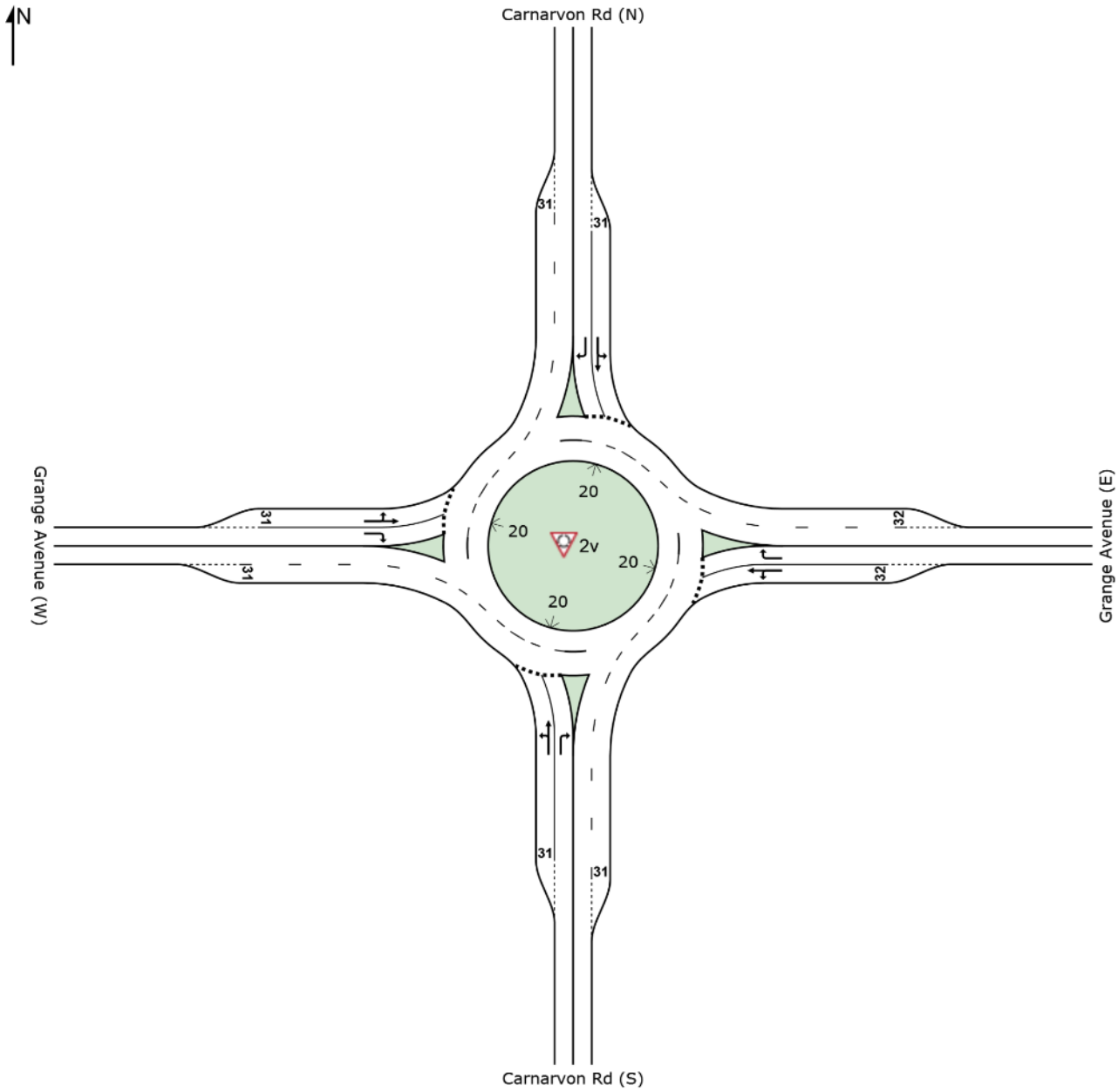
REF: Reference Phase
VAR: Variable Phase

Normal Movement	Permitted/Opposed
Slip/Bypass-Lane Movement	Opposed Slip/Bypass-Lane
Stopped Movement	Turn On Red
Other Movement Class (MC) Running	Undetected Movement
Mixed Running & Stopped MCs	Continuous Movement
Other Movement Class (MC) Stopped	Phase Transition Applied

SITE LAYOUT

Site: 2v [2_Carnarvon Road / Grange Avenue AM]

Carnarvon Road / Grange Avenue
Roundabout



MOVEMENT SUMMARY

Site: 2v [2_Carnarvon Road / Grange Avenue AM]

Carnarvon Road / Grange Avenue
Roundabout

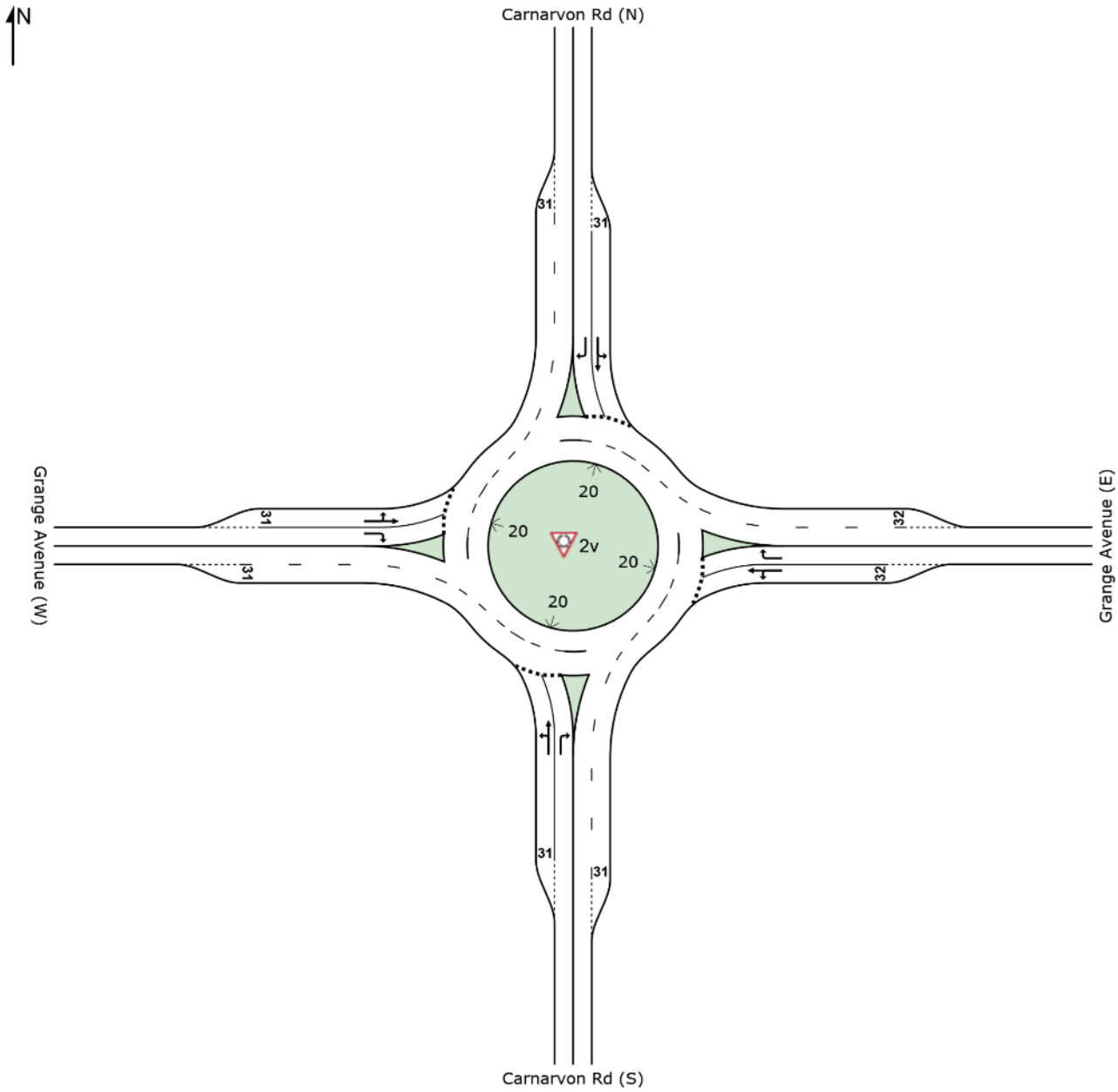
Movement Performance - Vehicles												
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Carnarvon Rd (S)											
1	L2	28	0.0	0.113	4.8	LOS A	0.6	4.1	0.36	0.47	48.9
2	T1	110	0.0	0.113	5.0	LOS A	0.6	4.1	0.36	0.47	53.5
3	R2	5	0.0	0.007	10.3	LOS A	0.0	0.2	0.39	0.60	50.5
Approach		144	0.0	0.113	5.1	LOS A	0.6	4.1	0.36	0.48	52.6
East: Grange Avenue (E)											
4	L2	26	0.0	0.083	5.1	LOS A	0.4	2.9	0.41	0.51	52.4
5	T1	70	0.0	0.083	5.3	LOS A	0.4	2.9	0.41	0.51	53.3
6	R2	84	0.0	0.078	10.0	LOS A	0.4	2.7	0.42	0.65	51.1
Approach		179	0.0	0.083	7.5	LOS A	0.4	2.9	0.41	0.57	52.0
North: Carnarvon Rd (N)											
7	L2	117	0.0	0.244	4.7	LOS A	1.5	10.3	0.34	0.47	53.3
8	T1	206	0.0	0.244	4.8	LOS A	1.5	10.3	0.34	0.47	53.7
9	R2	27	0.0	0.034	10.0	LOS A	0.2	1.1	0.35	0.61	47.7
Approach		351	0.0	0.244	5.2	LOS A	1.5	10.3	0.34	0.48	53.1
West: Grange Avenue (W)											
10	L2	1	0.0	0.084	4.8	LOS A	0.4	2.9	0.35	0.47	49.9
11	T1	102	0.0	0.084	5.0	LOS A	0.4	2.9	0.35	0.47	53.4
12	R2	26	0.0	0.035	10.5	LOS A	0.2	1.1	0.41	0.64	46.1
Approach		128	0.0	0.084	6.1	LOS A	0.4	2.9	0.36	0.50	52.1
All Vehicles		802	0.0	0.244	5.8	LOS A	1.5	10.3	0.37	0.50	52.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SITE LAYOUT

Site: 2v [2_Carnarvon Road / Grange Avenue PM]

Carnarvon Road / Grange Avenue
Roundabout



MOVEMENT SUMMARY

Site: 2v [2_Carnarvon Road / Grange Avenue PM]

Carnarvon Road / Grange Avenue
Roundabout

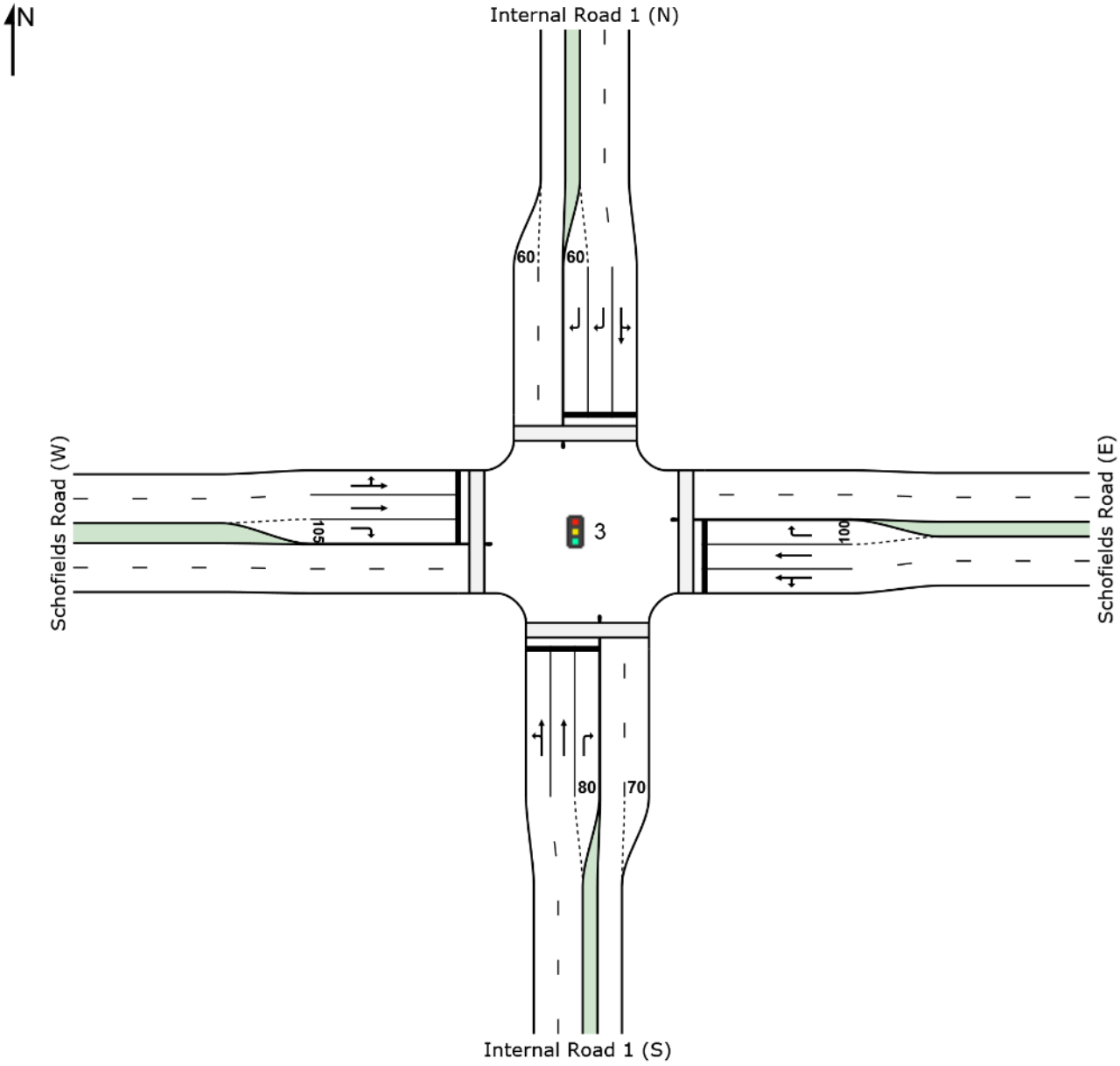
Movement Performance - Vehicles												
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Carnarvon Rd (S)											
1	L2	37	0.0	0.130	4.9	LOS A	0.7	4.8	0.37	0.48	48.8
2	T1	121	0.0	0.130	5.0	LOS A	0.7	4.8	0.37	0.48	53.4
3	R2	7	0.0	0.010	10.4	LOS A	0.0	0.3	0.40	0.61	50.5
Approach		166	0.0	0.130	5.2	LOS A	0.7	4.8	0.37	0.49	52.4
East: Grange Avenue (E)											
4	L2	6	0.0	0.094	4.9	LOS A	0.5	3.4	0.37	0.48	52.5
5	T1	108	0.0	0.094	5.1	LOS A	0.5	3.4	0.37	0.48	53.3
6	R2	81	0.0	0.076	9.9	LOS A	0.4	2.6	0.38	0.63	51.2
Approach		195	0.0	0.094	7.1	LOS A	0.5	3.4	0.38	0.54	52.3
North: Carnarvon Rd (N)											
7	L2	107	0.0	0.215	4.5	LOS A	1.3	8.9	0.28	0.45	53.6
8	T1	189	0.0	0.215	4.6	LOS A	1.3	8.9	0.28	0.45	54.0
9	R2	1	0.0	0.001	9.6	LOS A	0.0	0.0	0.29	0.56	47.9
Approach		297	0.0	0.215	4.6	LOS A	1.3	8.9	0.28	0.45	53.8
West: Grange Avenue (W)											
10	L2	1	0.0	0.058	4.9	LOS A	0.3	1.9	0.36	0.46	49.9
11	T1	69	0.0	0.058	5.0	LOS A	0.3	1.9	0.36	0.46	53.4
12	R2	20	0.0	0.025	10.4	LOS A	0.1	0.8	0.41	0.63	46.1
Approach		89	0.0	0.058	6.2	LOS A	0.3	1.9	0.37	0.50	51.9
All Vehicles		747	0.0	0.215	5.6	LOS A	1.3	8.9	0.34	0.49	52.9

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SITE LAYOUT

Site: 3 [3_Schofields Road / Internal Road 1 AM]

Schofields Road / Internal Road
Signals - Fixed Time Isolated



MOVEMENT SUMMARY

Site: 3 [3_Schofields Road / Internal Road 1 AM]

Schofields Road / Internal Road
Signals - Fixed Time Isolated Cycle Time = 120 seconds (User-Given Cycle Time)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Internal Road 1 (S)											
1	L2	81	0.0	0.208	48.0	LOS D	3.9	27.4	0.87	0.76	33.0
2	T1	41	0.0	0.094	39.4	LOS C	1.9	13.3	0.83	0.62	36.5
3	R2	1	0.0	0.002	37.8	LOS C	0.0	0.3	0.73	0.60	36.6
Approach		123	0.0	0.208	45.1	LOS D	3.9	27.4	0.85	0.71	34.1
East: Schofields Road (E)											
4	L2	5	0.0	0.370	36.7	LOS C	10.7	74.8	0.79	0.68	39.0
5	T1	487	0.0	0.370	31.5	LOS C	10.8	75.6	0.80	0.68	39.6
6	R2	1	0.0	0.002	40.6	LOS C	0.0	0.2	0.76	0.59	35.5
Approach		493	0.0	0.370	31.5	LOS C	10.8	75.6	0.80	0.68	39.6
North: Internal Road 1 (N)											
7	L2	1	0.0	0.356	47.9	LOS D	7.7	54.2	0.89	0.73	34.9
8	T1	156	0.0	0.356	42.4	LOS C	7.7	54.2	0.89	0.73	35.4
9	R2	391	0.0	0.371	42.6	LOS D	9.2	64.1	0.85	0.79	34.9
Approach		547	0.0	0.371	42.6	LOS D	9.2	64.1	0.86	0.77	35.0
West: Schofields Road (W)											
10	L2	109	0.0	0.318	35.3	LOS C	8.9	62.3	0.77	0.72	38.4
11	T1	314	0.0	0.318	30.7	LOS C	9.1	63.6	0.78	0.68	39.5
12	R2	22	0.0	0.088	43.3	LOS D	1.0	7.1	0.80	0.71	34.6
Approach		445	0.0	0.318	32.5	LOS C	9.1	63.6	0.78	0.69	39.0
All Vehicles		1608	0.0	0.371	36.6	LOS C	10.8	75.6	0.82	0.72	37.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	26	35.3	LOS D	0.1	0.1	0.77	0.77
P2	East Full Crossing	26	46.9	LOS E	0.1	0.1	0.88	0.88
P3	North Full Crossing	26	35.3	LOS D	0.1	0.1	0.77	0.77
P4	West Full Crossing	26	46.9	LOS E	0.1	0.1	0.88	0.88
All Pedestrians		105	41.1	LOS E			0.83	0.83

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

PHASING SUMMARY

Site: 3 [3_Schofields Road / Internal Road 1 AM]

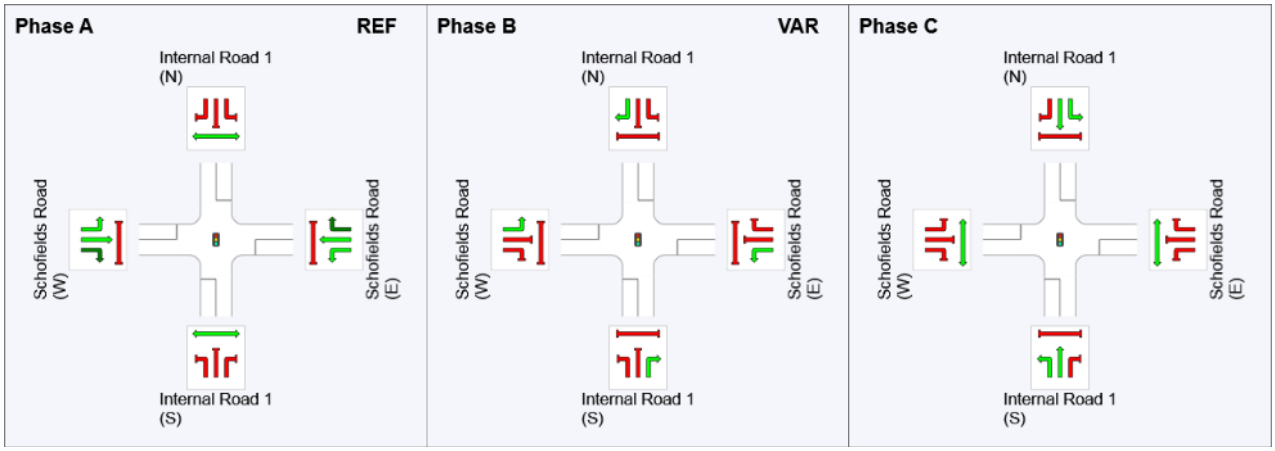
Schofields Road / Internal Road
Signals - Fixed Time Isolated Cycle Time = 120 seconds (User-Given Cycle Time)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Phase Times determined by the program
Phase Sequence: Variable Phasing
Reference Phase: Phase A
Input Phase Sequence: A, B*, C
Output Phase Sequence: A, B*, C
(* Variable Phase)

Phase Timing Results

Phase	A	B	C
Phase Change Time (sec)	0	47	87
Green Time (sec)	41	34	27
Phase Time (sec)	47	40	33
Phase Split	39 %	33 %	28 %

See the Phase Information section in the Detailed Output report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.



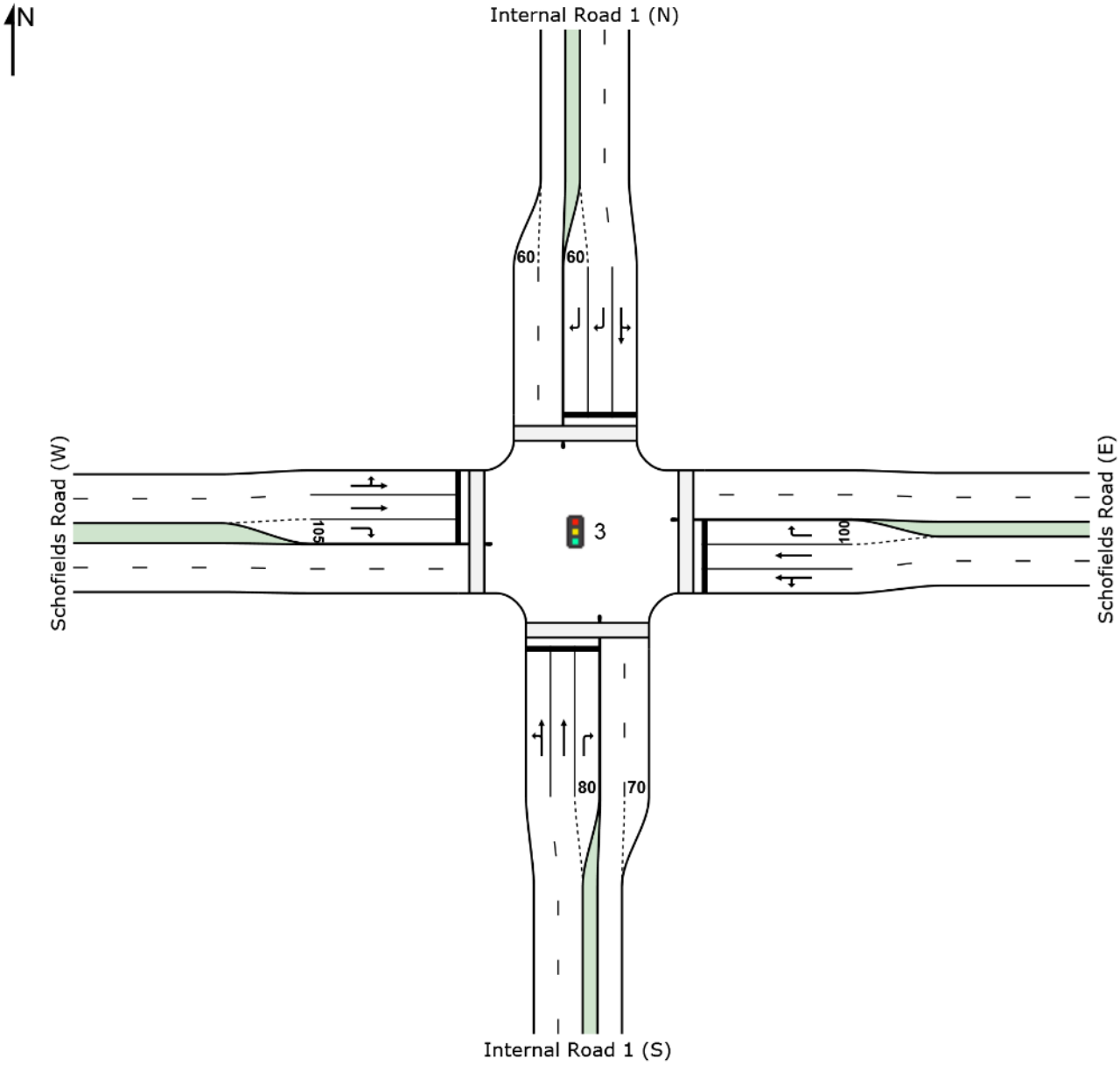
REF: Reference Phase
VAR: Variable Phase

Normal Movement	Permitted/Opposed
Slip/Bypass-Lane Movement	Opposed Slip/Bypass-Lane
Stopped Movement	Turn On Red
Other Movement Class (MC) Running	Undetected Movement
Mixed Running & Stopped MCs	Continuous Movement
Other Movement Class (MC) Stopped	Phase Transition Applied

SITE LAYOUT

Site: 3 [3_Schofields Road / Internal Road 1 PM]

Schofields Road / Internal Road
Signals - Fixed Time Isolated



MOVEMENT SUMMARY

Site: 3 [3_Schofields Road / Internal Road 1 PM]

Schofields Road / Internal Road
Signals - Fixed Time Isolated Cycle Time = 120 seconds (User-Given Cycle Time)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Internal Road 1 (S)											
1	L2	58	0.0	0.180	51.3	LOS D	2.9	20.6	0.89	0.75	32.1
2	T1	104	0.0	0.279	44.9	LOS D	5.3	36.8	0.90	0.71	34.6
3	R2	5	0.0	0.010	38.1	LOS C	0.2	1.5	0.74	0.64	36.4
Approach		168	0.0	0.279	46.9	LOS D	5.3	36.8	0.89	0.72	33.7
East: Schofields Road (E)											
4	L2	4	0.0	0.315	33.2	LOS C	9.4	65.5	0.75	0.63	40.5
5	T1	457	0.0	0.315	28.0	LOS B	9.5	66.2	0.75	0.63	41.1
6	R2	1	0.0	0.002	36.7	LOS C	0.0	0.1	0.71	0.59	37.0
Approach		461	0.0	0.315	28.0	LOS B	9.5	66.2	0.75	0.63	41.1
North: Internal Road 1 (N)											
7	L2	1	0.0	0.307	50.8	LOS D	5.8	40.7	0.90	0.72	34.0
8	T1	114	0.0	0.307	45.2	LOS D	5.8	40.7	0.90	0.72	34.5
9	R2	329	0.0	0.313	41.9	LOS C	7.6	53.0	0.83	0.78	35.1
Approach		444	0.0	0.313	42.8	LOS D	7.6	53.0	0.85	0.77	34.9
West: Schofields Road (W)											
10	L2	116	0.0	0.269	32.0	LOS C	7.8	54.5	0.72	0.70	39.6
11	T1	278	0.0	0.269	27.4	LOS B	7.9	55.4	0.73	0.64	41.0
12	R2	30	0.0	0.101	39.4	LOS C	1.3	9.1	0.76	0.72	36.0
Approach		424	0.0	0.269	29.5	LOS C	7.9	55.4	0.73	0.66	40.2
All Vehicles		1497	0.0	0.315	34.9	LOS C	9.5	66.2	0.79	0.69	38.0

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	26	32.3	LOS D	0.1	0.1	0.73	0.73
P2	East Full Crossing	26	50.5	LOS E	0.1	0.1	0.92	0.92
P3	North Full Crossing	26	32.3	LOS D	0.1	0.1	0.73	0.73
P4	West Full Crossing	26	50.5	LOS E	0.1	0.1	0.92	0.92
All Pedestrians		105	41.4	LOS E			0.83	0.83

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

PHASING SUMMARY

Site: 3 [3_Schofields Road / Internal Road 1 PM]

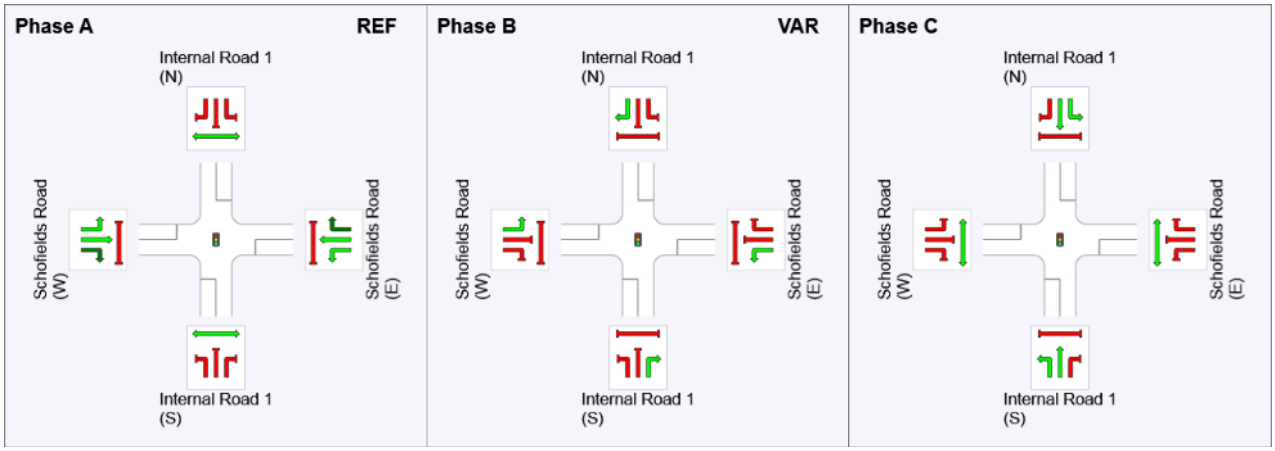
Schofields Road / Internal Road
Signals - Fixed Time Isolated Cycle Time = 120 seconds (User-Given Cycle Time)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Phase Times determined by the program
Phase Sequence: Variable Phasing
Reference Phase: Phase A
Input Phase Sequence: A, B*, C
Output Phase Sequence: A, B*, C
(* Variable Phase)

Phase Timing Results

Phase	A	B	C
Phase Change Time (sec)	0	51	91
Green Time (sec)	45	34	23
Phase Time (sec)	51	40	29
Phase Split	43 %	33 %	24 %

See the Phase Information section in the Detailed Output report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.



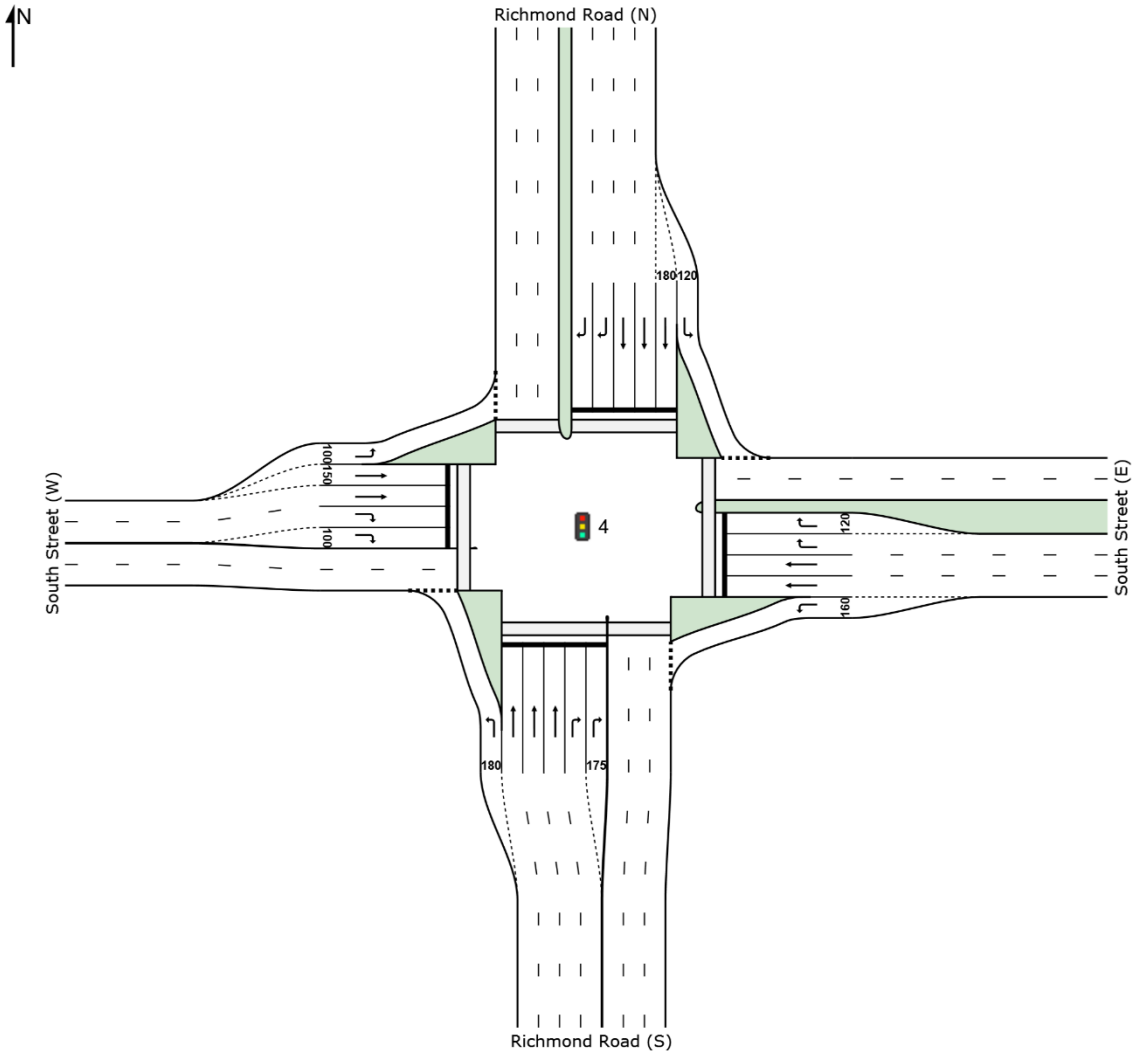
REF: Reference Phase
VAR: Variable Phase

Normal Movement	Permitted/Opposed
Slip/Bypass-Lane Movement	Opposed Slip/Bypass-Lane
Stopped Movement	Turn On Red
Other Movement Class (MC) Running	Undetected Movement
Mixed Running & Stopped MCs	Continuous Movement
Other Movement Class (MC) Stopped	Phase Transition Applied

SITE LAYOUT

Site: 4 [4_Richmond Road / South Street AM]

Richmond Road / South Street
Signals - Fixed Time Isolated



MOVEMENT SUMMARY

Site: 4 [4_Richmond Road / South Street AM]

Richmond Road / South Street
Signals - Fixed Time Isolated Cycle Time = 140 seconds (User-Given Cycle Time)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Richmond Road (S)											
1	L2	113	0.0	0.073	6.3	LOS A	0.6	4.4	0.15	0.59	53.7
2	T1	1381	0.0	0.674	22.5	LOS B	17.0	118.8	0.91	0.79	43.9
3	R2	354	0.0	0.342	28.5	LOS C	5.8	40.7	0.84	0.77	40.8
Approach		1847	0.0	0.674	22.7	LOS B	17.0	118.8	0.85	0.77	43.8
East: South Street (E)											
4	L2	754	0.0	0.658	15.9	LOS B	25.2	176.6	0.65	0.79	47.1
5	T1	81	0.0	0.364	71.8	LOS F	2.8	19.6	1.00	0.73	27.8
6	R2	124	0.0	0.583	79.2	LOS F	4.4	30.6	1.00	0.77	26.2
Approach		959	0.0	0.658	28.8	LOS C	25.2	176.6	0.72	0.78	40.5
North: Richmond Road (N)											
7	L2	48	0.0	0.035	7.4	LOS A	0.5	3.3	0.22	0.60	52.9
8	T1	1244	0.0	0.677	44.7	LOS D	24.5	171.7	0.93	0.81	34.8
9	R2	1	0.0	0.001	32.0	LOS C	0.0	0.1	0.83	0.55	39.2
Approach		1293	0.0	0.677	43.4	LOS D	24.5	171.7	0.91	0.81	35.2
West: South Street (W)											
10	L2	3	0.0	0.002	10.7	LOS A	0.0	0.3	0.33	0.58	50.5
11	T1	43	0.0	0.194	70.6	LOS F	1.5	10.3	0.98	0.70	28.0
12	R2	101	0.0	0.476	78.4	LOS F	3.5	24.7	1.00	0.75	26.3
Approach		147	0.0	0.476	74.9	LOS F	3.5	24.7	0.98	0.73	27.1
All Vehicles		4245	0.0	0.677	32.2	LOS C	25.2	176.6	0.84	0.78	39.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P11	South Stage 1	26	57.7	LOS E	0.1	0.1	0.91	0.91
P12	South Stage 2	26	46.5	LOS E	0.1	0.1	0.82	0.82
P2	East Full Crossing	26	45.7	LOS E	0.1	0.1	0.81	0.81
P31	North Stage 1	26	38.5	LOS D	0.1	0.1	0.87	0.87
P32	North Stage 2	26	54.1	LOS E	0.1	0.1	0.88	0.88
P4	West Full Crossing	26	28.0	LOS C	0.1	0.1	0.88	0.88
All Pedestrians		158	45.1	LOS E			0.86	0.86

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

PHASING SUMMARY

Site: 4 [4_Richmond Road / South Street AM]

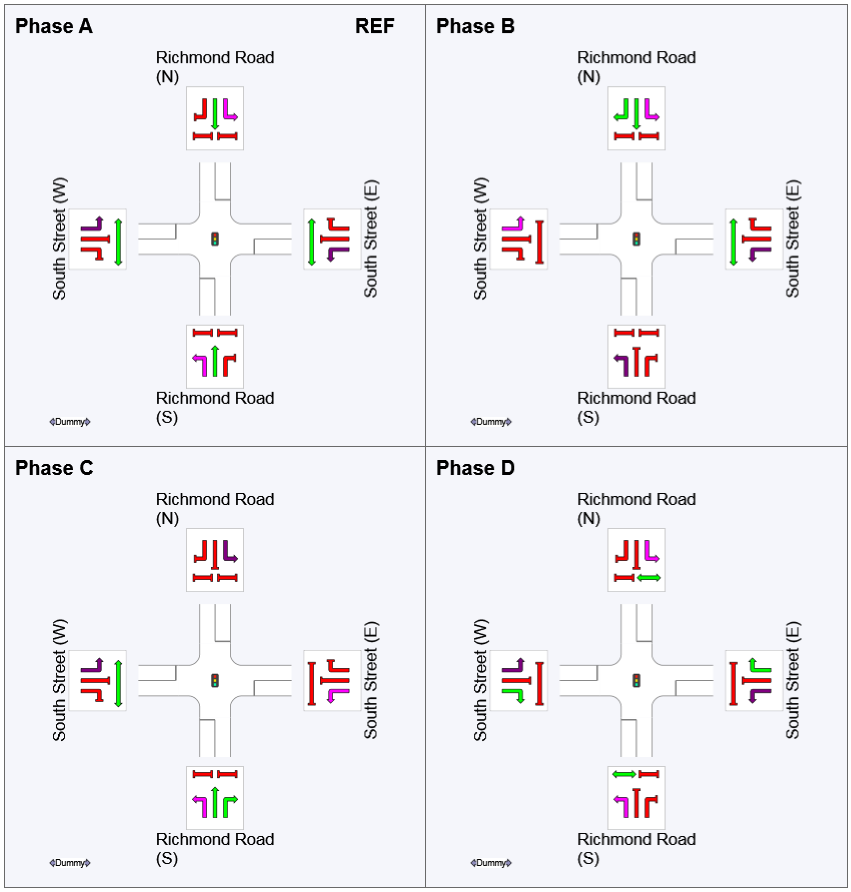
Richmond Road / South Street
Signals - Fixed Time Isolated Cycle Time = 140 seconds (User-Given Cycle Time)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

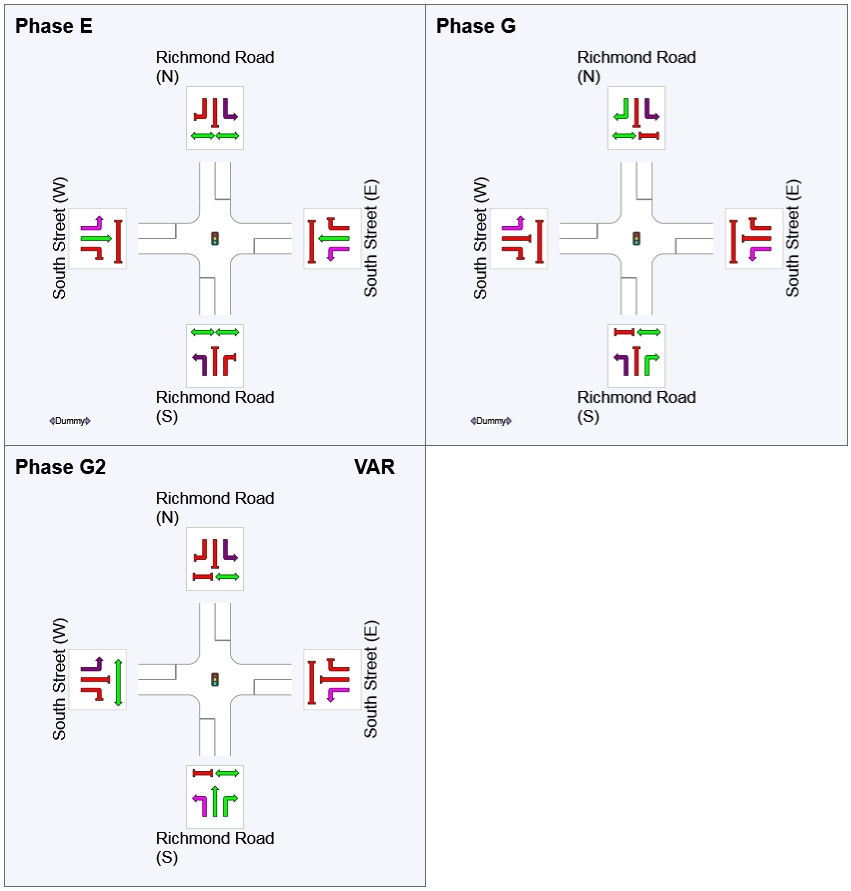
Phase Times determined by the program
Phase Sequence: New - Based on TCS
Reference Phase: Phase A
Input Phase Sequence: A, B, C, D, D1*, D2*, E, F1*, F2*, G, G1*, G2*
Output Phase Sequence: A, B, C, D, E, G, G2*
(* Variable Phase)

Phase Timing Results

Phase	A	B	C	D	E	G	G2
Phase Change Time (sec)	0	26	52	82	98	115	131
Green Time (sec)	18	18	22	8	8	8	1
Phase Time (sec)	26	26	30	17	16	16	9
Phase Split	19 %	19 %	21 %	12 %	11 %	11 %	6 %

See the Phase Information section in the Detailed Output report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.





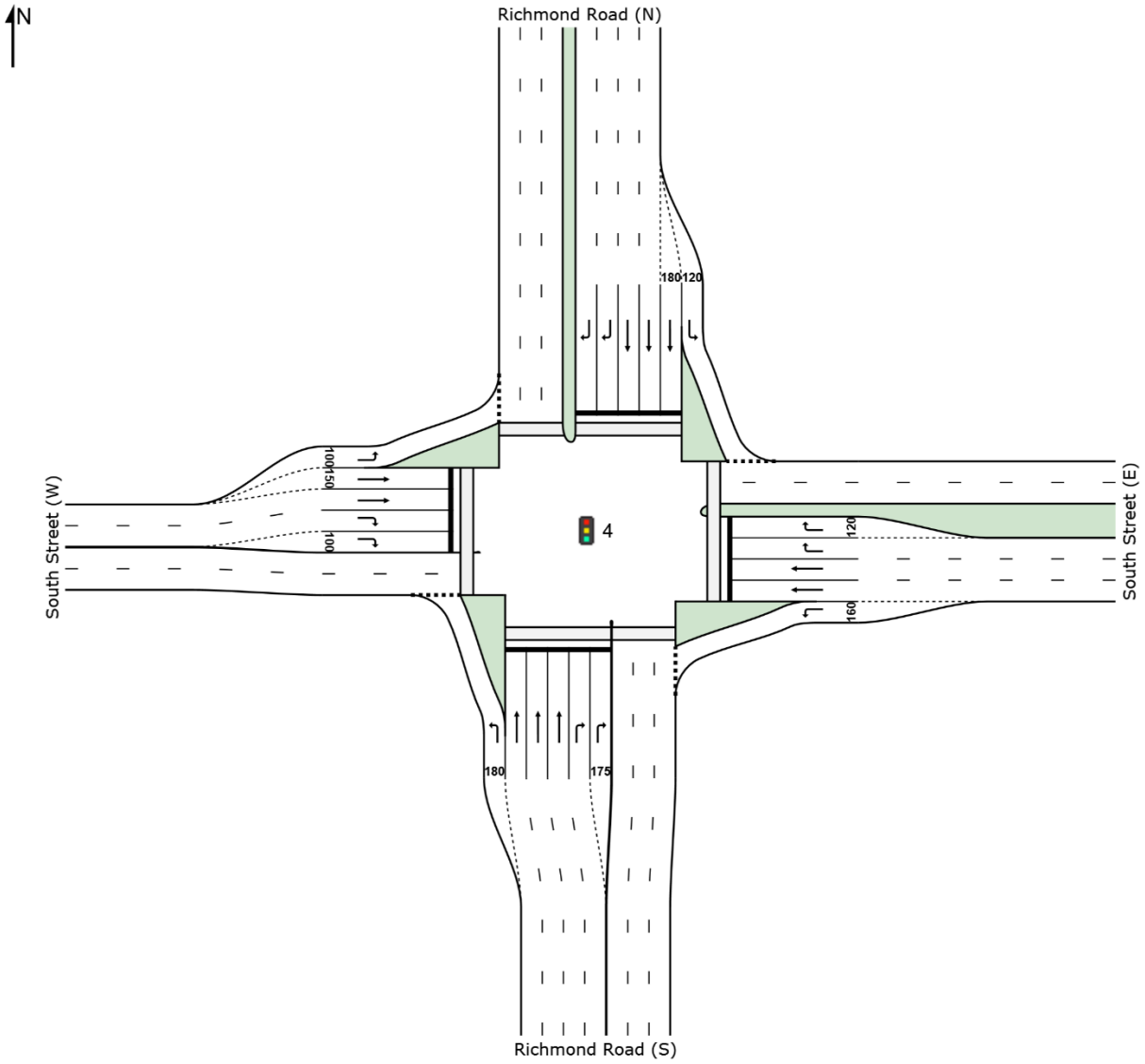
REF: Reference Phase
VAR: Variable Phase

Normal Movement	Permitted/Opposed
Slip/Bypass-Lane Movement	Opposed Slip/Bypass-Lane
Stopped Movement	Turn On Red
Other Movement Class (MC) Running	Undetected Movement
Mixed Running & Stopped MCs	Continuous Movement
Other Movement Class (MC) Stopped	Phase Transition Applied

SITE LAYOUT

Site: 4 [4_Richmond Road / South Street PM]

Richmond Road / South Street
Signals - Fixed Time Isolated



MOVEMENT SUMMARY

Site: 4 [4_Richmond Road / South Street PM]

Richmond Road / South Street
Signals - Fixed Time Isolated Cycle Time = 140 seconds (User-Given Cycle Time)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Richmond Road (S)											
1	L2	110	0.0	0.069	6.3	LOS A	0.6	3.9	0.14	0.59	53.8
2	T1	1712	0.0	0.719	22.2	LOS B	23.2	162.5	0.90	0.80	44.1
3	R2	346	0.0	0.521	36.6	LOS C	6.9	48.2	0.95	0.80	37.4
Approach		2167	0.0	0.719	23.7	LOS B	23.2	162.5	0.87	0.79	43.3
East: South Street (E)											
4	L2	595	0.0	0.516	11.4	LOS A	13.8	96.6	0.47	0.72	50.0
5	T1	63	0.0	0.281	71.3	LOS F	2.1	15.0	0.99	0.72	27.9
6	R2	187	0.0	0.706	78.8	LOS F	6.7	46.7	1.00	0.83	26.3
Approach		845	0.0	0.706	30.8	LOS C	13.8	96.6	0.63	0.74	39.7
North: Richmond Road (N)											
7	L2	20	0.0	0.014	7.5	LOS A	0.2	1.4	0.22	0.59	52.8
8	T1	1006	0.0	0.430	32.3	LOS C	16.4	114.5	0.77	0.67	39.4
9	R2	1	0.0	0.001	35.6	LOS C	0.0	0.1	0.90	0.54	37.8
Approach		1026	0.0	0.430	31.8	LOS C	16.4	114.5	0.76	0.67	39.6
West: South Street (W)											
10	L2	18	0.0	0.020	15.1	LOS B	0.4	3.1	0.44	0.63	47.7
11	T1	58	0.0	0.262	71.2	LOS F	2.0	14.0	0.99	0.71	27.9
12	R2	112	0.0	0.423	75.6	LOS F	3.8	26.8	1.00	0.75	26.9
Approach		189	0.0	0.423	68.3	LOS E	3.8	26.8	0.94	0.73	28.4
All Vehicles		4228	0.0	0.719	29.0	LOS C	23.2	162.5	0.80	0.75	40.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P11	South Stage 1	26	55.9	LOS E	0.1	0.1	0.89	0.89
P12	South Stage 2	26	54.1	LOS E	0.1	0.1	0.88	0.88
P2	East Full Crossing	26	36.5	LOS D	0.1	0.1	0.72	0.72
P31	North Stage 1	26	55.9	LOS E	0.1	0.1	0.89	0.89
P32	North Stage 2	26	54.1	LOS E	0.1	0.1	0.88	0.88
P4	West Full Crossing	26	24.5	LOS C	0.1	0.1	0.79	0.79
All Pedestrians		158	46.8	LOS E			0.84	0.84

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

PHASING SUMMARY

Site: 4 [4_Richmond Road / South Street PM]

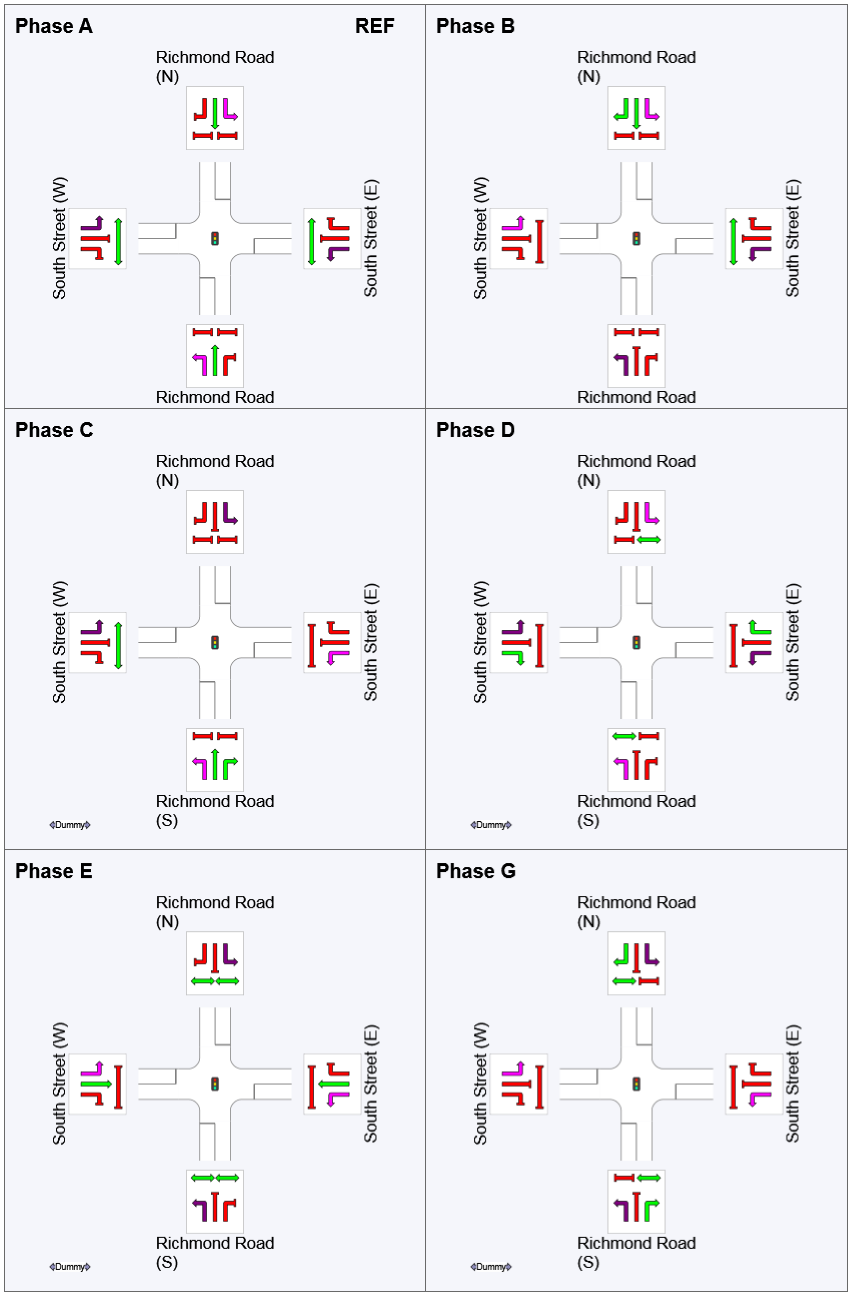
Richmond Road / South Street
Signals - Fixed Time Isolated Cycle Time = 140 seconds (User-Given Cycle Time)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Phase Times determined by the program
Phase Sequence: New - Based on TCS
Reference Phase: Phase A
Input Phase Sequence: A, B, C, D, D1*, D2*, E, F1*, F2*, G, G1*, G2*
Output Phase Sequence: A, B, C, D, E, G
(* Variable Phase)

Phase Timing Results

Phase	A	B	C	D	E	G
Phase Change Time (sec)	0	48	64	89	107	124
Green Time (sec)	40	8	17	10	8	8
Phase Time (sec)	48	16	25	19	16	16
Phase Split	34 %	11 %	18 %	14 %	11 %	11 %

See the Phase Information section in the Detailed Output report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.



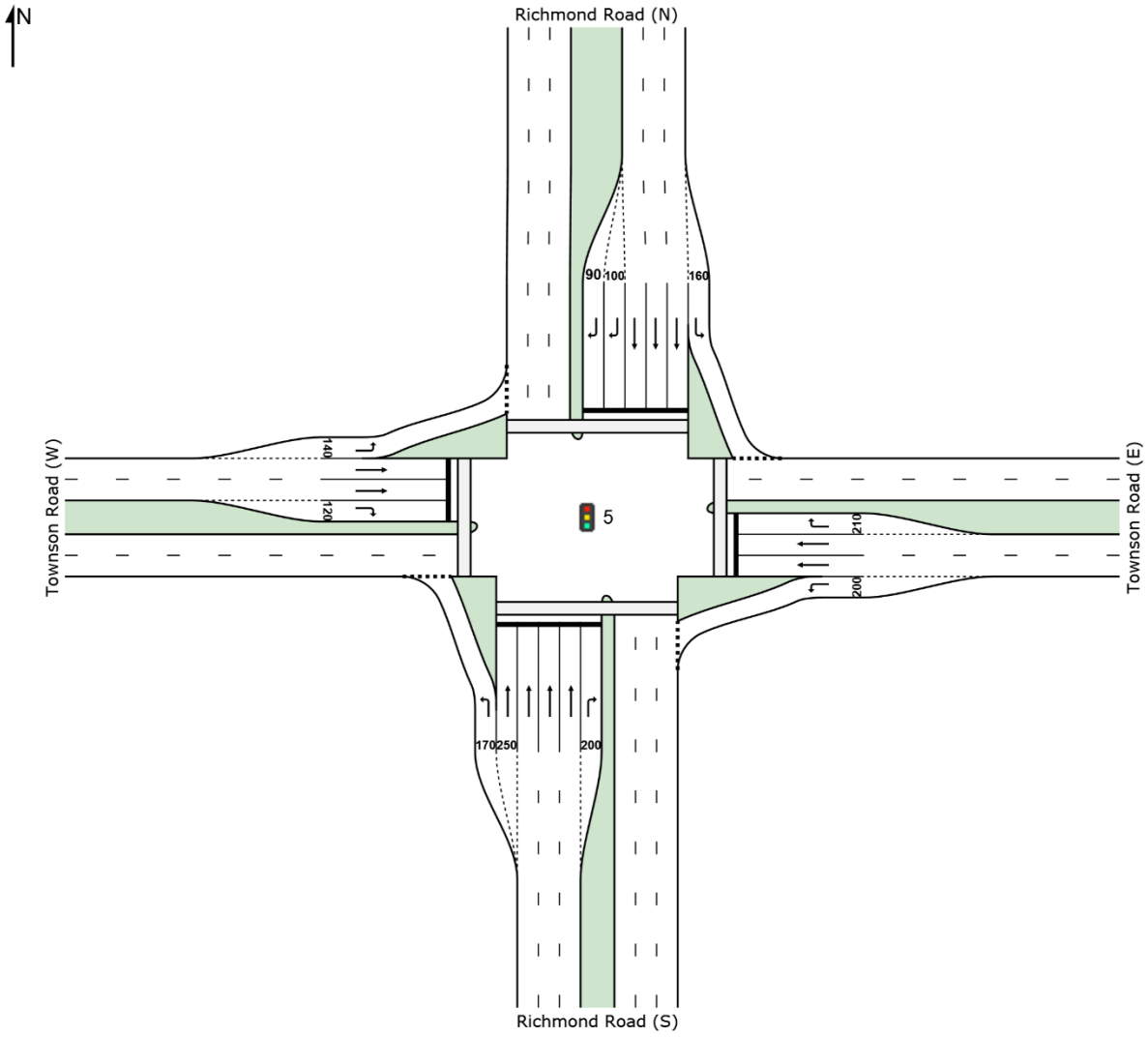
REF: Reference Phase
VAR: Variable Phase

Normal Movement	Permitted/Opposed
Slip/Bypass-Lane Movement	Opposed Slip/Bypass-Lane
Stopped Movement	Turn On Red
Other Movement Class (MC) Running	Undetected Movement
Mixed Running & Stopped MCs	Continuous Movement
Other Movement Class (MC) Stopped	Phase Transition Applied

SITE LAYOUT

Site: 5 [5_Richmond Road / Townson Road AM]

Richmond Road / Townson Road
Signals - Fixed Time Isolated



Organisation: ARUP PTY LTD | Created: Tuesday, 1 May 2018 11:55:51 AM
Project: \\global.arup.com\australasia\SYD\Projects\248000\248052-00 West Schofields Transport\Work\Internal\8. Modelling\04 Sidra\SIDRA_Model_v01\West Schofields major intersections_v03_WithOldTrafficVol - Ahsan Update.sip7

MOVEMENT SUMMARY

Site: 5 [5_Richmond Road / Townson Road AM]

Richmond Road / Townson Road
Signals - Fixed Time Isolated Cycle Time = 140 seconds (User-Given Cycle Time)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Richmond Road (S)											
1	L2	161	0.0	0.130	12.2	LOS A	3.3	23.0	0.39	0.66	49.5
2	T1	1557	0.0	0.896	44.9	LOS D	29.1	203.6	0.99	0.98	34.7
3	R2	183	0.0	0.810	44.5	LOS D	7.3	50.8	1.00	0.89	34.5
Approach		1900	0.0	0.896	42.1	LOS C	29.1	203.6	0.94	0.95	35.6
East: Townson Road (E)											
4	L2	549	0.0	0.662	31.6	LOS C	26.7	186.8	0.84	0.84	39.3
5	T1	451	0.0	0.951	94.0	LOS F	19.4	135.8	1.00	1.18	23.8
6	R2	55	0.0	0.229	65.4	LOS E	3.4	23.8	0.94	0.75	29.0
Approach		1055	0.0	0.951	60.0	LOS E	26.7	186.8	0.92	0.98	30.3
North: Richmond Road (N)											
7	L2	35	0.0	0.027	9.5	LOS A	0.5	3.7	0.30	0.61	51.3
8	T1	1759	0.0	0.919	65.0	LOS E	48.3	338.2	0.99	1.07	29.1
9	R2	433	0.0	0.859	56.3	LOS D	10.8	75.8	1.00	0.98	31.1
Approach		2227	0.0	0.919	62.5	LOS E	48.3	338.2	0.98	1.04	29.7
West: Townson Road (W)											
10	L2	388	0.0	0.353	15.9	LOS B	10.9	76.6	0.52	0.72	47.1
11	T1	333	0.0	0.704	66.2	LOS E	11.4	79.5	1.00	0.85	29.0
12	R2	222	0.0	0.928	91.7	LOS F	18.2	127.3	1.00	1.07	24.1
Approach		943	0.0	0.928	51.5	LOS D	18.2	127.3	0.80	0.85	32.6
All Vehicles		6125	0.0	0.951	54.0	LOS D	48.3	338.2	0.93	0.97	31.9

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	26	64.2	LOS F	0.1	0.1	0.96	0.96
P2	East Full Crossing	26	40.9	LOS E	0.1	0.1	0.77	0.77
P3	North Full Crossing	26	64.2	LOS F	0.1	0.1	0.96	0.96
P4	West Full Crossing	26	32.4	LOS D	0.1	0.1	0.85	0.85
All Pedestrians		105	50.4	LOS E			0.88	0.88

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

PHASING SUMMARY

Site: 5 [5_Richmond Road / Townson Road AM]

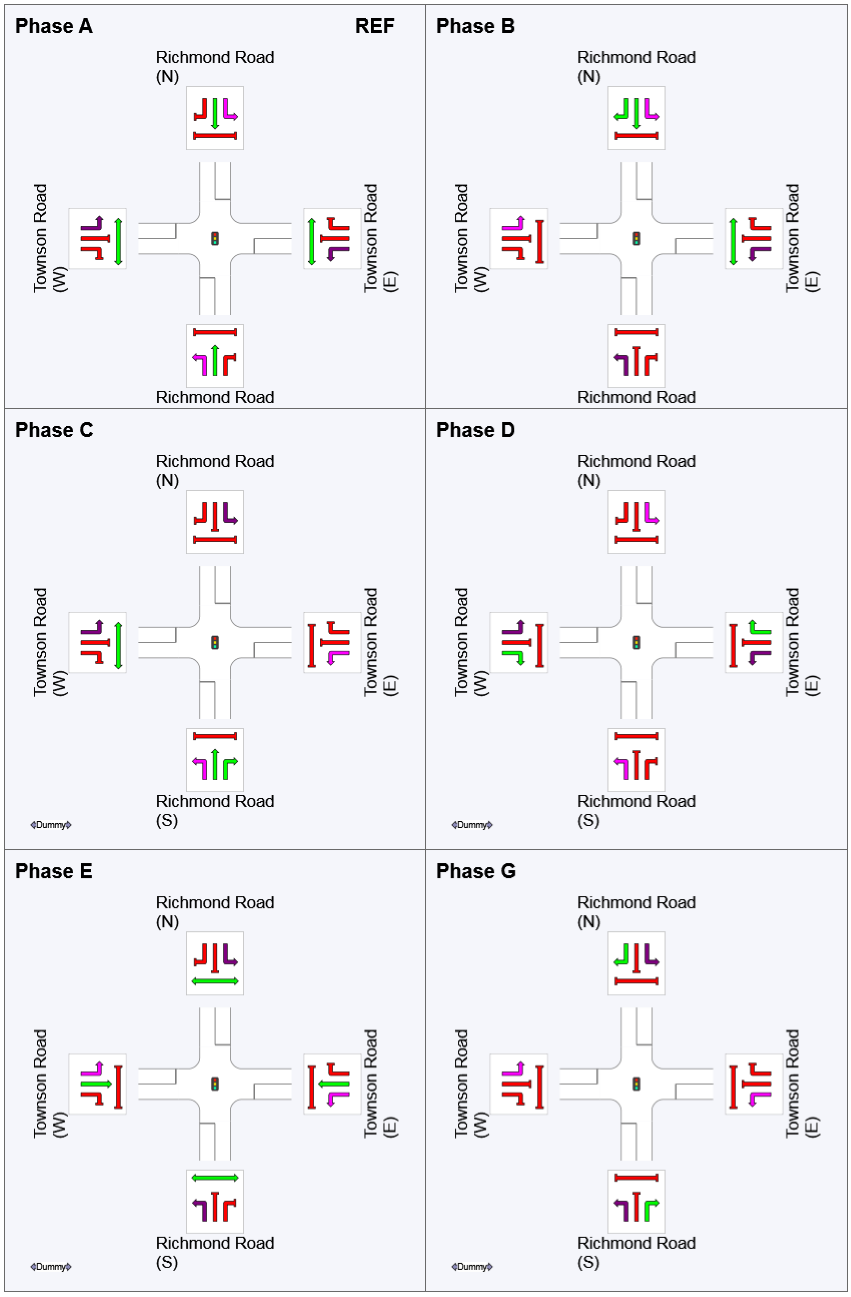
Richmond Road / Townson Road
Signals - Fixed Time Isolated Cycle Time = 140 seconds (User-Given Cycle Time)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Phase Times determined by the program
Phase Sequence: New - Based on TCSs
Reference Phase: Phase A
Input Phase Sequence: A, B, C, D, D1*, D2*, E, F1*, F2*, G, G1*, G2*
Output Phase Sequence: A, B, C, D, E, G
(* Variable Phase)

Phase Timing Results

Phase	A	B	C	D	E	G
Phase Change Time (sec)	0	38	56	72	98	123
Green Time (sec)	30	11	9	18	17	8
Phase Time (sec)	37	18	17	26	26	16
Phase Split	26 %	13 %	12 %	19 %	19 %	11 %

See the Phase Information section in the Detailed Output report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.



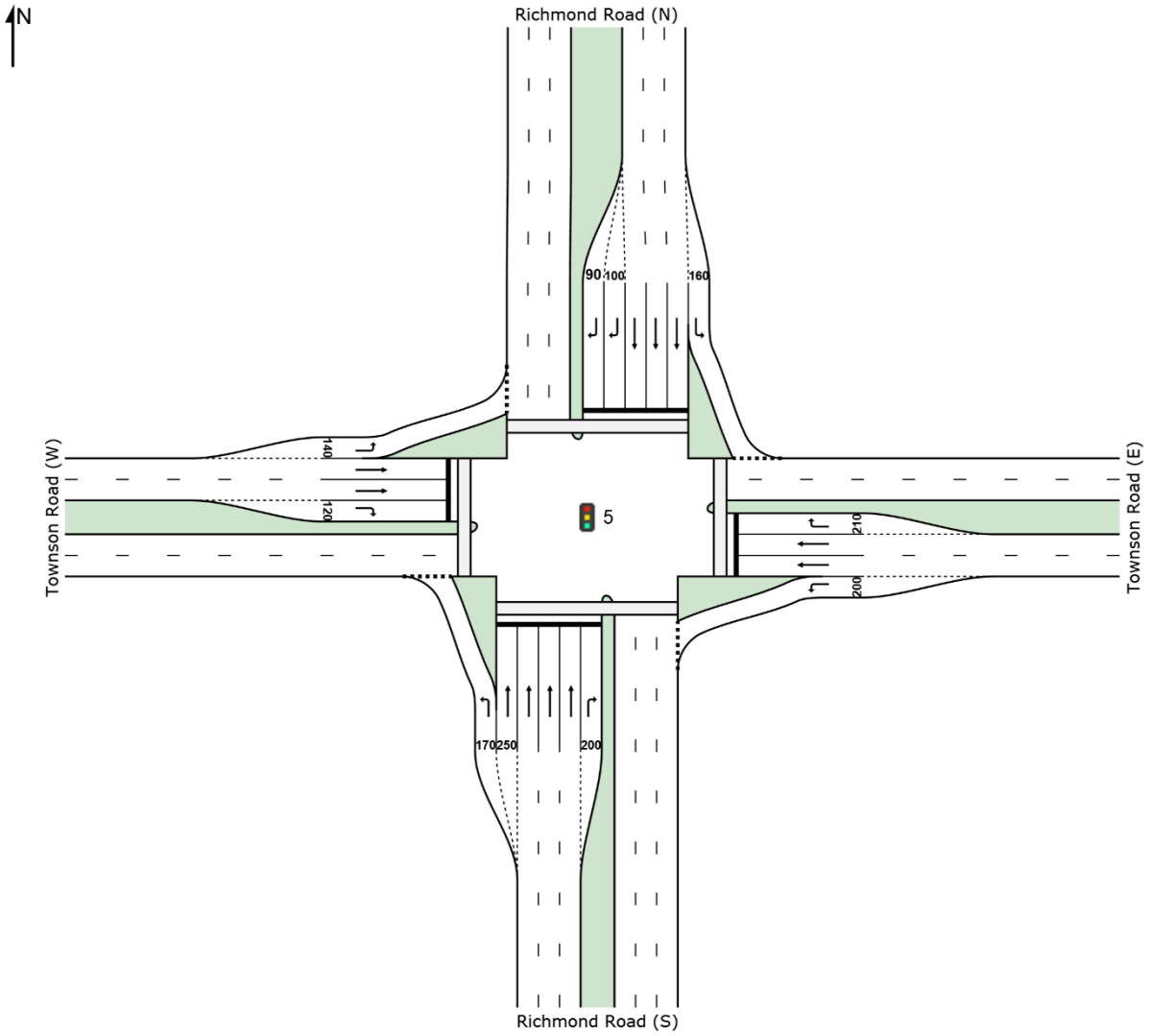
REF: Reference Phase
VAR: Variable Phase

Normal Movement	Permitted/Opposed
Slip/Bypass-Lane Movement	Opposed Slip/Bypass-Lane
Stopped Movement	Turn On Red
Other Movement Class (MC) Running	Undetected Movement
Mixed Running & Stopped MCs	Continuous Movement
Other Movement Class (MC) Stopped	Phase Transition Applied

SITE LAYOUT

Site: 5 [5_Richmond Road / Townson Road PM]

Richmond Road / Townson Road
Signals - Fixed Time Isolated



Organisation: ARUP PTY LTD | Created: Tuesday, 1 May 2018 12:38:28 PM
Project: \\global.arup.com\australasia\SYD\Projects\248000\248052-00 West Schofields Transport\Work\Internal\8. Modelling\04 Sidra\SIDRA_Model_v01\West Schofields major intersections_v03_WithOldTrafficVol - Ahsan Update.sip7

MOVEMENT SUMMARY

Site: 5 [5_Richmond Road / Townson Road PM]

Richmond Road / Townson Road
Signals - Fixed Time Isolated Cycle Time = 140 seconds (User-Given Cycle Time)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Richmond Road (S)											
1	L2	215	0.0	0.166	10.5	LOS A	3.8	26.9	0.35	0.65	50.6
2	T1	1764	0.0	0.899	44.2	LOS D	33.6	235.1	0.99	0.99	34.9
3	R2	174	0.0	0.689	39.4	LOS C	6.5	45.2	1.00	0.82	36.2
Approach		2152	0.0	0.899	40.4	LOS C	33.6	235.1	0.92	0.94	36.1
East: Townson Road (E)											
4	L2	387	0.0	0.425	20.4	LOS B	13.7	95.7	0.63	0.76	44.6
5	T1	378	0.0	0.848	73.8	LOS F	13.9	97.5	1.00	0.96	27.4
6	R2	58	0.0	0.273	67.9	LOS E	3.7	25.8	0.95	0.75	28.5
Approach		823	0.0	0.848	48.3	LOS D	13.9	97.5	0.82	0.85	33.5
North: Richmond Road (N)											
7	L2	54	0.0	0.041	9.8	LOS A	0.8	5.9	0.31	0.62	51.1
8	T1	1431	0.0	0.732	41.9	LOS C	29.6	206.9	0.93	0.82	35.7
9	R2	371	0.0	0.823	46.6	LOS D	8.7	60.6	1.00	0.90	33.8
Approach		1856	0.0	0.823	41.9	LOS C	29.6	206.9	0.92	0.83	35.6
West: Townson Road (W)											
10	L2	484	0.0	0.467	18.9	LOS B	16.3	113.8	0.61	0.76	45.4
11	T1	372	0.0	0.835	72.8	LOS F	13.6	95.0	1.00	0.95	27.6
12	R2	197	0.0	0.930	93.0	LOS F	16.2	113.5	1.00	1.08	23.9
Approach		1054	0.0	0.930	51.8	LOS D	16.3	113.8	0.82	0.88	32.5
All Vehicles		5885	0.0	0.930	44.0	LOS D	33.6	235.1	0.89	0.88	34.9

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	26	64.2	LOS F	0.1	0.1	0.96	0.96
P2	East Full Crossing	26	40.2	LOS E	0.1	0.1	0.76	0.76
P3	North Full Crossing	26	64.2	LOS F	0.1	0.1	0.96	0.96
P4	West Full Crossing	26	30.7	LOS D	0.1	0.1	0.82	0.82
All Pedestrians		105	49.8	LOS E			0.87	0.87

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

PHASING SUMMARY

Site: 5 [5_Richmond Road / Townson Road PM]

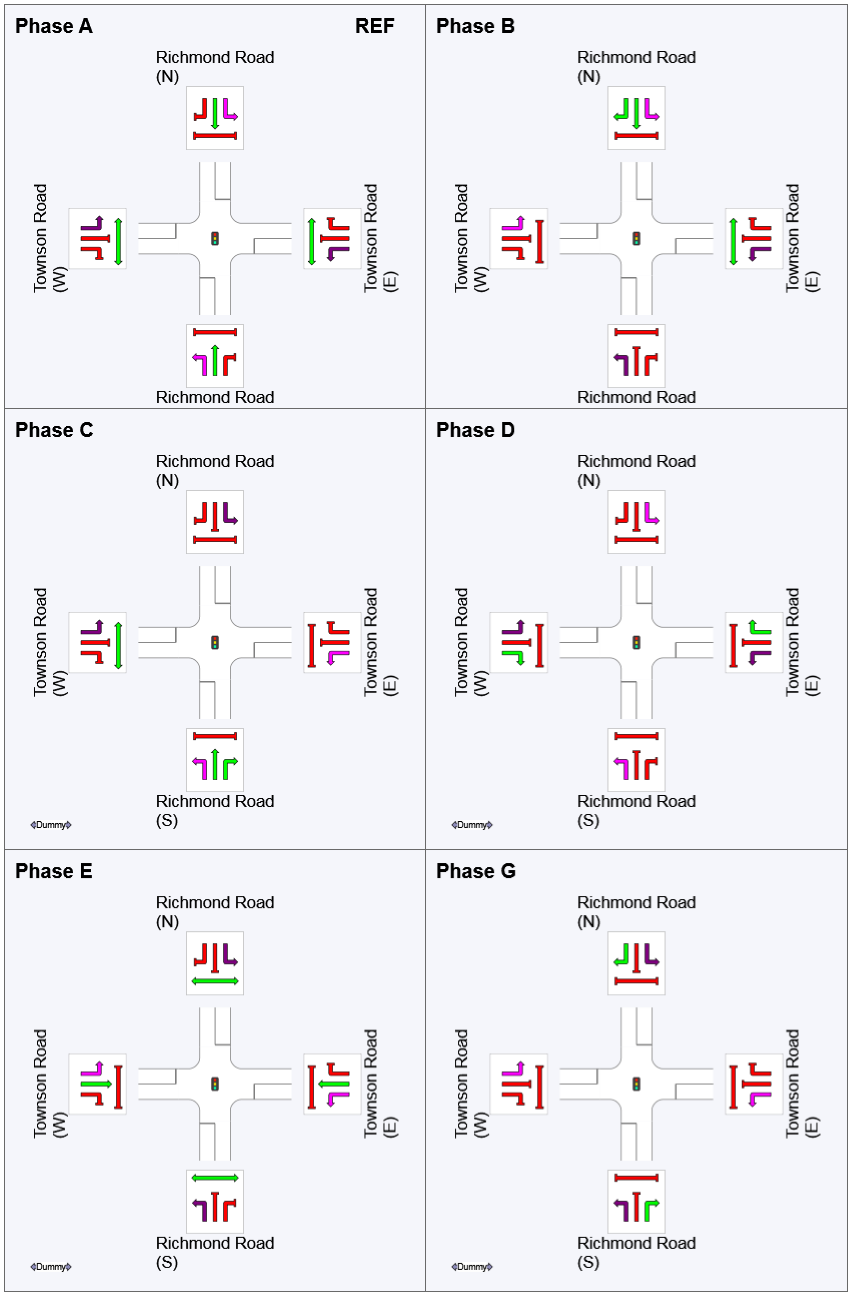
Richmond Road / Townson Road
Signals - Fixed Time Isolated Cycle Time = 140 seconds (User-Given Cycle Time)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Phase Times determined by the program
Phase Sequence: NEW - Based on TCSs
Reference Phase: Phase A
Input Phase Sequence: A, B, C, D, D1*, D2*, E, F1*, F2*, G, G1*, G2*
Output Phase Sequence: A, B, C, D, E, G
(* Variable Phase)

Phase Timing Results

Phase	A	B	C	D	E	G
Phase Change Time (sec)	0	42	57	74	98	122
Green Time (sec)	34	8	10	16	16	9
Phase Time (sec)	41	15	18	24	25	17
Phase Split	29 %	11 %	13 %	17 %	18 %	12 %

See the Phase Information section in the Detailed Output report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.



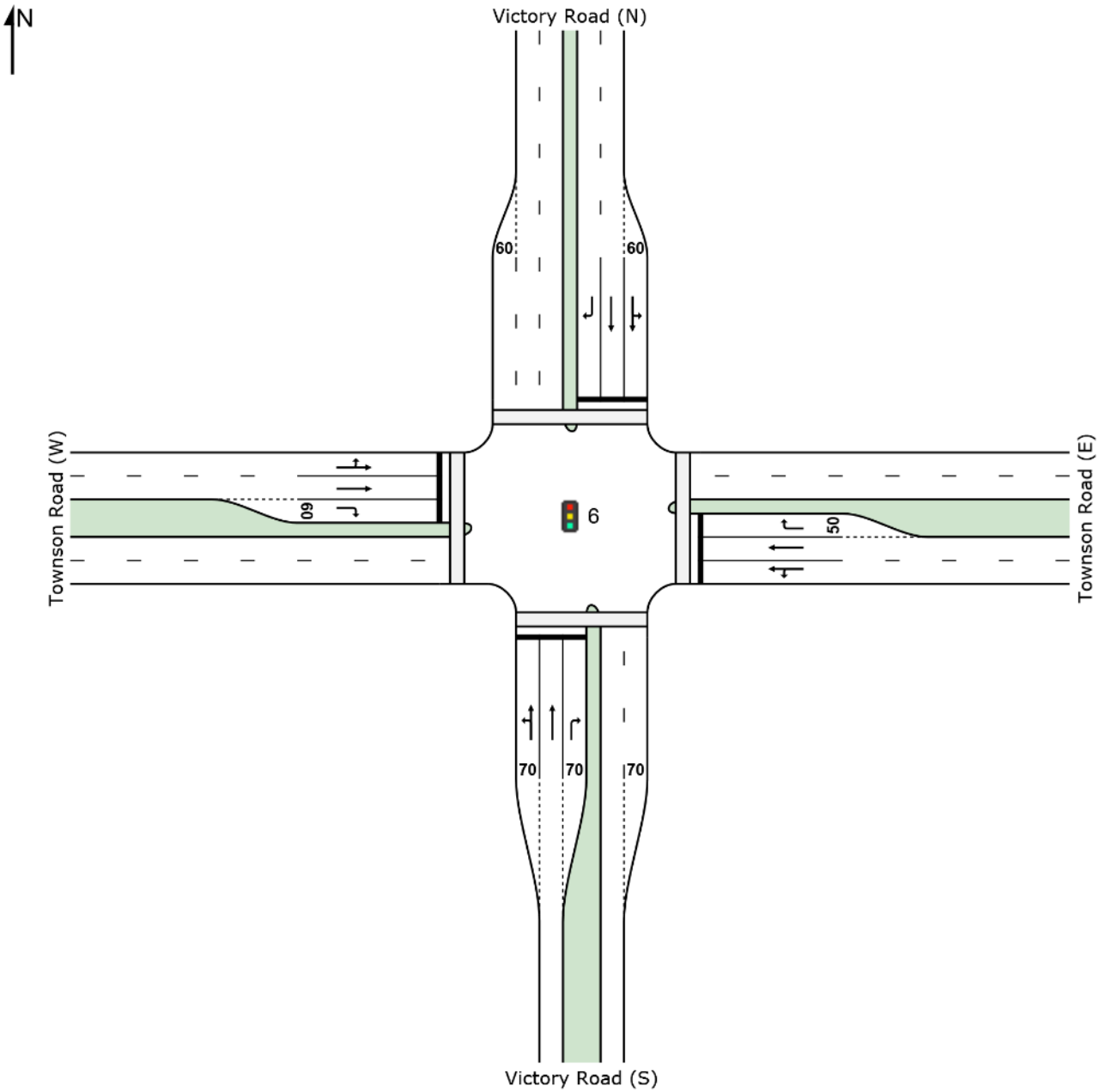
REF: Reference Phase
VAR: Variable Phase

Normal Movement	Permitted/Opposed
Slip/Bypass-Lane Movement	Opposed Slip/Bypass-Lane
Stopped Movement	Turn On Red
Other Movement Class (MC) Running	Undetected Movement
Mixed Running & Stopped MCs	Continuous Movement
Other Movement Class (MC) Stopped	Phase Transition Applied

SITE LAYOUT

Site: 6 [6_Townson Road / Victory Road AM]

Townson Road / Victory Road
Signals - Fixed Time Isolated



MOVEMENT SUMMARY

Site: 6 [6_Townson Road / Victory Road AM]

Townson Road / Victory Road
Signals - Fixed Time Isolated Cycle Time = 120 seconds (User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Victory Road (S)											
1	L2	34	0.0	0.041	25.6	LOS B	1.1	7.7	0.59	0.68	41.5
2	T1	84	0.0	0.094	19.4	LOS B	2.7	19.0	0.60	0.47	45.6
3	R2	101	0.0	0.200	29.5	LOS C	3.7	26.2	0.67	0.74	39.8
Approach		218	0.0	0.200	25.0	LOS B	3.7	26.2	0.63	0.63	42.1
East: Townson Road (E)											
4	L2	45	0.0	0.467	30.6	LOS C	16.2	113.6	0.75	0.68	41.5
5	T1	756	0.0	0.467	25.1	LOS B	16.4	114.6	0.75	0.67	42.5
6	R2	1	0.0	0.002	32.4	LOS C	0.0	0.1	0.66	0.59	38.6
Approach		801	0.0	0.467	25.4	LOS B	16.4	114.6	0.75	0.67	42.4
North: Victory Road (N)											
7	L2	1	0.0	0.073	24.7	LOS B	2.1	14.7	0.59	0.46	44.7
8	T1	217	0.0	0.171	19.9	LOS B	5.2	36.1	0.61	0.50	45.3
9	R2	266	0.0	0.465	31.6	LOS C	11.1	77.5	0.76	0.79	39.1
Approach		484	0.0	0.465	26.3	LOS B	11.1	77.5	0.69	0.66	41.7
West: Townson Road (W)											
10	L2	101	0.0	0.324	28.7	LOS C	10.2	71.1	0.69	0.66	41.7
11	T1	447	0.0	0.324	23.2	LOS B	10.5	73.4	0.69	0.62	43.1
12	R2	2	0.0	0.007	37.4	LOS C	0.1	0.5	0.72	0.62	36.7
Approach		550	0.0	0.324	24.2	LOS B	10.5	73.4	0.69	0.63	42.8
All Vehicles		2053	0.0	0.467	25.3	LOS B	16.4	114.6	0.71	0.65	42.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	26	28.0	LOS C	0.1	0.1	0.68	0.68
P2	East Full Crossing	26	26.7	LOS C	0.1	0.1	0.67	0.67
P3	North Full Crossing	26	29.4	LOS C	0.1	0.1	0.70	0.70
P4	West Full Crossing	26	26.7	LOS C	0.1	0.1	0.67	0.67
All Pedestrians		105	27.7	LOS C			0.68	0.68

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

PHASING SUMMARY

Site: 6 [6_Townson Road / Victory Road AM]

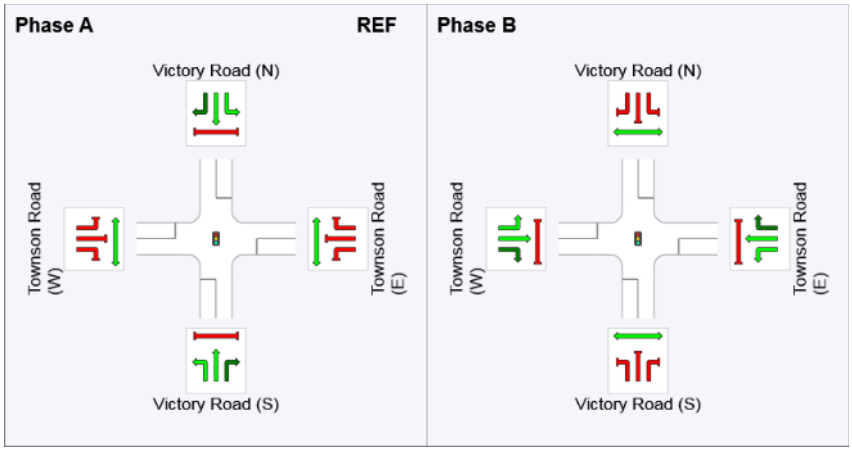
Townson Road / Victory Road
Signals - Fixed Time Isolated Cycle Time = 120 seconds (User-Given Cycle Time)

Phase Times determined by the program
Phase Sequence: Two-Phase
Reference Phase: Phase A
Input Phase Sequence: A, B
Output Phase Sequence: A, B

Phase Timing Results

Phase	A	B
Phase Change Time (sec)	0	61
Green Time (sec)	55	53
Phase Time (sec)	61	59
Phase Split	51 %	49 %

See the Phase Information section in the Detailed Output report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.



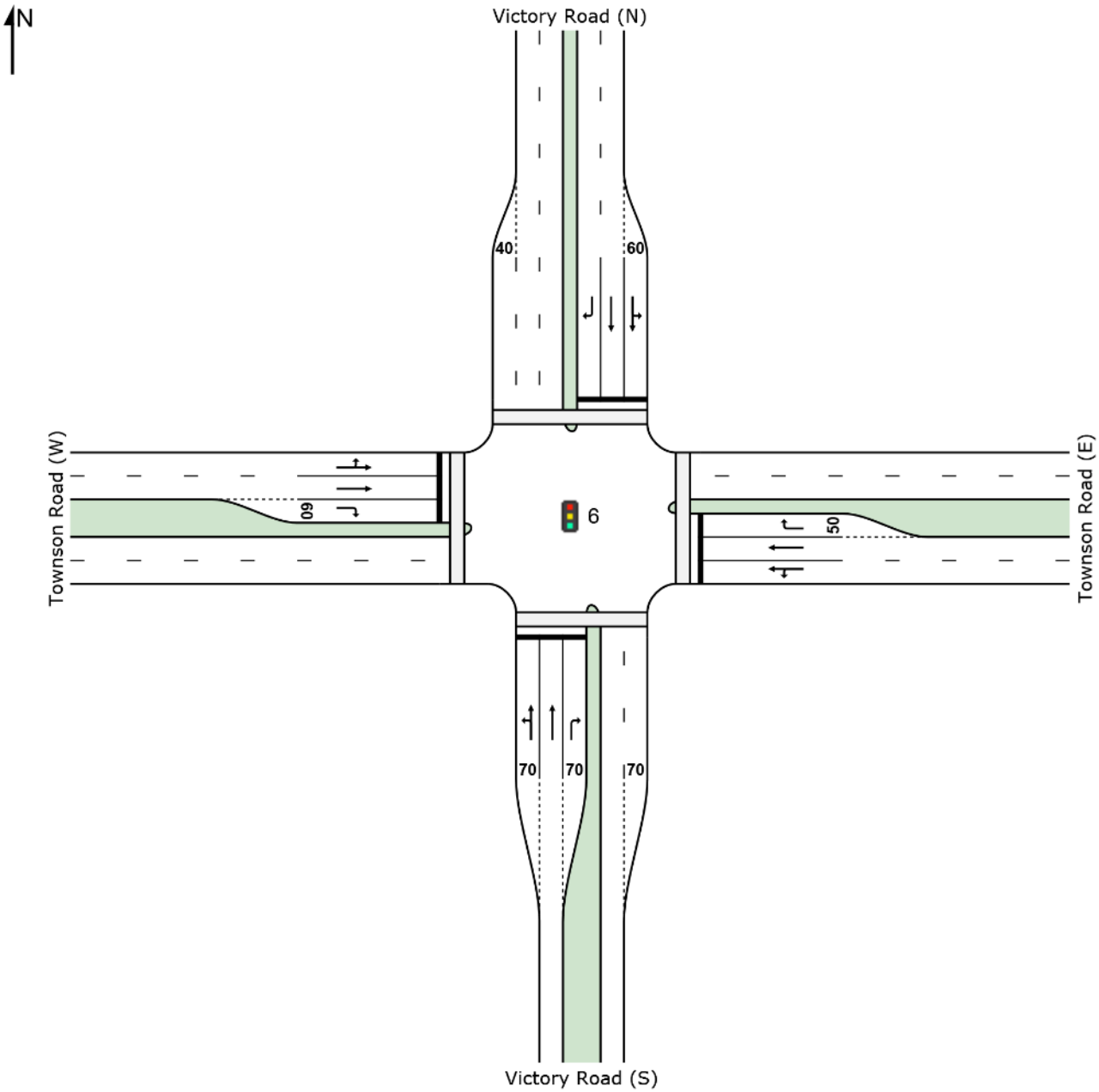
REF: Reference Phase
VAR: Variable Phase

Normal Movement	Permitted/Opposed
Slip/Bypass-Lane Movement	Opposed Slip/Bypass-Lane
Stopped Movement	Turn On Red
Other Movement Class (MC) Running	Undetected Movement
Mixed Running & Stopped MCs	Continuous Movement
Other Movement Class (MC) Stopped	Phase Transition Applied

SITE LAYOUT

Site: 6 [6_Townson Road / Victory Road PM]

Townson Road / Victory Road
Signals - Fixed Time Isolated



MOVEMENT SUMMARY

Site: 6 [6_Townson Road / Victory Road PM]

Townson Road / Victory Road
Signals - Fixed Time Isolated Cycle Time = 120 seconds (User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Victory Road (S)											
1	L2	24	0.0	0.049	25.1	LOS B	1.3	9.4	0.59	0.59	42.9
2	T1	164	0.0	0.164	20.0	LOS B	4.9	34.6	0.62	0.52	45.0
3	R2	150	0.0	0.253	28.2	LOS B	5.5	38.5	0.67	0.75	40.4
Approach		338	0.0	0.253	24.0	LOS B	5.5	38.5	0.64	0.63	42.7
East: Townson Road (E)											
4	L2	68	0.0	0.390	29.6	LOS C	12.9	90.2	0.72	0.66	41.7
5	T1	598	0.0	0.390	24.0	LOS B	13.1	91.7	0.72	0.64	42.9
6	R2	1	0.0	0.002	33.9	LOS C	0.0	0.1	0.68	0.59	38.0
Approach		667	0.0	0.390	24.6	LOS B	13.1	91.7	0.72	0.64	42.7
North: Victory Road (N)											
7	L2	1	0.0	0.032	24.3	LOS B	0.9	6.2	0.57	0.43	44.9
8	T1	94	0.0	0.074	19.0	LOS B	2.1	14.8	0.58	0.45	45.7
9	R2	201	0.0	0.388	31.9	LOS C	8.2	57.4	0.74	0.78	39.0
Approach		295	0.0	0.388	27.8	LOS B	8.2	57.4	0.69	0.67	40.9
West: Townson Road (W)											
10	L2	185	0.0	0.355	29.8	LOS C	11.2	78.3	0.71	0.72	40.5
11	T1	409	0.0	0.355	23.7	LOS B	11.7	81.8	0.71	0.64	42.8
12	R2	5	0.0	0.017	34.5	LOS C	0.2	1.3	0.69	0.65	37.8
Approach		599	0.0	0.355	25.7	LOS B	11.7	81.8	0.71	0.66	42.0
All Vehicles		1899	0.0	0.390	25.3	LOS B	13.1	91.7	0.70	0.65	42.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	26	28.0	LOS C	0.1	0.1	0.68	0.68
P2	East Full Crossing	26	26.7	LOS C	0.1	0.1	0.67	0.67
P3	North Full Crossing	26	29.4	LOS C	0.1	0.1	0.70	0.70
P4	West Full Crossing	26	26.7	LOS C	0.1	0.1	0.67	0.67
All Pedestrians		105	27.7	LOS C			0.68	0.68

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

PHASING SUMMARY

Site: 6 [6_Townson Road / Victory Road PM]

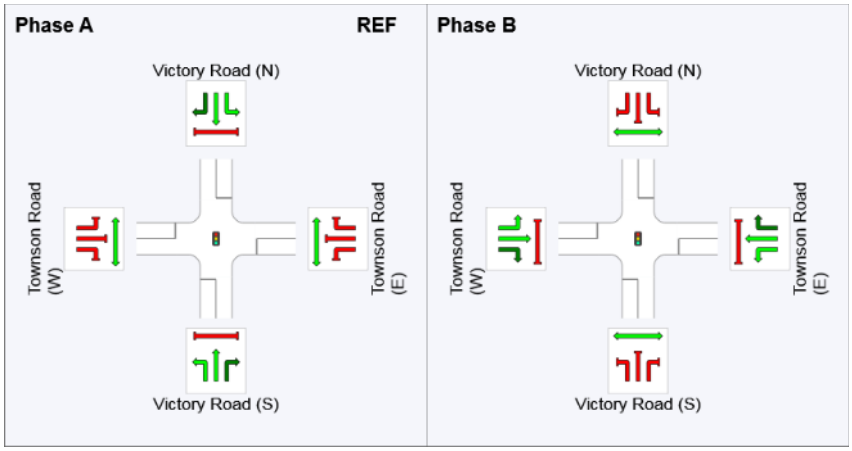
Townson Road / Victory Road
Signals - Fixed Time Isolated Cycle Time = 120 seconds (User-Given Cycle Time)

Phase Times determined by the program
Phase Sequence: Two-Phase
Reference Phase: Phase A
Input Phase Sequence: A, B
Output Phase Sequence: A, B

Phase Timing Results

Phase	A	B
Phase Change Time (sec)	0	61
Green Time (sec)	55	53
Phase Time (sec)	61	59
Phase Split	51 %	49 %

See the Phase Information section in the Detailed Output report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.



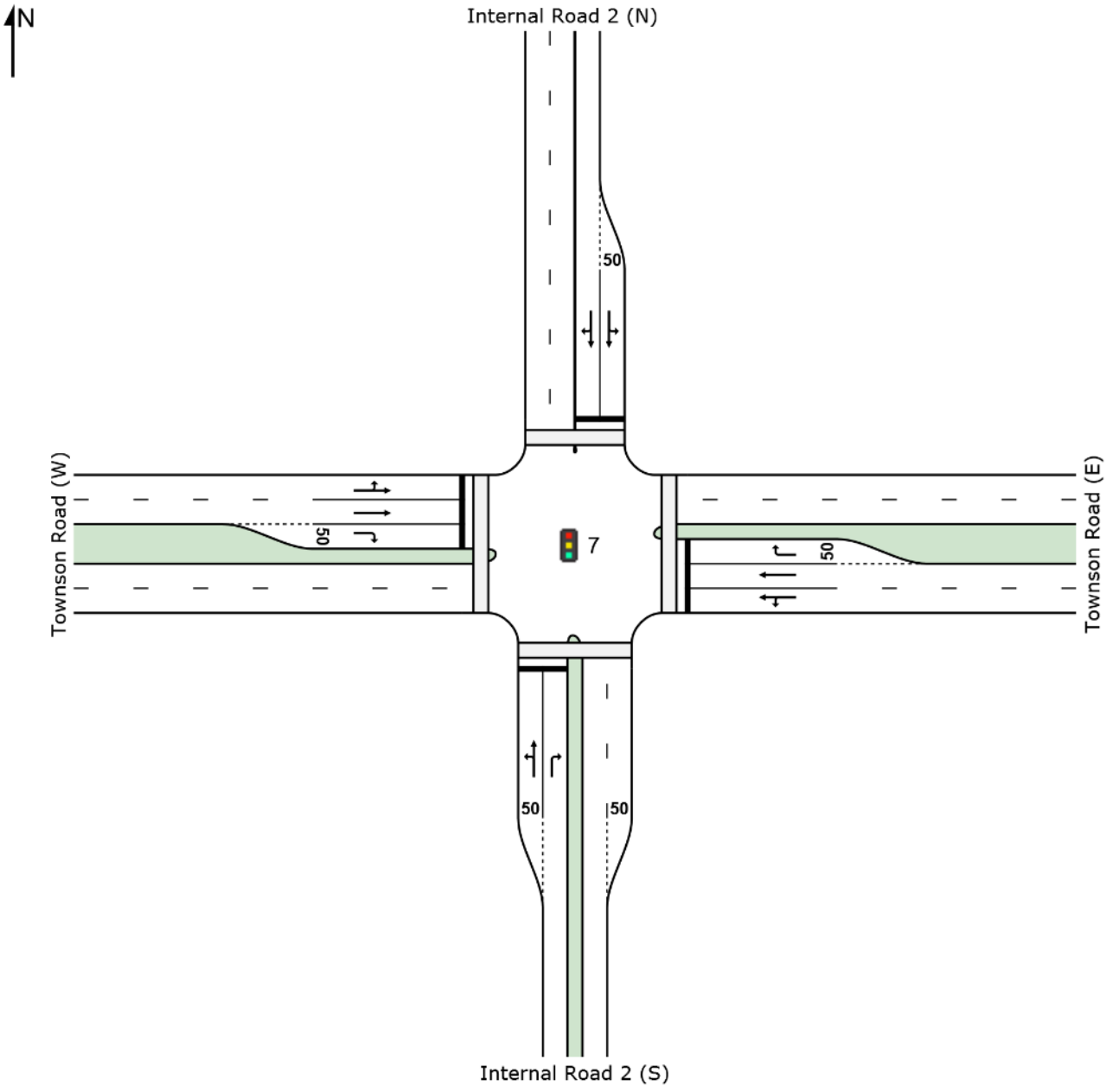
REF: Reference Phase
VAR: Variable Phase

Normal Movement	Permitted/Opposed
Slip/Bypass-Lane Movement	Opposed Slip/Bypass-Lane
Stopped Movement	Turn On Red
Other Movement Class (MC) Running	Undetected Movement
Mixed Running & Stopped MCs	Continuous Movement
Other Movement Class (MC) Stopped	Phase Transition Applied

SITE LAYOUT

Site: 7 [7_Townson Road / Internal Road 2 AM]

Townson Road / Internal Road 2
Signals - Fixed Time Isolated



MOVEMENT SUMMARY

Site: 7 [7_Townson Road / Internal Road 2 AM]

Townson Road / Internal Road 2
Signals - Fixed Time Isolated Cycle Time = 120 seconds (User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Internal Road 2 (S)											
1	L2	1	0.0	0.003	46.9	LOS D	0.0	0.3	0.82	0.55	34.3
2	T1	1	0.0	0.003	41.4	LOS C	0.0	0.3	0.82	0.55	34.8
3	R2	10	0.0	0.039	51.0	LOS D	0.5	3.5	0.87	0.68	32.3
Approach		11	0.0	0.039	50.3	LOS D	0.5	3.5	0.86	0.67	32.5
East: Townson Road (E)											
4	L2	9	0.0	0.269	12.5	LOS A	7.7	54.1	0.40	0.36	52.4
5	T1	724	0.0	0.269	7.0	LOS A	7.7	54.2	0.40	0.35	53.8
6	R2	42	0.0	0.075	13.8	LOS A	0.9	6.2	0.39	0.66	47.8
Approach		774	0.0	0.269	7.4	LOS A	7.7	54.2	0.40	0.37	53.4
North: Internal Road 2 (N)											
7	L2	57	0.0	0.168	50.3	LOS D	2.9	20.0	0.88	0.74	32.4
8	T1	1	0.0	0.271	45.3	LOS D	3.9	27.5	0.89	0.76	32.7
9	R2	77	0.0	0.271	50.9	LOS D	3.9	27.5	0.89	0.76	32.3
Approach		135	0.0	0.271	50.6	LOS D	3.9	27.5	0.89	0.76	32.4
West: Townson Road (W)											
10	L2	1	0.0	0.205	12.2	LOS A	5.6	39.0	0.37	0.32	52.8
11	T1	558	0.0	0.205	6.6	LOS A	5.6	39.0	0.37	0.32	54.1
12	R2	1	0.0	0.001	14.0	LOS A	0.0	0.1	0.37	0.59	47.7
Approach		559	0.0	0.205	6.6	LOS A	5.6	39.0	0.37	0.32	54.1
All Vehicles		1479	0.0	0.271	11.4	LOS A	7.7	54.2	0.44	0.39	50.4

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	26	9.6	LOS A	0.0	0.0	0.40	0.40
P2	East Full Crossing	26	51.4	LOS E	0.1	0.1	0.93	0.93
P3	North Full Crossing	26	8.8	LOS A	0.0	0.0	0.38	0.38
P4	West Full Crossing	26	51.4	LOS E	0.1	0.1	0.93	0.93
All Pedestrians		105	30.3	LOS D			0.66	0.66

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

PHASING SUMMARY

Site: 7 [7_Townson Road / Internal Road 2 AM]

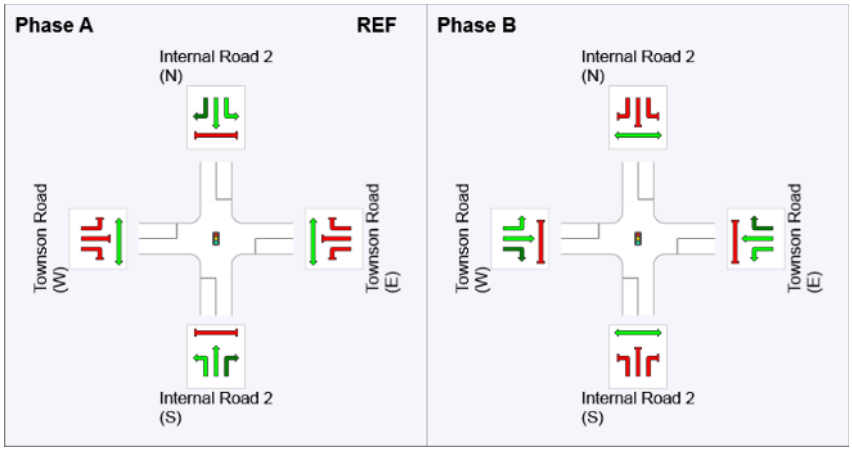
Townson Road / Internal Road 2
Signals - Fixed Time Isolated Cycle Time = 120 seconds (User-Given Cycle Time)

Phase Times determined by the program
Phase Sequence: Two-Phase
Reference Phase: Phase A
Input Phase Sequence: A, B
Output Phase Sequence: A, B

Phase Timing Results

Phase	A	B
Phase Change Time (sec)	0	30
Green Time (sec)	24	84
Phase Time (sec)	30	90
Phase Split	25 %	75 %

See the Phase Information section in the Detailed Output report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.



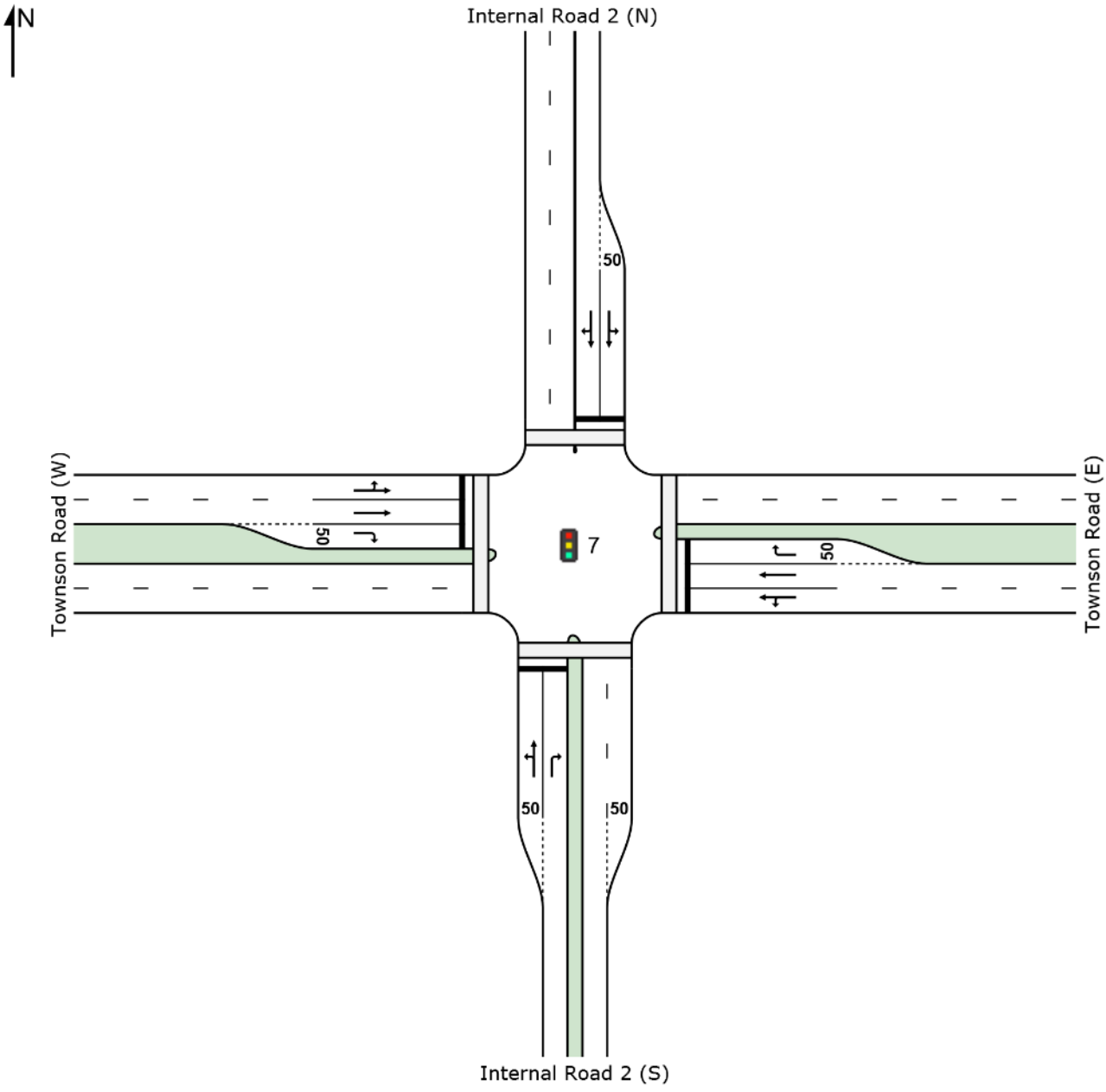
REF: Reference Phase
VAR: Variable Phase

Normal Movement	Permitted/Opposed
Slip/Bypass-Lane Movement	Opposed Slip/Bypass-Lane
Stopped Movement	Turn On Red
Other Movement Class (MC) Running	Undetected Movement
Mixed Running & Stopped MCs	Continuous Movement
Other Movement Class (MC) Stopped	Phase Transition Applied

SITE LAYOUT

Site: 7 [7_Townson Road / Internal Road 2 PM]

Townson Road / Internal Road 2
Signals - Fixed Time Isolated



MOVEMENT SUMMARY

Site: 7 [7_Townson Road / Internal Road 2 PM]

Townson Road / Internal Road 2
Signals - Fixed Time Isolated Cycle Time = 120 seconds (User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Internal Road 2 (S)											
1	L2	1	0.0	0.007	60.1	LOS E	0.1	0.4	0.93	0.57	30.5
2	T1	1	0.0	0.007	54.6	LOS D	0.1	0.4	0.93	0.57	30.9
3	R2	1	0.0	0.004	61.3	LOS E	0.0	0.2	0.94	0.57	29.6
Approach		2	0.0	0.007	58.7	LOS E	0.1	0.4	0.94	0.57	30.3
East: Townson Road (E)											
4	L2	5	0.0	0.213	8.3	LOS A	4.4	30.9	0.25	0.22	55.8
5	T1	666	0.0	0.213	2.8	LOS A	4.4	30.9	0.25	0.22	57.3
6	R2	107	0.0	0.169	9.3	LOS A	1.6	11.3	0.28	0.65	50.8
Approach		778	0.0	0.213	3.7	LOS A	4.4	30.9	0.25	0.28	56.3
North: Internal Road 2 (N)											
7	L2	28	0.0	0.200	64.0	LOS E	1.6	11.2	0.97	0.72	28.9
8	T1	1	0.0	0.007	54.8	LOS D	0.1	0.4	0.93	0.58	30.9
9	R2	1	0.0	0.007	60.4	LOS E	0.1	0.4	0.93	0.58	30.5
Approach		29	0.0	0.200	63.8	LOS E	1.6	11.2	0.97	0.71	28.9
West: Townson Road (W)											
10	L2	1	0.0	0.185	8.3	LOS A	3.7	26.1	0.24	0.21	55.9
11	T1	582	0.0	0.185	2.7	LOS A	3.7	26.1	0.24	0.21	57.4
12	R2	1	0.0	0.001	8.7	LOS A	0.0	0.0	0.23	0.59	51.2
Approach		583	0.0	0.185	2.7	LOS A	3.7	26.1	0.24	0.21	57.4
All Vehicles		1392	0.0	0.213	4.6	LOS A	4.4	30.9	0.26	0.26	55.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	26	5.1	LOS A	0.0	0.0	0.29	0.29
P2	East Full Crossing	26	54.2	LOS E	0.1	0.1	0.95	0.95
P3	North Full Crossing	26	4.5	LOS A	0.0	0.0	0.28	0.28
P4	West Full Crossing	26	54.2	LOS E	0.1	0.1	0.95	0.95
All Pedestrians		105	29.5	LOS C			0.62	0.62

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

PHASING SUMMARY

Site: 7 [7_Townson Road / Internal Road 2 PM]

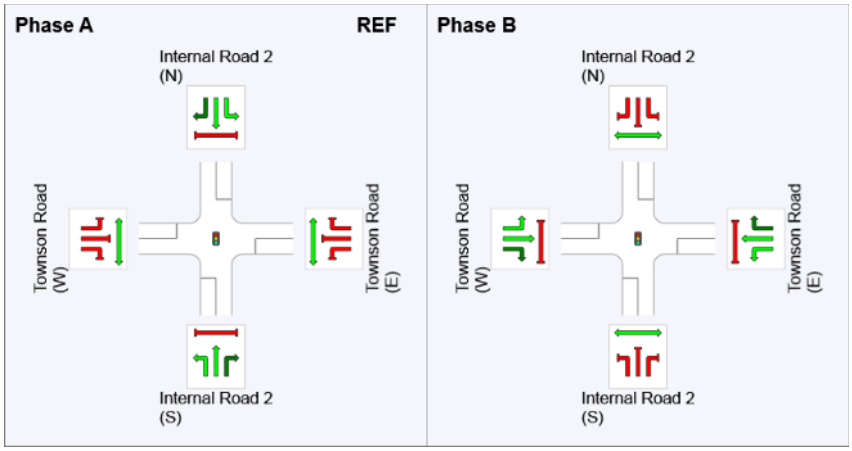
Townson Road / Internal Road 2
Signals - Fixed Time Isolated Cycle Time = 120 seconds (User-Given Cycle Time)

Phase Times determined by the program
Phase Sequence: Two-Phase
Reference Phase: Phase A
Input Phase Sequence: A, B
Output Phase Sequence: A, B

Phase Timing Results

Phase	A	B
Phase Change Time (sec)	0	17
Green Time (sec)	11	97
Phase Time (sec)	17	103
Phase Split	14 %	86 %

See the Phase Information section in the Detailed Output report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.



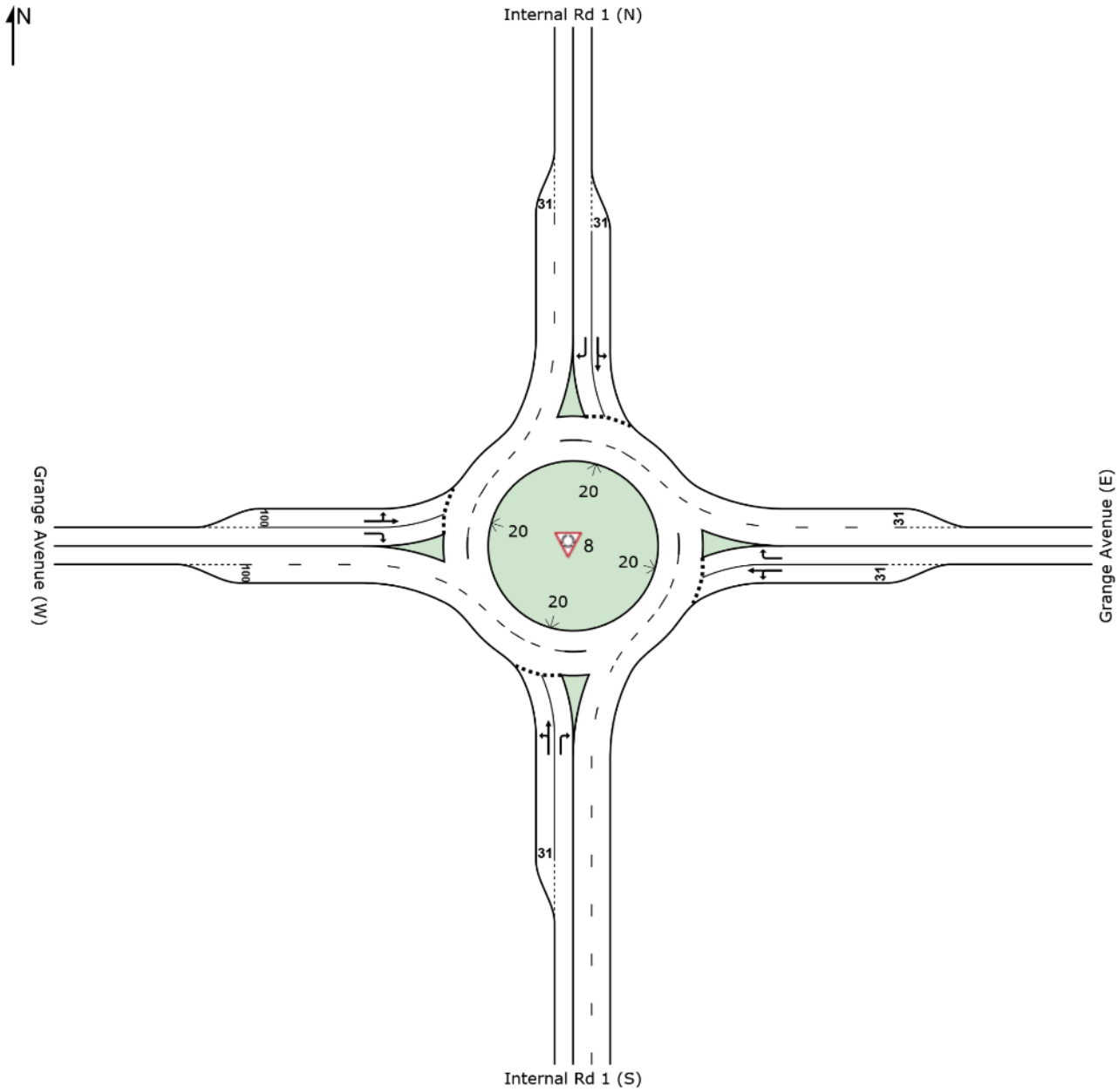
REF: Reference Phase
VAR: Variable Phase

Normal Movement	Permitted/Opposed
Slip/Bypass-Lane Movement	Opposed Slip/Bypass-Lane
Stopped Movement	Turn On Red
Other Movement Class (MC) Running	Undetected Movement
Mixed Running & Stopped MCs	Continuous Movement
Other Movement Class (MC) Stopped	Phase Transition Applied

SITE LAYOUT

Site: 8 [8_Grange Avenue / Internal Road 1 AM]

Carnarvon Road / Grange Avenue
Roundabout



MOVEMENT SUMMARY

Site: 8 [8_Grange Avenue / Internal Road 1 AM]

Carnarvon Road / Grange Avenue
Roundabout

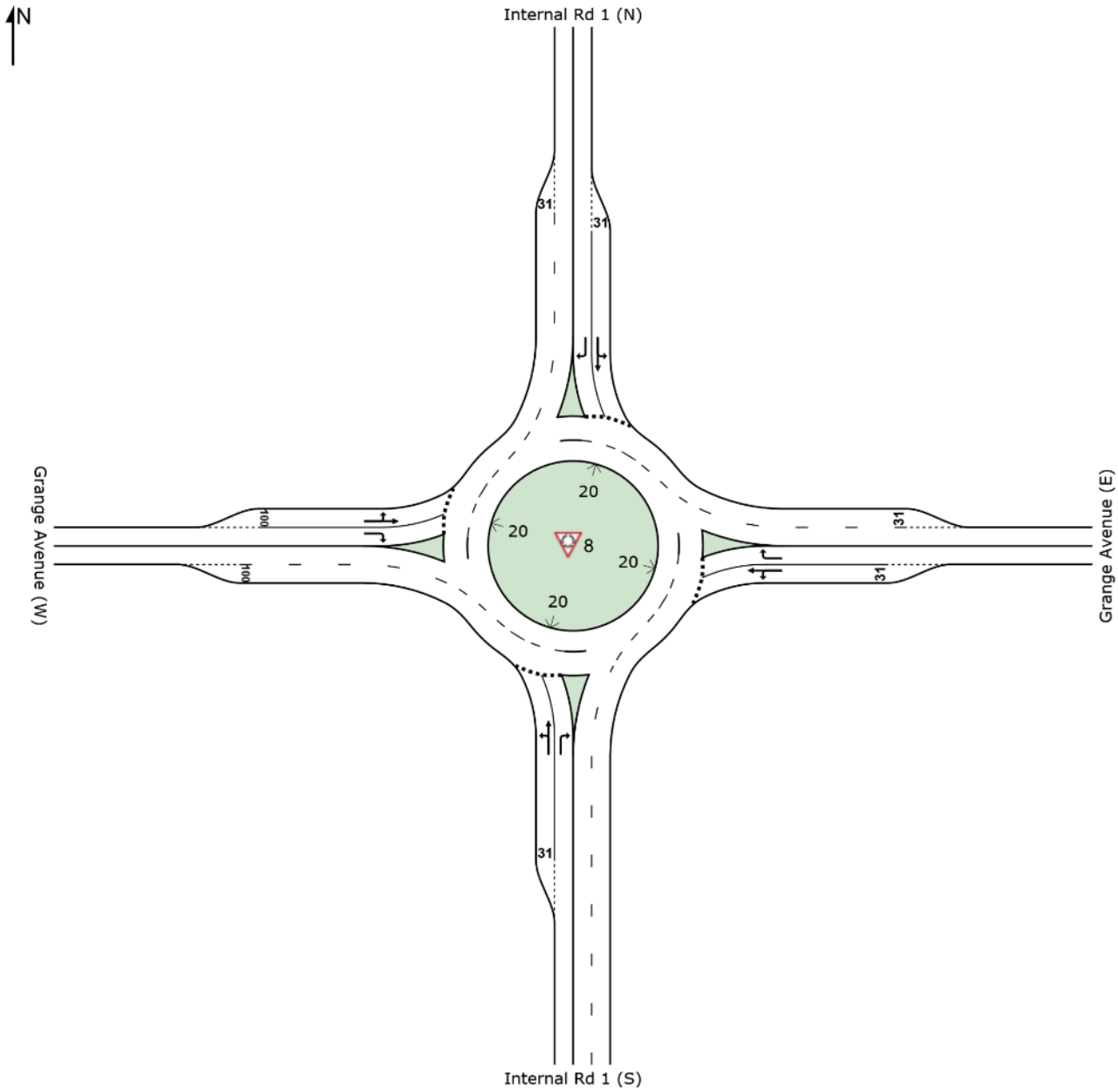
Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Internal Rd 1 (S)											
1	L2	5	0.0	0.035	4.8	LOS A	0.2	1.2	0.36	0.45	52.9
2	T1	36	0.0	0.035	5.0	LOS A	0.2	1.2	0.36	0.45	53.5
3	R2	14	0.0	0.017	10.2	LOS A	0.1	0.6	0.40	0.61	48.0
Approach		56	0.0	0.035	6.3	LOS A	0.2	1.2	0.37	0.49	52.1
East: Grange Avenue (E)											
4	L2	123	0.0	0.260	5.9	LOS A	1.4	10.1	0.53	0.61	49.7
5	T1	159	0.0	0.260	6.0	LOS A	1.4	10.1	0.53	0.61	53.3
6	R2	1	0.0	0.001	11.7	LOS A	0.0	0.0	0.51	0.58	47.1
Approach		283	0.0	0.260	6.0	LOS A	1.4	10.1	0.53	0.61	51.8
North: Internal Rd 1 (N)											
7	L2	16	0.0	0.216	4.2	LOS A	1.3	8.9	0.15	0.40	52.1
8	T1	321	0.0	0.216	4.3	LOS A	1.3	8.9	0.15	0.40	54.9
9	R2	42	0.0	0.046	9.1	LOS A	0.2	1.6	0.16	0.61	51.8
Approach		378	0.0	0.216	4.8	LOS A	1.3	8.9	0.15	0.42	54.4
West: Grange Avenue (W)											
10	L2	1	0.0	0.005	4.3	LOS A	0.0	0.2	0.19	0.40	53.9
11	T1	5	0.0	0.005	4.5	LOS A	0.0	0.2	0.19	0.40	55.0
12	R2	14	0.0	0.010	9.0	LOS A	0.1	0.4	0.17	0.60	51.7
Approach		19	0.0	0.010	7.6	LOS A	0.1	0.4	0.18	0.54	52.5
All Vehicles		736	0.0	0.260	5.5	LOS A	1.4	10.1	0.31	0.50	53.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SITE LAYOUT

Site: 8 [8_Grange Avenue / Internal Road 1 PM]

Carnarvon Road / Grange Avenue
Roundabout



MOVEMENT SUMMARY

Site: 8 [8_Grange Avenue / Internal Road 1 PM]

Carnarvon Road / Grange Avenue
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Internal Rd 1 (S)											
1	L2	17	0.0	0.081	4.6	LOS A	0.4	2.9	0.30	0.44	53.2
2	T1	86	0.0	0.081	4.7	LOS A	0.4	2.9	0.30	0.44	54.0
3	R2	21	0.0	0.026	10.0	LOS A	0.1	0.8	0.35	0.61	48.3
Approach		124	0.0	0.081	5.6	LOS A	0.4	2.9	0.31	0.47	52.9
East: Grange Avenue (E)											
4	L2	82	0.0	0.129	5.3	LOS A	0.7	4.6	0.44	0.54	50.3
5	T1	66	0.0	0.129	5.5	LOS A	0.7	4.6	0.44	0.54	53.9
6	R2	33	0.0	0.048	11.5	LOS A	0.2	1.5	0.48	0.68	47.4
Approach		180	0.0	0.129	6.5	LOS A	0.7	4.6	0.45	0.57	51.2
North: Internal Rd 1 (N)											
7	L2	3	0.0	0.171	4.1	LOS A	1.0	6.9	0.13	0.39	52.1
8	T1	263	0.0	0.171	4.3	LOS A	1.0	6.9	0.13	0.39	55.0
9	R2	35	0.0	0.038	9.1	LOS A	0.2	1.3	0.15	0.61	51.9
Approach		301	0.0	0.171	4.8	LOS A	1.0	6.9	0.13	0.42	54.5
West: Grange Avenue (W)											
10	L2	12	0.0	0.015	4.6	LOS A	0.1	0.5	0.29	0.44	53.6
11	T1	7	0.0	0.015	4.7	LOS A	0.1	0.5	0.29	0.44	54.7
12	R2	1	0.0	0.001	10.0	LOS A	0.0	0.0	0.34	0.56	51.1
Approach		20	0.0	0.015	4.8	LOS A	0.1	0.5	0.29	0.45	53.9
All Vehicles		625	0.0	0.171	5.5	LOS A	1.0	6.9	0.26	0.47	53.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.