Health Infrastructure

Blacktown Mount Druitt Hospital

Early Works Package 2: Building Envelope and Excavation - Transport Accessibility Study and Construction Traffic Management Plan

Rev B | 16 October 2015

Job number 221031

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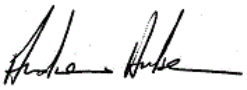
		Signature			
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Contents

Appendices

1 Introduction

1.1 Project Background

This report has been prepared following adoption of two stages of redevelopment for the Blacktown Hospital campus. Stage 1 for Blacktown Hospital is nearing completion and the second stage of development will now commence as occupation of Stage 1 occurs.

Stage 1 of Blacktown Hospital expansion consists of four components; a partial refurbishment of the existing main hospital, a new hospital facility, a multistorey car park and a new one storey mental health unit. Stage 2 of the expansion includes a new emergency department and clinical services.

Stage 2 involves two phases of work. The first early works package, which this report addresses, is the concept proposal for the development (including layout and building envelopes for the hospital building and associated works), site preparation works and bulk earthworks. The second phase is the detailed design of the new hospital facility and expansion of the multistorey car park which will the subject of a subsequent application.

1.2 Scope of Study

This Transport and Accessibility Study has been prepared in accordance with relevant authorities guidelines including Blacktown Council and RTA Guidelines for Traffic Generating Developments. The following chapters include:

- Existing Conditions
- Proposed Development
- Transport and Accessibility Impacts
- Conclusions

The study considered within its terms of reference the Secretary's Environmental Assessment Requirements for the Environmental Assessment of the proposed development. The latest SEARs regarding the study areas for the traffic and transport impact of the project are outlined in Section 1.3 of this report.

1.3 Project SEARs

The NSW Department of Planning and Environment issued the SEARs for the Blacktown and Mount Druitt Hospital Project (Application Number SSD7085) on 9 June 2015. The Transport & Accessibility Study must address the relevant planning provisions, goals and strategic planning objectives in the following:

- NSW 2021;
- A Plan for Growing Sydney;
- NSW Bike Plan;
- Planning Guidelines for Walking and Cycling;
- Integrating Land Use and Transport Policy Package; and
- Healthy Urban Development Checklist, NSW Health.

The SEARs are outlined in Table 1.

Table 1 SEARs Requirements

Description	Relevant Section of Report
Stage 1 Building Envelope and Excavation - Transport and Accessibility	
The Traffic and Transport Assessment for the concept proposal should address, but is not limited to, the following:	
- existing traffic and parking conditions, including peak and daily vehicle, public transport, pedestrian and bicycle movements, and performance of the intersections located adjacent to the hospital, including the following intersections: o Marcel Crescent/Blacktown Road/Main Street/Griffiths Street; o Blacktown Road/Wall Park Avenue/Prospect Highway; o Bungarribee Road/Panorama Parade/Lock Street; and o Bungarribee Road/Prospect Highway/Leabons Lane.	3
- daily and peak vehicle, public transport, pedestrian and bicycle movements to be generated by the development;	4
- assessment of the impacts on above intersections and the transport network and any measures to mitigate the impacts, having regard to local planning controls;	4.7
- access arrangements for vehicles, public transport, pedestrians and bicycles to and within the site;	4.2.4 & 0
- delivery, servicing and loading arrangements, including details of service vehicle movements;	4.8
- pedestrian and bicycle linkages to and within the site and any required upgrades to meet likely future demand; and	3.7 & 5
- access arrangements for emergency vehicles.	4.2.4
Construction Enabling Works (part of first stage)	
- Detail access arrangements for the first stage of construction and measures to mitigate any associated pedestrian, cycleway or traffic impacts.	7
- Details regarding car parking arrangements during first stage of construction, including the displacement of visitor and patient car parking. Alternative off-site arrangements should be made for staff and construction workers.	7.3.5 & 7.4.1
Plans and Documents	
- Preliminary Construction Management Plan, inclusive of a Preliminary Construction Traffic Management Plan that includes vehicle routes, number of trucks, hours of operation, access arrangements and traffic control measures during each stage of construction.	7

1.4 Consultation

Consultation has occurred with RMS, Blacktown Council and Transport for NSW.

1.4.1 RMS

Jana Jegathesan, Land Use Planner Network Management/ Journey Management (02 8849 2313) was contacted on 25 September 2015 to confirm the extent of traffic modelling.

1.4.2 Blacktown Council

Nadeem Shaikh, Co-ordinator Traffic Management, Blacktown City Council (9839 6017) was met on-site on 16 September 2015 to discuss the construction process and parking arrangements. He reiterated Council's concern about overflow car parking on-street. The project intends to provide adequate parking on the site for all staff and visitor, however, the hospital is unable to stop staff and visitors who choose to avoid the parking fee from parking on-street.

1.4.3 Transport for NSW

Para Sangar, Senior Transport Planner (8202 2672) was contacted on 24 September 2015 to discuss the travel initiatives being proposed as part of the site travel plan and the public transport accessibility of the site. Para requested that the car parking proposals and fees be discussed in the report. It was confirmed that staff, patients and visitors will all pay for car parking on the site.

2 NSW Government Strategies and Policies'

This report has been prepared in accordance with the following NSW Government Strategies and Policies:

- NSW 2021;
- A Plan for Growing Sydney;
- NSW Bike Plan;
- Integrated Land Use and Transport Policy Package 2001;
- NSW Planning Guidelines for Walking and Cycling;
- RTA's Guide to Traffic Generating Development;
- Healthy Urban Development Checklist 2010.

The development of the Blacktown Hospital will contribute to the achievement of transport objectives contained in the various NSW Government strategies. A summary of these strategies and policies is provided below.

2.1 NSW 2021

NSW 2021: A Plan to Make NSW Number One sets the Government's agenda for change in NSW. It provides the direction for the public sector for the next ten years. The goals, targets and actions in this plan will be integrated into the machinery of government, setting the priorities for funding, guiding decisions and focusing the day to day work of the public sector. The following summarises the contents of the Plan which are relevant to the Blacktown hospital development proposal.

Goal 8 - Grow patronage on public transport by making it a more attractive choice

- Increase the share of commuter trips made by public transport.
- Increase the proportion of total journeys to work by public transport in the Sydney Metropolitan Region to 28% by 2016.
- Increase walking and cycling.

Goal 12 - Provide world class clinical services with timely access and effective infrastructure

- We will provide timely access to world class health care through increased investment in infrastructure, making more beds available, and providing more nurses.

Commentary

The State Plan's priorities align with developing transport strategies that guide sustainable outcomes. Transport infrastructure improvements identified by the State Plan support increased transport modal choices to allow for more journeys to be undertaken using more sustainable forms of transport. The State Plan's priorities guide the Blacktown Hospital redevelopment proposal towards encouraging active transport choices among hospital staff and visitors, to facilitate healthy lifestyles and to reduce carbon dioxide emissions.

2.2 A Plan for Growing Sydney

A Plan for Growing Sydney is the Government's plan to achieve the following goals:

- make it easier for Sydney's residents to move between their homes, their jobs, the centres where they shop and use local services, and their open spaces;
- make a wider variety of housing available to suit the changing make-up of the population – more than one million people will be over the age of 65 years and almost the same number under the age of 15 years by 2031;
- deliver new infrastructure which supports our community as it grows, and strategic infrastructure that also strengthens the economy; and
- recognise our highly prized environment – the harbour, the coast, our mountains, parks and open spaces – and how to safeguard these places.

It's an action plan focused on bringing all stakeholders together with a common purpose – to develop a competitive economy with world-class services and transport; to deliver greater housing choice to meet our changing needs and lifestyles; to create communities that have a strong sense of wellbeing; and to safeguard our natural environment.

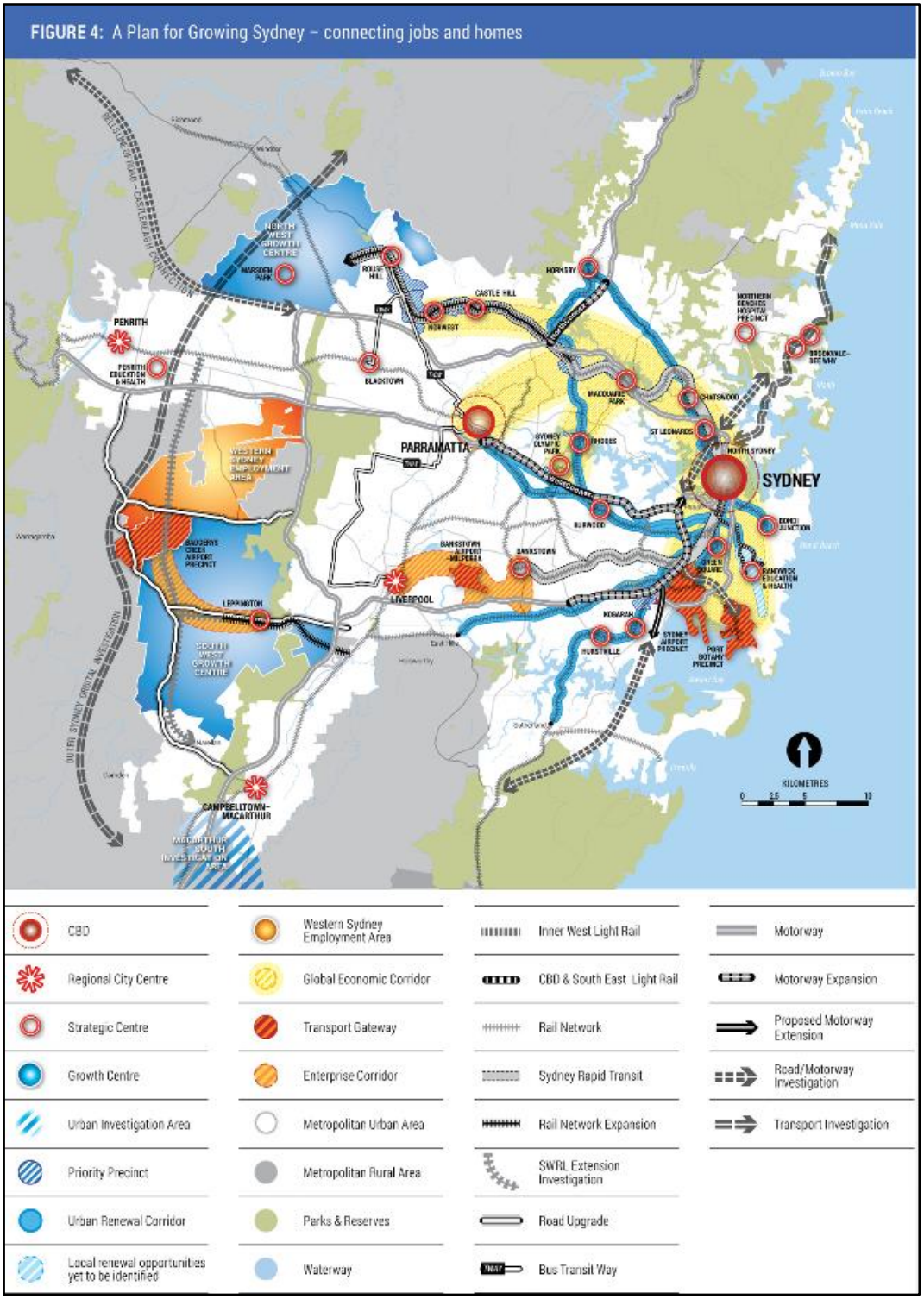
Goal 1: A competitive economy with world-class services and transport

- Plan for expansion of health facilities to service Sydney's growing population.
- Preserve future transport and road corridors to support future growth

Goal 4: A sustainable and resilient city that protects the natural environment and has a balanced approach to the use of land and resources

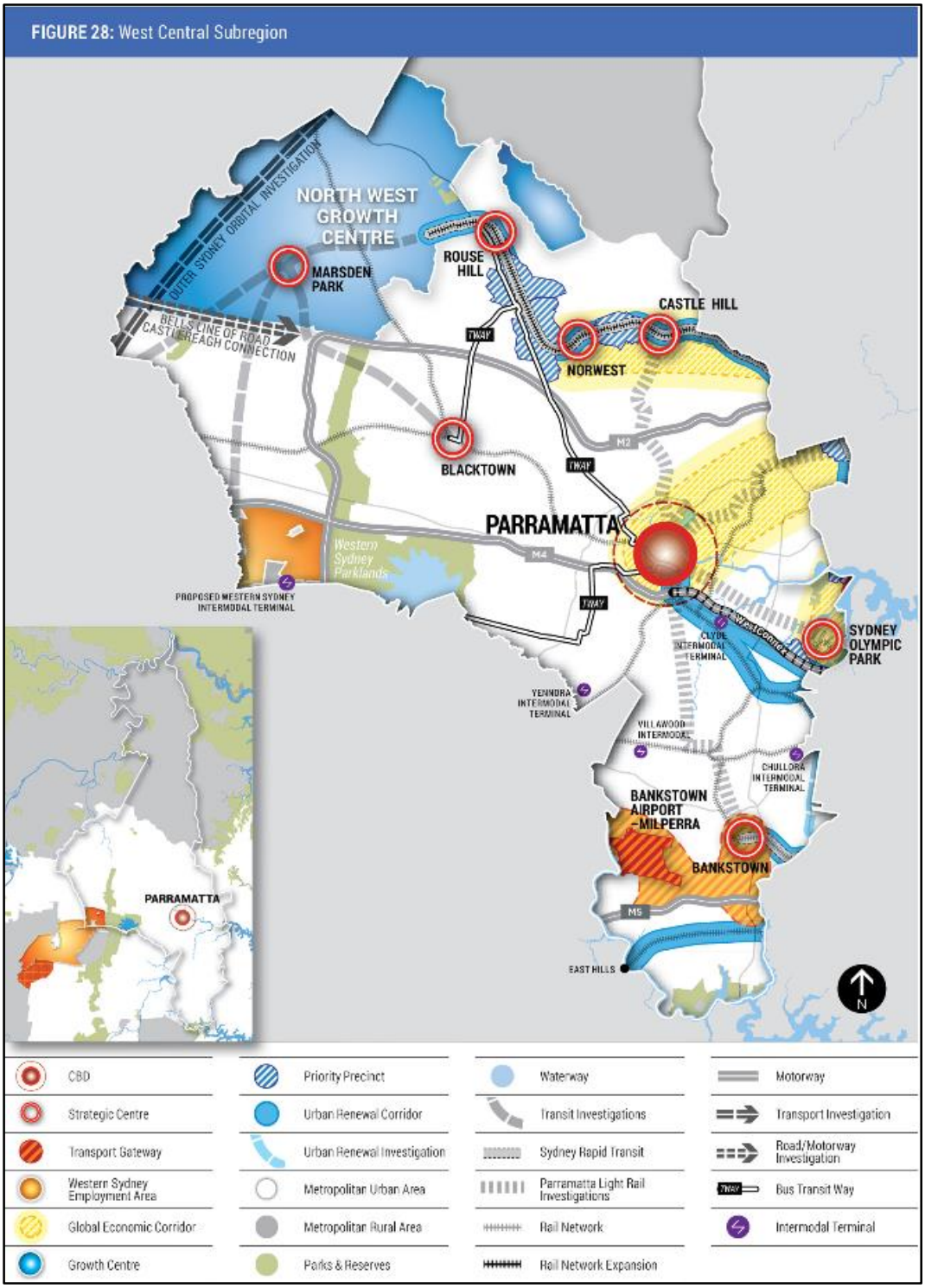
Principle 3: Connecting centres with a networked transport system

- The public transport network connects people to centres. In doing this, it connects people to jobs, education facilities, health centres and hospitals, and sporting, cultural and entertainment facilities.
- Centres rely on efficient transport to serve their customers, support their growing business and freight functions, and to connect to the global economy.
- Efficient links within centres improves convenience for customers, and efficient links into centres and between centres helps people to get to jobs, schools, universities, shops and leisure activities.
- Making it easy to get to centres and offering a range of services at centres makes them a focal point for the community and increases prospects for economic growth and job creation.



West Central Subregion Plan

The West Central subregion will be a significant focus for infrastructure investment and intensive growth over the next 20 years. For Blacktown, the plan will support hospital-related land uses and infrastructure around Blacktown Hospital.



Commentary

A Plan for Growing Sydney underscores the importance of the Western Sydney region to the future growth of the city. This is reflected in the dwelling and employment targets. The Blacktown Hospital redevelopment project is consistent with the objectives and policy settings and represents a necessary improvement of critical health infrastructure in Western Sydney to cater for the future demands in the region.

2.3 NSW BikePlan

The NSW Bike plan recognises a growth of people riding a bike in NSW, with many finding it an affordable, practical and healthy option for everyday personal travel. The NSW Bike Plan aims to build investments and initiatives that have encouraged cycling in NSW by outlining a 10-year bicycle infrastructure plan, including:

- Construction of over 4,000 kilometres of cycle facilities in NSW
- Delivery of extensive cycleways as an integrated component of major road upgrades
- Support for major events like the Sydney Spring Cycle and investment in programs to promote safe bike-riding in schools and as part of major urban development and
- Report cycling success stories from all parts of NSW as case studies.

The Plan also establishes the Metro Sydney Bike Network, a regional network of high-quality cycle routes that connect the city's Major Centres and Regional Cities. The following missing links to the existing Metro Sydney Bike Network have been identified as items of priority:

- Prospect to Blacktown
- Blacktown to Parramatta

Commentary

Blacktown Hospital is located in close proximity to existing facilities. An opportunity to encourage active transport modes such as cycling is recognised for the Blacktown Hospital redevelopment. Specifically, bicycle facilities for hospital staff and visitors are to be provided, including bicycle storage facilities, showers, lockers and change rooms. This is consistent with the NSW Bikeplan, in that it will encourage residents, hospital staff and visitors to an active travel mode.

2.4 Integrated Land Use and Transport Policy Package

The *Integrated Land Use and Transport Package* (DUAP, 2001) provides guidance to local councils in implementing the objective of 'promoting attractive and convenient places to live and work.' This Package emphasises the need for urban structures, building forms, land use location, development designs, subdivisions and street layouts to achieve sustainable transport objectives. The Package introduces the following concepts to be considered when planning for transport choice:

Convenience — the transport mode needs to be easy to find and use, and to transfer from one mode to another.

Information — reliable information at accessible locations is essential to encourage use of various travel alternatives.

Proximity — transport facilities and services, such as cycle paths and bus services, need to be in close, convenient and obvious locations to people's trip origins and destinations.

Destination choice — the more destinations that can be linked on a public transport route, the more attractive it will be.

Directness — routes should take the shortest and least deviating course, with priority to achieve fast travel times for walking, cycling and public transport (e.g. pedestrian links, dedicated bus lanes, and bikeways).

Security — the environment for walking and waiting needs to be comfortable and safe from personal attack or conflicts with traffic (e.g. waiting areas sheltered from the elements, natural surveillance, good lighting, bike lanes on major roads).

Commentary

The *Integrated Land use and Transport Package* highlights the key role that planning has in facilitating sustainable transport as well as the risks of inhibiting transport choice. The Package recognises that transport planning concepts need to be considered at all stages of land use planning to result in successful urban communities. The Blacktown Hospital redevelopment proposal has been designed with consideration to the key concepts outlined in the *Integrated Land Use and Transport Package.*

2.5 NSW Planning Guidelines for Walking and Cycling

This document was prepared by the NSW Department of Infrastructure, Planning and Natural Resources (DIPNR) in 2004, outlining guidelines to assist land-use planners and related professionals to improve consideration of walking and cycling in strategic planning and development assessment. The guidelines have been designed to provide a walking and cycling focus to the NSW Government's *Integrating Land Use and Transport Planning Policy Package*.

The guidelines encourage the preparation of Transport Management and Accessibility Plans (TMAPs) as part of masterplanning and development approvals process for larger developments. TMAPs promote a mode shift away from motor vehicle use toward walking, cycling and use of public transport.

TMAPs generally comprise a background study, an action plan and an agreement between council, the proponent (developer, building owner/manager or tenant) and other relevant stakeholders, aimed at:

- Managing transport impacts of developments;
- Maximising the use of public transport, walking and cycling;
- Reducing VKT (Vehicle Kilometres Travelled) growth by cars and commercial vehicles generated by the development
- Reducing car reliance; and
- Minimising the impacts of freight, whilst allowing for efficient freight movement.

The guidelines also recommend the preparation of Transport Access Guides as part of a development approval. TAGs are concise presentations of how to reach a site or venue by public transport, walking and cycling. The objective is to make the choice of travel by these modes easier. TAGs are to be prepared in accordance with the RTA/SEDA brochure, *Producing & Using Transport Access Guides*.

The *NSW Planning Guidelines for Walking and Cycling* suggest the following rates for the bicycle parking provision, shower and locker provision as applied to a hospital development, and these are summarised in Table 2 and Table 3.

Table 2 Bicycle Parking Provision Rates

Land use type	Resident/staff (long-term use)	Customer/visitor (short-term use)
Hospitals	5 – 10% of staff or 10 – 15% of beds	5 – 10% of staff

Table 3 End of Journey Bicycle Facilities

Staff	Lockers	Showers	Change rooms
0-12	1 per 3 racks	1	-
13-49	1 per 3 racks	2 (1 male and 1 female)	2 (1 male and 1 female)
50-149	1 per 3 racks	4 (2 male and 2 female)	2 (1 male and 1 female)
150-299	1 per 3 racks	6 (3 male and 3 female)	2 (1 male and 1 female)
300-500	1 per 3 racks	8 (4 male and 4 female)	2 (1 male and 1 female)

The guidelines provide the following design principles for bicycle parking facilities:

1. Open and attractive facilities in easily supervised places that feel safe and non-threatening, with good passive surveillance to deter acts of vandalism and theft
2. As close as possible to building entrances (preferably within 25m)
3. Relates to the travel requirements of the user (e.g. lockers for commuters and racks for short-term use)

2.6 RTA's Guide to Traffic Generating Development

This document was prepared by the NSW Roads and Traffic Authority in 2002, outlining all aspects of traffic generation considerations relating to developments. It provides the basis of which the RTA reviews development applications subject to SEPP 11 (which has been subsequently superseded by SEPP Infrastructure). Specifically, the guide outlines traffic generation rates and parking requirements for specific land uses, as well as cost impacts of traffic generated by developments.

Traffic and parking rates are only provided for private hospital developments. Public Hospitals need to be considered on a case by case arrangement given the complex and varied nature of the facilities provided.

Commentary

A project specific model has been developed to consider car parking demand, traffic generation and non-car modes of travel.

2.7 Healthy Urban Development Checklist 2010

The NSW Department of Health and Sydney South West Area Health Service has prepared the *Healthy Urban Development Checklist* (2010) to address the growing concern about the link between the built environment and 'lifestyle diseases and risk factors' including overweight and obesity, diabetes mellitus type 2, and heart disease. Specifically, the checklist aims to:

- Provide a standardised tool to guide and inform feedback and advice to local government and developers on urban development policies and plans
- Evaluate the health aspects of urban developments
- Support engagement between urban planners and developers and health professionals
- Inform others (planners, developers, policy makers) about the range of factors that need to be considered in healthy urban developments

The publication comprises of 10 checklist chapters, each based on a key characteristic of healthy urban development. These chapters include sections covering the relevance of the issue to NSW, evidence and leading practice, key summary questions, specific questions related to each key question, and sources of further information.

A summary assessment of the Blacktown Hospital proposal and its response to the checklist questions relating to issues of Transport and Physical Connectivity is provided below (Chapter 10).

Code	Question	Response
TC1: Improve public transport services		
TC1.1	Does the policy, plan or development proposal identify the provision of public transport as a priority?	Regular bus services are provided between the Blacktown Hospital site and Blacktown Train Station. Blacktown Train Station is located on the Western Rail Line, and receives regular good service.
TC1.2	Does the policy, plan or development proposal make provision for public transport routes/services to link the proposed development to the wider area?	The redevelopment proposal will include a traffic management and access plan to help encourage public transport use. The hospital site is located in close proximity to Blacktown train station, which is situated along the Main Western Rail Line.
TC1.3	Does the policy, plan or development proposal identify public transport routes that address the needs of different groups in the population (e.g. travel to education, shopping, recreation and employment areas)?	Shuttle services are available for different users groups.
TC1.4	Does the policy, plan or development proposal encourage alternative transport system development such as car share programs, electric taxis, walking/cycling "bus" programs and/or community bike hire schemes?	The redevelopment proposal promotes active transport modes by providing cycling facilities.

Code	Question	Response
TC1.5	Are public transport stops located in comfortable walking distance (approximately 400-500m for bus stops and 800m for train stations) of housing, employment and other local destinations?	The hospital site is located within 400-500m of bus stops connecting the hospitals to Blacktown train station.
TC1.6	Are public transport systems and nodes designed to be universally accessible?	Bus stops in and around the hospital site is to be designed to be universally accessible and consistent with the Disability Discrimination Act 1992.
TC1.7	Are public transport nodes safe and easy to approach on foot and bicycle (are they clearly signed and well-lit with direct routes and safe and convenient crossing points)?	The bus stops are located within the hospital campus providing direct access.
TC1.8	Do public transport nodes include places to park and/or rent bicycles? Can bicycles be taken onto trains and/or buses?	Appropriate bicycle parking facilities will be provided at Blacktown Hospital site.
TC1.9	Do public transport nodes include amenities such as: shelter, seating, proper lighting, transport user information, wayfinding guidance, washrooms, refreshments, bicycle parking, power outlets and internet service, as well as information about the surrounding area and transport options (including walking or cycling) for the onward journey?	Yes
TC1.10	Is the policy, plan or proposal located near an existing transport node and, if so, does this require upgrading to ensure that it can meet the needs of the future population?	No upgrade required
TC2: Reduce car dependency and encourage active transport		
TC2.1	Is a stated goal of the policy, plan or proposal to reduce car dependency and car use and encourage more active forms of transport?	Work Place Travel Plan is proposed
TC2.2	Does the policy, plan or proposal propose measures to encourage walking and cycling such as vehicle speed limits, restrictions on vehicle access, parking requirements etc.?	Yes
TC2.3	Does the policy, plan or proposal encourage car pooling or car sharing, including through designated parking spaces for car share programs?	This could be applied
TC2.4	Does the policy, plan or proposal include incentives to encourage bicycle use such as ‘park and bike’ measures, shared bicycle schemes etc.?	NA
TC2.5	Does the policy, plan or proposal encourage the reduction of car parking spaces in urban areas (particularly where there is good public transport available) including the reallocation of car parking spaces for bicycle parking and cycling routes?	Future car parking demand has been modelled with an increased public transport mode share.

Code	Question	Response
TC2.6	Does the plan, policy or proposal provide a well connected street pattern?	Yes with new connections for vehicles, cyclist and pedestrians.
TC2.7	Are there particular features that present potential safety hazards, such as busy roadways separating schools from residential areas, level crossings of rail lines etc.?	New pedestrian crossing facilities will be incorporated into the design of the facility.
TC2.8	Are there areas with both high pedestrian and bicycle activity, and high vehicle traffic that could benefit from additional safety measures?	Cycling within the campus will occur on local roads where vehicle speeds are low. Pedestrian crossings will be installed on key desire lines.
TC2.9	Do trees border streets where walking and cycling is desired (as a means for improving amenity and helping to reduce traffic speeds)?	A landscape plan has been developed for the site.
TC2.10	Are walking and cycling entrances to buildings prioritised and safe (avoiding conflict with cars)?	Yes
TC2.11	Are walking and cycling routes through parking areas clearly marked and safe (avoiding conflict with cars)? Is bicycle parking prioritised?	Yes
TC2.12	Where traffic 'squeeze points' are introduced (to slow traffic speeds and provide safer pedestrian crossings) are there provisions for cyclists to pass through unobstructed?	Cyclists will travel with the traffic on slow roads.
TC2.13	Are pedestrian areas (such as public plazas, squares, pathways, trails, shopping areas, etc.) designed to be universally accessible?	Yes
TC3: Encourage infill development and/or integration of new development with existing development		
TC3.1	Does the policy, plan or proposal encourage the integration of new development with existing development and key destinations?	Yes
TC3.2	Does the street network (including bicycle and walking pathways) build from and add new connections to an existing street network?	New connections are proposed to the external road network at Blacktown to improve permeability.
TC3.3	Are block sizes conducive to walking and cycling, and do they integrate with existing blocks?	NA

Commentary

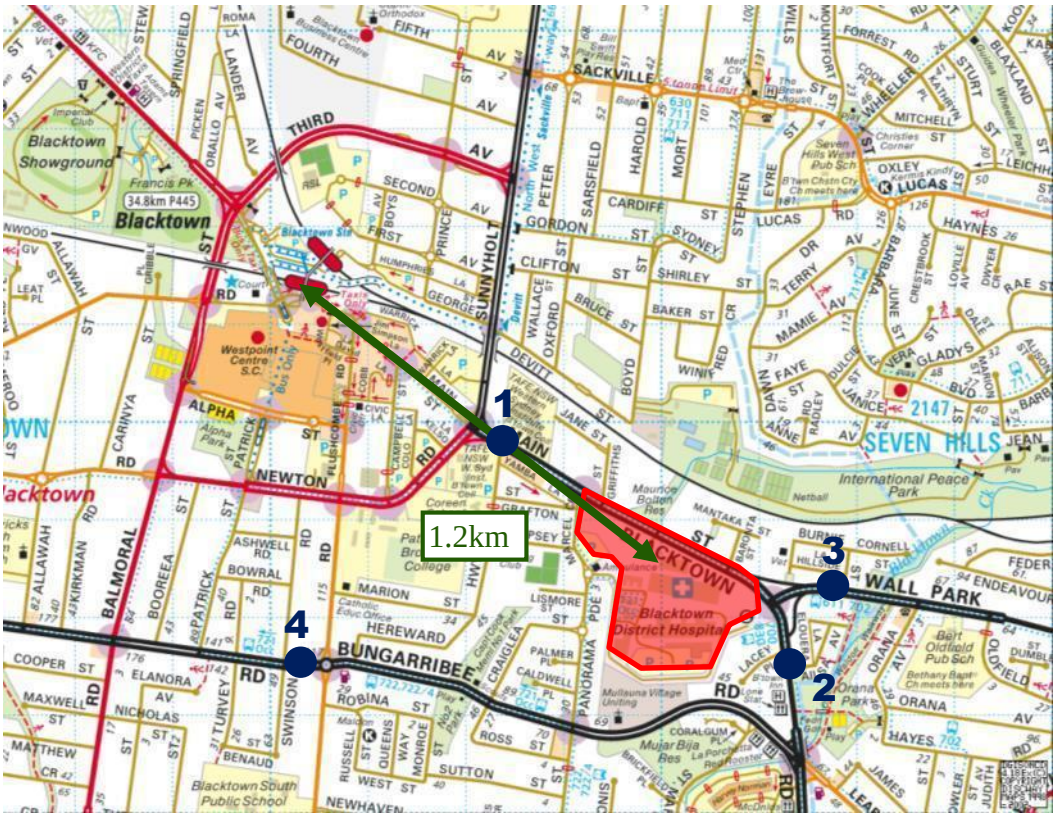
The Blacktown Hospital redevelopment is generally consistent with the transport and physical connectivity questions in the *Healthy Urban Development Checklist 2010*.

3 Existing Conditions

3.1 Site Location

The hospital campus is approximately 1.2km from Blacktown Railway Station and the Blacktown city centre as shown in Figure 1.

Figure 1 Site location



3.2 Road network configuration and traffic conditions

The Blacktown Hospital site is generally bounded by Blacktown Road to the north and Bungarribee Road to the south, both RTA State Roads carrying main road traffic flows. The primary access to the hospital is from Panorama Parade - Marcel Crescent which is part of the local street system under the control of Blacktown Council. Traffic signal control at the local street interface with the main arterial roads provides for hospital traffic access. At the Panorama Parade hospital access road a single lane roundabout provides control as shown in Figure 2.

Figure 2 Existing access arrangements and intersection control

Blacktown Road is configured with two through traffic lanes in each direction and additional turning lanes at intersections. It is heavily trafficked with significant peak hour traffic flows. A main access roadway occurred onto the site from Blacktown Road prior to construction of the main hospital building, which is now a service access driveway which operates as a priority intersection due to the low usage. A new left turn in / left turn out intersection is being constructed as part of Stage 1 onto Blacktown Road opposite Baronta Street which will provide a through site traffic link for improved access.

Panorama Parade is a local street configured with a single traffic lane in each direction and parking permitted generally on both sides of the road. A number of traffic calming devices are located along Panorama Parade to control vehicle speeds. This route is used by non-local traffic connecting between Bungarribee Road and Blacktown Road and connects further south on Lock Street which feeds a large residential precinct. Recent traffic surveys show a daily two way traffic flow of 4,500 vehicles which is in excess of local street traffic volumes usually up to 3,000 vpd. This indicates Panorama Parade is operating as a high order local street closer to a collector road function.

A local service access driveway is located on Blacktown Road as shown in Figure 3 which is configured for all movements with a right turn bay in the central median and a short right turn storage area for vehicles re-entering Blacktown Road to travel east. This arrangement is suitable for the low turnover of the loading docks which occurs throughout the day and does not necessarily impact on the traffic peak hours.

Figure 3 Service road access on Blacktown Road and Ambulance Station

3.3 Ambulance station

A purpose built Ambulance Station which is about thirty years of age is located adjacent to the main access road from Panorama Parade as shown in Figure 3. It currently accommodates appliances and staff for the region. A new facility is being constructed on Bungarribee Road next to St Martins Crescent which will enable this building to be decommissioned.

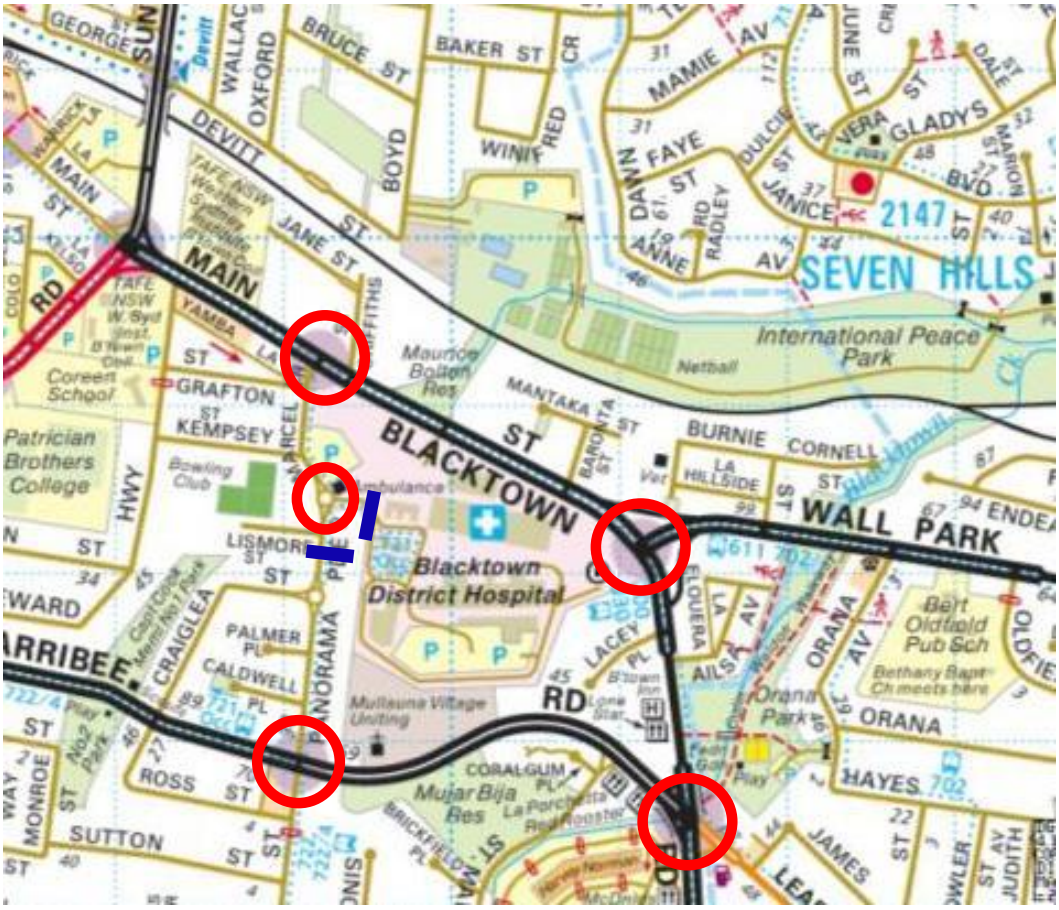
3.4 Traffic flow data

3.4.1 External road system

Traffic surveys were undertaken on Tuesday 15 September, 2015 in the AM (7.30am-9.30am) and PM (4.30pm-6.30pm) peak periods at the locations shown in Figure 4. Light and heavy vehicle classification data was collected. Vehicle turning counts occurred at the following intersections:

- Blacktown Road / Marcell Crescent – traffic signals
- Blacktown Road / Wall Park Avenue – traffic signals
- Blacktown Road / Bungaribee Road / Leabons Lane – traffic signals
- Bungarribee Road / Panorama Parade – traffic signals
- Panorama Parade / Marcel Cres / hospital access - roundabout

Figure 4 Traffic Survey Locations



The vehicle turning count data is included in Appendix A.

The peak hour approach and departure flows for each intersection are shown in Figure 5 and Figure 6.

Figure 5 Morning peak traffic flows (8.00-9.00am)

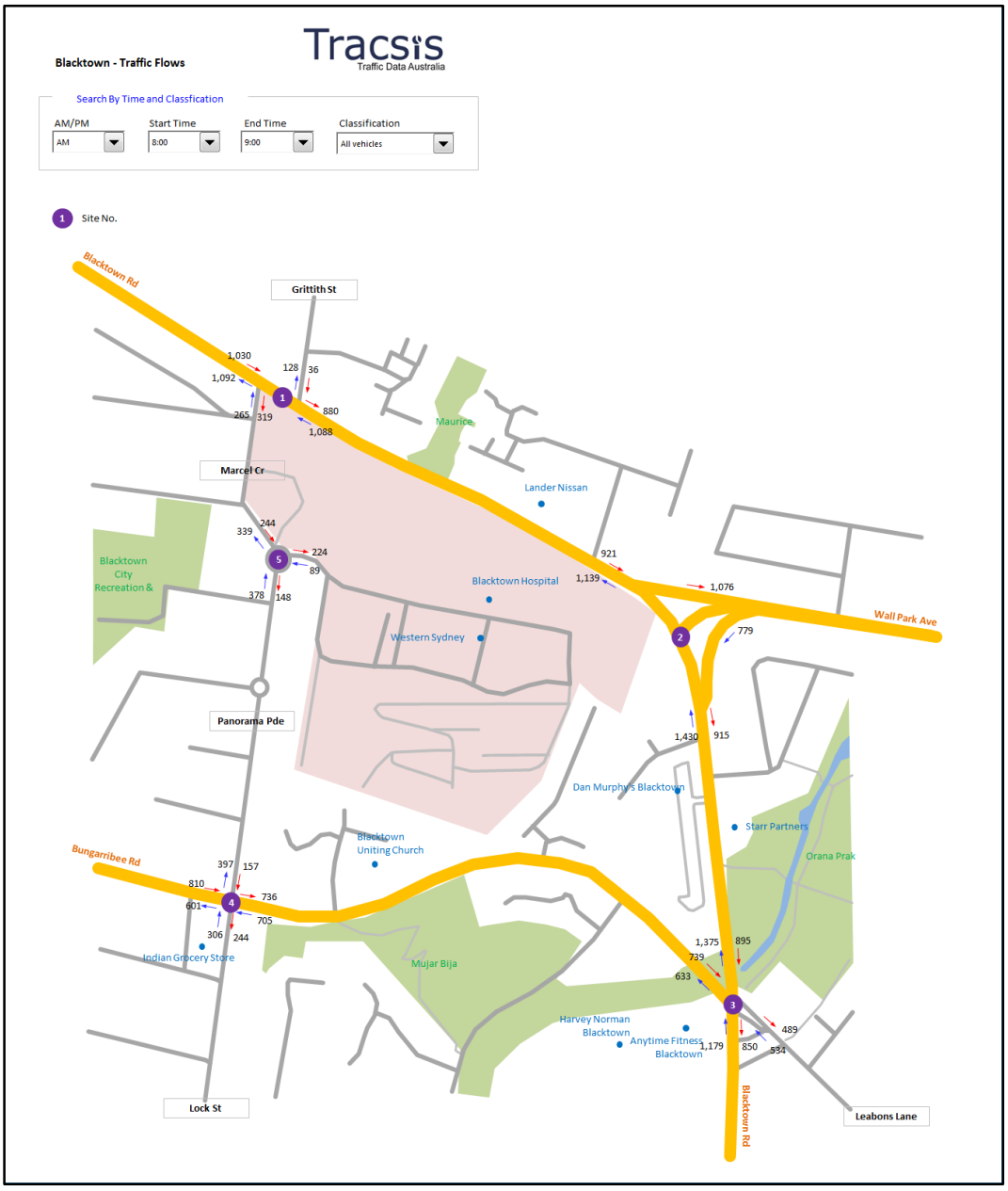
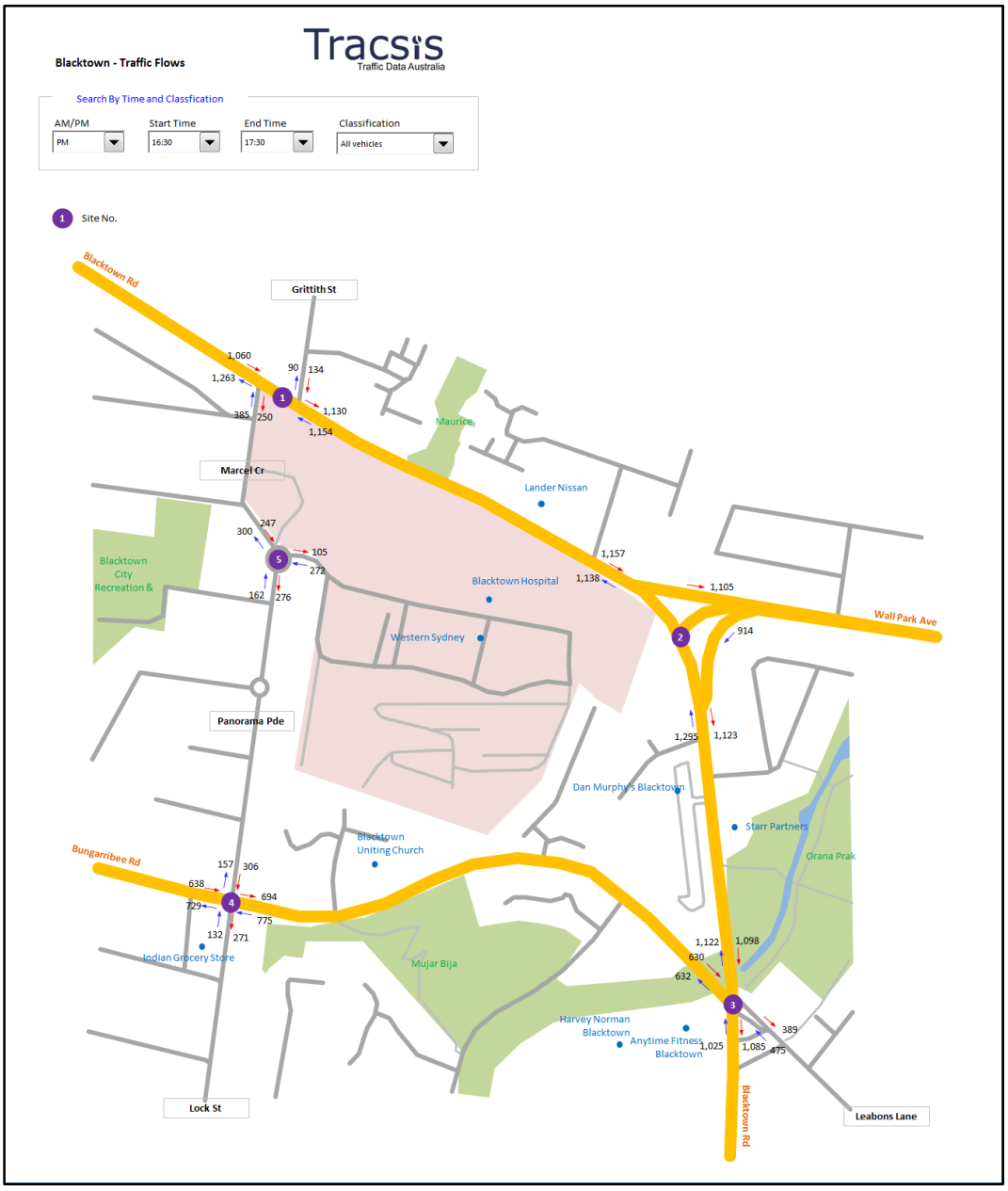


Figure 6 Afternoon peak traffic flows (4.30-5.30pm)



A comparison of the 2015 data with the 2010 data is shown in Table 4. Traffic has reduced on Blacktown Road at both the Marcell Crescent and Wall Park Avenue intersections is both peak periods. Generally there has been a decrease in traffic on the main road network and no change on the local street network.

Table 4 Comparison of 2010 and 2015 traffic at each intersection

Intersection	October 2010	September 2015
Total traffic entry volume AM Peak (8.00-9.00)		
Blacktown Road / Marcell Crescent	2,683	2,419
Blacktown Road / Wall Park Avenue	3,380	3,130
Blacktown Road / Bungaribee Road / Leabons Lane	-	3,347
Bungarribee Road / Panorama Parade	1,963	1,978
Panorama Parade / Marcel Cres / hospital access	729	711
Total traffic entry volume PM Peak (4.30-5.30)		
Blacktown Road / Marcell Crescent	3,032	2,419
Blacktown Road / Wall Park Avenue	3,943	3,366
Blacktown Road / Bungaribee Road / Leabons Lane	-	3,219
Bungarribee Road / Panorama Parade	1,953	1,851
Panorama Parade / Marcel Cres / hospital access	668	681

3.4.2 Hospital Entrance

Seven day classified tube count data was collected on Panorama Parade and on the Hospital Entrance Road in 2010. These were not updated in 2015, however peak hour counts were taken at the Panorama Parade / Marcel Cres / hospital access intersection which enables a comparison to be made between years. Table 5 shows that there has been very little change in the level of activity at the hospital during the Stage 1 construction works between 2010 and 2015.

Table 5 Comparison of 2010 and 2015 hospital main entrance traffic

Road Peak	2010			2015		
	In	Out	Total	In	Out	Total
AM Peak (8.00-9.00am)	279	70	349	224	89	313
PM Peak (4.30-5.30pm)	118	254	372	105	272	377

The 2010 weekly tube count data is plotted below in Figure 7 and Figure 8 to represent the typical daily profile of activity. The Hospital Entry Road carries up to 200 vehicles per hour each way with peak entry at 7-8am and again at 1-2pm which coincides with staff shift times and peak exit is at 4-5pm. Daily traffic flow is approximately 4,000 vehicles two-way. Panorama Parade has a pronounced northbound flow in the morning up to 300 vehicles per hour. It has a daily two-way traffic flow of 4,500 vehicles.

Figure 7 Hospital Entry Road

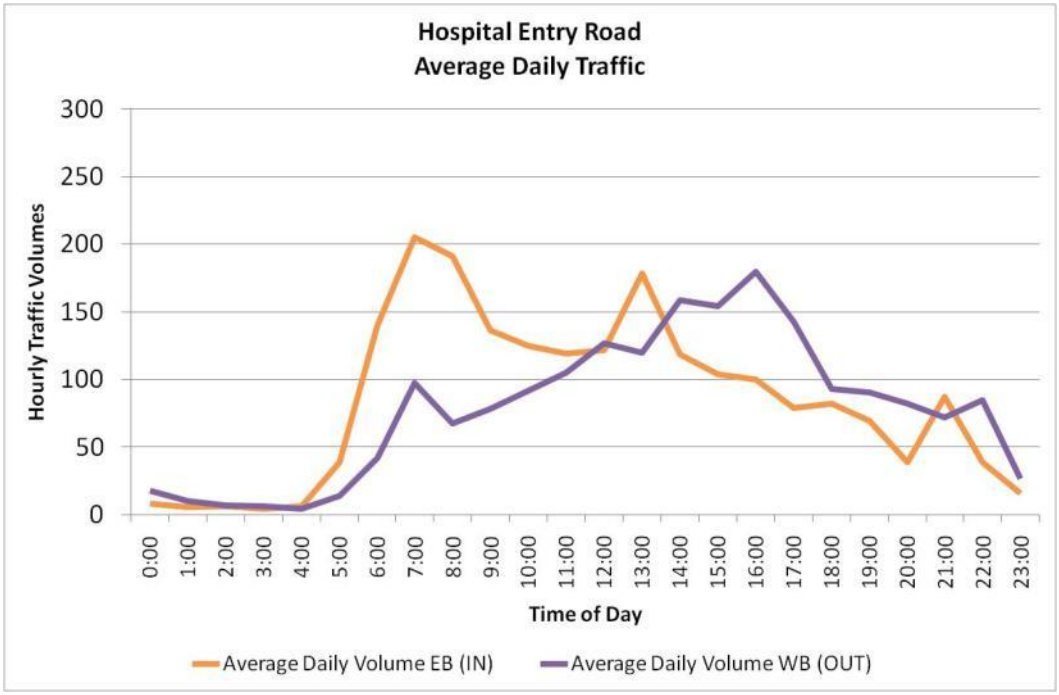
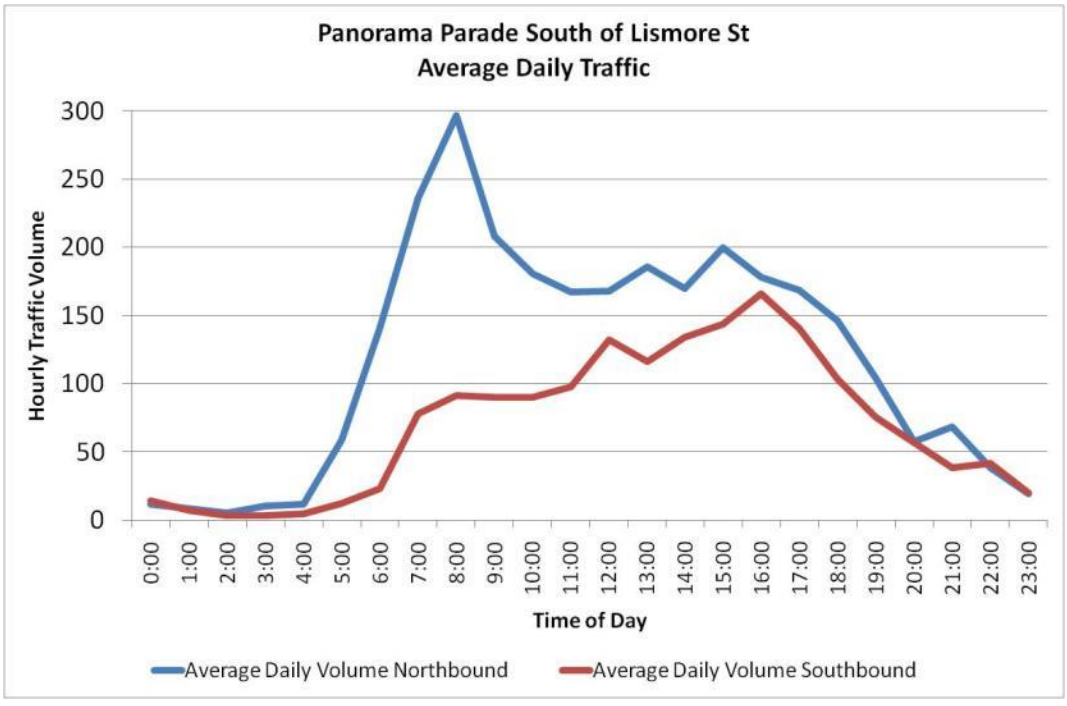


Figure 8 Panorama Parade south of Lismore Street



3.5 Intersection operations

For the purposes of this investigation, an individual intersection traffic control model, SIDRA, has been used to assess the performance of the surrounding road network.

The existing intersection performance is assessed in this report in terms of the following four factors for each intersection.

- Degree of Saturation
- Average Delay (seconds per vehicle)
- Level of Service
- Length and direction of peak traffic queue (95th percentile traffic queue)

In urban areas, the performance of the major road network is generally a function of the performance of key intersections. This performance is quantified in terms of Level of Service (LOS), which is an index of the operational performance of traffic at an intersection and is based on the average delay per vehicle. LOS ranges from A = very good to F = highly congested travel conditions, as shown in Table 6.

Table 6 Level of Service Definitions

Description	Level of Service (RTA Definition)	Average Delay per Vehicle (s)
Very Good	A	< 14.5
Good	B	14.5 ≤ 28.5
Satisfactory	C	28.5 ≤ 42.5
Near Capacity	D	42.5 ≤ 56.5
At Capacity	E	56.5 ≤ 70.5
Over Capacity	F	≥ 70.5

Generally it is desirable to aim at achieving a Level of Service of C or better at all major road intersections. However, in practice, it is reasonable for some intersections to operate at Level of Service D at peak times. Another common measure of intersection performance is the degree of saturation (DOS), which provides an overall measure of the capability of the intersection to accommodate additional traffic. A DOS of 1.0 indicates that an intersection is operating at capacity. The desirable maximum degree of saturation for an intersection with traffic signals is 0.9.

The performance of the five key intersections is shown in Table 7 for the AM Peak and Table 8 for the PM Peak. The Wall Park Ave and Blacktown Road intersection is operating at LOS C in the morning peak and LOS B in the afternoon peak. The Blacktown Road, Bungaribee Road and Leabons Lane intersection is operating at LOS D in both peak periods. The Blacktown Road, Marcel Crescent and Griffiths Street intersection is operating at LOS B with a DOS of around 0.8 if Griffiths Street is not included. When Griffiths Street is include the reported operation deteriorates due to the delay for the right turn movement from Griffiths Street which is not signalised. The two Panorama Parade intersections operate satisfactorily.

Table 7 AM Peak Existing Intersection Performance

Intersection AM Peak	Degree of Saturation	Average Delay (seconds)	Worst Movement (in terms of delay)	Level of Service
Blacktown Rd, Marcel Cres and Griffiths St	0.80	13	Right turn from Griffiths St	B
Wall Park Ave and Blacktown Rd	0.90	29	Right turn form Wall Park Avenue	C
Blacktown Road, Bungaribee Road and Leabons Lane	0.96	52	Right turn from Blacktown Rd N	D
Panorama Pde and Hospital Access Rd	0.32	10	U-turn from Marcel Cres	A
Bungarribee Rd and Panorama Pde	0.76	21	Left turn from Lock Street	B

Table 8 PM Peak Existing Intersection Performance

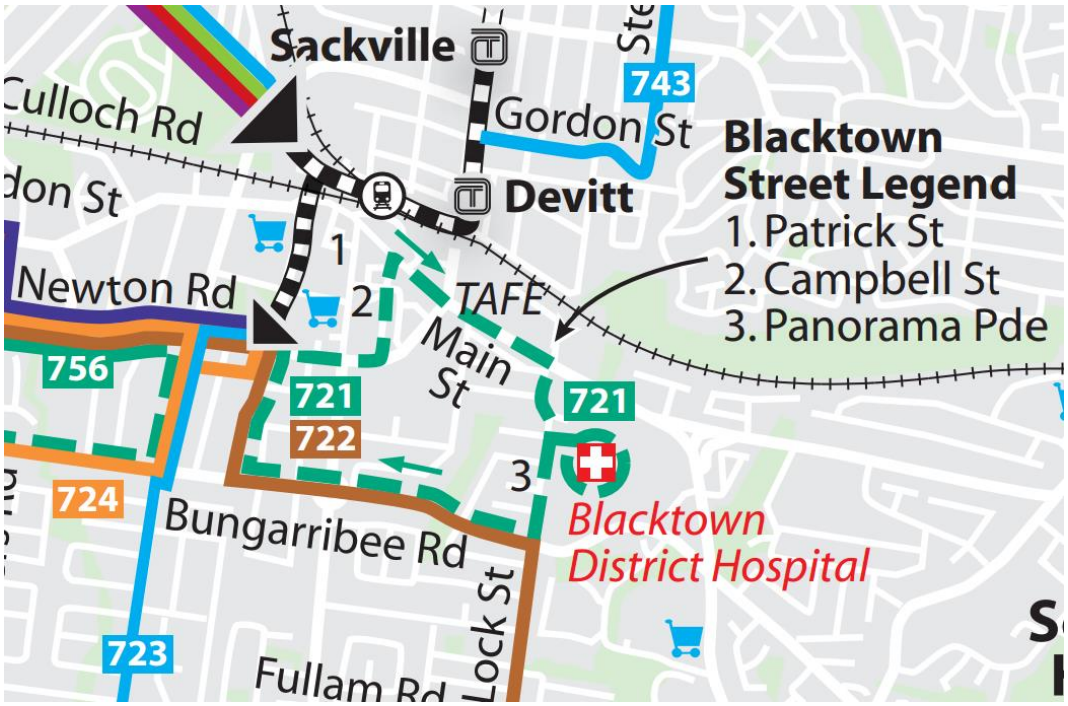
Intersection PM Peak	Degree of Saturation	Average Delay (seconds)	Worst Movement (in terms of delay)	Level of Service
Blacktown Rd, Marcel Cres and Griffiths St	1.01	16	Right turn from Griffiths St	B
Wall Park Ave and Blacktown Rd	0.88	22	Right turn from Wall Park Avenue	B
Blacktown Road, Bungaribee Road and Leabons Lane	0.94	43	Right turn from Bungarribee Road	D
Panorama Pde and Hospital Access Rd	0.26	10	U-turn from hospital	A
Bungarribee Rd and Panorama Pde	0.65	20	Right turn from Bungarribee Road	B

3.6 Public transport availability

The hospital is approximately 1.2km from Blacktown Railway Station which is outside the normal walk distance and hence staff and visitors rely on bus connections. Figure 9 shows the bus network map for the private bus company Busways that services the Blacktown area.

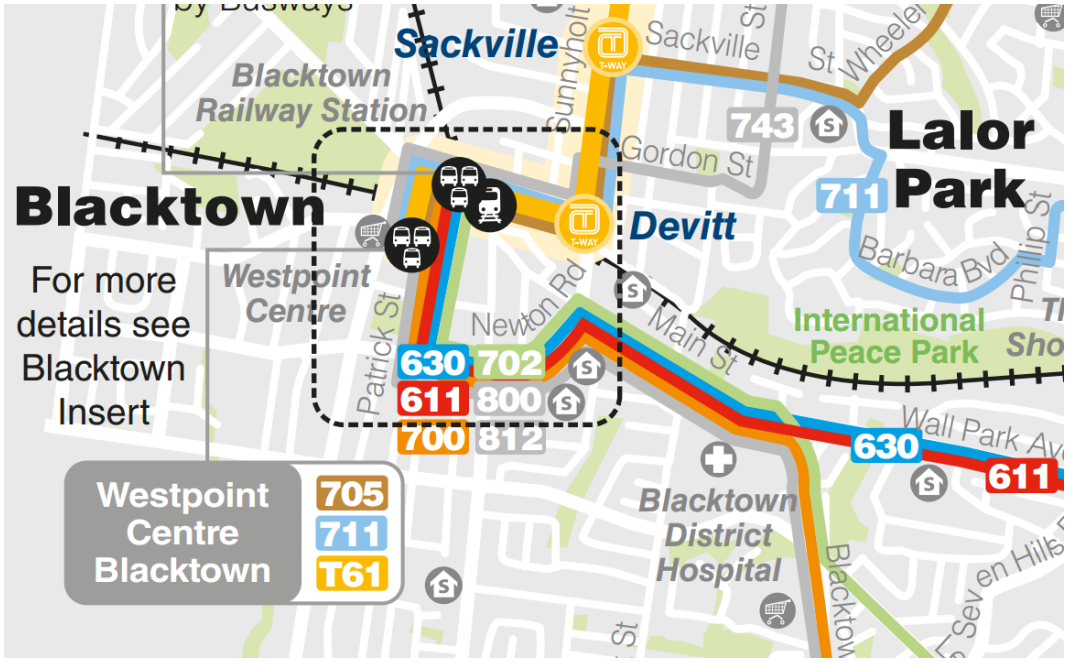
Busways operates a hospital service Route 721 which operates 8 services on weekdays between 8.56am and 5.34 pm between Blacktown Station and the hospital. Three of the 722 services are diverted in the mornings between 6.42 and 7.35am to provide access to the hospital. A similar number of services operate on weekend days.

Figure 9 Busways 721 map



Hillsbus operate regular services along Blacktown Road which provide access to the hospital including Routes 630, 611, 700, 702, and 812 as shown in Figure 10.

Figure 10 Hillsbus bus network map



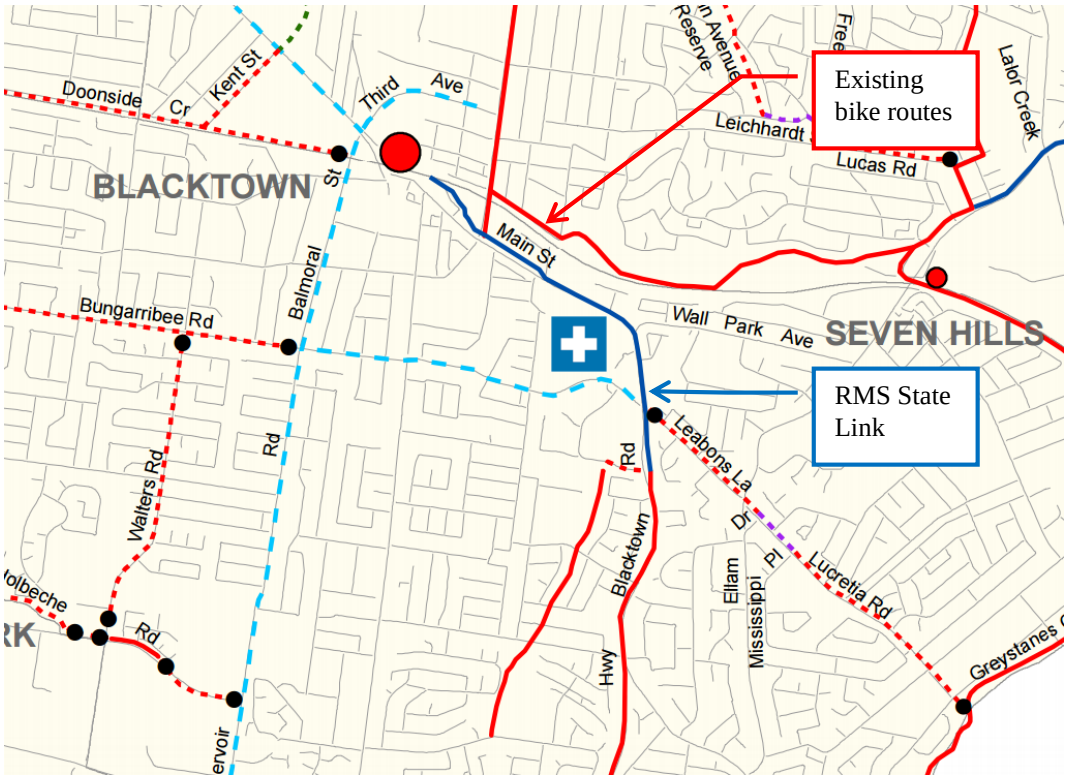
3.7 Pedestrian and cycle facilities and conditions

An existing off-road bicycle facility provides connection between Blacktown Railway Station and Seven Hills Railway Station running along International Peace Park to the north of the railway line as shown on Figure 11. Unfortunately there are no pedestrian or bicycle connections across the railway between these two stations.

The RMS State bicycle link runs along Blacktown Road which has recently been completed as a shared path facility. This provides a direct connection between the hospital and the city centre as well as linking to other local routes.

Footpaths generally occur on both sides of all roads in the vicinity of the hospital. The Marcel Road/ Blacktown Road traffic signal controlled intersection has pedestrian crossings on all legs. The intersection of Blacktown Road and Wall Park Road is controlled by traffic signals but there are no pedestrian crossing facilities which means that access from the east to the hospital is poor.

Figure 11 Blacktown City Council Bike Plan

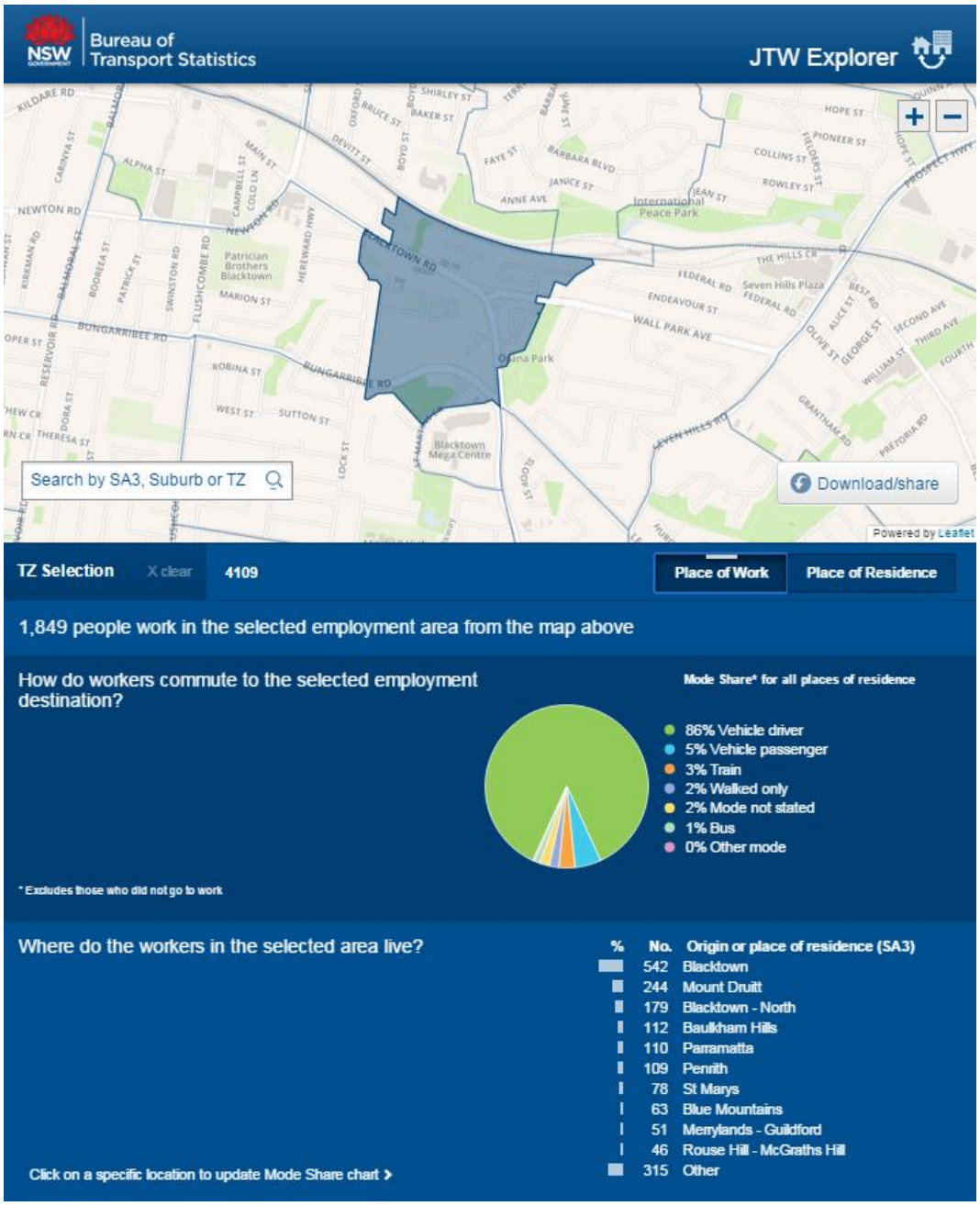


3.8 Travel Patterns

3.8.1 Mode split

The existing 2011 ABS Journey to Work data for the travel zone 4109 including Blacktown Hospital (see Figure 12) has been analysed for this study.

Figure 12 Travel Zone Including Blacktown Hospital



Source: Bureau of Transport Statistics (2011)

The mode split of workers travelling to this precinct is indicated in Table 9.

Table 9 Journey to Work Existing Mode Split

Mode	Total Trips	Proportion of Total Trips (%)
Car as driver	1362	86%
Car as passenger	82	5%
Train	50	3%
Bus	19	1%
Other mode	4	0%
Walked only	30	2%
Not Stated	30	2%
TOTAL	1849	100%

The analysis indicates that 91% of people travel by car to work in this precinct. Public transport currently accounts for only 4% of work related trips and walking 2%.

3.8.2 Home location of workers

The home location of all workers travelling to this travel zone, based on 2011 Journey to Work data, is presented in Table 10. Just over 50% of all workers in this travel zone live in Blacktown/Mount Druitt. This indicates that walk, cycle and bus modes could be viable travel options for many workers at Blacktown Hospital. In addition, train is a viable travel option for many of the high ranking home locations.

Table 10 Home LGA of Workers

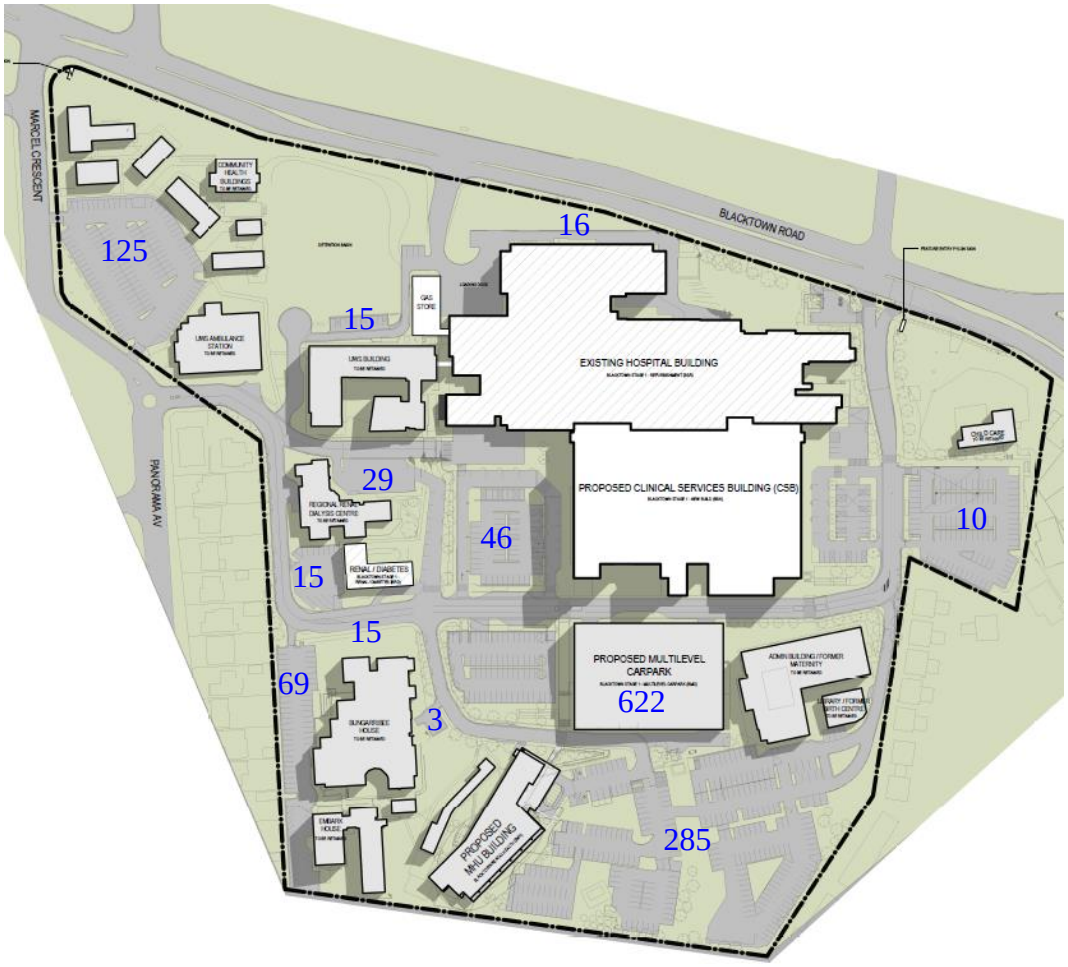
Home LGA	Total Trips	Proportion of Total Trips
Blacktown	542	29%
Mount Druitt	244	13%
Blacktown North	179	10%
Baulkham Hills	112	6%
Parramatta	110	6%
Penrith	109	6%
St Marys	78	4%
Blue Mountains	63	3%
Merrylands/Guidlford	51	3%
Rouse Hill	46	2%
Other	315	17%
Total	1,849	100%

3.9 On and off-site parking arrangements

Car parking is currently spread across the site in at-grade car parks and in the recently constructed multi-storey car park. A breakdown of hospital parking currently available during construction of Stage 1 is provided in Figure 13. There are approximately 628 at-grade spaces and 622 spaces in the multi-storey car park providing a total of 1,250 car parking spaces across the campus which adequately services current demand. All parking on the site is controlled by swipe access control for staff or pay control for visitors. The mid-level car park has an area that is sectioned off at 7am so that it is available for the afternoon shift arrivals from 12pm onwards for about 50 staff cars.

On-street car parking is limited in the vicinity of the site with time limits on parking in Kempsey Street although Panorama Parade, Marcel Crescent and connecting streets to the west have unlimited parking. On-street parking is available for some 200 vehicles within 400m of the site.

Figure 13 Existing Car Parking during construction of Stage 1



3.10 On and off-site parking utilisation

The current demand for staff and visitor car parking at the Blacktown Campus is approximately 1,000 cars. In addition there are about 200 construction workers cars parking in the multi-storey car park. The 1,250 car parking spaces available on the site can cater for this demand, however some 150-200 staff and visitors choose to park on street where parking is free.

4 Proposed Development

4.1 Future levels of activity

The existing and future Stages 1 and 2 staffing, patient and visitor levels of activity have been determined as shown in Table 11. The Stage 2 numbers are indicative at this stage and used to assess a likely level of car parking and traffic demand for an indicative building envelope.

Table 11 Staff, Patient and Visitor Activity

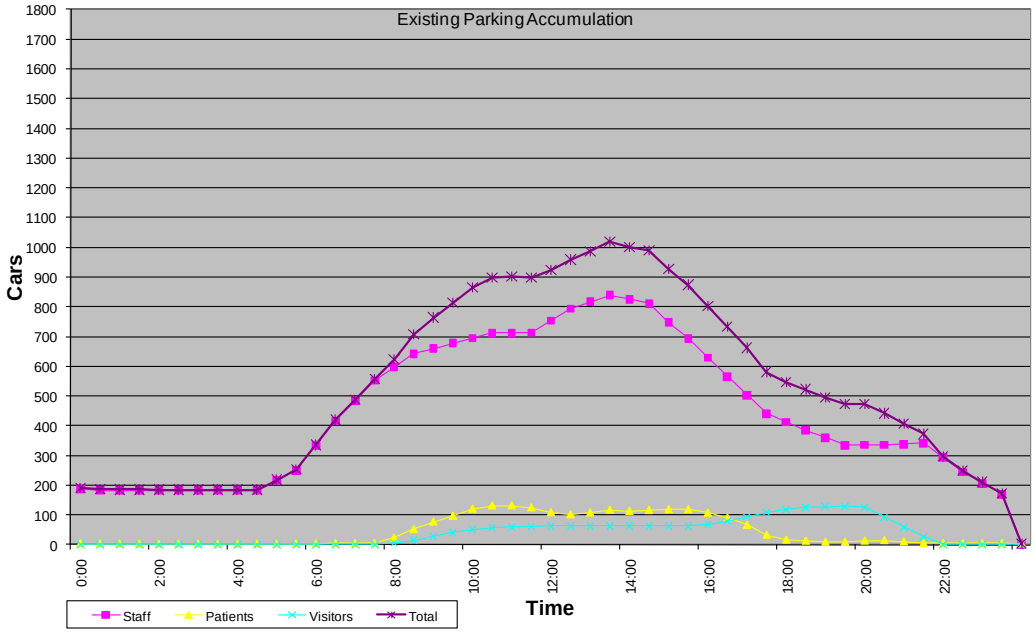
	Existing	**Stage 1 Proposed**	**Stage 2 Indicative Proposal**
1. Staff Attendance	staff/weekday	staff/weekday	staff/weekday
Nurses	796	1137	1295
Clerical/Misc	129	184	210
Ancillary Medicine/Community	285	407	464
Hotel/Allied	23	33	37
Medical - Sessional	121	173	197
TOTAL daily attendance	1354	1934	2203
2. Staff Vehicle Trip Characteristics			
Mode Split			
700-1100 (Day)	93%	88%	83%
1130-630 (Night)	98%	98%	98%
Car Occupancy			
700-1100 (Day)	1.18	1.25	1.25
1130-630 (Night)	1.05	1.05	1.05
3. Visitor/Patient Attendance			
Patients	people/p.a.	people/p.a.	people/p.a.
Outpatients	180000	380000	640000
Inpatients	25000	39329	41692
Casualty	36000	44526	60632
Day only surgery	16000	48000	80000
Renal Dialysis	7000	7000	7000
Community Health	47000	47000	47000
Cancer Centre	-	22579	22579
Beds	328	516	547
Assumed occupancy rate	0.85	0.85	0.85
4. Visitor/Patient Vehicle Trip Characteristics			
Mode Split (%)	80%	80%	80%
Vehicle Occupancy	1.65	1.65	1.65
Visitor Car Bed Trips / Day	2.00	2.00	2.00

4.2 Car Parking

4.2.1 Base car parking demand model

A traffic and parking model has been developed based on estimated daily staff, patient and visitor activity on the campus. The base model was developed using existing levels of activity prior to commencement of Stage 1 construction works which results in a peak parking accumulation of 1018 at 2.30pm. This correlates well with the on-site and on-street parking survey undertaken at that time in December 2010 which indicated just over 1000 cars parked associated with the hospital. The modelled parking demand is shown graphically for existing conditions in Figure 14. The modelling is based on a 93% mode split to car with a car occupancy of 1.18 by staff and 80% for patients and visitors with a car occupancy of 1.65. Staff car mode at night is 98% with 1.05 car occupancy.

Figure 14 Existing Parking Accumulation from Model



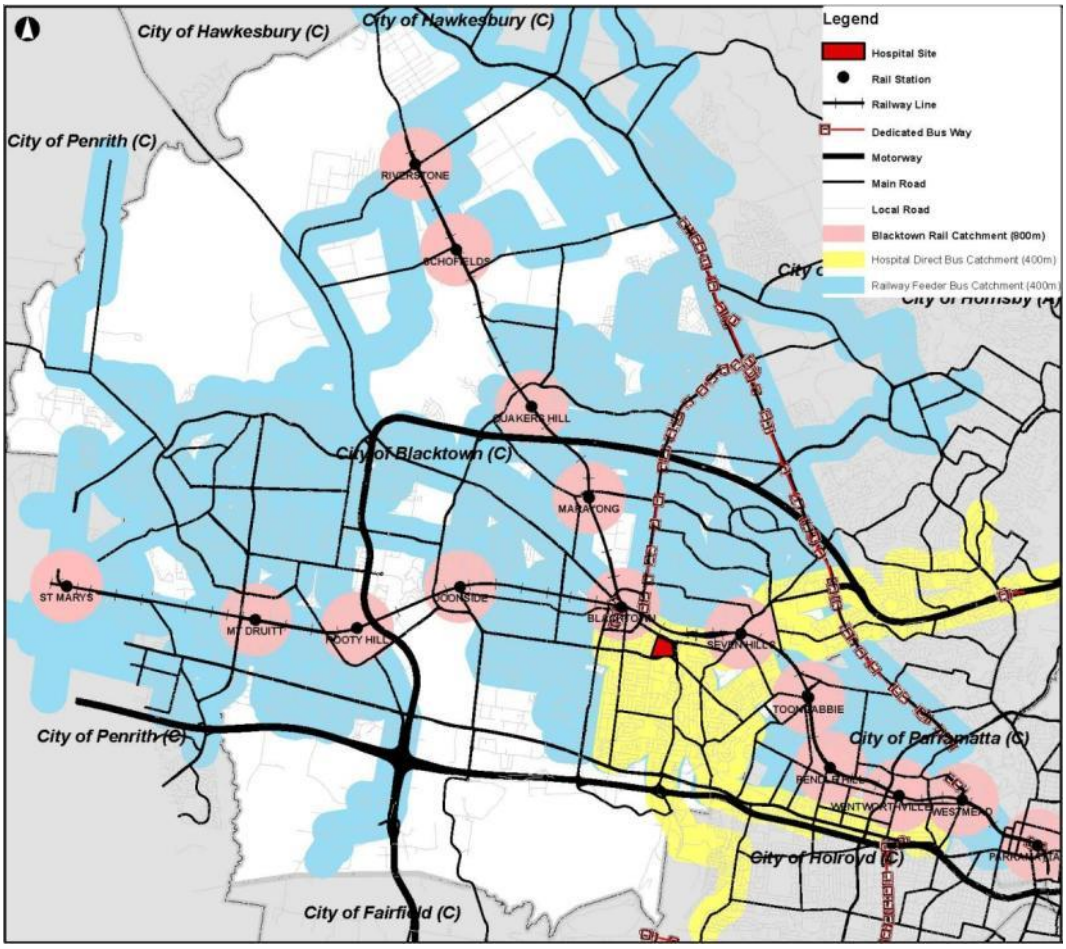
4.2.2 Non-car modes of travel for staff

For the future Stage 1 and Stage 2 development, the mode of travel and car occupancy assumptions for staff have been adjusted to reflect the Workplace Travel Plan initiatives that will be implemented (See Section 6). Car mode has been reduced to 88% with a car occupancy of 1.25 in Stage 1 and to 83% with a car occupancy of 1.25 in Stage 2. Night staff and visitor and patient travel characteristics have not been changed for the future modelling.

Based on 2011 Journey to work data as described in Section 3.8.2, the current home location of workers in the travel zone which represents Blacktown Hospital indicates that just over 50% of all workers live in the Blacktown/ Mount Druitt area. This indicates that walk, cycle and bus modes could be viable travel options for many workers at Blacktown Hospital. In addition, train is a viable travel option for many of the high ranking home locations. Figure 15 shows the public transport availability within the Blacktown LGA indicating railway station

catchments, direct bus routes passing the site and feeder bus routes to the railway stations.

Figure 15 Public Transport in Blacktown LGA



Based on the travel characteristics adopted for the travel model, the number of trips made by non-car modes can be determined. The potential future mode split of workers travelling to this precinct for day shifts is indicated in Table 12. There are good public transport services to provide for this potential increase in activity.

Table 12 Journey to Work Future Mode Split Assumptions for Daytime Staff

Mode	**Stage 1**		**Stage 2**	
	Trips	(%)	Trips	(%)
Car (driver & passenger)	1332	88%	1431	83%
Train	61	4%	103	6%
Bus	45	3%	69	4%
Taxi	8	0.5%	9	0.5%
Motorbike	8	0.5%	9	0.5%
Bicycle	15	1%	35	2%
Walked only	45	3%	69	4%
TOTAL	**1514**	**100%**	**1724**	**100%**

4.2.3 Future car parking demand

Based on future levels of activity predicted for the campus, a peak parking demand of 1469 is predicted for Stage 1 and 1737 for Stages 1 and 2 in the afternoon peak period at 2.30pm. The modelled parking demand is shown graphically for Stage 1 in Figure 16 and Stages 1 and 2 in Figure 17.

Figure 16 Stage 1 Parking Accumulation from Model

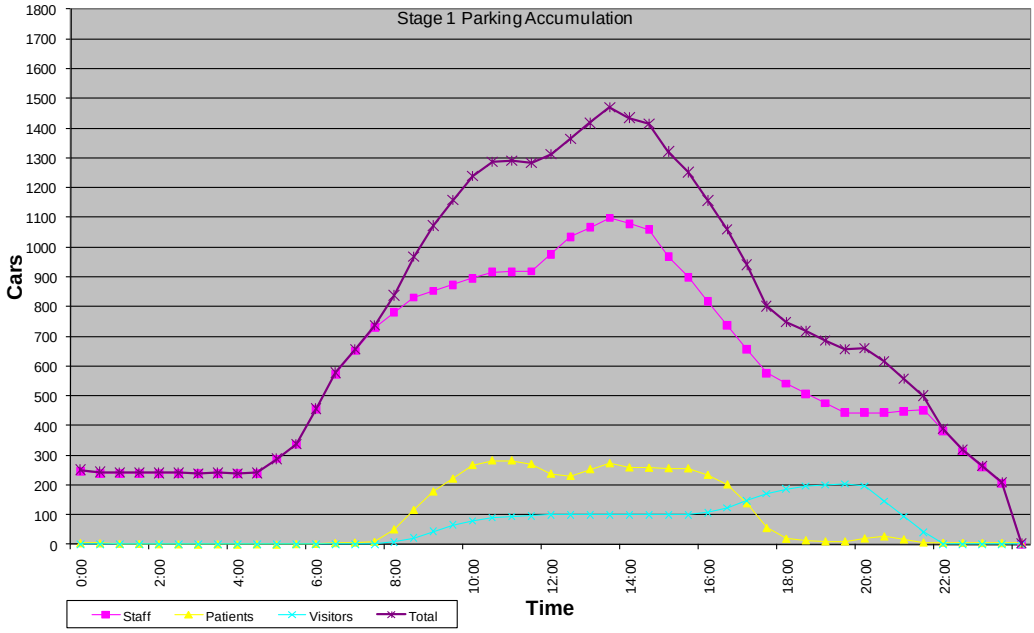
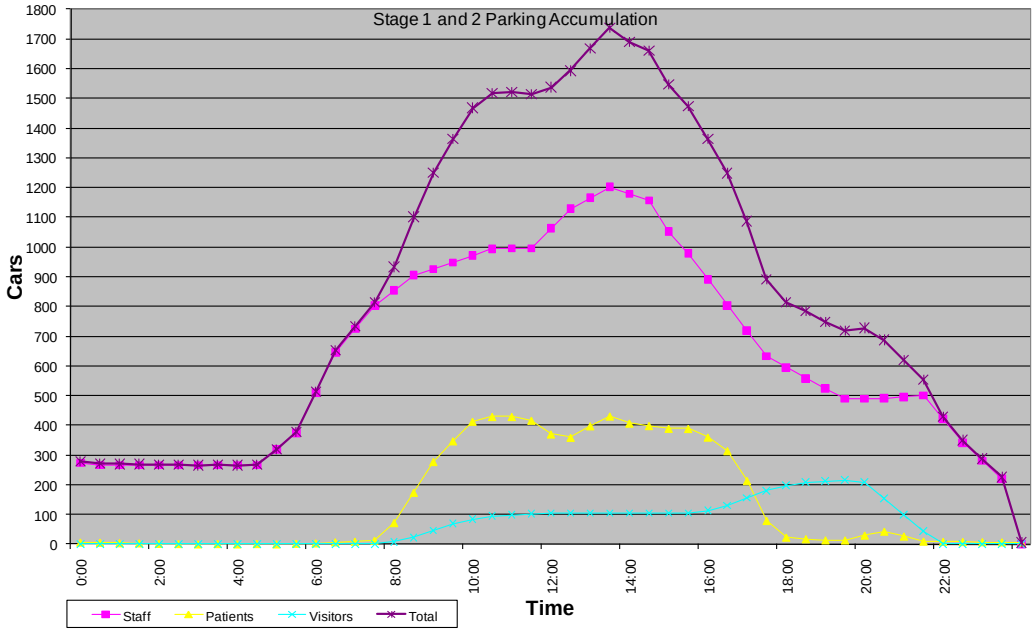


Figure 17 Stage 1 and 2 Parking Accumulation from Model



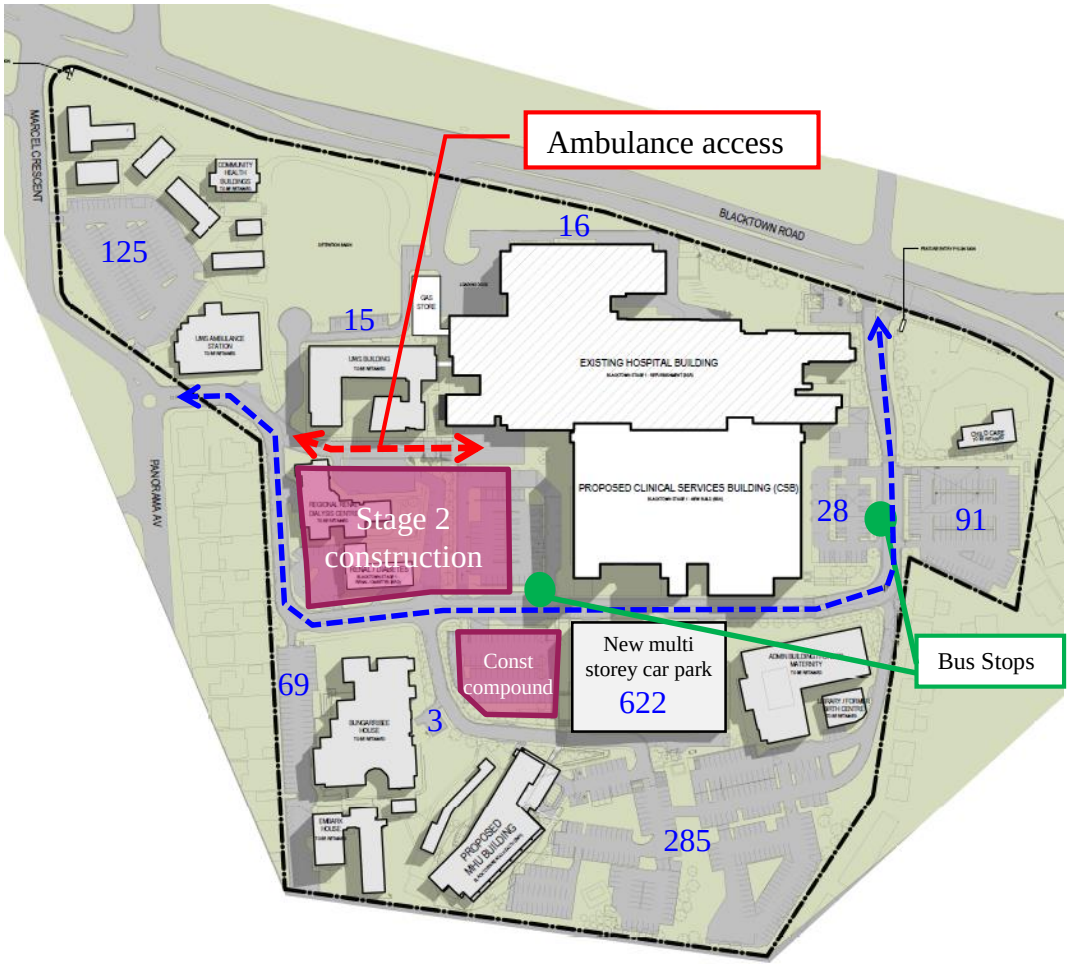
4.2.4 Future car parking provision and access

The floor plans and access arrangement that will be in place when Stage 1 opens are shown in Figure 18. The new access to Blacktown Road in conjunction with the existing Panorama Parade access provides a good level of access and services both sides of the campus improving internal circulation to car parks and drop-off areas. Ambulance access will remain from Panorama Parade.

Various works on the hospital site have recently been authorised under SEPP Infrastructure as 'Development Without Consent'. The modification to the eastern half of the P7 car park has resulted in the loss of 26 spaces. A further 40 spaces have been decommissioned from the existing Bungarribee House, RRDC and Oncology car parks. No further parking loss is proposed as part of the Stage 2 Enabling Works Package, however the redundant spaces within the development site will be physically removed as part of the proposed works.

Based on the above, there are currently 1,184 parking spaces available across the campus. This includes approximately 562 at-grade car parking spaces, and a new multi-storey car park providing an additional 622 spaces.

Figure 18 Blacktown Hospital Stage 1 showing new car parks

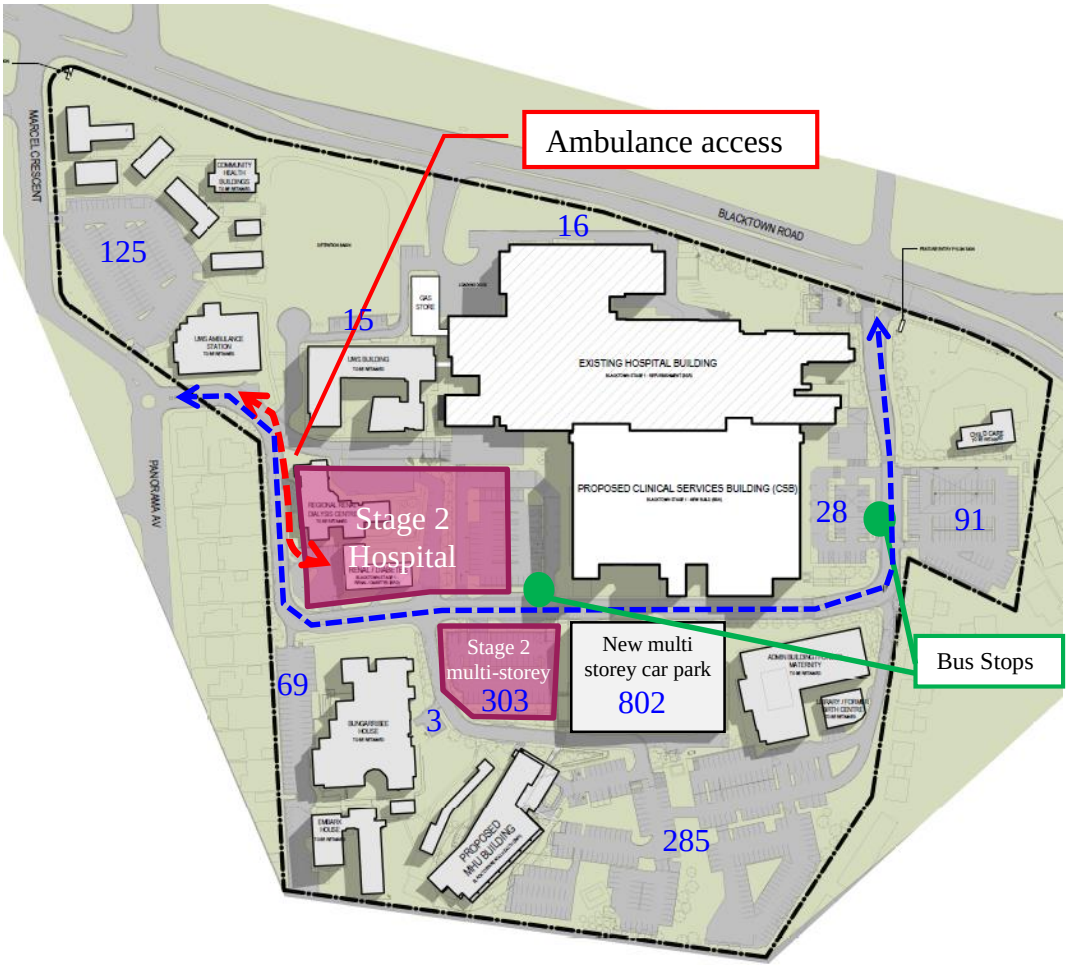


A number of new car parking locations are opened in Stage 1 as shown on Figure 18 take the total future provision in Stage 1 to 1,254 spaces on the site. The modelling indicates the need for a total of 1,469 spaces and hence supply will be 205 spaces short during construction of Stage 2. To accommodate this shortfall,

the first stage of extension of the multi-storey car park will be undertaken which involves two additional levels on the existing car park. This will add approximately 180 spaces and be the subject of a separate planning application. These spaces will be needed as activity at the campus associated with Stage 1 occupation builds up over a number of years.

For the Stage 2 redevelopment, current planning indicates the potential demand for up to 1,737 spaces. The expansion of the multi-deck car park to the west of the existing car park will be adjusted in Stage 2 to meet the demand forecasts at the time of that project application. A possible car parking provision is shown in Figure 19, with 303 spaces in the Stage 2 multi-storey car park predicted to meet demand. The further car park expansion is likely to be the subject of a separate planning application.

Figure 19 Blacktown Hospital Stage 2 showing potential car parks



4.2.5 Car Parking Summary

The current parking demand on the site for existing operations is approximately 1,018 cars. Construction of the multi-storey car park allowed the Stage 1 hospital site to be cleared of at-grade car parking. During the Stage 1 construction works there has been approximately 1,250 spaces available. Some 200 of these spaces have been used by construction workers. Car parking on the site has not been fully utilised as some visitors and staff choose to utilise free on-street car parking.

As Stage 2 construction commences, a number of car parks close and others become available maintaining supply on campus at 1,250 spaces. Expansion of the Stage 1 multi-storey car park by 180 spaces early in the Stage 2 construction process will provide for the ramp up of demand a Stage 1 is commissioned and occupied over a number of years.

Stage 2 construction workers will park off-site in the Blacktown Bowling Club car park where 220 spaces are available.

For the Stage 2 redevelopment, current planning indicates the potential demand for up to 1,737 spaces. The expansion of the multi-deck car park to the west of the existing car park will be adjusted in Stage 2 to meet the demand forecasts at the time of that project application. A possible car parking provision of 303 spaces in the Stage 2 multi-storey car park is predicted to meet demand.

The available supply of car parking compared with anticipated demand for each stage is shown in Table 13.

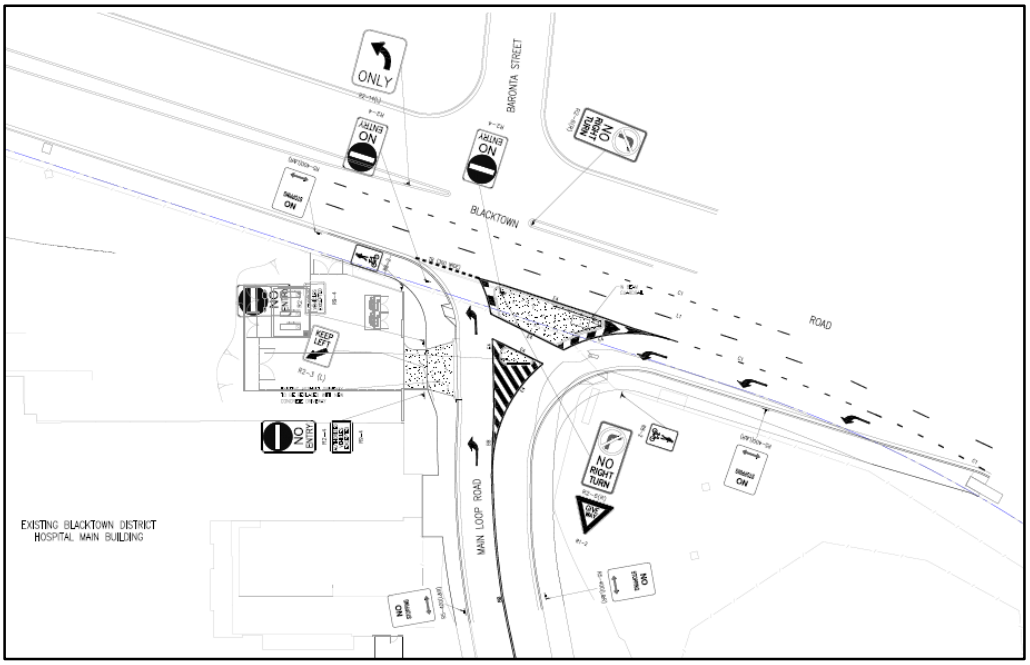
Table 13 Car parking supply versus demand

	Existing	**During Early Works**	**Stage 1 Operational (Stage 2 Construction phase)**	**Stage 2 Operational**
At- grade	628	562	632	632
Multi-storey	622	622	802	1,105
Total Supply	1,250	1,184	1,434	1,737
Demand	1,018	1,018	1,469	1,737
Difference	232	166	(35)	0

4.3 Future access road

The proposed new access point onto Blacktown Road at the eastern end of the campus aligns with Baronta Street as shown in Figure 20. Access to the hospital will only be provided for left turn in movements via a deceleration lane and left turn out movements into the traffic stream via give-way control. A large central island is proposed to store pedestrians and cyclists crossing the hospital access road and to control right turn movements. All turning movements are maintained for Baronta Street. The intersection is approximately 100m to the west of the Wall Park Avenue intersection.

Figure 20 New Hospital Access to Blacktown Road opposite Baronta Street



The left-in left-out arrangement requires vehicles to decelerate from 60km/h to approximately 20km/h to execute the left turn. The Blacktown Road approach is a long left hand curve travelling through the Wall Park Avenue intersection. The required deceleration distance on 60km/h roads is 50m as identified in Figure 21. A deceleration lane of 50m has been proposed.

Figure 21 Deceleration Distance (RTA Road Design Guide)

Table 4.8.3 Deceleration distances required for a vehicle on a level grade.

Design Speed of Approach Road (km/h)	Length of Deceleration (m) - including tapered approach where design speed of exit curve (km/h)										Diverge Length Td (m) for lane widths	
	0 **		20	30	40	50	60	70	80	90	3.5m	3.0m
	Comf. 2.5m/s^2	Max. 3.5m/s^2	Comfortable average rate of deceleration 2.5m/s^2									
50	40	[30]	30	25	15						50	40
60	55	[40]	50	40	30	15					60	50
70	75	[55]	70	60	50	40	20				70	60
80	100	[70]	95	85	75	60	45	25			80	65
90	125	[90]	120	110	100	85	70	50	25		90	75
100	155	[110]	150	140	130	115	100	80	55	30	100	85
110	185	[135]	180	175	160	150	130	110	90	60	110	

4.4 Design of access roads and car parks

The proposed access roads, drop-off facilities and car parking provisions associated with the proposed development have been designed to comply with the requirements of the relevant Australian Standards for turn paths, sight distance requirements, aisle widths, etc. The civil design has been undertaken by Robert Bird Group with vehicle turning paths checked by Arup.

4.5 Background traffic growth

The Roads and Maritime Services (RMS) operate a Sydney wide strategic traffic model on the EMME2 model platform. Projections for future years are calculated on a 5 yearly growth projection; 2016, 2021, 2026 and 2031 for the AM and PM peak periods.

The RMS emphasises that this modelling is approximate and based on assumptions which are subject to change. Furthermore, the outputs and its use are subject to the following:

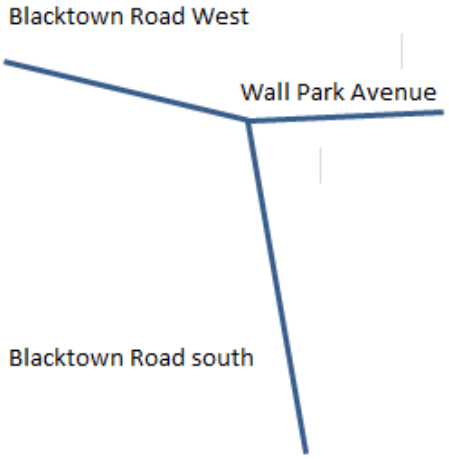
- The modelled volumes are very approximate.
- The configuration of the modelled road networks within the development area has been assumed for modelling and planning purposes, and does not imply any commitments on the part of RMS, Department of Planning and Infrastructure, or local government.
- Any changes to assumptions about future employment and road infrastructure will change the forecast traffic volumes.
- Any person who places any reliance on these forecasts does so at their own risk.
- The information is only provided to the proponent in relation to this development proposal.

The percentage change in traffic predicted by the EMME2 model from the base year 2013 to the future years 2016, 2026 and 2031 are shown in Figure 22 for each approach at the Blacktown Road/ Wall Park Avenue. In the AM peak for the period between 2013 and 2031, growth varies between 8% to 27% on each road link. In the PM Peak growth varies from 0% to 21%.

For Panorama Parade, the future RMS modelling is indicating similar levels of growth in traffic of approximately 25% for both peak periods between 2013 and 2031.

Figure 22 Traffic Growth from EMME2 Model (Source RMS)

Blacktown Road West									
westbound	**2013**	**2016**	**2026**	**2031**	**eastbound**	**2013**	**2016**	**2026**	**2031**
AM	2316	2436	2675	2740	AM	1961	2118	2407	2482
	100%	105%	116%	118%		100%	108%	123%	127%
PM	2384	2518	2698	2893	PM	2588	2739	2881	2711
	100%	106%	113%	121%		100%	106%	111%	105%



Wall Park Avenue				
eastbound	**2013**	**2016**	**2026**	**2031**
AM	2753	2808	2713	2969
	100%	102%	99%	108%
PM	3008	3036	3335	3244
	100%	101%	111%	108%
westbound	**2013**	**2016**	**2026**	**2031**
AM	2897	3044	3147	3314
	100%	105%	109%	114%
PM	3130	3126	3212	3085
	100%	100%	103%	99%

Blacktown Road south									
northbound	**2013**	**2016**	**2026**	**2031**	**southbound**	**2013**	**2016**	**2026**	**2031**
AM	2848	2904	2935	3190	AM	2533	2699	2945	3101
	100%	102%	103%	112%		100%	107%	116%	122%
PM	2546	2581	3090	3002	PM	2925	2972	3245	3132
	100%	101%	121%	118%		100%	102%	111%	107%

4.6 Traffic generation and distribution

The travel model predicts the traffic flows throughout the day. The predicted peak hour flows are shown in Table 14.

Table 14 Predicted Peak Hour Traffic Flows for each stage

	Road Peak Hour	**In**	**Out**	**Total**	**Increase from Base**	**% increase**
Existing Base	AM Peak	279	70	349	-	-
	PM Peak	101	209	310	-	-
Stage 1	AM Peak	399	146	545	196	56%
	PM Peak	103	330	433	123	43%
Stage 1 and 2	AM Peak	512	165	677	328	94%
	PM Peak	145	440	585	275	89%

The Stage 1 development results in approximately a 50% increase in traffic activity over the existing base whilst the Stage 2 development is predicted to result in a doubling of traffic activity over the existing base.

The future traffic flows have been distributed onto the road system based on the current patterns of arrival and departure, which have been determined based on the turning movement counts at the access point to Panorama Parade and the configuration of the main access road system.

For entry movements, the new left turn entry from Blacktown Road will pick up traffic from the east and south. The split of traffic between the existing access at Panorama Parade and the new access on Blacktown Road (left turn in/ left turn out opposite Baronta Street) is shown in Table 15.

Table 15 Predicted Peak Hour Traffic Flows by access location

	Road Peak Hour	**IN**				**OUT**			
		Panorama		**Left in/Left out Blacktown Rd Access**		**Panorama**		**Left in/Left out Blacktown Rd Access**	
		No	**%**	**No**	**%**	**No**	**%**	**No**	**%**
Existing Base	AM Peak	279	100%	-	-	70	100%	-	-
	PM Peak	101	100%	-	-	209	100%	-	-
Stage 1	AM Peak	234	59%	165	41%	118	90%	12	10%
	PM Peak	56	55%	47	45%	313	95%	17	5%
Stage 1 and 2	AM Peak	300	59%	212	41%	151	90%	23	10%
	PM Peak	80	55%	65	45%	417	95%	23	5%

For the entry movement, 41% of traffic has been assigned to the new access in the AM Peak and 45% in the PM Peak. This provides a good spread of activity and minimises the increase of entry traffic on the existing Panorama Parade access.

For the exit movements, the new left turn out onto Blacktown Road is not expected to be very attractive due to the need to travel backwards through the site from the main car parking areas to access the new road on the eastern end of the site. We have estimated that only 5 – 10% of exit traffic will use the new access road. This results in an increase in traffic exiting at Panorama Parade from 209 existing to 417 in the PM Peak hour at the completion of Stages 1 and 2.

The existing distribution is shown in Figure 23 for the AM Peak and Figure 24 for the PM Peak. The future Stage 1 and Stage2 traffic flows for the AM and PM Peaks are shown in Figure 25, Figure 26, Figure 27 and Figure 28 respectively.

Figure 23 Existing AM Peak Traffic Distribution

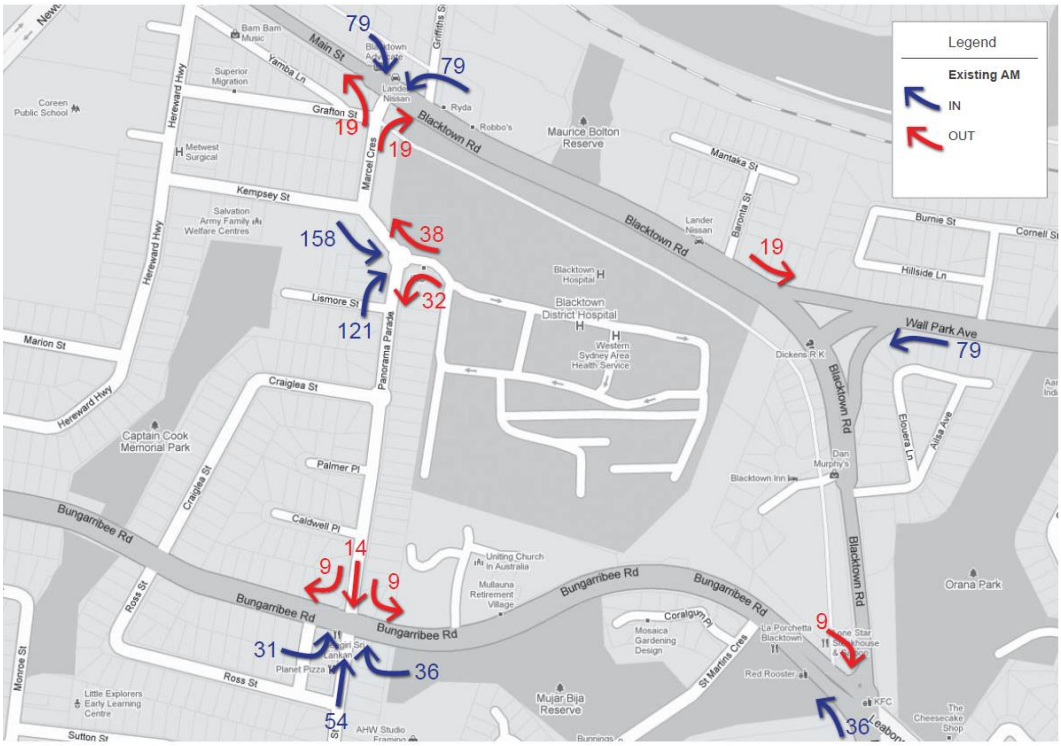


Figure 24 Existing PM Peak Traffic Distribution

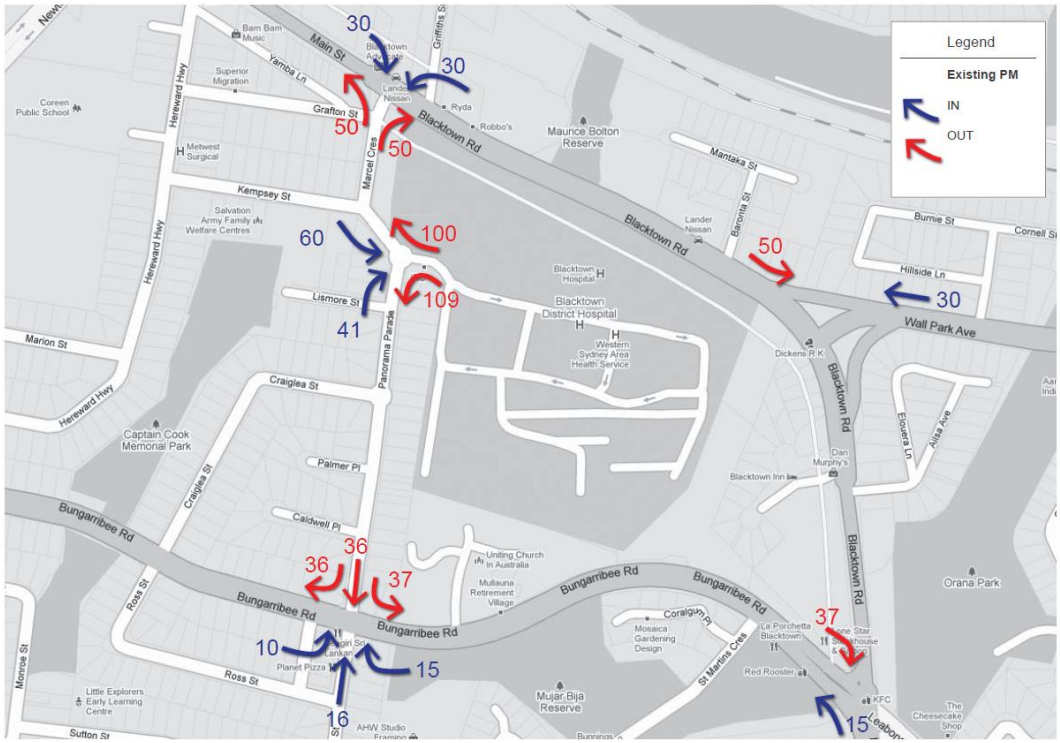


Figure 25 Proposed (Stage 1) Expansion AM Peak Traffic Redistribution

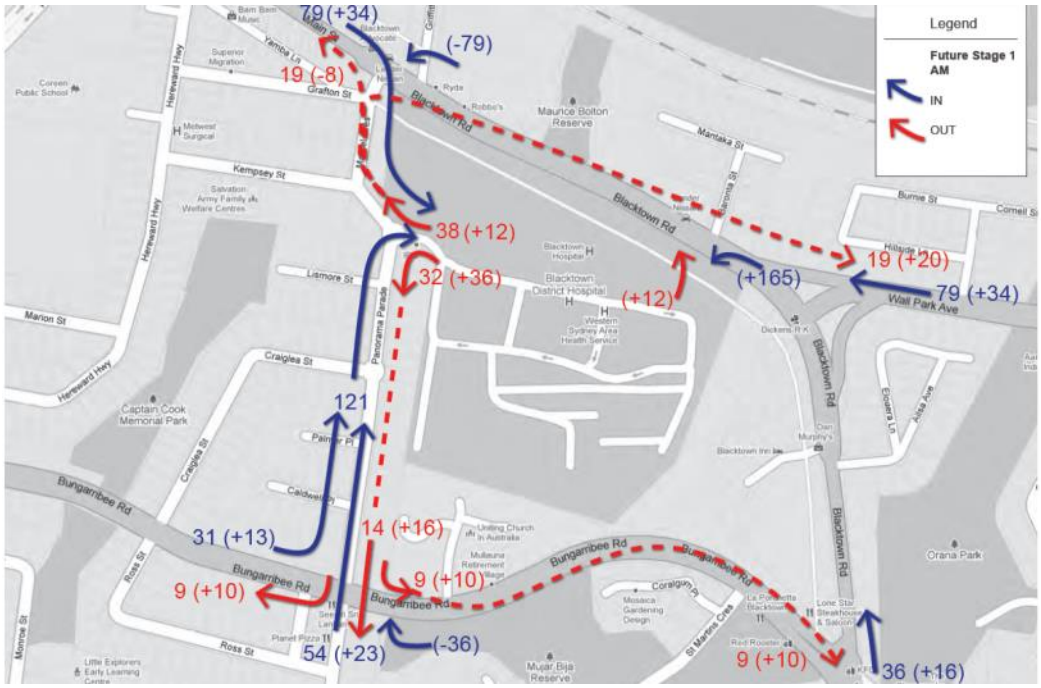


Figure 26 Proposed (Stage 1) Expansion PM Peak Traffic Redistribution

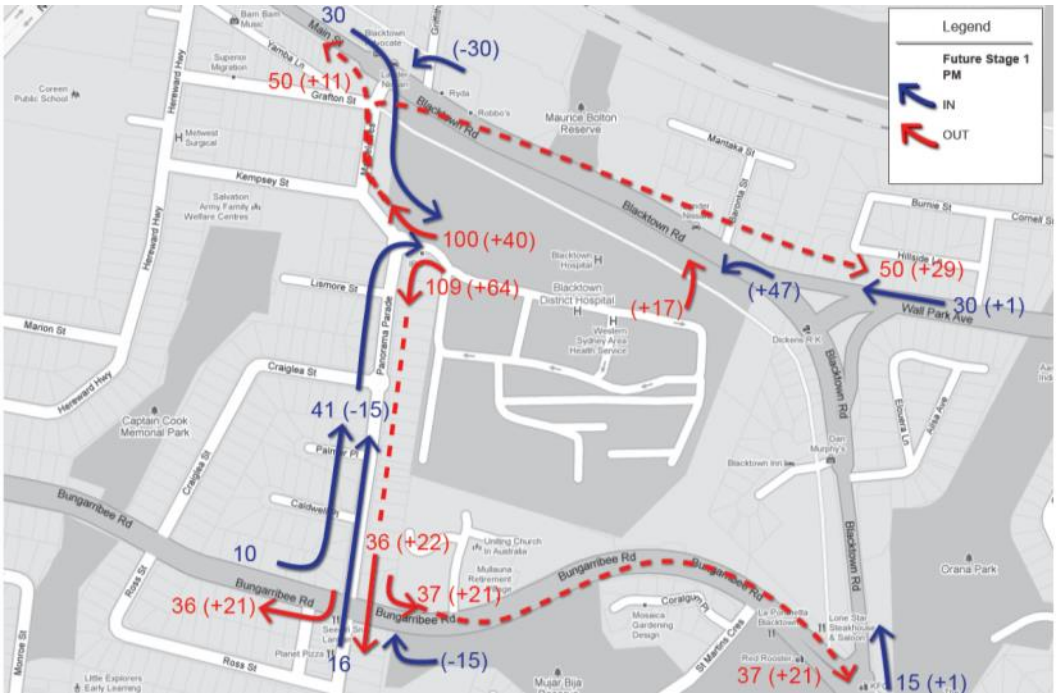


Figure 27 Future (Stage 2) Expansion AM Peak Traffic Redistribution

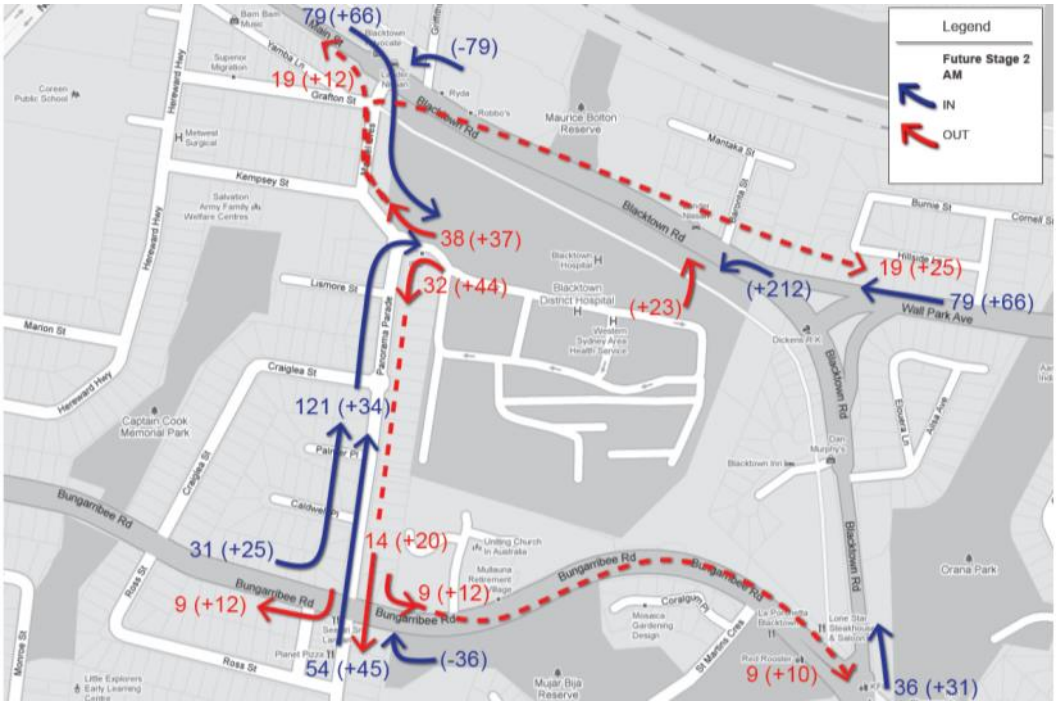
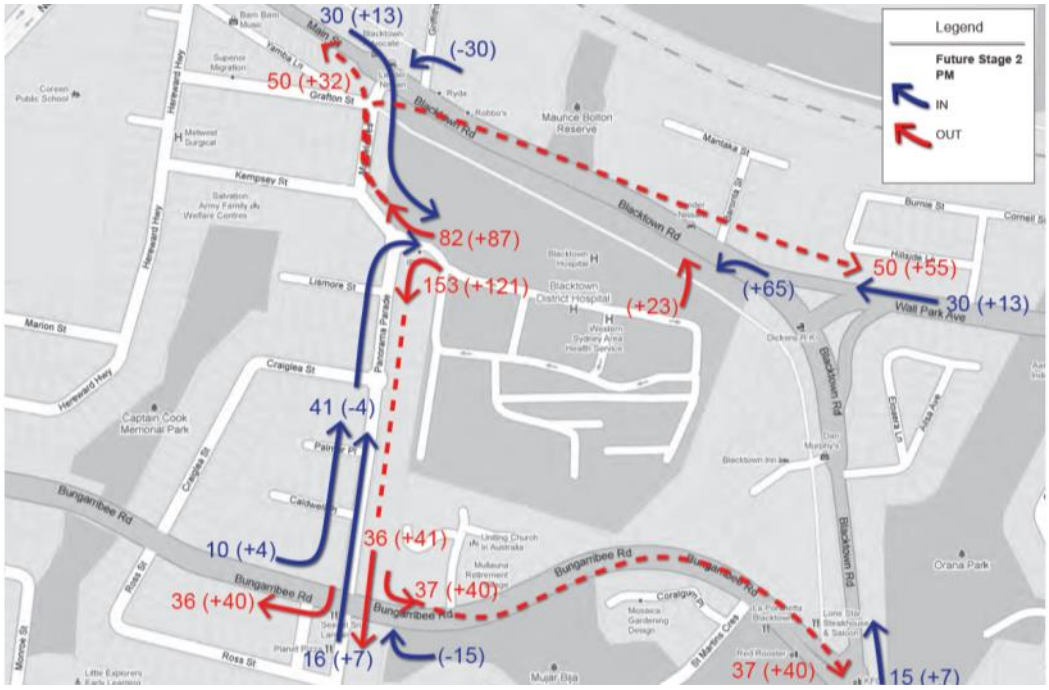


Figure 28 Future (Stage 2) Expansion PM Peak Traffic Redistribution



4.7 Traffic Assessment

Arup has undertaken intersection traffic capacity analysis for the proposed Stage 1 and Stage 2 hospital expansion using the SIDRA analysis package as described in Section 4.7.1.

The Main Street and Sunnyholt Road/Newton Road intersection to the west of the site has been considered in terms of the level of traffic increase expected as described in Section 4.6.

4.7.1 SIDRA Traffic Analysis

The SIDRA analysis used the previous models to analyse the five key intersections with changed traffic conditions. Please see Table 16 below for the results of the analysis for the AM and PM peak periods.

The analysis shows that the Level of Service for each intersection remains at the level prior to the proposed works with the exception of the Bungarribee Road / Blacktown Road / Leabons Lane intersection which degrades from Level of Service D to E in the AM peak period. The degree of saturation remains the same however the delay increases slightly. Otherwise the intersections analysed operate at the same level with the development with a nominal increase in delay.

As a result of this analysis it is expected that the distribution of additional hospital traffic towards the Panorama Parade access route for the Stage 1 and Stage 2 hospital expansion can be accommodated at the Blacktown Rd / Marcel Crescent and the Bungaribee Road / Panorama Parade intersections.

The 5 year period between 2010 and 2015 has seen no traffic growth according to the surveys undertaken for this project, as described in Section 3.4.1. It is assumed that much of the traffic growth on Panorama Parade predicted by the RMS modelling, described in Section 4.4, is as a result of the hospital growth with some other local traffic circulation growth.

The Wall Park Avenue and Blacktown Road intersection is currently operating close to capacity however the analysis indicates very little change due to the minor traffic increases due to hospital traffic on this route. After 2016, the RMS latest modelling indicates that there could be continued growth in traffic at the intersection which will need to be taken into account with any future traffic modelling.

Table 16 AM Peak Existing and Future Scenarios Intersection Performance

Intersection	Peak	Scenario	Los	Delay	Dos	Worst movement in terms of delay
Marcel Crescent / Blacktown Road (in isolation)	AM	Existing	B	16	0.80	Right turn from Blacktown Rd W
		Stage 1	B	17	0.76	Right turn from Marcel Cr
		Stage 2	B	18	0.78	Right turn from Marcel Cr
	PM	Existing	B	16	0.74	Right turn from Blacktown Rd W
		Stage 1	B	17	0.78	Right turn from Blacktown Rd W
		Stage 2	B	18	0.81	Right turn from Marcel Cr
Marcel Crescent / Blacktown Road (networked with Griffiths Street)	AM	Existing	B	13	0.80	Right turn from Griffiths St
		Stage 1	B	13	0.76	Right turn from Griffiths St
		Stage 2	B	15	0.78	Right turn from Griffiths St
	PM	Existing	B	16	1.01	Right turn from Griffiths St
		Stage 1	C	17	1.04	Right turn from Griffiths St
		Stage 2	C	19	1.11	Right turn from Griffiths St
Wall Park Avenue / Blacktown Road	AM	Existing	C	29	0.90	Right turn from Wall Park Ave
		Stage 1	C	30	0.90	Right turn from Wall Park Ave
		Stage 2	C	32	0.91	Right turn from Wall Park Ave
	PM	Existing	B	22	0.88	Right turn from Wall Park Ave
		Stage 1	B	22	0.88	Right turn from Wall Park Ave
		Stage 2	B	22	0.87	Right turn from Wall Park Ave
Bungarribee Road / Blacktown Road / Leabons Lane	AM	Existing	D	52	0.96	Right turn from Blacktown Rd N
		Stage 1	E	57	0.96	Right turn from Blacktown Rd N
		Stage 2	E	57	0.95	Right turn from Blacktown Rd N
	PM	Existing	D	43	0.94	Right turn from Bungarribee Road
		Stage 1	D	47	0.93	Right turn from Bungarribee Road
		Stage 2	D	49	0.94	Right turn from Bungarribee Road
Bungarribee Road / Lock Street / Panorama Parade	AM	Existing	B	21	0.76	Left turn from Lock Street
		Stage 1	B	22	0.74	Left turn from Bungarribee Road W
		Stage 2	B	22	0.77	Left turn from Lock Street
	PM	Existing	B	20	0.65	Left turn from Panorama Parade
		Stage 1	B	21	0.67	Left turn from Bungarribee Road E
		Stage 2	B	23	0.74	Left turn from Lock Street
Panorama Parade / Marcel Crescent / Hospital Entrance	AM	Existing	A	10	0.32	U-turn from Marcel Cres
		Stage 1	A	10	0.32	U-turn from Marcel Cres
		Stage 2	A	10	0.37	U-turn from Marcel Cres
	PM	Existing	A	10	0.26	U-turn from Hospital
		Stage 1	A	10	0.36	U-turn from Hospital
		Stage 2	A	11	0.45	U-turn from Hospital

4.7.2 Main Street and Sunnyholt Road/Newton Road

Based on the distribution of traffic described in Section 4.4, approximately 54 additional vehicles are predicted to travel to and from the west on Blacktown Road in the AM Peak representing a 2.3% increase on current traffic volumes. In the PM peak the increase is only 28 vehicles representing a 1.0% increase. These levels of increase will have minimal impact on the operations of the Main Street and Sunnyholt Road/Newton Road intersection.

4.7.3 Summary of the traffic assessment

For the new hospital access on Blacktown Road configured with left turn in / left turn out movements only, the right turn hospital traffic flows on Blacktown Road are directed to use the Panorama Parade access. The distribution of traffic and intersection analysis shows that the Level of Service for each of the intersections remains at the level prior to the proposed works. As a result of this analysis it is expected that the proposed works will have no adverse impact on the surrounding road network in terms of traffic capacity or delay. The increases in delay are not significant, however there will be more occasions when congestion will occur as minor incidents or spikes in demand affect the road system.

4.8 Loading Facilities

The existing loading dock on the northern side of the existing hospital building will continue to provide the central loading point for the entire campus. Incoming supplies are dispatched throughout the campus from the central stores facility.

The loading dock has its own all movements access driveway to Blacktown Road which means it does not interfere with the operations of the internal road system.

There are a number of smaller facilities located around the campus that are accessed by smaller delivery vehicles for special deliveries.

5 Pedestrian and Public Transport Access

5.1 Bus routes

There is currently one bus route that enters the hospital. Busways Route 721 loops within the hospital as it travels clockwise on a one-way route via Main Street, Panorama Parade and Bungarribee Road. This route could be adjusted to travel anti-clockwise allowing it to travel through the hospital from Panorama Parade to Blacktown Road as shown on Figure 29. This route provides good accessibility for travel within the Blacktown city centre and for connection to the Blacktown Train Station and Bus Interchange. This route is used by visitors and staff for travel to the hospital and have good capacity for further growth in patronage as the hospital develops.

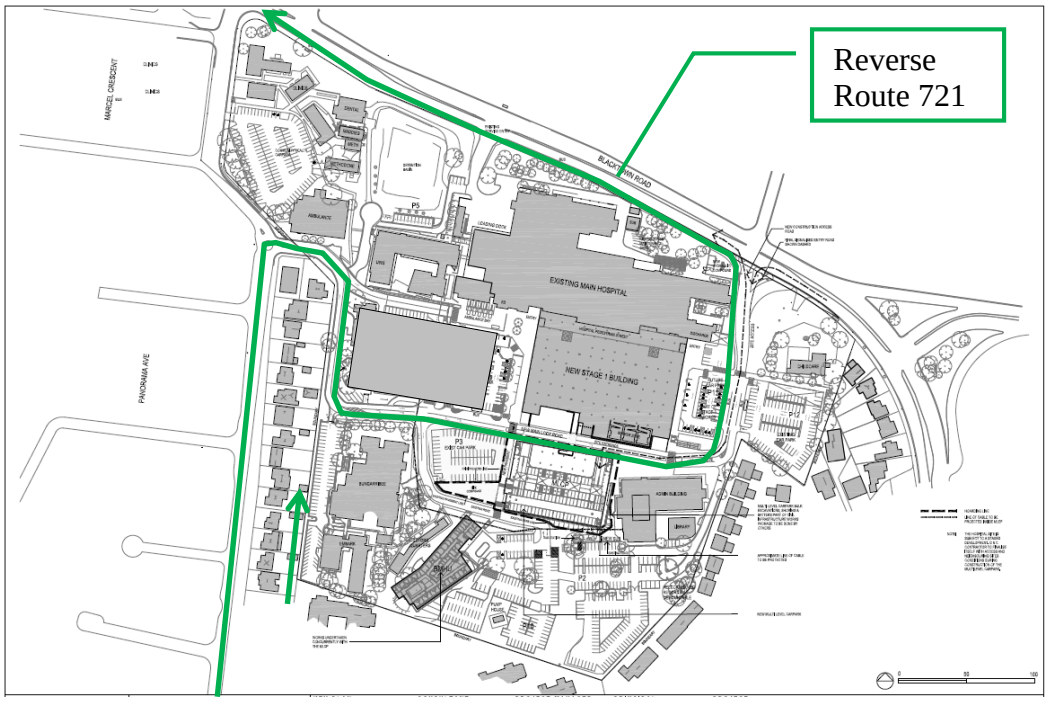


Figure 29 Bus Routes

The regular services along Blacktown Road include Hillsbus Routes 630, 611, 700, 702, and 812. These services do not currently enter the hospital. With the current stage of development the new access to Blacktown road does not permit right turn movements. It is unlikely that bus operators would wish to add additional travel time by running thorough the hospital grounds. The existing pedestrian access from the Blacktown Road bus stops will be available along Marcel Crescent for existing and new staff who will use bus as their mode of travel to work.

5.2 Bus stop locations

The existing westbound bus stop on Blacktown Road adjacent to Marcel Crescent is located a suitable distance away from the traffic light controls as shown in Figure 30 and Photograph 1.

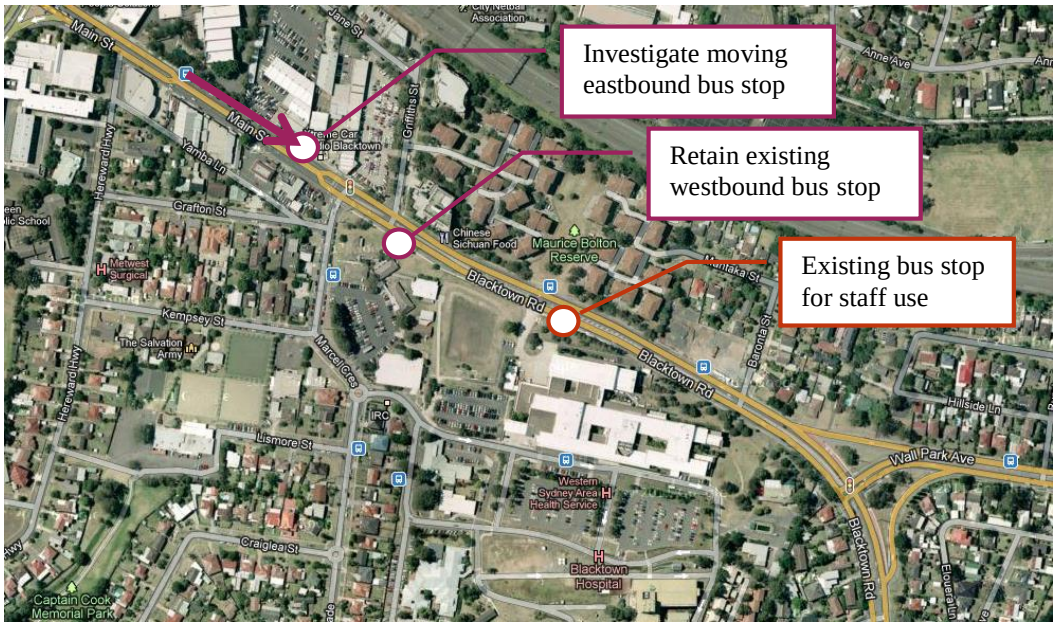
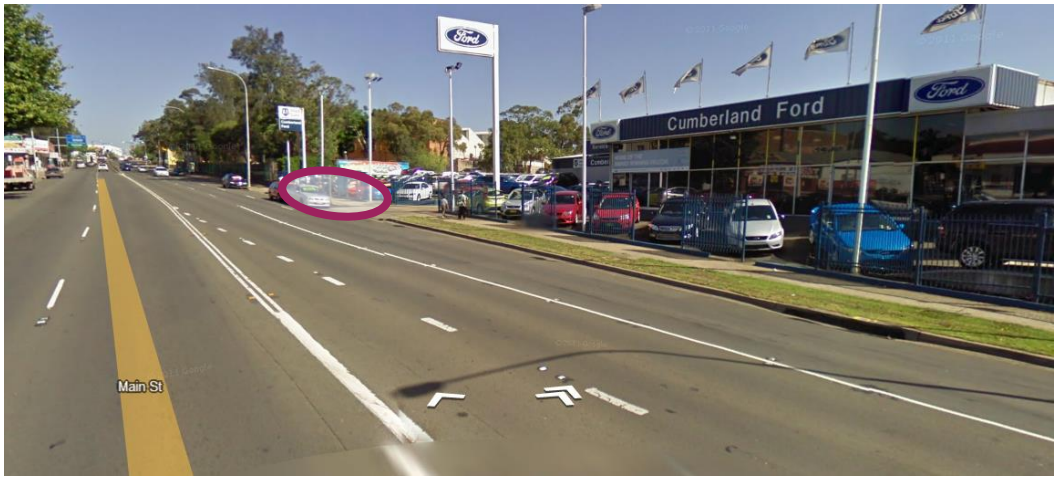


Figure 30 Bus Stop locations

Photograph 1 Westbound bus stop on Blacktown Road adjacent to Marcel Crescent

The existing eastbound bus stop on Blacktown Road is located adjacent to Western Sydney Institute TAFE some 200m west of Marcel Crescent. Consideration could be given to relocating this stop closer to Marcel Crescent or duplicating the stop. This would mean locating a bus shelter adjacent to the car dealership as shown in Photograph 2.



Photograph 2 Eastbound bus stop on Blacktown Road west on Marcel Crescent

5.3 Pedestrian access

There are two DDA compliant pedestrian routes for public access to the hospital. These are via Marcel Crescent which is the existing route and via the new eastern hospital road connection to Blacktown Road as shown on Figure 31. Staff may enter the hospital via the lower level adjacent to the loading dock.

Traffic light control at the intersection of Marcel Crescent and Blacktown Road provides for pedestrian crossing and access to the bus stops on Blacktown Road.

The footpath along the southern side of Blacktown Road has recently been updated to a shared bicycle pedestrian path. This provides an improved level of amenity for both pedestrians and cyclists with a wider paved facility and appropriate drop kerbs at road crossings.

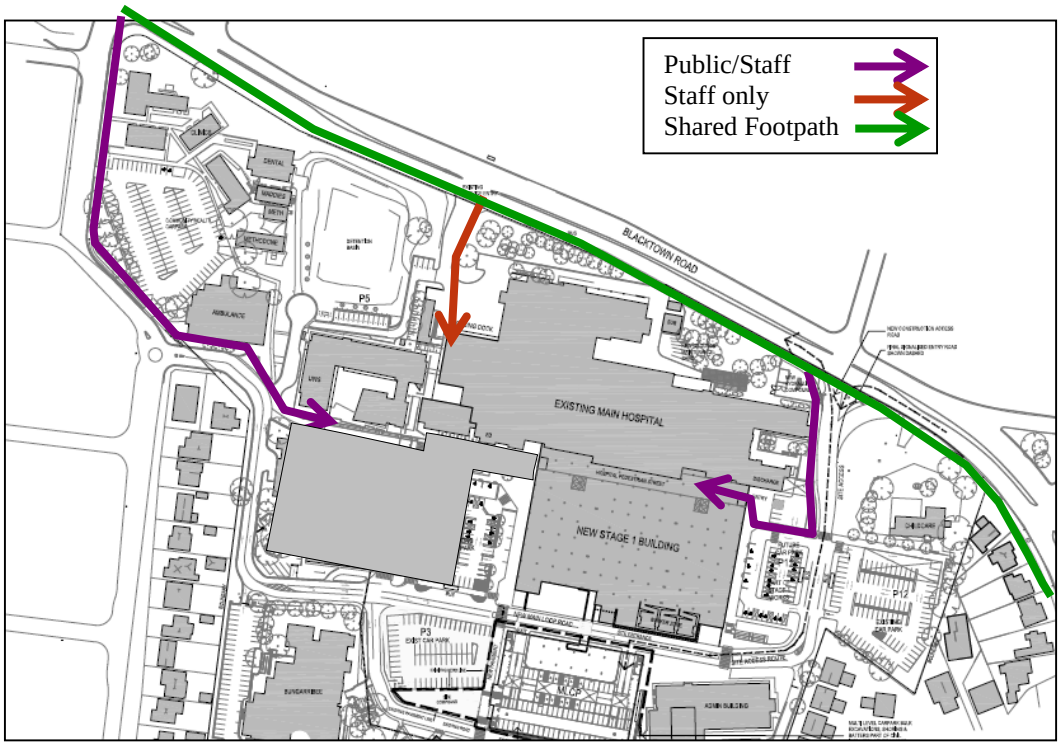


Figure 31 Pedestrian Access from Blacktown Road

6 Sustainable Transport Measures

The NSW State Plan 2010 includes the following transport targets:

- Increase the proportion of total journeys to work by public transport in the Sydney Metropolitan Region to 28% by 2016 (2009 value 24%)
- Increase the mode share of bicycle trips made in the Greater Sydney region, at a local and district level, to 5% by 2016 (2009 value 1%)

These targets will be met by measures to promote sustainable means of transport including public transport usage, car sharing, car pooling and pedestrian and bicycle linkages as described below.

6.1 Public transport accessibility

The Blacktown campus has a bus route running through the internal road system which provides direct connection to the nearby railway station. Additional bus routes travel past the site for local travel. The train station is within an acceptable walking distance (1.2km) for people who are willing to combine walking with their travel connection to public transport.

It is therefore considered that the campus is well connected to a number of existing public transport services.

6.2 Site travel plan

With the numerous transport options available to staff and visitors to access the site, the Blacktown Mount Druitt Hospital will establish a green transport plan. A green transport plan is a package of measures introduced to promote the use of public transport, walking and cycling by patrons and employees for travel to and from work and for business related trips. Some specific measures that could be incorporated in this travel plan include:

- Public transport timetables and maps
- Key local walking and cycling routes
- Improvement of current website detailing transport options for both staff and patients
- Establishment of transport information packs to new staff explaining the various ways (other than motor vehicle) of travelling to the site
- Development of a travel plan booklet for staff and visitors
- Liaising with staff, either face to face or via email/telephone, providing them with advice where needed about travelling to work

Provision of good bus service, complemented with the implementation of a green travel plan will reduce the reliance on private vehicle for Blacktown Mount Druitt Hospital staff and patients.

7 Construction Impacts

7.1 Overview

The Stage 1 Main Hospital building development works will be completed early in 2016. The works include the removal of the temporary access arrangements on the internal roads and the implementation of the future internal road arrangement, linking the hospital to the new access opposite Baronta Street.

The Stage 2 Early Works Package 1, followed by Early Works Package 2 (subject of the current SSD application) will commence in October 2015 to prepare the site for the Stage 2 hospital building works to commence in May 2016 (the subject of a separate planning application).

7.2 Construction programme

The construction process is proposed to occur in stages of varying length. The works timeframe is outlined in Table 17 and involves the enabling works, excavation and retaining works (the subject of this SSD) and construction of the Stage 2 Building and car park extension.

7.2.1 Indicative Construction Dates

Early Works Package 1

- Construction Start - October 2015
- Construction Finish – March 2016

Early Works Package 2 (This SSD)

- Construction Start – April 2016
- Construction Finish – September 2016

MSCP (Expansion to Existing MSCP and New MSCP)

- Construction Start – January 2017
- Construction Finish – January 2018

Stage 2 Main Building

- Construction Start – October 2016
- Construction Finish – December 2018

Table 17 Project timeframe for works

Construction Phase	2015	2016				2017				2018			
Early Works Package 1													
Early Works Package 2													
MSCP (Expansion to Existing & New)													
Stage 2 Main Building													

7.3 Impact of proposed works

7.3.1 Construction vehicle control point

It is proposed that construction vehicles will use the Panorama Parade access point and internal hospital road to access the construction control point. All construction vehicle manoeuvring will occur within the construction compound. See Figure 32 below for details of this proposal.

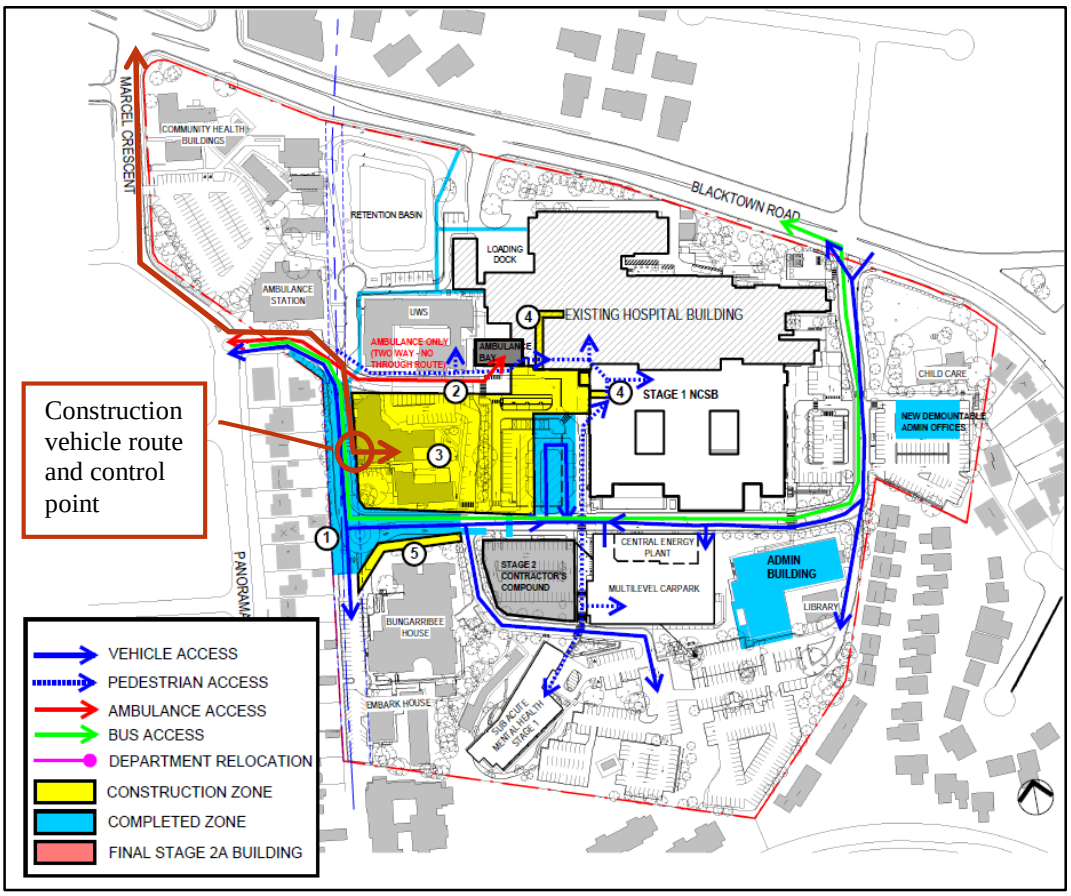
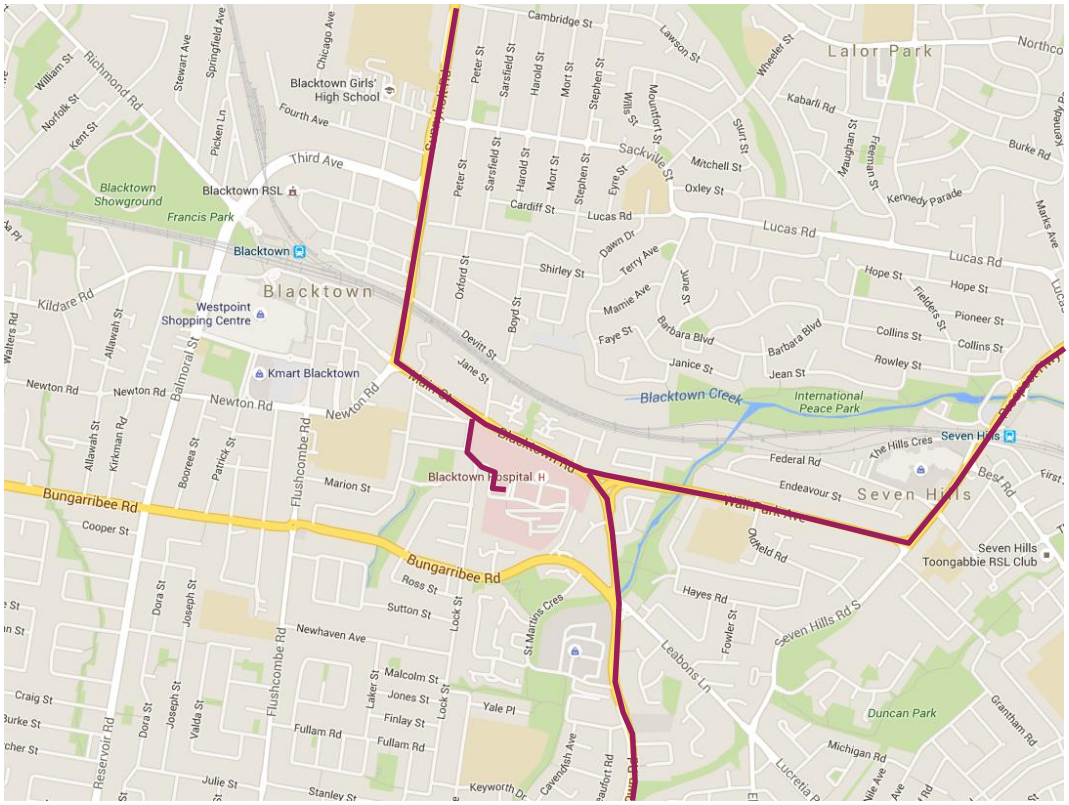


Figure 32 Vehicle routes within Blacktown Hospital during Stage 2 construction

7.3.2 Heavy vehicle routes to site

Trucks will utilise the Marcel Crescent traffic lights to access Blacktown Road for travel in both directions. As seen in Figure 33, the trucks will access the site on Blacktown Road for the M4 and Wall Park Avenue and Sunnyholt Road for the M2/M7.

Figure 33 Construction vehicle routes



7.3.3 Construction traffic volumes

Table 18 Estimated construction traffic volumes

Construction Phase	Approx daily vehicle movements (in + out)	Approx peak hour movements (in + out)
Early Works Package 1	40	4-6
Early Works Package 2	60	8-10
MSCP (Expansion to Existing & New)	40	4-6
Stage 2 Main Building	60	8-10

7.3.4 Cumulative impact of existing site and construction traffic

The additional site construction traffic generation (up to an average of approximately 10 trucks in the peak hour) is relatively small when compared to the existing site traffic generation of 313 vehicles in the AM peak and 377 vehicles in the PM peak (peak flows at the main roundabout entrance). Blacktown

Road carries high traffic volumes in platoons due to the SCATS coordinated signals and has adequate capacity for the additional truck traffic with negligible impact to the surrounding area.

7.3.5 Construction worker parking

The number of construction workers will be less than 100 during the Early Works Package 2. During Stage 2 construction up to 220 parking spaces will be available for construction worker parking at the Blacktown Bowling Club. In addition, it is expected that significant numbers of the construction workforce will travel by train and bus outside the morning and afternoon commuter peak. Construction worker inductions and briefings will reiterate the need to park in the designated car park rather than use on-street car parking or hospital parking.

7.4 Measures to ameliorate impacts

7.4.1 Parking

Demand management strategies are proposed to be utilised by the hospital to reduce the overall demand for car parking on the campus during construction works. These strategies include:

- Improved access control to existing car parking areas
- Staged implementation of the Stage 1 facilities
- Rationalising fleet vehicle parking on the site
- Promotion of public transport for staff access

It is estimated that these demand management strategies will reduce the staff demand for parking at the Blacktown campus at the peak usage times.

On-street car parking will remain available for overflow parking by the public and staff.

7.4.2 Pedestrians

Construction vehicles will use the existing site access and observe all pedestrian controls. The pedestrian footpaths along Blacktown Road and Marcel Crescent are to be maintained with appropriate signage to warn pedestrians of construction activity. If needed, traffic controllers will be used to control pedestrians during the peak heavy vehicle movements entering the site.

Provisions will be made for pedestrians and cyclists to pass the worksite safely. Suitable pedestrian road crossing points would be maintained.

At times it may be necessary to direct pedestrians and cyclists onto the road carriageway and adequate warning signs and barricades would be provided. Traffic controllers or other traffic devices to direct traffic would be provided in accordance with AS 1742.3: 1996.

7.4.3 Driver Code of Conduct

To manage driver conduct the following measures are to be implemented:

- All deliveries are to be pre booked
- All deliveries are to check in at the site office
- Vehicles are to enter and exit the site in a forward direction along the travel path shown on delivery maps
- Drivers are to give way to pedestrians and plant at all times.

7.4.4 Traffic Control Plans

Traffic control plans will be prepared by the contractor prior to work commencing. The TCP will provide a detailed plan of the required signage and traffic and safety management measures to be implemented on-site.

7.5 Public Transport Services

No bus services operating on Blacktown Road would be impacted by construction traffic as the work is confined to off street works within the hospital.

For each phase of the construction works, an internal loop route for the 721 hospital bus service will be maintained within the campus.

7.6 Provisions for Emergency Vehicles

Construction works and vehicle storage will be confined to the site. As such, no additional specific provisions for emergency vehicles have been identified on the surrounding road network.

7.7 Public Consultation

During construction works, residents in the vicinity of the site will be notified about the intended works:

- Prior to the commencement of works
- Where there is potential for works to cause nuisance

Residents will be notified by a letter specifying:

- The nature and extent of the works
- Contact details for the Site Safety Officer to whom complaints about the upgrade should be directed

Details of construction traffic routes and any potential traffic-related impacts will be included in this correspondence.

7.8 Summary

Through the implementation of traffic management measures, the anticipated level of construction traffic can be accommodated on the access road system.

A detailed construction traffic management plan would be prepared at the construction stage of the project. A summary of measures to mitigate potential impacts for pedestrians and cyclists during the construction stage of the project is given below. The measures recognise the high volumes of pedestrians in the vicinity of the site.

The construction schedule for the development will also aim to minimise:

- disruption to traffic movements particularly at peak periods
- interference with public transport services

Adequate fencing will be installed around the perimeter of the construction site to restrict unauthorised public access.

All demolition and construction related vehicles would comply with relevant Blacktown City Council traffic and parking regulations.

8 Conclusions

The Blacktown Hospital campus is approximately 1.2km from Blacktown Railway Station and the Blacktown City Centre. It is well serviced by bus with 6 routes travelling past the site on Blacktown Road and a dedicated loop service between the campus and Blacktown Railway Station. More than half of the staff working in the travel zone within which Blacktown Hospital is located live within the Blacktown and Mt Druitt. This indicates that there is good opportunity to encourage non-car mode or travel focusing on bicycle and bus in particular through a Workplace Travel Plan.

The future travel characteristics of staff, visitors and patients have been considered for the expanded campus facilities. Existing bus and train services are well placed to cater for increased demand. Car parking provision on the campus has been tailored to meet anticipated future demand as the hospital expands in 2 stages taking into account reduced car dependence. There is scope in Stage 2 to adjust on-site car parking provision to suit any reductions in demand that may occur from improved public transport use.

A new access road has been proposed at the eastern side of the campus connecting directly onto Blacktown Road as a left turn in / left turn out intersection opposite Baronta Street. The existing access via Panorama Parade will be maintained to service as the main hospital access including emergency access. The existing service vehicle access on Blacktown Road will be maintained. The adjacent Blacktown Road / Wall Park Avenue intersection currently operates at capacity however the proposed development would only nominally increase the saturation level. The remainder of the main road system has been modelled with the new access arrangements and continued acceptable levels of operation are expected.

The Stage 2 development will involve a considerable change to on-site parking arrangements. A number of existing parking areas will be replaced by new buildings. The multi-storey car park will initially be extended by two floors to accommodate full Stage 1 occupation and later extended to the west to accommodate Stage 2 occupation.

When Stage 1 opens there will be a parking supply of 1254 spaces on the site. The first stage of extension of the multi-storey car park will commence in January 2017 which involves two additional levels on the existing car park. This will add approximately 180 spaces and be the subject of a separate planning application. These spaces will be needed at this time as activity at the campus associated with Stage 1 occupation builds up over a number of years to the anticipated Stage 1 demand of 1469 spaces when fully occupied. All construction workers will park off site allowing the hospital to function utilising on-site car parking.

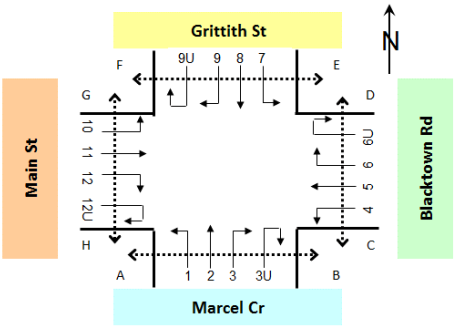
Appendix A

Traffic Survey Data

A1 Vehicle Turning Volume Data

Job No. : N1958
Client : Arup
Suburb : Blacktown
Location : 1. Blacktown Rd / Main St / Marcel Cr / Grittith St

Day/Date : Tuesday, 15th September 2015
Weather : Fine
Description : Classified Intersection Count
: Peak Hour Summary

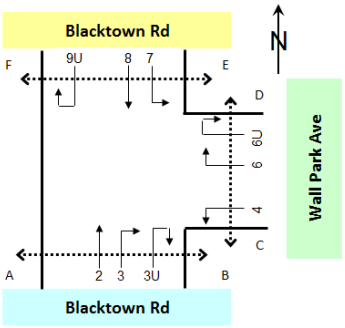


	Approach	Marcel Cr			Blacktown Rd			Grittith St			Main St			Grand Total
	Time Period	Lights	Heavies	Total	Lights	Heavies	Total	Lights	Heavies	Total	Lights	Heavies	Total	
AM	8:30 to 9:30	285	4	**289**	1,027	87	**1,114**	54	2	**56**	962	97	**1,059**	**2,518**
PM	16:30 to 17:30	385	0	**385**	1,107	47	**1,154**	134	0	**134**	1,013	47	**1,060**	**2,733**

Approach	Marcel Cr			Blacktown Rd			Grittith St			Main St			Grand Total
Time Period	Lights	Heavies	Total	Lights	Heavies	Total	Lights	Heavies	Total	Lights	Heavies	Total	
7:30 to 8:30	266	3	**269**	989	97	**1,086**	40	1	**41**	931	85	**1,016**	**2,412**
7:45 to 8:45	239	5	**244**	1,025	100	**1,125**	38	0	**38**	937	91	**1,028**	**2,435**
8:00 to 9:00	259	6	**265**	991	97	**1,088**	36	0	**36**	932	98	**1,030**	**2,419**
8:15 to 9:15	283	6	**289**	1,036	89	**1,125**	42	1	**43**	916	97	**1,013**	**2,470**
8:30 to 9:30	285	4	**289**	1,027	87	**1,114**	54	2	**56**	962	97	**1,059**	**2,518**
AM Totals	**551**	**7**	**558**	**2,016**	**184**	**2,200**	**94**	**3**	**97**	**1,893**	**182**	**2,075**	**4,930**
16:30 to 17:30	385	0	**385**	1,107	47	**1,154**	134	0	**134**	1,013	47	**1,060**	**2,733**
16:45 to 17:45	346	0	**346**	1,053	45	**1,098**	116	0	**116**	1,089	46	**1,135**	**2,695**
17:00 to 18:00	310	0	**310**	1,033	41	**1,074**	91	0	**91**	1,093	48	**1,141**	**2,616**
17:15 to 18:15	307	0	**307**	1,009	39	**1,048**	94	0	**94**	1,077	42	**1,119**	**2,568**
17:30 to 18:30	283	1	**284**	979	41	**1,020**	84	0	**84**	1,042	37	**1,079**	**2,467**
PM Totals	**668**	**1**	**669**	**2,086**	**88**	**2,174**	**218**	**0**	**218**	**2,055**	**84**	**2,139**	**5,200**

Job No. : N1958
Client : Arup
Suburb : Blacktown
Location : 2. Blacktown Rd / Wall Park Ave

Day/Date : Tuesday, 15th September 2015
Weather : Fine
Description : Classified Intersection Count
: Peak Hour Summary

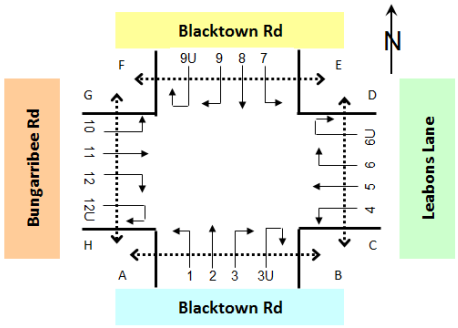


	Approach	Blacktown Rd			Wall Park Ave			Blacktown Rd				Grand Total
	Time Period	Lights	Heavies	Total	Lights	Heavies	Total	Lights	Heavies	Total		
AM	8:00 to 9:00	1,276	154	**1,430**	699	80	**779**	820	101	**921**		3,130
PM	16:30 to 17:30	1,239	56	**1,295**	866	48	**914**	1,112	45	**1,157**		3,366

Approach	Blacktown Rd			Wall Park Ave			Blacktown Rd				Grand Total
Time Period	Lights	Heavies	Total	Lights	Heavies	Total	Lights	Heavies	Total		
7:30 to 8:30	1,260	150	**1,410**	716	70	**786**	830	90	**920**		3,116
7:45 to 8:45	1,288	154	**1,442**	692	71	**763**	798	95	**893**		3,098
8:00 to 9:00	1,276	154	**1,430**	699	80	**779**	820	101	**921**		3,130
8:15 to 9:15	1,228	134	**1,362**	729	82	**811**	802	100	**902**		3,075
8:30 to 9:30	1,117	125	**1,242**	731	84	**815**	815	103	**918**		2,975
AM Totals	**2,377**	**275**	**2,652**	**1,447**	**154**	**1,601**	**1,645**	**193**	**1,838**		6,091
16:30 to 17:30	1,239	56	**1,295**	866	48	**914**	1,112	45	**1,157**		3,366
16:45 to 17:45	1,225	55	**1,280**	822	43	**865**	1,138	40	**1,178**		3,323
17:00 to 18:00	1,221	46	**1,267**	835	37	**872**	1,079	43	**1,122**		3,261
17:15 to 18:15	1,222	47	**1,269**	791	39	**830**	1,057	38	**1,095**		3,194
17:30 to 18:30	1,181	45	**1,226**	799	33	**832**	1,048	40	**1,088**		3,146
PM Totals	**2,420**	**101**	**2,521**	**1,665**	**81**	**1,746**	**2,160**	**85**	**2,245**		6,512

Job No. : N1958
Client : Arup
Suburb : Blacktown
Location : 3. Blacktown Rd / Bungarribee Rd / Leabons Lane

Day/Date : Tuesday, 15th September 2015
Weather : Fine
Description : Classified Intersection Count
: Peak Hour Summary

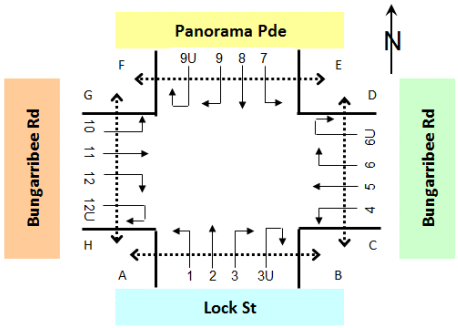


	Approach	Blacktown Rd			Leabons Lane			Blacktown Rd			Bungarribee Rd			Grand Total
	Time Period	Lights	Heavies	Total	Lights	Heavies	Total	Lights	Heavies	Total	Lights	Heavies	Total	
AM	8:00 to 9:00	1,037	142	**1,179**	521	13	**534**	772	123	**895**	720	19	**739**	3,347
PM	17:00 to 18:00	1,038	42	**1,080**	504	3	**507**	1,044	59	**1,103**	590	6	**596**	3,286

Approach	Blacktown Rd			Leabons Lane			Blacktown Rd			Bungarribee Rd			Grand Total
Time Period	Lights	Heavies	Total	Lights	Heavies	Total	Lights	Heavies	Total	Lights	Heavies	Total	
7:30 to 8:30	1,054	136	**1,190**	446	15	**461**	757	111	**868**	739	19	**758**	3,277
7:45 to 8:45	1,045	136	**1,181**	467	14	**481**	752	119	**871**	744	22	**766**	3,299
8:00 to 9:00	1,037	142	**1,179**	521	13	**534**	772	123	**895**	720	19	**739**	3,347
8:15 to 9:15	1,002	126	**1,128**	550	13	**563**	770	125	**895**	696	18	**714**	3,300
8:30 to 9:30	962	125	**1,087**	525	14	**539**	791	132	**923**	613	15	**628**	3,177
AM Totals	**2,016**	**261**	**2,277**	**971**	**29**	**1,000**	**1,548**	**243**	**1,791**	**1,352**	**34**	**1,386**	6,454
16:30 to 17:30	975	50	**1,025**	468	7	**475**	1,028	70	**1,098**	623	7	**630**	3,228
16:45 to 17:45	977	48	**1,025**	484	7	**491**	1,029	61	**1,090**	607	6	**613**	3,219
17:00 to 18:00	1,038	42	**1,080**	504	3	**507**	1,044	59	**1,103**	590	6	**596**	3,286
17:15 to 18:15	1,040	42	**1,082**	512	5	**517**	1,029	58	**1,087**	570	4	**574**	3,260
17:30 to 18:30	1,066	40	**1,106**	515	6	**521**	1,024	48	**1,072**	520	5	**525**	3,224
PM Totals	**2,041**	**90**	**2,131**	**983**	**13**	**996**	**2,052**	**118**	**2,170**	**1,143**	**12**	**1,155**	6,452

Job No. : N1958
Client : Arup
Suburb : Blacktown
Location : 4. Bungarribee Rd / Lock St / Panorama Pde

Day/Date : Tuesday, 15th September 2015
Weather : Fine
Description : Classified Intersection Count
: Peak Hour Summary

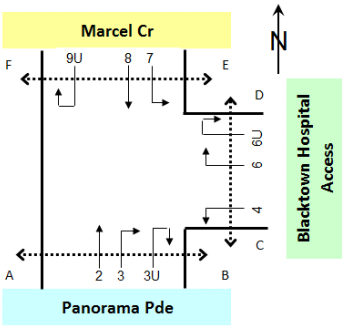


	Approach	Lock St			Bungarribee Rd			Panorama Pde			Bungarribee Rd			Grand Total
	Time Period	Lights	Heavies	Total	Lights	Heavies	Total	Lights	Heavies	Total	Lights	Heavies	Total	
AM	8:00 to 9:00	297	9	306	684	21	705	152	5	157	787	23	810	1,978
PM	16:30 to 17:30	128	4	132	761	14	775	305	1	306	627	11	638	1,851

Approach	Lock St			Bungarribee Rd			Panorama Pde			Bungarribee Rd			Grand Total
Time Period	Lights	Heavies	Total	Lights	Heavies	Total	Lights	Heavies	Total	Lights	Heavies	Total	
7:30 to 8:30	246	6	252	644	19	663	161	2	163	788	20	808	1,886
7:45 to 8:45	264	7	271	668	18	686	147	4	151	812	22	834	1,942
8:00 to 9:00	297	9	306	684	21	705	152	5	157	787	23	810	1,978
8:15 to 9:15	297	8	305	709	21	730	143	7	150	750	20	770	1,955
8:30 to 9:30	276	8	284	660	23	683	145	6	151	670	16	686	1,804
AM Totals	**522**	**14**	**536**	**1,304**	**42**	**1,346**	**306**	**8**	**314**	**1,458**	**36**	**1,494**	**3,690**
16:30 to 17:30	128	4	132	761	14	775	305	1	306	627	11	638	1,851
16:45 to 17:45	126	4	130	769	12	781	276	1	277	626	13	639	1,827
17:00 to 18:00	129	3	132	778	8	786	256	1	257	618	12	630	1,805
17:15 to 18:15	130	5	135	770	12	782	226	4	230	582	9	591	1,738
17:30 to 18:30	133	4	137	791	12	803	196	4	200	522	8	530	1,670
PM Totals	**261**	**8**	**269**	**1,552**	**26**	**1,578**	**501**	**5**	**506**	**1,149**	**19**	**1,168**	**3,521**

Job No. : N1958
Client : Arup
Suburb : Blacktown
Location : 5. Panorama Pde / Marcel Cr / Blacktown Hospital Access

Day/Date : Tuesday, 15th September 2015
Weather : Fine
Description : Classified Intersection Count
: Peak Hour Summary



	Approach	Panorama Pde			Blacktown Hospital Access			Marcel Cr			Grand Total
	Time Period	Lights	Heavies	Total	Lights	Heavies	Total	Lights	Heavies	Total	
AM	7:30 to 8:30	400	5	405	93	6	99	267	3	270	774
PM	16:30 to 17:30	161	1	162	271	1	272	246	1	247	681

Approach	Panorama Pde			Blacktown Hospital Access			Marcel Cr			Grand Total
Time Period	Lights	Heavies	Total	Lights	Heavies	Total	Lights	Heavies	Total	
7:30 to 8:30	400	5	405	93	6	99	267	3	270	774
7:45 to 8:45	384	7	391	76	5	81	235	3	238	710
8:00 to 9:00	372	6	378	83	6	89	240	4	244	711
8:15 to 9:15	348	6	354	98	3	101	259	4	263	718
8:30 to 9:30	331	3	334	104	2	106	265	3	268	708
AM Totals	**731**	**8**	**739**	**197**	**8**	**205**	**532**	**6**	**538**	**1,482**
16:30 to 17:30	161	1	162	271	1	272	246	1	247	681
16:45 to 17:45	170	1	171	237	1	238	240	1	241	650
17:00 to 18:00	181	2	183	217	2	219	217	2	219	621
17:15 to 18:15	183	2	185	183	2	185	191	2	193	563
17:30 to 18:30	174	1	175	182	1	183	187	2	189	547
PM Totals	**335**	**2**	**337**	**453**	**2**	**455**	**433**	**3**	**436**	**1,228**

Appendix B

SIDRA Results

B1 Blacktown Road / Marcel Crescent / Griffiths Street

AM Peak Existing

Stage 1

Stage 2

PM Peak Existing

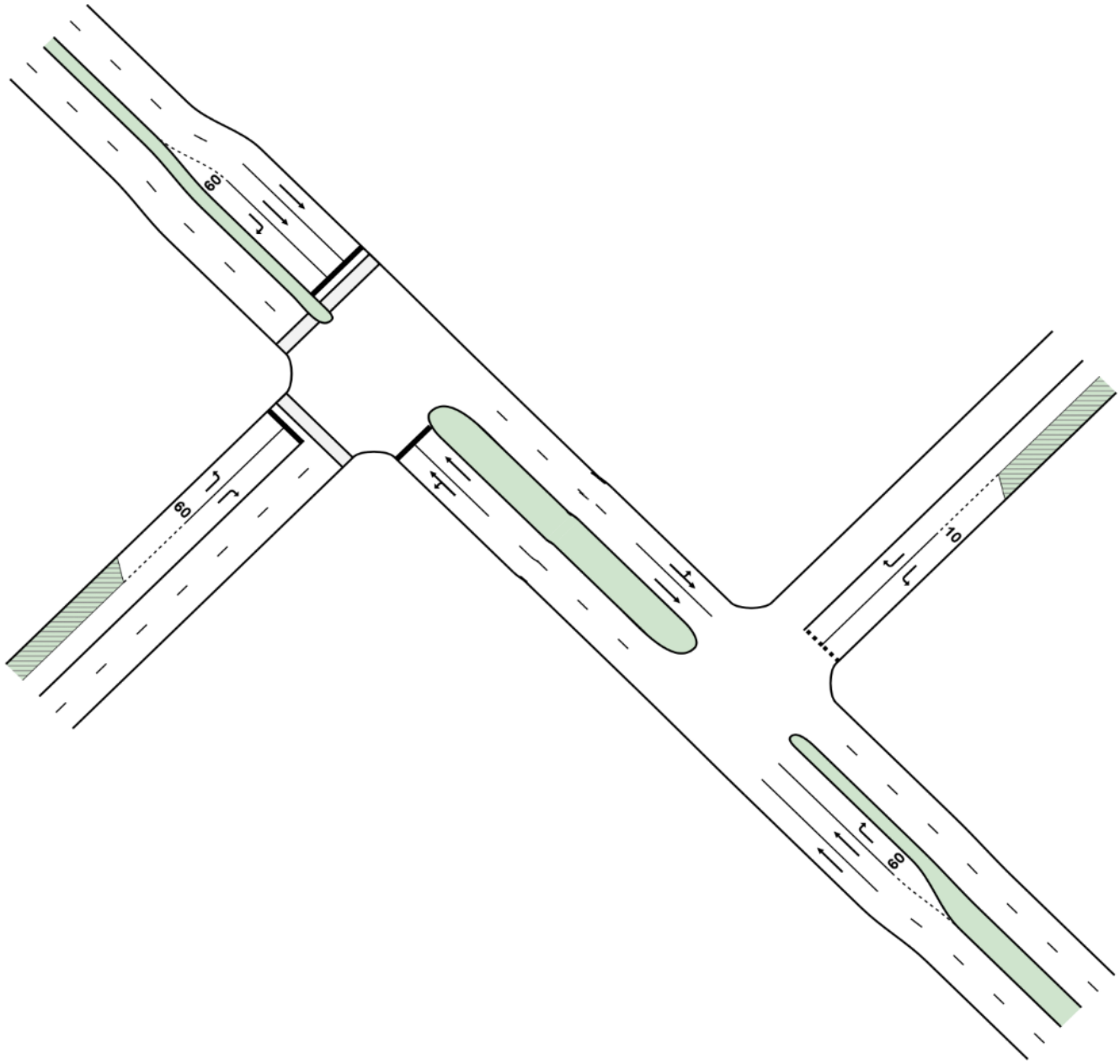
Stage 1

Stage 2

NETWORK LAYOUT

Network: AM Existing

New Network



SITES IN NETWORK	
Site ID	**Site Name**
1	AM Existing
1	AM Existing

NETWORK SUMMARY

Network: AM Existing

New Network

Network Performance - Hourly Values								
Performance Measure	**Vehicles**		**Per Unit Distance**		**Pedestrians**		**Persons**	
Network Level of Service (LOS)	LOS B							
Travel Time Index	8.05							
Speed Efficiency	0.82							
Congestion Coefficient	1.21							
Travel Speed (Average)	49.4	km/h			2.8	km/h	49.0	km/h
Travel Distance (Total)	3780.4	veh-km/h			2.3	ped-km/h	4538.7	pers-km/h
Travel Time (Total)	76.5	veh-h/h			0.8	ped-h/h	92.6	pers-h/h
Desired Speed	60.0	km/h						
Demand Flows (Total)	4757	veh/h			58	ped/h	5708	pers/h
Arrival Flows (Total)	4757	veh/h			58	ped/h	5708	pers/h
Percent Heavy Vehicles (Demand)	7.4	%						
Percent Heavy Vehicles (Arrival)	7.4	%						
Degree of Saturation	0.798							
Control Delay (Total)	13.06	veh-h/h			0.33	ped-h/h	16.01	pers-h/h
Control Delay (Average)	9.9	sec			20.4	sec	10.1	sec
Control Delay (Worst Lane)	105.9	sec						
Control Delay (Worst Movement)	105.9	sec			21.9	sec	105.9	sec
Geometric Delay (Average)	1.0	sec						
Stop-Line Delay (Average)	8.9	sec						
Queue Storage Ratio (Worst Lane)	1.00							
Total Effective Stops	2032	veh/h			50	ped/h	2488	pers/h
Effective Stop Rate	0.43	per veh	0.5	per km	0.86	per ped	0.44	per pers
Proportion Queued	0.43				0.86		0.44	
Performance Index	134.4				1.1		135.5	
Cost (Total)	2495.05	$/h	0.66	$/km	19.93	$/h	2514.98	$/h
Fuel Consumption (Total)	377.8	L/h	99.9	mL/km				
Fuel Economy	10.0	L/100km						
Carbon Dioxide (Total)	901.9	kg/h	238.6	g/km				
Hydrocarbons (Total)	0.072	kg/h	0.019	g/km				
Carbon Monoxide (Total)	0.961	kg/h	0.254	g/km				
NOx (Total)	2.233	kg/h	0.591	g/km				

Network Model Accuracy Level (largest change in degree of saturation for any lane): 2.5 %
Number of Iterations: 10
Network Level of Service (LOS) Method: SIDRA Speed Efficiency.
Model used: New South Wales.

Network Performance - Annual Values						
Performance Measure	**Vehicles**		**Pedestrians**		**Persons**	
Demand Flows (Total)	2,283,284	veh/y	27,789	ped/y	2,739,941	pers/y
Delay	6,271	veh-h/y	157	ped-h/y	7,683	pers-h/y
Effective Stops	975,285	veh/y	23,910	ped/y	1,194,253	pers/y
Travel Distance	1,814,588	veh-km/y	1,083	ped-km/y	2,178,588	pers-km/y
Travel Time	36,697	veh-h/y	389	ped-h/y	44,426	pers-h/y
Cost	1,197,625	$/y	9,564	$/y	1,207,189	$/y
Fuel Consumption	181,336	L/y				
Carbon Dioxide	432,914	kg/y				
Hydrocarbons	35	kg/y				
Carbon Monoxide	461	kg/y				
NOx	1,072	kg/y				

MOVEMENT SUMMARY

Site: AM Existing

Network: AM Existing

Blacktown Road and Marcel Crescent
Signals - Fixed Time Isolated Cycle Time = 55 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival 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
SouthEast: Blacktown Road E													
4	L2	114	0.0	114	0.0	0.779	24.4	LOS B	6.6	49.0	0.93	0.92	44.2
5	T1	1037	8.8	1037	8.8	0.779	18.9	LOS B	6.6	49.0	0.93	0.91	45.5
Approach		1151	8.0	1151	8.0	0.779	19.4	LOS B	6.6	49.0	0.93	0.91	45.4
NorthWest: Blacktown Road W													
11	T1	874	11.4	874	11.4	0.358	4.2	LOS A	5.1	39.0	0.46	0.40	52.9
12	R2	241	0.9	241	0.9	0.798	34.4	LOS C	7.2	51.0	1.00	0.95	37.7
Approach		1115	9.2	1115	9.2	0.798	10.7	LOS A	7.2	51.0	0.58	0.52	46.3
SouthWest: Marcel Crescent													
1	L2	180	1.2	180	1.2	0.256	18.3	LOS B	3.4	23.8	0.72	0.75	45.1
3	R2	124	1.7	124	1.7	0.620	33.6	LOS C	3.5	25.1	1.00	0.82	28.8
Approach		304	1.4	304	1.4	0.620	24.5	LOS B	3.5	25.1	0.84	0.78	39.3
All Vehicles		2569	7.7	2569	7.7	0.798	16.3	LOS B	7.2	51.0	0.77	0.73	44.9

Level of Service (LOS) Method: Delay (RTA NSW).
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
P4	NorthWest Full Crossing	41	21.9	LOS C	0.1	0.1	0.89	0.89
P1	SouthWest Full Crossing	17	16.8	LOS B	0.0	0.0	0.78	0.78
All Pedestrians		58	20.4	LOS C			0.86	0.86

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.

MOVEMENT SUMMARY

Site: AM Existing

Network: AM Existing

Blacktown Road and Griffiths Street
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival 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
SouthEast: Blacktown Road E													
5	T1	1077	4.6	1077	4.6	0.569	0.2	LOS A	13.2	96.1	0.00	0.00	59.6
6	R2	54	0.0	54	0.0	0.164	15.6	LOS B	0.5	3.8	0.76	0.90	46.9
Approach		1131	4.4	1131	4.4	0.569	1.0	NA	13.2	96.1	0.04	0.04	58.2
NorthEast: Griffiths Street													
7	L2	27	7.7	27	7.7	0.033	7.7	LOS A	0.1	0.9	0.43	0.64	51.8
9	R2	32	0.0	32	0.0	0.527	105.9	LOS F	2.0	14.0	0.96	1.06	13.6
Approach		59	3.6	59	3.6	0.527	60.3	LOS E	2.0	14.0	0.72	0.87	25.4
NorthWest: Blacktown Road W													
10	L2	104	3.0	104	3.0	0.274	5.6	LOS A	0.0	0.0	0.00	0.12	57.0
11	T1	894	11.1	894	11.1	0.274	0.0	LOS A	0.0	0.0	0.00	0.05	59.4
Approach		998	10.2	998	10.2	0.274	0.6	NA	0.0	0.0	0.00	0.06	59.1
All Vehicles		2187	7.0	2187	7.0	0.569	2.4	NA	13.2	96.1	0.04	0.07	56.8

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road 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.

NETWORK SUMMARY

Network: AM Stage 1

New Network

Network Performance - Hourly Values								
Performance Measure	**Vehicles**		**Per Unit Distance**		**Pedestrians**		**Persons**	
Network Level of Service (LOS)	LOS B							
Travel Time Index	7.98							
Speed Efficiency	0.82							
Congestion Coefficient	1.22							
Travel Speed (Average)	49.1	km/h			2.7	km/h	48.7	km/h
Travel Distance (Total)	3730.2	veh-km/h			2.3	ped-km/h	4478.5	pers-km/h
Travel Time (Total)	76.0	veh-h/h			0.8	ped-h/h	92.0	pers-h/h
Desired Speed	60.0	km/h						
Demand Flows (Total)	4677	veh/h			58	ped/h	5612	pers/h
Arrival Flows (Total)	4677	veh/h			58	ped/h	5612	pers/h
Percent Heavy Vehicles (Demand)	7.5	%						
Percent Heavy Vehicles (Arrival)	7.5	%						
Degree of Saturation	0.756							
Control Delay (Total)	13.44	veh-h/h			0.36	ped-h/h	16.49	pers-h/h
Control Delay (Average)	10.3	sec			22.6	sec	10.6	sec
Control Delay (Worst Lane)	114.0	sec						
Control Delay (Worst Movement)	114.0	sec			24.3	sec	114.0	sec
Geometric Delay (Average)	1.0	sec						
Stop-Line Delay (Average)	9.3	sec						
Queue Storage Ratio (Worst Lane)	1.00							
Total Effective Stops	1958	veh/h			50	ped/h	2400	pers/h
Effective Stop Rate	0.42	per veh	0.5	per km	0.87	per ped	0.43	per pers
Proportion Queued	0.43				0.87		0.44	
Performance Index	136.5				1.1		137.6	
Cost (Total)	2474.46	$/h	0.66	$/km	20.80	$/h	2495.26	$/h
Fuel Consumption (Total)	374.1	L/h	100.3	mL/km				
Fuel Economy	10.0	L/100km						
Carbon Dioxide (Total)	893.4	kg/h	239.5	g/km				
Hydrocarbons (Total)	0.071	kg/h	0.019	g/km				
Carbon Monoxide (Total)	0.951	kg/h	0.255	g/km				
NOx (Total)	2.226	kg/h	0.597	g/km				

Network Model Accuracy Level (largest change in degree of saturation for any lane): 2.5 %
Number of Iterations: 10
Network Level of Service (LOS) Method: SIDRA Speed Efficiency.
Model used: New South Wales.

Network Performance - Annual Values						
Performance Measure	**Vehicles**		**Pedestrians**		**Persons**	
Demand Flows (Total)	2,244,884	veh/y	27,789	ped/y	2,693,861	pers/y
Delay	6,450	veh-h/y	175	ped-h/y	7,915	pers-h/y
Effective Stops	939,804	veh/y	24,102	ped/y	1,151,866	pers/y
Travel Distance	1,790,482	veh-km/y	1,083	ped-km/y	2,149,662	pers-km/y
Travel Time	36,462	veh-h/y	406	ped-h/y	44,160	pers-h/y
Cost	1,187,739	$/y	9,986	$/y	1,197,725	$/y
Fuel Consumption	179,571	L/y				
Carbon Dioxide	428,831	kg/y				
Hydrocarbons	34	kg/y				
Carbon Monoxide	457	kg/y				
NOx	1,068	kg/y				

MOVEMENT SUMMARY

Site: AM Stage 1

Network: AM Stage 1

Blacktown Road and Marcel Crescent
Signals - Fixed Time Isolated Cycle Time = 60 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival 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
SouthEast: Blacktown Road E													
4	L2	31	0.0	31	0.0	0.756	25.4	LOS B	6.5	49.0	0.93	0.88	44.2
5	T1	1037	8.8	1037	8.8	0.756	19.8	LOS B	6.5	49.0	0.93	0.88	45.2
Approach		1067	8.6	1067	8.6	0.756	20.0	LOS B	6.5	49.0	0.93	0.88	45.2
NorthWest: Blacktown Road W													
11	T1	874	11.4	874	11.4	0.352	4.3	LOS A	5.3	41.0	0.45	0.39	52.7
12	R2	277	0.9	277	0.9	0.750	33.3	LOS C	8.5	60.0	1.00	0.90	38.1
Approach		1151	8.9	1151	8.9	0.750	11.3	LOS A	8.5	60.0	0.58	0.52	45.9
SouthWest: Marcel Crescent													
1	L2	188	1.2	188	1.2	0.246	17.9	LOS B	3.6	25.6	0.69	0.75	45.3
3	R2	145	1.7	145	1.7	0.679	36.1	LOS C	4.5	32.1	1.00	0.86	27.7
Approach		334	1.4	334	1.4	0.679	25.9	LOS B	4.5	32.1	0.82	0.79	38.5
All Vehicles		2552	7.8	2552	7.8	0.756	16.8	LOS B	8.5	60.0	0.76	0.70	44.4

Level of Service (LOS) Method: Delay (RTA NSW).
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
P4	NorthWest Full Crossing	41	24.3	LOS C	0.1	0.1	0.90	0.90
P1	SouthWest Full Crossing	17	18.4	LOS B	0.0	0.0	0.78	0.78
All Pedestrians		58	22.6	LOS C			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.

MOVEMENT SUMMARY

Site: AM Stage 1

Network: AM Stage 1

Blacktown Road and Griffiths Street
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival 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
SouthEast: Blacktown Road E													
5	T1	994	4.6	994	4.6	0.525	0.2	LOS A	12.7	92.3	0.00	0.00	59.6
6	R2	54	0.0	54	0.0	0.170	16.1	LOS B	0.6	3.9	0.77	0.90	46.6
Approach		1047	4.4	1047	4.4	0.525	1.0	NA	12.7	92.3	0.04	0.05	58.1
NorthEast: Griffiths Street													
7	L2	27	7.7	27	7.7	0.033	7.7	LOS A	0.1	0.9	0.44	0.64	51.7
9	R2	32	0.0	32	0.0	0.556	114.0	LOS F	2.1	14.7	0.96	1.07	12.8
Approach		59	3.6	59	3.6	0.556	64.7	LOS E	2.1	14.7	0.72	0.87	24.4
NorthWest: Blacktown Road W													
10	L2	104	3.0	104	3.0	0.280	5.6	LOS A	0.0	0.0	0.00	0.12	57.1
11	T1	915	11.1	915	11.1	0.280	0.0	LOS A	0.0	0.0	0.00	0.05	59.4
Approach		1019	10.2	1019	10.2	0.280	0.6	NA	0.0	0.0	0.00	0.06	59.2
All Vehicles		2125	7.2	2125	7.2	0.556	2.6	NA	12.7	92.3	0.04	0.08	56.6

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road 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.

NETWORK SUMMARY

Network: AM Stage 2

New Network

Network Performance - Hourly Values									
Performance Measure	**Vehicles**		**Per Unit Distance**		**Pedestrians**		**Persons**	
Network Level of Service (LOS)	LOS B							
Travel Time Index	7.88							
Speed Efficiency	0.81							
Congestion Coefficient	1.24							
Travel Speed (Average)	48.5	km/h			2.6	km/h	48.1	km/h
Travel Distance (Total)	3776.7	veh-km/h			2.3	ped-km/h	4534.3	pers-km/h
Travel Time (Total)	77.8	veh-h/h			0.9	ped-h/h	94.3	pers-h/h
Desired Speed	60.0	km/h						
Demand Flows (Total)	4725	veh/h			58	ped/h	5670	pers/h
Arrival Flows (Total)	4725	veh/h			58	ped/h	5670	pers/h
Percent Heavy Vehicles (Demand)	7.4	%						
Percent Heavy Vehicles (Arrival)	7.4	%						
Degree of Saturation	0.781							
Control Delay (Total)	14.51	veh-h/h			0.40	ped-h/h	17.80	pers-h/h
Control Delay (Average)	11.1	sec			24.6	sec	11.3	sec
Control Delay (Worst Lane)	117.0	sec						
Control Delay (Worst Movement)	117.0	sec			26.8	sec	117.0	sec
Geometric Delay (Average)	1.1	sec						
Stop-Line Delay (Average)	10.0	sec						
Queue Storage Ratio (Worst Lane)	1.00							
Total Effective Stops	1982	veh/h			50	ped/h	2429	pers/h
Effective Stop Rate	0.42	per veh	0.5	per km	0.87	per ped	0.43	per pers
Proportion Queued	0.43				0.87		0.44	
Performance Index	143.3				1.2		144.5	
Cost (Total)	2529.94	$/h	0.67	$/km	21.59	$/h	2551.53	$/h
Fuel Consumption (Total)	378.8	L/h	100.3	mL/km				
Fuel Economy	10.0	L/100km						
Carbon Dioxide (Total)	904.6	kg/h	239.5	g/km				
Hydrocarbons (Total)	0.073	kg/h	0.019	g/km				
Carbon Monoxide (Total)	0.964	kg/h	0.255	g/km				
NOx (Total)	2.229	kg/h	0.590	g/km				

Network Model Accuracy Level (largest change in degree of saturation for any lane): 2.5 %
Number of Iterations: 10
Network Level of Service (LOS) Method: SIDRA Speed Efficiency.
Model used: New South Wales.

Network Performance - Annual Values						
Performance Measure	**Vehicles**		**Pedestrians**		**Persons**	
Demand Flows (Total)	2,268,126	veh/y	27,789	ped/y	2,721,751	pers/y
Delay	6,963	veh-h/y	190	ped-h/y	8,545	pers-h/y
Effective Stops	951,503	veh/y	24,140	ped/y	1,165,944	pers/y
Travel Distance	1,812,824	veh-km/y	1,083	ped-km/y	2,176,472	pers-km/y
Travel Time	37,356	veh-h/y	421	ped-h/y	45,249	pers-h/y
Cost	1,214,370	$/y	10,366	$/y	1,224,736	$/y
Fuel Consumption	181,844	L/y				
Carbon Dioxide	434,193	kg/y				
Hydrocarbons	35	kg/y				
Carbon Monoxide	462	kg/y				
NOx	1,070	kg/y				

MOVEMENT SUMMARY

Site: AM Stage 2

Network: AM Stage 2

Blacktown Road and Marcel Crescent
Signals - Fixed Time Isolated Cycle Time = 65 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival 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
SouthEast: Blacktown Road E													
4	L2	31	0.0	31	0.0	0.753	26.5	LOS B	6.5	49.0	0.93	0.87	43.6
5	T1	1037	8.8	1037	8.8	0.753	20.9	LOS B	6.5	49.0	0.93	0.87	44.6
Approach		1067	8.6	1067	8.6	0.753	21.1	LOS B	6.5	49.0	0.93	0.87	44.5
NorthWest: Blacktown Road W													
11	T1	874	11.4	874	11.4	0.348	4.3	LOS A	5.6	43.0	0.43	0.38	52.6
12	R2	311	0.9	311	0.9	0.781	35.7	LOS C	10.5	73.8	1.00	0.92	37.2
Approach		1184	8.7	1184	8.7	0.781	12.6	LOS A	10.5	73.8	0.58	0.52	44.9
SouthWest: Marcel Crescent													
1	L2	193	1.2	193	1.2	0.243	18.3	LOS B	3.9	27.7	0.67	0.75	45.1
3	R2	151	1.7	151	1.7	0.667	37.8	LOS C	5.0	35.5	1.00	0.85	27.0
Approach		343	1.4	343	1.4	0.667	26.9	LOS B	5.0	35.5	0.82	0.79	37.9
All Vehicles		2595	7.7	2595	7.7	0.781	18.0	LOS B	10.5	73.8	0.76	0.70	43.7

Level of Service (LOS) Method: Delay (RTA NSW).
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
P4	NorthWest Full Crossing	41	26.8	LOS C	0.1	0.1	0.91	0.91
P1	SouthWest Full Crossing	17	19.2	LOS B	0.0	0.0	0.77	0.77
All Pedestrians		58	24.6	LOS C			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.

MOVEMENT SUMMARY

Site: AM Stage 2

Network: AM Stage 2

Blacktown Road and Griffiths Street
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival 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
SouthEast: Blacktown Road E													
5	T1	994	4.6	994	4.6	0.525	0.2	LOS A	14.2	103.3	0.00	0.00	59.6
6	R2	54	0.0	54	0.0	0.172	16.2	LOS B	0.6	4.0	0.77	0.90	46.5
Approach		1047	4.4	1047	4.4	0.525	1.0	NA	14.2	103.3	0.04	0.05	58.1
NorthEast: Griffiths Street													
7	L2	27	7.7	27	7.7	0.033	7.8	LOS A	0.1	0.9	0.44	0.65	51.7
9	R2	32	0.0	32	0.0	0.566	117.0	LOS F	2.1	15.0	0.97	1.07	12.6
Approach		59	3.6	59	3.6	0.566	66.3	LOS E	2.1	15.0	0.72	0.87	24.0
NorthWest: Blacktown Road W													
10	L2	104	3.0	104	3.0	0.282	5.6	LOS A	0.0	0.0	0.00	0.12	57.1
11	T1	920	11.1	920	11.1	0.282	0.0	LOS A	0.0	0.0	0.00	0.05	59.4
Approach		1024	10.3	1024	10.3	0.282	0.6	NA	0.0	0.0	0.00	0.06	59.2
All Vehicles		2131	7.2	2131	7.2	0.566	2.6	NA	14.2	103.3	0.04	0.08	56.6

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road 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.

NETWORK SUMMARY

Network: PM Existing

New Network

Network Performance - Hourly Values									
Performance Measure	**Vehicles**		**Per Unit Distance**		**Pedestrians**		**Persons**	
Network Level of Service (LOS)	LOS B							
Travel Time Index	7.84							
Speed Efficiency	0.81							
Congestion Coefficient	1.24							
Travel Speed (Average)	48.3	km/h			2.6	km/h	47.9	km/h
Travel Distance (Total)	4136.9	veh-km/h			2.3	ped-km/h	4966.6	pers-km/h
Travel Time (Total)	85.6	veh-h/h			0.9	ped-h/h	103.6	pers-h/h
Desired Speed	60.0	km/h						
Demand Flows (Total)	5228	veh/h			58	ped/h	6274	pers/h
Arrival Flows (Total)	5228	veh/h			58	ped/h	6274	pers/h
Percent Heavy Vehicles (Demand)	3.8	%						
Percent Heavy Vehicles (Arrival)	3.8	%						
Degree of Saturation	1.005							
Control Delay (Total)	16.32	veh-h/h			0.38	ped-h/h	19.97	pers-h/h
Control Delay (Average)	11.2	sec			23.8	sec	11.5	sec
Control Delay (Worst Lane)	279.0	sec						
Control Delay (Worst Movement)	279.0	sec			26.8	sec	279.0	sec
Geometric Delay (Average)	1.0	sec						
Stop-Line Delay (Average)	10.3	sec						
Queue Storage Ratio (Worst Lane)	1.00							
Total Effective Stops	2056	veh/h			49	ped/h	2517	pers/h
Effective Stop Rate	0.39	per veh	0.5	per km	0.85	per ped	0.40	per pers
Proportion Queued	0.42				0.85		0.42	
Performance Index	146.0				1.1		147.2	
Cost (Total)	2679.51	$/h	0.65	$/km	21.25	$/h	2700.77	$/h
Fuel Consumption (Total)	358.7	L/h	86.7	mL/km				
Fuel Economy	8.7	L/100km						
Carbon Dioxide (Total)	849.7	kg/h	205.4	g/km				
Hydrocarbons (Total)	0.069	kg/h	0.017	g/km				
Carbon Monoxide (Total)	0.956	kg/h	0.231	g/km				
NOx (Total)	1.245	kg/h	0.301	g/km				

Network Model Accuracy Level (largest change in degree of saturation for any lane): 2.5 %
Number of Iterations: 10
Network Level of Service (LOS) Method: SIDRA Speed Efficiency.
Model used: New South Wales.

Network Performance - Annual Values						
Performance Measure	**Vehicles**		**Pedestrians**		**Persons**	
Demand Flows (Total)	2,509,642	veh/y	27,789	ped/y	3,011,570	pers/y
Delay	7,833	veh-h/y	183	ped-h/y	9,583	pers-h/y
Effective Stops	987,065	veh/y	23,642	ped/y	1,208,120	pers/y
Travel Distance	1,985,731	veh-km/y	1,083	ped-km/y	2,383,960	pers-km/y
Travel Time	41,089	veh-h/y	415	ped-h/y	49,721	pers-h/y
Cost	1,286,166	$/y	10,202	$/y	1,296,368	$/y
Fuel Consumption	172,186	L/y				
Carbon Dioxide	407,865	kg/y				
Hydrocarbons	33	kg/y				
Carbon Monoxide	459	kg/y				
NOx	598	kg/y				

MOVEMENT SUMMARY

Site: PM Existing

Network: PM Existing

Blacktown Road and Marcel Crescent
Signals - Fixed Time Isolated Cycle Time = 65 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival 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
SouthEast: Blacktown Road E													
4	L2	95	1.1	95	1.1	0.719	22.2	LOS B	6.8	49.0	0.88	0.81	45.6
5	T1	1117	4.3	1117	4.3	0.719	16.6	LOS B	6.8	49.0	0.88	0.80	46.9
Approach		1212	4.1	1212	4.1	0.719	17.1	LOS B	6.8	49.0	0.88	0.80	46.8
NorthWest: Blacktown Road W													
11	T1	947	5.2	947	5.2	0.380	5.3	LOS A	6.8	49.5	0.48	0.43	51.2
12	R2	168	0.0	168	0.0	0.737	39.0	LOS C	5.8	40.3	1.00	0.89	35.9
Approach		1116	4.4	1116	4.4	0.737	10.4	LOS A	6.8	49.5	0.56	0.50	46.1
SouthWest: Marcel Crescent													
1	L2	213	0.0	213	0.0	0.310	21.5	LOS B	4.9	34.1	0.75	0.77	43.5
3	R2	193	0.0	193	0.0	0.674	36.0	LOS C	6.3	43.8	0.99	0.85	27.7
Approach		405	0.0	405	0.0	0.674	28.4	LOS B	6.3	43.8	0.87	0.81	36.9
All Vehicles		2733	3.6	2733	3.6	0.737	16.0	LOS B	6.8	49.5	0.75	0.68	44.9

Level of Service (LOS) Method: Delay (RTA NSW).
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
P4	NorthWest Full Crossing	41	26.8	LOS C	0.1	0.1	0.91	0.91
P1	SouthWest Full Crossing	17	16.3	LOS B	0.0	0.0	0.71	0.71
All Pedestrians		58	23.8	LOS C			0.85	0.85

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.

MOVEMENT SUMMARY

Site: PM Existing

Network: PM Existing

Blacktown Road and Griffiths Street
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival 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
SouthEast: Blacktown Road E													
5	T1	1166	4.2	1166	4.2	0.615	0.3	LOS A	14.3	103.9	0.00	0.00	59.5
6	R2	48	0.0	48	0.0	0.175	18.0	LOS B	0.6	4.0	0.80	0.92	45.5
Approach		1215	4.1	1215	4.1	0.615	1.0	NA	14.3	103.9	0.03	0.04	58.1
NorthEast: Griffiths Street													
7	L2	96	0.0	96	0.0	0.125	8.5	LOS A	0.5	3.3	0.51	0.74	51.4
9	R2	45	0.0	45	0.0	1.005	279.0	LOS F	6.2	43.2	1.00	1.36	6.0
Approach		141	0.0	141	0.0	1.005	95.3	LOS F	6.2	43.2	0.67	0.94	20.8
NorthWest: Blacktown Road W													
10	L2	47	0.0	47	0.0	0.301	5.6	LOS A	0.0	0.0	0.00	0.05	57.9
11	T1	1093	4.5	1093	4.5	0.301	0.0	LOS A	0.0	0.0	0.00	0.02	59.7
Approach		1140	4.3	1140	4.3	0.301	0.3	NA	0.0	0.0	0.00	0.02	59.6
All Vehicles		2496	4.0	2496	4.0	1.005	6.0	NA	14.3	103.9	0.05	0.08	53.0

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road 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.

NETWORK SUMMARY

Network: PM Stage 1

New Network

Network Performance - Hourly Values								
Performance Measure	**Vehicles**		**Per Unit Distance**		**Pedestrians**		**Persons**	
Network Level of Service (LOS)	LOS C							
Travel Time Index	7.76							
Speed Efficiency	0.80							
Congestion Coefficient	1.25							
Travel Speed (Average)	47.9	km/h			2.7	km/h	47.5	km/h
Travel Distance (Total)	4147.1	veh-km/h			2.3	ped-km/h	4978.8	pers-km/h
Travel Time (Total)	86.6	veh-h/h			0.8	ped-h/h	104.7	pers-h/h
Desired Speed	60.0	km/h						
Demand Flows (Total)	5238	veh/h			58	ped/h	6285	pers/h
Arrival Flows (Total)	5238	veh/h			58	ped/h	6285	pers/h
Percent Heavy Vehicles (Demand)	3.8	%						
Percent Heavy Vehicles (Arrival)	3.8	%						
Degree of Saturation	1.043							
Control Delay (Total)	17.15	veh-h/h			0.36	ped-h/h	20.93	pers-h/h
Control Delay (Average)	11.8	sec			22.2	sec	12.0	sec
Control Delay (Worst Lane)	306.5	sec						
Control Delay (Worst Movement)	306.5	sec			24.3	sec	306.5	sec
Geometric Delay (Average)	1.0	sec						
Stop-Line Delay (Average)	10.8	sec						
Queue Storage Ratio (Worst Lane)	1.00							
Total Effective Stops	2178	veh/h			50	ped/h	2663	pers/h
Effective Stop Rate	0.42	per veh	0.5	per km	0.86	per ped	0.42	per pers
Proportion Queued	0.43				0.86		0.44	
Performance Index	147.6				1.1		148.7	
Cost (Total)	2725.54	$/h	0.66	$/km	20.63	$/h	2746.17	$/h
Fuel Consumption (Total)	363.7	L/h	87.7	mL/km				
Fuel Economy	8.8	L/100km						
Carbon Dioxide (Total)	861.5	kg/h	207.7	g/km				
Hydrocarbons (Total)	0.070	kg/h	0.017	g/km				
Carbon Monoxide (Total)	0.967	kg/h	0.233	g/km				
NOx (Total)	1.271	kg/h	0.306	g/km				

Network Model Accuracy Level (largest change in degree of saturation for any lane): 2.5 %
Number of Iterations: 10
Network Level of Service (LOS) Method: SIDRA Speed Efficiency.
Model used: New South Wales.

Network Performance - Annual Values						
Performance Measure	**Vehicles**		**Pedestrians**		**Persons**	
Demand Flows (Total)	2,514,190	veh/y	27,789	ped/y	3,017,027	pers/y
Delay	8,231	veh-h/y	171	ped-h/y	10,048	pers-h/y
Effective Stops	1,045,472	veh/y	23,833	ped/y	1,278,399	pers/y
Travel Distance	1,990,601	veh-km/y	1,083	ped-km/y	2,389,804	pers-km/y
Travel Time	41,562	veh-h/y	402	ped-h/y	50,277	pers-h/y
Cost	1,308,258	$/y	9,901	$/y	1,318,159	$/y
Fuel Consumption	174,569	L/y				
Carbon Dioxide	413,507	kg/y				
Hydrocarbons	34	kg/y				
Carbon Monoxide	464	kg/y				
NOx	610	kg/y				

MOVEMENT SUMMARY

Site: PM Stage 1

Network: PM Stage 1

Blacktown Road and Marcel Crescent
Signals - Fixed Time Isolated Cycle Time = 60 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival 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
SouthEast: Blacktown Road E													
4	L2	63	1.1	63	1.1	0.749	23.6	LOS B	6.8	49.0	0.91	0.86	45.0
5	T1	1117	4.3	1117	4.3	0.749	18.0	LOS B	6.8	49.0	0.91	0.85	46.2
Approach		1180	4.2	1180	4.2	0.749	18.3	LOS B	6.8	49.0	0.91	0.85	46.1
NorthWest: Blacktown Road W													
11	T1	947	5.2	947	5.2	0.397	5.8	LOS A	6.8	49.7	0.52	0.46	50.5
12	R2	168	0.0	168	0.0	0.777	38.1	LOS C	5.5	38.4	1.00	0.92	36.3
Approach		1116	4.4	1116	4.4	0.777	10.7	LOS A	6.8	49.7	0.60	0.53	45.9
SouthWest: Marcel Crescent													
1	L2	224	0.0	224	0.0	0.315	19.7	LOS B	4.7	32.8	0.74	0.77	44.4
3	R2	223	0.0	223	0.0	0.721	34.1	LOS C	6.8	47.9	1.00	0.88	28.5
Approach		447	0.0	447	0.0	0.721	26.9	LOS B	6.8	47.9	0.87	0.83	37.4
All Vehicles		2743	3.6	2743	3.6	0.777	16.6	LOS B	6.8	49.7	0.78	0.72	44.4

Level of Service (LOS) Method: Delay (RTA NSW).
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
P4	NorthWest Full Crossing	41	24.3	LOS C	0.1	0.1	0.90	0.90
P1	SouthWest Full Crossing	17	16.9	LOS B	0.0	0.0	0.75	0.75
All Pedestrians		58	22.2	LOS C			0.86	0.86

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.

MOVEMENT SUMMARY

Site: PM Stage 1

Network: PM Stage 1

Blacktown Road and Griffiths Street
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival 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
SouthEast: Blacktown Road E													
5	T1	1135	4.2	1135	4.2	0.598	0.3	LOS A	13.8	99.8	0.00	0.00	59.5
6	R2	48	0.0	48	0.0	0.181	18.5	LOS B	0.6	4.2	0.81	0.92	45.2
Approach		1183	4.1	1183	4.1	0.598	1.0	NA	13.8	99.8	0.03	0.04	58.1
NorthEast: Griffiths Street													
7	L2	96	0.0	96	0.0	0.127	8.6	LOS A	0.5	3.3	0.52	0.75	51.3
9	R2	45	0.0	45	0.0	1.043	306.5	LOS F	6.8	47.8	1.00	1.39	5.5
Approach		141	0.0	141	0.0	1.043	104.2	LOS F	6.8	47.8	0.67	0.95	19.7
NorthWest: Blacktown Road W													
10	L2	47	0.0	47	0.0	0.309	5.6	LOS A	0.0	0.0	0.00	0.05	57.9
11	T1	1123	4.5	1123	4.5	0.309	0.0	LOS A	0.0	0.0	0.00	0.02	59.7
Approach		1171	4.3	1171	4.3	0.309	0.3	NA	0.0	0.0	0.00	0.02	59.6
All Vehicles		2495	4.0	2495	4.0	1.043	6.5	NA	13.8	99.8	0.05	0.08	52.5

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road 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.

NETWORK SUMMARY

Network: PM Stage 2

New Network

Network Performance - Hourly Values								
Performance Measure	**Vehicles**		**Per Unit Distance**		**Pedestrians**		**Persons**	
Network Level of Service (LOS)	LOS C							
Travel Time Index	7.60							
Speed Efficiency	0.78							
Congestion Coefficient	1.28							
Travel Speed (Average)	47.1	km/h			2.7	km/h	46.7	km/h
Travel Distance (Total)	4225.3	veh-km/h			2.3	ped-km/h	5072.7	pers-km/h
Travel Time (Total)	89.8	veh-h/h			0.8	ped-h/h	108.6	pers-h/h
Desired Speed	60.0	km/h						
Demand Flows (Total)	5328	veh/h			58	ped/h	6394	pers/h
Arrival Flows (Total)	5328	veh/h			58	ped/h	6394	pers/h
Percent Heavy Vehicles (Demand)	3.7	%						
Percent Heavy Vehicles (Arrival)	3.7	%						
Degree of Saturation	1.106							
Control Delay (Total)	19.04	veh-h/h			0.36	ped-h/h	23.21	pers-h/h
Control Delay (Average)	12.9	sec			22.4	sec	13.1	sec
Control Delay (Worst Lane)	353.9	sec						
Control Delay (Worst Movement)	353.9	sec			24.3	sec	353.9	sec
Geometric Delay (Average)	1.0	sec						
Stop-Line Delay (Average)	11.8	sec						
Queue Storage Ratio (Worst Lane)	1.00							
Total Effective Stops	2306	veh/h			50	ped/h	2817	pers/h
Effective Stop Rate	0.43	per veh	0.5	per km	0.86	per ped	0.44	per pers
Proportion Queued	0.44				0.86		0.45	
Performance Index	154.4				1.1		155.5	
Cost (Total)	2833.00	$/h	0.67	$/km	20.71	$/h	2853.72	$/h
Fuel Consumption (Total)	373.7	L/h	88.4	mL/km				
Fuel Economy	8.8	L/100km						
Carbon Dioxide (Total)	885.2	kg/h	209.5	g/km				
Hydrocarbons (Total)	0.073	kg/h	0.017	g/km				
Carbon Monoxide (Total)	0.991	kg/h	0.235	g/km				
NOx (Total)	1.294	kg/h	0.306	g/km				

Network Model Accuracy Level (largest change in degree of saturation for any lane): 2.5 %
Number of Iterations: 10
Network Level of Service (LOS) Method: SIDRA Speed Efficiency.
Model used: New South Wales.

Network Performance - Annual Values						
Performance Measure	**Vehicles**		**Pedestrians**		**Persons**	
Demand Flows (Total)	2,557,642	veh/y	27,789	ped/y	3,069,170	pers/y
Delay	9,139	veh-h/y	173	ped-h/y	11,140	pers-h/y
Effective Stops	1,106,886	veh/y	23,967	ped/y	1,352,230	pers/y
Travel Distance	2,028,167	veh-km/y	1,083	ped-km/y	2,434,883	pers-km/y
Travel Time	43,105	veh-h/y	404	ped-h/y	52,130	pers-h/y
Cost	1,359,841	$/y	9,943	$/y	1,369,784	$/y
Fuel Consumption	179,391	L/y				
Carbon Dioxide	424,880	kg/y				
Hydrocarbons	35	kg/y				
Carbon Monoxide	476	kg/y				
NOx	621	kg/y				

MOVEMENT SUMMARY

Site: PM Stage 2

Network: PM Stage 2

Blacktown Road and Marcel Crescent
Signals - Fixed Time Isolated Cycle Time = 60 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival 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
SouthEast: Blacktown Road E													
4	L2	63	1.1	63	1.1	0.780	25.7	LOS B	6.8	49.0	0.93	0.91	43.8
5	T1	1117	4.3	1117	4.3	0.780	20.1	LOS B	6.8	49.0	0.93	0.90	45.0
Approach		1180	4.2	1180	4.2	0.780	20.4	LOS B	6.8	49.0	0.93	0.90	44.9
NorthWest: Blacktown Road W													
11	T1	947	5.2	947	5.2	0.397	5.8	LOS A	6.8	49.7	0.52	0.46	50.5
12	R2	182	0.0	182	0.0	0.735	36.2	LOS C	5.7	40.2	1.00	0.89	37.0
Approach		1129	4.4	1129	4.4	0.735	10.7	LOS A	6.8	49.7	0.60	0.53	45.9
SouthWest: Marcel Crescent													
1	L2	246	0.0	246	0.0	0.332	19.2	LOS B	5.1	35.5	0.73	0.77	44.7
3	R2	251	0.0	251	0.0	0.809	36.9	LOS C	8.2	57.4	1.00	0.95	27.3
Approach		497	0.0	497	0.0	0.809	28.1	LOS B	8.2	57.4	0.87	0.86	36.8
All Vehicles		2806	3.5	2806	3.5	0.809	17.9	LOS B	8.2	57.4	0.79	0.75	43.6

Level of Service (LOS) Method: Delay (RTA NSW).
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
P4	NorthWest Full Crossing	41	24.3	LOS C	0.1	0.1	0.90	0.90
P1	SouthWest Full Crossing	17	17.6	LOS B	0.0	0.0	0.77	0.77
All Pedestrians		58	22.4	LOS C			0.86	0.86

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.

MOVEMENT SUMMARY

Site: PM Stage 2

Network: PM Stage 2

Blacktown Road and Griffiths Street
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival 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
SouthEast: Blacktown Road E													
5	T1	1135	4.2	1135	4.2	0.598	0.3	LOS A	15.2	110.6	0.00	0.00	59.5
6	R2	48	0.0	48	0.0	0.189	19.3	LOS B	0.6	4.4	0.82	0.93	44.8
Approach		1183	4.1	1183	4.1	0.598	1.0	NA	15.2	110.6	0.03	0.04	58.0
NorthEast: Griffiths Street													
7	L2	96	0.0	96	0.0	0.129	8.7	LOS A	0.5	3.4	0.52	0.75	51.3
9	R2	45	0.0	45	0.0	1.106	353.9	LOS F	8.0	55.7	1.00	1.45	4.8
Approach		141	0.0	141	0.0	1.106	119.5	LOS F	8.0	55.7	0.68	0.98	17.9
NorthWest: Blacktown Road W													
10	L2	47	0.0	47	0.0	0.316	5.6	LOS A	0.0	0.0	0.00	0.05	57.9
11	T1	1151	4.5	1151	4.5	0.316	0.0	LOS A	0.0	0.0	0.00	0.02	59.7
Approach		1198	4.3	1198	4.3	0.316	0.3	NA	0.0	0.0	0.00	0.02	59.6
All Vehicles		2522	4.0	2522	4.0	1.106	7.3	NA	15.2	110.6	0.05	0.08	51.8

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road 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.

B2 Blacktown Road / Wall Park Avenue

AM Peak Existing

Stage 1

Stage 2

PM Peak Existing

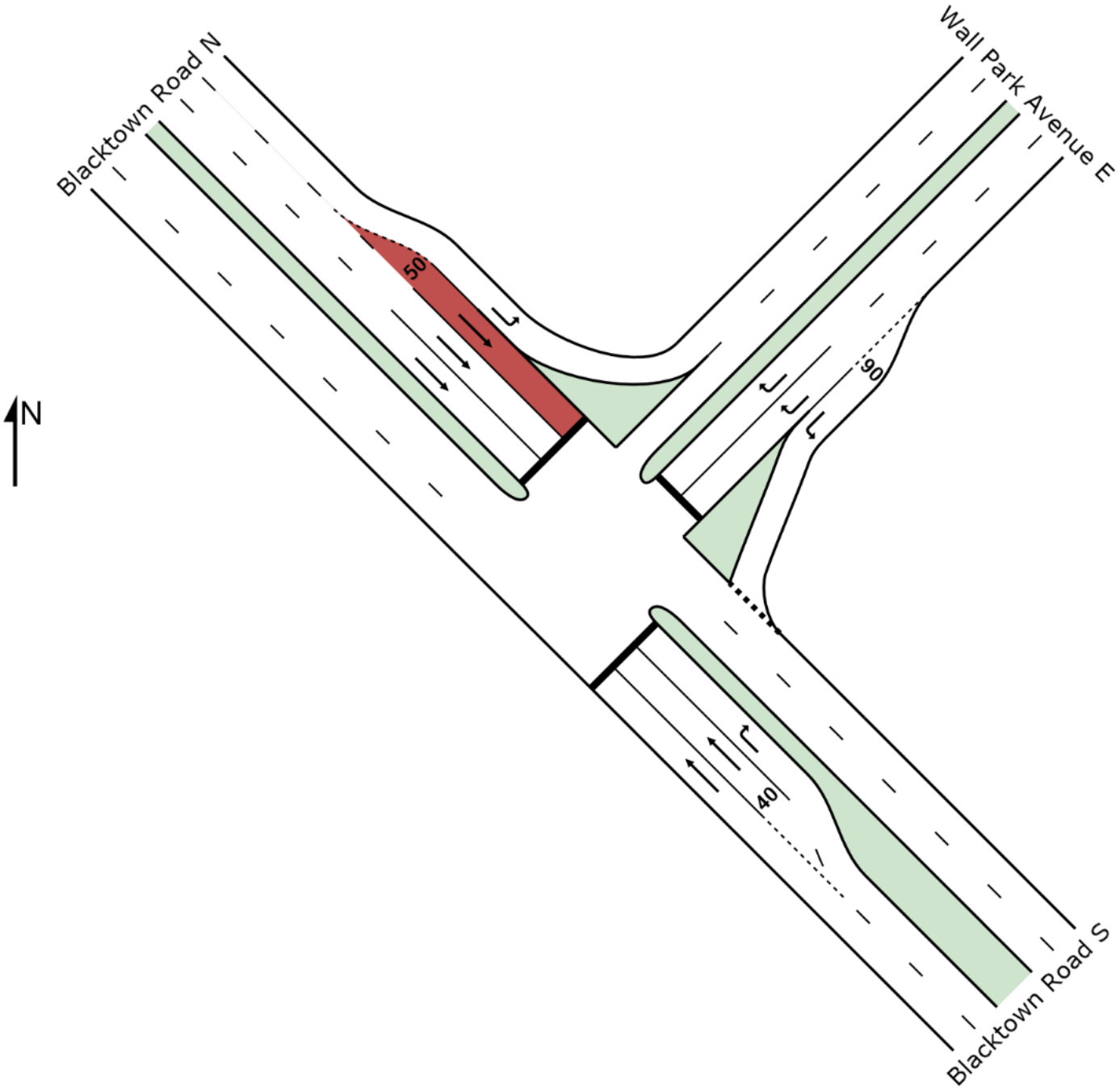
Stage 1

Stage 2

SITE LAYOUT

Site: AM Existing

Wall Park Avenue and Blacktown Road
Signals - Fixed Time Isolated



MOVEMENT SUMMARY

Site: AM Existing

Wall Park Avenue and Blacktown Road
Signals - Fixed Time Isolated Cycle Time = 95 seconds (Optimum Cycle Time - Minimum Delay)
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
SouthEast: Blacktown Road S											
2	T1	760	10.8	0.283	4.4	LOS A	5.8	44.0	0.36	0.31	56.0
3	R2	745	10.7	0.892	42.5	LOS C	38.7	295.8	0.98	0.99	34.8
Approach		1505	10.8	0.892	23.2	LOS B	38.7	295.8	0.67	0.65	43.0
NorthEast: Wall Park Avenue E											
4	L2	381	15.7	0.309	9.3	LOS A	5.1	40.1	0.36	0.66	51.0
6	R2	439	5.5	0.898	62.3	LOS E	12.1	88.5	1.00	1.03	29.5
Approach		820	10.3	0.898	37.7	LOS C	12.1	88.5	0.70	0.86	36.7
NorthWest: Blacktown Road N											
7	L2	387	6.8	0.219	5.7	LOS A	0.0	0.0	0.00	0.52	54.7
8	T1	598	16.0	0.858	48.8	LOS D	15.1	118.2	1.00	1.01	33.4
Approach		985	12.4	0.858	31.9	LOS C	15.1	118.2	0.60	0.82	39.5
All Vehicles		3311	11.1	0.898	29.4	LOS C	38.7	295.8	0.66	0.75	40.2

Level of Service (LOS) Method: Delay (RTA NSW).
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 SUMMARY

Site: AM Stage1

Wall Park Avenue and Blacktown Road
Signals - Fixed Time Isolated Cycle Time = 100 seconds (Optimum Cycle Time - Minimum Delay)
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
SouthEast: Blacktown Road S											
2	T1	815	10.8	0.306	5.0	LOS A	6.8	51.9	0.37	0.33	55.5
3	R2	745	10.7	0.900	45.5	LOS D	41.3	315.5	0.99	0.99	33.8
Approach		1560	10.8	0.900	24.3	LOS B	41.3	315.5	0.67	0.65	42.5
NorthEast: Wall Park Avenue E											
4	L2	381	15.7	0.308	9.5	LOS A	5.3	41.8	0.35	0.66	50.9
6	R2	475	5.5	0.886	62.4	LOS E	13.4	98.5	1.00	1.00	29.4
Approach		856	10.1	0.886	38.9	LOS C	13.4	98.5	0.71	0.85	36.2
NorthWest: Blacktown Road N											
7	L2	408	6.8	0.231	5.7	LOS A	0.0	0.0	0.00	0.52	54.7
8	T1	598	16.0	0.856	50.7	LOS D	15.8	123.4	1.00	1.00	32.8
Approach		1006	12.3	0.856	32.4	LOS C	15.8	123.4	0.59	0.81	39.2
All Vehicles		3422	11.0	0.900	30.3	LOS C	41.3	315.5	0.66	0.74	39.8

Level of Service (LOS) Method: Delay (RTA NSW).
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 SUMMARY

Site: AM Stage2

Wall Park Avenue and Blacktown Road
Signals - Fixed Time Isolated Cycle Time = 95 seconds (Optimum Cycle Time - Minimum Delay)
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
SouthEast: Blacktown Road S											
2	T1	831	10.8	0.318	5.3	LOS A	7.0	53.3	0.40	0.35	55.2
3	R2	745	10.7	0.912	47.6	LOS D	41.3	315.6	1.00	1.02	33.2
Approach		1576	10.8	0.912	25.3	LOS B	41.3	315.6	0.68	0.67	42.0
NorthEast: Wall Park Avenue E											
4	L2	381	15.7	0.305	9.0	LOS A	4.8	38.3	0.34	0.64	51.1
6	R2	508	5.5	0.901	61.8	LOS E	14.1	103.1	1.00	1.03	29.6
Approach		889	9.9	0.901	39.2	LOS C	14.1	103.1	0.72	0.86	36.1
NorthWest: Blacktown Road N											
7	L2	414	6.8	0.234	5.7	LOS A	0.0	0.0	0.00	0.52	54.7
8	T1	598	16.0	0.909	55.9	LOS D	16.3	127.8	1.00	1.09	31.4
Approach		1012	12.2	0.909	35.4	LOS C	16.3	127.8	0.59	0.86	38.0
All Vehicles		3477	11.0	0.912	31.8	LOS C	41.3	315.6	0.66	0.77	39.2

Level of Service (LOS) Method: Delay (RTA NSW).
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 SUMMARY

Site: PM Existing

Wall Park Avenue and Blacktown Road
Signals - Fixed Time Isolated Cycle Time = 70 seconds (Optimum Cycle Time - Minimum Delay)
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
SouthEast: Blacktown Road S											
2	T1	748	5.2	0.289	4.6	LOS A	5.0	36.4	0.42	0.37	55.8
3	R2	615	3.3	0.878	37.9	LOS C	24.6	176.8	1.00	1.01	36.5
Approach		1363	4.3	0.878	19.6	LOS B	24.6	176.8	0.68	0.65	45.0
NorthEast: Wall Park Avenue E											
4	L2	513	7.2	0.423	9.9	LOS A	6.0	44.3	0.47	0.71	50.9
6	R2	449	3.0	0.865	46.2	LOS D	9.0	64.7	1.00	1.02	33.8
Approach		962	5.3	0.865	26.8	LOS B	9.0	64.7	0.72	0.86	41.2
NorthWest: Blacktown Road N											
7	L2	548	2.1	0.300	5.7	LOS A	0.0	0.0	0.00	0.53	54.8
8	T1	685	7.5	0.829	34.4	LOS C	12.6	92.6	1.00	0.99	38.4
Approach		1234	5.1	0.829	21.6	LOS B	12.6	92.6	0.55	0.78	44.4
All Vehicles		3559	4.9	0.878	22.3	LOS B	24.6	176.8	0.65	0.75	43.7

Level of Service (LOS) Method: Delay (RTA NSW).
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 SUMMARY

Site: PM Stage1

Wall Park Avenue and Blacktown Road
Signals - Fixed Time Isolated Cycle Time = 70 seconds (Optimum Cycle Time - Minimum Delay)
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
SouthEast: Blacktown Road S											
2	T1	765	5.2	0.296	4.6	LOS A	5.1	37.4	0.42	0.37	55.8
3	R2	615	3.3	0.878	37.9	LOS C	24.6	176.8	1.00	1.01	36.5
Approach		1380	4.3	0.878	19.4	LOS B	24.6	176.8	0.68	0.65	45.1
NorthEast: Wall Park Avenue E											
4	L2	513	7.2	0.423	9.9	LOS A	6.0	44.3	0.47	0.71	50.9
6	R2	451	3.0	0.867	46.3	LOS D	9.1	65.1	1.00	1.03	33.8
Approach		963	5.2	0.867	26.9	LOS B	9.1	65.1	0.72	0.86	41.1
NorthWest: Blacktown Road N											
7	L2	579	2.1	0.316	5.7	LOS A	0.0	0.0	0.00	0.53	54.8
8	T1	685	7.5	0.829	34.4	LOS C	12.6	92.6	1.00	0.99	38.4
Approach		1264	5.0	0.829	21.2	LOS B	12.6	92.6	0.54	0.78	44.6
All Vehicles		3607	4.8	0.878	22.1	LOS B	24.6	176.8	0.64	0.75	43.8

Level of Service (LOS) Method: Delay (RTA NSW).
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 SUMMARY

Site: PM Stage2

Wall Park Avenue and Blacktown Road
Signals - Fixed Time Isolated Cycle Time = 75 seconds (Optimum Cycle Time - Minimum Delay)
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
SouthEast: Blacktown Road S											
2	T1	772	5.2	0.295	4.7	LOS A	5.4	39.4	0.41	0.36	55.7
3	R2	615	3.3	0.847	34.9	LOS C	24.1	173.2	0.97	0.96	37.6
Approach		1386	4.3	0.847	18.1	LOS B	24.1	173.2	0.66	0.63	45.9
NorthEast: Wall Park Avenue E											
4	L2	513	7.2	0.418	10.1	LOS A	6.2	46.4	0.46	0.71	50.8
6	R2	463	3.0	0.869	48.7	LOS D	9.9	71.2	1.00	1.02	33.1
Approach		976	5.2	0.869	28.4	LOS B	9.9	71.2	0.72	0.86	40.5
NorthWest: Blacktown Road N											
7	L2	606	2.1	0.331	5.7	LOS A	0.0	0.0	0.00	0.53	54.8
8	T1	685	7.5	0.833	36.7	LOS C	13.5	98.9	1.00	0.99	37.5
Approach		1292	5.0	0.833	22.2	LOS B	13.5	98.9	0.53	0.77	44.1
All Vehicles		3654	4.8	0.869	22.3	LOS B	24.1	173.2	0.63	0.74	43.7

Level of Service (LOS) Method: Delay (RTA NSW).
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.

B3 Blacktown Road / Bungaribee Road / Leabons lane

AM Peak Existing

Stage 1

Stage 2

PM Peak Existing

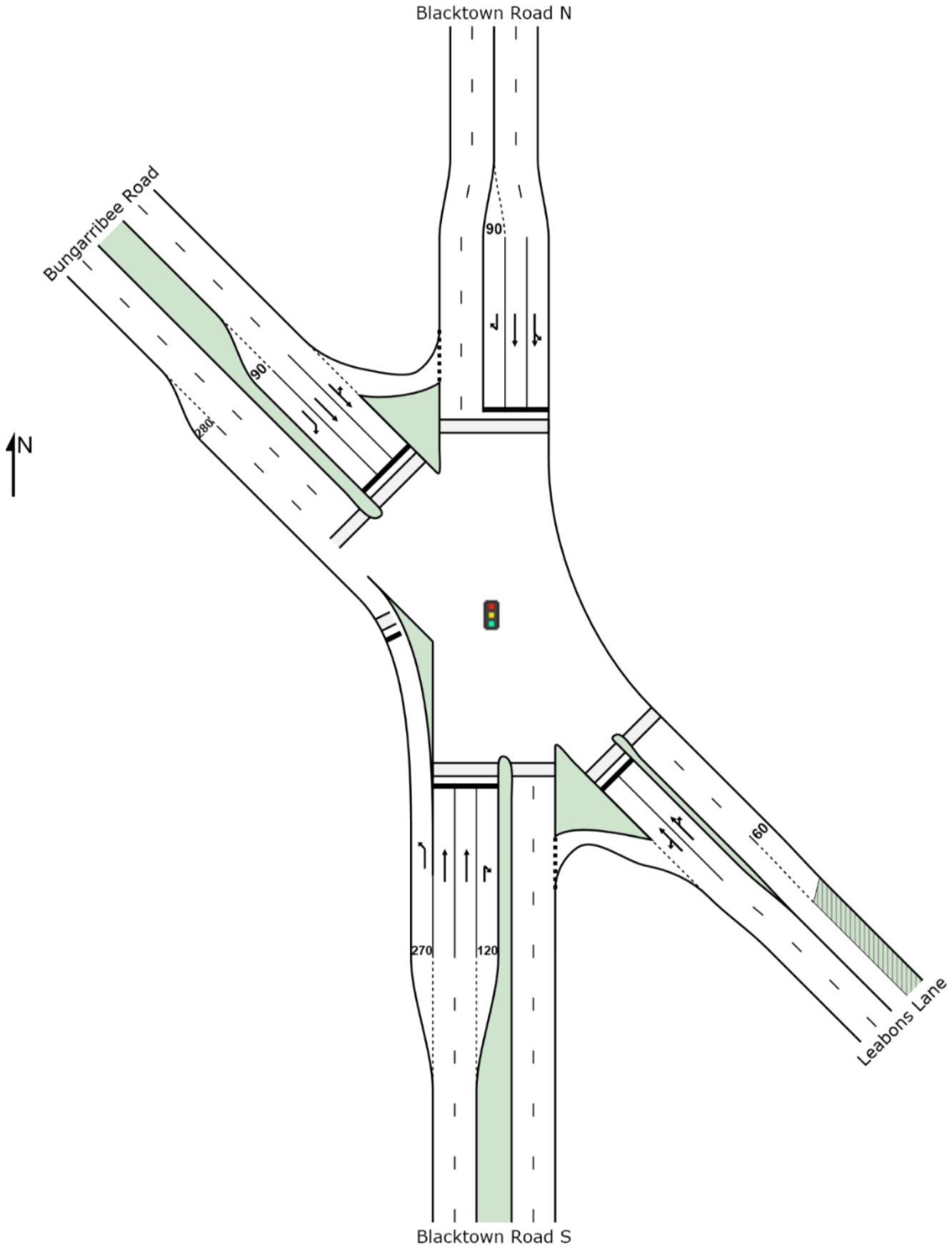
Stage 1

Stage 2

SITE LAYOUT

Site: AM Existing

Bungarribee Road/Leabons Lane and Blacktown Road
Signals - Fixed Time Isolated



PHASING SUMMARY

Site: AM Existing

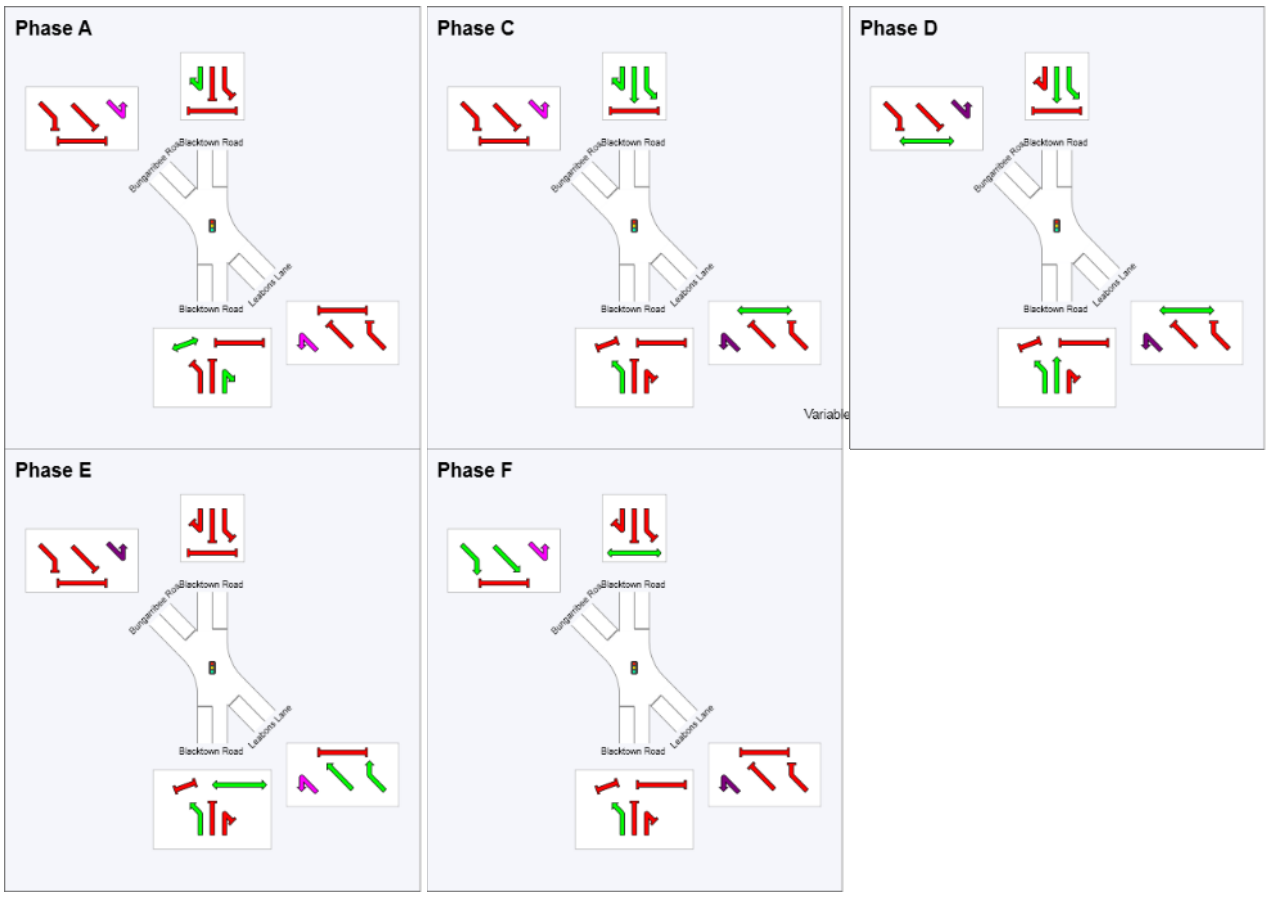
Bungarribee Road/Leabons Lane and Blacktown Road
Signals - Fixed Time Isolated Cycle Time = 110 seconds (Optimum Cycle Time - Minimum Delay)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Phase times determined by the program
Sequence: Variable Phasing
Movement Class: All Movement Classes
Input Sequence: A, B, C, D, E, F
Output Sequence: A, C, D, E, F

Phase Timing Results

Phase	A	C	D	E	F
Reference Phase	Yes	No	No	No	No
Phase Change Time (sec)	0	16	20	59	83
Green Time (sec)	10	***	33	18	21
Yellow Time (sec)	4	4	4	4	4
All-Red Time (sec)	2	2	2	2	2
Phase Time (sec)	16	4	39	24	27
Phase Split	15 %	4 %	35 %	22 %	25 %

*** No green time has been calculated for this phase because the next phase starts during its intergreen time.
This occurs with overlap phasing where there is no single movement connecting this phase to the next, or
where the only such movement is a dummy movement with zero minimum green time specified.
If a green time is required for this phase, specify a dummy movement with a non-zero minimum green time.



MOVEMENT SUMMARY

Site: AM Existing

Bungarribee Road/Leabons Lane and Blacktown Road
Signals - Fixed Time Isolated Cycle Time = 110 seconds (Optimum Cycle Time - Minimum Delay)
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: Blacktown Road S											
1a	L1	146	3.6	0.098	7.0	LOS A	1.7	12.0	0.23	0.59	52.7
2	T1	1006	14.2	0.940	64.3	LOS E	34.4	270.2	1.00	1.18	29.2
3b	R3	88	1.2	0.603	61.6	LOS E	4.9	34.4	1.00	0.80	29.4
Approach		1241	12.0	0.940	57.4	LOS E	34.4	270.2	0.91	1.08	30.8
SouthEast: Leabons Lane											
21b	L3	83	5.1	0.906	70.1	LOS E	17.2	122.8	1.00	1.10	29.0
22	T1	329	1.3	0.906	63.3	LOS E	17.7	126.6	1.00	1.09	29.0
23a	R1	149	3.5	0.906	67.4	LOS E	17.7	126.6	1.00	1.07	28.9
Approach		562	2.4	0.906	65.4	LOS E	17.7	126.6	1.00	1.08	29.0
North: Blacktown Road N											
7a	L1	88	6.0	0.633	37.9	LOS C	17.2	134.9	0.90	0.80	37.5
8	T1	663	17.0	0.633	33.3	LOS C	17.2	134.9	0.90	0.79	38.6
9b	R3	191	6.1	0.958	85.9	LOS F	13.5	99.2	1.00	1.08	24.7
Approach		942	13.7	0.958	44.3	LOS D	17.2	136.2	0.92	0.85	34.5
NorthWest: Bungarribee Road											
27b	L3	292	3.6	0.351	19.5	LOS B	8.3	60.0	0.61	0.75	45.4
28	T1	338	1.2	0.915	63.0	LOS E	21.6	152.8	1.00	1.09	29.5
29a	R1	148	3.5	0.417	47.1	LOS D	7.1	51.3	0.93	0.79	33.8
Approach		778	2.6	0.915	43.7	LOS D	21.6	152.8	0.84	0.90	35.0
All Vehicles		3523	8.9	0.958	52.1	LOS D	34.4	270.2	0.91	0.98	32.3

Level of Service (LOS) Method: Delay (RTA NSW).
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	7	49.2	LOS E	0.0	0.0	0.95	0.95
P1S	South Slip/Bypass Lane Crossing	16	47.3	LOS E	0.0	0.0	0.93	0.93
P5	SouthEast Full Crossing	5	32.1	LOS D	0.0	0.0	0.76	0.76
P3	North Full Crossing	3	47.3	LOS E	0.0	0.0	0.93	0.93
P7	NorthWest Full Crossing	8	40.2	LOS E	0.0	0.0	0.85	0.85
All Pedestrians		40	44.2	LOS E			0.89	0.89

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.

MOVEMENT SUMMARY

Site: AM Stage 1

Bungarribee Road/Leabons Lane and Blacktown Road
Signals - Fixed Time Isolated Cycle Time = 115 seconds (Optimum Cycle Time - Minimum Delay)
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: Blacktown Road S											
1a	L1	108	3.6	0.073	7.0	LOS A	1.3	9.0	0.22	0.58	52.7
2	T1	1061	14.2	0.960	73.1	LOS F	40.3	316.2	1.00	1.22	27.3
3b	R3	88	1.2	0.573	62.9	LOS E	5.0	35.5	1.00	0.79	29.1
Approach		1258	12.4	0.960	66.7	LOS E	40.3	316.2	0.93	1.14	28.6
SouthEast: Leabons Lane											
21b	L3	83	5.1	0.898	71.2	LOS F	17.6	126.0	1.00	1.09	28.7
22	T1	329	1.3	0.898	64.3	LOS E	18.2	130.2	1.00	1.07	28.8
23a	R1	149	3.5	0.898	68.3	LOS E	18.2	130.2	1.00	1.05	28.7
Approach		562	2.4	0.898	66.4	LOS E	18.2	130.2	1.00	1.07	28.8
North: Blacktown Road N											
7a	L1	88	6.0	0.612	38.1	LOS C	17.6	138.2	0.89	0.79	37.4
8	T1	663	17.0	0.612	33.5	LOS C	17.6	138.2	0.89	0.78	38.5
9b	R3	191	6.1	0.934	81.8	LOS F	13.3	98.2	1.00	1.04	25.4
Approach		942	13.7	0.934	43.7	LOS D	17.6	139.6	0.91	0.83	34.8
NorthWest: Bungarribee Road											
27b	L3	292	3.6	0.361	21.2	LOS B	9.1	65.3	0.63	0.76	44.5
28	T1	338	1.2	0.957	76.9	LOS F	24.5	173.4	1.00	1.17	26.5
29a	R1	159	3.5	0.467	50.3	LOS D	8.1	58.5	0.94	0.79	32.8
Approach		788	2.6	0.957	51.0	LOS D	24.5	173.4	0.85	0.94	32.7
All Vehicles		3551	9.0	0.960	57.0	LOS E	40.3	316.2	0.92	1.00	31.0

Level of Service (LOS) Method: Delay (RTA NSW).
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	7	51.7	LOS E	0.0	0.0	0.95	0.95
P1S	South Slip/Bypass Lane Crossing	16	48.9	LOS E	0.0	0.0	0.92	0.92
P5	SouthEast Full Crossing	5	32.2	LOS D	0.0	0.0	0.75	0.75
P3	North Full Crossing	3	49.8	LOS E	0.0	0.0	0.93	0.93
P7	NorthWest Full Crossing	8	40.1	LOS E	0.0	0.0	0.84	0.84
All Pedestrians		40	45.4	LOS E			0.89	0.89

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.

MOVEMENT SUMMARY

Site: AM Stage 2

Bungarribee Road/Leabons Lane and Blacktown Road
Signals - Fixed Time Isolated Cycle Time = 120 seconds (Optimum Cycle Time - Minimum Delay)
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: Blacktown Road S											
1a	L1	108	3.6	0.072	6.9	LOS A	1.3	9.0	0.22	0.58	52.8
2	T1	1077	14.2	0.944	67.8	LOS E	40.5	318.0	1.00	1.16	28.4
3b	R3	88	1.2	0.598	66.0	LOS E	5.3	37.3	1.00	0.79	28.4
Approach		1274	12.4	0.944	62.5	LOS E	40.5	318.0	0.93	1.09	29.6
SouthEast: Leabons Lane											
21b	L3	83	5.1	0.937	82.2	LOS F	19.7	140.8	1.00	1.15	26.4
22	T1	329	1.3	0.937	75.2	LOS F	20.2	144.6	1.00	1.13	26.5
23a	R1	149	3.5	0.937	79.1	LOS F	20.2	144.6	1.00	1.11	26.5
Approach		562	2.4	0.937	77.3	LOS F	20.2	144.6	1.00	1.13	26.5
North: Blacktown Road N											
7a	L1	88	6.0	0.581	37.5	LOS C	17.7	139.6	0.86	0.77	37.6
8	T1	663	17.0	0.581	32.8	LOS C	17.7	139.6	0.86	0.76	38.8
9b	R3	191	6.1	0.914	79.7	LOS F	13.4	98.5	1.00	1.00	25.8
Approach		942	13.7	0.914	42.7	LOS D	17.7	140.9	0.89	0.81	35.1
NorthWest: Bungarribee Road											
27b	L3	292	3.6	0.363	22.4	LOS B	9.6	69.2	0.64	0.76	43.9
28	T1	338	1.2	0.953	78.0	LOS F	25.2	177.9	1.00	1.15	26.3
29a	R1	151	3.5	0.440	51.8	LOS D	7.9	57.3	0.94	0.79	32.4
Approach		780	2.6	0.953	52.1	LOS D	25.2	177.9	0.85	0.94	32.4
All Vehicles		3558	9.0	0.953	57.3	LOS E	40.5	318.0	0.91	0.99	30.9

Level of Service (LOS) Method: Delay (RTA NSW).
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	7	54.2	LOS E	0.0	0.0	0.95	0.95
P1S	South Slip/Bypass Lane Crossing	16	51.4	LOS E	0.0	0.0	0.93	0.93
P5	SouthEast Full Crossing	5	31.5	LOS D	0.0	0.0	0.73	0.73
P3	North Full Crossing	3	51.3	LOS E	0.0	0.0	0.93	0.93
P7	NorthWest Full Crossing	8	40.0	LOS E	0.0	0.0	0.82	0.82
All Pedestrians		40	46.9	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.

MOVEMENT SUMMARY

Site: PM Existing

Bungarribee Road/Leabons Lane and Blacktown Road
Signals - Fixed Time Isolated Cycle Time = 95 seconds (Optimum Cycle Time - Minimum Delay)
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: Blacktown Road S											
1a	L1	94	0.0	0.064	7.3	LOS A	1.0	7.2	0.26	0.59	52.6
2	T1	923	4.7	0.891	48.0	LOS D	24.8	180.6	1.00	1.07	33.6
3b	R3	120	0.9	0.706	54.9	LOS D	5.9	41.4	1.00	0.85	31.1
Approach		1137	3.9	0.891	45.4	LOS D	24.8	180.6	0.94	1.01	34.3
SouthEast: Leabons Lane											
21b	L3	117	0.9	0.867	55.9	LOS D	13.0	91.5	1.00	1.06	32.4
22	T1	320	0.0	0.867	50.3	LOS D	13.8	97.3	1.00	1.04	32.3
23a	R1	97	2.2	0.867	55.6	LOS D	13.8	97.3	1.00	1.01	32.0
Approach		534	0.6	0.867	52.5	LOS D	13.8	97.3	1.00	1.04	32.3
North: Blacktown Road N											
7a	L1	82	5.1	0.662	32.4	LOS C	17.3	127.9	0.90	0.80	39.9
8	T1	803	6.6	0.662	27.8	LOS B	17.4	128.5	0.90	0.79	41.0
9b	R3	276	1.9	0.907	63.2	LOS E	15.6	111.2	1.00	1.02	29.2
Approach		1161	5.3	0.907	36.5	LOS C	17.4	128.5	0.92	0.85	37.3
NorthWest: Bungarribee Road											
27b	L3	207	5.1	0.270	22.7	LOS B	6.8	49.5	0.79	0.78	44.3
28	T1	212	2.0	0.730	41.6	LOS C	8.5	60.6	0.97	0.86	35.4
29a	R1	222	2.4	0.935	67.4	LOS E	12.9	92.4	1.00	1.12	28.5
Approach		641	3.1	0.935	44.4	LOS D	12.9	92.4	0.92	0.92	34.7
All Vehicles		3473	3.7	0.935	43.3	LOS D	24.8	180.6	0.94	0.94	35.0

Level of Service (LOS) Method: Delay (RTA NSW).
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	7	41.7	LOS E	0.0	0.0	0.94	0.94
P1S	South Slip/Bypass Lane Crossing	17	39.9	LOS D	0.0	0.0	0.92	0.92
P5	SouthEast Full Crossing	8	27.3	LOS C	0.0	0.0	0.76	0.76
P3	North Full Crossing	1	41.7	LOS E	0.0	0.0	0.94	0.94
P7	NorthWest Full Crossing	9	38.9	LOS D	0.0	0.0	0.91	0.91
All Pedestrians		43	37.6	LOS D			0.89	0.89

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.

MOVEMENT SUMMARY

Site: PM Stage 1

Bungarribee Road/Leabons Lane and Blacktown Road
Signals - Fixed Time Isolated Cycle Time = 100 seconds (Optimum Cycle Time - Minimum Delay)
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: Blacktown Road S											
1a	L1	78	0.0	0.053	7.3	LOS A	0.9	6.2	0.25	0.59	52.5
2	T1	940	4.7	0.920	55.8	LOS D	28.1	204.4	1.00	1.12	31.3
3b	R3	120	0.9	0.675	56.1	LOS D	6.1	42.8	1.00	0.83	30.8
Approach		1138	4.0	0.920	52.5	LOS D	28.1	204.4	0.95	1.06	32.2
SouthEast: Leabons Lane											
21b	L3	117	0.9	0.858	57.4	LOS E	13.5	94.5	1.00	1.05	32.0
22	T1	320	0.0	0.858	51.7	LOS D	14.3	101.0	1.00	1.02	31.9
23a	R1	97	2.2	0.858	56.9	LOS E	14.3	101.0	1.00	1.00	31.7
Approach		534	0.6	0.858	53.9	LOS D	14.3	101.0	1.00	1.02	31.9
North: Blacktown Road N											
7a	L1	82	5.1	0.677	34.6	LOS C	18.5	136.2	0.91	0.81	38.9
8	T1	803	6.6	0.677	29.9	LOS C	18.5	136.8	0.91	0.80	40.1
9b	R3	276	1.9	0.904	65.0	LOS E	16.3	115.7	1.00	1.01	28.7
Approach		1161	5.3	0.904	38.6	LOS C	18.5	136.8	0.93	0.85	36.6
NorthWest: Bungarribee Road											
27b	L3	207	5.1	0.258	22.1	LOS B	6.6	47.9	0.73	0.76	44.4
28	T1	212	2.0	0.696	43.2	LOS D	9.2	65.6	0.97	0.85	34.9
29a	R1	244	2.4	0.928	67.9	LOS E	14.7	105.0	1.00	1.11	28.4
Approach		663	3.1	0.928	45.7	LOS D	14.7	105.0	0.91	0.91	34.3
All Vehicles		3496	3.7	0.928	46.8	LOS D	28.1	204.4	0.94	0.96	33.9

Level of Service (LOS) Method: Delay (RTA NSW).
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	7	44.2	LOS E	0.0	0.0	0.94	0.94
P1S	South Slip/Bypass Lane Crossing	17	41.4	LOS E	0.0	0.0	0.91	0.91
P5	SouthEast Full Crossing	8	28.9	LOS C	0.0	0.0	0.76	0.76
P3	North Full Crossing	1	44.2	LOS E	0.0	0.0	0.94	0.94
P7	NorthWest Full Crossing	9	40.5	LOS E	0.0	0.0	0.90	0.90
All Pedestrians		43	39.3	LOS D			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.

MOVEMENT SUMMARY

Site: PM Stage 2

Bungarribee Road/Leabons Lane and Blacktown Road
Signals - Fixed Time Isolated Cycle Time = 100 seconds (Optimum Cycle Time - Minimum Delay)
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: Blacktown Road S											
1a	L1	78	0.0	0.053	7.3	LOS A	0.9	6.2	0.25	0.59	52.5
2	T1	946	4.7	0.926	57.3	LOS E	28.7	208.9	1.00	1.14	30.9
3b	R3	120	0.9	0.675	56.1	LOS D	6.1	42.8	1.00	0.83	30.8
Approach		1144	4.0	0.926	53.7	LOS D	28.7	208.9	0.95	1.07	31.8
SouthEast: Leabons Lane											
21b	L3	117	0.9	0.913	65.9	LOS E	14.8	104.1	1.00	1.13	29.8
22	T1	320	0.0	0.913	59.7	LOS E	15.4	108.7	1.00	1.10	29.9
23a	R1	97	2.2	0.913	64.4	LOS E	15.4	108.7	1.00	1.08	29.8
Approach		534	0.6	0.913	61.9	LOS E	15.4	108.7	1.00	1.10	29.8
North: Blacktown Road N											
7a	L1	82	5.1	0.677	34.6	LOS C	18.5	136.2	0.91	0.81	38.9
8	T1	803	6.6	0.677	29.9	LOS C	18.5	136.8	0.91	0.80	40.1
9b	R3	276	1.9	0.904	65.0	LOS E	16.3	115.7	1.00	1.01	28.7
Approach		1161	5.3	0.904	38.6	LOS C	18.5	136.8	0.93	0.85	36.6
NorthWest: Bungarribee Road											
27b	L3	207	5.1	0.249	19.8	LOS B	5.9	43.0	0.66	0.74	45.6
28	T1	212	2.0	0.674	42.8	LOS D	9.4	66.9	0.97	0.83	35.1
29a	R1	264	2.4	0.937	69.6	LOS E	16.2	115.9	1.00	1.13	28.0
Approach		683	3.1	0.937	46.2	LOS D	16.2	115.9	0.89	0.92	34.2
All Vehicles		3522	3.7	0.937	48.5	LOS D	28.7	208.9	0.94	0.97	33.3

Level of Service (LOS) Method: Delay (RTA NSW).
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	7	44.2	LOS E	0.0	0.0	0.94	0.94
P1S	South Slip/Bypass Lane Crossing	17	41.4	LOS E	0.0	0.0	0.91	0.91
P5	SouthEast Full Crossing	8	28.9	LOS C	0.0	0.0	0.76	0.76
P3	North Full Crossing	1	44.2	LOS E	0.0	0.0	0.94	0.94
P7	NorthWest Full Crossing	9	40.5	LOS E	0.0	0.0	0.90	0.90
All Pedestrians		43	39.3	LOS D			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.

B4 Bungarribee Road / Panorama Parade / Lock Street

AM Peak Existing

Stage 1

Stage 2

PM Peak Existing

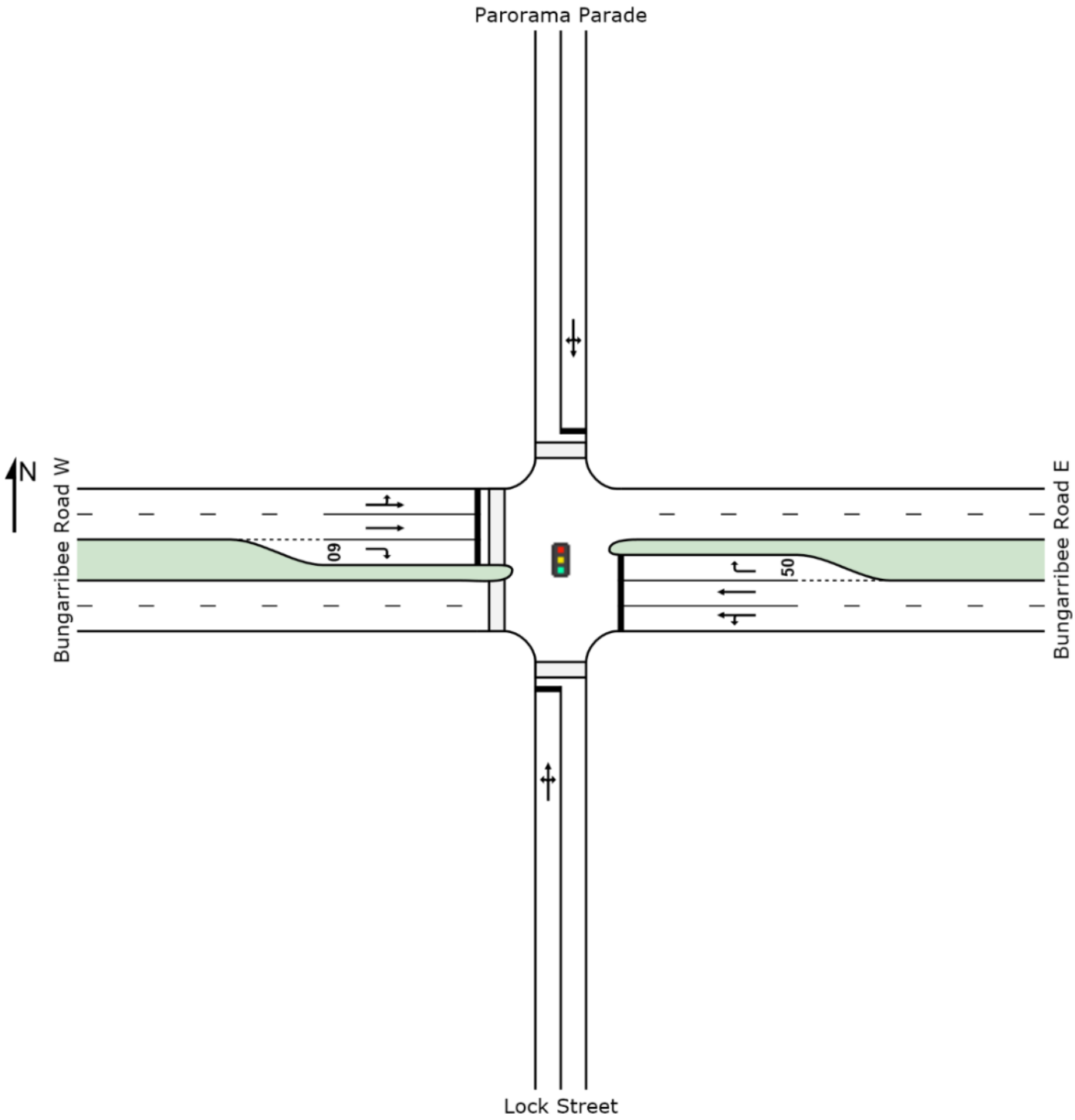
Stage 1

Stage 2

SITE LAYOUT

Site: AM Existing

Parorama Parade / Lock Street and Bungarribee Road
Signals - Fixed Time Isolated



PHASING SUMMARY

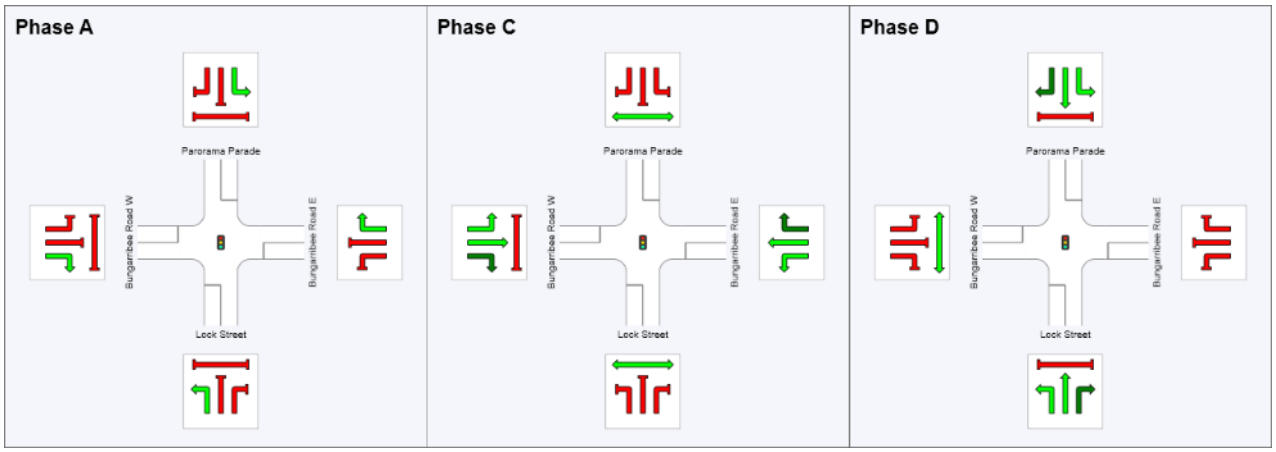
Site: AM Existing

Parorama Parade / Lock Street and Bungarribee Road
Signals - Fixed Time Isolated Cycle Time = 50 seconds (Optimum Cycle Time - Minimum Delay)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Phase times determined by the program
Sequence: Diamond Two-Phase
Movement Class: All Movement Classes
Input Sequence: A, B1, B2, C, D
Output Sequence: A, C, D

Phase Timing Results

Phase	A	C	D
Reference Phase	Yes	No	No
Phase Change Time (sec)	0	12	31
Green Time (sec)	6	13	13
Yellow Time (sec)	4	4	4
All-Red Time (sec)	2	2	2
Phase Time (sec)	12	19	19
Phase Split	24 %	38 %	38 %



MOVEMENT SUMMARY

Site: AM Existing

Parorama Parade / Lock Street and Bungarribee Road
Signals - Fixed Time Isolated Cycle Time = 50 seconds (Optimum Cycle Time - Minimum Delay)
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: Lock Street											
1	L2	48	15.2	0.754	27.2	LOS B	8.3	59.5	0.97	0.93	41.9
2	T1	180	0.6	0.754	21.5	LOS B	8.3	59.5	0.97	0.93	43.2
3	R2	94	1.1	0.754	27.0	LOS B	8.3	59.5	0.97	0.93	42.3
Approach		322	2.9	0.754	23.9	LOS B	8.3	59.5	0.97	0.93	42.7
East: Bungarribee Road E											
4	L2	74	1.4	0.614	24.1	LOS B	6.8	49.1	0.93	0.80	44.2
5	T1	533	3.4	0.614	18.5	LOS B	6.9	49.7	0.93	0.80	45.6
6	R2	136	2.3	0.353	16.4	LOS B	2.0	14.0	0.90	0.76	46.0
Approach		742	3.0	0.614	18.7	LOS B	6.9	49.7	0.93	0.79	45.5
North: Parorama Parade											
7	L2	35	9.1	0.457	24.2	LOS B	3.7	26.3	0.90	0.76	43.3
8	T1	79	0.0	0.457	18.5	LOS B	3.7	26.3	0.90	0.76	44.5
9	R2	52	4.1	0.457	24.1	LOS B	3.7	26.3	0.90	0.76	43.5
Approach		165	3.2	0.457	21.5	LOS B	3.7	26.3	0.90	0.76	43.9
West: Bungarribee Road W											
10	L2	102	2.1	0.757	27.1	LOS B	9.5	67.7	0.98	0.93	42.5
11	T1	646	2.9	0.757	21.5	LOS B	9.6	68.6	0.98	0.92	43.9
12	R2	104	3.0	0.255	15.5	LOS B	1.5	10.6	0.84	0.75	46.5
Approach		853	2.8	0.757	21.5	LOS B	9.6	68.6	0.96	0.90	44.1
All Vehicles		2082	2.9	0.757	20.9	LOS B	9.6	68.6	0.95	0.86	44.3

Level of Service (LOS) Method: Delay (RTA NSW).
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	3	17.6	LOS B	0.0	0.0	0.84	0.84
P3	North Full Crossing	2	17.6	LOS B	0.0	0.0	0.84	0.84
P4	West Full Crossing	35	19.4	LOS B	0.0	0.0	0.88	0.88
All Pedestrians		40	19.2	LOS B			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.

MOVEMENT SUMMARY

Site: AM Stage 1

Parorama Parade / Lock Street and Bungarribee Road
Signals - Fixed Time Isolated Cycle Time = 55 seconds (Optimum Cycle Time - Minimum Delay)
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: Lock Street											
1	L2	48	15.2	0.729	26.9	LOS B	9.3	66.5	0.95	0.90	42.1
2	T1	204	0.6	0.729	21.2	LOS B	9.3	66.5	0.95	0.90	43.4
3	R2	94	1.1	0.729	26.7	LOS B	9.3	66.5	0.95	0.90	42.6
Approach		346	2.8	0.729	23.5	LOS B	9.3	66.5	0.95	0.90	43.0
East: Bungarribee Road E											
4	L2	74	1.4	0.585	24.9	LOS B	7.3	52.2	0.92	0.78	43.8
5	T1	533	3.4	0.585	19.4	LOS B	7.3	52.9	0.92	0.78	45.2
6	R2	98	2.3	0.273	17.3	LOS B	1.5	11.0	0.88	0.75	45.5
Approach		704	3.0	0.585	19.7	LOS B	7.3	52.9	0.91	0.77	45.0
North: Parorama Parade											
7	L2	45	9.1	0.530	25.7	LOS B	5.0	35.7	0.91	0.78	42.5
8	T1	96	0.0	0.530	20.1	LOS B	5.0	35.7	0.91	0.78	43.6
9	R2	62	4.1	0.530	25.7	LOS B	5.0	35.7	0.91	0.78	42.7
Approach		203	3.3	0.530	23.0	LOS B	5.0	35.7	0.91	0.78	43.1
West: Bungarribee Road W											
10	L2	116	2.1	0.735	27.7	LOS B	10.2	73.0	0.97	0.90	42.2
11	T1	646	2.9	0.735	22.2	LOS B	10.3	74.0	0.97	0.90	43.6
12	R2	104	3.0	0.269	16.4	LOS B	1.6	11.8	0.83	0.75	46.0
Approach		866	2.8	0.735	22.2	LOS B	10.3	74.0	0.95	0.88	43.7
All Vehicles		2120	2.9	0.735	21.6	LOS B	10.3	74.0	0.93	0.84	43.9

Level of Service (LOS) Method: Delay (RTA NSW).
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	3	18.4	LOS B	0.0	0.0	0.82	0.82
P3	North Full Crossing	2	18.4	LOS B	0.0	0.0	0.82	0.82
P4	West Full Crossing	35	21.9	LOS C	0.0	0.0	0.89	0.89
All Pedestrians		40	21.4	LOS C			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.

MOVEMENT SUMMARY

Site: AM Stage 2

Parorama Parade / Lock Street and Bungarribee Road
Signals - Fixed Time Isolated Cycle Time = 55 seconds (Optimum Cycle Time - Minimum Delay)
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: Lock Street											
1	L2	48	15.2	0.774	28.6	LOS C	10.4	74.7	0.97	0.95	41.4
2	T1	227	0.6	0.774	22.9	LOS B	10.4	74.7	0.97	0.95	42.6
3	R2	94	1.1	0.774	28.4	LOS B	10.4	74.7	0.97	0.95	41.8
Approach		369	2.6	0.774	25.0	LOS B	10.4	74.7	0.97	0.95	42.2
East: Bungarribee Road E											
4	L2	74	1.4	0.585	24.9	LOS B	7.3	52.2	0.92	0.78	43.8
5	T1	533	3.4	0.585	19.4	LOS B	7.3	52.9	0.92	0.78	45.2
6	R2	98	2.3	0.275	17.3	LOS B	1.5	11.0	0.88	0.75	45.5
Approach		704	3.0	0.585	19.7	LOS B	7.3	52.9	0.91	0.77	45.0
North: Parorama Parade											
7	L2	47	9.1	0.564	25.9	LOS B	5.2	37.6	0.92	0.79	42.4
8	T1	100	0.0	0.564	20.3	LOS B	5.2	37.6	0.92	0.79	43.5
9	R2	64	4.1	0.564	25.9	LOS B	5.2	37.6	0.92	0.79	42.6
Approach		212	3.3	0.564	23.3	LOS B	5.2	37.6	0.92	0.79	43.0
West: Bungarribee Road W											
10	L2	128	2.1	0.748	28.1	LOS B	10.5	75.0	0.97	0.91	41.9
11	T1	646	2.9	0.748	22.5	LOS B	10.6	76.2	0.97	0.91	43.4
12	R2	104	3.0	0.269	16.4	LOS B	1.6	11.8	0.83	0.75	46.0
Approach		879	2.8	0.748	22.6	LOS B	10.6	76.2	0.95	0.89	43.4
All Vehicles		2164	2.9	0.774	22.1	LOS B	10.6	76.2	0.94	0.85	43.7

Level of Service (LOS) Method: Delay (RTA NSW).
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	3	18.4	LOS B	0.0	0.0	0.82	0.82
P3	North Full Crossing	2	18.4	LOS B	0.0	0.0	0.82	0.82
P4	West Full Crossing	35	21.9	LOS C	0.0	0.0	0.89	0.89
All Pedestrians		40	21.4	LOS C			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.

MOVEMENT SUMMARY

Site: PM Existing

Parorama Parade / Lock Street and Bungarribee Road
Signals - Fixed Time Isolated Cycle Time = 55 seconds (Optimum Cycle Time - Minimum Delay)
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: Lock Street											
1	L2	28	11.1	0.382	24.9	LOS B	3.2	23.3	0.87	0.75	42.8
2	T1	60	1.8	0.382	19.2	LOS B	3.2	23.3	0.87	0.75	43.9
3	R2	51	0.0	0.382	24.8	LOS B	3.2	23.3	0.87	0.75	43.1
Approach		139	3.0	0.382	22.4	LOS B	3.2	23.3	0.87	0.75	43.4
East: Bungarribee Road E											
4	L2	119	0.0	0.649	24.1	LOS B	9.2	65.6	0.92	0.81	44.0
5	T1	647	2.3	0.649	18.6	LOS B	9.3	66.6	0.92	0.80	45.5
6	R2	49	0.0	0.119	14.7	LOS B	0.7	4.9	0.76	0.71	47.1
Approach		816	1.8	0.649	19.1	LOS B	9.3	66.6	0.91	0.80	45.4
North: Parorama Parade											
7	L2	40	2.6	0.631	26.0	LOS B	6.5	46.0	0.93	0.83	42.6
8	T1	127	0.0	0.631	20.4	LOS B	6.5	46.0	0.93	0.83	43.5
9	R2	92	0.0	0.631	25.9	LOS B	6.5	46.0	0.93	0.83	42.7
Approach		259	0.4	0.631	23.2	LOS B	6.5	46.0	0.93	0.83	43.0
West: Bungarribee Road W											
10	L2	56	0.0	0.532	23.0	LOS B	7.2	51.0	0.88	0.75	45.0
11	T1	577	1.5	0.532	17.4	LOS B	7.3	51.5	0.88	0.75	46.3
12	R2	39	8.1	0.106	15.4	LOS B	0.5	4.1	0.79	0.71	46.4
Approach		672	1.7	0.532	17.8	LOS B	7.3	51.5	0.87	0.74	46.2
All Vehicles		1885	1.7	0.649	19.5	LOS B	9.3	66.6	0.90	0.78	45.2

Level of Service (LOS) Method: Delay (RTA NSW).
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	5	16.8	LOS B	0.0	0.0	0.78	0.78
P3	North Full Crossing	4	16.8	LOS B	0.0	0.0	0.78	0.78
P4	West Full Crossing	16	21.8	LOS C	0.0	0.0	0.89	0.89
All Pedestrians		25	20.0	LOS B			0.85	0.85

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.

MOVEMENT SUMMARY

Site: PM Stage 1

Parorama Parade / Lock Street and Bungarribee Road
Signals - Fixed Time Isolated Cycle Time = 60 seconds (Optimum Cycle Time - Minimum Delay)
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: Lock Street											
1	L2	28	11.1	0.350	25.6	LOS B	3.4	24.6	0.85	0.74	42.4
2	T1	60	1.8	0.350	20.0	LOS B	3.4	24.6	0.85	0.74	43.5
3	R2	51	0.0	0.350	25.5	LOS B	3.4	24.6	0.85	0.74	42.7
Approach		139	3.0	0.350	23.2	LOS B	3.4	24.6	0.85	0.74	43.0
East: Bungarribee Road E											
4	L2	119	0.0	0.668	26.4	LOS B	10.2	72.7	0.93	0.83	42.8
5	T1	647	2.3	0.668	20.9	LOS B	10.3	73.8	0.93	0.82	44.3
6	R2	34	0.0	0.088	16.2	LOS B	0.5	3.8	0.78	0.70	46.1
Approach		800	1.8	0.668	21.5	LOS B	10.3	73.8	0.92	0.82	44.1
North: Parorama Parade											
7	L2	62	2.6	0.662	26.0	LOS B	8.8	61.7	0.92	0.84	42.4
8	T1	151	0.0	0.662	20.5	LOS B	8.8	61.7	0.92	0.84	43.4
9	R2	114	0.0	0.662	26.0	LOS B	8.8	61.7	0.92	0.84	42.5
Approach		326	0.5	0.662	23.5	LOS B	8.8	61.7	0.92	0.84	42.9
West: Bungarribee Road W											
10	L2	56	0.0	0.548	25.0	LOS B	8.0	56.3	0.89	0.76	43.9
11	T1	577	1.5	0.548	19.5	LOS B	8.0	56.8	0.89	0.76	45.2
12	R2	39	8.1	0.116	17.1	LOS B	0.6	4.7	0.82	0.71	45.5
Approach		672	1.7	0.548	19.8	LOS B	8.0	56.8	0.88	0.75	45.1
All Vehicles		1937	1.7	0.668	21.4	LOS B	10.3	73.8	0.90	0.79	44.1

Level of Service (LOS) Method: Delay (RTA NSW).
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	5	18.4	LOS B	0.0	0.0	0.78	0.78
P3	North Full Crossing	4	18.4	LOS B	0.0	0.0	0.78	0.78
P4	West Full Crossing	16	24.3	LOS C	0.0	0.0	0.90	0.90
All Pedestrians		25	22.1	LOS C			0.86	0.86

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.

MOVEMENT SUMMARY

Site: PM Stage 2

Parorama Parade / Lock Street and Bungarribee Road
Signals - Fixed Time Isolated Cycle Time = 60 seconds (Optimum Cycle Time - Minimum Delay)
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: Lock Street											
1	L2	28	11.1	0.364	25.7	LOS B	3.6	26.0	0.86	0.74	42.4
2	T1	67	1.8	0.364	20.1	LOS B	3.6	26.0	0.86	0.74	43.6
3	R2	51	0.0	0.364	25.6	LOS B	3.6	26.0	0.86	0.74	42.8
Approach		146	3.0	0.364	23.1	LOS B	3.6	26.0	0.86	0.74	43.1
East: Bungarribee Road E											
4	L2	119	0.0	0.708	28.1	LOS B	10.7	76.1	0.95	0.87	42.0
5	T1	647	2.3	0.708	22.6	LOS B	10.8	77.3	0.95	0.86	43.4
6	R2	34	0.0	0.091	16.8	LOS B	0.6	3.9	0.79	0.70	45.8
Approach		800	1.8	0.708	23.2	LOS B	10.8	77.3	0.95	0.86	43.2
North: Parorama Parade											
7	L2	82	2.6	0.735	27.4	LOS B	11.0	77.5	0.94	0.90	41.7
8	T1	169	0.0	0.735	21.8	LOS B	11.0	77.5	0.94	0.90	42.6
9	R2	134	0.0	0.735	27.4	LOS B	11.0	77.5	0.94	0.90	41.8
Approach		385	0.6	0.735	24.9	LOS B	11.0	77.5	0.94	0.90	42.1
West: Bungarribee Road W											
10	L2	60	0.0	0.584	26.1	LOS B	8.2	58.2	0.91	0.78	43.4
11	T1	577	1.5	0.584	20.5	LOS B	8.3	58.8	0.91	0.77	44.6
12	R2	39	8.1	0.119	17.7	LOS B	0.6	4.9	0.83	0.71	45.1
Approach		676	1.7	0.584	20.8	LOS B	8.3	58.8	0.91	0.77	44.5
All Vehicles		2007	1.6	0.735	22.7	LOS B	11.0	77.5	0.93	0.83	43.4

Level of Service (LOS) Method: Delay (RTA NSW).
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	5	19.2	LOS B	0.0	0.0	0.80	0.80
P3	North Full Crossing	4	19.2	LOS B	0.0	0.0	0.80	0.80
P4	West Full Crossing	16	24.3	LOS C	0.0	0.0	0.90	0.90
All Pedestrians		25	22.4	LOS C			0.86	0.86

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.

B5 Panorama Parade / Hospital Access

AM Peak Existing

Stage 1

Stage 2

PM Peak Existing

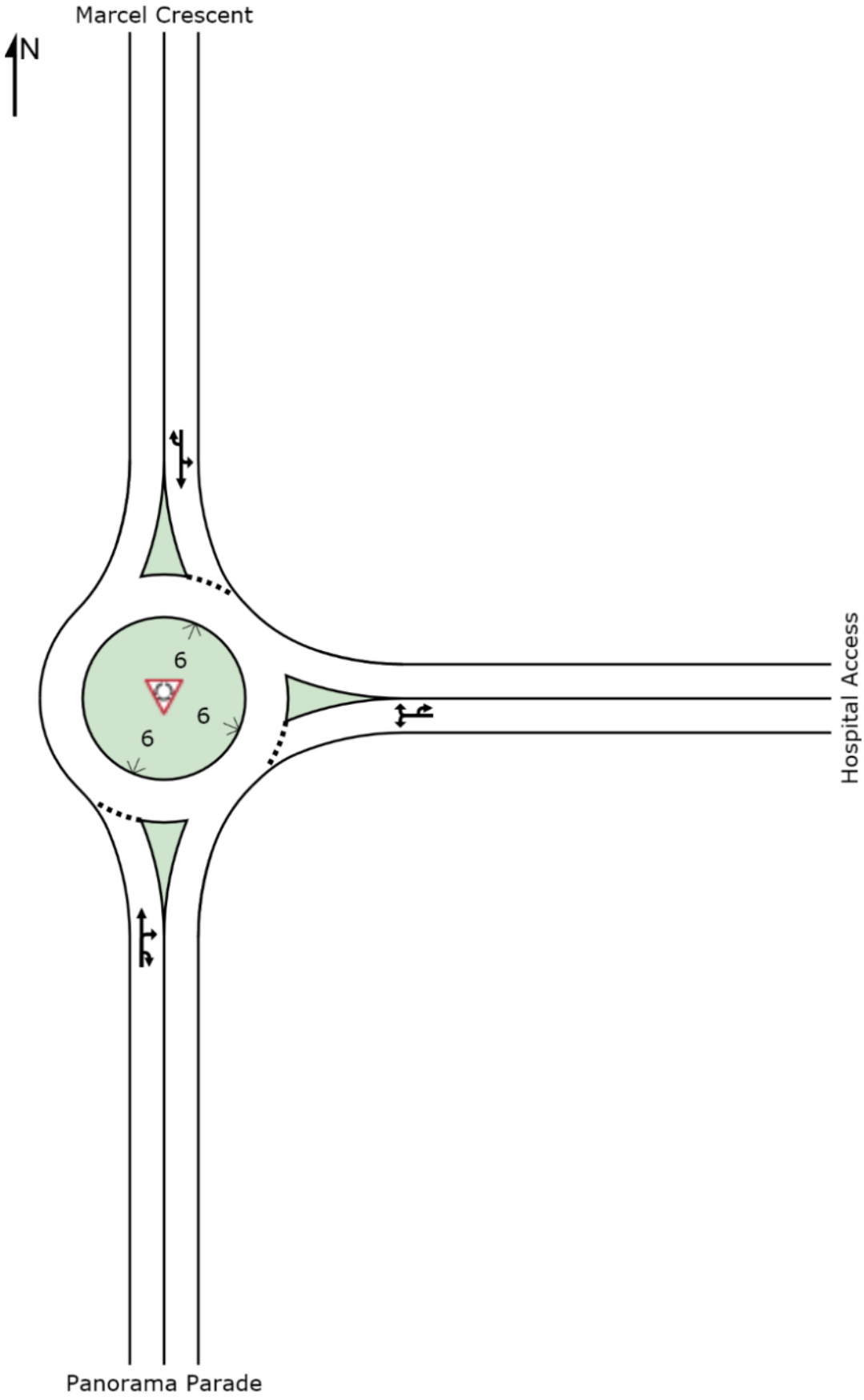
Stage 1

Stage 2

SITE LAYOUT

Site: AM Existing

Marcel Crescent, Panorama Parade and Hospital Access Roundabout



MOVEMENT SUMMARY

Site: AM Existing

Marcel Crescent, Panorama Parade and Hospital Access
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: Panorama Parade											
2	T1	287	1.1	0.316	5.2	LOS A	2.1	14.5	0.24	0.55	53.0
3	R2	137	1.5	0.316	7.9	LOS A	2.1	14.5	0.24	0.55	52.6
3u	U	2	0.0	0.316	9.2	LOS A	2.1	14.5	0.24	0.55	53.0
Approach		426	1.2	0.316	6.1	LOS A	2.1	14.5	0.24	0.55	52.9
East: Hospital Access											
4	L2	43	2.4	0.087	5.9	LOS A	0.4	3.2	0.29	0.60	51.6
6	R2	55	0.0	0.087	8.1	LOS A	0.4	3.2	0.29	0.60	52.0
6u	U	1	0.0	0.087	9.5	LOS A	0.4	3.2	0.29	0.60	52.3
Approach		99	1.1	0.087	7.1	LOS A	0.4	3.2	0.29	0.60	51.8
North: Marcel Crescent											
7	L2	176	1.2	0.247	6.1	LOS A	1.4	10.1	0.36	0.57	52.3
8	T1	105	1.0	0.247	5.7	LOS A	1.4	10.1	0.36	0.57	53.0
9u	U	3	0.0	0.247	9.8	LOS A	1.4	10.1	0.36	0.57	53.1
Approach		284	1.1	0.247	6.0	LOS A	1.4	10.1	0.36	0.57	52.6
All Vehicles		809	1.2	0.316	6.2	LOS A	2.1	14.5	0.29	0.56	52.6

Level of Service (LOS) Method: Delay (RTA NSW).
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.

MOVEMENT SUMMARY

Site: AM Stage 1

Marcel Crescent, Panorama Parade and Hospital Access
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: Panorama Parade											
2	T1	287	1.1	0.324	5.3	LOS A	2.1	15.0	0.27	0.55	52.9
3	R2	137	1.5	0.324	8.0	LOS A	2.1	15.0	0.27	0.55	52.5
3u	U	2	0.0	0.324	9.3	LOS A	2.1	15.0	0.27	0.55	52.9
Approach		426	1.2	0.324	6.2	LOS A	2.1	15.0	0.27	0.55	52.8
East: Hospital Access											
4	L2	81	2.4	0.130	5.9	LOS A	0.7	4.9	0.30	0.60	51.7
6	R2	67	0.0	0.130	8.1	LOS A	0.7	4.9	0.30	0.60	52.1
6u	U	1	0.0	0.130	9.5	LOS A	0.7	4.9	0.30	0.60	52.5
Approach		149	1.3	0.130	6.9	LOS A	0.7	4.9	0.30	0.60	51.9
North: Marcel Crescent											
7	L2	128	1.2	0.208	6.1	LOS A	1.2	8.3	0.35	0.56	52.3
8	T1	105	1.0	0.208	5.7	LOS A	1.2	8.3	0.35	0.56	53.1
9u	U	3	0.0	0.208	9.7	LOS A	1.2	8.3	0.35	0.56	53.1
Approach		237	1.1	0.208	6.0	LOS A	1.2	8.3	0.35	0.56	52.7
All Vehicles		813	1.2	0.324	6.3	LOS A	2.1	15.0	0.30	0.56	52.6

Level of Service (LOS) Method: Delay (RTA NSW).
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.

MOVEMENT SUMMARY

Site: AM Stage 2

Marcel Crescent, Panorama Parade and Hospital Access
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: Panorama Parade											
2	T1	287	1.1	0.365	5.5	LOS A	2.5	17.6	0.34	0.57	52.7
3	R2	173	1.5	0.365	8.2	LOS A	2.5	17.6	0.34	0.57	52.2
3u	U	2	0.0	0.365	9.5	LOS A	2.5	17.6	0.34	0.57	52.7
Approach		462	1.3	0.365	6.5	LOS A	2.5	17.6	0.34	0.57	52.5
East: Hospital Access											
4	L2	89	2.4	0.158	5.9	LOS A	0.9	6.2	0.31	0.60	51.6
6	R2	94	0.0	0.158	8.1	LOS A	0.9	6.2	0.31	0.60	52.0
6u	U	1	0.0	0.158	9.5	LOS A	0.9	6.2	0.31	0.60	52.4
Approach		184	1.2	0.158	7.1	LOS A	0.9	6.2	0.31	0.60	51.8
North: Marcel Crescent											
7	L2	162	1.2	0.248	6.4	LOS A	1.5	10.3	0.41	0.59	52.1
8	T1	105	1.0	0.248	6.0	LOS A	1.5	10.3	0.41	0.59	52.9
9u	U	3	0.0	0.248	10.0	LOS A	1.5	10.3	0.41	0.59	52.9
Approach		271	1.1	0.248	6.3	LOS A	1.5	10.3	0.41	0.59	52.4
All Vehicles		917	1.2	0.365	6.6	LOS A	2.5	17.6	0.35	0.58	52.3

Level of Service (LOS) Method: Delay (RTA NSW).
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.

MOVEMENT SUMMARY

Site: PM Existing

Marcel Crescent, Panorama Parade and Hospital Access
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	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Panorama Parade											
2	T1	128	0.0	0.161	6.0	LOS A	0.9	6.2	0.40	0.59	52.7
3	R2	39	2.7	0.161	8.7	LOS A	0.9	6.2	0.40	0.59	52.1
3u	U	3	0.0	0.161	10.0	LOS A	0.9	6.2	0.40	0.59	52.6
Approach		171	0.6	0.161	6.6	LOS A	0.9	6.2	0.40	0.59	52.6
East: Hospital Access											
4	L2	109	1.0	0.264	6.5	LOS A	1.5	10.7	0.42	0.65	51.2
6	R2	177	0.0	0.264	8.7	LOS A	1.5	10.7	0.42	0.65	51.6
6u	U	1	0.0	0.264	10.1	LOS A	1.5	10.7	0.42	0.65	51.9
Approach		287	0.4	0.264	7.9	LOS A	1.5	10.7	0.42	0.65	51.4
North: Marcel Crescent											
7	L2	72	1.5	0.192	5.5	LOS A	1.1	8.0	0.18	0.51	52.8
8	T1	178	0.0	0.192	5.1	LOS A	1.1	8.0	0.18	0.51	53.6
9u	U	11	0.0	0.192	9.1	LOS A	1.1	8.0	0.18	0.51	53.6
Approach		260	0.4	0.192	5.4	LOS A	1.1	8.0	0.18	0.51	53.4
All Vehicles		718	0.4	0.264	6.7	LOS A	1.5	10.7	0.33	0.59	52.4

Level of Service (LOS) Method: Delay (RTA NSW).
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.

MOVEMENT SUMMARY

Site: PM Stage 1

Marcel Crescent, Panorama Parade and Hospital Access
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	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Panorama Parade											
2	T1	128	0.0	0.152	6.2	LOS A	0.8	5.8	0.44	0.60	52.6
3	R2	23	2.7	0.152	8.9	LOS A	0.8	5.8	0.44	0.60	52.1
3u	U	3	0.0	0.152	10.2	LOS A	0.8	5.8	0.44	0.60	52.6
Approach		155	0.4	0.152	6.7	LOS A	0.8	5.8	0.44	0.60	52.6
East: Hospital Access											
4	L2	177	1.0	0.356	6.6	LOS A	2.2	15.7	0.45	0.65	51.2
6	R2	219	0.0	0.356	8.8	LOS A	2.2	15.7	0.45	0.65	51.6
6u	U	1	0.0	0.356	10.2	LOS A	2.2	15.7	0.45	0.65	52.0
Approach		397	0.4	0.356	7.8	LOS A	2.2	15.7	0.45	0.65	51.4
North: Marcel Crescent											
7	L2	72	1.5	0.183	5.4	LOS A	1.1	7.7	0.14	0.51	52.9
8	T1	178	0.0	0.183	5.0	LOS A	1.1	7.7	0.14	0.51	53.8
9u	U	11	0.0	0.183	9.0	LOS A	1.1	7.7	0.14	0.51	53.7
Approach		260	0.4	0.183	5.3	LOS A	1.1	7.7	0.14	0.51	53.5
All Vehicles		812	0.4	0.356	6.8	LOS A	2.2	15.7	0.35	0.60	52.3

Level of Service (LOS) Method: Delay (RTA NSW).
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.

MOVEMENT SUMMARY

Site: PM Stage 2

Marcel Crescent, Panorama Parade and Hospital Access
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: Panorama Parade											
2	T1	128	0.0	0.171	6.5	LOS A	1.0	6.8	0.49	0.63	52.4
3	R2	35	2.7	0.171	9.2	LOS A	1.0	6.8	0.49	0.63	51.8
3u	U	3	0.0	0.171	10.6	LOS A	1.0	6.8	0.49	0.63	52.3
Approach		166	0.6	0.171	7.2	LOS A	1.0	6.8	0.49	0.63	52.3
East: Hospital Access											
4	L2	237	1.0	0.448	6.7	LOS A	3.1	22.0	0.50	0.66	51.2
6	R2	268	0.0	0.448	9.0	LOS A	3.1	22.0	0.50	0.66	51.5
6u	U	1	0.0	0.448	10.4	LOS A	3.1	22.0	0.50	0.66	51.9
Approach		506	0.4	0.448	7.9	LOS A	3.1	22.0	0.50	0.66	51.3
North: Marcel Crescent											
7	L2	54	1.5	0.177	5.5	LOS A	1.1	7.5	0.18	0.51	52.8
8	T1	178	0.0	0.177	5.0	LOS A	1.1	7.5	0.18	0.51	53.7
9u	U	11	0.0	0.177	9.1	LOS A	1.1	7.5	0.18	0.51	53.6
Approach		242	0.3	0.177	5.3	LOS A	1.1	7.5	0.18	0.51	53.5
All Vehicles		915	0.4	0.448	7.1	LOS A	3.1	22.0	0.41	0.62	52.1

Level of Service (LOS) Method: Delay (RTA NSW).
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.