Health Infrastructure

Blacktown Mt Druitt Hospital

Stage 1 New Main Hospital Building - Transport & Accessibility Study

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Job number 221031

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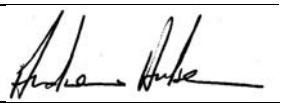
		Signature			
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1 Introduction

1.1 Project Background

This report has been prepared following adoption of two stages of redevelopment for the Blacktown and Mt Druitt Hospital campuses. Stage 1 for each campus forms the Project Application and Stage 2 defines the Concept Plan Application.

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 involves expansion of the new hospital facility and expansion of the multistorey car park which will the subject of a subsequent application.

Stage 1 of the Mt Druitt Hospital works consists of expansion of emergency and 1 new operating theatre, sub-acute rehabilitation unit and an expanded oral health unit. Stage 2 involves an expansion of a range of departments including day only surgery beds, medical beds and outpatient clinics.

1.2 Scope of Study

The development to which this application relates is Stage 1 of Blacktown Hospital. 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 Director General's Requirements for the Environmental Assessment of the proposed development. The latest DG's Requirements 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 DGRs

The NSW Government's Department of Planning issued a list of DGRs for the Blacktown and Mount Druitt Hospital Project (Application Number MP 11_0011) on 9 May 2012. Section 6 of the document has addressed the Transport, Access and Parking impacts as follows:

Provide a Transport & Accessibility Study prepared with reference to the Metropolitan Transport Plan - Connecting the City of Cities, the NSW State Plan, the NSW Planning Guidelines for Walking and Cycling, the Integrated Land Use and Transport policy package, the RTA's Guide to Traffic Generating Developments and NSW Bike Plan, considering the issues outlined in Table 1.

Table 1 DGR Requirements

Description	**Relevant Section of Report**
Detail the proposed final access arrangements between Blacktown Road and hospital, including augmentation requirements and intersection treatments for left and right vehicle movements to and from the site.	4.5
Detail access arrangements and service vehicle movements at all stages of operation (including vehicle type and likely arrival and departure times) and measures to mitigate any associated traffic impacts.	4.4
Prepare a Transport Accessibility Study that addresses the following:	
- the proposed access and parking provisions;	4.2
- demonstrates minimised car parking demand having regard to the availability of public transport and the proposed multistorey car park, which is the subject of a development application lodged with Blacktown City Council (Note: reduced car parking provision maybe supported in areas well serviced by public transport.);	4.2
- demonstrates how users of the development will be able to make travel choices that support the achievement of State Plan targets;	2.0
- details existing pedestrian and cycle movements within the vicinity of the site and determine the adequacy of the proposal to meet the likely future demand for increased public transport and pedestrian and cycle access; and	3.7
- describes measures to be implemented to promote sustainable means of transport including public transport usage and pedestrian and bicycle linkages in addition to addressing the potential for implementing a location specific sustainable travel plan.	5.0
Estimate the total daily and peak hour trips generated by the proposed development, including accurate details of the current and future daily vehicle movements and assess the impacts of the traffic generated on the local road network, including intersection capacity and any potential need for upgrading or road works (if required), having regard to local planning controls. Key intersections to be examined/modelled include: - Blacktown Road and Wall Park Avenue, including signalisation and proposed entry and exit point to Blacktown Hospital and impact on Baronta Street; - Blacktown Road/Main Street and Marcel Crescent; and - Main Street and Sunnyholt Road/Newton Road.	4.5

2 NSW Government Strategies and Policies'

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

- NSW State Plan 2010;
- Metropolitan Plan for Sydney 2036;
- Draft North West Subregional Strategy;
- Metropolitan Transport Plan;
- 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 two hospital campuses 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 State Plan 2010

NSW State Plan 2010 outlines the framework for the delivery of service improvements for NSW through strategies, priorities, targets and actions. The following summarises the contents of the State Plan which are relevant to the Blacktown and Mt Druitt hospital development proposal.

- **Better Transport and Liveable Cities**

This chapter recognises the key link between transport links and jobs, facilities and quality of life. It includes priorities to improve the public transport system and the road network. Specific targets are:

- Increase the proportion of total journeys to work by public transport in the Sydney Metropolitan region to 28% by 2016.
- Increase the share of commute trips made by public transport:
  - To and from Sydney CBD during peak hours to 80% by 2016
  - To and from Parramatta CBD during peak hours to 50% by 2016
  - To and from Liverpool CBD during peak hours to 20% by 2016
  - To and from Penrith CBD during peak hours to 25% by 2016
- Reduce road fatalities to 4.9 per 100,000 population by 2016
- Increase the mode share of bicycle trips made in the Greater Sydney Region at a local and district level to 5% by 2016.
- Increase the percentage of the population living within 30 minutes by public transport of a city or major centre in Metropolitan Sydney.

- **Healthy Communities**

  The chapter highlights the priority to 'Promote healthy lifestyles' through development and initiatives that can shape our lifestyles, such as influencing transport modes and supporting incidental exercise.

- **Green State**

  This chapter looks toward NSW being a 'green state.' The priority, 'Tackle climate change' seeks to promote initiatives that reduce carbon dioxide emissions, including those from transport.

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 and Mt Druitt 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 Metropolitan Plan for Sydney 2036

The NSW Government launched the Metropolitan Plan for Sydney 2036 in 2010 to shape the future growth of Sydney. The publication follows a scheduled five-year review of the Sydney Metropolitan Strategy (2005) to ensure that it is responding to the challenges facing Sydney. The Metropolitan Plan for Sydney 2036 is founded by the following policy settings:

- Establish no new Greenfield fronts to Sydney's existing urban footprint under the Plan
- Increase the proportion of homes within 30 minutes by public transport of jobs in a Major Centre, ensuring more jobs are located closer to home
- Build at least 70% of new homes in the existing urban area
- Enable residential and employment growth in areas where there is available or planned public transport capacity
- Build at least 80% of all new homes within the walking catchments of existing and planned centres of all sizes with good public transport
- Locate 50% of planned employment capacity in Western Sydney
- Plan land use, service provision and infrastructure capacity for 770,000 additional homes by 2036 and 760,000 more jobs by 2036.

The Metropolitan Plan for Sydney 2036 highlights the importance of integrating transport and land use planning to overcome Sydney's challenges of managing congestion and reducing Sydney's energy-related greenhouse gas emissions. The Plan promotes actions to support sustainable travel, including the implementation of the NSW Bike Plan and Workplace Travel Plans.

The document updates the dwelling and employment targets for Sydney's subregions. The updated targets for the North West subregion are shown in the table below.

Table 2 Dwelling and Employment Targets (Source: DoP, 2010)

Subregion	Net Additional Dwelling Target 2036 (Metropolitan Plan for Sydney 2036- 2010)	Net Additional Dwelling Target 2036 (Sydney Metropolitan Plan - 2005)	Net Additional Employment Target 2036 (Metropolitan Plan for Sydney 2036- 2010)	Net Additional Employment Target 2036 (Sydney Metropolitan Plan - 2005)
North West	+ 169,000	+140,000	+145,000	+130,000

Dwelling and employment targets at the LGA-level and updates to the Subregional Strategies have not yet been released.

Commentary

The Metropolitan Plan for Sydney 2036 underscores the importance of the Western Sydney region to the future growth of the city. This is reflected in the dwelling and employment targets for Blacktown LGA and the North West subregion. The Blacktown and Mt Druitt Hospital redevelopment project is consistent with the objectives and policy settings for the North West subregion as outlined in the Metropolitan Plan. The redevelopment of the two hospital sites represents a necessary improvement of critical health infrastructure in Western Sydney to cater for the future demands in the region.

2.3 Draft North West Subregional Strategy

In 2005, the NSW Government prepared the document Sydney Metropolitan Strategy - City of Cities, a strategic planning document that provides a broad framework for the growth and development of Sydney towards 2031. Part of the metropolitan strategy was the development of subregional plans that provided more detailed plans for the subregions of Sydney. As discussed in the previous section of the report, this document has since been superseded by the Metropolitan Plan for Sydney 2036. However, the subregional strategies continue to apply.

Under the Sydney Metropolitan Strategy, the suburbs of Blacktown and Mount Druitt lie within the North West Subregion. In order to accommodate the future population and demand for employment, the North West Subregion has been assigned an employment capacity target of 367,000 jobs by 2031 (an additional 130,000 jobs from 2001) and a dwelling target of 391,000 dwellings by 2031 (an additional 140,000 dwellings from 2004).

The Draft North West Subregional Strategy outlines key employment and housing growth earmarked for the Blacktown LGA. The Blacktown LGA is targeted to accommodate 21,500 more dwellings and 45,000 more jobs to 2031. Dwelling and employment targets for each LGA within North West Subregion are shown in Table 3.

Table 3 Dwelling and Employment Targets (Source: DoP, 2007)

Local Government Area	Dwelling Target for 2031	Employment Target for 2031
Baulkham Hills	21,500	47,000
Blacktown	21,500	45,000
Blue Mountains	7,000	7,000
Hawkesbury	5,000	3,000
Penrith	25,000	28,000
North West Growth Centre	60,000	-
Total	140,000	130,000

Note: These targets have been superseded by the NSW Government's Metropolitan Plan for Sydney (2036) as described earlier in this section.

The Metropolitan Strategy has designated Blacktown as a Major Centre and Mt Druitt as a potential Major Centre, with both being major focal points for regional transport connections and jobs growth. Much of the housing and employment growth within the North West subregion is planned to occur within Blacktown, as the majority of the North West Growth Centre and the Western Sydney Employment Hub is located within this LGA.

Blacktown is a Major Centre with a large and growing catchment, situated at a focal point for subregional road and public transport networks. It is located at the junction of the Main Western and Richmond Branch Rail Lines, is serviced by the North West Transitway and has good access to the Orbital Motorway. It is an important retail destination, with established health and education facilities nearby. However, the centre does not have a strong commercial office market, as it competes with Norwest, Parramatta and other surrounding centres. These attributes of Blacktown Centre indicates that it may have the capacity to emerge as a Regional City for the North West Subregion over the next 25 years. To emerge as a Regional City, Blacktown will need to develop a strong commercial core and plan for significant housing growth, including high densities to support the commercial and retail functions of the centre.

The designation of Mt Druitt as a potential Major Centre is largely due to its favourable position on the Main Western Rail Line, Mt Druitt Hospital, and a large number of educational institutions such as the local TAFE. Although current employment forecasts will not reach the minimum 8,000 jobs to qualify for Major Centre status, the centre has the potential to change and grow over the longer term. A key opportunity for the centre is its proximity to the Western Sydney Employment Hub, located at the intersection of the M4 and M7 motorways.

Other surrounding key nodes providing important economic, employment and retail roles for the subregion include Rouse Hill (Planned Major Centre) and Town Centres of Seven Hills, Stanhope Gardens and St Marys. The classification of centres and villages used in the North West Subregion is provided in Figure 1.

Figure 1 Classification of Centres and Villages in the North West Subregion

Strategy Classification and Description
Town Centre Town Centres have one or two supermarkets, community facilities, medical centre, schools, etc. Contain between 4,500 and 9,500 dwellings. Usually a residential origin than employment destination.
Villages A strip of shops and surrounding residential area with a 5 to 10 minute walk contains a small supermarket, hairdresser, take-away food shops. Contain between 2,100 and 5,500 dwellings.
Small Villages A small strip of shops and adjacent residential area within a 5 to 10 minute walk. Contain between 800 and 2,700 dwellings.
Neighbourhood Centres One or a small cluster of shops and services. Contain between 150 and 900 dwellings

Source: Draft North West Subregional Strategy, DoP 2007

The key outcomes from the Draft North West Subregional Strategy are to:

- Increase the provision of residential, commercial and employment land to meet housing and employment capacity targets;
- Develop Penrith as a Regional City by investigating opportunities to strengthen connections between UWS Penrith Campus, Nepean Hospital and Penrith Regional City;
- Strengthen the role of centres, including Blacktown as a Major Centre and explore Mt Druitt as a potential Major Centre;
- Enhance local centres through focusing increased housing choice and revitalisation of the existing retail/ commercial centres;
- Improve access to, from and within the subregion;
- Maintain and protect rural and resource lands;
- Promote environmental and scenic qualities of the region;
- Improve access to open space and recreation opportunities.

A summary of relevant chapters within *Draft North West Subregional Strategy* to the redevelopment of Blacktown and Mt Druitt Hospitals is provided below:

- **Transport**

  This chapter highlights the Subregion's anticipated growth in population and the subsequent growth of pressures on transport networks, including the Main Western Rail Line. The subregion also experiences high levels of car dependency, with 79 per cent of trips by North West residents are made by vehicle. The *Strategy* identifies improvements to the public transport access to and from the Subregion through the development of the North West Rail Link, better connection to the Western Sydney Employment Hub, and the need to integrate transport and land use opportunities.

- **Employment and Economy**

  This chapter highlights the strategic employment land precincts within Blacktown LGA. Employment lands that are particularly relevant to Blacktown and Mt Druitt Hospitals include a six hectare area in close proximity to Blacktown Hospital, located at the intersection of Bungaribee Road and Blacktown Road at Blacktown. This area primarily consists of urban support services such as Blacktown Mega Centre and a RTA Motor Registry. Another key employment land precinct is Mt Druitt Industrial Area, located approximately halfway between Mt Druitt and St Marys Stations on the Western Rail Line and situated north of the Great Western Highway, comprising of 54 hectares of primarily logistics / warehousing, light industrial uses and urban support services.

  The *Strategy* also highlights the significant influence of transport links within and without the Subregion towards the economic future of the Subregion.

- **Housing**

  A significant driver for change in the housing needs for the area is the anticipated population growth for the subregion and the aging of the resident population. The majority of housing in the subregion is focused around the Western Rail Line and Great Western Highway corridors.

Commentary

Directions from the *Draft North West Subregional Strategy* to increase the amount of dwellings in the Subregion have resulted in increased development along the Rail Line and along Pacific Highway. The reliance on the rail line as a key form of public transport suggests that there is a need to enhance and maintain the service to provide for additional growth, however no improvements to the existing line through the Ku-ring-gai LGA are planned.

The importance of integrated transport strategies are highlighted through the need to respond to changing demographics in the area. The *Draft North West Subregional Strategy* emphasises the need for residential development that enables residents to 'age in place' with small, self sufficient dwellings and good access to services and public transport.

2.4 Metropolitan Transport Plan

The *Metropolitan Transport Plan* is a complementary strategic document to the *Metropolitan Plan for Sydney 2036*. It outlines the NSW Government's strategy to effectively link Sydney's land use planning with its transport network. The four key vision statements of the *Plan* are:

- Commuting to work easily and quickly
- Transport and services accessible to all members of our community
- An efficient, integrated and customer focused public transport system
- Revitalised neighbourhoods with improved transport hubs

The *Metropolitan Transport Plan* highlights the role of transport in Sydney as needing to go beyond catering for growth to being able to contribute to shaping a compact and efficient city. The Metropolitan Transport Plan is shown in Figure 2.

Figure 2 Metropolitan Transport Plan

Source: NSW Government, 2010

Rail

The *Metropolitan Transport Plan* outlines the following initiatives and improvements to the rail network in 2010 – 2020:

- Constructing the South West Rail Link;
- Constructing the City Relief Line, adding new rolling stock and new platforms to busy CBD stations, leading to more and faster trains from Western Sydney;
- Beginning construction of the North West Rail Link;
- Rolling out new train carriages including Waratah and OSCARs to provide air conditioning to all passenger rail carriages;
- Extending light rail operations to Dulwich Hill and through the CBD.

Buses

The *Metropolitan Transport Plan* outlines the following initiatives to improve bus connections:

- Add 1000 new buses to Sydney's bus network, increasing the size of the bus fleet by approximately 25%
- 43 strategic bus corridors, all with new bus priority measures, to provide a network of routes connecting the City of Cities
- Future strategic bus corridors are planned for the areas around the North West and South West Growth Centres, and the Western Sydney Employment Hub

Bicycle and Pedestrian Infrastructure

A key element of the *Metropolitan Transport Plan* is the NSW Bikeplan 2010, which outlines the delivery of missing cycle links in the Metro Sydney Bike Network and provides funding to assist local councils in improving local cycleway networks. The Plan recognises the potential to shift a high number of short trips (under 10 kilometres) from car to active transport alternatives such as cycling and walking. Further commentary on the NSW Bikeplan is provided in Section 2.5.

Commentary

The *Metropolitan Transport Plan* recognises the strong links between land use planning and transport and the need for integration between the two, to enhance the social and economic value of Sydney. The *Plan's* vision responds to the significant shift in aging population in the Blacktown LGA and the need to provide accessible transport options for all. It also highlights that the city's economy relies on good transport infrastructure to allow access to jobs, and also highlights that the perception of transport access needs to be regarded high to encourage investment into employment centres.

The *Plan* identifies future strategic bus corridors proposed in the North West Growth Centre and the Western Sydney Employment Hub. A dedicated Western Express Rail line is also proposed, which will improve the frequency and travel times of train journeys to and from Blacktown and Mt Druitt.

The redevelopment of Blacktown and Mt Druitt Hospitals provides a significant upgrade of critical health infrastructure for the Western Sydney region. Local transportation networks in and around the two sites are able to respond to increased patronage resulting from the redevelopment.

2.5 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 and Mt Druitt Hospital are located in close proximity to . An opportunity to encourage active transport modes such as cycling is recognised for the Blacktown and Mt Druitt 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.

2.6 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 and Mt Druitt Hospital redevelopment proposal has been designed with consideration to the key concepts outlined in the *Integrated Land Use and Transport Package.*

2.7 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 4 and Table 5.

Table 4 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 5 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)

2.8 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.

2.9 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 Mt Druitt 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, and Mt Druitt Hospital and Mt Druitt Train Station. Blacktown and Mt Druitt Train Station are both located on the Western Rail Line, and receive 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 two hospital sites are located in close proximity to Blacktown and Mt Druitt train stations, which are 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.
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 sites are located within 400-500m of bus stops connecting the hospitals to Blacktown and Mt Druitt train stations.
TC1.6	Are public transport systems and nodes designed to be universally accessible?	Bus stops in and around the two hospital sites are to be designed to be universally accessible and consistent with the Disability Discrimination Act 1992.

Code	Question	Response
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 and Mt Druitt Hospital sites
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.
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 new traffic signals.

Code	Question	Response
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 campuses 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

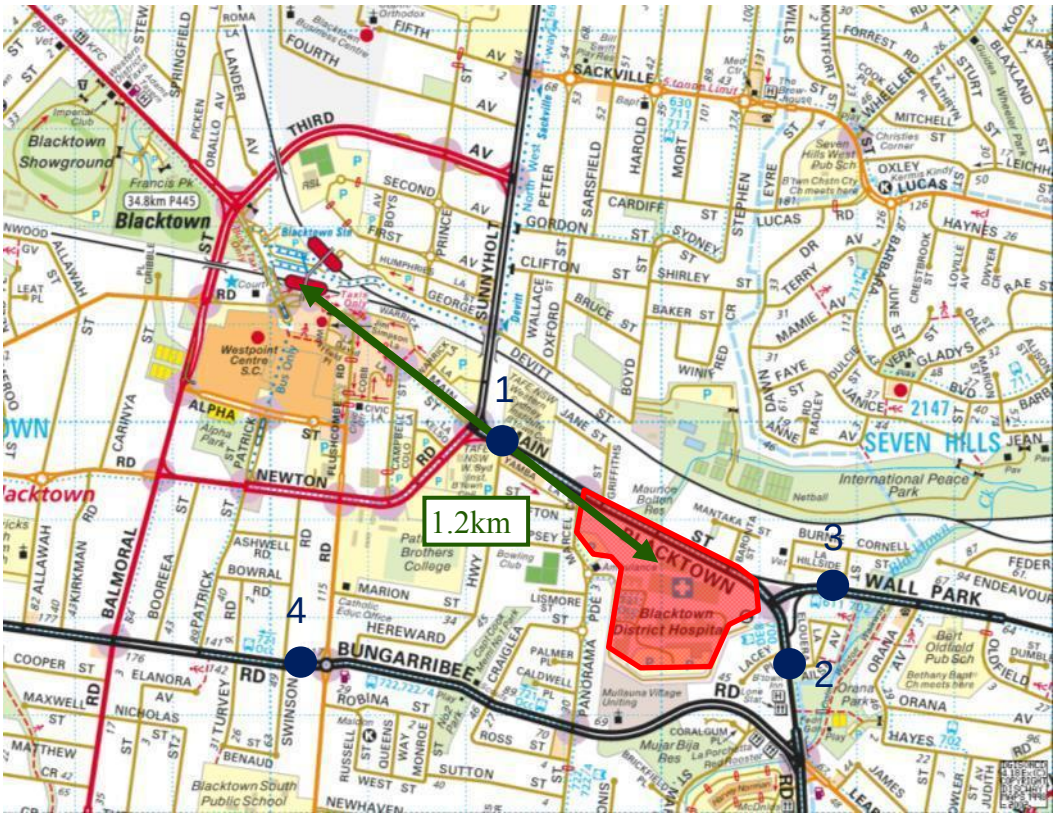
The Blacktown and Mt Druitt Hospital redevelopment is generally consistent with the transport and physical connectivity questions in the *Healthy Urban Development Checklist 2010*.

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 3.

Figure 3 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. Main road traffic flows are shown in Table 6.

Table 6 Daily Traffic Flow (AADT) Source: RTA

Site on map	Road	Location	Daily Traffic Flow (AADT)		
			2002	2005	2008
1	Blacktown Road	East of Marcel Crescent	33,911	32,707	Not available
2	Blacktown Road	South of Wall Park Ave	39,007	38,635	
3	Wall Park Ave	East of Blacktown Road	27,610	28,540	
4	Bungarribee Road	West of Flushcombe Road	20,791	20,192	

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 4.

Figure 4 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. The only direct access now available to Blacktown Road is currently a service access driveway which operates as a priority intersection due to the low usage.

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 5 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 5 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 5. It currently accommodates appliances and staff for the region and the ambulance service has no plans to relocate the service.

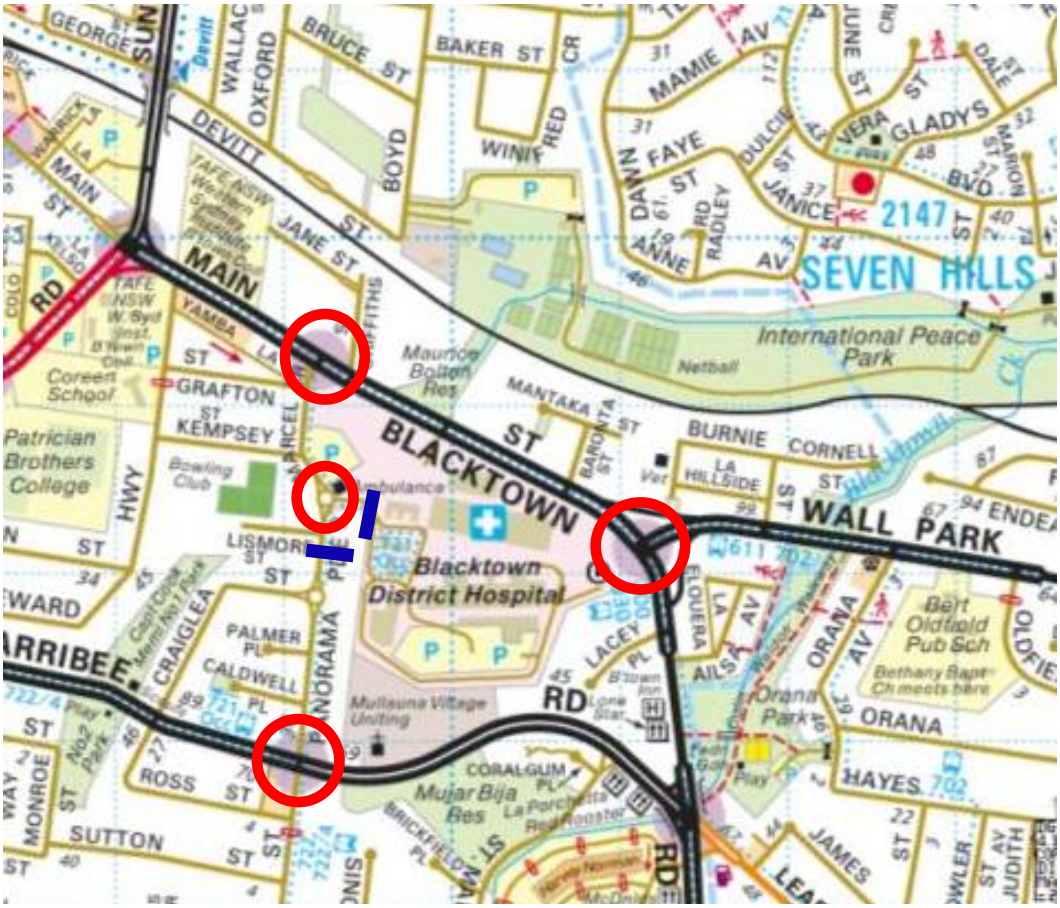
3.4 Traffic flow data

Traffic surveys were undertaken on Thursday 21 October, 2010 in the AM (6am-9am) and PM (3pm-6pm) peak periods at the locations shown in Figure 6. 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
- Bungarribee Road / Panorama Parade – traffic signals
- Panorama Parade / Marcel Cres / hospital access - roundabout

Seven day classified tube count data was collected on Panorama Parade and on the Hospital Entrance Road.

Figure 6 Traffic Survey Locations



The vehicle turning count data is included in Appendix A.

The weekly tube count data is plotted below in Figure 7 and Figure 8. 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

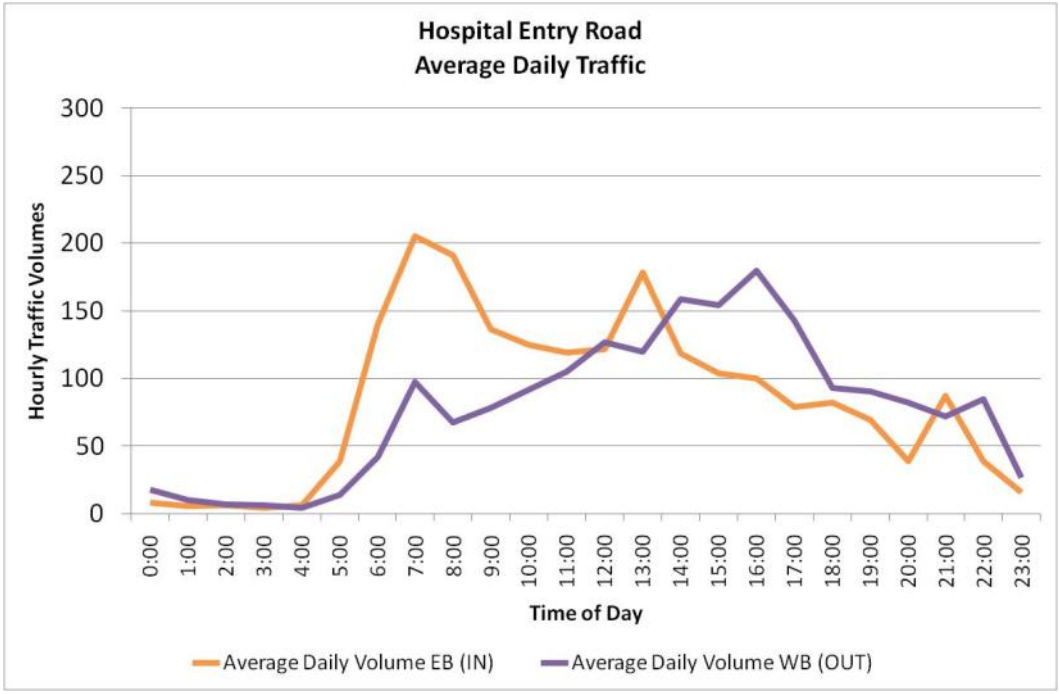
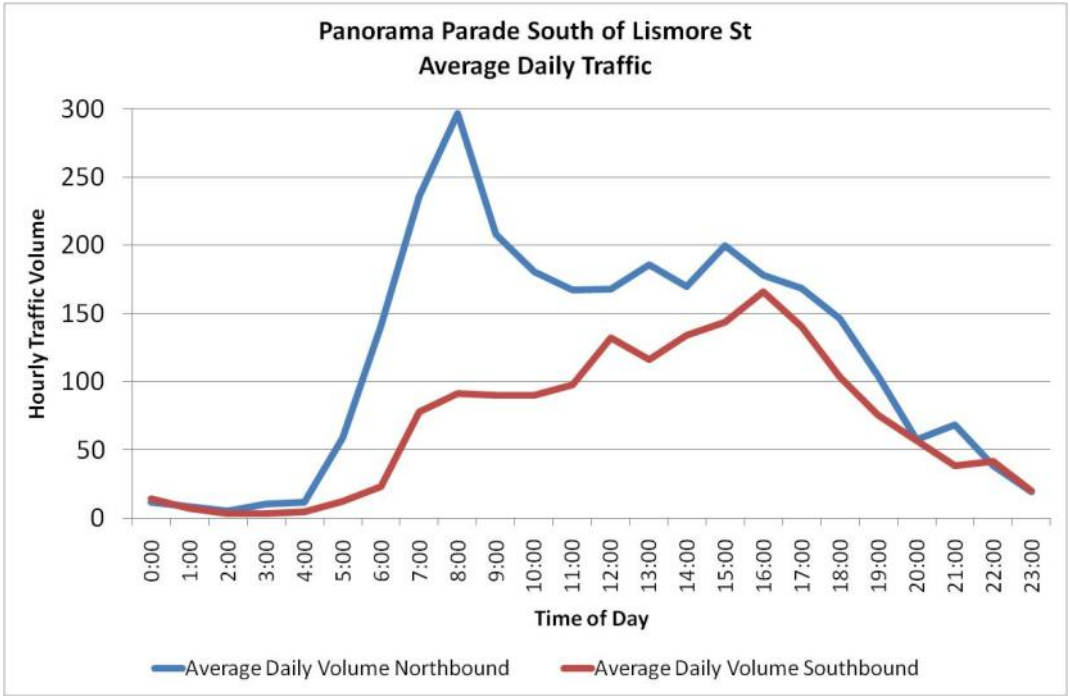


Figure 8 Panorama Parade south of Lismore Street



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 7.

Table 7 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 four key intersections is shown in Table 8 for the AM Peak and Table 9 for the PM Peak. The Wall Park Ave and Blacktown Road intersection is operating at LOS D in both peak periods which is to be expected given the major traffic flows that travel into and out of the Blacktown town centre through this intersection. With a DOS of 1.0, the intersection is effectively close to capacity. The Blacktown Road and Marcel Crescent intersection is operating at LOS B with a DOS of 0.9. The two Panorama Parade intersections operate satisfactorily.

Table 8 AM Peak Existing Intersection Performance

Intersection AM Peak	**Degree of Saturation**	**Average Delay (seconds)**	**Worst Movement (in terms of delay)**	**95% MMQ (Queue Length)**	**Level of Service**
Existing Scenario					
Blacktown Rd and Marcel Cres	0.88	25.9	Blacktown Rd W Right Turn	221.3m on Blacktown Rd E	B
Wall Park Ave and Blacktown Rd	1.00	50.9	Wall Park Avenue	272m on Blacktown Rd NW	D
Panorama Pde and Hospital Access Rd	0.29	7.2	Panorama Pde N U-turn	16.0m on Panorama Pde S	A
Bungarribee Rd and Panorama Pde	0.78	25.4	Bungarribee Rd W Right Turn	91.6m on Bungarribee Rd W	B

Table 9 PM Peak Existing Intersection Performance

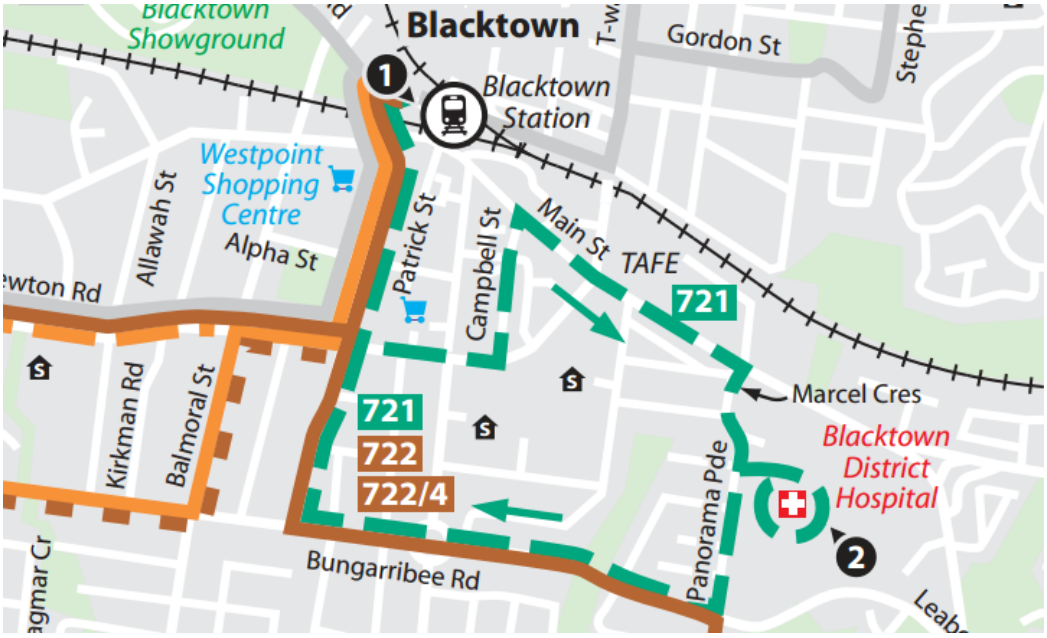
Intersection PM Peak	**Degree of Saturation**	**Average Delay (seconds)**	**Worst Movement (in terms of delay)**	**95% MMQ (Queue Length)**	**Level of Service**
Blacktown Rd and Marcel Cres	0.85	20.7	Blacktown Rd W Right Turn	209.1m on Blacktown Rd E	B
Wall Park Ave and Blacktown Rd	1.00	48.7	Wall Park Avenue	301m on Blacktown Rd NW	D
Panorama Pde and Hospital Access Rd	0.26	7.6	Panorama Pde N U-turn	10.5m on Panorama Pde S	A
Bungarribee Rd and Panorama Pde	0.63	21.0	Bungarribee Rd E Right Turn	91.6m on Bungarribee Rd W	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. **Error! Reference source not found.** shows the bus network map for the private bus companies that service the Blacktown area.

Busways operates a hospital service Route 721 which operates 8 services on weekdays between 8.51am and 5.33 pm between Blacktown Station and 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

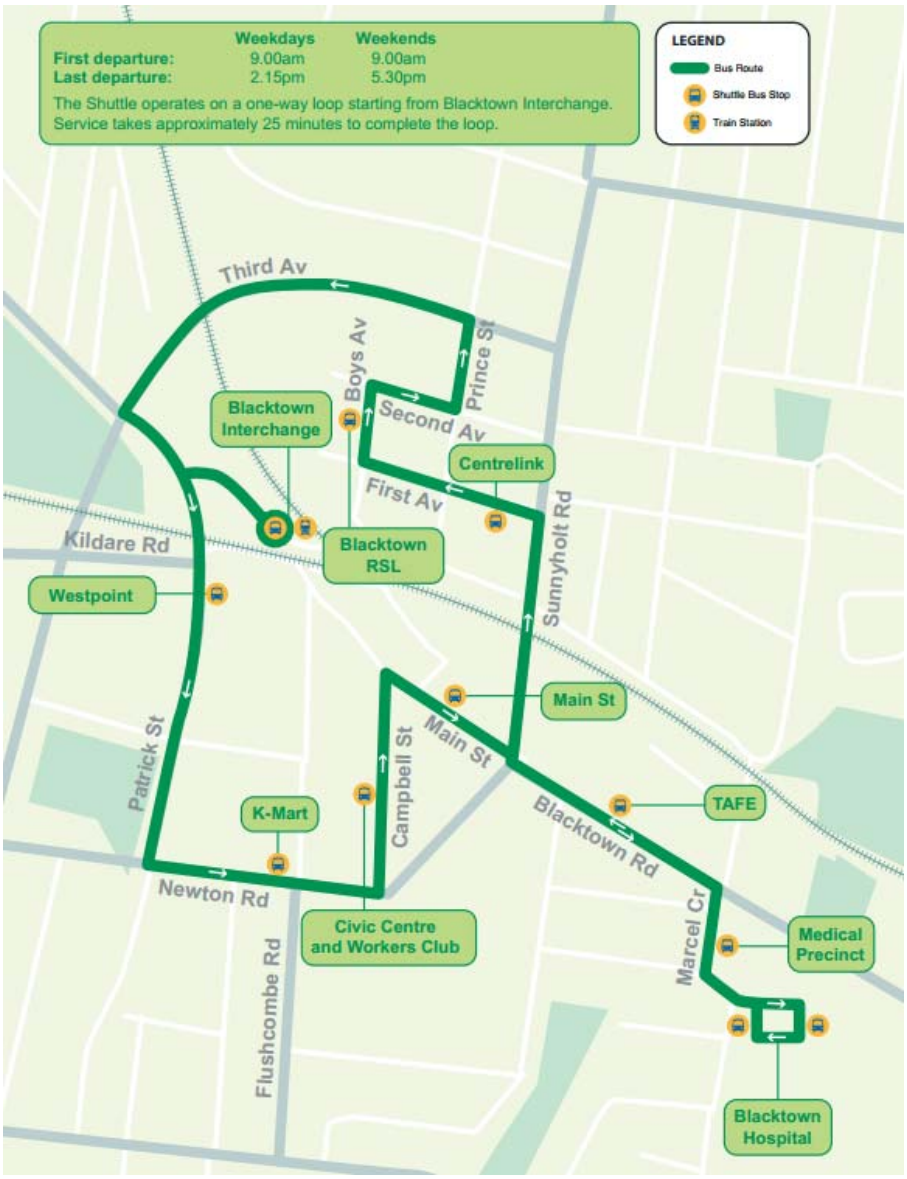
Blacktown City Council operates a free CBD shuttle bus that services the Blacktown CBD from the railway station to the Hospital. The route map is shown in Figure 11.

The free Blacktown Shuttle, introduced in March 2011, runs every 15 minutes (Route 720). The service operates on a one-way loop starting from Blacktown Interchange connecting Blacktown CBD to Blacktown Hospital. The hours of operation are:

- Weekdays: 9.00am to 2.15pm
- Weekends: 9.00am to 5.30pm

The Shuttle is attractive to visitors and patients, but does not suit the majority of staff travel times.

Figure 11 Blacktown CBD Shuttle route map



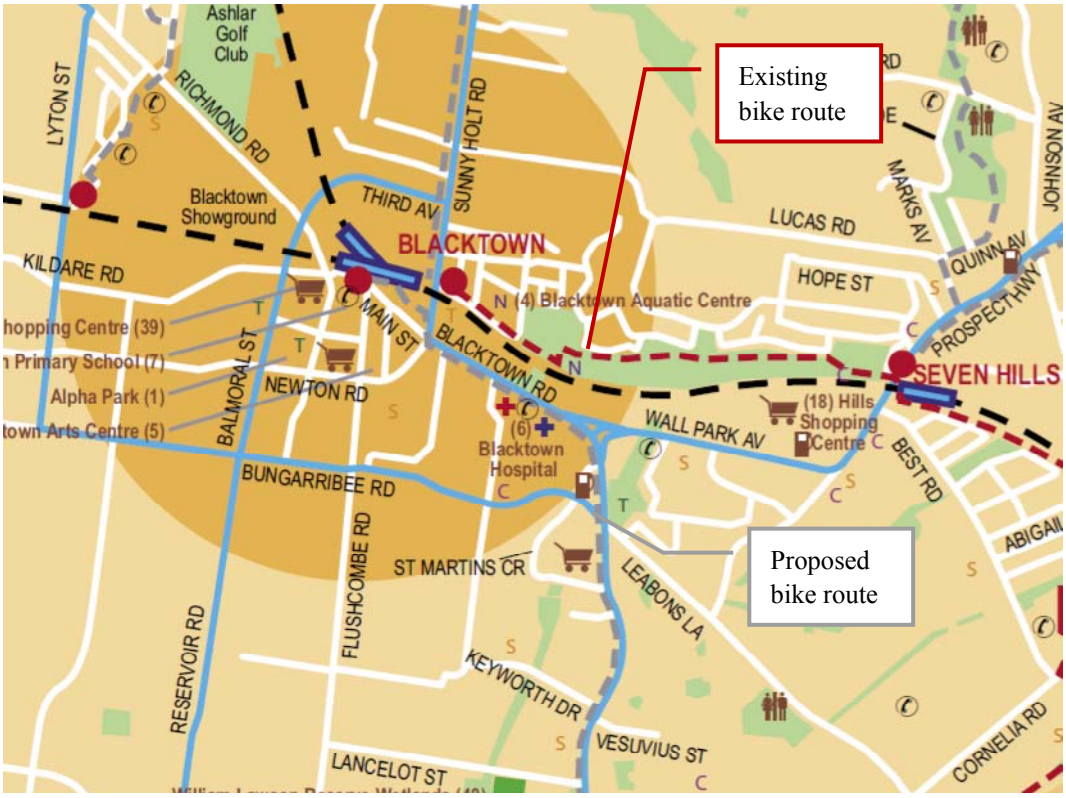
3.7 Pedestrian and cycle facilities and conditions

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 12. Unfortunately there are no pedestrian or bicycle connections across the railway between these two stations.

All cycling in the vicinity of the hospital currently occurs on road shared with traffic. The bike plan shows a proposed route along Blacktown Road which is currently under construction along the southern side of Blacktown Road configured as a shared footpath facility. This will provide 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 although walking connections into the hospital are poor. 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 12 Blacktown City Council Bike Plan

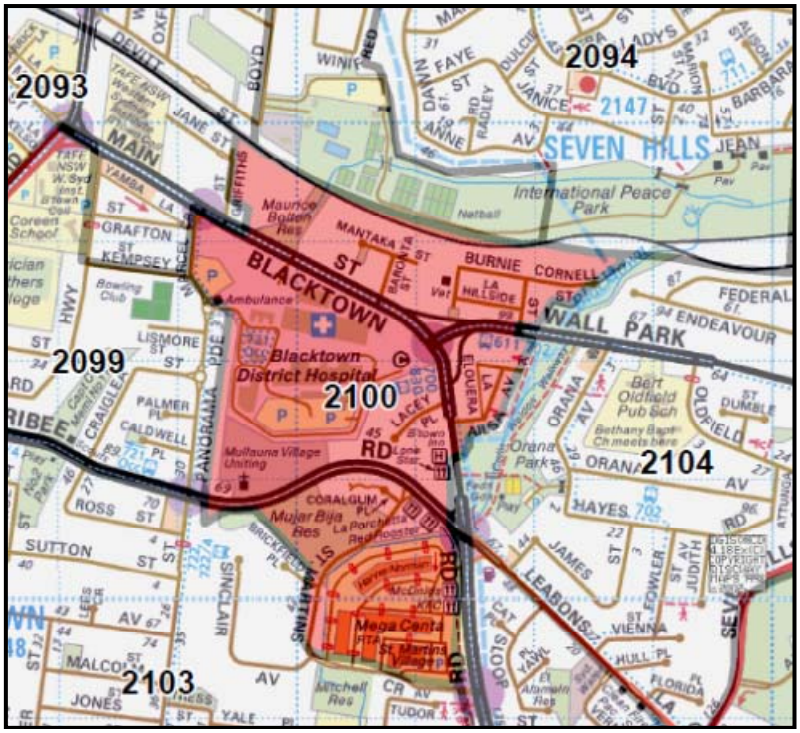


3.8 Travel Patterns

3.8.1 Mode split

The existing 2006 ABS Journey to Work data for the travel zone 2100 including Blacktown Hospital (see Figure 13) has been analysed for this study.

Figure 13 Travel Zones Including Blacktown Hospital



Source: Transport Data Centre (2010)

The mode split of workers travelling to this precinct is indicated in Table 10.

Table 10 Journey to Work Existing Mode Split

Mode	Total Trips	Proportion of Total Trips (%)
Car as driver	1125	83.64%
Car as passenger	101	7.51%
Train	36	2.68%
Bus	21	1.56%
Taxi	6	0.45%
Motorbike	3	0.22%
Bicycle	4	0.30%
Other mode	5	0.37%
Walked only	44	3.27%
TOTAL	1345	100%

The analysis indicates that 92% of people travel by car to work in this precinct. Public transport currently accounts for only 5% of work related trips and walking 3%.

3.8.2 Home location of workers

The home location of all workers travelling to this travel zone, based on 2006 Journey to Work data, is presented in Table 11. Just over 50% of all workers in this travel zone live in Blacktown. 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 11 Home LGA of Workers

Home LGA	Total Trips	Proportion of Total Trips
Blacktown	821	50.9%
Penrith	185	11.5%
Baulkham Hills	154	9.6%
Parramatta	83	5.1%
Holroyd	62	3.8%
Hawkesbury	57	3.5%
Blue Mountains	49	3.0%
Hornsby	27	1.7%
Fairfield	20	1.2%
Liverpool	18	1.1%
Other	136	8.4%
Total		100%

3.9 On and off-site parking arrangements

Car parking is currently spread across the site in at-grade car parks. A breakdown of hospital parking is provided in Table 12 and illustrated in Figure 14. There are approximately 1031 car parking spaces across the campus which adequately services current demand. Remote parking to the south of the site at the highest point is not well utilised by staff and other parking areas closer to the hospital are over parked with vehicles parking on the edges of islands in unmarked spaces rather than walk up the hill to the remote parking areas. All parking on the site, with the exception of the Marcel Crescent Car Park, 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.

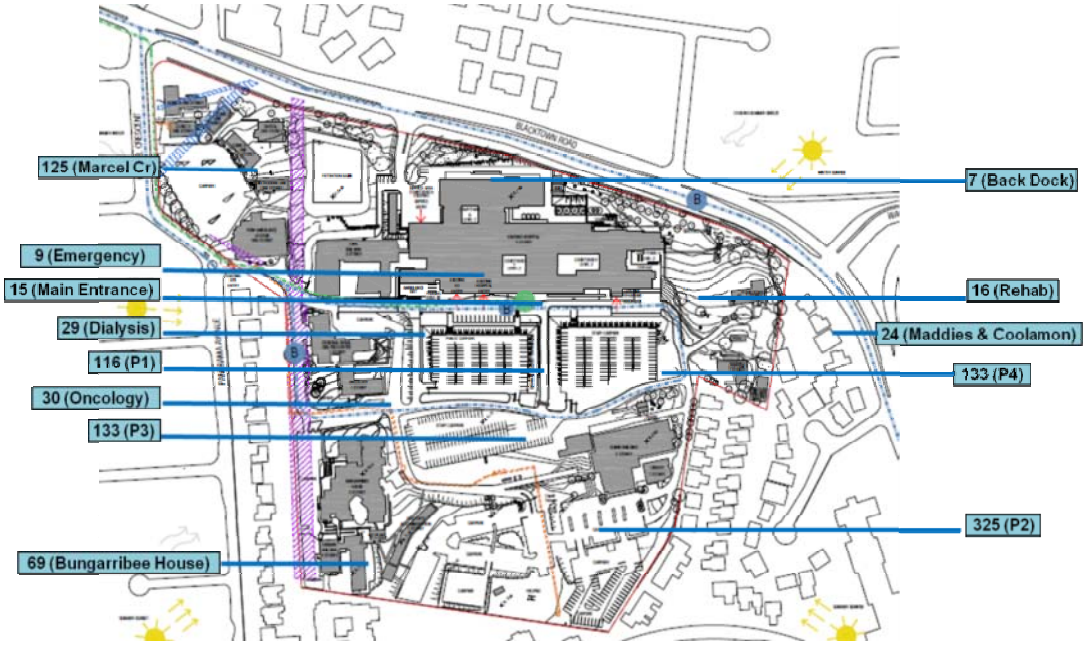
Table 12 Existing car parking

Location	Number
P1 Visitor	116
P2 Staff	325
P3 Staff	133
P4 Staff	133
Main Entrance	15
Back Dock	7
Bungarribee House	69
Oncology/Embark	30
Dialysis	29
Rehab	16
Emergency call in	9
Maddies and Coolamon Cottage	24
Marcel Crescent	125
Total	**1031**

The recently opened UWS Facility was determined to require 63 car parking spaces for new staff and student attendances. There were 91 car spaces displaced by the new building. The total requirement for 154 new spaces on the campus has been provided in the P4 car park and a number of small expansion areas in other car parks.

On-street car parking is limited in the vicinity of the site with time limits on parking in Kempsey Street although Panorama Parade and Marcell Crescent has unlimited parking. On-street parking is available for some 207 vehicles within 400m of the site.

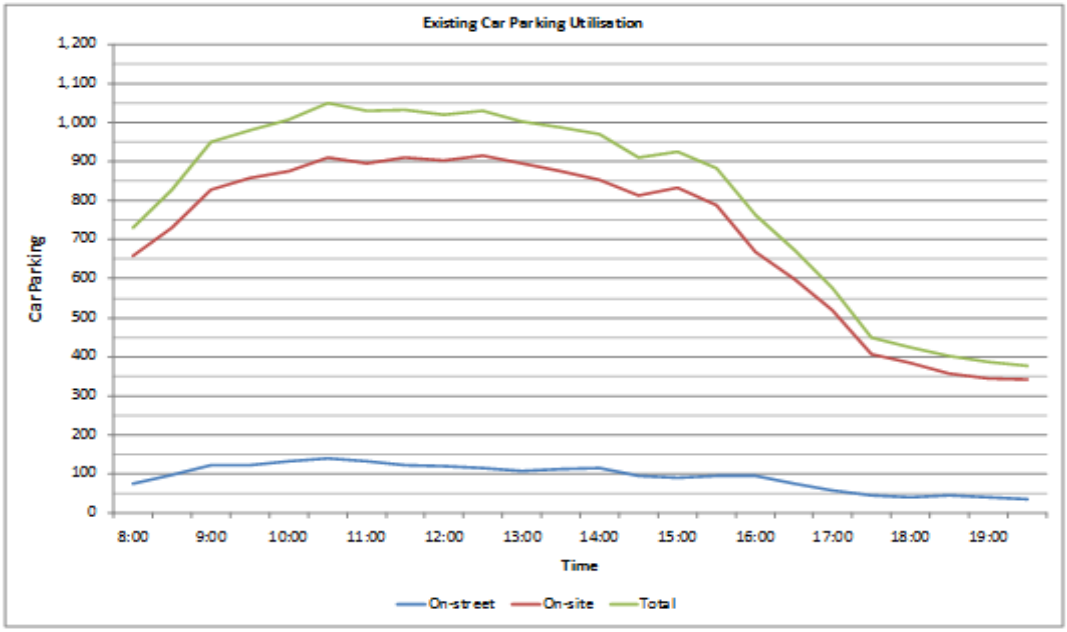
Figure 14 Existing Car Parking



3.10 On and off-site parking utilisation

Car parking utilisation surveys on site and on streets adjacent to the hospital were undertaken on Thursday 16 December 2010 between 8.00am and 8.00pm. The car parking data collected is detailed in Appendix B. Then utilisation of car parking is shown in Figure 15. On street car parking utilisation peaked at 10.30am when 139 cars were observed to be parked. It could be expected that some 80% of these were associated with hospital staff and visitor parking. On site car parking utilisation peaked at 12.30am when 915 cars were observed to be parked.

Figure 15 Existing Car Parking Utilisation



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 13.

Table 13 Staff, Patient and Visitor Activity

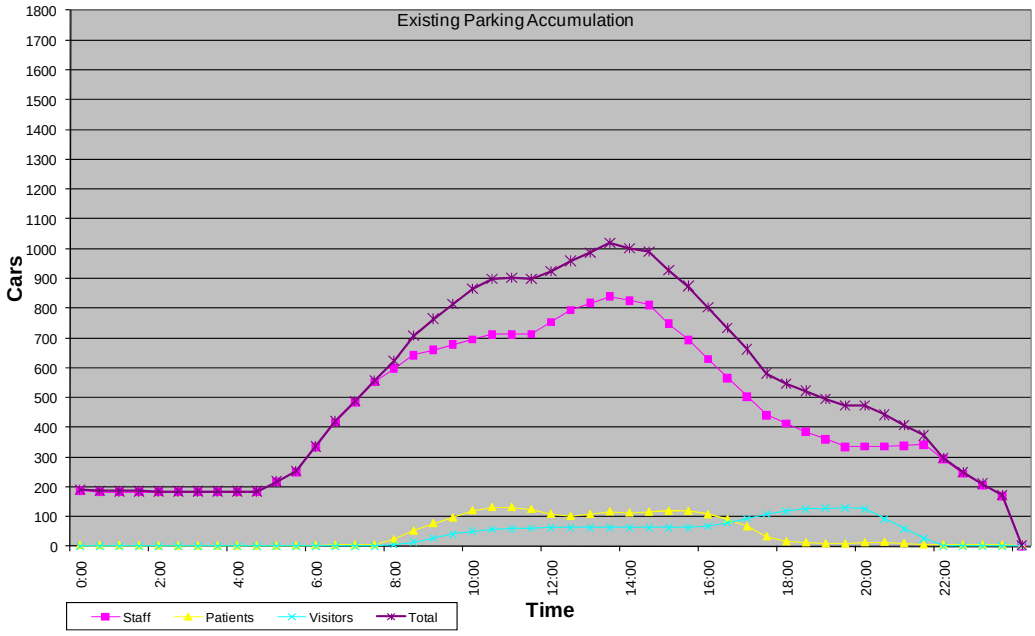
	Existing	**Stage 1 Proposed**	**Stage 2 Proposed**
1. Staff Attendance	staff/weekday	staff/weekday	staff/weekday
Nurses	796	1137	1295
Clerical/Misc	129	184	210
Ancillary Medicine/Community	285	407	464
Hotel/Allied	23	33	37
Medical - Sessional	121	173	197
TOTAL daily attendance	1354	1934	2203
2. Staff 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. A base model has been developed using existing levels of activity 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 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 16. 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 16 Existing Parking Accumulation from Model



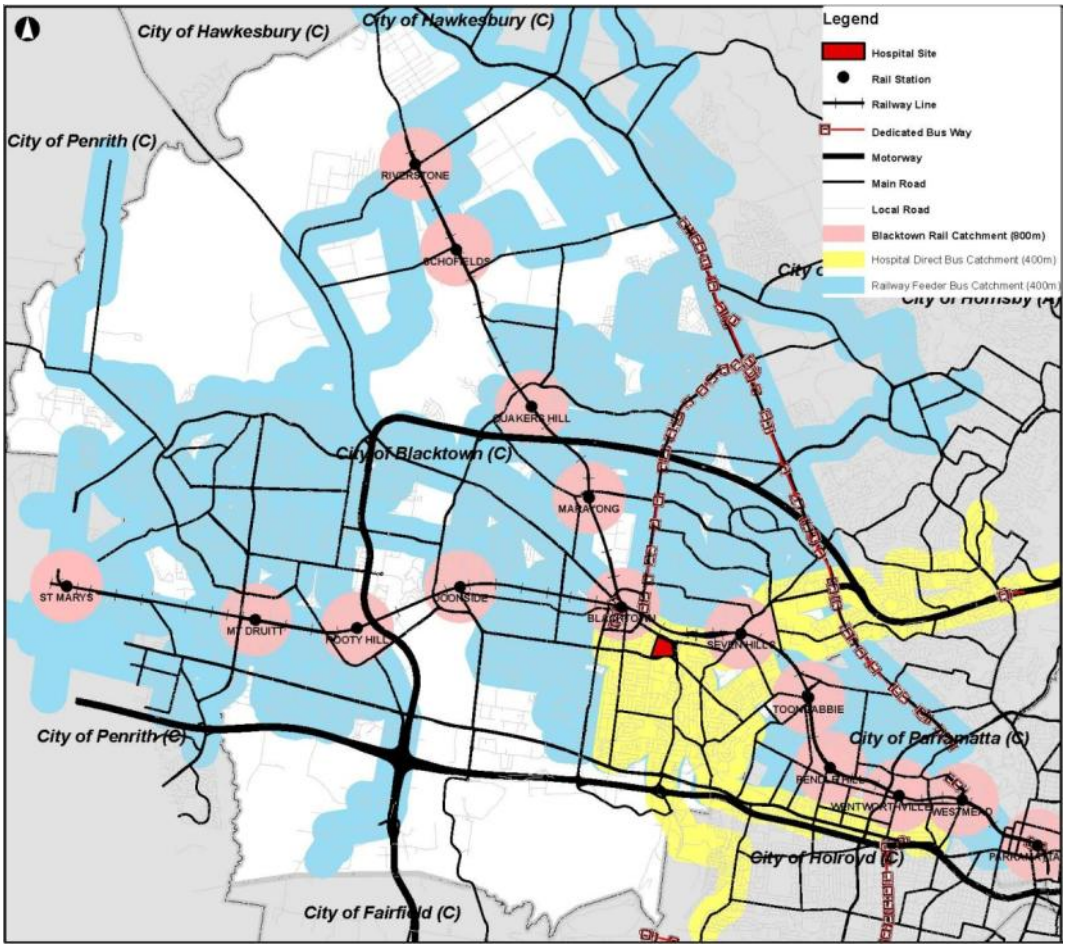
4.2.2 Non-car modes of travel for staff

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 5). 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 2006 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 local government 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 17 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 17 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 14. There are good public transport services to provide for this potential increase in activity.

Table 14 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 Stage 2 in the afternoon peak period at 2.30pm. The modelled parking demand is shown graphically for Stage 1 in Figure 18 and Stage 2 in Figure 19.

Figure 18 Stage 1 Parking Accumulation from Model

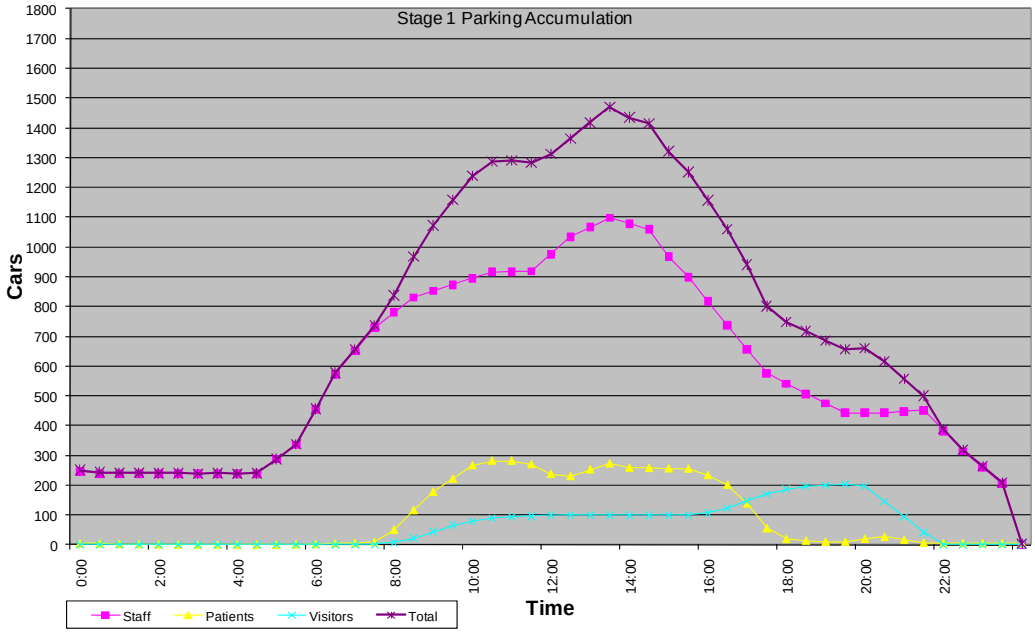
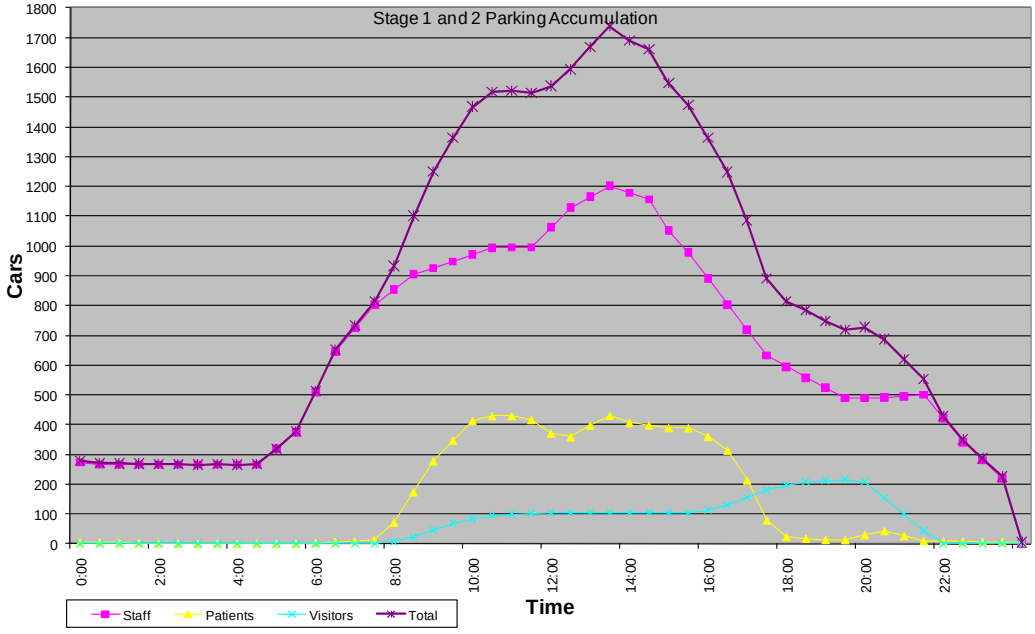


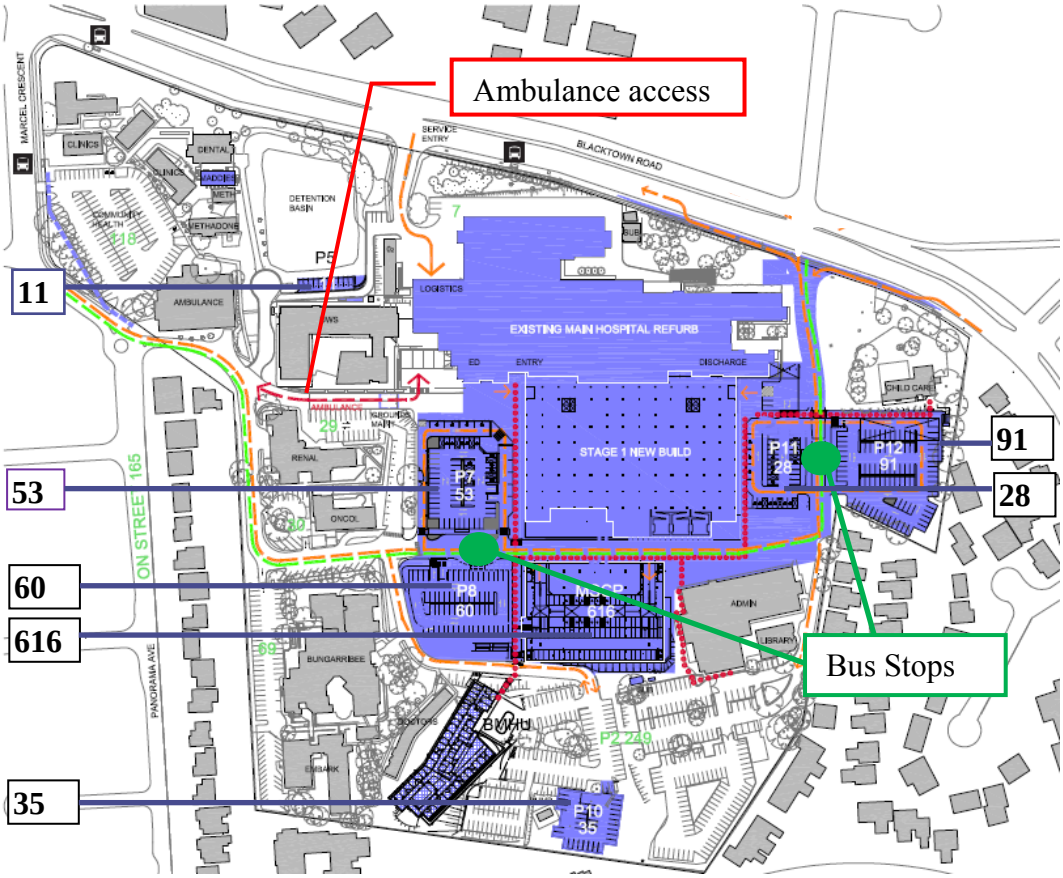
Figure 19 Stage 2 Parking Accumulation from Model



4.2.4 Future car parking provision and access

The floor plans and access arrangement that have been adopted for the Stage 1 Masterplan are shown in Figure 20. 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.

Figure 20 Blacktown Hospital Stage 1 Masterplan showing new car parks



The new building footprint and new car parking locations remove approximately 515 existing car spaces leaving 516 existing spaces. The new car parking areas which add 894 spaces are shown on Figure 20, taking the total future provision in Stage 1 to 1410 spaces on the site. The modelling indicates the need for a total of 1469 spaces and hence supply will almost meet demand, with minimal overflow on-street.

The provision of the new car parks can be staged across the site to cater for current demand whilst the multi-storey car park is under construction.

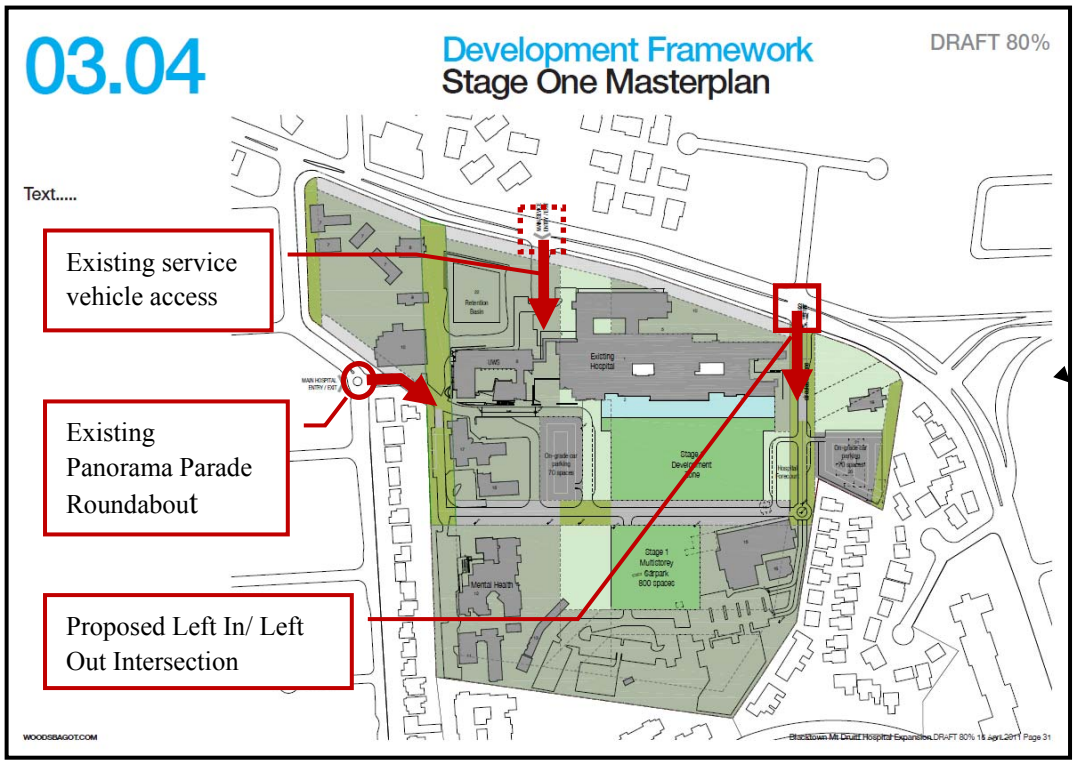
For the Stage 2 redevelopment, current planning indicates the potential demand for up to 1737 spaces. The expansion of the multi-deck car park will be adjusted in Stage 2 to meet the demand forecasts at the time of that project application.

4.3 Future access options

The key issue for access is achieving increased capacity onto the site whilst recognising the sensitivity of the Panorama Parade local road system to increases in traffic. For continued expansion of facilities on the hospital campus, it will be necessary to provide a more significant access address, ideally to Blacktown Road. This will increase legibility and access capacity. Continued access to Panorama Parade is recommended as a secondary access route which would provide route choice as well as redundancy.

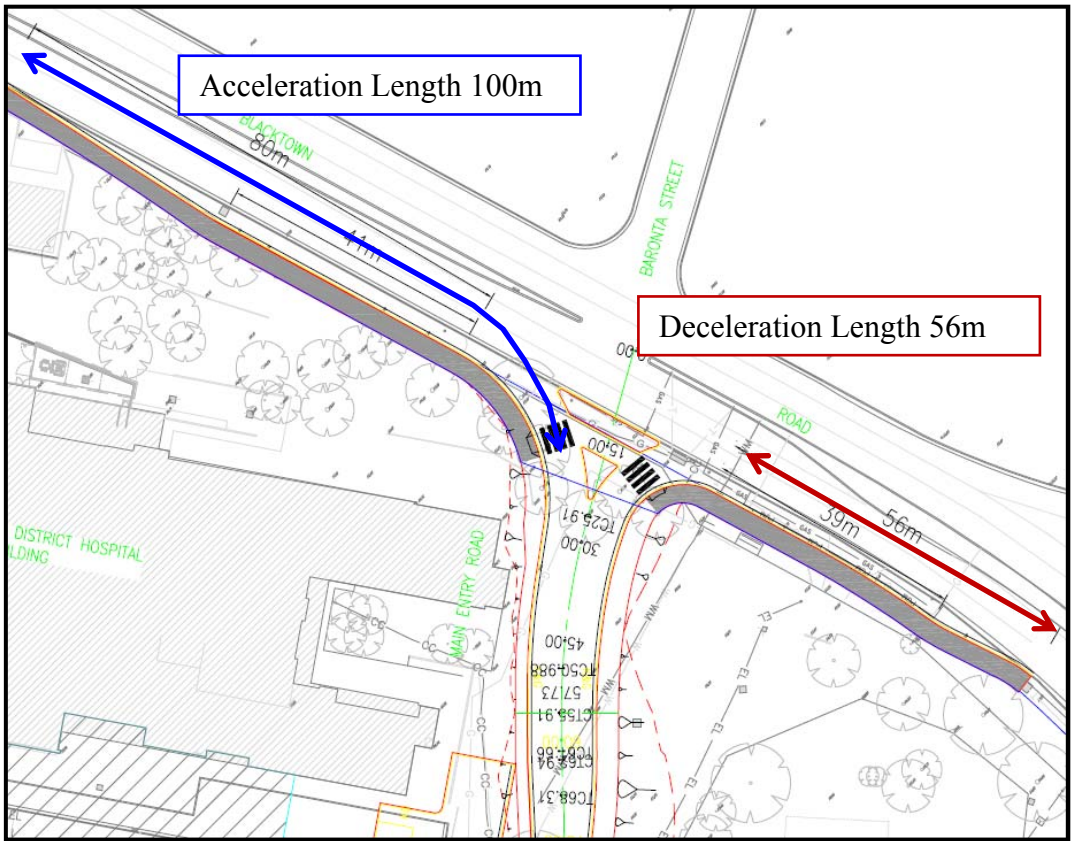
The Stage 1 Masterplan access points have been identified as shown in Figure 21.

Figure 21 Stage 1 Masterplan Access



The proposed new access point onto Blacktown Road at the eastern end of the campus aligns with Baronta Street as shown in Figure 22. Access to the hospital will only be provided for left turn in movements via a 56m long deceleration lane and left turn out movements via a 100m long acceleration lane. 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 22 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 23. A deceleration lane of 56m has been proposed.

Figure 23 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	

The length of acceleration lane required is identified in Table 4.8.5 of the RTA (RMS) Road Design Guide. Based on a 20 km/hr exit turning speed, an acceleration length including taper of 95 m is required for a 60km/hr road. An acceleration length of 100m has been provided which is the maximum possible given the site constraints at the boundary.

Figure 24 Acceleration Distance (RTA Road Design Guide)

Table 4.8.5 Length of Acceleration Lanes on Level Grade.
*(see **Table 4.8.6** for grade correction)*

Design speed of road entered (km / h)	Length of acceleration lane **A** (m) (including length of pavement taper) where design speed of entry curve (km / h)is								4 sec travel (m)	Merge Tm (m)	Min desir. length 4 sec +Tm
	0**	20	30	40	50	60	70	80			
50	70	55	45	30	-	-	-	-	55	50	105
60	110	95	85	70	40	-	-	-	65	60	125
70	165	150	140	125	95	55	-	-	80	70	150
80	235	220	210	195	165	125	75	-	90	80	170
90	330	315	305	290	260	220	170	95	100	90	190
100	450	435	425	410	380	340	290	220	110	100	210
110	610	595	585	570	540	500	450	320	120	110	230

Improvements to sight distance between the hospital access and Wall Park Avenue will be considered including removal/trimming of low tree branches and possible setting back of the embankment. Sight distance looking east towards the Wall Park Ave intersection is shown in Figure 25 and the low tree branches on hospital property that will be considered for trimming are shown in Figure 26. It is likely that the embankment will need cutting back for the shared path cycleway proposed in this location.

Figure 25 Sight distance looking east towards the Wall Park Ave intersection

Figure 26 Trees to be trimmed

4.4 Traffic generation and distribution

The travel model predicts the traffic flows throughout the day. The predicted peak hour flows are shown in Table 15.

Table 15 Predicted Peak Hour Traffic Flows

	Road Peak Hour	In	Out	Total
Existing	AM Peak	279	70	349
	PM Peak	101	209	310
Stage 1	AM Peak	399	146	545
	PM Peak	103	330	433
Stage2	AM Peak	512	165	677
	PM Peak	145	440	585

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. The existing distribution is shown in Figure 27 for the AM Peak and Figure 28 for the PM Peak. The future Stage 1 and Stage2 traffic flows for the AM and PM Peaks are shown in Figure 29, Figure 30, Figure 31 and Figure 32 respectively.

Figure 27 Existing AM Peak Traffic Distribution

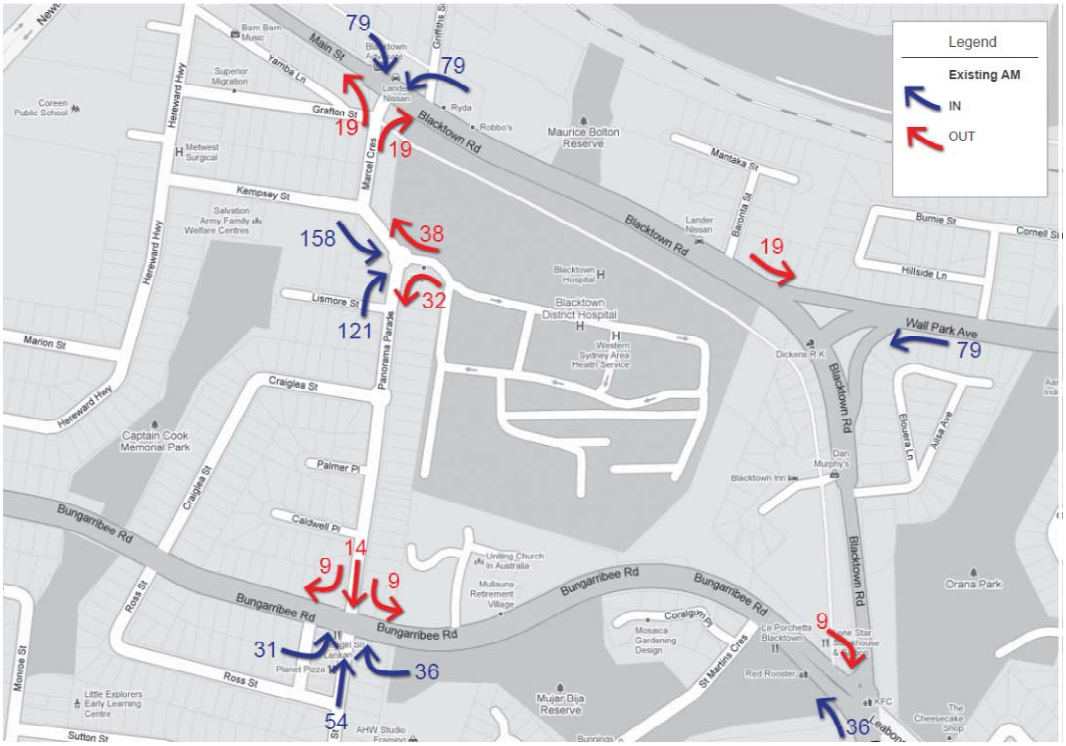


Figure 28 Existing PM Peak Traffic Distribution

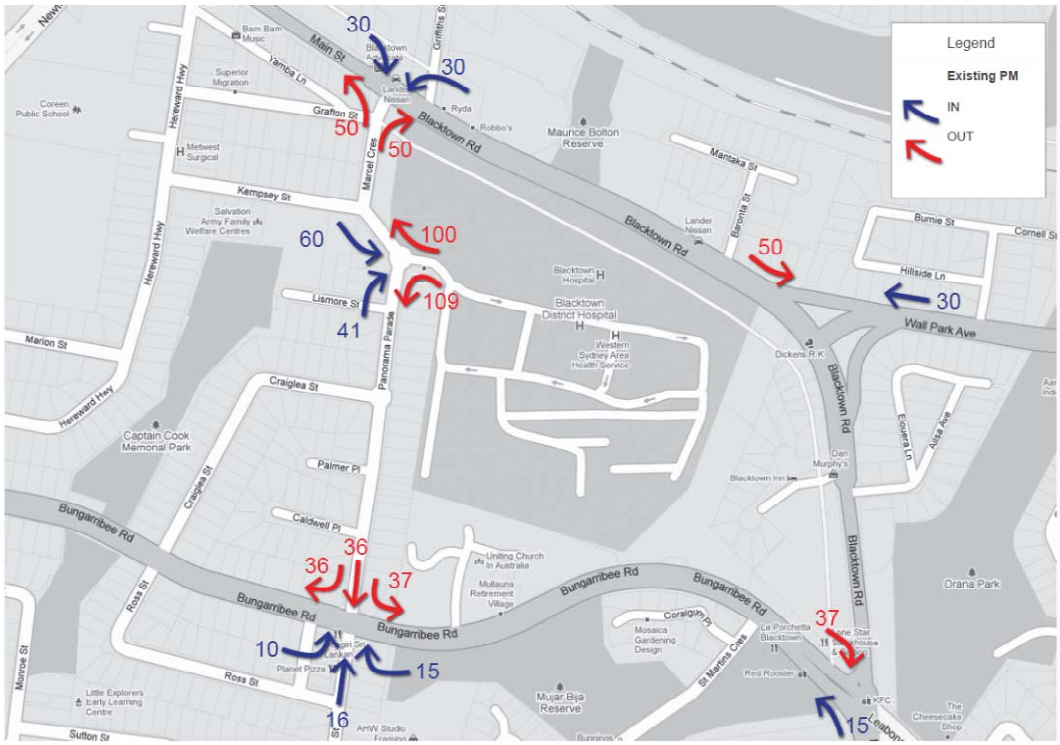


Figure 29 Proposed (Stage 1) Expansion AM Peak Traffic Redistribution

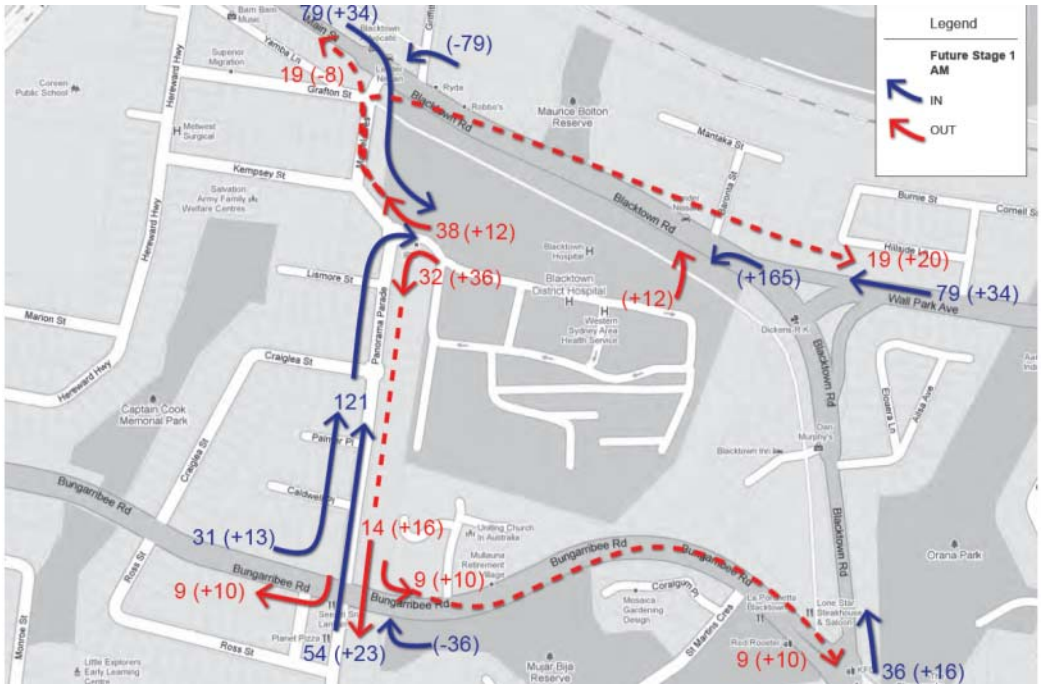


Figure 30 Proposed (Stage 1) Expansion PM Peak Traffic Redistribution

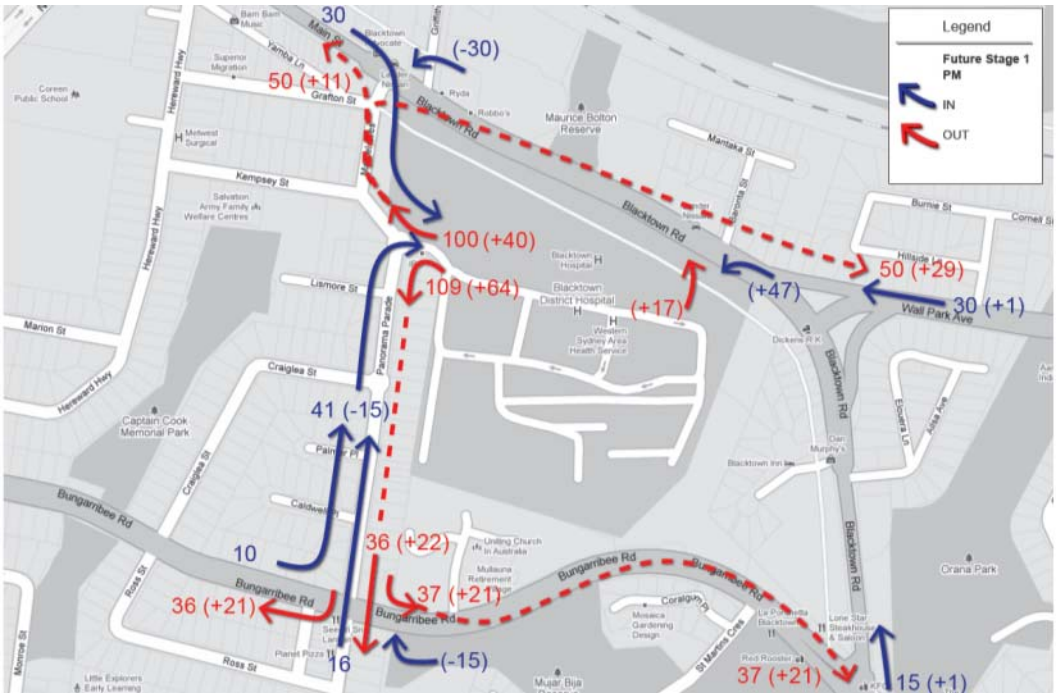


Figure 31 Future (Stage 2) Expansion AM Peak Traffic Redistribution

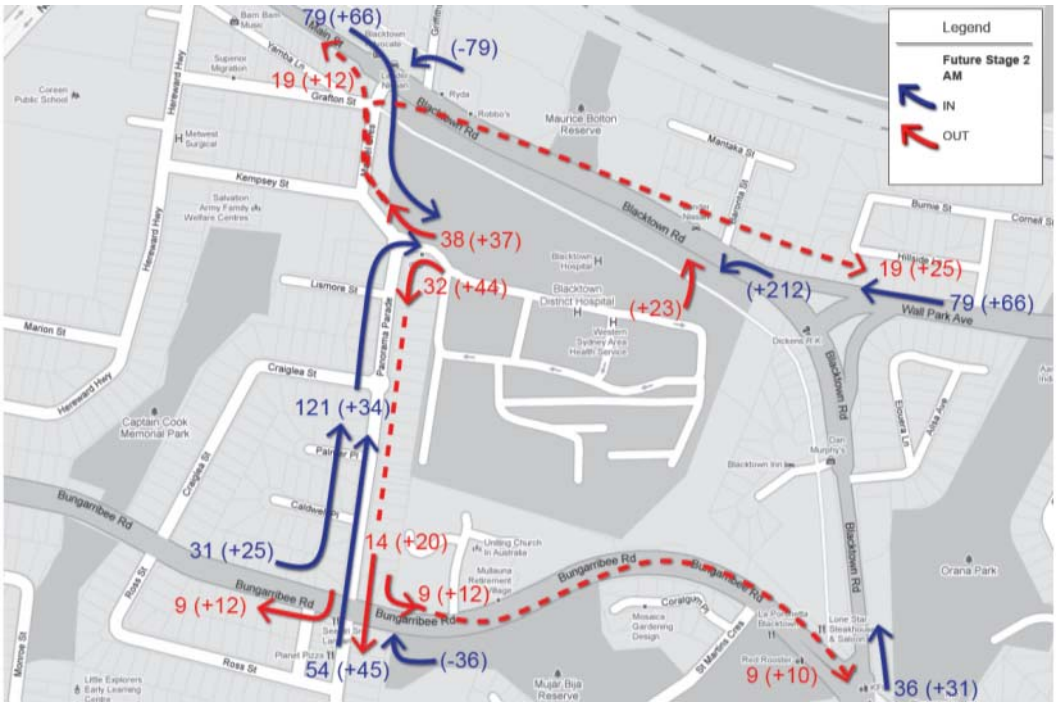
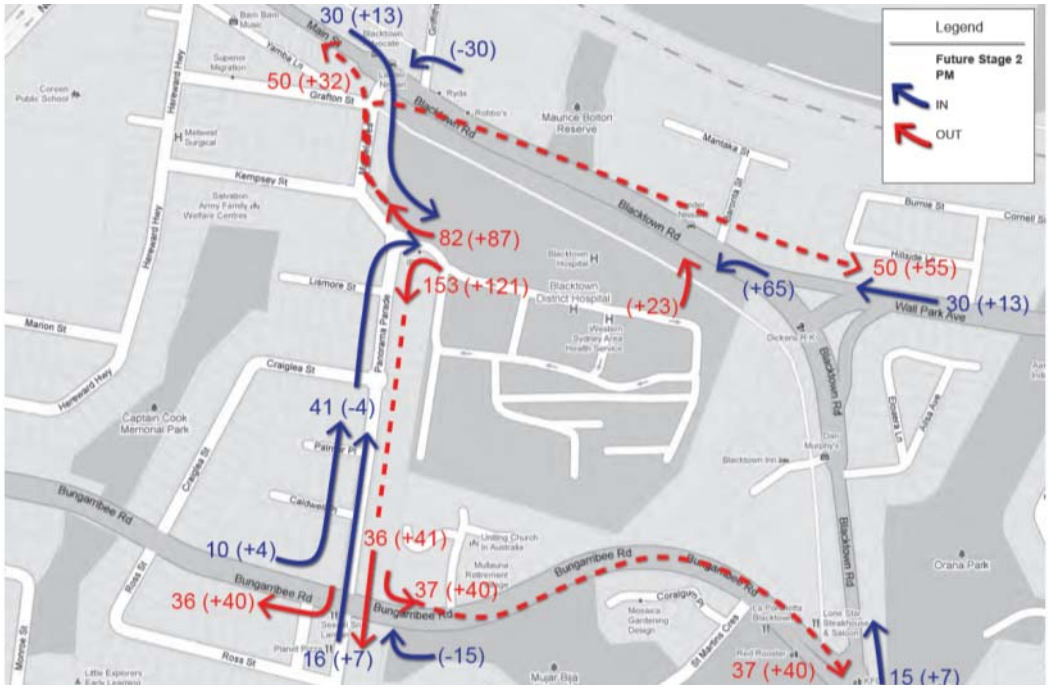


Figure 32 Future (Stage 2) Expansion PM Peak Traffic Redistribution



4.5 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 4.5.1.

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 4.5.2.

4.5.1 SIDRA Traffic Analysis

The SIDRA analysis used the previous models to analyse the four key intersections with changed traffic conditions. Please see Table 16 and

Table 17 below for the results of the analysis for the AM and PM peak periods.

Table 16 AM Peak Existing and Future Scenarios Intersection Performance

Intersection AM Peak	Degree of Saturation	Average Delay (seconds)	Worst Movement (in terms of delay)	95% MMQ (Queue Length)	Level of Service
Existing Scenario					
Blacktown Rd and Marcel Cres	0.88	25.9	Blacktown Rd W Right Turn	221.3m on Blacktown Rd E	B
Wall Park Ave and Blacktown Rd	1.00	50.9	Wall Park Avenue	272m on Blacktown Rd NW	D
Panorama Pde and Hospital Access Rd	0.29	7.2	Panorama Pde N U-turn	16.0m on Panorama Pde S	A
Bungarribee Rd and Panorama Pde	0.78	25.4	Bungarribee Rd W Right Turn	91.6m on Bungarribee Rd W	B
Proposed Expansion (Stage 1) Scenario					
Blacktown Rd and Marcel Crescent	0.89	26.6	Blacktown Rd E Left	209.2m on Blacktown Road E	B
Wall Park Ave and Blacktown Rd	1.01	53.1	Wall Park Avenue	272m on Blacktown Rd NW	D
Panorama Pde and Hospital Access Rd	0.30	7.2	Panorama Pde N Right	13.2m on Panorama Pde S	A
Bungarribee Rd and Panorama Pde	0.80	25.2	Bungarribee Road W Right Turn	82.9m on Bungarribee Rd W	B
Future Expansion (Stage 2) Scenario					
Blacktown Rd and Marcel Crescent	0.91	28.8	Blacktown Rd W Right Turn	227.0m on Blacktown Road E	C
Wall Park Ave and Blacktown Rd	1.03	55.4	Wall Park Avenue	272m on Blacktown Rd NW	D
Panorama Pde and Hospital Access Rd	0.40	7.6	Panorama Pde N Right	15.8m on Panorama Pde S	A
Bungarribee Rd and Panorama Pde	0.82	25.3	Bungarribee Road West Right Turn	85.7m on Bungarribee Rd W	B

Table 17 PM Peak Existing and Future Scenarios Intersection Performance

Intersection PM Peak	Degree of Saturation	Average Delay (seconds)	Worst Movement (in terms of delay)	95% MMQ (Queue Length)	Level of Service
Existing Scenario					
Blacktown Rd and Marcel Cres	0.85	20.7	Blacktown Rd W Right Turn	209.1m on Blacktown Rd E	B
Wall Park Ave and Blacktown Rd	1.00	48.7	Wall Park Avenue	301m on Blacktown Rd NW	D
Panorama Pde and Hospital Access Rd	0.26	7.6	Panorama Pde N U-turn	10.5m on Panorama Pde S	A
Bungarribee Rd and Panorama Pde	0.63	21.0	Bungarribee Rd E Right Turn	91.6m on Bungarribee Rd W	B
Proposed Expansion (Stage 1) Scenario					
Blacktown Rd and Marcel Crescent	0.84	20.6	Blacktown Rd W Right Turn	199.4m on Blacktown Road E	B
Wall Park Ave and Blacktown Rd	1.00	50.5	Wall Park Avenue	301m on Blacktown Rd NW	D
Panorama Pde and Hospital Access Rd	0.35	7.8	Hospital Entry Road Right	15.5m on Hospital Entry Road	A
Bungarribee Rd and Panorama Pde	0.90	26.8	Bungarribee Rd E Left Turn	108.8m on Bungarribee Rd E	B
Future Expansion (Stage 2) Scenario					
Blacktown Rd and Marcel Crescent	0.85	21.3	Blacktown Rd W Right	202.1m on Blacktown Road E	B
Wall Park Ave and Blacktown Rd	1.01	52.0	Wall Park Avenue	301m on Blacktown Rd NW	D
Panorama Pde and Hospital Access Rd	0.50	8.1	Hospital Entry Road Right	21.8m on Hospital Entry Road	A
Bungarribee Rd and Panorama Pde	0.90	26.6	Bungarribee Road E Left Turn	108.8m on Bungarribee Rd E	B

The analysis shows that the Level of Service for each intersection remains at the level prior to the proposed works with the exception of Blacktown Road / Marcel Crescent intersection which degrades from Level of Service B to C in the AM peak period. There are significantly more right turn movements on Blacktown Road turning into Marcel Crescent in the AM Peak period, increasing the intersection's Level of Service from B to C. Otherwise the intersections analysed operate at the same level with the development with a nominal increase in delay.

The degree of saturation at the intersection of Bungarribee Road and Panorama Parade increases in the PM Peak from 0.63 to 0.90 which is close to full operating capacity.

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 will take the Blacktown Rd / Marcel Crescent and the Bungaribee Road / Panorama Parade intersections close to their operating capacity. 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.

The Wall Park Avenue and Blacktown Road intersection is currently operating at capacity however the analysis indicates very little change due to the minor traffic increases due to hospital traffic on this route.

4.5.2 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.

4.5.3 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 Balcktown 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 with the exception of Blacktown Road / Marcel Crescent. 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, although the intersections are operating closer to their operating capacity. 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.

5 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.

5.1 Public Transport Accessibility

Both campuses have bus routes running through the internal road system which provide direct connection to the nearby railway station. Additional bus routes travel past each site for local travel. For each campus, 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 both campuses are well connected to a number of existing public transport services.

5.2 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.

6 Construction Impacts

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.

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.

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. Vehicular access points to the construction site will be selected to avoid conflict with high volume pedestrian desire lines.

7 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 LGA. 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.

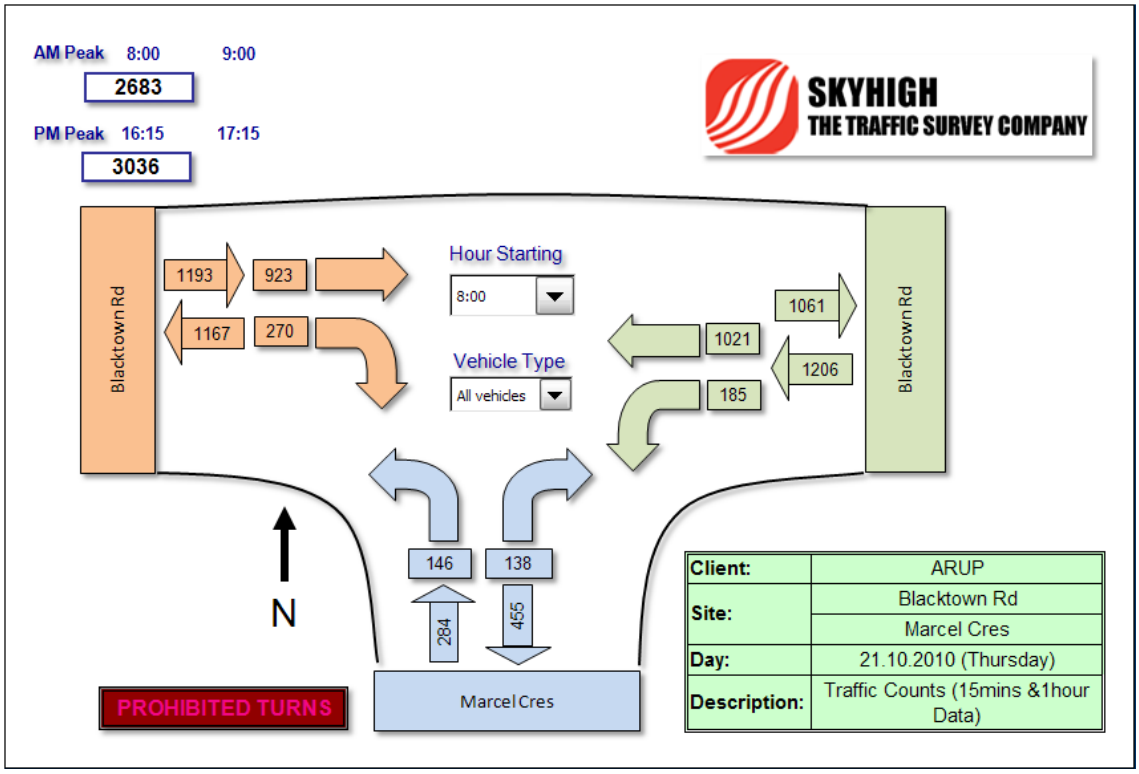
The Stage 1 development will involve a considerable change to on-site parking arrangements. A number of existing parking areas will be replaced by new buildings whilst other at-grade car parks will also be constructed. The traffic and parking model highlights that the multi-storey car park, with approximately 616 spaces, is an integral component of the Stage 1 development and will provide a suitable level of parking supply on the campus to meet demand.

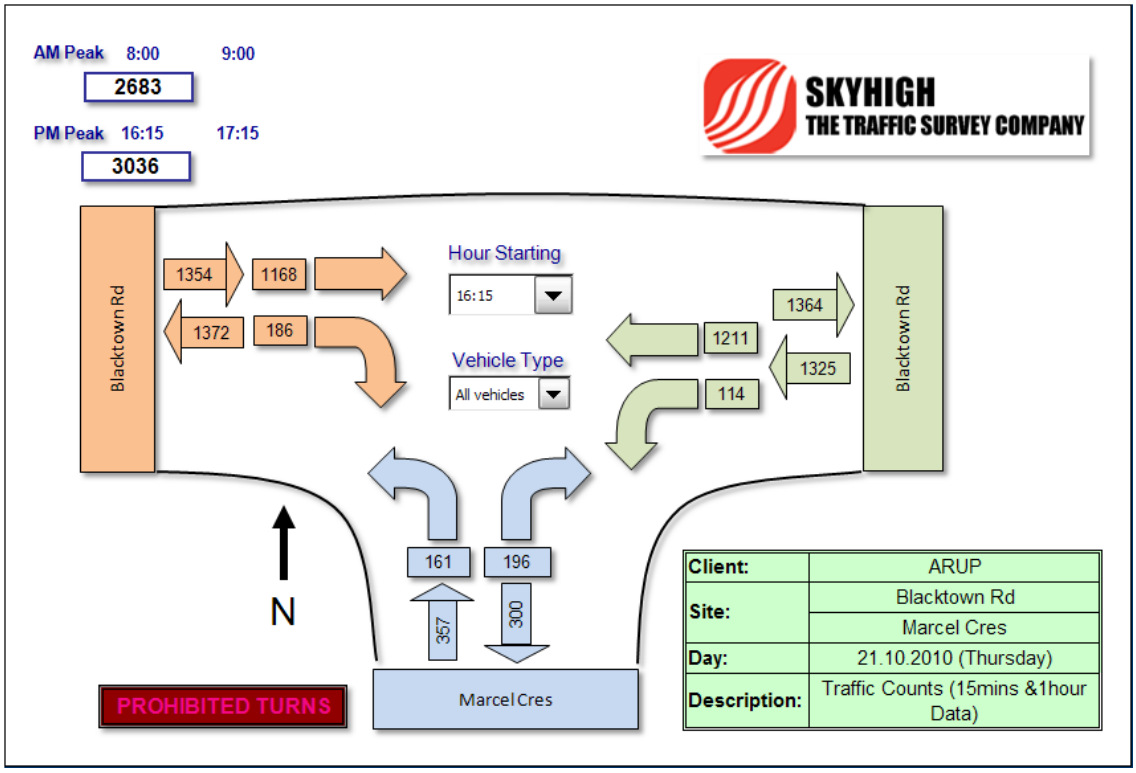
Appendix A

Traffic Survey Data

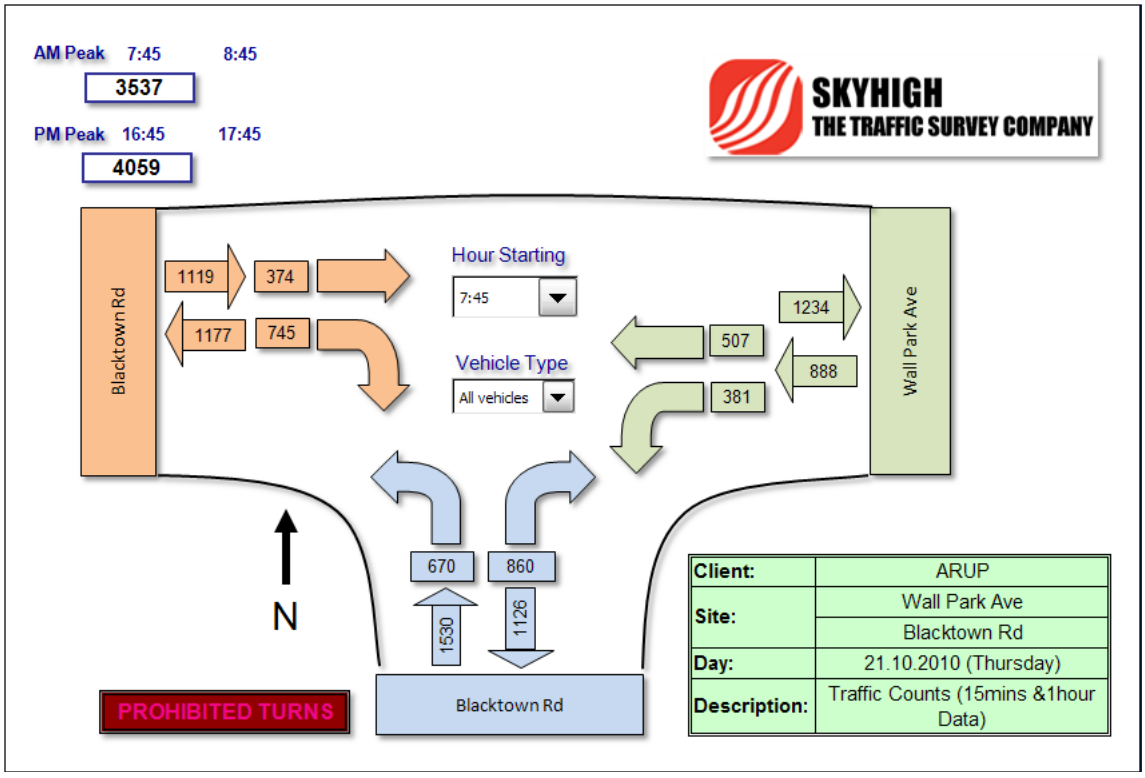
A1 Vehicle Turning Volume Data

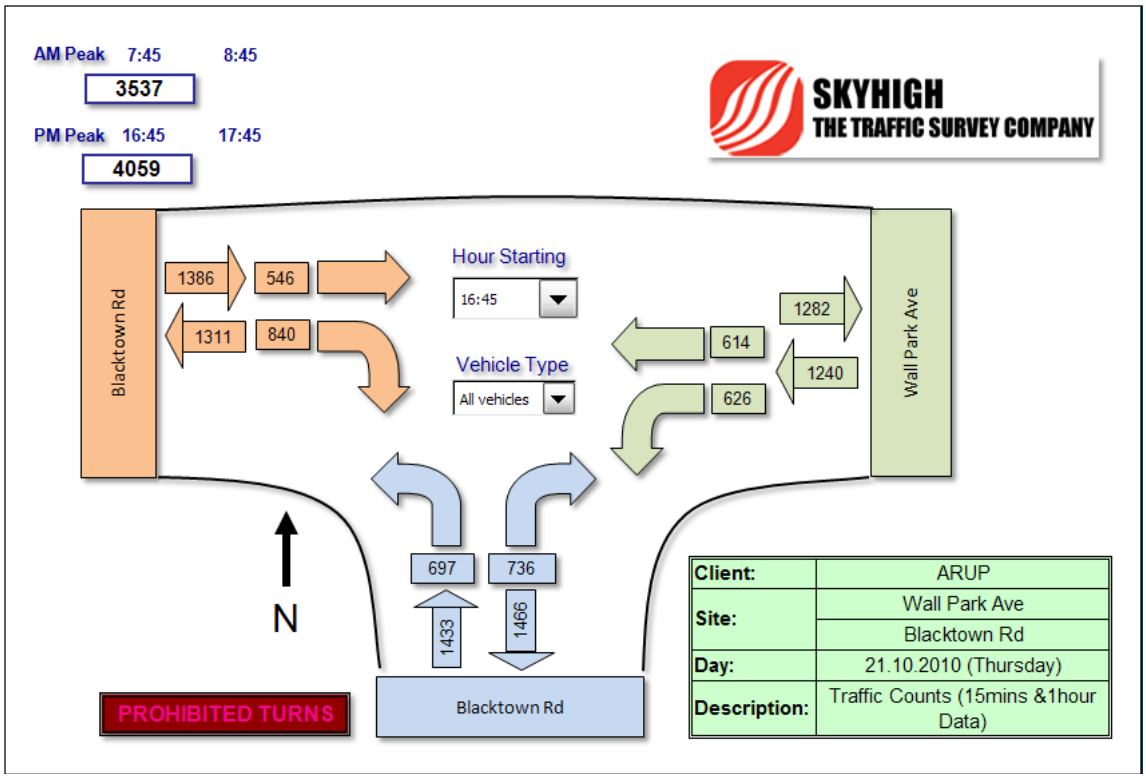
Blacktown Road/Marcel Crescent



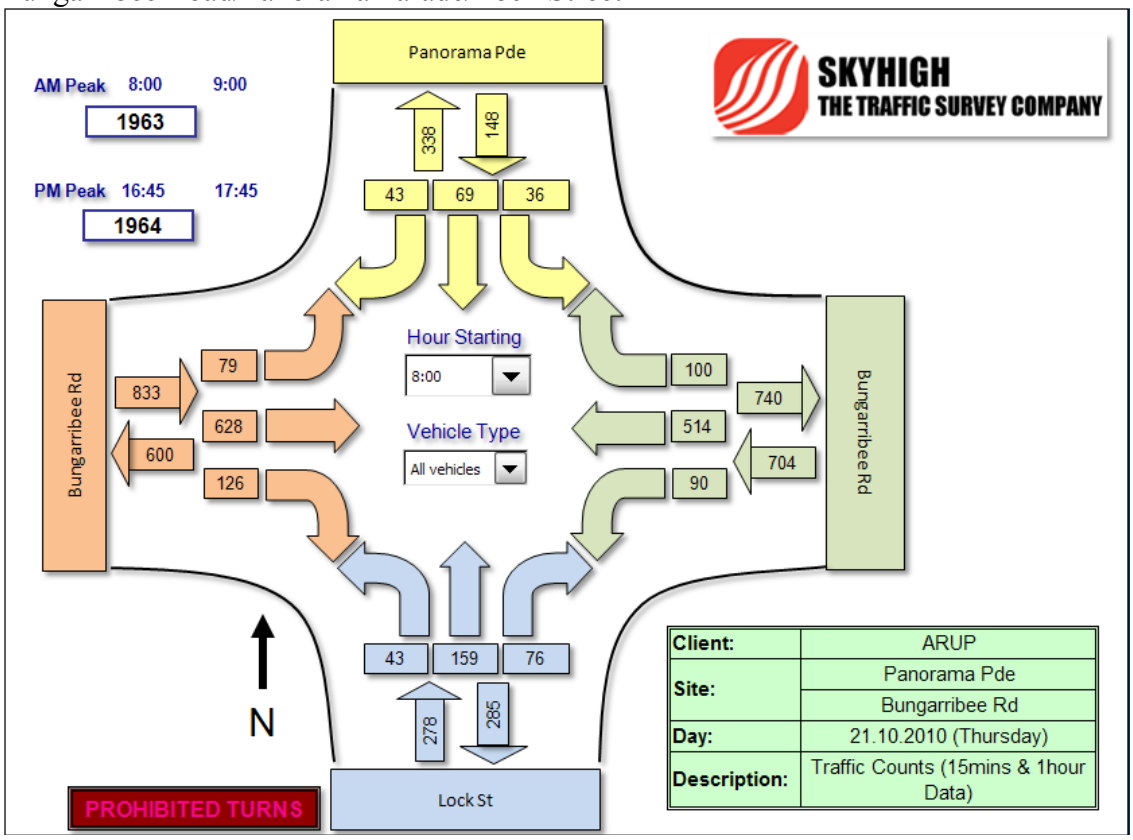


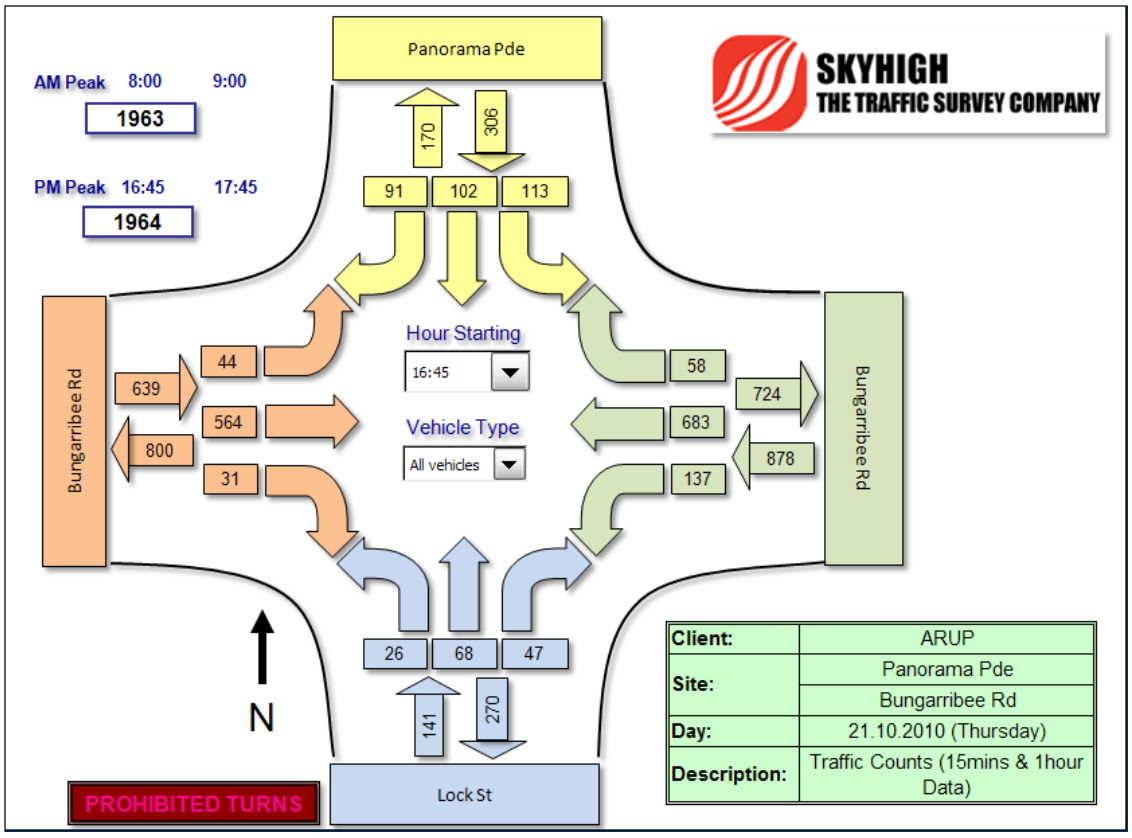
Blacktown Road/Wall Park Avenue



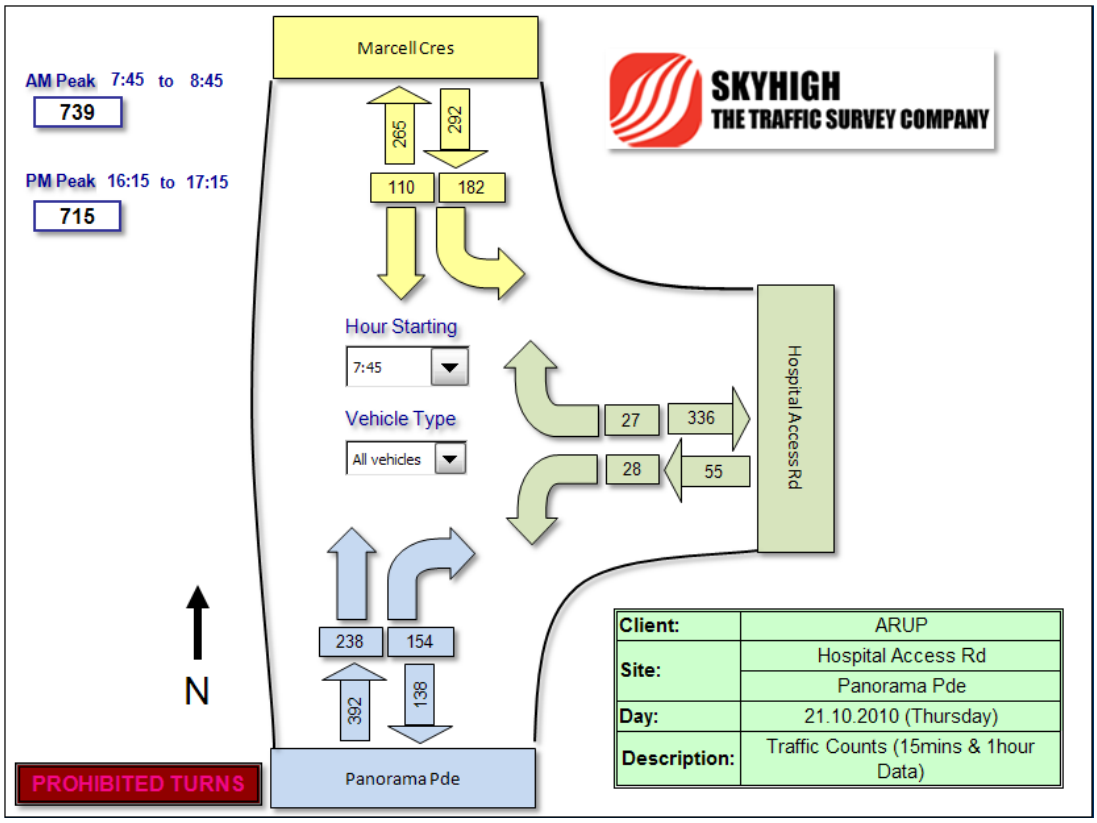


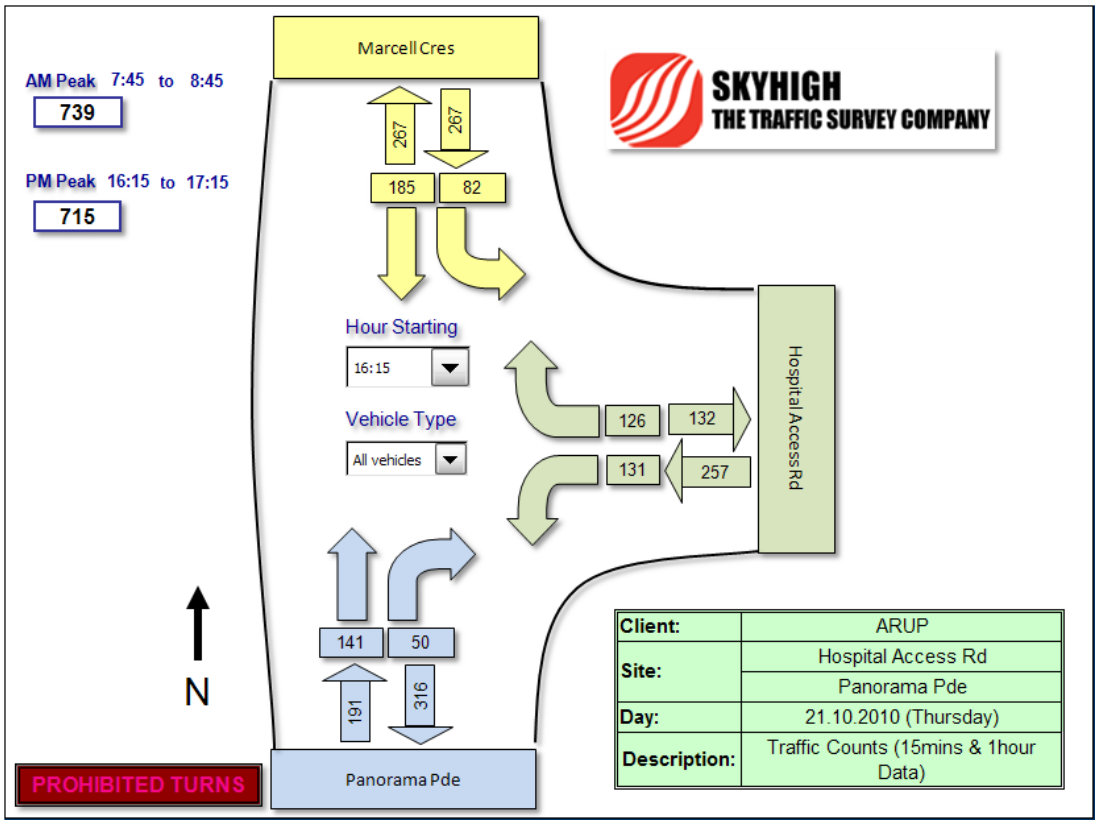
Bungarribee Road/Panorama Parade/Lock Street





Panorama Parade/Marcell Crescent/Hospital Access





Appendix B

Parking Survey Data

B1 Parking Surveys

B1.1 Survey Details

Arup conducted a parking survey on Blacktown Hospital on Thursday 16th December 2010. The survey purpose was to measure the occupancy of car parking on the campus and surrounding streets. The survey was conducted from 8:00am to 8:00pm at half hour intervals. Weather conditions started out fine with severe weather later in the day. Due to the severe weather conditions, the survey was stopped between 1:30pm – 2:30pm until the storm passed. The counts during this hour were interpolated between counts before and after the storm (as highlighted on Tables 1 and 2).

B1.2 Survey Methodology

The total parking areas were separated into street parking and the campus car parking. Two maps were drawn of these parking areas to allow surveyors to complete a half hour loop (see Figures B1 and B2 below for these maps). Survey staff counted the amount of cars occupied in each of the zones from the maps. Capacities of the car parks were obtained by counting marked spaces on campus. The same method was applied for the capacity of the street parking, where it was estimated from the currently parked cars and spatial estimation. The parking occupancy levels were then tabulated and graphed. The Marcel Crescent Car Park was included in the on-street car parking loop, however, data for this car park has been tabulated and graphed with the on-site car parking.

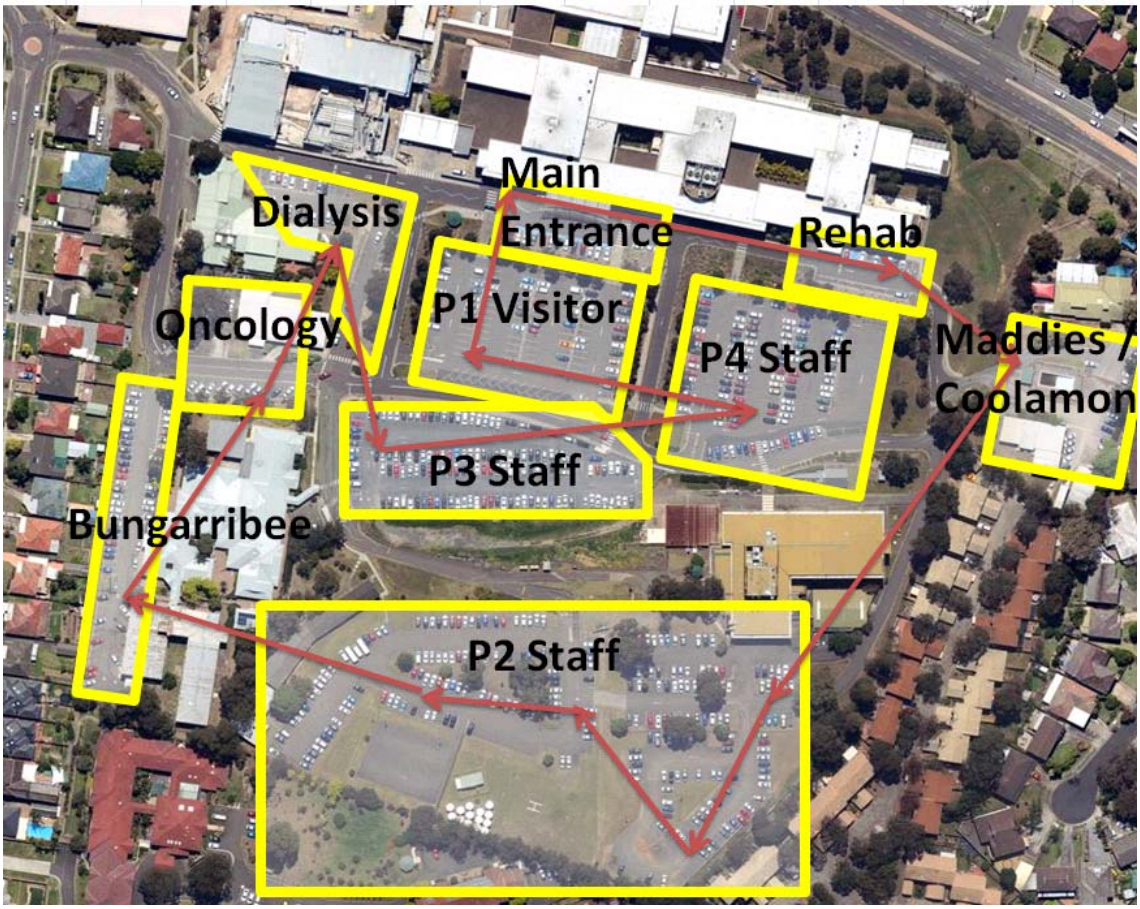


Figure B1: Campus Car Park survey route map

Figure B2: Street parking survey route map

B1.3 Survey Results and Observations

The street parking appeared to be only influenced as far as Craiglea Street and Panorama Parade (north of the roundabout). These are shown by the marked lines on the sides of the street. With all the streets included, the total occupancy was approximately 60% for the majority of the period surveyed. The capacity was estimated at 207 car spaces. The utilisation for the street parking is shown in Figure B3.

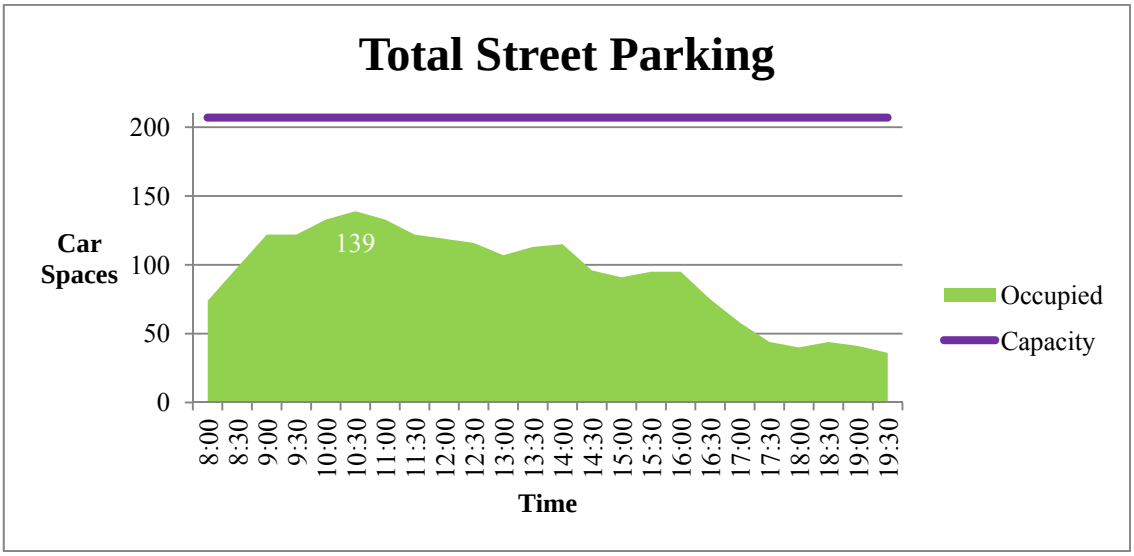


Figure 3: Total Street Parking

The campus parking was heavily occupied for the majority of the day also. The total parking of the campus is summarised in Figure B4 below. An extra 25 spaces were opened to staff in P3 at 1:00pm, bringing the total capacity to 1015. It was also observed that many cars parked illegally (outside marked parking areas) in the P1, P3 and P4 parking areas as they were closer to the hospital.

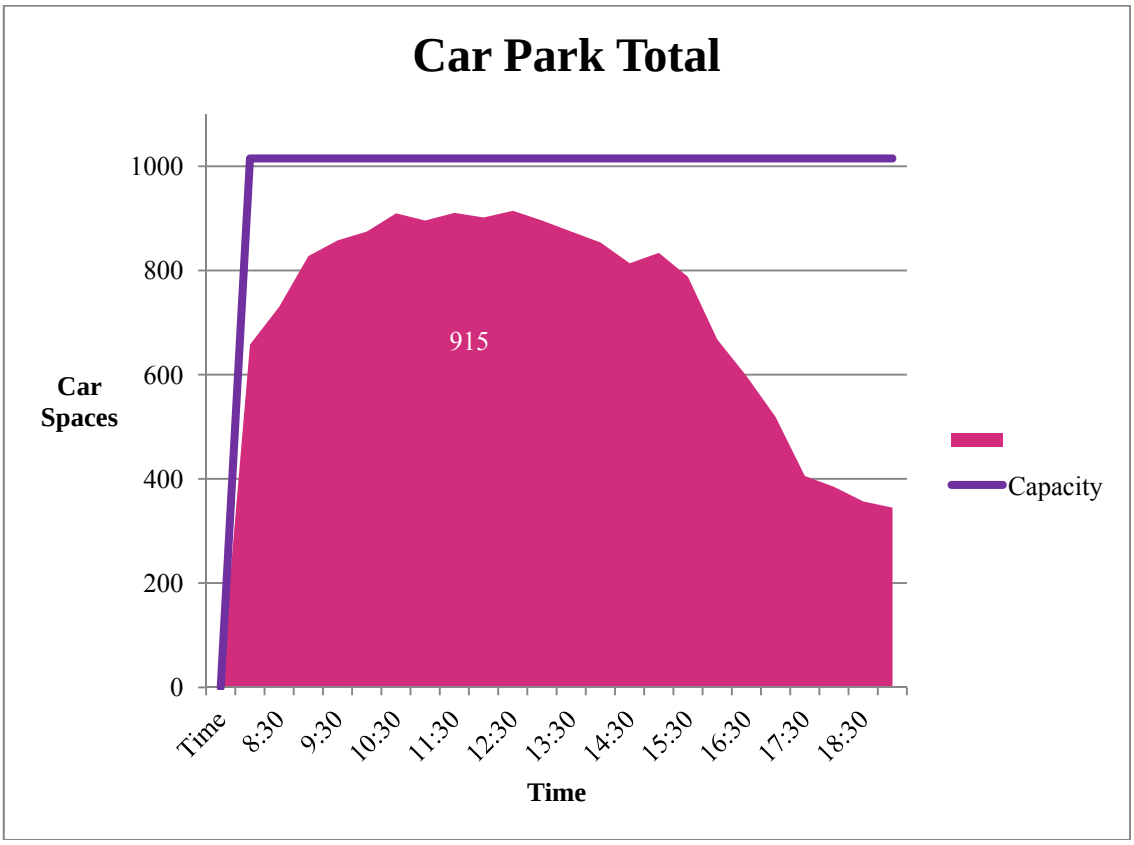


Figure 4: Total Campus Car Parking

The maximum values were highlighted in blue in the following tables. Table 1 shows that the busiest time was 10:30am for the street parking. Also highlighted in green are the interpolated values previously mentioned in the survey details. Occupancy levels are shown in table 2.

Table B1: Counts of vehicles in parking areas

Time	Grafton St	Marcel Cr	Kempsey St	Lismore St	Panorama Pde Nth	Craiglea St	Palmer Pl	Calowell Pl	Panorama Pde Sth	TOTAL
8:00	10	16	9	16	8	8	0	6	1	74
8:30	15	17	20	22	9	9	1	5	0	98
9:00	25	16	31	25	9	10	1	5	0	122
9:30	24	17	28	25	9	13	2	4	0	122
10:00	29	17	30	25	8	14	3	7	0	133
10:30	31	16	33	25	9	16	4	5	0	139
11:00	27	17	29	23	9	19	4	5	0	133
11:30	19	16	32	22	9	16	4	4	0	122
12:00	14	17	30	25	9	17	3	4	0	119
12:30	14	17	29	23	9	17	3	4	0	116
13:00	10	14	29	22	8	16	4	4	0	107
13:30	16	16	25	24	9	15	4	4	0	113
14:00	21	17	21	25	9	14	4	4	0	115
14:30	14	17	15	23	6	14	3	4	0	96
15:00	15	16	11	24	6	12	2	4	1	91
15:30	12	14	15	25	8	14	2	4	1	95
16:00	16	16	15	23	7	10	2	5	1	95
16:30	7	12	11	19	7	10	4	4	1	75
17:00	10	6	7	17	4	6	2	5	1	58
17:30	2	3	3	15	7	6	2	5	1	44
18:00	1	1	3	16	5	6	3	4	1	40

Time	Grafton St	Marcel Cr	Kempsey St	Lismore St	Panorama Pde Nth	Craiglea St	Palmer Pl	Calowell Pl	Panorama Pde Sth	TOTAL
18:30	2	3	2	18	6	5	3	4	1	44
19:00	4	2	1	15	6	5	4	3	1	41
19:30	3	1	0	14	5	5	4	3	1	36

Table B2: Occupancy levels of street parking

Time	Grafton St	Marcel Cr	Kempsey St	Lismore St	Panorama Pde Nth	Craiglea St	Palmer Pl	Calowell Pl	Panorama Pde Sth	TOTAL
8:00	25%	89%	21%	48%	80%	40%	0%	40%	6%	36%
8:30	38%	94%	48%	67%	90%	45%	8%	33%	0%	47%
9:00	63%	89%	74%	76%	90%	50%	8%	33%	0%	59%
9:30	60%	94%	67%	76%	90%	65%	17%	27%	0%	59%
10:00	73%	94%	71%	76%	80%	70%	25%	47%	0%	64%
10:30	78%	89%	79%	76%	90%	80%	33%	33%	0%	67%
11:00	68%	94%	69%	70%	90%	95%	33%	33%	0%	64%
11:30	48%	89%	76%	67%	90%	80%	33%	27%	0%	59%
12:00	35%	94%	71%	76%	90%	85%	25%	27%	0%	57%
12:30	35%	94%	69%	70%	90%	85%	25%	27%	0%	56%
13:00	25%	78%	69%	67%	80%	80%	33%	27%	0%	52%
13:30	40%	89%	60%	73%	90%	75%	33%	27%	0%	55%
14:00	53%	94%	50%	76%	90%	70%	33%	27%	0%	56%
14:30	35%	94%	36%	70%	60%	70%	25%	27%	0%	46%
15:00	38%	89%	26%	73%	60%	60%	17%	27%	6%	44%
15:30	30%	78%	36%	76%	80%	70%	17%	27%	6%	46%
16:00	40%	89%	36%	70%	70%	50%	17%	33%	6%	46%
16:30	18%	67%	26%	58%	70%	50%	33%	27%	6%	36%
17:00	25%	33%	17%	52%	40%	30%	17%	33%	6%	28%
17:30	5%	17%	7%	45%	70%	30%	17%	33%	6%	21%
18:00	3%	6%	7%	48%	50%	30%	25%	27%	6%	19%
18:30	5%	17%	5%	55%	60%	25%	25%	27%	6%	21%
19:00	10%	11%	2%	45%	60%	25%	33%	20%	6%	20%
19:30	8%	6%	0%	42%	50%	25%	33%	20%	6%	17%

The following data summarises the campus car park data. Maximum values are highlighted in blue and interpolated values are highlighted in green. Table B3 shows the peak at 12:30pm with a total of 915 vehicles occupying spaces on campus. Occupancy levels over 100% indicate that vehicles are parked illegally and not within marked spaces.

Table B3: Counts of car parks on campus

Time	Dialysis	P3 Staff	P1 Visitor	Main Entrance	P4 Staff	Rehab	Maddies Cottage	P2 Staff	Bungarribee	Oncology/ Embark	Marcel Cr Carpark	TOTAL
8:00	14	122	25	15	94	5	18	179	58	16	112	658
8:30	17	128	33	15	102	7	20	214	59	23	113	731
9:00	23	126	44	15	114	12	20	278	59	27	110	828
9:30	22	127	52	15	110	12	23	290	57	28	122	858
10:00	21	125	53	15	111	13	24	298	58	27	130	875
10:30	24	128	79	15	112	15	23	300	57	27	130	910
11:00	22	127	91	16	110	14	22	290	58	24	122	896
11:30	23	126	93	15	111	13	21	294	59	23	133	911
12:00	24	124	92	15	109	13	23	292	57	25	128	902
12:30	22	127	91	15	110	14	22	301	57	23	133	915
13:00	14	122	78	15	135	13	24	300	42	20	133	896
13:30	13	121	71	15	130	13	22	300	41	19	130	875
14:00	13	121	65	14	125	12	20	300	40	18	126	854
14:30	12	120	58	14	120	12	17	291	37	15	118	814
15:00	19	125	47	15	133	13	19	305	40	12	106	834
15:30	13	126	42	13	115	13	18	312	35	12	89	788
16:00	21	70	48	14	99	10	13	245	30	15	103	668
16:30	21	50	43	15	110	11	5	210	22	10	101	598
17:00	19	48	47	16	86	12	6	161	21	11	92	519
17:30	16	45	44	13	72	10	2	87	18	9	90	406
18:00	17	40	45	12	65	12	2	78	20	7	87	385
18:30	18	36	43	15	71	15	1	48	21	7	82	357
19:00	22	31	39	14	68	15	1	47	17	8	83	345
19:30	19	30	42	13	72	14	1	44	14	8	84	341

Table B4: Occupancy levels of car parks on campus

Time	Dialysis	P3 Staff	P1 Visitor	Main Entrance	P4 Staff	Rehab	Maddies Cottage	P2 Staff	Bungarribee	Oncology/ Embark	Marcel Cr Carpark	TOTAL
8:00	48%	92%	22%	100%	71%	31%	75%	55%	84%	53%	90%	65%
8:30	59%	96%	28%	100%	77%	44%	83%	66%	86%	77%	90%	72%
9:00	79%	95%	38%	100%	86%	75%	83%	86%	86%	90%	88%	82%
9:30	76%	95%	45%	100%	83%	75%	96%	89%	83%	93%	98%	85%
10:00	72%	94%	46%	100%	83%	81%	100%	92%	84%	90%	104%	86%
10:30	83%	96%	68%	100%	84%	94%	96%	92%	83%	90%	104%	90%
11:00	76%	95%	78%	107%	83%	88%	92%	89%	84%	80%	98%	88%
11:30	79%	95%	80%	100%	83%	81%	88%	90%	86%	77%	106%	90%
12:00	83%	93%	79%	100%	82%	81%	96%	90%	83%	83%	102%	89%
12:30	76%	95%	78%	100%	83%	88%	92%	93%	83%	77%	106%	90%
13:00	48%	92%	67%	100%	102%	81%	100%	92%	61%	67%	106%	88%
13:30	45%	91%	61%	100%	98%	81%	92%	92%	59%	63%	104%	86%
14:00	45%	91%	56%	93%	94%	75%	83%	92%	58%	60%	101%	84%
14:30	41%	90%	50%	93%	90%	75%	71%	90%	54%	50%	94%	80%
15:00	66%	94%	41%	100%	100%	81%	79%	94%	58%	40%	85%	82%
15:30	45%	95%	36%	87%	86%	81%	75%	96%	51%	40%	71%	78%
16:00	72%	53%	41%	93%	74%	63%	54%	75%	43%	50%	82%	66%
16:30	72%	38%	37%	100%	83%	69%	21%	65%	32%	33%	81%	59%
17:00	66%	36%	41%	107%	65%	75%	25%	50%	30%	37%	74%	51%
17:30	55%	34%	38%	87%	54%	63%	8%	27%	26%	30%	72%	40%
18:00	59%	30%	39%	80%	49%	75%	8%	24%	29%	23%	70%	38%
18:30	62%	27%	37%	100%	53%	94%	4%	15%	30%	23%	66%	35%
19:00	76%	23%	34%	93%	51%	94%	4%	14%	25%	27%	66%	34%
19:30	66%	23%	36%	87%	54%	88%	4%	14%	20%	27%	67%	34%

Appendix C

SIDRA Results

C1 Blacktown Road and Marcel Crescent

AM Peak Existing

Stage 1

Stage 2

PM Peak Existing

Stage 1

Stage 2

MOVEMENT SUMMARY

Site: Blacktown Rd and Marcel Cres AM

Blacktown Rd and Marvel Cres
Signals - Fixed Time Cycle Time = 90 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow 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: Marcel Crescent											
1	L	154	2.7	0.177	22.6	LOS B	5.2	37.4	0.60	0.76	37.0
3	R	145	0.7	0.337	39.6	LOS C	7.0	49.4	0.88	0.79	28.7
Approach		299	1.8	0.337	30.8	LOS C	7.0	49.4	0.74	0.78	32.5
East: Blacktown Road East											
4	L	195	2.2	0.883	41.9	LOS C	29.4	217.3	0.96	1.01	28.9
5	T	1075	8.3	0.884	33.6	LOS C	29.5	221.3	0.96	0.98	29.5
Approach		1269	7.4	0.884	34.9	LOS C	29.5	221.3	0.96	0.99	29.4
West: Blacktown Road West											
11	T	972	7.7	0.413	4.3	LOS A	6.6	49.5	0.26	0.23	52.5
12	R	284	0.4	0.863	54.1	LOS D	15.0	105.3	1.00	0.94	24.1
Approach		1256	6.0	0.863	15.5	LOS B	15.0	105.3	0.43	0.39	41.5
All Vehicles		2824	6.2	0.884	25.9	LOS B	29.5	221.3	0.70	0.70	34.2

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 used.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	Across S approach	53	22.8	LOS C	0.1	0.1	0.71	0.71
P7	Across W approach	53	39.2	LOS D	0.1	0.1	0.93	0.93
All Pedestrians		106	31.0	LOS D			0.82	0.82

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: Stage 1 Blacktown Rd and Marcel Cres AM 120604 remodelled flows

Blacktown Rd and Marvel Cres
Signals - Fixed Time Cycle Time = 90 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow 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: Marcel Crescent											
1	L	145	2.9	0.160	21.3	LOS B	3.4	24.6	0.57	0.76	37.9
3	R	166	0.6	0.386	40.0	LOS C	6.3	44.1	0.89	0.80	28.6
Approach		312	1.7	0.386	31.3	LOS C	6.3	44.1	0.74	0.78	32.3
East: Blacktown Road East											
4	L	112	3.8	0.885	43.9	LOS D	27.8	207.0	0.97	1.02	28.4
5	T	1087	8.2	0.885	35.6	LOS C	27.9	209.2	0.97	1.00	28.8
Approach		1199	7.8	0.885	36.4	LOS C	27.9	209.2	0.97	1.00	28.8
West: Blacktown Road West											
11	T	972	7.7	0.413	4.3	LOS A	5.0	37.6	0.26	0.23	52.5
12	R	320	0.3	0.864	52.9	LOS D	15.2	106.9	1.00	0.95	24.5
Approach		1292	5.9	0.864	16.3	LOS B	15.2	106.9	0.44	0.41	40.9
All Vehicles		2802	6.2	0.885	26.6	LOS B	27.9	209.2	0.70	0.70	33.8

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 used.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	Across S approach	53	24.2	LOS C	0.1	0.1	0.73	0.73
P7	Across W approach	53	39.2	LOS D	0.1	0.1	0.93	0.93
All Pedestrians		106	31.7	LOS D			0.83	0.83

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

MOVEMENT SUMMARY

Site: Stage 2 Blacktown Rd and Marcel Cres AM 120604 remodelled flows

Blacktown Rd and Marvel Cres
Signals - Fixed Time Cycle Time = 90 seconds (User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow 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: Marcel Crescent											
1	L	166	2.5	0.178	20.9	LOS B	3.9	27.8	0.57	0.76	38.1
3	R	172	0.6	0.398	40.1	LOS C	6.5	45.6	0.89	0.80	28.5
Approach		338	1.6	0.398	30.6	LOS C	6.5	45.6	0.73	0.78	32.6
East: Blacktown Road East											
4	L	112	3.8	0.914	49.5	LOS D	30.2	224.7	1.00	1.07	26.5
5	T	1089	8.2	0.914	41.1	LOS C	30.3	227.0	1.00	1.08	26.8
Approach		1201	7.8	0.914	41.9	LOS C	30.3	227.0	1.00	1.08	26.8
West: Blacktown Road West											
11	T	972	7.7	0.413	4.3	LOS A	5.0	37.6	0.26	0.23	52.5
12	R	354	0.3	0.904	50.0	LOS D	16.3	114.2	1.00	0.90	25.3
Approach		1325	5.7	0.904	16.5	LOS B	16.3	114.2	0.46	0.41	40.8
All Vehicles		2864	6.1	0.914	28.8	LOS C	30.3	227.0	0.72	0.73	32.6

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 used.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	Across S approach	53	24.9	LOS C	0.1	0.1	0.74	0.74
P7	Across W approach	53	39.2	LOS D	0.1	0.1	0.93	0.93
All Pedestrians		106	32.1	LOS D			0.84	0.84

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: Blacktown Rd and Marcel Cres PM

Blacktown Rd and Marvel Cres
Signals - Fixed Time Cycle Time = 90 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow 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: Marcel Crescent											
1	L	169	0.0	0.211	25.2	LOS B	6.1	43.0	0.66	0.77	35.4
3	R	206	0.0	0.476	40.8	LOS C	9.7	67.7	0.91	0.81	28.3
Approach		376	0.0	0.476	33.8	LOS C	9.7	67.7	0.80	0.79	31.1
East: Blacktown Road East											
4	L	120	1.8	0.849	34.4	LOS C	28.7	207.3	0.89	0.98	32.3
5	T	1275	4.2	0.850	26.1	LOS B	28.8	209.1	0.89	0.88	33.1
Approach		1395	4.0	0.850	26.8	LOS B	28.8	209.1	0.89	0.89	33.0
West: Blacktown Road West											
11	T	1229	5.4	0.515	4.7	LOS A	9.1	66.4	0.30	0.27	51.8
12	R	196	1.1	0.797	53.5	LOS D	10.7	75.7	1.00	0.89	24.3
Approach		1425	4.8	0.797	11.4	LOS A	10.7	75.7	0.39	0.35	44.9
All Vehicles		3196	3.9	0.850	20.7	LOS B	28.8	209.1	0.66	0.64	37.1

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 used.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	Across S approach	53	20.0	LOS B	0.1	0.1	0.67	0.67
P7	Across W approach	53	39.2	LOS D	0.1	0.1	0.93	0.93
All Pedestrians		106	29.6	LOS C			0.80	0.80

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: Stage 1 Blacktown Rd and Marcel Cres PM 120604 remodelled flows

Blacktown Rd and Marvel Cres
Signals - Fixed Time Cycle Time = 90 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow 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: Marcel Crescent											
1	L	181	0.0	0.225	25.3	LOS B	5.0	34.8	0.67	0.78	35.3
3	R	237	0.0	0.547	41.4	LOS C	9.3	65.3	0.93	0.82	28.0
Approach		418	0.0	0.547	34.5	LOS C	9.3	65.3	0.82	0.80	30.8
East: Blacktown Road East											
4	L	88	2.4	0.841	33.6	LOS C	27.4	198.2	0.89	0.98	32.7
5	T	1293	4.2	0.841	25.3	LOS B	27.5	199.4	0.89	0.86	33.5
Approach		1381	4.0	0.841	25.8	LOS B	27.5	199.4	0.89	0.87	33.5
West: Blacktown Road West											
11	T	1229	5.4	0.515	4.7	LOS A	7.4	54.0	0.30	0.27	51.8
12	R	196	1.1	0.797	53.5	LOS D	9.0	63.8	1.00	0.89	24.3
Approach		1425	4.8	0.797	11.4	LOS A	9.0	63.8	0.39	0.35	44.9
All Vehicles		3224	3.9	0.841	20.6	LOS B	27.5	199.4	0.66	0.63	37.2

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 used.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	Across S approach	53	20.0	LOS B	0.1	0.1	0.67	0.67
P7	Across W approach	53	39.2	LOS D	0.1	0.1	0.93	0.93
All Pedestrians		106	29.6	LOS C			0.80	0.80

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: Stage 2 Blacktown Rd and Marcel Cres PM 120604 remodelled flows

Blacktown Rd and Marvel Cres
Signals - Fixed Time Cycle Time = 90 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow 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: Marcel Crescent											
1	L	203	0.0	0.252	25.6	LOS B	5.7	39.6	0.67	0.78	35.2
3	R	264	0.0	0.610	42.0	LOS C	10.6	74.2	0.95	0.83	27.8
Approach		467	0.0	0.610	34.9	LOS C	10.6	74.2	0.83	0.81	30.6
East: Blacktown Road East											
4	L	88	2.4	0.845	33.9	LOS C	27.8	200.8	0.89	0.98	32.6
5	T	1299	4.1	0.845	25.6	LOS B	27.9	202.1	0.89	0.87	33.4
Approach		1387	4.0	0.845	26.2	LOS B	27.9	202.1	0.89	0.88	33.3
West: Blacktown Road West											
11	T	1229	5.4	0.515	4.7	LOS A	7.4	54.0	0.30	0.27	51.8
12	R	209	1.0	0.852	56.0	LOS D	10.1	71.0	1.00	0.93	23.6
Approach		1439	4.8	0.852	12.1	LOS A	10.1	71.0	0.40	0.36	44.2
All Vehicles		3294	3.8	0.852	21.3	LOS B	27.9	202.1	0.67	0.64	36.8

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 used.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	Across S approach	53	20.0	LOS B	0.1	0.1	0.67	0.67
P7	Across W approach	53	39.2	LOS D	0.1	0.1	0.93	0.93
All Pedestrians		106	29.6	LOS C			0.80	0.80

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.

C2 Blacktown Road and Wall Park Avenue

AM Peak Existing

Stage 1

Stage 2

PM Peak Existing

Stage 1

Stage 2

MOVEMENT SUMMARY

Site: Blacktown Road and Wall Park Avenue AM

Blacktown Road and Wall Park Avenue AM
Signals - Fixed Time Cycle Time = 140 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow 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 East: Blacktown Road SE											
22	T	1369	8.7	0.513	15.8	LOS B	19.7	148.0	0.46	0.76	41.9
23	R	242	5.9	1.000[3]	46.6	LOS D	10.0	73.4	1.00	0.82	26.4
Approach		1611	7.1	1.000	20.5	LOS B	19.7	148.0	0.54	0.77	38.5
East: Wall Park Road - Slip Lane											
4	L	401	14.2	0.272	9.5	LOS A	1.9	15.2	0.13	0.66	48.0
Approach		401	14.2	0.272	9.5	LOS A	1.9	15.2	0.13	0.66	48.0
North East: Wall Park Avenue											
26	R	534	3.9	0.990	114.5	LOS F	25.2	182.5	1.00	1.15	14.4
Approach		534	3.9	0.990	114.5	LOS F	25.2	182.5	1.00	1.15	14.4
North: Blacktown Road NW slip lane											
7	L	394	4.0	0.218	8.9	X	X	X	X	0.64	48.7
Approach		394	4.0	0.218	8.9	NA	0.0	0.0	0.00	0.64	48.7
North West: Blacktown Road NW Buses											
28	T	16	100.0	0.055	43.8	LOS D	0.8	10.8	0.80	0.58	27.5
Approach		16	100.0	0.055	43.8	LOS D	0.8	10.8	0.80	0.58	27.5
West: Blacktown Road NW											
11	T	768	7.5	0.998	113.7	LOS F	36.5	272.1	1.00	1.14	14.5
Approach		768	7.5	0.998	113.7	LOS F	36.5	272.1	1.00	1.14	14.5
All Vehicles		3723	7.6	1.000	50.9	LOS D	36.5	272.1	0.60	0.87	25.1

X: Not applicable for Continuous movement.

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 used.

3 x = 1.00 due to short lane. Refer to the Lane Summary report for information about excess flow and related conditions.

MOVEMENT SUMMARY

Site: Blktown Rd Wall PkAve St1 AM

Blacktown Road and Wall Park Avenue AM
Signals - Fixed Time Cycle Time = 140 seconds (User-Given Phase Times)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow 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 East: Blacktown Road SE											
22	T	1405	8.3	0.531	16.4	LOS B	21.1	158.2	0.48	0.76	41.5
23	R	239	5.9	1.000[3]	47.1	LOS D	10.0	73.4	1.00	0.82	26.2
Approach		1644	7.0	1.000	20.9	LOS B	21.1	158.2	0.56	0.77	38.2
East: Wall Park Road - Slip Lane											
4	L	401	14.2	0.272	9.5	LOS A	1.9	15.2	0.13	0.66	48.0
Approach		401	14.2	0.272	9.5	LOS A	1.9	15.2	0.13	0.66	48.0
North East: Wall Park Avenue											
26	R	569	3.7	1.014	127.5	LOS F	28.6	206.4	1.00	1.20	13.3
Approach		569	3.7	1.014	127.5	LOS F	28.6	206.4	1.00	1.20	13.3
North: Blacktown Road NW slip lane											
7	L	415	3.8	0.229	8.9	X	X	X	X	0.64	48.7
Approach		415	3.8	0.229	8.9	NA	0.0	0.0	0.00	0.64	48.7
North West: Blacktown Road NW Buses											
28	T	16	100.0	0.055	43.8	LOS D	0.8	10.8	0.80	0.58	27.5
Approach		16	100.0	0.055	43.8	LOS D	0.8	10.8	0.80	0.58	27.5
West: Blacktown Road NW											
11	T	768	7.5	0.998	113.7	LOS F	36.5	272.1	1.00	1.14	14.5
Approach		768	7.5	0.998	113.7	LOS F	36.5	272.1	1.00	1.14	14.5
All Vehicles		3814	7.4	1.014	53.1	LOS D	36.5	272.1	0.61	0.88	24.5

X: Not applicable for Continuous movement.

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 used.

3 x = 1.00 due to short lane. Refer to the Lane Summary report for information about excess flow and related conditions.

MOVEMENT SUMMARY

Site: Blktown Rd Wall PkAve St2 AM

Blacktown Road and Wall Park Avenue AM
Signals - Fixed Time Cycle Time = 140 seconds (User-Given Phase Times)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow 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 East: Blacktown Road SE											
22	T	1445	7.9	0.550	17.0	LOS B	22.7	169.4	0.50	0.77	41.0
23	R	236	5.9	1.000[3]	47.6	LOS D	10.0	73.4	1.00	0.82	26.1
Approach		1681	6.8	1.000	21.3	LOS B	22.7	169.4	0.57	0.78	37.9
East: Wall Park Road - Slip Lane											
4	L	401	14.2	0.272	9.5	LOS A	1.9	15.2	0.13	0.66	48.0
Approach		401	14.2	0.272	9.5	LOS A	1.9	15.2	0.13	0.66	48.0
North East: Wall Park Avenue											
26	R	603	3.5	1.032	139.1	LOS F	31.7	228.8	1.00	1.23	12.4
Approach		603	3.5	1.032	139.1	LOS F	31.7	228.8	1.00	1.23	12.4
North: Blacktown Road NW slip lane											
7	L	420	3.8	0.232	8.9	X	X	X	X	0.64	48.7
Approach		420	3.8	0.232	8.9	NA	0.0	0.0	0.00	0.64	48.7
North West: Blacktown Road NW Buses											
28	T	16	100.0	0.055	43.8	LOS D	0.8	10.8	0.80	0.58	27.5
Approach		16	100.0	0.055	43.8	LOS D	0.8	10.8	0.80	0.58	27.5
West: Blacktown Road NW											
11	T	768	7.5	0.998	113.7	LOS F	36.5	272.1	1.00	1.14	14.5
Approach		768	7.5	0.998	113.7	LOS F	36.5	272.1	1.00	1.14	14.5
All Vehicles		3889	7.3	1.032	55.4	LOS D	36.5	272.1	0.62	0.89	23.9

X: Not applicable for Continuous movement.

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 used.

3 x = 1.00 due to short lane. Refer to the Lane Summary report for information about excess flow and related conditions.

MOVEMENT SUMMARY

Site: Blacktown Road and Wall Park Avenue PM

Blacktown Road and Wall Park Avenue AM
Signals - Fixed Time Cycle Time = 140 seconds (User-Given Phase Times)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow 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 East: Blacktown Road SE											
22	T	1299	4.2	0.505	18.1	LOS B	20.9	151.5	0.51	0.77	40.0
23	R	210	3.9	1.000[3]	51.1	LOS D	10.1	73.4	1.00	0.83	25.0
Approach		1508	4.0	1.000	22.7	LOS B	20.9	151.5	0.58	0.78	36.9
East: Wall Park Road - Slip Lane											
4	L	659	5.3	0.421	9.4	LOS A	3.9	28.8	0.17	0.67	47.8
Approach		659	5.3	0.421	9.4	LOS A	3.9	28.8	0.17	0.67	47.8
North East: Wall Park Avenue											
26	R	646	2.8	0.959	97.9	LOS F	28.6	204.7	1.00	1.09	16.2
Approach		646	2.8	0.959	97.9	LOS F	28.6	204.7	1.00	1.09	16.2
North: Blacktown Road NW slip lane											
7	L	575	1.6	0.313	8.9	X	X	X	X	0.64	48.7
Approach		575	1.6	0.313	8.9	NA	0.0	0.0	0.00	0.64	48.7
North West: Blacktown Road NW Buses											
28	T	16	100.0	0.051	41.3	LOS C	0.8	10.4	0.77	0.57	28.3
Approach		16	100.0	0.051	41.3	LOS C	0.8	10.4	0.77	0.57	28.3
West: Blacktown Road NW											
11	T	868	4.0	1.000	113.0	LOS F	41.5	300.6	1.00	1.14	14.6
Approach		868	4.0	1.000	113.0	LOS F	41.5	300.6	1.00	1.14	14.6
All Vehicles		4273	4.1	1.000	48.6	LOS D	41.5	300.6	0.59	0.86	25.8

X: Not applicable for Continuous movement.

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 used.

3 x = 1.00 due to short lane. Refer to the Lane Summary report for information about excess flow and related conditions.

MOVEMENT SUMMARY

Site: Blktown Rd Wall Pk Ave St1 PM

Blacktown Road and Wall Park Avenue AM
Signals - Fixed Time Cycle Time = 140 seconds (User-Given Phase Times)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow 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 East: Blacktown Road SE											
22	T	1313	4.1	0.505	17.7	LOS B	20.8	150.3	0.50	0.77	40.4
23	R	212	3.9	1.000[3]	50.6	LOS D	10.1	73.4	1.00	0.83	25.2
Approach		1525	4.0	1.000	22.2	LOS B	20.8	150.3	0.57	0.78	37.2
East: Wall Park Road - Slip Lane											
4	L	659	5.3	0.421	9.4	LOS A	3.9	28.8	0.17	0.67	47.8
Approach		659	5.3	0.421	9.4	LOS A	3.9	28.8	0.17	0.67	47.8
North East: Wall Park Avenue											
26	R	647	2.8	0.992	114.1	LOS F	31.0	222.3	1.00	1.15	14.5
Approach		647	2.8	0.992	114.1	LOS F	31.0	222.3	1.00	1.15	14.5
North: Blacktown Road NW slip lane											
7	L	605	1.6	0.330	8.9	X	X	X	X	0.64	48.7
Approach		605	1.6	0.330	8.9	NA	0.0	0.0	0.00	0.64	48.7
North West: Blacktown Road NW Buses											
28	T	16	100.0	0.051	41.3	LOS C	0.8	10.4	0.77	0.57	28.3
Approach		16	100.0	0.051	41.3	LOS C	0.8	10.4	0.77	0.57	28.3
West: Blacktown Road NW											
11	T	868	4.0	1.000	113.0	LOS F	41.5	300.6	1.00	1.14	14.6
Approach		868	4.0	1.000	113.0	LOS F	41.5	300.6	1.00	1.14	14.6
All Vehicles		4321	4.0	1.000	50.5	LOS D	41.5	300.6	0.58	0.87	25.3

X: Not applicable for Continuous movement.

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 used.

3 x = 1.00 due to short lane. Refer to the Lane Summary report for information about excess flow and related conditions.

MOVEMENT SUMMARY

Site: Blktown Rd Wall Pk Ave St2 PM

Blacktown Road and Wall Park Avenue AM
Signals - Fixed Time Cycle Time = 140 seconds (User-Given Phase Times)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow 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 East: Blacktown Road SE											
22	T	1320	4.0	0.507	17.7	LOS B	20.9	151.4	0.50	0.77	40.3
23	R	212	3.9	1.000[3]	50.6	LOS D	10.1	73.4	1.00	0.83	25.2
Approach		1532	4.0	1.000	22.3	LOS B	20.9	151.4	0.57	0.78	37.2
East: Wall Park Road - Slip Lane											
4	L	659	5.3	0.421	9.4	LOS A	3.9	28.8	0.17	0.67	47.8
Approach		659	5.3	0.421	9.4	LOS A	3.9	28.8	0.17	0.67	47.8
North East: Wall Park Avenue											
26	R	660	2.7	1.011	124.8	LOS F	33.1	237.3	1.00	1.19	13.5
Approach		660	2.7	1.011	124.8	LOS F	33.1	237.3	1.00	1.19	13.5
North: Blacktown Road NW slip lane											
7	L	633	1.5	0.344	8.9	X	X	X	X	0.64	48.6
Approach		633	1.5	0.344	8.9	NA	0.0	0.0	0.00	0.64	48.6
North West: Blacktown Road NW Buses											
28	T	16	100.0	0.051	41.3	LOS C	0.8	10.4	0.77	0.57	28.3
Approach		16	100.0	0.051	41.3	LOS C	0.8	10.4	0.77	0.57	28.3
West: Blacktown Road NW											
11	T	868	4.0	1.000	113.0	LOS F	41.5	300.6	1.00	1.14	14.6
Approach		868	4.0	1.000	113.0	LOS F	41.5	300.6	1.00	1.14	14.6
All Vehicles		4367	4.0	1.011	52.0	LOS D	41.5	300.6	0.58	0.88	24.8

X: Not applicable for Continuous movement.

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 used.

3 x = 1.00 due to short lane. Refer to the Lane Summary report for information about excess flow and related conditions.

C3 Panorama Parade and Hospital Access

AM Peak Existing

Stage 1

Stage 2

PM Peak Existing

Stage 1

Stage 2

MOVEMENT SUMMARY

Site: Panorama Parade and Hospital Access Road AM

Panorama Parade and Hospital Access Road
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow 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 S											
2	T	251	1.7	0.291	5.6	LOS A	2.3	16.0	0.17	0.48	37.9
3	R	162	0.0	0.292	9.1	LOS A	2.3	16.0	0.17	0.74	34.5
Approach		413	1.0	0.291	7.0	LOS A	2.3	16.0	0.17	0.58	36.5
East: Hospital Entry Road											
4	L	29	3.6	0.053	7.2	LOS A	0.3	2.4	0.29	0.58	36.0
6	R	29	0.0	0.053	9.6	LOS A	0.3	2.4	0.29	0.67	33.8
Approach		59	1.8	0.053	8.4	LOS A	0.3	2.4	0.29	0.62	34.9
North: Panorama Parade N											
7	L	192	1.1	0.281	7.6	LOS A	2.0	14.5	0.39	0.64	35.8
8	T	116	2.7	0.281	6.5	LOS A	2.0	14.5	0.39	0.55	36.3
9	R	6	0.0	0.287	11.2	LOS A	2.0	14.5	0.39	0.76	32.9
Approach		314	1.7	0.281	7.3	LOS A	2.0	14.5	0.39	0.61	35.9
All Vehicles		785	1.3	0.291	7.2	LOS A	2.3	16.0	0.27	0.60	36.1

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 used.

SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: Stage 1 Panorama Parade and Hospital Access Road AM 120604 remodelled flows

Panorama Parade and Hospital Access Road
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow 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 S											
2	T	251	1.7	0.297	5.7	LOS A	1.9	13.2	0.21	0.49	37.7
3	R	162	0.0	0.297	9.1	LOS A	1.9	13.2	0.21	0.73	34.4
Approach		413	1.0	0.297	7.1	LOS A	1.9	13.2	0.21	0.58	36.3
East: Hospital Entry Road											
4	L	67	1.6	0.097	7.2	LOS A	0.5	3.5	0.30	0.59	36.0
6	R	42	0.0	0.097	9.6	LOS A	0.5	3.5	0.30	0.68	33.8
Approach		109	1.0	0.097	8.1	LOS A	0.5	3.5	0.30	0.62	35.1
North: Panorama Parade N											
7	L	144	1.5	0.237	7.5	LOS A	1.3	9.5	0.38	0.64	35.9
8	T	116	2.7	0.237	6.5	LOS A	1.3	9.5	0.38	0.55	36.4
9	R	6	0.0	0.237	11.2	LOS A	1.3	9.5	0.38	0.77	33.0
Approach		266	2.0	0.237	7.2	LOS A	1.3	9.5	0.38	0.60	36.0
All Vehicles		788	1.3	0.297	7.2	LOS A	1.9	13.2	0.28	0.59	36.0

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.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: Stage 2 Panorama Parade and Hospital Access Road AM 120604 remodelled flows

Panorama Parade and Hospital Access Road
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow 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 S											
2	T	251	1.7	0.339	5.9	LOS A	2.2	15.8	0.28	0.50	37.1
3	R	198	0.0	0.339	9.3	LOS A	2.2	15.8	0.28	0.72	34.2
Approach		448	0.9	0.339	7.4	LOS A	2.2	15.8	0.28	0.59	35.8
East: Hospital Entry Road											
4	L	76	1.4	0.127	7.2	LOS A	0.7	4.8	0.31	0.59	35.9
6	R	68	0.0	0.127	9.6	LOS A	0.7	4.8	0.31	0.67	33.8
Approach		144	0.7	0.127	8.3	LOS A	0.7	4.8	0.31	0.63	34.8
North: Panorama Parade N											
7	L	174	1.2	0.274	7.8	LOS A	1.6	11.5	0.44	0.66	35.6
8	T	116	2.7	0.274	6.8	LOS A	1.6	11.5	0.44	0.57	36.0
9	R	6	0.0	0.274	11.5	LOS A	1.6	11.5	0.44	0.77	32.7
Approach		296	1.8	0.274	7.5	LOS A	1.6	11.5	0.44	0.63	35.7
All Vehicles		888	1.2	0.339	7.6	LOS A	2.2	15.8	0.34	0.61	35.6

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 used.

MOVEMENT SUMMARY

Site: Panorama Parade and Hospital Access Road PM

Panorama Parade and Hospital Access Road
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow 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 S											
2	T	148	0.7	0.187	6.4	LOS A	1.3	9.2	0.37	0.54	36.6
3	R	56	0.0	0.187	9.9	LOS A	1.3	9.2	0.37	0.75	34.1
Approach		204	0.5	0.187	7.3	LOS A	1.3	9.2	0.37	0.60	35.9
East: Hospital Entry Road											
4	L	138	0.8	0.264	8.0	LOS A	1.9	13.2	0.45	0.65	35.2
6	R	134	1.6	0.264	10.4	LOS A	1.9	13.2	0.45	0.71	33.3
Approach		272	1.2	0.264	9.1	LOS A	1.9	13.2	0.45	0.68	34.2
North: Panorama Parade N											
7	L	86	2.4	0.228	6.9	LOS A	1.7	11.9	0.22	0.62	36.6
8	T	195	0.5	0.228	5.7	LOS A	1.7	11.9	0.22	0.50	37.6
9	R	18	0.0	0.227	10.5	LOS A	1.7	11.9	0.22	0.79	33.5
Approach		299	1.1	0.228	6.3	LOS A	1.7	11.9	0.22	0.55	37.0
All Vehicles		775	1.0	0.264	7.6	LOS A	1.9	13.2	0.34	0.61	35.7

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.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model used.

SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: Stage 1 Panorama Parade and Hospital Access Road PM 120604 remodelled flows

Panorama Parade and Hospital Access Road
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow 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 S											
2	T	148	0.7	0.178	6.6	LOS A	1.0	7.0	0.41	0.57	36.3
3	R	40	0.0	0.178	10.1	LOS A	1.0	7.0	0.41	0.76	33.9
Approach		188	0.6	0.178	7.3	LOS A	1.0	7.0	0.41	0.61	35.8
East: Hospital Entry Road											
4	L	205	0.5	0.354	8.0	LOS A	2.2	15.5	0.47	0.65	35.1
6	R	176	1.2	0.354	10.4	LOS A	2.2	15.5	0.47	0.72	33.3
Approach		381	0.8	0.354	9.1	LOS A	2.2	15.5	0.47	0.68	34.2
North: Panorama Parade N											
7	L	55	3.8	0.195	6.8	LOS A	1.1	8.0	0.18	0.62	36.8
8	T	195	0.5	0.195	5.6	LOS A	1.1	8.0	0.18	0.49	37.9
9	R	18	0.0	0.195	10.4	LOS A	1.1	8.0	0.18	0.81	33.5
Approach		267	1.2	0.195	6.2	LOS A	1.1	8.0	0.18	0.54	37.4
All Vehicles		837	0.9	0.354	7.8	LOS A	2.2	15.5	0.36	0.62	35.5

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 used.

MOVEMENT SUMMARY

Site: Stage 2 Panorama Parade and Hospital Access Road PM 120604 remodelled flows

Panorama Parade and Hospital Access Road
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow 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 S											
2	T	148	0.7	0.199	6.9	LOS A	1.1	8.0	0.47	0.60	35.9
3	R	53	0.0	0.199	10.4	LOS A	1.1	8.0	0.47	0.77	33.6
Approach		201	0.5	0.199	7.8	LOS A	1.1	8.0	0.47	0.64	35.3
East: Hospital Entry Road											
4	L	265	0.4	0.449	8.2	LOS A	3.1	21.8	0.52	0.66	34.9
6	R	225	0.9	0.449	10.5	LOS A	3.1	21.8	0.52	0.72	33.1
Approach		491	0.6	0.449	9.3	LOS A	3.1	21.8	0.52	0.69	34.0
North: Panorama Parade N											
7	L	68	3.1	0.211	6.8	LOS A	1.3	8.9	0.21	0.62	36.7
8	T	195	0.5	0.211	5.7	LOS A	1.3	8.9	0.21	0.50	37.7
9	R	18	0.0	0.211	10.4	LOS A	1.3	8.9	0.21	0.79	33.5
Approach		281	1.1	0.211	6.3	LOS A	1.3	8.9	0.21	0.54	37.1
All Vehicles		973	0.8	0.449	8.1	LOS A	3.1	21.8	0.42	0.64	35.1

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 used.

C4 Bungarribee Road and Panorama Parade

AM Peak Existing

Stage 1

Stage 2

PM Peak Existing

Stage 1

Stage 2

MOVEMENT SUMMARY

Bungarribee Road and Panorama Parade
Signals - Fixed Time Cycle Time = 60 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow 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: Lock St S											
1	L	45	7.0	0.440	21.7	LOS B	8.2	58.3	0.79	0.83	33.7
2	T	167	0.6	0.439	15.1	LOS B	8.2	58.3	0.79	0.67	34.5
3	R	80	2.6	0.439	21.4	LOS B	8.2	58.3	0.79	0.82	33.7
Approach		293	2.2	0.439	17.8	LOS B	8.2	58.3	0.79	0.74	34.2
East: Bungarribee Road E											
4	L	95	3.3	0.680	31.7	LOS C	10.2	74.4	0.91	0.88	33.4
5	T	541	5.8	0.680	23.4	LOS B	10.3	75.4	0.91	0.80	34.3
6	R	105	0.0	0.567	38.6	LOS C	4.5	31.5	1.00	0.80	29.1
Approach		741	4.7	0.680	26.6	LOS B	10.3	75.4	0.93	0.81	33.4
North: Panorama Parade N											
7	L	38	8.3	0.244	16.8	LOS B	3.8	27.8	0.72	0.79	36.3
8	T	73	1.4	0.244	10.3	LOS A	3.8	27.8	0.72	0.57	37.3
9	R	45	4.7	0.244	16.6	LOS B	3.8	27.8	0.72	0.78	36.3
Approach		156	4.1	0.244	13.7	LOS A	3.8	27.8	0.72	0.68	36.8
West: Bungarribee Road W											
10	L	83	1.3	0.788	34.3	LOS C	12.5	90.6	0.96	0.94	32.3
11	T	661	4.5	0.788	26.1	LOS B	12.6	91.6	0.96	0.90	32.9
12	R	133	3.2	0.730	40.7	LOS C	5.8	41.4	1.00	0.88	28.3
Approach		877	4.0	0.788	29.0	LOS C	12.6	91.6	0.97	0.90	32.1
All Vehicles		2066	4.0	0.788	25.4	LOS B	12.6	91.6	0.91	0.83	33.1

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 used.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	Across S approach	53	20.8	LOS C	0.1	0.1	0.83	0.83
P5	Across N approach	53	20.8	LOS C	0.1	0.1	0.83	0.83
P7	Across W approach	53	24.3	LOS C	0.1	0.1	0.90	0.90
All Pedestrians		159	22.0	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: Stage 1 Bungarribee Road and Panorama Parade AM 120604 remodelled flows

Bungarribee Road and Panorama Parade
Signals - Fixed Time Cycle Time = 60 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow 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: Lock St S											
1	L	45	7.0	0.482	22.0	LOS B	7.2	51.1	0.80	0.84	33.6
2	T	192	0.5	0.482	15.4	LOS B	7.2	51.1	0.80	0.69	34.3
3	R	80	2.6	0.482	21.7	LOS B	7.2	51.1	0.80	0.83	33.6
Approach		317	2.0	0.482	18.0	LOS B	7.2	51.1	0.80	0.74	34.0
East: Bungarribee Road E											
4	L	95	3.3	0.680	31.7	LOS C	8.5	62.0	0.91	0.88	33.4
5	T	541	5.8	0.680	23.4	LOS B	8.6	63.0	0.91	0.80	34.3
6	R	67	0.0	0.363	37.5	LOS C	2.0	13.9	0.97	0.75	29.5
Approach		703	4.9	0.680	25.9	LOS B	8.6	63.0	0.92	0.80	33.7
North: Panorama Parade N											
7	L	48	6.5	0.310	17.2	LOS B	3.5	25.0	0.74	0.80	36.1
8	T	89	1.2	0.310	10.6	LOS A	3.5	25.0	0.74	0.60	37.0
9	R	56	3.8	0.310	17.0	LOS B	3.5	25.0	0.74	0.79	36.1
Approach		194	3.3	0.310	14.1	LOS A	3.5	25.0	0.74	0.70	36.5
West: Bungarribee Road W											
10	L	97	1.1	0.803	34.8	LOS C	11.3	81.8	0.97	0.95	32.0
11	T	661	4.5	0.803	26.6	LOS B	11.4	82.9	0.97	0.92	32.6
12	R	133	3.2	0.730	40.7	LOS C	4.3	30.7	1.00	0.88	28.3
Approach		891	3.9	0.803	29.6	LOS C	11.4	82.9	0.97	0.92	31.8
All Vehicles		2104	3.9	0.803	25.2	LOS B	11.4	82.9	0.91	0.83	33.1

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 used.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	Across S approach	53	20.8	LOS C	0.1	0.1	0.83	0.83
P5	Across N approach	53	20.8	LOS C	0.1	0.1	0.83	0.83
P7	Across W approach	53	24.3	LOS C	0.1	0.1	0.90	0.90
All Pedestrians		159	22.0	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: Stage 2 Bungarribee Road and Panorama Parade AM 120604 remodelled flows

Bungarribee Road and Panorama Parade
Signals - Fixed Time Cycle Time = 60 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow 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: Lock St S											
1	L	45	7.0	0.516	22.2	LOS B	7.8	55.8	0.82	0.84	33.5
2	T	215	0.5	0.516	15.7	LOS B	7.8	55.8	0.82	0.70	34.2
3	R	80	2.6	0.516	22.0	LOS B	7.8	55.8	0.82	0.84	33.5
Approach		340	1.9	0.516	18.0	LOS B	7.8	55.8	0.82	0.75	33.9
East: Bungarribee Road E											
4	L	95	3.3	0.680	31.7	LOS C	8.5	62.0	0.91	0.88	33.4
5	T	541	5.8	0.680	23.4	LOS B	8.6	63.0	0.91	0.80	34.3
6	R	67	0.0	0.363	37.5	LOS C	2.0	13.9	0.97	0.75	29.5
Approach		703	4.9	0.680	25.9	LOS B	8.6	63.0	0.92	0.80	33.7
North: Panorama Parade N											
7	L	51	6.3	0.323	17.2	LOS B	3.7	26.2	0.74	0.80	36.1
8	T	94	1.1	0.323	10.7	LOS A	3.7	26.2	0.74	0.60	36.9
9	R	58	3.6	0.323	17.0	LOS B	3.7	26.2	0.74	0.79	36.1
Approach		202	3.1	0.323	14.1	LOS A	3.7	26.2	0.74	0.71	36.4
West: Bungarribee Road W											
10	L	109	1.0	0.816	35.4	LOS C	11.7	84.4	0.97	0.96	31.7
11	T	661	4.5	0.816	27.2	LOS B	11.8	85.7	0.97	0.94	32.3
12	R	133	3.2	0.730	40.7	LOS C	4.3	30.7	1.00	0.88	28.3
Approach		903	3.8	0.816	30.2	LOS C	11.8	85.7	0.98	0.93	31.6
All Vehicles		2148	3.8	0.816	25.3	LOS B	11.8	85.7	0.91	0.84	33.0

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 used.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	Across S approach	53	20.8	LOS C	0.1	0.1	0.83	0.83
P5	Across N approach	53	20.8	LOS C	0.1	0.1	0.83	0.83
P7	Across W approach	53	24.3	LOS C	0.1	0.1	0.90	0.90
All Pedestrians		159	22.0	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

Bungarribee Road and Panorama Parade
Signals - Fixed Time Cycle Time = 70 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow 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: Lock St S											
1	L	27	11.5	0.296	25.2	LOS B	5.2	37.0	0.77	0.80	31.8
2	T	72	0.0	0.296	18.5	LOS B	5.2	37.0	0.77	0.63	32.6
3	R	49	0.0	0.296	24.8	LOS B	5.2	37.0	0.77	0.79	31.8
Approach		148	2.1	0.296	21.8	LOS B	5.2	37.0	0.77	0.72	32.2
East: Bungarribee Road E											
4	L	144	1.5	0.632	27.4	LOS B	12.7	90.3	0.80	0.87	35.4
5	T	719	1.8	0.632	19.2	LOS B	12.9	91.6	0.80	0.69	37.1
6	R	61	0.0	0.384	43.4	LOS D	3.1	21.7	0.98	0.75	27.3
Approach		924	1.6	0.632	22.0	LOS B	12.9	91.6	0.81	0.72	36.0
North: Panorama Parade N											
7	L	119	0.9	0.529	22.6	LOS B	9.8	69.5	0.86	0.83	32.8
8	T	107	0.0	0.529	16.2	LOS B	9.8	69.5	0.86	0.72	33.1
9	R	96	3.3	0.528	22.5	LOS B	9.8	69.5	0.86	0.82	32.8
Approach		322	1.3	0.529	20.5	LOS B	9.8	69.5	0.86	0.79	32.9
West: Bungarribee Road W											
10	L	46	2.3	0.466	26.0	LOS B	9.1	65.1	0.72	0.89	36.5
11	T	594	2.0	0.467	17.8	LOS B	9.2	65.5	0.72	0.61	38.3
12	R	33	6.5	0.214	42.9	LOS D	1.7	12.5	0.96	0.72	27.6
Approach		673	2.2	0.467	19.5	LOS B	9.2	65.5	0.73	0.63	37.5
All Vehicles		2067	1.8	0.632	21.0	LOS B	12.9	91.6	0.79	0.70	35.7

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 used.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	Across S approach	53	17.9	LOS B	0.1	0.1	0.71	0.71
P5	Across N approach	53	17.9	LOS B	0.1	0.1	0.71	0.71
P7	Across W approach	53	29.3	LOS C	0.1	0.1	0.91	0.91
All Pedestrians		159	21.7	LOS C			0.78	0.78

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.

SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: Stage 1 Bungarribee Road and Panorama Parade PM 120604 remodelled flows

Bungarribee Road and Panorama Parade
Signals - Fixed Time Cycle Time = 60 seconds (User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow 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: Lock St S											
1	L	27	11.5	0.250	19.9	LOS B	3.0	21.1	0.70	0.80	34.6
2	T	72	0.0	0.250	13.2	LOS A	3.0	21.1	0.70	0.58	35.7
3	R	49	0.0	0.250	19.5	LOS B	3.0	21.1	0.70	0.78	34.6
Approach		148	2.1	0.250	16.5	LOS B	3.0	21.1	0.70	0.69	35.1
East: Bungarribee Road E											
4	L	144	1.5	0.903	41.9	LOS C	15.1	107.1	1.00	1.08	28.9
5	T	719	1.8	0.903	33.6	LOS C	15.3	108.8	1.00	1.08	29.4
6	R	45	0.0	0.244	37.0	LOS C	1.3	9.2	0.96	0.73	29.7
Approach		908	1.6	0.903	35.1	LOS C	15.3	108.8	1.00	1.06	29.3
North: Panorama Parade N											
7	L	141	0.7	0.536	17.7	LOS B	7.7	54.3	0.82	0.83	35.5
8	T	131	0.0	0.536	11.3	LOS A	7.7	54.3	0.82	0.68	36.0
9	R	118	2.7	0.536	17.6	LOS B	7.7	54.3	0.82	0.82	35.5
Approach		389	1.1	0.536	15.5	LOS B	7.7	54.3	0.82	0.78	35.7
West: Bungarribee Road W											
10	L	46	2.3	0.667	31.4	LOS C	8.4	60.2	0.91	0.88	33.9
11	T	594	2.0	0.667	23.1	LOS B	8.5	60.6	0.91	0.79	34.6
12	R	33	6.5	0.184	37.0	LOS C	0.9	6.9	0.95	0.72	29.8
Approach		673	2.2	0.667	24.3	LOS B	8.5	60.6	0.91	0.79	34.3
All Vehicles		2119	1.7	0.903	26.8	LOS B	15.3	108.8	0.92	0.90	32.2

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 used.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	Across S approach	53	20.8	LOS C	0.1	0.1	0.83	0.83
P5	Across N approach	53	20.8	LOS C	0.1	0.1	0.83	0.83
P7	Across W approach	53	24.3	LOS C	0.1	0.1	0.90	0.90
All Pedestrians		159	22.0	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: Stage 2 Bungarribee Road and Panorama Parade PM 120604 remodelled flows

Bungarribee Road and Panorama Parade
Signals - Fixed Time Cycle Time = 60 seconds (User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow 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: Lock St S											
1	L	27	11.5	0.274	20.0	LOS B	3.2	22.5	0.71	0.80	34.5
2	T	79	0.0	0.274	13.4	LOS A	3.2	22.5	0.71	0.59	35.6
3	R	49	0.0	0.274	19.7	LOS B	3.2	22.5	0.71	0.79	34.5
Approach		156	2.0	0.274	16.6	LOS B	3.2	22.5	0.71	0.69	35.1
East: Bungarribee Road E											
4	L	144	1.5	0.903	41.9	LOS C	15.1	107.1	1.00	1.08	28.9
5	T	719	1.8	0.903	33.6	LOS C	15.3	108.8	1.00	1.08	29.4
6	R	45	0.0	0.244	37.0	LOS C	1.3	9.2	0.96	0.73	29.7
Approach		908	1.6	0.903	35.1	LOS C	15.3	108.8	1.00	1.06	29.3
North: Panorama Parade N											
7	L	161	0.7	0.631	18.4	LOS B	9.4	66.5	0.86	0.84	35.1
8	T	151	0.0	0.631	12.0	LOS A	9.4	66.5	0.86	0.73	35.5
9	R	138	2.3	0.631	18.3	LOS B	9.4	66.5	0.86	0.84	35.1
Approach		449	0.9	0.631	16.2	LOS B	9.4	66.5	0.86	0.80	35.2
West: Bungarribee Road W											
10	L	51	2.1	0.672	31.4	LOS C	8.5	60.7	0.91	0.88	33.8
11	T	594	2.0	0.672	23.2	LOS B	8.6	61.2	0.91	0.79	34.6
12	R	33	6.5	0.184	37.0	LOS C	0.9	6.9	0.95	0.72	29.8
Approach		677	2.2	0.672	24.5	LOS B	8.6	61.2	0.91	0.79	34.3
All Vehicles		2191	1.7	0.903	26.6	LOS B	15.3	108.8	0.92	0.90	32.2

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 used.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	Across S approach	53	20.8	LOS C	0.1	0.1	0.83	0.83
P5	Across N approach	53	20.8	LOS C	0.1	0.1	0.83	0.83
P7	Across W approach	53	24.3	LOS C	0.1	0.1	0.90	0.90
All Pedestrians		159	22.0	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.