Kirrawee Brick Pit

Traffic Management and Accessibility Plan (Incorporating Traffic and Parking Study)

October 2010

Prepared for

Henroth Pty Ltd

Halcrow

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This report has been issued and amended as follows:

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Contents

Executive Summary

This Traffic Management and Accessibility Plan (TMAP) has been prepared in support of an application for Concept Plan approval under Part 3A of the Environmental Planning and Assessment Act at 566-594 Princes Highway Kirrawee, otherwise known as the former Kirrawee Brick Pit (Reference MP 10_0076). The application seeks approval for a mixed-use development comprising residential, retail and commercial uses and building envelopes of between 5 and 15 storeys. The proposal also involves basement car parking and includes commuter parking, landscaping, services and the provision of a major new public park. Specifically, this report addresses issue number 7 - Transport and Accessibility (Construction and Operational), as detailed in the Director General's Requirements (DGR's) issued by the Department of Planning on 24 August 2010.

The subject site is well located in transport terms being adjacent to or close to major arterial roads and in close proximity of Kirrawee station and commercial area. The proposal offers to be an excellent example of Transit Oriented Development with good public transport and convenient local shops and services allowing the use of private transport to be minimized.

Surveys and analysis of traffic on the surrounding road network have found that traffic levels in the area peak periods are heavy but that in general the road system operates within the capacity levels expected in a modern metropolitan urban area. Arising from a previous development proposal for the site, a series of road improvements have been identified for the surrounding road network. These were suggested by the RTA and were split into Stage 1 and Stage 2 road improvement works. The analysis found that with the Stage 1 works in place, the road system would have the operational capacity to satisfactorily accommodate traffic that would be generated by the proposal. Accordingly the Stage 2 works would not be required.

Bus services in the area are good and City Rail is about to bring in a new rail timetable that will significantly improve rail services in the area. Accordingly no specific public transport improvements will be necessitated by the proposal although as is the case

throughout Sydney, demand on individual bus services will need to be monitored so that amplification can take place as needed.

The proposal includes 200 commuter parking spaces. These would improve access to Kirrawee station for persons that did not have a convenient bus service to do so. Provision of this parking is subject to the Department of Transport's acceptance of it.

Sutherland Council has plans for a cycleway between Sutherland and Cronulla that would run south of and adjacent to the Kirrawee railway station. This will considerably improve cycling convenience for employees and residents in Kirrawee. To support this, bicycle parking and facilities will be provided within the proposal in accordance with the Sutherland Development Control Plan.

The proposal will improve pedestrian access through:

- Provision of new pedestrian paths along all frontages of the site.
- Replace a roundabout at the intersection of Oak Road and Flora Street with traffic signals which would assist pedestrians in crossing the adjoining roads.
- Provision of an internal plaza, mall and walkway with connections to all surrounding streets.

It is proposed to provide a supply of car parking that is appropriate to the situation of the site, taking in to consideration its proximity to Kirrawee railway station. As such, the proposed supply will be a little below the Sutherland DCP requirement but sufficient to avoid overspill problems for surrounding areas. Existing on-street parking that would be displaced by urban design improvements associated with the proposal would be replaced on site.

Overall it is concluded that the site provides an excellent location for a transit oriented mixed-use development and that transport aspects of the concept plan are satisfactory.

1 Introduction

This Traffic Management and Accessibility Plan (TMAP) has been prepared in support of an application for Concept Plan approval under Part 3A of the Environmental Planning and Assessment Act at 566-594 Princes Highway Kirrawee, otherwise known as the former Kirrawee Brick Pit (Reference MP 10_0076). The application seeks approval for a mixed-use development comprising residential, retail and commercial uses and building envelopes of between 5 and 15 storeys. The proposal also involves basement car parking and includes commuter parking, landscaping, services and the provision of a major new public park. Specifically, this report addresses issue number 7 - Transport and Accessibility (Construction and Operational), as detailed in the Director General's Requirements (DGR's) issued by the Department of Planning on 24 August 2010.

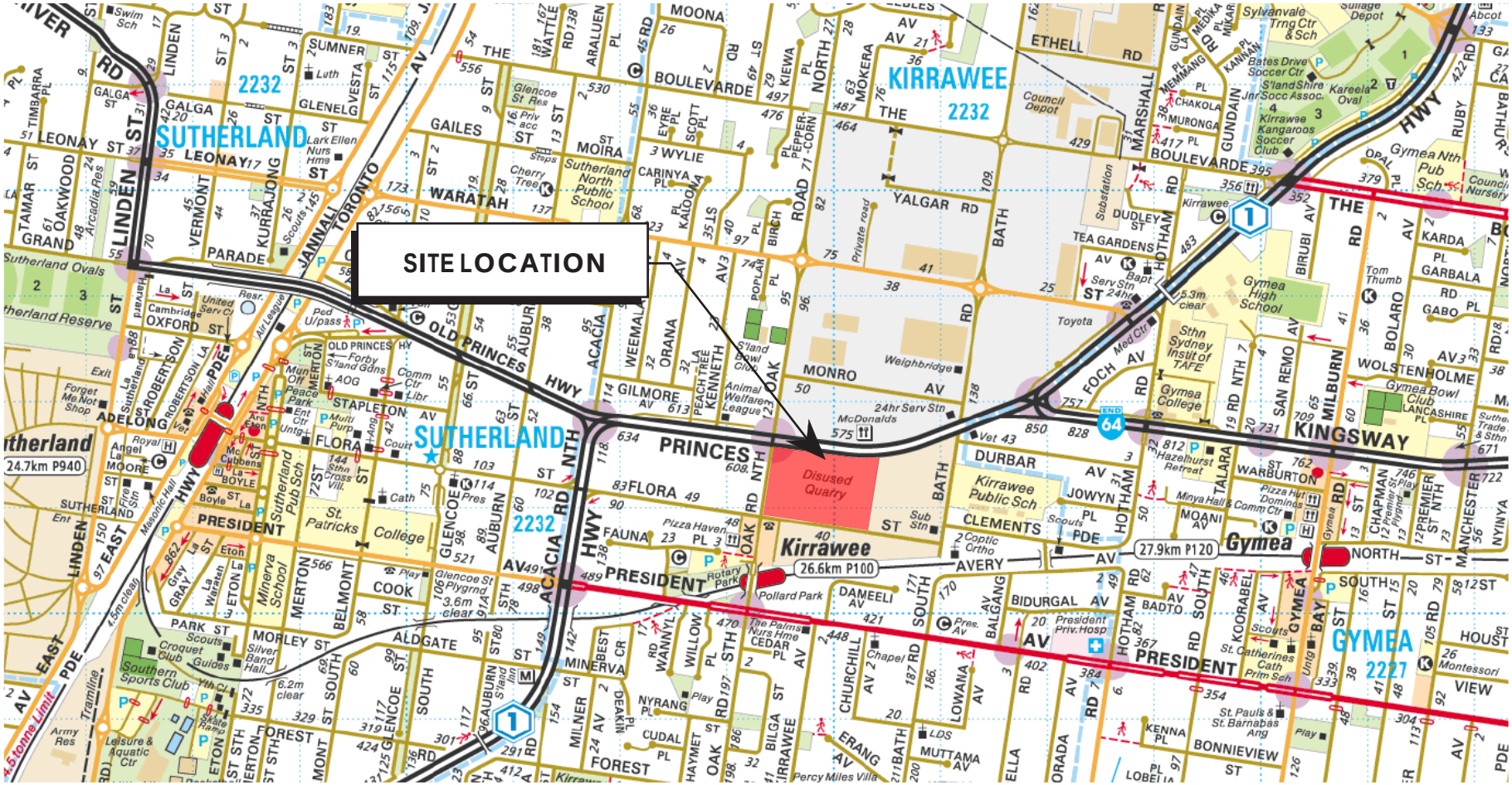
The location of the site is indicated on **Figure 1**. It is surrounded by roads on three sides and includes a large water filled former clay extraction pit, undeveloped land around it and a strip of forest on its western side.

The concept plan proposes some 12,420m^2 of retail space including a large and a small supermarket, specialty stores and restaurant/cafes and showrooms along Princes Highway. It includes a small amount of office and 450 apartments.

As the application is for a "Concept Application" the architectural plans have been resolved only to demonstrate that the development applied for can satisfactorily be accommodated on site. Accordingly internal traffic and parking arrangements have been indicated to demonstrate feasibility only. Resolved designs would be prepared for a subsequent "Project Application". In view of this the internal layouts for car and bicycle parking and for loading arrangements are not considered in detail in this report. Suffice to say that the intent is that Australian Standards be adhered to when the Project Application is prepared.

SITE LOCATION

KIRRAWEE BRICK PIT TMAP



This report focuses on external traffic impacts and on general transport and mobility considerations. It follows NSW procedures for the preparation of a Traffic Management and Accessibility Plan.

Finally it is noted that the site was the subject of a previous application for a different but generally similar development. In consideration of that development there was considerable discussion between the applicant's traffic engineers, Sutherland Council's consulting traffic engineer and the RTA. As a result of this extensive work, a series of road improvement initiatives around the site were identified. This report builds on this important base with fresh traffic counts taking into account changes in the area that were at that time incomplete.

2 Site Location

2.1 The Kirrawee Brick Pit Site

The Kirrawee Brick Pit site is located within the suburb of Kirrawee in the Sutherland Shire.

The rectangular site, which is approximately 4.25 hectares in size, is located between the Princes Highway to the north and Flora Street to the south. The site is bounded by Oak Road on its western border and existing industrial land on its eastern border. The location of the site is shown on **Figure 1**.

The site was formerly used for brick manufacture. The site is currently vacant.

2.2 Overview of the Proposed Development

Henroth proposes to build a mixed-use development on the site consisting of retail, commercial and residential land uses. The proposal can be summarised as follows:

- Two supermarkets providing a total of 5,270m^2 of Gross Leasable Floor Area (GLA);
- Specialty retail including cafes and kiosks and a mini major totalling 4,600m^2 of GLA;
- 3,200m^2 of Gross Floor Area (GFA) bulky retail;
- 660m^2 of commercial/office GFA;
- 450 residential apartments consisting of:
  - 48 one-bedroom apartments;
  - 267 two-bedroom apartments; and
  - 131 three-bedroom apartments.

A copy of the plans is contained in **Appendix A**.

It is noted that the plans indicate proposed site accesses at an architectural level of resolution. It is proposed that in a subsequent Project Application these be designed to comply fully with RTA and/or Australian Standard requirements as appropriate.

3 Strategic Context

3.1 Strategic Planning Policy and Plans

This section outlines government plans and strategies which provide a transport context within which this proposed development should be considered.

3.1.1 NSW State Plan

The NSW State Plan 2006 and its update in 2010 define the NSW Government's overarching goals and priorities for action. It is intended to set a framework for linking the various other NSW Government plans and policies, including the Metropolitan Strategy.

Transport-relevant goals include:

- A high quality transport system;
- Practical environmental solutions; and
- Improved urban environments.

Beneath these goals are a number of transport-relevant priorities with associated targets.

The 2010 priorities are:

- Improve the public transport system;
  - Increase the share of commute trips made by public transport;
  - Increase the proportion of total journeys to work by public transport in the Sydney Metropolitan Region to 28% by 2016;
- Provide reliable public transport;
- Improve the road network;
- Maintain road infrastructure;
- Improve road safety;
- Increase walking and cycling;
- Increase the number of jobs closer to home; and
- Grow cities and centres as function and attractive places to live, work and visit.

3.1.2 Metropolitan Strategy and Metropolitan Transport Plan

The Metropolitan Strategy (December 2005) outlines a broad framework vision for the future growth of the Sydney metropolitan area to 2031. The strategy proposes the concentration of growth in centers by identifying housing and employment capacity targets for Sydney's sub regions and strategic centers.

3.1.3 The Metropolitan Strategy

The Metropolitan Strategy's transport vision for Sydney is "… *neighbourhoods with improved local transport, with walking and cycling facilities and bus services to major centres. People will be able to carry out more of their trips closer to home, reducing the time taken and cost of longer trips*".

Transport actions proposed by the Metro Strategy are:

- Improve transport between Sydney's centres;
- Improve the existing transport system;
- Influence travel choices to encourage more sustainable travel;
- Improve transport decision-making, planning, evaluation and funding;
- Ensure sufficient port capacity is available to serve Sydney;
- Improve the efficiency of all types of freight movements in Sydney;
- Connect the regions and economic gateways within the GMR; and
- Minimise the adverse impacts from freight movements.

A review of the Metropolitan Strategy is presently underway and is expected to be completed by the end of 2010.

3.1.4 Metropolitan Transport Plan

This was released in February 2010 and provides a 25 year vision for the linking of Sydney's land use planning with its transport network. It is intended that this plan be merged with the updated Metropolitan Strategy when it is completed. The plan includes a 10 year funding guarantee for essential transport infrastructure and services.

The plan includes:

- The $4.5 billion Western Express City Rail Service – a separate dedicated rail track to slash travelling times from Western Sydney to the city;
- Start of work on the $6.75 billion North West rail link from Epping to Rouse Hill;
- A $500 million expansion of the current light rail system with an extension from Lilyfield to Dulwich Hill;
- Improvement to bus services – including 1000 new buses in strategic bus corridors.
- New trains – addition of 626 rail carriages;
- $158 million for cycleways;
- $400 million for commuter car park;
- $225 millions for ferries;
- $536 million for motorway planning, transit corridor reservations and land acquisition;
- $483 million to deliver important freight works in Sydney; and
- $21.9 million of State and Federal Funded road projects.

3.1.5 State Environmental Planning Policy No. 66 – Integrating Land Use and Transport

The Integrating Land Use & Transport policy has since been withdrawn. However it included a set of guidelines with incorporating Accessible Development Principles which still remain applicable.

The Accessible Development Principles are:

1. Develop concentrated centres of housing, employment, services and public facilities within an acceptable walking distance (400 to 1,000m) of major public transport nodes, such as railway stations and high frequency bus routes with at least a 15-minute frequency at peak times;
2. Encourage a mix of housing, employment, services, public facilities and other compatible land uses, in accessible centres;
3. Concentrate high density, mixed-use, accessible centres along major public transport corridors within urban areas;
4. Plan and implement public transport infrastructure and services in conjunction with land use strategies to maximise access along corridors, and to and from centres;
5. Provide street networks with multiple and direct connections to public transport services and efficient access for buses;

6. Provide walkable environments and give greater priority to access for pedestrians, including access for people with disabilities;
7. Maximise cyclists' accessibility to centres, services, facilities and employment locations;
8. Use the location, supply and availability of parking to discourage car use;
9. Improve transport choice and propose an integrated transport approach by management road traffic flow and priority of transport modes; and
10. Design with an emphasis on the needs of pedestrians, cyclists and public transport users.

3.1.6 Draft Centres Policy

This draft policy seeks to replace Draft SEPP 66 (Integrating Lane Use and Transport). It sets out the following principles in relation to the development of centres:

1. The need to reinforce the importance of centres and clustering business activities;
2. The need to ensure the planning is flexible, allows centres to grow and new centres to form;
3. The market is best places to determine need. The planning system should accommodate this need whilst regulating its location and scale;
4. Councils should zone sufficient land to accommodate demand including larger retail formats;
5. Centres should have a mix of retail types that encourage competition; and
6. Centres should be well designed to encourage people to visit and stay longer.

3.2 Local Planning and Policy

3.2.1 Sutherland Council Strategic Plan

This is set out in the document "Our Shire, Our Future – Our Guide to Shaping the Shire to 2030." This was published in 2007.

The Plan sets out a vision for the Shire which includes directions for "People", "Place" and "Nature". The vision statement is for:

"*A community working together to attain safe, healthy and active lifestyles through accountable decision making that achieves sustainable development and economic opportunities which respect people and nature.*"

The subject proposal seeks to contribute to this vision through the provision of sustainable development and economic opportunities. Of further relevance to the project are specified key directions under the heading "place". These are:

- Greater housing choice to suit a changing population, increased access to housing and design that is sustainable within the environment;
- Improved transport options, including well integrated cycling paths and footpaths and high quality public transport infrastructure; and
- Leisure and recreation opportunities to suit the needs of the changing population that are designed to have minimal impact on the environment.

The plan specifies the following desired outcomes that are of relevance to transport aspects of the proposal:

- An integrated shire-wide bicycle and pedestrian network, with a particular emphasis on connecting communities;
- Reduced car dependence and increased alternative transport options within an improved urban design;
- Well planned neighbourhoods and activity centres that encourage physical activity;
- Suburban activity centres at key locations offering a range of services and contributing to a sense of place;
- Employment opportunities that integrate into local communities; and
- Reduced greenhouse gas emissions.

The plan summarises transport directions and potential responses there to as follows:

Key Directions	Outcomes	Responsibility	Potential Response
Improved transport options including well integrated cycle paths and footpaths, and a high quality public transport infrastructure.	An integrated Shire-wide bicycle and pedestrian network, with a particular emphasis on connecting communities. Reduced car dependence and increased alternative transport options within an improved urban design. Well planned neighbourhoods and activity centres that encourage physical activity.	Council Cycle groups Rail Corporation of NSW Sydney Ferries Corporation State Transit Authority of NSW Private Transport Providers State Planning Private Recreation and Leisure providers Major employers	Continue to enhance the Shire's bicycle networks and bike plan, in collaboration with all user groups. Improve integration of various transport types at interchange points, particularly through timetabling. State Government to finalise decision about the use of the F6 corridor land. Improve the ferry service between Bindeena and Cronulla, and construct a wharf at Kurnell to enable a ferry link between various points in Botany Bay. Engage community groups and private sector providers in planning, development and delivery of neighbourhood facilities. Major employers encouraged to provide workplace resources that support employees use of alternative transport e.g. change rooms, showers, bicycle lockers etc.

3.2.2 Sutherland Development Control Plan – Vehicular Access, Traffic, Parking and Bicycles

This specifies the provision and design requirements for access via these modes. It sets out the following objectives:

a. To ensure all land uses and/or combination of activities provide sufficient parking on site to satisfy the demand for parking by different vehicle types generated by the development, including Traffic Generating Development;
b. To ensure all land use have a described parking provision;
c. To minimise reliance on street parking;
d. To minimise amenity impacts on neighbouring properties, including streetscape, noise and light spill;

e. To ensure appropriate on-site provision and design of parking for older people and people with limited mobility or disability, in accordance with Australian Standards;
f. To recognise the need for innovative site specific parking solutions for development; and
g. To encourage greater use of more sustainable transport modes such as public transport, motor bikes, walking and cycling.

The application seeks to meet these objectives by providing an appropriate level of car, bicycle and motorcycle parking and through its location adjacent to a local centre with a railway system.

3.3 Comment on Strategic Context

Many of the underlying themes of the strategies have relevance to the proposal. Current State Policies provide a good framework to support local strategies to improve the level of accessibility and sustainable transport for the area.

A list of objectives has been developed for this TMAP in the following section which aims to support the State and Local Strategies.

4 Objectives of the TMAP

4.1 Objectives

This TMAP will guide future sustainable development of the Kirrawee Brick Pit.

The TMAP is intended to provide a plan which would:

- Minimise car based trips;
- Support and promote sustainable travel to and from the site;
- Maintain satisfactory operation on the local road network; and
- Manage freight movements generated by the centre.

Key TMAP outcomes are to:

- Identify measures to improve transport network, corridors and services with a view to integrating walking cycling, public transport and traffic management to achieve sustainable outcomes;
- Identify travel demand management programs to encourage use of public transport; and
- At the same time ensure that appropriate provisions are made for car parking and for traffic travelling to and from the centre.

4.2 Considerations

The development site and the nature of site have a number of advantages in relation to the achievement of the TMAP objectives, namely:

- Kirrawee Station is within easy walking distance;
- Bus routes operate directly past the site;
- There are well developed or planned pedestrian and cyclist networks in the area;
- There is an established commercial area to which access can be enhanced and which offers potential for shared trip making; and
- A well designed mixed-use development with a significant residential component built near a railway station is highly consistent with good Transit Oriented Development planning principles.

4.3 Environmental Transport Measures

The primary targets for site access will be:

- Car parking to be appropriate for needs but limited to the minimum necessary;
- Suitable bicycle and motorcycle parking and facilities to be provided;
- Good paths to transport modes to be provided;
- Cycle connections to be provided to existing and future cycle routes;
- Safety – access by road and by public transport, walking and cycling will be as safe and efficient as possible;
- Transport Access Guide – preparation and maintenance guides for staff and for patrons will be a priority; and
- Freight – deliveries will be well managed, entirely within the site.

5 Travel Characteristics and Forecast Growth

5.1 Sutherland Travel Characteristics

Table 5-1a and **5-1b** provide Census Journey to Work statistics for the Sutherland Shire as a whole and for the Kirrawee local area. **Table 5-1a** covers the home end (i.e. residents who live in Sutherland Shire) and **Table 5-1b** covers the work end (i.e. persons who work in Sutherland Shire).

Table 5-1a indicates that whilst 60% of persons drive to work from the whole of Sutherland Shire, only 54% of persons drive to work from the vicinity of Kirrawee station.

Table 5-1b on the other hand 62% of persons drove to work in Sutherland shire as a whole but while 65% drove to work in the vicinity of the station. This difference is largely explained by a greater number of persons working at home throughout the Shire than in Kirrawee.

The census statistics emphasize the importance of locating homes near to railway stations and public transport nodes. They also emphasize the relatively high use of private vehicles and the desirability of implementing Transit Oriented Development as a means of reducing this dependency within Sutherland Shire.

Table 5-1a – 2006 Census Journey to Work from Statistics

	To Work From				
MainMode	Sutherland Shire Total Total	Sutherland Council Depot TZ_766	Kirrawee Industrial Area TZ_769	Kirrawee Station TZ_775	Kirrawee Suburb Total Total
Bicycle	0%	1%	0%	0%	**0%**
Bus	0%	1%	1%	0%	**0%**
Car as driver	60%	60%	51%	54%	**56%**
Car as passenger	4%	5%	4%	5%	**5%**
Did not go to work	12%	12%	16%	12%	**12%**
Ferry	0%	0%	0%	0%	**0%**
Motorbike/scooter	0%	0%	0%	0%	**0%**
Not stated	2%	1%	0%	2%	**1%**
Taxi	0%	0%	1%	0%	**0%**
Train	13%	12%	16%	18%	**16%**
Tram	0%	0%	0%	0%	**0%**
Truck	1%	2%	2%	2%	**2%**
Walked only	2%	2%	3%	3%	**3%**
Worked at home	4%	4%	6%	3%	**4%**
Other	0%	0%	0%	0%	**0%**
Total	**100%**	**100%**	**100%**	**100%**	**100%**

Table 5-1b – 2006 Census Journey to Work in Statistics

	To Work In				
MainMode	Sutherland Shire Total Total	Sutherland Council Depot TZ_766	Kirrawee Industrial Area TZ_769	Kirrawee Station TZ_775	Kirrawee Suburb Total Total
Bicycle	1%	1%	1%	0%	**1%**
Bus	1%	1%	0%	0%	**0%**
Car as driver	62%	75%	72%	65%	**71%**
Car as passenger	6%	6%	6%	5%	**6%**
Did not go to work	14%	5%	8%	11%	**8%**
Ferry	0%	0%	0%	0%	**0%**
Motorbike/scooter	0%	0%	1%	1%	**1%**
Not stated	1%	1%	1%	1%	**1%**
Taxi	0%	0%	0%	1%	**0%**
Train	4%	2%	5%	5%	**4%**
Tram	0%	0%	0%	0%	**0%**
Truck	1%	3%	2%	2%	**2%**
Walked only	4%	2%	2%	5%	**2%**
Worked at home	7%	4%	1%	5%	**3%**
Other	0%	0%	0%	0%	**0%**
Total	**100%**	**100%**	**100%**	**100%**	**100%**

5.2 Mode Share

To estimate indicative shopper travel modes for the centre, previous RTA surveys of shopper travel behaviours at Miranda and Kareela Shopping Centres were compared and from this an estimate was made for the Kirrawee proposal. This is provided in **Table 5-2**.

Table 5-2 – Comparative Shopping Centre Travel Modes

Mode	Miranda	Kareela	Kirrawee Estimate
Car Drivers	69%	84%	72%
Car Passengers	5%	7%	5.5%
Walk	10%	9%	10%
Bus	6%	0%	5%
Dropped Off	N/A	N/A	1%
Bicycle	0%	0%	1%
Taxi	1%	0%	0.5%
Train	9%	0%	5%
TOTAL	**100%**	**100%**	**100%**

As would be expected in Sutherland, most shopper visits would be made by car. However a significant number would be made by walking and public transport. It is therefore important to foster these modes.

5.3 Population Growth

The most recent projections of population growth by the state at SLA level were published in 2010. A summary of existing and DoP projected future population is presented in **Table 5-3**.

Table 5-3 – Comparison of projections of population, from 2006 to 2021

	Population - 2006	Population - 2026	Population - 2036
2010 Projections			
Sutherland LGA[1]	212,520	229,800	238,500

Thus population is expected to grow at a moderate linear rate of about 0.4 percent per annum.

[1] Sydney LGA is aggregation of SLAs 7201, 7203 and 7205

6 Existing Transport Situation

6.1 Road Network

6.1.1 Road Network Description

The roads in the area are briefly described below.

Princes Highway is an RTA State Road. Princes Highway, in conjunction with **Acacia Road North**, provides the main north-south arterial corridor through Sutherland Shire linking it with Sydney City in the north and Wollongong is the south.

In the vicinity of the Brick Pit site, Princes Highway is a six-lane divided road consisting of three traffic lanes in each direction separated by a raised concrete median. The designated speed limit is 70 km/h. Parking is generally prohibited on both sides of Princes Highway.

In conjunction with **Old Princes Highway** in the west and **Kingsway** in the east, Princes Highway also forms part of one of two west-east sub-arterial routes through Sutherland Shire. This route links Kirrawee with Sutherland town centre in the west and Gymea, Miranda, Caringbah, Woolooware and eventually Cronulla in the east.

President Avenue is an RTA Regional Road. President Avenue provides the second west-east sub-arterial corridor through Sutherland Shire. Running generally parallel to Kingsway, President Avenue also links Kirrawee with Sutherland town in the west and Cronulla in the east.

In the vicinity of Kirrawee, President Avenue is a four-lane divided road consisting of two traffic lanes in each direction separated by a raised concrete median. The designated speed limit is 60 km/h. Parking is generally prohibited on both sides of President Avenue.

Oak Road runs north-south along the eastern boundary of the brick-pit site and intersects with **Flora Street**, which runs east-west along the southern boundary of the site. Both are local unclassified roads performing the function of a sub-arterial or busy

collector route. The designated speed limit for both is 50 km/h and on-street car parking is permitted along certain sections.

Kirrawee town centre consists of a strip of retail/commercial development that runs either side of Oak Road for a section of about 100 metres in length, from the existing roundabout intersection with Flora Street in the north, to the Kirrawee train station in the south. Raised pedestrian zebra-crossings are located across Oak Road at either end of the town centre strip.

6.1.2 Study Network and Existing Traffic Volumes

The following intersections have been assessed on the basis that they constitute the significant intersections within the surrounding network:

- Princes Highway with Kingsway;
- Princes Highway with Oak Road;
- Princes Highway with Acacia Road North;
- Oak Road with Flora Street; and
- Oak Road with President Avenue.

The network reflected by these principal intersections accords with the extensive work carried out by the Proponent, Council and the RTA on previous DAs for the Brick Pit site. In particular, the network accords with the network agreed to and assessed as part of the 2008/09 Land & Environment Court proceedings.

In June 2010, traffic counts were undertaken at seven locations; the five intersections listed above and the following two additional intersections:

- Bath Road South with Durbar Avenue; and
- Bath Road South with Clements Parade, e.g. the intersection with Flora Street.

The surveys were conducted over a Thursday morning and evening period and on a Saturday midday period. The results indicated that the busiest peak hours were:

- 8.00-9.00am on a Thursday morning;
- 4.45-5.45pm on a Thursday evening; and
- 11.45am-12.45pm at midday Saturday.

The peak hour results of the 2010 surveys are presented on **Figures 2** and **3** for the Thursday morning and evening peak periods respectively; **Figure 4** presents the Saturday midday peak hour flows. The following **Table 6-1** presents two-way flows for links on the local road network.

Table 6-1 – Existing Two-Way Peak Hour Traffic Volumes (vph)

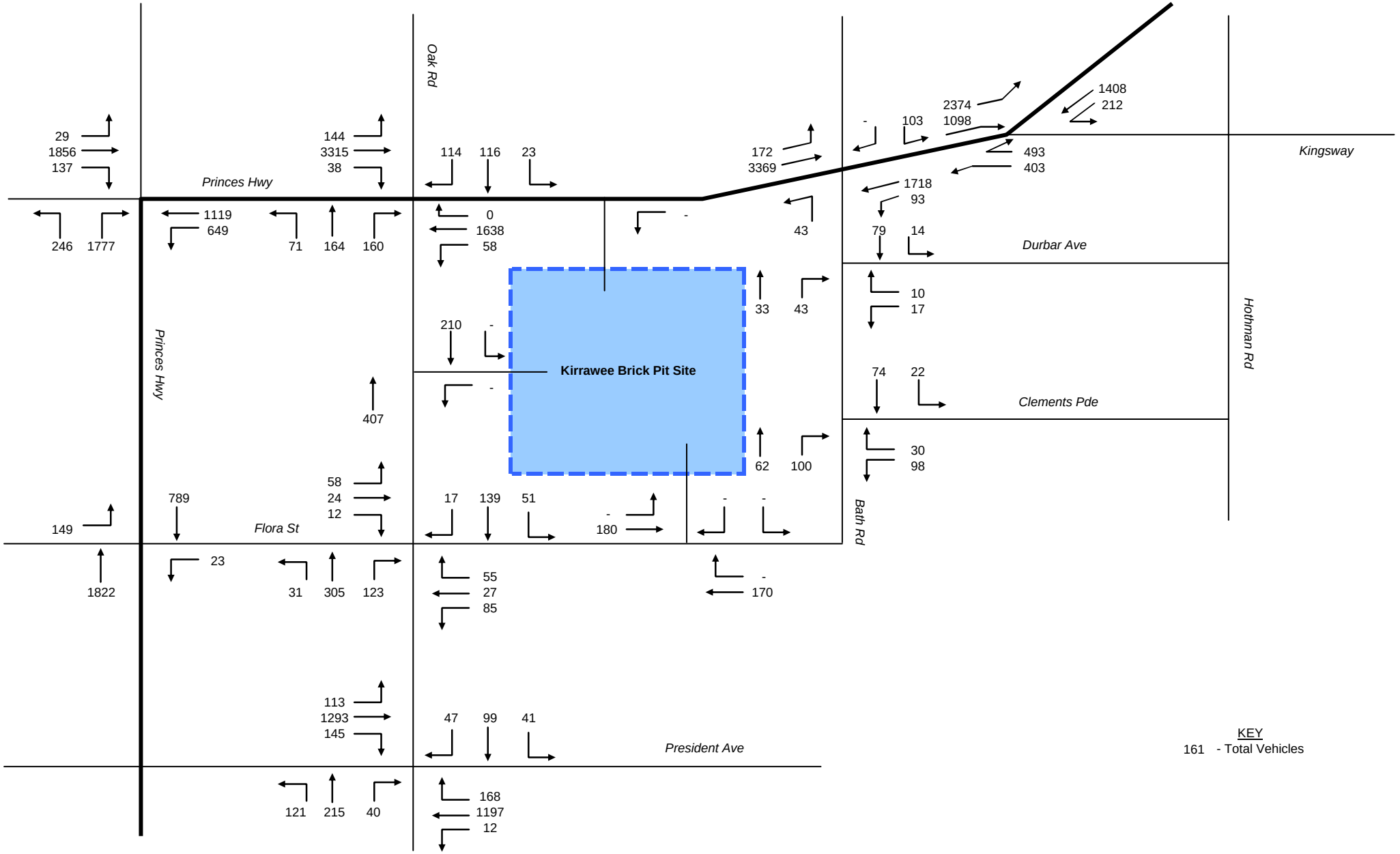
Link	Location	Thursday Morning	Thursday Evening	Saturday Midday
Princes Hwy	North of Kingsway	4487	5300	5006
Kingsway	East of Princes Hwy	2143	2452	2466
Princes Hwy	Between Bath Rd & Kingsway	5283	6336	6005
Princes Hwy	West of Bath Rd	5302	6153	5822
Princes Hwy	East of Oak Rd	5194	5824	5904
Princes Hwy	Between Acacia Rd Nth & Oak Rd	5361	6041	6080
Old Princes Hwy	West of Acacia Rd	3387	3739	3849
Acacia Rd Nth	Between Princes Hwy & Flora St	2784	3246	3216
Acacia Rd Nth	South of Flora St	2694	3106	3092
Oak Rd	North of Princes Hwy	561	511	626
Oak Rd	South of Princes Hwy	612	544	672
Oak Rd	North of Flora St	621	561	675
Oak Rd	Between Flora St & President Av	683	733	751
Oak Rd	South of President Av	632	508	564
Flora St	Between Acacia Rd Nth & Oak Rd	96	194	143
Flora St	East of Oak Rd	357	536	368
President Av	West of Oak Rd	3046	3070	2818
President Av	East of Oak Rd	2751	2977	2815
Clements Pde	East of Bath Rd	250	383	212

The traffic counts revealed the following:

- The Princes Highway/Acacia Road North route is a significant north-south arterial route that runs through Sutherland Shire. As such, it carries peak hour traffic flows in the region of 5,000-6,000 vehicles per hour (vph).
- Of the two west-east sub-arterial routes, President Avenue is the busiest with peak hour traffic flows in the region of 2,700-3,000 vph. The other sub-arterial route of Kingsway caries marginally less traffic with peak hour traffic flows in the order of 2,100-2,500 vph; and

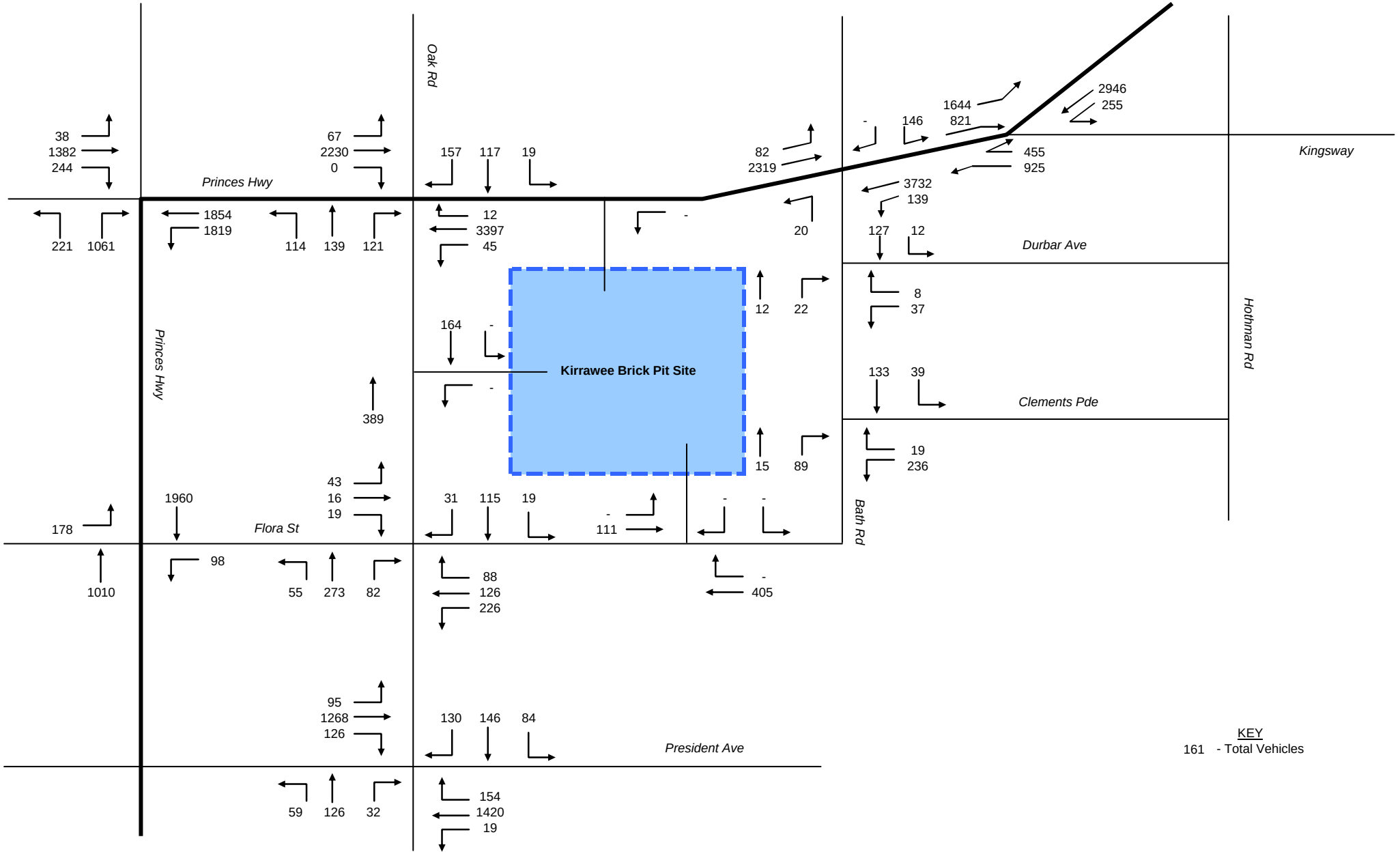
2010 Surveyed, Existing Network Traffic Flows, Morning Peak

KIRRAWEE BRICK PIT TMAP



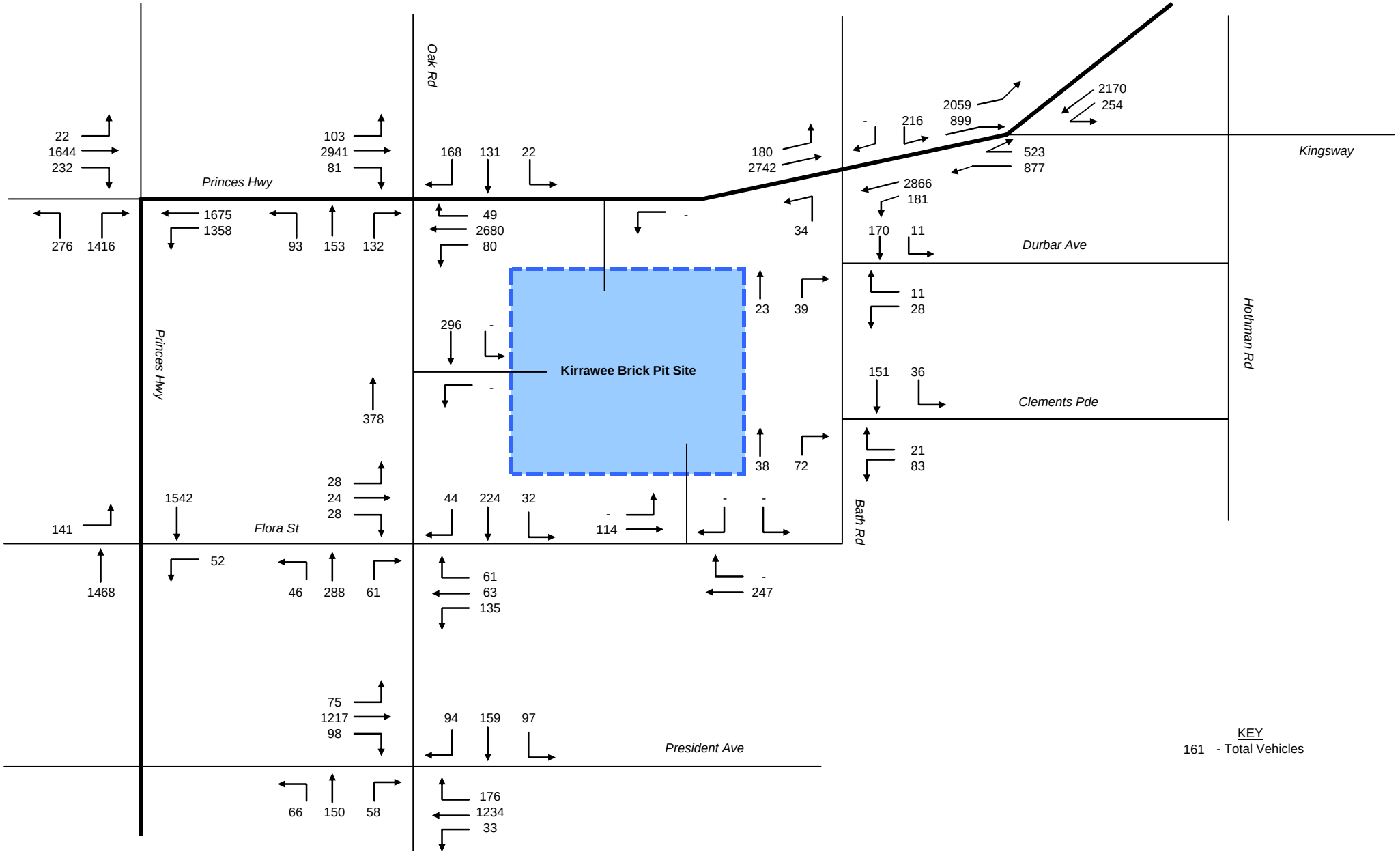
2010 Surveyed, Existing Network Traffic Flows, Evening Peak

KIRRAWEE BRICK PIT TMAP



2010 Surveyed, Existing Network Traffic Flows, Saturday Peak

KIRRAWEE BRICK PIT TMAP



- The local roads of Oak Road and Flora Street carry significantly lower levels of traffic with peak hour volumes in the 500-800 vph range for Oak Road and the 100-600 range for Flora Street.

6.1.3 Existing Intersection Performance

The five main intersections of the study network have been analysed using SIDRA 5.0 Intersection software to determine the existing level of intersection performance. SIDRA determines the average delay that vehicles encounter, the degree of saturation of the intersection and the corresponding level of service (LoS). The degree of saturation is the ratio of the arrival rate of vehicles to the capacity of the approach.

SIDRA provides analysis of the operating conditions which can be compared to the performance criteria set out in **Table 6-2**.

Table 6-2 – Level of Service Criteria

Level of Service	Average Delay per Vehicle (secs/veh)	Signals & Roundabouts	Give Way & Stop Signs
A	less than 14	Good operation	Good operation
B	15 to 28	Good with acceptable delays & spare capacity	Acceptable delays & Spare capacity
C	29 to 42	Satisfactory	Satisfactory, but accident study required
D	43 to 56	Operating near capacity	Near capacity & accident study required
E	57 to 70	At capacity; at signals, incidents will cause excessive delays Roundabouts require other control mode	At capacity, requires other control mode
F	> 70	Extra capacity required	Extreme delay, traffic signals or other major treatment required

Adapted from RTA Guide to Traffic Generating Developments, 2002.

The results of the analysis are provided in the following **Table 6-3**.

Table 6-3 – Existing Peak Hour Intersection Operation

Intersection	Control	Thu. Morning		Thu. Evening		Sat. Midday	
		Av. Del	LoS	Av. Del	LoS	Av. Del	LoS
Princes Hwy / Kingsway	Signals	20	B	38	C	25	B
Princes Hwy / Oak Rd	Signals	52	D	31	C	45	D
Princes Hwy / Acacia Rd Nth	Signals	32	C	23	B	41	D
Oak Rd / Flora St	Roundabout	7	A	7	A	7	A
Oak Rd / President Av	Signals	23	B	22	B	23	B

Average Delay is for the worst movement at priority intersections and roundabouts

The results in Table 6-3 show that the intersections within the study network currently operate at a satisfactory level. It is however noted that peak period traffic levels on the Princes Highway are high and that a small upset can lead to extensive delays. At times there is tail back queuing interference from one intersection to the next.

6.1.4 Princes Highway Intersections

As discussed below, it was previously suggested that the Bath Road / Princes Highway Road intersection be signalised because of apprehended concerns that the new Bunnings store (corner of Bath Road and Monro Avenue) would elevate background traffic levels such that in combination with any new development on the subject site there would be operational problems at the Princes Highway / Oak Road intersection.

As the Bunnings store is now completed it is relevant to compare before and after Bunnings traffic flows at the Oak Road intersection. The most relevant times for comparison in relation to the proposed development are before and after traffic movements, at this intersection.

Accordingly, **Table 6-4** presents the previous counts, (which supported the earlier DA and were conducted late July 2007) and the new counts, which were conducted in June 2010.

Table 6-4 – Comparison of Before and After Bunnings Traffic Count.

Oak Road / Princes Hwy Intersection	AM Peak Previous	AM Peak Present	PM Peak Previous	PM Peak Present
R out of Oak N	114	114	195	157
T out of Oak N	94	116	141	117
L out of Oak N	18	23	15	19
L into Oak N	153	144	41	67
R into Oak N	0	0	12	12
R out of Oak S	174	160	129	114
T out of Oak S	154	164	130	139
L out of Oak S	77	71	122	121
R into Oak S	34	38	0	0
L into Oak S	48	58	48	45
Total	**866**	**888**	**833**	**791**

Table 6-4 indicates that overall the Bunnings store has not lead to the traffic increases through the Oak Road / Princes Highway intersection that were previously apprehended.

6.2 Public Transport

6.2.1 Rail Services

The subject site is located approximately 150m (walking distance) from Kirrawee train station, on the Eastern Suburbs & Illawarra Line. Kirrawee station provides direct services to the Redfern, Central, Town Hall and Bondi Junction train stations. At Central Station connections are available to other services on the CityRail Network as well as to Intercity train services.

The brick pit site is also located approximately 1.4km from Sutherland train station, the next citybound stop past Kirrawee train station. Sutherland station is a stop on the South Coast Intercity train line. **Table 6-5** summarises the peak hour train frequencies for these two stations.

Table 6-5 – Train Frequencies

	To City	From City	Total
Kirrawee Station via Eastern suburbs & Illawarra line			
Morning Peak Hour (7-8AM)	5	3	8
Off Peak Hour	2	2	4
Afternoon Peak Hour (5-6PM)	4	4	8
Sutherland Station via Eastern suburbs & Illawarra and South Coast lines			
Morning Peak Hour (7-8AM)	13	8	21
Off Peak Hour	7	7	14
Afternoon Peak Hour (5-6PM)	8	11	19

During peak commuting periods, the service frequency of a train to/from the city at Kirrawee station is about one in every 15 minutes. The off peak service frequency is one in every 30 minutes. As can be seen, Sutherland station provides significantly more train services with about 20 trains stopping at this station during each of the commuter peak hours.

However, a new train timetable is to be launched in October 2010 for the Eastern Suburbs & Illawarra Line. As a result of the recently completed $436 million Cronulla Branch Line Duplication and Sutherland Resignalling Project, CityRail has indicated that the final timetable will provide more services between Cronulla and the City (via Kirrawee) during peak, off-peak and weekends, including express services in the morning peak and more frequent services to Bondi Junction at the weekend.

6.2.2 Bus Services

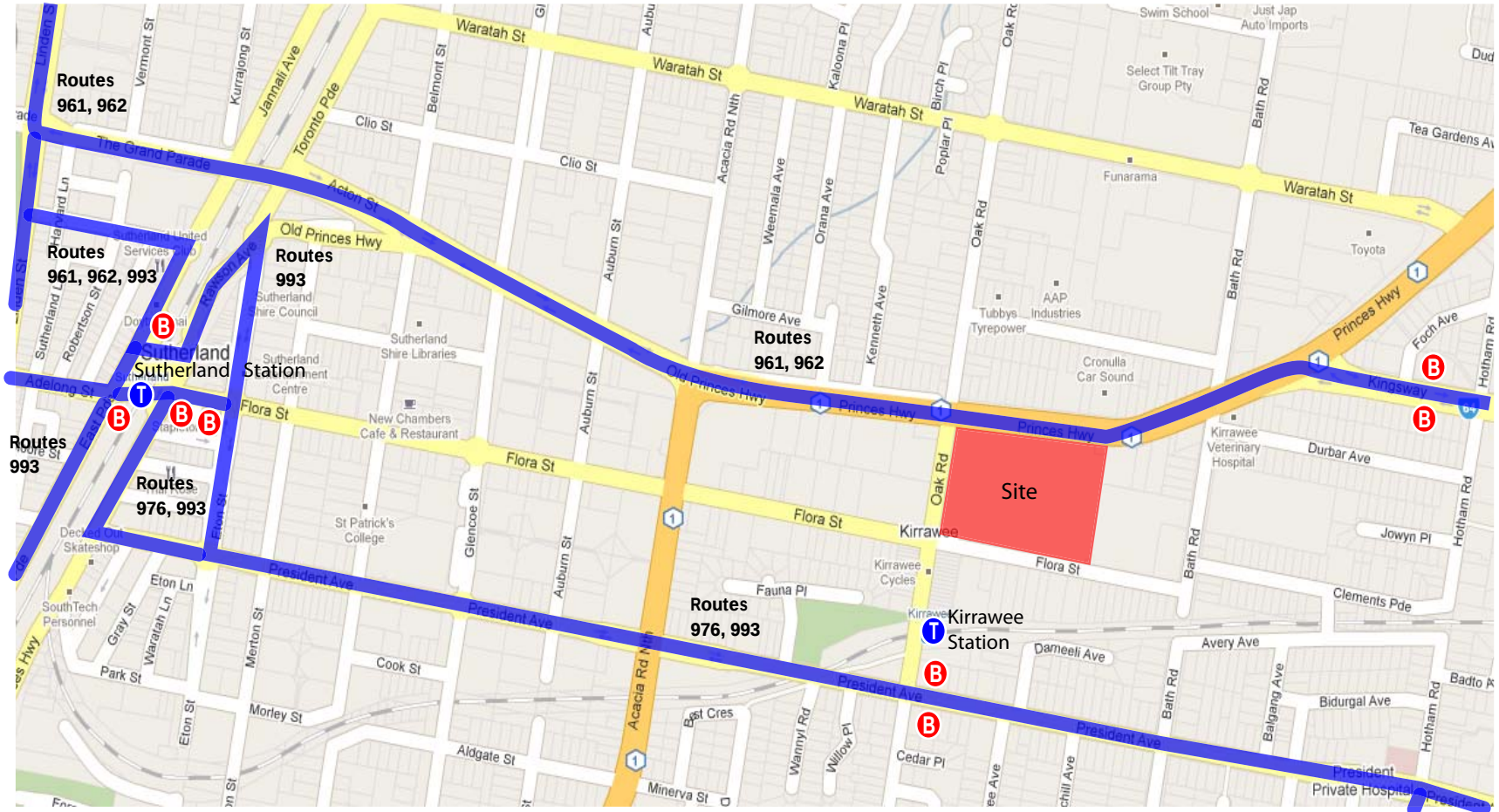
Kirrawee is located in 'Region 10' and is serviced by Veolia Transport NSW. Routes servicing this area are:

- 961 Miranda – Barden Ridge;
- 962 Cronulla – Bankstown;
- 976 Sutherland – Grays Point;
- 989 Maianbar – Bundeena; and
- 993 Woronora Heights – Miranda.

Figure 5 indicates the bus routes in the immediate vicinity of the brick pit site and the closest bus stops. The frequencies of these services are also summarised in **Table 6-6**.

EXISTING BUS ROUTES AND BUS STOPS

KIRRAWEE BRICK PIT TMAP



Key

961 Miranda to Barden Ridge
962 Cronulla to Bankstown
993 Woronora Heights to Miranda
976 Sutherland to Grays Point

Key

- Bus Routes
- B Bus Stops
- T Train Station

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Figure 5

Filename: CTLRLQdi02.ai

Date: 18 October 2010

Table 6-6 – Bus Frequencies

Route Number	via	Weekday			Saturday	Sunday
		AM Peak Hr	Off-Peak Hr	PM Peak Hr		
961/962	Princes Hwy	4-5	4	4-5	4	2
976	President Ave	2-3	-	2	-	-
989	Princes Hwy	Only limited services				
993	President Ave	1-2	1	1-2	1	-

From Table 6-6 it can be seen that the area is well serviced by buses along Princes Highway between Miranda and Sutherland during the weekday peak and off-peak periods. The frequency of buses during the Saturday is about one every 15 minutes and one every 30 minutes on Sundays and public holidays.

6.3 Pedestrians and Cyclists

Surrounding the site, pedestrian footpaths are provided on both sides of Princes Highway and Oak Road and along the southern side of Flora Street.

Footpaths in the Kirrawee area vary in quality and width and generally all local roads provide footpaths on at least one side of the road, if not both sides.

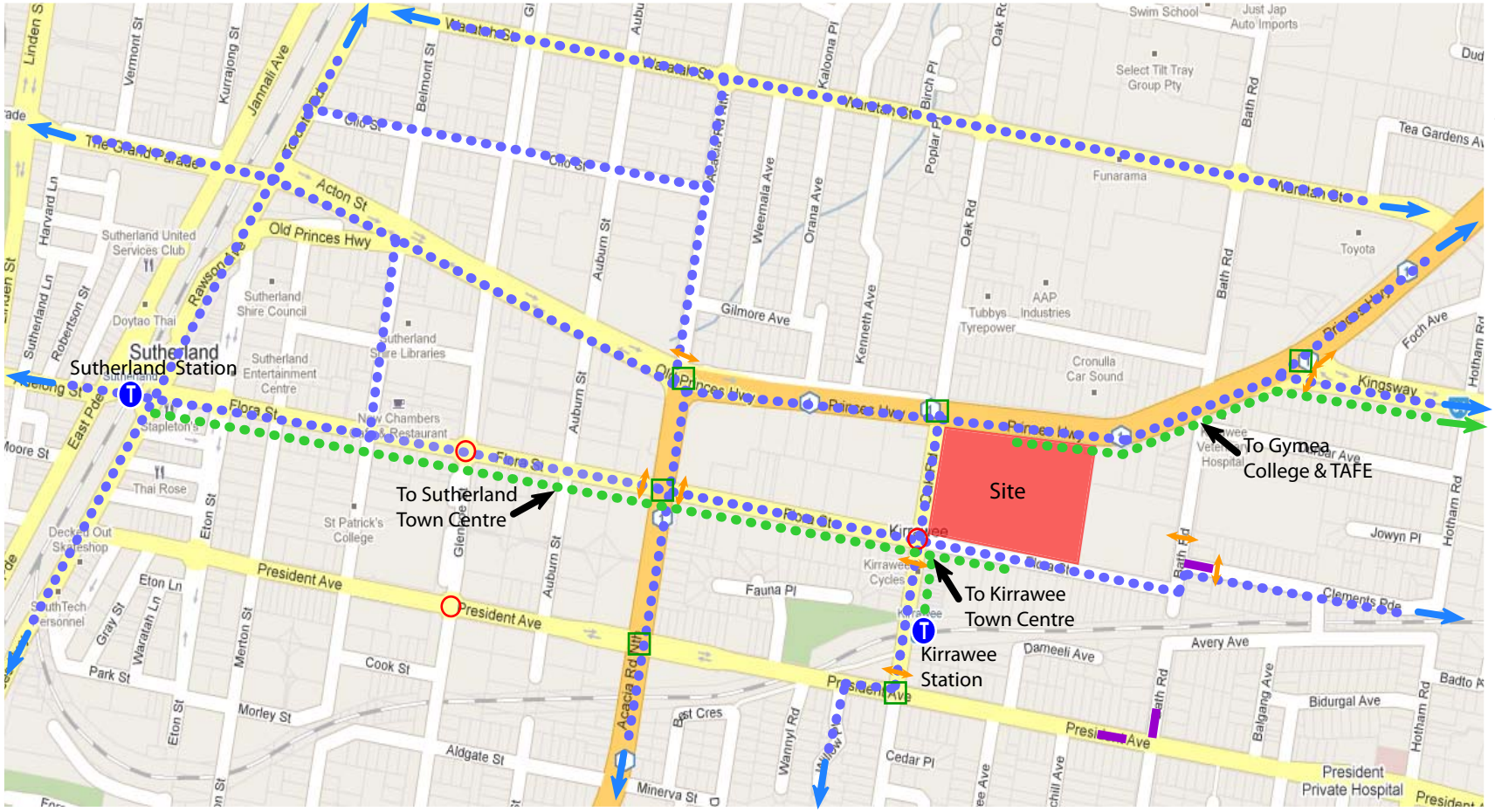
Figure 6 identifies three significant pedestrian routes from the site which provide access to the following:

- Gymea College and South Sydney Institute of TAFE in the northeast;
- Kirrawee town centre and train station in the south; and
- Sutherland town centre and train station in the west.

Figure 6 also shows bicycle routes surrounding the site. These routes form part of a network that connects Sutherland in the west with Cronulla in the east and all suburbs between. The network also extends to the Botany Bay cycleway which links to other parts of Sydney.

EXISTING BICYCLE, PEDESTRIAN FACILITIES AND WALKING ROUTES

KIRRAWEE BRICK PIT TMAP



Key

- Roundabout
- Signals
- Pedestrian Crossing
- Traffic Island/Refuge
- Main Walking Route
- Bicycle Route
- Train Station
- Connections to wider bicycle networks

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Figure 6

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Date: 18 October 2010

7 Proposed Transport Improvements

7.1 Future Road Improvements

The road improvement schemes set out in this section were developed on the basis of capacity analysis of the existing traffic flows and of likely traffic increases that would arise from the proposed expansion of the centre.

Consideration was also given to the work that had previously been carried out for the earlier application for the site. In particular, the RTA has on previous occasions set out two stages of improvements to local road infrastructure that they considered necessary for development of the site.

7.2 Stage 1 RTA Requirements

7.2.1 Intersection of Princes Highway with Oak Road

The proposed improvement scheme for the existing signalised intersection of Princes Highway with Oak Road consists of the following:

- Three northbound lanes on Oak Road on the southern leg of the intersection with each lane a minimum of 90 metres in length;
- An 80 metre long left turn slip lane on the westbound carriageway of Princes Highway into Oak Road;
- One southbound lane on Oak Road on the southern leg of the intersection; and
- A raised 900mm wide central concrete median island on Oak Road in front of the proposed left-in, left-out driveway with the median extending from the stop line at the Princes Highway intersection to an appropriate point to the south of the proposed driveway.

This is set out in the letter from the RTA to Sutherland Council which is provided in **Appendix B** of the report.

7.2.2 Intersection of Oak Road with Flora Street

To facilitate pedestrian movements the existing roundabout at this intersection to be replaced by traffic signals.

7.2.3 Entry Deceleration lane on Princes Highway

This to have a minimum length of 60m and be designed in accordance with the RTA Road Design Guide.

7.2.4 Road Safety Audit

A road safety audit is required in the design stage to ensure that a safe separation would be provided between the left in driveway on Oak Drive and the Oak Drive / Princes Highway intersection.

7.3 Stage 2 RTA Requirements

7.3.1 Background

These were required to cover increased traffic generation that would have arisen in later stages of the previous scheme when a supermarket was added. A major motivation for these was that a new Bunnings store had been approved for Bath Road in the industrial area on the northern side of the Princes Highway. Concerns were held that traffic from this in combination with traffic from the proposed development would overload the intersection of Oak Road with Princes Highway.

As the Bunnings store is now complete, its traffic generation was taken into account in the fresh traffic surveys for the proposed development. This allowed the effect of the proposed development on the road network without the Stage 2 improvements to be reconsidered. This aspect is discussed further below; the Stage 2 improvements were as follows:

7.3.2 Intersection of Princes Highway and Oak Road

Reconfiguration of the intersection through a half closure of the Oak Road northern approach to the Princes Highway involving discontinuation of the south bound lanes with the northbound lanes remaining open.

7.3.3 Intersection of Princes Highway and Bath Road

Traffic signals to be provided at this intersection associated with the northern closure of Oak Road at the Princes Highway.

The intersection would incorporate:

- Left in/left out only for Bath Road southern approach, left turn out to be signalised;
- No movements across Princes Highway (i.e. no north-south traffic from Bath Road);
- Signalised left in/right turn & out of Bath Road northern approach with a double right turn lane; and
- No right turns permitted from Princes Highway from either direction to Bath Road.

In essence the Stage 2 works would transfer right and left turn from the northern approach of Oak Road into Princes Highway to Bath Road. Direct southbound crossing movements over the highway would no longer be allowed. Instead vehicles wishing to make such a crossing would need to turn right from Bath Road on to the Princes Highway and then left turn into Oak Road.

As a result of the more intensive use of Bath Road that would result from the Oak Road works, Sutherland Council has expressed concern that the operation of the intersection of Oak Road with Waratah Street in the industrial area may be adversely affected. This aspect is also discussed further in **Section 8.6**.

8 Road Network and Parking Implications

8.1 The Proposal

As indicated above, the proposed development mix is as follows:

• Supermarkets	(5,270m^2 GFA)	5,270m^2	GLA
• Mini Major	(1,280m^2 GFA)	1,280m^2	GLA
• Specialty Shops	(2,940m^2 GFA)	2,940m^2	GLA
• Retail Showrooms	(2,930m^2 GFA)	2,930m^2	GLA
• Commercial/Office	(840m^2 GFA)	840m^2	GFA
• Residential Apartments		450	Units
• Internal Mall area etc	(1,820m^2 GFA)		
• Toilets/Centre Management	(230m^2 GFA)		

The breakdown of apartments is as follows:

- One Bedroom 49
- Two Bedroom 267
- Three Bedroom 134

8.2 Traffic Generation

Based on RTA guidelines the 12,420m^2 GLA of retail space on the development would generate the following traffic generation.

- Thursday evening 12,420m^2 @ 7.6 veh/hr/100m^2 = 944 veh/hr
- Saturday 12,420m^2 @ 7.5 veh/hr/100m^2 = 932 veh/hr

Weekday morning retail traffic generation would typically be about 30% of the Thursday evening traffic generation i.e. 283 veh/hr.

Office traffic generation would be:

- Weekday AM and PM peak hrs 840m^2 @ 2 veh/hr/100m^2 = 17 veh/hr
- Saturday – not operational = 0 veh/hr

Residential traffic generation would be:

- Weekday AM and PM peak hr 450 units @ 0.29/veh/hr/unit = 131 veh/hr
- Saturday – no RTA specified rate but assume the same = 131 veh/hr

Adding these all up the combined traffic generation at different times would be:

- Thursday evening peak hour = 1,092 veh/hr
- Saturday peak hour = 1,063 veh/hr
- Weekday morning peak hour = 431 veh/hr

200 commuter parking spaces would potentially increase the weekday morning and evening trip generation by around 80 vehicles per hour. On a Saturday there would be minimal commuter traffic impact.

8.3 Vehicular Access

Vehicular access is proposed as follows:

- Left in via a westbound deceleration lane off the Princes Highway;
- Left in/left out to Oak Road; and
- Left and right in and out of Flora Street.

Service vehicles would enter via the Princes Highway driveway and exit via the Flora Street driveway.

8.4 Future Traffic Flows

Future traffic flows were estimated by adding the additional traffic that would be generated by the centre on to the surveyed existing traffic flows. The distribution of the additional traffic was based on the traffic distribution assessed for the previous scheme as assessed and separately acknowledged by the RTA and Council's consultant traffic engineer.

In summary the expected traffic distribution for the Thursday evening was as shown in the following **Table 8-1**.

Table 8-1 – Assumed Thursday Evening Traffic Distribution

Origin / Destination	Arrive	Depart
Old Princes Highway (West)	0%	11%
Oak Road (North)	22%	14%
Princes Highway (North)	34%	11%
Kingsway (East)	5%	4%
Clements Parade (East)	10%	10%
President Avenue (East)	13%	12%
Oak Road (South)	6%	7%
President Ave (West)	10%	11%
Princes Highway (South)	0%	20%

Traffic distributions for other periods were similar with slight variations.

The forecast future traffic flows are presented on **Figures 7**, **8** and **9** for the Thursday morning, Thursday evening and Saturday peak periods respectively. It is noted that the forecast traffic flows do not make the normal RTA suggested 20% reduction in generated traffic to account for the fact that a significant amount of traffic generated by a new shopping centre is diverted from traffic that would have passed the site anyway.

This safety factor counters two other traffic effects that have a bearing on the application. These are:

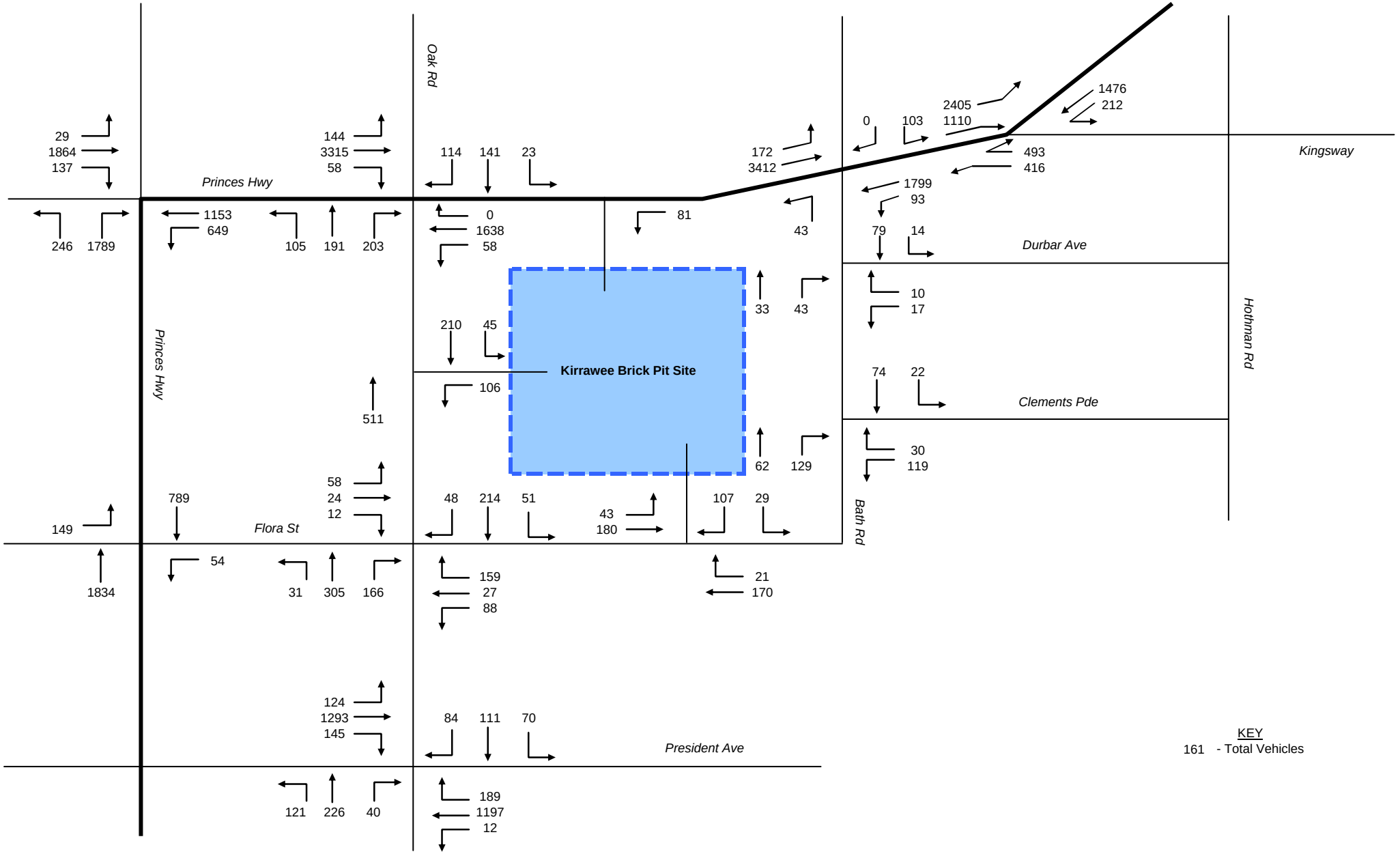
1. Commuter car park traffic generation has not been separately accounted for; and
2. There is a possibility that at times the assignment of the traffic distribution could differ from that previously assessed.

In relation to the first point, commuter traffic would potentially comprise about 6 or 7% of the forecast evening peak traffic generation and therefore is easily accommodated by the conservative traffic forecasts for the centre outlined above. In addition most likely commuters would at times be shoppers as well.

In relation to the second point, even allowing for commuter traffic, there is sufficient conservativeness in the traffic analysis to overcome the effects of any variation in the traffic distribution from time to time.

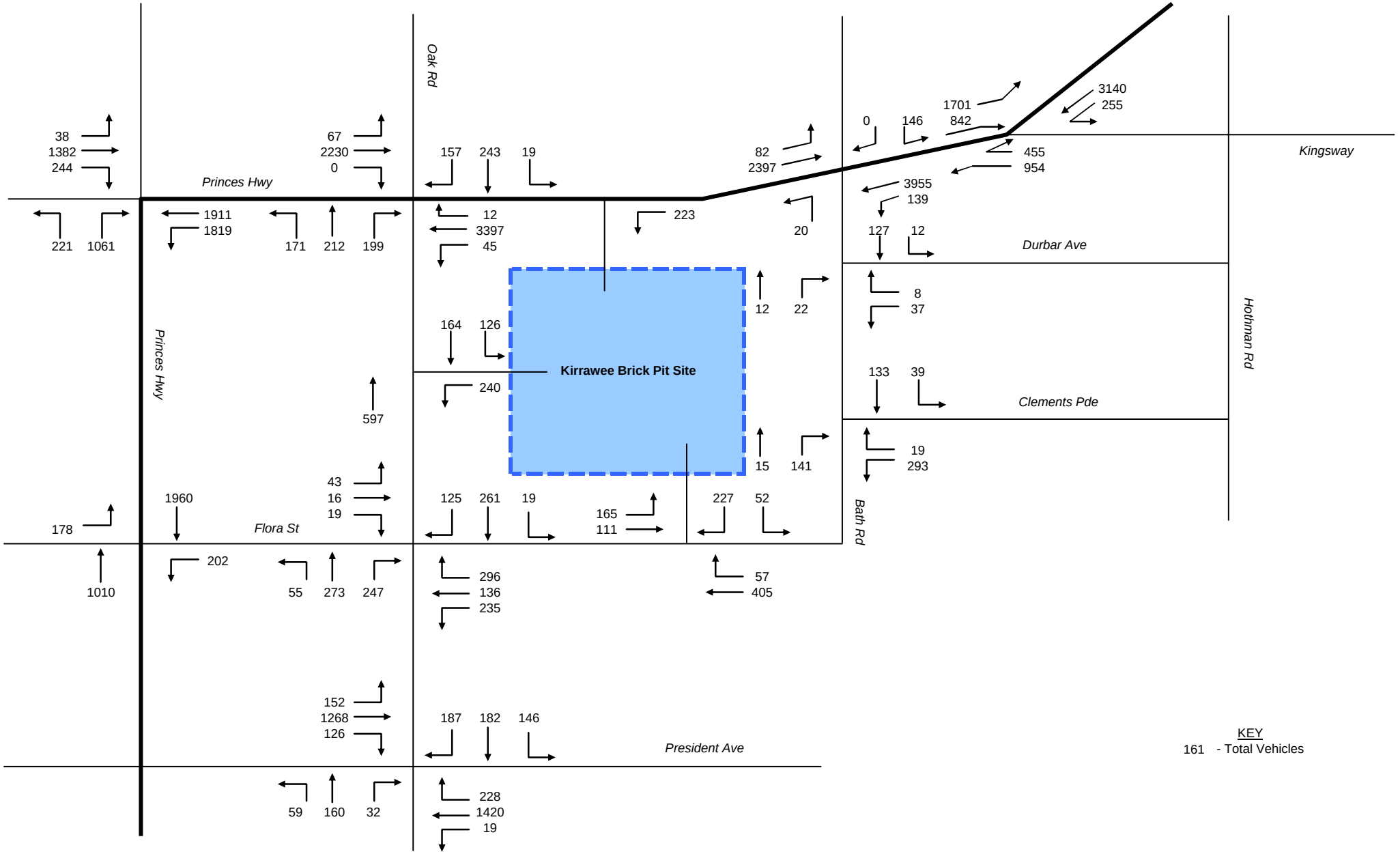
Future (with Development) Network Traffic Flows, Morning Peak

KIRRAWEE BRICK PIT TMAP



Future (with Development) Network Traffic Flows, Evening Peak

KIRRAWEE BRICK PIT TMAP



KEY

161 - Total Vehicles

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Figure 8

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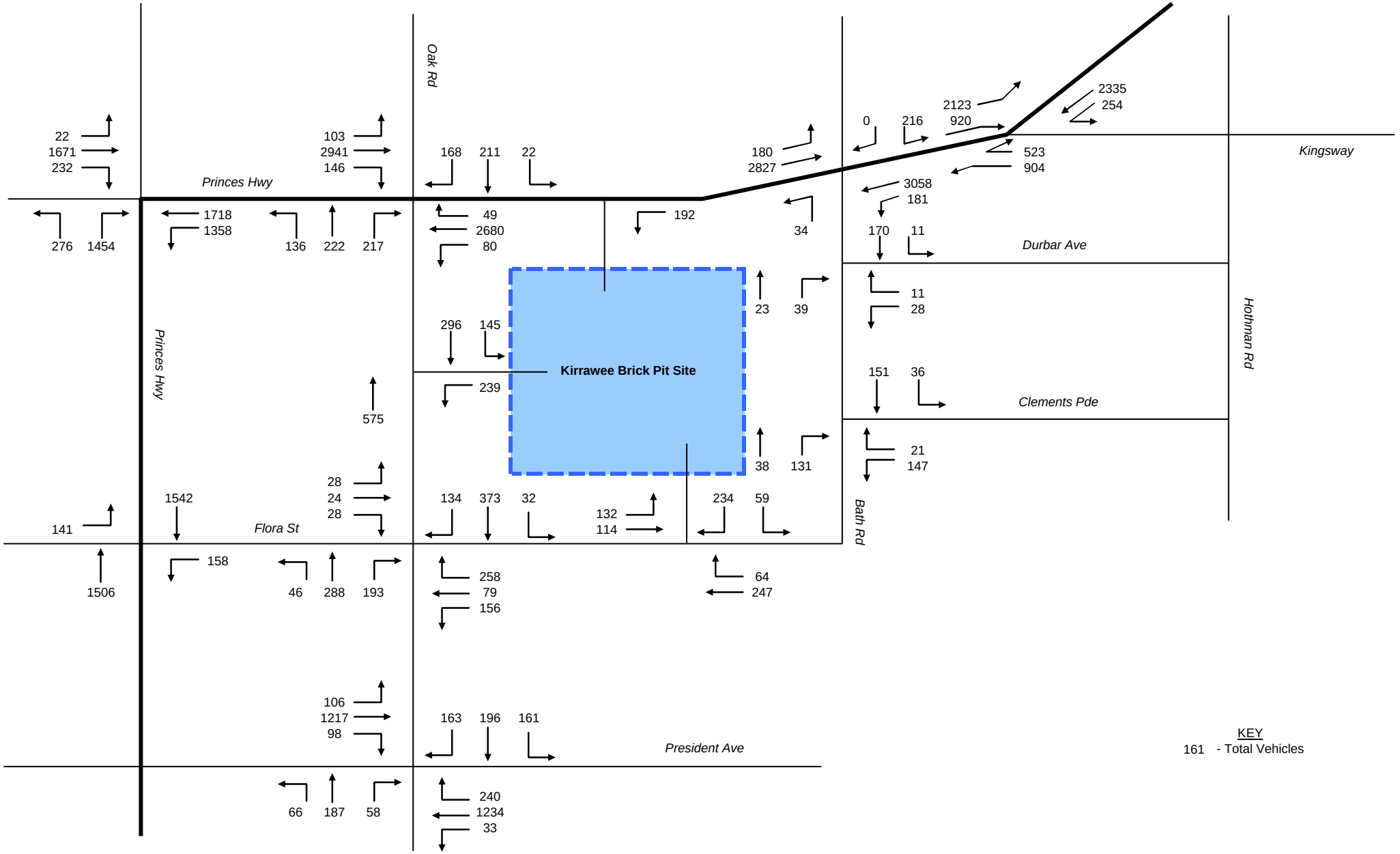
Future (with Development) Network Traffic Flows, Saturday Peak

KIRRAWEE BRICK PIT TMAP



8.5 Link Flows Analysis

Table 8-2 compares existing and future traffic flows for links on the local road network.

Table 8-2 – Comparison of Existing and Future Two-Way Peak Hour Traffic Volumes (vph)

Link	Location	Thursday AM		Thursday PM		Saturday	
		Existing	Future	Existing	Future	Existing	Future
Princes Hwy	North of Kingsway	4487	4586	5300	5551	5006	5235
Kingsway	East of Princes Hwy	2143	2168	2452	2502	2466	2514
Princes Hwy	Between Bath Rd & Kingsway	5283	5407	6336	6637	6005	6282
Princes Hwy	West of Bath Rd	5302	5426	6153	6454	5822	6099
Princes Hwy	East of Oak Rd	5194	5237	5824	5902	5904	5989
Princes Hwy	Between Acacia Rd Nth & Oak Rd	5361	5415	6041	6098	6080	6188
Old Princes Hwy	West of Acacia Rd	3387	3429	3739	3796	3849	3919
Acacia Rd Nth	Between Princes Hwy & Flora St	2784	2796	3246	3246	3216	3254
Acacia Rd Nth	South of Flora St	2694	2737	3106	3210	3092	3236
Oak Rd	North of Princes Hwy	561	613	511	710	626	775
Oak Rd	South of Princes Hwy	612	761	544	878	672	1014
Oak Rd	North of Flora St	621	831	561	1009	675	1111
Oak Rd	Between Flora St & President Av	689	810	753	1073	767	1069
Oak Rd	South of President Av	632	655	508	578	564	638
Flora St	Between Acacia Rd Nth & Oak Rd	96	127	194	298	143	249
Flora St	East of Oak Rd	357	432	536	732	368	551
President Av	West of Oak Rd	3046	3094	3070	3184	2818	2918
President Av	East of Oak Rd	2751	2801	2977	3113	2815	2943
Clements Pde	East of Bath Rd	250	300	383	492	212	335

As would be expected, traffic flow increases would be greatest on Oak Road and Flora Street as these would provide vehicular access to the site. Oak Road would be widened to accommodate the extra traffic, while Flora Street would have its 90º parking removed which would expedite traffic flow.

Traffic flows on Oak Road between President Avenue and Flora Street would increase significantly. However, conditions through the section would be assisted through the change of control from a roundabout to traffic signals at the Flora Street intersection as this would create breaks in the traffic stream along Oak Road.

Traffic flows in Princes Highway and President Avenue would increase only moderately. Again, in practice the actual increase would not be as great as indicated once the effect of the interception of passing traffic was taken into account.

Traffic flow on Clements Parade would change only a little during morning peak periods. During afternoon peak periods it would remain below 500 veh/hr which is the desirable limit for a collector road. Traffic flows on Saturday will be even lower.

8.6 Future Intersection Performance

The intersections surrounding the site were re-analysed using SIDRA 5.0. **Table 8-3** compares the existing and future operation of these. Key SIDRA outputs are provided in **Appendix C**.

Table 8-3 – Comparison of Existing and Future Peak Hour Intersection Operation

Intersection		Control	Thursday AM		Thursday PM		Saturday	
			LoS	Av. Delay	LoS	Av. Delay	LoS	Av. Delay
Princes Hwy / Kingsway	Existing	Signals	B	20	C	38	B	25
	Future	Signals	B	22	D	45	C	29
Princes Hwy / Oak Rd	Existing	Signals	D	52	C	31	D	45
	Future	Signals	B	22	C	30	D	54
Princes Hwy / Acacia Rd Nth	Existing	Signals	C	32	B	23	D	41
	Future	Signals	C	32	C	33	D	48
Oak Rd / Flora St	Existing	Roundabout	A	7	A	7	A	7
	Future	Signals	B	16	B	17	B	17
Oak Rd / President Av	Existing	Signals	B	23	B	22	B	23
	Future	Signals	B	26	C	33	C	31
Flora St Site Access	Existing	n/a	-	-	-	-	-	-
	Future	Priority - T	A	9	A	9	A	10
Oak Rd Site Access	Existing	n/a	-	-	-	-	-	-
	Future	Priority - T	A	9	A	12	A	10

Table 8-3 confirms that all intersections would operate satisfactorily (Level of Service D or better in peak periods) provided the Stage 1 improvements outlined in **Section 7.2** above were implemented. As the intersections would operate satisfactorily under the RTA's required Stage 1 improvements even at ultimate development of the site, it follows that the Stage 2 improvements suggested by the RTA would not be necessary.

Furthermore, the potential effects of the suggested Stage 2 works on Bath Road would not proceed and the Council's apprehended consequential traffic effects at the Bath Road/Waratah Street intersection would not be realised. In view of this, no further analysis of these effects was undertaken.

Finally, the results also indicate that the proposed site accesses would operate satisfactorily under the proposed priority controls.

8.7 Conclusions on Traffic Implications

The additional traffic generated by the proposed expansion would necessitate the RTA's Stage 1 road improvements at several locations external to the site. Subject to these, traffic impacts would be satisfactory.

8.8 Internal Traffic Arrangements

8.8.1 Car Parking Design

It is proposed that parking spaces be designed to meet the geometric requirements of Australian Standards AS 2890.1-2004.

8.8.2 Loading Area Design

It is proposed that the loading are comply with A12890.2-2002 Part 2 – Off Street Loading Facilities.

8.9 Parking

8.9.1 Car Parking Requirements

Parking requirements for the non-residential components were calculated in accordance with Sutherland Shire Council's parking code as follows:

- Normal Retail + Mall GFA of 11,410m^2 @ 1 space/30m^2 = 380.3
- Showrooms (bulky retail) GFA of 2,930m^2 @ 1 space/45m^2 = 65.1
- Office GFA of 840m^2 @ 1 space/30m^2 = 28.0
- Total retail requirement = 474.0 spaces

Based on parking rates agreed for the previous application the required provision would be:

- Supermarkets (GLA) 5,270m^2 @ 1 space/23.8m^2 = 221.4 spaces
- Other retail (GLA) 4,220m^2 @ 1 space/22.2m^2 = 190.1 spaces
- Commercial Office (GFA) 840m^2 @ 1 space/30m^2 = 24.0 spaces
- Bulky Retail (showroom) (GLA) 2,930m^2 @ 1 space/45m^2 = 65.1 spaces
- Total Retail/Commercial Parking (rounding) = 501 spaces

The two requirements are very close. It is proposed to provide 500 retail/commercial spaces in accordance with the previously agreed provision ratios.

Residential parking is proposed as set out on **Table 8-4**. A rate lower than the general Sutherland parking code rate is proposed in accordance with good Transit Oriented Development principles. These acknowledge that a location with good public transport and a range of shops and services within easy walking distance has a lower requirement for car parking than a comparable development without these advantages.

Table 8-4 – Calculation of Parking Requirements

Unit Type	No.	SSC. Code Rate (per unit)	SSC No.	Code Rate per unit	Proposed No.
1 BR	49	1	49	1	49
2 BR	267	1.5	400.5	1.25	334
3 BR	134	2	268	1.5	201
Visitor	450	0.25	112.5	0.125	56
Total			**830**		**640**

The proposed residential parking provision is considered satisfactory as:

- car ownership is likely to be lower in a Transit Oriented Community;
- visitors would be able to use retail car park while it was open; and
- particularly because census records of overnight car parking support a lower parking rate as presented on **Table 8-5**.

Table 8-5 – 2006 Census Records of Cars Parked Over Night at Apartments

Location	Unit Type	Units	Vehicles	Veh/Unit
Kirrawee				
	Studio	3	0	0.00
	1 BR	152	79	0.52
	2 BR	480	531	1.11
	3 BR	37	40	1.08
Miranda				
	Studio	3	3	1.00
	1 BR	196	115	0.59
	2 BR	1,171	1,296	1.11
	3 BR	247	361	1.46
Sutherland Shire LGA				
	Studio	63	28	0.44
	1 BR	2,158	1,510	0.70
	2 BR	9,835	11,267	1.15
	3 BR	1,856	2,622	1.41

The census records indicate the total cars parked overnight for different apartment sizes. From this actual parking demand, rates can be assessed.

The figures for Kirrawee, Miranda and for Sutherland as a whole were similar for two bedroom units but somewhat lower for Kirrawee for one and three bedroom units. The figures support the proposed supply rates of:

- 1 space per 1 bedroom unit;
- 1.25 spaces per 2 bedroom unit; and
- 1.5 spaces per 3 bedroom unit.

It is proposed to provide a total of about 1,349 parking spaces to be allocated approximately as follows:

- Retail and Commercial 500
- Residential 650
- Commuter Parking 200

The residential and commuter parking would be provided separately from the retail/commercial parking.

8.9.2 Motorcycle Parking

The DCP suggests that one motorcycle space be provided per 25 non-residential car spaces. On this basis for the 500 non-residential parking spaces proposed, 20 motorcycle spaces would be required. It is proposed to provide these.

8.9.3 Bicycle Parking

Sutherland Council's DCP requires parking for bicycles at the following rates:

- Flats – 1 per 5 dwellings plus 1 visitor space per 10 dwellings.
- Industrial/Commercial/Business – 1 per 10 car spaces then one per 20 spaces thereafter. 1 unisex shower per 10 employees.

The DCP required bicycle parking would thus be:

• 450 residential units	@ 0.3/unit	=	135
• 200 non-residential car spaces	@ 1/10 car spaces	=	20
• 300 non-residential (after 1st 200 spaces)	@ 1/20 car spaces	=	15
• Total Bicycle Spaces		=	170 spaces

It is proposed to provide these. The residential bicycle spaces may be provided in conjunction with general storage for each apartment. This will be determined at the Project Application stage.

9 Construction Traffic Management

At this Concept Development level of planning it has not been possible to prepare a formal construction management plan as development staging will depend on the market and on the particular approach of the builder when contracted.

It is however noted that construction traffic generation will be very much less than the operational traffic when the development is completed.

With this traffic being lower it is proposed that approval be sought to have left in/left out construction access off the Princes Highway supplemented by full access off Flora Street. This would help to minimise traffic impacts on the Princes Highway and in the local area.

Otherwise it is proposed that a separate formal Construction Traffic Management Plan will be submitted for each development stage. Whilst at this stage of planning the formal construction methodologies have not been determined, the following principles would be incorporated given that the site is located close to transit corridors and that there are pedestrian movements in and around the site.

- The Construction Traffic Management Plan will include proposed truck parking areas, construction zones, crane usage, truck routes, etc;
- Pedestrian movements along footpaths will be maintained as much as possible on roads surrounding the site;
- Trucks must enter and leave the site in a forward direction unless accredited flag persons are in place to control traffic and pedestrians;
- The Building Contractor will maintain strict traffic management procedures to ensure the safety of the public road users and pedestrians utilising traffic wardens;
- All vehicles carrying materials to or from the site must have their loads covered with tarpaulins or similar covers;
- Openings in the construction fencing at the construction access driveways will be managed and controlled by qualified site personnel; and
- Temporary pedestrian warning signs and flashing lights will be erected adjacent to construction access driveways where appropriate.

It is anticipated that a condition would be imposed on any Project Application consent requiring that a construction traffic management plan be approved by the Sutherland Traffic Committee prior to the issue of a construction certificate for the main building works.

10 Green Travel Plan

From the above, it can be seen that Kirrawee already enjoys excellent external transport infrastructure that both encourages and facilitate access by non-car modes.

In order to build on this strong foundation, a number of measures or initiatives are proposed for the development. These are outlined below.

10.1 Travel Access Guide

The centre would be proactive in providing up to date public transport information to customers and staff as well as new tenant owners. A TAG will be prepared in accordance with RTA Guidelines for employees and customers. In particular:

- The Centre will include public transport access information in its tenant information kits to encourage staff to travel by public transport;
- Tenants will be encouraged to display travel information in staff amenity rooms where appropriate;
- Centre management will provide transport information on its website;
- Directions to bus stops and the railway station will be available at the information desk; and
- Boards will be erected within the centre to provide information on public transport options at each of the street entrances.

10.2 Home Delivery

The supermarkets in the centre will be encouraged to provide a home delivery service.

10.3 Parking Limitation

The amount of parking added to the Centre will result in an adequate supply of parking but the supply rate will be slightly below the Sutherland DCP.

The car parking provision is intended to avoid the overflow of parking into the neighbouring local streets whilst encouraging the use of public transport through the restriction of car parking.

10.4 Encouragement

Centre Management will liaise with tenants through tenant meetings and encourage them to raise any transport improvement suggestions that could be made in representations to Sutherland Council, City Rail, bus operators or the taxi council.

Centre Management will actively encourage tenants to promote car pooling by their staff.

10.5 Pedestrian Way Finding Signage

In conjunction with Sutherland Council, Centre Management will review way finding signage on streets with Council and it will install new signs showing the way to the Centre and other local facilities as agreed with Council.

Maps and information on walking routes will be available at the centre entrance points and at bus stops in the area.

10.6 Car Park Priority Parking

Priority parking for mobility impaired, seniors, and parents with prams will be marked within the centre car park near accessible entrances to the centre.

10.7 Fuel Efficient Travel

Use of motorcycles and motor scooters has increased in recent years. Travel by these is much more sustainable than by car for one person trips.

20 motorcycle parking spaces will be provided to encourage motorcycle use. In addition bicycle parking will be provided both within the car park and at convenient locations on the ground level of the Centre.

10.8 Car Share Parking

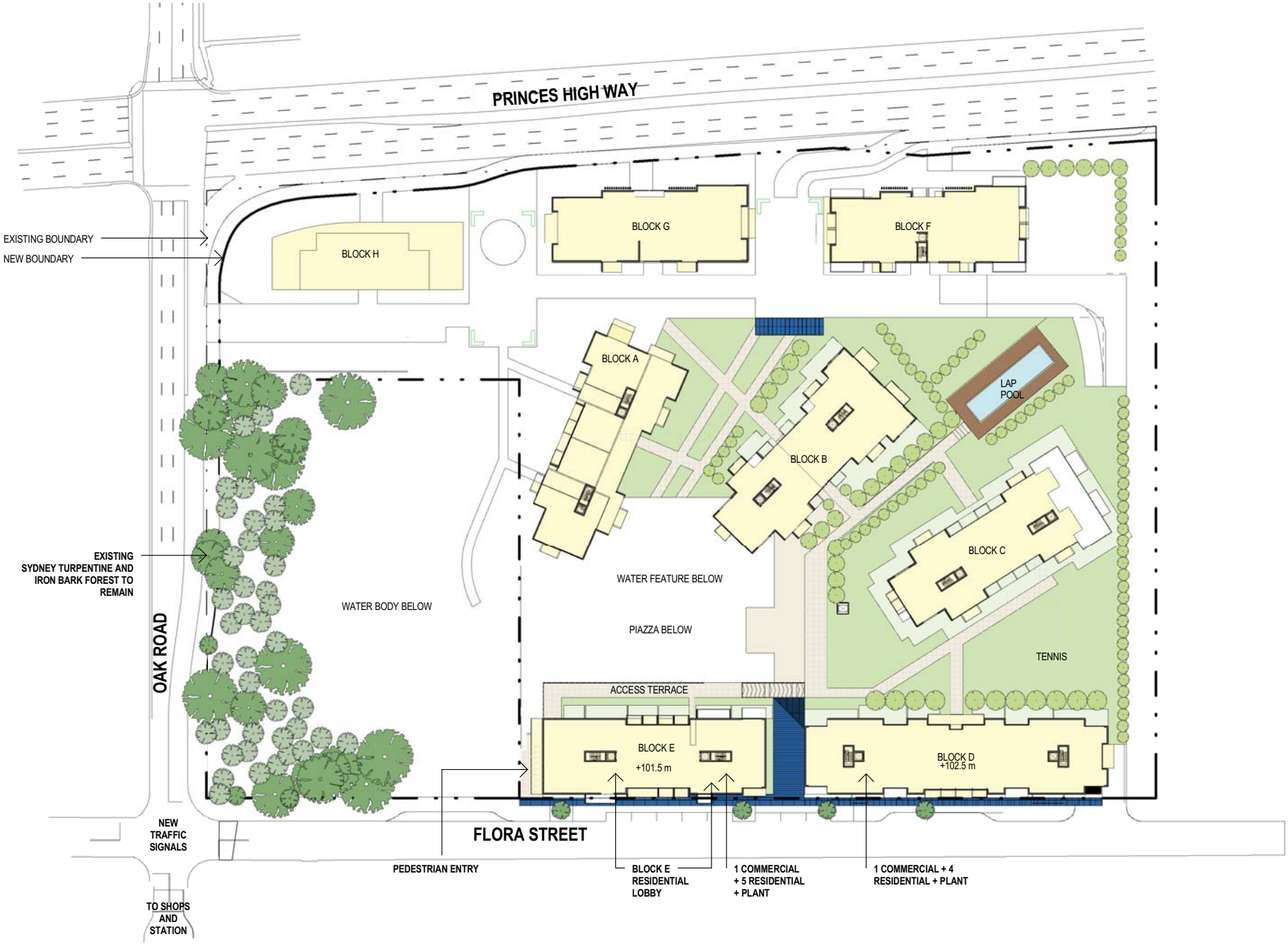
It is proposed to allocate three of the parking spaces in the public car park as "car share" parking. These spaces will be available free of charge for use by a car share operator.

11 Conclusions and recommendations

It is concluded from the analysis above that:

- Subject to recommended improvements, traffic effects of the proposal would be satisfactory;
- In this regard the Stage 1 road improvement works previously suggested by the RTA would be sufficient and consequently the RTA's suggested Stage 2 works are not required by the proposed development;
- The proposed parking provision is appropriate; and
- The development is very well located in terms of proximity to public transport and other local shops and services. It will benefit from the good transport facilities in the area and contribute to their viability.

Appendix A Plans of the Proposal



1 RL 100.50 UPPER GROUND FLOOR PLAN
1 : 1000

NSW Registered & Nominated Architects: David Holm 5428, Geoffrey Lee 4223, Philip Bowen 4527

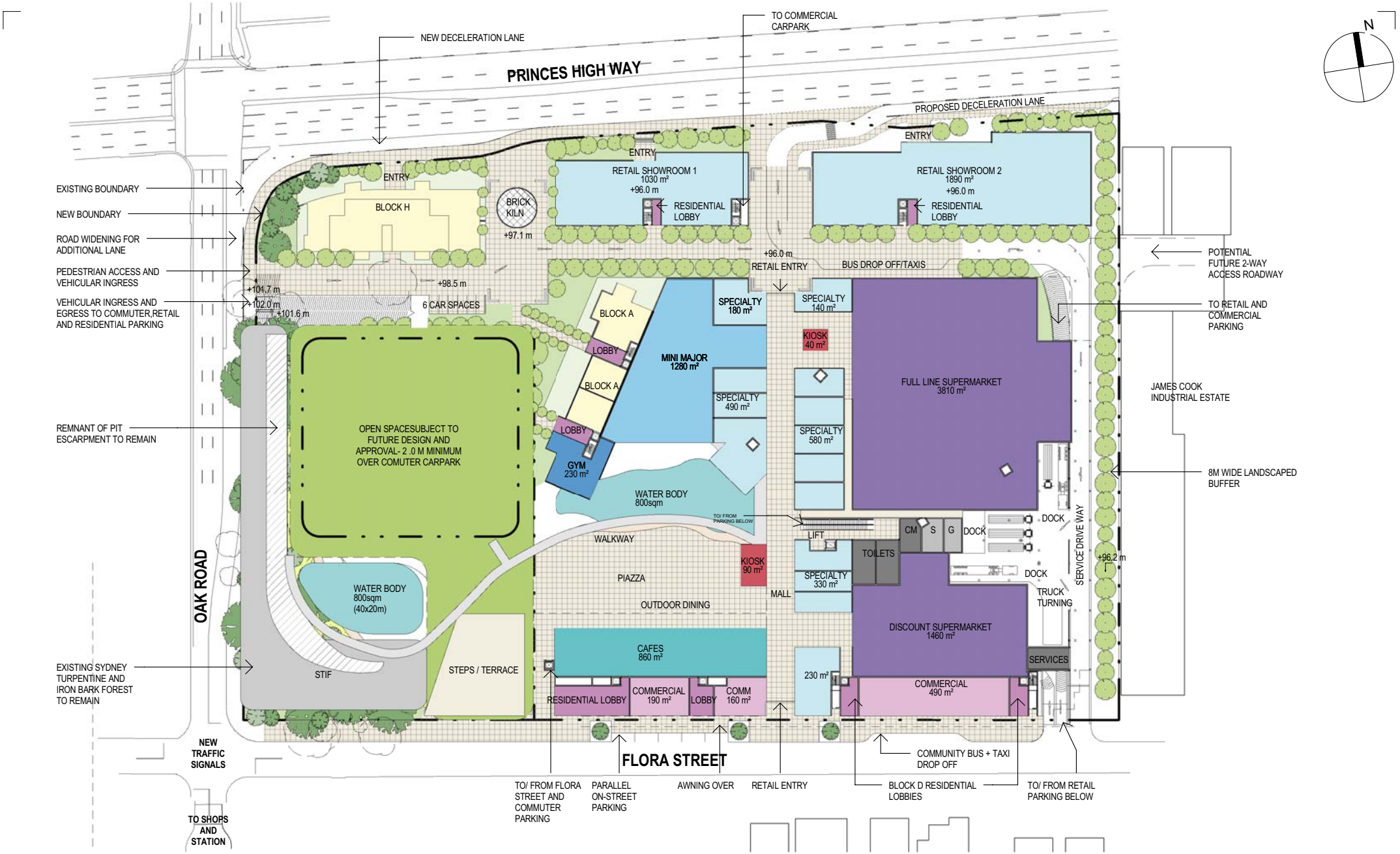
Australia
Asia
Europe

Client
Henroth Investments Pty Limited
46-56 Kippax Street
Surry Hills NSW 2010

343 Pacific Highway
North Sydney NSW 2060
T +612 9964 9500
F +612 9964 9683
ABN 61 007 747 748

woodhead™

DRAWING TITLE: UPPER GROUND FLOOR PLAN				
PROJECT NAME: KIRRAWEE BRICK PIT		CLIENT NAME: HENROTH INVESTMENTS PTY LIMITED		
PROJECT NUMBER: 09211902	SCALE: 1:1000	DRAWING NUMBER: 0120	DATE: 22/10/10	REVISION NUMBER:



1 RL 96.00 LOWER GROUND FLOOR PLAN
1 : 1000

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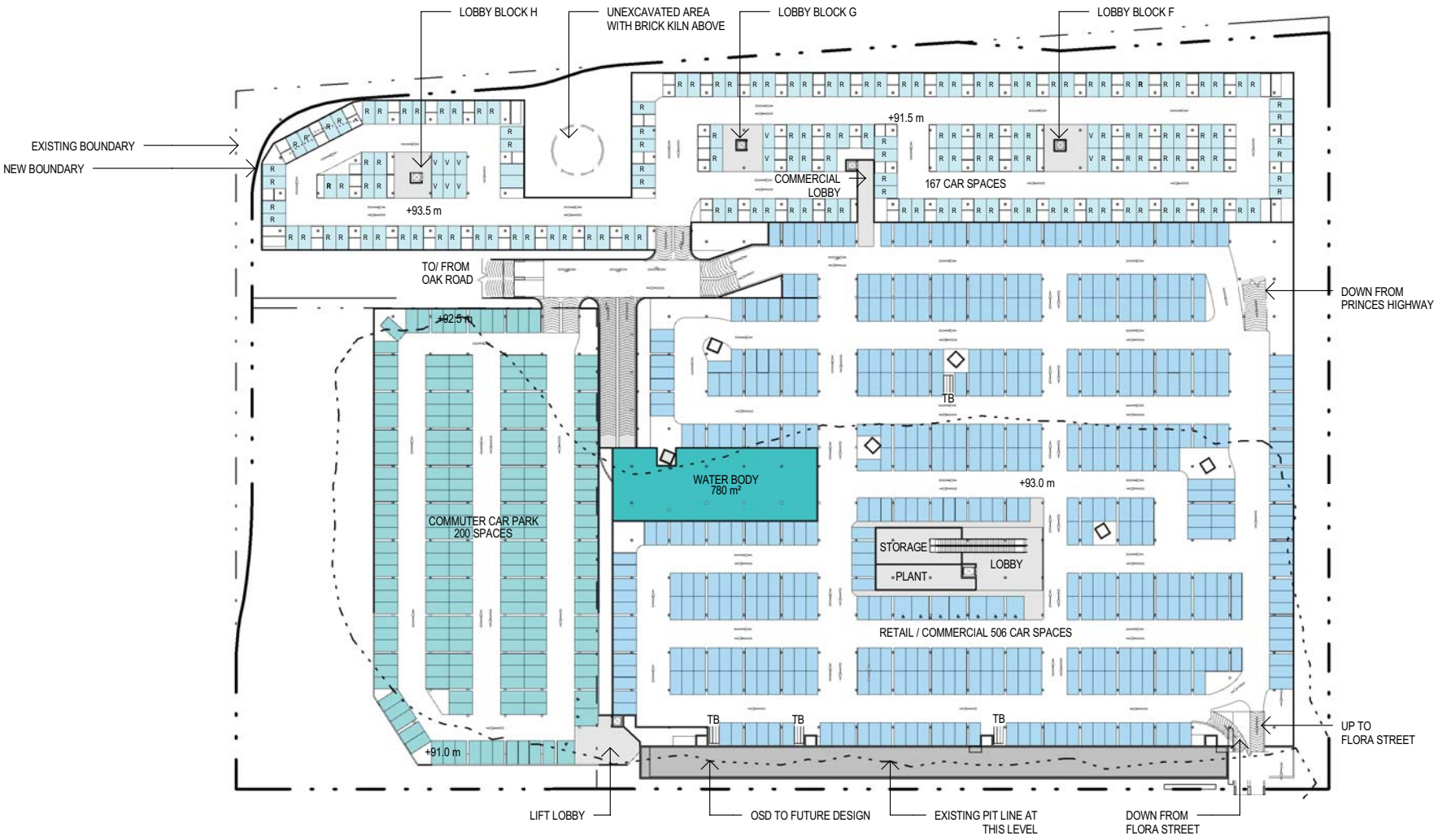
DRAWING TITLE: LOWER GROUND FLOOR PLAN				
PROJECT NAME: KIRRAWEE BRICK PIT			CLIENT NAME: HENROTH INVESTMENTS PTY LIMITED	
PROJECT NUMBER: 09211902	SCALE: 1:1000	DRAWING NUMBER: 0130	DATE: 22/10/10	REVISION NUMBER



1 RL 91.50 BASEMENT 1 PLAN - PARKING
1 : 1000

NSW Registered & Nominated Architects: David Holm 5428, Geoffrey Lee 4223, Philip Bowen 4527

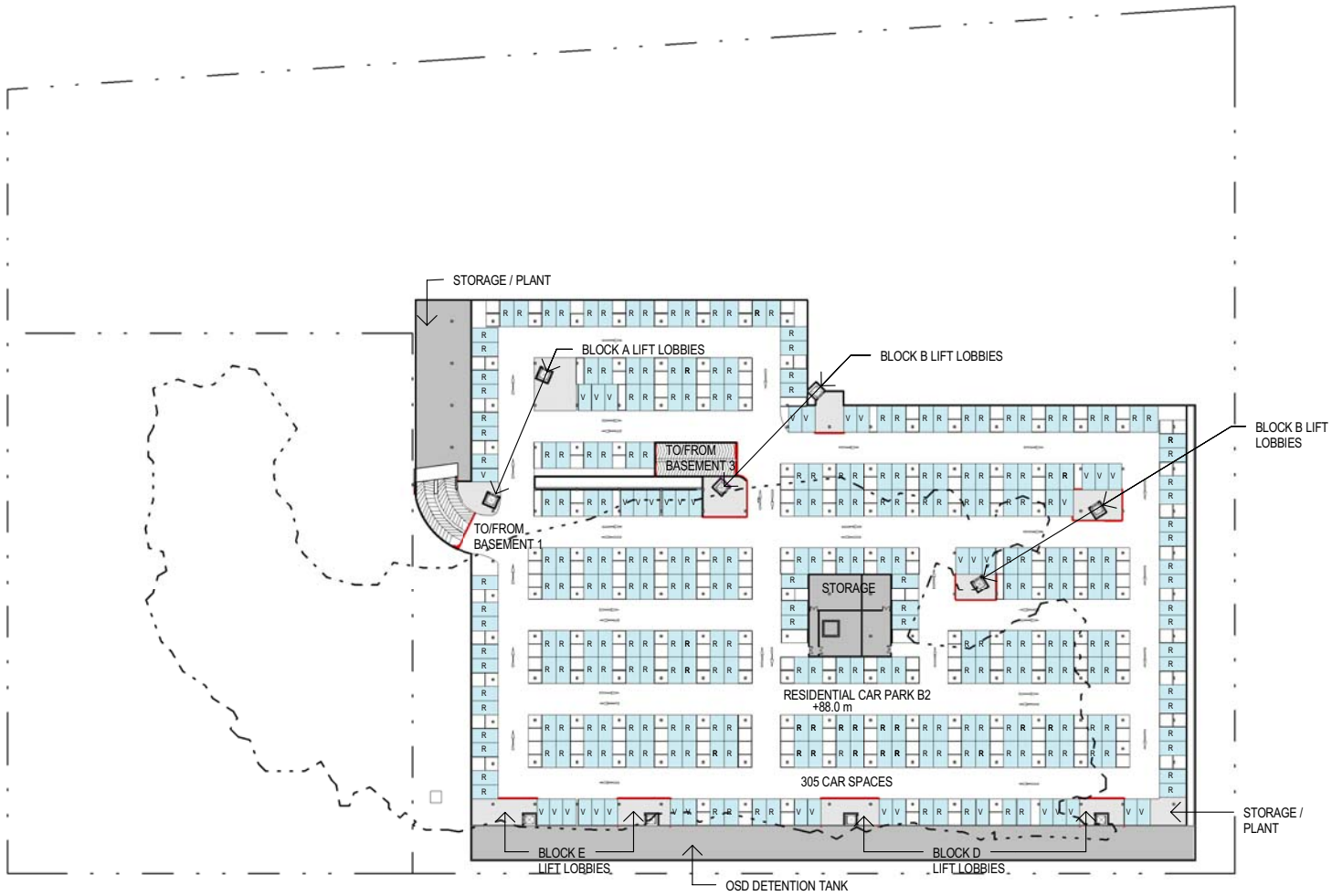
Australia
Asia
Europe

Client

Henroth Investments Pty Limited
46-56 Kippax Street
Surry Hills NSW 2010

woodhead™

DRAWING TITLE:	BASEMENT 1 PLAN
PROJECT NAME:	KIRRAWEE BRICK PIT
CLIENT NAME:	HENROTH INVESTMENTS PTY LIMITED
PROJECT NUMBER:	09211902
SCALE:	
DRAWING NUMBER:	0140
DATE:	22/10/10
REVISION NUMBER	



1 RL 88.50 BASEMENT 2 PLAN - PARKING
1 : 1000

NSW Registered & Nominated Architects: David Holm 5428, Geoffrey Lee 4223, Philip Bowen 4527

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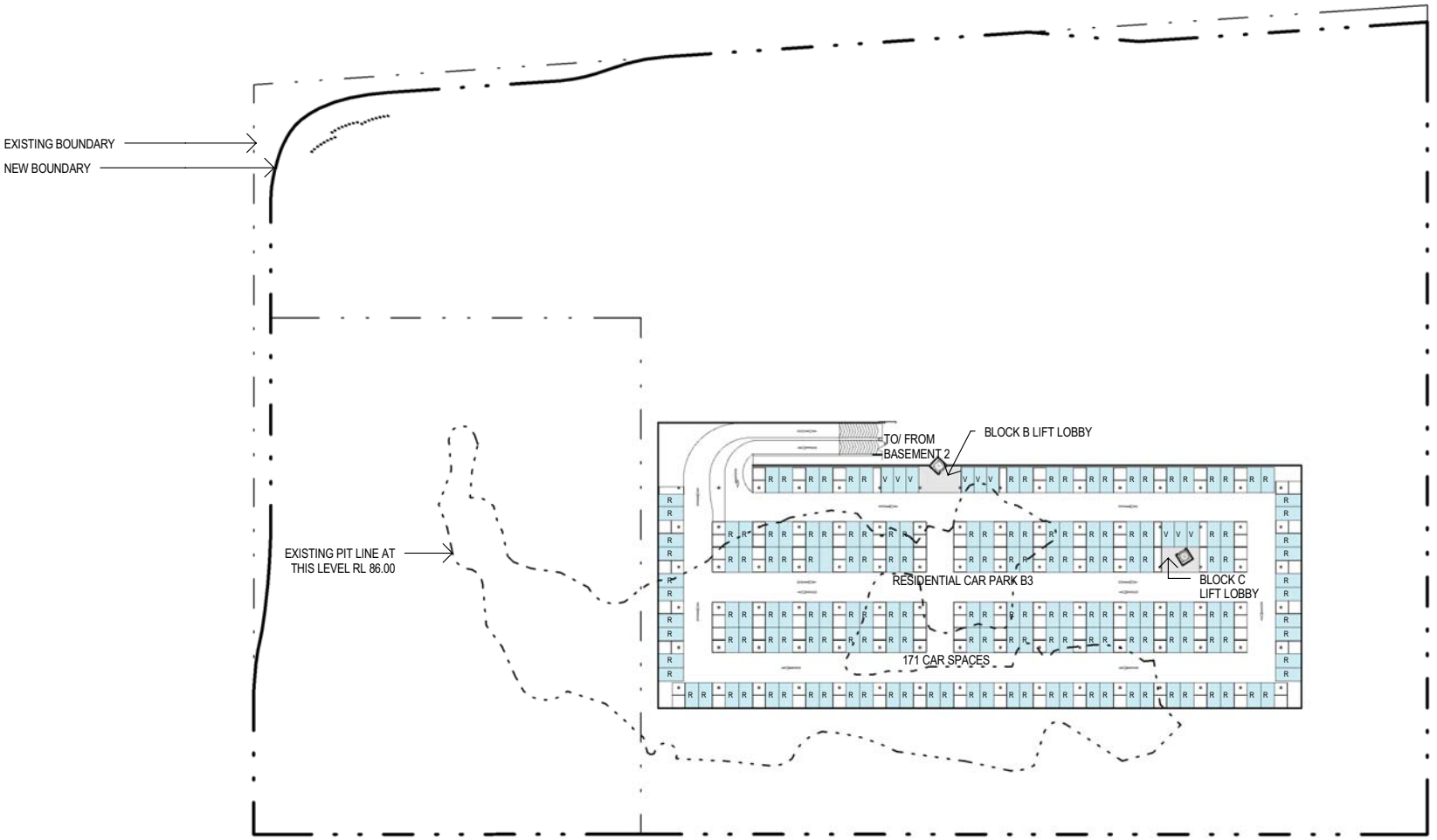
DRAWING TITLE: BASEMENT 2 PLAN				
PROJECT NAME: KIRRAWEE BRICK PIT		CLIENT NAME: HENROTH INVESTMENTS PTY LIMITED		
PROJECT NUMBER: 09211902	SCALE:	DRAWING NUMBER: 0150	DATE: 22/10/10	REVISION NUMBER



1 RL 86.00 BASEMENT 3 PLAN - PARKING
1 : 1000

NSW Registered & Nominated Architects: David Holm 5428, Geoffrey Lee 4223, Philip Bowen 4527

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woodhead™

DRAWING TITLE: BASEMENT 3 PLAN				
PROJECT NAME: KIRRAWEE BRICK PIT		CLIENT NAME: HENROTH INVESTMENTS PTY LIMITED		
PROJECT NUMBER: 09211902	SCALE:	DRAWING NUMBER: 0160	DATE: 22/10/10	REVISION NUMBER

Appendix B RTA Letter on Roadworks

Your Reference:	DA08/0347
Our Reference:	ID 08M496 Vol 5
Contact:	Aleks Tancevski
Telephone:	8849 2313

RTA

The General Manager
Sutherland Shire Council
DX 4511
SUTHERLAND

Attention: Adam Markham

FURTHER AMENDED PLANS FOR A PROPOSED MIXED USE DEVELOPMENT AT 566-594 PRINCES HIGHWAY (FORMER KIRRAWEE BRICK PIT SITE)

Dear Sir,

I refer to Council's letter dated 25 May 2009 (Council Ref: DA08/0347) with regard to the further amended plans and documentation submitted by Council to the Roads and Traffic Authority (RTA) for the above-mentioned development application. The RTA understands that, with the permission of the Land and Environment Court (LEC), the applicant is relying on further amended plans for the development proposal.

The RTA advises that the applicant's traffic consultant Traffix Pty Ltd advised the RTA in a letter dated 13 May 2009 that certain agreements had been reached with the parties (ie Council) with regard to the type and level of roadworks, staging of works and levels of contribution from the developer. Subsequently, Council's traffic consultant Craig McLaren Traffic Engineering Pty Ltd advised the RTA in a letter dated 25 June 2009 that they refuted the statement in the letter from Traffix that full agreement had been reached between the parties. The RTA has considered both these letters in its review of the recently amended plans.

The RTA has reviewed the amended plans and associated documentation submitted and the RTA is prepared to accept a two staged approach (as outlined in the letter to the RTA from Traffix Pty Ltd dated 13 May 2009) to the construction of the signal and civil works on the Princes Highway at the intersections of Oak Road and Bath Road and the traffic signals at the intersection of Oak Road and Flora Street. In this regard, the initial stage (Stage 1) will involve the widening of Oak Road, the left turn slip lane and deceleration lane on the Princes Highway and the traffic signals at the intersection of Oak and Flora Street. In this regard, the RTA requests the following requirements be incorporated into the development consent and shall apply to any stage of the development (if the development application were to be approved) to mitigate the traffic impact of the proposed development on the road network:

27-31 Argyle Street Parramatta NSW 2150
PO Box 973 Parramatta CBD NSW 2150 DX28555 Parramatta
www.rta.nsw.gov.au | 13 17 82

STAGE 1 – RTA REQUIREMENTS

1. Princes Highway Intersection at Oak Road

The layout of the existing signalised intersection on Princes Highway at Oak Road shall be reconfigured as follows:

a) Three northbound lanes shall be provided on Oak Road on the southern leg of the intersection and each lane shall be a minimum of 90 metres in length.

b) An 80 metre long left turn slip lane shall be provided on the westbound carriageway of Princes Highway into Oak Road.

c) One southbound lane shall be provided on Oak Road on the southern leg of the intersection.

d) A raised central concrete median island shall be installed on Oak Road in front of the proposed left in/left out driveway and the median shall extend from the stop line at the Princes Highway intersection to an appropriate point to the south of the proposed driveway. This median shall be a minimum of 900mm wide.

2. Traffic Signals on Oak Road at Flora Street Intersection

The applicant shall provide traffic control signals on Oak Road at the Flora Street intersection. In this regard, an electronic copy of the intersection analysis shall be submitted with the signal design plan to the RTA for review and comment. The configuration of the signalised intersection shall be to RTA satisfaction.

3. Operational Fee for Traffic Signals

The applicant will be required to provide an upfront 10 year operational fee for the above-mentioned traffic control signals at the intersection of Oak Road and Flora Street. The amount of this fee will be advised following the submission of the detailed signal and civil design plans to the RTA for construction approval. The approved plans will not be released until the fee is fully paid.

4. Deceleration Lane on Princes Highway

The left turn deceleration lane into the subject site from Princes Highway shall be a minimum of 60 metres in length (including taper) and shall be designed and constructed in accordance with the RTA's Road Design Guide.

5. Road Safety Audit

Road safety concerns are raised with regard to the close proximity of the proposed left in/left out driveway on Oak Road to the proposed left turn slip lane on Princes Highway into Oak Road and the subsequent potential for rear end accidents. In this regard, prior to any 'Construction Certificate' being issued for any stage of the proposed development, a Road Safety Audit shall be undertaken that investigates this issue and is to be undertaken by a certified Road Safety Auditor. The audit shall be completed in accordance with the Austroads: *Guidelines for Road Safety Audits.*

A copy of the findings of the audit shall be submitted to Council and the RTA for review.

6. Excavation of the Site and Support Structures

The developer is to submit detailed design drawings and geotechnical reports relating to the excavation of the site and support structures to the RTA for assessment (prior to the approval of any Construction Certificate). The developer is to meet the full cost of the assessment by the RTA.

This report would need to address the following key issues:

a. The impact of excavation/rock anchors on the stability of the Princes Highway and detailing how the carriageway would be monitored for settlement.
b. The impact of the excavation on the structural stability of the Princes Highway.
c. Any other issues that may need to be addressed (Contact: Geotechnical Engineer Stanley Yuen on Ph: 8837 0246 or Graham Yip on Ph: 8837 0245) for details.

7. Relocation of Public Utilities

The developer shall be responsible for all public utility adjustment/relocation works, necessitated by the above work and as required by the various public utility authorities and/or their agents.

8. Land Dedication

To facilitate the provision of the left turn deceleration lane on the Princes Highway and the left turn slip lane into Oak Road, the applicant shall provide a 3.5 metre wide land dedication from the subject site on the Princes Highway frontage of the site for the full length of the left turn deceleration lane into the site and slip lane into Oak Road. This land shall be dedicated as public road at no cost to the RTA and Council. Sufficient land dedication is to be provided for the relocation of the footway.

In addition, the applicant shall provide land dedication along the Oak Road frontage of the subject site to provide the additional lane on the southern leg of the Princes Highway intersection and the 900mm raised central concrete median island on Oak Road. This land shall be dedicated as public road at no cost to the RTA and Council.

This public road land dedication from the subject site shall be executed, prior to any release of a Construction Certificate for the proposed development.

9. Construction Certificate

No Construction Certificate shall be released for any stage of the development until such time that all the above-mentioned signal and civil works are fully constructed and operational.

Further to the above, no Construction Certificate shall be approved for any stage of the development until such time that a detailed Construction Traffic Management Plan (CTMP) and associated Traffic Control Plan (TCP) is submitted to Council and the RTA for review and acceptance. The CTMP and TCP shall be undertaken in accordance with the RTA's Traffic Control at Worksites Manual and the author shall be certified.

Comment: If the signal and civil works on Oak Road and Princes Highway were to be constructed at the same time as construction is taking place on site, it is likely to create significant delays on the road network.

10. Works Authorisation Deed

The developer will be required to enter into a "Major Works Authorisation Deed" (WAD) with the RTA for the above-mentioned signal and civil works. In this regard the developer is required to submit detailed design plans and all relevant additional information, as may be required in the RTA's Works Authorisation Deed documentation, for each specific change to state road network for the RTA's assessment and final decision concerning the work. The detailed design plans submitted shall be in accordance with the RTA's Road Design Guide and RTA requirements.

Comment: It is requested that Council advise the developer that the conditions of consent set by Council do not guarantee the RTA's final consent to the specific road work, traffic control facilities and other structures works on the classified road network. The RTA must provide a final consent for each specific change to the state road network prior to the commencement of any work.

11. Stormwater

Detailed design plans and hydraulic calculations of any changes to the stormwater drainage system are to be submitted to the RTA for approval, prior to the commencement of any works.

Details should be forwarded to:

The Sydney Asset Management
PO Box 973
Parramatta CBD NSW 2124

A plan checking fee will be payable and a performance bond may be required before the RTA's approval is issued. With regard to the Civil Works requirement please contact the RTA's Project Engineer, External Works Ph: 8849 2114 or Fax: 8849 2766.

12. No Cost to RTA or Council

All roadworks and traffic control signals associated with the proposed development shall be at full cost to the developer and at no cost to the RTA or Council.

STAGE 2 – RTA REQUIREMENTS

The half closure of the northern leg of the Oak Road intersection at the Princes Highway and signal and civil works at the intersection of Princes Highway and Bath Road (as outlined below) forms the second stage of the identified intersection and road upgrades required to mitigate the traffic impact of the development. The trigger for the second stage is the construction of the supermarket component of the application as the supermarket is the principle traffic generator of the overall development. In this regard, the RTA requests that the following requirements also be incorporated into the development consent and the trigger for these works is any stage of the development involving the supermarket:

13. Intersection of Princes Highway and Oak Road

The existing signalised intersection of Princes highway and Oak Road shall be reconfigured as follows:

a) Half closure of the Oak Road northern approach to the Princes Highway involving the discontinuation of the southbound lanes with northbound lanes remaining open.

14. Traffic Signals on Princes Highway at Bath Road Intersection

Traffic control signals shall be provided at the intersection of Princes Highway and Bath Road (associated with the northern closure of Oak Road at the Princes Highway intersection) and shall consist of the following works:

a) Left in/left out only for the Bath Road southern approach. The left turn out would be signalised.

b) No through movements across Princes Highway (ie no north-south traffic from Bath Road).

c) Signalised left and right turn out of Bath Road northern approach with a double right turn lane.

d) No right turns permitted from Princes Highway from either direction to Bath Road.

15. Operational Fee for Traffic Signals

The applicant will be required to provide an upfront 10 year operational fee for the traffic control signals on the Princes Highway at the Bath Road intersection. The amount of this fee will be advised following the submission of the detailed signal and civil design plans to the RTA for construction approval. The approved plans will not be released until the fee is fully paid.

16. Construction Certificate

The Construction Certificate for the supermarket shall not be released until the above-mentioned signal and civil works are fully constructed and operational.

17. Relocation of Public Utilities

The developer shall be responsible for all public utility adjustment/relocation works, necessitated by the above work and as required by the various public utility authorities and/or their agents.

18. Works Authorisation Deed

The developer will be required to enter into a "Major Works Authorisation Deed" (WAD) with the RTA for the above-mentioned signal and civil works. In this regard the developer is required to submit detailed design plans and all relevant additional information, as may be required in the RTA's Works Authorisation Deed documentation, for each specific change to state road network for the RTA's assessment and final decision concerning the work. The detailed design plans submitted shall be, in accordance with the RTA's Road Design Guide and RTA requirements.

Comment: It is requested that Council advise the developer that the conditions of consent set by Council do not guarantee the RTA's final consent to the specific road work, traffic control facilities and other structures works on the classified road network. The RTA must provide a final consent for each specific change to the state road network prior to the commencement of any work.

19. No Cost to RTA or Council

All roadworks and traffic control signals associated with the proposed development shall be at full cost to the developer and at no cost to the RTA or Council.

Further to the above staged implementation of the signal and civil works on the Princes Highway and Oak Road, Council should consider requesting the applicant to make a monetary contribution to Council's satisfaction towards upgrading the existing intersection of Waratah Street and Bath Road.

In accordance with Clause 104 (4) of State Environmental Planning Policy (Infrastructure) 2007, it is essential that a copy of the determination (conditions of consent if approved) is forwarded to the RTA at the same time it is sent to the developer.

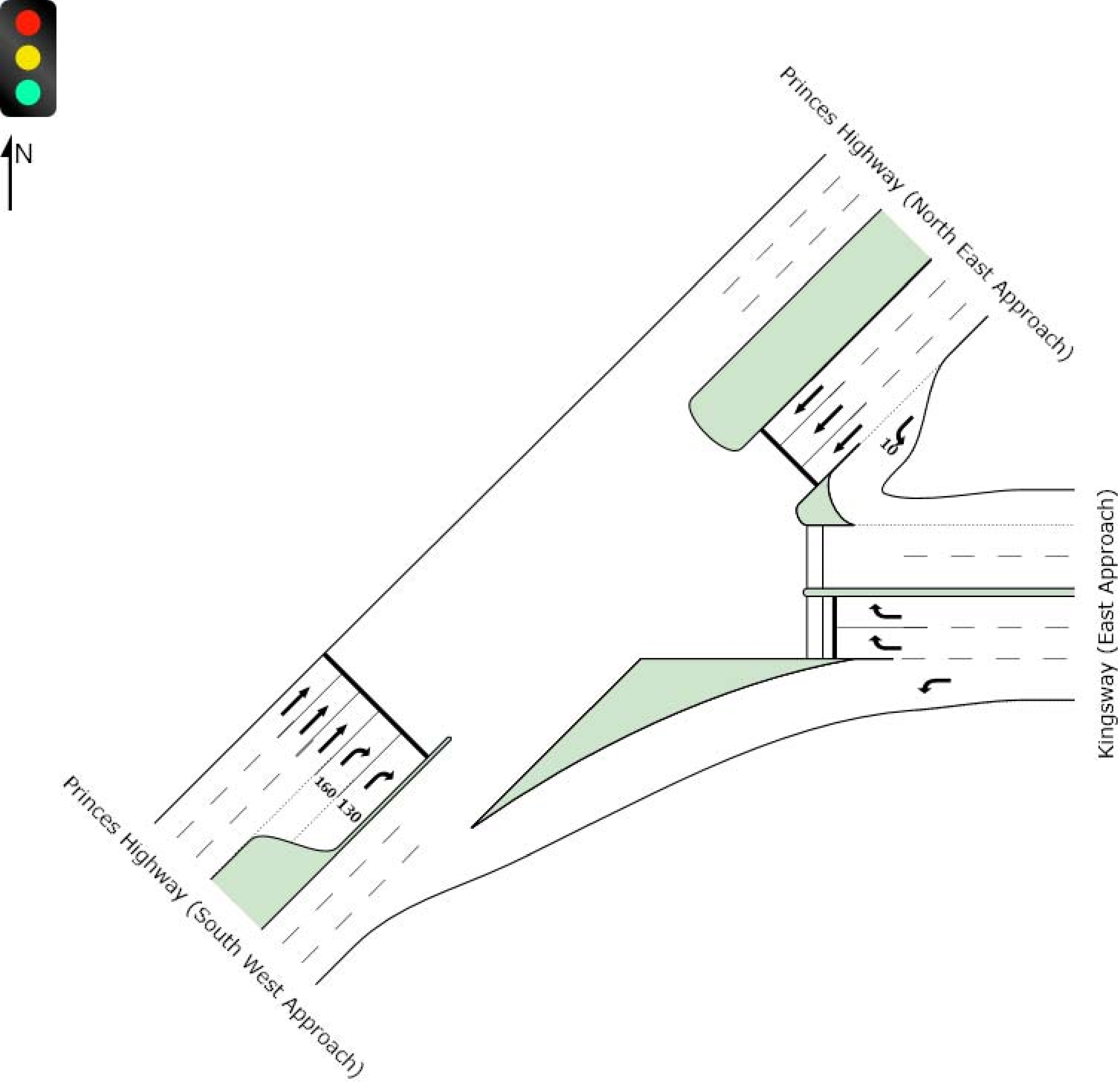
Any inquiries can be directed to the nominated Assistant Land Use and Transport Planner, Aleks Tancevski by telephone on 8849 2313, or facsimile 8849 2918.

Yours faithfully,

James Hall
A/Senior Land Use Planner
Transport Planning, Sydney Region

29 June 2009

Appendix C SIDRA Analysis Outputs


N
Princes Highway (North East Approach)
10
Kingsway (East Approach)
160
130
Princes Highway (South West Approach)

LANE SUMMARY

Princes Hwy x Kingsway
AM Existing Peak Period
Signals - Fixed Time Cycle Time = 90 seconds

Lane Use and Performance

	Demand Flows L veh/h	T veh/h	R veh/h	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Lane Length m	SL Type	Cap. Adj. %	Prob. Block. %
East: Kingsway (East Approach)																
Lane 1	424	0	0	424	3.2	1974	0.215	100	4.2	NA[9]	NA[9]	NA[9]	260	–	0.0	NA[9]
Lane 2	0	0	259	259	0.6	298	0.871	100	59.4	LOS E	14.5	101.7	260	–	0.0	0.0
Lane 3	0	0	259	259	0.6	298	0.871	100	59.4	LOS E	14.5	101.7	260	–	0.0	0.0
Approach	424	0	519	943	1.8		0.871		34.6	LOS C	14.5	101.7				
North East: Princes Highway (North East Approach)																
Lane 1	223	0	0	223	0.9	1930	0.116	100	10.8	NA[9]	NA[9]	NA[9]	10	Turn Bay	0.0	NA[9]
Lane 2	0	489	0	489	3.8	560	0.873	100	28.3	LOS B	22.0	159.0	265	–	0.0	0.0
Lane 3	0	504	0	504	3.8	577	0.873	100	28.1	LOS B	22.6	163.0	265	–	0.0	0.0
Lane 4	0	489	0	489	3.8	560	0.873	100	28.3	LOS B	22.0	159.0	265	–	0.0	0.0
Approach	223	1482	0	1705	3.4		0.873		25.9	LOS B	22.6	163.0				
South West: Princes Highway (South West Approach)																
Lane 1	0	834	0	834	2.0	1376	0.607	100	1.5	LOS A	5.9	42.3	500	–	0.0	0.0
Lane 2	0	830	0	830	2.0	1369	0.607	100	1.5	LOS A	5.9	42.1	500	–	0.0	0.0
Lane 3	0	834	0	834	2.0	1376	0.607	100	1.5	LOS A	5.9	42.3	500	–	0.0	0.0
Lane 4	0	0	571	571	1.3	657	0.869	100	41.1	LOS C	26.3	186.2	160	Turn Bay	0.0	17.2
Lane 5	0	0	585	585	1.3	673	0.869	100	40.9	LOS C	26.8	189.9	130	Turn Bay	0.0	37.8
Approach	0	2499	1156	3655	1.8		0.869		14.0	LOS A	26.8	189.9				
Intersection				6303	2.2		0.873		20.3	LOS B	26.8	189.9				

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all lanes. LOS Method: Delay (RTA NSW).
Level of Service (Worst Lane): LOS E. LOS Method for individual lanes: Delay (RTA NSW).
Approach LOS values are based on average delay for all lanes.

9 Continuous lane

SIDRA INTERSECTION

LANE SUMMARY

Site: Princes Hwy x Kingsway - 2010 Existing PM Peak Period

Princes Hwy x Kingsway
PM Existing Peak Period
Signals - Fixed Time Cycle Time = 150 seconds

Lane Use and Performance

	Demand Flows L veh/h	T veh/h	R veh/h	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Lane Length m	SL Type	Cap. Adj. %	Prob. Block. %
East: Kingsway (East Approach)																
Lane 1	974	0	0	974	0.8	2009	0.485	100	6.1	NA[9]	NA[9]	NA[9]	260	–	0.0	NA[9]
Lane 2	0	0	239	239	1.8	241	0.995	100	123.4	LOS F	24.0	170.7	260	–	0.0	0.0
Lane 3	0	0	239	239	1.8	241	0.995	100	123.4	LOS F	24.0	170.7	260	–	0.0	0.0
Approach	974	0	479	1453	1.1		0.995		44.8	LOS D	24.0	170.7				
North East: Princes Highway (North East Approach)																
Lane 1	268	0	0	268	2.4	1911	0.140	100	10.8	NA[9]	NA[9]	NA[9]	10	Turn Bay	0.0	NA[9]
Lane 2	0	1023	0	1023	0.4	1017	1.006	100	46.8	LOS D	96.4	676.8	265	–	0.0	93.2
Lane 3	0	1055	0	1055	0.4	1049	1.006	100	46.1	LOS D	98.9	694.6	265	–	0.0	95.8
Lane 4	0	1023	0	1023	0.4	1017	1.006	100	46.8	LOS D	96.4	676.8	265	–	0.0	93.2
Approach	268	3101	0	3369	0.5		1.006		43.7	LOS D	98.9	694.6				
South West: Princes Highway (South West Approach)																
Lane 1	0	583	0	583	0.7	1548	0.376	100	1.3	LOS A	4.5	31.7	500	–	0.0	0.0
Lane 2	0	580	0	580	0.7	1540	0.376	100	1.3	LOS A	4.5	31.5	500	–	0.0	0.0
Lane 3	0	568	14[0]	582	0.7	1546	0.376	100	1.3	LOS A	4.5	31.6	500	–	0.0	0.0
Lane 4	0	0	420	420	1.1	420	1.000[3]	100	94.8[8]	LOS F[8]	37.1[8]	262.4[8]	160	Turn Bay	0.0	50.0
Lane 5	0	0	430	430	1.1	430	1.000[3]	100	69.2[8]	LOS E[8]	32.0[8]	225.8[8]	130	Turn Bay	0.0	55.0
Approach	0	1731	864	2595	0.8		1.000		27.7	LOS B	37.1	262.4				
Intersection				7417	0.7		1.006		38.3	LOS C	98.9	694.6				

Level of Service (Aver. Int. Delay): LOS C. Based on average delay for all lanes. LOS Method: Delay (RTA NSW).
Level of Service (Worst Lane): LOS F. LOS Method for individual lanes: Delay (RTA NSW).
Approach LOS values are based on average delay for all lanes.

0 Excess flow from back of an adjacent short lane
3 x = 1.00 due to short lane.
8 Delay, queue length and stops for the short lane have been cut down to fit in the queuing space. You may wish to change the short lane to a full lane to investigate the effect on the adjacent lane performance.
9 Continuous lane

LANE SUMMARY

Site: Princes Hwy x Kingsway - 2010 Existing Saturday Peak Period

Princes Hwy x Kingsway
W/E Existing Midday Period
Signals - Fixed Time Cycle Time = 120 seconds

Lane Use and Performance

	Demand Flows L veh/h	T veh/h	R veh/h	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Lane Length m	SL Type	Cap. Adj. %	Prob. Block. %
East: Kingsway (East Approach)																
Lane 1	923	0	0	923	1.0	2005	0.460	100	4.2	NA[9]	NA[9]	NA[9]	260	–	0.0	NA[9]
Lane 2	0	0	275	275	1.1	302	0.911	100	78.8	LOS F	19.8	140.2	260	–	0.0	0.0
Lane 3	0	0	275	275	1.1	302	0.911	100	78.8	LOS F	19.8	140.2	260	–	0.0	0.0
Approach	923	0	551	1474	1.1		0.911		32.0	LOS C	19.8	140.2				
North East: Princes Highway (North East Approach)																
Lane 1	267	0	0	267	1.2	1927	0.139	100	10.8	NA[9]	NA[9]	NA[9]	10	Turn Bay	0.0	NA[9]
Lane 2	0	754	0	754	1.0	807	0.933	100	29.4	LOS C	44.3	312.4	265	–	0.0	19.8
Lane 3	0	777	0	777	1.0	833	0.933	100	29.0	LOS C	45.4	320.5	265	–	0.0	22.1
Lane 4	0	754	0	754	1.0	807	0.933	100	29.4	LOS C	44.3	312.4	265	–	0.0	19.8
Approach	267	2284	0	2552	1.0		0.933		27.4	LOS B	45.4	320.5				
South West: Princes Highway (South West Approach)																
Lane 1	0	724	0	724	0.9	1445	0.501	100	1.5	LOS A	5.4	38.0	500	–	0.0	0.0
Lane 2	0	720	0	720	0.9	1438	0.501	100	1.5	LOS A	5.4	37.8	500	–	0.0	0.0
Lane 3	0	724	0	724	0.9	1445	0.501	100	1.5	LOS A	5.4	38.0	500	–	0.0	0.0
Lane 4	0	0	467	467	0.6	511	0.914	100	64.7	LOS E	30.8	216.9	160	Turn Bay	0.0	31.7
Lane 5	0	0	479	479	0.6	524	0.914	100	61.5[8]	LOS E[8]	30.5[8]	214.7[8]	130	Turn Bay	0.0	50.0
Approach	0	2167	946	3114	0.8		0.914		20.2	LOS B	30.8	216.9				
Intersection				7139	0.9		0.933		25.2	LOS B	45.4	320.5				

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all lanes. LOS Method: Delay (RTA NSW).
Level of Service (Worst Lane): LOS F. LOS Method for individual lanes: Delay (RTA NSW).
Approach LOS values are based on average delay for all lanes.

8 Delay, queue length and stops for the short lane have been cut down to fit in the queuing space. You may wish to change the short lane to a full lane to investigate the effect on the adjacent lane performance.

9 Continuous lane

LANE SUMMARY

Site: Princes Hwy x Kingsway - Future AM Peak Period

Princes Hwy x Kingsway
AM Future Peak Period
Signals - Fixed Time Cycle Time = 90 seconds

Lane Use and Performance

	Demand Flows L veh/h	T veh/h	R veh/h	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Lane Length m	SL Type	Cap. Adj. %	Prob. Block. %
East: Kingsway (East Approach)																
Lane 1	443	0	0	443	3.1	1976	0.224	100	4.2	NA[9]	NA[9]	NA[9]	260	–	0.0	NA[9]
Lane 2	0	0	259	259	0.6	298	0.871	100	59.4	LOS E	14.5	101.7	260	–	0.0	0.0
Lane 3	0	0	259	259	0.6	298	0.871	100	59.4	LOS E	14.5	101.7	260	–	0.0	0.0
Approach	443	0	519	962	1.8		0.871		34.0	LOS C	14.5	101.7				
North East: Princes Hwy (North East Approach)																
Lane 1	223	0	0	223	0.9	1930	0.116	100	10.8	NA[9]	NA[9]	NA[9]	10	Turn Bay	0.0	NA[9]
Lane 2	0	522	0	522	3.5	581	0.897	100	29.5	LOS C	24.2	174.5	265	–	0.0	0.0
Lane 3	0	538	0	538	3.5	600	0.897	100	29.3	LOS C	24.8	179.0	265	–	0.0	0.0
Lane 4	0	522	0	522	3.5	581	0.897	100	29.5	LOS C	24.2	174.5	265	–	0.0	0.0
Approach	223	1581	0	1804	3.2		0.897		27.1	LOS B	24.8	179.0				
South West: Princes Hwy (South West Approach)																
Lane 1	0	849	0	849	2.0	1376	0.617	100	1.5	LOS A	6.1	43.8	500	–	0.0	0.0
Lane 2	0	844	0	844	2.0	1369	0.617	100	1.5	LOS A	6.1	43.6	500	–	0.0	0.0
Lane 3	0	849	0	849	2.0	1376	0.617	100	1.5	LOS A	6.1	43.8	500	–	0.0	0.0
Lane 4	0	0	579	579	1.3	636	0.911	100	47.8	LOS D	29.3	207.6	160	Turn Bay	0.0	27.5
Lane 5	0	0	594	594	1.3	651	0.911	100	47.5	LOS D	29.9	211.8	130	Turn Bay	0.0	48.7
Approach	0	2542	1173	3715	1.8		0.911		16.1	LOS B	29.9	211.8				
Intersection				6481	2.2		0.911		21.8	LOS B	29.9	211.8				

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all lanes. LOS Method: Delay (RTA NSW).
Level of Service (Worst Lane): LOS E. LOS Method for individual lanes: Delay (RTA NSW).
Approach LOS values are based on average delay for all lanes.

9 Continuous lane

LANE SUMMARY

Site: Princes Hwy x Kingsway - Future PM Peak Period

Princes Hwy x Kingsway
PM Future Peak Period
Signals - Fixed Time Cycle Time = 150 seconds

Lane Use and Performance

	Demand Flows L veh/h	T veh/h	R veh/h	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Lane Length m	SL Type	Cap. Adj. %	Prob. Block. %
East: Kingsway (East Approach)																
Lane 1	1004	0	0	1004	0.7	2009	0.500	100	6.1	NA[9]	NA[9]	NA[9]	260	–	0.0	NA[9]
Lane 2	0	0	239	239	1.8	241	0.995	100	123.4	LOS F	24.0	170.7	260	–	0.0	0.0
Lane 3	0	0	239	239	1.8	241	0.995	100	123.4	LOS F	24.0	170.7	260	–	0.0	0.0
Approach	1004	0	479	1483	1.1		0.995		44.0	LOS D	24.0	170.7				
North East: Princes Highway (North East Approach)																
Lane 1	268	0	0	268	2.4	1911	0.140	100	10.8	NA[9]	NA[9]	NA[9]	10	Turn Bay	0.0	NA[9]
Lane 2	0	1091	0	1091	0.4	1055	1.034	100	62.9	LOS E	111.3	781.6	265	–	0.0	100.0
Lane 3	0	1125	0	1125	0.4	1088	1.034	100	62.3	LOS E	114.3	802.7	265	–	0.0	100.0
Lane 4	0	1091	0	1091	0.4	1055	1.034	100	62.9	LOS E	111.3	781.6	265	–	0.0	100.0
Approach	268	3307	0	3576	0.5		1.034		58.8	LOS E	114.3	802.7				
South West: Princes Highway (South West Approach)																
Lane 1	0	638	0	638	0.6	1548	0.412	100	1.4	LOS A	5.1	35.9	500	–	0.0	0.0
Lane 2	0	634	0	634	0.6	1541	0.412	100	1.4	LOS A	5.1	35.8	500	–	0.0	0.0
Lane 3	0	519	113[0]	632	0.6	1534	0.412	100	1.4	LOS A	5.1	35.7	500	–	0.0	0.0
Lane 4	0	0	382	382	1.1	382	1.000[3]	100	112.2	LOS F	37.1	262.4	160	Turn Bay	0.0	50.0
Lane 5	0	0	391	391	1.1	391	1.000[3]	100	76.3[8]	LOS F[8]	30.4[8]	214.7[8]	130	Turn Bay	0.0	50.0
Approach	0	1791	886	2677	0.8		1.000		28.2	LOS B	37.1	262.4				
Intersection				7736	0.7		1.034		45.3	LOS D	114.3	802.7				

Level of Service (Aver. Int. Delay): LOS D. Based on average delay for all lanes. LOS Method: Delay (RTA NSW).
Level of Service (Worst Lane): LOS F. LOS Method for individual lanes: Delay (RTA NSW).
Approach LOS values are based on average delay for all lanes.

0 Excess flow from back of an adjacent short lane
3 x = 1.00 due to short lane.
8 Delay, queue length and stops for the short lane have been cut down to fit in the queuing space. You may wish to change the short lane to a full lane to investigate the effect on the adjacent lane performance.
9 Continuous lane

LANE SUMMARY

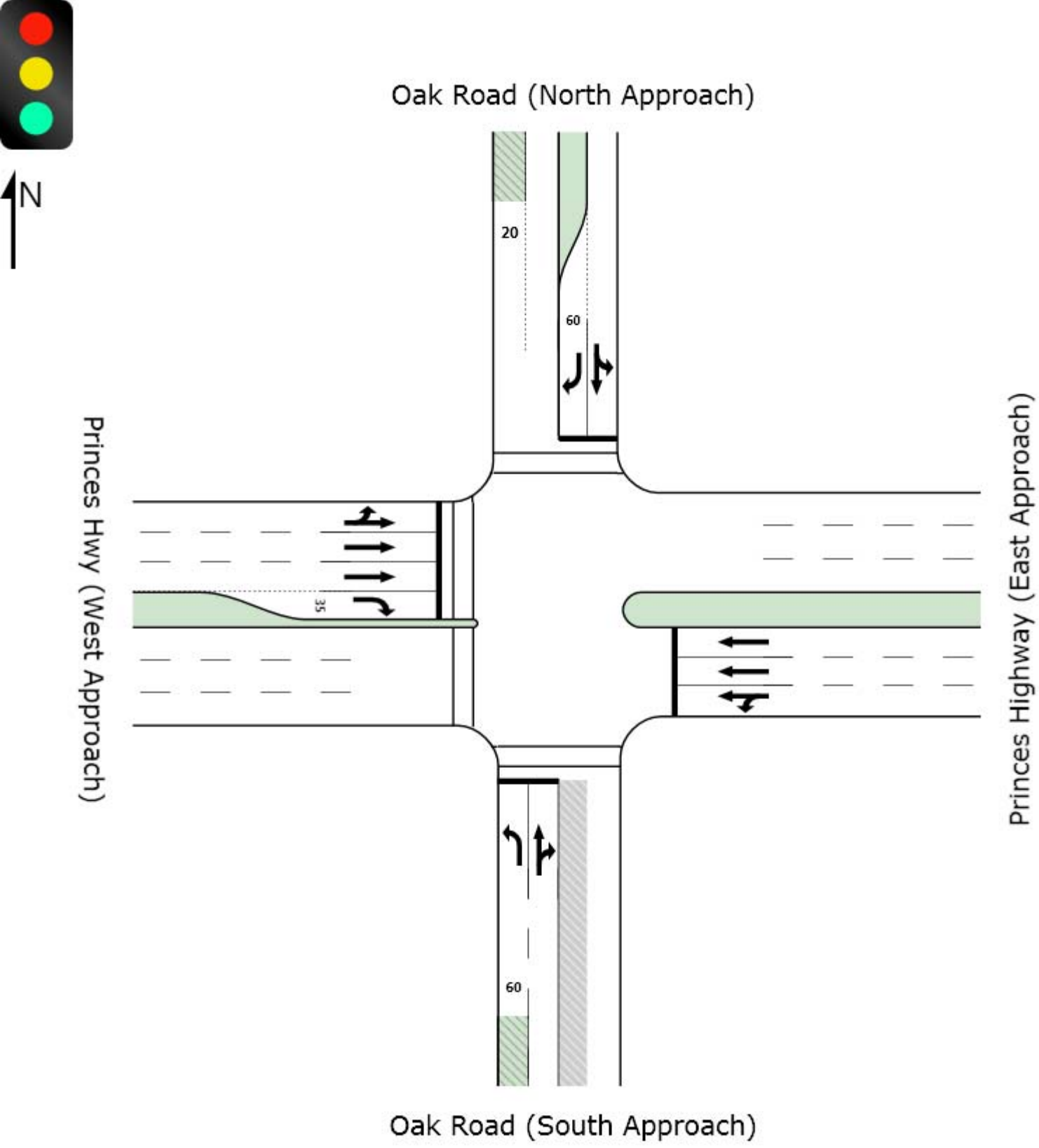
Princes Hwy x Kingsway
W/E Existing Midday Period
Signals - Fixed Time Cycle Time = 120 seconds

Lane Use and Performance

	Demand Flows L veh/h	T veh/h	R veh/h	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Lane Length m	SL Type	Cap. Adj. %	Prob. Block. %
East: Kingsway (East Approach)																
Lane 1	952	0	0	952	1.0	2006	0.474	100	4.2	NA[9]	NA[9]	NA[9]	260	–	0.0	NA[9]
Lane 2	0	0	275	275	1.1	286	0.962	100	92.5	LOS F	21.6	153.0	260	–	0.0	0.0
Lane 3	0	0	275	275	1.1	286	0.962	100	92.5	LOS F	21.6	153.0	260	–	0.0	0.0
Approach	952	0	551	1502	1.1		0.962		36.5	LOS C	21.6	153.0				
North East: Princes Highway (North East Approach)																
Lane 1	267	0	0	267	1.2	1927	0.139	100	10.8	NA[9]	NA[9]	NA[9]	10	Turn Bay	0.0	NA[9]
Lane 2	0	811	0	811	0.9	839	0.966	100	36.9	LOS C	54.1	381.9	265	–	0.0	38.3
Lane 3	0	836	0	836	0.9	866	0.966	100	36.4	LOS C	55.6	391.9	265	–	0.0	40.8
Lane 4	0	811	0	811	0.9	839	0.966	100	36.9	LOS C	54.1	381.9	265	–	0.0	38.3
Approach	267	2459	0	2726	0.9		0.966		34.2	LOS C	55.6	391.9				
South West: Princes Highway (South West Approach)																
Lane 1	0	746	0	746	0.9	1462	0.511	100	1.5	LOS A	5.6	39.6	500	–	0.0	0.0
Lane 2	0	742	0	742	0.9	1454	0.511	100	1.5	LOS A	5.6	39.4	500	–	0.0	0.0
Lane 3	0	746	0	746	0.9	1462	0.511	100	1.5	LOS A	5.6	39.6	500	–	0.0	0.0
Lane 4	0	0	478	478	0.5	495	0.966	100	79.5	LOS F	35.7	250.8	160	Turn Bay	0.0	45.6
Lane 5	0	0	490	490	0.5	507	0.966	100	59.3[8]	LOS E[8]	30.5[8]	214.7[8]	130	Turn Bay	0.0	50.0
Approach	0	2235	968	3203	0.8		0.966		22.0	LOS B	35.7	250.8				
Intersection				7432	0.9		0.966		29.4	LOS C	55.6	391.9				

Level of Service (Aver. Int. Delay): LOS C. Based on average delay for all lanes. LOS Method: Delay (RTA NSW).
Level of Service (Worst Lane): LOS F. LOS Method for individual lanes: Delay (RTA NSW).
Approach LOS values are based on average delay for all lanes.

8 Delay, queue length and stops for the short lane have been cut down to fit in the queuing space. You may wish to change the short lane to a full lane to investigate the effect on the adjacent lane performance.
9 Continuous lane


Oak Road (North Approach)
N
20
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35
60
Princes Hwy (West Approach)
Princes Highway (East Approach)
Oak Road (South Approach)

LANE SUMMARY

Princes Hwy x Oak Road
AM Existing Peak Period
Signals - Fixed Time Cycle Time = 150 seconds

Lane Use and Performance

	Demand Flows L veh/h	T veh/h	R veh/h	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Lane Length m	SL Type	Cap. Adj. %	Prob. Block. %
South: Oak Road (South Approach)																
Lane 1	75	0	0	75	1.4	196[1]	0.382	100	69.6	LOS E	6.5	45.9	60	Parking	0.0	0.0
Lane 2	0	173	168	341	0.0	337	1.011	100	124.3	LOS F	35.3	247.0	370	–	0.0	0.0
Approach	75	173	168	416	0.3		1.011		114.5	LOS F	35.3	247.0				
East: Princes Highway (East Approach)																
Lane 1	61	532	0	593	3.5	856	0.694	100	17.5	LOS B	21.5	154.7	500	–	0.0	0.0
Lane 2	0	594	0	594	3.9	857	0.694	100	15.8	LOS B	22.1	160.1	500	–	0.0	0.0
Lane 3	0	597	0	597	3.9	861	0.694	100	15.8	LOS B	22.2	160.9	500	–	0.0	0.0
Approach	61	1724	0	1785	3.8		0.694		16.4	LOS B	22.2	160.9				
North: Oak Road (North Approach)																
Lane 1	24	122	0	146	0.7	149	0.985	100	111.4	LOS F	15.1	106.6	400	–	0.0	0.0
Lane 2	0	0	120	120	1.8	140	0.857	100	91.2	LOS F	11.3	80.3	60	Turn Bay	0.0	19.5
Approach	24	122	120	266	1.2		0.985		102.3	LOS F	15.1	106.6				
West: Princes Hwy (West Approach)																
Lane 1	152	1066	0	1217	1.9	1178	1.033	100	58.6	LOS E	100.6	716.0	380	–	0.0	63.6
Lane 2	0	1209	0	1209	1.9	1170	1.033	100	60.2	LOS E	123.0	875.2	380	–	0.0	83.1
Lane 3	0	1215	0	1215	1.9	1176	1.033	100	60.1	LOS E	123.6	879.2	380	–	0.0	83.5
Lane 4	0	0	40	40	0.0	143[1]	0.280	100	24.8	LOS B	1.7	12.1	35	Turn Bay	0.0	0.0
Approach	152	3489	40	3681	1.9		1.033		59.3	LOS E	123.6	879.2				
Intersection				6148	2.3		1.035		52.4	LOS D	123.6	879.2				

Level of Service (Aver. Int. Delay): LOS D. Based on average delay for all lanes. LOS Method: Delay (RTA NSW).
Level of Service (Worst Lane): LOS F. LOS Method for individual lanes: Delay (RTA NSW).
Approach LOS values are based on average delay for all lanes.

1 Reduced capacity due to a short lane effect

SIDRA INTERSECTION

LANE SUMMARY

Princes Hwy x Oak Road
PM Existing Peak Period
Signals - Fixed Time Cycle Time = 150 seconds

Lane Use and Performance

	Demand Flows L veh/h	T veh/h	R veh/h	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Lane Length m	SL Type	Cap. Adj. %	Prob. Block. %
South: Oak Road (South Approach)																
Lane 1	120	0	0	120	0.0	189[1]	0.636	100	77.6	LOS F	10.3	71.9	60	Parking	0.0	12.1
Lane 2	0	146	127	274	0.4	275	0.997	100	117.6	LOS F	27.5	193.0	370	–	0.0	0.0
Approach	120	146	127	394	0.3		0.997		105.4	LOS F	27.5	193.0				
East: Princess Highway (East Approach)																
Lane 1	47	1163	0	1210	0.5	1225	0.988	100	31.4	LOS C	90.5	636.4	500	–	0.0	26.9
Lane 2	0	1203	0	1203	0.5	1218	0.988	100	31.1	LOS C	90.0	632.8	500	–	0.0	26.4
Lane 3	0	1210	0	1210	0.5	1225	0.988	100	30.9	LOS C	90.4	635.4	500	–	0.0	26.8
Lane 4	0	0	13	13	0.0	191	0.066	100	22.7	LOS B	0.5	3.4	40	Turn Bay	0.0	0.0
Approach	47	3576	13	3636	0.5		0.988		31.1	LOS C	90.5	636.4				
North: Oak Road (North Approach)																
Lane 1	20	123	0	143	0.0	174	0.821	100	80.2	LOS F	12.7	89.1	400	–	0.0	0.0
Lane 2	0	0	165	165	0.0	165	0.999	100	99.8[8]	LOS F[8]	15.4[8]	107.5[8]	60	Turn Bay	0.0	50.0
Approach	20	123	165	308	0.0		0.999		90.7	LOS F	15.4	107.5				
West: Princess Hwy (West Approach)																
Lane 1	71	739	0	809	0.8	1009	0.802	100	12.0	LOS A	23.2	163.6	380	–	0.0	0.0
Lane 2	0	802	0	802	0.9	1000	0.802	100	9.1	LOS A	24.4	172.2	380	–	0.0	0.0
Lane 3	0	806	0	806	0.9	1006	0.802	100	9.1	LOS A	24.5	173.0	380	–	0.0	0.0
Approach	71	2347	0	2418	0.8		0.802		10.0	LOS A	24.5	173.0				
Intersection				6756	0.6		0.999		30.6	LOS C	90.5	636.4				

Level of Service (Aver. Int. Delay): LOS C. Based on average delay for all lanes. LOS Method: Delay (RTA NSW).
Level of Service (Worst Lane): LOS F. LOS Method for individual lanes: Delay (RTA NSW).
Approach LOS values are based on average delay for all lanes.

1 Reduced capacity due to a short lane effect
8 Delay, queue length and stops for the short lane have been cut down to fit in the queuing space. You may wish to change the short lane to a full lane to investigate the effect on the adjacent lane performance.

SIDRA INTERSECTION

LANE SUMMARY

Site: Princes Hwy x Oak Road - 2010 Existing Saturday Peak Period

Princes Hwy x Oak Road
W/E Existing Midday Peak Period
Signals - Fixed Time Cycle Time = 150 seconds

Lane Use and Performance

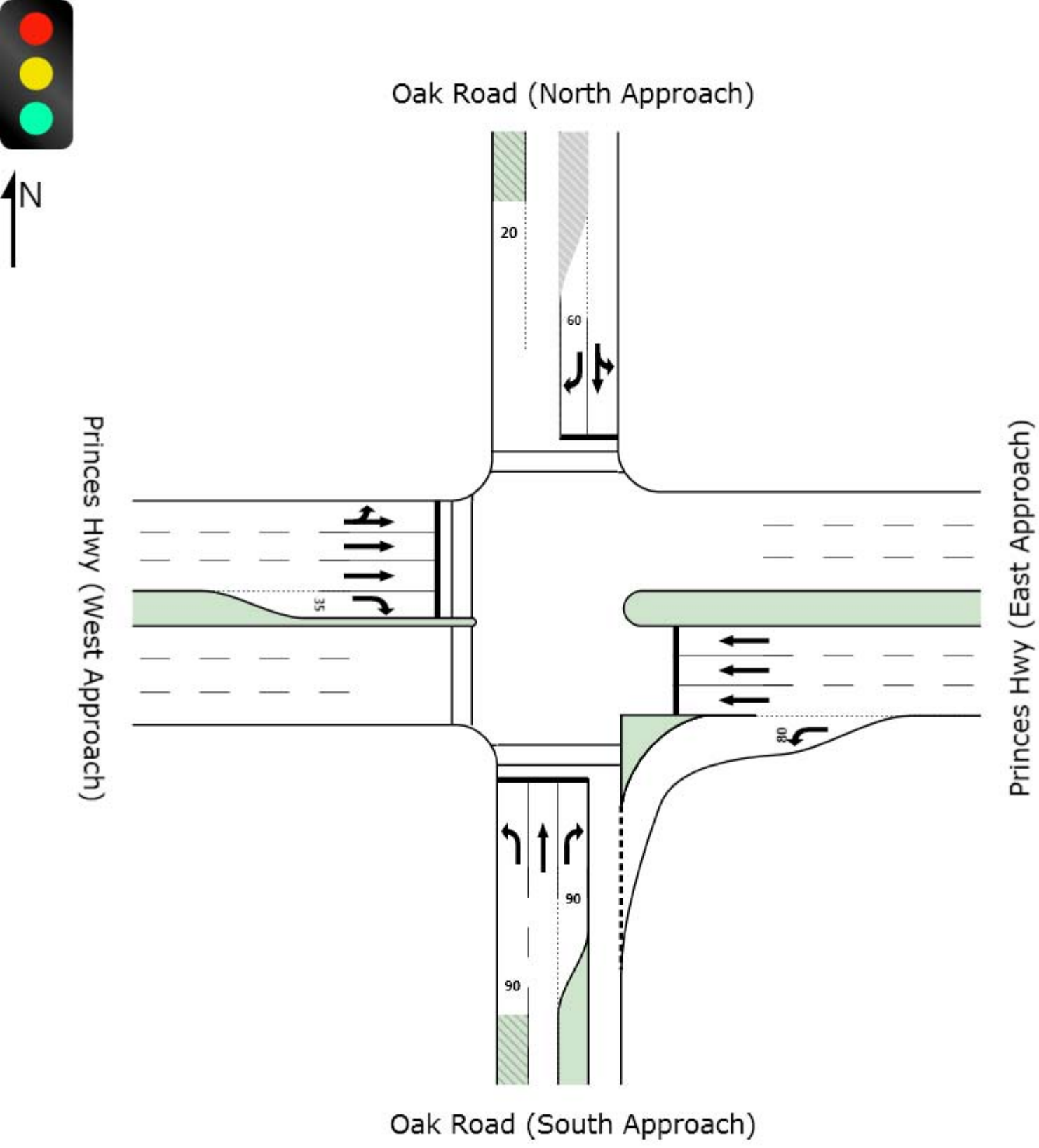
	Demand Flows L veh/h	T veh/h	R veh/h	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Lane Length m	SL Type	Cap. Adj. %	Prob. Block. %
South: Oak Road (South Approach)																
Lane 1	98	0	0	98	0.0	191[1]	0.513	100	75.0	LOS F	8.5	59.4	60	Parking	0.0	4.8
Lane 2	0	161	139	300	0.0	288	1.043	100	145.4	LOS F	33.3	233.2	370	–	0.0	0.0
Approach	98	161	139	398	0.0		1.043		128.1	LOS F	33.3	233.2				
East: Princes Highway (East Approach)																
Lane 1	84	882	0	967	1.0	1036	0.933	100	16.8	LOS B	45.5	321.2	500	–	0.0	0.0
Lane 2	0	967	0	967	1.1	1036	0.933	100	16.5	LOS B	47.9	338.7	500	–	0.0	0.0
Lane 3	0	972	0	972	1.1	1042	0.933	100	16.4	LOS B	48.1	340.0	500	–	0.0	0.0
Lane 4	0	0	52	52	0.0	126	0.410	100	79.3	LOS F	5.1	35.6	40	Turn Bay	0.0	2.7
Approach	84	2821	52	2957	1.1		0.933		17.7	LOS B	48.1	340.0				
North: Oak Road (North Approach)																
Lane 1	23	138	0	161	0.0	187	0.862	100	82.6	LOS F	14.3	100.1	400	–	0.0	0.0
Lane 2	0	0	177	177	0.0	177	0.997	100	88.8[8]	LOS F[8]	15.4[8]	107.5[8]	60	Turn Bay	0.0	50.0
Approach	23	138	177	338	0.0		0.997		85.9	LOS F	15.4	107.5				
West: Princes Hwy (West Approach)																
Lane 1	108	964	0	1072	0.7	1048	1.024	100	52.3	LOS D	81.6	574.8	380	–	0.0	42.9
Lane 2	0	1063	0	1063	0.8	1039	1.024	100	56.6	LOS E	105.4	742.5	380	–	0.0	67.1
Lane 3	0	1069	0	1069	0.8	1044	1.024	100	56.5	LOS D	105.8	745.9	380	–	0.0	67.5
Lane 4	0	0	85	85	0.0	144	0.592	100	51.6	LOS D	7.1	49.6	35	Turn Bay	0.0	18.0
Approach	108	3096	85	3289	0.7		1.024		55.0	LOS D	105.8	745.9				
Intersection				6982	0.8		1.043		44.9	LOS D	105.8	745.9				

Level of Service (Aver. Int. Delay): LOS D. Based on average delay for all lanes. LOS Method: Delay (RTA NSW).
Level of Service (Worst Lane): LOS F. LOS Method for individual lanes: Delay (RTA NSW).
Approach LOS values are based on average delay for all lanes.

1 Reduced capacity due to a short lane effect

8 Delay, queue length and stops for the short lane have been cut down to fit in the queuing space. You may wish to change the short lane to a full lane to investigate the effect on the adjacent lane performance.

SIDRA INTERSECTION


Oak Road (North Approach)
N
20
60
Princes Hwy (West Approach)
35
Princes Hwy (East Approach)
80
90
90
Oak Road (South Approach)

LANE SUMMARY

Site: Princes Hwy x Oak Road - Future AM Peak Period

Princes Hwy x Oak Road
AM Future Peak Period
Signals - Fixed Time Cycle Time = 140 seconds

Lane Use and Performance

	Demand Flows L veh/h	T veh/h	R veh/h	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Lane Length m	SL Type	Cap. Adj. %	Prob. Block. %
South: Oak Road (South Approach)																
Lane 1	122	0	0	122	0.9	374[1]	0.326	100	42.1	LOS C	7.4	52.5	90	Parking	0.0	0.0
Lane 2	0	209	10[0]	219	0.0	465	0.471	100	48.7	LOS D	14.3	99.8	370	–	0.0	0.0
Lane 3	0	0	219	219	0.0	219	1.000[3]	100	120.0[8]	LOS F[8]	21.8[8]	152.6[8]	90	Turn Bay	0.0	50.0
Approach	122	209	228	560	0.2		1.000		75.1	LOS F	21.8	152.6				
East: Princes Hwy (East Approach)																
Lane 1	61	0	0	61	0.0	1149[1]	0.053	100	8.5	LOS A	0.2	1.5	80	Turn Bay	0.0	0.0
Lane 2	0	578	0	578	3.9	1008	0.573	100	6.4	LOS A	10.2	73.7	500	–	0.0	0.0
Lane 3	0	572	0	572	3.9	998	0.573	100	6.4	LOS A	10.1	73.1	500	–	0.0	0.0
Lane 4	0	575	0	575	3.9	1003	0.573	100	6.4	LOS A	10.1	73.4	500	–	0.0	0.0
Approach	61	1724	0	1785	3.8		0.573		6.5	LOS A	10.2	73.7				
North: Oak Road (North Approach)																
Lane 1	24	158	0	182	0.6	452	0.403	100	48.9	LOS D	12.1	84.8	400	–	0.0	0.0
Lane 2	0	0	120	120	1.8	185	0.648	100	70.8	LOS F	9.8	69.6	60	Turn Bay	0.0	10.3
Approach	24	158	120	302	1.0		0.648		57.6	LOS E	12.1	84.8				
West: Princes Hwy (West Approach)																
Lane 1	152	1063	0	1215	1.9	1272	0.955	100	17.5	LOS B	55.7	396.6	380	–	0.0	8.8
Lane 2	0	1210	0	1210	1.9	1267	0.955	100	16.5	LOS B	55.6	395.6	380	–	0.0	8.6
Lane 3	0	1216	0	1216	1.9	1273	0.955	100	16.3	LOS B	55.8	396.9	380	–	0.0	8.9
Lane 4	0	0	67	67	0.0	119[1]	0.566	100	75.3	LOS F	6.0	42.1	35	Turn Bay	0.0	10.1
Approach	152	3489	67	3708	1.9		0.955		17.8	LOS B	55.8	396.9				
Intersection				6356	2.2		1.000		21.6	LOS B	55.8	396.9				

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all lanes. LOS Method: Delay (RTA NSW).
Level of Service (Worst Lane): LOS F. LOS Method for individual lanes: Delay (RTA NSW).
Approach LOS values are based on average delay for all lanes.

0 Excess flow from back of an adjacent short lane
1 Reduced capacity due to a short lane effect
3 x = 1.00 due to short lane.
8 Delay, queue length and stops for the short lane have been cut down to fit in the queuing space. You may wish to change the short lane to a full lane to investigate the effect on the adjacent lane performance.

LANE SUMMARY

Princes Hwy x Oak Road
PM Future Peak Period
Signals - Fixed Time Cycle Time = 150 seconds

Lane Use and Performance

	Demand Flows L veh/h	T veh/h	R veh/h	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Lane Length m	SL Type	Cap. Adj. %	Prob. Block. %
South: Oak Road (South Approach)																
Lane 1	180	0	0	180	0.0	321[1]	0.560	100	56.4	LOS D	12.4	86.5	90	Parking	0.0	3.6
Lane 2	0	222	0	222	0.5	561	0.396	100	45.2	LOS D	14.3	100.7	370	–	0.0	0.0
Lane 3	0	0	209	209	0.0	210	0.999[3]	100	122.2[8]	LOS F[8]	21.8[8]	152.6[8]	90	Turn Bay	0.0	50.0
Approach	180	222	209	612	0.2		0.999		74.9	LOS F	21.8	152.6				
East: Princes Hwy (East Approach)																
Lane 1	47	0	0	47	0.0	823[1]	0.058	100	8.6	LOS A	0.2	1.6	80	Turn Bay	0.0	0.0
Lane 2	0	1198	0	1198	0.5	1205	0.994	100	34.5	LOS C	99.0	696.3	500	–	0.0	35.2
Lane 3	0	1186	0	1186	0.5	1193	0.994	100	34.8	LOS C	98.2	690.5	500	–	0.0	34.4
Lane 4	0	1192	0	1192	0.5	1199	0.994	100	34.7	LOS C	98.6	693.4	500	–	0.0	34.8
Lane 5	0	0	13	13	0.0	73	0.173	100	87.9	LOS F	1.5	10.2	40	Turn Bay	0.0	0.0
Approach	47	3576	13	3636	0.5		0.994		34.5	LOS C	99.0	696.3				
North: Oak Road (North Approach)																
Lane 1	20	257	0	277	0.0	552	0.502	100	46.8	LOS D	17.7	124.2	400	–	0.0	0.0
Lane 2	0	0	165	165	0.0	201	0.820	100	81.3	LOS F	14.5	101.2	60	Turn Bay	0.0	43.4
Approach	20	257	165	442	0.0		0.820		59.7	LOS E	17.7	124.2				
West: Princes Hwy (West Approach)																
Lane 1	71	738	0	808	0.8	1045	0.773	100	7.3	LOS A	18.5	130.4	380	–	0.0	0.0
Lane 2	0	803	0	803	0.9	1038	0.773	100	6.7	LOS A	18.4	129.8	380	–	0.0	0.0
Lane 3	0	807	0	807	0.9	1044	0.773	100	6.7	LOS A	18.5	130.3	380	–	0.0	0.0
Approach	71	2347	0	2418	0.8		0.773		6.9	LOS A	18.5	130.4				
Intersection				7107	0.5		0.999		30.1	LOS C	99.0	696.3				

Level of Service (Aver. Int. Delay): LOS C. Based on average delay for all lanes. LOS Method: Delay (RTA NSW).
Level of Service (Worst Lane): LOS F. LOS Method for individual lanes: Delay (RTA NSW).
Approach LOS values are based on average delay for all lanes.

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LANE SUMMARY

Site: Princes Hwy x Oak Road - Future Saturday Peak Period

Princes Hwy x Oak Road
W/E Existing Midday Peak Period
Signals - Fixed Time Cycle Time = 130 seconds

Lane Use and Performance

	Demand Flows L veh/h	T veh/h	R veh/h	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Lane Length m	SL Type	Cap. Adj. %	Prob. Block. %
South: Oak Road (South Approach)																
Lane 1	143	0	0	143	0.0	392[1]	0.365	100	41.3	LOS C	8.2	57.5	90	Parking	0.0	0.0
Lane 2	0	234	53[0]	287	0.0	439	0.654	100	49.1	LOS D	17.8	124.3	370	–	0.0	0.0
Lane 3	0	0	175	175	0.0	158	1.111	100	196.2	LOS F	21.8	152.4	90	Turn Bay	0.0	49.8
Approach	143	234	228	605	0.0		1.111		89.8	LOS F	21.8	152.4				
East: Princes Highway (East Approach)																
Lane 1	84	0	0	84	0.0	762[1]	0.111	100	8.7	LOS A	0.3	2.3	80	Turn Bay	0.0	0.0
Lane 2	0	945	0	945	1.1	1032	0.916	100	14.7	LOS B	39.7	280.3	500	–	0.0	0.0
Lane 3	0	935	0	935	1.1	1021	0.916	100	14.8	LOS B	39.4	278.2	500	–	0.0	0.0
Lane 4	0	940	0	940	1.1	1026	0.916	100	14.8	LOS B	39.5	279.2	500	–	0.0	0.0
Lane 5	0	0	52	52	0.0	151[1]	0.341	100	66.2	LOS E	4.2	29.6	40	Turn Bay	0.0	0.0
Approach	84	2821	52	2957	1.1		0.916		15.5	LOS B	39.7	280.3				
North: Oak Road (North Approach)																
Lane 1	23	222	10[0]	256	0.0	436	0.587	100	48.2	LOS D	15.8	110.4	400	–	0.0	0.0
Lane 2	0	0	167	167	0.0	154	1.080	100	173.2	LOS F	19.6	137.5	80	Turn Bay	0.0	50.0
Approach	23	222	177	422	0.0		1.080		97.5	LOS F	19.6	137.5				
West: Princes Hwy (West Approach)																
Lane 1	108	971	0	1079	0.7	1029	1.049	100	76.0	LOS F	104.6	736.8	380	–	0.0	66.4
Lane 2	0	1073	0	1073	0.8	1023	1.049	100	75.2	LOS F	104.1	733.4	380	–	0.0	65.9
Lane 3	0	1052	26[0]	1077	0.8	1027	1.049	100	75.1	LOS F	104.5	736.0	380	–	0.0	66.3
Lane 4	0	0	128	128	0.0	128[1]	1.000[3]	100	69.0[8]	LOS E[8]	9.9[8]	69.0[8]	35	Turn Bay	0.0	50.0
Approach	108	3096	154	3358	0.7		1.049		75.2	LOS F	104.6	736.8				
Intersection				7342	0.8		1.111		53.6	LOS D	104.6	736.8				

Level of Service (Aver. Int. Delay): LOS D. Based on average delay for all lanes. LOS Method: Delay (RTA NSW).
Level of Service (Worst Lane): LOS F. LOS Method for individual lanes: Delay (RTA NSW).
Approach LOS values are based on average delay for all lanes.

0 Excess flow from back of an adjacent short lane
1 Reduced capacity due to a short lane effect
3 x = 1.00 due to short lane.
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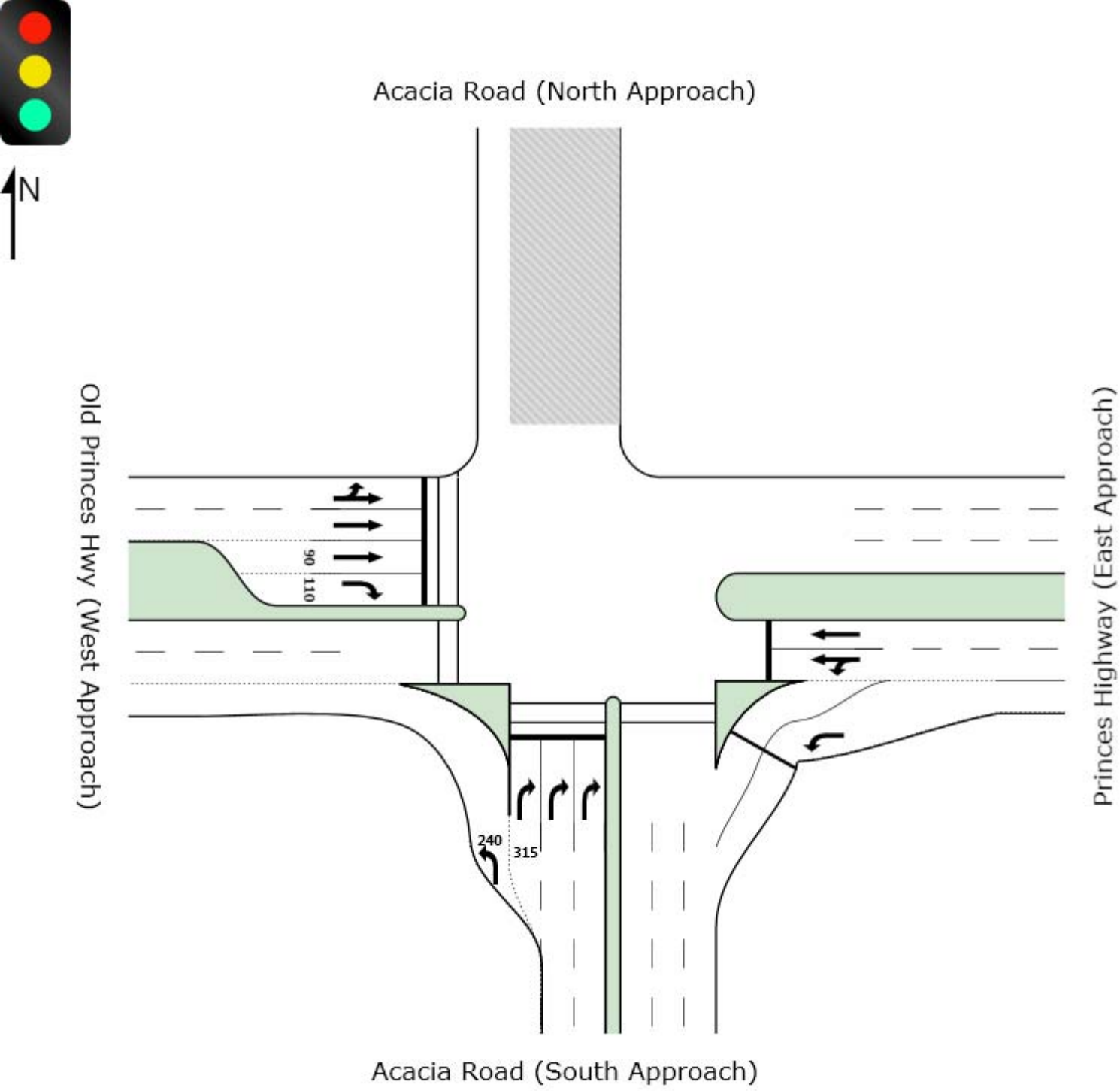

Acacia Road (North Approach)
N
Old Princes Hwy (West Approach)
Princes Highway (East Approach)
90
110
240
315
Acacia Road (South Approach)

LANE SUMMARY

Acacia Rd x Old Princes Hwy x Princes Hwy
AM Existing Peak Period
Signals - Fixed Time Cycle Time = 100 seconds

Lane Use and Performance

	Demand Flows L veh/h	T veh/h	R veh/h	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Lane Length m	SL Type	Cap. Adj. %	Prob. Block. %
South: Acacia Road (South Approach)																
Lane 1	259	0	0	259	3.7	1810	0.143	100	9.6	NA[9]	NA[9]	NA[9]	240	Turn Bay	0.0	NA[9]
Lane 2	0	0	624	624	1.6	735	0.849	100	41.0	LOS C	29.0	205.6	315	Turn Bay	0.0	0.0
Lane 3	0	0	624	624	1.6	735	0.849	100	41.0	LOS C	29.0	205.6	370	–	0.0	0.0
Lane 4	0	0	624	624	1.6	735	0.849	100	41.0	LOS C	29.0	205.6	370	–	0.0	0.0
Approach	259	0	1871	2129	1.8		0.849		37.2	LOS C	29.0	205.6				
East: Princes Highway (East Approach)																
Lane 1	683	0	0	683	4.8	1473	0.464	54[5]	10.5	LOS A	4.1	30.1	380	–	0.0	0.0
Lane 2	0	594	0	594	3.2	688	0.863	100	36.1	LOS C	29.1	209.4	380	–	0.0	0.0
Lane 3	0	584	0	584	3.2	677	0.863	100	36.2	LOS C	28.7	206.8	380	–	0.0	0.0
Approach	683	1178	0	1861	3.8		0.863		26.7	LOS B	29.1	209.4				
West: Old Princes Hwy (West Approach)																
Lane 1	31	737	0	767	2.1	921	0.833	100	28.4	LOS B	35.1	250.1	500	–	0.0	0.0
Lane 2	0	768	0	768	2.2	923	0.833	100	28.0	LOS B	35.1	250.6	500	–	0.0	0.0
Lane 3	0	477	0	477	2.2	573[1]	0.833	100	28.7	LOS C	20.2	144.2	90	Turn Bay	0.0	43.8
Lane 4	0	0	144	144	2.9	197	0.733	100	58.5	LOS E	9.0	64.3	110	Turn Bay	0.0	0.0
Approach	31	1982	144	2157	2.2		0.833		30.3	LOS C	35.1	250.6				
Intersection				6147	2.6		0.863		31.6	LOS C	35.1	250.6				

Level of Service (Aver. Int. Delay): LOS C. Based on average delay for all lanes. LOS Method: Delay (RTA NSW).
Level of Service (Worst Lane): LOS E. LOS Method for individual lanes: Delay (RTA NSW).
Approach LOS values are based on average delay for all lanes.

1 Reduced capacity due to a short lane effect
5 Lane underutilisation determined by program
9 Continuous lane

LANE SUMMARY

Acacia Rd x Old Princes Hwy x Princes Hwy
PM Existing Peak Period
Signals - Fixed Time Cycle Time = 100 seconds

Lane Use and Performance

	Demand Flows L veh/h	T veh/h	R veh/h	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Lane Length m	SL Type	Cap. Adj. %	Prob. Block. %
South: Acacia Road (South Approach)																
Lane 1	233	0	0	233	1.4	1839	0.126	100	9.5	NA[9]	NA[9]	NA[9]	240	Turn Bay	0.0	NA[9]
Lane 2	0	0	372	372	0.6	444	0.839	100	54.0	LOS D	19.6	137.7	315	Turn Bay	0.0	0.0
Lane 3	0	0	372	372	0.6	444	0.839	100	54.0	LOS D	19.6	137.7	370	–	0.0	0.0
Lane 4	0	0	372	372	0.6	444	0.839	100	54.0	LOS D	19.6	137.7	370	–	0.0	0.0
Approach	233	0	1117	1349	0.7		0.839		46.4	LOS D	19.6	137.7				
East: Princes Highway (East Approach)																
Lane 1	1407	0	0	1407	0.4	1630	0.863	100	7.3	LOS A	12.2	85.4	380	–	0.0	0.0
Lane 2	508	894	0	1401	0.4	1623	0.863	100	3.6	LOS A	12.7	89.4	380	–	0.0	0.0
Lane 3	0	1058	0	1058	0.4	1225	0.863	100	10.8	LOS A	32.1	225.5	380	–	0.0	0.0
Approach	1915	1952	0	3866	0.4		0.863		7.0	LOS A	32.1	225.5				
West: Old Princes Hwy (West Approach)																
Lane 1	40	554	0	594	0.7	1238	0.480	100	10.6	LOS A	16.1	113.6	500	–	0.0	0.0
Lane 2	0	595	0	595	0.8	1242	0.480	100	9.9	LOS A	16.2	113.9	500	–	0.0	0.0
Lane 3	0	306	94[0]	400	0.8	834[1]	0.480	100	8.7	LOS A	10.4	73.4	110	Turn Bay	0.0	0.0
Lane 4	0	0	163	163	0.4	128	1.266	100	329.9[8]	LOS F[8]	26.1[8]	183.4[8]	110	Turn Bay	0.0	50.0
Approach	40	1455	257	1752	0.7		1.266		39.5	LOS C	26.1	183.4				
Intersection				6967	0.5		1.268		22.8	LOS B	32.1	225.5				

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all lanes. LOS Method: Delay (RTA NSW).
Level of Service (Worst Lane): LOS F. LOS Method for individual lanes: Delay (RTA NSW).
Approach LOS values are based on average delay for all lanes.

0 Excess flow from back of an adjacent short lane
1 Reduced capacity due to a short lane effect
8 Delay, queue length and stops for the short lane have been cut down to fit in the queuing space. You may wish to change the short lane to a full lane to investigate the effect on the adjacent lane performance.
9 Continuous lane

SIDRA INTERSECTION

LANE SUMMARY

Site: Princes Hwy x Acacia Rd - 2010 Existing Saturday Peak Period

Acacia Rd x Old Princes Hwy x Princes Hwy
W/E Existing Midday Peak Period
Signals - Fixed Time Cycle Time = 150 seconds

Lane Use and Performance

	Demand Flows L veh/h	T veh/h	R veh/h	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Lane Length m	SL Type	Cap. Adj. %	Prob. Block. %
South: Acacia Road (South Approach)																
Lane 1	291	0	0	291	0.7	1848	0.157	100	9.4	NA[9]	NA[9]	NA[9]	240	Turn Bay	0.0	NA[9]
Lane 2	0	0	497	497	1.0	529	0.940	100	84.4	LOS F	41.6	293.3	315	Turn Bay	0.0	0.0
Lane 3	0	0	497	497	1.0	529	0.940	100	84.4	LOS F	41.6	293.3	370	–	0.0	0.0
Lane 4	0	0	497	497	1.0	529	0.940	100	84.4	LOS F	41.6	293.3	370	–	0.0	0.0
Approach	291	0	1491	1781	0.9		0.940		72.1	LOS F	41.6	293.3				
East: Princes Highway (East Approach)																
Lane 1	1413	0	0	1413	1.0	1513	0.934	100	17.2	LOS B	50.1	353.2	380	–	0.0	0.0
Lane 2	17	884	0	901	1.0	964	0.934	100	43.3	LOS D	66.1	467.0	380	–	0.0	23.7
Lane 3	0	879	0	879	1.0	941	0.934	100	43.5	LOS D	65.6	463.4	380	–	0.0	23.0
Approach	1429	1763	0	3193	1.0		0.934		31.8	LOS C	66.1	467.0				
West: Old Princes Hwy (West Approach)																
Lane 1	23	688	0	711	0.9	1225	0.580	100	17.1	LOS B	29.8	210.6	500	–	0.0	0.0
Lane 2	0	714	0	714	0.7	1230	0.580	100	16.8	LOS B	29.9	210.8	500	–	0.0	0.0
Lane 3	0	329	0	329	0.7	566[1]	0.580	100	13.6	LOS A	12.0	84.2	90	Turn Bay	0.0	2.8
Lane 4	0	0	242	242	0.0	254	0.953	100	114.4	LOS F	22.5	157.4	110	Turn Bay	0.0	34.6
Approach	23	1731	242	1996	0.7		0.953		28.2	LOS B	29.9	210.8				
Intersection				6969	0.9		0.953		41.1	LOS C	66.1	467.0				

Level of Service (Aver. Int. Delay): LOS C. Based on average delay for all lanes. LOS Method: Delay (RTA NSW).
Level of Service (Worst Lane): LOS F. LOS Method for individual lanes: Delay (RTA NSW).
Approach LOS values are based on average delay for all lanes.

1 Reduced capacity due to a short lane effect
9 Continuous lane

LANE SUMMARY

Acacia Rd x Old Princes Hwy x Princes Hwy
AM Future Peak Period
Signals - Fixed Time Cycle Time = 100 seconds

Lane Use and Performance

	Demand Flows L veh/h	T veh/h	R veh/h	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Lane Length m	SL Type	Cap. Adj. %	Prob. Block. %
South: Acacia Road (South Approach)																
Lane 1	259	0	0	259	3.7	1810	0.143	100	9.6	NA[9]	NA[9]	NA[9]	240	Turn Bay	0.0	NA[9]
Lane 2	0	0	629	629	1.6	716	0.878	100	45.1	LOS D	31.4	222.5	315	Turn Bay	0.0	0.0
Lane 3	0	0	629	629	1.6	716	0.878	100	45.1	LOS D	31.4	222.5	370	–	0.0	0.0
Lane 4	0	0	629	629	1.6	716	0.878	100	45.1	LOS D	31.4	222.5	370	–	0.0	0.0
Approach	259	0	1887	2146	1.8		0.878		40.8	LOS C	31.4	222.5				
East: Princes Highway (East Approach)																
Lane 1	683	0	0	683	4.8	1473	0.464	53[5]	10.5	LOS A	4.1	30.1	380	–	0.0	0.0
Lane 2	0	617	0	617	3.1	707	0.873	100	36.2	LOS C	30.6	220.1	380	–	0.0	0.0
Lane 3	0	608	0	608	3.1	696	0.873	100	36.4	LOS C	30.2	217.4	380	–	0.0	0.0
Approach	683	1225	0	1908	3.7		0.873		27.1	LOS B	30.6	220.1				
West: Old Princes Hwy (West Approach)																
Lane 1	31	731	0	761	2.2	940	0.810	100	25.6	LOS B	33.0	235.1	500	–	0.0	0.0
Lane 2	0	762	0	762	2.3	942	0.810	100	25.2	LOS B	33.0	235.6	500	–	0.0	0.0
Lane 3	0	471	0	471	2.3	581[1]	0.810	100	25.3	LOS B	18.9	134.7	90	Turn Bay	0.0	36.7
Lane 4	0	0	144	144	2.9	196	0.736	100	58.7	LOS E	9.0	64.4	110	Turn Bay	0.0	0.0
Approach	31	1964	144	2139	2.3		0.810		27.6	LOS B	33.0	235.6				
Intersection				6194	2.5		0.878		32.0	LOS C	33.0	235.6				

Level of Service (Aver. Int. Delay): LOS C. Based on average delay for all lanes. LOS Method: Delay (RTA NSW).
Level of Service (Worst Lane): LOS E. LOS Method for individual lanes: Delay (RTA NSW).
Approach LOS values are based on average delay for all lanes.

1 Reduced capacity due to a short lane effect
5 Lane underutilisation determined by program
9 Continuous lane

SIDRA INTERSECTION

LANE SUMMARY

Acacia Rd x Old Princes Hwy x Princes Hwy
PM Future Peak Period
Signals - Fixed Time Cycle Time = 150 seconds

Lane Use and Performance

	Demand Flows L veh/h	T veh/h	R veh/h	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Lane Length m	SL Type	Cap. Adj. %	Prob. Block. %
South: Acacia Road (South Approach)																
Lane 1	233	0	0	233	1.4	1839	0.126	100	9.5	NA[9]	NA[9]	NA[9]	240	Turn Bay	0.0	NA[9]
Lane 2	0	0	372	372	0.6	382	0.974	100	103.3	LOS F	34.1	239.7	315	Turn Bay	0.0	0.0
Lane 3	0	0	372	372	0.6	382	0.974	100	103.3	LOS F	34.1	239.7	370	–	0.0	0.0
Lane 4	0	0	372	372	0.6	382	0.974	100	103.3	LOS F	34.1	239.7	370	–	0.0	0.0
Approach	233	0	1117	1349	0.7		0.974		87.1	LOS F	34.1	239.7				
East: Princes Highway (East Approach)																
Lane 1	1498	0	0	1498	0.4	1593	0.940	100	13.3	LOS A	55.2	387.7	380	–	0.0	6.8
Lane 2	417	907	0	1324	0.4	1408	0.940	100	13.5	LOS A	44.6	313.1	380	–	0.0	0.0
Lane 3	0	1104	0	1104	0.4	1174	0.940	100	27.8	LOS B	73.3	515.0	380	–	0.0	32.7
Approach	1915	2012	0	3926	0.4		0.940		17.5	LOS B	73.3	515.0				
West: Old Princes Hwy (West Approach)																
Lane 1	40	565	0	605	0.7	1380	0.438	100	10.0	LOS A	19.0	133.9	500	–	0.0	0.0
Lane 2	0	607	0	607	0.8	1384	0.438	100	9.4	LOS A	19.1	134.3	500	–	0.0	0.0
Lane 3	0	283	50[0]	333	0.8	759[1]	0.438	100	7.8	LOS A	9.9	69.7	110	Turn Bay	0.0	0.0
Lane 4	0	0	207	207	0.4	193	1.072	100	148.7	LOS F	26.0	182.9	110	Turn Bay	0.0	49.7
Approach	40	1455	257	1752	0.7		1.072		25.8	LOS B	26.0	182.9				
Intersection				7027	0.5		1.072		32.9	LOS C	73.3	515.0				

Level of Service (Aver. Int. Delay): LOS C. Based on average delay for all lanes. LOS Method: Delay (RTA NSW).
Level of Service (Worst Lane): LOS F. LOS Method for individual lanes: Delay (RTA NSW).
Approach LOS values are based on average delay for all lanes.

0 Excess flow from back of an adjacent short lane
1 Reduced capacity due to a short lane effect
9 Continuous lane

LANE SUMMARY

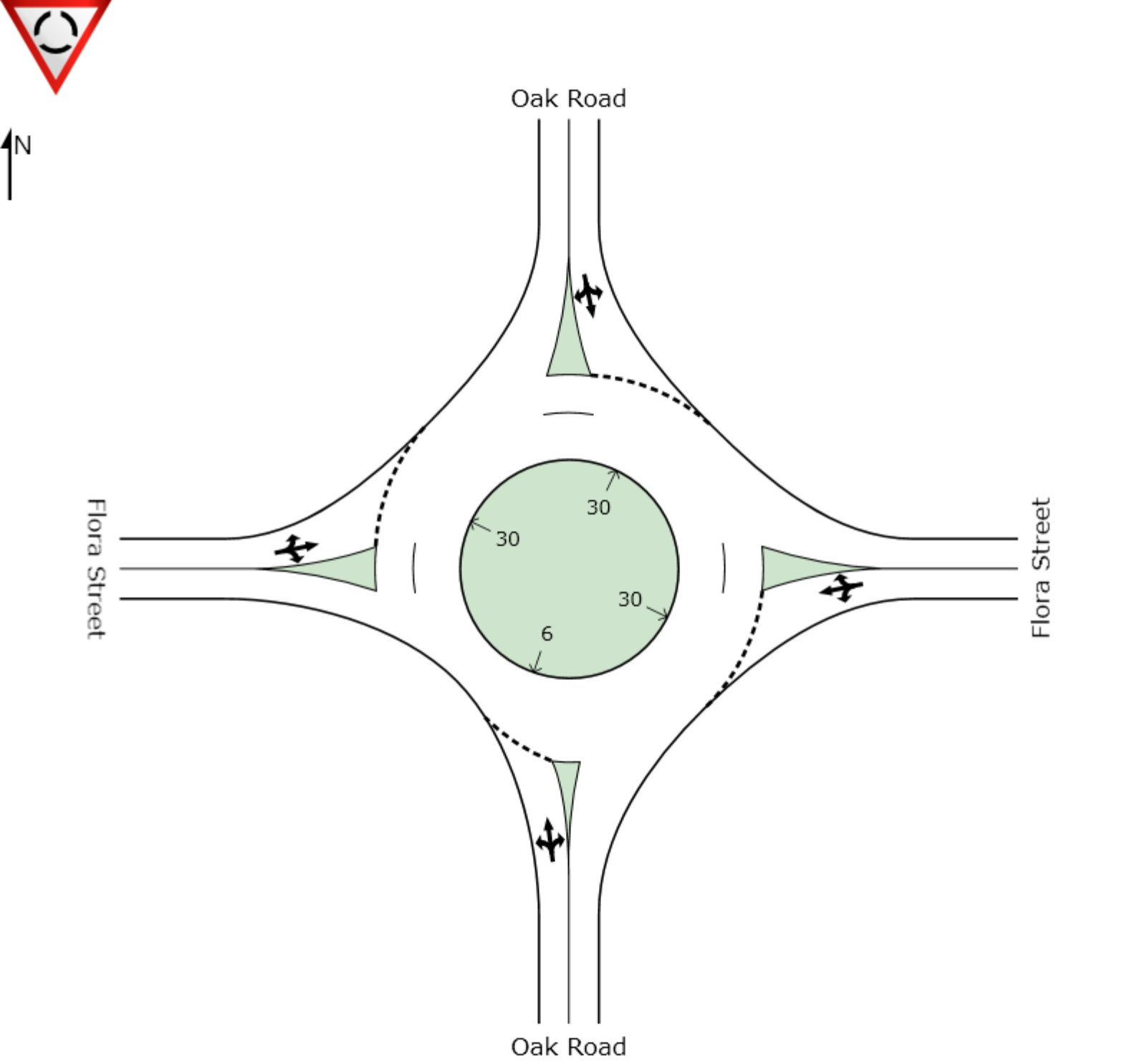
Acacia Rd x Old Princes Hwy x Princes Hwy
W/E Future Midday Peak Period
Signals - Fixed Time Cycle Time = 150 seconds

Lane Use and Performance

	Demand Flows L veh/h	T veh/h	R veh/h	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Lane Length m	SL Type	Cap. Adj. %	Prob. Block. %
South: Acacia Road (South Approach)																
Lane 1	291	0	0	291	0.7	1848	0.157	100	9.4	NA[9]	NA[9]	NA[9]	240	Turn Bay	0.0	NA[9]
Lane 2	0	0	510	510	1.0	529	0.965	100	93.2	LOS F	45.4	320.3	315	Turn Bay	0.0	6.5
Lane 3	0	0	510	510	1.0	529	0.965	100	93.2	LOS F	45.4	320.3	370	–	0.0	0.0
Lane 4	0	0	510	510	1.0	529	0.965	100	93.2	LOS F	45.4	320.3	370	–	0.0	0.0
Approach	291	0	1531	1821	0.9		0.965		79.8	LOS F	45.4	320.3				
East: Princes Highway (East Approach)																
Lane 1	1429	0	0	1429	1.0	1500	0.953	99[5]	24.2	LOS B	66.1	466.3	380	–	0.0	23.6
Lane 2	0	911	0	911	1.0	943	0.966	100	56.2	LOS D	77.3	545.7	380	–	0.0	38.1
Lane 3	0	897	0	897	1.0	928	0.966	100	56.6	LOS E	76.3	538.9	380	–	0.0	36.9
Approach	1429	1808	0	3238	1.0		0.966		42.2	LOS C	77.3	545.7				
West: Old Princes Hwy (West Approach)																
Lane 1	23	700	0	723	0.9	1225	0.590	100	17.2	LOS B	30.6	215.8	500	–	0.0	0.0
Lane 2	0	725	0	725	0.7	1230	0.590	100	16.9	LOS B	30.7	216.0	500	–	0.0	0.0
Lane 3	0	334	0	334	0.7	566[1]	0.590	100	13.9	LOS A	12.1	85.5	90	Turn Bay	0.0	3.3
Lane 4	0	0	244	244	0.0	257	0.951	100	111.0	LOS F	22.0	154.0	110	Turn Bay	0.0	32.4
Approach	23	1759	244	2026	0.7		0.951		27.9	LOS B	30.7	216.0				
Intersection				7085	0.9		0.966		47.8	LOS D	77.3	545.7				

Level of Service (Aver. Int. Delay): LOS D. Based on average delay for all lanes. LOS Method: Delay (RTA NSW).
Level of Service (Worst Lane): LOS F. LOS Method for individual lanes: Delay (RTA NSW).
Approach LOS values are based on average delay for all lanes.

1 Reduced capacity due to a short lane effect
5 Lane underutilisation determined by program
9 Continuous lane


Oak Road
N
Flora Street
Flora Street
30
30
30
6
Oak Road

LANE SUMMARY

Oak Road x FLora St
AM Existing Peak Period
Roundabout

Lane Use and Performance

	Demand Flows L veh/h	T veh/h	R veh/h	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Lane Length m	SL Type	Cap. Adj. %	Prob. Block. %
South: Oak Road																
Lane 1	33	321	129	483	0.2	1235	0.391	100	6.0	LOS A	3.0	20.8	500	–	0.0	0.0
Approach	33	321	129	483	0.2		0.391		6.0	LOS A	3.0	20.8				
East: Flora Street																
Lane 1	89	28	58	176	1.2	1162	0.151	100	6.0	LOS A	1.0	7.1	500	–	0.0	0.0
Approach	89	28	58	176	1.2		0.151		6.0	LOS A	1.0	7.1				
North: Oak Road																
Lane 1	54	146	18	218	0.5	1176	0.185	100	3.9	LOS A	1.0	7.2	500	–	0.0	0.0
Approach	54	146	18	218	0.5		0.185		3.9	LOS A	1.0	7.2				
West: Flora Street																
Lane 1	61	25	13	99	0.0	937	0.106	100	6.5	LOS A	0.8	5.8	500	–	0.0	0.0
Approach	61	25	13	99	0.0		0.106		6.5	LOS A	0.8	5.8				
Intersection				976	0.4		0.391		5.6	LOS A	3.0	20.8				

Level of Service (Aver. Int. Delay): LOS A. Based on average delay for all lanes. LOS Method: Delay (RTA NSW).
Level of Service (Worst Lane): LOS A. LOS Method for individual lanes: Delay (RTA NSW).
Approach LOS values are based on the worst delay for any lane.
Roundabout Capacity Model: SIDRA Standard.

SIDRA INTERSECTION

LANE SUMMARY

Oak Road x FLora St
AM Existing Peak Period
Roundabout

Lane Use and Performance

	Demand Flows L veh/h	T veh/h	R veh/h	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Lane Length m	SL Type	Cap. Adj. %	Prob. Block. %
South: Oak Road																
Lane 1	58	287	86	432	0.2	997	0.433	100	7.2	LOS A	3.2	22.6	500	–	0.0	0.0
Approach	58	287	86	432	0.2		0.433		7.2	LOS A	3.2	22.6				
East: Flora Street																
Lane 1	238	133	93	463	0.0	1226	0.378	100	5.5	LOS A	3.1	21.6	500	–	0.0	0.0
Approach	238	133	93	463	0.0		0.378		5.5	LOS A	3.1	21.6				
North: Oak Road																
Lane 1	20	121	33	174	0.0	1211	0.143	100	4.2	LOS A	0.7	5.2	500	–	0.0	0.0
Approach	20	121	33	174	0.0		0.143		4.2	LOS A	0.7	5.2				
West: Flora Street																
Lane 1	45	17	20	82	0.0	945	0.087	100	6.6	LOS A	0.6	4.3	500	–	0.0	0.0
Approach	45	17	20	82	0.0		0.087		6.6	LOS A	0.6	4.3				
Intersection				1151	0.1		0.434		6.0	LOS A	3.2	22.6				

Level of Service (Aver. Int. Delay): LOS A. Based on average delay for all lanes. LOS Method: Delay (RTA NSW).
Level of Service (Worst Lane): LOS A. LOS Method for individual lanes: Delay (RTA NSW).
Approach LOS values are based on the worst delay for any lane.
Roundabout Capacity Model: SIDRA Standard.

SIDRA INTERSECTION

LANE SUMMARY

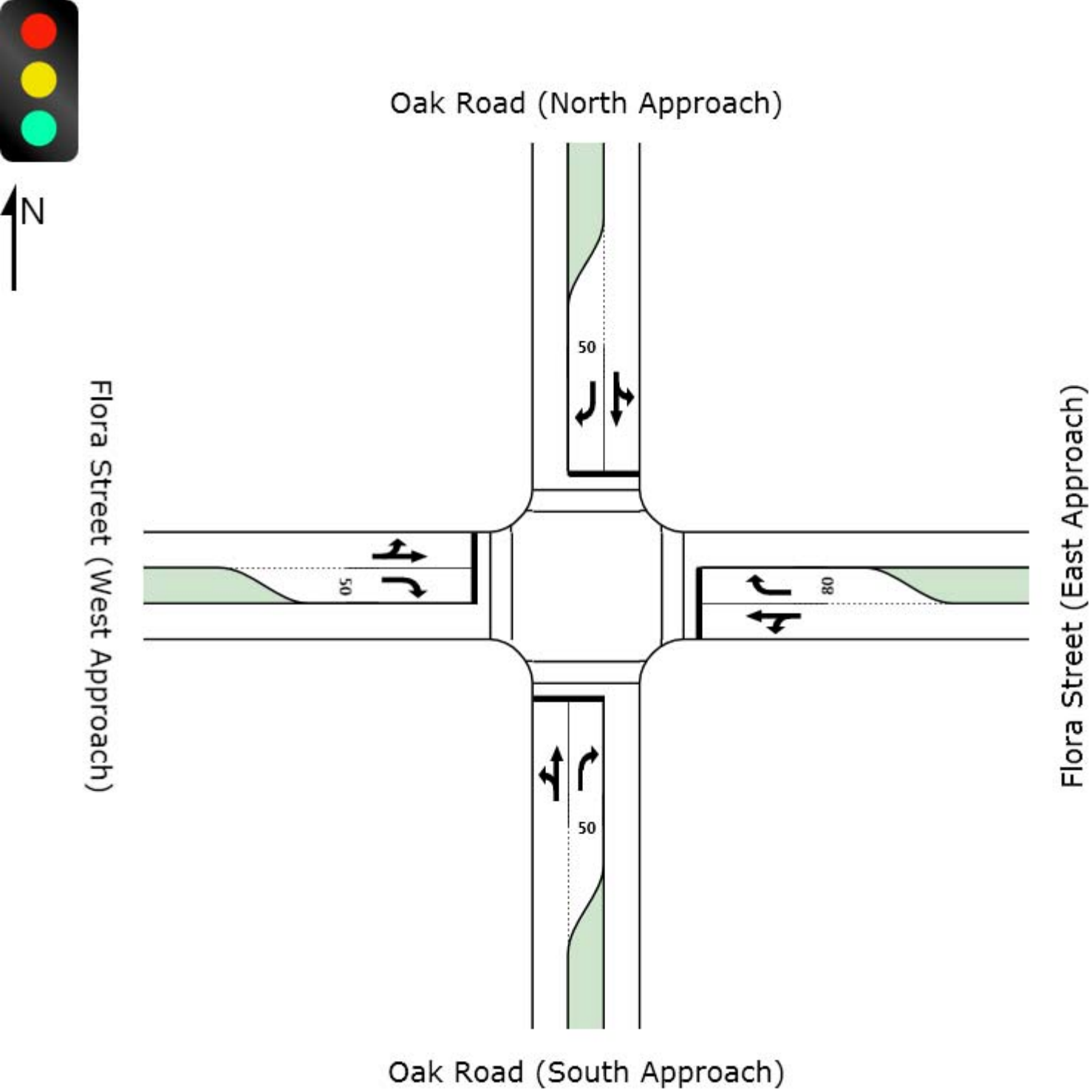
Oak Road x FLora St
AM Existing Peak Period
Roundabout

Lane Use and Performance

	Demand Flows L veh/h	T veh/h	R veh/h	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Lane Length m	SL Type	Cap. Adj. %	Prob. Block. %
South: Oak Road																
Lane 1	48	303	64	416	0.0	1102	0.377	100	6.1	LOS A	2.8	19.6	500	–	0.0	0.0
Approach	48	303	64	416	0.0		0.377		6.1	LOS A	2.8	19.6				
East: Flora Street																
Lane 1	142	66	64	273	0.0	1070	0.255	100	6.4	LOS A	2.0	13.7	500	–	0.0	0.0
Approach	142	66	64	273	0.0		0.255		6.4	LOS A	2.0	13.7				
North: Oak Road																
Lane 1	34	236	46	316	0.0	1264	0.250	100	3.9	LOS A	1.4	9.9	500	–	0.0	0.0
Approach	34	236	46	316	0.0		0.250		3.9	LOS A	1.4	9.9				
West: Flora Street																
Lane 1	29	25	29	84	0.0	977	0.086	100	6.9	LOS A	0.6	4.3	500	–	0.0	0.0
Approach	29	25	29	84	0.0		0.086		6.9	LOS A	0.6	4.3				
Intersection				1088	0.0		0.378		5.6	LOS A	2.8	19.6				

Level of Service (Aver. Int. Delay): LOS A. Based on average delay for all lanes. LOS Method: Delay (RTA NSW).
Level of Service (Worst Lane): LOS A. LOS Method for individual lanes: Delay (RTA NSW).
Approach LOS values are based on the worst delay for any lane.
Roundabout Capacity Model: SIDRA Standard.

SIDRA INTERSECTION


Oak Road (North Approach)
N
Flora Street (West Approach)
Flora Street (East Approach)
Oak Road (South Approach)
50
50
80
50

LANE SUMMARY

Oak Road x President Avenue
AM Future Peak Period
Signals - Fixed Time Cycle Time = 40 seconds

Lane Use and Performance

	Demand Flows L veh/h	T veh/h	R veh/h	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Lane Length m	SL Type	Cap. Adj. %	Prob. Block. %
South: Oak Road (South Approach)																
Lane 1	33	321	0	354	0.0	683	0.518	100	11.6	LOS A	7.2	50.5	370	–	0.0	0.0
Lane 2	0	0	193	193	0.5	384	0.501	100	21.5	LOS B	4.7	33.2	50	Turn Bay	0.0	0.0
Approach	33	321	193	546	0.2		0.518		15.0	LOS B	7.2	50.5				
East: Flora Street (East Approach)																
Lane 1	93	28	0	121	0.9	612	0.198	100	16.6	LOS B	2.6	18.5	500	–	0.0	0.0
Lane 2	0	0	202	202	0.5	476	0.424	100	20.4	LOS B	4.7	32.8	80	Turn Bay	0.0	0.0
Approach	93	28	202	323	0.7		0.424		19.0	LOS B	4.7	32.8				
North: Oak Road (North Approach)																
Lane 1	54	251	0	304	0.3	723	0.421	100	11.6	LOS A	6.1	42.8	270	–	0.0	0.0
Lane 2	0	0	61	61	0.0	342	0.179	100	21.7	LOS B	1.6	11.0	50	Turn Bay	0.0	0.0
Approach	54	251	61	365	0.3		0.421		13.3	LOS A	6.1	42.8				
West: Flora Street (West Approach)																
Lane 1	61	25	0	86	0.0	612	0.141	100	15.9	LOS B	1.9	13.1	400	–	0.0	0.0
Lane 2	0	0	13	13	0.0	450	0.028	100	18.6	LOS B	0.3	2.0	50	Turn Bay	0.0	0.0
Approach	61	25	13	99	0.0		0.141		16.2	LOS B	1.9	13.1				
Intersection				1334	0.3		0.518		15.6	LOS B	7.2	50.5				

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all lanes. LOS Method: Delay (RTA NSW).
Level of Service (Worst Lane): LOS B. LOS Method for individual lanes: Delay (RTA NSW).
Approach LOS values are based on average delay for all lanes.

SIDRA INTERSECTION

LANE SUMMARY

Oak Road x President Avenue
PM Future Peak Period
Signals - Fixed Time Cycle Time = 38 seconds

Lane Use and Performance

	Demand Flows L veh/h	T veh/h	R veh/h	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Lane Length m	SL Type	Cap. Adj. %	Prob. Block. %
South: Oak Road (South Approach)																
Lane 1	58	287	0	345	0.3	585	0.591	100	13.7	LOS A	7.4	51.6	370	–	0.0	0.0
Lane 2	0	0	262	262	0.0	360	0.729	100	24.9	LOS B	6.9	48.1	50	Turn Bay	0.0	4.1
Approach	58	287	262	607	0.2		0.729		18.6	LOS B	7.4	51.6				
East: Flora Street (East Approach)																
Lane 1	249	143	0	393	0.0	651	0.603	100	16.5	LOS B	8.1	56.4	500	–	0.0	0.0
Lane 2	0	0	311	311	0.0	523	0.593	100	19.6	LOS B	6.7	47.0	80	Turn Bay	0.0	0.0
Approach	249	143	311	703	0.0		0.603		17.9	LOS B	8.1	56.4				
North: Oak Road (North Approach)																
Lane 1	20	273	0	293	0.0	665	0.440	100	11.4	LOS A	5.9	41.2	270	–	0.0	0.0
Lane 2	0	0	131	131	0.0	335	0.390	100	22.4	LOS B	3.3	22.9	50	Turn Bay	0.0	0.0
Approach	20	273	131	423	0.0		0.440		14.8	LOS B	5.9	41.2				
West: Flora Street (West Approach)																
Lane 1	45	17	0	62	0.0	644	0.096	100	14.9	LOS B	1.2	8.7	400	–	0.0	0.0
Lane 2	0	0	20	20	0.0	293	0.068	100	22.3	LOS B	0.5	3.6	50	Turn Bay	0.0	0.0
Approach	45	17	20	82	0.0		0.096		16.7	LOS B	1.2	8.7				
Intersection				1816	0.1		0.729		17.3	LOS B	8.1	56.4				

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all lanes. LOS Method: Delay (RTA NSW).
Level of Service (Worst Lane): LOS B. LOS Method for individual lanes: Delay (RTA NSW).
Approach LOS values are based on average delay for all lanes.

SIDRA INTERSECTION

LANE SUMMARY

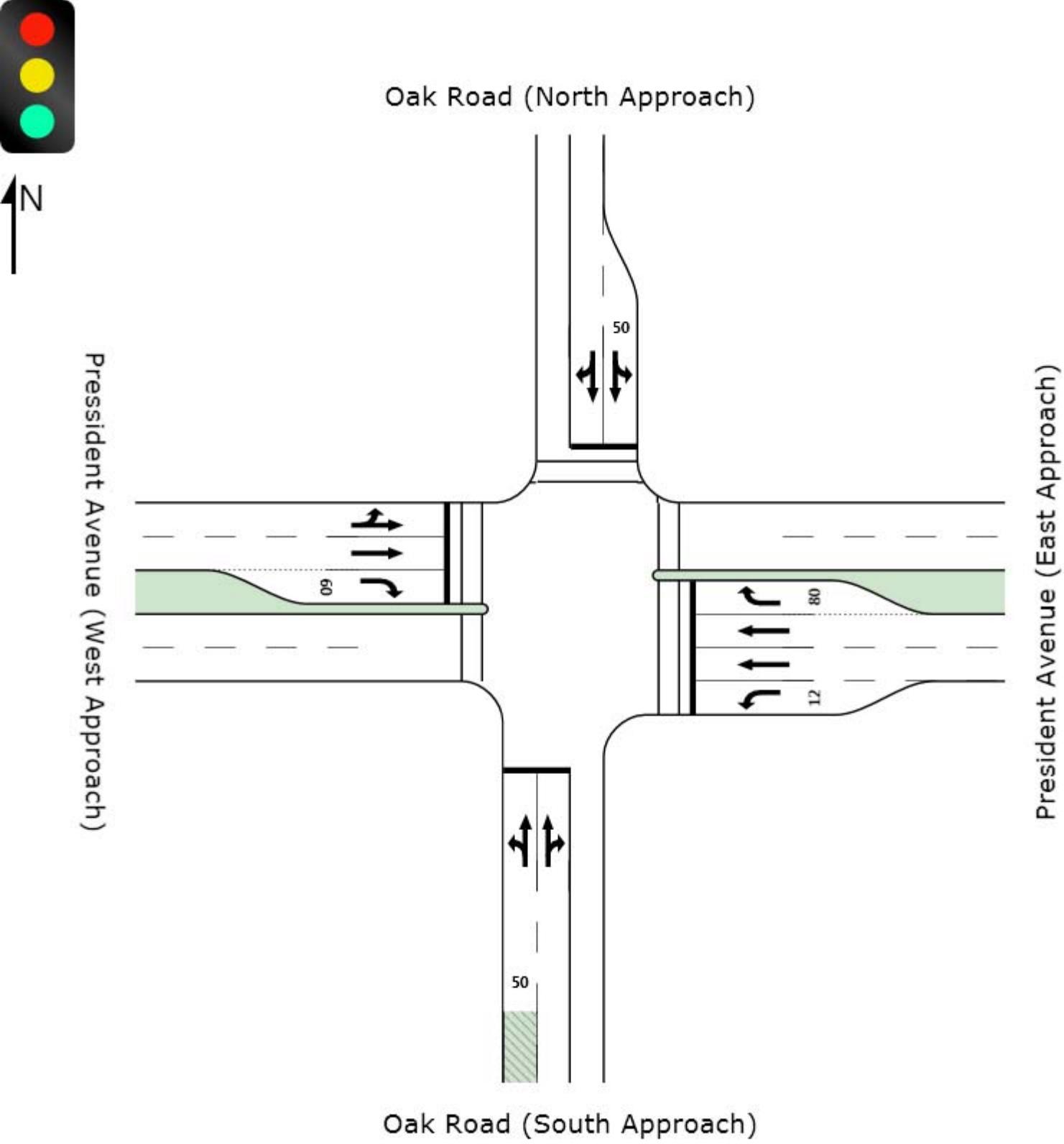
Oak Road x President Avenue
Saturday Future Peak Period
Signals - Fixed Time Cycle Time = 40 seconds

Lane Use and Performance

	Demand Flows L veh/h	T veh/h	R veh/h	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Lane Length m	SL Type	Cap. Adj. %	Prob. Block. %
South: Oak Road (South Approach)																
Lane 1	48	303	0	352	0.0	664	0.529	100	12.7	LOS A	7.4	51.5	370	–	0.0	0.0
Lane 2	0	0	203	203	0.0	307	0.663	100	25.6	LOS B	5.6	39.4	50	Turn Bay	0.0	0.4
Approach	48	303	203	555	0.0		0.663		17.4	LOS B	7.4	51.5				
East: Flora Street (East Approach)																
Lane 1	163	83	0	246	0.0	618	0.399	100	16.7	LOS B	5.3	37.2	500	–	0.0	0.0
Lane 2	0	0	272	272	0.0	501	0.542	100	20.2	LOS B	6.1	43.0	80	Turn Bay	0.0	0.0
Approach	163	83	272	518	0.0		0.542		18.5	LOS B	6.1	43.0				
North: Oak Road (North Approach)																
Lane 1	34	394	0	427	0.0	728	0.587	100	11.8	LOS A	8.7	60.6	270	–	0.0	0.0
Lane 2	0	0	142	142	0.0	367	0.387	100	21.7	LOS B	3.6	24.9	50	Turn Bay	0.0	0.0
Approach	34	394	142	569	0.0		0.587		14.3	LOS A	8.7	60.6				
West: Flora Street (West Approach)																
Lane 1	29	25	0	55	0.0	617	0.089	100	14.4	LOS A	1.2	8.3	400	–	0.0	0.0
Lane 2	0	0	29	29	0.0	361	0.082	100	21.5	LOS B	0.8	5.3	50	Turn Bay	0.0	0.0
Approach	29	25	29	84	0.0		0.089		16.9	LOS B	1.2	8.3				
Intersection				1726	0.0		0.663		16.7	LOS B	8.7	60.6				

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all lanes. LOS Method: Delay (RTA NSW).
Level of Service (Worst Lane): LOS B. LOS Method for individual lanes: Delay (RTA NSW).
Approach LOS values are based on average delay for all lanes.

SIDRA INTERSECTION


Oak Road (North Approach)
N
50
President Avenue (West Approach)
60
80
12
President Avenue (East Approach)
50
Oak Road (South Approach)

LANE SUMMARY

Oak Road x President Avenue
AM Existing Peak Period
Signals - Fixed Time Cycle Time = 100 seconds

Lane Use and Performance

	Demand Flows L veh/h	T veh/h	R veh/h	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Lane Length m	SL Type	Cap. Adj. %	Prob. Block. %
South: Oak Road (South Approach)																
Lane 1	127	0	0	127	0.8	258[1]	0.494	67[5]	42.9	LOS D	6.9	48.6	50	Parking	0.0	4.3
Lane 2	0	226	42	268	0.4	365	0.736	100	43.7	LOS D	14.4	101.3	370	–	0.0	0.0
Approach	127	226	42	396	0.5		0.736		43.4	LOS D	14.4	101.3				
East: President Avenue (East Approach)																
Lane 1	13	0	0	13	16.7	139[1]	0.091	100	14.0	LOS A	0.3	2.6	12	Turn Bay	0.0	0.0
Lane 2	0	635	0	635	1.2	1271	0.499	100	9.1	LOS A	16.7	118.2	500	–	0.0	0.0
Lane 3	0	625	9[0]	634	1.2	1270	0.499	100	9.1	LOS A	16.7	118.1	500	–	0.0	0.0
Lane 4	0	0	168	168	0.0	158	1.063	100	164.9	LOS F	19.6	137.5	80	Turn Bay	0.0	50.0
Approach	13	1260	177	1449	1.2		1.063		27.2	LOS B	19.6	137.5				
North: Oak Road (North Approach)																
Lane 1	43	0	0	43	2.4	256[1]	0.168	26[5]	41.0	LOS C	2.5	18.0	50	Turn Bay	0.0	0.0
Lane 2	0	104	49	154	0.7	238	0.645	100	47.8	LOS D	9.2	64.5	200	–	0.0	0.0
Approach	43	104	49	197	1.1		0.645		46.3	LOS D	9.2	64.5				
West: Pressident Avenue (West Approach)																
Lane 1	119	618	0	737	0.5	1272	0.579	100	11.1	LOS A	20.4	143.7	400	–	0.0	0.0
Lane 2	0	743	0	743	0.5	1283	0.579	100	9.9	LOS A	20.6	144.7	400	–	0.0	0.0
Lane 3	0	0	153	153	1.4	233	0.655	100	31.0	LOS C	7.9	55.8	60	Turn Bay	0.0	3.2
Approach	119	1361	153	1633	0.6		0.655		12.4	LOS A	20.6	144.7				
Intersection				3675	0.8		1.063		23.4	LOS B	20.6	144.7				

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all lanes. LOS Method: Delay (RTA NSW).
Level of Service (Worst Lane): LOS F. LOS Method for individual lanes: Delay (RTA NSW).
Approach LOS values are based on average delay for all lanes.

0 Excess flow from back of an adjacent short lane
1 Reduced capacity due to a short lane effect
5 Lane underutilisation determined by program

SIDRA INTERSECTION

LANE SUMMARY

Oak Road x President Avenue
PM Existing Peak Period
Signals - Fixed Time Cycle Time = 80 seconds

Lane Use and Performance

	Demand Flows L veh/h	T veh/h	R veh/h	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Lane Length m	SL Type	Cap. Adj. %	Prob. Block. %
South: Oak Road (South Approach)																
Lane 1	62	0	0	62	0.0	334[1]	0.186	46[5]	30.8	LOS C	2.7	19.0	50	Parking	0.0	0.0
Lane 2	0	133	34	166	0.0	411	0.405	100	29.1	LOS C	7.2	50.3	370	–	0.0	0.0
Approach	62	133	34	228	0.0		0.405		29.5	LOS C	7.2	50.3				
East: President Avenue (East Approach)																
Lane 1	20	0	0	20	0.0	158[1]	0.127	100	15.1	LOS B	0.5	3.6	12	Turn Bay	0.0	0.0
Lane 2	0	747	0	747	0.4	1113	0.671	100	12.6	LOS A	21.0	147.6	500	–	0.0	0.0
Lane 3	0	747	0	747	0.4	1113	0.671	100	12.6	LOS A	21.0	147.6	500	–	0.0	0.0
Lane 4	0	0	162	162	0.6	158	1.026	100	122.9	LOS F	14.9	105.0	80	Turn Bay	0.0	21.9
Approach	20	1495	162	1677	0.4		1.026		23.3	LOS B	21.0	147.6				
North: Oak Road (North Approach)																
Lane 1	88	0	0	88	0.0	334[1]	0.265	32[5]	31.2	LOS C	3.8	26.5	50	Turn Bay	0.0	0.0
Lane 2	0	154	137	291	0.0	353	0.824	100	42.3	LOS C	14.0	97.9	200	–	0.0	0.0
Approach	88	154	137	379	0.0		0.824		39.7	LOS C	14.0	97.9				
West: Pressident Avenue (West Approach)																
Lane 1	100	615	0	715	0.2	1112	0.643	100	13.3	LOS A	19.7	138.4	400	–	0.0	0.0
Lane 2	0	720	0	720	0.2	1120	0.643	100	12.3	LOS A	19.9	139.3	400	–	0.0	0.0
Lane 3	0	0	133	133	0.0	162	0.817	100	49.8	LOS D	8.0	56.2	60	Turn Bay	0.0	3.4
Approach	100	1335	133	1567	0.2		0.817		15.9	LOS B	19.9	139.3				
Intersection				3852	0.2		1.026		22.3	LOS B	21.0	147.6				

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all lanes. LOS Method: Delay (RTA NSW).
Level of Service (Worst Lane): LOS F. LOS Method for individual lanes: Delay (RTA NSW).
Approach LOS values are based on average delay for all lanes.

1 Reduced capacity due to a short lane effect
5 Lane underutilisation determined by program

LANE SUMMARY

Site: Oak Road x President Ave - 2010 Existng Saturday Peak Period

Oak Road x President Avenue
W/E Existing Midday Peak Period
Signals - Fixed Time Cycle Time = 80 seconds

Lane Use and Performance

	Demand Flows L veh/h	T veh/h	R veh/h	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Lane Length m	SL Type	Cap. Adj. %	Prob. Block. %
South: Oak Road (South Approach)																
Lane 1	62	0	0	62	0.0	334[1]	0.186	46[5]	30.8	LOS C	2.7	19.0	50	Parking	0.0	0.0
Lane 2	0	133	34	166	0.0	411	0.405	100	29.1	LOS C	7.2	50.3	370	–	0.0	0.0
Approach	62	133	34	288	0.0		0.653		34.6	LOS C	10.0	70.0				
South: Oak Road (South Approach)																
Lane 1	62	0	0	62	0.0	334[1]	0.186	46[5]	30.8	LOS C	2.7	19.0	50	Parking	0.0	0.0
Lane 2	0	133	34	166	0.0	411	0.405	100	29.1	LOS C	7.2	50.3	370	–	0.0	0.0
Approach	62	133	34	228	0.0		0.405		29.5	LOS C	7.2	50.3				
East: President Avenue (East Approach)																
Lane 1	20	0	0	20	0.0	158[1]	0.127	100	15.1	LOS B	0.5	3.6	12	Turn Bay	0.0	0.0
Lane 2	0	747	0	747	0.4	1113	0.671	100	12.6	LOS A	21.0	147.6	500	–	0.0	0.0
Lane 3	0	747	0	747	0.4	1113	0.671	100	12.6	LOS A	21.0	147.6	500	–	0.0	0.0
Lane 4	0	0	162	162	0.6	158	1.026	100	122.9	LOS F	14.9	105.0	80	Turn Bay	0.0	21.9
Approach	20	1495	162	1519	0.2		1.049		26.6	LOS B	17.9	125.0				
East: President Avenue (East Approach)																
Lane 1	20	0	0	20	0.0	158[1]	0.127	100	15.1	LOS B	0.5	3.6	12	Turn Bay	0.0	0.0
Lane 2	0	747	0	747	0.4	1113	0.671	100	12.6	LOS A	21.0	147.6	500	–	0.0	0.0
Lane 3	0	747	0	747	0.4	1113	0.671	100	12.6	LOS A	21.0	147.6	500	–	0.0	0.0
Lane 4	0	0	162	162	0.6	158	1.026	100	122.9	LOS F	14.9	105.0	80	Turn Bay	0.0	21.9
Approach	20	1495	162	1677	0.4		1.026		23.3	LOS B	21.0	147.6				
North: Oak Road (North Approach)																
Lane 1	88	0	0	88	0.0	334[1]	0.265	32[5]	31.2	LOS C	3.8	26.5	50	Turn Bay	0.0	0.0
Lane 2	0	154	137	291	0.0	353	0.824	100	42.3	LOS C	14.0	97.9	200	–	0.0	0.0
Approach	88	154	137	368	0.0		0.807		39.0	LOS C	12.8	89.8				
North: Oak Road (North Approach)																
Lane 1	88	0	0	88	0.0	334[1]	0.265	32[5]	31.2	LOS C	3.8	26.5	50	Turn Bay	0.0	0.0
Lane 2	0	154	137	291	0.0	353	0.824	100	42.3	LOS C	14.0	97.9	200	–	0.0	0.0
Approach	88	154	137	379	0.0		0.824		39.7	LOS C	14.0	97.9				
West: Pressident Avenue (West Approach)																
Lane 1	100	615	0	715	0.2	1112	0.643	100	13.3	LOS A	19.7	138.4	400	–	0.0	0.0
Lane 2	0	720	0	720	0.2	1120	0.643	100	12.3	LOS A	19.9	139.3	400	–	0.0	0.0
Lane 3	0	0	133	133	0.0	162	0.817	100	49.8	LOS D	8.0	56.2	60	Turn Bay	0.0	3.4
Approach	100	1335	133	1463	0.0		0.595		12.9	LOS A	17.9	125.6				
West: Pressident Avenue (West Approach)																
Lane 1	100	615	0	715	0.2	1112	0.643	100	13.3	LOS A	19.7	138.4	400	–	0.0	0.0
Lane 2	0	720	0	720	0.2	1120	0.643	100	12.3	LOS A	19.9	139.3	400	–	0.0	0.0
Lane 3	0	0	133	133	0.0	162	0.817	100	49.8	LOS D	8.0	56.2	60	Turn Bay	0.0	3.4
Approach	100	1335	133	1567	0.2		0.817		15.9	LOS B	19.9	139.3				
Intersection				3639	0.1		1.049		23.0	LOS B	17.9	125.6				

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all lanes. LOS Method: Delay (RTA NSW).
Level of Service (Worst Lane): LOS F. LOS Method for individual lanes: Delay (RTA NSW).
Approach LOS values are based on average delay for all lanes.

1 Reduced capacity due to a short lane effect
5 Lane underutilisation determined by program

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LANE SUMMARY

Oak Road x President Avenue
AM Future Peak Period
Signals - Fixed Time Cycle Time = 80 seconds

Lane Use and Performance

	Demand Flows L veh/h	T veh/h	R veh/h	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Lane Length m	SL Type	Cap. Adj. %	Prob. Block. %
South: Oak Road (South Approach)																
Lane 1	127	0	0	127	0.8	330[1]	0.386	61[5]	31.9	LOS C	5.4	37.7	50	Parking	0.0	0.0
Lane 2	0	243	42	285	0.4	453	0.630	100	29.8	LOS C	11.7	82.4	370	–	0.0	0.0
Approach	127	243	42	413	0.5		0.630		30.5	LOS C	11.7	82.4				
East: President Avenue (East Approach)																
Lane 1	13	0	0	13	16.7	138[1]	0.091	100	15.6	LOS B	0.3	2.6	12	Turn Bay	0.0	0.0
Lane 2	0	650	0	650	1.2	1107	0.587	100	11.7	LOS A	17.4	123.1	500	–	0.0	0.0
Lane 3	0	610	39[0]	649	1.2	1104	0.587	100	11.7	LOS A	17.4	122.8	500	–	0.0	0.0
Lane 4	0	0	168	168	0.0	148	1.136	100	203.3	LOS F	19.6	137.5	80	Turn Bay	0.0	50.0
Approach	13	1260	207	1480	1.1		1.136		33.5	LOS C	19.6	137.5				
North: Oak Road (North Approach)																
Lane 1	83	0	0	83	1.3	331[1]	0.251	33[5]	31.2	LOS C	3.6	25.3	50	Turn Bay	0.0	0.0
Lane 2	0	121	100	221	0.5	286	0.773	100	41.1	LOS C	10.9	76.4	200	–	0.0	0.0
Approach	83	121	100	304	0.7		0.773		38.4	LOS C	10.9	76.4				
West: President Avenue (West Approach)																
Lane 1	135	610	0	744	0.5	1107	0.672	100	14.0	LOS A	21.0	147.4	400	–	0.0	0.0
Lane 2	0	751	0	751	0.5	1118	0.672	100	12.6	LOS A	21.1	148.5	400	–	0.0	0.0
Lane 3	0	0	153	153	1.4	206	0.742	100	39.5	LOS C	8.0	56.7	60	Turn Bay	0.0	3.6
Approach	135	1361	153	1648	0.6		0.742		15.7	LOS B	21.1	148.5				
Intersection				3845	0.8		1.136		25.9	LOS B	21.1	148.5				

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all lanes. LOS Method: Delay (RTA NSW).
Level of Service (Worst Lane): LOS F. LOS Method for individual lanes: Delay (RTA NSW).
Approach LOS values are based on average delay for all lanes.

0 Excess flow from back of an adjacent short lane
1 Reduced capacity due to a short lane effect
5 Lane underutilisation determined by program

SIDRA INTERSECTION

LANE SUMMARY

Oak Road x President Avenue
PM Future Peak Period
Signals - Fixed Time Cycle Time = 70 seconds

Lane Use and Performance

	Demand Flows L veh/h	T veh/h	R veh/h	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Lane Length m	SL Type	Cap. Adj. %	Prob. Block. %
South: Oak Road (South Approach)																
Lane 1	62	0	0	62	0.0	389[1]	0.160	35[5]	25.7	LOS B	2.3	15.9	50	Parking	0.0	0.0
Lane 2	0	169	34	203	0.0	450	0.451	100	25.4	LOS B	7.7	53.7	370	–	0.0	0.0
Approach	62	169	34	265	0.0		0.451		25.5	LOS B	7.7	53.7				
East: President Avenue (East Approach)																
Lane 1	20	0	0	20	0.0	157[1]	0.128	100	16.3	LOS B	0.5	3.7	12	Turn Bay	0.0	0.0
Lane 2	0	785	0	785	0.4	996	0.789	100	17.3	LOS B	24.3	170.6	500	–	0.0	0.0
Lane 3	0	709	72[0]	782	0.4	991	0.789	100	17.4	LOS B	24.2	170.1	500	–	0.0	0.0
Lane 4	0	0	169	169	0.4	143	1.178	100	223.5[8]	LOS F[8]	19.6[8]	137.6[8]	80	Turn Bay	0.0	50.0
Approach	20	1495	241	1756	0.4		1.178		37.2	LOS C	24.3	170.6				
North: Oak Road (North Approach)																
Lane 1	154	0	0	154	0.0	388[1]	0.396	40[5]	26.8	LOS B	5.4	37.9	50	Turn Bay	0.0	0.0
Lane 2	0	192	197	388	0.0	391	0.995	100	76.4	LOS F	23.6	165.2	200	–	0.0	0.0
Approach	154	192	197	542	0.0		0.995		62.3	LOS E	23.6	165.2				
West: President Avenue (West Approach)																
Lane 1	160	583	0	743	0.2	991	0.750	100	16.9	LOS B	21.6	151.3	400	–	0.0	0.0
Lane 2	0	751	0	751	0.2	1001	0.750	100	15.3	LOS B	21.8	152.6	400	–	0.0	0.0
Lane 3	0	0	133	133	0.0	146	0.909	100	59.4	LOS E	8.0	56.1	60	Turn Bay	0.0	3.4
Approach	160	1335	133	1627	0.2		0.909		19.6	LOS B	21.8	152.6				
Intersection				4191	0.2		1.178		32.9	LOS C	24.3	170.6				

Level of Service (Aver. Int. Delay): LOS C. Based on average delay for all lanes. LOS Method: Delay (RTA NSW).
Level of Service (Worst Lane): LOS F. LOS Method for individual lanes: Delay (RTA NSW).
Approach LOS values are based on average delay for all lanes.

0 Excess flow from back of an adjacent short lane
1 Reduced capacity due to a short lane effect
5 Lane underutilisation determined by program
8 Delay, queue length and stops for the short lane have been cut down to fit in the queuing space. You may wish to change the short lane to a full lane to investigate the effect on the adjacent lane performance.

LANE SUMMARY

Oak Road x President Avenue
W/E Existing Midday Peak Period
Signals - Fixed Time Cycle Time = 70 seconds

Lane Use and Performance

	Demand Flows L veh/h	T veh/h	R veh/h	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Lane Length m	SL Type	Cap. Adj. %	Prob. Block. %
South: Oak Road (South Approach)																
Lane 1	69	0	0	69	0.0	389[1]	0.179	26[5]	25.8	LOS B	2.5	17.7	50	Parking	0.0	0.0
Lane 2	0	197	61	258	0.0	382	0.675	100	30.1	LOS C	10.3	71.9	370	–	0.0	0.0
Approach	69	197	61	327	0.0		0.675		29.2	LOS C	10.3	71.9				
East: President Avenue (East Approach)																
Lane 1	35	0	0	35	0.0	156[1]	0.222	100	16.4	LOS B	0.9	6.3	12	Turn Bay	0.0	0.0
Lane 2	0	687	0	687	0.2	996	0.690	100	13.8	LOS A	18.8	132.0	500	–	0.0	0.0
Lane 3	0	612	72[0]	684	0.2	991	0.690	100	13.8	LOS A	18.7	131.4	500	–	0.0	0.0
Lane 4	0	0	181	181	0.0	158	1.146	100	199.7[8]	LOS F[8]	19.6[8]	137.5[8]	80	Turn Bay	0.0	50.0
Approach	35	1299	253	1586	0.2		1.146		35.1	LOS C	19.6	137.5				
North: Oak Road (North Approach)																
Lane 1	169	0	0	169	0.0	388[1]	0.437	44[5]	27.0	LOS B	5.9	41.6	50	Turn Bay	0.0	1.3
Lane 2	0	206	172	378	0.0	380	0.995	100	75.7	LOS F	22.9	160.0	200	–	0.0	0.0
Approach	169	206	172	547	0.0		0.995		60.6	LOS E	22.9	160.0				
West: Pressident Avenue (West Approach)																
Lane 1	112	582	0	694	0.0	995	0.697	100	15.1	LOS B	19.1	133.5	400	–	0.0	0.0
Lane 2	0	699	0	699	0.0	1003	0.697	100	13.9	LOS A	19.2	134.4	400	–	0.0	0.0
Lane 3	0	0	103	103	0.0	176	0.588	100	35.0	LOS C	4.8	33.5	60	Turn Bay	0.0	0.0
Approach	112	1281	103	1496	0.0		0.697		15.9	LOS B	19.2	134.4				
Intersection				3957	0.1		1.146		30.9	LOS C	22.9	160.0				

Level of Service (Aver. Int. Delay): LOS C. Based on average delay for all lanes. LOS Method: Delay (RTA NSW).
Level of Service (Worst Lane): LOS F. LOS Method for individual lanes: Delay (RTA NSW).
Approach LOS values are based on average delay for all lanes.

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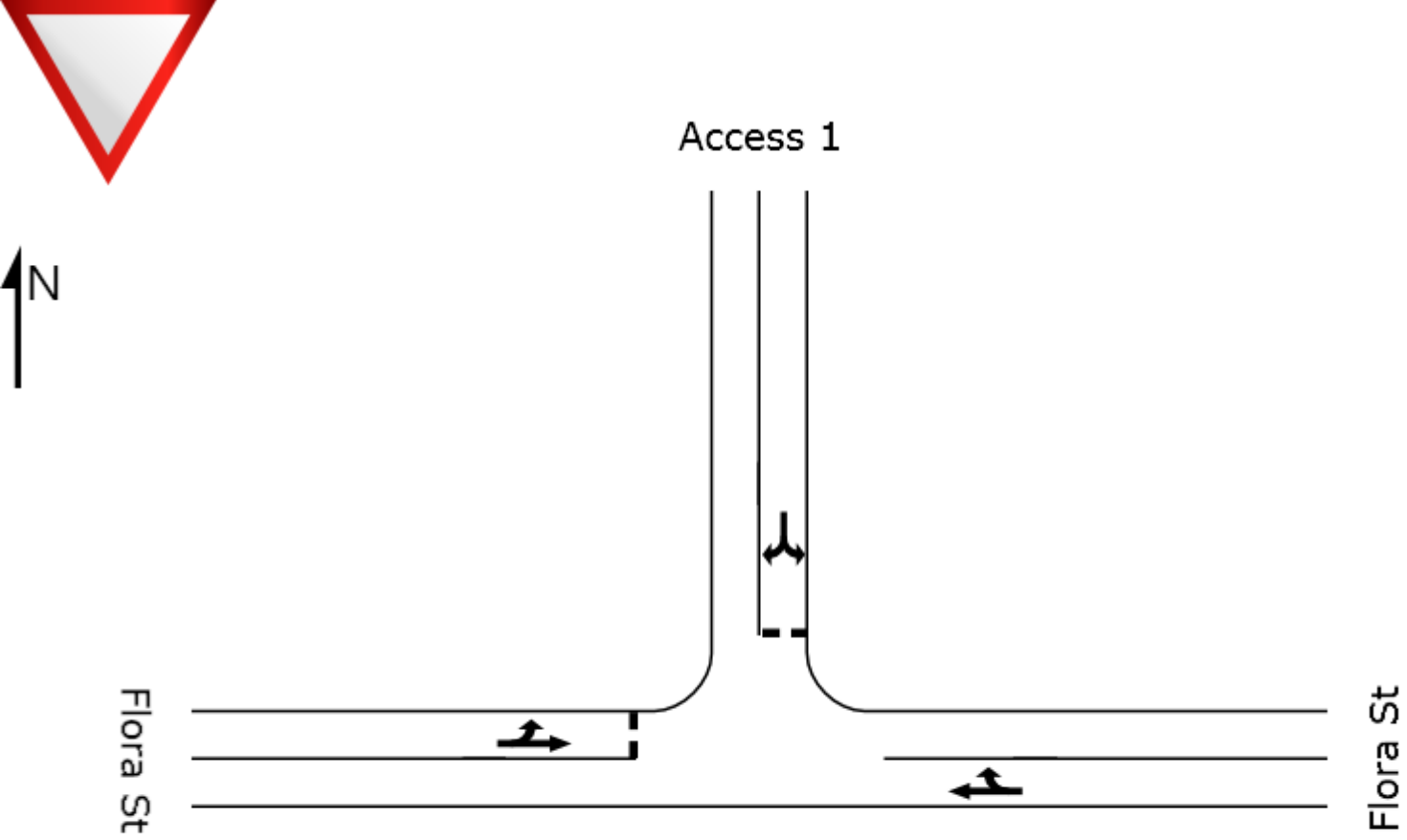

Access 1
N
Flora St
Flora St

LANE SUMMARY

Flora Street x Access 1
Future AM Peak Period
Giveway / Yield (Two-Way)

Lane Use and Performance

	Demand Flows L veh/h	T veh/h	R veh/h	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Lane Length m	SL Type	Cap. Adj. %	Prob. Block. %
East: Flora St																
Lane 1	0	179	31	209	0.5	1904	0.110	100	1.4	LOS A	0.8	5.3	500	–	0.0	0.0
Approach	0	179	31	209	0.5		0.110		1.4	LOS A	0.8	5.3				
North: Access 1																
Lane 1	40	0	147	187	0.0	1115	0.168	100	9.4	LOS A	0.8	5.9	500	–	0.0	0.0
Approach	40	0	147	187	0.0		0.168		9.4	LOS A	0.8	5.9				
West: Flora St																
Lane 1	63	189	0	253	0.4	1921	0.132	100	7.3	LOS A	0.0	0.0	500	–	0.0	0.0
Approach	63	189	0	253	0.4		0.132		7.3	LOS A	0.0	0.0				
Intersection				649	0.3		0.168		6.0	NA	0.8	5.9				

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.
Level of Service (Worst Lane): LOS A. LOS Method for individual lanes: Delay (RTA NSW).
Approach LOS values are based on the worst delay for any lane.

SIDRA INTERSECTION

LANE SUMMARY

Flora Street x Access 1
Future PM Peak Period
Giveway / Yield (Two-Way)

Lane Use and Performance

	Demand Flows L veh/h	T veh/h	R veh/h	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Lane Length m	SL Type	Cap. Adj. %	Prob. Block. %
East: Flora St																
Lane 1	0	426	61	487	0.0	1887	0.258	100	1.8	LOS A	2.2	15.3	500	–	0.0	0.0
Approach	0	426	61	487	0.0		0.258		1.8	LOS A	2.2	15.3				
North: Access 1																
Lane 1	55	0	240	295	0.0	810	0.364	100	12.1	LOS A	2.3	15.9	500	–	0.0	0.0
Approach	55	0	240	295	0.0		0.364		12.1	LOS A	2.3	15.9				
West: Flora St																
Lane 1	176	117	0	293	0.0	1893	0.155	100	7.7	LOS A	0.0	0.0	500	–	0.0	0.0
Approach	176	117	0	293	0.0		0.155		7.7	LOS A	0.0	0.0				
Intersection				1075	0.0		0.364		6.2	NA	2.3	15.9				

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.
Level of Service (Worst Lane): LOS A. LOS Method for individual lanes: Delay (RTA NSW).
Approach LOS values are based on the worst delay for any lane.

SIDRA INTERSECTION

LANE SUMMARY

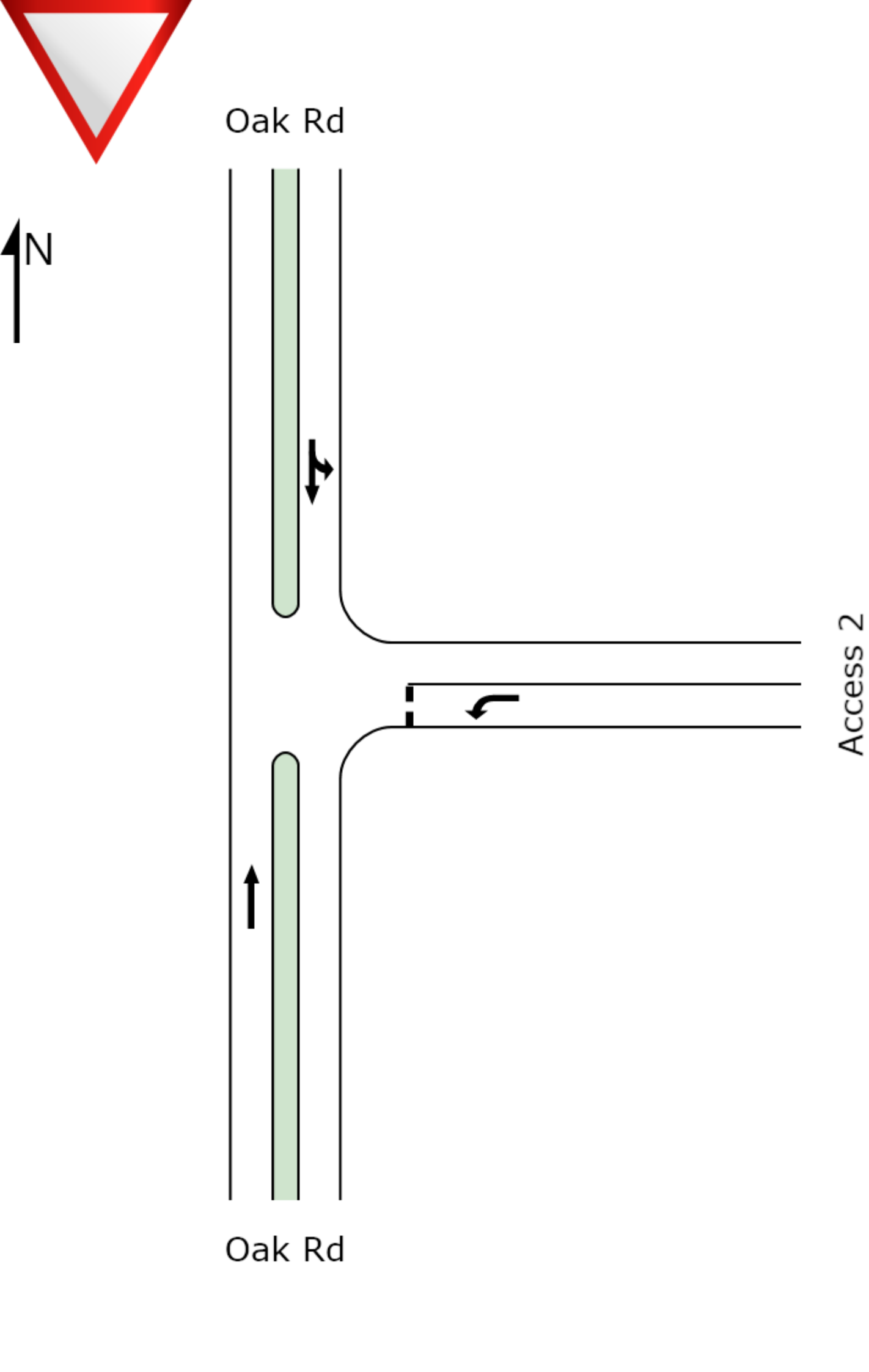
Flora Street x Access 1
Saturday Future Peak Period
Giveway / Yield (Two-Way)

Lane Use and Performance

	Demand Flows L veh/h	T veh/h	R veh/h	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Lane Length m	SL Type	Cap. Adj. %	Prob. Block. %
East: Flora St																
Lane 1	0	260	67	327	0.0	1864	0.176	100	2.2	LOS A	1.3	9.2	500	–	0.0	0.0
Approach	0	260	67	327	0.0		0.176		2.2	LOS A	1.3	9.2				
North: Access 1																
Lane 1	62	0	245	307	0.0	975	0.315	100	10.4	LOS A	1.8	12.3	500	–	0.0	0.0
Approach	62	0	245	307	0.0		0.315		10.4	LOS A	1.8	12.3				
West: Flora St																
Lane 1	139	120	0	259	0.0	1899	0.136	100	7.6	LOS A	0.0	0.0	500	–	0.0	0.0
Approach	139	120	0	259	0.0		0.136		7.6	LOS A	0.0	0.0				
Intersection				894	0.0		0.315		6.6	NA	1.8	12.3				

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.
Level of Service (Worst Lane): LOS A. LOS Method for individual lanes: Delay (RTA NSW).
Approach LOS values are based on the worst delay for any lane.

SIDRA INTERSECTION


Oak Rd
N
Access 2
Oak Rd

LANE SUMMARY

Oak Road x Access 2
AM Future Peak Period
Giveway / Yield (Two-Way)

Lane Use and Performance

	Demand Flows L veh/h	T veh/h	R veh/h	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Lane Length m	SL Type	Cap. Adj. %	Prob. Block. %
South: Oak Rd																
Lane 1	0	573	0	573	0.2	1948	0.294	100	0.0	LOS A	0.0	0.0	500	–	0.0	0.0
Approach	0	573	0	573	0.2		0.294		0.0	LOS A	0.0	0.0				
East: Access 2																
Lane 1	147	0	0	147	0.0	1339	0.110	100	9.1	LOS A	0.7	4.7	500	–	0.0	0.0
Approach	147	0	0	147	0.0		0.110		9.1	LOS A	0.7	4.7				
North: Oak Rd																
Lane 1	63	221	0	284	0.4	1924	0.148	100	1.8	LOS A	0.0	0.0	500	–	0.0	0.0
Approach	63	221	0	284	0.4		0.148		1.8	LOS A	0.0	0.0				
Intersection				1004	0.2		0.294		1.8	NA	0.7	4.7				

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.
Level of Service (Worst Lane): LOS A. LOS Method for individual lanes: Delay (RTA NSW).
Approach LOS values are based on the worst delay for any lane.

LANE SUMMARY

Oak Road x Access 2
PM Future Peak Period
Giveway / Yield (Two-Way)

Lane Use and Performance

	Demand Flows L veh/h	T veh/h	R veh/h	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Lane Length m	SL Type	Cap. Adj. %	Prob. Block. %
South: Oak Rd																
Lane 1	0	627	0	627	0.2	1948	0.322	100	0.0	LOS A	0.0	0.0	500	–	0.0	0.0
Approach	0	627	0	627	0.2		0.322		0.0	LOS A	0.0	0.0				
East: Access 2																
Lane 1	249	0	0	249	0.0	1354	0.184	100	9.1	LOS A	1.2	8.4	500	–	0.0	0.0
Approach	249	0	0	249	0.0		0.184		9.1	LOS A	1.2	8.4				
North: Oak Rd																
Lane 1	134	173	0	306	0.0	1908	0.161	100	3.6	LOS A	0.0	0.0	500	–	0.0	0.0
Approach	134	173	0	306	0.0		0.161		3.6	LOS A	0.0	0.0				
Intersection				1183	0.1		0.322		2.8	NA	1.2	8.4				

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.
Level of Service (Worst Lane): LOS A. LOS Method for individual lanes: Delay (RTA NSW).
Approach LOS values are based on the worst delay for any lane.

LANE SUMMARY

Oak Road x Access 2
Saturday Future Peak Period
Giveway / Yield (Two-Way)

Lane Use and Performance

	Demand Flows L veh/h	T veh/h	R veh/h	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Lane Length m	SL Type	Cap. Adj. %	Prob. Block. %
South: Oak Rd																
Lane 1	0	605	0	605	0.0	1950	0.310	100	0.0	LOS A	0.0	0.0	500	–	0.0	0.0
Approach	0	605	0	605	0.0		0.310		0.0	LOS A	0.0	0.0				
East: Access 2																
Lane 1	254	0	0	254	0.0	1183	0.214	100	9.8	LOS A	1.4	9.5	500	–	0.0	0.0
Approach	254	0	0	254	0.0		0.214		9.8	LOS A	1.4	9.5				
North: Oak Rd																
Lane 1	153	312	0	464	0.0	1918	0.242	100	2.7	LOS A	0.0	0.0	500	–	0.0	0.0
Approach	153	312	0	464	0.0		0.242		2.7	LOS A	0.0	0.0				
Intersection				1323	0.0		0.310		2.8	NA	1.4	9.5				

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.
Level of Service (Worst Lane): LOS A. LOS Method for individual lanes: Delay (RTA NSW).
Approach LOS values are based on the worst delay for any lane.