

Appendix C Traffic and transport assessment



Roads and Maritime Services

Showground Road upgrade between Carrington Road and Old Northern Road, Castle Hill Traffic and Transport Assessment

February 2014

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1. Introduction

1.1 Background

NSW Roads and Maritime Services (Roads and Maritime) is proposing to widen about 1.5 kilometres of Showground Road, between Carrington Road and Old Northern Road. The proposal is located in the suburb of Castle Hill, which is located about 24 kilometres north-west of the Sydney central business district.

This report has been prepared by GHD as part of the environmental assessment of the project. Roads and Maritime is the proponent of the proposal, and an environmental assessment in the form of a review of environmental factors (REF) is being prepared by GHD in accordance with the requirements of Part 5 of the *NSW Environmental Planning and Assessment Act 1979* (EP&A Act).

This report assesses and documents the potential traffic impacts of the proposed road upgrades for accommodating the predicted traffic along Showground Road in interim and design horizon year of 2016 and 2026 respectively.

1.2 Proposal outline

Showground Road is generally a two-lane, two way road between Carrington Road and Pennant Street. Roads and Maritime is proposing to widen this section of Showground Road. The proposal involves the construction of a four-lane divided carriageway for a length of approximately 1.5 kilometres, to connect with the existing four-lane section west of Carrington Road. The proposal would include:

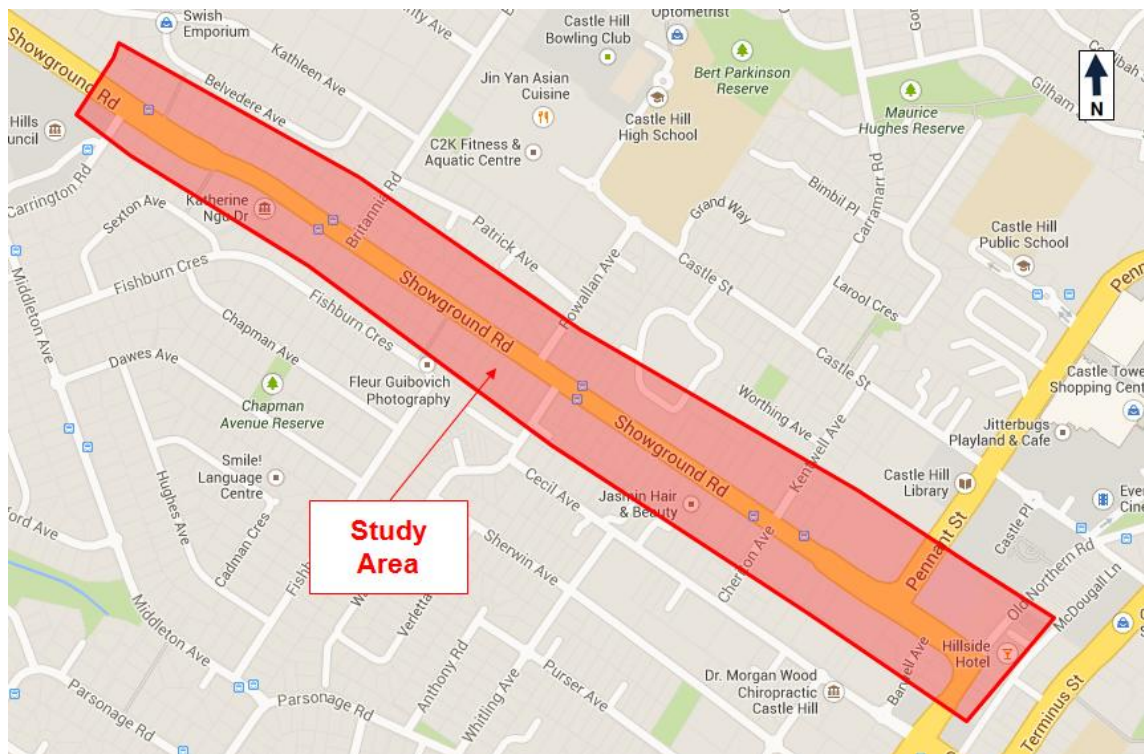
- Widen and upgrade about 1.5 kilometres of Showground Road from a two-lane partially divided carriageway to a four-lane divided carriageway, to connect with the existing four-lane section west of Carrington Road and east of Pennant Street, including:
 - Upgrade the existing carriageway and associated drainage amplification and pavement strengthening work to create a four-lane divided carriageway between Carrington Road and Rowallan Avenue.
 - Widen the carriageway and associated works to the north to create a four-lane divided carriageway between Rowallan Avenue and Kentwell Avenue.
 - Widen the carriageway and associated works to both sides of the existing carriageway to create a four-lane divided carriageway between Kentwell Avenue and Pennant Street.
- Modify the intersections of Showground Road with Britannia Road, Rowallan Avenue, Cecil Avenue, Kentwell Avenue/Cheriton Avenue and Pennant Street.
- Provide left-in/left-out restrictions at the intersection of Showground Road and Britannia Road.
- Provide new sets of traffic lights at the intersections of Showground Road with:
 - Rowallan Avenue.
 - Kentwell Avenue/Cheriton Avenue.
- Remove the existing pedestrian controlled traffic lights at the intersection of Showground Road and Cecil Avenue.
- Modify the existing signals at the intersection of Showground Road and Pennant Street.

- Provide bus priority measures in the eastbound direction at the intersections of Showground Road with Rowallan Avenue, Kentwell Avenue and Pennant Street.
- Construct a 2.5 metre wide shared footpath and cycleway along the northern side of Showground Road between Carrington Road and Pennant Street.
- Construct a 1.5 metre wide footpath along the southern side of Showground Road.
- Construct a median with varying width.
- Adjust property accesses to be compatible with the road widening proposal.
- Relocate and/or adjust utility services that are in conflict with the road widening proposal.

1.3 Study area

The study area includes the Showground Road corridor between Carrington Road and Old Northern Road and is shown in Figure 1.

Figure 1 Study area



Source: Google Maps (2013), modified by GHD

1.4 Study purpose and scope

The primary purpose of this study is to assess the traffic and transport impact from the operation and construction of the proposed Showground Road widening between Carrington Road and Old Northern Road. This study also forms part of the REF process. The scope of work includes:

- Consideration of short, medium and long term planning strategies within the area in respect to land use, public transport, pedestrian, cyclists and other planned projects in the area.
- Identification of the current and future travel patterns and volumes on roads within the study area.
- Evaluation of the proposal in terms of intersection and network performance in relation to the desired design criteria under future traffic conditions.

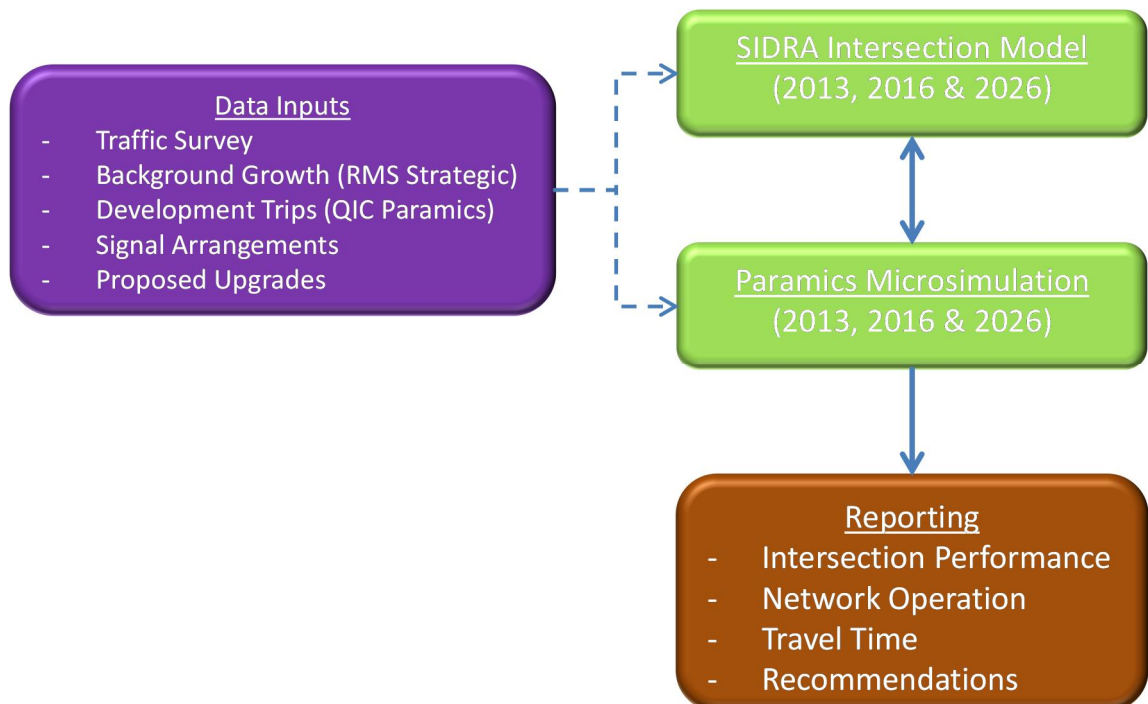
- Appraisal of the proposed bus priority options as part of the proposal on potential travel time improvement for public transport.
- Provision of construction impact assessment.

1.5 Study process

Traffic modelling is a core component of this study and will be used to predict and evaluate the traffic impacts of both future land use patterns and planned road network changes. GHD has adopted a two-tiered approach using both the SIDRA and Paramics modelling tools for intersection performance and network operation analysis.

Figure 2 below outlines the process of traffic modelling development based on the latest traffic data and subsequently applying the outputs drawn from the Roads and Maritime Services' Strategic Highway Assignment and the Paramics model developed as part of Queensland Investment Corporation's (QIC) S96 Application (refer to as the Castle Towers model), to facilitate the evaluation of future traffic operation

Figure 2 Traffic modelling process



The traffic modelling framework adopted by GHD in the assessment of the Showground Road widening proposal includes the following:

- SIDRA intersection modelling is used to provide intersection performance measures such as LoS and DoS, and to optimise signal arrangements for any new and upgraded intersections under future traffic conditions.
- A calibrated and validated Paramics model has been developed by GHD for this study (referred to as the Showground Road Model) to compliment SIDRA modelling by taking into consideration overall network operation. It also provides an understanding of likely travel time changes, queuing effects and allows for the identification of network constraints where appropriate traffic mitigations were recommended. Additionally, the bus priority options planned as part of the proposal require detailed simulation of vehicle behaviour in order to provide evidence-based analysis for evaluation purposes.

1.6 Report structure

The report is comprised of the following sections:

- **Section 2** – Existing conditions: summarises the existing conditions along the Showground Road corridor and its surrounds.
- **Section 3** – Planned improvements: summarises the proposed improvement as part of the proposal.
- **Section 4** – Traffic assessment: discusses the results of the transport evaluation process and considers the construction impacts associated with the construction of the road upgrade.
- **Section 5** – Summary and conclusion: presents a summary of the study findings and sets out the principal conclusions for the study.

2. Existing conditions

2.1 Overview

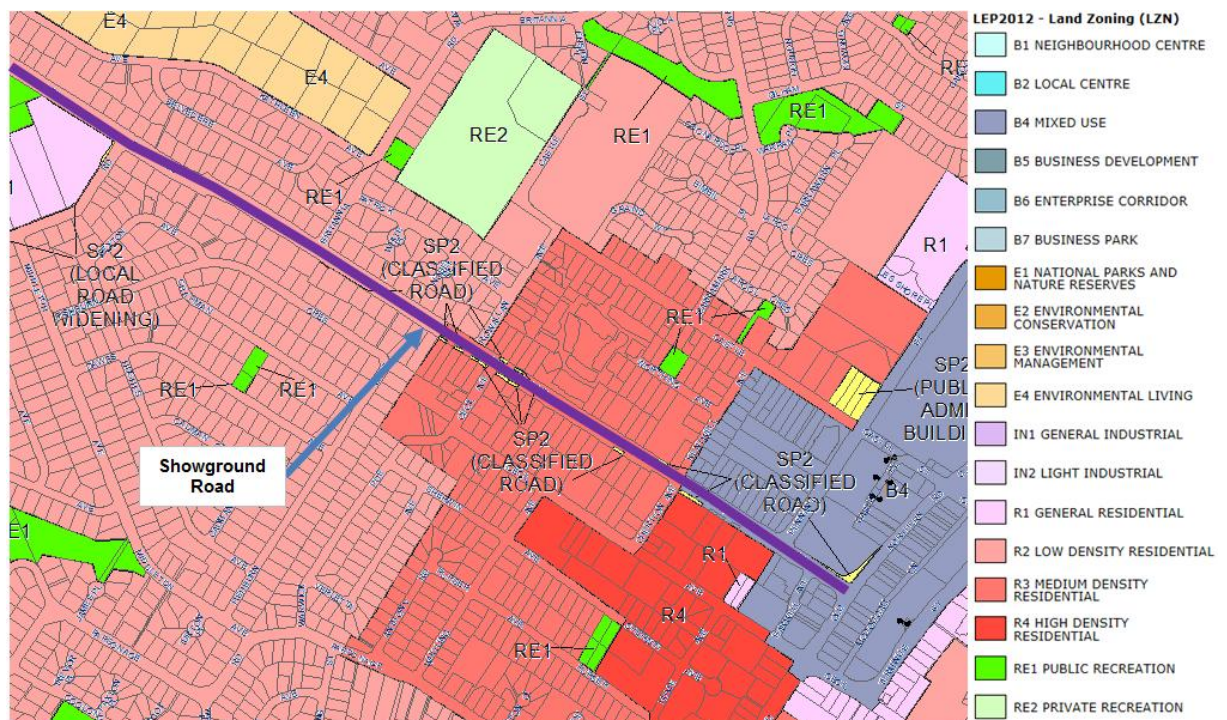
This section reviews the existing traffic, transport and land uses that influence the future development of the proposed upgrade to Showground Road.

2.2 Existing land uses

Existing land uses in the study area consist of a mix of retail, commercial and residential development. An extract from *The Hills Shire Council Local Environmental Plan 2012* (The Hills LEP) is shown in Figure 3.

As shown, the northern and western sections of the study area are generally comprised of low density residential development, with the central section of the study area zoned for medium density residential. Land use the south-eastern end of Showground Road is zoned as B4 mixed use, which includes the Castle Hill Shopping Centre, and high density residential development.

Figure 3 Land zoning – The Hills LEP 2012



Source: *The Hills LEP 2012, The Hills Shire Council*

2.3 Study area and existing road network

The road network in the study area is shown in Figure 4.

Figure 4 Existing road network



Source: Google Maps (2013), modified by GHD

The road network in the study area serves several functions and includes local roads and state roads of strategic importance.

2.3.1 Showground Road

Showground Road carries around 37,000 vehicles per day (vpd) and functions as an arterial road providing access to Castle Hill town centre at its eastern end and surrounding residential areas at its western end.

At its south-eastern end, Showground Road forms the western arm of a signal controlled T-intersection with Old Northern Road. The carriageway is typically around 22 metres wide, providing one 3.5 metre wide traffic lane in each direction.

Parking is provided within the sealed shoulders along either side of Showground Road, with the shoulder along the northern side up to 8 metres wide in some locations. Vehicles also currently use this very wide shoulder to pass other vehicles waiting to turn right into Cheriton Avenue from Showground Road.

The sign-posted speed limit on Showground Road is 60 kilometres per hour. Figure 5 shows a view of Showground Road to the east of Rowallan Avenue.

Figure 5 Showground Road



Showground Road viewed eastward from Rowallan Avenue

2.3.2 Carrington Road

Carrington Road functions as a local road providing access to the Castle Hill Trading Zone industrial area and The Hills Shire Council offices. Carrington Road forms a signal controlled T-intersection with Showground Road at its northern end.

The sign-posted speed limit on Carrington Avenue is 50 kilometres per hour. Figure 7 shows a view of Carrington Road.

Figure 6 Carrington Road



Carrington Road viewed from the intersection with Showground Road

2.3.3 Britannia Road

Britannia Road functions as a local road, providing access to residential development. At its southern end, Britannia Road forms the minor arm of a priority controlled T-intersection with Showground Road.

The sign-posted speed limit on Britannia Road is 50 kilometres per hour. Figure 7 shows a view of Britannia Road.

Figure 7 Britannia Road



Britannia Road viewed from Showground Road

2.3.4 Rowallan Avenue

Rowallan Avenue functions as a local road, providing access to residential developments along with the Castle Hill RSL Club. At its southern end, Britannia Road forms the minor arm of a priority controlled T-intersection with Showground Road, where a right turn bay is provided for vehicles turning into Rowallan Avenue.

The sign-posted speed limit on Rowallan Avenue is 50 kilometres per hour. Figure 8 shows a view of Rowallan Avenue from Showground Road. Rowallan Avenue has a vehicle weight restriction of three tonnes.

Figure 8 Rowallan Avenue



Rowallan Avenue viewed from Showground Road

2.3.5 Cecil Avenue

Cecil Avenue forms a left-in left-out only intersection with Showground Road at its northern end. Cecil Avenue functions as a local road, providing access to residential development.

The sign-posted speed limit on Cecil Avenue is 50 kilometres per hour and has a vehicle weight restriction of three tonnes. Figure 9 shows a view of Cecil Avenue from Showground Road.

Figure 9 Cecil Avenue



Cecil Avenue viewed from Showground Road

2.3.6 Kentwell Avenue

Kentwell Avenue functions as a local road, forming the northern approach to a four-way priority controlled intersection with Showground Road and Cheriton Avenue. The sign-posted speed limit on Kentwell Avenue is 50 kilometres per hour.

Figure 10 shows a view of Kentwell Avenue from Showground Road.

Figure 10 Kentwell Avenue



Kentwell Avenue viewed from Showground Road

2.3.7 Cheriton Avenue

Cheriton Avenue forms the southern approach to a four-way priority controlled intersection with Showground Road and Kentwell Avenue. Cheriton Avenue functions as a local road and has a sign-posted speed limit of 50 kilometres per hour.

Vehicles currently use the wide shoulder on the northern side of Showground Road to pass other vehicles waiting to turn right into Cheriton Avenue from Showground Road.

Figure 11 shows a view of Cheriton Avenue from Showground Road.

Figure 11 Cheriton Avenue



Cheriton Avenue viewed from Showground Road

2.3.8 Pennant Street

Pennant Street is a two-way divided-carriageway road which provides access to the Castle Towers Shopping Centre and Castle Hill Public School. Pennant Street functions as a sub-arterial road and bus corridor, with two lanes generally provided in either direction.

The sign-posted speed limit on Pennant Street is 60 kilometres per hour. Figure 12 shows a view of Pennant Street from Showground Road.

Figure 12 Pennant Street



Pennant Street view northward from Showground Road

2.3.9 Old Northern Road

Old Northern Road forms the southern and northern approaches to a signal controlled T-intersection with Showground Road. To the north of Showground Road, Old Northern Road functions as a local road with one traffic lane provided in either direction.

Old Northern Road provides access to Castle Hill Town Centre to the north of Showground Road and has a sign-posted speed limit of 40 kilometres per hour. Figure 13 shows a view of Old Northern Road to the north of Showground Road.

To the south of Showground Road, Old Northern Road functions as a sub-arterial road with two traffic lanes provided in either direction.

Figure 13 Old Northern Road



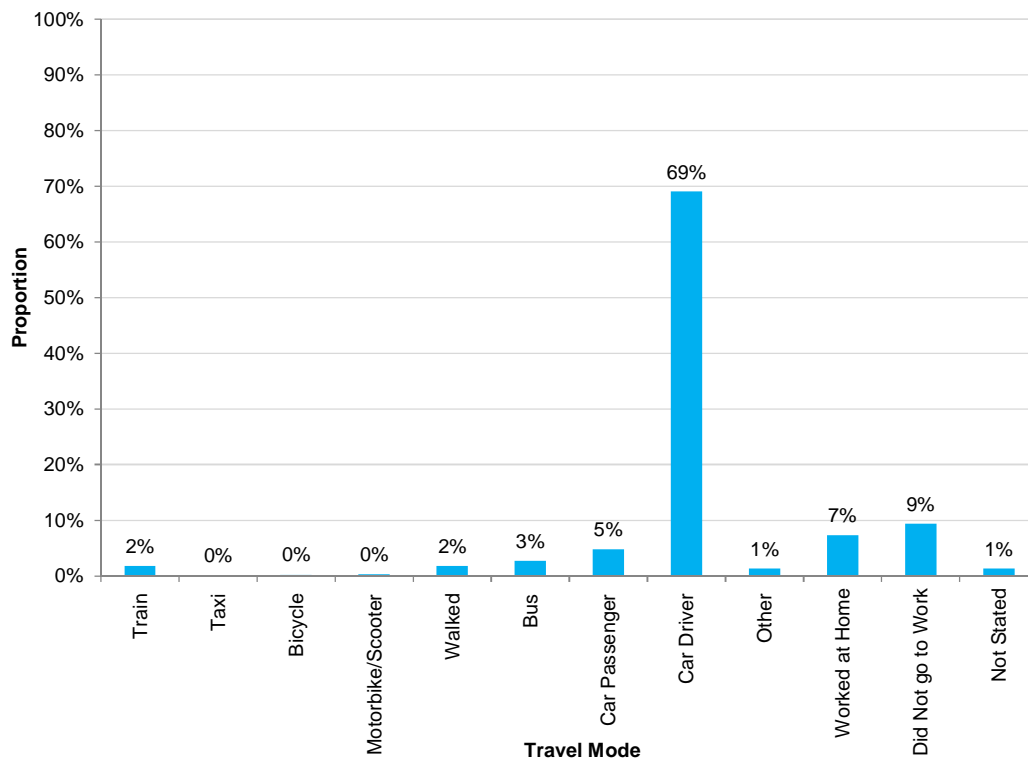
Old Northern Road Avenue northward from Showground Road

2.4 Existing travel characteristics

An analysis of 2011 Journey-to-Work data was undertaken to develop an initial understanding of the travel market for the region. This information provides a broad understanding of the likely demand for different modes under the existing situation and can be used to review regional and/or external travel movements forecast by the Sydney Strategic Traffic Model for 2016 and 2026 future horizon years.

Figure 14 shows the mode shares for journey-to-work trips in The Hills Shire LGA and indicates that car driver and car passenger are the predominant journey modes, representing 75 per cent of all journey to work trips.

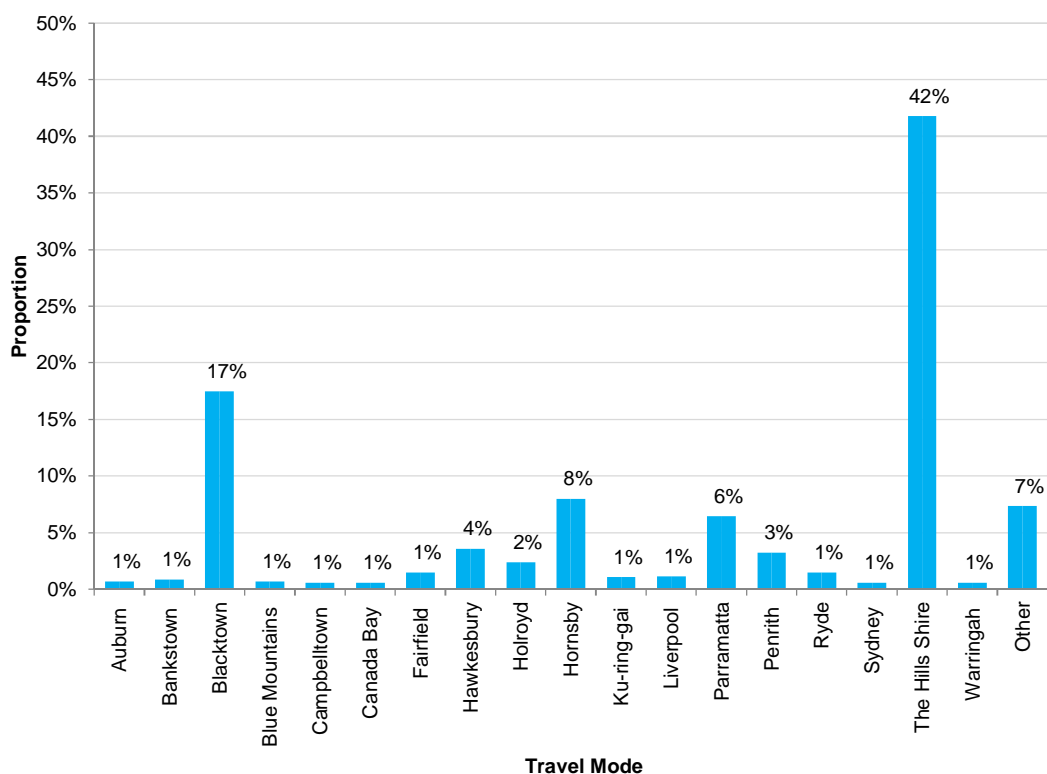
Figure 14 Journey to work mode share (The Hills Shire LGA)



Source: Journey to Work (2011), NSW Bureau of Transport Statistics

Figure 15 shows that 42 per cent of journey to work trips in The Hills Shire LGA are generated from within the LGA itself, with the remaining from outside the LGA.

Figure 15 Origin of employees working in The Hills Shire LGA



Source: *Journey to Work (2011)*, NSW Bureau of Transport Statistics

2.5 2013 traffic surveys

GHD undertook a review of traffic survey data for roads within the study area provided by Roads and Maritime. This review identified the following ‘gaps’ in the existing traffic data:

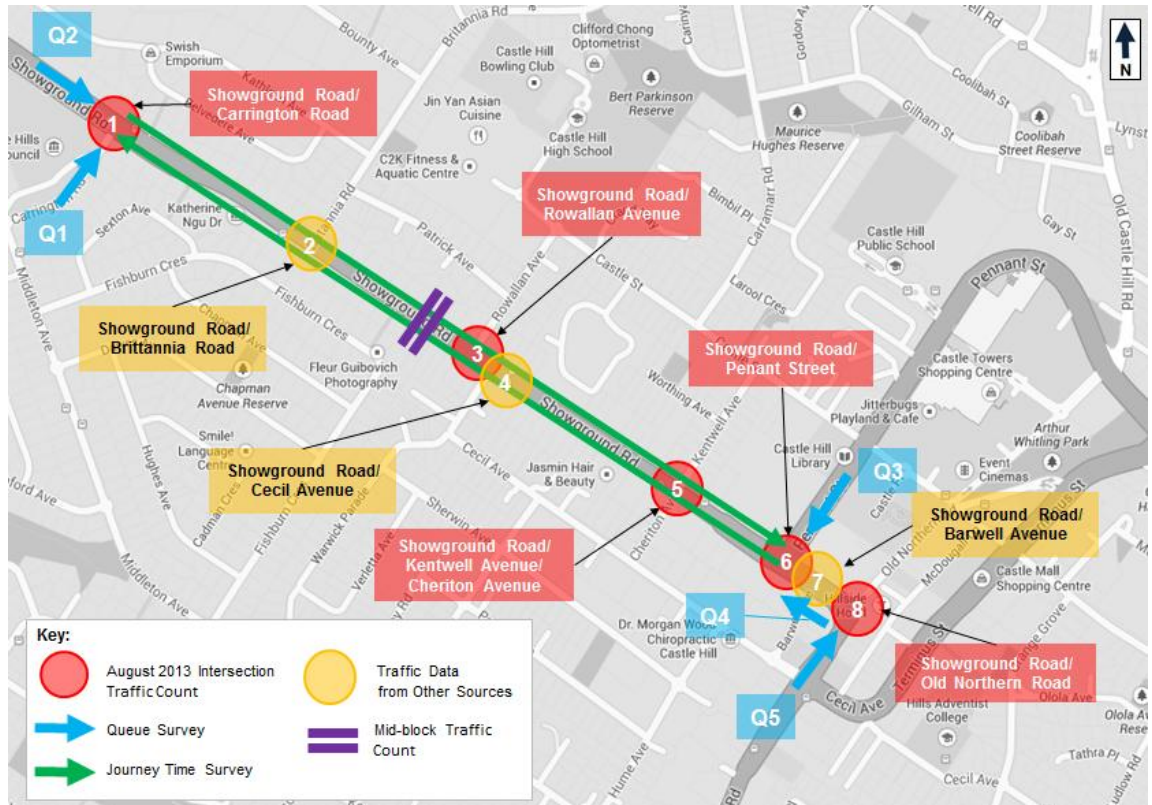
- Morning peak traffic counts.
- Queue length survey data.
- Travel time data.

As such, Roads and Maritime commissioned additional surveys for this study. The surveys included the following:

- Classified intersection counts.
- Mid-block traffic automatic counts.
- Queue length surveys at key intersection approaches.
- Travel time surveys along Showground Road.

A plan showing the locations of the above surveys undertaken for this study is provided at Figure 16. The following sections provide details of the traffic data collection undertaken for this study.

Figure 16 Traffic survey, queue survey and journey time survey locations



Source: Google Maps (2013), modified by GHD

2.5.1 Intersection traffic counts

Roads and Maritime commissioned Skyhigh Pty. Ltd. to undertake weekday morning and evening peak traffic counts at the following intersections (refer to Figure 16 for traffic survey locations):

1. Showground Road/Carrington Road.
3. Showground Road/Rowallan Avenue.
5. Showground Road/Kentwell Avenue/Cheriton Avenue.
6. Showground Road/Pennant Street.
8. Showground Road/Old Northern Road.

Figure 16 provides a plan showing the location of the above mentioned surveys.

The intersection traffic surveys were undertaken on Tuesday 29 August 2013 between 6-9am and 4-7pm. Traffic counts were also undertaken on Saturday 31 August 2013 between 11am-2pm.

Additional intersection turning movement volume data

Traffic turning movements for the following intersection were determined based on available traffic count data for Showground Road and site observations traffic turning movements (refer to Figure 16 for the intersection location):

2. Showground Road/Britannia Road.

In addition to the intersection traffic counts undertaken in August 2013, turning movement volume data was provided by Roads and Maritime from the Castle Towers Paramics Model.

This traffic data was provided for the following intersections (refer to Figure 16 for the intersection locations):

4. Showground Road/Cecil Avenue.
7. Showground Road/Barwell Avenue.

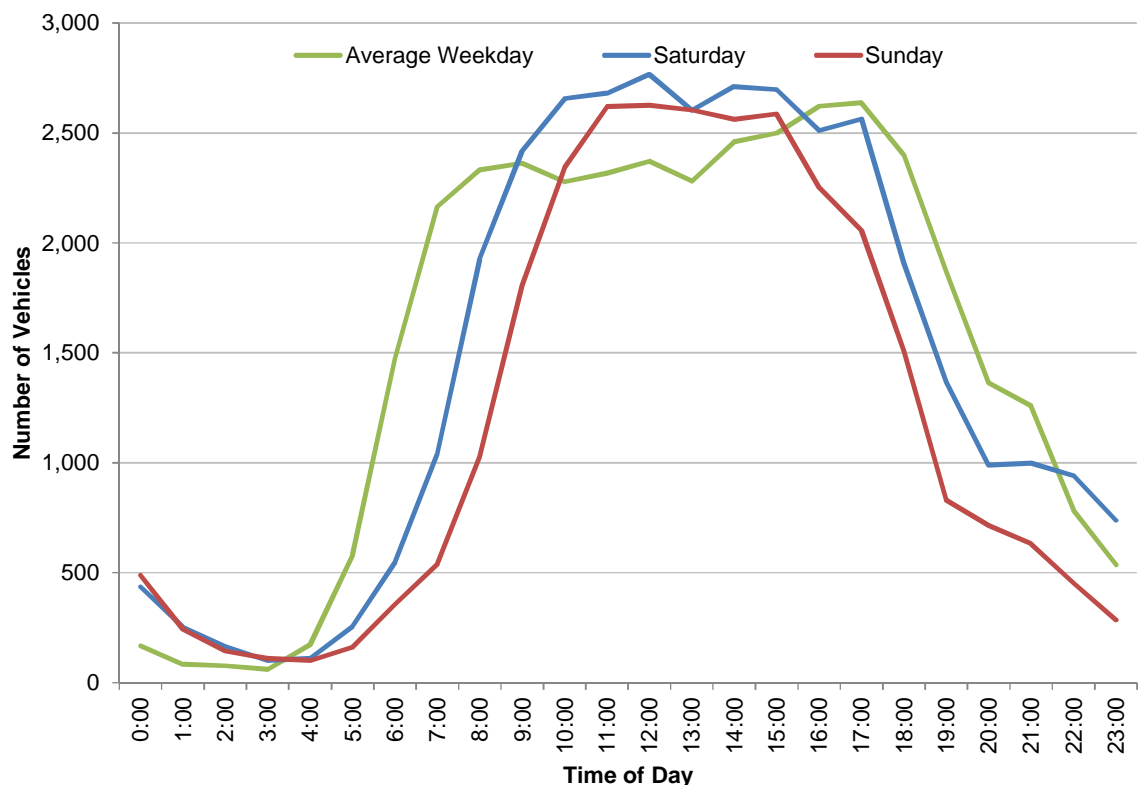
2.5.2 Midblock automatic traffic counts

Mid-block automatic traffic counts were undertaken over a seven day period between Tuesday 13 and Monday 19 August 2013 at Showground Road, approximately 60 metres west of the Showground Road/Rowallan Avenue intersection.

The daily profiles of two-way traffic along Showground Road on an average weekday, Saturday and Sunday shown at Figure 17. As shown, a fairly flat profile for traffic was recorded along Showground Road during a weekday between 9am-3pm, with the peak period occurring between 8-9am in the morning and 5-6pm in the evening.

During the Saturday, a flat profile for traffic was observed between 9am-6pm with the peak period occurring between 12-1pm. Similarly, a flat profile for traffic was observed during the Sunday between 11am-4pm.

Figure 17 Showground road daily traffic profile (two-way traffic flows)



2.5.3 Travel time surveys

Roads and Maritime commissioned Skyhigh Pty. Ltd. to undertake travel time surveys along Showground Road between Carrington and Old Northern Road. The travel time surveys were undertaken on 29 August 2013 between 6-9am and 4-7pm. Travel time surveys were also undertaken on Saturday 31 August 2013 between 11am-2pm.

The surveys recorded times for general traffic and buses travelling along Showground Road in each direction, using the origin-destination methodology of recording numberplates at two locations at either end of Showground Road.

2.5.4 Queue surveys

Roads and Maritime commissioned Skyhigh Pty. Ltd. to undertake surveys of queue lengths on Showground Road at the following locations:

- Q1 - Showground Road - western approach to Carrington Road intersection.
- Q2 - Carrington Road – southern approach to Showground Road intersection.
- Q3 - Pennant Street – northern approach to Showground Road intersection.
- Q4 - Showground Road - eastern approach to Pennant Street intersection.
- Q5 - Old Northern Rd - southern approach to Showground Road intersection.

Queue surveys were undertaken on 29 August 2013 between 6-9am and 4-7pm. The surveys were also undertaken on Saturday 31 August 2013 between 11am-2pm.

A summary of the average and maximum queue lengths observed from the queue surveys is shown at Table 2-1.

Table 2-1 Queue survey results - average and maximum queue lengths

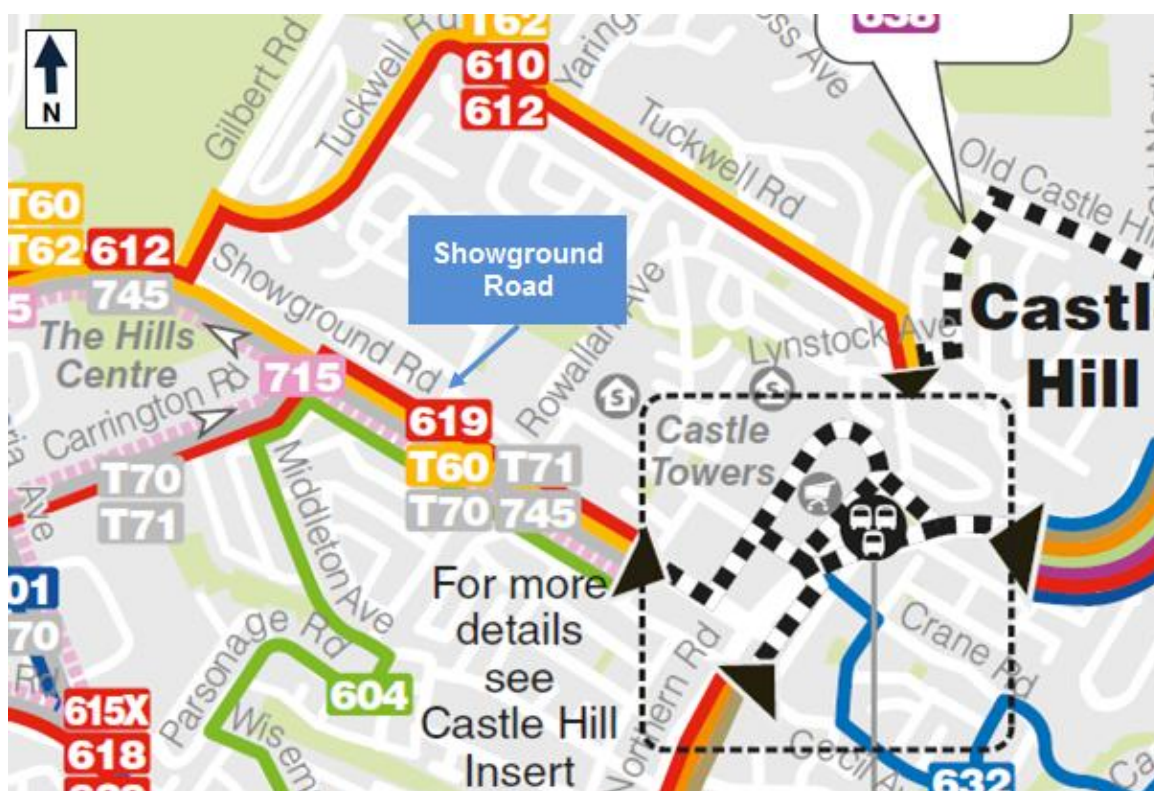
ID	Location	AM peak (vehicles)		PM peak (vehicles)		Saturday peak (vehicles)	
		Ave Queue	Max Queue	Ave Queue	Max Queue	Ave Queue	Max Queue
Q1	Showground Road - west approach to Carrington Road	9	19	9	12	9	16
Q2	Carrington Road - south approach to Showground Road	5	10	13	14	13	14
Q3	Pennant Street - north approach to Showground Road	8	11	10	11	13	17
Q4	Showground Road - east approach to Pennant Street	7	15	20	27	17	25
Q5	Old Northern Road - south approach to Showground Road	6	15	13	18	12	15

2.5.5 Public transport

The Hills Bus Guide shows the bus routes which operate in the study area. An extract from The Hills Bus Guide is shown in Figure 18. Figure 4 shows the locations of the existing bus stops on Showground Road.

The majority of buses operating along Showground Road stop at the Castle Towers Interchange on Old Castle Hill Road. A summary of bus service routes and peak hour frequencies operating from bus stops within the study area is provided in Table 2-2.

Figure 18 Bus routes along Showground Road



Source: The Hills District Bus Guide (June 2013)

Table 2-2 Showground Road bus services

Service	Route	Via	AM peak	PM peak	Saturday peak
604	Castle Hill to Parramatta	Baulkham Hills	Hourly	Hourly	Hourly
604	Parramatta to Castle Hill	Baulkham Hills	Hourly	Hourly	Hourly
619	Rouse Hill Town Centre to Macquarie Park	Kellyville, Castle Hill, Baulkham Hills, M2 Busway & Macquarie Centre	30 mins	30 mins	Hourly
619	Macquarie Park to Rouse Hill Town Centre	Macquarie Centre, M2 Busway, Baulkham Hills, Castle Hill & Kellyville	30 mins	30 mins	Hourly
715	Castle Hill to Seven Hills	Bella Vista	-	30 mins	-
715	Seven Hills to Castle Hill	Bella Vista	30 mins	-	-
745	Castle Hill to St Marys	Stanhope Gardens	Hourly	Hourly	2 Hourly
745	St Marys to Castle Hill	Stanhope Gardens	Hourly	Hourly	2 Hourly
T60	Castle Hill to Parramatta	Baulkham Hills	15 mins	20 mins	Hourly
T60	Parramatta to Castle Hill	Baulkham Hills	30 mins	30 mins	Hourly
T70	Castle Hill to Blacktown	Glenmore	30 mins	20 mins	Hourly
T70	Blacktown to Castle Hill	Glenmore	30 mins	20 mins	Hourly
T71	Castle Hill to Blacktown	Stanhope Gardens	30 mins	20 mins	Hourly
T71	Blacktown to Castle Hill	Stanhope Gardens	30 mins	20 mins	Hourly

2.6 Active transport

2.6.1 Pedestrians

Sealed pedestrian footways are generally provided at most road frontages within the study area with the exception of the following locations:

- Northern side of Showground Road to the west of Rowallan Avenue.
- Southern side of Showground Road to the west of Cecil Avenue.
- Along either side of Kentwell Avenue.
- Western side of Cheriton Avenue.
- Western side of Cecil Avenue.
- Eastern side of Britannia Road.
- Eastern side of Carrington Road.

Signal controlled pedestrian crossings are provided at the following locations:

- Carrington Road and Showground Road (west) approaches at the Carrington Road/Showground Road intersection.
- Mid-block crossing on Showground Road to the east of Cecil Avenue.
- Pennant Street and Showground Road (east) approaches to the Pennant Street/Showground Road intersection.
- Showground Road and Old Northern Road (north) approaches to the Old Northern Road/Showground Road intersection.

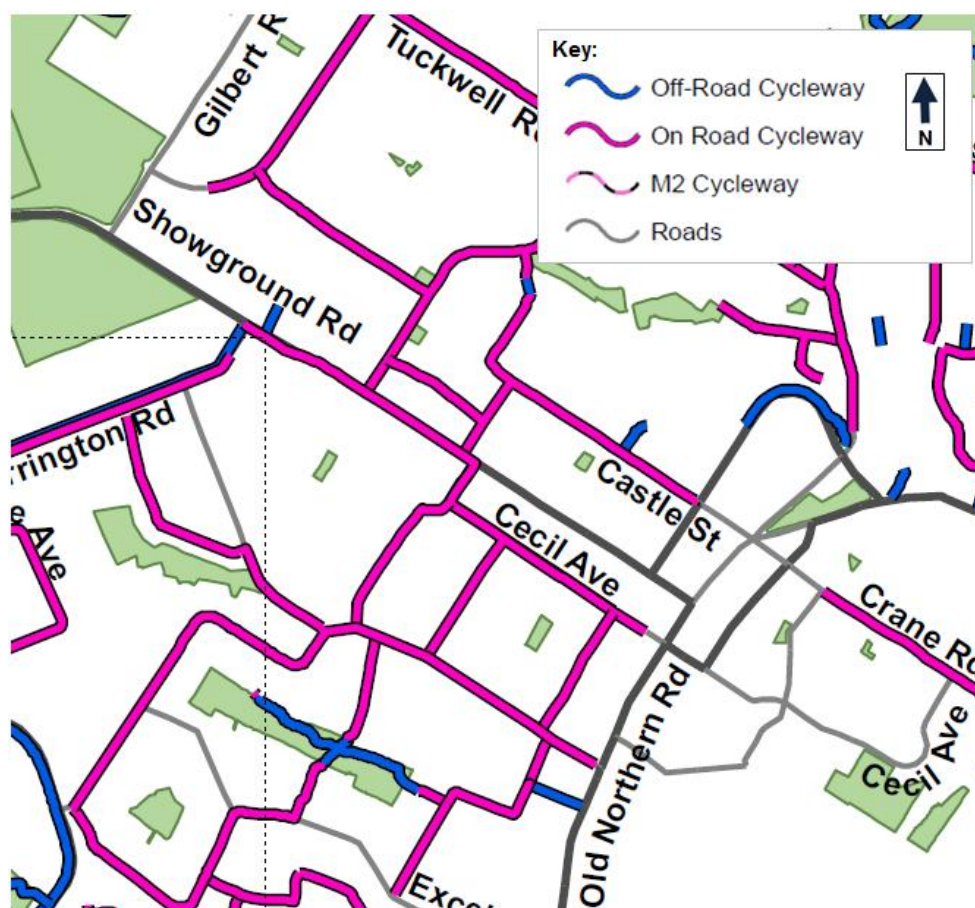
Zebra crossings are provided at the following locations within the study area:

- Left-turn slip lane into Pennant Street from Showground Road.
- Left-turn slip lane into Showground Road from Old Northern Road.

2.6.2 Cyclists

Existing cycling facilities in the area include on-road lanes that are provided within the sealed shoulder areas on Showground Road and Cecil Avenue. An extract of The Hills Shire Interactive cycling Map is shown at Figure 19.

Figure 19 Cycle routes within the study area



Source: <http://www.thehills.nsw.gov.au/Off-road-cycleways.html>

2.7 Existing road network performance

2.7.1 Classification of Roads

The classification of roads within the study area can be used as an indication of the functional role each road plays with respect to the volume of traffic they carry. Roads and Maritime has developed a set of road hierarchy classifications detailed in Table 2-3, which indicates typical nominal average annual daily traffic (AADT) volumes for various classes of roads.

Table 2-3 Functional classification of roads

Type of road	Traffic volume (vpd*)	Peak hour volume (vph*)
Motorways/Freeways	>15,000	>5,600
Arterial Road	>15,000	1,500 – 5,600
Sub-Arterial Road	5,000 – 20,000	500 – 2,000
Collector Road	2,000 – 10,000	200 – 1,000
Local Road	<2,000	0 – 200

Source: NSW Roads and Maritime Service (formerly NSW RTA), Road Design Guide and AMCORD

*Note vpd = vehicles per day, vph = vehicles per hour

Roads in the study area have been appraised based on the classification provided in Table 2-3. The outcomes of the ADT data assessment for Showground Road, based on the mid-block automatic traffic count is highlighted in Table 2-4, and was limited to the availability of daily traffic volume datasets.

Table 2-4 Average daily traffic

Road	Average daily traffic	Classification
Showground Road	37,161	Arterial

The above shows that daily traffic volumes fall within the criteria provided in Table 2-3.

2.7.2 Existing peak hour traffic

The traffic assessment undertaken for this study focuses on the impacts during the weekday morning, weekday evening and Saturday peak periods, when demand for traffic capacity in the surrounding network is perceived to be at its highest. Analysis of the traffic survey data found the peak hours to occur during the following:

- Weekday morning peak hour between 8-9am.
- Weekday evening peak hour between 5-6pm.
- Saturday peak hour between 12-1pm.

Peak hour two-way traffic volumes and the portion of heavy vehicles on each road in the study area are outlined Table 2-5.

Table 2-5 Peak hour traffic volumes

Road Section	AM peak (8-9am)		PM peak (5-6pm)		Saturday peak (12-1pm)	
	Total vehicles	% Heavy vehicles	Total vehicles	% Heavy vehicles	Total vehicles	% Heavy vehicles
Showground Road east of Carrington Road	2,387	4%	2,817	1%	3,195	1%
Showground Road east of Britannia Road	2,397	3%	2,720	1%	3,084	1%
Showground Road east of Rowallan Avenue	2,388	3%	2,559	1%	2,984	1%
Showground Road east of Kentwell Avenue	2,200	4%	2,411	1%	2,805	1%
Showground Road east of Pennant Street	1,017	2%	1,261	1%	1,490	1%
Carrington Road	1,223	2%	1,360	0%	1,206	0%
Britannia Road	152	No data	211	No data	199	No data
Rowallan Avenue	231	1%	401	1%	342	0%
Cecil Avenue	87	0%	115	0%	151	0%
Kentwell Avenue	42	0%	47	5%	28	0%
Cheriton Avenue	305	1%	204	1%	256	0%
Pennant Street	2,023	3%	2,398	0%	2,738	1%
Barwell Avenue	167	0%	157	0%	214	0%
Old Northern Road north of Showground Road	465	3%	457	1%	476	1%
Old Northern Road south of Showground Road	1,173	2%	1,369	1%	1,503	1%

2.7.3 Assessment criteria (level of service)

The performance of the existing road network is largely dependent on the operating performance of intersections which form critical capacity control points on the road network.

The 'level of service' (or LoS) is the standard measure used to assess the operational performance of the network and intersections. There are six levels of service from LoS A to LoS F, with LoS A representing the best performance and LoS F the worst.

The assessment of intersection operation is based on criteria outlined in Table 2-6, as defined by the *NSW Roads and Traffic Authority (Guide to Traffic Generating Developments, 2002)*.

Table 2-6 Level of service criteria for intersections (Roads and Maritime 2002)

Level of service	Average delay per vehicle (secs/veh)	Traffic signals, roundabouts	Give way & stop signs
A	< 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 modes	At capacity, requires other control mode
F	> 70	Over Capacity Unstable operation	Over Capacity Unstable operation

Source: *RTA Guide to Traffic Generating Developments (2002)*

Notes:

1. The average delay assessed for signalised intersections is over all movements.
2. For roundabouts and priority control intersections (with Stop and Give Way signs or operating under the T-junction rule), the critical criterion for assessment is the movement with the highest delay per vehicle. Average delay is expressed in seconds per vehicle.

2.8 Existing intersection operation

2.8.1 Sidra intersection analysis

The results of the SIDRA intersection modelling for each intersection within the study area are shown in Table 2-7, with detailed SIDRA outputs provided at Appendix D.

As shown, all of the intersections within the study area currently operate with an acceptable level of service during the morning peak with the exception of the Kentwell Avenue/Showground Road intersection which operates with a LoS F.

During both the evening peak and Saturday peak, the Britannia Road/Showground Road, Rowallan Avenue/Showground Road and Kentwell Avenue/Showground Road intersections operate with unacceptable delays, operating with a LoS F. All other intersections currently operate satisfactorily during the evening and Saturday peak periods.

Table 2-7 SIDRA results – 2013 surveyed traffic flows

ID	Intersection	AM peak			PM peak			Saturday peak		
		Ave delay	LoS	DoS	Ave delay	LoS	DoS	Ave delay	LoS	DoS
1	Carrington Road/ Showground Road	28	B	0.75	34	C	0.80	28	B	0.80
2	Britannia Road/ Showground Road	45	D	0.65	74	F	0.85	107	F	0.91
3	Rowallan Avenue/ Showground Road	45	D	0.66	99	F	0.81	148	F	0.94
4	Cecil Avenue/ Showground Road	9	A	0.75	10	A	0.78	11	A	0.87
5	Kentwell Avenue/ Showground Road	74	F	0.92	74	F	0.92	235	F	1.05
6	Pennant Street/ Showground Road	29	C	0.65	27	B	0.68	29	C	0.76
7	Barwell Avenue/ Showground Road	9	A	0.13	9	A	0.13	9	A	0.18
8	Old Northern Road/ Showground Road	18	B	0.46	18	B	0.38	21	B	0.41

2.8.2 Paramics network analysis

The microsimulation network model takes into consideration the cumulative traffic impact of intersections and other capacity constraints along a route and allows for the identification of the traffic system as a whole. In addition, the planned bus priority options which form part of the proposal require detailed simulation of vehicle behaviours in order to provide an evidence-based analysis for evaluation purposes.

Although not part of the works proposed, the Showground Road/Old Northern Road and Showground Road/Carrington Road intersections have been included in the modelling analysis to provide a holistic view of the network operation. Notwithstanding the above, findings from the modelling were primarily focused on the proposed works only. Potential improvements required and associated with these two intersections would be assessed as part of a separate project. Figure 20 shows the network extent of the Showground Road Paramics model. The development of the calibrated and validated Showground Road base model is also documented in Appendix G of this report.

Figure 20 Network extent of Showground Road Paramics model



The following existing key traffic issues and operational characteristics of the road network are shown in the Paramics model:

- Queuing at the right turn bay on Showground Road east approach to Pennant Street was observed during the evening and Saturday peak periods. The right turn bay can currently accommodate approximately 16 cars before extended queues spill back into the left-turn slip lane from Old Northern Road.
- Delays to eastbound traffic on Showground Road approaching the slip lane for vehicles turning left into Pennant Street were observed in the model. This occurs in the evening peak at around 5.30pm. Depending on platooning, eastbound queues occasionally propagate from Pennant Street towards Kentwell Avenue but typically dissipate within multiple signal cycles. Video captures collected from the traffic surveys show that this is likely due to the downstream capacity constraint caused by northbound traffic turning right from Pennant Street into Castle Street.
- In the morning peak period, eastbound traffic right turning from Showground Road into Carrington Road occasionally overflows from the right turn bay and impedes the through movements typically after 8.30am.
- Northbound traffic queues along Carrington Road were observed in the model during the evening and Saturday peak periods. Queues in excess of 20 vehicles are observed in the model.

2.9 Parking

Car parking is currently provided within the surfaced shoulder along both sides of Showground Road. All existing on-street car parking along Showground Road is currently unrestricted. A summary of the approximate number of existing car parking spaces along each section of Showground Road is shown in Table 2-8.

Showground Road has on-street car parking provision for around 155 cars along the western section of the study area. However, the current use of the available parking was observed to be low based on the site visit undertaken on 30 August 2013 in the evening peak between 4-6pm and video captures produced for the traffic surveys in the morning peak between 6-9am. The majority of residential and commercial properties fronting Showground Road generally have off-street car parking provided.

Table 2-8 Existing car parking on Showground Road

Road section	Aspect	Number of spaces available
Carrington Road to Britannia Road	North side	35
Carrington Road to Britannia Road	South side	0
Britannia Road to Rowallan Avenue	North side	35
Britannia Road to Cecil Avenue	South side	15
Rowallan Avenue to Kentwell Avenue	North Side	35
Cecil Avenue to Cheriton Avenue	South Side	35
Kentwell Avenue to Pennant Street	North Side	0
Cheriton Avenue to Barwell Avenue	South side	0
Pennant Street to Old Northern Road	North Side	0
Barwell Avenue to Old Northern Road	South side	0
Total		155

2.10 Existing road safety trends

Roads and Maritime supplied crash statistics for key roads within the study area over a five year period between 1 January 2008 and 31 December 2012. This crash data was used to determine the main factors contributing to crashes within the study area. A summary of the crash trends for the key roads in the study area for this five year period is presented in the following sections.

Carrington Road

There was one crash recorded on Carrington Road at the intersection with Showground Road, which involved a vehicle emerging from a driveway and colliding with another vehicle.

Old Northern Road

In total, there were 13 crashes recorded along Old Northern Road at the intersection with Showground Road. Of these:

- 7 (54 per cent) incidents involved vehicle turning right and colliding with through traffic.
- 3 (23 per cent) incidents involved rear end shunts.
- 2 (15 per cent) incident involved a collision off the road.
- 1 (8 per cent) incident involved a pedestrian.

Pennant Street

In total, there were 4 crashes recorded along Pennant Street at the intersection with Showground Road. Of these:

- 2 (50 per cent) incidents involved vehicle turning left and colliding with another vehicle.
- 2 (50 per cent) incidents involved vehicle turning right and colliding with through traffic.

Rowallan Avenue

There was 1 crash recorded along Rowallan Avenue at the intersection with Showground Road, which involved a left turning vehicle sideswipe.

Showground Road

In total, there were 152 crashes recorded along the Showground Road within the study area. Of these:

- 5 crashes occurred within 50 metres of the **Showground Road/Barwell Avenue intersection**, including:
 - 4 (80 per cent) incidents involved right turning vehicles colliding with through traffic.
 - 1 (20 per cent) incident involved a vehicle turning left and colliding with nearside traffic.
- 9 crashes occurred within 50 metres of the **Showground Road/Britannia Road intersection**, including:
 - 8 (89 per cent) incidents involved rear end shunts.
 - 1 (11 per cent) incident involved a vehicle turning right.
- 24 crashes occurred within 50 metres of the **Showground Road/Carrington Road intersection**, including:
 - 11 (45 per cent) incidents involved rear end shunts.
 - 10 (42 per cent) incidents involved vehicle turning left and colliding with another vehicle.
 - 1 (4 per cent) incident involved a collision occurring between cross traffic.
 - 1 (4 per cent) incident involved a vehicle changing lane.
 - 1 (4 per cent) incident involved a left turn sideswipe.
- 9 crashes occurred within 50 metres of the **Showground Road/Cecil Avenue intersection**, including:
 - 7 (78 per cent) incidents involved rear end shunts.
 - 1 (11 per cent) incident involved a vehicle changing lane.
 - 1 (11 per cent) incident involved a collision of vehicles on the left near side.
- 30 crashes occurred within 50 metres of the **Showground Road/Kentwell Avenue/Cheriton Avenue intersection**, including:
 - 7 (23 per cent) incidents involved rear end shunts with vehicles turning into Cheriton Avenue.
 - 5 (17 per cent) incidents involved rear end shunts with vehicles turning into Kentwell Avenue.
 - 6 (20 per cent) incidents involved vehicle turning right into Cheriton Avenue and colliding with through traffic.

- 5 (17 per cent) incidents involved vehicle turning right into Cheriton Avenue and colliding with through traffic.
- 3 (10 per cent) involved a collision between cross traffic vehicles.
- 1 (3 per cent) involved a head on collision of vehicles.
- 3 (10 per cent) involved left turning vehicles or left sideswipe collisions.
- 4 crashes occurred within 50 metres of the **Showground Road/Old Northern Road intersection**, including:
 - 2 (50 per cent) incidents involved rear end shunts.
 - 1 (25 per cent) involved a pedestrian on the nearside of the road.
 - 1 (25 per cent) was a result of a vehicle changing lane into the right lane and colliding with another vehicle.
- 21 crashes occurred within 50 metres of the **Showground Road/Pennant Street intersection**, including:
 - 16 (77 per cent) incidents involved right turning vehicles colliding with through traffic.
 - 1 (4 per cent) involved a collision between cross traffic vehicles.
 - 3 (15 per cent) incidents involved a vehicle colliding with an object in the road.
 - 1 (4 per cent) involved a driver losing control of their vehicle.
- 13 crashes occurred within 50 metres of the **Showground Road/Rowallan Avenue intersection**, including:
 - 10 (77 per cent) incidents involved rear end shunts.
 - 3 (23 per cent) incidents involved vehicles turning right and colliding with vehicles.
- 37 crashes occurred along **mid-block sections of Showground Road**, including:
 - 35 (95 per cent) incidents involved rear end shunts.
 - 2 (5 per cent) incidents involved right turning vehicles turning into driveways.

2.10.1 Crash data summary

Analysis of the crash data provided by Roads and Maritime for road sections within the study area indicated that there are current road safety issues at the following locations:

- Showground Road/Kentwell Avenue/Cheriton Avenue intersection, where 30 crashes occurred over a 5 year period.
- Showground Road/Pennant Street intersection, where 25 crashes occurred at the intersection over a 5 year period.
- Showground Road/Carrington Road intersection, where 25 crashes occurred over a 5 year period.
- Showground Road/Rowallan Avenue intersection, which had 14 crashes occurring over a 5 year period.
- Along mid-block sections of Showground Road where 37 crashes occurred over a 5 year period. These incidents mostly involved rear end shunts, indicating the incidents occurred in longer queues at intersections or vehicles turning into/out of driveways or on-street parking spaces.

2.11 Key findings

An appraisal of the existing transport conditions in the study area identified a number of key findings in the existing transport system:

- Good public transport coverage provided by frequent bus services along Showground Road.
- 2011 Journey to work data indicate that 42 per cent of trips to work in The Hills Shire LGA are generated from within the LGA itself.
- Mode share data for journey-to-work trips in The Hills Shire LGA indicates that car driver and car passenger are the predominant journey modes, representing 75 per cent of all work trips.
- High delays at some intersections during peak periods, particularly at the Showground Road/Britannia Road intersection, Showground Road/Rowallan Avenue intersection and Showground Road/Kentwell Avenue/Cheriton Avenue intersection.
- Pedestrian infrastructure is currently provided within the study area with footways generally provided along road frontages and pedestrian crossings provided at signal controlled intersections. However, no pedestrian footways are provided along the northern or southern sides of Showground Road to the west of Rowallan Avenue.
- Existing cycling facilities in the area include on-road lanes within the sealed shoulder areas on Showground Road and Cecil Avenue.
- Identified crash trends at some locations in the study area including at:
 - Showground Road/Kentwell Avenue/Cheriton Avenue.
 - Showground Road/Pennant Street.
 - Showground Road/Carrington Road.
 - Showground Road/Rowallan Avenue.
 - Mid-block road sections of Showground Road, indicating the incidents occurred in longer queues at intersections or vehicles turning into/out of driveways or on-street parking spaces.

3. Planned road network improvements

The following planned road network improvements have been included in the analysis for assessing the future traffic conditions:

- Upgrading the existing carriageway to provide a four-lane divided carriageway between Carrington Road and Pennant Street with a sign-posted speed limit of 60 kilometres per hour.
- Upgrading the intersections at:
 - Showground Road/Rowallan Avenue to a new signalised intersection.
 - Removal of mid-block signal crossing at Showground Road near Cecil Avenue.
 - Showground Road/Kentwell Avenue/Cheriton Avenue to a new signalised intersection.
 - Showground Road/Pennant Street to signalise the existing left turn slip lane with a second traffic lane approximately 50 metres in length.
 - Showground Road/Britannia Road to restrict traffic movements to left-in and left-out only.
 - Showground Road/Barwell Avenue to restrict traffic movement out of Barwell Avenue to access Pennant Street.
- Provision of bus priority measures for eastbound traffic at the Showground Road/Rowallan Avenue, Showground Road/Kentwell Avenue and Showground Road/Pennant Street intersections.

3.1 Intersection signalisation

This section details the signalisation treatment for affected intersections along Showground Road as part of the widening work between Carrington Road and Old Northern Road.

3.1.1 Showground Road/Rowallan Avenue

- Signalisation of the T-intersection with pedestrian crossings at all approaches.
- Allowing all traffic movements with a right turn bay at the eastern approach.
- Provision of a bus-only downstream short lane for eastbound traffic.

3.1.2 Showground Road/Kentwell Avenue/Cheriton Avenue

- Signalisation of the four-way intersection with pedestrian crossings at all approaches.
- Left-in and left-out only at Cheriton Avenue.
- Dual right turn lanes at Kentwell Avenue and the Showground Road eastern approach.
- A right turn bay at the western approach on Showground Road.
- Provision of a bus-only downstream short lane for eastbound traffic.

3.1.3 Showground Road/Pennant Street

- Upgrading the left turn slip lane with an additional (second) traffic lane of approximately 50 metres with signal control.
- Provision of a bus-only storage with 'early start' signal arrangement at approach to Pennant Street for eastbound traffic.

Appendix E provides the proposed intersection layouts and lane configurations adopted in the SIDRA analysis under the future 'Upgrade' scenarios for intersections along Showground within the study area.

3.2 Bus priority options

Roads and Maritime has proposed three options for the arrangement of eastbound bus priority measures along Showground Road for the 'Upgrade' scenario. These options are:

Option 1

- Left turn only, bus-excepted eastbound kerbside lane at approach to Rowallan Avenue and Kentwell Avenue.
- Actuated 'early start' signal phase with buses accessing the bus-only storage from the median lane.

Option 2

- Bus uses the eastbound median through only lane with general traffic to cross the intersections at approach to Rowallan Avenue and Kentwell Avenue.
- Actuated 'early start' signal phase with buses accessing the bus-only storage from the median lane.

Option 3

- Left turn only, bus-excepted eastbound kerbside lane at approach to Rowallan Avenue and Kentwell Avenue.
- Actuated 'early start' signal phase with buses accessing the bus-only storage from the otherwise left turn only kerbside slip lane.

In addition to the above road network changes, it has also been assumed that buses currently travelling eastbound along Showground Road through to the town centre via Pennant Street will be rerouted to continue eastwards through the Showground Road/Old Northern Road intersection. An increase of bus numbers during the peak hours by 10 per cent in 2026 had also been agreed with Roads and Maritime as a modelling assumption to account for future bus planning changes. Subsequent to the agreement of these modelling assumptions, additional bus planning information became available that indicated the potential of further increase of bus services as part of the NWRL project. It is expected that the additional increase of bus services is unlikely to have a substantial impact on the outcomes of the modelling analysis.

The signal operation at the intersection of Showground Road and Pennant Street had been modified to allow for an actuated 'early start' phase for through-on bus movement. This phase runs for 6 seconds at the beginning of a signal cycle upon detection of a bus at the storage, and the time for this phase is taken from the existing A-phase.

4. Project traffic impact assessment

4.1 Modelling approach

GHD has employed a two-tiered modelling approach to examine the road network performance based on intersection Level of Service, average delay, degree of saturation and network constraints as follows:

- Intersection modelling along Showground Road using SIDRA.
- Microsimulation modelling in Paramics of the study area as shown in Figure 20.

As part of the process of future demand estimation, outputs from the Roads and Maritime Services' Strategic Highway Assignment Model (EMME) were used to assess background traffic changes along Showground Road and adjoining roads. A spreadsheet model was developed to generate future traffic demands by examining various components of traffic generation from future land use changes within the town centre. Subsequently, the difference in future traffic was superimposed onto the existing demands in the spreadsheet model which forms the basis for loading traffic into the road network at the turning-movement level.

The existing traffic conditions were first modelled in SIDRA and Paramics based on the traffic count data collected from surveys undertaken in August 2013 for Thursday morning, evening and Saturday midday peak periods. The assessment of future traffic conditions was then undertaken for 2016 and 2026 horizon years with ('Upgrade') and without ('Do Nothing') the proposed road network improvements. The 'Do Nothing' scenario with the estimated future traffic demands was used for baseline comparison to assess the potential benefits of the proposed improvements along Showground Road. The three (3) proposed bus priority options were also assessed in the future 'Upgrade' scenarios in Paramics for 2016 and 2026 horizon years in all peak periods.

4.1.1 Key modelling assumptions

The information and assumptions adopted for the modelling are summarised as follows:

- The concept plan (SK36) provided by Roads and Maritime for the proposed widening and intersection upgrade.
- Road network and intersection upgrades described in Section 3 were modelled in both SIDRA and Paramics.
- Bus information based on timetables and schedules currently published by bus operators. A 10 per cent increase of the existing bus flows in 2026 as agreed with Roads and Maritime and documented in Section 3.2.
- Background traffic growth based on outputs from the Roads and Maritime Services' Strategic Highway Assignment Model.
- Future land use assumptions and traffic generation based on the review of recent planning reports and traffic models as discussed in Section 4.3.
- Recommendations on signal arrangements and traffic mitigation measures were supplemented by SIDRA analysis.
- Testing of the additional modelling scenario as described in Section 4.6.3 was conducted in SIDRA.

4.2 Background traffic growth

Future traffic flows from the Strategic Highway Assignment Model (EMME) were provided by Roads and Maritime to estimate the background traffic increase for 2016 and 2026 horizon years. This was achieved by fixing the land use assumptions for the three (3) catchment zones within the Castle Hill Town Centre to existing demand. The peak hour background growth in comparison to the existing 2013 traffic demands within the extent of the Showground Road model is shown in Table 4-1.

Table 4-1 Background traffic growth – additional peak hour trips for 2016 and 2026

Peak period	2016 vs. 2013	2026 vs. 2013
Thursday AM	639	1227
Thursday PM	437	1098
Saturday Midday	470	1181

4.3 Key planned developments in the study area

As part of the analysis, GHD has been tasked with reviewing relevant planning documents, traffic models and land use assumptions within the area to ensure consistent planning strategies and assumptions are used in this analysis. The outcomes from the review were also used to facilitate the estimation of future traffic demands. The review includes the following:

- Proposed Expansion of Castle Towers Shopping Centre, Section 96 Application Transport Report, GTA Consultants, July 2013.
- Showground Road Intersection Analysis, Transport Impact Assessment Report, GTA Consultants, April 2012.
- Castle Towers Paramics Model (as part of the Section 96 Application), GTA Consultants.
- North West Rail Link (NWRL), Operation Traffic and Transport Report, Aecom, October 2012.

Based on the review, key planned developments in the area have been identified and described in the following sections.

4.3.1 Castle Towers Shopping Centre Expansion

Castle Towers Shopping Centre owned by Queensland Investment Corporation (QIC) currently comprises of approximately 113,197 m² of gross leasable floor area (GLFA) and has been approved for expansion, subject to conditions including the proposed upgrade of Showground Road. The proposed expansion would bring the GLFA to a total of 173,684 m² and is expected to be completed towards the end of 2016. The majority of the proposed development is anticipated to be on the sites adjacent to Showground Road to the eastern and western side of Pennant Street respectively.

The additional trips generated from the proposed Castle Towers expansion included in this analysis have been determined from examining the Castle Towers Paramics models supplied by GTA Consultants and verified against the development assumptions documented in the Section 96 Application Report for Thursday evening and Saturday midday peak periods.

However, as no assessment or modelling was undertaken for the Castle Towers expansion for the morning peak period, trip generation in the morning peak period was not available. GHD has estimated morning peak hour generation for the Castle Towers expansion based on assumptions derived from the *Roads and Maritime Services, Guide to Traffic Generating Developments August 2013* as follows:

- 1.78 veh/hr/100m² trip generation rate for the Castle Towers development.
- 80/20 per cent inbound/outbound split for development trips.
- 72 per cent of the total additional development trips passing through the Showground Road model network (as per the Castle Towers Paramics model in the evening peak period).

Table 4-2 summarises the overall additional peak hour trips generated by the Castle Towers expansion and the trips that pass through the study area.

Table 4-2 Castle Towers Expansion – additional peak hour trips

Peak period	Add. Castle Towers Expansion trips (Veh/hr)	Within the Showground model (Veh/hr)
Thursday AM	1,078	776
Thursday PM	1,736	1,249
Saturday Midday	1,797	1,325

4.3.2 Other Future Developments

Other planned developments within the Castle Hill Town Centre include a mix of land uses comprising retail, commercial and residential (collectively referred to as Non-QIC Development). The Hills Shire Council has also identified the potential of other peripheral residential developments to the north and northwest of the Castle Hill Town Centre (referred to as Peripheral Development). Summary of this development potential is shown in Table 4-3.

Table 4-3 Non-QIC and Peripheral Development Potentials

Site	Retail (m2)	Commercial (m2)	Residential (units)	Completion
Crane Road Precinct	6,600	9,900	165	2016
Terminus Street Precinct	Nil	29,000	680	2016
Pennant Street Precinct	Nil	Nil	100	2016
Peripheral Development	Nil	Nil	1,040	2031

Source: Proposed Expansion of Castle Towers Shopping Centre, Section 96 Application Transport Report, July 2013

Notes:

1. The completion year is indicative only and adopted as part of the working assumptions for future traffic demand estimation. Actual completion time for the full development is likely to vary depending on future masterplanning strategies.

The additional vehicle trips generated from the above developments have been included as part of the estimated future traffic demands in this study. By examining the Castle Towers Paramics model, the additional vehicle trips expected to go through the Showground Road study area was calculated for the evening and midday peak periods.

Similarly, trip generation for other developments in the study area during the morning peak period were not available. GHD has estimated morning peak traffic generation for these developments based on the following assumptions:

- 1.78 veh/hr/100m² trip generation rate for retail development.
- 2.0 veh/hr/100m² and 0.29 veh/unit generation rates for Non-QIC commercial and residential developments (same as the Castle Towers Paramics model in the evening peak period).
- 80, 90 and 20 per cent inbound percentage split for Non-QIC retail, commercial and residential developments respectively.

- 20 per cent of the total peripheral residential development trips passing through the Showground Road model network (same as per the Castle Towers Paramics model in the evening and Saturday peak periods).

Table 4-4 summarises the additional peak hour trips generated by the Non-QIC and Peripheral developments and the trips that pass through the study area.

Table 4-4 Non-QIC and Peripheral Developments – Additional Peak Hour Trips

Peak period	Non-QIC developments		Peripheral developments	
	Add. trips (Veh/hr)	Within Showground model (Veh/hr)	Add. trips (Veh/hr)	Within Showground model (Veh/hr)
Thursday AM	490	202	460	94
Thursday PM	507	209	460	94
Saturday Midday	213	142	460	94

4.3.3 North West Rail Link

The North West Rail Link (NWRL) project involves the construction of a new heavy rail link from Epping to the North West Growth Sector and will include the construction of new stations within the study area at Castle Hill and Showground Road. NWRL has an expected completion date of 2019 and it is therefore crucial to understand whether a reduction in mode share to car is likely to occur in the area as this may impact on the estimation of future traffic demands.

A review of *NWRL Traffic and Transport Assessment Report (Aecom 2012)*, which is primarily focused on the morning peak period, indicates the following:

- “Showground station – a substantial increase in traffic on Carrington Road (in the order of 80 *per cent*) accessing the station precinct, with a modest increase in traffic on Showground Road, approaching the station from the north (and using Carrington Road to access the station).”
- “Castle Hill station - a mix of modest increases and decreases in Castle Hill centre traffic on approach roads and the ring-road, with a focus of increased traffic on Old Castle Hill Road, where kiss and ride will be provided.”

Further to the above, the paper also indicated that the Showground Road/Carrington Road intersection with NWRL would still operate at LoS B in the morning with 0.75 DoS with the increase of traffic demand. This is due to wider network constraints to the west, such as the Windsor Road/Showground Road intersection being over capacity and restricting traffic from accessing through to the Carrington Road/Showground Road intersection.

Based on the above information, our analysis for this project has taken a conservative approach by inferring that substantial impacts on future traffic using Showground Road between Carrington Road and Pennant Street is unlikely for the following reasons:

- Although moderate traffic growth is expected on Showground Road in the morning peak, it is likely to be around road network to the west of Carrington which is beyond the study extent of the study.
- Additionally, there will be network constraints outside the study area which may restrict traffic growth on Showground Road near Carrington Road.
- There is no evidence to suggest a net decrease of traffic on the road network within the Castle Hill Town Centre.
- Mitigation measures in terms of access arrangements to the Showground Station could reduce the expected growth on Carrington Road.

Consequently, no reduction or growth in traffic has been adopted as a result of the completion of the NWRL and associated stations within the study, reflecting the assumption that the impact of the NWRL on traffic volumes in the study area will be neutral after accounting for capacity constraints in the road network.

4.4 Future traffic demand

In order to assess the future traffic conditions, the additional trips generated for each of the previously discussed developments and expected background traffic growth have been superimposed onto the existing demands using a spreadsheet model. This spreadsheet model showing the peak hour traffic demands adopted in the analysis for existing and future scenarios is shown in Appendix F.

Table 4-5 and Table 4-6 summarise the peak hour additional trips and their composition for horizon years 2016 and 2026 within the Showground Road study area. Diagrammatic representation of these additional trips on Showground Road is also provided in Figure 21.

Table 4-5 2016 Total additional peak hour trips

Interim 2016	QIC	Non-QIC	Background	Peripheral	Add. Trips
Thursday AM	48%	12%	39%	0%	1,625
Thursday PM	66%	11%	23%	0%	1,894
Saturday Middy	68%	7%	24%	0%	1,936

Table 4-6 2026 Total additional peak hour trips

Interim 2026	QIC	Non-QIC	Background	Peripheral	Add. Trips
Thursday AM	33%	8%	51%	8%	2300
Thursday PM	47%	8%	41%	4%	2651
Saturday Middy	48%	5%	43%	4%	2745

Figure 21 Showground Road estimated traffic demands



Source: Google Maps (2013), modified by GHD

4.5 Desired level of service criteria

The desired assessment criteria for road network planning for the Showground Road widening are as follow:

- Level of Service 'D' or better, and a degree of saturation below 90 per cent for new or modified intersection at the design year of 2026.
- Minimisation of travel time for eastbound public transport (bus) services as a result of the widening and the proposed bus priority measures.
- Provision of optimum intersection configurations that are responsive to physical constraints.

4.5.1 Intersection performance

The intersection performance criteria presented in Section 2.7.3 were used to assess intersection performance along Showground Road for the future horizon year scenarios.

4.6 Future network performance

4.6.1 Intersection capacity assessment – 2016 Interim

'Do Nothing' scenario

The results of the SIDRA intersection modelling for each intersection within the study area under the 2016 'Do Nothing' traffic flow scenario is shown in Table 4-7, with detailed SIDRA outputs provided in Appendix D. As shown, the following intersections are expected to operate with an unacceptable LoS under the 2016 'Do Nothing' traffic flow scenario:

- Carrington Road/Showground Road.
- Britannia Road/Showground Road.
- Rowallan Avenue/Showground Road.
- Cecil Avenue/Showground Road.
- Kentwell Avenue/Showground Road.

Table 4-7 SIDRA results – 2016 ‘Do Nothing’ traffic flows

ID	Intersection	AM peak			PM peak			Saturday peak		
		Ave delay	LoS	Dos	Ave delay	LoS	Dos	Ave delay	LoS	DoS
1	Carrington Road/ Showground Road	41	C	0.97	76	F	1.07	69	E	1.01
2	Britannia Road/ Showground Road	100+	F	9.12	100+	F	8.42	100+	F	12.9
3	Rowallan Avenue/ Showground Road	100+	F	35.61	100+	F	52.4	100+	F	47.5
4	Cecil Avenue/ Showground Road	100+	F	1.32	100+	F	1.18	100+	F	1.26
5	Kentwell Avenue/ Showground Road	100+	F	25.44	100+	F	107	100+	F	113.3
6	Pennant Street/ Showground Road	47	D	0.97	39	C	0.94	42	C	0.96
7	Barwell Avenue/ Showground Road	10	A	0.24	10	A	0.25	10	A	0.31
8	Old Northern Road/ Showground Road	18	B	0.61	18	B	0.64	21	B	0.80

‘Upgrade’ scenario

The results of the SIDRA intersection modelling for each intersection within the study area under the 2016 ‘Upgrade’ traffic flow scenario, assuming the proposed widening of Showground Road is shown in Table 4-8. Detailed SIDRA outputs provided in Appendix D.

As shown, the following intersections are expected to operate with an unacceptable LoS under the 2016 ‘Upgrade’ traffic flow scenario:

- Carrington Road/Showground Road during the weekday PM and Saturday peak.
- Pennant Street/Showground Road during the Saturday peak.

Table 4-8 SIDRA Results – 2016 ‘Upgrade’ Traffic Flows

ID	Intersection	AM Peak			PM Peak			Saturday Peak		
		Ave delay	LoS	DoS	Ave delay	LoS	DoS	Ave delay	LoS	DoS
1	Carrington Road/ Showground Road	47	D	0.94	83	F	1.07	71	F	1.01
2	Britannia Road/ Showground Road	13	A	0.53	14	A	0.59	15	A	0.61
3	Rowallan Avenue/ Showground Road	18	B	0.71	25	B	0.83	34	C	0.94
4	Cecil Avenue/ Showground Road	13	A	0.50	13	A	0.50	26	B	0.57
5	Kentwell Avenue/ Showground Road	35	C	0.77	42	D	0.85	46	D	0.89
6	Pennant Street/ Showground Road	45	D	0.92	43	D	0.94	110	F	1.18
7	Barwell Avenue/ Showground Road	9	A	0.20	9	A	0.22	10	A	0.27
8	Old Northern Road/ Showground Road	18	B	0.61	18	B	0.64	21	B	0.80

4.6.2 Intersection capacity assessment – 2026 design year

‘Do Nothing’ scenario

The results of the SIDRA intersection modelling under the 2026 ‘Do Nothing’ traffic flow scenario are shown in Table 4-9. Detailed SIDRA outputs provided in Appendix D.

The following intersections are expected to operate with an unacceptable LoS under the 2026 ‘Do Nothing’ traffic flow scenario:

- Carrington Road/Showground Road.
- Britannia Road/Showground Road.
- Rowallan Avenue/Showground Road.
- Cecil Avenue/Showground Road.
- Kentwell Avenue/Showground Road.
- Pennant Street/Showground Road.

Table 4-9 SIDRA results – 2026 ‘Do Nothing’ traffic flows

ID	Intersection	AM Peak			PM Peak			Saturday Peak		
		Ave Delay	LoS	Dos	Ave Delay	LoS	Dos	Ave Delay	LoS	DoS
1	Carrington Road/Showground Road	100+	E	1.01	100+	F	1.11	100+	F	1.13
2	Britannia Road/Showground Road	100+	F	9.47	100+	F	9.47	100+	F	12.98
3	Rowallan Avenue/Showground Road	100+	F	37.5 4	100+	F	55.9 7	100+	F	49.47
4	Cecil Avenue/Showground Road	100+	F	1.40	100+	F	1.26	100+	F	1.35
5	Kentwell Avenue/Showground Road	100+	F	24.7 4	100+	F	108. 4	100+	F	114.2
6	Pennant Street/Showground Road	66	E	1.02	78	F	1.06	97	F	1.11
7	Barwell Avenue/Showground Road	10	A	0.26	10	A	0.27	11	A	0.33
8	Old Northern Road/Showground Road	19	B	0.70	18	B	0.70	22	B	0.85

‘Upgrade’ scenario

The results of the SIDRA intersection modelling under the 2026 ‘Upgrade’ traffic flow scenario, assuming the proposed widening of Showground Road is shown in Table 4-10. Detailed SIDRA outputs provided in Appendix D. As shown, the following intersections are expected to operate with an unacceptable LoS under the 2026 ‘Upgrade’ traffic flow scenario:

- Carrington Road/Showground Road.
- Kentwell Avenue/Showground Road.
- Pennant Street/Showground Road.

Table 4-10 SIDRA results – 2026 ‘Upgrade’ traffic flows

ID	Intersection	AM peak			PM peak			Saturday peak		
		Ave delay	LoS	DoS	Ave Delay	LoS	DoS	Ave Delay	LoS	DoS
1	Carrington Road/Showground Road	73	F	1.02	140	F	1.14	116	F	1.12
2	Britannia Road/Showground Road	14	A	0.56	15	A	0.64	17	B	0.65
3	Rowallan Avenue/Showground Road	19	B	0.76	31	C	0.89	42	C	0.95
4	Cecil Avenue/Showground Road	15	A	0.53	27	B	0.58	46	D	0.78
5	Kentwell Avenue/Showground Road	38	C	0.86	42	C	0.84	60	E	0.99
6	Pennant Street/Showground Road	77	F	1.04	93	F	1.13	109	F	1.18
7	Barwell Avenue/Showground Road	10	A	0.22	10	A	0.25	11	A	0.30
8	Old Northern Road/Showground Road	19	B	0.70	18	B	0.70	22	B	0.85

4.6.3 Intersection upgrades

The intersection analysis discussed in 4.6.1 and 4.6.2 identified that the following intersections within the study area would operate with unacceptable level of service during peak periods under future development traffic conditions and proposed intersection designs:

- Carrington Road/Showground Road.
- Kentwell Avenue/Showground Road.
- Pennant Street/Showground Road.

The following sections discuss potential improvements to these intersections, where possible, to achieve the desired standards of service.

Carrington Road/Showground Road

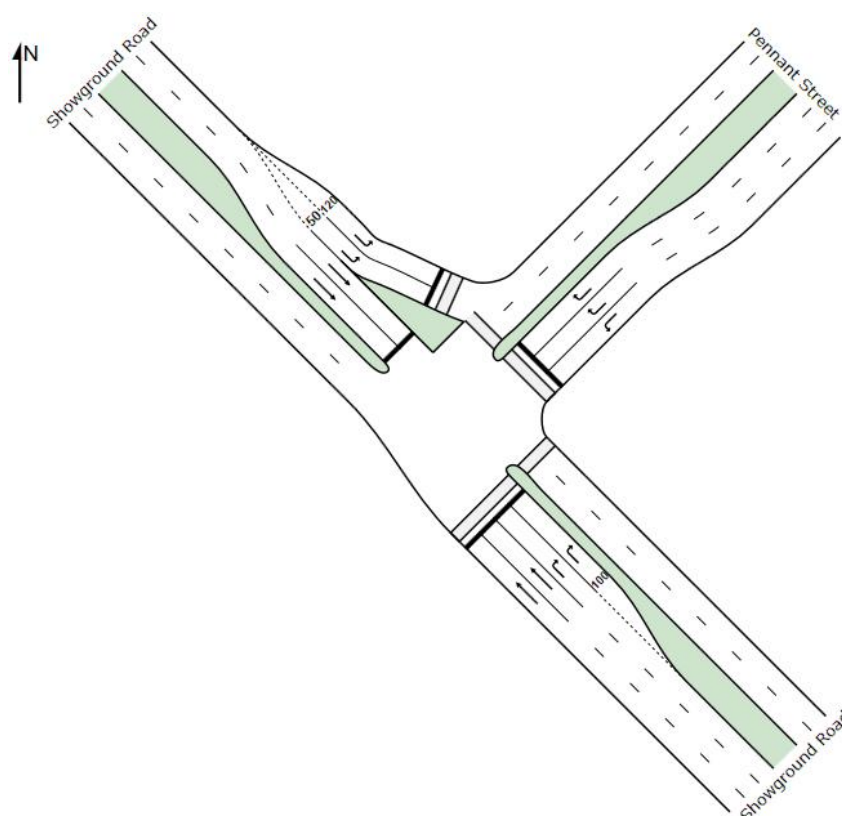
It is noted The Carrington Road/Showground Road intersection is expected to operate with an unacceptable LoS in both the ‘Do Nothing’ and ‘Upgrade’ scenarios. This intersection is also outside of the scope of works area for the proposed Showground Road intersection.

Pennant Street/Showground Road

Consideration of further improvements has been undertaken Pennant Street/Showground Road. This would involve providing an additional right turn bay from Showground Road into Pennant Street.

A summary of the mitigated intersection performance for this intersection is provided in Table 4-11, with a concept layout for the intersection upgrade provided at Figure 22.

Figure 22 Showground Road/Pennant Street intersection improvement



Source: SIDRA 6 (2013)

Table 4-11 SIDRA results – Showground Road/Pennant Street intersection upgrade

ID	Intersection	AM peak			PM peak			Saturday peak		
		Ave delay	LoS	DoS	Ave delay	LoS	DoS	Ave Delay	LoS	DoS
6	2016 'Upgrade' traffic flows	37	C	0.82	35	C	0.82	37	C	0.87
6	2026 'Upgrade' traffic flows	34	C	0.75	31	C	0.71	37	C	0.88

Showground Road/Kentwell Avenue/Cheriton Avenue

The SIDRA analysis summarised in Table 4-8 and Table 4-10 was undertaken based on a four-phase arrangement for the Showground Road/Kentwell Avenue/Cheriton Avenue intersection. Additional SIDRA analysis of the intersection has been undertaken assuming a revised three-phase arrangement for the intersection.

This phasing arrangement would require the double right-turn bay on Kentwell Avenue to run in the same phase as, and opposed to, the pedestrian crossing on the Showground Road west approach. This would provide a more efficient phasing arrangement for the intersection.

The proposed three-phase arrangement at this intersection would require a right turn signal protection for the pedestrian crossing the west approach of this intersection. Alternatively, removal of the western approach crossing could be investigated in the event that there is very little pedestrian demand for this movement.

A summary of the SIDRA results assuming the revised phasing arrangement is shown in Table 4-12, with the SIDRA outputs provided in Appendix D.

Table 4-12 SIDRA results – Showground Road/Kentwell Avenue/Cheriton Avenue intersection revised phasing

ID	Intersection	AM peak			PM peak			Saturday peak		
		Ave Delay	LoS	DoS	Ave Delay	LoS	DoS	Ave Delay	LoS	DoS
5	2016 'Upgrade' Traffic Flows	23	B	0.67	33	C	0.71	34	C	0.75
5	2026 'Upgrade' Traffic Flows	25	B	0.70	33	C	0.70	34	C	0.82

4.6.4 Network operation assessment

In conjunction with the above findings from SIDRA analysis, Paramics modelling has identified key network issues which are most pronounced in the evening and Saturday peak periods under the 2026 'Upgrade' scenarios:

- In both the peak periods in 2026, capacity constraints at the edge of the study area were found to limit the amount of traffic that could reach Showground Road.
- At the eastern end, congestion is observed along Pennant Street on the approach to Showground Road; along Old Northern Road on the approach to the left turn slip lane into Showground Road.
- Congestion at the eastern end of the study area is primarily due to westbound traffic on Showground Road accessing Pennant Street and overflowing from the single right turn lane. This in turn impacts on the throughput of traffic from Pennant Street with both approaches competing for green time at the signal.
- SIDRA analysis of the provision of dual right turn lanes at the Showground Road/Pennant Street intersection shows that this change in the intersection arrangement would improve the performance of this intersection to within the desired level of service. It is also understood that a separate investigation would be undertaken for the Showground Road/Old Northern Road intersection .
- At the western end of the study area, congestion is observed in the model along Carrington Road at approach to Showground Road. This approach accounts for approximately 53 and 34 per cent of the total traffic waiting to enter the network ('unreleased') at the end of the hourly peak periods between 5-6pm in the evening; 12-1pm on Saturday respectively. The remaining unreleased traffic is accounted for by the eastern end constraints described above. Table 4-15 in Section 4.6.5 provides further details on the 'unreleased' trips recoded in the model.
- Review of the NWRL report and the Castle Towers Paramics model suggests that wider network constraints may further restrict future traffic demands from accessing the modelled network.
- The Windsor Road/Showground Road intersection is highlighted in the NWRL report as a potential bottleneck for traffic from the west accessing Showground Road at approach to Carrington Road.
- Queuing of southbound traffic along Old Northern Road at approach to McMullen Avenue was observed through preliminary simulation runs of the Castle Towers Paramics model. It is expected that with the addition of background traffic growth as assumed in this study, the traffic delays generated by these wider network constraints would be further exacerbated.

4.6.5 Travel time appraisal

Journey time statistics generated from the Showground Road Paramics model had been employed as a performance indicator for evaluating the benefits of the proposed bus priority options associated as part of the Showground Road widening works. The average travel time for eastbound traffic is generated based on 10 simulation runs of each modelled scenario for bus and general traffic separately.

Table 4-13 and Table 4-14 show the modelled bus and general traffic average travel time of the 'Upgrade' scenario (with bus priority options) in comparison to the 'Do Nothing' scenario during the peak periods. It was reported for the section of Showground Road between Carrington Road and Pennant Street.

Table 4-13 Eastbound peak period bus travel times

Peak period (bus)	Do Nothing (mm:ss)	Option 1 Diff. (s)	Option 2 Diff. (s)	Option 3 Diff. (s)
2016 AM	03:23	-32	-42	-57
2026 AM	03:39	-22	-28	-64
2016 PM	04:36	-1	17	-48
2026 PM	04:42	-59	-36	-55
2016 Sat	04:29	-38	-13	-45
2026 Sat	04:31	20	83	-26

Table 4-14 Eastbound peak period general traffic travel times

Peak period (bus)	Do Nothing (mm:ss)	Option 1 Diff. (s)	Option 2 Diff. (s)	Option 3 Diff. (s)
2016 AM	03:04	-31	-36	-26
2026 AM	03:23	-19	-22	1
2016 PM	04:11	8	8	-4
2026 PM	04:27	-82	-65	-54
2016 Sat	03:53	-34	-16	-23
2026 Sat	03:59	24	75	31

Based on the above travel time outputs, findings are summarised as follows:

- The majority of the modelled options have shown substantial improvements in travel time with the highest reduction being 64 seconds and 82 seconds for bus and general traffic respectively.
- There are cases where an increase in travel time is reported as a result of the intersection upgrades, particularly during the Saturday peak period in 2026. This is due to the fact that upgrade of these intersections increases their capacity and allows more traffic to enter the model, resulting in increased congestion and increased travel times. Under the 'Do Nothing' scenario, these vehicles would also experience comparable, if not higher delays, but would do so outside of the study area, and are reflected in the increase in 'unreleased' traffic under the 'Do Nothing' scenario.
- The current single lane road network arrangement for eastbound traffic on Showground Road in the 'Do Nothing' scenario had resulted in a significant proportion of the traffic being unable to enter the network at the Carrington Road south and Showground Road west approaches as shown in the Paramics model. This results in less congestion and delay within the study area and more congestion and delay outside the study area.

For these reasons, cumulative ‘unreleased’ trips recorded at the end of the peak periods have been shown in Table 4-15 to provide a clearer understanding of the impacts of the proposal on the wider road network outside the study area.

Table 4-15 Cumulative ‘Unreleased’ Trips at Peak Periods

Peak period (All Veh.)	Do Nothing (vehicles)	Option 1 (vehicles)	Option 2 (vehicles)	Option 3 (vehicles)
2016 AM	1,069	65	70	67
2026 AM	2,047	258	261	270
2016 PM	3,300	481	487	479
2026 PM	4,645	1,230	1,338	1,385
2016 Sat	4,454	263	275	314
2026 Sat	5,679	1,168	1,264	1,271

The above table shows that there is a significantly higher number of ‘unreleased’ trips in the ‘Do Nothing’ scenario particularly during the evening and Saturday peak periods in 2026. It also indicates that travel time improvements are likely to be expected in all the ‘Upgrade’ scenarios when taking into consideration the delays of ‘unreleased’ trips outside the study area.

4.6.6 Bus priority

In order to quantify the potential benefits of the proposal in relation to all road users within the study network to further differentiate the efficiency of the bus priority options, global network statistics such as Vehicle Hours of Travel (VHT), Vehicle Kilometres of Travel (VKT) and average network speed from the Paramics Showground Road model have been shown in Table 4-16.

Table 4-16 Global network statistics

Peak Period	Do Nothing			Option 1			Option 2			Option 3		
	VHT	VKT	km/h	VHT	VKT	km/h	VHT	VKT	km/h	VHT	VKT	km/h
2016 AM	937	15,951	17.0	570	17,179	30.2	569	17,185	30.2	559	17,207	30.8
2026 AM	1,336	16,584	12.4	689	18,418	26.7	699	18,747	26.8	693	18,447	26.6
2016 PM	4,526	18,022	4.0	1,860	23,229	12.5	1,891	23,245	12.3	1,853	23,418	12.6
2026 PM	5,778	18,264	3.2	3,236	24,183	7.5	3,318	24,583	7.4	3,490	24,326	7.0
2016 Sat	5,446	17,330	3.2	1,589	25,384	16.0	1,658	25,084	15.1	1,714	25,025	14.6
2026 Sat	6,760	17,289	2.6	3,238	26,248	8.1	3,456	26,184	7.6	3,446	26,237	7.6

The VHT statistics typically show the total time required by all vehicles in the network to complete their journey. It is demonstrated that Option 1 has the most preferable arrangements where the lowest VHT values are reported under the most congested traffic conditions in the 2026 evening and Saturday peak periods.

This indicated that the ‘left turn only bus-excepted’ arrangement coupled with bus accessing the ‘early start’ storage from the median lane has resulted in the most efficient operation for the overall network. The Paramics model also shows that eastbound buses accessing the ‘early start’ storage from the kerbside lane (as in Option 3) are likely to queue behind traffic waiting to make a left turn from Showground Road into Pennant Street, potentially negating the travel time improvements of other bus priority measures upstream.

4.7 Impacts on local roads and access

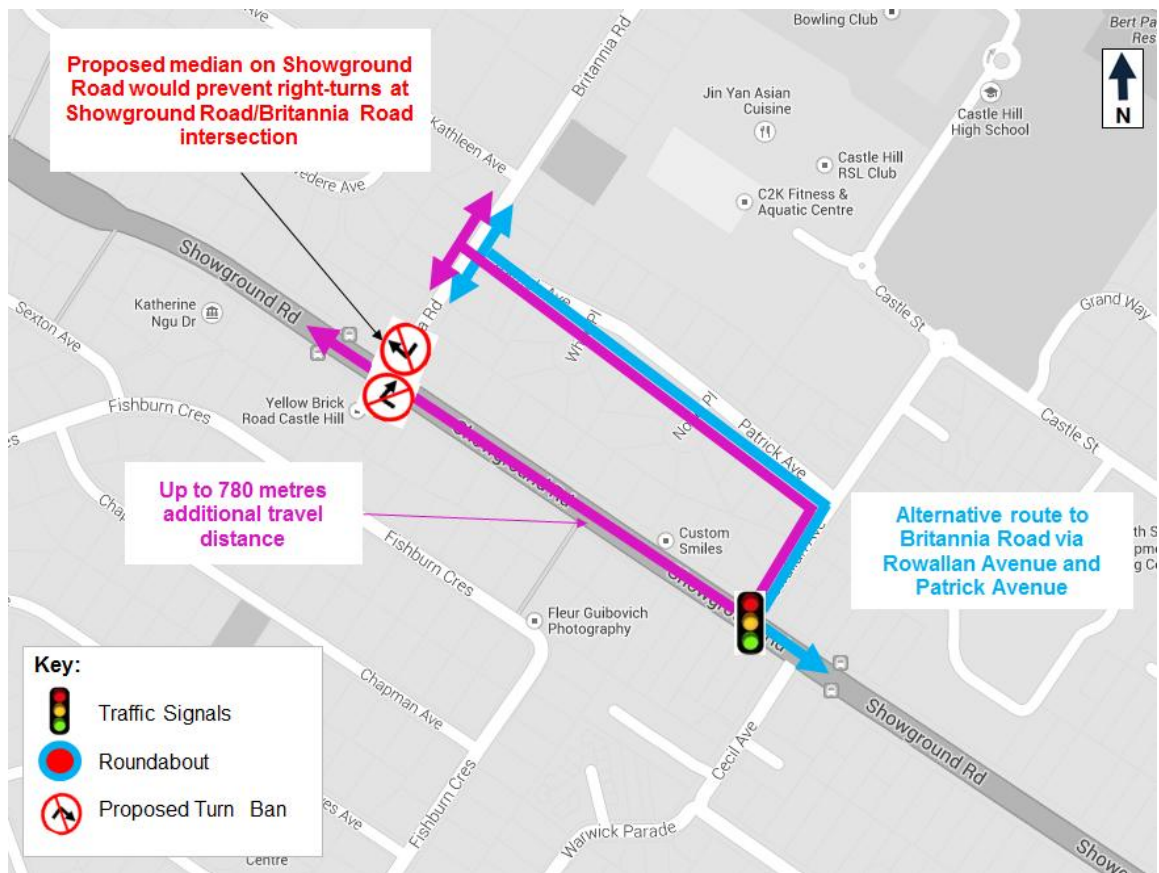
The purpose of the proposed upgrade is to increase mobility for traffic along Showground Road. As mobility generally comes at the cost of accessibility, the proposed road upgrade would inevitably result in some of trade-off between local accessibility and regional mobility along the road corridor.

The proposed Showground Road upgrade has been designed to fit, where possible, within the existing road reservation and seeks to maintain existing access to and from Showground Road with all local roads within the study area. The Proposal maintains existing turning movements at all intersections with the exception of the Showground Road/Britannia Road intersection which would become a left in/left out only intersection. The proposed introduction of a central median along Showground Road would also prevent vehicles from turning right into and out of properties fronting Showground Road, and alternative access routes for local access would be necessary. The impacts to local accessibility are considered in the following sections.

Britannia Road access

A part of the proposed Showground Road Upgrade, the Showground Road/Britannia Road intersection would become a left in/left out only intersection. As such, vehicles that currently make a right turn into or out of Britannia Road at the intersection would be required to do so via Patrick Avenue and the proposed Rowallan Avenue/Showground Road signal controlled intersection. This alternative access between Britannia Road and Showground Road is shown in Figure 23.

Figure 23 Alternative route between Showground Road and Britannia Road



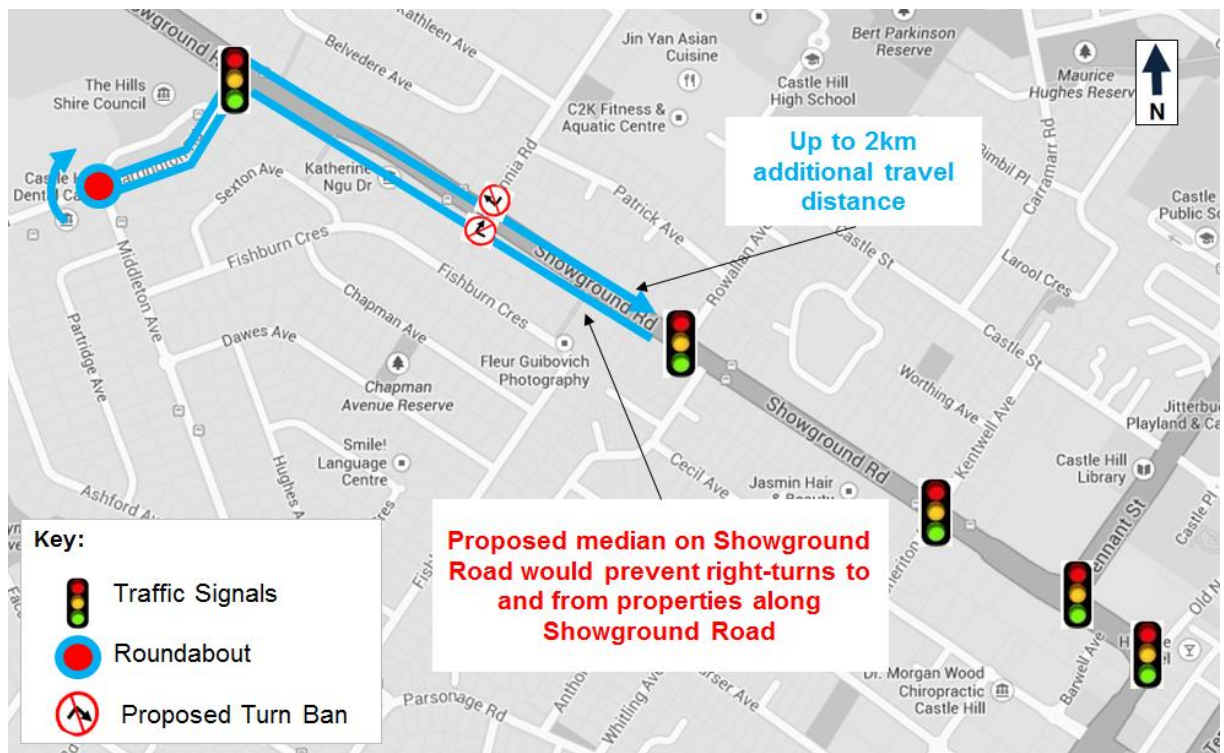
Source: Google Maps (2013), modified by GHD

Properties fronting Showground Road

The proposed introduction of the median strip along Showground Road would restrict right turn movements into and out of properties fronting Showground Road between Pennant Street and Carrington Road. As such, vehicles would be required to take an alternative access route to these properties along Showground Road, where vehicles may be required to travel additional distances.

The worst case example of this would be from properties located along the southern side of Showground Road to the west of the intersection with Rowallan Avenue. Vehicles travelling from these properties to the east would be required to do so via the route shown at Figure 24. This would result in an additional travel distance of around two kilometres.

Figure 24 Alternative access from residential properties fronting southern side of Showground Road



Source: Google Maps (2013), modified by GHD

Other traffic diversions for vehicles accessing properties along Showground Road resulting from the Proposal would be along Castle Street, Cecil Avenue and Patrick Street.

4.8 Parking

On-street car parking for around 155 cars is available along Showground Road within the existing sealed shoulders on the western section of the study area, between Carrington Road and Kentwell Avenue.

The proposed widening of Showground Road would introduce 24 hour clearway operations along the entire length of Showground Road within the study area, and would remove all existing on-street parking.

The proposal would therefore result in the loss of around 155 parking spaces within the study area. However, the current use of the available parking was observed to be low based on the site visit undertaken on 30 August 2013 in the evening peak between 4-6pm and video captures produced for the traffic surveys in the morning peak between 6-9am. The majority of residential and commercial properties fronting Showground Road generally have off-street car parking

provided. Any future development fronting Showground Road would also require car parking to be provided in accordance with The Hills Shire Council's car parking standards.

As such, the proposal is expected to have marginal impacts to car parking.

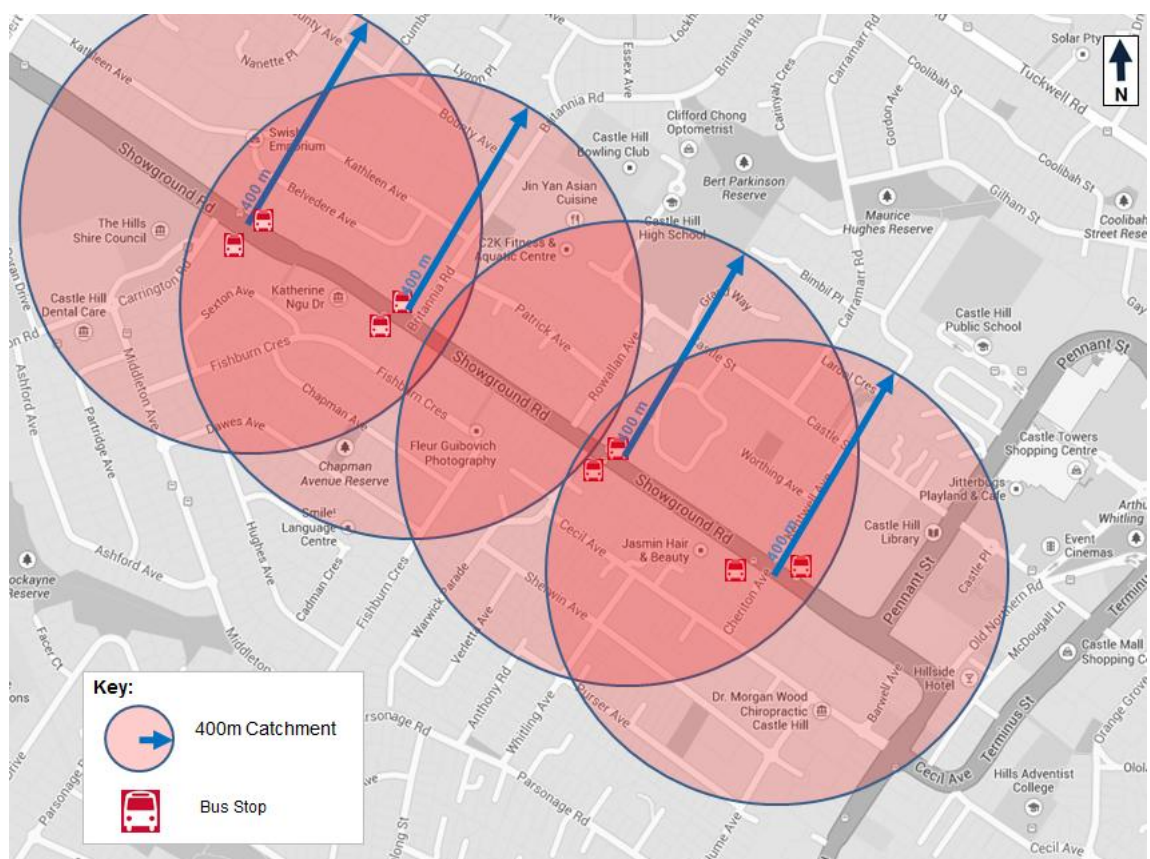
4.9 Public transport

The proposal maintains on-street bus stops located at existing bus stop locations along showground Road.

Figure 25 shows the location of the proposed bus stops along Showground Road and the 400 metre walking catchments from each bus stop. As shown, the bus stops locations provide an acceptable walking distance from all properties fronting Showground Road.

The proposed bus stops along Showground Road would serve existing bus route services operating along Showground Road, as identified in Section 2.5.5. These services support connectivity between the study area, Castle Hill and Castle Towers Shopping Centre with other areas including Macquarie Park, Parramatta and Baulkham Hills.

Figure 25 Bus catchments on Showground Road



Source: Google Maps (2013), modified by GHD

4.9.1 Bus travel times

The measures proposed would improve bus operations along Showground Road by reducing delays and travel times for buses along the Showground Road, especially in the eastbound direction. As such, the Proposal would have a positive impact on peak hour bus operations along Showground Road, particularly in the eastbound direction where bus priority measures would be provided.

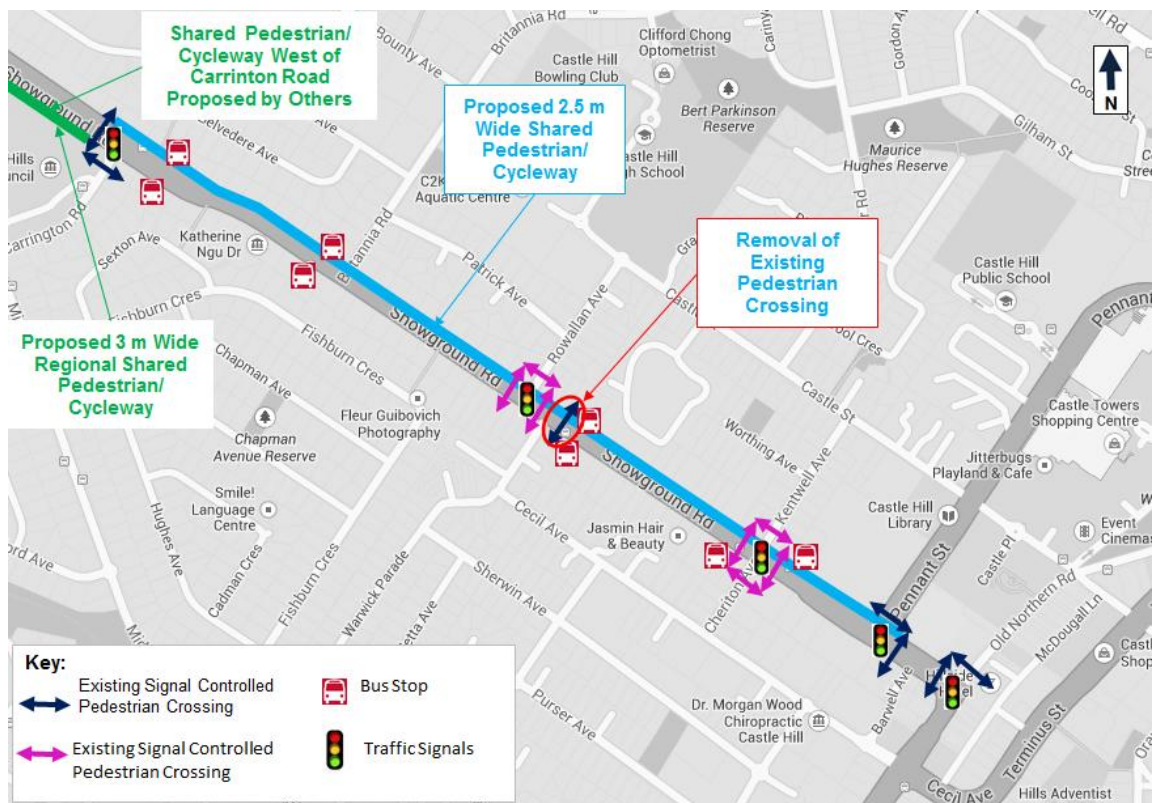
4.10 Active transport

The following improvements to the pedestrian and cyclist infrastructure along Showground Road would be provided as part of the Showground Road Upgrade:

- A new 2.5 metre shared path for pedestrians and cyclists between Carrington Road and Pennant Street.
- Signal controlled pedestrian crossings at each approach to the proposed Showground Road/Rowallan Avenue intersection.
- Signal controlled pedestrian crossings at each approach to the proposed Showground Road/Kentwell Avenue/Cheriton Avenue intersection.
- Removal of the existing signal controlled pedestrian crossing on Showground Road to the east of Cecil Avenue.

The proposed pedestrian and cyclist infrastructure arrangements are shown at Figure 26.

Figure 26 Proposed cycle and pedestrian infrastructure



Source: Google Maps (2013), modified by GHD

There is a proposal from The Hills Shire Council to provide a three metre wide shared pedestrian/cycle path along the southern side of Showground Road between Carrington Road and Windsor Road (shown in green in Figure 26). The proposed 2.5 metre shared pedestrian and cycle path that would be provided as part of the Showground Road Upgrade project would provide a connection to this proposed regional cycle route which would be implemented by others. The crossing point for cyclists on Showground Road would be at the existing signal controlled pedestrian crossing at the Showground Road/Carrington Road intersection.

The preferred location for the proposed shared pedestrian and cycle path is along the northern side of Showground Road. The reasons for this include:

- There would be more uncontrolled crossing for cyclists along the southern side of Showground Road, including at Cecil Avenue and Barwell Avenue.

- Proximity of the proposed shared pedestrian and cycle path to Castle Hill High School, Castle Towers Shopping Centre, Castle Hill Library and Castle Hill RSL.
- Proximity to the expanded Castle Towers Shopping Centre retail precinct between Kentwell Avenue and Old Northern Road.
- The footpath reservation is already formed along the northern side of Showground Road.

4.11 Construction traffic impacts

4.11.1 Overview

A construction traffic impact assessment has been undertaken to obtain an understanding of the likely impacts from construction scheduling and sequencing.

The construction period of the proposed Showground Road Upgrade is expected to be approximately 18 months, between 2015 and 2016.

4.11.2 Proposed working hours

The construction workforce would vary depending on the phase of construction and associated activities and includes both construction and design personnel. An on-site workforce of around 40 to 60 people is expected to be engaged at any given time during the construction period, with a maximum of 100 workers per day during peak construction periods.

Construction would be undertaken during standard working hours which are assumed to be as follows:

- Monday to Friday: between 7am-6pm.
- Saturday: between 8am-1pm.
- Sunday and public holidays: no work.

It may be necessary to undertake night works to minimise disruption to traffic. Further appraisals would be undertaken once the detailed design stage is undertaken and the requirements are known. All night work would be undertaken in accordance with the Office of Environment and Heritage (formerly DECCW) *Interim Construction Noise Guideline* (DECC 2009) and the *Roads and Maritime Services Environmental Noise Management Manual (RTA 2001): Practice Note vii – Road works outside normal working hours*.

Prior notice would be given to the community if any works are planned to be undertaken outside normal construction hours.

4.11.3 Heavy vehicle generation

Heavy vehicle traffic would mainly be generated by activities associated with the following:

- Delivery of construction materials.
- Spoil removal.
- Delivery and removal of construction equipment and machinery.
- Movement of construction personnel, including contractors, site labour force and specialist supervisory personnel.

Approximately 10 heavy vehicles would be required on-site per day, resulting in approximately 40 heavy vehicle movements in and out of the site per day. These heavy vehicle movements are likely to be spread through the day, however for a worst case assessment of the traffic impacts it has been assumed that 10 per cent, or 4 vehicle movements would occur during the peak hour.

Construction vehicles would access the site via arterial roads wherever possible. However, given that these roads already carry high volumes of traffic it is not anticipated that the project would have a high degree of impact above what is currently experienced, as this additional construction traffic would be within the range of daily variation in traffic on these routes.

As a part of the construction management plan it is expected that heavy vehicle traffic would be constrained, as much as possible, to the regional road network and that the impact on local roads would be minimised. Any disruption to access side streets and properties would be minimised and would only be undertaken following consultation with the community and with individual property owners affected by the works.

The movement of materials would be managed through the scheduling of deliveries and availability of fleet, and would aim to minimise the number of haulage and delivery vehicles required during peak periods and weekends.

Light vehicles generation

Light vehicle traffic generation would be associated with staff movements to the site. Staff would comprise of project managers, various trades, and general construction staff. Light vehicles used to transport staff to and from the site would be parked at the main site compound facility.

Over the construction period, the peak construction workforce is estimated to be around 100 people, which represents the worst case scenario in terms of vehicle movement impact during the morning or evening road network peak through the construction period. It is assumed that the majority of the workforce would arrive between 6.30-7.00am and depart generally between 5.00-5.30pm. The workforce arrival and departure periods represent the peak construction traffic generation periods. It is likely that the construction traffic generation peak periods would occur outside the existing road network morning peak period and that the evening peak would not generate significant heavy vehicle movements.

Allowing for some vehicle sharing, it is expected that up to 90 daily two-way trips (assuming 1.1 people per vehicle) would be generated by light vehicles during the peak period. Taking a conservative approach, it is expected that up to 90 vehicle movements would be generated during each of the morning and afternoon construction peak arrival and departure periods.

During the construction traffic peak periods, the workforce traffic movements are likely to be distributed based on a 100/0 arrival and departure split in the morning peak period, and the reverse during the afternoon peak period. Based on this traffic generation, construction traffic is likely to result in increases of up to 90 vehicles per hour in the evening peak period, which is well within the daily variation traffic on the road network within the study area.

4.11.4 Cumulative construction impacts

Cumulative impacts for the construction of other planned development in the Castle Hill area may also result in traffic impacts to Showground Road. Construction of these developments may also occur at the same time as the construction of the proposed Showground Road upgrade. These include the following developments:

- North West Rail Link.
- Castle Towers Shopping Centre expansion.
- Crane Road mixed used development.

The impacts of these other planned developments should be assessed and managed through the implementation of a detailed construction traffic management plan.

4.11.5 Construction mitigation measures

The following proposed traffic management principles would be adopted during the construction period:

- Traffic control would need to be provided to manage and regulate traffic movements during construction.
- Disruption to all road users during the construction period would be kept to a minimum.
- In most cases property access would be maintained throughout the construction period with suitable alternative access arrangements provided otherwise.
- Construction and delivery vehicles entering or leaving the site compound and/or stockpile sites would use arterial roads. These movements would be restricted to non-peak traffic periods.
- It is recommended that a detailed construction traffic management plan is developed as part of the detailed design stage.

4.11.6 Summary of construction traffic generation

The construction stage is estimated to generate up to 40 truck movements per day during the earth moving phase. The majority of these truck movements would take place outside the peak periods, and based on a worst case scenarios, approximately 4 trucks per hour would be expected in the peak hours.

Worker traffic is expected to generate 90 inbound and outbound light vehicle trips during peak periods. The majority of trips occur at the start (6.30-7.00am) or end of the day (5.00-5.30pm) and are not expected to clash with other construction activity. The morning arrival period is noted to fall outside of commuter peak periods in the part of the regional road network. Based on this assessment, construction of the Proposal is not likely to have a significant impact on the road network in the study area.

4.12 Key findings

- The SIDRA intersection analysis indicates that under 2016 'Do Nothing' conditions, the following intersections would operate at an unacceptable level of service:
 - Carrington Road/Showground Road during the weekday evening and Saturday Peak.
 - Pennant Street/Showground Road during the Saturday Peak.
- The SIDRA intersection analysis indicates that under 2026 'Do Nothing' conditions, the following intersections would operate at an unacceptable level of service:
 - Carrington Road/Showground Road.
 - Britannia Road/Showground Road.
 - Rowallan Avenue/Showground Road.
 - Cecil Avenue/Showground Road.
 - Kentwell Avenue/Showground Road.
 - Pennant Street/Showground Road.
- The SIDRA intersection analysis indicates that under 2016 'Upgrade' conditions, the following intersections would operate at an unacceptable level of service:
 - Carrington Road/Showground Road.
 - Pennant Street/Showground Road.

- The SIDRA intersection analysis indicates that under 2026 'Upgrade' conditions, the following intersections would operate with under an unacceptable level of service:
 - Carrington Road/Showground Road.
 - Kentwell Avenue/Showground Road.
 - Pennant Street/Showground Road.
- Consideration of a further improvement has been given to the Pennant Street/Showground Road intersection which provides an additional right turn bay at Showground Road east approach. SIDRA intersection analysis indicates that under 2026 'Upgrade' conditions the proposed intersection would operate under an acceptable level of service.
- Additional SIDRA analysis of the Kentwell Avenue/Showground Road intersection has been undertaken assuming a revised three phase arrangement for the intersection. This analysis indicates that under 2026 'Upgrade' conditions the intersection would operate under an acceptable level of service. This would also need a right turn signal protection for the pedestrian crossing at the west approach of this intersection. Alternatively, removal of the western approach crossing could be investigated if there is very little pedestrian demand for crossing at this location.
- Bus priority measures as proposed are recommended to be provided as part of the Showground Road Upgrade.
- The proposal would result in the loss of around 155 parking spaces within the study area. However, the current utilisation is very low as all residential and commercial properties fronting Showground Road have off street parking provided. As such, the proposal is expected to have minimal impacts to car parking.
- The following proposed improvements to the pedestrian and cyclist infrastructure along Showground Road would be provided as part of the Showground Road Upgrade:
 - A new 2.5 metre shared path for pedestrians and cyclists between Carrington Road and Pennant Street.
 - Signal controlled pedestrian crossings at each approach to the proposed Showground Road/Rowallan Avenue intersection.
 - Signal controlled pedestrian crossings at each approach to the proposed Showground Road/Kentwell Avenue/Cheriton Avenue intersection.
 - Removal of the existing signal controlled pedestrian crossing on Showground Road to the east of Cecil Avenue.
- The proposal would maintain existing bus stop locations along the road corridor between Carrington Road and Kentwell Avenue.
- There would be minimal impacts to local access, including:
 - Britannia Road, where vehicles that currently make a right turn into/out of Britannia Road would be required to do so via the proposed Rowallan Avenue/Showground Road signal controlled intersection.
 - Right turn movements into and out of properties fronting Showground Road would be required to travel via alternate routes. The worst case example of this is from properties located along the southern side of Showground Road to the west of the intersection with Rowallan Avenue, which would need to travel up to 2 kilometres further.

- Other traffic diversions for vehicles accessing properties along Showground Road resulting from the Proposal would be along Castle Street, Cecil Avenue and Patrick Street.
- The construction stage is estimated to generate up to 40 truck movements per day and 90 light vehicle movements per day. Construction of the Proposal is not likely to have a significant impact on the road network in the study area. However, it is recommended that a detailed construction traffic management plan is developed as part of the detailed design stage.

5. Summary and conclusion

5.1 Overview

The purpose of this study was to assess the traffic and transport impact from the operation and construction of the proposed Showground Road widening between Carrington Road and Old Northern Road. It is acknowledged that the need for improvements along the corridor is directly linked to accommodating additional travel demands generated by the planned developments and general continued background traffic growth.

5.2 Key findings

The key findings from this study can be summarised as follows:

Existing conditions

- Good public transport coverage is provided by frequent bus services along Showground Road.
- 2011 Journey to work data indicates that 42 per cent of trips to work in The Hills Shire LGA are generated from within the LGA itself.
- Mode share data for journey-to-work trips in The Hills Shire LGA indicates that car driver and car passenger are the predominant journey modes, representing 75 per cent of all work trips.
- High delays at some intersections during peak periods, particularly at the Showground Road/Britannia Road intersection, Showground Road/Rowallan Avenue intersection and Showground Road/Kentwell Avenue/Cheriton Avenue intersection.
- Pedestrian infrastructure is currently provided within the study with footways generally provided along road frontages and pedestrian crossings provided at signal controlled intersections. However, no pedestrian footways are provided along the northern or southern sides of Showground Road to the west of Rowallan Avenue.
- Existing cycling facilities in the area include on-road lanes within the sealed shoulder areas on Showground Road and Cecil Avenue.
- Identified crash trends at some locations in the study area including at:
 - Showground Road/Kentwell Avenue/Cheriton Avenue.
 - Showground Road/Pennant Street.
 - Showground Road/Carrington Road.
 - Showground Road/Rowallan Avenue.
 - Mid-block road sections of Showground Road, indicating the incidents occurred in longer queues at intersections or vehicles turning into/out of driveways or on-street parking spaces.

Future conditions

- There is a need for network capacity enhancements to provide an adequate level of service for road users on Showground Road in 2016 and 2026 horizon years.
- The proposed Showground Road widening provides the following benefits:
 - Provides additional east-west road capacity, which would assist in relieving congestion on Showground Road under future traffic conditions.

- Supports and promotes access by active transport through the provision of pedestrian and cyclist shared path.
- Improves the quality of bus services in the town centre through the provision of bus priority measures.
- Reduces travel times and vehicle operating costs for both the community and industry located in the town centre.
- Improves operational efficiency and safety from local roads located along Britannia Road and Cheriton Avenue.
- The 2026 design year intersection layouts indicate that satisfactory Level of Service (LoS) D or better with Degree of Saturation (DoS) lower than 0.90 are achieved for intersections along Showground Road, with the exception of Showground Road/Pennant Street and Showground Road/Kentwell Avenue/Cheriton Avenue intersections. Feasible intersection upgrades can be put in place to satisfactorily mitigate these impacts and improve the operational performance of these two intersections.
- It is acknowledged that network capacity constraints within the proximity of this proposal will have an impact on the operational performance of Showground Road and its surrounding road network. The Showground Road /Carrington Road and Showground Road/Old Northern Road intersections are identified to be the likely bottlenecks governing the delays for traffic accessing Showground Road.
- Review of the NWRL report and the Castle Towers Paramics model suggests that wider network constraints may further restrict the throughputs of traffic on Showground Road. These include the Windsor Road/Showground Road intersection to the west; the Old Northern Road/McMullen Avenue intersection and its adjoining Eastern Ring Road to the east. The overall impact of the NWRL, however, is likely to be neutral with respect to traffic in the study area.
- The following proposed improvements to the pedestrian and cycle infrastructure along Showground Road would be provided as part of the Showground Road Upgrade:
 - A new 2.5 metre shared path for pedestrians and cyclists between Carrington Road and Pennant Street.
 - Signal controlled pedestrian crossings at each approach to the proposed Showground Road/Rowallan Avenue intersection.
 - Signal controlled pedestrian crossings at each approach to the proposed Showground Road/Kentwell Avenue/Cheriton Avenue intersection.
 - Removal of the existing signal controlled pedestrian crossing on Showground Road to the east of Cecil Avenue.
- The construction stage is estimated to generate up to 40 truck movements per day and 90 light vehicle movements per day. Construction of the Proposal is not likely to have a significant impact on the road network in the study area.

5.3 Recommendations

5.3.1 Intersection configuration

The proposed and recommended intersection layouts for the 2016 and 2026 horizon years are shown in the SIDRA outputs provided in Appendix D.

- SIDRA modelling has demonstrated the need for an additional right turn bay for approximately 100 metres in 2016 and 2026 in addition to the proposed arrangement, to allow dual right turn movements from Showground Road into Pennant Street.

5.3.2 Signal phasings

Signal information including phasing arrangement and timings are shown in the SIDRA outputs provided in Appendix D.

- SIDRA modelling has shown that a three phase signal arrangement at the Showground Road/Kentwell Avenue/Cheriton Avenue intersection would allow the most optimum operation. This would also need a right turn signal protection for the pedestrian crossing at the west approach of this intersection. Alternatively, removal of the western approach crossing could be investigated if there is very little pedestrian demand for crossing at this location.

5.3.3 Active transport measures

- Provision of a new 2.5 metre shared path for pedestrians and cyclists between Carrington Road and Pennant Street along the northern side of Showground Road.

5.3.4 Construction mitigation measures

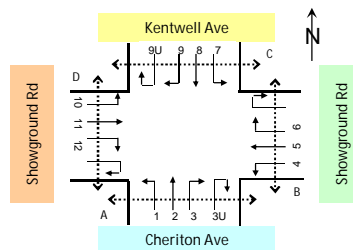
- It is recommended that a detailed construction traffic management plan is developed as part of the detailed design stage.

Appendices

Appendix A – Traffic survey data

Job No. : N1170
 Client : GHD
 Suburb : Castle Hill
 Location : 3. Showground Rd / Kentwell Ave / Cheriton Ave

Day/Date : Sat, 31st August 2013
 Weather : Fine
 Description : Classified Intersection Count
 : Peak Hour Summary

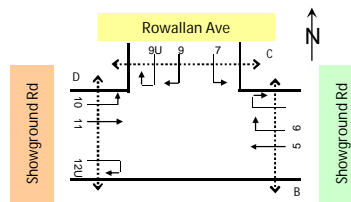


Approach	Cheriton Ave					Showground Rd					Kentwell Ave					Showground Rd					Grand Total
Time Period	Cars	Trucks	Buses	Cyclists	Total	Cars	Trucks	Buses	Cyclists	Total	Cars	Trucks	Buses	Cyclists	Total	Cars	Trucks	Buses	Cyclists	Total	
13:00 to 14:00	53	0	0	0	53	1,511	9	5	0	1,525	22	0	0	0	22	1,344	9	6	1	1,360	2,960

Approach	Cheriton Ave					Showground Rd					Kentwell Ave					Showground Rd					Grand Total
Time Period	Cars	Trucks	Buses	Cyclists	Total	Cars	Trucks	Buses	Cyclists	Total	Cars	Trucks	Buses	Cyclists	Total	Cars	Trucks	Buses	Cyclists	Total	
11:00 to 12:00	51	0	0	0	51	1,418	14	6	0	1,438	26	1	0	0	27	1,288	19	5	2	1,314	2,830
11:15 to 12:15	54	0	0	0	54	1,438	17	5	1	1,461	20	1	0	0	21	1,318	20	6	2	1,346	2,882
11:30 to 12:30	56	0	0	0	56	1,461	13	5	1	1,480	20	1	0	0	21	1,333	19	8	0	1,360	2,917
11:45 to 12:45	52	0	0	0	52	1,505	13	7	1	1,526	15	0	0	0	15	1,309	14	7	0	1,330	2,923
12:00 to 13:00	61	0	0	0	61	1,466	11	6	1	1,484	18	0	0	0	18	1,351	11	7	0	1,369	2,932
12:15 to 13:15	57	0	0	0	57	1,485	11	7	0	1,503	21	0	0	0	21	1,344	6	6	0	1,356	2,937
12:30 to 13:30	59	0	0	0	59	1,504	9	7	0	1,520	20	0	0	0	20	1,343	7	5	0	1,355	2,954
12:45 to 13:45	60	0	0	0	60	1,486	7	5	0	1,498	18	0	0	0	18	1,360	9	4	0	1,373	2,949
13:00 to 14:00	53	0	0	0	53	1,511	9	5	0	1,525	22	0	0	0	22	1,344	9	6	1	1,360	2,960
Total	165	0	0	0	165	4,395	34	17	1	4,447	66	1	0	0	67	3,983	39	18	3	4,043	8,722

Job No. : N1170
 Client : GHD
 Suburb : Castle Hill
 Location : 4. Showground Rd / Rowallan Ave

Day/Date : Thu, 29th August 2013
 Weather : Fine
 Description : Classified Intersection Count
 : Peak Hour Summary



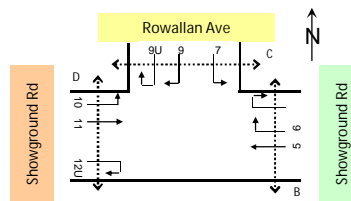
SKYHIGH - THE TRAFFIC SURVEY COMPANY

Approach		Showground Rd					Rowallan Ave					Showground Rd					Grand Total
		Cars	Trucks	Buses	Cyclists	Total	Cars	Trucks	Buses	Cyclists	Total	Cars	Trucks	Buses	Cyclists	Total	
Time Period																	
AM 8:00 to 9:00		1,220	43	19	0	1,282	62	1	1	0	64	1,144	38	13	1	1,196	2,542
PM 16:30 to 17:30		1,257	13	12	2	1,284	94	1	0	0	95	1,399	10	16	2	1,427	2,806

Approach		Showground Rd					Rowallan Ave					Showground Rd					Grand Total
		Cars	Trucks	Buses	Cyclists	Total	Cars	Trucks	Buses	Cyclists	Total	Cars	Trucks	Buses	Cyclists	Total	
Time Period																	
6:00 to 7:00		441	23	8	0	472	28	0	0	0	28	957	62	15	1	1,035	1,535
6:15 to 7:15		532	25	13	1	571	39	0	0	0	39	1,058	60	14	1	1,133	1,743
6:30 to 7:30		682	22	17	1	722	39	1	0	0	40	1,134	55	16	1	1,206	1,968
6:45 to 7:45		809	28	18	1	856	36	2	0	1	39	1,208	50	17	1	1,276	2,171
7:00 to 8:00		921	38	18	1	978	41	3	0	1	45	1,180	44	19	0	1,243	2,266
7:15 to 8:15		1,012	45	18	0	1,075	33	3	0	1	37	1,175	37	23	0	1,235	2,347
7:30 to 8:30		1,091	44	15	0	1,150	37	2	0	1	40	1,157	32	21	0	1,210	2,400
7:45 to 8:45		1,162	44	20	0	1,226	53	1	0	0	54	1,110	31	20	1	1,162	2,442
8:00 to 9:00		1,220	43	19	0	1,282	62	1	1	0	64	1,144	38	13	1	1,196	2,542
AM Totals		2,582	104	45	1	2,732	131	4	1	1	137	3,281	144	47	2	3,474	6,343
16:00 to 17:00		1,275	17	16	0	1,308	75	0	0	0	75	1,367	14	19	0	1,400	2,783
16:15 to 17:15		1,233	16	13	1	1,263	81	0	0	0	81	1,385	10	17	0	1,412	2,756
16:30 to 17:30		1,257	13	12	2	1,284	94	1	0	0	95	1,399	10	16	2	1,427	2,806
16:45 to 17:45		1,264	13	13	2	1,292	77	1	0	0	78	1,405	11	17	2	1,435	2,805
17:00 to 18:00		1,237	12	15	2	1,266	75	1	0	0	76	1,417	10	15	2	1,444	2,786
17:15 to 18:15		1,215	15	15	1	1,246	72	1	1	0	74	1,444	9	17	2	1,472	2,792
17:30 to 18:30		1,208	16	14	0	1,238	73	0	1	0	74	1,424	8	17	0	1,449	2,761
17:45 to 18:45		1,186	14	13	0	1,213	80	0	1	0	81	1,421	5	14	0	1,440	2,734
18:00 to 19:00		1,226	15	18	0	1,259	81	0	1	0	82	1,423	4	17	0	1,444	2,785
PM Totals		3,738	44	49	2	3,833	231	1	1	0	233	4,207	28	51	2	4,288	8,354

Job No. : N1170
 Client : GHD
 Suburb : Castle Hill
 Location : 4. Showground Rd / Rowallan Ave

Day/Date : Sat, 31st August 2013
 Weather : Fine
 Description : Classified Intersection Count
 : Peak Hour Summary



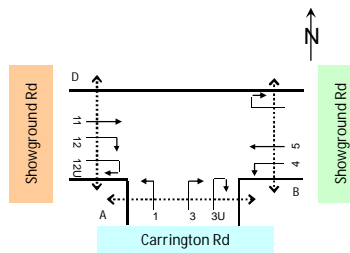
SKYHIGH - THE TRAFFIC SURVEY COMPANY

Approach	Showground Rd					Rowallan Ave					Showground Rd					Grand Total
Time Period	Cars	Trucks	Buses	Cyclists	Total	Cars	Trucks	Buses	Cyclists	Total	Cars	Trucks	Buses	Cyclists	Total	
11:45 to 12:45	1,537	13	7	1	1,558	83	0	1	0	84	1,482	15	7	0	1,504	3,146

Approach	Showground Rd					Rowallan Ave					Showground Rd					Grand Total
Time Period	Cars	Trucks	Buses	Cyclists	Total	Cars	Trucks	Buses	Cyclists	Total	Cars	Trucks	Buses	Cyclists	Total	
11:00 to 12:00	1,485	15	7	1	1,508	75	1	0	0	76	1,455	20	5	1	1,481	3,065
11:15 to 12:15	1,483	18	6	2	1,509	66	1	0	0	67	1,503	23	6	1	1,533	3,109
11:30 to 12:30	1,514	13	5	1	1,533	85	0	1	0	86	1,489	20	7	0	1,516	3,135
11:45 to 12:45	1,537	13	7	1	1,558	83	0	1	0	84	1,482	15	7	0	1,504	3,146
12:00 to 13:00	1,533	10	6	1	1,550	84	0	1	0	85	1,484	12	7	0	1,503	3,138
12:15 to 13:15	1,544	10	7	0	1,561	88	1	1	0	90	1,482	5	6	0	1,493	3,144
12:30 to 13:30	1,554	8	7	0	1,569	81	1	0	0	82	1,475	8	5	0	1,488	3,139
12:45 to 13:45	1,545	6	5	0	1,556	77	1	0	0	78	1,484	10	4	0	1,498	3,132
13:00 to 14:00	1,539	9	5	0	1,553	73	1	0	0	74	1,477	12	6	0	1,495	3,122
Total	4,557	34	18	2	4,611	232	2	1	0	235	4,416	44	18	1	4,479	9,325

Job No. : N1170
 Client : GHD
 Suburb : Castle Hill
 Location : 5. Showground Rd / Carrington Rd

Day/Date : Thu, 29th August 2013
 Weather : Fine
 Description : Classified Intersection Count
 : Peak Hour Summary

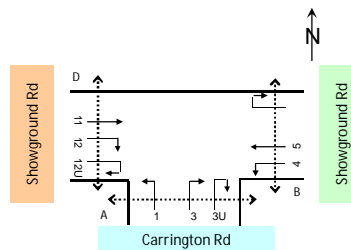


Approach	Carrington Rd					Showground Rd					Grand Total
	Cars	Trucks	Buses	Cyclists	Total	Cars	Trucks	Buses	Cyclists	Total	
Time Period											
AM 8:00 to 9:00	274	9	9	1	293	1,139	47	18	0	1,204	1,369
PM 17:00 to 18:00	860	2	9	1	872	1,173	11	15	1	1,200	1,137

Approach	Carrington Rd					Showground Rd					Grand Total
	Cars	Trucks	Buses	Cyclists	Total	Cars	Trucks	Buses	Cyclists	Total	
Time Period											
6:00 to 7:00	67	4	8	1	80	421	23	8	0	452	947
6:15 to 7:15	90	10	9	1	110	509	23	12	1	545	1,066
6:30 to 7:30	117	17	9	1	144	649	21	18	1	689	1,154
6:45 to 7:45	153	21	9	1	184	795	24	20	1	840	1,259
7:00 to 8:00	172	27	9	0	208	903	32	19	1	955	1,295
7:15 to 8:15	192	22	13	0	227	983	42	19	0	1,044	1,357
7:30 to 8:30	219	16	13	0	248	1,065	45	14	0	1,124	1,337
7:45 to 8:45	232	12	11	1	256	1,088	45	18	0	1,151	1,329
8:00 to 9:00	274	9	9	1	293	1,139	47	18	0	1,204	1,369
AM Totals	513	40	26	2	581	2,463	102	45	1	2,611	3,611
16:00 to 17:00	759	7	10	0	776	1,225	15	16	2	1,258	1,138
16:15 to 17:15	799	5	10	0	814	1,185	14	13	3	1,215	1,113
16:30 to 17:30	838	5	9	1	853	1,182	13	12	3	1,210	1,094
16:45 to 17:45	884	4	8	1	897	1,175	12	13	3	1,203	1,075
17:00 to 18:00	860	2	9	1	872	1,173	11	15	1	1,200	1,137
17:15 to 18:15	838	2	10	1	851	1,144	13	15	0	1,172	1,153
17:30 to 18:30	763	2	10	0	775	1,136	13	14	0	1,163	1,190
17:45 to 18:45	668	1	11	0	680	1,122	12	13	0	1,147	1,229
18:00 to 19:00	602	1	12	0	615	1,149	15	17	0	1,181	1,201
PM Totals	2,221	10	31	1	2,263	3,547	41	48	3	3,639	3,476

Job No. : N1170
 Client : GHD
 Suburb : Castle Hill
 Location : 5. Showground Rd / Carrington Rd

Day/Date : Sat, 31st August 2013
 Weather : Fine
 Description : Classified Intersection Count
 : Peak Hour Summary



Approach	Carrington Rd					Showground Rd					Showground Rd					Grand Total
Time Period	Cars	Trucks	Buses	Cyclists	Total	Cars	Trucks	Buses	Cyclists	Total	Cars	Trucks	Buses	Cyclists	Total	
12:00 to 13:00	574	2	5	0	581	1,524	11	7	0	1,542	1,352	10	2	0	1,364	3,487

Approach	Carrington Rd					Showground Rd					Showground Rd					Grand Total
Time Period	Cars	Trucks	Buses	Cyclists	Total	Cars	Trucks	Buses	Cyclists	Total	Cars	Trucks	Buses	Cyclists	Total	
11:00 to 12:00	549	6	4	2	561	1,415	16	7	0	1,438	1,347	18	0	1	1,366	3,365
11:15 to 12:15	594	7	4	2	607	1,409	19	6	0	1,434	1,353	19	2	0	1,374	3,415
11:30 to 12:30	609	6	5	1	621	1,455	14	5	0	1,474	1,333	17	2	0	1,352	3,447
11:45 to 12:45	582	3	5	1	591	1,484	14	7	0	1,505	1,326	15	2	0	1,343	3,439
12:00 to 13:00	574	2	5	0	581	1,524	11	7	0	1,542	1,352	10	2	0	1,364	3,487
12:15 to 13:15	577	1	5	0	583	1,510	11	7	0	1,528	1,336	4	1	0	1,341	3,452
12:30 to 13:30	558	3	4	0	565	1,513	10	7	1	1,531	1,336	7	2	0	1,345	3,441
12:45 to 13:45	544	4	4	0	552	1,503	8	5	1	1,517	1,325	6	2	0	1,333	3,402
13:00 to 14:00	524	5	4	0	533	1,476	10	5	1	1,492	1,297	7	3	0	1,307	3,332
Total	1,647	13	13	2	1,675	4,415	37	19	1	4,472	3,996	35	5	1	4,037	10,184

Appendix B – Queue survey data

Client GHD
 Location Q1 - Showground Rd (West approach to Carrington)
 Date Thu, 29th August 2013
 Survey Time 06:00-09:00am , 16:00- 19:00pm
 Description Queue length survey



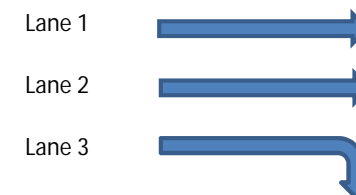
AM	West Leg(Showground Rd)					
	Lane 1		Lane 2		Lane 3	
	Car	Bus	Car	Bus	Car	Bus
6:00 to 6:15	2	0	3	0	3	0
6:15 to 6:30	3	0	4	0	2	0
6:30 to 6:45	3	0	7	0	2	0
6:45 to 7:00	5	0	9	0	3	0
7:00 to 7:15	8	0	11	0	3	0
7:15 to 7:30	3	1	7	0	5	0
7:30 to 7:45	4	1	11	0	9	0
7:45 to 8:00	1	0	1	0	13	0
8:00 to 8:15	1	0	3	0	15	0
8:15 to 8:30	1	0	2	0	15	1
8:30 to 8:45	1	1	2	0	17	0
8:45 to 9:00	3	0	10	0	19	0

PM	West Leg(Showground Rd)						
	Lane 1		Lane 2		Lane 3		
	Car	Bus	Car	Bus	Car	Bus	
16:00 to 16:15	1	0	2	0	10	0	
16:15 to 16:30	0	0	2	0	9	1	
16:30 to 16:45	2	0	4	0	10	1	
16:45 to 17:00	4	0	10	0	8	1	
17:00 to 17:15	3	0	5	0	8	0	
17:15 to 17:30	2	0	7	0	11	0	
17:30 to 17:45	1	0	4	0	8	0	
17:45 to 18:00	4	0	12	0	12	0	
18:00 to 18:15	4	0	10	0	9	0	
18:15 to 18:30	2	0	6	0	10	0	
18:30 to 18:45	5	0	11	0	6	0	
18:45 to 19:00	6	0	9	0	7	0	

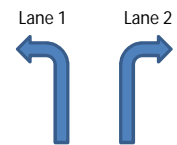
Client GHD
 Location Q1 - Showground Rd (West approach to Carrington)
 Date Sat, 31st August 2013
 Survey Time 11:00 - 14:00
 Description Queue length survey



AM			West Leg(Showground Rd)					
			Lane 1		Lane 2		Lane 3	
			Car	Bus	Car	Bus	Car	Bus
11:00	to	11:15	1	0	6	0	11	0
11:15	to	11:30	10	0	11	0	6	0
11:30	to	11:45	10	0	14	0	12	0
11:45	to	12:00	9	0	16	0	9	0
12:00	to	12:15	13	0	16	0	15	0
12:15	to	12:30	0	0	1	0	8	0
12:30	to	12:45	1	0	3	0	9	0
12:45	to	13:00	0	0	5	0	9	0
13:00	to	13:15	0	0	7	0	6	0
13:15	to	13:30	1	0	4	0	11	0
13:30	to	13:45	1	0	3	0	6	0
13:45	to	14:00	8	0	9	0	9	0



Client GHD
 Location Q2 - Carrington Rd (Sth approach to Showground Rd)
 Date Thu, 29th August 2013
 Survey Time 06:00-09:00am , 16:00- 19:00pm
 Description Queue length survey



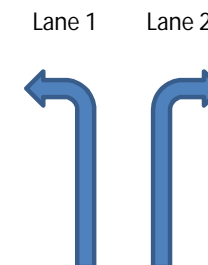
AM	South Leg(Carrington Rd)			
	Lane 1		Lane 2	
	Car	Bus	Car	Bus
6:00 to 6:15	3	0	1	1
6:15 to 6:30	1	1	3	0
6:30 to 6:45	2	0	3	2
6:45 to 7:00	1	1	4	0
7:00 to 7:15	3	1	3	0
7:15 to 7:30	2	1	4	0
7:30 to 7:45	5	1	6	1
7:45 to 8:00	4	1	6	1
8:00 to 8:15	4	1	9	1
8:15 to 8:30	5	1	7	0
8:30 to 8:45	5	0	7	1
8:45 to 9:00	6	0	10	0

PM	South Leg(Carrington Rd)			
	Lane 1		Lane 2	
	Car	Bus	Car	Bus
16:00 to 16:15	10	1	12	1
16:15 to 16:30	7	1	14	1
16:30 to 16:45	11	1	13	1
16:45 to 17:00	10	1	14	0
17:00 to 17:15	9	1	14	0
17:15 to 17:30	7	0	14	1
17:30 to 17:45	8	0	14	1
17:45 to 18:00	10	0	14	1
18:00 to 18:15	7	0	10	1
18:15 to 18:30	9	0	11	0
18:30 to 18:45	5	1	8	1
18:45 to 19:00	5	1	12	1

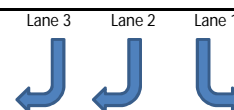
Client GHD
 Location Q2 - Carrington Rd (Sth approach to Showground Rd)
 Date Sat, 31st August 2013
 Survey Time 11:00 - 14:00
 Description Queue length survey



AM			South Leg(Carrington Rd)			
			Lane 1		Lane 2	
			Car	Bus	Car	Bus
11:00	to	11:15	8	0	12	0
11:15	to	11:30	8	0	12	0
11:30	to	11:45	13	1	13	0
11:45	to	12:00	11	0	14	0
12:00	to	12:15	11	0	12	0
12:15	to	12:30	10	0	13	1
12:30	to	12:45	7	0	14	0
12:45	to	13:00	11	0	14	0
13:00	to	13:15	8	0	13	0
13:15	to	13:30	6	0	10	0
13:30	to	13:45	9	0	11	0
13:45	to	14:00	8	0	12	0



Client GHD
 Location Q3 - Pennant St (Nth approach to Showground Rd)
 Date Thu, 29th August 2013
 Survey Time 06:00-09:00am , 16:00- 19:00pm
 Description Queue length survey



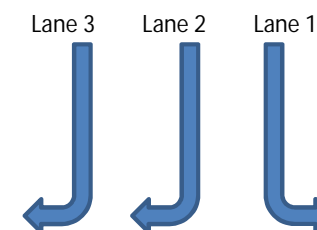
AM	North Leg(Pennant St)						
	Lane 1		Lane 2		Lane 3		
	Car	Bus	Car	Bus	Car	Bus	
6:00 to 6:15	1	0	1	0	4	0	
6:15 to 6:30	2	0	4	0	7	0	
6:30 to 6:45	2	0	4	0	6	0	
6:45 to 7:00	1	0	1	1	7	0	
7:00 to 7:15	1	0	6	1	10	0	
7:15 to 7:30	3	0	4	0	11	0	
7:30 to 7:45	4	0	5	1	8	0	
7:45 to 8:00	3	0	3	0	8	0	
8:00 to 8:15	3	0	4	0	8	0	
8:15 to 8:30	4	1	8	0	10	0	
8:30 to 8:45	5	0	3	1	9	0	
8:45 to 9:00	3	0	8	0	10	0	




PM	North Leg(Pennant St)						
	Lane 1		Lane 2		Lane 3		
	Car	Bus	Car	Bus	Car	Bus	
16:00 to 16:15	5	0	11	1	11	0	
16:15 to 16:30	4	0	6	1	10	0	
16:30 to 16:45	2	0	7	1	10	0	
16:45 to 17:00	4	0	8	0	10	0	
17:00 to 17:15	4	0	6	2	10	0	
17:15 to 17:30	5	0	8	1	10	0	
17:30 to 17:45	3	0	7	1	9	0	
17:45 to 18:00	4	0	5	1	9	0	
18:00 to 18:15	4	0	8	1	10	0	
18:15 to 18:30	2	0	10	0	9	0	
18:30 to 18:45	4	0	8	1	10	0	
18:45 to 19:00	2	0	10	1	10	1	

Client GHD
 Location Q3 - Pennant St (Nth approach to Showground Rd)
 Date Sat, 31st August 2013
 Survey Time 11:00 - 14:00
 Description Queue length survey



AM			North Leg(Pennant St)					
			Lane 1		Lane 2		Lane 3	
			Car	Bus	Car	Bus	Car	Bus
11:00	to	11:15	3	0	8	0	11	0
11:15	to	11:30	3	0	7	0	11	0
11:30	to	11:45	6	0	9	0	12	0
11:45	to	12:00	8	0	14	0	17	0
12:00	to	12:15	3	0	11	0	13	0
12:15	to	12:30	4	0	10	0	15	0
12:30	to	12:45	3	0	6	1	11	0
12:45	to	13:00	6	0	10	1	13	0
13:00	to	13:15	5	0	12	0	15	0
13:15	to	13:30	3	0	11	1	14	0
13:30	to	13:45	6	0	10	0	13	0
13:45	to	14:00	9	0	14	1	15	0



Client	GHD		
Location	Q4 - Showground Rd (East approach to Pennant St)	Lane 3	
Date	Thu, 29th August 2013	Lane 2	
Survey Time	06:00-09:00am , 16:00- 19:00pm	Lane 1	
Description	Queue length survey		



AM	East Leg(Showground Rd)					
	Lane 1		Lane 2		Lane 3 *	
	Car	Bus	Car	Bus	Car	Bus
6:00 to 6:15	1	0	2	0	2	0
6:15 to 6:30	1	0	2	0	2	0
6:30 to 6:45	1	0	4	0	2	0
6:45 to 7:00	1	0	2	0	2	0
7:00 to 7:15	1	0	2	0	4	0
7:15 to 7:30	2	0	7	0	6	0
7:30 to 7:45	1	0	4	0	5	0
7:45 to 8:00	3	0	6	0	10	1
8:00 to 8:15	3	0	8	0	11	0
8:15 to 8:30	4	0	5	0	10	0
8:30 to 8:45	4	0	8	0	13	0
8:45 to 9:00	4	0	10	0	15	0

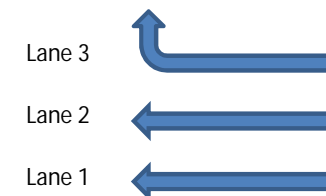
PM	East Leg(Showground Rd)					
	Lane 1		Lane 2		Lane 3 *	
	Car	Bus	Car	Bus	Car	Bus
16:00 to 16:15	5	0	6	0	22	1
16:15 to 16:30	5	0	9	0	12	0
16:30 to 16:45	4	0	7	0	15	0
16:45 to 17:00	5	0	9	0	18	0
17:00 to 17:15	5	0	8	0	26	0
17:15 to 17:30	5	0	7	0	20	0
17:30 to 17:45	4	0	10	0	21	0
17:45 to 18:00	3	0	7	0	27	0
18:00 to 18:15	4	0	6	0	22	0
18:15 to 18:30	4	0	5	0	20	0
18:30 to 18:45	4	0	10	0	19	0
18:45 to 19:00	3	0	6	0	16	0

* Note: Lane 3 has a maximum length of 16 vehicles on Showground Rd. Queue lengths greater than 16 indicate additional vehicles queuing on Old Northern Rd along the southern approach to Showground Rd.

Client GHD
 Location Q4 - Showground Rd (East approach to Pennant St)
 Date Sat, 31st August 2013
 Survey Time 11:00 - 14:00
 Description Queue length survey



AM	East Leg(Showground Rd)					
	Lane 1		Lane 2		Lane 3 *	
	Car	Bus	Car	Bus	Car	Bus
11:00 to 11:15	4	0	8	0	12	0
11:15 to 11:30	4	0	6	0	18	0
11:30 to 11:45	5	0	9	0	16	0
11:45 to 12:00	4	0	5	0	12	0
12:00 to 12:15	4	0	8	0	21	0
12:15 to 12:30	5	0	7	0	12	0
12:30 to 12:45	5	0	8	0	25	0
12:45 to 13:00	6	0	6	0	24	0
13:00 to 13:15	8	0	11	0	19	0
13:15 to 13:30	7	0	7	0	23	0
13:30 to 13:45	5	0	7	0	11	0
13:45 to 14:00	5	0	9	0	16	0



* Note: Lane 3 has a maximum length of 16 vehicles on Showground Rd. Queue lengths greater than 16 indicate additional vehicles queuing along the southern approach to Showground Rd on Old Northern Rd.

Client GHD
 Location Q5 - Old Northern Rd (Sth approach to Showground Rd)
 Date Thu, 29th August 2013
 Survey Time 06:00-09:00am , 16:00- 19:00pm
 Description Queue length survey



AM	South Leg(Old Northern Rd)				
	Lane 1 *		Lane 2		
	Car	Bus	Car	Bus	
6:00 to 6:15	0	1	3	0	
6:15 to 6:30	0	0	3	0	
6:30 to 6:45	1	0	3	1	
6:45 to 7:00	1	0	4	0	
7:00 to 7:15	1	0	5	1	
7:15 to 7:30	1	0	5	0	
7:30 to 7:45	2	0	6	0	
7:45 to 8:00	0	0	9	1	
8:00 to 8:15	1	0	8	0	
8:15 to 8:30	3	0	5	1	
8:30 to 8:45	2	0	8	1	
8:45 to 9:00	2	0	15	0	

* Max. 4 vehicles
 Left-turn vehicles counted in Q4 Lane 3 queue

PM	South Leg(Old Northern Rd)				
	Lane 1 *		Lane 2		
	Car	Bus	Car	Bus	
16:00 to 16:15	1	0	17	0	
16:15 to 16:30	1	0	10	0	
16:30 to 16:45	2	0	16	0	
16:45 to 17:00	1	0	12	0	
17:00 to 17:15	2	0	13	0	
17:15 to 17:30	2	0	9	0	
17:30 to 17:45	2	0	15	1	
17:45 to 18:00	4	0	18	0	
18:00 to 18:15	2	0	11	0	
18:15 to 18:30	4	0	9	0	
18:30 to 18:45	4	0	14	0	
18:45 to 19:00	2	0	10	0	

* Max. 4 vehicles
 Left-turn vehicles counted in Q4 Lane 3 queue

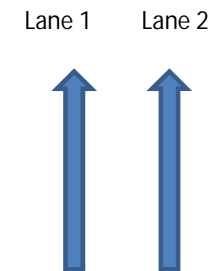
Client GHD
 Location Q5 - Old Northern Rd (Sth approach to Showground Rd)
 Date Sat, 31st August 2013
 Survey Time 11:00 - 14:00
 Description Queue length survey



AM			South Leg(Old Northern Rd)			
			Lane 1 *		Lane 2	
			Car	Bus	Car	Bus
11:00	to	11:15	4	0	11	0
11:15	to	11:30	2	0	11	0
11:30	to	11:45	2	0	13	0
11:45	to	12:00	1	0	12	0
12:00	to	12:15	4	0	14	0
12:15	to	12:30	3	0	11	0
12:30	to	12:45	2	0	13	0
12:45	to	13:00	2	0	15	0
13:00	to	13:15	5	0	11	0
13:15	to	13:30	4	0	11	0
13:30	to	13:45	2	0	12	0
13:45	to	14:00	1	0	13	0

* Max. 4 vehicles

Left-turn vehicles counted in Q4 Lane 3 queue



Appendix C – Journey time survey data

Client GHD
 Location SHOWGROUND RD BETWEEN PENNANT ST & CARRINGTON ST
 Date Thu, 29th August 2013 & Sat, 31 Aug 2013
 Survey Time 06:00-09:00am , 16:00- 19:00pm
 Description Travel Times



	Westbound			Eastbound		
Thu AM	BUS	CAR	TOTAL	BUS	CAR	TOTAL
6:00-6:15	0:03:19	0:01:23	0:01:28	0:01:27	0:01:27	0:01:25
6:15-6:30	0:00:00	0:01:18	0:01:18	0:01:22	0:01:19	0:01:19
6:30-6:45	0:01:28	0:01:22	0:01:23	0:02:19	0:01:30	0:01:31
6:45-7:00	0:01:36	0:01:24	0:01:24	0:01:27	0:01:26	0:01:26
7:00-7:15	0:01:54	0:01:21	0:01:29	0:02:15	0:01:33	0:01:33
7:15-7:30	0:01:38	0:01:38	0:01:40	0:01:20	0:01:28	0:01:28
7:30-7:45	0:01:46	0:01:30	0:01:31	0:01:48	0:01:37	0:01:38
7:45-8:00	0:02:36	0:01:40	0:01:44	0:01:36	0:01:37	0:01:37
8:00-8:15	0:02:18	0:02:52	0:02:44	0:02:01	0:01:54	0:01:54
8:15-8:30	0:01:35	0:01:54	0:01:54	0:01:39	0:01:41	0:01:39
8:30-8:45	0:02:06	0:01:41	0:01:48	0:01:50	0:01:57	0:01:56
8:45-9:00	0:02:32	0:01:52	0:01:56	0:01:29	0:02:36	0:02:36
Average	0:02:04	0:01:40	0:01:41	0:01:43	0:01:40	0:01:40
Sample	33	230	263	32	435	467

	Westbound			Eastbound		
Thu PM	BUS	CAR	TOTAL	BUS	CAR	TOTAL
16:00-16:15	0:02:03	0:01:56	0:01:59	0:01:51	0:01:54	0:01:53
16:15-16:30	0:02:17	0:01:54	0:01:55	0:02:02	0:02:10	0:02:09
16:30-16:45	0:02:01	0:01:50	0:01:53	0:02:00	0:01:48	0:01:49
16:45-17:00	0:02:29	0:01:36	0:01:38	0:01:34	0:01:41	0:01:41
17:00-17:15	0:01:44	0:01:31	0:01:32	0:02:10	0:02:10	0:02:10
17:15-17:30	0:01:45	0:01:44	0:01:43	0:01:58	0:02:02	0:02:02
17:30-17:45	0:02:01	0:01:53	0:01:56	0:01:59	0:01:41	0:01:42
17:45-18:00	0:01:45	0:01:38	0:01:39	0:02:20	0:02:09	0:02:09
18:00-18:15	0:01:41	0:01:46	0:01:45	0:02:09	0:02:17	0:02:15
18:15-18:30	0:00:00	0:01:42	0:01:42	0:02:22	0:02:04	0:02:04
18:30-18:45	0:01:58	0:01:37	0:01:44	0:01:54	0:01:57	0:01:57
18:45-19:00	0:01:44	0:01:46	0:01:45	0:02:38	0:02:03	0:02:08
Average	0:01:57	0:01:44	0:01:46	0:02:05	0:02:00	0:02:00
Sample	39	318	357	46	465	511

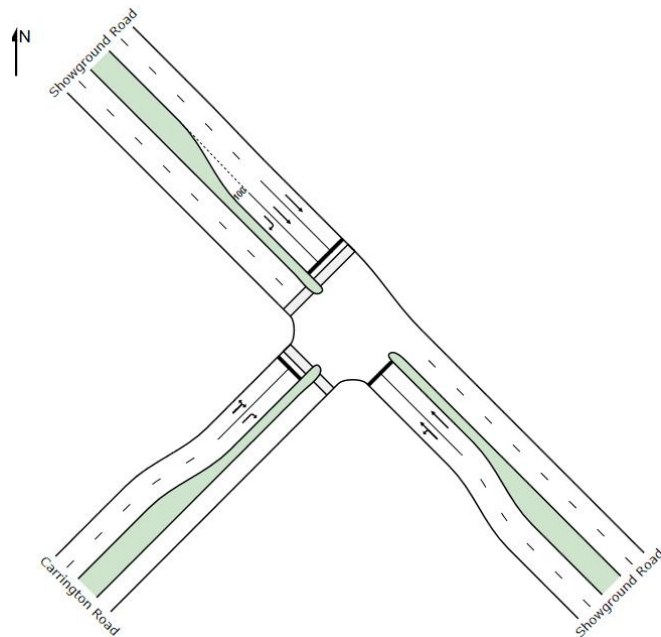
	Westbound			Eastbound		
Saturday	BUS	CAR	TOTAL	BUS	CAR	TOTAL
11:00-11:15	0:01:55	0:01:45	0:01:46	0:02:11	0:01:54	0:01:55
11:15-11:30	0:02:03	0:01:39	0:01:40	0:01:56	0:01:54	0:01:54
11:30-11:45	0:00:00	0:01:38	0:01:38	0:02:29	0:02:15	0:02:17
11:45-12:00	0:01:42	0:01:43	0:01:43	0:00:00	0:02:35	0:02:35
12:00-12:15	0:00:00	0:01:34	0:01:34	0:02:22	0:02:18	0:02:18
12:15-12:30	0:01:47	0:01:43	0:01:43	0:02:09	0:02:17	0:02:16
12:30-12:45	0:01:49	0:01:41	0:01:42	0:02:09	0:02:07	0:02:08
12:45-13:00	0:01:21	0:01:32	0:01:32	0:00:00	0:02:03	0:02:03
13:00-13:15	0:01:38	0:01:51	0:01:51	0:01:57	0:02:06	0:02:06
13:15-13:30	0:01:54	0:01:52	0:01:52	0:01:49	0:02:16	0:02:16
13:30-13:45	0:00:00	0:01:34	0:01:34	0:02:13	0:02:00	0:02:00
13:45-14:00	0:01:33	0:01:33	0:01:33	0:01:34	0:01:56	0:01:56
Average	0:01:45	0:01:40	0:01:41	0:02:05	0:02:09	0:02:09
Sample	16	480	496	18	565	583

Appendix D – SIDRA outputs

2013 Existing &
2016 + 2026 “Do Minimum” Scenario

SIDRA Outputs

Showground Road/Carrington Road – 2013 Existing



LANE SUMMARY

Site: AM Peak Existing

Carrington Rd / Showground Rd AM Peak Existing
Signals - Fixed Time Cycle Time = 120 seconds (User-Given Cycle Time)

Lane Use and Performance

	Demand Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Queue Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
SouthEast: Showground Road													
Lane 1	655	1.7	884	0.741	100	33.0	LOS C	30.6	217.0	Full	500	0.0	0.0
Lane 2	594	6.0	802	0.741	100	30.9	LOS C	29.0	213.3	Full	500	0.0	0.0
Approach	1248	3.7		0.741		32.0	LOS C	30.6	217.0				
NorthWest: Showground Road													
Lane 1	534	3.0	1410	0.379	100	6.2	LOS A	11.3	80.9	Full	500	0.0	0.0
Lane 2	534	3.0	1410	0.379	100	6.2	LOS A	11.3	80.9	Full	500	0.0	0.0
Lane 3	423	3.0	564	0.750	100	48.7	LOS D	19.7	141.8	Short	100	0.0	36.9
Approach	1491	3.0		0.750		18.3	LOS B	19.7	141.8				
SouthWest: Carrington Road													
Lane 1	160	3.6	351	0.456	100	53.4	LOS D	8.4	60.5	Full	500	0.0	0.0
Lane 2	138	3.0	301	0.456	100	56.8	LOS E	7.4	53.2	Full	500	0.0	0.0
Approach	298	3.3		0.456		54.9	LOS D	8.4	60.5				
Intersection	3037	3.3		0.750		27.5	LOS B	30.6	217.0				

PHASING SUMMARY

Site: AM Peak Existing

Carrington Rd / Showground Rd AM Peak Existing
Signals - Fixed Time Cycle Time = 120 seconds (User-Given Cycle Time)

Phase times determined by the program
Sequence: Split Phasing
Movement Class: All Movement Classes
Input Sequence: A, B, C
Output Sequence: A, B, C

Phase Timing Results

Phase	A	B	C
Green Time (sec)	51	31	20
Yellow Time (sec)	3	3	3
All-Red Time (sec)	3	3	3
Phase Time (sec)	57	37	26
Phase Split	48 %	31 %	22 %

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

Lane LOS values are based on average delay per lane.

Intersection and Approach LOS values are based on average delay for all lanes.

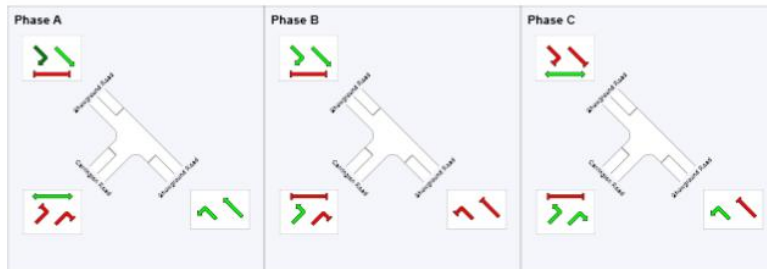
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

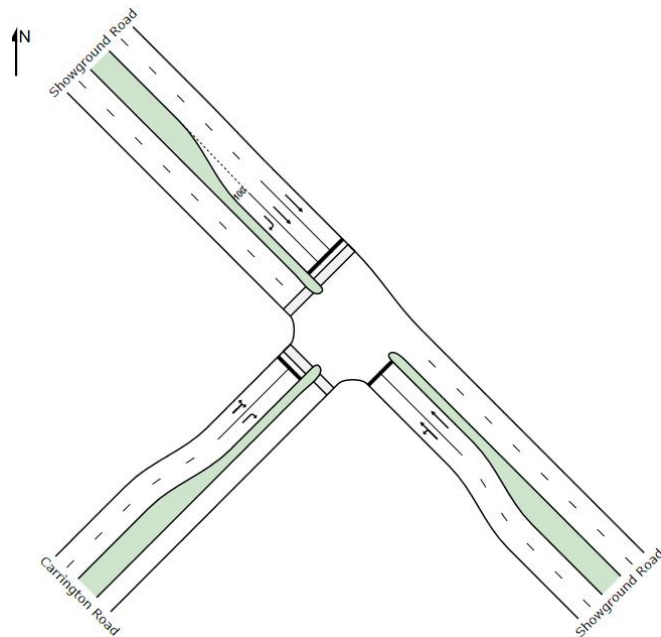
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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SIDRA INTERSECTION 6.0.14.4193 www.sidrasolutions.com
Project: G:\21\22830\Technical\Traffic\Technical\SIDRA\Existing Layout\1 Carrington Rd_Showground Rd.sip6
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**SIDRA
INTERSECTION 6**



Showground Road/Carrington Road – 2013 Existing



PHASING SUMMARY

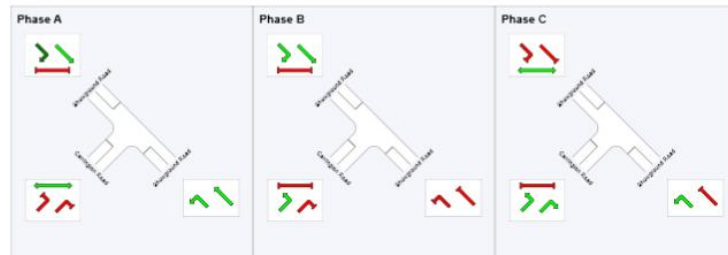
Site: PM Peak Existing

Carrington Rd / Showground Rd PM Peak Existing
Signals - Fixed Time Cycle Time = 120 seconds (User-Given Cycle Time)

Phase times determined by the program
Sequence: Split Phasing
Movement Class: All Movement Classes
Input Sequence: A, B, C
Output Sequence: A, B, C

Phase Timing Results

Phase	A	B	C
Green Time (sec)	51	15	36
Yellow Time (sec)	4	4	4
All-Red Time (sec)	2	2	2
Phase Time (sec)	57	21	42
Phase Split	48 %	18 %	35 %



LANE SUMMARY

Site: PM Peak Existing

Carrington Rd / Showground Rd PM Peak Existing
Signals - Fixed Time Cycle Time = 120 seconds (User-Given Cycle Time)

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	95% Back of Queue Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
SouthEast: Showground Road													
Lane 1	668	0.5	837	0.798	100	35.7	LOS C	34.1	239.6	Full	500	0.0	0.0
Lane 2	660	1.0	828	0.798	100	33.1	LOS C	34.0	240.2	Full	500	0.0	0.0
Approach	1328	0.8		0.798		34.4	LOS C	34.1	240.2				
NorthWest: Showground Road													
Lane 1	499	1.0	1168	0.427	100	13.6	LOS A	15.4	108.8	Full	500	0.0	0.0
Lane 2	499	1.0	1168	0.427	100	13.6	LOS A	15.4	108.8	Full	500	0.0	0.0
Lane 3	208	0.0	321	0.649	100	57.4	LOS E	11.3	78.9	Short	100	0.0	0.0
Approach	1206	0.8		0.649		21.2	LOS B	15.4	108.8				
SouthWest: Carrington Road													
Lane 1	469	0.0	594	0.790	100	50.3	LOS D	26.0	182.1	Full	500	0.0	0.0
Lane 2	438	0.0	554	0.790	100	52.5	LOS D	24.6	172.3	Full	500	0.0	0.0
Approach	907	0.0		0.790		51.3	LOS D	26.0	182.1				
Intersection	3442	0.6		0.798		34.2	LOS C	34.1	240.2				

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

Lane LOS values are based on average delay per lane.

Intersection and Approach LOS values are based on average delay for all lanes.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

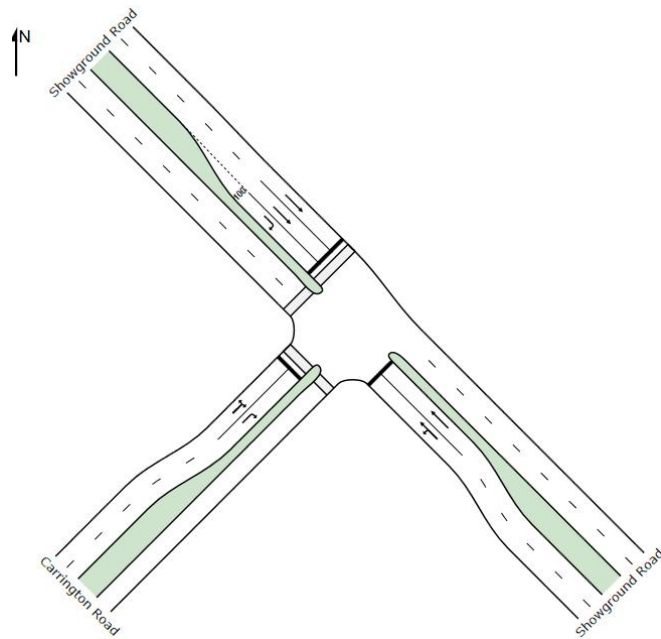
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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**SIDRA
INTERSECTION 6**

Showground Road/Carrington Road – 2013 Existing



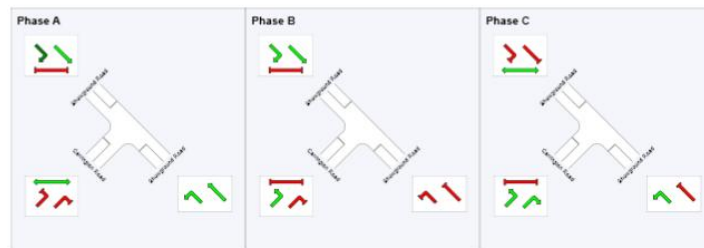
PHASING SUMMARY

Site: Saturday Peak Existing

Carrington Rd / Showground Rd SAT Peak Existing
Signals - Fixed Time Cycle Time = 120 seconds (User-Given Cycle Time)

Phase times determined by the program
Sequence: Split Phasing
Movement Class: All Movement Classes
Input Sequence: A, B, C
Output Sequence: A, B, C

Phase Timing Results			
Phase	A	B	C
Green Time (sec)	64	14	24
Yellow Time (sec)	4	4	4
All-Red Time (sec)	2	2	2
Phase Time (sec)	70	20	30
Phase Split	58 %	17 %	25 %



LANE SUMMARY

Site: Saturday Peak Existing

Carrington Rd / Showground Rd SAT Peak Existing
Signals - Fixed Time Cycle Time = 120 seconds (User-Given Cycle Time)

Lane Use and Performance

	Demand Flows			Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue	Dist	Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	Total veh/h	HV %	Cap. veh/h	v/c	%	sec		Veh	m		m	%	%
SouthEast: Showground Road													
Lane 1	837	0.5	1047	0.799	100	26.8	LOS B	38.5	270.9	Full	500	0.0	0.0
Lane 2	830	1.0	1039	0.799	100	24.2	LOS B	39.0	275.2	Full	500	0.0	0.0
Approach	1666	0.7		0.799		25.5	LOS B	39.0	275.2				
NorthWest: Showground Road													
Lane 1	625	1.0	1363	0.458	100	8.4	LOS A	15.8	111.6	Full	500	0.0	0.0
Lane 2	625	1.0	1363	0.458	100	8.4	LOS A	15.8	111.6	Full	500	0.0	0.0
Lane 3	221	0.0	300	0.737	100	62.1	LOS E	12.8	89.9	Short	100	0.0	0.0
Approach	1471	0.8		0.737		16.5	LOS B	15.8	111.6				
SouthWest: Carrington Road													
Lane 1	315	0.5	399	0.789	100	59.5	LOS E	18.5	130.2	Full	500	0.0	0.0
Lane 2	292	0.0	369	0.789	100	61.5	LOS E	17.3	121.1	Full	500	0.0	0.0
Approach	606	0.3		0.789		60.4	LOS E	18.5	130.2				
Intersection	3743	0.7		0.799		27.6	LOS B	39.0	275.2				

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

Lane LOS values are based on average delay per lane.

Intersection and Approach LOS values are based on average delay for all lanes.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

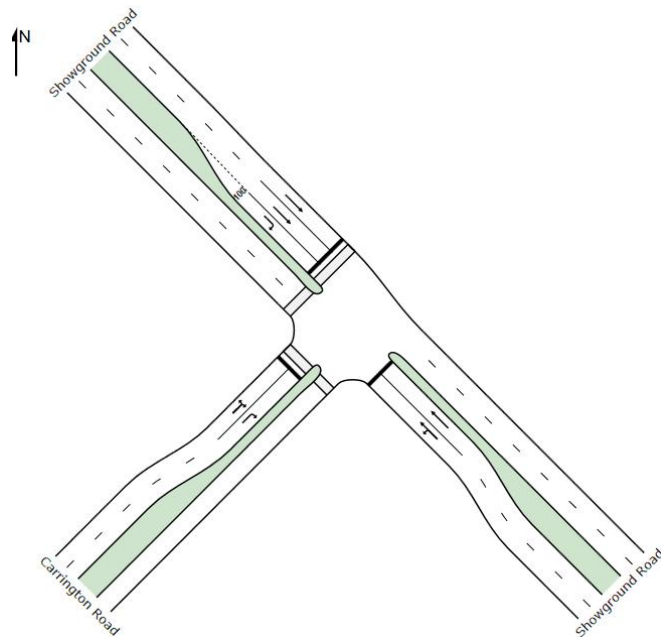
Gap-Acceptance Capacity: SIDRA Standard (Akcelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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**SIDRA
INTERSECTION 6**

Showground Road/Carrington Road – “Do Nothing”



PHASING SUMMARY

Site: AM Peak - 2016 Base

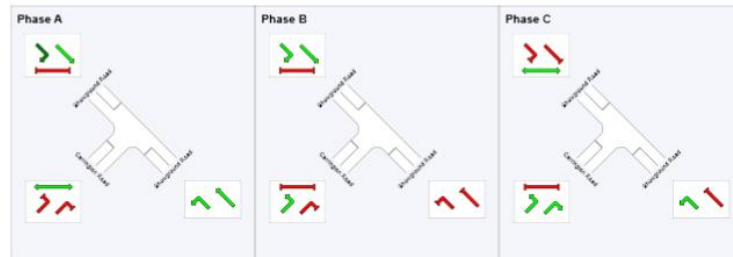
Carrington Rd / Showground Rd AM Peak Existing
Signals - Fixed Time Cycle Time = 120 seconds (User-Given Cycle Time)

Phase times determined by the program

Sequence: Split Phasing
Movement Class: All Movement Classes
Input Sequence: A, B, C
Output Sequence: A, B, C

Phase Timing Results

Phase	A	B	C
Green Time (sec)	51	29	22
Yellow Time (sec)	3	3	3
All-Red Time (sec)	3	3	3
Phase Time (sec)	57	35	28
Phase Split	48 %	29 %	23 %



LANE SUMMARY

Site: AM Peak - 2016 Base

Carrington Rd / Showground Rd AM Peak Existing

Signals - Fixed Time Cycle Time = 120 seconds (User-Given Cycle Time)

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	95% Back of Queue Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
SouthEast: Showground Road													
Lane 1	775	1.8	877	0.883	100	45.8	LOS D	46.5	330.4	Full	500	0.0	0.0
Lane 2	708	6.0	802	0.883	100	43.5	LOS D	43.4	319.2	Full	500	0.0	0.0
Approach	1483	3.8		0.883		44.7	LOS D	46.5	330.4				
NorthWest: Showground Road													
Lane 1	790	3.0	1378	0.573	100	8.6	LOS A	21.8	156.4	Full	500	0.0	0.0
Lane 2	790	3.0	1378	0.573	100	8.6	LOS A	21.8	156.4	Full	500	0.0	0.0
Lane 3	492	3.0	507	0.970	100	94.4	LOS F	35.7	256.4	Short	100	0.0	93.7
Approach	2072	3.0		0.970		29.0	LOS C	35.7	256.4				
SouthWest: Carrington Road													
Lane 1	322	3.4	353	0.912	100	74.6	LOS F	22.3	160.4	Full	500	0.0	0.0
Lane 2	302	3.0	332	0.912	100	75.4	LOS F	20.9	149.7	Full	500	0.0	0.0
Approach	624	3.2		0.912		74.9	LOS F	22.3	160.4				
Intersection	4179	3.3		0.970		41.4	LOS C	46.5	330.4				

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

Lane LOS values are based on average delay per lane.

Intersection and Approach LOS values are based on average delay for all lanes.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Processed: Thursday, 3 October 2013 11:39:35 AM

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Project: G:\21\22830\Technical\Traffic\Technical\SIDRA\Existing Layout\1 Carrington Rd_Showground Rd.sip8

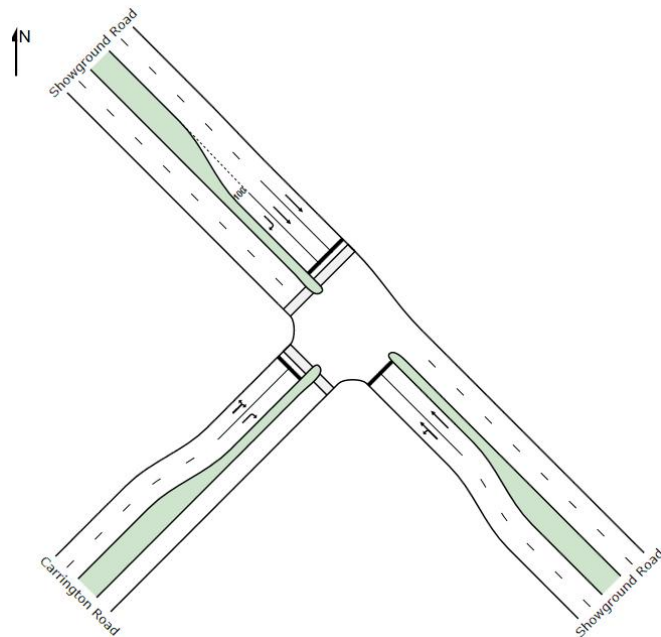
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**SIDRA
INTERSECTION 6**

Showground Road/Carrington Road – “Do Nothing”



PHASING SUMMARY

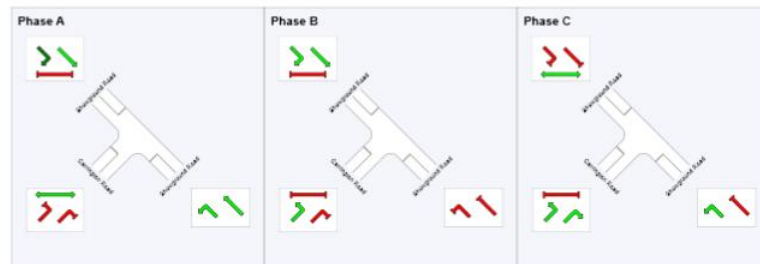
Site: PM Peak - 2016 Base

Carrington Rd / Showground Rd PM Peak Existing
Signals - Fixed Time Cycle Time = 150 seconds (Practical Cycle Time)

Phase times determined by the program
Sequence: Split Phasing
Movement Class: All Movement Classes
Input Sequence: A, B, C
Output Sequence: A, B, C

Phase Timing Results

Phase	A	B	C
Green Time (sec)	71	13	48
Yellow Time (sec)	4	4	4
All-Red Time (sec)	2	2	2
Phase Time (sec)	77	19	54
Phase Split	51 %	13 %	36 %



LANE SUMMARY

Site: PM Peak - 2016 Base

Carrington Rd / Showground Rd PM Peak Existing
Signals - Fixed Time Cycle Time = 150 seconds (Practical Cycle Time)

Lane Use and Performance													
	Demand Flows		Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Queue Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
	Total veh/h	HV %											
SouthEast: Showground Road													
Lane 1	914	0.5	924	0.989	100	87.5	LOS F	89.6	630.3	Full	500	0.0	26.1
Lane 2	912	1.0	922	0.989	100	84.1	LOS F	89.1	629.2	Full	500	0.0	25.9
Approach	1826	0.8		0.989		85.8	LOS F	89.6	630.3				
NorthWest: Showground Road													
Lane 1	706	1.0	1168	0.604	100	19.8	LOS B	31.7	223.5	Full	500	0.0	0.0
Lane 2	673	1.0	1115 ¹	0.604	100	19.3	LOS B	29.4	207.8	Full	500	0.0	0.0
Lane 3	226	0.0	211	1.071	100	118.9	LOS F	25.1	175.8	Short	100	0.0	57.0
Approach	1605	0.9		1.071		33.5	LOS C	31.7	223.5				
SouthWest: Carrington Road													
Lane 1	618	0.0	614	1.006	100	116.2	LOS F	64.1	448.7	Full	500	0.0	0.0
Lane 2	595	0.0	591	1.006	100	117.2	LOS F	61.6	431.5	Full	500	0.0	0.0
Approach	1213	0.0		1.006		116.7	LOS F	64.1	448.7				
Intersection	4644	0.6		1.071		75.8	LOS F	89.6	630.3				

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

Lane LOS values are based on average delay per lane.

Intersection and Approach LOS values are based on average delay for all lanes.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akcelik M3D).

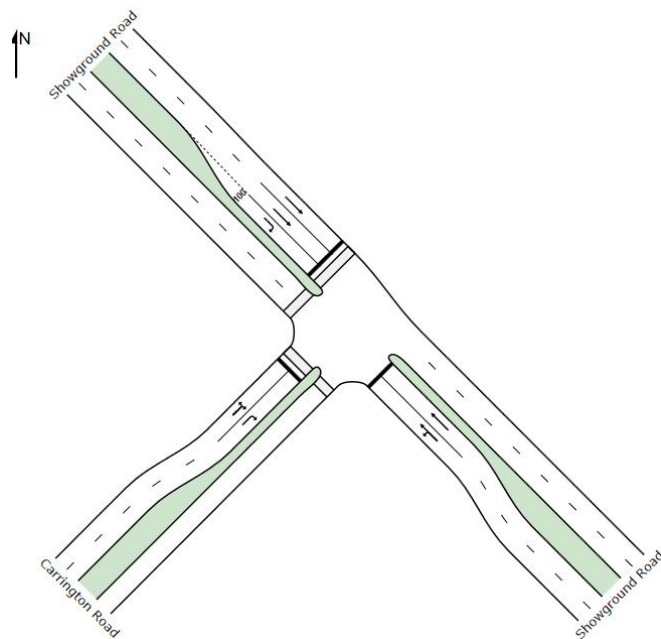
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

¹ Reduced capacity due to a short lane effect

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**SIDRA
INTERSECTION 6**

Showground Road/Carrington Road – “Do Nothing”



PHASING SUMMARY

Site: Saturday Peak - 2016 Base

Carrington Rd / Showground Rd SAT Peak Existing
Signals - Fixed Time Cycle Time = 150 seconds (Practical Cycle Time)

Phase times determined by the program

Sequence: Split Phasing

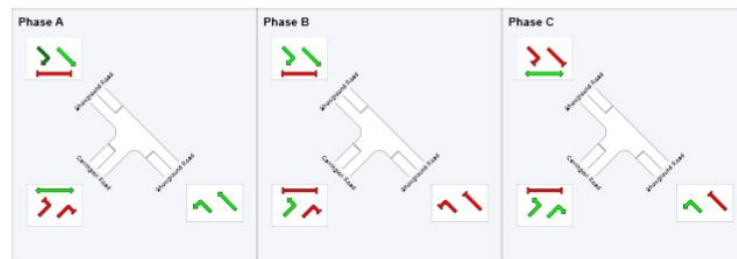
Movement Class: All Movement Classes

Input Sequence: A, B, C

Output Sequence: A, B, C

Phase Timing Results

Phase	A	B	C
Green Time (sec)	80	17	35
Yellow Time (sec)	4	4	4
All-Red Time (sec)	2	2	2
Phase Time (sec)	86	23	41
Phase Split	57 %	15 %	27 %



LANE SUMMARY

Site: Saturday Peak - 2016 Base

Carrington Rd / Showground Rd SAT Peak Existing
Signals - Fixed Time Cycle Time = 150 seconds (Practical Cycle Time)

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Queue Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
SouthEast: Showground Road													
Lane 1	1055	0.5	1041	1.014	100	97.9	LOS F	111.2	781.6	Full	500	0.0	46.0
Lane 2	1053	1.0	1039	1.014	100	94.3	LOS F	110.4	779.4	Full	500	0.0	45.7
Approach	2108	0.7		1.014		96.1	LOS F	111.2	781.6				
NorthWest: Showground Road													
Lane 1	866	1.0	1337	0.648	100	13.9	LOS A	34.9	246.2	Full	500	0.0	0.0
Lane 2	819	1.0	1265 ¹	0.648	100	13.3	LOS A	31.6	223.2	Full	500	0.0	0.0
Lane 3	238	0.0	260	0.915	100	97.5	LOS F	19.0	132.7	Short	100	0.0	30.8
Approach	1923	0.9		0.915		24.0	LOS B	34.9	246.2				
SouthWest: Carrington Road													
Lane 1	437	0.4	448	0.974	100	105.4	LOS F	41.6	292.0	Full	500	0.0	0.0
Lane 2	420	0.0	431	0.974	100	106.1	LOS F	39.8	278.8	Full	500	0.0	0.0
Approach	857	0.2		0.974		105.7	LOS F	41.6	292.0				
Intersection	4888	0.7		1.014		69.4	LOS E	111.2	781.6				

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

Lane LOS values are based on average delay per lane.

Intersection and Approach LOS values are based on average delay for all lanes.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

1 Reduced capacity due to a short lane effect

Processed: Friday, 4 October 2013 10:43:36 AM

SIDRA INTERSECTION 6.0.14.4193

Project: G:\21\22830\Technical\Traffic\Technical\SIDRA\Existing Layout\1 Carrington Rd_Showground Rd.sip6

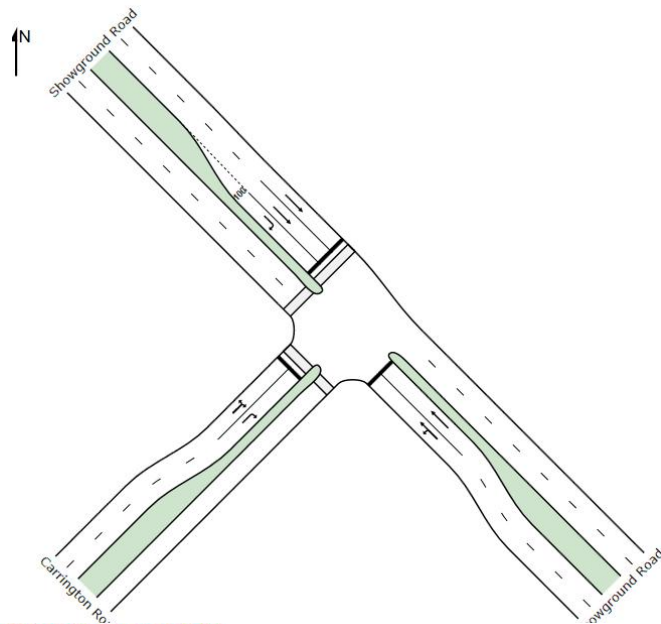
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**SIDRA
INTERSECTION 6**

Showground Road/Carrington Road – “Do Nothing”



PHASING SUMMARY

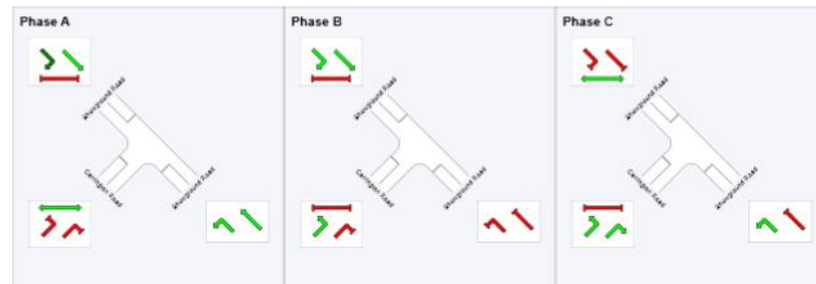
Site: AM Peak - 2026 Base

Carrington Rd / Showground Rd AM Peak Existing
Signals - Fixed Time Cycle Time = 120 seconds (User-Given Cycle Time)

Phase times determined by the program
Sequence: Split Phasing
Movement Class: All Movement Classes
Input Sequence: A, B, C
Output Sequence: A, B, C

Phase Timing Results

Phase	A	B	C
Green Time (sec)	49	31	22
Yellow Time (sec)	3	3	3
All-Red Time (sec)	3	3	3
Phase Time (sec)	55	37	28
Phase Split	46 %	31 %	23 %



LANE SUMMARY

Site: AM Peak - 2026 Base

Carrington Rd / Showground Rd AM Peak Existing
Signals - Fixed Time Cycle Time = 120 seconds (User-Given Cycle Time)

Lane Use and Performance													
	Demand Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Queue Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
SouthEast: Showground Road													
Lane 1	856	1.9	844	1.014	100	100.7	LOS F	78.4	557.4	Full	500	0.0	14.8
Lane 2	781	6.0	770	1.014	100	96.9	LOS F	71.1	523.4	Full	500	0.0	9.1
Approach	1637	3.8		1.014		98.9	LOS F	78.4	557.4				
NorthWest: Showground Road													
Lane 1	826	3.0	1378	0.599	100	8.9	LOS A	23.5	168.9	Full	500	0.0	0.0
Lane 2	826	3.0	1378	0.599	100	8.9	LOS A	23.5	168.9	Full	500	0.0	0.0
Lane 3	505	3.0	528	0.957	100	85.0	LOS F	34.9	250.2	Short	100	0.0	91.3
Approach	2157	3.0		0.957		26.7	LOS B	34.9	250.2				
SouthWest: Carrington Road													
Lane 1	352	3.4	353	0.997	100	105.2	LOS F	29.8	214.4	Full	500	0.0	0.0
Lane 2	330	3.0	332	0.997	100	105.3	LOS F	27.8	199.4	Full	500	0.0	0.0
Approach	682	3.2		0.997		105.2	LOS F	29.8	214.4				
Intersection	4476	3.3		1.014		65.1	LOS E	78.4	557.4				

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

Lane LOS values are based on average delay per lane.

Intersection and Approach LOS values are based on average delay for all lanes.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akcelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Processed: Thursday, 3 October 2013 11:41:40 AM

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Project: G:\21\22830\Technical\Traffic\Technical\SIDRA\Existing Layout\1 Carrington Rd_Showground Rd.sip6

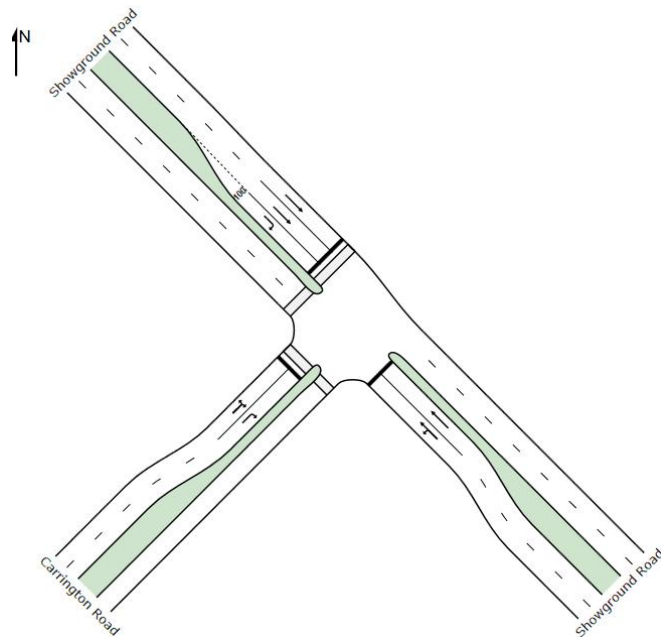
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SIDRA
INTERSECTION 6

Showground Road/Carrington Road – “Do Nothing”



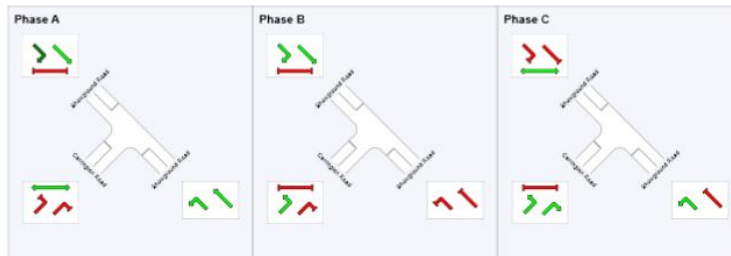
PHASING SUMMARY

Site: PM Peak - 2026 Base

Carrington Rd / Showground Rd PM Peak Existing
Signals - Fixed Time Cycle Time = 150 seconds (Practical Cycle Time)

Phase times determined by the program
Sequence: Split Phasing
Movement Class: All Movement Classes
Input Sequence: A, B, C
Output Sequence: A, B, C

Phase Timing Results			
Phase	A	B	C
Green Time (sec)	70	15	47
Yellow Time (sec)	4	4	4
All-Red Time (sec)	2	2	2
Phase Time (sec)	76	21	53
Phase Split	51 %	14 %	35 %



LANE SUMMARY

Site: PM Peak - 2026 Base

Carrington Rd / Showground Rd PM Peak Existing
Signals - Fixed Time Cycle Time = 150 seconds (Practical Cycle Time)

Lane Use and Performance

	Demand	Flows												
	Total	HV	Cap.	Deg.	Lane	Average	Level of	95% Back of Queue	Lane	Lane	Cap.	Prob.		
	veh/h	%	veh/h	Satn	Util.	Delay	Service	Veh	Dist	Config	Length	Adj.	Block.	
				v/c	%	sec			m		m	%	%	
SouthEast: Showground Road														
Lane 1	1010	0.5	911	1.108	100	176.4	LOS F	134.3	944.5	Full	500	0.0	63.9	
Lane 2	1007	1.0	909	1.108	100	172.9	LOS F	133.5	942.6	Full	500	0.0	63.7	
Approach	2017	0.8		1.108		174.6	LOS F	134.3	944.5					
NorthWest: Showground Road														
Lane 1	764	1.0	1181	0.646	100	20.1	LOS B	35.4	249.6	Full	500	0.0	0.0	
Lane 2	716	1.0	1108 ¹	0.646	100	19.3	LOS B	31.9	225.0	Full	500	0.0	0.0	
Lane 3	241	0.0	236	1.023	100	83.9	LOS F	23.6	165.0	Short	100	0.0	51.0	
Approach	1721	0.9		1.023		28.7	LOS C	35.4	249.6					
SouthWest: Carrington Road														
Lane 1	666	0.0	602	1.106	100	190.4	LOS F	87.4	612.1	Full	500	0.0	23.4	
Lane 2	640	0.0	579	1.106	100	191.1	LOS F	84.0	587.8	Full	500	0.0	19.7	
Approach	1306	0.0		1.106		190.7	LOS F	87.4	612.1					
Intersection	5044	0.6		1.108		129.0	LOS F	134.3	944.5					

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

Lane LOS values are based on average delay per lane.

Intersection and Approach LOS values are based on average delay for all lanes.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

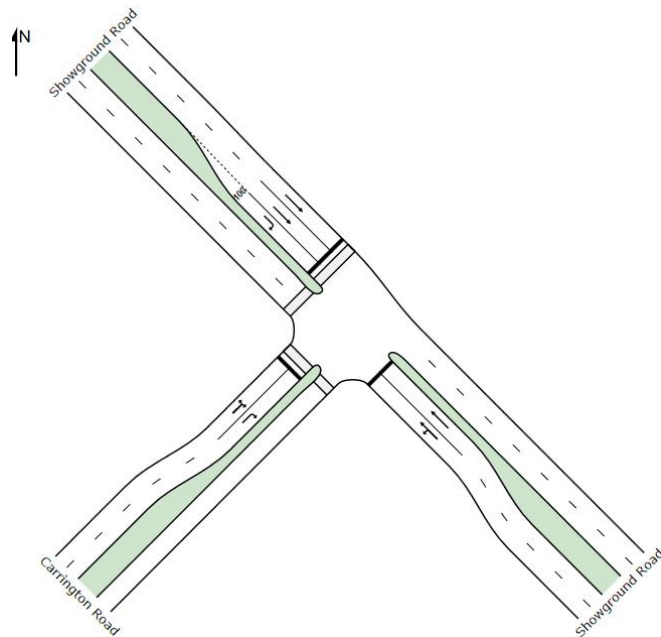
¹ Reduced capacity due to a short lane effect

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SIDRA
INTERSECTION 6

Showground Road/Carrington Road – “Do Nothing”



LANE SUMMARY

Site: Saturday Peak - 2026 Base

Carrington Rd / Showground Rd SAT Peak Existing

Signals - Fixed Time Cycle Time = 150 seconds (Practical Cycle Time)

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	100% Queue Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
SouthEast: Showground Road													
Lane 1	1162	0.5	1079	1.077	100	144.4	LOS F	144.6	1016.2	Full	500	0.0	70.9
Lane 2	1161	1.0	1078	1.077	100	140.7	LOS F	143.7	1014.8	Full	500	0.0	70.8
Approach	2323	0.7		1.077		142.6	LOS F	144.6	1016.2				
NorthWest: Showground Road													
Lane 1	926	1.0	1337	0.692	100	14.7	LOS B	39.5	278.6	Full	500	0.0	0.0
Lane 2	863	1.0	1246	0.692	100	13.9	LOS A	34.6	244.5	Full	500	0.0	0.0
Lane 3	252	0.0	223	1.126	100	162.2	LOS F	31.8	222.3	Short	100	0.0	79.6
Approach	2040	0.9		1.126		32.6	LOS C	39.5	278.6				
SouthWest: Carrington Road													
Lane 1	483	0.4	449	1.076	100	170.8	LOS F	58.7	412.2	Full	500	0.0	0.0
Lane 2	464	0.0	431	1.076	100	171.2	LOS F	56.2	393.3	Full	500	0.0	0.0
Approach	946	0.2		1.076		171.0	LOS F	58.7	412.2				
Intersection	5309	0.7		1.126		105.4	LOS F	144.6	1016.2				

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

Lane LOS values are based on average delay per lane.

Intersection and Approach LOS values are based on average delay for all lanes.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

1 Reduced capacity due to a short lane effect

PHASING SUMMARY

Site: Saturday Peak - 2026 Base

Carrington Rd / Showground Rd SAT Peak Existing

Signals - Fixed Time Cycle Time = 150 seconds (Practical Cycle Time)

Phase times determined by the program

Sequence: Split Phasing

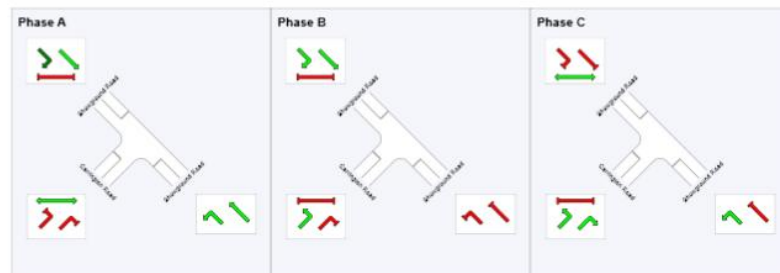
Movement Class: All Movement Classes

Input Sequence: A, B, C

Output Sequence: A, B, C

Phase Timing Results

Phase	A	B	C
Green Time (sec)	83	14	35
Yellow Time (sec)	4	4	4
All-Red Time (sec)	2	2	2
Phase Time (sec)	89	20	41
Phase Split	59 %	13 %	27 %



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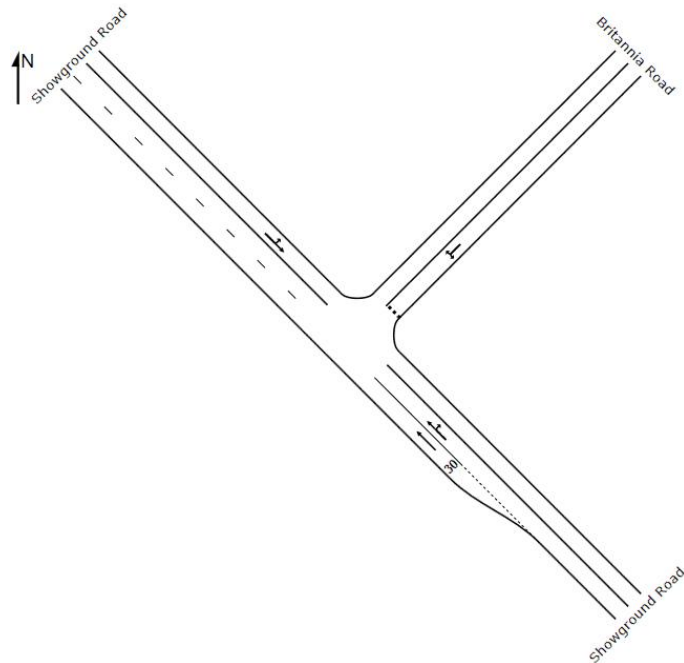
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**SIDRA
INTERSECTION 6**

Showground Road/Britannia Road – 2013 Existing



LANE SUMMARY

Site: AM Peak Existing

Britannia Rd / Showground Rd AM Peak Existing
Giveaway / Yield (Two-Way)

Lane Use and Performance													
	Demand Flows			Deg.	Lane	Average	Level of	95% Back of Queue		Lane	Lane	Cap.	Prob.
	Total	HV	Cap.	Satn	Util.	Delay	Service	Veh	Dist	Config	Length	Adj.	Block.
	veh/h	%	veh/h	v/c	%	sec			m		m	%	%
SouthEast: Showground Road													
Lane 1	754	1.0	1937	0.389	100	0.1	LOS A	0.0	0.0	Short	30	0.0	0.0
Lane 2	525	0.9	1347	0.389	100	16.4	LOS B	6.4	44.9	Full	500	0.0	0.0
Approach	1279	1.0		0.389		6.8	NA	6.4	44.9				
NorthEast: Britannia Road													
Lane 1	55	0.0	123	0.446	100	45.3	LOS D	1.3	9.4	Full	500	0.0	0.0
Approach	55	0.0		0.446		45.3	LOS D	1.3	9.4				
NorthWest: Showground Road													
Lane 1	1264	1.0	1934	0.654	100	0.6	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	1264	1.0		0.654		0.6	NA	0.0	0.0				
Intersection	2598	0.9		0.654		4.6	NA	6.4	44.9				

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

Lane LOS values are based on average delay per lane.

Minor Road Approach LOS values are based on average delay for all lanes.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akelik M3D).

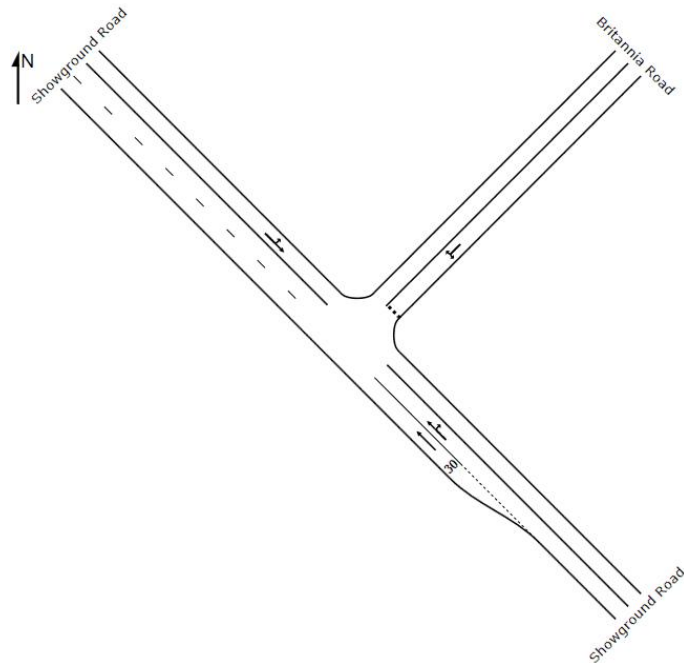
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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SIDRA
INTERSECTION 6

Showground Road/Britannia Road – 2013 Existing



LANE SUMMARY

▽ Site: PM Peak Existing

Britannia Rd / Showground Rd AM Peak Existing
Giveaway / Yield (Two-Way)

Lane Use and Performance													
	Demand Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	95% Back of Queue Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
SouthEast: Showground Road													
Lane 1	1234	1.0	1937	0.637	100	0.2	LOS A	0.0	0.0	Short	30	0.0	0.0
Lane 2	127	0.6	199	0.637	100	69.4	LOS E	5.1	35.9	Full	500	0.0	0.0
Approach	1361	1.0		0.637		6.6	NA	5.1	35.9				
NorthEast: Britannia Road													
Lane 1	27	0.0	160	0.171	100	26.6	LOS B	0.4	2.9	Full	500	0.0	0.0
Approach	27	0.0		0.171		26.6	LOS B	0.4	2.9				
NorthWest: Showground Road													
Lane 1	1637	1.0	1929	0.849	100	1.3	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	1637	1.0		0.849		1.3	NA	0.0	0.0				
Intersection	3025	1.0		0.849		3.9	NA	5.1	35.9				

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

Lane LOS values are based on average delay per lane.

Minor Road Approach LOS values are based on average delay for all lanes.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akcelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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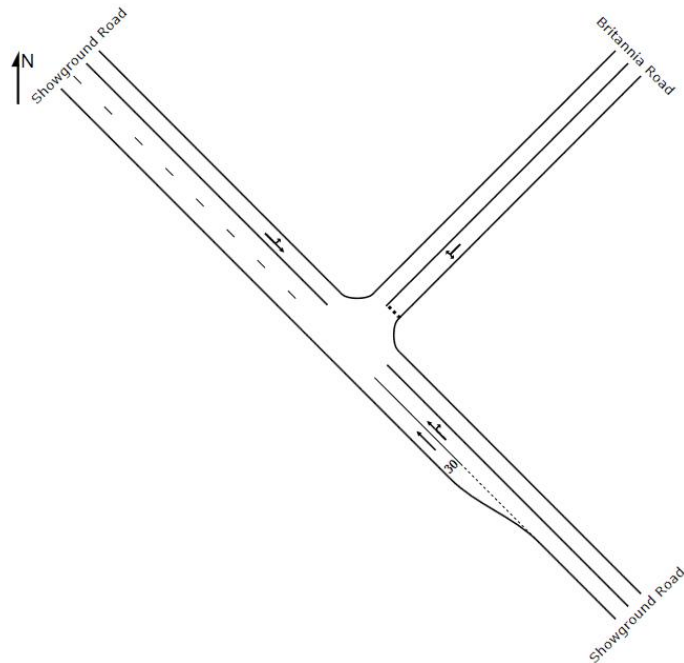
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**SIDRA
INTERSECTION 6**

Showground Road/Britannia Road – 2013 Existing



LANE SUMMARY

▽ Site: Saturday Peak Existing

Britannia Rd / Showground Rd AM Peak Existing
Giveaway / Yield (Two-Way)

Lane Use and Performance													
	Demand Flows		Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Queue Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
	Total veh/h	HV %											
SouthEast: Showground Road													
Lane 1	1194	1.0	1937	0.616	100	0.2	LOS A	0.0	0.0	Short	30	0.0	0.0
Lane 2	441	1.0	715	0.616	100	101.9	LOS F	25.9	182.6	Full	500	0.0	0.0
Approach	1635	1.0		0.616		27.6	NA	25.9	182.6				
NorthEast: Britannia Road													
Lane 1	78	0.0	86	0.906	100	107.6	LOS F	3.2	22.1	Full	500	0.0	0.0
Approach	78	0.0		0.906		107.6	LOS F	3.2	22.1				
NorthWest: Showground Road													
Lane 1	1697	1.0	1931	0.879	100	1.2	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	1697	1.0		0.879		1.2	NA	0.0	0.0				
Intersection	3409	1.0		0.906		16.3	NA	25.9	182.6				

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

Lane LOS values are based on average delay per lane.

Minor Road Approach LOS values are based on average delay for all lanes.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akcelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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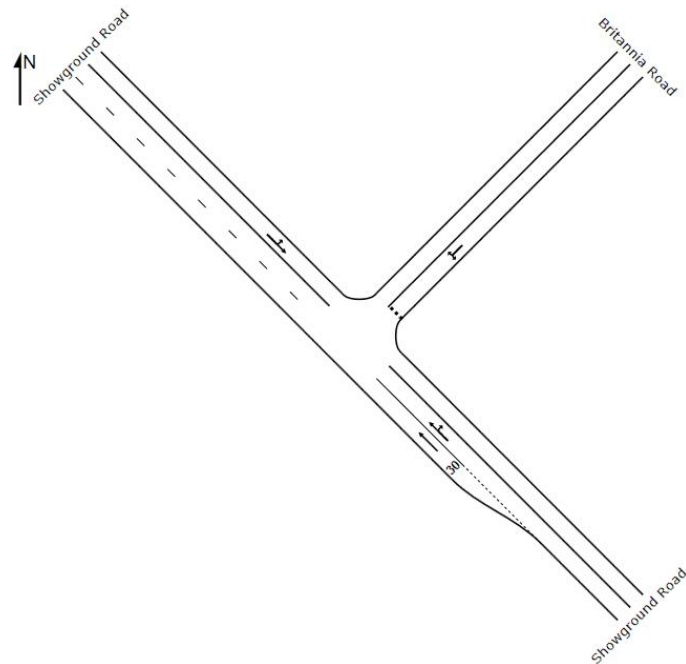
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**SIDRA
INTERSECTION 6**

Showground Road/Britannia Road – “Do Nothing”



LANE SUMMARY

▽ Site: AM Peak - 2016 Base

Britannia Rd / Showground Rd AM Peak Existing
Giveaway / Yield (Two-Way)

Lane Use and Performance													
	Demand Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	95% Back of Queue Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
SouthEast: Showground Road													
Lane 1	1465	1.0	1937	0.756	9 ⁵	0.3	LOS A	0.0	0.0	Short	30	0.0	0.0
Lane 2	53	0.0	6	8.772	100	7630.1	LOS F	47.0	328.7	Full	500	0.0	0.0
Approach	1518	1.0		8.772		264.9	NA	47.0	328.7				
NorthEast: Britannia Road													
Lane 1	55	0.0	6	9.123	100	7945.4	LOS F	49.1	343.6	Full	500	0.0	0.0
Approach	55	0.0		9.123		7945.4	LOS F	49.1	343.6				
NorthWest: Showground Road													
Lane 1	2066	1.0	1935	1.068	100	33.5	LOS C	0.0	0.0	Full	500	0.0	0.0
Approach	2066	1.0		1.068		33.5	NA	0.0	0.0				
Intersection	3639	1.0		9.123		249.0	NA	49.1	343.6				

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

Lane LOS values are based on average delay per lane.

Minor Road Approach LOS values are based on average delay for all lanes.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akcelik M3D).

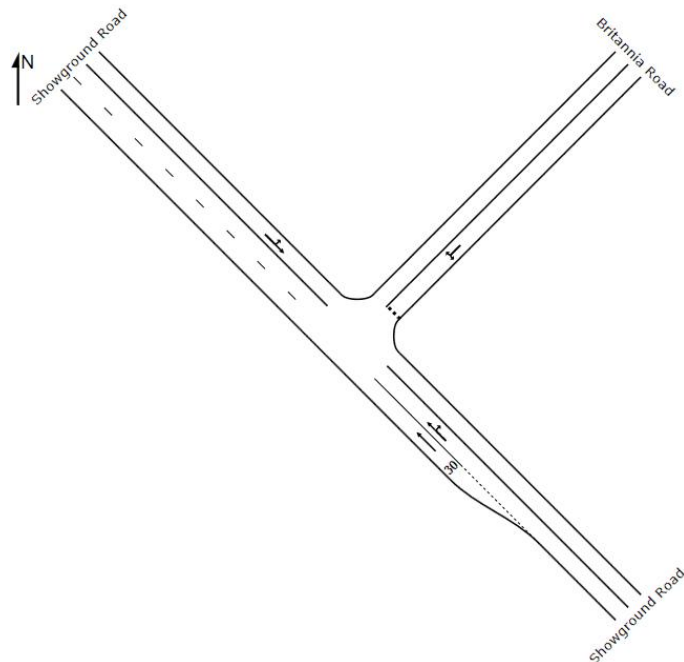
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

⁵ Lane underutilisation determined by program

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**SIDRA
INTERSECTION 6**

Showground Road/Britannia Road – “Do Nothing”



LANE SUMMARY

Site: PM Peak - 2016 Base

Britannia Rd / Showground Rd AM Peak Existing
Giveaway / Yield (Two-Way)

Lane Use and Performance													
	Demand Flows		Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue		Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
	Total veh/h	HV %						Veh	Dist m				
SouthEast: Showground Road													
Lane 1	1809	1.0	1937	0.934	11 ⁵	1.3	LOS A	0.0	0.0	Short	30	0.0	0.0
Lane 2	51	0.0	6	8.421	100	7317.9	LOS F	44.9	314.5	Full	500	0.0	0.0
Approach	1860	1.0		8.421		200.1	NA	44.9	314.5				
NorthEast: Britannia Road													
Lane 1	27	0.0	6	4.561	100	3864.4	LOS F	22.2	155.5	Full	500	0.0	0.0
Approach	27	0.0		4.561		3864.4	LOS F	22.2	155.5				
NorthWest: Showground Road													
Lane 1	2292	1.0	1930	1.187	100	86.5	LOS F	0.0	0.0	Full	500	0.0	0.0
Approach	2292	1.0		1.187		86.5	NA	0.0	0.0				
Intersection	4179	1.0		8.421		161.8	NA	44.9	314.5				

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

Lane LOS values are based on average delay per lane.

Minor Road Approach LOS values are based on average delay for all lanes.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

5 Lane underutilisation determined by program

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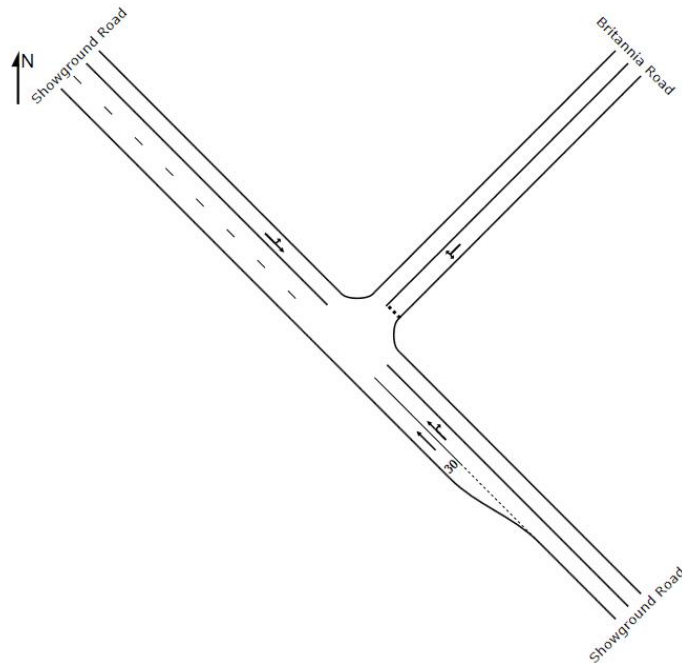
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INTERSECTION 6

Showground Road/Britannia Road – “Do Nothing”



LANE SUMMARY

▽ Site: Saturday Peak - 2016 Base

Britannia Rd / Showground Rd AM Peak Existing
Giveaway / Yield (Two-Way)

Lane Use and Performance													
	Demand Flows			Deg.	Lane	Average	Level of	95% Back of Queue		Lane	Lane	Cap.	Prob.
	Total	HV	Cap.	Satn	Util.	Delay	Service	Veh	Queue	Config	Length	Adj.	Block.
	veh/h	%	veh/h	v/c	%	sec			Dist		m	%	%
SouthEast: Showground Road													
Lane 1	2056	1.0	1937	1.061	29 ⁵	30.4	LOS C	0.0	0.0	Short	30	0.0	0.0
Lane 2	22	0.0	6	3.684	100	3151.6	LOS F	17.6	123.2	Full	500	0.0	0.0
Approach	2078	1.0		3.684		63.6	NA	17.6	123.2				
NorthEast: Britannia Road													
Lane 1	78	0.0	6	12.982	100	11330.2	LOS F	69.3	485.1	Full	500	0.0	4.1
Approach	78	0.0		12.982		11330.2	LOS F	69.3	485.1				
NorthWest: Showground Road													
Lane 1	2349	1.0	1932	1.216	100	99.6	LOS F	0.0	0.0	Full	500	0.0	0.0
Approach	2349	1.0		1.216		99.6	NA	0.0	0.0				
Intersection	4505	1.0		12.982		277.2	NA	69.3	485.1				

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

Lane LOS values are based on average delay per lane.

Minor Road Approach LOS values are based on average delay for all lanes.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akcelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

5 Lane underutilisation determined by program

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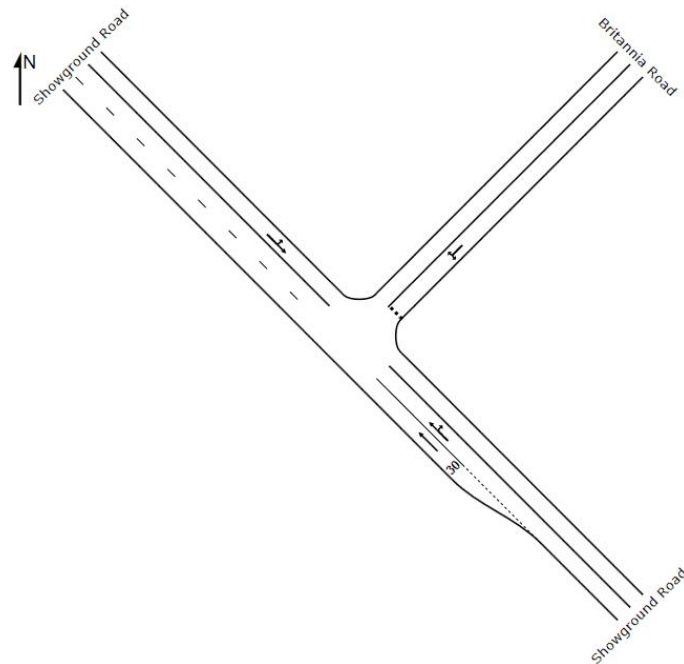
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**SIDRA
INTERSECTION 6**

Showground Road/Britannia Road – “Do Nothing”



LANE SUMMARY

Site: AM Peak - 2026 Base

Britannia Rd / Showground Rd AM Peak Existing
Giveaway / Yield (Two-Way)

Lane Use and Performance													
	Demand Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Queue Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
SouthEast: Showground Road													
Lane 1	1620	1.0	1937	0.836	9 ⁵	0.5	LOS A	0.0	0.0	Short	30	0.0	0.0
Lane 2	57	0.0	6	9.474	100	8255.2	LOS F	51.0	357.0	Full	500	0.0	0.0
Approach	1677	1.0		9.474		280.3	NA	51.0	357.0				
NorthEast: Britannia Road													
Lane 1	55	0.0	6	9.123	100	7924.6	LOS F	48.7	341.0	Full	500	0.0	0.0
Approach	55	0.0		9.123		7924.6	LOS F	48.7	341.0				
NorthWest: Showground Road													
Lane 1	2184	1.0	1935	1.129	100	60.2	LOS E	0.0	0.0	Full	500	0.0	0.0
Approach	2184	1.0		1.129		60.2	NA	0.0	0.0				
Intersection	3916	1.0		9.474		264.4	NA	51.0	357.0				

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

Lane LOS values are based on average delay per lane.

Minor Road Approach LOS values are based on average delay for all lanes.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

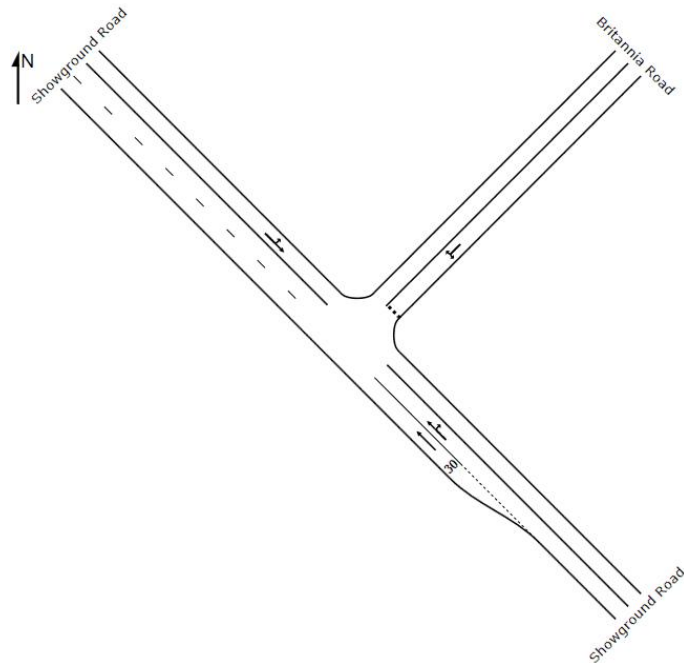
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

5 Lane underutilisation determined by program

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**SIDRA
INTERSECTION 6**

Showground Road/Britannia Road – “Do Nothing”



LANE SUMMARY

Site: PM Peak - 2026 Base

Britannia Rd / Showground Rd AM Peak Existing
Giveaway / Yield (Two-Way)

Lane Use and Performance													
	Demand Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	95% Back of Queue Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
SouthEast: Showground Road													
Lane 1	2001	1.0	1937	1.033	11 ⁵	18.5	LOS B	0.0	0.0	Short	30	0.0	0.0
Lane 2	57	0.0	6	9.474	100	8255.2	LOS F	51.0	357.0	Full	500	0.0	0.0
Approach	2058	1.0		9.474		246.0	NA	51.0	357.0				
NorthEast: Britannia Road													
Lane 1	27	0.0	6	4.561	100	3863.5	LOS F	22.2	155.4	Full	500	0.0	0.0
Approach	27	0.0		4.561		3863.5	LOS F	22.2	155.4				
NorthWest: Showground Road													
Lane 1	2461	1.0	1931	1.275	100	126.6	LOS F	0.0	0.0	Full	500	0.0	0.0
Approach	2461	1.0		1.275		126.6	NA	0.0	0.0				
Intersection	4546	1.0		9.474		203.1	NA	51.0	357.0				

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

Lane LOS values are based on average delay per lane.

Minor Road Approach LOS values are based on average delay for all lanes.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

⁵ Lane underutilisation determined by program

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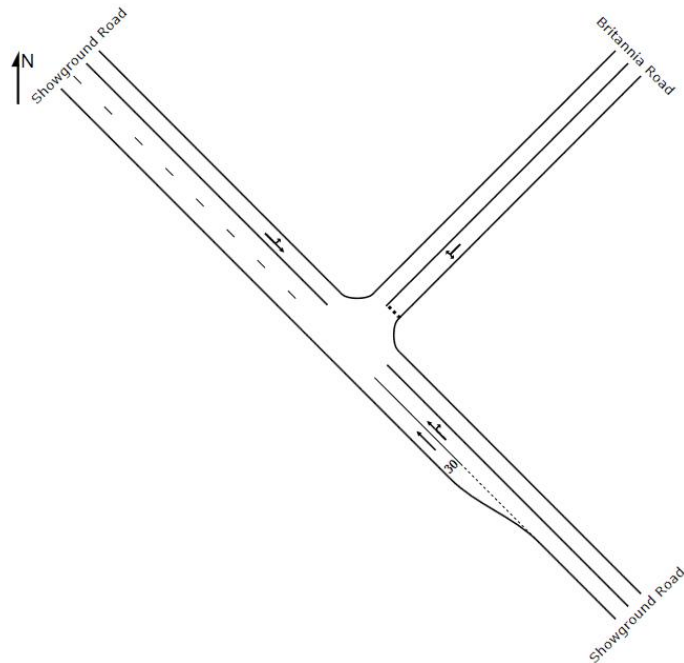
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**SIDRA
INTERSECTION 6**

Showground Road/Britannia Road – “Do Nothing”



LANE SUMMARY

Site: Saturday Peak - 2026 Base

Britannia Rd / Showground Rd AM Peak Existing
Giveaway / Yield (Two-Way)

Lane Use and Performance													
	Demand Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	95% Back of Queue Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
SouthEast: Showground Road													
Lane 1	2271	1.0	1937	1.172	28 ⁵	79.5	LOS F	0.0	0.0	Short	30	0.0	0.0
Lane 2	25	0.0	6	4.211	100	3605.9	LOS F	20.6	144.5	Full	500	0.0	0.0
Approach	2296	1.0		4.211		118.3	NA	20.6	144.5				
NorthEast: Britannia Road													
Lane 1	78	0.0	6	12.982	100	11329.3	LOS F	69.3	484.9	Full	500	0.0	4.1
Approach	78	0.0		12.982		11329.3	LOS F	69.3	484.9				
NorthWest: Showground Road													
Lane 1	2521	1.0	1932	1.305	100	140.3	LOS F	0.0	0.0	Full	500	0.0	0.0
Approach	2521	1.0		1.305		140.3	NA	0.0	0.0				
Intersection	4895	1.0		12.982		308.0	NA	69.3	484.9				

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

Lane LOS values are based on average delay per lane.

Minor Road Approach LOS values are based on average delay for all lanes.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akcelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

5 Lane underutilisation determined by program

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SIDRA INTERSECTION 6.0.14.4193

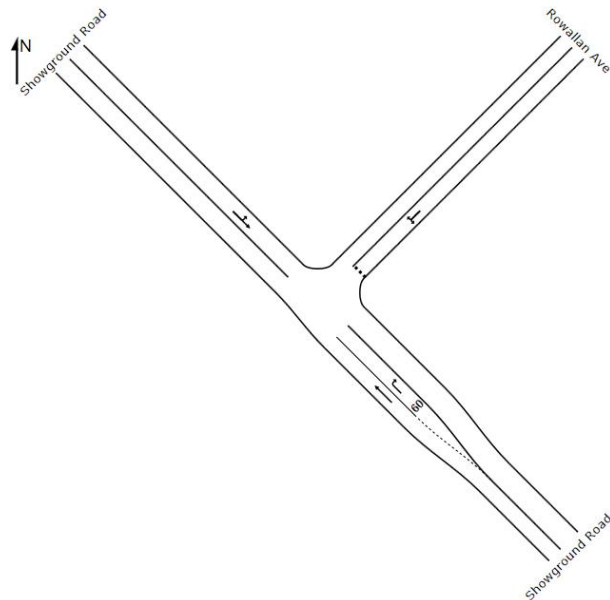
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**SIDRA
INTERSECTION 6**

Showground Road/Rowallan Avenue – 2013 Existing



LANE SUMMARY

▽ Site: AM Peak Existing

Rowallan Ave / Showground Rd AM Peak Existing
Giveaway / Yield (Two-Way)

Lane Use and Performance													
	Demand Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Queue Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
SouthEast: Showground Road													
Lane 1	1262	4.0	1901	0.664	100	0.2	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	67	0.0	407	0.165	100	17.2	LOS B	0.5	3.7	Short	60	0.0	0.0
Approach	1329	3.8		0.664		1.1	NA	0.5	3.7				
NorthEast: Rowallan Ave													
Lane 1	66	1.5	134	0.493	100	44.8	LOS D	1.6	11.1	Full	500	0.0	0.0
Approach	66	1.5		0.493		44.8	LOS D	1.6	11.1				
NorthWest: Showground Road													
Lane 1	1244	2.8	1976	0.630	100	0.9	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	1244	2.8		0.630		0.9	NA	0.0	0.0				
Intersection	2640	3.3		0.664		2.1	NA	1.6	11.1				

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

Lane LOS values are based on average delay per lane.

Minor Road Approach LOS values are based on average delay for all lanes.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akcelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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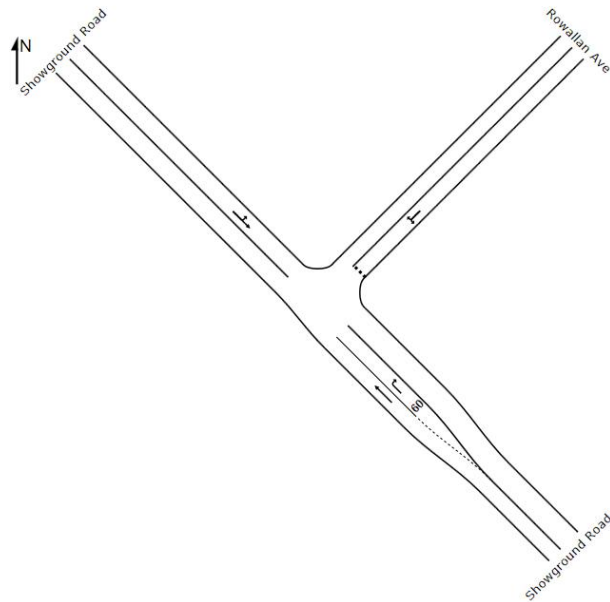
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**SIDRA
INTERSECTION 6**

Showground Road/Rowallan Avenue – 2013 Existing



LANE SUMMARY

▽ Site: PM Peak Existing

Rowallan Ave / Showground Rd PM Peak Existing
Giveaway / Yield (Two-Way)

Lane Use and Performance													
	Demand Flows			Deg.	Lane	Average	Level of	95% Back of Queue		Lane	Lane	Cap.	Prob.
	Total	HV	Cap.	Satn	Util.	Delay	Service	Veh	Dist	Config	Length	Adj.	Block.
	veh/h	%	veh/h	v/c	%	sec			m		m	%	%
SouthEast: Showground Road													
Lane 1	1339	1.0	1937	0.691	100	0.2	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	68	0.0	176	0.390	100	35.1	LOS C	1.1	8.0	Short	60	0.0	0.0
Approach	1407	1.0		0.691		1.9	NA	1.1	8.0				
NorthEast: Rowallan Ave													
Lane 1	80	1.4	98	0.814	100	99.2	LOS F	3.2	22.8	Full	500	0.0	0.0
Approach	80	1.4		0.814		99.2	LOS F	3.2	22.8				
NorthWest: Showground Road													
Lane 1	1502	0.8	1992	0.754	100	1.8	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	1502	0.8		0.754		1.8	NA	0.0	0.0				
Intersection	2989	0.9		0.814		4.4	NA	3.2	22.8				

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

Lane LOS values are based on average delay per lane.

Minor Road Approach LOS values are based on average delay for all lanes.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akcelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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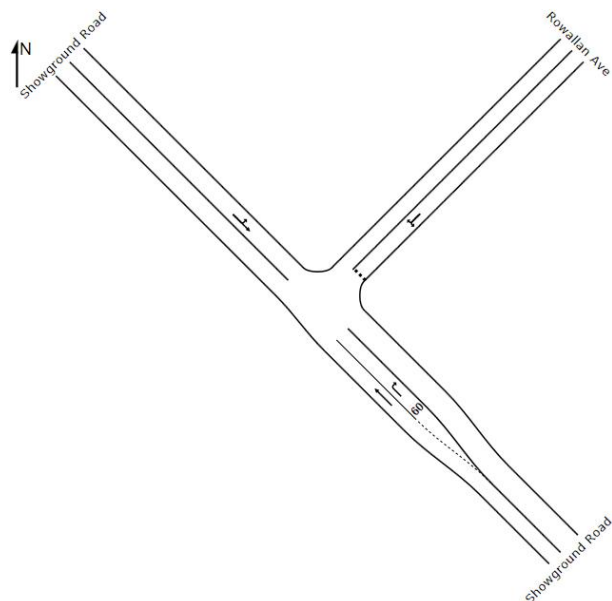
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SIDRA
INTERSECTION 6

Showground Road/Rowallan Avenue – 2013 Existing



LANE SUMMARY

▽ Site: Saturday Peak Existing

Rowallan Ave / Showground Rd SAT Peak Existing
Giveaway / Yield (Two-Way)

Lane Use and Performance													
	Demand Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Queue Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
SouthEast: Showground Road													
Lane 1	1616	1.0	1937	0.834	100	0.5	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	59	0.0	102	0.575	100	63.2	LOS E	1.6	11.3	Short	60	0.0	0.0
Approach	1675	1.0		0.834		2.7	NA	1.6	11.3				
NorthEast: Rowallan Ave													
Lane 1	87	1.6	93	0.944	100	147.5	LOS F	5.0	35.7	Full	500	0.0	0.0
Approach	87	1.6		0.944		147.5	LOS F	5.0	35.7				
NorthWest: Showground Road													
Lane 1	1612	0.9	1996	0.807	100	1.5	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	1612	0.9		0.807		1.5	NA	0.0	0.0				
Intersection	3374	0.9		0.944		5.9	NA	5.0	35.7				

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

Lane LOS values are based on average delay per lane.

Minor Road Approach LOS values are based on average delay for all lanes.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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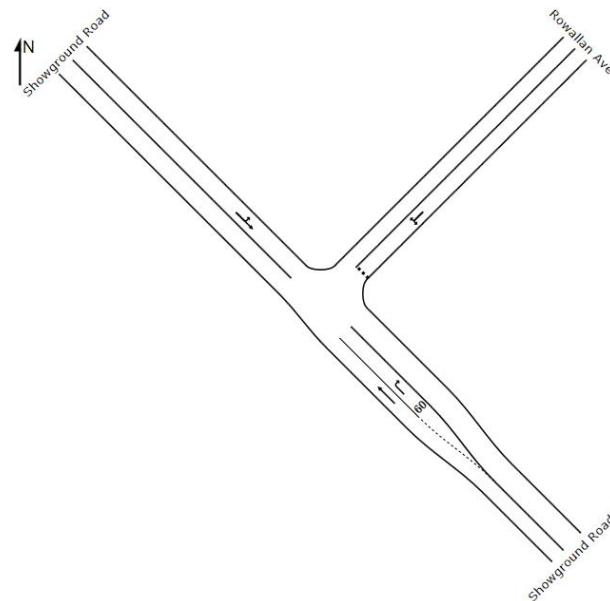
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**SIDRA
INTERSECTION 6**

Showground Road/Rowallan Avenue – “Do Nothing”



LANE SUMMARY

Site: AM Peak - 2016 Base

Rowallan Ave / Showground Rd AM Peak Existing
Giveaway / Yield (Two-Way)

Lane Use and Performance													
	Demand Flows			Deg.	Lane	Average	Level of	95% Back of Queue		Lane	Lane	Cap.	Prob.
	Total	HV	Cap.	Satn	Util.	Delay	Service	Veh	Dist	Config	Length	Adj.	Block.
	veh/h	%	veh/h	v/c	%	sec			m		m	%	%
SouthEast: Showground Road													
Lane 1	1487	4.0	1901	0.783	100	0.4	LOS A	0.0	0.0	Full	500	0.0	21.9 ⁸
Lane 2	126	0.0	6	21.053	100	18680.5	LOS F	115.9	811.6	Short	60	0.0	100.0
Approach	1614	3.7		21.053		1462.6	NA	115.9	811.6				
NorthEast: Rowallan Ave													
Lane 1	214	0.9	6	35.614	100	31763.1	LOS F	207.9	1466.0	Full	500	0.0	97.7
Approach	214	0.9		35.614		31763.1	LOS F	207.9	1466.0				
NorthWest: Showground Road													
Lane 1	2036	2.9	1978	1.029	100	17.3	LOS B	0.0	0.0	Full	500	0.0	0.0
Approach	2036	2.9		1.029		17.3	NA	0.0	0.0				
Intersection	3863	3.1		35.614		2377.0	NA	207.9	1466.0				

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

Lane LOS values are based on average delay per lane.

Minor Road Approach LOS values are based on average delay for all lanes.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akcelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

⁸ Probability of Blockage has been set on the basis of a queue that overflows from an adjacent short lane.

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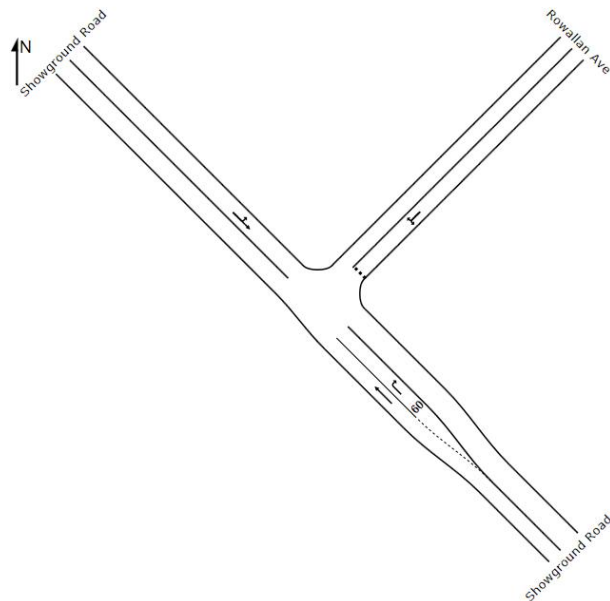
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**SIDRA
INTERSECTION 6**

Showground Road/Rowallan Avenue – “Do Nothing”



LANE SUMMARY

Site: PM Peak - 2016 Base

Rowallan Ave / Showground Rd PM Peak Existing
Giveaway / Yield (Two-Way)

Lane Use and Performance													
	Demand Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Queue Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
SouthEast: Showground Road													
Lane 1	1838	1.0	1937	0.949	100	1.7	LOS A	0.0	0.0	Full	500	0.0	100.0 ⁸
Lane 2	315	0.0	6	52.456	100	46890.4	LOS F	289.4	2026.0	Short	60	0.0	100.0
Approach	2153	0.9		52.456		6857.3	NA	289.4	2026.0				
NorthEast: Rowallan Ave													
Lane 1	134	1.7	12	11.617	100	9902.8	LOS F	101.6	721.3	Full	500	0.0	17.1
Approach	134	1.7		11.617		9902.8	LOS F	101.6	721.3				
NorthWest: Showground Road													
Lane 1	2140	0.9	1996	1.072	100	35.5	LOS C	0.0	0.0	Full	500	0.0	0.0
Approach	2140	0.9		1.072		35.5	NA	0.0	0.0				
Intersection	4426	0.9		52.456		3651.2	NA	289.4	2026.0				

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

Lane LOS values are based on average delay per lane.

Minor Road Approach LOS values are based on average delay for all lanes.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akcelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

⁸ Probability of Blockage has been set on the basis of a queue that overflows from an adjacent short lane.

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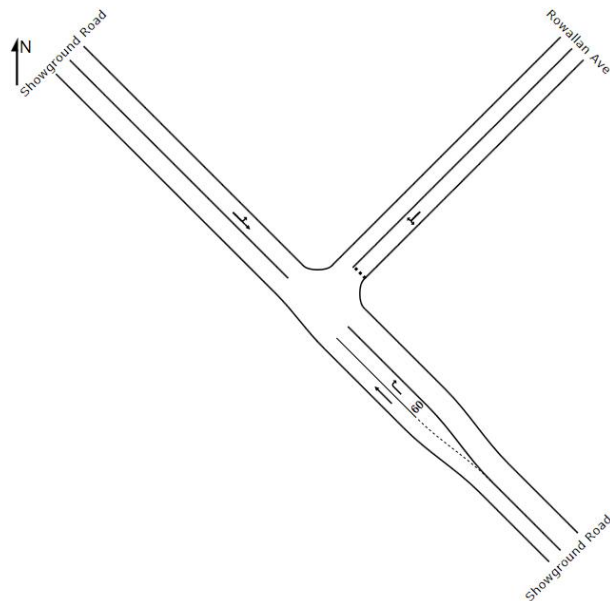
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**SIDRA
INTERSECTION 6**

Showground Road/Rowallan Avenue – “Do Nothing”



LANE SUMMARY

Site: Saturday Peak - 2016 Base

Rowallan Ave / Showground Rd SAT Peak Existing
Giveaway / Yield (Two-Way)

Lane Use and Performance													
	Demand Flows		Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue	Queue	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
	Total veh/h	HV %						Veh	Dist m				
SouthEast: Showground Road													
Lane 1	2059	1.0	1937	1.063	100	31.1	LOS C	0.0	0.0	Full	500	0.0	100.0 ^s
Lane 2	285	0.0	6	47.544	100	42467.5	LOS F	261.7	1831.8	Short	60	0.0	100.0
Approach	2344	0.9		47.544		5195.1	NA	261.7	1831.8				
NorthEast: Rowallan Ave													
Lane 1	134	1.7	6	22.281	100	19739.7	LOS F	125.7	892.7	Full	500	0.0	26.3
Approach	134	1.7		22.281		19739.7	LOS F	125.7	892.7				
NorthWest: Showground Road													
Lane 1	2254	0.9	1999	1.127	100	59.5	LOS E	0.0	0.0	Full	500	0.0	0.0
Approach	2254	0.9		1.127		59.5	NA	0.0	0.0				
Intersection	4732	0.9		47.544		3160.0	NA	261.7	1831.8				

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

Lane LOS values are based on average delay per lane.

Minor Road Approach LOS values are based on average delay for all lanes.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akcelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

⁸ Probability of Blockage has been set on the basis of a queue that overflows from an adjacent short lane.

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SIDRA INTERSECTION 6.0.14.4193

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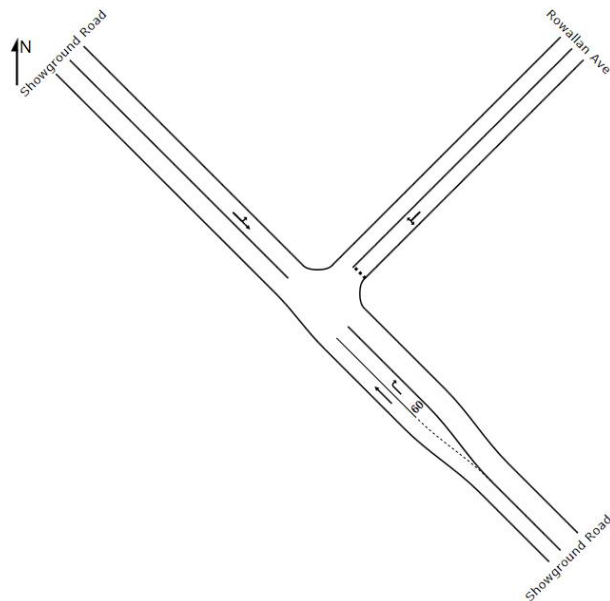
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**SIDRA
INTERSECTION 6**

Showground Road/Rowallan Avenue – “Do Nothing”



LANE SUMMARY

Site: AM Peak - 2026 Base

Rowallan Ave / Showground Rd AM Peak Existing
Giveaway / Yield (Two-Way)

Lane Use and Performance												
	Demand Flows											
	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Queue Dist m	Lane Config	Lane Length m	Cap. Adj. %
SouthEast: Showground Road												
Lane 1	1642	4.0	1901	0.864	100	0.6	LOS A	0.0	0.0	Full	500	0.0
Lane 2	146	0.0	6	24.386	100	21671.5	LOS F	134.9	944.1	Short	60	0.0
Approach	1788	3.7		24.386		1773.6	NA	134.9	944.1			
NorthEast: Rowallan Ave												
Lane 1	225	0.9	6	37.544	100	33446.7	LOS F	214.2	1510.6	Full	500	0.0
Approach	225	0.9		37.544		33446.7	LOS F	214.2	1510.6			
NorthWest: Showground Road												
Lane 1	2151	2.9	1978	1.087	100	41.9	LOS C	0.0	0.0	Full	500	0.0
Approach	2151	2.9		1.087		41.9	NA	0.0	0.0			
Intersection	4164	3.1		37.544		2592.7	NA	214.2	1510.6			

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

Lane LOS values are based on average delay per lane.

Minor Road Approach LOS values are based on average delay for all lanes.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akcelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

8 Probability of Blockage has been set on the basis of a queue that overflows from an adjacent short lane.

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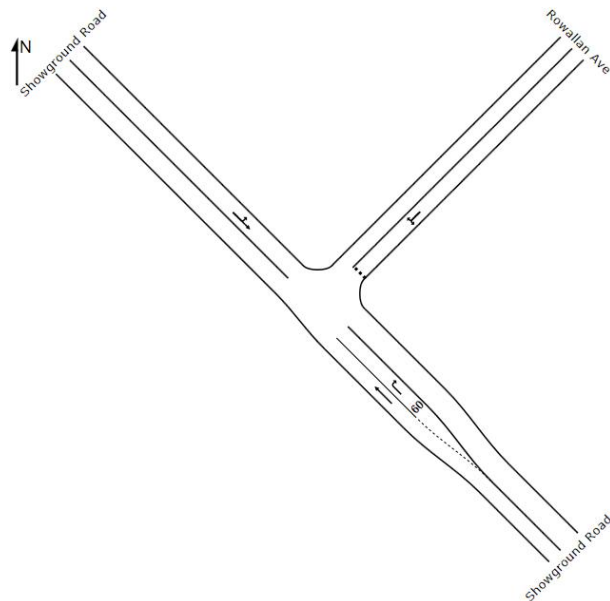
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**SIDRA
INTERSECTION 6**

Showground Road/Rowallan Avenue – “Do Nothing”



LANE SUMMARY

Site: PM Peak - 2026 Base

Rowallan Ave / Showground Rd PM Peak Existing
Giveaway / Yield (Two-Way)

Lane Use and Performance													
	Demand Flows		Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue		Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
	Total veh/h	HV %						Veh	Dist m				
SouthEast: Showground Road													
Lane 1	2036	1.0	1937	1.051	100	26.0	LOS B	0.0	0.0	Full	500	0.0	100.0 ⁸
Lane 2	336	0.0	6	55.965	100	50045.6	LOS F	309.0	2163.2	Short	60	0.0	100.0
Approach	2372	0.9		55.965		7108.2	NA	309.0	2163.2				
NorthEast: Rowallan Ave													
Lane 1	134	1.7	6	22.281	100	19729.6	LOS F	125.3	889.6	Full	500	0.0	26.1
Approach	134	1.7		22.281		19729.6	LOS F	125.3	889.6				
NorthWest: Showground Road													
Lane 1	2300	0.9	1996	1.152	100	70.7	LOS F	0.0	0.0	Full	500	0.0	0.0
Approach	2300	0.9		1.152		70.7	NA	0.0	0.0				
Intersection	4805	0.9		55.965		4090.9	NA	309.0	2163.2				

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

Lane LOS values are based on average delay per lane.

Minor Road Approach LOS values are based on average delay for all lanes.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akcelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

⁸ Probability of Blockage has been set on the basis of a queue that overflows from an adjacent short lane.

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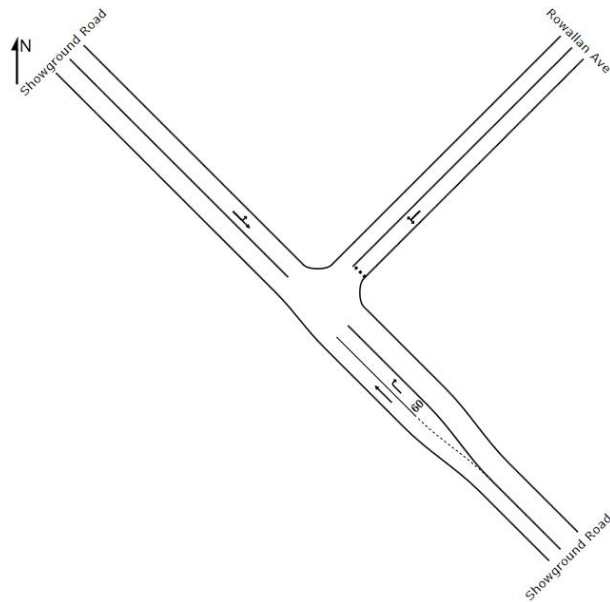
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**SIDRA
INTERSECTION 6**

Showground Road/Rowallan Avenue – “Do Nothing”



LANE SUMMARY

Site: Saturday Peak - 2026 Base

Rowallan Ave / Showground Rd SAT Peak Existing
Giveaway / Yield (Two-Way)

Lane Use and Performance													
	Demand Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Queue Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
SouthEast: Showground Road													
Lane 1	2276	1.0	1937	1.175	100	80.7	LOS F	0.0	0.0	Full	500	0.0	100.0 ⁸
Lane 2	297	0.0	6	49.474	100	44202.7	LOS F	272.5	1907.2	Short	60	0.0	100.0
Approach	2573	0.9		49.474		5171.7	NA	272.5	1907.2				
NorthEast: Rowallan Ave													
Lane 1	134	1.7	6	22.281	100	19739.5	LOS F	125.7	892.7	Full	500	0.0	26.2
Approach	134	1.7		22.281		19739.5	LOS F	125.7	892.7				
NorthWest: Showground Road													
Lane 1	2415	0.9	1999	1.208	100	96.1	LOS F	0.0	0.0	Full	500	0.0	0.0
Approach	2415	0.9		1.208		96.1	NA	0.0	0.0				
Intersection	5121	0.9		49.474		3158.7	NA	272.5	1907.2				

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

Lane LOS values are based on average delay per lane.

Minor Road Approach LOS values are based on average delay for all lanes.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akcelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

⁸ Probability of Blockage has been set on the basis of a queue that overflows from an adjacent short lane.

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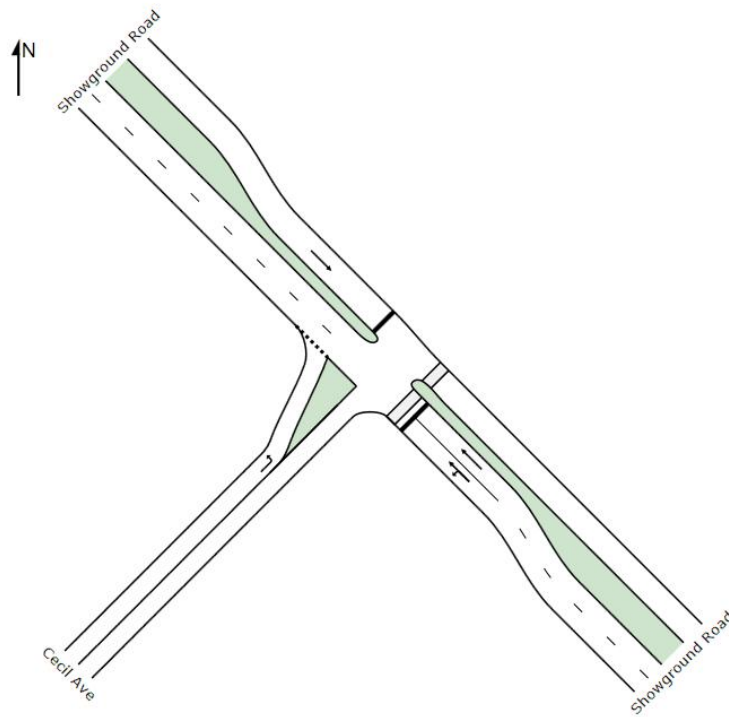
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**SIDRA
INTERSECTION 6**

Showground Road/Cecil Avenue – 2013 Existing



LANE SUMMARY

 **Site: AM Peak Existing**

Cecil Ave / Showground Rd AM Peak Existing

Signals - Fixed Time Cycle Time = 110 seconds (User-Given Cycle Time)

Lane Use and Performance

	Demand Flows			Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	Total veh/h	HV %	Cap. veh/h	v/c	%	sec		Veh	Dist m		m	%	%
SouthEast: Showground Road													
Lane 1	624	0.0	1453	0.430	100	5.6	LOS A	12.3	85.9	Full	500	0.0	0.0
Lane 2	624	0.0	1454	0.430	100	5.5	LOS A	12.3	86.0	Full	500	0.0	0.0
Approach	1248	0.0		0.430		5.6	LOS A	12.3	86.0				
NorthWest: Showground Road													
Lane 1	1184	0.0	1582	0.748	100	8.5	LOS A	35.8	250.9	Full	500	0.0	0.0
Approach	1184	0.0		0.748		8.5	LOS A	35.8	250.9				
SouthWest: Cecil Ave													
Lane 1	86	0.0	605	0.143	100	9.2	LOS A	1.0	6.9	Full	500	0.0	0.0
Approach	86	0.0		0.143		9.2	LOS A	1.0	6.9				
Intersection	2519	0.0		0.748		7.1	LOS A	35.8	250.9				

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

Lane LOS values are based on average delay per lane.

Intersection and Approach LOS values are based on average delay for all lanes.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

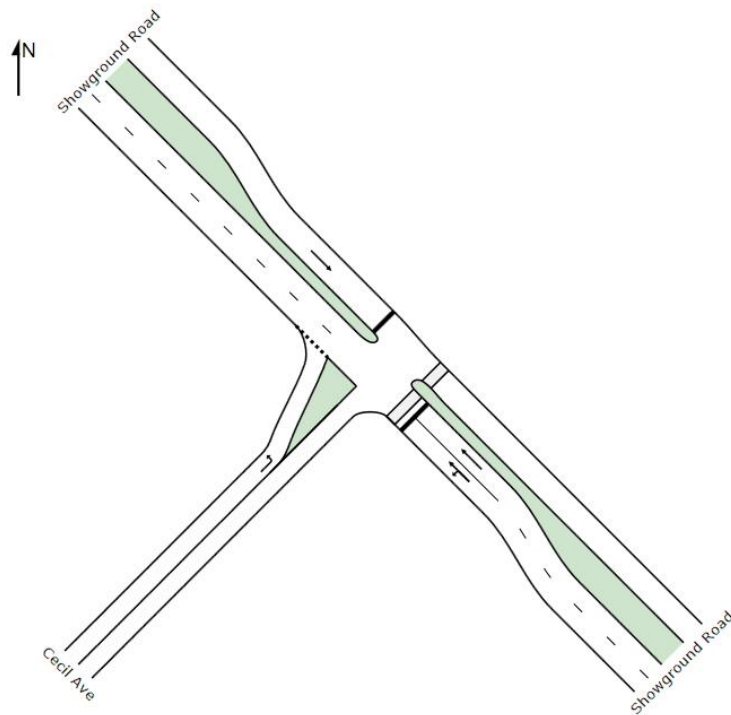
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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**SIDRA
INTERSECTION 6**

Showground Road/Cecil Avenue – 2013 Existing



LANE SUMMARY

Site: PM Peak Existing

Cecil Ave / Showground Rd PM Peak Existing

Signals - Fixed Time Cycle Time = 130 seconds (User-Given Cycle Time)

Lane Use and Performance

	Demand Flows			Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	Total veh/h	HV %	Cap. veh/h	v/c	%	sec		Veh	Dist m		m	%	%
SouthEast: Showground Road													
Lane 1	646	1.0	1520	0.425	100	4.8	LOS A	12.9	91.1	Full	500	0.0	0.0
Lane 2	646	1.0	1520	0.425	100	4.7	LOS A	12.9	91.1	Full	500	0.0	0.0
Approach	1293	1.0		0.425		4.8	LOS A	12.9	91.1				
NorthWest: Showground Road													
Lane 1	1286	1.0	1654	0.777	100	8.1	LOS A	43.9	310.1	Full	500	0.0	0.0
Approach	1286	1.0		0.777		8.1	LOS A	43.9	310.1				
SouthWest: Cecil Ave													
Lane 1	118	0.0	537	0.220	100	9.3	LOS A	1.6	11.2	Full	500	0.0	0.0
Approach	118	0.0		0.220		9.3	LOS A	1.6	11.2				
Intersection	2697	1.0		0.777		6.6	LOS A	43.9	310.1				

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

Lane LOS values are based on average delay per lane.

Intersection and Approach LOS values are based on average delay for all lanes.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

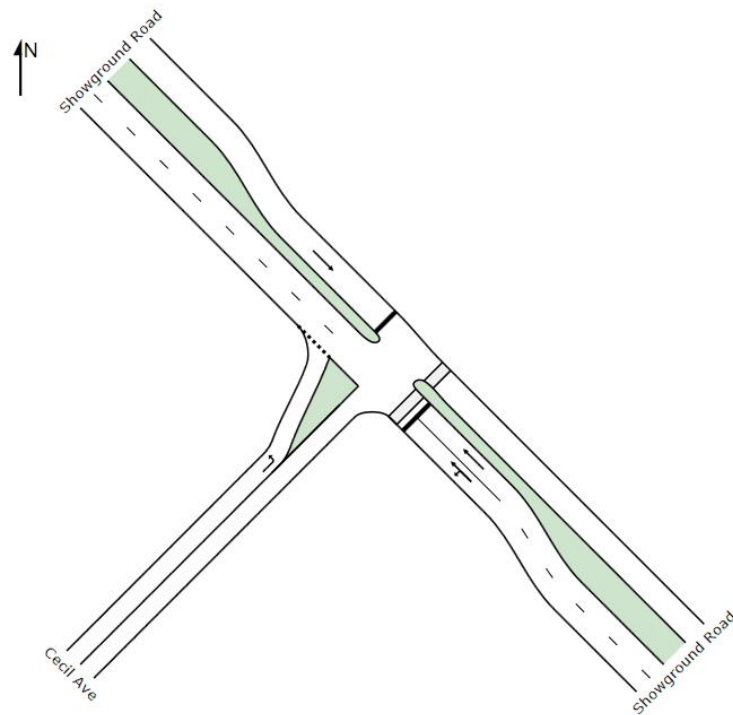
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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**SIDRA
INTERSECTION 6**

Showground Road/Cecil Avenue – 2013 Existing



LANE SUMMARY

Site: Saturday Peak Existing

Cecil Ave / Showground Rd SAT Peak Existing

Signals - Fixed Time Cycle Time = 140 seconds (User-Given Cycle Time)

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Queue Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
SouthEast: Showground Road													
Lane 1	765	1.0	1549	0.494	100	4.9	LOS A	16.8	118.7	Full	500	0.0	0.0
Lane 2	765	1.0	1550	0.494	100	4.8	LOS A	16.8	118.7	Full	500	0.0	0.0
Approach	1531	1.0		0.494		4.9	LOS A	16.8	118.7				
NorthWest: Showground Road													
Lane 1	1466	1.0	1687	0.869	100	9.6	LOS A	64.0	451.9	Full	500	0.0	0.0
Approach	1466	1.0		0.869		9.6	LOS A	64.0	451.9				
SouthWest: Cecil Ave													
Lane 1	152	0.0	442	0.343	100	11.1	LOS A	3.3	23.2	Full	500	0.0	0.0
Approach	152	0.0		0.343		11.1	LOS A	3.3	23.2				
Intersection	3148	0.9		0.869		7.4	LOS A	64.0	451.9				

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

Lane LOS values are based on average delay per lane.

Intersection and Approach LOS values are based on average delay for all lanes.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akcelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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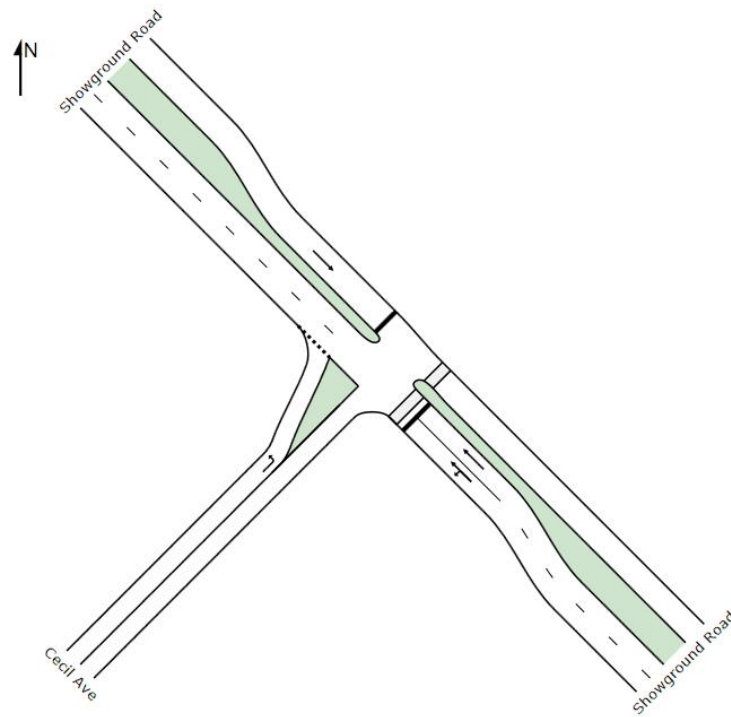
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**SIDRA
INTERSECTION 6**

Showground Road/Cecil Avenue – “Do Nothing”



LANE SUMMARY

Site: AM Peak - 2016 Base

Cecil Ave / Showground Rd AM Peak Existing

Signals - Fixed Time Cycle Time = 110 seconds (User-Given Cycle Time)

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	95% Back of Queue Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
SouthEast: Showground Road													
Lane 1	759	0.0	1453	0.523	100	6.2	LOS A	16.7	116.6	Full	500	0.0	0.0
Lane 2	760	0.0	1454	0.523	100	6.2	LOS A	16.7	116.6	Full	500	0.0	0.0
Approach	1519	0.0		0.523		6.2	LOS A	16.7	116.6				
NorthWest: Showground Road													
Lane 1	2088	0.0	1582	1.320	100	331.7	LOS F	351.5	2460.2	Full	500	0.0	100.0
Approach	2088	0.0		1.320		331.7	LOS F	351.5	2460.2				
SouthWest: Cecil Ave													
Lane 1	100	0.0	513	0.195	100	10.6	LOS A	1.6	10.9	Full	500	0.0	0.0
Approach	100	0.0		0.195		10.6	LOS A	1.6	10.9				
Intersection	3707	0.0		1.320		189.7	LOS F	351.5	2460.2				

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

Lane LOS values are based on average delay per lane.

Intersection and Approach LOS values are based on average delay for all lanes.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Capacity-Acceptance Capacity: SIDRA Standard (Akcelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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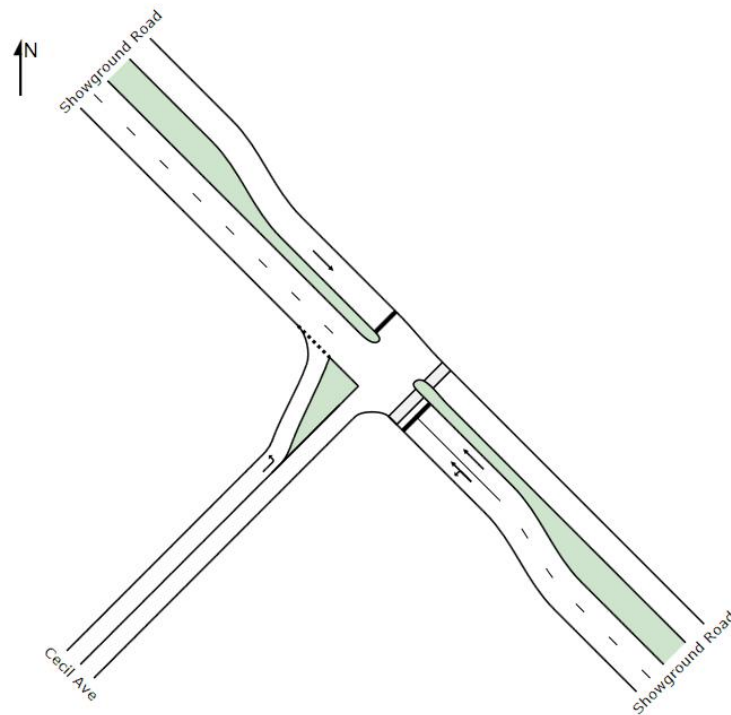
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**SIDRA
INTERSECTION 6**

Showground Road/Cecil Avenue – “Do Nothing”



LANE SUMMARY

Site: PM Peak - 2016 Base

Cecil Ave / Showground Rd PM Peak Existing

Signals - Fixed Time Cycle Time = 130 seconds (User-Given Cycle Time)

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	95% Back of Queue Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
SouthEast: Showground Road													
Lane 1	1020	1.0	1520	0.671	100	6.7	LOS A	28.8	203.0	Full	500	0.0	0.0
Lane 2	1021	1.0	1520	0.671	100	6.7	LOS A	28.8	203.0	Full	500	0.0	0.0
Approach	2041	1.0		0.671		6.7	LOS A	28.8	203.0				
NorthWest: Showground Road													
Lane 1	1951	1.0	1654	1.179	100	206.2	LOS F	279.7	1974.5	Full	500	0.0	100.0
Approach	1951	1.0		1.179		206.2	LOS F	279.7	1974.5				
SouthWest: Cecil Ave													
Lane 1	114	0.0	348	0.326	100	19.9	LOS B	4.7	32.7	Full	500	0.0	0.0
Approach	114	0.0		0.326		19.9	LOS B	4.7	32.7				
Intersection	4105	1.0		1.179		101.9	LOS F	279.7	1974.5				

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

Lane LOS values are based on average delay per lane.

Intersection and Approach LOS values are based on average delay for all lanes.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akcelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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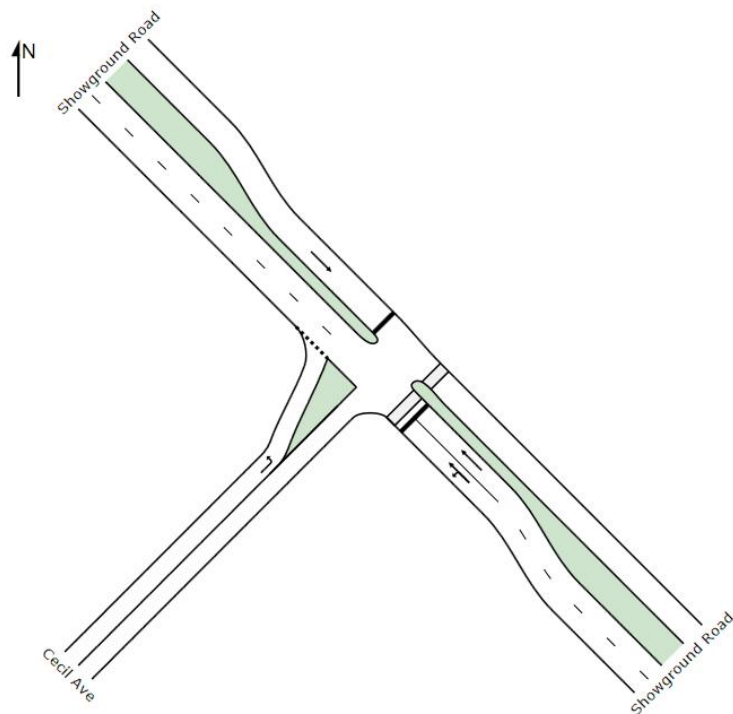
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**SIDRA
INTERSECTION 6**

Showground Road/Cecil Avenue – “Do Nothing”



LANE SUMMARY

 **Site: Saturday Peak - 2016**

Cecil Ave / Showground Rd SAT Peak Existing

Signals - Fixed Time Cycle Time = 140 seconds (User-Given Cycle Time)

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	95% Back of Queue Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
SouthEast: Showground Road													
Lane 1	1105	1.0	1549	0.713	100	6.9	LOS A	34.2	241.6	Full	500	0.0	0.0
Lane 2	1105	1.0	1550	0.713	100	6.8	LOS A	34.2	241.6	Full	500	0.0	0.0
Approach	2209	1.0		0.713		6.9	LOS A	34.2	241.6				
NorthWest: Showground Road													
Lane 1	2132	1.0	1687	1.264	100	283.1	LOS F	364.4	2572.7	Full	500	0.0	100.0
Approach	2132	1.0		1.264		283.1	LOS F	364.4	2572.7				
SouthWest: Cecil Ave													
Lane 1	142	0.0	310	0.458	100	36.8	LOS C	9.1	63.8	Full	500	0.0	0.0
Approach	142	0.0		0.458		36.8	LOS C	9.1	63.8				
Intersection	4483	1.0		1.264		139.1	LOS F	364.4	2572.7				

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

Lane LOS values are based on average delay per lane.

Intersection and Approach LOS values are based on average delay for all lanes.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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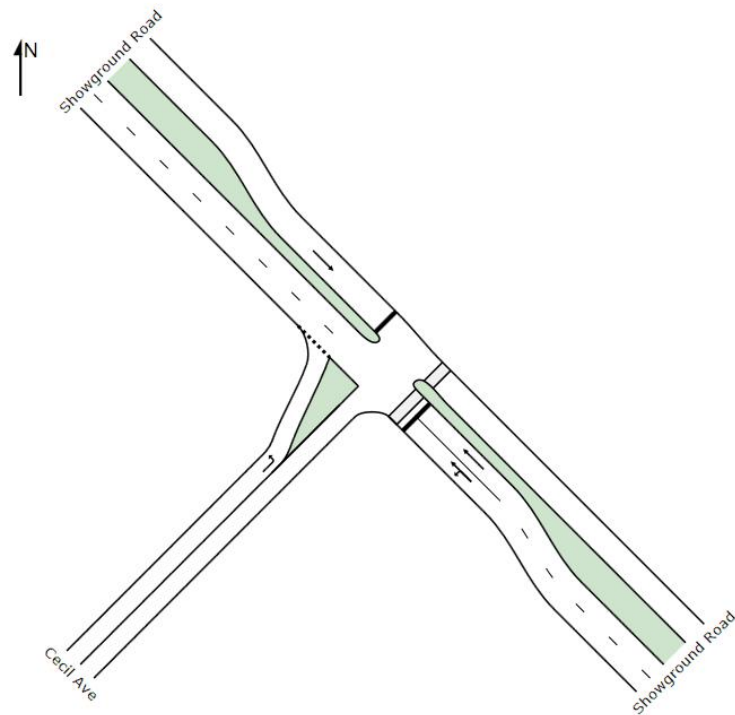
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**SIDRA
INTERSECTION 6**

Showground Road/Cecil Avenue – “Do Nothing”



LANE SUMMARY

 Site: AM Peak - 2026 Base

Cecil Ave / Showground Rd AM Peak Existing

Signals - Fixed Time Cycle Time = 110 seconds (User-Given Cycle Time)

Lane Use and Performance

	Demand Flows			Deg.	Lane	Average	Level of	95% Back of Queue		Lane	Lane	Cap.	Prob.
	Total	HV	Cap.	Satn	Util.	Delay	Service	Veh	Dist	Config	Length	Adj.	Block.
	veh/h	%	veh/h	v/c	%	sec			m		m	%	%
SouthEast: Showground Road													
Lane 1	814	0.0	1453	0.560	100	6.5	LOS A	18.7	131.0	Full	500	0.0	0.0
Lane 2	814	0.0	1454	0.560	100	6.5	LOS A	18.7	131.1	Full	500	0.0	0.0
Approach	1628	0.0		0.560		6.5	LOS A	18.7	131.1				
NorthWest: Showground Road													
Lane 1	2207	0.0	1582	1.395	100	399.8	LOS F	407.1	2849.5	Full	500	0.0	100.0
Approach	2207	0.0		1.395		399.8	LOS F	407.1	2849.5				
SouthWest: Cecil Ave													
Lane 1	165	0.0	483	0.342	100	13.3	LOS A	4.0	27.8	Full	500	0.0	0.0
Approach	165	0.0		0.342		13.3	LOS A	4.0	27.8				
Intersection	4001	0.0		1.395		223.8	LOS F	407.1	2849.5				

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

Lane LOS values are based on average delay per lane.

Intersection and Approach LOS values are based on average delay for all lanes.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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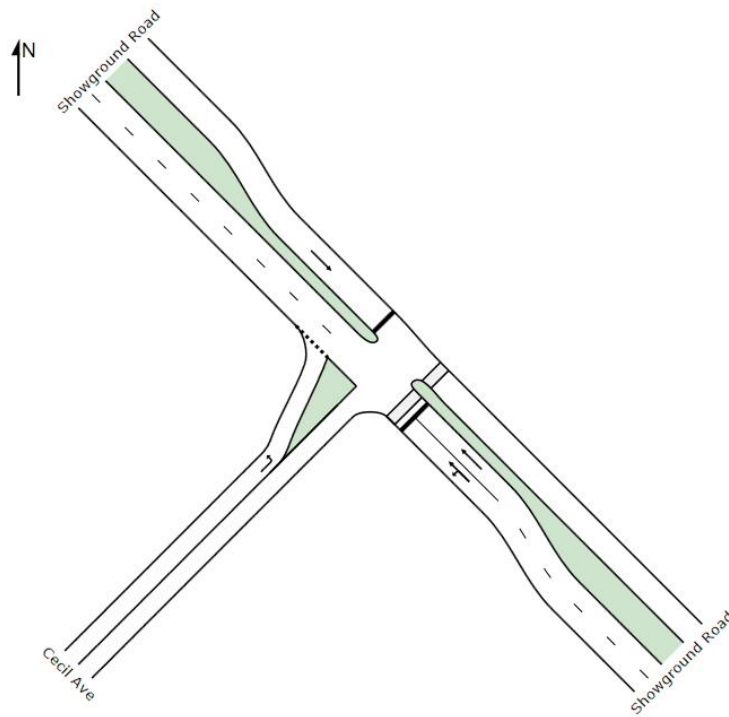
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SIDRA
INTERSECTION 6

Showground Road/Cecil Avenue – “Do Nothing”



LANE SUMMARY

Site: PM Peak - 2026 Base

Cecil Ave / Showground Rd PM Peak Existing

Signals - Fixed Time Cycle Time = 130 seconds (User-Given Cycle Time)

Lane Use and Performance													
	Demand Flows												
	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
SouthEast: Showground Road													
Lane 1	1128	1.0	1520	0.742	100	7.6	LOS A	36.0	254.3	Full	500	0.0	0.0
Lane 2	1128	1.0	1520	0.742	100	7.6	LOS A	36.0	254.3	Full	500	0.0	0.0
Approach	2256	1.0		0.742		7.6	LOS A	36.0	254.3				
NorthWest: Showground Road													
Lane 1	2089	1.0	1654	1.263	100	281.9	LOS F	346.0	2443.0	Full	500	0.0	100.0
Approach	2089	1.0		1.263		281.9	LOS F	346.0	2443.0				
SouthWest: Cecil Ave													
Lane 1	117	0.0	325	0.360	100	29.8	LOS C	6.9	48.2	Full	500	0.0	0.0
Approach	117	0.0		0.360		29.8	LOS C	6.9	48.2				
Intersection	4462	1.0		1.263		136.6	LOS F	346.0	2443.0				

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

Lane LOS values are based on average delay per lane.

Intersection and Approach LOS values are based on average delay for all lanes.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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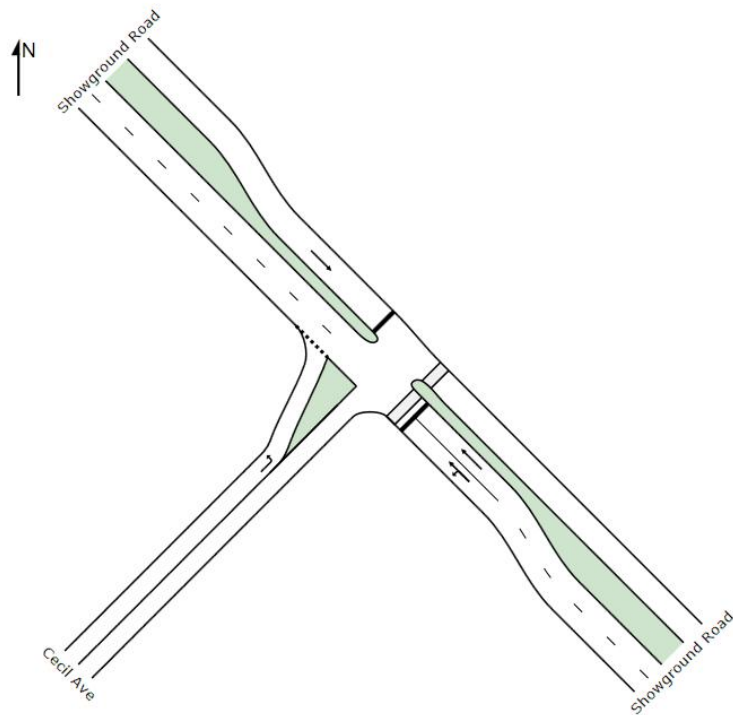
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**SIDRA
INTERSECTION 6**

Showground Road/Cecil Avenue – “Do Nothing”



LANE SUMMARY

 Site: Saturday Peak - 2026

Cecil Ave / Showground Rd SAT Peak Existing

Signals - Fixed Time Cycle Time = 140 seconds (User-Given Cycle Time)

Lane Use and Performance													
	Demand Flows												
	Total	HV	Cap.	Deg.	Lane	Average	Level of	95% Back of Queue		Lane	Lane	Cap.	Prob.
	veh/h	%	veh/h	Satn	Util.	Delay	Service	Veh	Dist	Config	Length	Adj.	Block.
				v/c	%	sec			m		m	%	%
SouthEast: Showground Road													
Lane 1	1215	1.0	1550	0.784	100	7.9	LOS A	43.4	306.6	Full	500	0.0	0.0
Lane 2	1215	1.0	1550	0.784	100	7.9	LOS A	43.4	306.6	Full	500	0.0	0.0
Approach	2431	1.0		0.784		7.9	LOS A	43.4	306.6				
NorthWest: Showground Road													
Lane 1	2276	1.0	1687	1.349	100	361.1	LOS F	434.9	3070.2	Full	500	0.0	100.0
Approach	2276	1.0		1.349		361.1	LOS F	434.9	3070.2				
SouthWest: Cecil Ave													
Lane 1	149	0.0	293	0.510	100	49.1	LOS D	9.8	68.4	Full	500	0.0	0.0
Approach	149	0.0		0.510		49.1	LOS D	9.8	68.4				
Intersection	4856	1.0		1.349		174.7	LOS F	434.9	3070.2				

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

Lane LOS values are based on average delay per lane.

Intersection and Approach LOS values are based on average delay for all lanes.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Processed: Friday, 4 October 2013 8:49:11 AM

SIDRA INTERSECTION 6.0.14.4193

Project: G:\21\22830\Technical\Traffic\Technical\SIDRA\Existing Layout\4 Cecil Ave_Showground Rd.sip6

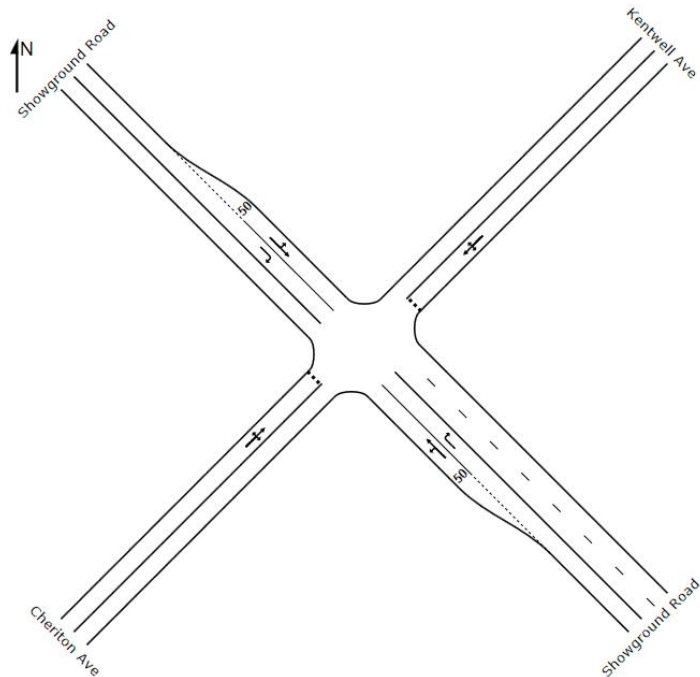
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SIDRA
INTERSECTION 6

Showground Road/Kentwell Avenue – 2013 Existing



LANE SUMMARY

▽ Site: AM Peak Existing

Kentwell Ave / Showground Rd AM Peak Existing
Giveaway / Yield (Two-Way)

Lane Use and Performance													
	Demand Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Queue Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
SouthEast: Showground Road													
Lane 1	1414	3.8	1896	0.746	100	0.9	LOS A	0.0	0.0	Short	50	0.0	0.0
Lane 2	153	0.0	6	25.439	100	22602.9	LOS F	146.2	1023.6	Full	500	0.0	33.8
Approach	1566	3.4	25.439			2203.4	NA	146.2	1023.6				
NorthEast: Kentwell Ave													
Lane 1	184	0.0	8	23.448	100	20651.2	LOS F	155.5	1088.6	Full	500	0.0	37.9
Approach	184	0.0	23.448			20651.2	LOS F	155.5	1088.6				
NorthWest: Showground Road													
Lane 1	1882	2.5	1884	0.999 ³	100	9.2	LOS A	0.0	0.0	Short	50	0.0	0.0
Lane 2	206	0.0	110	1.874	100	842.7	LOS F	65.6	458.9	Full	500	0.0	2.5
Approach	2088	2.2	1.874			91.6	NA	65.6	458.9				
SouthWest: Cheriton Ave													
Lane 1	82	1.9	35	2.317	100	1375.4	LOS F	34.5	245.5	Full	500	0.0	0.0
Approach	82	1.9	2.317			1375.4	LOS F	34.5	245.5				
Intersection	3921	2.6	25.439			1927.9	NA	155.5	1088.6				

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

Lane LOS values are based on average delay per lane.

Minor Road Approach LOS values are based on average delay for all lanes.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akcelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

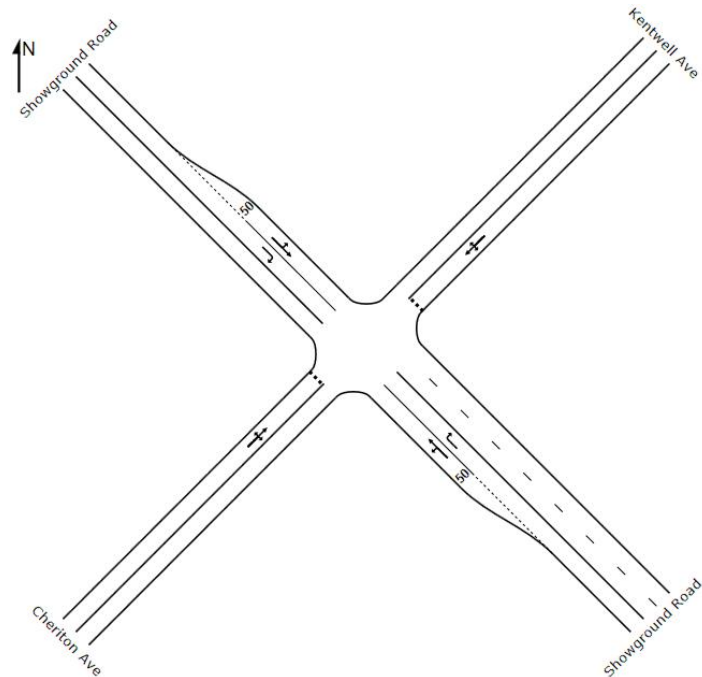
³ x = 1.00 due to short lane.

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**SIDRA
INTERSECTION 6**

Showground Road/Kentwell Avenue – 2013 Existing



LANE SUMMARY

▽ Site: PM Peak Existing

Kentwell Ave / Showground Rd AM Peak Existing
Giveaway / Yield (Two-Way)

Lane Use and Performance													
	Demand Flows												
	Total	HV	Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue	Queue Dist	Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	veh/h	%	veh/h	v/c	%	sec		Veh	m		m	%	%
SouthEast: Showground Road													
Lane 1	1575	0.9	1932	0.815	100	1.0	LOS A	0.0	0.0	Short	50	0.0	0.0
Lane 2	1	0.0	161	0.007	100	28.5	LOS C	0.0	0.1	Full	500	0.0	0.0
Approach	1576	0.9		0.815		1.0	NA	0.0	0.1				
NorthEast: Kentwell Ave													
Lane 1	21	0.0	36	0.590	100	154.0	LOS F	1.5	10.3	Full	500	0.0	0.0
Approach	21	0.0		0.590		154.0	LOS F	1.5	10.3				
NorthWest: Showground Road													
Lane 1	1368	1.0	1937	0.707	100	0.3	LOS A	0.0	0.0	Short	50	0.0	0.0
Lane 2	98	0.0	98	0.997	100	129.5	LOS F	5.6	39.5	Full	500	0.0	0.0
Approach	1466	0.9		0.997		8.9	NA	5.6	39.5				
SouthWest: Cheriton Ave													
Lane 1	65	0.0	62	1.049	100	234.5	LOS F	6.5	45.6	Full	500	0.0	0.0
Approach	65	0.0		1.049		234.5	LOS F	6.5	45.6				
Intersection	3128	0.9		1.049		10.6	NA	6.5	45.6				

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

Lane LOS values are based on average delay per lane.

Minor Road Approach LOS values are based on average delay for all lanes.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

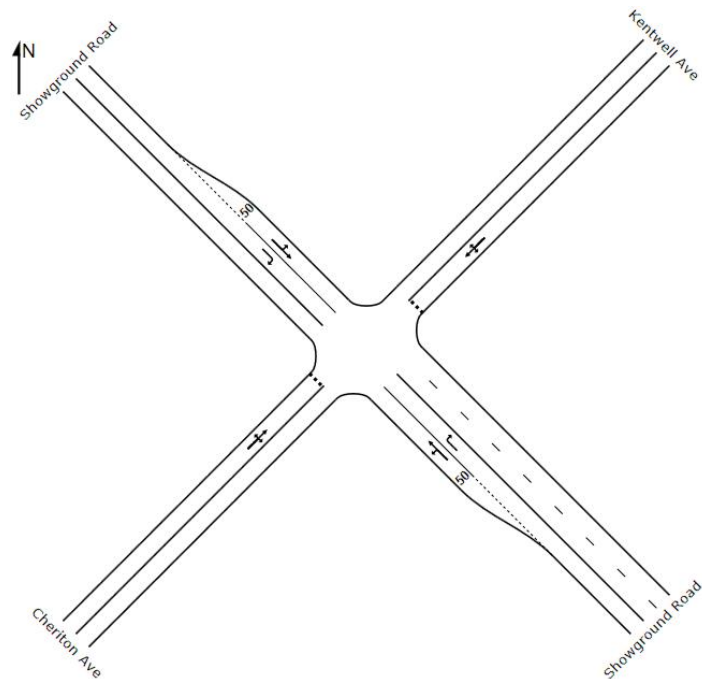
Gap-Acceptance Capacity: SIDRA Standard (Akcelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Processed: Wednesday, 2 October 2013 3:25:54 PM
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**SIDRA
INTERSECTION 6**

Showground Road/Kentwell Avenue – 2013 Existing



LANE SUMMARY

▽ Site: Saturday Peak Existing

Kentwell Ave / Showground Rd AM Peak Existing
Giveaway / Yield (Two-Way)

Lane Use and Performance													
	Demand Flows			Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	Total veh/h	HV %	Cap. veh/h	v/c	%	sec		Veh	Dist m		m	%	%
SouthEast: Showground Road													
Lane 1	1575	0.9	1932	0.815	100	1.0	LOS A	0.0	0.0	Short	50	0.0	0.0
Lane 2	1	0.0	161	0.007	100	28.5	LOS C	0.0	0.1	Full	500	0.0	0.0
Approach	1576	0.9		0.815		1.0	NA	0.0	0.1				
NorthEast: Kentwell Ave													
Lane 1	21	0.0	36	0.590	100	154.0	LOS F	1.5	10.3	Full	500	0.0	0.0
Approach	21	0.0		0.590		154.0	LOS F	1.5	10.3				
NorthWest: Showground Road													
Lane 1	1368	1.0	1937	0.707	100	0.3	LOS A	0.0	0.0	Short	50	0.0	0.0
Lane 2	98	0.0	98	0.997	100	129.5	LOS F	5.6	39.5	Full	500	0.0	0.0
Approach	1466	0.9		0.997		8.9	NA	5.6	39.5				
SouthWest: Cheriton Ave													
Lane 1	65	0.0	62	1.049	100	234.5	LOS F	6.5	45.6	Full	500	0.0	0.0
Approach	65	0.0		1.049		234.5	LOS F	6.5	45.6				
Intersection	3128	0.9		1.049		10.6	NA	6.5	45.6				

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

Lane LOS values are based on average delay per lane.

Minor Road Approach LOS values are based on average delay for all lanes.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akcelik M3D).

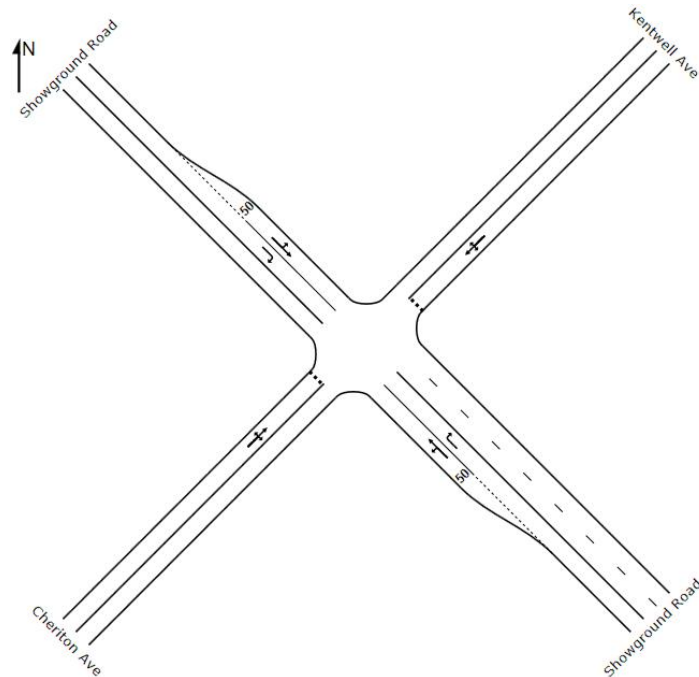
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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**SIDRA
INTERSECTION 6**

Showground Road/Kentwell Avenue – “Do Nothing”



LANE SUMMARY

Site: AM Peak - 2016 Base

Kentwell Ave / Showground Rd AM Peak Existing
Giveaway / Yield (Two-Way)

Lane Use and Performance													
	Demand Flows			Deg.	Lane	Average	Level of	95% Back of Queue	Queue	Lane	Lane	Cap.	Prob.
	Total	HV	Cap.	Satn	Util.	Delay	Service	Veh	Dist	Config	Length	Adj.	Block.
	veh/h	%	veh/h	v/c	%	sec			m		m	%	%
SouthEast: Showground Road													
Lane 1	1414	3.8	1896	0.746	100	0.9	LOS A	0.0	0.0	Short	50	0.0	0.0
Lane 2	153	0.0	6	25.439	100	22602.9	LOS F	146.2	1023.6	Full	500	0.0	33.8
Approach	1566	3.4		25.439		2203.4	NA	146.2	1023.6				
NorthEast: Kentwell Ave													
Lane 1	184	0.0	8	23.448	100	20651.2	LOS F	155.5	1088.6	Full	500	0.0	37.9
Approach	184	0.0		23.448		20651.2	LOS F	155.5	1088.6				
NorthWest: Showground Road													
Lane 1	1882	2.5	1884	0.999 ³	100	9.2	LOS A	0.0	0.0	Short	50	0.0	0.0
Lane 2	206	0.0	110	1.874	100	842.7	LOS F	65.6	458.9	Full	500	0.0	2.5
Approach	2088	2.2		1.874		91.6	NA	65.6	458.9				
SouthWest: Cheriton Ave													
Lane 1	82	1.9	35	2.317	100	1375.4	LOS F	34.5	245.5	Full	500	0.0	0.0
Approach	82	1.9		2.317		1375.4	LOS F	34.5	245.5				
Intersection	3921	2.6		25.439		1927.9	NA	155.5	1088.6				

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

Lane LOS values are based on average delay per lane.

Minor Road Approach LOS values are based on average delay for all lanes.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akcelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

³ x = 1.00 due to short lane.

Processed: Friday, 4 October 2013 9:07:25 AM

SIDRA INTERSECTION 6.0.14.4193

Project: G:\21\22830\Technical\Traffic\Technical\SIDRA\Existing Layout\6 Kentwell Ave_Showground Rd.sip8

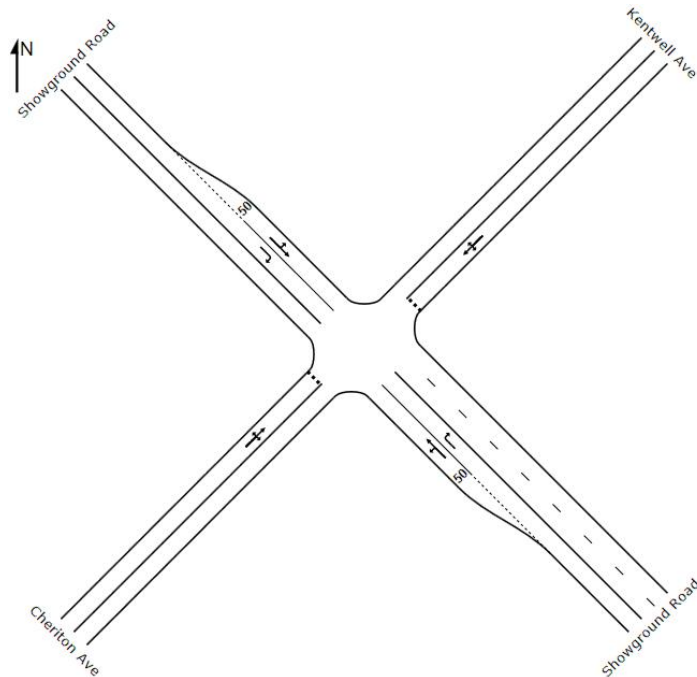
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SIDRA
INTERSECTION 6

Showground Road/Kentwell Avenue – “Do Nothing”



LANE SUMMARY

▽ Site: PM Peak - 2016 Base

Kentwell Ave / Showground Rd AM Peak Existing
Giveaway / Yield (Two-Way)

Lane Use and Performance													
	Demand Flows												
	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
SouthEast: Showground Road													
Lane 1	1461	0.9	1932	0.756	100	0.8	LOS A	0.0	0.0	Short	50	0.0	0.0
Lane 2	131	0.0	6	21.754	100	19324.9	LOS F	126.2	883.5	Full	500	0.0	25.7
Approach	1592	0.9		21.754		1585.6	NA	126.2	883.5				
NorthEast: Kentwell Ave													
Lane 1	772	0.0	7	107.90 0	100	96639.1	LOS F	685.9	4801.2	Full	500	0.0	100.0
Approach	772	0.0		107.90 0		96639.1	LOS F	685.9	4801.2				
NorthWest: Showground Road													
Lane 1	1848	0.7	1915	0.965	100	4.5	LOS A	0.0	0.0	Short	50	0.0	0.0
Lane 2	102	0.0	160	0.639	100	37.8	LOS C	2.0	13.7	Full	500	0.0	0.0
Approach	1951	0.7		0.965		6.2	NA	2.0	13.7				
SouthWest: Cheriton Ave													
Lane 1	38	0.0	25	1.520	100	784.6	LOS F	11.7	81.8	Full	500	0.0	0.0
Approach	38	0.0		1.520		784.6	LOS F	11.7	81.8				
Intersection	4352	0.6		107.90 0		17724.6	NA	685.9	4801.2				

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

Lane LOS values are based on average delay per lane.

Minor Road Approach LOS values are based on average delay for all lanes.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akcelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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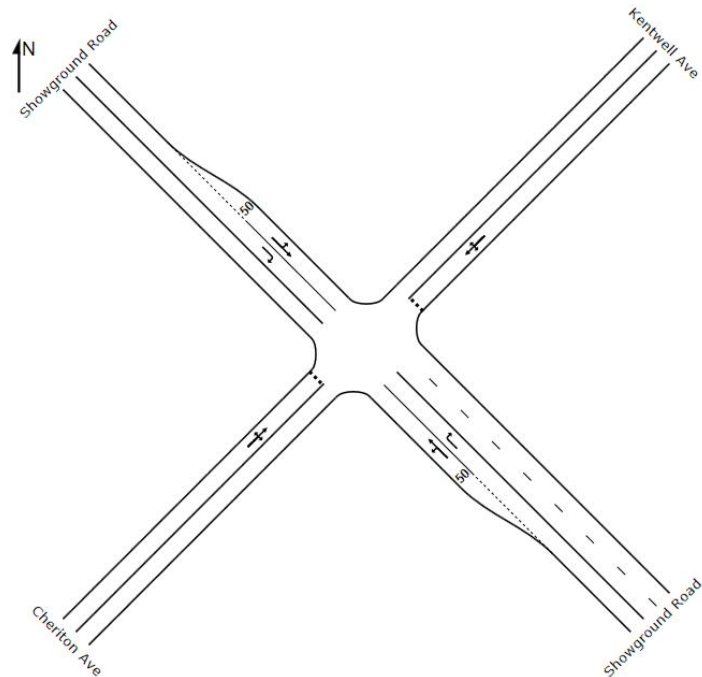
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**SIDRA
INTERSECTION 8**

Showground Road/Kentwell Avenue – “Do Nothing”



LANE SUMMARY

▽ Site: Saturday Peak - 2016 Base

Kentwell Ave / Showground Rd AM Peak Existing
Giveway / Yield (Two-Way)

Lane Use and Performance													
	Demand Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
SouthEast: Showground Road													
Lane 1	1632	0.9	1931	0.845	100	1.1	LOS A	0.0	0.0	Short	50	0.0	0.0
Lane 2	127	0.0	6	21.228	100	18779.4	LOS F	118.8	831.7	Full	500	0.0	23.0
Approach	1759	0.9	21.228			1360.9	NA	118.8	831.7				
NorthEast: Kentwell Ave													
Lane 1	803	0.0	7	113.25 1	100	101437.9	LOS F	707.6	4953.0	Full	500	0.0	100.0
Approach	803	0.0	113.25 1			101437.9	LOS F	707.6	4953.0				
NorthWest: Showground Road													
Lane 1	2023	0.7	1912	1.058	100	30.0	LOS C	0.0	0.0	Short	50	0.0	0.0
Lane 2	107	0.0	73	1.475	100	512.1	LOS F	25.5	178.7	Full	500	0.0	0.0
Approach	2131	0.7	1.475			54.3	NA	25.5	178.7				
SouthWest: Cheriton Ave													
Lane 1	34	0.0	14	2.390	100	1670.2	LOS F	17.1	119.6	Full	500	0.0	0.0
Approach	34	0.0	2.390			1670.2	LOS F	17.1	119.6				
Intersection	4726	0.6	113.25 1			17780.5	NA	707.6	4953.0				

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

Lane LOS values are based on average delay per lane.

Minor Road Approach LOS values are based on average delay for all lanes.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akapel M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Processed: Friday, 4 October 2013 9:46:15 AM

SIDRA INTERSECTION 8.0.14.4193

Project: G:\21\22830\Technical\Traffic\Technical\SIDRA\Existing Layout\6 Kentwell Ave_Showground Rd.sip6

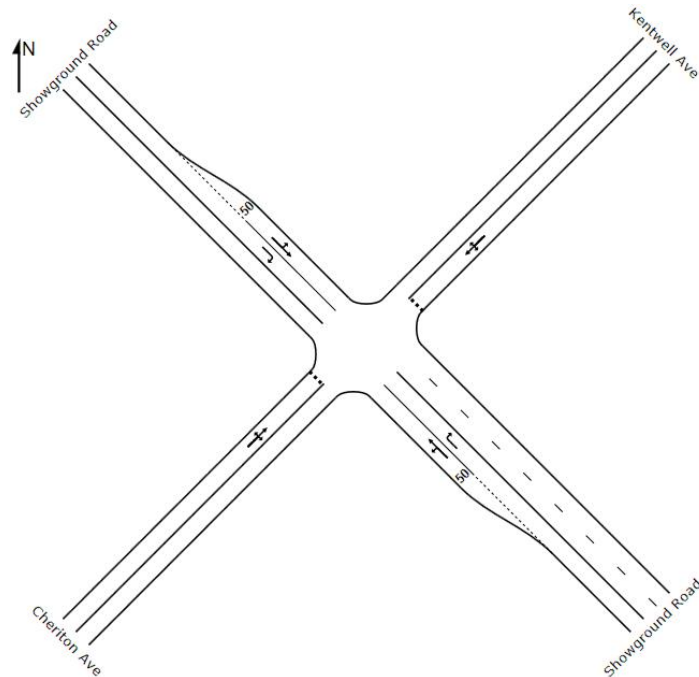
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**SIDRA
INTERSECTION 6**

Showground Road/Kentwell Avenue – “Do Nothing”



LANE SUMMARY

▽ Site: AM Peak - 2026 Base

Kentwell Ave / Showground Rd AM Peak Existing
Giveaway / Yield (Two-Way)

Lane Use and Performance													
	Demand Flows		Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue Veh	Queue Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
	Total veh/h	HV %	veh/h	v/c	%	sec							
SouthEast: Showground Road													
Lane 1	1578	3.7	1896	0.832	100	1.2	LOS A	0.0	0.0	Short	50	0.0	0.0
Lane 2	148	0.0	6	24.737	100	21929.4	LOS F	139.1	973.4	Full	500	0.0	30.8
Approach	1726	3.4		24.737		1886.5	NA	139.1	973.4				
NorthEast: Kentwell Ave													
Lane 1	178	0.0	8	23.491	100	20679.4	LOS F	150.4	1052.6	Full	500	0.0	35.6
Approach	178	0.0		23.491		20679.4	LOS F	150.4	1052.6				
NorthWest: Showground Road													
Lane 1	1994	2.6	1885	1.058	100	30.1	LOS C	0.0	0.0	Short	50	0.0	0.0
Lane 2	214	0.0	46	4.620	100	3356.2	LOS F	115.6	809.4	Full	500	0.0	21.8
Approach	2207	2.3		4.620		352.1	NA	115.6	809.4				
SouthWest: Cheriton Ave													
Lane 1	53	1.9	21	2.521	100	1651.8	LOS F	25.1	178.6	Full	500	0.0	0.0
Approach	53	1.9		2.521		1651.8	LOS F	25.1	178.6				
Intersection	4164	2.7		24.737		1873.0	NA	150.4	1052.6				

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

Lane LOS values are based on average delay per lane.

Minor Road Approach LOS values are based on average delay for all lanes.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akcelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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SIDRA INTERSECTION 8.0.14.4193

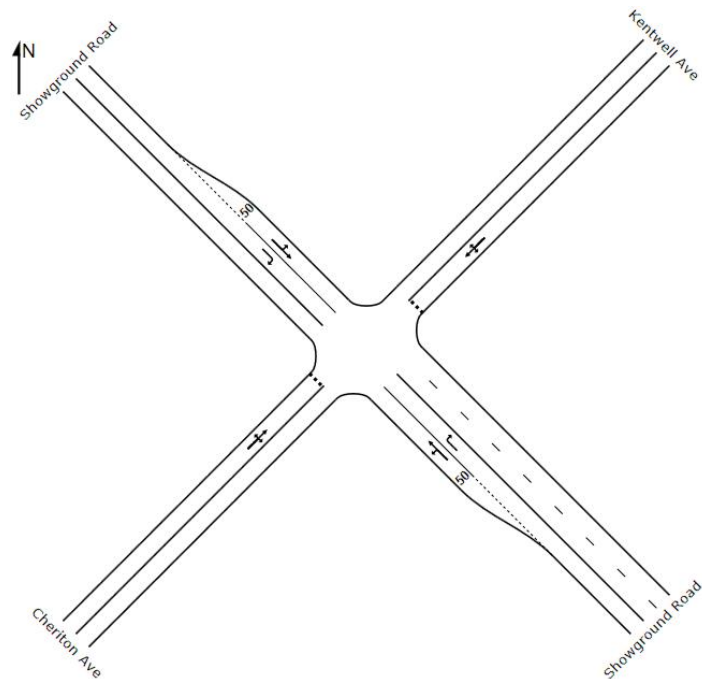
Project: G:\21\22830\Technical\Traffic\Technical\SIDRA\Existing Layout\6 Kentwell Ave_Showground Rd.sip6
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**SIDRA
INTERSECTION 6**

Showground Road/Kentwell Avenue – “Do Nothing”



LANE SUMMARY

▽ Site: PM Peak - 2026 Base

Kentwell Ave / Showground Rd AM Peak Existing
Giveaway / Yield (Two-Way)

Lane Use and Performance													
	Demand Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	95% Back of Queue Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
SouthEast: Showground Road													
Lane 1	1695	0.9	1932	0.877	100	1.2	LOS A	0.0	0.0	Short	50	0.0	0.0
Lane 2	132	0.0	6	21.930	100	19409.3	LOS F	122.9	860.0	Full	500	0.0	24.5
Approach	1826	0.9		21.930		1399.5	NA	122.9	860.0				
NorthEast: Kentwell Ave													
Lane 1	772	0.0	7	108.44 3	100	97105.0	LOS F	677.4	4741.7	Full	500	0.0	100.0
Approach	772	0.0		108.44 3		97105.0	LOS F	677.4	4741.7				
NorthWest: Showground Road													
Lane 1	1979	0.7	1916	1.033	100	19.6	LOS B	0.0	0.0	Short	50	0.0	0.0
Lane 2	109	0.0	49	2.229	100	1205.9	LOS F	42.9	300.4	Full	500	0.0	0.0
Approach	2088	0.7		2.229		81.8	NA	42.9	300.4				
SouthWest: Cheriton Ave													
Lane 1	35	0.0	13	2.617	100	1869.0	LOS F	18.7	131.0	Full	500	0.0	0.0
Approach	35	0.0		2.617		1869.0	LOS F	18.7	131.0				
Intersection	4721	0.6		108.44 3		16461.5	NA	677.4	4741.7				

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

Lane LOS values are based on average delay per lane.

Minor Road Approach LOS values are based on average delay for all lanes.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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SIDRA INTERSECTION 8.0.14.4193

Project: G:\21\22830\Technical\Traffic\Technical\SIDRA\Existing Layout\6 Kentwell Ave_Showground Rd.sip6

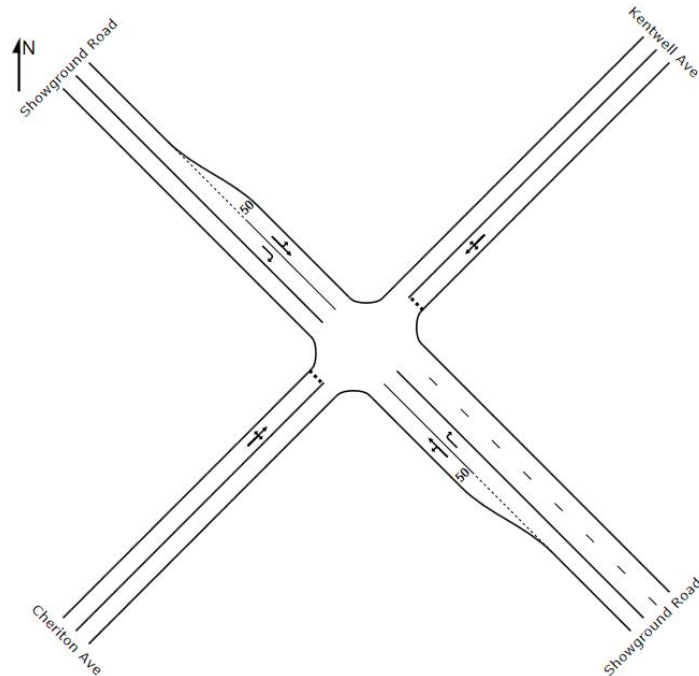
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**SIDRA
INTERSECTION 6**

Showground Road/Kentwell Avenue – “Do Nothing”



LANE SUMMARY

Site: Saturday Peak - 2026 Base

Kentwell Ave / Showground Rd AM Peak Existing
Giveaway / Yield (Two-Way)

Lane Use and Performance													
	Demand Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Queue Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
SouthEast: Showground Road													
Lane 1	1885	0.9	1931	0.976	100	3.7	LOS A	0.0	0.0	Short	50	0.0	0.0
Lane 2	124	0.0	6	20.702	100	18307.1	LOS F	115.8	810.5	Full	500	0.0	21.8
Approach	2009	0.9		20.702		1135.1	NA	115.8	810.5				
NorthEast: Kentwell Ave													
Lane 1	803	0.0	7	114.19 6	100	102270.1	LOS F	700.9	4906.1	Full	500	0.0	100.0
Approach	803	0.0		114.19 6		102270.1	LOS F	700.9	4906.1				
NorthWest: Showground Road													
Lane 1	2161	0.7	1914	1.129	100	60.4	LOS E	0.0	0.0	Short	50	0.0	0.0
Lane 2	116	0.0	7	16.361	100	14312.5	LOS F	101.1	707.5	Full	500	0.0	16.4
Approach	2277	0.7		16.361		785.2	NA	101.1	707.5				
SouthWest: Cheriton Ave													
Lane 1	16	0.0	6	2.632	100	2335.2	LOS F	11.8	82.9	Full	500	0.0	0.0
Approach	16	0.0		2.632		2335.2	LOS F	11.8	82.9				
Intersection	5105	0.6		114.19 6		16893.3	NA	700.9	4906.1				

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

Lane LOS values are based on average delay per lane.

Minor Road Approach LOS values are based on average delay for all lanes.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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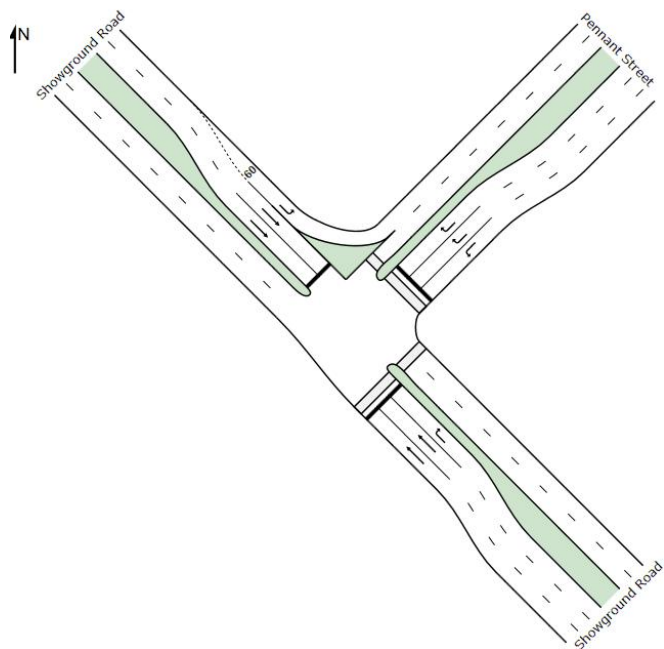
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**SIDRA
INTERSECTION 6**

Showground Road/Pennant Street – 2013 Existing



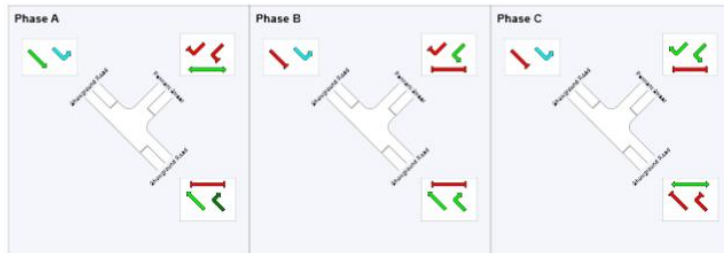
PHASING SUMMARY

Site: AM Peak Existing

Pennant St / Showground Rd AM Peak Existing
Signals - Fixed Time Cycle Time = 120 seconds (User-Given Cycle Time)

Phase times determined by the program
Sequence: Split Phasing
Movement Class: All Movement Classes
Input Sequence: A, B, C
Output Sequence: A, B, C

Phase Timing Results			
Phase	A	B	C
Green Time (sec)	21	29	52
Yellow Time (sec)	3	3	3
All-Red Time (sec)	3	3	3
Phase Time (sec)	27	35	58
Phase Split	23 %	29 %	48 %



LANE SUMMARY

Site: AM Peak Existing

Pennant St / Showground Rd AM Peak Existing
Signals - Fixed Time Cycle Time = 120 seconds (User-Given Cycle Time)

Lane Use and Performance													
	Demand Flows												
	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Queue Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
SouthEast: Showground Road													
Lane 1	135	4.0	887	0.153	100	19.4	LOS B	4.5	32.3	Full	150	0.0	0.0
Lane 2	135	4.0	887	0.153	100	19.4	LOS B	4.5	32.3	Full	150	0.0	0.0
Lane 3	298	0.0	580	0.514	100	43.4	LOS D	13.4	93.5	Full	100	0.0	0.0
Approach	568	1.9		0.514		32.0	LOS C	13.4	93.5				
NorthEast: Pennant Street													
Lane 1	144	1.0	1337	0.108	100	13.3	LOS A	2.4	17.3	Full	500	0.0	0.0
Lane 2	511	3.0	788	0.648	100	36.7	LOS C	23.4	167.9	Full	500	0.0	0.0
Lane 3	511	3.0	788	0.648	100	36.7	LOS C	23.4	167.9	Full	500	0.0	0.0
Approach	1165	2.8		0.648		33.8	LOS C	23.4	167.9				
NorthWest: Showground Road													
Lane 1	666	4.0	1806	0.369	100	7.6	LOS A	0.0	0.0	Short	60	0.0	0.0
Lane 2	179	3.0	335	0.535	100	49.3	LOS D	9.7	69.6	Full	500	0.0	0.0
Lane 3	179	3.0	335	0.535	100	49.3	LOS D	9.7	69.6	Full	500	0.0	0.0
Approach	1024	3.7		0.535		22.2	LOS B	9.7	69.6				
Intersection	2758	2.9		0.648		29.1	LOS C	23.4	167.9				

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

Lane LOS values are based on average delay per lane.

Intersection and Approach LOS values are based on average delay for all lanes.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akcelik M3D).

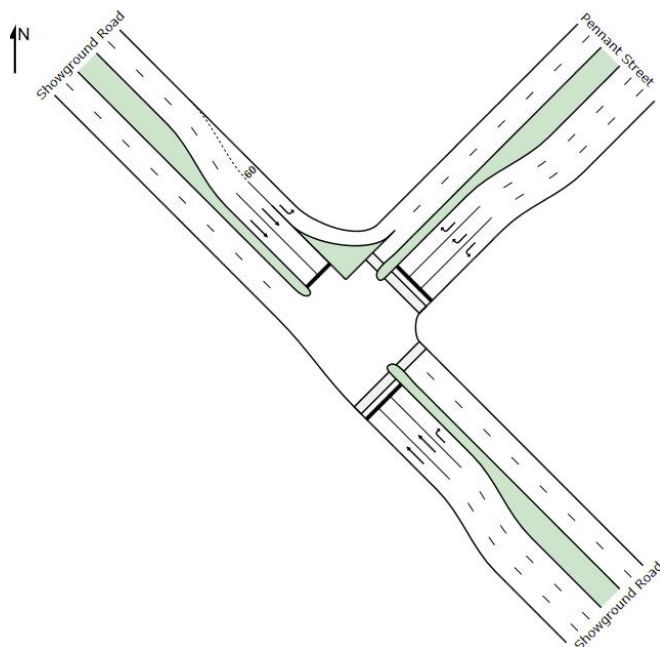
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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Project: G:\21\22830\Technical\Traffic\Technical\SIDRA\Existing Layout\7 Pennant St_Showground Rd.sip8
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SIDRA
INTERSECTION 6

Showground Road/Pennant Street – 2013 Existing



PHASING SUMMARY

Site: PM Peak Existing

Pennant St / Showground Rd PM Peak Existing
Signals - Fixed Time Cycle Time = 120 seconds (User-Given Cycle Time)

Phase times determined by the program
Sequence: Split Phasing
Movement Class: All Movement Classes
Input Sequence: A, B, C
Output Sequence: A, B, C

Phase Timing Results

Phase	A	B	C
Green Time (sec)	21	36	45
Yellow Time (sec)	3	3	3
All-Red Time (sec)	3	3	3
Phase Time (sec)	27	42	51
Phase Split	23 %	35 %	43 %



LANE SUMMARY

Site: PM Peak Existing

Pennant St / Showground Rd PM Peak Existing
Signals - Fixed Time Cycle Time = 120 seconds (User-Given Cycle Time)

Lane Use and Performance													
	Demand Flows												
	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
SouthEast: Showground Road													
Lane 1	195	1.0	1017	0.192	100	15.9	LOS B	5.9	41.8	Full	150	0.0	0.0
Lane 2	195	1.0	1017	0.192	100	15.9	LOS B	5.9	41.8	Full	150	0.0	0.0
Lane 3	478	0.0	717	0.667	100	39.9	LOS C	19.5	136.8	Full	100	0.0	33.5
Approach	868	0.4		0.667		29.1	LOS C	19.5	136.8				
NorthEast: Pennant Street													
Lane 1	179	0.0	1346	0.133	100	13.4	LOS A	3.1	21.7	Full	500	0.0	0.0
Lane 2	471	1.0	691	0.680	100	41.8	LOS C	23.0	162.7	Full	500	0.0	0.0
Lane 3	471	1.0	691	0.680	100	41.8	LOS C	23.0	162.7	Full	500	0.0	0.0
Approach	1120	0.8		0.680		37.3	LOS C	23.0	162.7				
NorthWest: Showground Road													
Lane 1	926	0.0	1857	0.499	100	7.6	LOS A	0.0	0.0	Short	60	0.0	0.0
Lane 2	140	2.0	337	0.416	100	48.1	LOS D	7.4	52.7	Full	500	0.0	0.0
Lane 3	140	2.0	337	0.416	100	48.1	LOS D	7.4	52.7	Full	500	0.0	0.0
Approach	1206	0.5		0.499		17.0	LOS B	7.4	52.7				
Intersection	3195	0.6		0.680		27.4	LOS B	23.0	162.7				

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

Lane LOS values are based on average delay per lane.

Intersection and Approach LOS values are based on average delay for all lanes.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

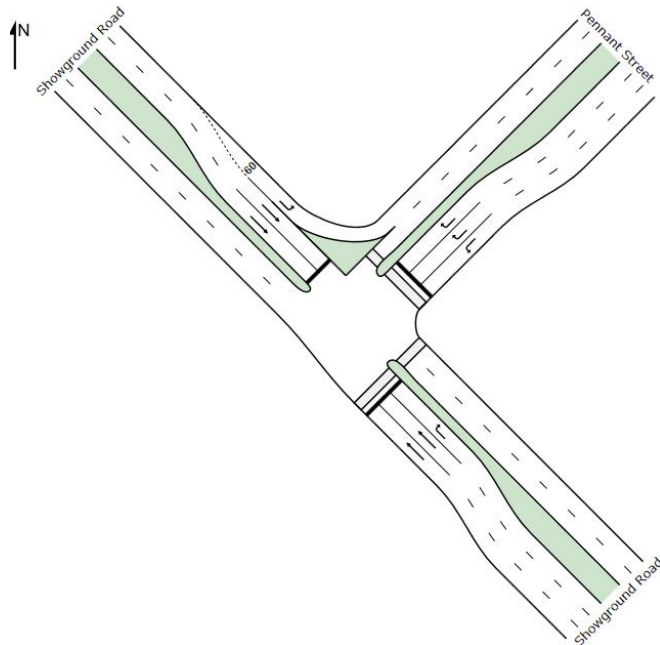
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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SIDRA
INTERSECTION 6

Showground Road/Pennant Street – 2013 Existing



PHASING SUMMARY

Site: Saturday Peak Existing

Pennant St / Showground Rd SAT Peak Existing
Signals - Fixed Time Cycle Time = 120 seconds (User-Given Cycle Time)

Phase times determined by the program
Sequence: Split Phasing
Movement Class: All Movement Classes
Input Sequence: A, B, C
Output Sequence: A, B, C

Phase Timing Results			
Phase	A	B	C
Green Time (sec)	21	31	50
Yellow Time (sec)	3	3	3
All-Red Time (sec)	3	3	3
Phase Time (sec)	27	37	56
Phase Split	23 %	31 %	47 %



LANE SUMMARY

Site: Saturday Peak Existing

Pennant St / Showground Rd SAT Peak Existing
Signals - Fixed Time Cycle Time = 120 seconds (User-Given Cycle Time)

Lane Use and Performance													
	Demand Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	95% Back of Queue Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
SouthEast: Showground Road													
Lane 1	202	1.0	936	0.216	100	18.9	LOS B	6.7	47.3	Full	150	0.0	0.0
Lane 2	202	1.0	936	0.216	100	18.9	LOS B	6.7	47.3	Full	150	0.0	0.0
Lane 3	447	1.0	591	0.757	100	49.4	LOS D	20.3	143.5	Full	100	0.0	38.0
Approach	852	1.0		0.757		34.9	LOS C	20.3	143.5				
NorthEast: Pennant Street													
Lane 1	305	1.0	1337	0.228	100	13.9	LOS A	5.7	40.6	Full	500	0.0	0.0
Lane 2	585	1.0	768	0.762	100	40.1	LOS C	29.1	205.6	Full	500	0.0	0.0
Lane 3	585	1.0	768	0.762	100	40.1	LOS C	29.1	205.6	Full	500	0.0	0.0
Approach	1476	1.0		0.762		34.7	LOS C	29.1	205.6				
NorthWest: Showground Road													
Lane 1	959	0.0	1857	0.516	100	7.7	LOS A	0.0	0.0	Short	60	0.0	0.0
Lane 2	206	1.0	339	0.607	100	50.0	LOS D	11.3	79.9	Full	500	0.0	0.0
Lane 3	206	1.0	339	0.607	100	50.0	LOS D	11.3	79.9	Full	500	0.0	0.0
Approach	1371	0.3		0.607		20.4	LOS B	11.3	79.9				
Intersection	3698	0.7		0.762		29.4	LOS C	29.1	205.6				

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

Lane LOS values are based on average delay per lane.

Intersection and Approach LOS values are based on average delay for all lanes.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

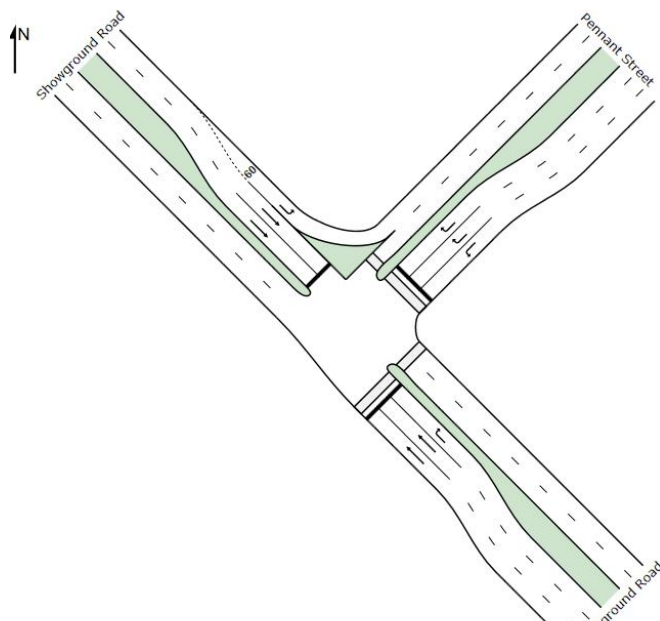
Gap-Acceptance Capacity: SIDRA Standard (Akcelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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**SIDRA
INTERSECTION 6**

Showground Road/Pennant Street – “Do Nothing”



PHASING SUMMARY

Site: AM Peak - 2016 Base

Pennant St / Showground Rd AM Peak Existing
Signals - Fixed Time Cycle Time = 120 seconds (Practical Cycle Time)

Phase times determined by the program
Sequence: Split Phasing
Movement Class: All Movement Classes
Input Sequence: A, B, C
Output Sequence: A, B, C

Phase Timing Results

Phase	A	B	C
Green Time (sec)	25	36	41
Yellow Time (sec)	3	3	3
All-Red Time (sec)	3	3	3
Phase Time (sec)	31	42	47
Phase Split	26 %	35 %	39 %



LANE SUMMARY

Site: AM Peak - 2016 Base

Pennant St / Showground Rd AM Peak Existing
Signals - Fixed Time Cycle Time = 120 seconds (Practical Cycle Time)

Lane Use and Performance													
	Demand Flows			Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue	95% Back of Queue	Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	Total veh/h	HV %	Cap. veh/h	v/c	%	sec		Veh	Dist m		m	%	%
SouthEast: Showground Road													
Lane 1	230	4.0	1061	0.217	100	14.0	LOS A	6.6	48.0	Full	150	0.0	0.0
Lane 2	230	4.0	1061	0.217	100	14.0	LOS A	6.6	48.0	Full	150	0.0	0.0
Lane 3	512	0.0	623	0.821	100	54.5	LOS D	25.4	178.1	Full	100	0.0	58.3
Approach	972	1.9		0.821		35.3	LOS C	25.4	178.1				
NorthEast: Pennant Street													
Lane 1	243	1.0	1275	0.191	100	15.1	LOS B	4.9	34.8	Full	500	0.0	0.0
Lane 2	553	3.0	621	0.890	100	60.4	LOS E	35.8	256.7	Full	500	0.0	0.0
Lane 3	553	3.0	621	0.890	100	60.4	LOS E	35.8	256.7	Full	500	0.0	0.0
Approach	1349	2.6		0.890		52.2	LOS D	35.8	256.7				
NorthWest: Showground Road													
Lane 1	531	4.0	1806	0.294	100	7.6	LOS A	0.0	0.0	Short	60	0.0	0.0
Lane 2	295	3.0	304 ¹	0.971	100	84.6	LOS F	22.6	162.2	Full	500	0.0	0.0
Lane 3	387	3.0	398	0.971	100	83.7	LOS F	30.3	217.3	Full	500	0.0	0.0
Approach	1213	3.4		0.971		50.6	LOS D	30.3	217.3				
Intersection	3534	2.7		0.971		47.0	LOS D	35.8	256.7				

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

Lane LOS values are based on average delay per lane.

Intersection and Approach LOS values are based on average delay for all lanes.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

¹ Reduced capacity due to a short lane effect

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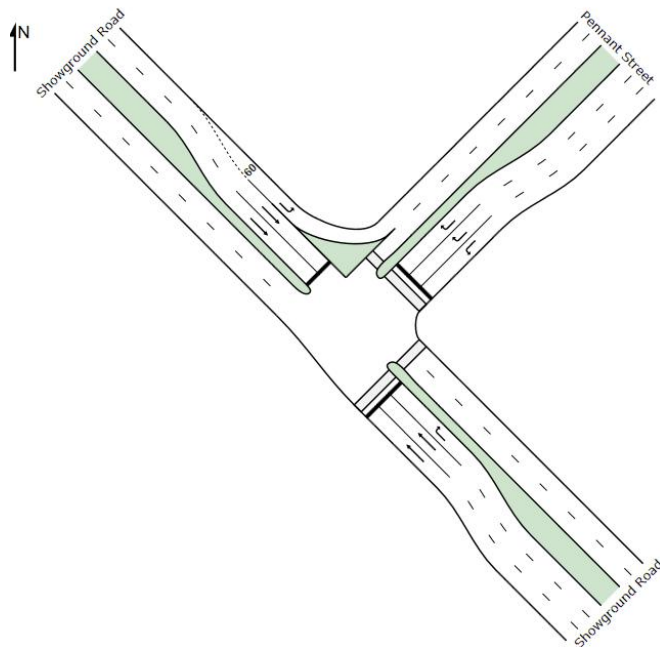
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**SIDRA
INTERSECTION 6**

Showground Road/Pennant Street – “Do Nothing”



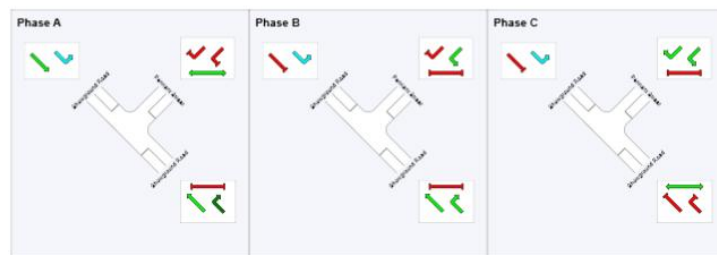
PHASING SUMMARY

Site: PM Peak - 2016 Base

Pennant St / Showground Rd PM Peak Existing
Signals - Fixed Time Cycle Time = 120 seconds (User-Given Cycle Time)

Phase times determined by the program
Sequence: Split Phasing
Movement Class: All Movement Classes
Input Sequence: A, B, C
Output Sequence: A, B, C

Phase Timing Results			
Phase	A	B	C
Green Time (sec)	23	45	34
Yellow Time (sec)	3	3	3
All-Red Time (sec)	3	3	3
Phase Time (sec)	29	51	40
Phase Split	24 %	43 %	33 %



LANE SUMMARY

Site: PM Peak - 2016 Base

Pennant St / Showground Rd PM Peak Existing
Signals - Fixed Time Cycle Time = 120 seconds (User-Given Cycle Time)

Lane Use and Performance													
	Demand Flows												
	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Queue Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
SouthEast: Showground Road													
Lane 1	324	1.0	1195	0.271	100	11.1	LOS A	8.5	60.4	Full	150	0.0	0.0
Lane 2	324	1.0	1195	0.271	100	11.1	LOS A	8.5	60.4	Full	150	0.0	0.0
Lane 3	645	0.0	773	0.834	100	48.0	LOS D	31.5	220.7	Full	100	0.0	78.9
Approach	1294	0.5		0.834		29.5	LOS C	31.5	220.7				
NorthEast: Pennant Street													
Lane 1	357	0.0	1315	0.271	100	14.8	LOS B	7.4	51.6	Full	500	0.0	0.0
Lane 2	472	1.0	522	0.904	100	67.3	LOS E	31.7	224.0	Full	500	0.0	0.0
Lane 3	472	1.0	522	0.904	100	67.3	LOS E	31.7	224.0	Full	500	0.0	0.0
Approach	1301	0.7		0.904		52.9	LOS D	31.7	224.0				
NorthWest: Showground Road													
Lane 1	859	0.0	1857	0.463	100	7.6	LOS A	0.0	0.0	Short	60	0.0	0.0
Lane 2	264	2.0	282	0.936	100	72.9	LOS F	18.6	132.2	Full	500	0.0	0.0
Lane 3	345	2.0	369	0.936	100	72.4	LOS F	24.8	176.4	Full	500	0.0	0.0
Approach	1468	0.8		0.936		34.6	LOS C	24.8	176.4				
Intersection	4063	0.7		0.936		38.9	LOS C	31.7	224.0				

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

Lane LOS values are based on average delay per lane.

Intersection and Approach LOS values are based on average delay for all lanes.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

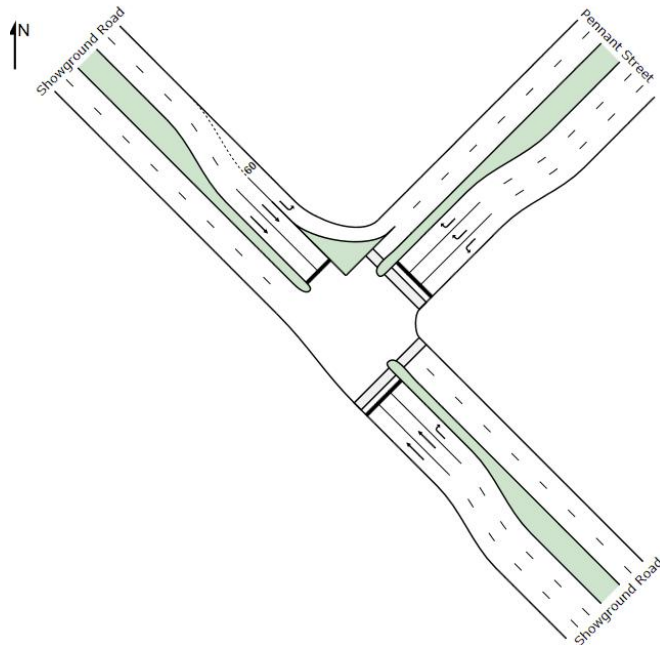
1 Reduced capacity due to a short lane effect

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SIDRA
INTERSECTION 6

Showground Road/Pennant Street – “Do Nothing”



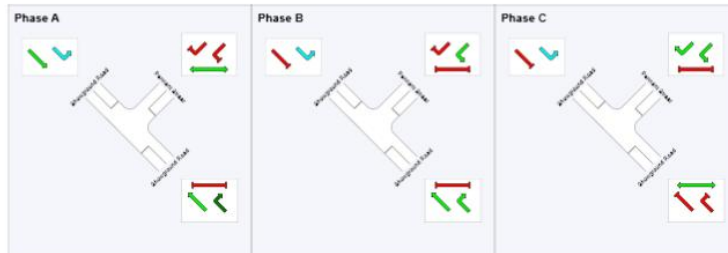
PHASING SUMMARY

Site: Saturday Peak - 2016 Base

Pennant St / Showground Rd SAT Peak Existing
Signals - Fixed Time Cycle Time = 120 seconds (User-Given Cycle Time)

Phase times determined by the program
Sequence: Split Phasing
Movement Class: All Movement Classes
Input Sequence: A, B, C
Output Sequence: A, B, C

Phase Timing Results			
Phase	A	B	C
Green Time (sec)	25	39	38
Yellow Time (sec)	3	3	3
All-Red Time (sec)	3	3	3
Phase Time (sec)	31	45	44
Phase Split	26 %	38 %	37 %



LANE SUMMARY

Site: Saturday Peak - 2016 Base

Pennant St / Showground Rd SAT Peak Existing
Signals - Fixed Time Cycle Time = 120 seconds (User-Given Cycle Time)

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	95% Back of Queue Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
SouthEast: Showground Road													
Lane 1	342	1.0	1130	0.302	100	13.3	LOS A	9.9	70.0	Full	150	0.0	0.0
Lane 2	342	1.0	1130	0.302	100	13.3	LOS A	9.9	70.0	Full	150	0.0	0.0
Lane 3	637	1.0	665	0.958	100	80.7	LOS F	44.7	315.9	Full	100	0.0	100.0
Approach	1320	1.0		0.958		45.8	LOS D	44.7	315.9				
NorthEast: Pennant Street													
Lane 1	533	1.0	1275	0.418	100	16.6	LOS B	13.2	93.5	Full	500	0.0	0.0
Lane 2	538	1.0	584	0.921	100	69.0	LOS E	37.4	264.1	Full	500	0.0	0.0
Lane 3	538	1.0	584	0.921	100	69.0	LOS E	37.4	264.1	Full	500	0.0	0.0
Approach	1608	1.0		0.921		51.7	LOS D	37.4	264.1				
NorthWest: Showground Road													
Lane 1	882	0.0	1857	0.475	100	7.6	LOS A	0.0	0.0	Short	60	0.0	0.0
Lane 2	327	1.0	404	0.810	100	53.5	LOS D	19.6	138.2	Full	500	0.0	0.0
Lane 3	327	1.0	404	0.810	100	53.5	LOS D	19.6	138.2	Full	500	0.0	0.0
Approach	1536	0.4		0.810		27.1	LOS B	19.6	138.2				
Intersection	4464	0.8		0.958		41.5	LOS C	44.7	315.9				

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

Lane LOS values are based on average delay per lane.

Intersection and Approach LOS values are based on average delay for all lanes.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akcelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Processed: Friday, 4 October 2013 9:36:06 AM

SIDRA INTERSECTION 8.0.14.4193

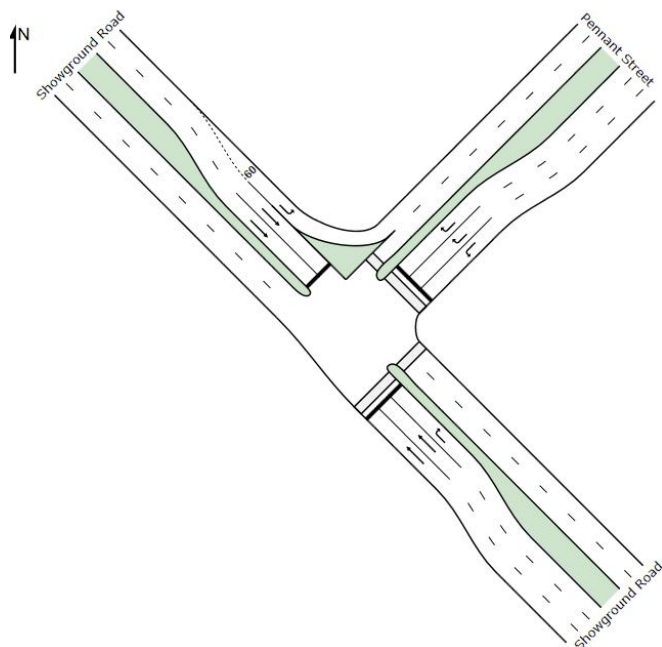
Project: G:\21\22830\Technical\Traffic\Technical\SIDRA\Existing Layout\7 Pennant St_Showground Rd.sip8
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**SIDRA
INTERSECTION 6**

Showground Road/Pennant Street – “Do Nothing”



PHASING SUMMARY

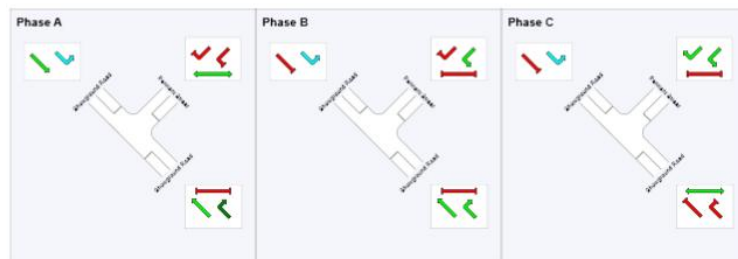
Site: AM Peak - 2026 Base

Pennant St / Showground Rd AM Peak Existing
Signals - Fixed Time Cycle Time = 150 seconds (Practical Cycle Time)

Phase times determined by the program
Sequence: Split Phasing
Movement Class: All Movement Classes
Input Sequence: A, B, C
Output Sequence: A, B, C

Phase Timing Results

Phase	A	B	C
Green Time (sec)	38	48	46
Yellow Time (sec)	3	3	3
All-Red Time (sec)	3	3	3
Phase Time (sec)	44	54	52
Phase Split	29 %	36 %	35 %



LANE SUMMARY

Site: AM Peak - 2026 Base

Pennant St / Showground Rd AM Peak Existing
Signals - Fixed Time Cycle Time = 150 seconds (Practical Cycle Time)

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	95% Back of Queue Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
SouthEast: Showground Road													
Lane 1	307	4.0	1166	0.263	100	14.0	LOS A	10.1	73.0	Full	150	0.0	0.0
Lane 2	307	4.0	1166	0.263	100	14.0	LOS A	10.1	73.0	Full	150	0.0	0.0
Lane 3	657	0.0	647	1.015	100	74.9	LOS F	55.5	388.4	Full	100	0.0	100.0
Approach	1271	1.9		1.015		45.5	LOS D	55.5	388.4				
NorthEast: Pennant Street													
Lane 1	264	1.0	1229	0.215	100	18.4	LOS B	7.3	51.6	Full	500	0.0	0.0
Lane 2	556	3.0	558	0.998	100	113.4	LOS F	56.5	405.7	Full	500	0.0	0.0
Lane 3	556	3.0	558	0.998	100	113.4	LOS F	56.5	405.7	Full	500	0.0	0.0
Approach	1377	2.6		0.998		95.2	LOS F	56.5	405.7				
NorthWest: Showground Road													
Lane 1	562	4.0	1806	0.311	100	7.6	LOS A	0.0	0.0	Short	60	0.0	0.0
Lane 2	291	3.0	302 ¹	0.962	100	92.1	LOS F	25.5	183.2	Full	500	0.0	0.0
Lane 3	466	3.0	485	0.962	100	90.3	LOS F	42.8	307.3	Full	500	0.0	0.0
Approach	1319	3.4		0.962		55.4	LOS D	42.8	307.3				
Intersection	3966	2.7		1.015		66.0	LOS E	56.5	405.7				

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

Lane LOS values are based on average delay per lane.

Intersection and Approach LOS values are based on average delay for all lanes.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

1 Reduced capacity due to a short lane effect

Processed: Friday, 4 October 2013 9:37:31 AM

SIDRA INTERSECTION 6.0.14.4193

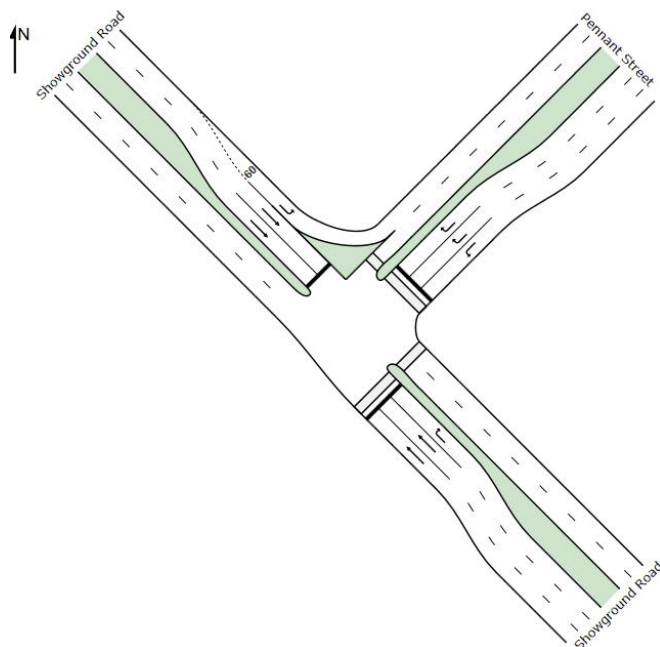
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**SIDRA
INTERSECTION 6**

Showground Road/Pennant Street – “Do Nothing”



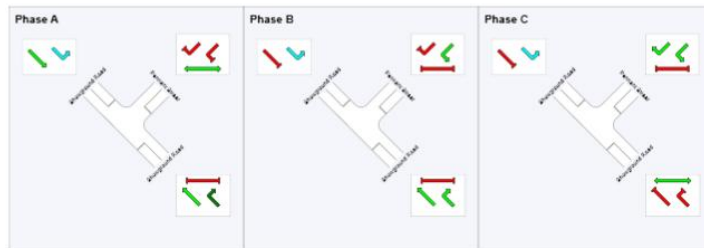
PHASING SUMMARY

Site: PM Peak - 2026 Base

Pennant St / Showground Rd PM Peak Existing
Signals - Fixed Time Cycle Time = 150 seconds (Practical Cycle Time)

Phase times determined by the program
Sequence: Split Phasing
Movement Class: All Movement Classes
Input Sequence: A, B, C
Output Sequence: A, B, C

Phase Timing Results			
Phase	A	B	C
Green Time (sec)	32	61	39
Yellow Time (sec)	3	3	3
All-Red Time (sec)	3	3	3
Phase Time (sec)	38	67	45
Phase Split	25 %	45 %	30 %



LANE SUMMARY

Site: PM Peak - 2026 Base

Pennant St / Showground Rd PM Peak Existing
Signals - Fixed Time Cycle Time = 150 seconds (Practical Cycle Time)

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	95% Back of Queue Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
SouthEast: Showground Road													
Lane 1	403	1.0	1279	0.315	100	11.5	LOS A	12.3	87.0	Full	150	0.0	0.0
Lane 2	403	1.0	1279	0.315	100	11.5	LOS A	12.3	87.0	Full	150	0.0	0.0
Lane 3	831	0.0	808	1.028	100	82.6	LOS F	67.9	475.4	Full	100	0.0	100.0
Approach	1637	0.5		1.028		47.5	LOS D	67.9	475.4				
NorthEast: Pennant Street													
Lane 1	377	0.0	1312	0.287	100	16.7	LOS B	9.9	69.1	Full	500	0.0	0.0
Lane 2	510	1.0	479	1.064	100	160.5	LOS F	60.4	426.2	Full	500	0.0	0.0
Lane 3	510	1.0	479	1.064	100	160.5	LOS F	60.4	426.2	Full	500	0.0	0.0
Approach	1397	0.7		1.064		121.7	LOS F	60.4	426.2				
NorthWest: Showground Road													
Lane 1	917	0.0	1857	0.494	100	7.6	LOS A	0.0	0.0	Short	60	0.0	0.0
Lane 2	256	2.0	246 ¹	1.039	100	186.8	LOS F	29.0	206.4	Full	500	0.0	0.0
Lane 3	427	2.0	411	1.039	100	136.0	LOS F	47.0	334.8	Full	500	0.0	0.0
Approach	1599	0.9		1.039		70.5	LOS F	47.0	334.8				
Intersection	4633	0.7		1.064		77.8	LOS F	67.9	475.4				

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

Lane LOS values are based on average delay per lane.

Intersection and Approach LOS values are based on average delay for all lanes.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akcelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

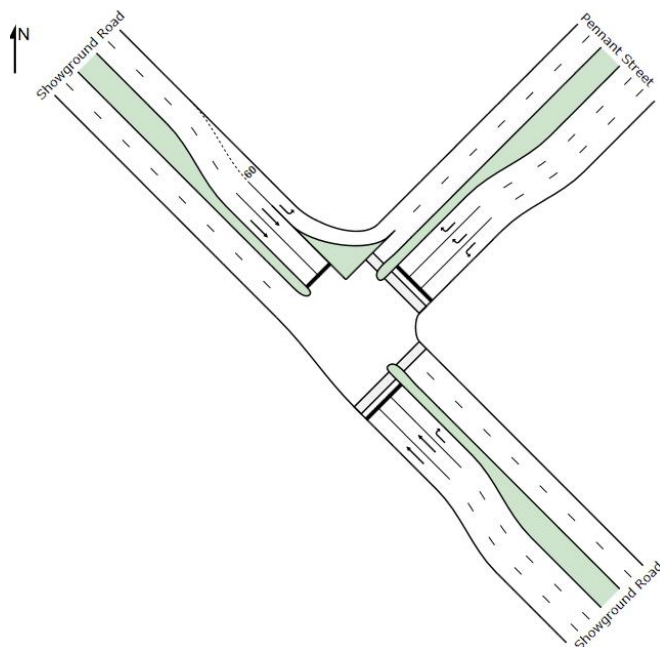
1 Reduced capacity due to a short lane effect

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**SIDRA
INTERSECTION 8**

Showground Road/Pennant Street – “Do Nothing”



PHASING SUMMARY

Site: Saturday Peak - 2026 Base

Pennant St / Showground Rd SAT Peak Existing
Signals - Fixed Time Cycle Time = 150 seconds (Practical Cycle Time)

Phase times determined by the program
Sequence: Split Phasing
Movement Class: All Movement Classes
Input Sequence: A, B, C
Output Sequence: A, B, C

Phase Timing Results

Phase	A	B	C
Green Time (sec)	32	58	42
Yellow Time (sec)	3	3	3
All-Red Time (sec)	3	3	3
Phase Time (sec)	38	64	48
Phase Split	25 %	43 %	32 %



LANE SUMMARY

Site: Saturday Peak - 2026 Base

Pennant St / Showground Rd SAT Peak Existing
Signals - Fixed Time Cycle Time = 150 seconds (Practical Cycle Time)

Lane Use and Performance													
	Demand Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	95% Back of Queue Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
SouthEast: Showground Road													
Lane 1	431	1.0	1240	0.348	100	13.1	LOS A	14.2	100.4	Full	150	0.0	0.0
Lane 2	431	1.0	1240	0.348	100	13.1	LOS A	14.2	100.4	Full	150	0.0	0.0
Lane 3	821	1.0	766	1.072	100	116.1	LOS F	78.8	556.6	Full	100	0.0	100.0
Approach	1683	1.0		1.072		63.4	LOS E	78.8	556.6				
NorthEast: Pennant Street													
Lane 1	556	1.0	1303	0.427	100	17.9	LOS B	16.6	117.4	Full	500	0.0	0.0
Lane 2	574	1.0	516	1.111	100	196.7	LOS F	75.7	534.2	Full	500	0.0	11.0
Lane 3	574	1.0	516	1.111	100	196.7	LOS F	75.7	534.2	Full	500	0.0	11.0
Approach	1703	1.0		1.111		138.4	LOS F	75.7	534.2				
NorthWest: Showground Road													
Lane 1	949	0.0	1857	0.511	100	7.7	LOS A	0.0	0.0	Short	60	0.0	0.0
Lane 2	271	1.0	249	1.091	100	224.4	LOS F	34.5	243.5	Full	500	0.0	0.0
Lane 3	451	1.0	413	1.091	100	175.0	LOS F	56.2	396.5	Full	500	0.0	0.0
Approach	1672	0.4		1.091		88.0	LOS F	56.2	396.5				
Intersection	5058	0.8		1.111		96.7	LOS F	78.8	556.6				

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

Lane LOS values are based on average delay per lane.

Intersection and Approach LOS values are based on average delay for all lanes.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akcelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

1 Reduced capacity due to a short lane effect

Processed: Friday, 4 October 2013 9:41:35 AM

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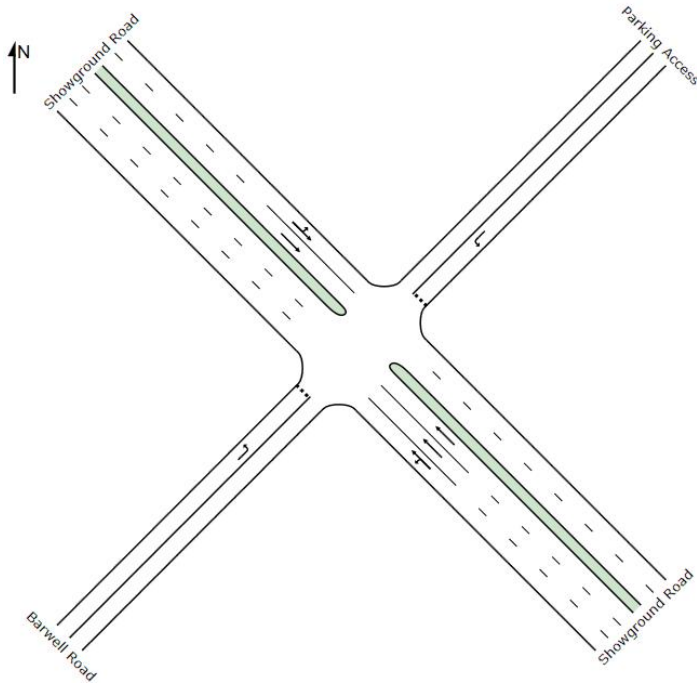
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**SIDRA
INTERSECTION 6**

Showground Road/Barwell Avenue – 2013 Existing



LANE SUMMARY

▽ Site: AM Peak Existing

Barwell Ave / Showground Rd AM Peak Existing
Giveaway / Yield (Two-Way)

Lane Use and Performance													
	Demand Flows												
	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back Veh	Queue Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
SouthEast: Showground Road													
Lane 1	148	0.0	1933	0.076	100	1.5	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	149	0.0	1950	0.076	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 3	149	0.0	1950	0.076	100	0.0	LOS A	0.0	0.0	Full	100	0.0	0.0
Approach	445	0.0		0.076		0.5	NA	0.0	0.0				
NorthEast: Parking Access													
Lane 1	2	0.0	1325	0.002	100	8.9	LOS A	0.0	0.0	Full	100	0.0	0.0
Approach	2	0.0		0.002		8.9	LOS A	0.0	0.0				
NorthWest: Showground Road													
Lane 1	251	0.0	1946	0.129	100	0.4	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	251	0.0	1950	0.129	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	502	0.0		0.129		0.2	NA	0.0	0.0				
SouthWest: Barwell Road													
Lane 1	149	0.0	1478	0.101	100	8.6	LOS A	0.4	3.0	Full	500	0.0	0.0
Approach	149	0.0		0.101		8.6	LOS A	0.4	3.0				
Intersection	1099	0.0		0.129		1.5	NA	0.4	3.0				

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

Lane LOS values are based on average delay per lane.

Minor Road Approach LOS values are based on average delay for all lanes.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akcelik M3D).

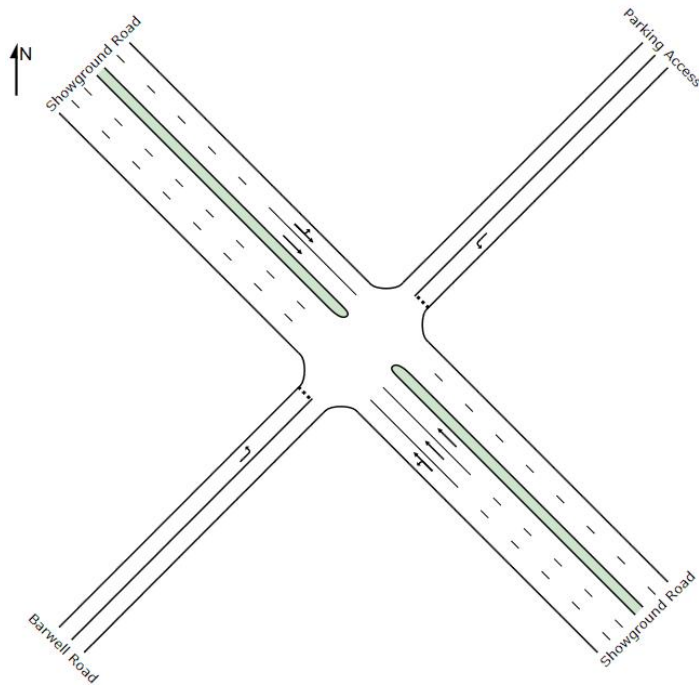
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Processed: Wednesday, 2 October 2013 4:00:10 PM
SIDRA INTERSECTION 6.0.14.4193
Project: G:\21\22830\Technical\Traffic\Technical\SIDRA\Existing Layout\8 Barwell Ave_Showground Rd.sip6
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SIDRA
INTERSECTION 6

Showground Road/Barwell Avenue – 2013 Existing



LANE SUMMARY

▽ Site: PM Peak Existing

Barwell Ave / Showground Rd PM Peak Existing
Giveaway / Yield (Two-Way)

Lane Use and Performance

	Demand	Flows		Deg.	Lane	Average	Level of	95% Back of Queue		Lane	Lane	Cap.	Prob.
	Total	HV	Cap.	Satn	Util.	Delay	Service	Veh	Dist	Config	Length	Adj.	Block.
	veh/h	%	veh/h	v/c	%	sec			m		m	%	%
SouthEast: Showground Road													
Lane 1	244	0.0	1944	0.125	100	0.5	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	244	0.0	1950	0.125	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 3	244	0.0	1950	0.125	100	0.0	LOS A	0.0	0.0	Full	100	0.0	0.0
Approach	733	0.0		0.125		0.2	NA	0.0	0.0				
NorthEast: Parking Access													
Lane 1	25	0.0	1372	0.018	100	8.8	LOS A	0.1	0.5	Full	100	0.0	0.0
Approach	25	0.0		0.018		8.8	LOS A	0.1	0.5				
NorthWest: Showground Road													
Lane 1	229	0.0	1939	0.118	100	0.9	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	230	0.0	1950	0.118	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	459	0.0		0.118		0.5	NA	0.0	0.0				
SouthWest: Barwell Road													
Lane 1	151	0.0	1339	0.112	100	9.0	LOS A	0.5	3.3	Full	500	0.0	0.0
Approach	151	0.0		0.112		9.0	LOS A	0.5	3.3				
Intersection	1367	0.0		0.125		1.4	NA	0.5	3.3				

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

Lane LOS values are based on average delay per lane.

Minor Road Approach LOS values are based on average delay for all lanes.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Processed: Wednesday, 2 October 2013 4:00:52 PM

SIDRA INTERSECTION 8.0.14.4193

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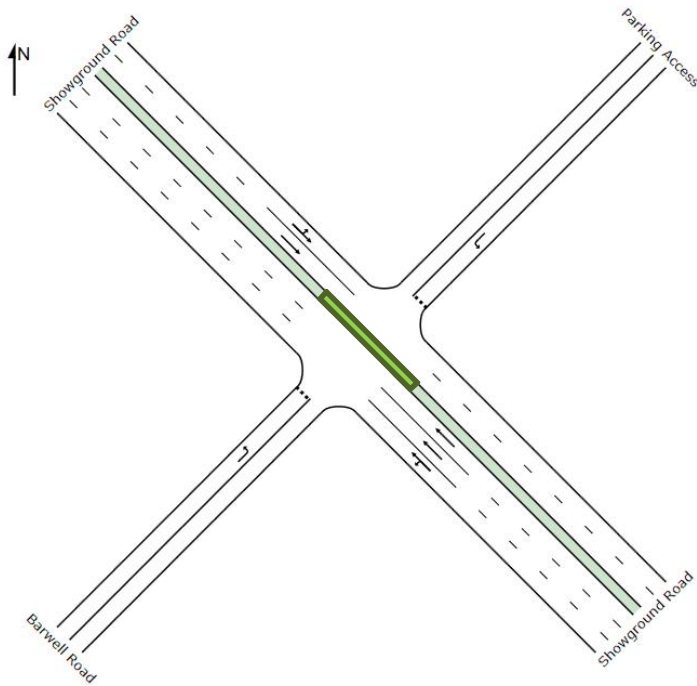
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SIDRA
INTERSECTION 6

Showground Road/Barwell Avenue – 2013 Existing



LANE SUMMARY

▽ Site: Saturday Peak Existing

Barwell Ave / Showground Rd SAT Peak Existing
Giveaway / Yield (Two-Way)

Lane Use and Performance													
	Demand Flows												
	Total	HV	Cap.	Deg.	Lane	Average	Level	95% Back of Queue		Lane	Lane	Cap.	Prob.
	veh/h	%	veh/h	Satn	Util.	Delay	of Service	Veh	Dist	Config	Length	Adj.	Block.
				v/c	%	sec			m		m	%	%
SouthEast: Showground Road													
Lane 1	227	0.0	1938	0.117	100	1.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	228	0.0	1950	0.117	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 3	228	0.0	1950	0.117	100	0.0	LOS A	0.0	0.0	Full	100	0.0	0.0
Approach	683	0.0		0.117		0.4	NA	0.0	0.0				
NorthEast: Parking Access													
Lane 1	20	0.0	1225	0.016	100	9.2	LOS A	0.1	0.4	Full	100	0.0	0.0
Approach	20	0.0		0.016		9.2	LOS A	0.1	0.4				
NorthWest: Showground Road													
Lane 1	357	0.0	1940	0.184	100	0.9	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	359	0.0	1950	0.184	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	717	0.0		0.184		0.5	NA	0.0	0.0				
SouthWest: Barwell Road													
Lane 1	197	0.0	1378	0.143	100	8.9	LOS A	0.6	4.3	Full	500	0.0	0.0
Approach	197	0.0		0.143		8.9	LOS A	0.6	4.3				
Intersection	1617	0.0		0.184		1.5	NA	0.6	4.3				

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

Lane LOS values are based on average delay per lane.

Minor Road Approach LOS values are based on average delay for all lanes.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

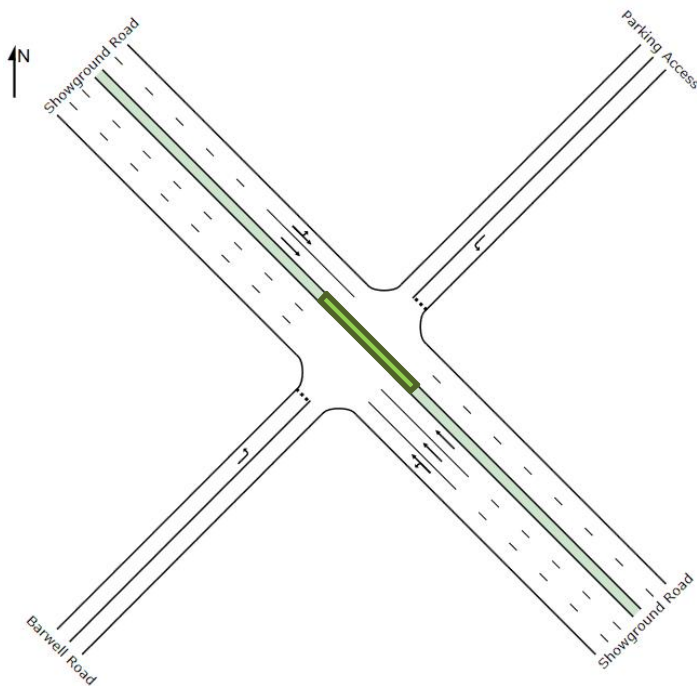
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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SIDRA
INTERSECTION 6

Showground Road/Barwell Avenue – “Do Nothing”



LANE SUMMARY

Site: AM Peak - 2016 Base

Barwell Ave / Showground Rd AM Peak Existing
Giveaway / Yield (Two-Way)

Lane Use and Performance													
	Demand Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	95% Back of Queue Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
SouthEast: Showground Road													
Lane 1	263	0.0	1939	0.136	100	1.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	264	0.0	1950	0.136	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 3	264	0.0	1950	0.136	100	0.0	LOS A	0.0	0.0	Full	100	0.0	0.0
Approach	792	0.0		0.136		0.3	NA	0.0	0.0				
NorthEast: Parking Access													
Lane 1	1	0.0	1051	0.001	100	9.7	LOS A	0.0	0.0	Full	100	0.0	0.0
Approach	1	0.0		0.001		9.7	LOS A	0.0	0.0				
NorthWest: Showground Road													
Lane 1	462	0.0	1950	0.237	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	462	0.0	1950	0.237	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	924	0.0		0.237		0.0	NA	0.0	0.0				
SouthWest: Barwell Road													
Lane 1	209	0.0	1335	0.157	100	9.0	LOS A	0.7	4.7	Full	500	0.0	0.0
Approach	209	0.0		0.157		9.0	LOS A	0.7	4.7				
Intersection	1926	0.0		0.237		1.1	NA	0.7	4.7				

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

Lane LOS values are based on average delay per lane.

Minor Road Approach LOS values are based on average delay for all lanes.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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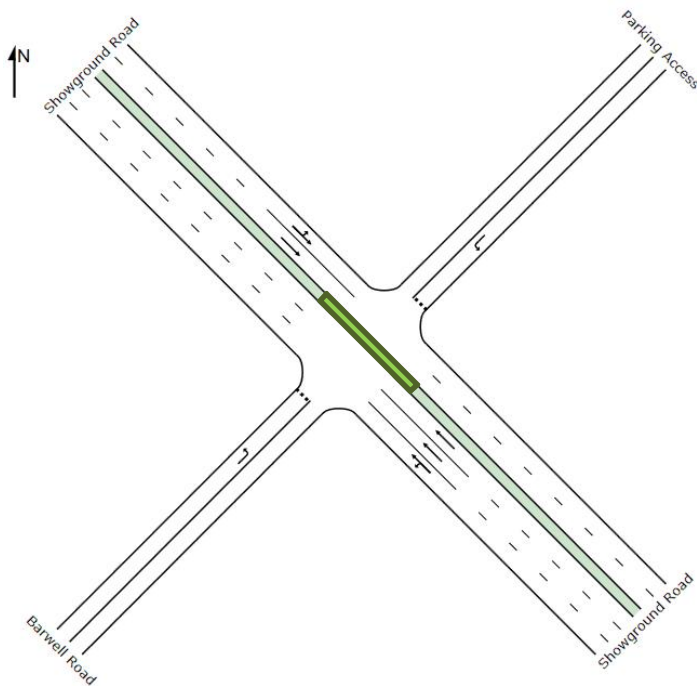
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**SIDRA
INTERSECTION 6**

Showground Road/Barwell Avenue – “Do Nothing”



LANE SUMMARY

Site: PM Peak - 2016 Base

Barwell Ave / Showground Rd PM Peak Existing
Giveaway / Yield (Two-Way)

Lane Use and Performance													
	Demand Flows												
	Total	HV	Cap.	Deg.	Lane	Average	Level of	95% Back of Queue		Lane	Lane	Cap.	Prob.
	veh/h	%	veh/h	Satn	Util.	Delay	Service	Veh	Dist	Config	Length	Adj.	Block.
				v/c	%	sec			m		m	%	%
SouthEast: Showground Road													
Lane 1	367	0.0	1946	0.189	100	0.4	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	368	0.0	1950	0.189	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 3	368	0.0	1950	0.189	100	0.0	LOS A	0.0	0.0	Full	100	0.0	0.0
Approach	1103	0.0		0.189		0.1	NA	0.0	0.0				
NorthEast: Parking Access													
Lane 1	1	0.0	1025	0.001	100	9.8	LOS A	0.0	0.0	Full	100	0.0	0.0
Approach	1	0.0		0.001		9.8	LOS A	0.0	0.0				
NorthWest: Showground Road													
Lane 1	484	0.0	1950	0.248	100	0.1	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	484	0.0	1950	0.248	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	967	0.0		0.248		0.0	NA	0.0	0.0				
SouthWest: Barwell Road													
Lane 1	206	0.0	1185	0.174	100	9.6	LOS A	0.7	5.2	Full	500	0.0	0.0
Approach	206	0.0		0.174		9.6	LOS A	0.7	5.2				
Intersection	2278	0.0		0.248		1.0	NA	0.7	5.2				

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

Lane LOS values are based on average delay per lane.

Minor Road Approach LOS values are based on average delay for all lanes.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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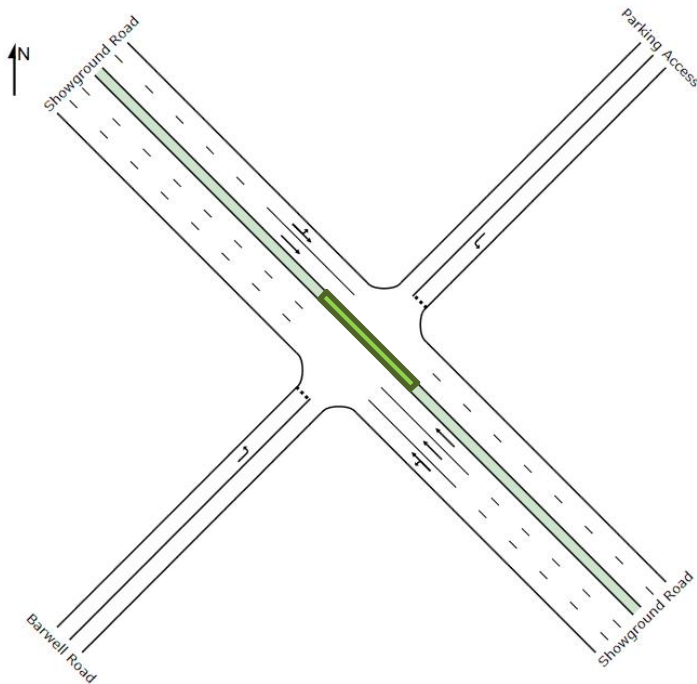
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SIDRA
INTERSECTION 6

Showground Road/Barwell Avenue – “Do Nothing”



LANE SUMMARY

▽ Site: Saturday Peak - 2016 Base

Barwell Ave / Showground Rd SAT Peak Existing
Giveaway / Yield (Two-Way)

Lane Use and Performance													
	Demand Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
SouthEast: Showground Road													
Lane 1	364	0.0	1942	0.188	100	0.7	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	366	0.0	1950	0.188	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 3	366	0.0	1950	0.188	100	0.0	LOS A	0.0	0.0	Full	100	0.0	0.0
Approach	1096	0.0		0.188		0.2	NA	0.0	0.0				
NorthEast: Parking Access													
Lane 1	1	0.0	894	0.001	100	10.4	LOS A	0.0	0.0	Full	100	0.0	0.0
Approach	1	0.0		0.001		10.4	LOS A	0.0	0.0				
NorthWest: Showground Road													
Lane 1	595	0.0	1950	0.305	100	0.1	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	595	0.0	1950	0.305	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	1191	0.0		0.305		0.1	NA	0.0	0.0				
SouthWest: Barwell Road													
Lane 1	254	0.0	1206	0.210	100	9.5	LOS A	0.9	6.4	Full	500	0.0	0.0
Approach	254	0.0		0.210		9.5	LOS A	0.9	6.4				
Intersection	2541	0.0		0.305		1.1	NA	0.9	6.4				

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

Lane LOS values are based on average delay per lane.

Minor Road Approach LOS values are based on average delay for all lanes.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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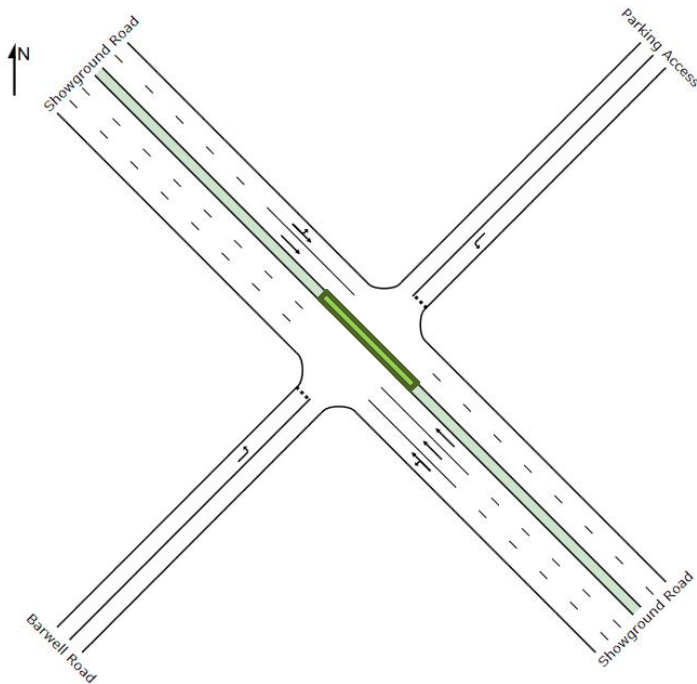
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**SIDRA
INTERSECTION 6**

Showground Road/Barwell Avenue – “Do Nothing”



LANE SUMMARY

▽ Site: AM Peak - 2026 Base

Barwell Ave / Showground Rd AM Peak Existing
Giveaway / Yield (Two-Way)

Lane Use and Performance													
	Demand Flows												
	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
SouthEast: Showground Road													
Lane 1	368	0.0	1938	0.190	100	1.1	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	370	0.0	1950	0.190	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 3	370	0.0	1950	0.190	100	0.0	LOS A	0.0	0.0	Full	100	0.0	0.0
Approach	1108	0.0		0.190		0.4	NA	0.0	0.0				
NorthEast: Parking Access													
Lane 1	1	0.0	994	0.001	100	10.0	LOS A	0.0	0.0	Full	100	0.0	0.0
Approach	1	0.0		0.001		10.0	LOS A	0.0	0.0				
NorthWest: Showground Road													
Lane 1	510	0.0	1950	0.262	100	0.1	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	510	0.0	1950	0.262	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	1020	0.0		0.262		0.0	NA	0.0	0.0				
SouthWest: Barwell Road													
Lane 1	209	0.0	1224	0.171	100	9.4	LOS A	0.7	5.1	Full	500	0.0	0.0
Approach	209	0.0		0.171		9.4	LOS A	0.7	5.1				
Intersection	2339	0.0		0.262		1.0	NA	0.7	5.1				

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

Lane LOS values are based on average delay per lane.

Minor Road Approach LOS values are based on average delay for all lanes.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akcelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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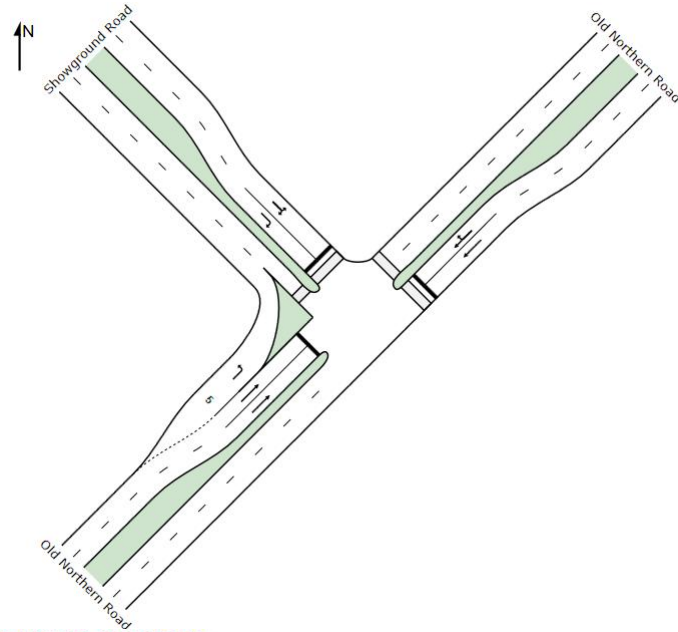
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**SIDRA
INTERSECTION 6**

Showground Road/Old Northern Road – 2013 Existing



PHASING SUMMARY

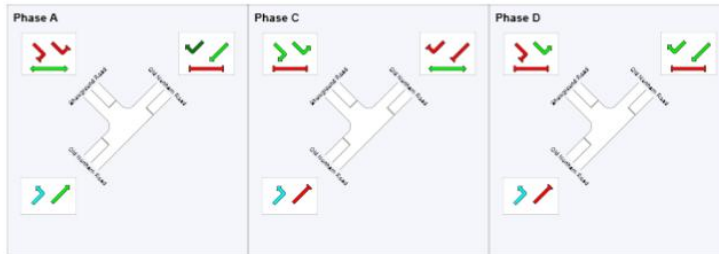
Site: AM Peak Existing

Old Northern Road / Showground Road AM Peak Existing
Signals - Fixed Time Cycle Time = 60 seconds (User-Given Cycle Time)

Phase times determined by the program
Sequence: Split Phasing (phase reduction applied)
Movement Class: All Movement Classes
Input Sequence: A, B, C, D
Output Sequence: A, C, D

Phase Timing Results

Phase	A	C	D
Green Time (sec)	19	17	6
Yellow Time (sec)	3	3	3
All-Red Time (sec)	3	3	3
Phase Time (sec)	25	23	12
Phase Split	42 %	38 %	20 %



LANE SUMMARY

Site: AM Peak Existing

Old Northern Road / Showground Road AM Peak Existing
Signals - Fixed Time Cycle Time = 60 seconds (User-Given Cycle Time)

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	95% Back of Queue Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
NorthEast: Old Northern Road													
Lane 1	51	2.0	1005	0.050	56 ⁵	7.7	LOS A	0.7	5.2	Full	500	0.0	0.0
Lane 2	43	0.0	480	0.090	100	17.9	LOS B	0.7	4.7	Full	500	0.0	0.0
Approach	94	1.1		0.090		12.4	LOS A	0.7	5.2				
NorthWest: Showground Road													
Lane 1	254	2.5	553	0.459	100	26.9	LOS B	6.2	44.4	Full	500	0.0	0.0
Lane 2	240	1.0	522	0.459	100	27.6	LOS B	6.0	42.1	Full	500	0.0	0.0
Approach	494	1.8		0.459		27.2	LOS B	6.2	44.4				
SouthWest: Old Northern Road													
Lane 1	402	3.0	1979	0.203	100	7.6	LOS A	0.0	0.0	Short	5	0.0	0.0
Lane 2	92	2.0	219 ¹	0.417	100	16.1	LOS B	2.0	13.9	Full	500	0.0	0.0
Lane 3	251	2.0	600	0.417	100	17.8	LOS B	5.9	42.2	Full	500	0.0	0.0
Approach	744	2.5		0.417		12.1	LOS A	5.9	42.2				
Intersection	1332	2.1		0.459		17.7	LOS B	6.2	44.4				

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

Lane LOS values are based on average delay per lane.

Intersection and Approach LOS values are based on average delay for all lanes.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

1 Reduced capacity due to a short lane effect

5 Lane underutilisation determined by program

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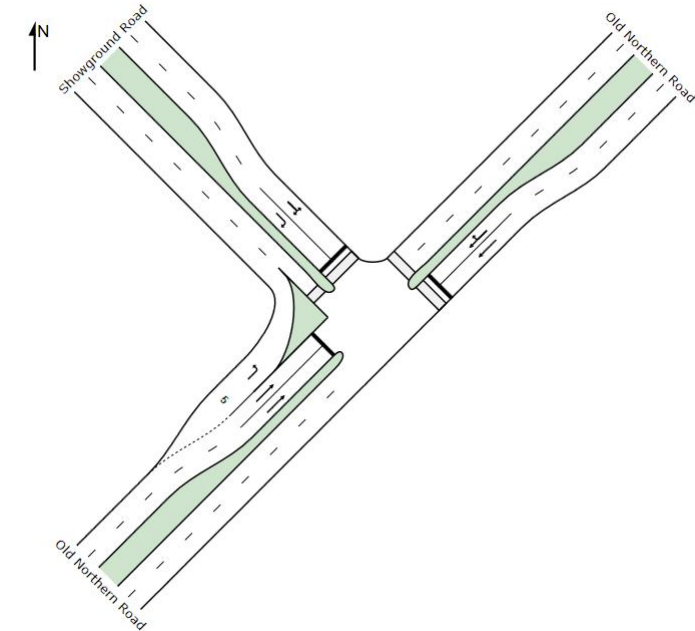
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**SIDRA
INTERSECTION 6**

Showground Road/Old Northern Road – 2013 Existing



PHASING SUMMARY

Site: PM Peak Existing

Old Northern Road / Showground Road AM Peak Existing
Signals - Fixed Time Cycle Time = 90 seconds (User-Given Cycle Time)

Phase times determined by the program
Sequence: Split Phasing (phase reduction applied)
Movement Class: All Movement Classes
Input Sequence: A, B, C, D
Output Sequence: A, C, D

Phase Timing Results			
Phase	A	C	D
Green Time (sec)	33	33	6
Yellow Time (sec)	3	3	3
All-Red Time (sec)	3	3	3
Phase Time (sec)	39	39	12
Phase Split	43 %	43 %	13 %



LANE SUMMARY

Site: PM Peak Existing

Old Northern Road / Showground Road AM Peak Existing
Signals - Fixed Time Cycle Time = 90 seconds (User-Given Cycle Time)

Lane Use and Performance													
	Demand Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	95% Back of Queue Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
NorthEast: Old Northern Road													
Lane 1	53	2.0	972	0.054	51 ⁵	12.2	LOS A	1.2	8.3	Full	500	0.0	0.0
Lane 2	49	0.0	471	0.105	100	22.6	LOS B	1.2	8.4	Full	500	0.0	0.0
Approach	102	1.0		0.105		17.3	LOS B	1.2	8.4				
NorthWest: Showground Road													
Lane 1	236	1.6	715	0.330	100	29.4	LOS C	7.4	52.3	Full	500	0.0	0.0
Lane 2	223	1.0	676	0.330	100	30.1	LOS C	7.1	49.9	Full	500	0.0	0.0
Approach	459	1.3		0.330		29.8	LOS C	7.4	52.3				
SouthWest: Old Northern Road													
Lane 1	683	0.0	2021	0.338	100	7.6	LOS A	0.0	0.0	Short	5	0.0	0.0
Lane 2	47	0.0	126 ¹	0.377	100	19.7	LOS B	1.3	9.4	Full	500	0.0	0.0
Lane 3	265	0.0	704	0.377	100	22.6	LOS B	8.6	60.0	Full	500	0.0	0.0
Approach	996	0.0		0.377		12.2	LOS A	8.6	60.0				
Intersection	1557	0.4		0.377		17.7	LOS B	8.6	60.0				

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

Lane LOS values are based on average delay per lane.

Intersection and Approach LOS values are based on average delay for all lanes.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

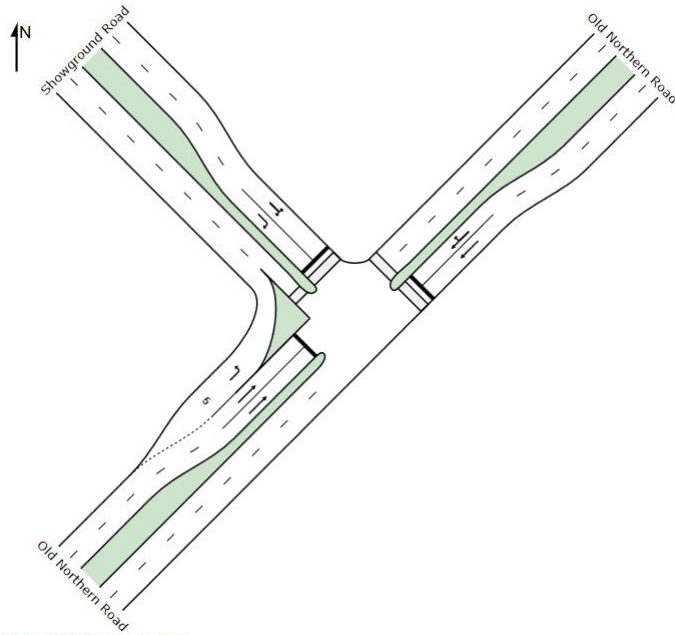
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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

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**SIDRA
INTERSECTION 6**

Showground Road/Old Northern Road – 2013 Existing



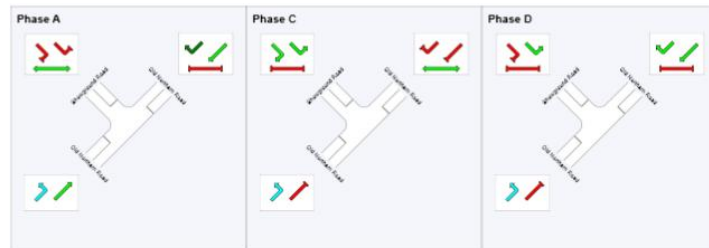
PHASING SUMMARY

Site: Saturday Peak Existing

Old Northern Road / Showground Road SAT Peak Existing
Signals - Fixed Time Cycle Time = 110 seconds (User-Given Cycle Time)

Phase times determined by the program
Sequence: Split Phasing (phase reduction applied)
Movement Class: All Movement Classes
Input Sequence: A, B, C, D
Output Sequence: A, C, D

Phase Timing Results			
Phase	A	C	D
Green Time (sec)	36	50	6
Yellow Time (sec)	3	3	3
All-Red Time (sec)	3	3	3
Phase Time (sec)	42	56	12
Phase Split	38 %	51 %	11 %



LANE SUMMARY

Site: Saturday Peak Existing

Old Northern Road / Showground Road SAT Peak Existing
Signals - Fixed Time Cycle Time = 110 seconds (User-Given Cycle Time)

Lane Use and Performance													
	Demand Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
NorthEast: Old Northern Road													
Lane 1	53	2.0	849	0.062	52 ⁵	18.9	LOS B	1.6	11.4	Full	500	0.0	0.0
Lane 2	45	2.0	377	0.120	100	30.4	LOS C	1.5	10.8	Full	500	0.0	0.0
Approach	98	2.0		0.120		24.3	LOS B	1.6	11.4				
NorthWest: Showground Road													
Lane 1	359	1.0	884	0.406	100	28.8	LOS C	12.6	88.9	Full	500	0.0	0.0
Lane 2	340	1.0	838	0.406	100	29.3	LOS C	12.1	85.4	Full	500	0.0	0.0
Approach	699	1.0		0.406		29.1	LOS C	12.6	88.9				
SouthWest: Old Northern Road													
Lane 1	638	1.0	2007	0.318	100	7.6	LOS A	0.0	0.0	Short	5	0.0	0.0
Lane 2	44	1.0	109 ¹	0.406	100	27.1	LOS B	1.6	11.4	Full	500	0.0	0.0
Lane 3	253	1.0	624	0.406	100	30.9	LOS C	10.5	74.4	Full	500	0.0	0.0
Approach	936	1.0		0.406		14.8	LOS B	10.5	74.4				
Intersection	1733	1.1		0.406		21.1	LOS B	12.6	88.9				

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

Lane LOS values are based on average delay per lane.

Intersection and Approach LOS values are based on average delay for all lanes.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

1 Reduced capacity due to a short lane effect

5 Lane underutilisation determined by program

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