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Shepparton North East Growth Corridor Development
Traffic Impact Assessment

Nordic Pty Ltd

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Traffic Impact Assessment

Prepared for

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Executive Summary

Maunsell Australia Pty Ltd (Maunsell AECOM) has been requested by Sam Mondous to prepare a Traffic Impact Assessment to support the preparation of the Shepparton North East Growth Area Outline Development Plan.

The site is located approximately four kilometres north east of Shepparton town centre and is bordered to the east and west by Verney Road and Grahamvale Road respectively. These roads are proposed to provide access to the development.

The proposed development of the site comprises a residential with a complimentary retail and community component located at the heart of the development. As part of the development, it is also proposed to relocate the Grahamvale Primary School (PS) adjacent to the retail and community hub.

This assessment provides the findings from a traffic investigation undertaken to determine whether the existing road network can support the proposed development. It also details the improvements that will be necessary in order to minimise the impact of the development on the surrounding road network based upon the likely future development traffic.

The investigation has included:

- Data collection to establish existing AM and PM traffic volumes;
- A review of existing information pertinent to the investigation, including the current road network and capacity, the expected background traffic growth, committed developments in the area, committed road network improvements, the accident history and traffic patterns;
- The future development traffic generation and assignment has been assessed;
- The operation of the forecast road network with and without the proposed development has been analysed; and
- Recommendations have been made based on the current network and improvements necessary to the local road network based on forecast traffic generations.

Traffic Survey information collected by City of Greater Shepparton (CGS) for local roads in the vicinity of the development has been included to provide an understanding of the existing character of the road network. Surveys showed that the AM peak occurred consistently between 8:00 – 9:00am and the PM peak occurred consistently between 3:00 – 4:00pm.

Turning movement volume surveys were undertaken by Global Workforce on behalf of Maunsell AECOM on Tuesday 5 August 2008 in the AM peak between 7:30am and 10:30am and in the PM peak between 3:00pm and 6:00pm.

During initial discussions with CGS Engineering Projects department it was agreed that the following four intersections would be most adversely affected by the proposed development (and would require analysis):

- Verney Road and Balaclava Road
- Verney Road and Ford Road
- Grahamvale Road and New Dookie Road
- Grahamvale Road and Ford Road

At the time discussions were carried out it was not apparent that there may be any significant impact on traffic along Hawkins Street and therefore the operation of the intersections of Hawkins Street / Verney Street and Hawkins Street / Goulbourn Valley Highway were not investigated.

However, CGS previously conducted surveys of the Hawkins Street / Goulbourn Valley Highway intersection in 2005 and these surveys have been utilised to analyse an estimation of current (2008) operation and future (2020) operation.

A Hawkins Street / Verney Road intersection estimation has also been created based on historical classified traffic counts collected by CGS on Hawkins Street (2007) and Verney Road (2008). This has been used to provide an approximate understanding of the forecast traffic conditions.

Within the local road network the roads that are expected to be most significantly impacted by the development include Verney Road, Grahamvale Road, Hawkins Street and Balaclava Road. Hawkins Street and Balaclava Road form connections to Goulburn Valley Highway.

Analysis using SIDRA INTERSEECTION 3.1 indicated that currently all the other intersections analysed appear to operate well in the AM and PM peak hours.

The forecast traffic generation rates and distribution for the proposed development has been agreed with the City of Greater Shepparton (CGS) Engineering Projects team and the intersections have been analysed based on these traffic generations.

Analysis of the forecast additional development traffic flows on the network generally indicates that most of the intersections are adequate to accommodate the additional forecast traffic.

Grahamvale Road will operate satisfactorily when Heavy Goods Vehicle (HGV) movements are assessed with 7% HGV. However if the HGV usage was expected to remain as high as 20% in the 2020 design forecast, the Grahamvale Road / Dookie Shepparton Road roundabout would experience operational problems. Due to this, CGS should continue to pursue the construction of the Shepparton Bypass as a matter of priority to ensure that no local problems develop.

Whilst the Hawkins Street / Goulburn Valley Highway is currently operating generally well as a priority intersection, already movements from Hawkins Street are experiencing notable delays in the AM and PM peaks. Further to this, crash history of four collisions has been recorded in the last five years indicating that there are some safety issues with the current operation. Accordingly analysis with of the forecast traffic for the design year 2020 (with and without the proposed development) indicates that without improvement, Hawkins Street will experience unacceptable delays and inevitably an increased safety risk.

Based on these factors the operation of the Hawkins Street / Goulburn Valley Highway intersection was analysed to understand how it could operate as a signalised intersection in 2020 (with and without the forecast development traffic). It was found that the priority was more evenly distributed resulting in acceptable average delays for all arms of the intersection.

As the base traffic flows for this analysis were collected in 2005 it is recommended that further traffic analysis should be carried out (with recent survey data) to ensure the intersection can cater for the future demands. Notwithstanding this, it is highly probable that the flows along Hawkins Street and Goulburn Valley Highway will necessitate improvements (such as signalisation) to this intersection.

All analysis of Hawkins Street / Verney Road intersection has been based on the possible operation constructed only on an estimate of existing conditions. Recommendations in this report are indicative only and further data collection and analysis is required to provide a robust assessment of the improvements likely to be required at this intersection.

The estimated analysis indicates that the proposed additional forecast traffic flows at the Hawkins Street / Verney Road intersection may be likely to result in the requirement of intersection improvements such as a roundabout. This option should be explored further based on new data collection and analysis.

Based on the forecast traffic flows for the proposed development and the expected background flows along Verney Road and Grahamvale Road, it is recommended that the most suitable entrance

treatments will include signalisation. This should be taken into consideration during the detail design of the development.

Based on the findings of the investigation the following table summarises the likely nexus for the infrastructure development contributions as a result of developing the NE Growth Corridor area.

Infrastructure Item	Likely Nexus
Verney Road Entrance	High
Grahamvale Road Entrance	High
Verney Road / Hawkins Street Possibly: Roundabout or Signalisation of Intersection	High
Goulburn Valley Highway / Hawkins Street Signalisation of Intersection	Low
General improvements to the surrounding pedestrian and cycle networks	Low

Further to the findings of this investigation there are issues that may impact the traffic operation of the local road network. These issues include:

- **Sustainable Transport Design**: Measures to reduce the reliance on the private car should be investigated to encourage a reduction in trips made by private cars which ultimately will reduce the pressure on the local road network and enable more sustainable transport choices.

- **Further data collection and analysis** is necessary to provide a greater understanding of the operation of the Hawkins Street intersections and will provide a clearer understanding of the likely traffic improvements necessary to ensure safe and effective operation of the intersections as a result of the proposed development.

  Further to this, no analysis has been carried out for the intersections of Goulburn Valley Highway with Balaclava Road, Ford Road or Verney Road. Analysis of these intersections may provide a greater understanding of how they will be affected by the proposed development.

  These further investigations should be carried out following the completion of a draft ODP. This investigation would include analysis of the existing road network together with the operation of proposed roads within the ODP area.

1.0 Introduction

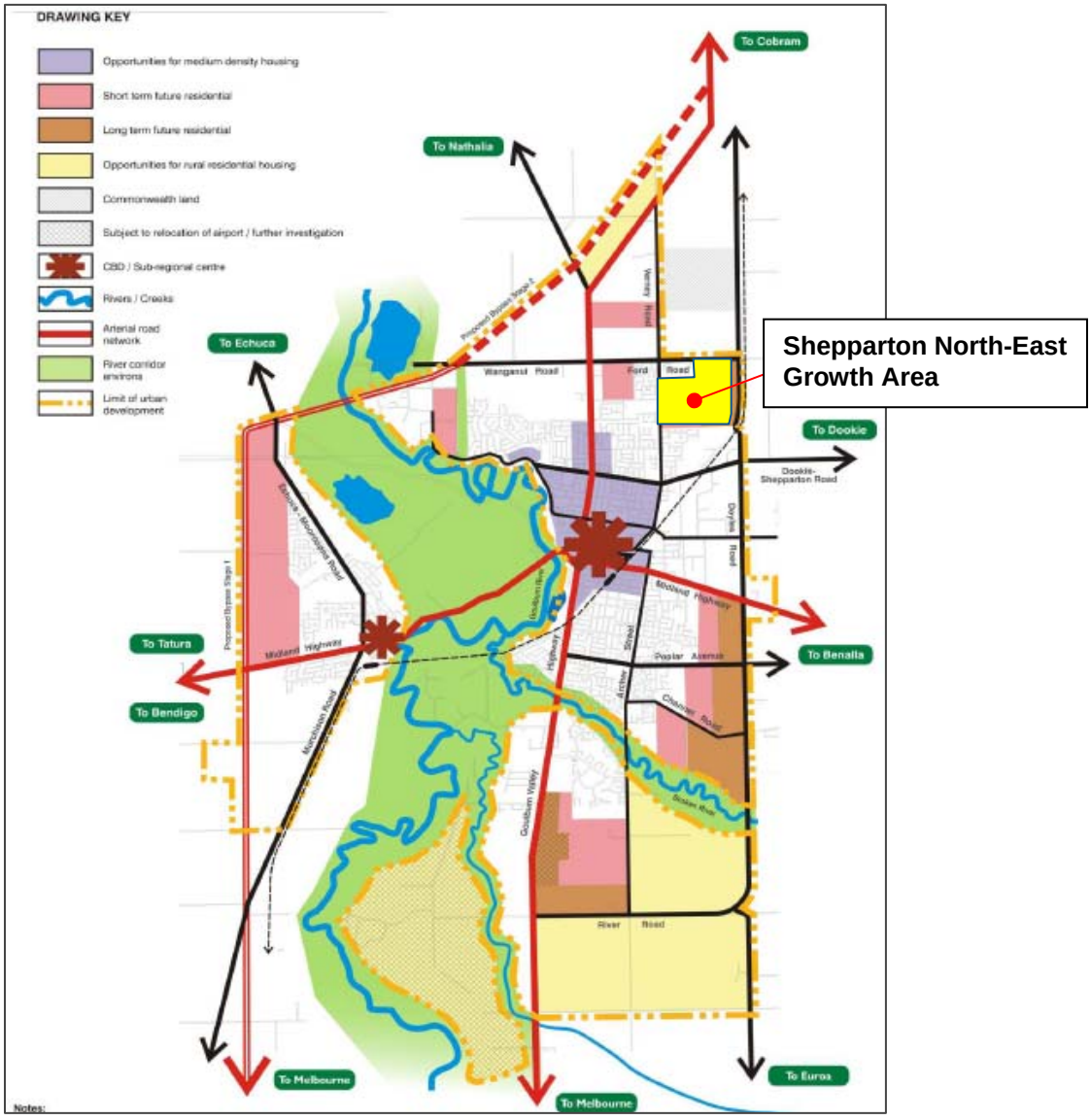
1.1 Project Background

Maunsell AECOM is undertaking numerous specialist studies required to support the preparation of an Outline Development Plan (ODP) and Development Contributions Plan (DCP) reports for Shepparton North-East Growth Corridor, also to be prepared by Maunsell AECOM.

The Shepparton North-East Growth Corridor has been earmarked by City of Greater Shepparton to be developed as a residential estate to support the growing town. The North-East Growth Corridor has a site area of 168.5 hectares which will be developed by a private developer. Figure 1 identifies the subject site which compromises the entire Shepparton North-East Growth Area.

In order to support the preparation of the ODP and DCP, a technical study assessing the demands for community infrastructure is required.

Figure 1 Location of the Shepparton North-East Growth Area



1.2 Purpose

This report provides the findings from a traffic investigation undertaken to determine whether the existing road network can support the proposed development. It also details the improvements that will be necessary in order to minimise the impact of the development on the surrounding road network based upon the likely future development traffic.

1.3 Project Methodology

Maunsell's Traffic Engineers will investigate the overall implications of residential expansion on the existing transport network to the north east of Shepparton including the broader sub-region. We will investigate the following:

- Reviewing existing information pertinent to the investigation, including the current road network and capacity, the expected background traffic growth, committed developments in the area, committed road network improvements, the accident history and traffic patterns;
- Assessment of the existing traffic movements in the area and anticipated traffic generated by the development in the growth area;
- Potential capacity constraints on the existing road network;
- The adequacy of access and car parking requirements to support future residential development in the growth area;
- Recommendations on necessary improvements to the local road network in order to support the proposed development;
- Potential design solutions for the growth area, which will ensure public transport, walking and cycling are practical and realistic alternatives for local trips;
- Impact of additional traffic on Ford Road due to the opening of the Shepparton Bypass; and
- Opportunities to maximise benefits of existing public transport services and infrastructure requirements.

1.4 Report Structure

The remainder of this report is set out as follows:

Chapter 2: Describes the existing conditions including; site locality, local road network, traffic volume and intersection turning movement volume surveys, local accident history and other committed traffic improvements and developments, cycle network and road network improvements located in the vicinity of the site.

Chapter 3: Assessment of existing intersection operation using SIDRA INTERSECTION software

Chapter 4: Details of the proposed development and car parking rates.

Chapter 5: Details the vehicular traffic generation associated with the site and the expected traffic distribution.

Chapter 6: Includes a description of the expected traffic impact of the development based on the forecast traffic flows on the local road network and the traffic impact conclusions.

Chapter 7: Discusses further traffic issues that should be considered as a part of the development process.

Appendix A details the existing traffic flows, Appendix B includes the summaries for the SIDRA analysis and Appendix C includes the details of the traffic distribution.

2.0 Existing Conditions

2.1 Site Locality

The site is located approximately four kilometres north east of Shepparton town centre.

As shown in Figure 2.1, the development site is bordered by Ford Road in the north, Grahamvale Road to the east, private agricultural land to the south and Verney Road to the west.

Figure 2.1: Site Location

(source: maps.google.com)

2.2 Road Network

Verney Road is a local road aligned north south between Goulburn Valley Highway and Balaclava/New Dookie Road. In the vicinity of the site there is one lane in each direction and cycle lanes on both sides. Mainly the shoulders are unsealed, however near some intersections the shoulders are sealed and formal footpaths exist. There is a short length of shared path on the western side of Verney Road in the vicinity of the site.

Balaclava Road is a collector road aligned east west between Goulburn Valley Highway (Numurkah Road) and New Dookie Road. There is one lane in each direction, cycle lanes on both sides and parallel car parking on the northern side. There are formal footpaths on both sides.

New Dookie Road extends east approximately 400 m where it becomes Dookie Shepparton Road and continues to Dookie. In the vicinity of the site (between Verney Road and Grahamvale Road) this road has one lane in each direction with unsealed shoulders.

Forming the eastern border of the site, **Grahamvale Road** is a local road aligned north south from Katamatite Shepparton Road to the roundabout at Dookie Shepparton Road. In the vicinity of the site Grahamvale Road has one lane in each direction and a narrow sealed shoulder. Grahamvale Road is the current formal town bypass for Heavy Goods Vehicles (HGVs) and accordingly HGVs comprise approximately 20% of all movements along this route.

Forming the northern border of the site, **Ford Road** is a local road aligned east west between Lemnos North Road, Lemnos and Goulburn Valley Highway. In the vicinity of the site there is one lane in each direction (unmarked) and unsealed shoulders.

Hawkins Street is aligned east west between Verney Road and Goulburn Valley Highway and provides the most direct access to Goulburn Valley Highway from the site. Hawkins Street has been designed to act as a an informal collector road with the Northern Neighbourhood (Retail) Centre located on the corner of Hawkins Street and Goulburn Valley Highway and reduced number of houses with frontages (including 18 crossovers on the North side and 12 crossovers on the South side).

Goulburn Valley Highway (Numurkah Road) is defined as a road of national importance. In the greater area near the site the Goulburn Valley Highway (Numurkah Road) has one lane in each direction, sealed shoulders and a series of service roads to cater for active frontages.

2.3 Traffic Volumes on Local Roads

Traffic Survey information collected by City of Greater Shepparton (CGS) for local roads in the vicinity of the development has been included to provide an understanding of the existing character of the road network.

Surveys showed that the AM peak occurred consistently between 8:00 – 9:00am and the PM peak occurred consistently between 3:00 – 4:00pm.

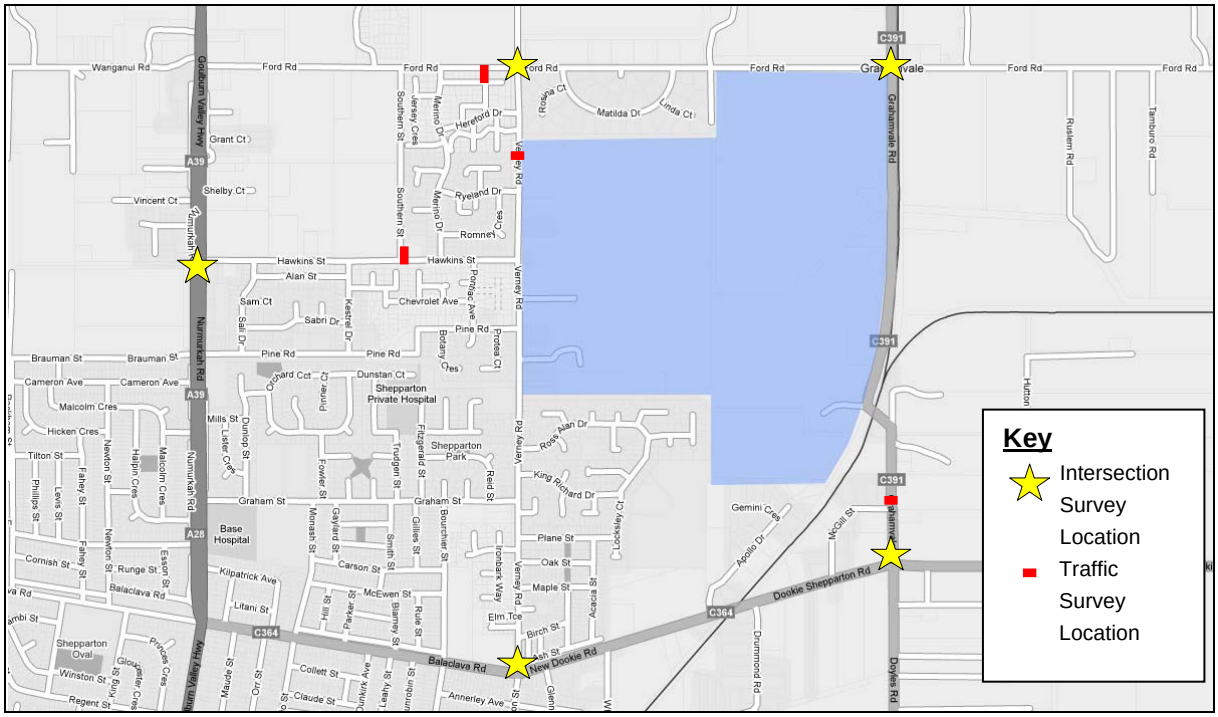
Table 2.1 details peak hour and daily 2-way traffic flows for Verney Road, Hawkins Street, Ford Road and Grahamvale Road in the vicinity of the site. Figure 2.2 details the exact locations of the survey counts.

Table 2.1: Peak Hour Traffic Volumes

Road	Location	AM Peak 8:00am -9:00am	PM Peak 3:00pm – 4:00pm	24 Hour Flow
Verney Road (July 2008)	Between Ryeland Drive and Hereford Road	429	446	3896 (HGV 10.6%)
Hawkins Street (February 2007)	Between Southdown Street and Merino Drive	198	315	2716 (HGV 4.9%)
Ford Road (July 2008)	West of Verney Road	271	295	2335 (HGV 7.2%)
Grahamvale Road (May 2003)	North of New Dookie Road	455	431	4141 (HGV 21.7%)

As shown in Table 2.1, all of the local roads carry high traffic volumes. High levels of HGVs were also observed on all roads, particularly the formal HGV town bypass route, Grahamvale Road, which carries over 20% HGV traffic.

Figure 2.2: Survey Location



(source: maps.google.com)

2.4 Turning Movement Counts

Turning movement volume surveys were undertaken by Global Workforce on behalf of Maunsell AECOM on Tuesday 5 August 2008 in the AM peak between 7:30am and 10:30am and in the PM peak between 3:00pm and 6:00pm.

The intersections assessed as in Figure 2.2 include:

- Verney Road / Balaclava Road / New Dookie Road
- Verney Road / Ford Road
- Grahamvale Road / Dookie Shepparton Road
- Grahamvale Road / Ford Road

For the Hawkins Road / Goulburn Valley Highway priority intersection the traffic flows have sourced from CGS surveys collected in 2005 and a compound growth factor of 1.5% per annum has been applied to create a 2008 flow scenario for this intersection.

Figure 2.3 to Figure 2.11 illustrate the AM and PM peak hour traffic volumes for the intersections analysed. Full survey results are contained within Appendix A.

Figure 2.3: Verney Road / Balaclava Road AM Peak Hour

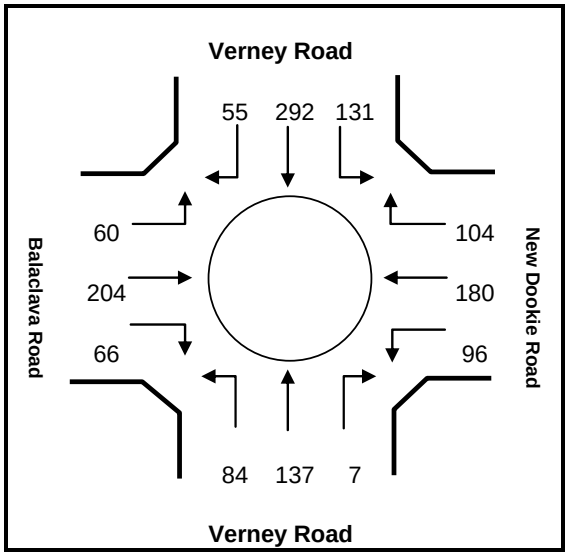


Figure 2.4: Verney Road / Balaclava Road PM Peak Hour

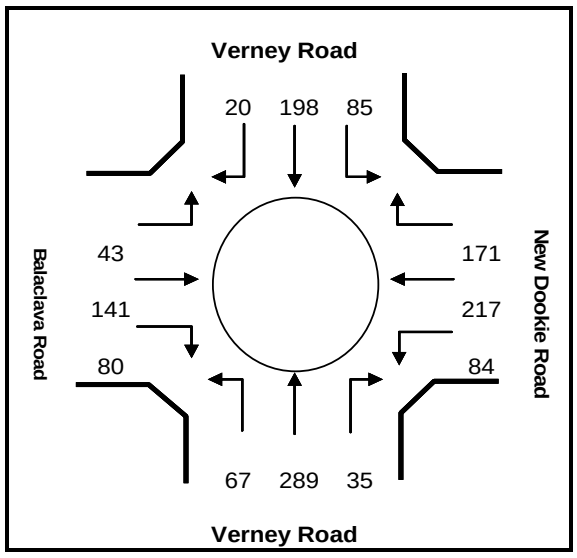


Figure 2.5: Verney Road / Ford Road AM Peak Hour

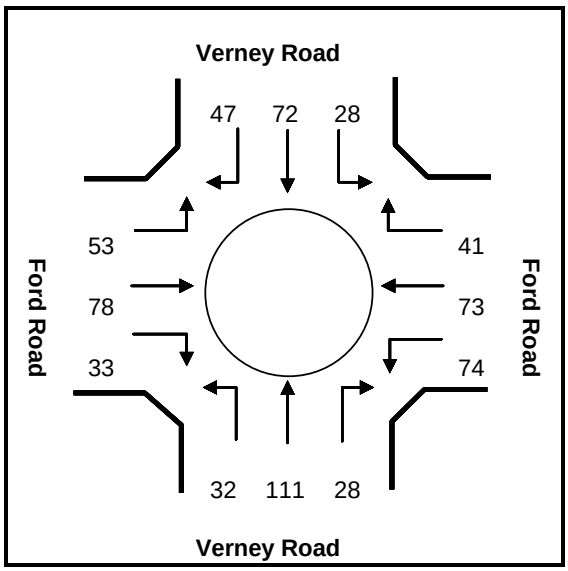


Figure 2.6: Verney Road / Ford Road PM Peak Hour

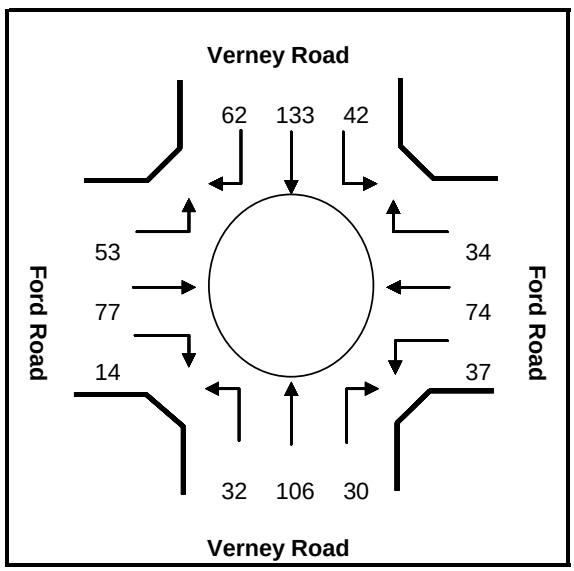


Figure 2.7: Grahamvale Rd/Dookie Shepprtn Rd AM Pk Hr

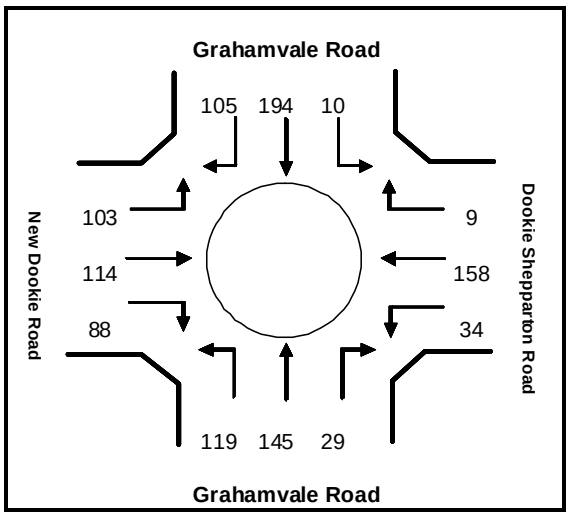


Figure 2.8: Grahamvale Rd/Dookie Shepprtn Rd AM Pk Hr

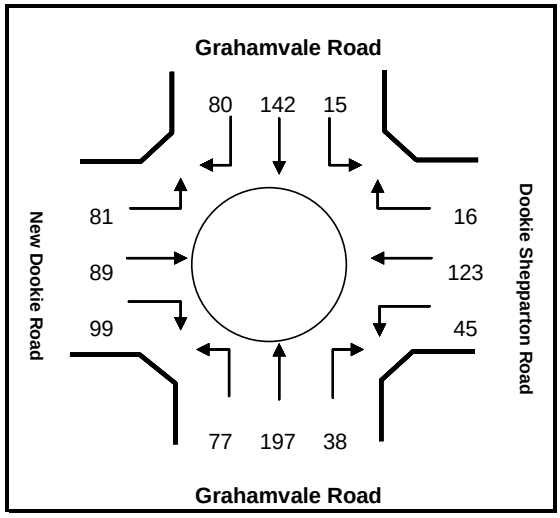


Figure 2.9: Grahamvale Road / Ford Road AM Pk Hr

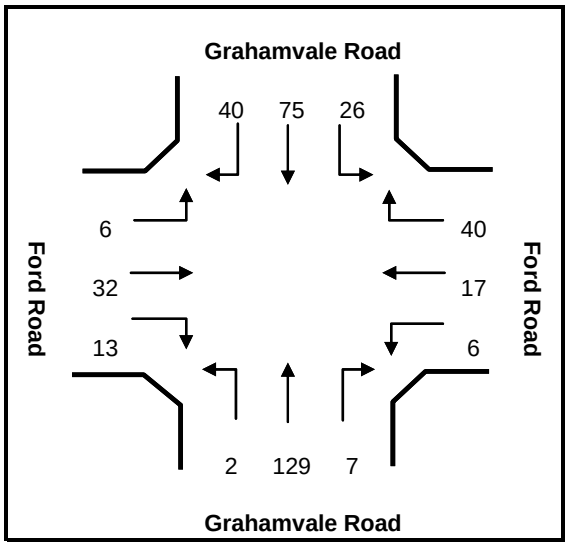


Figure 2.10: Grahamvale Road / Ford Road PM Pk Hr

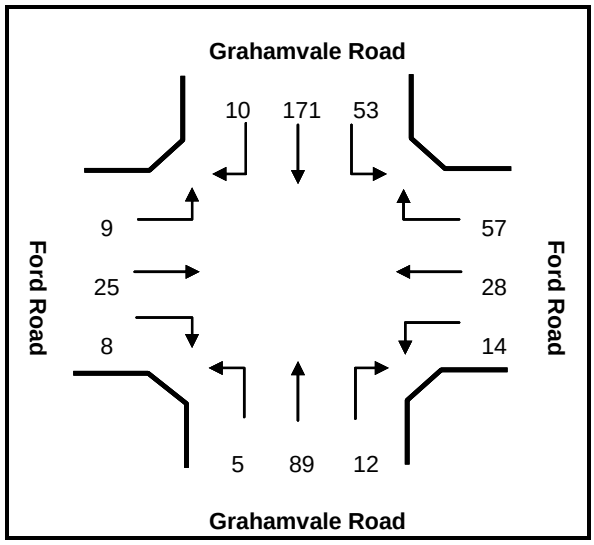


Figure 2.11: Hawkins Road / GV Hwy AM Pk Hr

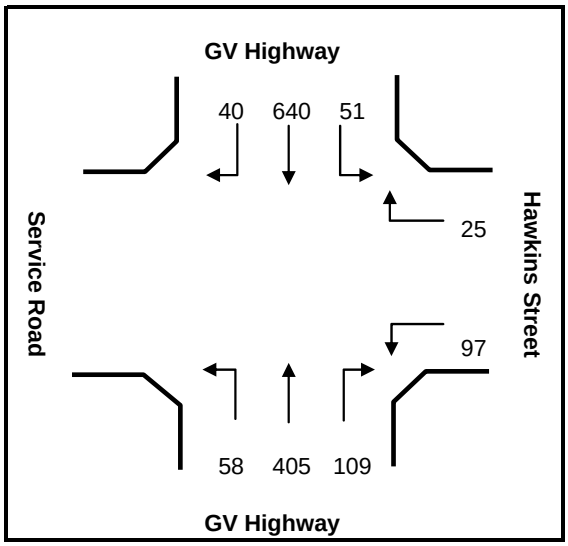
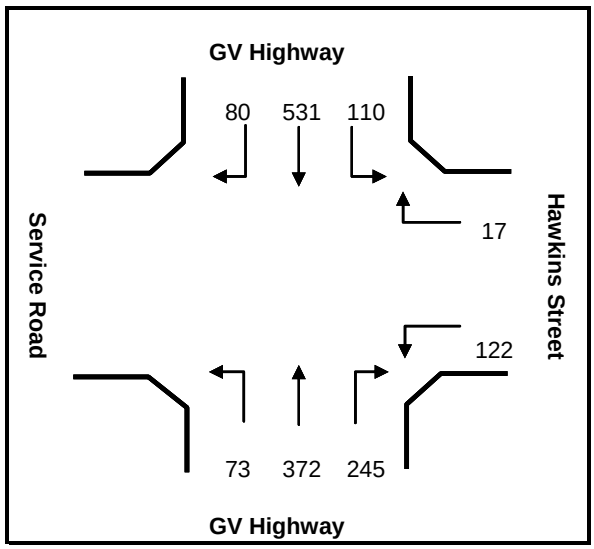


Figure 2.12: Hawkins Road / GV Hwy PM Pk Hr



2.5 Accident History

An accident review for the area has been performed using the VicRoads CrashStats database.

The roads reviewed included:

- Verney Road between Balaclava Road and Ford Road
- Grahamvale Road between Dookie Shepparton Road and Ford Road
- Ford Road between Verney Road and Grahamvale Road
- Balaclava Road, New Dookie Road and Dookie Shepparton Road to Grahamvale Road
- Hawkins Street
- Goulburn Valley Highway at the intersections of Balaclava Road, Hawkins Street, Ford Road and Verney Road.
- Hawdon Street (just south of Verney Road)

In the five year period between January 2003 and December 2007 there have been 32 accidents along these roads. This resulted in 14 serious injuries and 28 other injuries. No fatalities were recorded at these locations.

Between 2003 and 2006 the priority intersection of Hawkins Street and Goulburn Valley Highway experienced four accidents, all during light, day and clear conditions. The accidents were all collisions and they resulted in one serious and seven non-serious injuries. One accident involved a motorbike and another involved a cyclist. These accidents indicate that there are existing safety issues at this intersection.

Another pattern was observed just south of the Verney Road / Hawdon Street intersection where 3 rear end accidents were recorded, however there was no pattern to the time of day or road conditions of these accidents. No serious injuries were sustained.

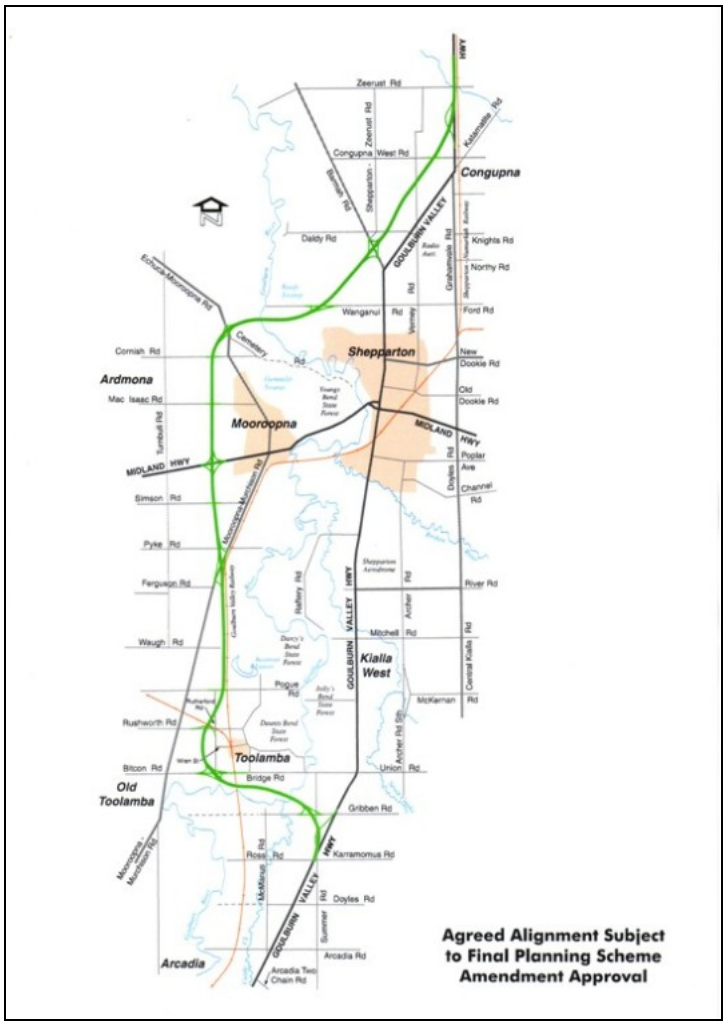
2.6 Committed Traffic Improvements and Developments

2.6.1 Shepparton Valley Bypass

The boundaries for the Shepparton Bypass have been finalised and were incorporated into the Greater Shepparton Planning Scheme in late 2006. A program for the construction of the Shepparton Bypass is yet to be agreed with the Australian Federal Government. Figure 2.13 shows the confirmed bypass route which will reduce through traffic on Goulburn Valley Highway and replace the HGV bypass route along Grahamvale Road.

As the timeframe for the Shepparton Bypass has not yet been confirmed it is important to consider that it may not actually be opened prior to completion of the development.

Figure 2.13: Goulburn Valley Bypass Route



2.6.2 Northern Neighbourhood Centre Extension

The Northern Neighbourhood Centre is a retail development located on the corner of Goulburn Valley Highway and Hawkins Street. It has a committed expansion planned to increase the retail floor space from 3800 sqm to 7300 sqm, resulting in an additional 3500 sqm of retail space.

This is anticipated to place further pressure on the Hawkins Street / Goulburn Valley Highway intersection.

At the time of preparing this report, there were no other known committed developments expected to impact the local traffic network.

2.7 Cycle Network

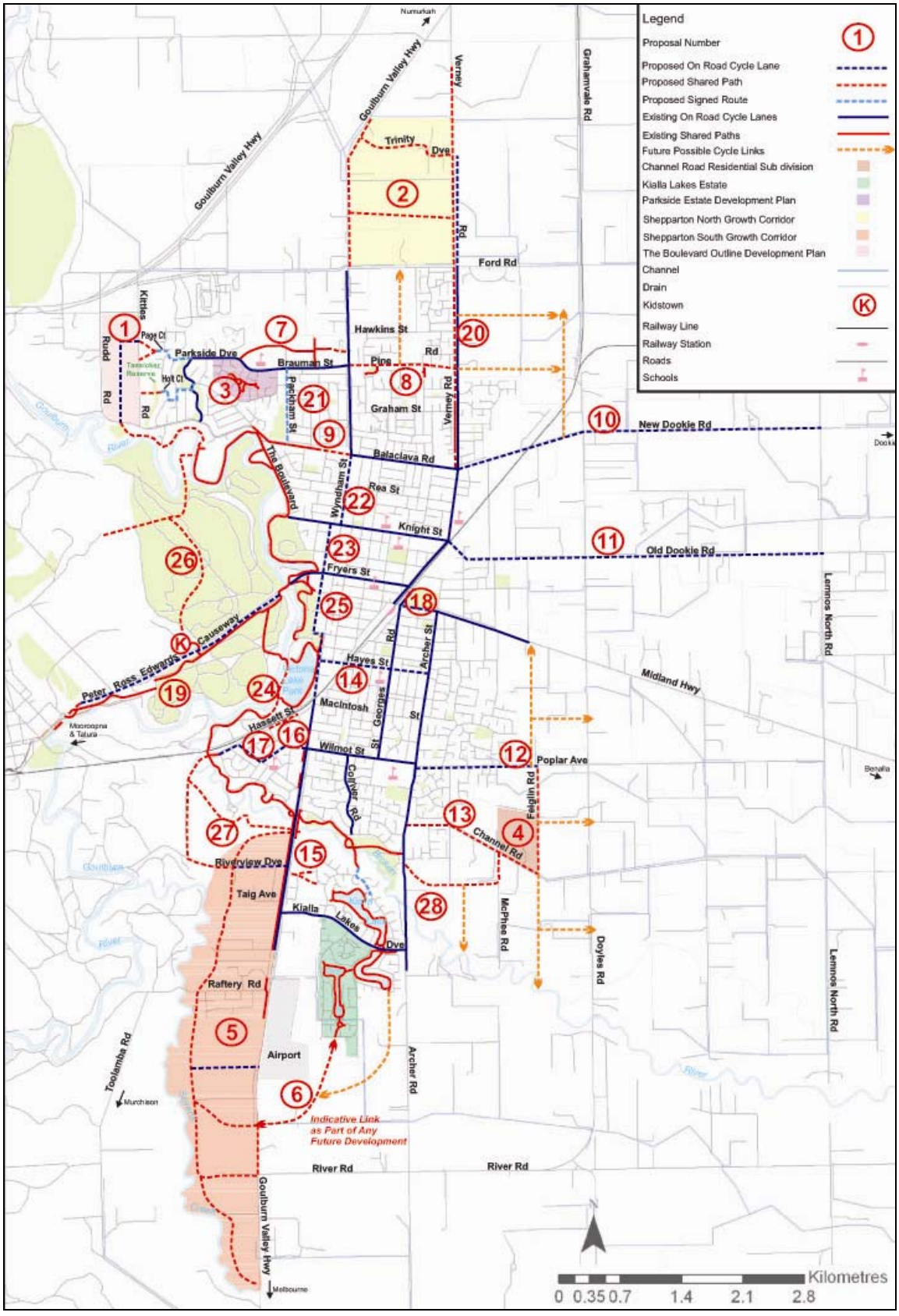
Shepparton has a well established cycle network that is continuously improving. The Shepparton Cycle network map provided by CGS is included in Figure 2.14.

As shown in Figure 2.14, there are currently on-road cycle lanes on Verney Road, Balaclava Road and Goulburn Valley Highway. An on-road cycle lane is proposed to extend from Balaclava Road along Dookie Shepparton Road and past Grahamvale Road.

There is also a shared path along a section of the west side of Verney Road and this is proposed to be extended.

The proposed development is well placed to integrate a safe, convenient cycle network, maximise permeable route and connections to the external road network.

Figure 2.14: Shepparton Cycle Network



3.0 Existing Traffic Operation

3.1 Overview of Local Road Network

During initial discussions with CGS Engineering Projects department it was agreed that the following four intersections would be most adversely affected by the proposed development:

- Verney Road and Balaclava Road
- Verney Road and Ford Road
- Grahamvale Road and New Dookie Road
- Grahamvale Road and Ford Road

At the time it was not apparent that there may be any significant impact on traffic along Hawkins Street and therefore the operation of the intersections of Hawkins Street / Verney Street and Hawkins Street / Goulbourn Valley Highway were not investigated.

However, CGS previously conducted surveys of the Hawkins Street / Goulbourn Valley Highway intersection in 2005 to determine whether signalisation was warranted in line with VicRoads requirements. In 2005 investigations concluded that signalisation was not warranted, but the intersection was flagged as a potential future location suitable for signalisation.

Historical traffic growth in this area has averaged 1.5% per annum[1]. Therefore, a growth factor of 1.5% per annum has been applied to the traffic movement flows recorded in 2005 and the intersection has been modelled using SIDRA to provide an estimation of current (2008) operation.

A Hawkins Street / Verney Road intersection estimation has also been created based on historical classified traffic counts collected by CGS on Hawkins Street (2007) and Verney Road (2008). In order to provide an approximate of the forecast traffic conditions the estimated intersection is analysed later in this chapter.

3.2 SIDRA INTERSECTION Analysis

The operation of the local intersections described in 3.1 have been analysed using SIDRA INTERSECTION 3.1 (SIDRA).

The SIDRA software package is a computer program that estimates intersection capacity and performance statistics using iterative approximation.

The following three main operational parameters have been detailed to provide a broad understanding of the intersection performance. These are Degree of Saturation, Level of Service and Average Delay. Each is described below.

Degree of Saturation

The level of congestion at an intersection is most commonly measured by the Degree of Saturation (DOS). This is defined as the ratio of arrival flow to capacity and is otherwise known as the volume capacity ratio, and has a theoretical maximum value of one. In practice, a DOS of greater than 0.95 would indicate that the intersection is operating under congested conditions, with lengthening queues and delays. As a guide the operating conditions under various degrees of saturation can be defined as:

- DOS < 0.75 Very good operating conditions;

[1] Source: CGS

- 0.75 < DOS < 0.90 Good operating conditions;
- 0.90 < DOS < 0.95 Acceptable operating conditions; and
- DOS < 0.95 Congested operating conditions.

When utilising SIDRA to analyse intersections, it is prudent to compare not only the DOS, but also factors such as queues and delays, which are qualitatively captured through assessment of the level of service.

Level of Service

Austroads have developed standards for level of service for urban streets within Australia. Level of Service (LOS) is based on average through-vehicle travel speed for the segment, section, or entire urban street under consideration.

SIDRA uses average control delay, which is the average delay that the driver will experience when waiting at the intersection as a measure of the "level of service" that the intersection is operating as a whole and/or for each movement. The delay levels that apply to different levels of service under SIDRA are summarised in Table 3.1.

Table 3.1: SIDRA Definition of Levels of Service and Delay

Level of Service	Characteristic Flows	Control delay per vehicle in seconds (d)
A	Primarily free-flow operations at average travel speeds	d<=10
B	Reasonable unimpeded operations at average travel speeds	10<d<=20
C	Stable operations; however, ability to manoeuvre and change lanes in mid block locations may be more restricted	20<d<=35
D	Small increases in flow may cause substantial increases in delay and decreases in travel speed	35<d<=55
E	Significant delays and average travel speeds of 33 percent or less of the free flow speed	55<d<=80
F	Urban street flow at extremely low speeds, typically one-third to one-fourth of the free flow speed	80<d

Average Delay

The delay to a vehicle is the difference between the interrupted and uninterrupted travel time through the intersection. The reported delay includes the deceleration and acceleration delays for the major stop experienced by queued vehicles as well as the geometric delays experienced by all vehicles negotiating the intersection.

3.2.1 Verney Road and Grahamvale Road Intersections

Table 3.2 to Table 3.5 summarise the existing operational characteristics of the Verney Road / Balaclava Road, Verney Road / Ford Road, Grahamvale Road / New Dookie Road and Grahamvale Road /Ford Road intersections during the AM and PM weekday peak hours.

Full SIDRA analysis results are included in Appendix B.

Table 3.2: Verney Road / Balaclava Road Existing Peak Hour Intersection Operation (Roundabout)

Intersection Arm	Degree of Saturation		Average Delay (sec)		Level of Service	
	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
Hawdon Street (South)	0.229	0.418	5.8	6.7	LOS A	LOS A
New Dookie Road (East)	0.441	0.484	7.5	7.3	LOS A	LOS A
Verney Road (North)	0.485	0.310	5.5	4.8	LOS A	LOS A
Balaclava Road (West)	0.329	0.327	5.4	7.6	LOS A	LOS A
All Approaches	**0.486**	**0.484**	**6.1**	**6.7**	**LOS A**	**LOS A**

Table 3.3: Verney Road / Ford Road Existing Peak Hour Intersection Operation (Roundabout)

Intersection Arm	Degree of Saturation		Average Delay (sec)		Level of Service	
	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
Verney Road (North)	0.137	0.413	4.9	5.3	LOS A	LOS A
Ford Road (East)	0.162	0.141	5.0	5.6	LOS A	LOS A
Verney Road (South)	0.094	0.209	3.7	5.0	LOS A	LOS A
Ford Road (West)	0.234	0.137	5.4	4.5	LOS A	LOS A
All Approaches	**0.234**	**0.209**	**4.9**	**5.1**	**LOS A**	**LOS A**

Table 3.4: Grahamvale Road / Dookie Shepparton Road Existing Peak Hour Intersection Operation (Roundabout)

Intersection Arm	Degree of Saturation		Average Delay (sec)		Level of Service	
	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
Grahamvale Road (South)	0.273	0.277	5.9	5.5	LOS A	LOS A
Dookie Shepparton Road (East)	0.228	0.193	5.5	5.3	LOS A	LOS A
Grahamvale Road (North)	0.305	0.234	5.9	5.9	LOS A	LOS A
Dookie Shepparton Road (West)	0.287	0.272	5.9	6.7	LOS A	LOS A
All Approaches	**0.306**	**0.277**	**5.8**	**5.9**	**LOS A**	**LOS A**

Table 3.5: Grahamvale Road / Ford Road Existing Peak Hour Intersection Operation (Priority Junction)

Intersection Arm	Degree of Saturation		Average Delay (sec)		Level of Service	
	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
Grahamvale Road (South)	0.082	0.066	1.0	2.2	LOS A	LOS A
Ford Road (East)	0.110	0.175	9.4	9.9	LOS A	LOS A
Grahamvale Road (North)	0.092	0.137	3.9	2.5	LOS A	LOS A
Ford Road (West)	0.080	0.069	8.5	8.8	LOS A	LOS A
All Approaches	**0.11**	**0.176**	**4.4**	**4.5**	**LOS A**	**LOS A**

As shown in Table 3.2 to Table 3.5, all intersections currently operate with an excellent LOS of 'A' in both peak periods and have very low average delays, of less than 7 seconds.

This indicates that there is plenty of additional capacity at these intersections.

3.2.2 Hawkins Street / Goulburn Valley Highway

Table 3.6 displays the results of the Hawkins Street / Goulburn Valley Highway intersection analysis for 2008 scenario based on the CGS 2005 traffic counts.

Table 3.6: Hawkins Street / Goulburn Valley Highway SIDRA Analysis for 2008 Scenario

Intersection Arm	Degree of Saturation		Average Delay (sec)		Level of Service	
	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
Goulburn Valley Highway (South)	0.180	0.372	3.2	5.6	LOS A	LOS A
Hawkins Street (East)	0.449	0.296	30.0	21.0	LOS D	LOS C
Goulburn Valley Highway (North)	0.195	0.179	1.2	2.3	LOS A	LOS A
All Approaches	0.448	0.372	4.5	5.5	-	-

Table 3.6 reveals that the intersection is mainly operating satisfactorily however there are significant delays for vehicles turning right from Hawkins Street. These vehicles experienced an average delay of 93 seconds in the AM peak. The delay is considered excessive and potentially dangerous.

3.2.3 Verney Road and Hawkins Street (Estimated Intersection)

As discussed previously data was not collected for the intersection of Verney Road and Hawkins Street. In order to provide an estimation of the likely operation of intersection has been created based on classified traffic surveys on Hawkins Street in 2007 and Verney Road during 2008.

The SIDRA analysis of the estimated intersection is included in Table 3.7 and the full SIDRA results are included in Appendix B.

Table 3.7: Verney Road / Hawkins Street SIDRA Analysis for 2008 Intersection Estimate

Intersection Arm	Degree of Saturation		Average Delay (sec)		Level of Service	
	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
Verney Road (South)	0.101	0.138	1.3	1.3	LOS A	LOS A
Hawkins Street (West)	0.160	0.141	2.3	2.7	LOS A	LOS A
Verney Road (North)	0.129	0.281	11.1	12.3	LOS B	LOS B
All Approaches	**0.160**	**0.282**	**3.2**	**4.4**	**-**	**-**

As shown in Table 3.7, the estimated T-intersection would operate with a good level of service and with short delays. This is comparable operation to the other intersections analysed and is considered a fair estimate to base a future forecast analysis estimate.

4.0 Proposed Development

The proposed mixed use development is primarily residential with a complimentary retail and community component located at the heart of the development. As part of the development, it is also proposed to relocate the Grahamvale Primary School (PS) adjacent to the retail and community hub.

Primary access to the site is proposed along Verney Road, between Ryeland Drive and Hawkins Street. Secondary access is proposed along Grahamvale Road.

4.1 Land Use

4.1.1 Residential

It is proposed that the residential component of the development will include a total of 1836 residential dwellings as detailed in Table 4.1.

Table 4.1: Residential Dwelling Composition

Number of Bedrooms	Number of Dwellings
3 – 4 bedrooms	1261
2 bedrooms	575
Total	**1836**

4.1.2 Retail and Community Facilities

It is proposed to develop a retail and community hub including 1350sqm gross floor area (GFA), comprising a convenience supermarket with GFA 900sqm and 450sqm of small tenancies. It is recommended that a preschool, childcare, maternal and child health services are included within the community hub.

The retail and community facilities are proposed to be located east of the Verney Street entrance and west of the Primary School facilities.

4.1.3 Grahamvale Primary School

There have been discussions regarding possible relocation of Grahamvale Primary School to the western side of the Shepparton North-East Growth Area at Verney Road. The relocation could have lent itself to the possibility of incorporating a community hub. However it is possible that the school may stay at the current location and future expansion will occur adjacent to the current site.

For the purpose of this investigation, the worst case traffic scenario has been assessed. This scenario assumes relocation of the Grahamvale PS to the community hub.

It is not yet understood how many children will attend the primary school (however, this is estimated as discussed in Section 5.1.4).

4.2 Car Parking Rates

4.2.1 Residential Car Parking

Residential car parking shall be designed in accordance with the Greater Shepparton Planning Scheme.

4.2.2 Retail Car Parking

Car parking for the development should be designed in accordance with the most current car parking rates applicable. According to the current Clause 52.06 of the Greater Shepparton Planning Scheme, a provision of 8 Car spaces to each 100sqm of leasable floor area is required for the majority of retail developments anticipated to occupy this retail component.

However, recently the Department of Planning and Community Development (DPCD) facilitated a state wide review of planning scheme parking rates. This process culminated in the release of a report by an Advisory Committee (appointed by the Minister for Planning) titled Review of Parking Provisions in the Victoria Planning Provisions, August 2007. This report aims to provide advice on car parking issues and to prepare a new Clause 52.06 suitable for inclusion in the Victoria Planning Provisions (VPP) and planning schemes.

The Advisory Committee report has been prepared following extensive research across Victoria and contribution from numerous stakeholders and experts. If adopted, the report's recommendations will alter the existing parking rates provided in Clause 52.06 of the VPP.

In general the parking rates proposed in the Advisory Committee report are lower or equal to the existing parking rates in Clause 52.06.

However, it is relevant to note that the adoption of this report is, in all likelihood, some months away and there is not necessarily a guarantee that the report's recommendations will be adopted in any form. Comments are currently being sought on the Advisory Committee report and the Advisory Committee is currently analysing the submissions on all the draft documents.

Notwithstanding the uncertainty in respect of the possible adoption of the revised parking rates proposed in the Advisory Committee report, it is still important for the parking rates to be considered for future developments.

The Advisory Committee Report specifies a proposed parking rate of 4.0 car spaces per 100sqm of leasable floor area for retail developments (for standard retail developments, as in this case).

Therefore, even though the current planning scheme rate is 8 spaces per 100sqm of leasable floor area, it is expected that a lower rate of 4.0 spaces per 100sqm of leasable floor area is in line with the recommendations of the recent Advisory Committee Report and will be considered suitable for this future development.

5.0 Vehicular Traffic Generation and Distribution

The following traffic investigation has been undertaken to ascertain the levels of traffic that will be generated and assigned to the existing road network as a result of new residential development in the Shepparton North East Growth Area.

5.1 Traffic Generation

Traffic generation rates have been discussed and agreed with the CGS Engineering Projects department and are presented as follows.

5.1.1 Background Traffic Growth

An annual background traffic growth rate of 1.5% per annum has been applied to surveyed traffic movements. This is based on the historical growth rate of the area as monitored by CGS. The growth rate takes into account growth in traffic caused by developments in the greater area, such as other residential and retail developments.

5.1.2 Residential

The Greater Shepparton Infrastructure Design Manual requires a traffic generation of 10 vehicle trips per lot per day. This results in a total of 18,360 vehicle trips per day.

In accordance with the Greater Shepparton Infrastructure Design Manual a weekday peak hour vehicle trip rate of 0.9 movements per dwelling has been agreed with CGS Engineering Projects department and applied to the AM and PM peak hours. This results in a total traffic generation of 1652 movements generated by residential traffic in the AM and PM peak hours.

Vehicle trips are defined as a one-way vehicular movement from one point to another excluding the return journey. Therefore a vehicle entering and leaving a land use is counted as two trips. For residential trips the following profile has been assumed:

- AM Peak: 10% of trips in and 90% of trips out
- PM Peak: 70% of trips in and 30% of trips out

5.1.3 Retail

The RTA “Guide to Traffic Generating Developments” (October 2002) is a widely used, comprehensive guide to covering all aspects of traffic generation relating to developments. It was developed in New South Wales and provides good guidance for Australian conditions generally. The Guide commonly provides generation rates for daily (24 hour) and evening peak hour periods for a wide range of land uses.

The rates detailed in Table 5.1 have been discussed and agreed to be suitable for the land uses envisaged within the NE Growth Corridor Residential/Mixed Use Development:

Table 5.1: RTA Guide Generation Rates (October 2002)

Land Use	Daily Rate (vehicles per 100sqm GLFA)	Peak Hour Rate (vehicles per 100sqm GLFA)
Supermarket	121 vehicle trips per 100sqm of gross leasable floor area	12.5 vehicle trips per 100sqm of gross leasable floor area
Retail	121 vehicle trips per 100sqm of gross leasable floor area	12.5 vehicle trips per 100sqm of gross leasable floor area

Based on the proposed development of 1350sqm supermarket and retail area the traffic generation is estimated to be 1634 per day and 169 movements in the peak hours.

However it is estimated that only 10% of traffic attracted to the retail site will originate from traffic passing outside the development[2]. Therefore the additional traffic on the external road network is estimated to be 164 movements per day and 17 movements in the peak hours.

For retail trips the following profile has been assumed:

- AM Peak: 50% of trips in and 50% of trips out
- PM Peak: 50% of trips in and 50% of trips out

5.1.4 Primary School

As described in section 4.1.3, for the purpose of the traffic generation assessment, it has been assumed that Grahamvale Primary School will relocate to the centre of the development.

In this case, access is proposed to remain available via Grahamvale Road, but it is expected that many trips will be redistributed to arrive and depart through Verney Road[3].

As we do not have information regarding the anticipated growth of the school an estimation has been created based on reasonable assumptions. The current school student population is 300 students.

It is estimated that when the development site is fully occupied in 2020 there will be a projected development population of 4140 people. Based on ABS population statistics it is anticipated that the development site would include approximately 455 primary school-aged children[4], who are most suitably located for enrolment at Grahamvale PS.

Discussions with the Department of Education revealed that one of the major attractors to the current school is the “country feel”, which would change as the area is developed. It considered that the school population will draw fewer children from other areas in Shepparton.

Demand for student placements residing off-site is estimated to include approximately half of current student population, 145 placements. This would result in a total primary school population of 600 children.

Students residing within the development site area would not generate any external trips to/from the site. School trips are actually taken into consideration within the standard residential peak hour traffic generation rate of 0.9 trips per dwelling, as discussed in 5.1.2.

The relocation of the school would therefore be likely to result in a reduction in external trips. For the purpose of this investigation the effect of any potential reduction in trips from the external road network has not been analysed.

5.1.5 Primary School Traffic Generation Methodology

As there are no formal guidelines recommended for calculating traffic generation for primary schools a methodology has been formulated and agreed with the CGS Engineering Projects department. The methodology is described in the following paragraphs.

[2] *‘Shepparton North East Growth Area Activity Centre Demand’* report prepared by Applied Development Research Pty Ltd, October 2008

[3] This is consistent with the overall proposed development traffic distribution as discussed in section 5.2.

[4] Based on Shepparton ABS Population Data (2006) for people aged from 5 to 11.

The traffic generation for Grahamvale PS is based on number of students in each vehicle. The 2006 ABS census data for the Shepparton North ABS catchment area demonstrates the family composition includes a total of:

- 35% family households have one child and
- 65% of family households have two or more children.

Maunsell AECOM estimate that trips to the school made by the students residing externally to the development site include one trip for families with one child and one trip for families with two or more children each way.

Trips generated by staff are estimated based on the following assumptions:

- 600 students
- 30 teachers (1 teacher per 20 students)
- 5 support staff
- Total 35 staff members

Table 5.2 displays the trip generation estimation of the existing Grahamvale PS and the proposed relocation.

Table 5.2: Total Trips Generated by Students on the External Road Network

Children in Family	Percentage of Total	Existing Children	Existing Trip Generation	Proposed Children	Proposed Trip Generation
1 child	35%	105	210	51	102
2 + children	65%	195	195	94	94
Staff	-	-	-	-	70
Total	**-**	**300**	**405**	**145**	**266**

* include 2 or more children in each car trip

Therefore a reduction in 209 trips on the external road network is expected[5]. The proposed 266 trips are expected to be distributed as described in section 5.2.

Due to the set down/pick up nature of primary school trips, for trips from external locations the following profile has been assumed:

Students

- AM Peak: 50% of trips in and 50% of trips out
- PM Peak: 50% of trips in and 50% of trips out

Staff

- AM Peak: 100% of trips in
- PM Peak: 100% of trips out

[5] For the purpose of this assessment the reduced trips will not been reduced from the road network.

5.2 Vehicular Traffic Distribution

A traffic distribution assignment has been estimated for traffic generated by the site and has been agreed with the CGS Engineering Projects department. The agreed traffic distribution assignment for the North East Growth Area proposed development is estimated to be:

- 10% north
- 10% east
- 60% south and
- 20% west.

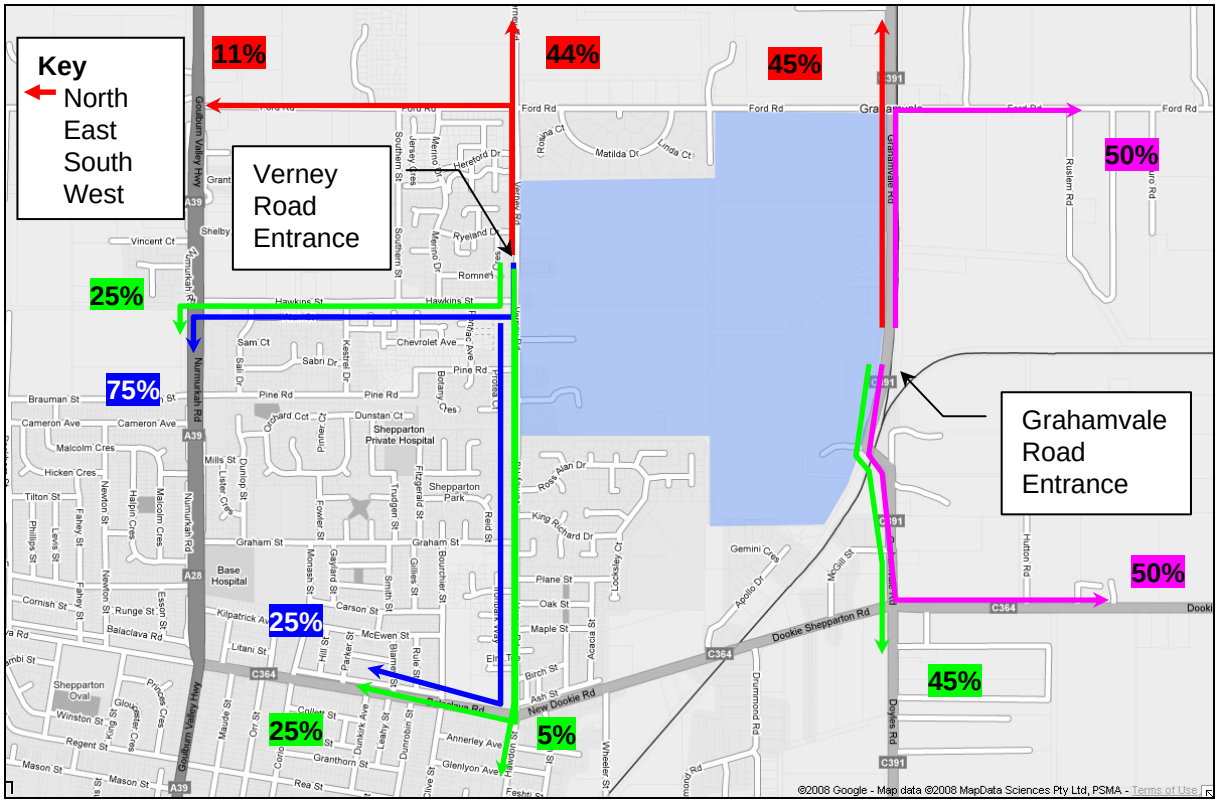
This includes a bias toward Shepparton town centre and slightly increased traffic flows to Mooroopna west of Shepparton.

Traffic distribution out of the development site area is divided with 55% of traffic using the Verney Street access point and 45% utilising the Grahamvale Road access point.

The distribution has been further broken down and assigned to the routes as detailed Figure 5.1

A full summary of the volumes added to each intersection analysed in included in Appendix C.

Figure 5.1: Verney Road Traffic Movement Distribution



(source: maps.google.com)

5.3 Summary of Forecast Traffic

The forecast traffic generated by the development is summarised in Table 5.3. Appendix C details the additional forecast traffic for each intersection analysed.

Table 5.3: Summary of Forecast Traffic

Direction	Distribution Share	Verney Road Entrance	Grahamvale Road Entrance	Peak Hour Trips
North	10%	96	94	190
East	10%	0	190	190
South	60%	575	563	1138
West	20%	379	0	379
Total Peak Hour Trips		**1050**	**847**	**1897**

Table 5.3 shows that there is a total forecast of 1897 trips generated by the development in the AM and PM peaks. These trips will be distributed on the external road network as illustrated in Figure 5.1.

As requested, it has been assumed that these will be divided between two entrances, one on Verney Road and one on Grahamvale Road. The Verney Road entrance is forecast to accommodate approximately 1050 trips in the AM and PM peaks. The Grahamvale Road entrance is forecast to accommodate approximately 847 trips in the AM and PM peaks.

6.0 Traffic Impact

The following paragraphs outline the impact of the proposed development on the surrounding road network. The analysis has been estimated for the year the development is expected to be completed (2020) and assumes full occupancy of residential, retail and educational facilities.

The intersections analysed include:

- Verney Road and Balaclava Road
- Verney Road and Ford Road
- Grahamvale Road and Dookie Shepparton Road
- Grahamvale Road and Ford Road and
- Hawkins Street and Goulburn Valley
- Hawkins Street and Verney Road (example based on an estimated traffic profile)

Full SIDRA analysis results are contained within Appendix B.

Recommendations are also provided in Section 6.4 on appropriate treatments at the entrances to the development site on Verney Road and Grahamvale Road.

6.1 Verney Road and Grahamvale Road Intersections

Table 6.1 to Table 6.4 summarise the likely operational characteristics of the other four intersections along Verney Road and Grahamvale Road during the AM and PM weekday peak hours in the design year 2020 based on the traffic generation estimated in the previous chapters.

6.1.1 Verney Road Intersections

Table 6.1 summarises the operation of the Verney Road / Balaclava Road roundabout with the forecast traffic.

Table 6.1: Verney Road / Balaclava Road 2020 Peak Hour Roundabout Operation with Development Traffic

Intersection Arm	Degree of Saturation		Average Delay (sec)		Level of Service	
	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
Hawdon Street (South)	0.383	0.722	7.4	12.5	LOS A	LOS B
New Dookie Road (East)	0.982	0.677	72.6	12.1	LOS E	LOS B
Verney Road (North)	0.954	0.534	24.1	5.9	LOS C	LOS A
Balaclava Road (West)	0.455	0.639	6.3	14.0	LOS A	LOS B
All Approaches	0.985	0.725	28.5	11.0	LOS C	LOS B

Table 6.1 indicates that with the inclusion of the development traffic, the roundabout intersection will operate with a satisfactory level of service, but will be quite highly saturated particularly in the AM peak hour.

Table 6.2 summarises the operation of the Verney Road / Ford Road roundabout with the forecast traffic.

Table 6.2: Verney Road / Ford Road 2020 Peak Hour Roundabout Operation with Development Traffic

Intersection Arm	Degree of Saturation		Average Delay (sec)		Level of Service	
	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
Verney Road (North)	0.258	0.237	5.6	5.1	LOS A	LOS A
Ford Road (East)	0.214	0.214	5.6	5.5	LOS A	LOS A
Verney Road (South)	0.176	0.175	5.5	5.5	LOS A	LOS A
Ford Road (West)	0.205	0.204	5.7	5.7	LOS A	LOS A
All Approaches	0.258	0.238	5.6	5.4	LOS A	LOS A

Table 6.2 indicates that the Verney Road / Ford Road intersection has plenty of capacity, even with the additional movements forecast by the development.

6.1.2 Grahamvale Road Intersections

The Grahamvale Road intersections have been assessed with a theoretical HGV profile of 7%. This is based on the assumption that the proportion of HGV movements will decrease due to the increased number of cars movements as a result of the development site and also a reduction in HGV movements as a result of the opening of the Shepparton Bypass.

Table 6.3 summarises the operation of the Grahamvale Road / Dookie Shepparton Road roundabout with the forecast traffic.

Table 6.3: Grahamvale Road / Dookie Shepparton Road 2020 Peak Hour Roundabout Operation with Development Traffic

Intersection Arm	Degree of Saturation		Average Delay (sec)		Level of Service	
	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
Doyles Road (South)	0.443	0.667	6.4	7.7	LOS A	LOS A
Dookie Shepparton Road (East)	0.648	0.390	20.2	8.9	LOS C	LOS A
Grahamvale Road (North)	0.899	0.567	13.3	5.8	LOS B	LOS A
Dookie Shepparton Road (West)	0.397	0.516	6.9	11.9	LOS A	LOS B
All Approaches	0.898	0.671	11.5	8.0	LOS B	LOS A

Table 6.3 indicates that the additional eastbound and southbound movements along the Grahamvale Road / Dookie Shepparton Road roundabout result in a high degree of saturation on most arms, however the roundabout is still operating well.

Table 6.4: Grahamvale Road / Ford Road 2020 Peak Hour Priority Junction Operation with Development Traffic

Intersection Arm	Degree of Saturation		Average Delay (sec)		Level of Service	
	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
Grahamvale Road (South)	0.208	0.145	2.6	3.9	LOS A	LOS A
Ford Road (East)	0.200	0.313	13.8	15.5	LOS B	LOS C
Grahamvale Road (North)	0.125	0.195	4.3	2.5	LOS A	LOS A
Ford Road (West)	0.159	0.170	11.5	10.0	LOS B	LOS B
All Approaches	**0.214**	**0.313**	**5.4**	**5.9**	**-**	**-**

Table 6.4 indicates that the Grahamvale Road / Ford Road intersection has plenty of capacity, even with the additional movements forecast by the development.

6.2 Hawkins Street Intersections

6.2.1 Hawkins / Goulburn Valley Highway Priority Intersection

For the Hawkins Street / Goulburn Valley Highway intersection two scenarios for 2020 have been analysed these include:

- 2020 Scenario without forecast development traffic
- 2020 Scenario with forecast development traffic

2020 Scenario Without Forecast Development Traffic

The estimated 2020 scenario peak hour traffic flows (without forecast development traffic) set out in Table 6.5.

Table 6.5: Estimated 2020 Traffic Flows[6]

Intersection Arm	Left		Through		Right	
	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
Goulburn Valley Highway (Southbound)	63	134	776	644	49	98
Goulburn Valley Highway (Northbound)	70	89	491	451	133	299
Hawkins Street	118	148	0	0	30	21

As shown in Table 6.5 in the AM Peak Goulburn Valley Highway is projected to experience 776 southbound and 491 northbound movements in the peak hour. Hawkins Street is expected to experience approximately 198 eastbound and 148 westbound movements in the AM Peak hour.

In the PM Peak Goulburn Valley Highway is projected to experience 644 southbound and 451 northbound movements in the peak hour. Hawkins Street is expected to experience approximately 433 eastbound and 169 westbound movements in the PM Peak hour.

[6] CGS 2005 survey information plus 1.5% growth per annum (except for movements to the service road which are not expected to attract additional growth

Table 6.6 displays the results of the intersection analysis for a 2020 scenario without forecast traffic for the proposed development. Full SIDRA results are included in Appendix B.

Table 6.6: Hawkins Street / Goulburn Valley Highway SIDRA Analysis for 2020 Scenario without Development Traffic

Intersection Arm	Degree of Saturation		Average Delay (sec)		Level of Service	
	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
Goulburn Valley Highway (South)	0.229	0.466	3.6	6.3	LOS A	LOS A
Hawkins Street (East)	0.729	0.392	48.4	24.3	LOS E	LOS C
Goulburn Valley Highway (North)	0.220	0.201	1.3	2.5	LOS A	LOS A
All Approaches	0.732	0.466	6.2	6.1	-	-

The results of the 2020 intersection analysis suggest that the intersection would require improvements, especially due to the significant delays for vehicles turning right from Hawkins Street. These vehicles experienced an average delay of almost 3 minutes in the AM peak and 1.5 minutes in the PM peak. The delay is considered excessive and warrants signalisation.

As detailed the Traffic Engineering Manual Volume 1, Chapter 3 – Edition 3, Revision A, (2001) VicRoads recommend that signalisation may be required under the following circumstances:

Traffic signals may be considered subject to detailed analysis; when the major road carries at least 600 vehicles/hour (two way) and the minor road concurrently carries at least 200 vehicles (one way) on one approach over any 4 hours of an average day.

Based on the 2020 forecast SIDRA analysis, previous consideration of signalisation and accident history, it is considered that this intersection would operate more efficiently and safely with signalisation even without the proposed development.

2020 Scenario with development traffic

The estimated 2020 scenario peak hour traffic flows with forecast development traffic are set out in Table 6.7.

Table 6.7: Estimated 2020 Traffic Flows[7] with Development Traffic

Intersection Arm	Left		Through		Right	
	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
Goulburn Valley Highway (Southbound)	63	134	776	644	39	78
Goulburn Valley Highway (Northbound)	56	71	491	451	219	613
Hawkins Street	574	376	0	0	30	21

As shown in Table 6.7 the through movements along Goulburn Valley Highway are expected to remain the same with the addition of the development traffic.

The inclusion of the development traffic is expected to further increase the number of eastbound and westbound movements along Hawkins Street to approximately 282 eastbound and 604 westbound

[7] As described for Table 6.5.

movements in the AM peak and approximately 747 eastbound and 397 westbound movements in the PM peak.

Table 6.8 displays the results of the intersection analysis for a 2020 scenario with forecast flows for the proposed development. Full SIDRA results are included in Appendix B.

Table 6.8: Hawkins Street / Goulburn Valley Highway SIDRA Analysis for 2020 Scenario with Forecast Development Traffic

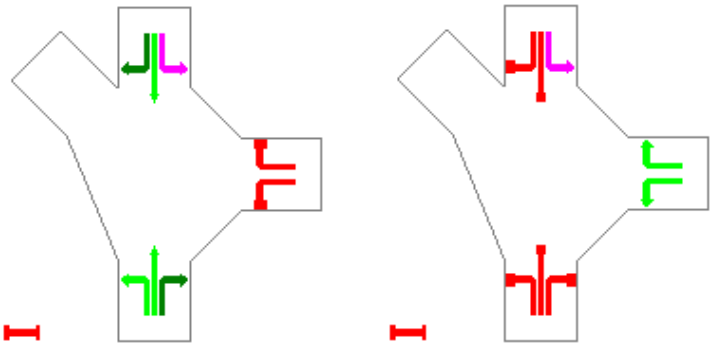
Intersection Arm	Degree of Saturation		Average Delay (sec)		Level of Service	
	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
Goulburn Valley Highway (South)	0.229	0.466	3.6	6.3	LOS A	LOS A
Hawkins Street (East)	0.729	0.392	48.4	24.3	LOS E	LOS C
Goulburn Valley Highway (North)	0.220	0.201	1.3	2.5	LOS A	LOS A
All Approaches	0.732	0.466	6.2	6.1	-	-

The results of the 2020 intersection analysis suggest that in the 2020 scenario with development traffic the intersection would require improvements to enable safe and efficient operation, especially due to the significant delays for vehicles turning right from Hawkins Street. These vehicles experienced an average delay of almost 3 minutes in the AM peak and 1.5 minutes in the PM peak.

The results of the estimated traffic generation indicate that signalisation of the intersection may be necessary to provide safe and efficient operation. Accordingly, the intersection has been analysed to provide an understanding of operation with signalisation based on the estimated flows.

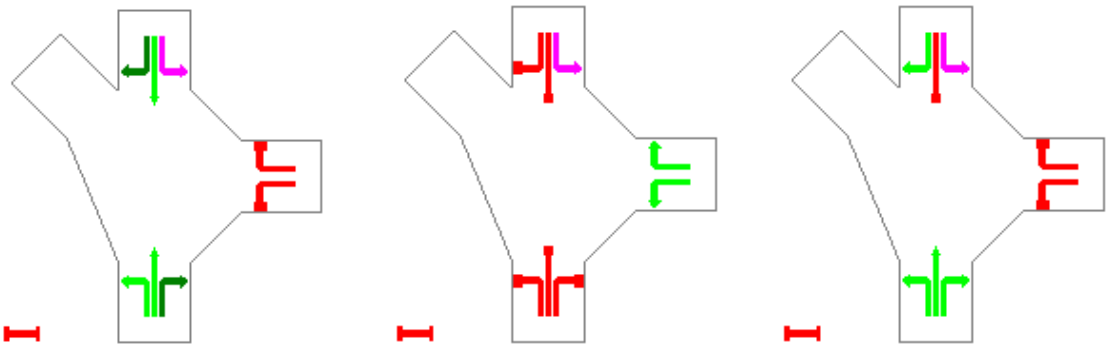
The following phasing sequence was used to construct the phasing operation for the SIDRA model. In the AM peak the phasing sequence used for the SIDRA model included:

Phase A **Phase B**



In the PM peak the phasing sequence used for the SIDRA model included:

Phase A **Phase B** **Phase C**



The SIDRA models were set to optimised phase times and the results reflected a reasonable distribution of time for the particular volume of movements.

Table 6.9 displays the results of the intersection analysis for a 2020 scenario with the proposed development estimated traffic flows.

Table 6.9: Hawkins Street / Goulburn Valley Highway Signalised Intersection SIDRA Analysis for 2020 Scenario with Proposed Development

Intersection Arm	Degree of Saturation		Average Delay (sec)		Level of Service	
	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
Goulburn Valley Highway (South)	0.871	0.857	15.6	21.1	LOS C	LOS B
Hawkins Street (East)	0.819	0.837	21.8	45.9	LOS D	LOS C
Goulburn Valley Highway (North)	0.810	0.841	16.0	35.0	LOS C	LOS B
All Approaches	0.872	0.857	17.4	30.1	LOS C	LOS B

As shown in Table 6.9, the results of the signalised intersection analysis indicate a more even distribution of traffic flows. The results indicate higher levels of saturation for Goulburn Valley Highway, however the operation of Hawkins Street indicates significant improvement and acceptable operation in both peak periods with average delays ranging from 17 to 30 seconds.

6.3 Verney Road / Hawkins Street T-Intersection Estimate

As discussed earlier, the following analysis is an estimation of possible operation of the Verney Road / Hawkins Street T-intersection based only on an estimate of existing conditions. Further data collection and analysis is required to provide a robust assessment of the improvements likely to be required at this intersection.

The estimated traffic flows have been combined with the forecast proposed development traffic demand and assessed using SIDRA. The results of the analysis for the AM and PM peaks are included in Table 6.10.

Table 6.10: Verney Road / Hawkins Street T-Intersection Estimate SIDRA Analysis 2020 with Proposed Development

Intersection Arm	Degree of Saturation		Average Delay (sec)		Level of Service	
	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
Verney Road (South)	0.157	0.299	1.0	0.7	LOS A	LOS A
Hawkins Street (West)	0.856	0.626	16.8	12.7	LOS C	LOS B
Verney Road (North)	1.424	2.816	663.4	2485.8	LOS F	LOS F
All Approaches	1.424	2.842	158.9	966.2	-	-

As shown in Table 6.10, the T-Intersection appears inadequate to accommodate the additional forecast traffic. Further data collection is required to form an accurate understanding of the likely operation of this intersection.

Notwithstanding this, it is possible, based on the anticipated flows, that improvements to the intersection may be required in order to facilitate the anticipated demand.

In order to demonstrate the estimated operational performance of the intersection operating as a roundabout a SIDRA analysis has been carried out. The SIDRA analysis for a roundabout at this location are summarised in Table 6.11.

Table 6.11: Verney Road / Hawkins Street Roundabout Estimate SIDRA Analysis 2020 with Proposed Development Flows

Intersection Arm	Degree of Saturation		Average Delay (sec)		Level of Service	
	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
Verney Road (South)	0.374	0.554	8.3	6.9	LOS A	LOS A
Hawkins Street (West)	0.791	0.544	6.1	5.9	LOS A	LOS A
Verney Road (North)	0.397	0.929	6.3	25.8	LOS A	LOS C
All Approaches	0.790	0.931	6.5	13.9	LOS A	LOS B

As shown in Table 6.11, the estimated roundabout control appears to accommodate the forecast traffic flows with only minor delays on the Verney Road (north) arm of 6 seconds in the AM peak and 26 seconds in the PM peak hours.

6.4 Development Entrance Treatments

As detailed in Chapter 5, it is proposed to provide one entrance on Verney Road (primary entrance) and one on Grahamvale Road (secondary entrance).

The Verney Road entrance is forecast to accommodate approximately 1050 trips in the AM and PM peaks.

Based on classified traffic counts provided by CGS and the 1.5% growth rate of the local area, it is estimated that the traffic along Verney Road, in the vicinity of the proposed entrance will carry approximately:

- 300 southbound movements and 210 northbound movements in the AM peak
- 260 southbound movements and 230 northbound movements in the AM peak

The Grahamvale Road entrance is forecast to accommodate approximately 847 trips in the AM and PM peaks.

Based on turning movement counts carried out on behalf of Maunsell AECOM at the Grahamvale Road / New Dookie Road intersection and the 1.5% growth rate of the local area, it is estimated that the traffic along Grahamvale Road, in the vicinity of the proposed entrance will carry approximately:

- 300 southbound movements and 210 northbound movements in the AM peak
- 260 southbound movements and 230 northbound movements in the AM peak

As detailed the Traffic Engineering Manual Volume 1, Chapter 3 – Edition 3, Revision A, (2001) VicRoads recommend that signalisation may be required when:

- **Traffic Volume** – Signals may be considered when the major road carries at least 600 vehicles per hour and the minor road concurrently carries at least 200 vehicles per hour over any four hours of the day; or
- **Continuous Traffic** – Where traffic on the major road is sufficient to cause undue delay or hazard for traffic on a minor road, signals may be warranted when traffic on the major road carries at least 900 vehicles per hour and the minor road carries at least 100 vehicles per hour over any four hours of an average day.

Therefore, based on the forecast traffic flows for a development this size with two entrances and the expected background flows along Verney Road and Grahamvale Road, it is recommended that the most suitable proposed development entrance treatments will include signalisation. This should be taken into consideration during the detail design of the development.

6.5 Conclusions

The following paragraphs discuss the conclusions of the traffic impact on the local road network as a result of the proposed development of the North East Growth Area in Shepparton.

6.5.1 Verney Road and Grahamvale Road

Generally the intersections are adequate to accommodate the additional forecast traffic as proposed in Chapter 5.

Grahamvale Road will operate satisfactorily when HGV movements are assessed with 7% HGV. However if the HGV usage was expected to remain as high as 20% in the 2020 design forecast the Grahamvale Road / Dookie Shepparton Road roundabout would experience operational problems. Due to this CGS should continue to pursue the construction of the Shepparton Bypass as a matter of priority to ensure that no local problems develop.

6.5.2 Hawkins Street / Goulburn Valley Highway

Whilst the Hawkins Street / Goulburn Valley Highway is currently operating generally well as a priority intersection, already movements from Hawkins Street are experiencing delays and crash history of four collisions in the last five years indicates that there are some safety issues with the current operation. CGS are aware of these issues and are monitoring the intersection.

Accordingly analysis of the forecast traffic for the design year 2020 (with and without the proposed development) indicate that without improvement, Hawkins Street will experience excessive delays and inevitably an increased safety risk.

Based on these factors the operation of the Hawkins Street / Goulburn Valley Highway intersection was analysed to understand how it could operate as a signalised intersection in 2020 (with and without the forecast development traffic). It was found that the priority was more evenly distributed resulting in acceptable average delays for all arms of the intersection.

As the base traffic flows for this analysis were collected in 2005 it is recommended that further traffic analysis should be carried out (with recent survey data) to ensure the intersection can cater for the future demands. Notwithstanding this, it is highly probable that the flows along Hawkins Street and Goulburn Valley Highway will necessitate improvements (such as signalisation) to this intersection.

6.5.3 Hawkins Street / Verney Road

As previously discussed, all analysis of Hawkins Street / Verney Road intersection has been based on the possible operation constructed only on an estimate of existing conditions. Recommendations in this report are indicative only and further data collection and analysis is required to provide a robust assessment of the improvements likely to be required at this intersection.

The estimated analysis indicates that the proposed additional forecast traffic flows at the Hawkins Street / Verney Road intersection may be likely to result in the requirement of intersection improvements such as a roundabout. This option should be explored further based on new data collection and analysis.

6.5.4 Development Entrance Treatments

Based on the forecast traffic flows for the proposed development and the expected background flows along Verney Road and Grahamvale Road, it is recommended that the most suitable entrance treatments will include signalisation. This should be taken into consideration during the detail design of the development.

7.0 Further Issues

Further to the findings of this investigation there are issues that may impact the traffic operation of the local road network. These issues have been summarised in the following paragraphs.

7.1 Sustainable Transport Design

Measures to reduce the reliance on the private car should be investigated for this development. This will enable a reduction in trips made by private cars reducing the pressure on the local road network. This will also enable residents and employers travel options other than the private car.

Well planned and strategically placed bus routes and links to existing services should be explored for trips to Shepparton, Mooroopna, other civic attractions, employment areas and secondary colleges. This will enable sustainable transport choice, reduction in vehicle trips on the local road network and increase the accessibility of residents that do not drive (including senior citizens and teenagers).

A well planned, permeable cycle network with strategic links should also be designed to assist the reduction in vehicle trips on the local road network. There is already a good cyclist network infrastructure established in the local area and there is opportunity to strengthen this as a part of the proposed development.

In addition safe, well planned permeable pedestrian network should be established to encourage local trips by foot and reduce vehicle trips on the local road network.

Other sustainable travel planning initiatives such as local travel plans and car sharing clubs should also be considered to reduce the reliance of the private car, reduce vehicle trips on the local road network and increase accessibility of the future residents and employees of the North East Growth Area development.

The development should be designed in accordance with the Public Transport: Guidelines for Land Use and Development.

7.2 Encouraging Shepparton Bypass Development

The development and opening of the Shepparton Bypass will directly impact the local road network of the North East Growth Area development.

As discussed previously, Grahamvale Road is currently the bypass route for HGVs and accordingly experiences a high proportion of HGV traffic. It is estimated that the traffic operation with forecast development flows is likely fit comfortably within the existing intersections with Ford Road and New Dookie Road however, if Grahamvale Road was to experience 20% HGV traffic these two intersections may experience operational difficulties and increase the risk of accidents.

In addition, there are considerable safety issues as Grahamvale Road will also accommodate the secondary access point for the development likely to carry approximately 45% of all trips to/from the site.

It is recommended that CGS continue to pursue the timely development of the Shepparton Bypass in order to reduce the risk and enable satisfactory traffic operation along Grahamvale Road.

7.3 Data Collection and Analysis

As previously discussed, further data collection and analysis is necessary to provide a greater understanding of the operation of the Hawkins Street intersections and will provide a clearer

understanding of the likely traffic improvements necessary to ensure safe and effective operation of the intersections as a result of the proposed development.

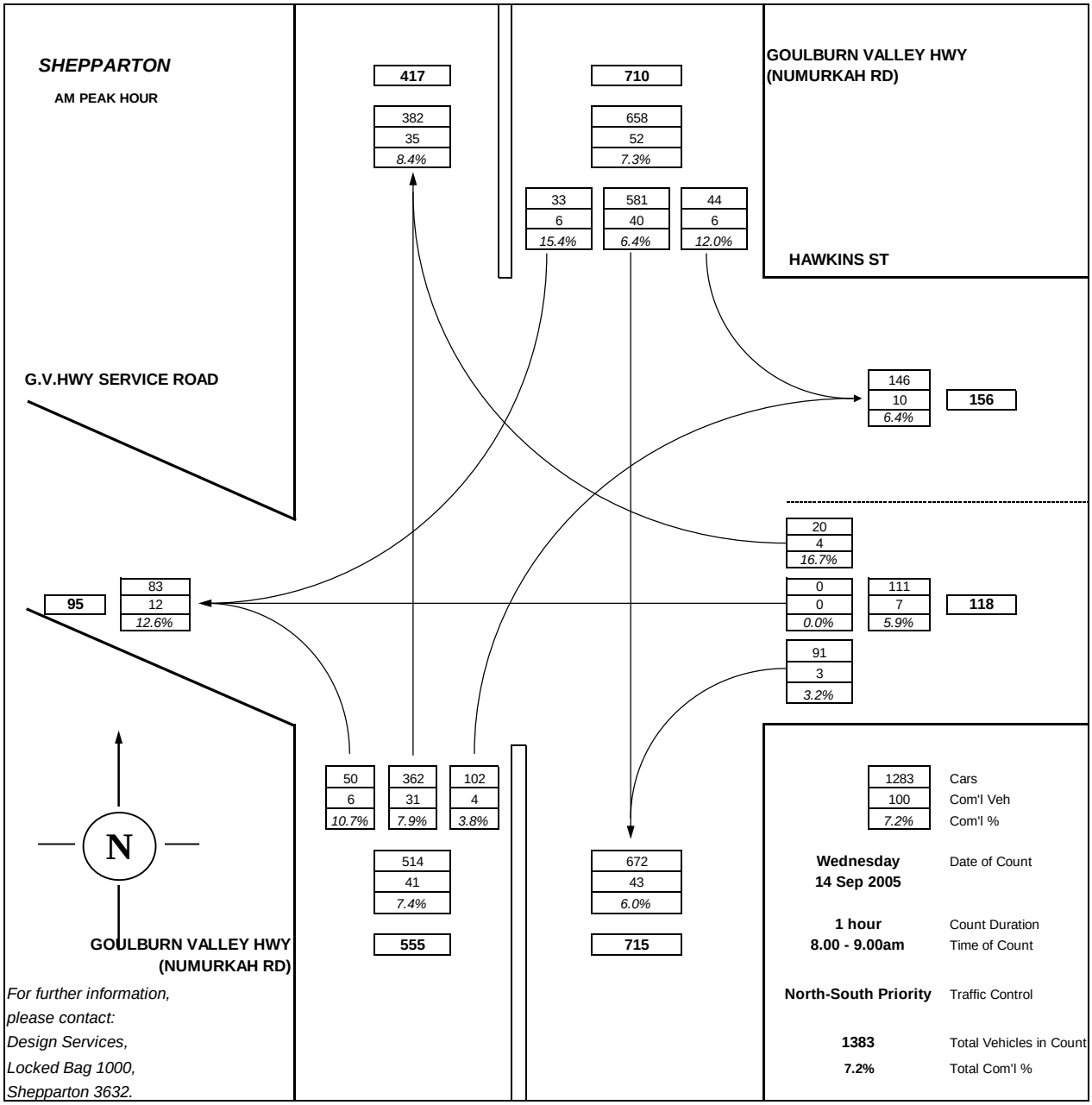
No analysis has been carried out for the intersections of Goulburn Valley Highway with Balaclava Road, Ford Road or Verney Road. Analysis of these intersections may provide a greater understanding of how they will be affected by the proposed development.

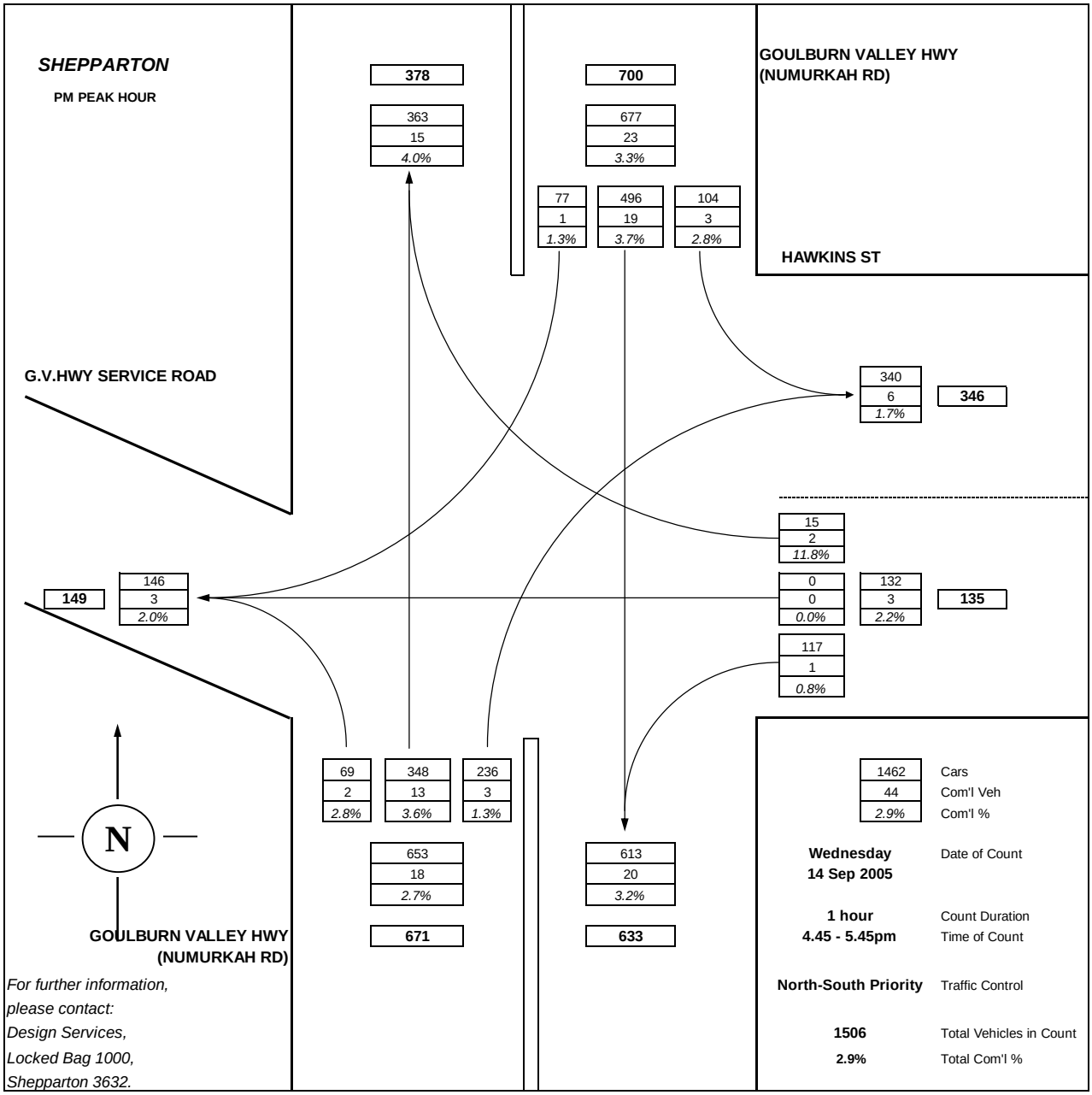
7.4 Further Developments of in the North East Growth Area

Consideration should be given to the possibility of further residential development on the North East Shepparton Growth Area site.

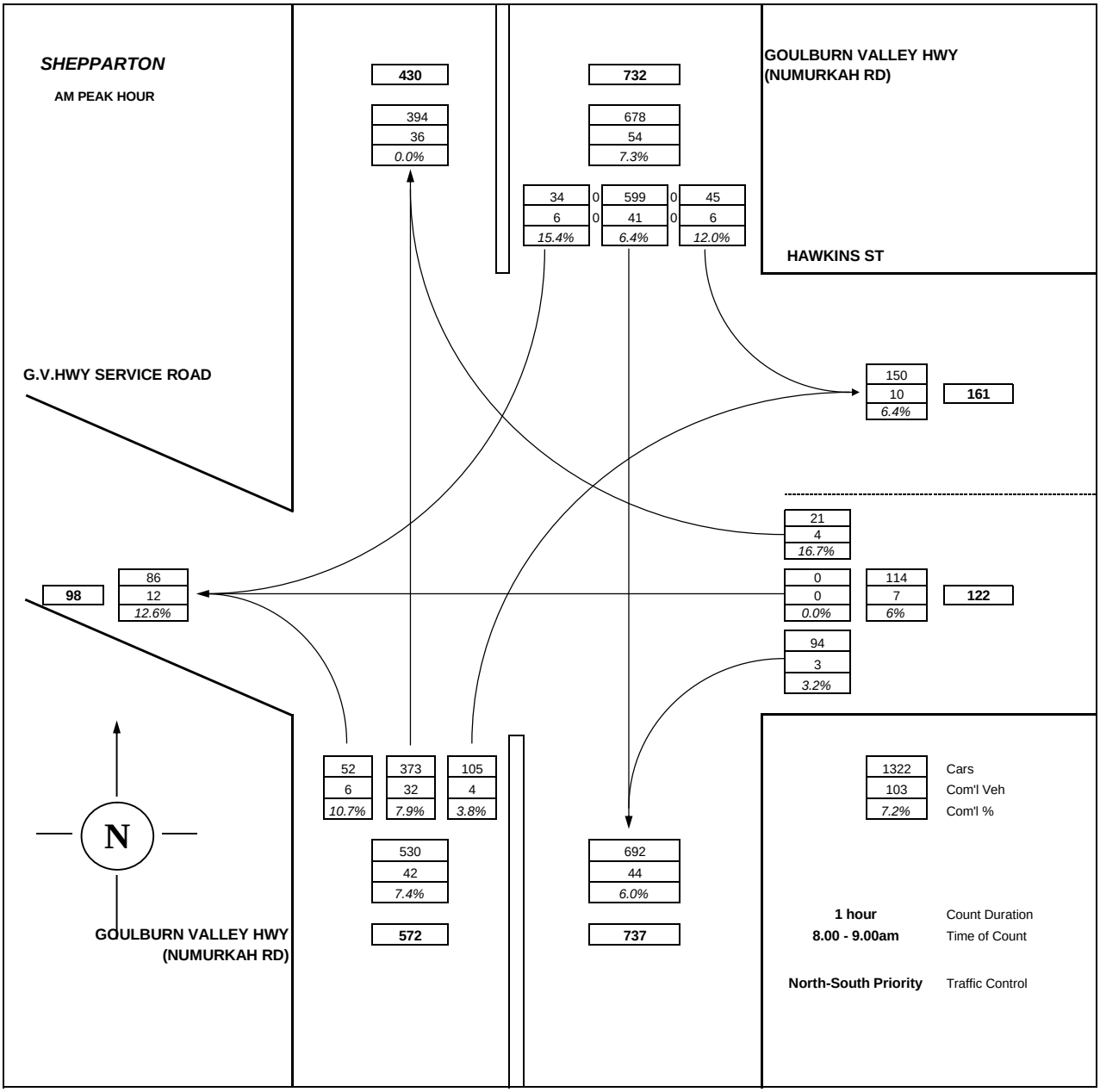
This investigation has considered a traffic forecast as described in Chapter 5 of this report, it does not take into consideration any additional development of the site than described in this report. If there is potential to develop the North East Growth Area further this should be addressed in the Outline Development Plan.

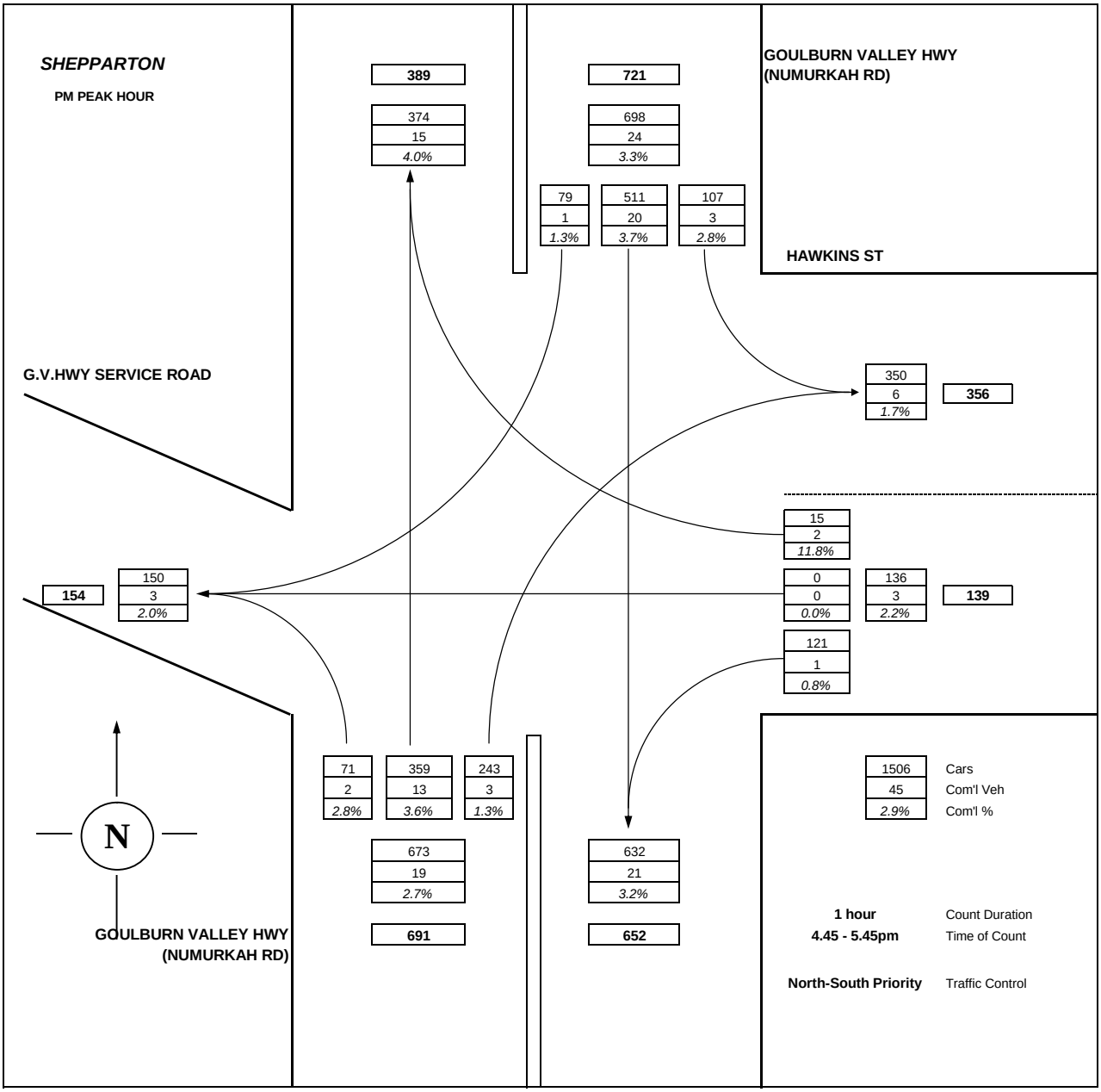
Appendix A Existing Traffic Flows

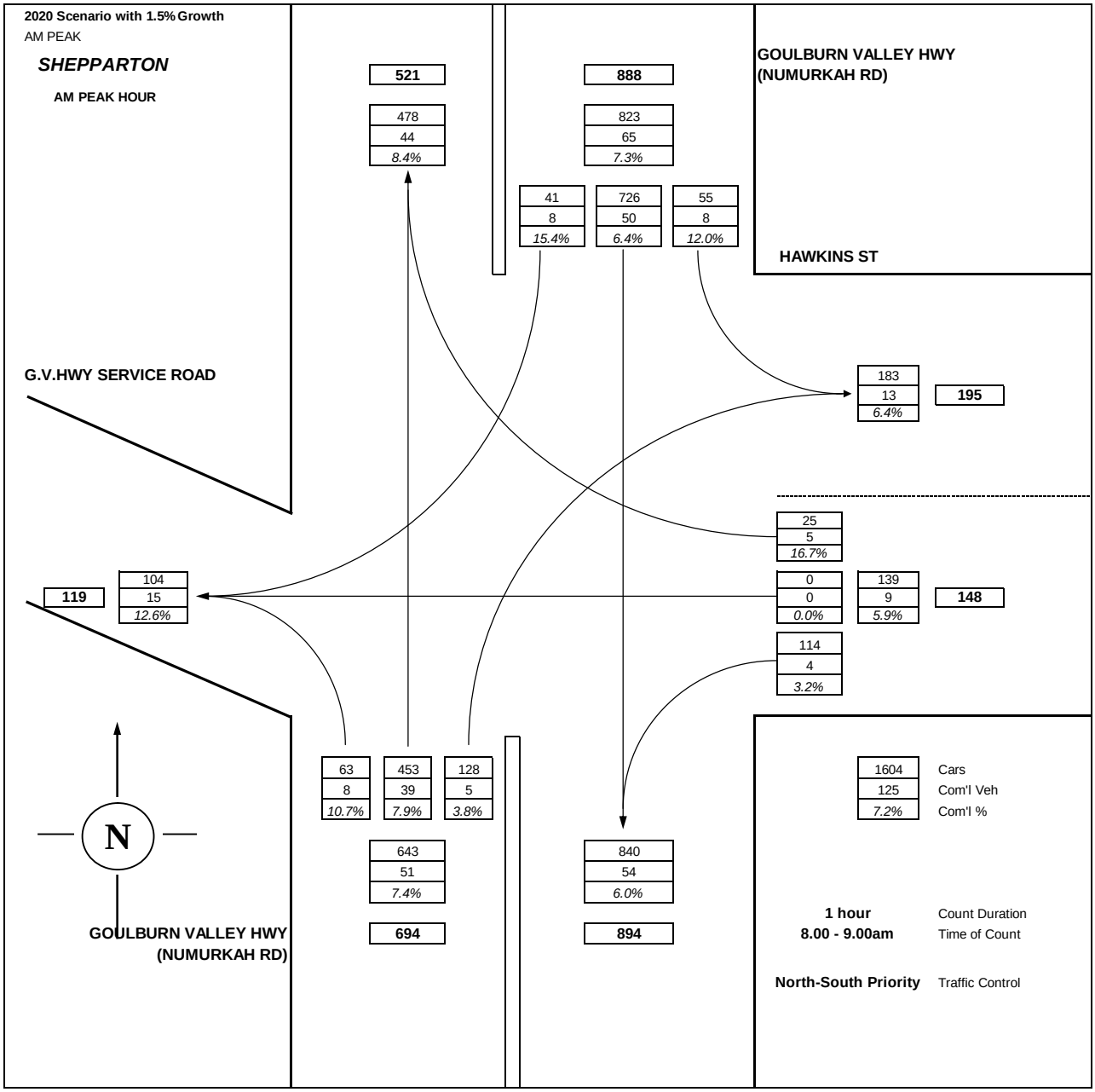

SHEPPARTON
AM PEAK HOUR
GOULBURN VALLEY HWY
(NUMURKAH RD)
HAWKINS ST
G.V.HWY SERVICE ROAD
417
382
35
8.4%
710
658
52
7.3%
33
6
15.4%
581
40
6.4%
44
6
12.0%
146
10
6.4%
156
20
4
16.7%
95
83
12
12.6%
0
0
0.0%
111
7
5.9%
118
91
3
3.2%
50
6
10.7%
362
31
7.9%
102
4
3.8%
514
41
7.4%
555
672
43
6.0%
715
N
GOULBURN VALLEY HWY
(NUMURKAH RD)
1283
100
7.2%
Cars
Com'l Veh
Com'l %
Wednesday
14 Sep 2005
Date of Count
1 hour
8.00 - 9.00am
Count Duration
Time of Count
North-South Priority
Traffic Control
1383
Total Vehicles in Count
7.2%
Total Com'l %
For further information,
please contact:
Design Services,
Locked Bag 1000,
Shepparton 3632.

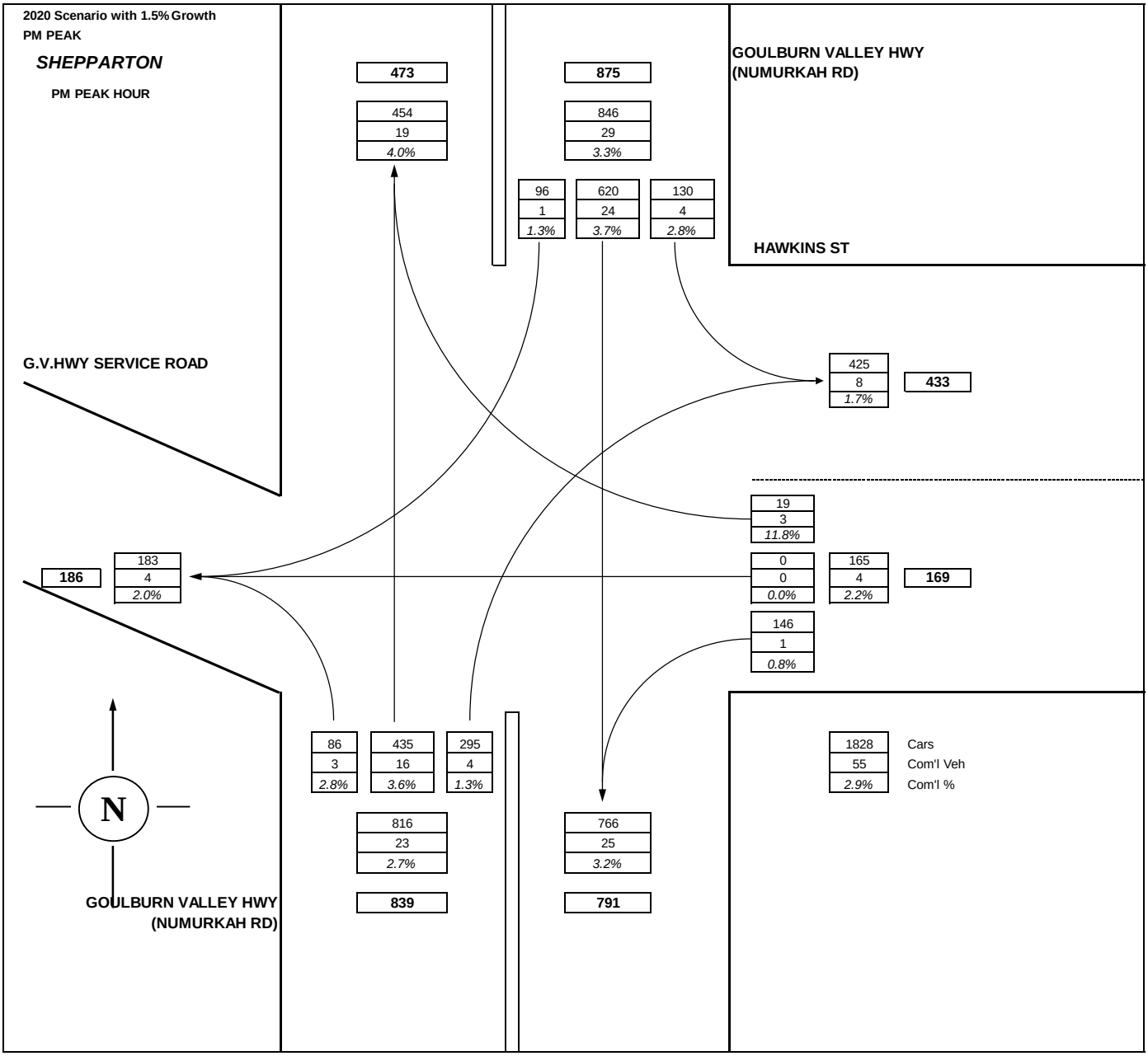


For further information, please contact:
Design Services,
Locked Bag 1000,
Shepparton 3632.


SHEPPARTON
AM PEAK HOUR
GOULBURN VALLEY HWY
(NUMURKAH RD)
HAWKINS ST
G.V.HWY SERVICE ROAD
430
394
36
0.0%
732
678
54
7.3%
34
6
15.4%
0
0
599
41
6.4%
0
0
45
6
12.0%
150
10
6.4%
161
21
4
16.7%
98
86
12
12.6%
0
0
0.0%
114
7
6%
122
94
3
3.2%
52
6
10.7%
373
32
7.9%
105
4
3.8%
530
42
7.4%
572
692
44
6.0%
737
N
GOULBURN VALLEY HWY
(NUMURKAH RD)
1322
103
7.2%
Cars
Com'l Veh
Com'l %
1 hour
Count Duration
8.00 - 9.00am
Time of Count
North-South Priority
Traffic Control


SHEPPARTON
PM PEAK HOUR
389
374
15
4.0%
721
698
24
3.3%
GOULBURN VALLEY HWY
(NUMURKAH RD)
79
1
1.3%
511
20
3.7%
107
3
2.8%
HAWKINS ST
G.V.HWY SERVICE ROAD
350
6
1.7%
356
15
2
11.8%
154
150
3
2.0%
0
0
0.0%
136
3
2.2%
139
121
1
0.8%
71
2
2.8%
359
13
3.6%
243
3
1.3%
673
19
2.7%
691
632
21
3.2%
652
N
GOULBURN VALLEY HWY
(NUMURKAH RD)
1506
45
2.9%
Cars
Com'l Veh
Com'l %
1 hour
Count Duration
4.45 - 5.45pm
Time of Count
North-South Priority
Traffic Control


2020 Scenario with 1.5% Growth
AM PEAK
SHEPPARTON
AM PEAK HOUR
GOULBURN VALLEY HWY
(NUMURKAH RD)
HAWKINS ST
G.V.HWY SERVICE ROAD
GOULBURN VALLEY HWY
(NUMURKAH RD)
N
521
478
44
8.4%
888
823
65
7.3%
41
8
15.4%
726
50
6.4%
55
8
12.0%
183
13
6.4%
195
25
5
16.7%
119
104
15
12.6%
0
0
0.0%
139
9
5.9%
148
114
4
3.2%
63
8
10.7%
453
39
7.9%
128
5
3.8%
643
51
7.4%
694
840
54
6.0%
894
1604
125
7.2%
Cars
Com'l Veh
Com'l %
1 hour
Count Duration
8.00 - 9.00am
Time of Count
North-South Priority
Traffic Control


2020 Scenario with 1.5% Growth
PM PEAK
SHEPPARTON
PM PEAK HOUR
GOULBURN VALLEY HWY
(NUMURKAH RD)
HAWKINS ST
G.V.HWY SERVICE ROAD
GOULBURN VALLEY HWY
(NUMURKAH RD)
N
473
454
19
4.0%
875
846
29
3.3%
96
1
1.3%
620
24
3.7%
130
4
2.8%
425
8
1.7%
433
19
3
11.8%
186
183
4
2.0%
0
0
0.0%
165
4
2.2%
169
146
1
0.8%
86
3
2.8%
435
16
3.6%
295
4
1.3%
816
23
2.7%
839
766
25
3.2%
791
1828
55
2.9%
Cars
Com'l Veh
Com'l %

600 282 55 Shepparton NE Growth Development

Location: Balaclava/Verney Peak Hour Ends 9:00

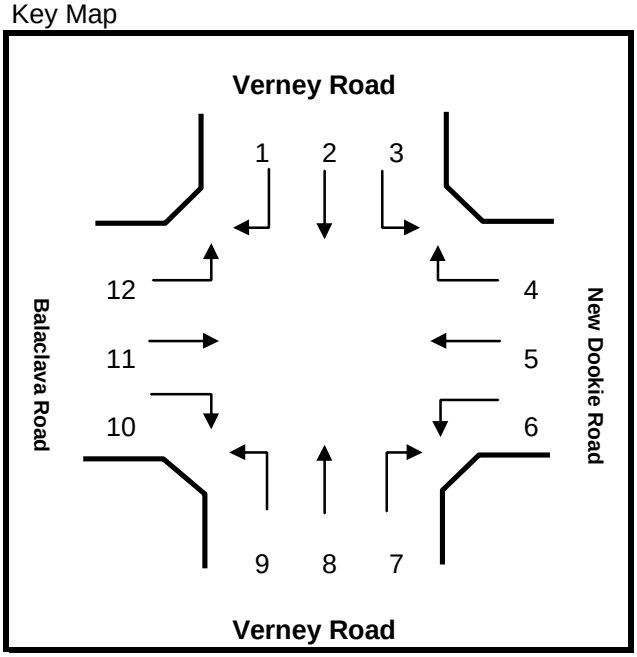
Date: 5 August 2008

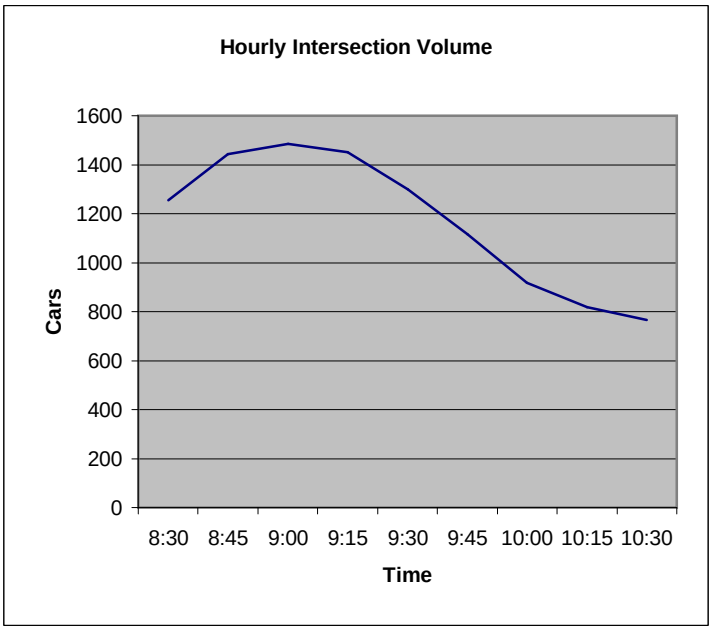
Time: 7:30-10:30

Surveyor:

Weather Conditions:

Key Map





Road	Verney Road				New Dookie Road				Verney Road				Balaclava Road				15 min	hour
Movement	R	T	L	Total	R	T	L	Total	R	T	L	Total	R	T	L	Total		
ID	1	2	3		1	2	3		1	2	3		1	2	3		total	total
7:30 to 7:45	6	46	28	**80**	19	18	10	**47**	18	23	2	**43**	7	50	3	**60**	**230**	-
7:45 to 8:00	9	70	47	**126**	17	31	14	**62**	22	24	10	**56**	17	70	1	**88**	**332**	-
8:00 to 8:15	9	46	34	**89**	23	44	19	**86**	13	23	24	**60**	13	51	8	**72**	**307**	-
8:15 to 8:30	14	78	28	**120**	21	55	21	**97**	20	38	25	**83**	24	48	14	**86**	**386**	**1255**
8:30 to 8:45	18	91	32	**141**	28	35	36	**99**	29	35	20	**84**	18	60	16	**94**	**418**	**1443**
8:45 to 9:00	14	77	37	**128**	32	46	20	**98**	15	41	15	**71**	11	45	22	**78**	**375**	**1486**
9:00 to 9:15	12	47	26	**85**	27	50	18	**95**	7	25	18	**50**	12	24	7	**43**	**273**	**1452**
9:15 to 9:30	10	37	20	**67**	15	31	12	**58**	11	36	4	**51**	13	38	6	**57**	**233**	**1299**
9:30 to 9:45	6	41	10	**57**	20	44	8	**72**	6	39	12	**57**	12	29	9	**50**	**236**	**1117**
9:45 to 10:00	8	41	24	**73**	8	19	11	**38**	3	19	7	**29**	8	23	4	**35**	**175**	**917**
10:00 to 10:15	4	26	14	**44**	13	23	7	**43**	11	28	7	**46**	11	23	7	**41**	**174**	**818**
10:15 to 10:30	2	37	16	**55**	16	17	10	**43**	7	24	9	**40**	5	30	7	**42**	**180**	**765**
AM Peak	55	292	131	**478**	104	180	96	**380**	77	137	84	**298**	66	204	60	**330**	**1486**	

600 282 55 Shepparton NE Growth Development

Location: Balaclava/Verney Peak Hour Ends 17:30

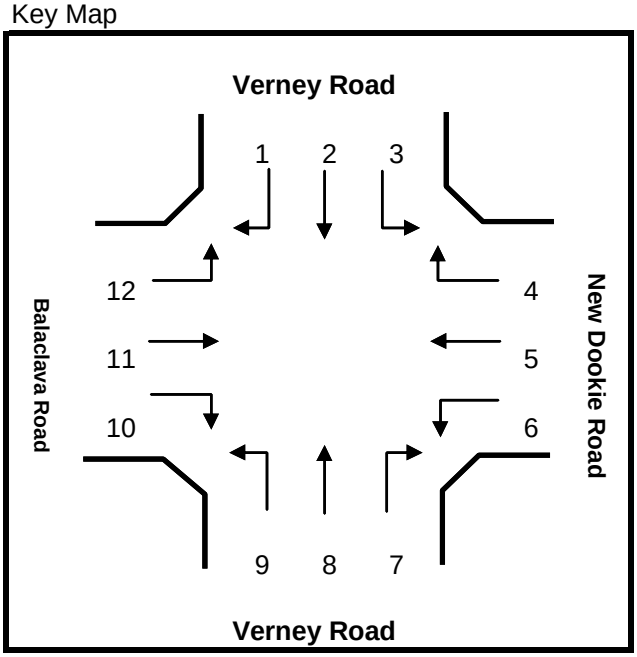
Date: 5 August 2008

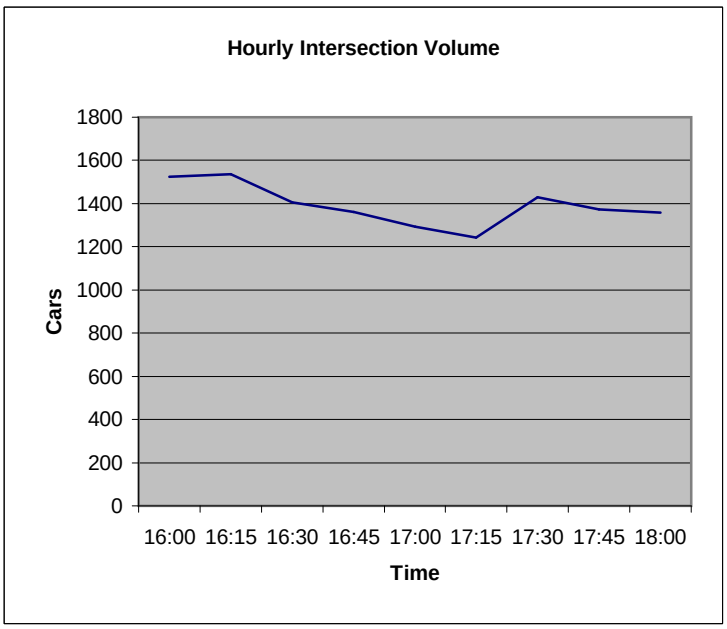
Time: 15:00-18:00

Surveyor:

Weather Conditions:

Key Map





Road	Verney Road				New Dookie Road				Verney Road				Balaclava Road				15 min total	hour total
Movement	R	T	L		R	T	L		R	T	L		R	T	L			
ID	1	2	3	Total	1	2	3	Total	1	2	3	Total	1	2	3	Total		
15:00 to 15:15	9	55	30	**94**	23	50	14	**87**	19	41	17	**77**	21	38	15	**74**	**332**	-
15:15 to 15:30	14	66	35	**115**	40	56	21	**117**	18	49	18	**85**	13	36	13	**62**	**379**	-
15:30 to 15:45	12	68	24	**104**	30	60	29	**119**	15	60	16	**91**	30	42	14	**86**	**400**	-
15:45 to 16:00	9	60	32	**101**	46	48	29	**123**	15	73	15	**103**	26	50	11	**87**	**414**	**1525**
16:00 to 16:15	10	66	19	**95**	32	53	21	**106**	13	48	22	**83**	24	29	6	**59**	**343**	**1536**
16:15 to 16:30	12	41	20	**73**	20	30	13	**63**	14	41	16	**71**	12	23	7	**42**	**249**	**1406**
16:30 to 16:45	7	53	22	**82**	35	56	17	**108**	6	68	18	**92**	21	43	10	**74**	**356**	**1362**
16:45 to 17:00	5	43	28	**76**	41	49	16	**106**	8	69	13	**90**	21	39	12	**72**	**344**	**1292**
17:00 to 17:15	3	39	15	**57**	40	47	27	**114**	8	52	17	**77**	14	26	6	**46**	**294**	**1243**
17:15 to 17:30	5	63	20	**88**	55	65	24	**144**	13	100	19	**132**	24	33	15	**72**	**436**	**1430**
17:30 to 17:45	9	49	13	**71**	27	40	13	**80**	20	76	6	**102**	10	24	11	**45**	**298**	**1372**
17:45 to 18:00	8	57	21	**86**	22	39	10	**71**	14	89	22	**125**	5	28	14	**47**	**329**	**1357**
PM Peak	20	198	85	**303**	171	217	84	**472**	35	289	67	**391**	80	141	43	**264**	**1430**	

600 282 55 Shepparton NE Growth Development

Location: Verney/Ford Peak Hour Ends: 9:15

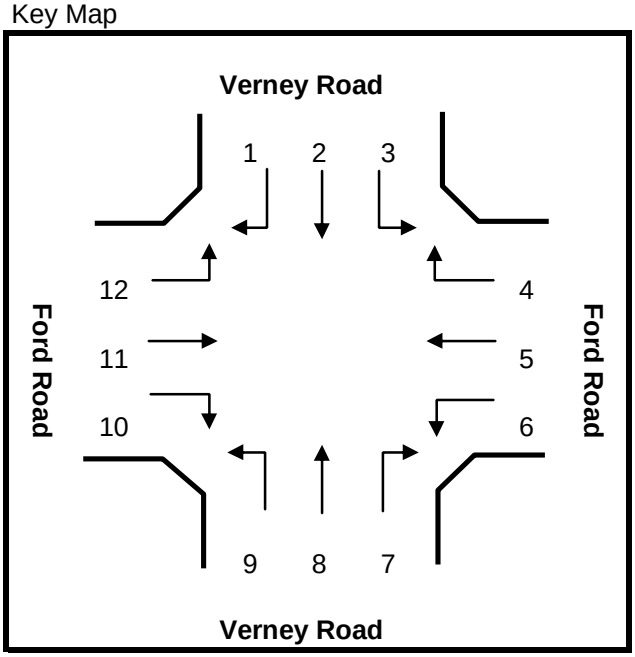
Date: 5 August 2008

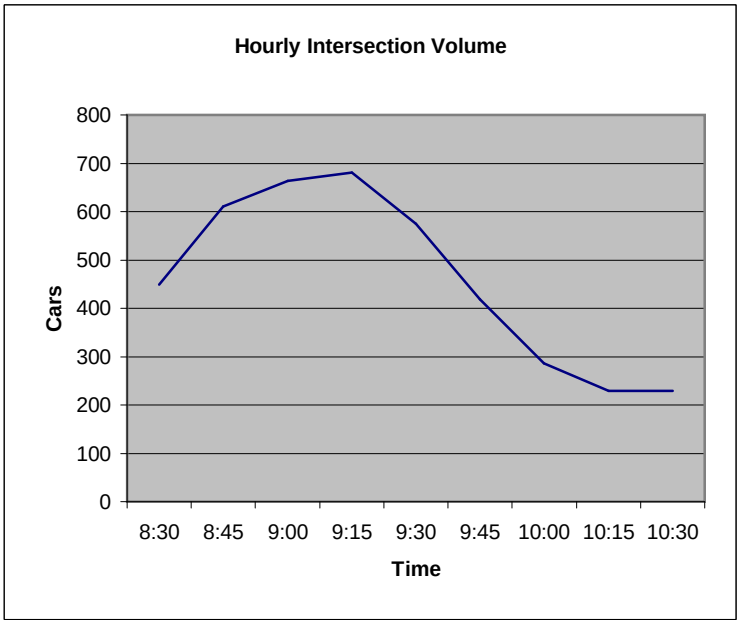
Time: 7:30-10:30

Surveyor:

Weather Conditions:

Key Map





Road	Verney Road				Ford Road				Verney Road				Ford Road				15 min total	hour total
Movement	R	T	L	Total	R	T	L	Total	R	T	L	Total	R	T	L	Total		
ID	1	2	3		1	2	3		1	2	3		1	2	3			
7:30 to 7:45	3	11	4	**18**	5	9	0	**14**	1	8	0	**9**	2	6	1	**9**	**50**	-
7:45 to 8:00	2	23	14	**39**	10	24	11	**45**	1	21	3	**25**	3	17	6	**26**	**135**	-
8:00 to 8:15	0	9	3	**12**	7	14	6	**27**	2	21	9	**32**	2	17	5	**24**	**95**	-
8:15 to 8:30	3	21	10	**34**	10	16	21	**47**	7	31	4	**42**	10	25	11	**46**	**169**	**449**
8:30 to 8:45	10	25	5	**40**	10	25	34	**69**	7	34	10	**51**	13	19	19	**51**	**211**	**610**
8:45 to 9:00	27	17	10	**54**	14	18	13	**45**	12	25	9	**46**	8	17	18	**43**	**188**	**663**
9:00 to 9:15	7	17	7	**31**	5	6	9	**20**	4	6	26	**36**	3	4	19	**26**	**113**	**681**
9:15 to 9:30	7	6	11	**24**	6	5	0	**11**	0	17	0	**17**	0	7	4	**11**	**63**	**575**
9:30 to 9:45	1	8	10	**19**	6	3	1	**10**	0	19	1	**20**	0	4	2	**6**	**55**	**419**
9:45 to 10:00	2	8	5	**15**	5	3	1	**9**	0	17	2	**19**	0	9	3	**12**	**55**	**286**
10:00 to 10:15	2	12	5	**19**	5	3	3	**11**	0	15	0	**15**	2	6	3	**11**	**56**	**229**
10:15 to 10:30	5	6	12	**23**	4	10	0	**14**	1	8	7	**16**	1	5	4	**10**	**63**	**229**
AM Peak	47	80	32	**159**	39	65	77	**181**	30	96	49	**175**	34	65	67	**166**	**681**	

600 282 55 Shepparton NE Growth Development

Location: Verney/Ford Peak Hour Ends: 16:00

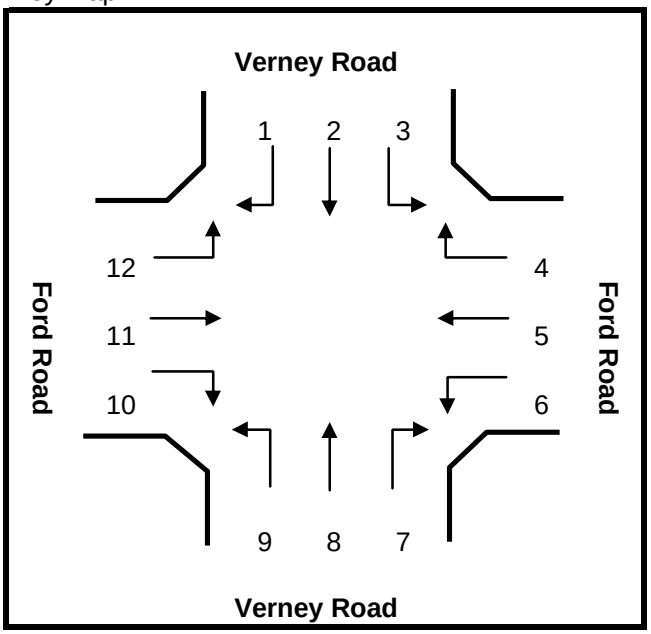
Date: 5 August 2008

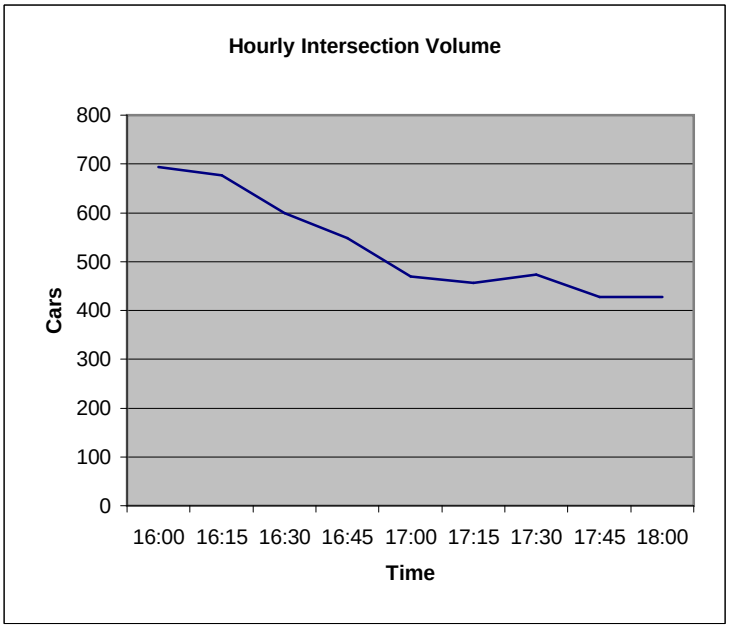
Time: 15:00-18:00

Surveyor:

Weather Conditions:

Key Map





Road	Verney Road				Ford Road				Verney Road				Ford Road					
Movement	R	T	L		R	T	L		R	T	L		R	T	L		15 min total	hour total
ID	1	2	3	Total	1	2	3	Total	1	2	3	Total	1	2	3	Total		
15:00 to 15:15	16	30	6	**52**	15	11	6	**32**	2	13	4	**19**	1	17	9	**27**	**130**	-
15:15 to 15:30	13	40	11	**64**	7	28	16	**51**	8	28	10	**46**	4	9	5	**18**	**179**	-
15:30 to 15:45	18	32	6	**56**	6	18	8	**32**	14	38	13	**65**	3	26	23	**52**	**205**	-
15:45 to 16:00	15	31	19	**65**	6	17	7	**30**	6	27	5	**38**	6	25	16	**47**	**180**	**694**
16:00 to 16:15	4	16	8	**28**	6	8	7	**21**	10	25	3	**38**	1	14	11	**26**	**113**	**677**
16:15 to 16:30	5	6	10	**21**	11	8	7	**26**	10	13	7	**30**	10	6	8	**24**	**101**	**599**
16:30 to 16:45	7	17	10	**34**	18	20	16	**54**	11	10	12	**33**	14	5	14	**33**	**154**	**548**
16:45 to 17:00	7	11	10	**28**	5	11	8	**24**	9	10	6	**25**	8	9	7	**24**	**101**	**469**
17:00 to 17:15	9	18	9	**36**	6	10	3	**19**	3	13	3	**19**	0	11	15	**26**	**100**	**456**
17:15 to 17:30	3	30	6	**39**	9	9	8	**26**	3	13	10	**26**	2	19	6	**27**	**118**	**473**
17:30 to 17:45	6	13	6	**25**	10	7	5	**22**	4	15	4	**23**	18	13	8	**39**	**109**	**428**
17:45 to 18:00	7	22	10	**39**	2	4	6	**12**	3	18	5	**26**	4	12	7	**23**	**100**	**427**
PM Peak	62	133	42	**237**	34	74	37	**145**	30	106	32	**168**	14	77	53	**144**	**694**	

600 282 55 Shepparton NE Growth Development

Location: Grahamvale/New Dookie Peak Hour Ends: 9:00

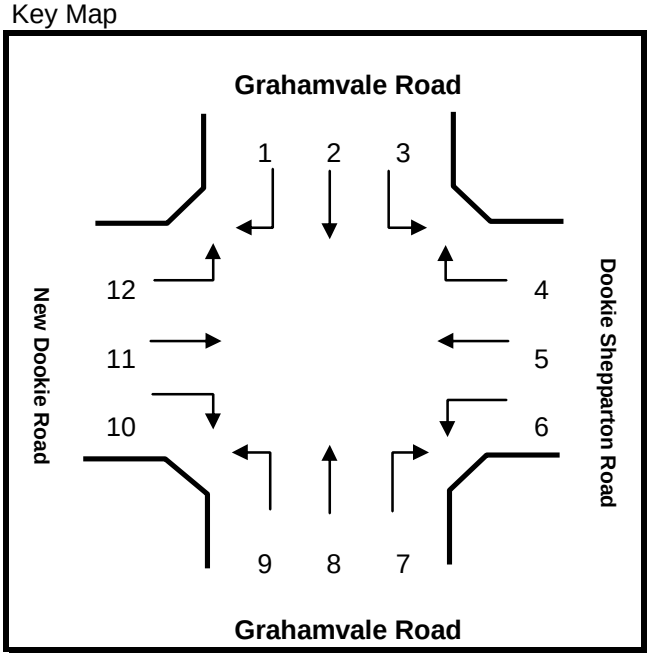
Date: 5 August 2008

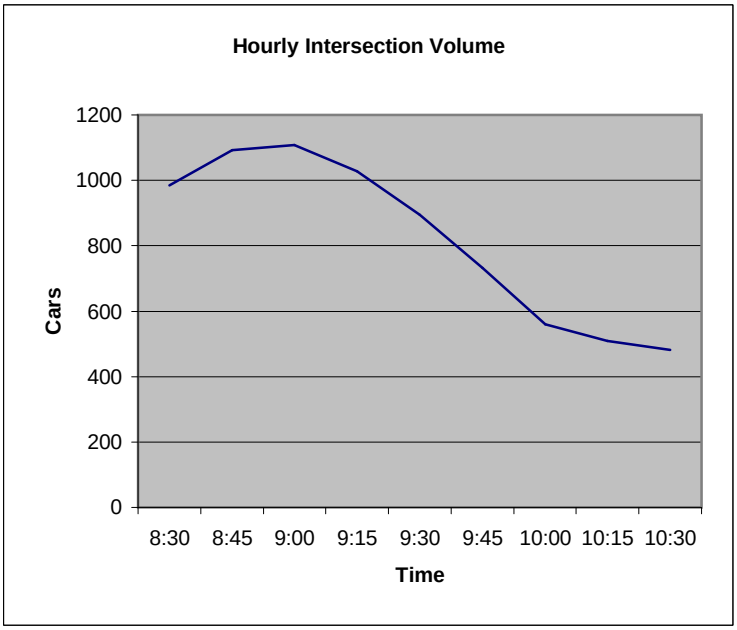
Time: 7:30-10:30

Surveyor:

Weather Conditions:

Key Map





Road	Grahamvale Road				ookie Shepparton Roa				Grahamvale Road				New Dookie Road				15 min total	hour total
Movement	R	T	L	Total	R	T	L	Total	R	T	L	Total	R	T	L	Total		
ID	1	2	3		1	2	3		1	2	3		1	2	3			
7:30 to 7:45	15	39	4	**58**	0	28	3	**31**	6	22	25	**53**	15	26	9	**50**	**192**	**-**
7:45 to 8:00	26	37	4	**67**	2	30	6	**38**	30	37	37	**104**	25	33	14	**72**	**281**	**-**
8:00 to 8:15	18	32	0	**50**	1	44	7	**52**	11	25	32	**68**	17	28	17	**62**	**232**	**-**
8:15 to 8:30	19	50	3	**72**	0	43	9	**52**	4	47	27	**78**	20	37	20	**77**	**279**	**984**
8:30 to 8:45	28	54	1	**83**	4	32	11	**47**	5	41	36	**82**	29	24	36	**89**	**301**	**1093**
8:45 to 9:00	40	58	6	**104**	4	39	7	**50**	9	32	24	**65**	22	25	30	**77**	**296**	**1108**
9:00 to 9:15	22	30	2	**54**	0	22	3	**25**	7	21	16	**44**	13	10	6	**29**	**152**	**1028**
9:15 to 9:30	8	26	3	**37**	2	18	8	**28**	2	17	23	**42**	16	14	8	**38**	**145**	**894**
9:30 to 9:45	5	26	6	**37**	1	17	6	**24**	8	19	20	**47**	9	15	7	**31**	**139**	**732**
9:45 to 10:00	8	24	2	**34**	1	20	4	**25**	7	18	14	**39**	10	11	5	**26**	**124**	**560**
10:00 to 10:15	7	13	0	**20**	2	17	3	**22**	4	14	10	**28**	12	12	6	**30**	**100**	**508**
10:15 to 10:30	6	18	1	**25**	1	14	5	**20**	8	18	14	**40**	11	18	4	**33**	**118**	**481**
AM Peak	105	194	10	**309**	9	158	34	**201**	29	145	119	**293**	88	114	103	**305**	**1108**	

600 282 55 Shepparton NE Growth Development

Location: Grahamvale/New Dookie Peak Hour Ends: 16:15

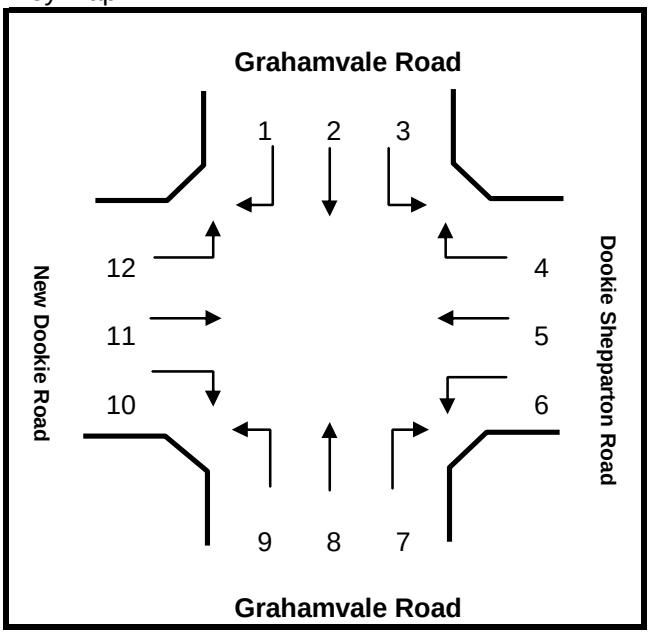
Date: 5 August 2008

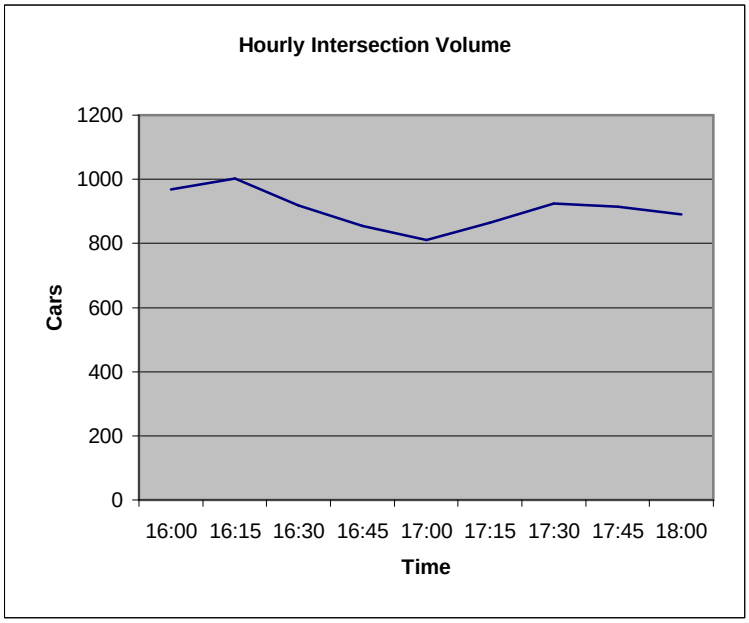
Time: 15:00-18:00

Surveyor:

Weather Conditions:

Key Map





Road	Grahamvale Road				ookie Shepparton Roa				Grahamvale Road				New Dookie Road					
Movement	R	T	L		R	T	L		R	T	L		R	T	L		15 min total	hour total
ID	1	2	3	Total	1	2	3	Total	1	2	3	Total	1	2	3	Total		
15:00 to 15:15	10	27	1	**38**	2	37	4	**43**	10	32	17	**59**	15	23	17	**55**	**195**	-
15:15 to 15:30	11	30	2	**43**	5	29	8	**42**	13	55	18	**86**	28	13	24	**65**	**236**	-
15:30 to 15:45	32	46	7	**85**	7	36	9	**52**	7	45	18	**70**	29	32	27	**88**	**295**	-
15:45 to 16:00	28	37	3	**68**	3	25	8	**36**	6	50	25	**81**	21	21	16	**58**	**243**	**969**
16:00 to 16:15	9	29	3	**41**	1	33	20	**54**	12	47	16	**75**	21	23	14	**58**	**228**	**1002**
16:15 to 16:30	9	20	1	**30**	2	22	6	**30**	5	35	14	**54**	16	16	6	**38**	**152**	**918**
16:30 to 16:45	11	14	0	**25**	1	25	9	**35**	17	44	38	**99**	26	30	16	**72**	**231**	**854**
16:45 to 17:00	13	18	1	**32**	3	25	8	**36**	13	36	19	**68**	22	29	12	**63**	**199**	**810**
17:00 to 17:15	12	29	1	**42**	3	31	15	**49**	11	54	22	**87**	34	44	27	**105**	**283**	**865**
17:15 to 17:30	8	20	0	**28**	0	23	18	**41**	9	51	16	**76**	23	33	10	**66**	**211**	**924**
17:30 to 17:45	7	22	4	**33**	0	17	8	**25**	16	61	21	**98**	19	36	10	**65**	**221**	**914**
17:45 to 18:00	4	26	1	**31**	0	27	10	**37**	10	21	27	**58**	16	26	7	**49**	**175**	**890**
PM Peak	80	142	15	**237**	16	123	45	**184**	38	197	77	**312**	99	89	81	**269**	**1002**	

600 282 55 Shepparton NE Growth Development

Location: Grahamvale/Ford Peak Hour Ends: 16:15

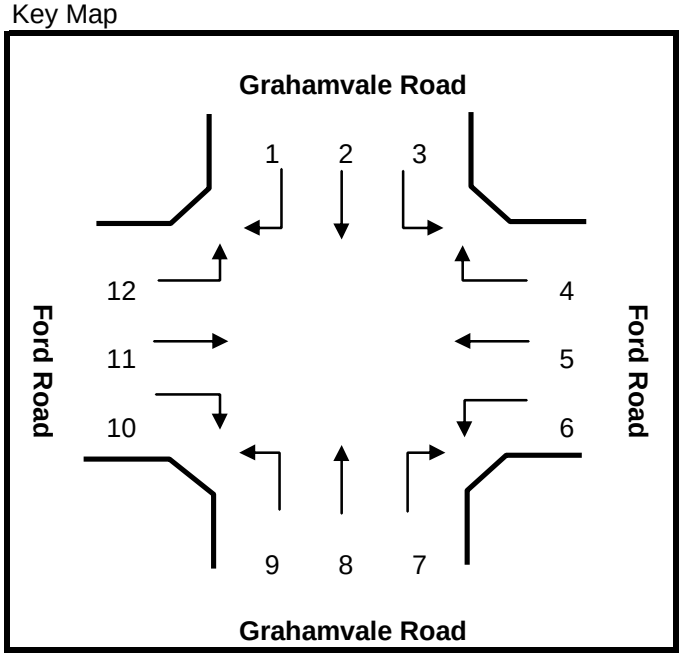
Date: 5 August 2008

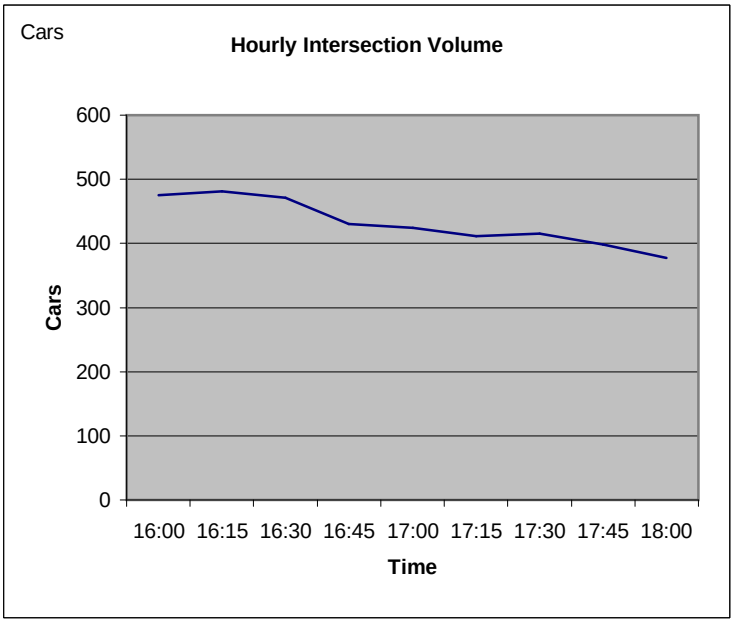
Time: 15:00-18:00

Surveyor:

Weather Conditions:

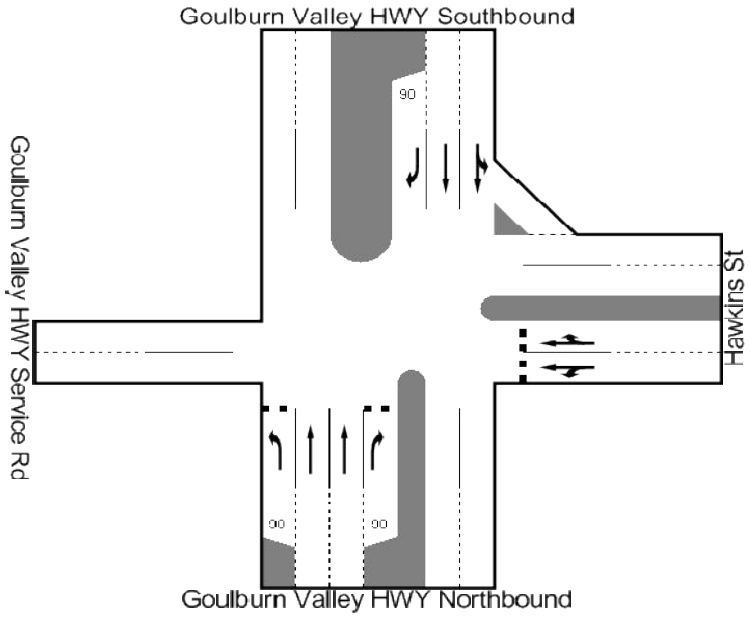
Key Map





Road	Grahamvale Road				Ford Road				Grahamvale Road				Ford Road					
Movement	R	T	L		R	T	L		R	T	L		R	T	L		15 min total	hour total
ID	1	2	3	Total	1	2	3	Total	1	2	3	Total	1	2	3	Total		
15:00 to 15:15	2	29	7	**38**	15	4	1	**20**	1	26	1	**28**	3	13	5	**21**	**107**	-
15:15 to 15:30	2	30	6	**38**	18	6	3	**27**	1	23	1	**25**	3	7	4	**14**	**104**	-
15:30 to 15:45	6	61	20	**87**	23	9	6	**38**	4	20	1	**25**	2	6	2	**10**	**160**	-
15:45 to 16:00	1	36	21	**58**	6	6	2	**14**	1	24	2	**27**	1	2	2	**5**	**104**	**475**
16:00 to 16:15	1	44	6	**51**	10	7	3	**20**	6	22	1	**29**	2	10	1	**13**	**113**	**481**
16:15 to 16:30	1	36	6	**43**	8	8	5	**21**	2	22	0	**24**	0	5	1	**6**	**94**	**471**
16:30 to 16:45	3	50	5	**58**	10	6	4	**20**	4	22	2	**28**	1	9	3	**13**	**119**	**430**
16:45 to 17:00	1	44	12	**57**	5	11	2	**18**	1	20	0	**21**	0	1	1	**2**	**98**	**424**
17:00 to 17:15	3	51	10	**64**	6	9	3	**18**	1	15	0	**16**	0	2	0	**2**	**100**	**411**
17:15 to 17:30	2	45	8	**55**	7	8	0	**15**	3	17	0	**20**	1	6	1	**8**	**98**	**415**
17:30 to 17:45	4	50	10	**64**	3	6	1	**10**	3	20	0	**23**	0	5	0	**5**	**102**	**398**
17:45 to 18:00	1	30	6	**37**	4	9	1	**14**	0	16	1	**17**	1	6	2	**9**	**77**	**377**
PM Peak	10	171	53	**234**	57	28	14	**99**	12	89	5	**106**	8	25	9	**42**	**481**	

Appendix B SIDRA Analysis



SIDRA INTERSECTION

Movement Summary

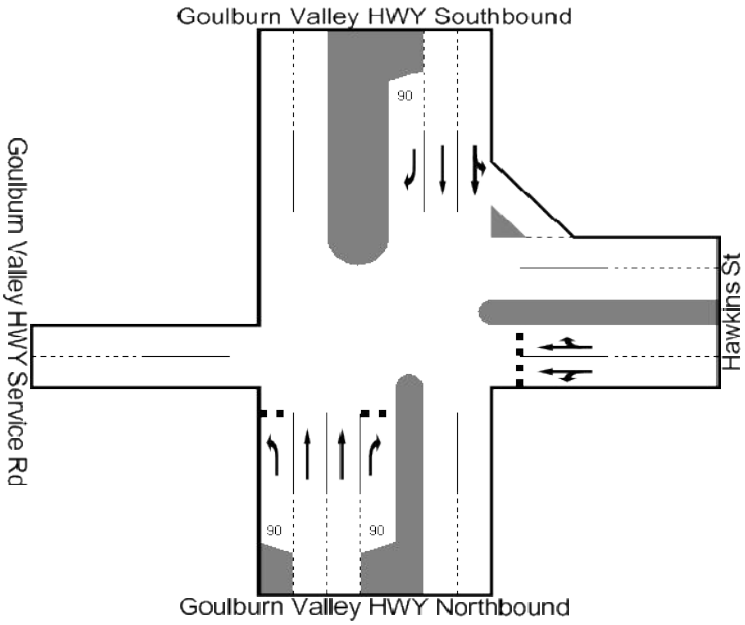
Shepparton

Hawkins Street / Goulburn Valley Highway / Numurkah Road

Give-way

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Goulburn Valley HWY Northbound										
1	L	61	9.8	0.035	8.6	LOS A	0	0.00	0.67	49.0
2	T	426	8.0	0.115	0.0	LOS A	0	0.00	0.00	60.0
3	R	115	3.5	0.180	12.5	LOS B	6	0.61	0.85	44.8
Approach		603	7.3	0.180	3.2	LOS A	6	0.12	0.23	55.2
Hawkins St										
4	L	102	2.9	0.208	14.3	LOS B	7	0.63	0.88	43.2
5	T	1	0.0	0.200	13.6	LOS B	7	0.63	0.86	43.8
6	R	26	15.4	0.448	92.5	LOS F	15	0.96	1.04	17.1
Approach		129	5.4	0.449	30.0	LOS D	15	0.70	0.91	32.9
Goulburn Valley HWY Southbound										
7	L	54	11.3	0.196	8.2	LOS A	0	0.00	0.63	49.4
8	T	674	6.4	0.195	0.0	LOS A	0	0.00	0.00	60.0
9	R	42	14.3	0.055	11.3	LOS B	2	0.50	0.72	46.3
Approach		769	7.2	0.195	1.2	LOS A	2	0.03	0.08	58.2
All Vehicles		1501	7.1	0.448	4.5	Not Applicable	15	0.12	0.21	53.5



SIDRA INTERSECTION

Movement Summary

Shepparton

Hawkins Street / Goulburn Valley Highway / Numurkah Road

Give-way

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Goulburn Valley HWY Northbound										
1	L	77	2.6	0.042	8.3	LOS A	0	0.00	0.67	49.0
2	T	392	3.6	0.103	0.0	LOS A	0	0.00	0.00	60.0
3	R	259	1.2	0.372	13.2	LOS B	17	0.64	0.93	44.2
Approach		728	2.6	0.372	5.6	LOS A	17	0.23	0.40	52.1
Hawkins St										
4	L	128	0.8	0.229	13.2	LOS B	8	0.59	0.87	44.0
5	T	1	0.0	0.250	12.6	LOS B	8	0.59	0.85	44.7
6	R	18	11.1	0.295	77.1	LOS F	9	0.95	1.01	19.4
Approach		147	2.0	0.296	21.0	LOS C	9	0.63	0.89	38.0
Goulburn Valley HWY Southbound										
7	L	116	2.6	0.179	7.9	LOS A	0	0.00	0.63	49.4
8	T	559	3.8	0.179	0.0	LOS A	0	0.00	0.00	60.0
9	R	84	1.2	0.092	10.2	LOS B	3	0.48	0.72	46.9
Approach		759	3.3	0.179	2.3	LOS A	3	0.05	0.18	56.4
All Vehicles		1634	2.9	0.372	5.5	Not Applicable	17	0.18	0.34	52.2

Hawkins Street / Goulburn Valley Highway / Numurkah Road

AM Peak 2020 and Site - Giveway

Give-way

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Goulburn Valley HWY Northbound										
1	L	59	10.2	0.034	9.3	LOS A	0	0.00	0.73	48.1
2	T	518	7.9	0.140	0.0	LOS A	0	0.00	0.00	60.0
3	R	231	2.2	0.447	16.9	LOS C	20	0.77	1.01	41.1
Approach		807	6.4	0.448	5.5	LOS A	20	0.22	0.34	52.2
Hawkins St										
4	L	604	0.7	1.473	452.0	LOS F	926	1.00	6.92	4.5
6	R	41	36.6	1.000*	667.0	LOS F	77	1.00	1.72	3.1
Approach		645	2.9	1.473	465.6	LOS F	926	1.00	6.59	4.3
Goulburn Valley HWY Southbound										
7	L	66	12.1	0.237	8.3	LOS A	0	0.00	0.63	49.4
8	T	817	6.5	0.238	0.0	LOS A	0	0.00	0.00	60.0
9	R	41	14.6	0.057	12.8	LOS B	2	0.52	0.77	44.9
Approach		924	7.3	0.238	1.2	LOS A	2	0.02	0.08	58.2
All Vehicles		2376	5.8	1.473	128.7	Not Applicable	926	0.35	1.94	13.2

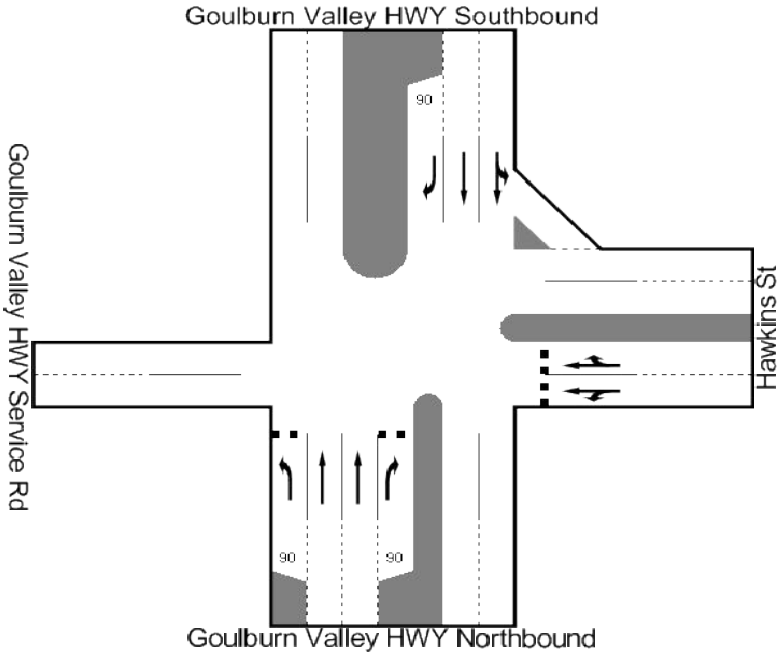
Hawkins Street / Goulburn Valley Highway / Numurkah Road

AM Peak 2020and Site - Signalised

Signalised - Fixed time Cycle Time = 30 seconds

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Goulburn Valley HWY Northbound										
1	L	59	10.2	0.118	18.0	LOS B	8	0.76	0.75	40.3
2	T	518	7.9	0.486	9.9	LOS A	35	0.86	0.71	47.1
3	R	231	2.2	0.872	27.6	LOS C	40	1.00	1.05	34.2
Approach		807	6.4	0.871	15.6	LOS B	40	0.90	0.81	42.1
Hawkins St										
4	L	604	0.7	0.820	22.2	LOS C	84	0.97	1.04	37.2
6	R	41	36.6	0.070	15.4	LOS B	6	0.68	0.70	42.7
Approach		645	2.9	0.819	21.8	LOS C	84	0.95	1.02	37.5
Goulburn Valley HWY Southbound										
7	L	66	12.1	0.808	23.4	LOS C	68	0.98	1.04	36.9
8	T	817	6.5	0.810	15.1	LOS B	68	0.98	1.02	42.4
9	R	41	14.6	0.138	21.3	LOS C	7	0.85	0.73	38.3
Approach		924	7.3	0.810	16.0	LOS B	68	0.97	1.01	41.7
All Vehicles		2376	5.8	0.872	17.4	LOS B	84	0.94	0.95	40.6



SIDRA INTERSECTION

Movement Summary

Hawkins Street / Goulburn Valley Highway / Numurkah Road

2020 AM Peak - Giveway

Give-way

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Goulburn Valley HWY Northbound										
1	L	68	10.3	0.039	9.3	LOS A	0	0.00	0.73	48.1
2	T	480	7.9	0.129	0.0	LOS A	0	0.00	0.00	60.0
3	R	129	3.9	0.229	13.8	LOS B	8	0.67	0.89	43.7
Approach		677	7.4	0.229	3.6	LOS A	8	0.13	0.24	54.7
Hawkins St										
4	L	115	2.6	0.255	15.7	LOS C	9	0.69	0.92	42.0
6	R	31	16.7	0.732	174.1	LOS F	26	0.99	1.11	10.4
Approach		145	5.5	0.729	48.4	LOS E	26	0.75	0.96	25.8
Goulburn Valley HWY Southbound										
7	L	61	11.5	0.220	8.3	LOS A	0	0.00	0.63	49.4
8	T	759	6.3	0.220	0.0	LOS A	0	0.00	0.00	60.0
9	R	47	14.9	0.063	12.5	LOS B	2	0.51	0.76	45.2
Approach		867	7.2	0.220	1.3	LOS A	2	0.03	0.09	58.1
All Vehicles		1689	7.1	0.732	6.2	Not Applicable	26	0.13	0.22	51.3

Hawkins Street / Goulburn Valley Highway / Numurkah Road

2020 PM Peak and Site - Giveway

Give-way

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Goulburn Valley HWY Northbound										
1	L	75	2.7	0.041	9.0	LOS A	0	0.00	0.73	48.1
2	T	475	3.2	0.139	0.0	LOS A	0	0.00	0.00	60.0
3	R	645	0.7	1.024	71.5	LOS F	237	1.00	2.87	20.3
Approach		1195	1.9	1.025	35.9	LOS E	237	0.49	1.46	30.3
Hawkins St										
4	L	396	0.3	0.810	25.5	LOS D	64	0.88	1.40	35.2
6	R	27	25.9	1.000*	763.4	LOS F	55	1.00	1.44	2.7
Approach		423	1.9	1.000	72.6	LOS F	64	0.89	1.40	20.0
Goulburn Valley HWY Southbound										
7	L	141	2.8	0.217	8.0	LOS A	0	0.00	0.63	49.4
8	T	678	3.7	0.217	0.0	LOS A	0	0.00	0.00	60.0
9	R	82	1.2	0.092	11.5	LOS B	3	0.48	0.75	45.7
Approach		901	3.3	0.217	2.3	LOS A	3	0.04	0.17	56.5

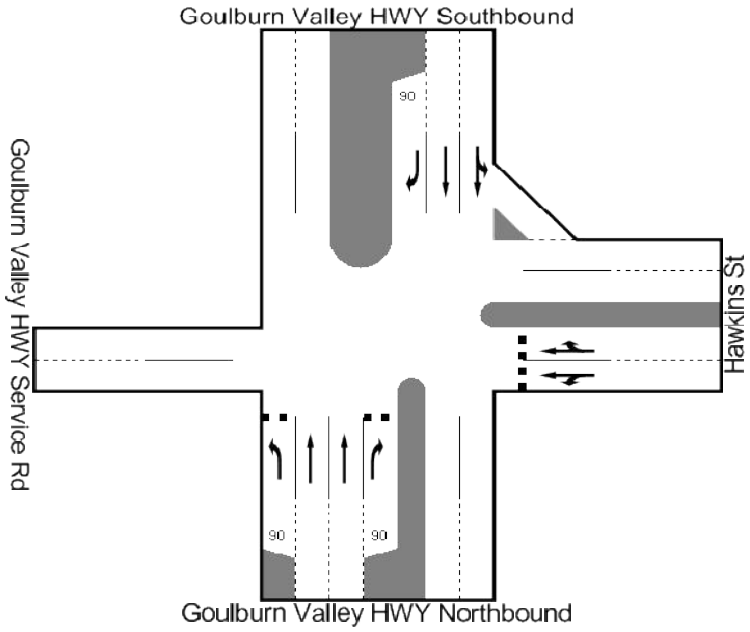
Hawkins Street / Goulburn Valley Highway / Numurkah Road

PM Peak 2020 and Site - Signalised

Signalised - Fixed time Cycle Time = 80 seconds

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Goulburn Valley HWY Northbound										
1	L	75	2.7	0.085	13.0	LOS B	10	0.33	0.75	44.2
2	T	494	3.4	0.193	4.4	LOS A	33	0.37	0.32	53.5
3	R	645	0.6	0.857	34.8	LOS C	164	0.97	1.05	30.8
Approach		1214	1.9	0.857	21.1	LOS C	164	0.69	0.73	38.0
Hawkins St										
4	L	396	0.3	0.837	46.3	LOS D	112	1.00	1.11	26.3
6	R	23	13.0	0.071	38.6	LOS D	9	0.87	0.71	29.4
Approach		419	1.0	0.837	45.9	LOS D	112	0.99	1.09	26.5
Goulburn Valley HWY Southbound										
7	L	141	2.8	0.841	42.0	LOS D	129	1.00	1.01	28.0
8	T	678	3.7	0.841	36.0	LOS D	131	1.00	1.01	30.2
9	R	82	1.2	0.141	14.6	LOS B	13	0.39	0.74	42.9
Approach		901	3.3	0.841	35.0	LOS C	131	0.94	0.98	30.6



SIDRA INTERSECTION

Movement Summary

Hawkins Street / Goulburn Valley Highway / Numurkah Road

2020 PM Peak - Giveway

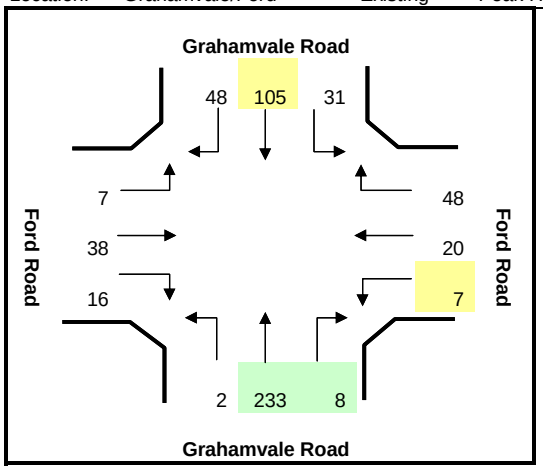
Give-way

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Goulburn Valley HWY Northbound										
1	L	86	2.3	0.047	9.0	LOS A	0	0.00	0.73	48.1
2	T	441	3.6	0.116	0.0	LOS A	0	0.00	0.00	60.0
3	R	292	1.0	0.466	15.0	LOS C	23	0.71	1.00	42.6
Approach		818	2.6	0.466	6.3	LOS A	23	0.25	0.43	51.2
Hawkins St										
4	L	144	0.7	0.272	14.2	LOS B	10	0.64	0.90	43.1
6	R	21	9.5	0.389	93.4	LOS F	12	0.96	1.02	16.9
Approach		165	1.8	0.392	24.3	LOS C	12	0.68	0.92	36.0
Goulburn Valley HWY Southbound										
7	L	131	2.3	0.201	7.9	LOS A	0	0.00	0.63	49.4
8	T	629	3.7	0.201	0.0	LOS A	0	0.00	0.00	60.0
9	R	95	1.1	0.103	11.3	LOS B	4	0.47	0.75	45.9
Approach		854	3.2	0.201	2.5	LOS A	4	0.05	0.18	56.2
All Vehicles		1837	2.8	0.466	6.1	Not Applicable	23	0.20	0.36	51.4

600 282 55 Shepparton NE Growth Development

Location: Grahamvale/Ford Existing Peak Hour: 8:00 - 9:00am



Growth Rate	1.02
per annum	
No Years	12

Road	Grahamvale Road				Ford Road				Grahamvale Road				Ford Road			
Movement	R	T	L	Total	R	T	L	Total	R	T	L	Total	R	T	L	Total
ID	1	2	3		4	5	6		7	8	9		10	11	12	
8:00 - 9:00ar	40	75	26	**141**	40	17	6	**63**	7	129	2	**138**	13	32	6	**51**
2020 Growt	**48**	**90**	**31**	**169**	**48**	**20**	**7**	**75**	**8**	**154**	**2**	**165**	**16**	**38**	**7**	**61**
2020 + Devt	48	105	31	**169**	48	20	7	**75**	8	233	2	**165**	16	38	7	**61**

94

Out

In

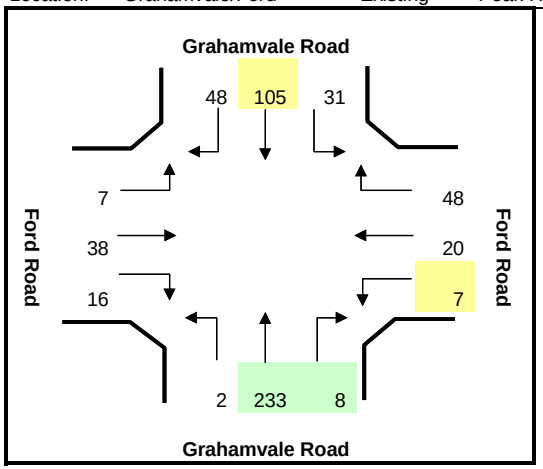
Graham/Ford 2020 with Devt AM

8:00 - 9:00

Mov ID		Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Grahamvale Road (South)										
9	L	2	33.3	0.214	7.3	LOS A	12	0.31	0.42	42.2
8	T	245	6.9	0.208	0.7	LOS A	12	0.31	0.00	47.2
7	R	93	6.5	0.208	7.5	LOS A	12	0.31	0.61	42.1
Approach		340	7.1	0.208	2.6	LOS A	12	0.31	0.17	45.7
Ford Road (East)										
6	L	7	12.5	0.200	14.1	LOS B	7	0.57	0.60	37.5
5	T	21	4.8	0.200	12.8	LOS B	7	0.57	0.79	38.3
4	R	51	7.8	0.200	14.3	LOS B	7	0.57	0.80	37.3
Approach		80	7.5	0.200	13.8	LOS B	7	0.57	0.78	37.6
Grahamvale Road (North)										
3	L	33	6.3	0.125	8.7	LOS A	7	0.42	0.37	42.3
2	T	111	7.2	0.125	1.3	LOS A	7	0.42	0.00	46.3
1	R	51	7.8	0.125	8.1	LOS A	7	0.42	0.65	41.7
Approach		194	7.2	0.125	4.3	LOS A	7	0.42	0.23	44.3
Ford Road (West)										
12	L	22	8.7	0.160	12.7	LOS B	6	0.55	0.70	39.6
11	T	40	7.5	0.159	10.6	LOS B	6	0.55	0.78	39.9
10	R	17	5.9	0.159	12.1	LOS B	6	0.55	0.78	38.8
Approach		80	7.5	0.159	11.5	LOS B	6	0.55	0.75	39.6
All Vehicles		694	7.2	0.214	5.4	Not Applicable	12	0.40	0.32	43.4

600 282 55 Shepparton NE Growth Development

Location: Grahamvale/Ford Existing Peak Hour: 8:00 - 9:00am



Growth Rate	1.02
per annum	
No Years	12

Road	Grahamvale Road				Ford Road				Grahamvale Road				Ford Road			
Movement	R	T	L	Total	R	T	L	Total	R	T	L	Total	R	T	L	Total
ID	1	2	3		4	5	6		7	8	9		10	11	12	
8:00 - 9:00ar	40	75	26	**141**	40	17	6	**63**	7	129	2	**138**	13	32	6	**51**
2020 Growt	**48**	**90**	**31**	**169**	**48**	**20**	**7**	**75**	**8**	**154**	**2**	**165**	**16**	**38**	**7**	**61**
2020 + Devt	48	105	31	**169**	48	20	7	**75**	8	233	2	**165**	16	38	7	**61**

94

Out

In

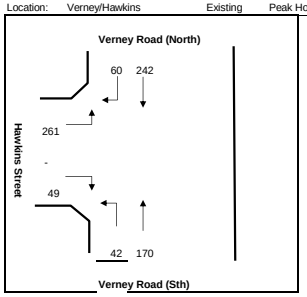
Graham/Ford 2020 with Devt AM

8:00 - 9:00

Mov ID		Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Grahamvale Road (South)										
9	L	2	33.3	0.214	7.3	LOS A	12	0.31	0.42	42.2
8	T	245	6.9	0.208	0.7	LOS A	12	0.31	0.00	47.2
7	R	93	6.5	0.208	7.5	LOS A	12	0.31	0.61	42.1
Approach		340	7.1	0.208	2.6	LOS A	12	0.31	0.17	45.7
Ford Road (East)										
6	L	7	12.5	0.200	14.1	LOS B	7	0.57	0.60	37.5
5	T	21	4.8	0.200	12.8	LOS B	7	0.57	0.79	38.3
4	R	51	7.8	0.200	14.3	LOS B	7	0.57	0.80	37.3
Approach		80	7.5	0.200	13.8	LOS B	7	0.57	0.78	37.6
Grahamvale Road (North)										
3	L	33	6.3	0.125	8.7	LOS A	7	0.42	0.37	42.3
2	T	111	7.2	0.125	1.3	LOS A	7	0.42	0.00	46.3
1	R	51	7.8	0.125	8.1	LOS A	7	0.42	0.65	41.7
Approach		194	7.2	0.125	4.3	LOS A	7	0.42	0.23	44.3
Ford Road (West)										
12	L	22	8.7	0.160	12.7	LOS B	6	0.55	0.70	39.6
11	T	40	7.5	0.159	10.6	LOS B	6	0.55	0.78	39.9
10	R	17	5.9	0.159	12.1	LOS B	6	0.55	0.78	38.8
Approach		80	7.5	0.159	11.5	LOS B	6	0.55	0.75	39.6
All Vehicles		694	7.2	0.214	5.4	Not Applicable	12	0.40	0.32	43.4

600 282 55 Shepparton NE Growth Development

Location: Verney/Hawkins Existing Peak Hour: 8:00 - 9:00am



Road	Verney Road (North)				Verney Road (Sth)				Hawkins Street			
Movement	R	T				T	L		R	T	L	
ID	1	2		Total		8	9	Total	10	11	12	Total
8:00 - 9:00am	50	202		**252**		142	35	**142**	41	0	**183**	**577**
2020 Growth	**60**	**242**		301		**170**	**42**	212	**49**	**-**	**261**	**310**
2020 + Devt	60	242	-	301	-	170	42	212	49	-	261	**310**

-

Growth Rate 1.02

per annum

No Years 12

2008 Verney Hawkins AM

0800 - 0900

Give-way

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Verney Road (South)										
9	L	37	8.1	0.101	6.6	LOS A	0	0.00	0.61	43.3
8	T	149	6.7	0.101	0.0	LOS A	0	0.00	0.00	50.0
Approach		186	7.0	0.101	1.3	LOS A		0.00	0.12	48.5
Verney Road (North)										
2	T	213	7.0	0.160	0.9	LOS A	10	0.35	0.00	46.9
1	R	53	7.5	0.160	7.8	LOS A	10	0.35	0.63	41.9
Approach		266	7.1	0.160	2.3	LOS A	10	0.35	0.13	45.8
Hawkins Street (West)										
12	L	29	6.9	0.129	11.4	LOS B	5	0.45	0.63	40.5
10	R	43	7.0	0.130	10.8	LOS B	5	0.45	0.78	39.8
Approach		72	6.9	0.129	11.1	LOS B	5	0.45	0.72	40.1
All Vehicles		524	7.1	0.160	3.2	Applicable	10	0.24	0.21	45.8

Verney Hawkins 2020 with Devt AM

8:00 - 9:00

Give-way

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Verney Road (South)										
9	L	44	6.8	0.157	6.6	LOS A	0	0.00	0.61	43.3
8	T	247	6.9	0.157	0.0	LOS A	0	0.00	0.00	50.0
Approach		291	6.9	0.157	1.0	LOS A		0.00	0.09	48.9
Verney Road (North)										
2	T	618	7.0	0.856	13.6	LOS B	226	1.00	0.00	37.6
1	R	543	7.0	0.855	20.4	LOS C	226	1.00	1.47	33.6
Approach		1161	7.0	0.856	16.8	LOS C	226	1.00	0.69	35.6
Hawkins Street (West)										
12	L	365	7.1	1.424	663.5	LOS F	1014	1.00	10.53	3.1
10	R	52	7.7	1.405	662.9	LOS F	1014	1.00	5.92	2.9
Approach		418	7.2	1.424	663.4	LOS F	1014	1.00	9.95	3.1
All Vehicles		1870	7.0	1.424	158.9	Applicable	1014	0.84	2.67	10.4

Verney Hawkins Roundabout 2020 with Devt AM

0800 - 0900

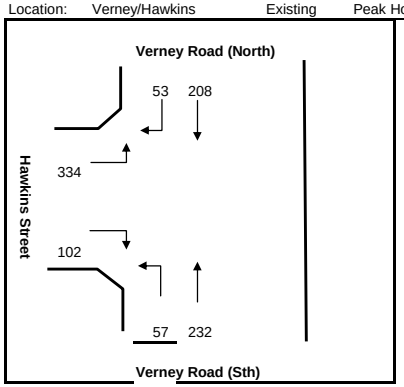
Roundabout

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Verney Road (South)										
9	L	44	6.8	0.373	10.5	LOS B	23	0.74	0.83	40.0
8	T	247	6.9	0.374	7.9	LOS A	23	0.74	0.76	41.9
Approach		291	6.9	0.374	8.3	LOS A	23	0.74	0.77	41.6
Verney Road (North)										
2	T	618	7.0	0.790	3.0	LOS A	98	0.45	0.33	44.4
1	R	543	7.0	0.790	9.6	LOS A	98	0.45	0.56	40.1
Approach		1161	7.0	0.791	6.1	LOS A	98	0.45	0.43	42.2
Hawkins Street (west)										
12	L	365	7.1	0.397	5.8	LOS A	23	0.51	0.55	43.8
10	R	52	7.7	0.397	10.2	LOS B	23	0.51	0.68	40.1
Approach		418	7.2	0.397	6.3	LOS A	23	0.51	0.57	43.3
All Vehicles		1870	7.0	0.790	6.5	LOS A	98	0.51	0.52	42.4

600 282 55 Shepparton NE Growth Development

Location: Verney/Hawkins Existing Peak Hour: PM



Growth Rate 1.02

per annum

No Years 12

Road	Verney Road (North)				Verney Road (Sth)				Hawkins Street			
Movement	R	T		Total		T	L	Total	R	T	L	Total
ID	1	2				8	9		10	11	12	
8:00 - 9:00a	44	174		**218**		194	48	**194**	85	57	**279**	**691**
2020 Growt	**53**	**208**		**261**		**232**	**57**	**232**	**102**	**68**	**334**	**826**
2020 + Devt	53	208	-	261	-	232	57	232	102	68	334	**826**

2008 Verney Hawkins PM

1500 - 1600

Give-way Vehicle

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Verney Road (South)										
9	L	51	7.8	0.138	6.6	LOS A	0	0.00	0.61	43.3
8	T	204	6.9	0.138	0.0	LOS A	0	0.00	0.00	50.0
Approach		255	7.1	0.138	1.3	LOS A		0.00	0.12	48.5
Verney Road (North)										
2	T	183	7.1	0.141	1.3	LOS A	9	0.41	0.00	46.5
1	R	46	6.5	0.141	8.1	LOS A	9	0.41	0.66	41.8
Approach		229	7.0	0.141	2.7	LOS A	9	0.41	0.13	45.4
Hawkins Street (West)										
12	L	60	6.7	0.282	12.7	LOS B	11	0.54	0.72	39.6
10	R	89	6.7	0.282	12.1	LOS B	11	0.54	0.85	38.8
Approach		149	6.7	0.281	12.3	LOS B	11	0.54	0.80	39.2
All Vehicles		633	7.0	0.282	4.4	Not Applicable	11	0.27	0.28	44.8

Verney Hawkins 2020 with Devt PM

15:00 - 16:00

Give-way Vehicle

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Verney Road (South)										
9	L	60	6.7	0.300	6.6	LOS A	0	0.00	0.61	43.3
8	T	495	7.1	0.299	0.0	LOS A	0	0.00	0.00	50.0
Approach		555	7.0	0.299	0.7	LOS A		0.00	0.07	49.2
Verney Road (North)										
2	T	401	7.0	0.627	9.8	LOS A	80	1.00	0.00	40.4
1	R	296	7.1	0.626	16.6	LOS C	80	1.00	1.27	35.8
Approach		697	7.0	0.626	12.7	LOS B	80	1.00	0.54	38.3
Hawkins Street (West)										
12	L	682	7.0	2.818	2485.9	LOS F	3659	1.00	18.24	0.9
10	R	107	7.4	2.842	2485.3	LOS F	3659	1.00	13.33	0.8
Approach		790	7.1	2.816	2485.8	LOS F	3659	1.00	17.57	0.9
All Vehicles		2042	7.1	2.842	966.2	Not Applicable	3659	0.73	7.00	2.1

Verney Hawkins Roundabout 2020 with

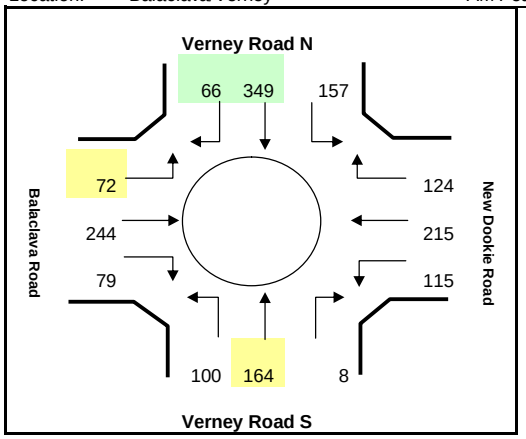
1500 - 1600

Roundabout Vehicle

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Verney Road (South)										
9	L	60	6.7	0.556	9.3	LOS A	41	0.69	0.75	41.0
8	T	495	7.1	0.554	6.6	LOS A	41	0.69	0.67	42.2
Approach		555	7.0	0.554	6.9	LOS A	41	0.69	0.68	42.1
Verney Road (North)										
2	T	401	7.0	0.544	3.1	LOS A	42	0.44	0.33	44.5
1	R	296	7.1	0.544	9.7	LOS A	42	0.44	0.62	40.1
Approach		697	7.0	0.544	5.9	LOS A	42	0.44	0.45	42.5
Hawkins Street (west)										
12	L	682	7.0	0.929	25.1	LOS C	181	1.00	1.55	32.3
10	R	107	7.4	0.931	29.6	LOS C	181	1.00	1.55	30.3
Approach		790	7.1	0.929	25.8	LOS C	181	1.00	1.55	32.0
All Vehicles		2042	7.1	0.931	13.9	LOS B	181	0.72	0.94	37.5

600 282 55 Shepparton NE Growth Development **55/45 split**

Location: Balaclava/Verney AM Peak 8:00 - 9:00am



Growth Rate 1.02

per annum

No Years 12

Road	Verney Road N				New Dookie Road				Verney Road S				Balaclava Road			
Movement	R	T	L	Total	R	T	L	Total	R	T	L	Total	R	T	L	Total
ID	1	2	3		4	5	6		7	8	9		10	11	12	
8:00 - 9:00am	55	292	131	**478**	104	180	96	**380**	8	137	84	**298**	66	204	60	**330**
2020 Growth	66	349	157	**572**	124	215	115	**454**	10	164	100	**356**	79	244	72	**395**
2020 + Devt	66	349	157	**572**	124	215	115	**454**	10	164	100	**356**	79	244	72	**395**

Out

In

Verney Balaclava 2020 with Devt AM

8:00 - 9:00 only one checked

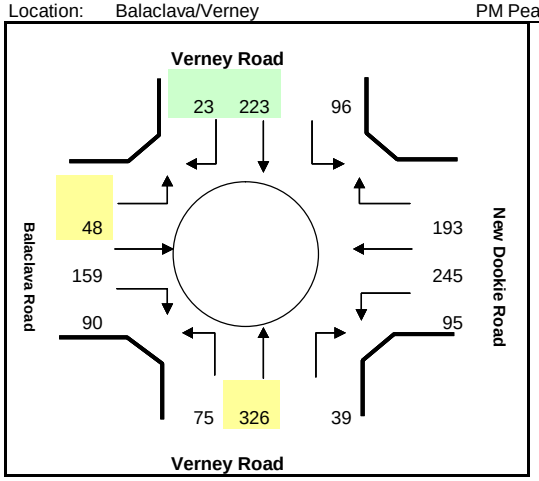
Roundabout

Vehicle

Mov ID		Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Verney Road (South)										
9	L	105	6.7	0.383	8.2	LOS A	25	0.77	0.78	41.5
8	T	216	6.9	0.383	6.7	LOS A	25	0.77	0.71	42.1
7	R	8	11.1	0.375	12.5	LOS B	25	0.77	0.78	39.1
Approach		330	7.0	0.383	7.4	LOS A	25	0.77	0.73	41.8
New Dookey Road (East)										
6	L	121	6.6	0.984	71.3	LOS E	219	1.00	2.21	18.4
5	T	226	7.1	0.983	70.9	LOS E	219	1.00	2.21	18.6
4	R	131	6.9	0.985	76.7	LOS E	219	1.00	2.16	18.5
Approach		477	6.9	0.982	72.6	LOS E	219	1.00	2.19	18.5
Verney Road (North)										
3	L	165	7.2	0.954	24.3	LOS C	231	1.00	1.47	32.7
2	T	596	7.0	0.954	22.3	LOS C	231	1.00	1.47	32.6
1	R	204	6.9	0.953	28.9	LOS C	231	1.00	1.41	30.5
Approach		966	7.0	0.954	24.1	LOS C	231	1.00	1.46	32.1
Balaclava Road (West)										
12	L	101	6.9	0.455	6.6	LOS A	26	0.60	0.63	43.3
11	T	257	7.0	0.456	4.6	LOS A	26	0.60	0.51	43.5
10	R	83	7.2	0.456	11.0	LOS B	26	0.60	0.72	39.8
Approach		441	7.0	0.455	6.3	LOS A	26	0.60	0.57	42.6
All Vehicles		2214	7.0	0.985	28.5	LOS C	231	0.89	1.33	29.9

600 282 55 Shepparton NE Growth Development

Location: Balaclava/Verney PM Peak 16:30 to 17:30



Growth Rate	1.01
per annum	
No Years	12

Road	Verney Road				New Dookie Road				Verney Road				Balaclava Road			
Movement	R	T	L	Total	R	T	L	Total	R	T	L	Total	R	T	L	Total
ID	1	2	3		4	5	6		7	8	9		10	11	12	
16:30 to 17:30	20	198	85	303	171	217	84	472	35	289	67	391	80	141	43	264
2020 Growt	**23**	**223**	**96**	**341**	**193**	**245**	**95**	**532**	**39**	**326**	**75**	**441**	**90**	**159**	**48**	**297**
2020 + Devt	23	223	96	**341**	193	245	95	**532**	39	326	75	**441**	90	159	48	**297**

Out

In

Verney Balaclava 2020 with Devt PM

16:30 to 17:30

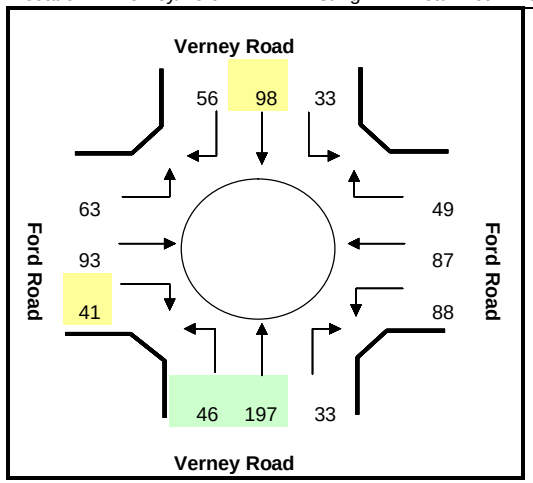
Roundabout

Vehicle

Mov ID		Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Verney Road (South)										
9	L	79	7.6	0.725	13.4	LOS B	81	0.97	1.09	37.9
8	T	500	7.0	0.722	11.9	LOS B	81	0.97	1.08	39.0
7	R	41	7.3	0.719	17.7	LOS B	81	0.97	1.02	35.9
Approach		620	7.1	0.722	12.5	LOS B	81	0.97	1.08	38.6
New Dookie Road (East)										
6	L	100	7.0	0.676	10.3	LOS B	61	0.85	0.99	40.2
5	T	258	7.0	0.677	10.0	LOS A	61	0.85	0.98	40.5
4	R	203	6.9	0.677	15.7	LOS B	61	0.85	0.96	37.1
Approach		561	7.0	0.677	12.1	LOS B	61	0.85	0.98	39.1
Verney Road (North)										
3	L	101	6.9	0.534	6.4	LOS A	36	0.65	0.62	43.1
2	T	349	6.9	0.534	4.5	LOS A	36	0.65	0.50	43.2
1	R	88	6.8	0.533	11.0	LOS B	36	0.65	0.71	39.5
Approach		538	6.9	0.534	5.9	LOS A	36	0.65	0.55	42.5
Balaclava Road (West)										
12	L	144	6.9	0.640	13.8	LOS B	55	0.93	1.10	38.9
11	T	167	7.1	0.639	11.8	LOS B	55	0.93	1.09	39.0
10	R	95	7.4	0.638	18.3	LOS B	55	0.93	1.03	35.7
Approach		407	7.1	0.639	14.0	LOS B	55	0.93	1.08	38.1
All Vehicles		2126	7.0	0.725	11.0	LOS B	81	0.85	0.92	39.6

600 282 55 Shepparton NE Growth Development

Location: Verney/Ford Existing Peak Hour 8:15-9:15



Growth Rate 1.02

per annum

No Years 12

Road	Verney Road				Ford Road				Verney Road				Ford Road			
Movement	R	T	L	Total	R	T	L	Total	R	T	L	Total	R	T	L	Total
ID	1	2	3		4	5	6		7	8	9		10	11	12	
8:15-9:15	47	72	28	140	41	73	74	188	28	111	32	171	33	78	53	164
2020 Grow	56	86	33	167	49	87	88	225	33	133	38	204	39	93	63	196
2020 + Dev	56	98	33	167	49	87	88	225	33	197	46	204	41	93	63	196

Out

In

Verney Ford 2020 with Devt AM

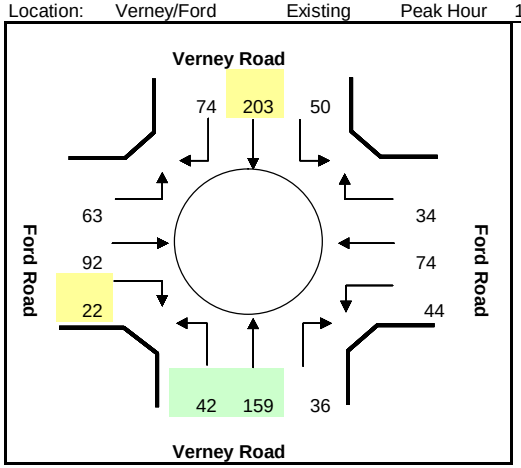
8:15 - 9:15

Roundabout

Mov ID		Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Verney Road (South)										
9	L	48	6.2	0.258	6.5	LOS A	14	0.43	0.57	42.6
8	T	207	7.2	0.258	4.6	LOS A	14	0.43	0.48	43.8
7	R	35	5.9	0.258	10.2	LOS B	14	0.43	0.63	40.2
Approach		290	6.9	0.258	5.6	LOS A	14	0.43	0.51	43.1
Ford Road (East)										
6	L	93	6.5	0.215	4.4	LOS A	10	0.36	0.46	44.1
5	T	92	6.6	0.214	4.3	LOS A	10	0.36	0.45	44.2
4	R	52	7.7	0.215	9.9	LOS A	10	0.36	0.64	40.5
Approach		235	6.8	0.214	5.6	LOS A	10	0.36	0.50	43.2
Verney Road (North)										
3	L	35	5.9	0.176	5.1	LOS A	8	0.33	0.48	44.8
2	T	103	6.8	0.175	3.2	LOS A	8	0.33	0.35	45.2
1	R	59	6.8	0.176	9.7	LOS A	8	0.33	0.62	40.6
Approach		196	6.6	0.176	5.5	LOS A	8	0.33	0.45	43.6
Ford Road (West)										
12	L	66	7.5	0.205	5.7	LOS A	9	0.44	0.55	44.2
11	T	98	7.1	0.205	3.8	LOS A	9	0.44	0.41	44.5
10	R	43	7.0	0.204	10.2	LOS B	9	0.44	0.65	40.3
Approach		208	7.2	0.205	5.7	LOS A	9	0.44	0.51	43.4
All Vehicles		929	6.9	0.258	5.6	LOS A	14	0.39	0.49	43.3

600 282 55 Shepparton NE Growth Development

Location: Verney/Ford Existing Peak Hour 15:00 to 16:00



Growth Rate	1.02
per annum	
No Years	12

Road	Verney Road				Ford Road				Verney Road				Ford Road			
Movement	R	T	L		R	T	L		R	T	L		R	T	L	
ID	1	2	3	Total	4	5	6	Total	7	8	9	Total	10	11	12	Total
15:00 to 16:00	62	133	42	237	34	74	37	145	30	106	32	168	14	77	53	144
2020 Growt	**74**	**159**	**50**	**283**	**41**	**88**	**44**	**173**	**36**	**127**	**38**	**201**	**17**	**92**	**63**	**172**
2020 + Devt	74	203	50	**283**	41	88	44	**173**	36	159	42	**201**	22	92	63	**172**

Out

In

Verney Ford 2020 with Devt PM

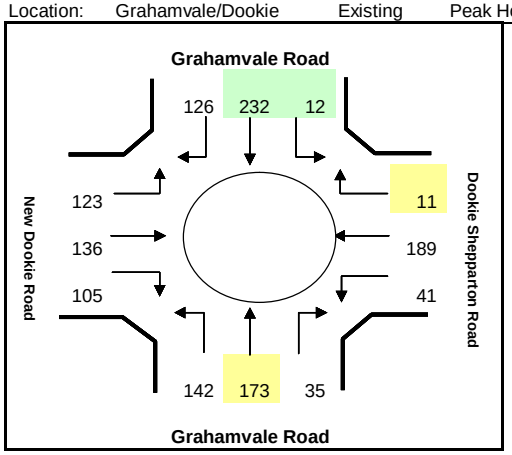
15:00 - 16:00

Roundabout

Mov ID		Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Verney Road (South)										
9	L	48	6.2	0.238	5.7	LOS A	13	0.41	0.53	43.1
8	T	207	7.2	0.237	4.2	LOS A	13	0.41	0.44	44.1
7	R	35	5.9	0.238	10.0	LOS A	13	0.41	0.62	40.3
Approach		290	6.9	0.237	5.1	LOS A	13	0.41	0.48	43.4
Ford Road (East)										
6	L	93	6.5	0.214	4.4	LOS A	10	0.36	0.46	44.1
5	T	92	6.6	0.214	4.1	LOS A	10	0.36	0.43	44.4
4	R	52	7.7	0.214	9.9	LOS A	10	0.36	0.63	40.5
Approach		235	6.8	0.214	5.5	LOS A	10	0.36	0.49	43.3
Verney Road (North)										
3	L	35	5.9	0.175	5.1	LOS A	8	0.33	0.48	44.8
2	T	103	6.8	0.175	3.2	LOS A	8	0.33	0.35	45.2
1	R	59	6.8	0.175	9.7	LOS A	8	0.33	0.62	40.6
Approach		196	6.6	0.175	5.5	LOS A	8	0.33	0.45	43.6
Ford Road (West)										
12	L	66	7.5	0.204	5.7	LOS A	9	0.44	0.55	44.2
11	T	98	7.1	0.204	3.8	LOS A	9	0.44	0.41	44.5
10	R	43	7.0	0.204	10.2	LOS B	9	0.44	0.65	40.3
Approach		208	7.2	0.204	5.7	LOS A	9	0.44	0.51	43.4
All Vehicles		929	6.9	0.238	5.4	LOS A	13	0.39	0.48	43.4

600 282 55 Shepparton NE Growth Development

Location: Grahamvale/Dookie Existing Peak Hour 8:00 to 9:00



Growth Rate 1.02

per annum

No Years 12

Road	Grahamvale Road				Dookie Shepparton Road				Grahamvale Road				New Dookie Road				
Movement	R	T	L	Total	R	T	L	Total	R	T	L	Total	R	T	L	Total	
ID	1	2	3		4	5	6		7	8	9		10	11	12		
8:00 to 9:00	105	194	10	309	9	158	34	201	29	145	119	293	88	114	103	305	
2020 Growt	**126**	**232**	**12**	**369**	**11**	**189**	**41**	**240**	**35**	**173**	**142**	**350**	**105**	**136**	**123**	**365**	-
2020 + Devt	126	232	12	**369**	11	189	41	**240**	35	173	142	**350**	105	136	123	**365**	-

Out

In

New Dookie / Grahamvale 2020 with Devt AM

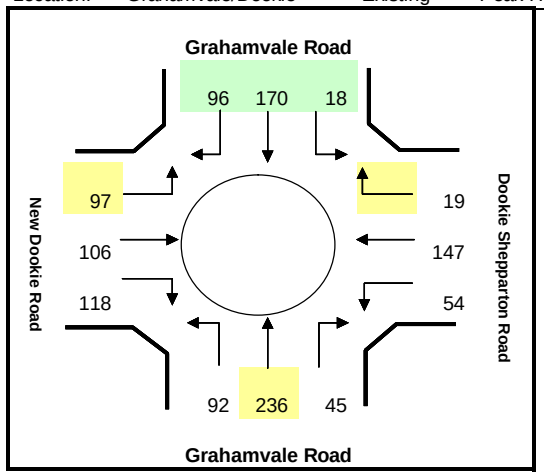
0800 - 0900

Roundabout

Mov ID	Vehicle	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Doyles Rd										
9	L	149	6.7	0.442	7.0	LOS A	30	0.67	0.68	41.9
8	T	277	6.9	0.443	5.5	LOS A	30	0.67	0.58	42.6
7	R	37	8.1	0.440	11.2	LOS B	30	0.67	0.71	39.5
Approach		462	6.9	0.443	6.4	LOS A	30	0.67	0.62	42.1
Dookie Shepparton Rd										
6	L	43	7.0	0.652	19.9	LOS B	56	1.00	1.17	33.9
5	T	199	7.0	0.648	19.5	LOS B	56	1.00	1.17	34.2
4	R	27	7.4	0.643	25.3	LOS C	56	1.00	1.09	32.0
Approach		269	7.1	0.648	20.2	LOS C	56	1.00	1.16	33.9
GrahamVale Rd										
3	L	97	7.2	0.898	14.2	LOS B	157	1.00	1.08	38.6
2	T	742	7.0	0.898	12.2	LOS B	157	1.00	1.08	38.7
1	R	133	6.8	0.898	18.8	LOS B	157	1.00	1.03	35.3
Approach		971	7.0	0.899	13.3	LOS B	157	1.00	1.07	38.2
New Dookie Rd										
12	L	129	7.0	0.397	6.3	LOS A	22	0.58	0.61	43.5
11	T	143	7.0	0.397	4.4	LOS A	22	0.58	0.48	43.6
10	R	111	7.2	0.396	10.8	LOS B	22	0.58	0.70	39.8
Approach		383	7.0	0.397	6.9	LOS A	22	0.58	0.59	42.4
All Vehicles		2085	7.0	0.898	11.5	LOS B	157	0.85	0.89	39.1

600 282 55 Shepparton NE Growth Development

Location: Grahamvale/Dookie Existing Peak Hour 15:15 to 16:15



Growth Rate 1.02

per annum

No Years 12

Road	Grahamvale Road				Dookie Shepparton Road				Grahamvale Road				New Dookie Road			
Movement	R	T	L		R	T	L		R	T	L		R	T	L	
ID	1	2	3	Total	4	5	6	Total	7	8	9	Total	10	11	12	Total
15:15 to 16:15	80	142	15	237	16	123	45	184	38	197	77	312	99	89	81	269
2020 Growt	**96**	**170**	**18**	**283**	**19**	**147**	**54**	**220**	**45**	**236**	**92**	**373**	**118**	**106**	**97**	**322**
2020 + Devt	96	170	18	**283**	19	147	54	**220**	45	236	92	**373**	118	106	97	**322**

Out

In

New Dookie / Grahamvale 2020 with Devt PM

15:15 to 16:15

Roundabout

Vehicle

Mov ID		Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Doyles Rd										
9	L	97	7.2	0.669	8.6	LOS A	65	0.79	0.79	41.4
8	T	592	6.9	0.667	7.2	LOS A	65	0.79	0.76	42.0
7	R	47	6.4	0.671	12.9	LOS B	65	0.79	0.79	38.9
Approach		735	6.9	0.667	7.7	LOS A	65	0.79	0.77	41.7
Dookie Shepparton Rd										
6	L	57	7.0	0.390	7.6	LOS A	23	0.75	0.80	42.0
5	T	155	7.1	0.390	7.3	LOS A	23	0.75	0.78	42.2
4	R	78	6.5	0.391	13.1	LOS B	23	0.75	0.80	38.8
Approach		289	6.9	0.390	8.9	LOS A	23	0.75	0.79	41.2
GrahamVale Rd										
3	L	61	6.6	0.565	6.5	LOS A	40	0.64	0.63	43.1
2	T	428	7.0	0.567	4.5	LOS A	40	0.64	0.50	43.2
1	R	101	6.9	0.567	11.0	LOS B	40	0.64	0.71	39.6
Approach		590	6.9	0.567	5.8	LOS A	40	0.64	0.55	42.5
New Dookie Rd										
12	L	102	6.9	0.515	10.9	LOS B	37	0.87	0.98	41.0
11	T	112	7.1	0.516	8.9	LOS A	37	0.87	0.96	41.3
10	R	124	7.2	0.517	15.4	LOS B	37	0.87	0.92	37.4
Approach		339	7.1	0.516	11.9	LOS B	37	0.87	0.95	39.6
All Vehicles		1953	7.0	0.671	8.0	LOS A	65	0.75	0.74	41.5

Appendix C Additional Traffic Movement Distribution

North East Development Growth Area Traffic Generation and Trip Rates

Residential

Peak Hour		
Total Dwellings		1836
Peak hr movements (per dwe	90%	1652

24 Hour			
Total Dwellings			1836
24 Hr Traffic (movements/dwelling)		10	18360

AM Peak		
In	10%	165
Out	90%	1487

PM Peak		
In	60%	991
Out	40%	661

Retail and Community Uses

Peak Hour		
Total Retail Area	1350	sqm
% of Passing Trade	0	
Peak Hour Trips	13	
Peak Hour Retail Trips	169	
Peak Hour External Retail T	**17**	

24 Hour		
Total Retail Area	1350	sqm
% of Passing Trade	0	
24 Hr Trips	121	
24 Hour Total Retail Trips	1634	
24 Hour Total Trips from Externa	**163**	

AM Peak		
In	50%	8
Out	50%	8

PM Peak		
In	50%	8
Out	50%	8

Primary School

Peak Hour	
Students	
Current External Students	300
Proposed External Students	145
Reduced Return trips	405
Total external trips	**196**
Staff	
1teacher/20 children	30
support staff	5
Total Staff	35
Assume 90% staff will drive	32
AM In and PM Out	**32**

24 Hour	
Students	196
Staff	63
Total	**259**

AM Peak		
In (students + teachers)	50%	129
Out	50%	98

PM Peak		
In	50%	98
Out (students + teachers)	50%	129

Total Peak Hour Trips

AM Peak		
In	303	16%
Out	1593	84%
Total	**1897**	100%

PM Peak		
In	1098	58%
Out	799	42%
Total	**1897**	100%

Total Daily External Trips

18782

North East Shepparton Development Area Traffic Distribution Based on 55/45 Split

Site Traffic Distribution	Distribution Share	Total	G/Vale 35%	Verney		
				Total	Ford & Balaclava (29%)	Hawkins (36%)
North	10%	190	**94**	**96**	96	0
East (grahamvale only)	10%	190	**190**	**0**	0	0
South	60%	1138	**563**	**575**	316	259
West (verney only)	20%	379	**0**	**379**	95	284
Total Movements		**1897**	**847**	**1050**	**507**	**543**
	Checks	**1897**	**45%**	**55%**	**27%**	**29%**

AM Peak

		Verney Road / Balaclava Road						PM Peak: Verney Road / Balaclava Road					
		Through			Right			Through			Right		
Site Traffic Distribution		In	Out	Total	In	Out	Total	In	Out	Total	In	Out	Total
North	0%	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
East (grahamvale only)	0%	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
South	60%	41	217	**259**	9	48	**57**	150	109	**259**	33	24	**57**
West (verney only)	30%	0	0	**0**	15	80	**95**	0	0	**0**	55	40	**95**
		41	217	**259**	24	128	**152**	150	109	**259**	88	64	**152**
							411						**411**

AM Peak

		Verney Road / Ford Road						PM Peak: Verney Road / Ford Road					
		Through			Left			Through			Left		
Site Traffic Distribution		In	Out	Total	In	Out	Total	In	Out	Total	In	Out	Total
North	90%	12	64	**77**	2	8	**10**	44	32	**77**	6	4	**10**
East (grahamvale only)	0%	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
South	0%	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
West (verney only)	0%	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
		12	64	**77**	2	8	**10**	44	32	**77**	6	4	**10**
							86						**86**

AM Peak

		Verney Road / Hawkins Road						PM Peak: Verney Road / Hawkins Road					
		Through			Right			Through			Right		
Site Traffic Distribution		In	Out	Total	In	Out	Total	In	Out	Total	In	Out	Total
North	10%	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
East (grahamvale only)	0%	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
South	40%	51	266	**316**	41	217	**259**	183	133	**316**	150	109	**259**
West (verney only)	70%	15	80	**95**	45	239	**284**	55	40	**95**	165	120	**284**
		66	345	**411**	87	456	**543**	238	173	**411**	314	229	**543**
							954						**954**

AM Peak

		Grahamvale Road / Dookie Shepparton Road						PM Peak: Grahamvale Road / Dookie Shepparton Road					
		Left			Through			Left			Through		
Site Traffic Distribution		In	Out	Total	In	Out	Total	In	Out	Total	In	Out	Total
North	0%	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
East (grahamvale only)	50%	15	80	**95**	0	0	**0**	55	40	**95**	0	0	**0**
South	100%	0	0	**0**	90	473	**563**	0	0	**0**	326	237	**563**
West (verney only)	0%	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
		15	80	**95**	90	473	**563**	55	40	**95**	326	237	**563**
							658						**658**

AM Peak

		Grahamvale Road / Ford Road						PM Peak: Grahamvale Road / Ford Road					
		Through			Right			Through			Right		
Site Traffic Distribution		In	Out	Total	In	Out	Total	In	Out	Total	In	Out	Total
North	100%	15	79	**94**	0	0	**0**	54	40	**94**	0	0	**0**
East (grahamvale only)	50%	0	0	**0**	15	80	**95**	0	0	**0**	55	40	**95**
South	0%	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
West (verney only)	0%	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
		15	79	**94**	15	80	**95**	54	40	**94**	55	40	**95**
							189						**189**

AM Peak

		Hawkins Road / GV Hwy						PM Peak: Hawkins Road / GV Hwy					
		Left			Right			Left			Right		
Site Traffic Distribution		In	Out	Total	In	Out	Total	In	Out	Total	In	Out	Total
North	10%	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
East (grahamvale only)	0%	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
South	40%	41	217	**259**	0	0	**0**	150	109	**259**	0	0	**0**
West (verney only)	70%	45	239	**284**	0	0	**0**	165	120	**284**	0	0	**0**
		87	456	**543**	0	0	**0**	314	229	**543**	0	0	**0**
							543						**543**