Appendix A Maunsell Traffic Report

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Mooroopna West Growth Corridor

North-South Road Traffic Investigation

Greater Shepparton City Council

16 December 2008
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Mooroopna West Growth Corridor

Prepared for

Greater Shepparton City Council

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1.0 Introduction

The following Report supports the preparation of the Mooroopna West Outline Development Plan (‘Mooroopna West ODP’) and the Mooroopna West Development Contribution Plan (‘Mooroopna West CDP’). It provides the findings from a traffic investigation undertaken by Maunsell Australia Pty Ltd (‘Maunsell AECOM’) to determine whether an appropriate justification exists for the establishment of a North-South Road through the Mooroopna West Growth Corridor, based upon the likely future traffic to be generated by the development.

The investigation has included:

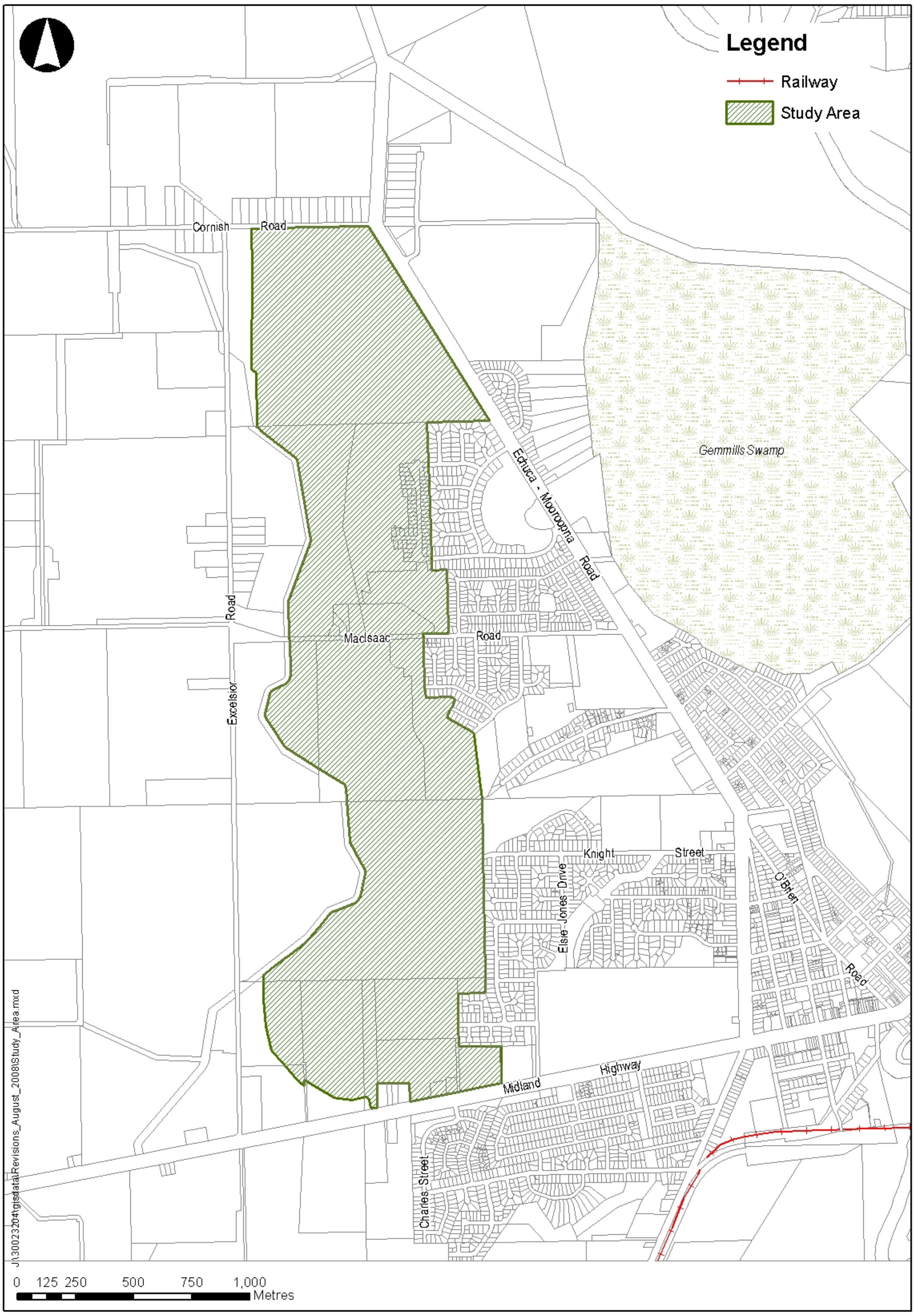
- Undertaking traffic counts, and reviewing existing counts to establish existing AM and PM traffic volumes;
- Reviewing existing information pertinent to the investigation, including the flood study, current development trends, local accident history and traffic patterns;
- Estimating future development traffic generation and assignment;
- Assessing the impact of the development traffic with and without the proposed future North-South Road; and
- Recommendations on the overall alignment of the North-South Road and its intersections.

2.0 Existing Conditions

2.1 Road Network

The existing road network and the Mooroopna West Growth Corridor area is shown in **Figure 1** below.

Figure 1 Mooroopna West Growth Corridor Study Area



The current road network within the township of Mooroopna is centred on the large signalised intersection of the Midland Highway and Echuca-Mooroopna Road (‘Echuca Road’) with these two roads extending west and north respectively towards the study area. This intersection represents the approximate centre of Mooroopna. The streets surrounding this intersection can be classified as local or collector roads and, aside from this signalised intersection, the remaining intersections to the west of Echuca Road are priority controlled.

The Midland Highway and Echuca Road are both Declared Main Roads, and provide a route for heavy vehicle access to and from Shepparton and the surrounding areas. Shepparton is located approximately four kilometres east of Mooroopna along the Midland Highway.

The Midland Highway is a dual carriageway (with generally two lanes in each direction). It broadens into three approach lanes from both directions on the approach to Echuca Road. The dual carriageway relinquishes approximately 200 metres west of Echuca Road where it reduces to an undivided road with single lanes in each direction.

Echuca Road has single lanes in both directions, with service roads and turning lanes at some locations. It broadens into three lanes on the approach to the Midland Highway intersection.

2.2 Traffic Counts

The Greater Shepparton City Council (‘The Council’) provided information on all available existing traffic counts within the Mooroopna area. These counts (undertaken in 2004 or prior) included the following locations:

- Midland Highway;
- Echuca Road;
- Knight Street;
- Mac Isaac Road; and
- Elsie Jones Drive.

These counts were supplemented by PM peak period turning counts conducted by Maunsell AECOM in 2004 (for durations of 15 – 30 minutes) at the following locations:

- Mac Isaac Road and Echuca Road;
- Knight Street and Echuca Road;
- Echuca Road and Midland Highway;
- Elsie Jones Drive and Midland Highway; and
- Charles Street and Midland Highway.

The background tube and turning counts were used to estimate the PM peak hour turning counts at the relevant junctions. Furthermore, turning movements were “reversed” and in conjunction with AM tube count traffic volumes, these were used to estimate the AM peak hour turning volumes.

Details of the background traffic counts are provided in **Appendix A.**

2.3 Existing Intersection Performance

The Midland Highway and Echuca Road intersection as a whole is operating satisfactorily, as waiting times range from 30 to 50 seconds during peak times of the day. However vehicle numbers are approaching capacity. Local Area Traffic Management proposals exist to reduce rat-running in streets east of Echuca Road. When implemented, these measures are likely to force additional traffic back onto the Midland Highway and hence to the intersection with Echuca Road, which is likely to increase queues and delays.

A summary of the performance of some other key intersections is provided in Table 1 below.

Table 1 Existing Intersection Performance

Road 1	Road 2	Traffic Control	Maximum Waiting time	Side Road LOS
Mac Isaac Road	Echuca Road	Give way	30-60 Seconds	D-F
Knight Street	Echuca Road	Give way	15 Seconds	C
Elsie-Jones Drive	Midland Highway	Give way	30 Seconds	D
Charles Street	Midland Highway	Give way	20 Seconds	

LOS = Worst Level of Service of Side Road (priority controlled) traffic (for AM or PM peak)

Austroads have developed the following standards for level of service for urban streets within Australia. LOS is based on average through-vehicle travel speed for the segment, section, or entire urban street under consideration. The following general statements characterise LOS along urban streets.

LOS A describes primarily free-flow operations at average travel speeds, usually about 90 percent of the Free Flow Speed (FFS) for the given street class. Vehicles are completely unimpeded in their ability to manoeuvre within the traffic stream. Control delay at signalised intersections is minimal.

LOS B describes reasonable unimpeded operations at average travel speeds, usually about 70 percent of the FFS for the street class. The ability to manoeuvre within the traffic stream is only slightly restricted, and control delays at signalised intersections are not significant.

LOS C describes stable operations; however, ability to manoeuvre and change lanes in midblock locations may be more restricted than at LOS B, and longer queues, adverse signal coordination, or both may contribute to lower average travel speeds of about 50 percent of the FFS for the street class.

LOS D borders on a range in which small increases in flow may cause substantial increases in delay and decreases in travel speed. LOS D may be due to adverse signal progression, inappropriate signal timing, high volumes, or a combination of these factors. Average travel speeds are about 40 percent of FFS.

LOS E is characterised by significant delays and average travel speeds of 33 percent or less of the FFS. Such operations are caused by a combination of adverse progression, high signal density, high volumes, extensive delays at crucial intersections, and inappropriate signal timing.

LOS F is characterised by urban street flow at extremely low speeds, typically one-third to one-fourth of the FFS. Intersection congestion is likely at critical signalised locations, with high delays, high volumes, and extensive queuing.

2.4 Accident History

Accident information was obtained from Crashstats on the VicRoads website. The accident history of the area was reviewed to identify any significant safety concerns relating to the performance of the existing road network. Table 2 below provides an outline of some multiple casualty accident sites in the area, based on the previous 5 years of data available at the time of the analysis (1998 to 2002 inclusive).

Table 2 **Accident History (1998 to 2002)**

Location	No. of Accidents	Fatal	Serious Injury	Other Injury
Echuca Road & Midland Hwy	12		3	9
On Mac Isaac Road	6		3	3
On Echuca Road between Mac Isaac and O'Brien	6		2	4
Echuca Road and O'Brien St	4		1	3
On Midland Hwy between Echuca & Elsie-Jones	4	1	2	1
Mac Isaac Road & Echuca Road	2			2
Knight St and Echuca Road.	2			2

A new accident analysis was undertaken in 2008 based on the updated accident available for the period 2003 to 2007 inclusive. This analysis is summarised in Table 3 below.

Table 3 **Accident History (2003 to 2007)**

Location	No. of Accidents	Fatal	Serious Injury	Other Injury
Echuca Rd & Midland Hwy	11	0	2	9
On Mac Isaac Rd	2	1	0	1
Echuca Rd btw Cornish Rd & Mac Isaac Rd	5	2	2	1
On Echuca Rd btw Mac Isaac & Knight	9	0	5	4
Echuca Rd btw Knight & Midland Hwy	2	0	2	0
Midland Highway btw Excelsior & Elsie Jones	1	1	0	0
Midland Highway btw Elsie Jones & Echuca	2	0	2	0

The accident details and a map identifying the accident sites are attached in **Appendix B**.

The accident history shows that the main site of concern is the Echuca Road and Midland Highway intersection. The majority of accidents involved right turn accidents and rear ends. Any likely increase in traffic flows at this intersection could potentially worsen the accident record. Also, based on this accident history, additional right-turn manoeuvres are more likely to increase accident problems than any increase to "through" manoeuvres.

Other areas of concern include Echuca Road, between Mac Isaac Road and Knight Street, where there have been nine reported casualty accidents. There have also been five casualty accidents on Echuca Road between Cornish Road and MacIsaac Road including two fatalities. Four of these five accidents occurred during "dark" conditions, and may suggest the need for street lighting (improvements).

3.0 Traffic Generation and Assignment

The following traffic investigation has been undertaken to ascertain the expected levels of traffic that will be generated and assigned to the road network as a result of new residential development at Mooroopna West.

3.1 Traffic Generation

The Mooroopna West Outline Development Plan area has been sub-divided into four areas for the purpose of this analysis. These four areas are based on the natural floodway boundaries existing within the Study Area. Attached, and marked **Appendix C**, is a Development Areas Map. The available area for household development has been estimated from the total land area excluding the floodway zone, less 30% area for infrastructure and open space. The average lot size has been estimated at 650 m^2 with some medium density housing with lot sizes of 350 m^2 (186 medium density properties and 1604 conventional properties). The available development land in each defined sub-area, as well as the associated number of estimated houses have been summarised in the following table.

Table 4 Estimated Development Lots

Development Area and Size	Land Use	Developable Land by Use (ha)	Estimated Number of Lots
A 52.76 ha	Conventional Residential Medium Density residential School Commercial	45.07 3.39 3.50 0.80	693 97
B 11.42 ha	Conventional Residential Medium Density Residential	10.85 0.57	167 16
C 13.23 ha	Conventional Residential Medium Density Residential	12.57 0.66	193 19
D 37.68 ha	Conventional Residential Medium Density Residential	35.80 1.88	551 54
Total Conventional Residential **Total Medium Density Residential**		**104.28** **6.51**	**1604** **186**

3.1.1 Daily Traffic Generation

Residential

The traffic generation from the proposed Mooroopna West Outline Development Plan area has been estimated at around 10 trip ends per household per day (by private vehicle).

This figure has been based on information obtained from a number of sources:

The *RTA Guide to Traffic Generating Developments* (Version 2.2, October 2002), Section 3.3.1 states that Daily Trips per Dwelling (houses) = 9.0 per day, and for new subdivisions, where *standard* lots are given, some additional allowance may be made for dual occupancy and group homes. As such RTA Guide indicates that The *Australian Model Code for Residential Development* (AMCORD) assumes a daily vehicle generation rate of 10.0 per dwelling, with 10% of that taking place in the commuter peak period. RTA Guide indicates that the use of these figures (10.0 per dwelling) provides some allowance for later dual occupancy development.

"*Traffic Engineering and Management*" published by the Department of Civil Engineering, Monash University provides residential traffic generation rates as follows:

Outer Suburbs 8-12 vehicle trip ends/household/day

Maunsell AECOM has therefore adopted the average value within this range. These guidelines also state that a typical household generates 10 to 12% of its daily vehicle movements during the peak hour.

These are recognised traffic generation rates based on industry practice and substantial surveys.

Furthermore, the Greater Shepparton Infrastructure Design Manual stipulates a traffic generation of 10 vehicle trips per lot per day, substantiating adoption of this rate for this area.

Commercial

Assumptions regarding the traffic generation for the 0.80 ha commercial development in Precinct A are as follows:

- The leasable development area (excluding carparks, accessways, walkways, and amenities) is assumed to be 50% of the total development area, resulting in 4,000 m^2 leasable floor area.
- Daily traffic generation for cars will be in the order of 12 vehicle trip ends per 100 m^2 of leasable floor area.
- 80% of the daily car trips will be generated from the Mooroopna West Growth Corridor.
- 20% of the daily car trips will be generated from surrounding residential areas outside of the Mooroopna West Growth Corridor.
- Daily traffic generation for trucks will be in the order of 1 vehicle trip end per 100 m^2 of leasable floor area.
- 100% of deliveries (truck arrivals and departures) are likely to be external (primarily to/from Shepparton).

School

Assumptions regarding the traffic generation of the school are as follows:

Student and Staff Numbers

- The school will accommodate approximately 400 students
- The school will accommodate approximately 25 staff members (including teachers, administration, cleaning and other staff)

Travel Mode

- Approximately 50% of students will arrive by car, at an average car occupancy of 1.5 students per vehicle (the remaining 50% will walk, cycle or catch the bus)
- Approximately 90% of staff will arrive by car as the driver, (with the remaining 10% car sharing, cycling, walking or catching the bus)

Catchment

- 80% of students arriving by car will be from within the Mooroopna West Growth Corridor (precincts, A, B, C or D), and the remaining 20% will be from surrounding residential areas (predominantly immediately east or south of this area).
- 20% of staff arriving by car will be from within the Mooroopna West Growth Corridor (precincts A, B, C or D), and the remaining 80% will be from outside of this area (predominantly from the south-east towards Shepparton).

3.1.2 Peak Hour Traffic Generation

Residential

The peak hour traffic distribution has been assumed to be 12% of daily trips, for both the AM and PM peak hours.

This 12% peak hour was based on observation of the percentage traffic observed to occur in the peak hour from the tube count surveys. Midland Highway experiences 11.5% of its daily traffic during the PM peak hour. This figure is also within the recommended range for peak hour traffic generation stated in the Monash University publication of "Traffic Engineering and Management".

This figure is therefore based on real, observed, **local conditions** relevant to the site. In addition, it is considered that the relatively "rural" nature of the area makes a more pronounced peak period likely, as travel times and distances are relatively short, and hence peak-spreading has not occurred (due to congestion issues) in this area.

Further assumptions regarding the peak hour traffic generation were made as follows:

- The arrival to departure ratio for the AM peak is estimated at 20/80.
- The arrival to departure ratio for the PM peak is estimated at 70/30.

Based upon these assumptions, the arrivals and departures for each of the four identified development areas is summarised in Table 5 below.

Table 5 AM and PM Peak Traffic Generation Proportions – Residential Land Use

Precinct	Peak Hour Trips	AM Arrivals	AM Departures	PM Arrivals	PM Departures
A	948	190	759	664	284
B	220	44	176	154	66
C	255	51	204	178	76
D	725	145	580	508	218

Commercial and School Traffic

The peak hour traffic distribution for the commercial development has been assumed to be 12% of daily trips, for both the AM and PM peak hours (consistent with the residential peaks). This figure has been chosen as it is considered that a number of trips generated by the commercial development will be linked trips coinciding with the arrival or departure of residents on their way to/from work, school or other activities.

The peak hour for schools does not necessarily coincide with the peak period on the road network particularly in the PM peak. In this regard, the student school departures (and associated car trips) are generally focussed in the period of 3-4pm, whilst the majority of work trips (including school staff trips) would occur around 4:30 to 5:30pm. The vast majority of school trips will coincide with one of these peak periods (in addition to the AM peak). Trips outside of these hours are considered negligible.

So that no "double-counting" of internal trips occurs, internal and external trips will be addressed separately.

Table 6 AM and PM Peak Traffic Generation – School and Commercial Land Uses

Land Use	Peak Hour Trips	AM Arrivals	AM Departures	PM Arrivals[1]	PM Departures[1]	PM Arrivals[2]	PM Departures[2]
Internal trips (to/from Precincts A, B, C, D)							
School	218	111	107	107	107	0	5
Commercial	50	25	25	25	25	25	25
External trips							
School	71	45	27	27	27	0	18
Commercial	12	6	6	6	6	6	6
All Trips							
School	289	156	133	133	133	0	23
Commercial	62	31	31	31	31	31	31

Where 1 = PM 3:00-4:00pm, 2 = 4:30-5:30pm

3.2 Traffic Distribution

Traffic distribution estimates have been made for arrivals and departures during the AM and PM peak periods. It has been assumed that:

- the majority of traffic (70%) will head to Shepparton during the AM peak, and
- the majority of traffic (70%) will arrive from Shepparton during the PM peak.
- The remaining traffic in the peak direction is split equally between a north, south and west “destination” or “origin” or is internal within the broader subdivision.
- The traffic in the non-peak direction (namely arrivals in the AM and departures in the PM) is still split in favour of Shepparton (40%), however the bias is less pronounced.
- Again, the remaining movements are distributed equally north, south and west of the Outline Development Plan area, or is internal within the area.

Table 7 shows the directional distribution for the peak periods.

Table 7 Directional Distribution

Direction	AM		PM	
	Traffic To:	Traffic From	Traffic To:	Traffic From:
North (Echuca Road)	10%	20%	20%	10%
East (Shepparton)	70%	40%	40%	70%
South (Murchison Road)	10%	20%	20%	10%
West (Midland Highway)	10%	20%	20%	10%
Total	100%	100%	100%	100%

The traffic distribution assumptions were tested against actual peak hour turning counts in order to determine whether these assumptions yielded similar turning ratios and directional splits for the development traffic compared with the existing peak hour turning ratios. While the existing peak turning ratios varied significantly between sites, overall it was considered that the traffic distribution assumptions compared favourably, and the assumptions can be considered satisfactory.

The above represents the proportional directional splits for external traffic to/from the development areas. Assuming the presence of a North-South Road, it would further be assumed that up to 15% of residential traffic trips will be internal within the development areas. (This figure would change substantially if there were no North-South Road to connect the adjacent areas).

To simplify the assumptions, internal trips generated by the school and commercial development have been ignored in this analysis as it has been assumed these trips would be represented by the residential internal trip rate (of approximately 15%).

The resultant traffic generation and distribution is estimated as follows.

Table 8 AM and PM Peak Traffic Generation Proportions – Residential Land Use

Description	AM		PM[1] (3-4pm)		PM[2] (4:30-5:30pm)	
	Traffic To:	Traffic From	Traffic To:	Traffic From:	Traffic To:	Traffic From:
Precinct A	**245**	**796**	**701**	**322**	**674**	**313**
External	216	682	601	279	575	270
North	26	136	120	31	115	29
East	138	273	241	187	230	184
South	26	136	120	31	115	29
West	26	136	120	31	115	29
Internal	28	114	100	43	100	43
Precinct B	**44**	**176**	**154**	**66**	**154**	**66**
External	37	149	131	56	131	56
North	4	30	26	6	26	6
East	26	60	52	39	52	39
South	4	30	26	6	26	6
West	4	30	26	6	26	6
Internal	7	26	23	10	23	10
Precinct C	**51**	**204**	**178**	**76**	**178**	**76**
External	43	173	152	65	152	65
North	4	35	30	6	30	6
East	30	69	61	45	61	45
South	4	35	30	6	30	6
West	4	35	30	6	30	6
Internal	8	31	27	11	27	11
Precinct D	**145**	**580**	**508**	**218**	**508**	**218**
External	123	493	432	185	432	185
North	12	99	86	18	86	18
East	86	197	173	129	173	129
South	12	99	86	18	86	18
West	12	99	86	18	86	18
Internal	22	87	76	33	76	33

3.3 Traffic Assignment

Traffic has been assigned to the road network manually, based upon the shortest or most convenient traffic route. Two scenarios have been considered, namely with and without a north-south aligned collector road within the Mooroopna West Outline Development Plan Area.

Details of the individual traffic assignment assumptions and resultant traffic counts at intersections are provided in **Appendix D**. Some of the key assumptions are also summarised in Table 9**.**

Table 9 Traffic Assignment Assumptions

Development Area	With North-South Road	Without North-South Road
D	Via North-South Road to Echuca Road Via North-South Road to Midland Highway	Direct access to Echuca Road
C	Via North-South Road to Mac Isaac Road to Echuca Road Via North-South Road to Echuca Road Via North-South Road to Midland Highway	Via Mac Isaac Road to Echuca Road Via Dennison Street to Echuca Road
B	Direct to Mac Isaac Road and Echuca Road Via North-South Road to Echuca Road Via North-South Road to Midland Highway	Via Mac Isaac Road to Echuca Road
A	Via North-South Road to Midland Highway Via North-South Road to Echuca Road	Direct access to Midland Highway Via Knight St to Echuca Road

While other smaller roads may also be used by some traffic to access the main arterials of Echuca Road and Midland Highway, the traffic assignment routes have been limited to the more direct and significant roads within the existing network. If excessive or inappropriate traffic volumes did develop on the smaller roads, as a result of the residential development, then traffic management would be an option in order to reduce or eliminate the incidence of traffic using local streets for access to the main arterial network.

3.4 Proposed Community Facilities and Local Retail Clusters

It is understood that some additional facilities are proposed as part of the Mooroopna West Growth Corridor to service the new residential development catchments. This development may include community facilities (such as a place of assembly, a maternal and child health centre or other community hub), in addition to some local retail premises (small supermarket, shops and/or other facilities). These facilities will ensure the provision of local services to the local community.

The site allocations for the purposes of the ODP and DCP are;

- A Southern Local Cluster in 'Area A' with a site area of 7437.5 sqm say 0.75 ha to be co-located with the proposed Primary School and Community Facilities. This based on the provision of 1,700 sqm of leasable area and 4.5 car spaces per 100 sqm of leasable area. The Cluster comprises a small supermarket outlet of 1,100sqm and 600 sqm of specialty outlets.

- A Northern Local Retail Cluster (location yet to be confirmed) with a site area of 2625.0 sqm say 0.27 ha based on 600 sqm of leasable area and 4.5 car spaces per 100 sqm of leasable area. The cluster comprises a small (express style) supermarket of 400 sqm and 200sqm of speciality outlets.

The traffic generation rates proposed for such facilities would generally produce predominantly "local" trips. Therefore, provided that an internal access road is provided between the community precincts (A, B, C and D) the majority of trips will not utilise the external road network.

In this respect, there is not anticipated to be any additional external trips generated by the community and minor retail establishments assuming that these facilities are provided in place of the proposed residential area (i.e. they therefore substitute development land already forecast to produce external residential trip rates).

4.0 Impact of Generated Traffic

As discussed in Section 3, the traffic assignment was determined for two scenarios: with and without a North-South Road. On this basis, there is a need to analyse the impact of the generated traffic on the future road networks for both scenarios. This has been done using the intersection modelling program *SIDRA Intersection 3.2* (SIDRA) and the results are summarised in sections 4.2 and 4.3. Full details of the analyses are included in **Appendix E**. The broad assumptions that have been made about the future structure of the road network are outlined in Sections 4.1, 4.2 and 4.3.

4.1 Operation of Future Road Network – Shepparton Bypass

One possible major change to the road network is the introduction of the Goulburn Valley Highway – Shepparton Bypass. One section of the Bypass is planned from the Midland Highway, following an alignment immediately west of the Mooroopna West ODP area (along the alignment of the existing Excelsior Road), heading north to Echuca Road, immediately north of the development area. The local impact of the Bypass would be to remove a significant proportion of the heavy vehicle traffic that currently utilises Echuca Road and the Midland Highway. This would help to reduce the currently increasing congestion levels experienced at the intersection of Echuca Road and Midland Highway. The staging of the Bypass will be dependent upon a number of factors, including the possible introduction of a new multi-modal freight terminal south of Mooroopna. Even if this new development becomes operational thereby providing additional justification for the construction of the Bypass, it is likely that the Bypass will not be fully operational for many years. Therefore, for the purposes of this assessment, it has been assumed that the Bypass is not operational. However, its ultimate alignment will be considered in the planning of the North-South Road and other intersection designs.

It should be noted that (in the absence of a Bypass) the introduction of a new North-South Road through the ODP area, could create an attractive alternate bypass for any Echuca Road-Midland Highway vehicles. Consequently, as 30% of these bypass vehicles are heavy vehicles, it will be necessary to ensure that the North-South Road is not used as an alternative heavy vehicle route, and that traffic mitigation measures are provided to discourage these vehicles from using the collector road and entering the residential area. One option would be to introduce a load limit restriction with signage installed at either end of the ODP area. (Other options are discussed further in Section 5.2).

4.2 Operation of Future Road Network – No North-South Road Option

The future road network without a North-South Road is expected to look similar to the existing road network. Some possible changes from the existing conditions include:

- Possible signalisation of the Echuca Road and Mac Isaac Road intersection;
- Possible signalisation of the Echuca Road and Knight Street intersection;
- New signalised intersection to service the northern end of the development at Echuca Road;
- New signalised intersection to service the southern end of the development at Midland Highway; and
- Possible duplication of the Midland Highway between Echuca Road and the new bypass.

The SIDRA results for all key existing intersections without a North-South Road are summarised below.

Echuca Road and Midland Highway

It has been estimated that traffic through this intersection will experience long queues (up to 245 metres) and delays of up to 62 seconds. While the operation of traffic signals has been optimised in the SIDRA analysis, the intersection will operate with a Level of Service D (refer Section 2.3) once the new development traffic is introduced.

Echuca Road and Mac Isaac Road

This intersection is currently priority controlled (Mac Isaac Road giving way to Echuca Road). Although the SIDRA analysis indicates that currently a low level of service is experienced in the AM peak, the observed queues are modest and delays are still less than 1 minute. However, with the addition of the new development traffic, queuing and delay levels would become completely unacceptable for a priority controlled junction, as delays for side road traffic are estimated by SIDRA to exceed 30 minutes. Traffic signals could alleviate these problems, however the results indicate that intersection flaring would be required in order to increase the number of traffic lanes, and hence capacity, and therefore enable the intersection to cope with the forecast traffic flows.

Echuca Road and Knight Street

This intersection currently operates well with only minimal delays observed. However, with the introduction of the new development traffic gaining access to Knight Street, the level of service for right turns from Knight Street would reduce to F, and vehicles would experience long queues and unacceptable delays, particularly during the AM peak. Traffic signals would be necessary at this intersection, along with some localised widening to provide additional traffic lane capacity in order to ensure that the signals operate efficiently.

Midland Highway and Elsie Jones Drive

While it has not been assumed that any new traffic flows would use Elsie Jones Drive, it is possible that vehicle “rat-running” would occur and additional traffic volumes would use this street in the absence of a North-South Road. The current operation of this intersection is adequate during the peak periods, however the intersection would be unlikely to have the ability to accommodate additional traffic from the new residential areas.

Echuca Road and Direct Access Road

A new access development road would be required to facilitate access directly to Echuca Road towards the north of the development area (if no North-South Road were provided). This intersection would experience level of service F for the access road traffic under priority control. As such, signalised operation of the intersection would be required along with localised flaring of the intersection (including Echuca Road) to ensure the intersection can cater for the forecast traffic flows.

Midland Highway and Direct Access Road

A new access development road would be required to facilitate access directly to Midland Highway to service the development area (if no North-South Road were provided). This intersection would experience level of service F for the access road traffic under priority control. As such, signalised operation of the intersection would be required along with localised flaring of the intersection (including Midland Highway) to ensure the intersection can cater for the forecast traffic flows.

If traffic signals are installed at this location, a duplicated carriageway should also be provided on the Midland Highway to avoid the need to reconfigure the signals at a later stage. The duplicated carriageway is not essential for the operation of the signals, but was modelled to coincide with the anticipated duplication of the road.

Summary

It is considered that the operation of the intersections leading into the Mooroopna West precincts would be sub-optimal with long queues and delays at many locations following the introduction of new residential development traffic. The lack of a North-South “collector road” would leave existing intersections operating with poor levels of service and hence lead to circulation and access problems for the Mooroopna West ODP area. Traffic signals on Echuca Road would be required at both Knight Street and Mac Isaac Road, as well as some intersection widening to create additional traffic lane capacity. Furthermore, two new signalised intersections would also be required providing direct access to the development, one on Echuca Road and one on Midland Highway. The increased congestion on the road network is likely to include the Midland Highway and Echuca Road signals leading to a potential rise in accidents at this and other sites that experience a significant reduction in the overall level of service and operational efficiency.

4.3 Operation of Future Road Network – With North-South Road Option

The operation of the road network is expected to improve significantly through the introduction of a North-South Road. However, there are still envisaged to be some problematic intersections. The changes to the road network are likely to include:

- Possible signalisation of the Echuca Road and Mac Isaac Road intersection;
- Possible duplication of the Midland Highway between Echuca Road and the new Bypass;
- New North-South Road intersection with Midland Highway (signalised); and
- New North-South Road intersection with Echuca Road (unsignalised).

The *SIDRA* results for all key existing and proposed intersections with the North-South Road are summarised below.

Echuca Road and Midland Highway

The SIDRA results indicate that this signalised intersection will experience queuing and delays, however they may not be quite as extensive as that expected without a North-South Road. This is because there is likely to be more “through” traffic flows, and less turning movements. Turning movements are generally slower and have to compete with opposing traffic flows and/or pedestrians and therefore exhibit reduced capacity compared with through movements. Nonetheless, despite the predominance of through movements, the overall intersection operation is expected to be poor as some turning movements will still operate with a Level of Service D and E. This will greatly improve with the introduction of the Bypass.

Echuca Road and Mac Isaac Road

This priority control junction would be unable to sustain the additional traffic flows from the ODP area traffic. The increased traffic is expected to lead to long queues and delays for right turns from Mac Isaac Road into Echuca Road. The results indicate that the intersection would need to be signalised, with only minor modifications to ensure safe and efficient access to Echuca Road. However, in reality, when traffic queues develop, traffic will divert to alternate routes to avoid the delays, and therefore the staging of the signals may be less critical.

Echuca Road and Knight Street

After the introduction of a North-South Road, it is expected that Knight Street will not sustain any significant additional traffic volumes, due to the proposed alignment of the North-South Road (the North-South Road will provide an ‘easier’ route due to the lack of signals along it’s length, compared to Echuca Road) In this respect, the intersection will continue to operate satisfactorily.

Echuca Road and North-South Road

The new North-South Road would terminate at its northern end at an intersection with Echuca Road. The development flows at this location are unlikely to warrant the need for traffic signals. Nonetheless, signals may be desirable from a safety perspective.

Midland Highway and North-South Road

Based upon a cross-intersection with Charles Street, and a duplicated carriageway, traffic signals would be required at this intersection to ensure it operated safely and without long queues and delays.

The duplicated carriageway is not essential for the operation of the signals, but was modelled to coincide with the anticipated duplication of the road.

Summary

With the introduction of a North-South Road, the intersection of Mac Isaac Road and Echuca Road will need to be signalised(if it is assumed that traffic does not divert to an alternate route), as will the intersection of the North-South Road with the Midland Highway (and Charles Street). With the introduction of these treatments, it is considered that access and circulation within the Mooroopna ODP area would be greatly improved by the establishment of a North-South Road.

5.0 North-South Road Recommendations

Based upon the intersection analyses and information relating to the new development, it is recommended that a North-South *Collector* Road be introduced in the Mooroopna West ODP area, connecting the Midland Highway to Echuca Road. From the analyses of future traffic loads and the function of the North-South Road, we can make the following recommendations relating to the design and operation of the road and its intersections.

5.1 Traffic Flows

The traffic forecast to be carried on the North-South Road will vary along its length. The estimated traffic flows have been based upon the predicted number of lots in the development, plus a variation of up between 10 and 25% additional load to account for trips from the existing residential areas that may transfer to this new road. Therefore, a summary of the likely traffic flow range in different sections of the North-South Road is provided in Table 7 below.

Table 10 Traffic Volumes on North-South Road

Location	AM Peak Hour		PM Peak Hour	
	Northbound (veh/hr)	Southbound (veh/hr)	Northbound (veh/hr)	Southbound (veh/hr)
South-West of Echuca Road	570-630	150-200	230-290	500-630
North of Mac Isaac Road/North of Knight Street	165-210	350-440	330-420	200-260
North of Midland Highway	210-260	830-920	720-800	310-390

These traffic flows could vary considerably; possibly beyond the above ranges, depending on the access options provided to and from the existing and new residential development areas to the new road and/or to other roads. In addition, if the North-South Road becomes an attractive bypass route, there is a potential for cut-through non-local traffic to use the route. It will be important to control this by ensuring that any non-local heavy vehicle traffic is discouraged or prevented from using the route (ie. load limits).

The peak traffic flows on the North-South Road are expected to be around 700-800 vehicles per hour (two-way flow). However, immediately north of the Midland Highway, volumes will be higher, and could reach up to 1200 vehicles per hour.

The route is expected to carry an average weekday traffic volume of between 6,000 to 10,000 vehicles per day. This range is compatible with the expected traffic flows for a *collector* to *arterial* road in a suburban environment. However, it is generally preferable to maintain traffic flows at less than 8000 vehicles per day for residential collectors, to retain manageable traffic volumes near residential properties. In any event, traffic flows north of Knight Street are unlikely to exceed this volume, and accordingly, impacts associated with traffic noise and volume are not expected to be significant.

5.2 Road Alignment and Cross-Section

5.2.1 Alignment

In order to ensure connectivity and an optimum alignment to maximise developable land within the Mooroopna West ODP area, the following are recommended:

- At the northern end of the road, it should connect to Echuca Road in the southern section of Precinct “D” to maximise the potential catchment.

- It should also provide as direct a connection as possible to Echuca Road. Hence, a right-angle connection may be more desirable to achieve a “shorter” route, and also ensure a well-designed intersection.
- The road should also provide good connections to Mac Isaac Road, and possibly to Knight Street to maximise the benefits of the road for the existing residential development areas.
- At its southern end, the North-South Road should connect to the Midland Highway opposite to Charles Street, to provide a four-way intersection.

An example of a potential road alignment that satisfies the above criteria is shown in Figure 2 overleaf.

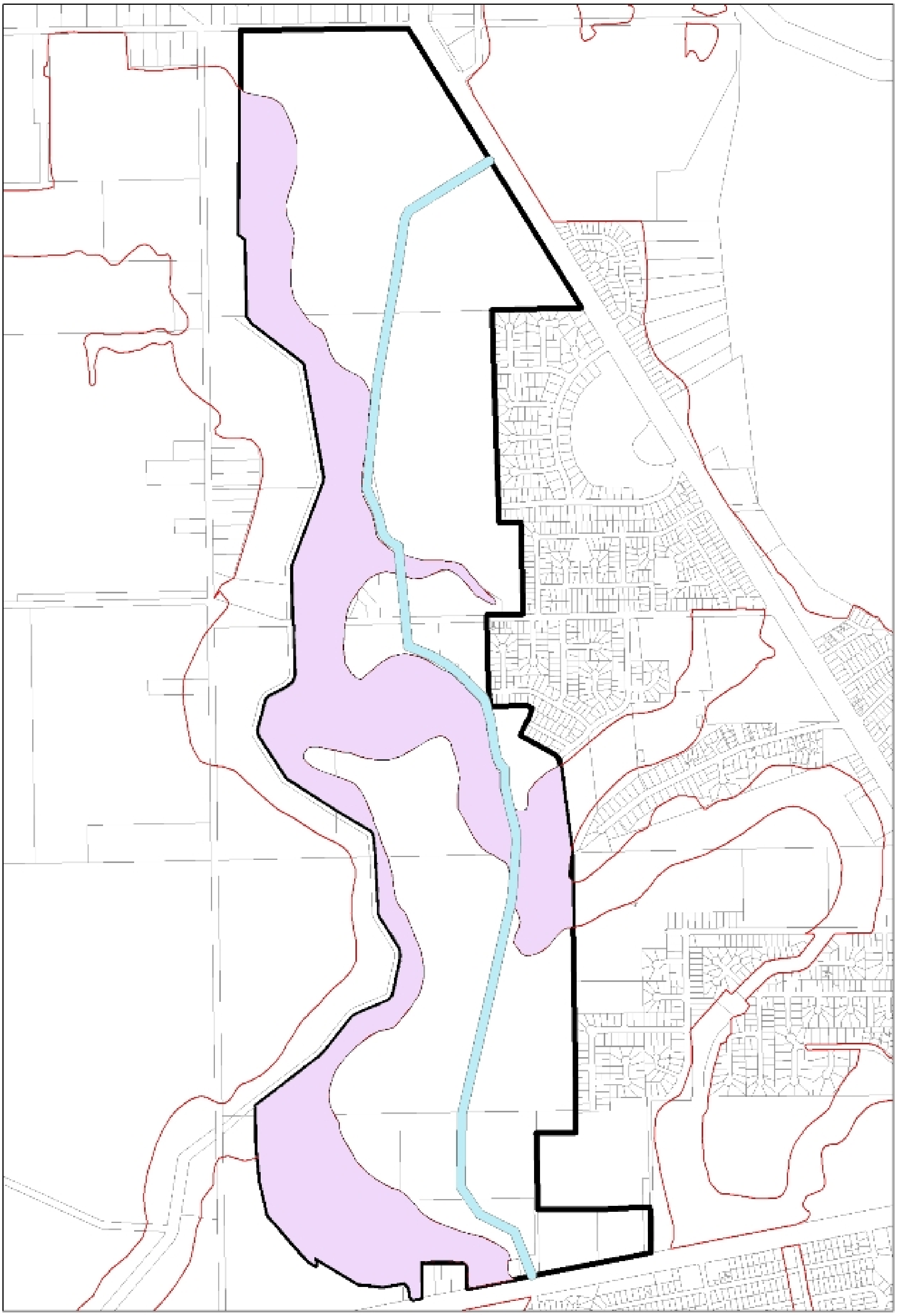
5.2.2 Cross Section

The North-South Road is intended to operate as a *collector* or *distributor* road. It is therefore intended to carry higher traffic volumes than the other local roads within the network, however it is not expected to be classified as a *declared road*, and will effectively be a Council-controlled road. In its capacity as a *collector* or *distributor* through a residential environment, it is expected to have relatively high pedestrian and cyclist activity, and is therefore required to operate safely for these potentially vulnerable road users. A 50 km/hr speed limit should therefore apply to this road. Its alignment and cross-section should also be designed to discourage higher speeds from the outset. Some typical Local Area Traffic Management techniques applied to distributor roads include:

- Roundabouts and/or mid-block splitter islands at about 500 metre spacing;
- Median islands or barrier lanes to restrict overtaking (and allow for incorporation of pedestrian refuges)
- Carriageway width confined to one lane in each direction of travel;
- Definition of parking lanes by line marking to help confine traffic to one travelling lane; and
- 50 km/hr speed limit.

The use of vertical displacement devices such as speed humps or single lane slow points could also be considered as appropriate treatments to discourage excessive traffic volumes. However, as this road is an entirely new facility (deliberately designed to achieve lower speeds from the start), initial emphasis should be placed on designing an appropriate curvilinear road alignment. Long straight roads, with unimpeded sight lines over long distances, are more likely to attract and encourage higher vehicle speeds and such alignments should therefore be avoided. Gentle curvilinear alignments are preferable to straight alignments as they can actively promote lower speeds over the length of the road without compromising safe sightlines.

Figure 2 Possible North-South Road Alignment



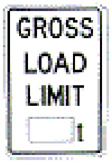
Capacity

In order to carry the traffic volumes predicted for this road, one lane is each direction is adequate. However, immediately north of the Midland Highway, this road section may require some localised widening at intersections to prevent the higher traffic flows from causing delays. Two lanes in each direction may be warranted for a short road section north of Midland Highway. Treatments appropriate for this section part of the road may include right turn lanes and left turn deceleration lanes to enable through traffic to proceed unimpeded, and improve access to and from the residential streets running west off the North-South Road.

In the southbound direction, flaring at the intersection with the Midland Highway will be essential to maintain adequate intersection capacity.

Vehicle Restrictions

To reduce the incidence of heavy vehicles using the North-South Road, signage should be used in conjunction with the 50km/h speed limit and curvilinear road alignment. The most appropriate signage to be used would be weight restrictions, as using length restrictions will not stop some heavy vehicles entering the area (as provision will be made for buses to use the North-South Road). The use of roundabouts on the North-South Road will assist in restricting access to longer vehicles.



Bicycles

It will be desirable to allow for on-road cycle lanes in the carriageway profile. The proposed cross-section should therefore include on-road cycle lanes. This will complement the shared pathway network contained within the public open space corridor throughout the ODP area.

Parking

Parking may be necessary in some locations, to facilitate access to adjacent properties. Parking should be indented, to reduce the wide expanse of pavement that a continuous parking lane would provide. The cross section shown in Figure 3 shows a parking lane only on one side of the North-South Road.

Median

As previously mentioned, a range of local area traffic management treatments such as splitter islands, refuges etc. are recommended to improve pedestrian safety, promote a narrower road environment, and prevent over-taking manoeuvres. On mechanism that could achieve this objective for the North-South Road is the introduction of a median along its entire length.

Buses

The North-South Road is also expected to ultimately cater for a bus route, and an allowance should be made for bus stops. The current preferred practice for bus stops is to not provide indented bays, as such treatments can reduce visibility and delay buses in trying to “pull back” into the traffic stream. Accordingly, bus stops should be located within the normal carriageway width, without an indented bay. However, at special locations such as layover areas, timing points, a major bus interchange, or at the proposed school the use of specially designed solutions may be necessary.

Pedestrians

Pedestrian footways should be provided on at least one side of the road, desirably on both sides. If footpaths are provided on both sides, one path may provide a more “recreational” function and connect to the network of shared pathways and open space reserves. Such a footpath may not necessarily follow directly alongside the North-South Road, but could meander between reserves and open spaces.

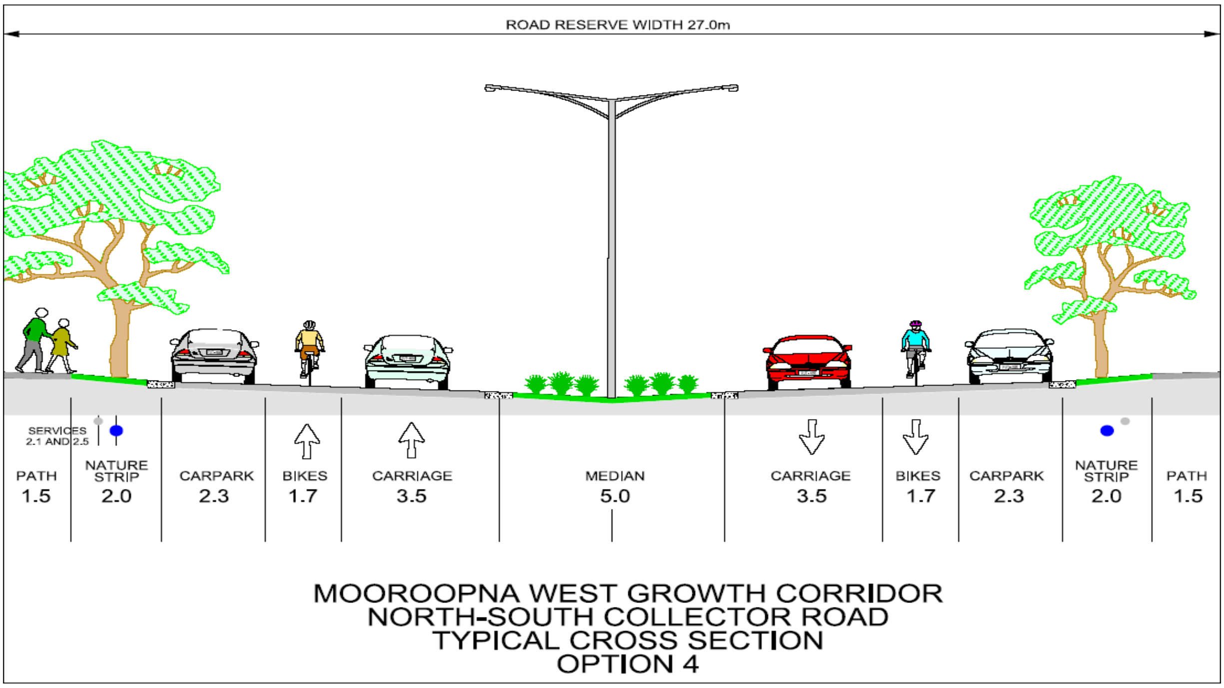
Access

The North-South Road will be a *collector* road. In this context, the ability to provide for direct property access is a legitimate function. Where direct property access is provided, there could be a greater need for indented parking to service visitors to these properties. Gaps may also be required in the median to provide access and u-turn opportunities. If the median is narrow (with insufficient space to store a turning vehicle clear of opposing vehicular travel paths), the gaps could contribute to conflict occurrences. The design of such facilities needs to be carefully considered in order to avoid such outcomes. Another alternative would be to provide a service road to facilitate access clear of the main traffic stream; such an option could be used to facilitate access to a limited number of properties.

Cross Section Options

There are a number of options for the North-South Road cross-section that would provide suitable facilities to cater for the road's various users. An option considered to achieve the desired objectives is shown in **Figure 3** below.

Figure 3 Possible North-South Road Cross-Section



5.3 North-South Road Intersections

5.3.1 Midland Highway Intersection

It is recommended that traffic signals be installed at the intersection of the North-South Road with the Midland Highway. It is considered that traffic signals should be installed at an early stage, even if the intersection could operate satisfactorily from a traffic capacity perspective (as a priority controlled junction), as the safety aspects of intersection operation dictate the adoption of traffic signals to optimise safety.

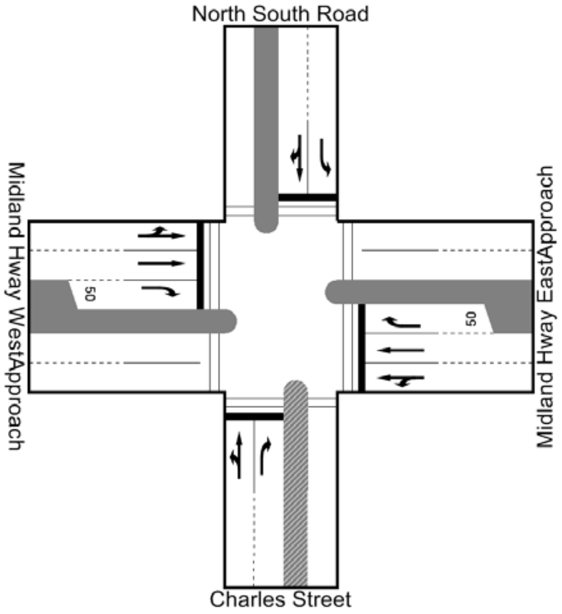
The accident record for the Midland Highway between Excelsior Road and Echuca Road indicates three casualty accidents in the past 5 years of accident data. If significant additional development traffic were introduced without signals, greater accident numbers could be expected. The installation of traffic signals could significantly reduce accident potential at this site, as well as at other locations along the Midland Highway, as the signals would create artificial "gaps" in the traffic flow thus creating safer access opportunities along the length of the road.

On this basis, a cross-intersection with Charles Street would provide a suitable option, as the traffic signals would manage access from residential areas both north and south of the Midland Highway, and offer the added benefit of a safe egress from the south. Furthermore, it would integrate the two residential areas more readily, thus reducing the barrier created by the Midland Highway.

As the ultimate alignment of the Midland Highway in the vicinity of these signals would be a duplicated carriageway, it is highly recommended that the duplication be introduced along with the signals, to reduce costs of removing and reintroducing the traffic signal hardware at a later stage. Therefore, the staging of the signalisation and duplication should occur at the same time.

Figure 4 shows a possible proposed layout lane for and configuration for this intersection.

Figure 4 Proposed Midland Highway and North-South Road Intersection Layout



5.3.2 Echuca Road Intersection

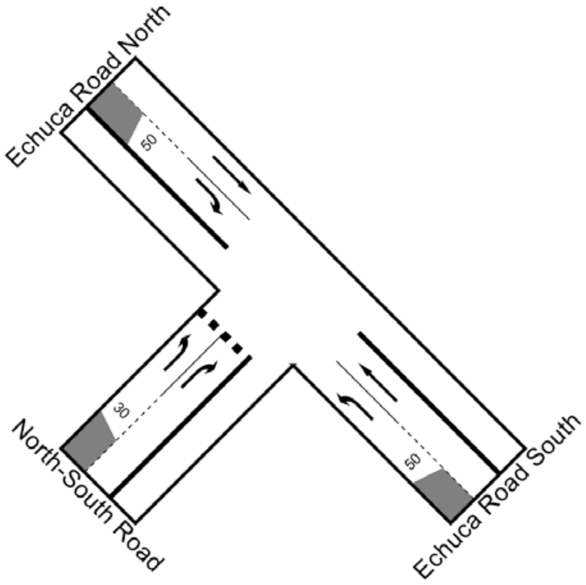
Traffic signals are not warranted for the intersection of the North-South Road and Echuca Road based purely on the current forecast development numbers. However, signals in this area would aid existing residential areas to safely access Echuca Road, and therefore a signalised intersection may attract a greater demand.

Since the North-South Road is intended to attract traffic to use this route (in preference to other local roads in the area), an exclusive right turn lane from Echuca Road (north approach) into the North-South Road is recommended.

Also, to prevent queuing, the intersection approach from the North-South Road should be flared to create an additional short traffic lane and enable left turns into Echuca Road to proceed, even with several queued right turn vehicles.

Figure 5 shows a possible layout of the intersection.

Figure 5 Proposed Echuca Road and North-South Road Intersection Layout



5.3.3 Minor North-South Road Intersections

The majority of intersections along the North-South Road will be priority controlled in favour of the North-South Road. However, Mac Isaac Road will cross the North-South Road on approximately a right angle alignment, and as it provides a significant east-west route, a standard give-way or stop priority control may not be suitable. Furthermore, it is noted that Mac Isaac Road already features an accident history, and the intersection should therefore be designed to reduce the potential for accidents. As such, it is recommended that the intersection be a roundabout control.

5.3.4 Other Intersections

Although beyond the scope of this Study, there are some road network treatments that could be considered to improve operation and safety:

- **Mac Isaac Road/Echuca Road intersection and Echuca Road/Knight Street intersection**. The increase in traffic associated with the new development (with or without the North-South Road) will add significant flows onto Echuca Road. This will reduce the opportunities for uncontrolled traffic to egress from these side streets onto Echuca Road. Furthermore, traffic from the side streets will also increase substantially, potentially leading to excessive queues and delays. It is recommended that traffic signals be installed to assist the safe movement of traffic at the intersection of Mac Isaac Road/Echuca Road. Furthermore, the provision of signals will provide gaps in the Echuca Road traffic, which could help to address some of the accident types experienced along this section of road.

- **Midland Highway and Echuca Road intersection.** This intersection is currently controlled by traffic signals. The SIDRA analyses indicate that it is already approaching capacity for a number of movements, and that the new development traffic is likely to deteriorate operating conditions. Furthermore, it is understood that the local area traffic management treatments due to be introduced in O'Brien Street and/or Morrell Street could redirect a large proportion of traffic, which is currently avoiding these traffic signals. Consequently, it is recommended that the traffic signal operation and layout be investigated with a view to increasing the intersection capacity. A more detailed review of the accident history is also recommended to determine whether remedial measures can be introduced to reduce accident types.

Appendix A Traffic Counts

Appendix A Traffic Counts

Traffic Counts Tuesday 11/5/04

MacIsaac Rd and Echuca Road

	MacIsaac Rd		Echuca Rd - north appr		Echuca Rd - south appr	
	right out	left out	right in	southbound	northbound	left in
4:00-4:15	36	3	4	67	83	46
4:15-4:30	32	3	5	62	90	57

Knight Street and Echuca Road

	Knight Street		Echuca Rd - north appr	Echuca Rd - south appr
	right out	left out	right in	left in
4:35-4:50	8	6	16	16

Echuca Road and Midland Highway

	Midland Highway west approach			Echuca Road north approach		
	right	through	left	right	through	left
5:00-5:15	1	77	1	11	21	33

Charles Street and Midland Highway

	Charles Street		Midland H'way -west appr		Midland Hwy - east appr	
	right out	left out	right in	eastbound	westbound	left in
4:00-4:15	6	2	2	70 incl. 9 HV	85 incl. 10 HV	8
4:15-4:30	5	0	0	74 incl. 3 HV	79 including 7 HV	12

Elsie Jones Drive and Midland Highway

	Elsie Jones Drive		Midland Hwy -east appr	Midland Hwy - west appr
	right out	left out	right in	left in
4:35-4:50	2	10	11	4

Echuca Road and Midland Highway

	Midland Highway east approach			Echuca Road south approach		
	right	through	left	right	through	left
5:00-5:15	70					
5:15-5:30	74	143	84	67	20	1

Appendix B Accidents

Appendix B1 2004 Accidents

Road Crash Statistics: Victoria Accidents By Site

Location is LGA(s): SHEPPARTON; Query: Casualty accidents; Sites: Complex Intersection 3057 Intersection of Midland Hwy and Joseph Street [Contains smaller 'sub'-intersections], Int 2211 Intersection of Macisaac Road and Norton Drive, Complex Intersection 3052 Intersection of Echuca-Mooroopna Road and Larsen Street [Contains smaller 'sub'-intersections], Complex Intersection 3038 Intersection of Echuca-Mooroopna Road and Baker Crescent [Contains smaller 'sub'-intersections], Int 5246 Intersection of Elsie Jones Drive and Pell Crescent, Int 6710 Intersection of Clydesdale Court and Rodney Park Drive, Int 26742 Intersection of Midland Hwy and Elsie Jones Drive, Complex Intersection 3030 Intersection of Echuca-Mooroopna Road and Gange Street [Contains smaller 'sub'-intersections], Int 26744 Intersection of Anderson Street and Macisaac Road, Int 26745 Intersection of Macisaac Road and Stevens Crescent, Complex Intersection 3055 Intersection of Midland Hwy and Echuca-Mooroopna Road [Contains smaller 'sub'-intersections], Int 26748 Intersection of Echuca-Mooroopna Road and Echuca-Mooroopna Road Inbound Service Rd, Complex Intersection 3033 Intersection of Echuca-Mooroopna Road and Centennial Drive [Contains smaller 'sub'-intersections], Int 26750 Intersection of Echuca-Mooroopna Road and Homewood Drive, Complex Intersection 3056 Intersection of Midland Hwy and Emma Street [Contains smaller 'sub'-intersections], Complex Intersection 3041 Intersection of Echuca-Mooroopna Road and Mcfarlane Road [Contains smaller 'sub'-intersections], Complex Intersection 3045 Intersection of Echuca-Mooroopna Road and Obrien Street [Contains smaller 'sub'-intersections], Complex Intersection 3046 Intersection of Echuca-Mooroopna Road and Knight Street [Contains smaller 'sub'-intersections], Complex Intersection 3051 Intersection of Echuca-Mooroopna Road and Anselmi Street [Contains smaller 'sub'-intersections], RdSeg 176403 on Macisaac Road btw Menzies Street and Norton Drive, RdSeg 177222 on Knight Street btw Elsie Jones Drive and Rodney Park Drive, RdSeg 104836 on Echuca-Mooroopna Road btw Larsen Street and Ann Street, RdSeg 176304 on Friend Street btw Gange Street and Stevens Crescent, RdSeg 104511 on Echuca-Mooroopna Road btw Paisley Crescent and Paisley Crescent, RdSeg 104894 on Midland Hwy btw Midland Hwy and Elsie Jones Drive, RdSeg 104627 on Echuca-Mooroopna Road btw Gange Street and ...

Map Refs Road Number Km from start		Location (Road names)	SEVERITY ALL injury	Fatal	Serious	Other Injury	DCA GROUPS Pedestrian	Cross Traffic	Right Near	Right Against	Lost Control	Rear End	OBJECT HIT Pole	Tree	Fence Wall	ROAD Dry	Wet	LIGHT Day	Dark	VEHICLE NUMBERS Car	Truck	Motor Cycle	Bike	YEARLY TREND '96	'97	'98	'99	'00	'01	'02
VCD ED4 32 G8 152979 0.621 Km Shepparton	On btw &	Macisaac Road Mac Isaac Road Gange Street	1		1						1					1		1				1							1	
VCD ED4 272 A7 5366 2.996 Km Shepparton	On btw &	Echuca-Mooroopna Road Paisley Crescent Paisley Crescent	2		1	1	2									2			2	1			1			1				1
VCD ED4 272 A9 132001 0.000 Km Shepparton	At &	Gange Street Macisaac Road	1			1			1							1		1		2										
VCD ED4 272 A13 2590 322.414 Km Shepparton	On btw &	Midland Hwy Midland Hwy Elsie Jones Drive	1		1											1			1	2								1		
VCD ED4 272 B9 5366 1.929 Km Shepparton	At &	Echuca-Mooroopna Road Echuca-Mooroopna Road Inbound Service Rd	2			2			2							1	1	1	1	4							2			
VCD ED4 272 B9 102297 0.000 Km Shepparton	At &	Anderson Street Macisaac Road	1			1						1				1		1		2								1		
VCD ED4 272 B9 152979 1.231 Km Shepparton	On btw &	Macisaac Road Norton Drive Stevens Crescent	1		1											1			1	2										1
VCD ED4 272 B9 152979 1.516 Km Shepparton	On btw &	Macisaac Road Stevens Crescent Anderson Street	1		1						1		1			1		1				1							1	
VCD ED4 272 B9 152979 1.633 Km Shepparton	On btw &	Macisaac Road Anderson Street Echuca-Mooroopna Road Outbound Service Rd	1			1										1		1				1				1				

Road Crash Statistics: Victoria Accidents By Site

Location is LGA(s): SHEPPARTON; Query: Casualty accidents; Sites: Complex Intersection 3057 Intersection of Midland Hwy and Joseph Street [Contains smaller 'sub'-intersections], Int 2211 Intersection of Macisaac Road and Norton Drive, Complex Intersection 3052 Intersection of Echuca-Mooroopna Road and Larsen Street [Contains smaller 'sub'-intersections], Complex Intersection 3038 Intersection of Echuca-Mooroopna Road and Baker Crescent [Contains smaller 'sub'-intersections], Int 5246 Intersection of Elsie Jones Drive and Pell Crescent, Int 6710 Intersection of Clydesdale Court and Rodney Park Drive, Int 26742 Intersection of Midland Hwy and Elsie Jones Drive, Complex Intersection 3030 Intersection of Echuca-Mooroopna Road and Gange Street [Contains smaller 'sub'-intersections], Int 26744 Intersection of Anderson Street and Macisaac Road, Int 26745 Intersection of Macisaac Road and Stevens Crescent, Complex Intersection 3055 Intersection of Midland Hwy and Echuca-Mooroopna Road [Contains smaller 'sub'-intersections], Int 26748 Intersection of Echuca-Mooroopna Road and Echuca-Mooroopna Road Inbound Service Rd, Complex Intersection 3033 Intersection of Echuca-Mooroopna Road and Centennial Drive [Contains smaller 'sub'-intersections], Int 26750 Intersection of Echuca-Mooroopna Road and Homewood Drive, Complex Intersection 3056 Intersection of Midland Hwy and Emma Street [Contains smaller 'sub'-intersections], Complex Intersection 3041 Intersection of Echuca-Mooroopna Road and Mcfarlane Road [Contains smaller 'sub'-intersections], Complex Intersection 3045 Intersection of Echuca-Mooroopna Road and Obrien Street [Contains smaller 'sub'-intersections], Complex Intersection 3046 Intersection of Echuca-Mooroopna Road and Knight Street [Contains smaller 'sub'-intersections], Complex Intersection 3051 Intersection of Echuca-Mooroopna Road and Anselmi Street [Contains smaller 'sub'-intersections], RdSeg 176403 on Macisaac Road btw Menzies Street and Norton Drive, RdSeg 177222 on Knight Street btw Elsie Jones Drive and Rodney Park Drive, RdSeg 104836 on Echuca-Mooroopna Road btw Larsen Street and Ann Street, RdSeg 176304 on Friend Street btw Gange Street and Stevens Crescent, RdSeg 104511 on Echuca-Mooroopna Road btw Paisley Crescent and Paisley Crescent, RdSeg 104894 on Midland Hwy btw Midland Hwy and Elsie Jones Drive, RdSeg 104627 on Echuca-Mooroopna Road btw Gange Street and ...

Map Refs Road Number Km from start		Location (Road names)	SEVERITY ALL injury	Fatal	Serious	Other Injury	DCA GROUPS Pedestrian	Cross Traffic	Right Near	Right Against	Lost Control	Rear End	OBJECT HIT Pole	Tree	Fence Wall	ROAD Dry	Wet	LIGHT Day	Dark	VEHICLE NUMBERS Car	Truck	Motor Cycle	Bike	YEARLY TREND '96	'97	'98	'99	'00	'01	'02
VCD ED4 272 B10 140781 0.199 Km Shepparton	On btw &	Homewood Drive Campbell Court Echuca-Mooroopna Road	1		1						1						1		1	1								1		
VCD ED4 272 B13 2590 322.641 Km Shepparton	 At &	Complex intersection no. 3057 Midland Hwy Joseph Street	3	1	2		1		1	1						3		2	1	4							2		1	
VCD ED4 272 C9 5366 1.640 Km Shepparton	 At &	Complex intersection no. 3035 Echuca-Mooroopna Road Carr Crescent	2		1	1						1				1	1	1		4										
VCD ED4 272 C10 5366 0.995 Km Shepparton	 At &	Complex intersection no. 3045 Echuca-Mooroopna Road Obrien Street	4		1	3			3	1						3	1	2	1	7		1				1		1	1	1
VCD ED4 272 C10 5366 1.173 Km Shepparton	 At &	Complex intersection no. 3041 Echuca-Mooroopna Road Mcfarlane Road	1			1			1							1		1		2						1				
VCD ED4 272 C10 5366 1.212 Km Shepparton	On btw &	Echuca-Mooroopna Road Baker Crescent Mcfarlane Road	1			1										1			1	2								1		
VCD ED4 272 C10 5366 1.231 Km Shepparton	On btw &	Echuca-Mooroopna Road Inbound Service Rd Baker Crescent Mcfarlane Road	1		1							1				1			1	1	1								1	
VCD ED4 272 C10 5366 1.524 Km Shepparton	At &	Echuca-Mooroopna Road Homewood Drive	1			1						1				1		1		3						1				
VCD ED4 272 C11 5366 0.774 Km Shepparton	On btw &	Echuca-Mooroopna Road Northgate Street Graeme Street	1			1					1			1		1			1	1										1

Road Crash Statistics: Victoria Accidents By Site

Location is LGA(s): SHEPPARTON; Query: Casualty accidents; Sites: Complex Intersection 3057 Intersection of Midland Hwy and Joseph Street [Contains smaller 'sub'-intersections], Int 2211 Intersection of Macisaac Road and Norton Drive, Complex Intersection 3052 Intersection of Echuca-Mooroopna Road and Larsen Street [Contains smaller 'sub'-intersections], Complex Intersection 3038 Intersection of Echuca-Mooroopna Road and Baker Crescent [Contains smaller 'sub'-intersections], Int 5246 Intersection of Elsie Jones Drive and Pell Crescent, Int 6710 Intersection of Clydesdale Court and Rodney Park Drive, Int 26742 Intersection of Midland Hwy and Elsie Jones Drive, Complex Intersection 3030 Intersection of Echuca-Mooroopna Road and Gange Street [Contains smaller 'sub'-intersections], Int 26744 Intersection of Anderson Street and Macisaac Road, Int 26745 Intersection of Macisaac Road and Stevens Crescent, Complex Intersection 3055 Intersection of Midland Hwy and Echuca-Mooroopna Road [Contains smaller 'sub'-intersections], Int 26748 Intersection of Echuca-Mooroopna Road and Echuca-Mooroopna Road Inbound Service Rd, Complex Intersection 3033 Intersection of Echuca-Mooroopna Road and Centennial Drive [Contains smaller 'sub'-intersections], Int 26750 Intersection of Echuca-Mooroopna Road and Homewood Drive, Complex Intersection 3056 Intersection of Midland Hwy and Emma Street [Contains smaller 'sub'-intersections], Complex Intersection 3041 Intersection of Echuca-Mooroopna Road and Mcfarlane Road [Contains smaller 'sub'-intersections], Complex Intersection 3045 Intersection of Echuca-Mooroopna Road and Obrien Street [Contains smaller 'sub'-intersections], Complex Intersection 3046 Intersection of Echuca-Mooroopna Road and Knight Street [Contains smaller 'sub'-intersections], Complex Intersection 3051 Intersection of Echuca-Mooroopna Road and Anselmi Street [Contains smaller 'sub'-intersections], RdSeg 176403 on Macisaac Road btw Menzies Street and Norton Drive, RdSeg 177222 on Knight Street btw Elsie Jones Drive and Rodney Park Drive, RdSeg 104836 on Echuca-Mooroopna Road btw Larsen Street and Ann Street, RdSeg 176304 on Friend Street btw Gange Street and Stevens Crescent, RdSeg 104511 on Echuca-Mooroopna Road btw Paisley Crescent and Paisley Crescent, RdSeg 104894 on Midland Hwy btw Midland Hwy and Elsie Jones Drive, RdSeg 104627 on Echuca-Mooroopna Road btw Gange Street and ...

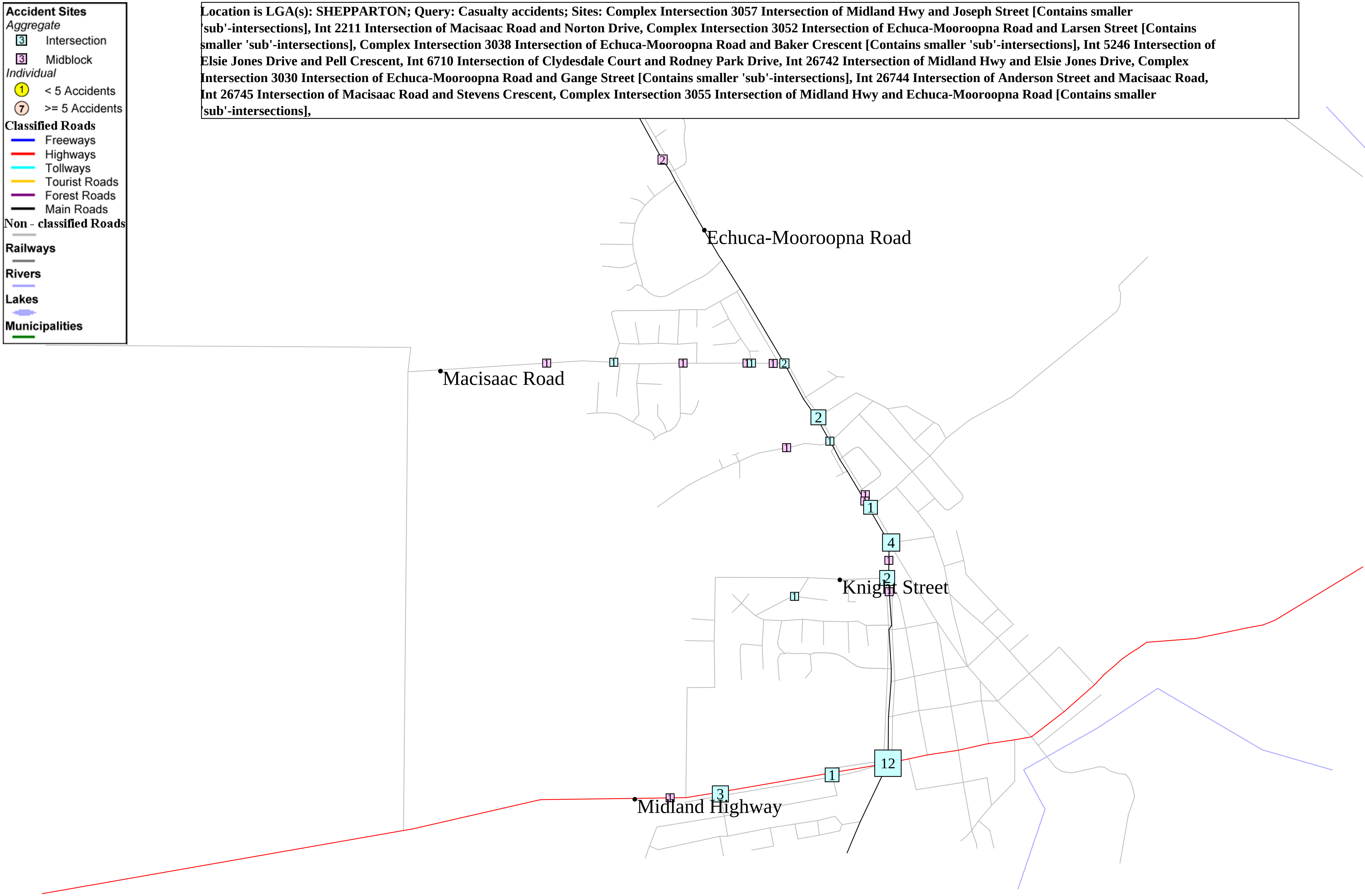
Map Refs Road Number Km from start		Location (Road names)	SEVERITY ALL injury	Fatal	Serious	Other Injury	DCA GROUPS Pedestrian	Cross Traffic	Right Near	Right Against	Lost Control	Rear End	OBJECT HIT Pole	Tree	Fence Wall	ROAD Dry	Wet	LIGHT Day	Dark	VEHICLE NUMBERS Car	Truck	Motor Cycle	Bike	YEARLY TREND '96	'97	'98	'99	'00	'01	'02
VCD ED4 272 C11 5366 0.837 Km Shepparton	 At &	Complex intersection no. 3046 Echuca-Mooroopna Road Knight Street	2			2			1	1						2		2		4							2			
VCD ED4 272 C10 5366 0.916 Km Shepparton	On btw &	Echuca-Mooroopna Road Treacy Street Knight Street	1	1			1									1		1			1									1
VCD ED4 272 C11 118026 0.000 Km Shepparton	At &	Clydesdale Court Rodney Park Drive	1			1					1			1		1		1		1						1				
VCD ED4 272 C12 2590 323.148 Km Shepparton	 At &	Complex intersection no. 3056 Midland Hwy Emma Street	1			1			1							1		1		2										1
VCD ED4 272 C12 2590 323.163 Km Shepparton	On btw &	Midland Hwy Emma Street Midland Highway Inbound Service Rd	1			1					1					1		1		1							1			
VCD ED4 272 C12 2590 323.405 Km Shepparton	 At &	Complex intersection no. 3055 Midland Hwy Echuca-Mooroopna Road	12		3	9			1	7		4				7	5	8	4	21	3		1			2	3	4	1	
Totals:			44	2	14	28	4		11	10	6	8	1	2		35	9	27	15	67	5	4	2			8	10	9	6	6

Note:

Object Hit: Only most common categories listed. An animal or object is not his in every crash.
Road Condition: Only dry and wet provided, other excluded.
Accident numbers are tallied within each category except for VEHICLE subsection where number and type of vehicles within the accident are tallied.

The crashes on roads that make up local government area (lga) borders are allocated to both lgas. Double counting only occurs when two or more lgas are queried separately (not together).

Location is LGA(s): SHEPPARTON; Query: Casualty accidents; Sites: Complex Intersection 3057 Intersection of Midland Hwy and Joseph Street [Contains smaller 'sub'-intersections], Int 2211 Intersection of Macisaac Road and Norton Drive, Complex Intersection 3052 Intersection of Echuca-Mooroopna Road and Larsen Street [Contains smaller 'sub'-intersections], Complex Intersection 3038 Intersection of Echuca-Mooroopna Road and Baker Crescent [Contains smaller 'sub'-intersections], Int 5246 Intersection of Elsie Jones Drive and Pell Crescent, Int 6710 Intersection of Clydesdale Court and Rodney Park Drive, Int 26742 Intersection of Midland Hwy and Elsie Jones Drive, Complex Intersection 3030 Intersection of Echuca-Mooroopna Road and Gange Street [Contains smaller 'sub'-intersections], Int 26744 Intersection of Anderson Street and Macisaac Road, Int 26745 Intersection of Macisaac Road and Stevens Crescent, Complex Intersection 3055 Intersection of Midland Hwy and Echuca-Mooroopna Road [Contains smaller 'sub'-intersections],



(c) 2004 VicRoads

Appendix B2 2008 Accidents

Road Crash Statistics: Victoria Accident Details

Location is Region(s): TOTAL VICTORIA; Query: Casualty accidents; Sites: Declared road 5366 from Start to Cornish Road (3.984Km) (inclusive), Local road 161013 from Start to Excelsior Road (3.238Km) (inclusive), Declared road 2590 from Echuca-Mooroopna Road (323.41Km) (inclusive) to Elsie Jones Drive (322.488Km) (inclusive); Date range is 01/01/2003 to 31/12/2007; Sorted by location.

Map Refs Road Number Km from Start		Location (Road Names)	Severity Traffic Control Date/Time	Injury Summary	DCA/Accident Classification Sub Types (Sub DCA)	Light Road Atmosphere	Vehicles/Direction (+ DCA arrow) Total Vehicles	Road User -1	Age	Sex	Injury Level	Accident No. Speed Zone Urbanisation
VCD ED5 32 F8 161013 1.615 Km Shepparton	At &	Macisaac Road Turnbull Road	Fatal Giveway sign 2/1/2005 Sun 13:50	1 killed 1 serious inj. 0 other inj. 1 not inj.	110 Cross traffic(intersections only) Not Required	Day Dry Clear	Rigid Truck, N(1) Car, W(2) TOTAL VEH=2	Driver Passenger Driver	65 71 39	M F F	Not injured Killed/died in 30 days Sent to hospital	32005001032 100 km/hr Rural
VCD ED5 32 F8 161013 1.615 Km Shepparton	At &	Macisaac Road Turnbull Road	Other Injury Giveway sign 16/5/2005 Mon 08:00	0 killed 0 serious inj. 2 other inj. 0 not inj.	110 Cross traffic(intersections only) Not Required	Day Dry Clear	Car, N(2) Car, E(1) TOTAL VEH=2	Driver Driver	45 42	M M	Injured, needed treatm Injured, needed treatm	32005017786 100 km/hr Rural
VCD ED5 32 G7 5366 3.984 Km Shepparton	At &	Echuca-Mooroopna Road Cornish Road	Fatal No control 13/9/2004 Mon 03:05	1 killed 0 serious inj. 0 other inj. 0 not inj.	181 Off right bend into object/parked vehicle Hit Poles (telephone/ electricity) Mounted/struck median Leaves carriageway to left	Dark, no street lights Dry Not known	Car, N(1) TOTAL VEH=1	Driver	26	M	Killed/died in 30 days	32004031088 80 km/hr Rural
VCD ED5 32 G7 5366 3.984 Km Shepparton	At &	Echuca-Mooroopna Road Cornish Road	Serious injury Giveway sign 26/1/2005 Wed 13:50	0 killed 1 serious inj. 0 other inj. 1 not inj.	113 Right near (intersections only) Not Required	Day Dry Clear	Car, E(1) Utility, N(2) TOTAL VEH=2	Driver Driver	26 57	M M	Sent to hospital Not injured	32005003945 80 km/hr Rural
VCD ED5 272 A7 5366 2.874 Km Shepparton	At &	Echuca-Mooroopna Road Craigmuir Drive (0 m of Craigmuir)	Fatal No control 18/8/2006 Fri 02:00	1 killed 0 serious inj. 0 other inj. 0 not inj.	173 Right off carriageway into object/parked vehicle No vehicle mounted/struck Hit Tree (Shrub/scrub)	Dark, no street lights Dry Clear	Car, NW(1) TOTAL VEH=1	Driver	55	F	Killed/died in 30 days	T20060031663 80 km/hr Sml. Prov. City
VCD ED5 272 A7 5366 2.874 Km Shepparton	At &	Echuca-Mooroopna Road Craigmuir Drive (0 m of Craigmuir)	Serious injury Giveway sign 7/6/2007 Thu 06:45	0 killed 1 serious inj. 0 other inj. 1 not inj.	113 Right near (intersections only) Not Required	Dark, no street lights Dry Clear	Car, E(1) Bicycle, N(2) TOTAL VEH=2	Driver Bicyclist	28 41	M M	Not injured Sent to hospital	T20070020486 80 km/hr Sml. Prov. City
VCD ED5 272 A7 5366 2.912 Km Shepparton	At &	Echuca-Mooroopna Road Paisley Crescent (0 m of Paisley)	Other Injury No control 27/8/2005 Sat 05:45	0 killed 0 serious inj. 1 other inj. 1 not inj.	174 Out of control on carriageway (on straight) No vehicle mounted/struck	Dark, street lights on Unknown Fog	Car, SW(8) Motor cycle, SE(1) TOTAL VEH=2	Driver Motor cyclist	31 52	M M	Not injured Injured, needed treatm	32005030610 80 km/hr Sml. Prov. City
VCD ED5 272 C9 5366 1.651 Km Shepparton	At &	Echuca-Mooroopna Road Inbound Service Rd Carr Crescent	Other Injury Pedestrian light 14/5/2003 Wed 17:01	0 killed 0 serious inj. 1 other inj. 1 not inj.	130 Rear end (vehicles in same lane) Vehicle entering intersection Intersection	Dusk/dawn Wet Raining	Car, S(1) Car, S(2) TOTAL VEH=2	Driver Driver	21 19	M M	Not injured Injured, needed treatm	32003016219 999 km/hr Sml. Prov. City
VCD ED5 272 C9 5366 1.651 Km Shepparton	At &	Echuca-Mooroopna Road Inbound Service Rd Carr Crescent	Serious injury Giveway sign 13/2/2003 Thu 08:55	0 killed 2 serious inj. 0 other inj. 2 not inj.	147 Vehicle strikes another veh while emerging from dr Vehicle foward departing Commercial(includes shops,school,station) driveway Collision on second half of carriageway	Day Dry Clear	Car, E(1) Car, S(2) TOTAL VEH=2	Passenger Driver Driver Passenger	74 77 26 6	F M F M	Sent to hospital Not injured Sent to hospital Not injured	32003006290 70 km/hr Sml. Prov. City
VCD ED5 272 C10 5366 1.085 Km Shepparton	On btw &	Echuca-Mooroopna Road Treacy Street (75 m NW of Obrien)	Other Injury No control 28/4/2004 Wed 18:15	0 killed 0 serious inj. 1 other inj. 0 not inj.	173 Right off carriageway into object/parked vehicle Hit Tree (Shrub/scrub) No vehicle mounted/struck	Dark, street lights on Dry Clear	Car, NW(1) TOTAL VEH=1	Driver	25	M	Injured, needed treatm	32004015237 50 km/hr Sml. Prov. City

Road Crash Statistics: Victoria Accident Details

Location is Region(s): TOTAL VICTORIA; Query: Casualty accidents; Sites: Declared road 5366 from Start to Cornish Road (3.984Km) (inclusive), Local road 161013 from Start to Excelsior Road (3.238Km) (inclusive), Declared road 2590 from Echuca-Mooroopna Road (323.41Km) (inclusive) to Elsie Jones Drive (322.488Km) (inclusive); Date range is 01/01/2003 to 31/12/2007; Sorted by location.

Map Refs Road Number Km from Start		Location (Road Names)	Severity Traffic Control Date/Time	Injury Summary	DCA/Accident Classification Sub Types (Sub DCA)	Light Road Atmosphere	Vehicles/Direction (+ DCA arrow) Total Vehicles	Road User -1	Age	Sex	Injury Level	Accident No. Speed Zone Urbanisation
VCD ED5 272 C10 5366 1.093 Km Shepparton	On btw &	Echuca-Mooroopna Road Treacy Street (84 m NW of Obrien)	Other Injury Giveway sign 4/4/2005 Mon 16:50	0 killed 0 serious inj. 2 other inj. 1 not inj.	147 Vehicle strikes another veh while emerging from dr Vehicle foward departing Commercial(includes shops,school,station) driveway Collision on first half of carriageway	Day Dry Clear	Car, E(1) Car, N(2) TOTAL VEH=2	Driver Passenger Driver	62 22 37	M M M	Injured, needed treatm Not injured Injured, needed treatm	32005012401 60 km/hr Sml. Prov. City
VCD ED5 272 C10 5366 1.182 Km Shepparton	At &	Echuca-Mooroopna Road Inbound Service Rd Mcfarlane Road	Serious injury Giveway sign 6/9/2005 Tue 18:19	0 killed 1 serious inj. 0 other inj. 1 not inj.	113 Right near (intersections only) Not Required	Dark, street lights on Dry Clear	Car, SW(1) Motor cycle, SE(2) TOTAL VEH=2	Driver Motor cyclist	30 30	M M	Not injured Sent to hospital	32005031574 60 km/hr Sml. Prov. City
VCD ED5 272 C10 5366 1.182 Km Shepparton	At &	Echuca-Mooroopna Road Inbound Service Rd Mcfarlane Road	Serious injury Giveway sign 8/8/2007 Wed 15:40	0 killed 1 serious inj. 2 other inj. 1 not inj.	113 Right near (intersections only) Not Required	Day Icy Dry Clear	Car, SW(1) Car, SE(2) TOTAL VEH=2	Driver Passenger Passenger Driver	28 8 4 32	F M F F	Injured, needed treatm Injured, needed treatm Not injured Sent to hospital	T20070028796 60 km/hr Sml. Prov. City
VCD ED5 272 C10 5366 1.436 Km Shepparton	At &	Echuca-Mooroopna Road Baker Crescent (0 m of Baker)	Serious injury No control 1/11/2007 Thu 20:48	0 killed 1 serious inj. 0 other inj. 1 not inj.	100 Ped near side. ped hit by vehicle from the right. Vehicle entering intersection Vehicle going straight through	Dark, street lights on Dry Clear	Car, SE(1) TOTAL VEH=1	Driver Pedestrian	 27	F M	Not injured Sent to hospital	T20070039683 60 km/hr Sml. Prov. City
VCD ED5 272 C10 5366 1.543 Km Shepparton	At &	Echuca-Mooroopna Road Inbound Service Rd Carr Crescent (0 m of Carr)	Serious injury No control 31/12/2005 Sat 23:25	0 killed 1 serious inj. 0 other inj. 1 not inj.	107 Ped on foothpath struck by veh entering/leaving dri Paved footpath Vehicle reverse departing Private driveway/laneway	Dark, street lights on Dry Clear	Car, W(1) TOTAL VEH=1	Driver Pedestrian	52 40	M F	Not injured Sent to hospital	T20060002094 60 km/hr Sml. Prov. City
VCD ED5 272 C11 5366 0.674 Km Shepparton	On btw &	Echuca-Mooroopna Road Northgate Street Graeme Street (51 m N of Anselmi)	Serious injury No control 31/5/2004 Mon 17:40	0 killed 1 serious inj. 0 other inj. 3 not inj.	100 Ped near side. ped hit by vehicle from the right. Not Required	Dusk/dawn Dry Clear	Car, S(1) TOTAL VEH=1	Driver Passenger Passenger Pedestrian	40 11 12	F M F M	Not injured Not injured Not injured Sent to hospital	32004018163 60 km/hr Sml. Prov. City
VCD ED5 272 C11 5366 0.971 Km Shepparton	On btw &	Echuca-Mooroopna Road Outbound Service Rd Knight Street (107 m N of Knight)	Other Injury No control 12/9/2004 Sun 20:00	0 killed 0 serious inj. 1 other inj. 3 not inj.	147 Vehicle strikes another veh while emerging from dr Vehicle foward departing Commercial(includes shops,school,station) driveway Collision on first half of carriageway	Dark, street lights on Dry Clear	Stn. wagon, W(1) Stn. wagon, S(2) TOTAL VEH=2	Driver Passenger Passenger Driver	43 15 34 38	M F M M	Not injured Not injured Injured, needed treatm Not injured	32004031286 60 km/hr Sml. Prov. City
VCD ED5 272 C12 2590 323.389 Km Shepparton	At &	Midland Highway Inbound Cwy Echuca-Mooroopna Road	Other Injury Stop go lights 11/9/2004 Sat 20:05	0 killed 0 serious inj. 2 other inj. 0 not inj.	121 Right through Not Required	Dark, street lights on Wet Raining	Utility, E(1) Car, W(2) TOTAL VEH=2	Driver Driver	19 18	M F	Injured, needed treatm Injured, needed treatm	32004030798 60 km/hr Sml. Prov. City
VCD ED5 272 C12 2590 323.389 Km Shepparton	At &	Midland Highway Inbound Cwy Echuca-Mooroopna Road	Other Injury Stop go lights 25/1/2006 Wed 08:10	0 killed 0 serious inj. 1 other inj. 2 not inj.	121 Right through Not Required	Day Dry Clear	Utility, E(1) Car, W(2) TOTAL VEH=2	Driver Passenger Driver	35 35 48	M F M	Not injured Not injured Injured, needed treatm	T20060017966 50 km/hr Sml. Prov. City
VCD ED5 272 C12 2590 323.389 Km Shepparton	At &	Midland Highway Inbound Cwy Echuca-Mooroopna Road	Other Injury No control 2/2/2006 Thu 17:25	0 killed 0 serious inj. 1 other inj. 3 not inj.	110 Cross traffic(intersections only)	Day Dry Clear	Panel van, S(2) Utility, W(1) TOTAL VEH=2	Driver Passenger Passenger Driver	19 24 25 38	F F F M	Not injured Not injured Not injured Injured, needed treatm	T20060011874 60 km/hr Sml. Prov. City

Road Crash Statistics: Victoria Accident Details

Location is Region(s): TOTAL VICTORIA; Query: Casualty accidents; Sites: Declared road 5366 from Start to Cornish Road (3.984Km) (inclusive), Local road 161013 from Start to Excelsior Road (3.238Km) (inclusive), Declared road 2590 from Echuca-Mooroopna Road (323.41Km) (inclusive) to Elsie Jones Drive (322.488Km) (inclusive); Date range is 01/01/2003 to 31/12/2007; Sorted by location.

Map Refs Road Number Km from Start		Location (Road Names)	Severity Traffic Control Date/Time	Injury Summary	DCA/Accident Classification Sub Types (Sub DCA)	Light Road Atmosphere	Vehicles/Direction (+ DCA arrow) Total Vehicles	Road User -1	Age	Sex	Injury Level	Accident No. Speed Zone Urbanisation
VCD ED5 272 C12 2590 323.389 Km Shepparton	At &	Midland Highway Inbound Cwy Echuca-Mooroopna Road	Other Injury Stop go lights 9/3/2005 Wed 15:40	0 killed 0 serious inj. 1 other inj. 1 not inj.	121 Right through Not Required	Day Dry Clear	Car, E(1) Stn. wagon, W(2) TOTAL VEH=2	Driver Driver	24 22	F F	Injured, needed treatm Not injured	32005010343 80 km/hr Sml. Prov. City
VCD ED5 272 C12 2590 323.389 Km Shepparton	At &	Midland Highway Inbound Cwy Echuca-Mooroopna Road	Other Injury Stop go lights 13/2/2006 Mon 11:10	0 killed 0 serious inj. 1 other inj. 2 not inj.	130 Rear end (vehicles in same lane) Vehicle entering intersection Intersection	Day Dry Clear	Stn. wagon, W(8) Semi trailer, W(1) Car, W(2) TOTAL VEH=3	Driver Driver Driver	53 65 49	M M F	Not injured Not injured Injured, needed treatm	T20060006710 50 km/hr Sml. Prov. City
VCD ED5 272 C12 2590 323.389 Km Shepparton	At &	Midland Highway Inbound Cwy Echuca-Mooroopna Road	Other Injury Stop go lights 31/3/2005 Thu 12:05	0 killed 0 serious inj. 1 other inj. 3 not inj.	121 Right through Not Required	Day Dry Clear	Car, E(1) Car, W(2) TOTAL VEH=2	Passenger Driver Driver Passenger	 69 52 42	F M M M	Injured, needed treatm Not injured Not injured Not injured	32005012402 60 km/hr Sml. Prov. City
VCD ED5 272 C12 2590 323.389 Km Shepparton	At &	Midland Highway Inbound Cwy Echuca-Mooroopna Road	Other Injury Stop go lights 22/2/2005 Tue 13:17	0 killed 0 serious inj. 1 other inj. 2 not inj.	110 Cross traffic(intersections only)	Day Dry Clear	Stn. wagon, W(1) Car, S(2) TOTAL VEH=2	Driver Passenger Driver	48 29 45	M M F	Not injured Not injured Injured, needed treatm	32005008271 50 km/hr Sml. Prov. City
VCD ED5 272 C12 2590 323.405 Km Shepparton	At &	Midland Hwy Echuca-Mooroopna Road	Other Injury Stop go lights 27/6/2003 Fri 11:30	0 killed 0 serious inj. 1 other inj. 2 not inj.	130 Rear end (vehicles in same lane) Vehicle entering intersection Intersection	Day Wet Raining	Semi trailer, E(1) Car, E(2) TOTAL VEH=2	Driver Driver Passenger	34 71 22	M M F	Not injured Injured, needed treatm Not injured	32003021521 60 km/hr Sml. Prov. City
VCD ED5 272 C12 2590 323.405 Km Shepparton	At &	Midland Hwy Echuca-Mooroopna Road	Other Injury Stop go lights 4/3/2003 Tue 10:50	0 killed 0 serious inj. 1 other inj. 1 not inj.	113 Right near (intersections only)	Day Dry Clear	Rigid Truck, N(1) Car, W(2) TOTAL VEH=2	Driver Driver	31 33	M F	Not injured Injured, needed treatm	32003007905 60 km/hr Sml. Prov. City
VCD ED5 272 C12 2590 323.405 Km Shepparton	At &	Midland Hwy Echuca-Mooroopna Road	Serious injury Stop go lights 28/3/2004 Sun 12:35	0 killed 1 serious inj. 0 other inj. 1 not inj.	111 Right far (intersections only)	Day Dry Clear	Utility, S(2) Car, W(1) TOTAL VEH=2	Driver Driver	57 35	M F	Not injured Sent to hospital	32004010953 50 km/hr Sml. Prov. City
VCD ED5 272 C12 2590 323.405 Km Shepparton	At &	Midland Hwy Echuca-Mooroopna Road	Serious injury Stop go lights 7/3/2004 Sun 09:20	0 killed 1 serious inj. 1 other inj. 0 not inj.	111 Right far (intersections only) Not Required	Day Dry Clear	Car, W(2) Car, N(1) TOTAL VEH=2	Driver Driver	78 56	F M	Sent to hospital Injured, needed treatm	32004007892 60 km/hr Sml. Prov. City
VCD ED5 272 C12 5366 0.266 Km Shepparton	On btw &	Echuca-Mooroopna Road Ann Street Alexandra Street (40 m N of Alexandra)	Serious injury No control 22/11/2007 Thu 14:50	0 killed 1 serious inj. 0 other inj. 0 not inj.	151 Out of control (overtaking) Hit other objects (Telephone/Culvert/RX) Fixed/Not Fi	Day Dry Clear	Car, N(1) TOTAL VEH=1	Driver	35	F	Sent to hospital	T20070042662 100 km/hr Sml. Prov. City

The crashes on roads that make up local government area (lga) borders are allocated to both (or more) lgas. Double counting only occurs when two or more lgas are queried separately (not together).

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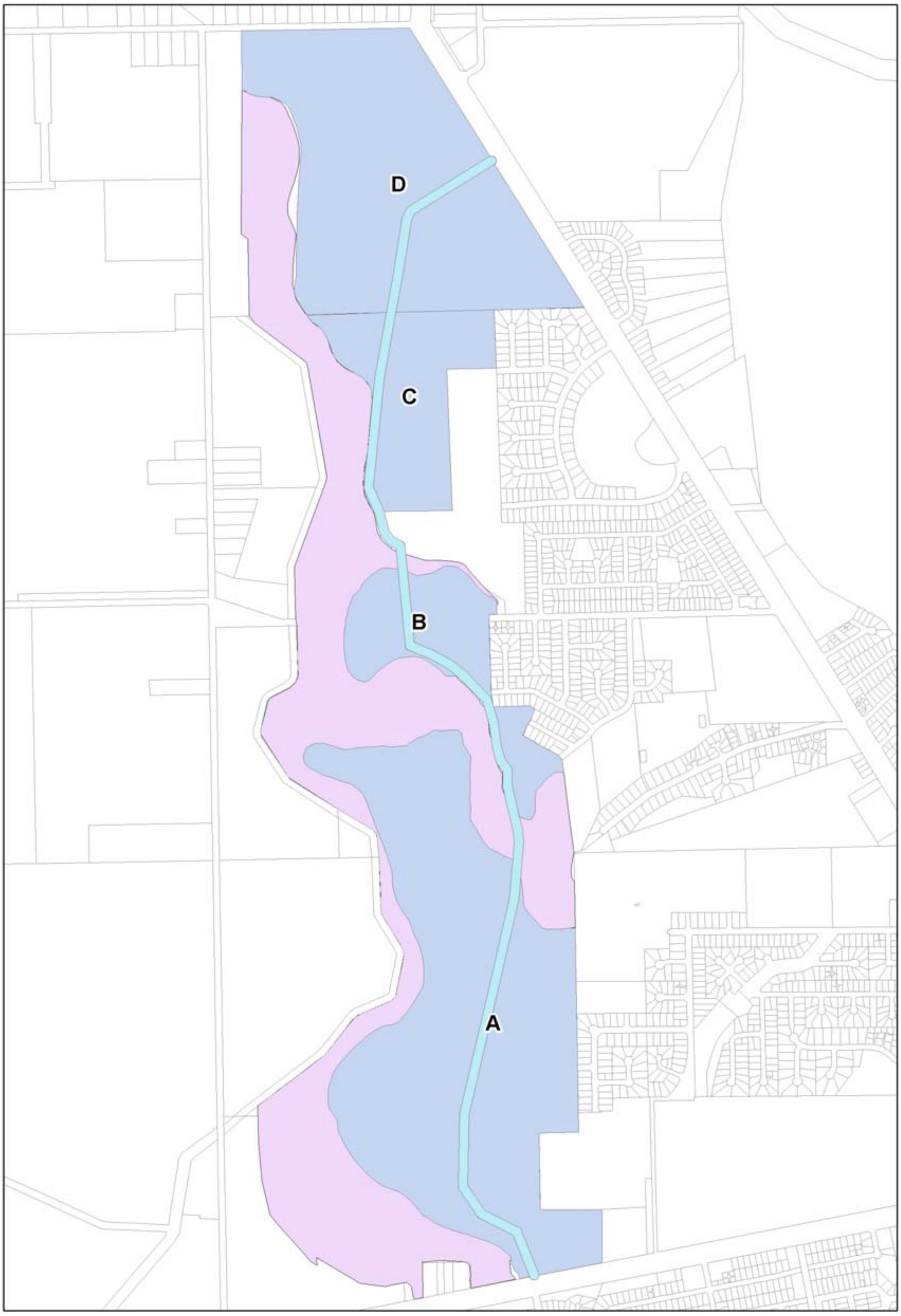
(1) For each line break group the vehicles are matched to the persons (road users) inside that vehicle. Pedestrians have no vehicle.

Appendix C Development Areas Map

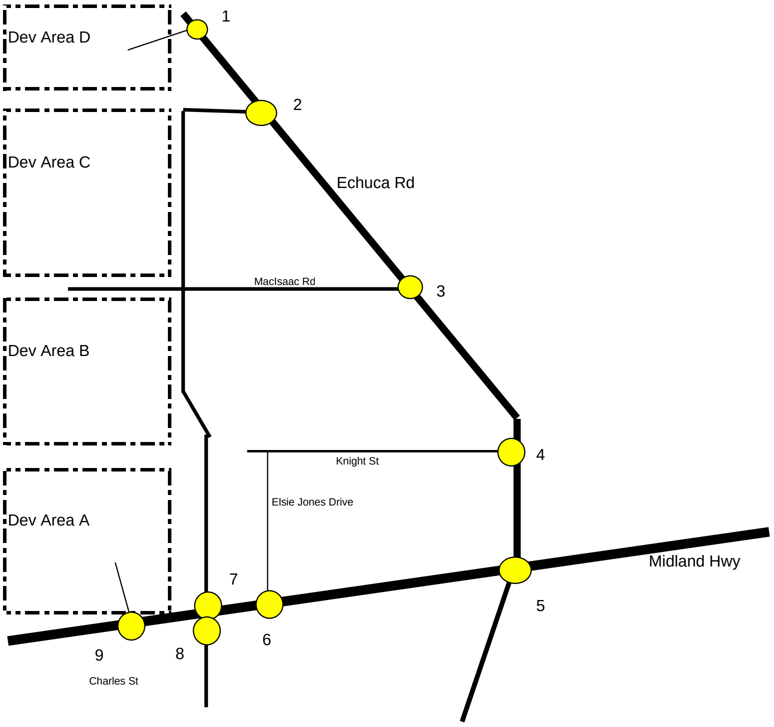
Appendix C Development Areas Map



Appendix D Traffic Assignment

Appendix D Traffic Assignment

Traffic Distribution
With North South Road



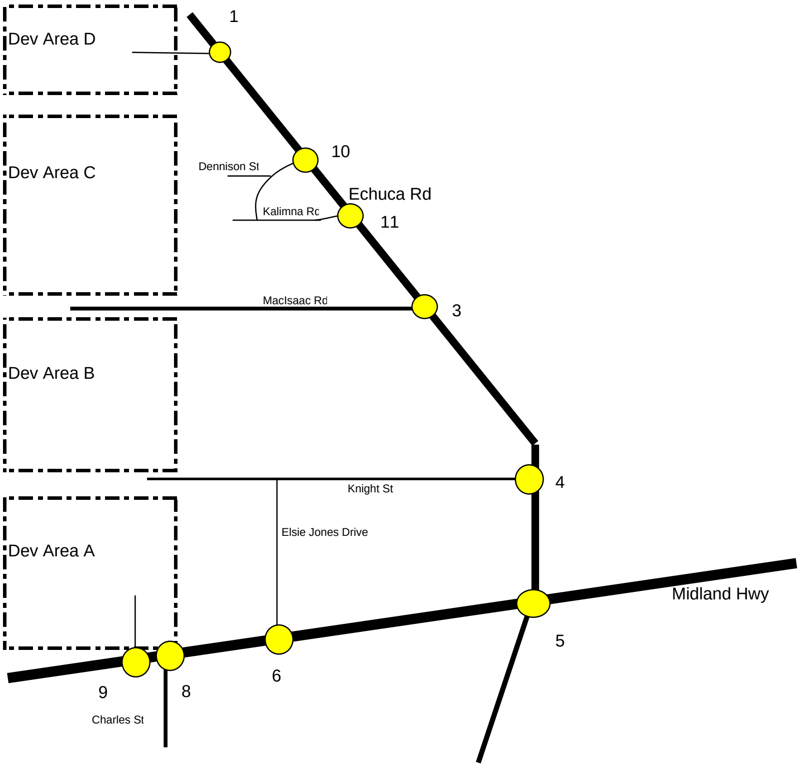
DISTRIBUTION SPLIT:	AM PEAK	PM PEAK
To North	10%	20%
To South	10%	20%
To East	70%	40%
To West	10%	20%
From North	20%	10%
From South	20%	10%
From East	40%	70%
From West	20%	10%

IN/OUT RATIO	In	Out
AM	20%	80%
PM	70%	30%

Traffic Route Assumptions:

Dev Area	**Direction**	**Route**
D	North	0% via direct Echuca Rd access
		100% via North-South Road and then north onto Echuca Road
	South	0% via direct Echuca Rd access
		100% via North-South Road and then south onto Echuca Road
	East	0% via direct Echuca Rd access
		100% via North-South Road and then south onto Echuca Road
	West	0% via direct Echuca Rd access
		100% via North-South Road and then west onto Midland Highway
C	North	100% left onto North-South Road and then north onto Echuca Road
	South	20% left onto North-South Road and then south onto Echuca Road
		80% right onto North-South Road, left on to MacIsaac and then south onto Echuca Road
	East	20% left onto North-South Road and then south onto Echuca Road
		80% right onto North-South Road left on to MacIsaac and then south onto Echuca Road
	West	100% right onto North-South Road and then west onto Midland Highway
B	North	100% left onto North-South Road and then north onto Echuca Road
		0% via MacIsaac Road
	South	20% via MacIsaac Road and then south onto Echuca Road
		80% right onto North-South Road and then left onto Midland Highway
	East	80% right onto North-South Road and then left onto Midland Highway
		20% via MacIsaac Road and then south onto Echuca Road
	West	100% right onto North-South Road and then right onto Midland Highway
		0% via MacIsaac Road
A	North	0% via direct access onto Midland Highway
		100% left onto North-South Road and then north onto Echuca Road
	South	0% via direct access onto Midland Highway (left/east)
		100% via North-South Road and then onto Midland Highway (left/east)
	East	0% via direct access onto Midland Highway (left/east)
		100% via North-South Road and then onto Midland Highway (left/east)
	West	0% via direct access onto Midland Highway (right/west)
		100% via North-South Road and then onto Midland Highway (right/west)

Traffic Distribution
Without North South Road



DISTRIBUTION SPLIT:

	AM PEAK	PM PEAK
To North	10%	20%
To South	10%	20%
To East	70%	40%
To West	10%	20%
From North	20%	10%
From South	20%	10%
From East	40%	70%
From West	20%	10%

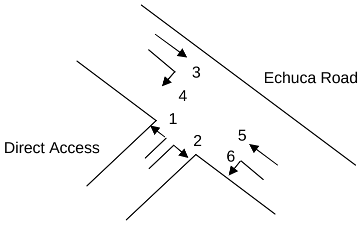
IN/OUT RATIO

	In	Out
AM	20%	80%
PM	70%	30%

Traffic Route Assumptions:

Dev Area	**Direction**	**Route**	
D	North	100%	via direct Echuca Rd access
	South	100%	via direct Echuca Rd access
	East	100%	via direct Echuca Rd access
	West	100%	via direct Echuca Rd access
C	North	50%	left onto MacIsaac left onto Echuca
		50%	via Dennisonn St left onto Echuca
	South	50%	left onto MacIsaac right onto Echuca
		50%	via Dennisonn St right onto Echuca
	East	50%	left onto MacIsaac right onto Echuca
		50%	via Dennisonn St right onto Echuca
	West	50%	left onto MacIsaac right onto Echuca right onto Midland
		50%	via Dennisonn St right onto Echuca right onto Midland
B	North	100%	MacIsaac Road and left onto Echuca
	South	100%	MacIsaac Road and right onto Echuca
	East	100%	MacIsaac Road and right onto Echuca
	West	100%	MacIsaac Road and right onto Echuca right onto Midland
A	North	30%	via direct access onto Midland Highway left onto Echuca
		70%	right onto Knight left onto Echuca
	South	70%	via direct access onto Midland Highway
		30%	via Knight street right onto Echuca
	East	70%	via direct access onto Midland Highway
		30%	via Knight street right onto Echuca
	West	100%	via direct access onto Midland Highway
		0%	via Knight street right onto Echuca right onto Midland

Intersection 1



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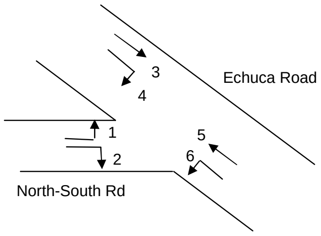

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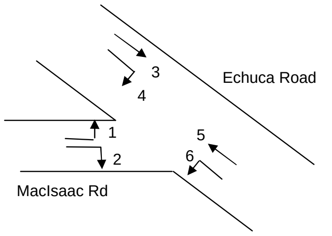

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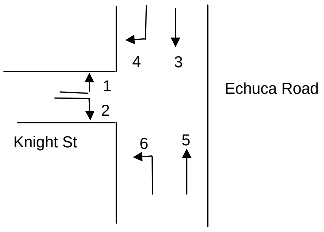

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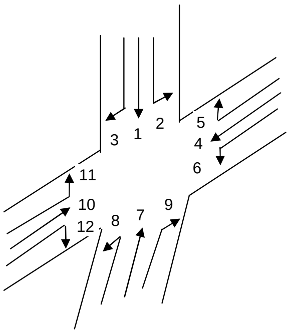

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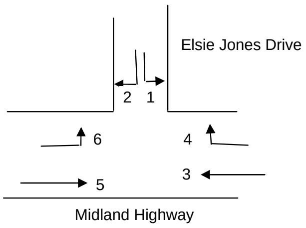

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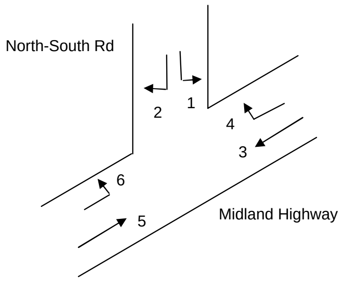

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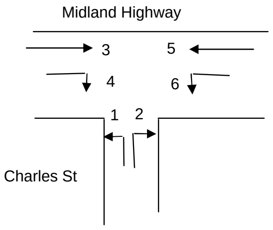

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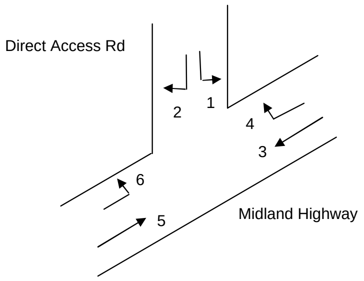
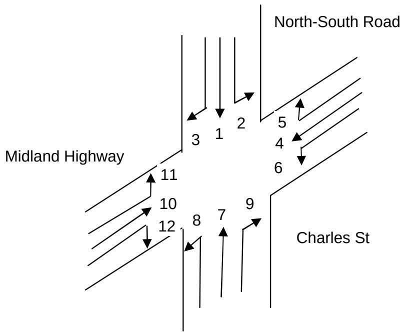


Intersection 7 & 8



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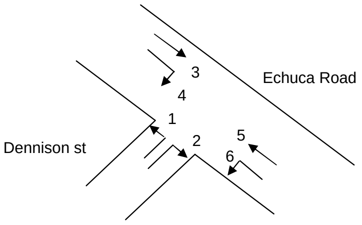


Traffic Flows at Intersections After Development - With North-South Road

	MOVEMENT											
INTERSECTION	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
AM Peak												
2	153	422	371	77	332	79						
3	18	341	781	12	393	161						
4	64	64	252	24	227	32						
5	386	775	4	368	202	268	115	46	336	1054	73	90
6	62	16	244	40	375	8						
7&8	8	671	153	266	126	22	3	4	57	457	77	4
PM Peak (3:00-4:00)												
2	114	119	276	133	358	370						
3	12	176	377	18	716	324						
4	47	36	381	38	260	38						
5	135	240	44	1077	723	336	141	76	268	471	5	66
6	34	7	620	71	356	26						
7&8	6	185	114	328	577	40	1	4	22	421	133	4
PM Peak (4:30-5:30)												
2	112	119	276	131	358	370						
3	12	176	377	18	716	324						
4	47	36	381	38	260	38						
5	135	240	44	1059	723	336	141	74	268	466	5	64
6	34	7	620	71	356	26						
7&8	6	179	112	328	557	40	1	4	22	419	131	4

Traffic Flows at Intersections After Development - No North-South Road

	MOVEMENT											
INTERSECTION	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
AM Peak												
1	49	444	41	25	203	99						
10	9	78	444	4	99	17						
3	42	418	881	24	480	183						
4	114	237	986	49	390	54						
5	419	911	86	309	224	268	132	29	336	819	94	57
9	486	88	311	101	416	8						

PM Peak (3:00-4:00)												
1	37	148	71	43	466	388						
10	6	26	148	8	98	68						
3	30	207	432	39	840	392						
4	84	83	625	82	903	186						
5	161	267	105	874	925	336	170	47	268	421	20	41
9	161	60	670	435	427	26						

PM Peak (4:30-5:30)												
1	41	165	78	48	518	434						
10	7	29	165	8	108	76						
3	32	215	452	41	896	414						
4	87	86	654	84	978	196						
5	169	281	112	894	993	336	180	50	268	426	21	44
9	170	63	676	459	436	26						

Appendix E SIDRA Results

Appendix E SIDRA Results

						MOVEMENT					
						Direct East Bound		Echuca Road South Bound		Echuca Road North Bound	
Intersection	Time Period	North-South Road	Development Traffic	Control		1 left	2 right	3 through	4 right	5 through	6 left
Echuca Road and Direct Access (Development Area A)	PM	N	New Dev	Giveway	95% back of queue (m)	6	85	5	0	0	0
					LOS	D	F	C	A	A	B
					Ave. Delay (sec)	26	95	19	9	9	10
	AM	N	New Dev	Giveway	95% back of queue (m)	3	118	0	2	0	0
					LOS	A	D	A	B	A	B
					Ave. Delay (sec)	10	26	9	13	9	10
	PM	N	New Dev	Signals	95% back of queue (m)	7	27	11	9	70	70
					LOS	C	C	B	C	B	C
					Ave. Delay (sec)	21	22	12	22	14	21
	AM	N	New Dev	Signals	95% back of queue (m)	8	60	6	5	26	26
					LOS	B	B	B	C	B	C
					Ave. Delay (sec)	17	19	16	24	17	24

						NS East Bound		Echuca Road South Bound		Echuca Road North Bound	
Intersection	Time Period	North-South Road	Development Traffic	Control		1 left	2 right	3 through	4 right	5 through	6 left
Echuca Road and North-South Road	AM	Y	New Dev	Giveway	95% back of queue (m)	0	0	0	0	0	0
					LOS	A	A	A	A	A	A
					Ave. Delay (sec)	8	9	9	1	8	0
	PM	Y	New Dev	Giveway	95% back of queue (m)	0	0	0	0	0	0
					LOS	A	A	A	A	A	A
					Ave. Delay (sec)	8	9	0	9	0	8
	AM	Y	New Dev	Signals	95% back of queue (m)	23	66	63	16	55	3
					LOS	B	C	B	C	B	A
					Ave. Delay (sec)	18	20	13	25	13	9
	PM	Y	New Dev	Signals	95% back of queue (m)	19	20	41	25	54	16
					LOS	B	C	A	C	B	A
					Ave. Delay (sec)	20	20	10	23	10	10

						MacIsaac East Bound		Echuca Road South Bound		Echuca Road North Bound	
Intersection	Time Period	North-South Road	Development Traffic	Control		1 left	2 right	3 through	4 right	5 through	6 left
Echuca Road and MacIsaac Road	AM	N	Existing	Giveway	95% back of queue (m)	1	69	5	5	4	0
					LOS	B	F	A	A	A	A
					Ave. Delay (sec)	15	54	9	9	9	10
	AM	Y	New Dev	Giveway	95% back of queue (m)	2	1143	0	1	0	0
					LOS	C	F	A	C	A	A
					Ave. Delay (sec)	15	1891	3	19	3	10
	AM	N	New Dev	Giveway	95% back of queue (m)	0	1434	0	1	0	0
					LOS	A	F	A	B	A	A
					Ave. Delay (sec)	9	2069	3	13	3	10
	AM	Y	New Dev	Signals	95% back of queue (m)	5	80	163	3	79	35
					LOS	C	C	C	C	B	C
					Ave. Delay (sec)	29	34	25	22	17	22
	AM	N	New Dev	Signals	95% back of queue (m)	13	113	217	6	103	43
					LOS	C	D	C	C	B	C
					Ave. Delay (sec)	32	43	33	24	19	26
	PM	N	Existing	Giveway	95% back of queue (m)	1	27	3	3	5	0
					LOS	C	D	A	A	A	A
					Ave. Delay (sec)	16	31	9	9	9	10
	PM	Y	New Dev	Giveway	95% back of queue (m)	3	353	0	5	0	0
					LOS	D	F	A	E	A	A
					Ave. Delay (sec)	31	614	3	43	3	10
	PM	N	New Dev	Giveway	95% back of queue (m)	12	537	0	28	0	0
					LOS	F	F	A	F	A	A
					Ave. Delay (sec)	81	1035	3	163	3	10
	PM	Y	New Dev	Signals	95% back of queue (m)	3	38	63	4	116	53
					LOS	C	C	B	B	B	B
					Ave. Delay (sec)	28	29	13	19	17	20
	PM	N	New Dev	Signals	95% back of queue (m)	7	46	71	8	157	48
					LOS	C	C	B	C	C	B
					Ave. Delay (sec)	28	31	13	25	23	16
						left	right	through	right	through	left

						Knight East Bound		Echuca Road South Bound		Echuca Road North Bound	
Intersection	**Time Period**	**North-South Road**	**Development Traffic**	**Control**		**1** left	**2** right	**3** through	**4** right	**5** through	**6** left
Echuca Road and Knight Street	AM	N	Existing	Giveway	95% back of queue (m)	4	7	4	1	0	0
					LOS	B	C	A	B	A	A
					Ave. Delay (sec)	11	17	0	10	0	9
	AM	N	New Dev	Giveway	95% back of queue (m)	15	634	0	2	0	0
					LOS	C	F	A	B	A	A
					Ave. Delay (sec)	21	1131	1	11	1	9
	AM	N	New Dev	Signals	95% back of queue (m)	12	88	235	14	84	17
				40 m lane from	LOS	C	D	C	C	B	C
				Macisaac	Ave. Delay (sec)	33	43	27	26	14	35
	PM	N	Existing	Giveway	95% back of queue (m)	3	5	6	1	0	0
					LOS	B	C	A	B	A	A
					Ave. Delay (sec)	11	21	0	10	0	9
	PM	N	New Dev	Giveway	95% back of queue (m)	16	155	0	7	0	0
					LOS	E	F	A	C	A	A
					Ave. Delay (sec)	44	509	1	19	1	9
	PM	N	New Dev	Signals	95% back of queue (m)	12	41	131	26	193	59
				40 m lane from	LOS	D	D	B	D	B	D
				Macisaac	Ave. Delay (sec)	36	38	14	36	16	44

						Elsie Jones DR South Bound		Midland Hwy West Bound		Midland Hwy East Bound	
Intersection	**Time Period**	**North-South Road**	**Development Traffic**	**Control**		**1** left	**2** right	**3** through	**4** right	**5** through	**6** left
Midland Highway and Elsie Jones Drive	AM	N	Existing	Giveway	95% back of queue (m)	5	2	3	1	5	0
					LOS	B	C	A	B	A	B
					Ave. Delay (sec)	14	20	0	13	0	11
	PM	N	Existing	Giveway	95% back of queue (m)	2	2	8	2	5	0
					LOS	B	E	B	B	A	B
					Ave. Delay (sec)	12	36	0	13	0	11

						Direct Access Rd		Midland Hwy West Bound		Midland Hwy East Bound	
Intersection	**Time Period**	**North-South Road**	**Development Traffic**	**Control**		**1** left	**2** right	**3** through	**4** right	**5** through	**6** left
Midland Highway and Direct Access Road (Development Area D)	AM	N	New Dev	Giveway	95% back of queue (m)	16	1039	6	6	0	0
					LOS	C	F	A	B	B	A
					Ave. Delay (sec)	16	1026	3	12	10	3
	PM	N	New Dev	Giveway	95% back of queue (m)	16	69	0	29	0	0
					LOS	C	F	A	B	B	A
					Ave. Delay (sec)	17	370	3	14	10	3
	AM	N	New Dev	Signals	95% back of queue (m)	12	67	39	29	34	34
					LOS	B	C	B	C	B	B
					Ave. Delay (sec)	17	20	18	27	18	25
	PM	N	New Dev	Signals	95% back of queue (m)	12	38	102	82	39	39
					LOS	C	C	B	C	B	B
					Ave. Delay (sec)	27	29	15	28	12	19

Intersection	**Time Period**	**North-South Road**	**Development Traffic**	**Control**		Charles Street			Midland Hwy East			North-South Road			Midland Hwy West		
						left	through	right	left	through	right	left	through	right	left	through	right
Midland Highway and North-South Road and Charles Street	AM	Y	New Dev	Signals	95% back of queue (m)	3	3	19	35	35	32	115	38	38	80	81	2
					LOS	C	C	C	C	B	C	B	B	C	D	C	C
					Ave. Delay (sec)	28	20	33	24	16	27	17	15	23	38	29	32
	PM	Y	New Dev	Signals	95% back of queue (m)	2	2	7	76	76	92	26	28	28	90	92	2
					LOS	C	C	C	C	B	D	B	B	C	D	D	C
					Ave. Delay (sec)	28	20	29	26	18	48	14	14	22	44	36	34

Intersection	**Time Period**	**North-South Road**	**Development Traffic**	**Control**		Echuca Rd (sth app)			Midland Hwy East appr			Echuca Rd (nth app)			Midland Hwy West appr		
						8 left	7 through	9 right	6 left	4 through	5 right	2 left	1 through	3 right	11 left	10 through	12 right
Midland Highway and Echuca Road	AM	N	Existing	Signals	95% back of queue (m)	9	9	91	61	64	47	22	66	1	80	81	4
					LOS	B	B	C	C	B	D	A	B	B	D	C	C
					Ave. Delay (sec)	19	12	32	25	17	44	8	14	18	39	31	32
	AM	Y	New Dev	Signals	95% back of queue (m)	24	25	92	65	67	84	100	103	1	244	245	29
					LOS	C	B	C	B	B	E	A	C	C	E	E	C
					Ave. Delay (sec)	27	20	33	20	12	59	10	24	27	71	64	31
	AM	N	New Dev	Signals	95% back of queue (m)	24	24	92	62	65	92	130	107	25	179	180	20
					LOS	C	B	C	C	B	E	B	C	C	E	D	C
					Ave. Delay (sec)	25	18	28	21	14	60	10	22	27	61	54	33
	PM	N	Existing	Signals	95% back of queue (m)	30	30	92	108	113	92	10	36	21	91	91	3
					LOS	D	C	D	C	B	D	A	C	D	E	E	E
					Ave. Delay (sec)	41	33	50	21	13	40	7	34	43	69	62	59
	PM	Y	New Dev	Signals	95% back of queue (m)	38	39	92	224	224	92	19	46	18	93	93	30
					LOS	D	C	D	C	B	C	A	C	D	D	D	D
					Ave. Delay (sec)	36	29	42	23	15	34	8	29	39	53	46	50
	PM	N	New Dev	Signals	95% back of queue (m)	53	53	92	245	245	92	22	64	50	99	100	23
					LOS	D	C	D	C	B	C	A	D	D	E	D	D
					Ave. Delay (sec)	42	35	53	21	14	34	8	36	49	62	54	53

Appendix B JPT Traffic Report

John Piper Traffic Pty Ltd
ABN 70 066 652 177

46 WADHURST DRIVE
BORONIA VIC 3155
PHONE: (03) 8805 3400 FAX: (03) 9800 3914

Mooroopna West Growth Corridor
North-South Collector Road,
Traffic Review

Traffic Assessment Report

September 2007

CLIENT:

City of Greater Shepparton

Table of Contents

1. INTRODUCTION

As stated in the preamble to the Overall Development Plan (ODP) prepared by Maunsell, land development pressures on the Greater Shepparton City Council for residential expansion within the growth corridor situated to the west of Mooroopna township is intensifying with the completion of the final stages of existing land release opportunities. Due to the overall extent of flood-prone land surrounding Mooroopna, existing Council policy has directed new residential development to the Mooroopna West Growth Corridor. As one of four key residential growth corridors in the municipality, the Council has identified a clear need to maintain a satisfactory supply of residential land within Mooroopna and associated with this, a need to undertake detailed strategic planning to accommodate these opportunities in a coordinated and sustainable manner.

The Mooroopna West Outline Development Plan (‘ODP’) area comprises 329 hectares and is bounded by the established township area situated on the western side of Echuca-Mooroopna Road, as well as Cornish Road to the north, the Goulburn Valley Highway (Shepparton Bypass) reservation to the west and Midland Highway to the south.

A Traffic Investigation Report was prepared by Maunsell in November 2006 as a precursor to the Mooroopna West ODP. The main recommendation of this report is that a North-South Collector or Distributor Road be introduced within the Mooroopna West ODP area to connect the Midland Highway in the south to Echuca-Mooroopna Road in the north. From the analyses of future traffic loads and the function of the North-South Road, a series of traffic engineering recommendations were made in relation to the design and operation of the road and its key intersections.

The Traffic Investigation was followed by the preparation of an ODP and a Development Contributions Plan for the Mooroopna West Growth Corridor by Maunsell in April 2007. Council has now engaged John Piper Traffic (JPT) to undertake detailed assessment of the traffic impacts of the North-South Collector Road, specifically to:

- Establish the trigger point for installation of traffic signals at the Collector Road connection to Echuca-Mooroopna Road at its northern end, and estimate the area of the Growth Corridor that would contribute to the cost of such signals;
- Establish the trigger point for installation of traffic signals at the Collector Road connection to Midland Highway at its southern end, and estimate the area of the Growth Corridor that would contribute to the cost of such signals;
- Establish the trigger point for installation of traffic signals at the intersection of MacIsaac Road to the Echuca-Mooroopna Road, and estimate the area of the Growth Corridor that would contribute to the cost of such signals;
- Review the typical cross section of the North-South Collector Road in the context of different traffic volumes experienced along various segments of its length.

1.1 Documentation

The documentation assembled for this assessment includes:

- Mooroopna West Growth Corridor North-South Road Traffic Investigation by Maunsell/AECOM dated November 2006;
- Mooroopna West Growth Corridor Outline Development Plan by Maunsell/AECOM dated April 2007;

- Mooroopna West Growth Corridor Outline Development Contributions Plan by Maunsell/AECOM dated April 2007.

1.2 Technical References

The technical references used in the preparation of this assessment are:

- The Austroads *Guide to Traffic Engineering Practice – Part 5, Intersections at Grade*;
- *ResCode,* the Victorian Government provisions governing the planning and building of residential developments dated August 2001, for local street design criteria.

2. DEVELOPMENT PROPOSAL

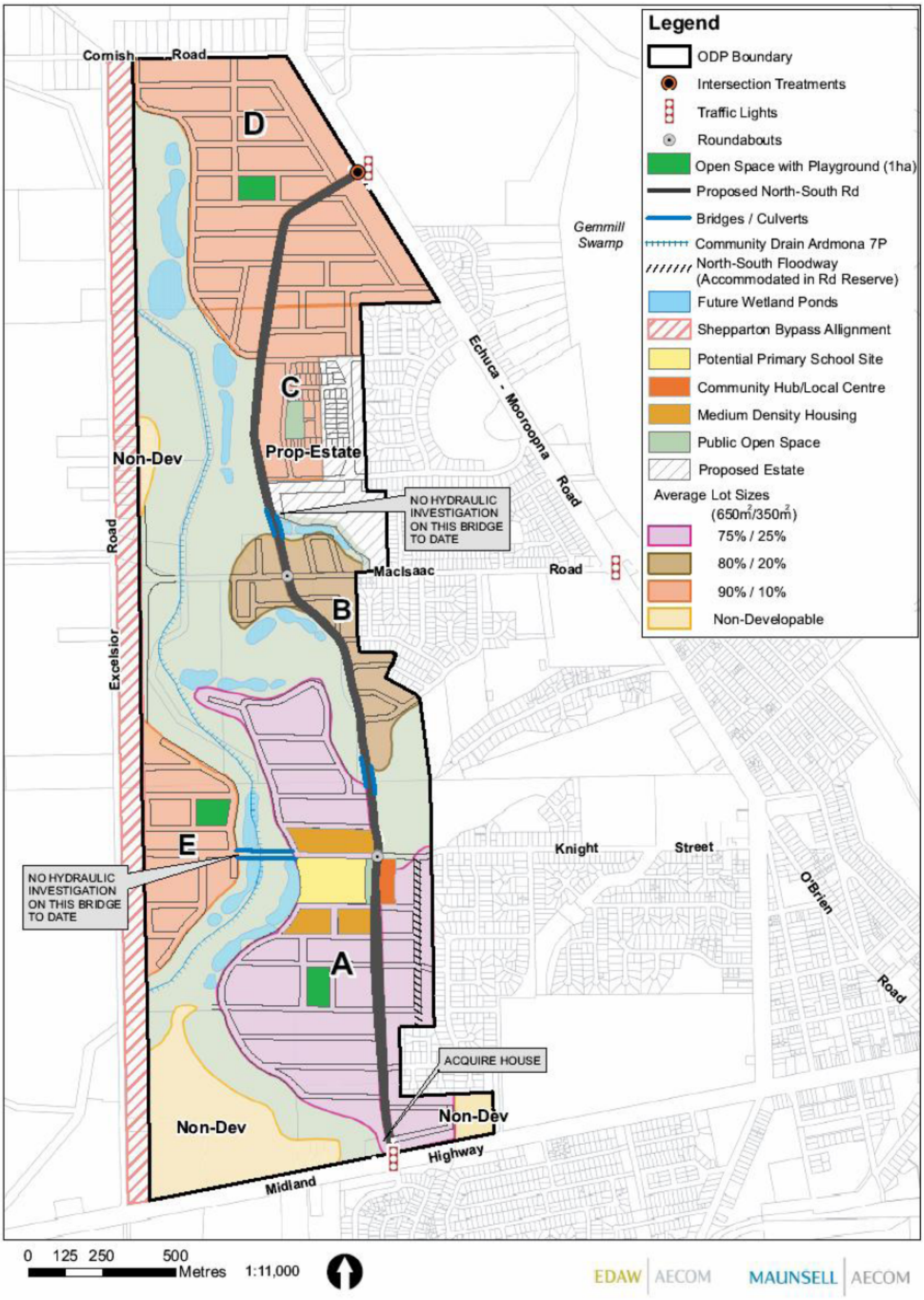


Figure 2.1: Mooroopna West Growth Corridor Outline Development Plan.

2.1 Precincts

In setting the future development landscape for Mooroopna West, the Maunsell report identified developable land via a set of “precincts”. The precincts are land units that essentially reflect localized topographical and flooding conditions as well as their capacity to integrate with the existing township area. The precincts are not based on land ownership arrangements. The precinct areas are shown in Figure 2.1 and summarized in the table in Figure 2.2 below.

Precinct	Gross Area (Ha)	Potential Lot Yield
A	67.16	798
B	15.65	197
C	16.22	190
D	5197	608
E	18.87	221

Figure 2.2: Growth Area Development Precincts.

2.2 Traffic Generation & Distribution

The above lot yield has been used to estimate traffic generation from each precinct using the average trip rate of 10 trips/dwelling/day used in the Maunsell traffic report and a peak hour volume approximating to 12% of the daily total. Although total traffic volumes in the morning and afternoon peaks are comparable, only the morning peak has been subjected to detailed analysis as this is expected to have a greater impact on the surrounding arterial road network at the connecting intersections.

Again for consistency with the Maunsell report, traffic orientation during the morning peak is assumed to be 80% outbound and 20% inbound with a directional distribution as outlined in Figure 2.3. For the Midland Highway intersection the afternoon peak has assumed a traffic orientation of 30% outbound and 70% inbound.

Direction	AM		PM	
	Traffic To	Traffic From	Traffic To	Traffic From
North (Echuca)	10%	20%	20%	10%
East (Shepparton)	70%	40%	40%	70%
South (Murchison)	10%	20%	20%	10%
West (Midland Highway)	10%	20%	20%	10%

Figure 2.3: Traffic Direction Distribution.

Other assumptions that have been made in the traffic generation modelling are:

- Negligible impact on Knight Street as it offers no trip length advantage and presents access problems at the Echuca-Mooroopna Road intersection;
- Leakage via Kalimna Drive/Craigmuir Drive minimised with traffic calming measures.

3. TRAFFIC IMPACTS

Total traffic generation from the area at the major connection nodes, as established from first principles using the above criteria, is within the ranges estimated in Table 7 of the Maunsell traffic report and confirm consistency of the results. Traffic impacts at individual locations are discussed below.

3.1 Intersections

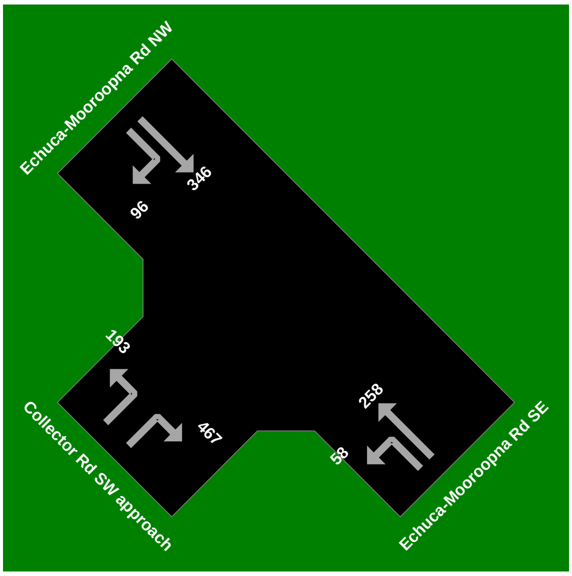
The analysis of the operation of the intersections was undertaken using aaSIDRA. This is a computer analysis program originally developed by the Australian Road Research Board (ARRB) to analyse the operation of signalized intersections.

The program produces many statistics and information on the operation of an intersection being assessed but typically the main characteristics used to assess the operation of the intersection are the Degree of Saturation (X), average delays and 95th percentile queue lengths. To provide an understanding of the meaning of various values of X, Figure 3.1 is provided for information.

Degree of Saturation (X)	**Description of Intersection Operation**
Less than 0.65	Below capacity. Good operating conditions, few delays
0.65 – 0.85	Desirable range. Satisfactory operating conditions
0.85 – 0.95	High range. Increasing congestion and delays
Over 0.95	Undesirable range. Very high congestion and very long delays

Figure 3.1 – Degree of Saturation.

3.1.1 North-South Collector at Echuca-Mooroopna Road

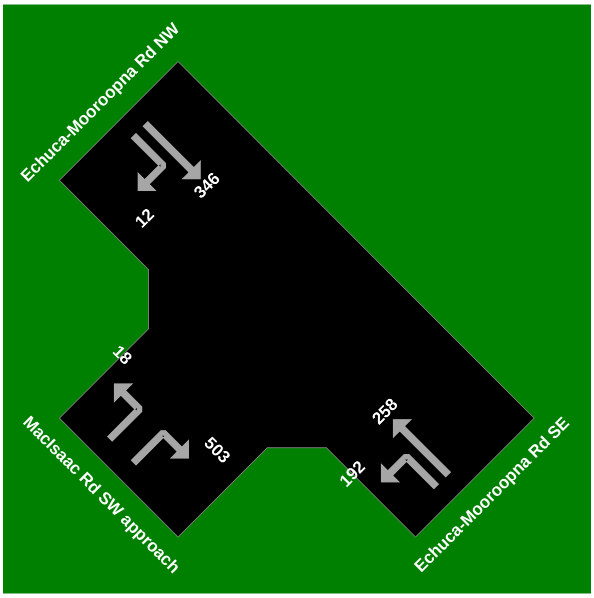


Traffic volumes expected to be generated at full development are described in the Input Diagram to the right. When these are analysed with aaSIDRA under Give Way conditions they result in total saturation, with the through traffic on Echuca-Mooroopna Road exceeding any capacity to absorb the right turn volumes from the North-South Collector.

A further assessment that removes the contributions from precincts A, B, C and E reduces the left turn exit demand but still results in total saturation of the right turn, indicating that signals are required from the time of initial development of precinct D.

Analysis of signalisation of the site indicates satisfactory operation using two signals phases and right turns from the north filtering through the oncoming traffic stream. Degrees of Saturation (X) are low – between 0.53 and 0.64, with delays below 18 seconds. The queue length of 71m for the right turn from the south can be reduced by introducing a free-flow left slip lane on this approach.

3.1.2 MacIsaac Road at Echuca-Mooroopna Road

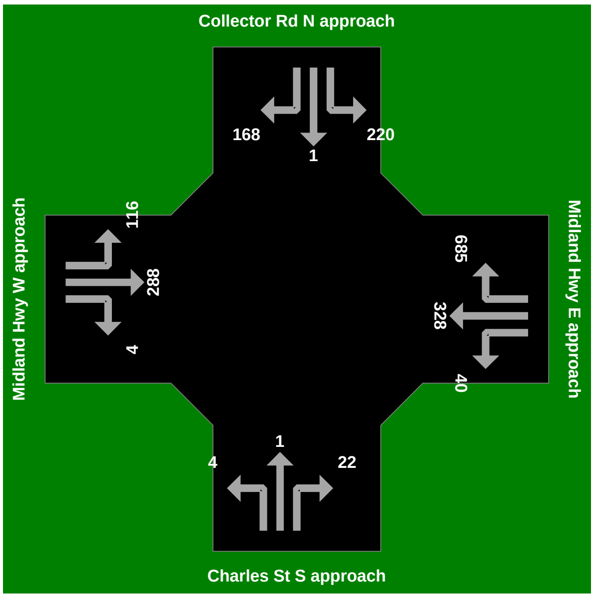


Again traffic volumes generated at full development are described in the Input Diagram to the right. When these are analysed under Give Way conditions they result in total saturation, with the through traffic on Echuca-Mooroopna Road exceeding any capacity to absorb right turn movements from MacIsaac Road.

A further assessment that removes the contributions from precincts C & D still results in saturation of the right turn, indicating that signals are required from initial development of precinct B.

Analysis of signalisation of the site indicates satisfactory operation using two signal phases and right turns from the north filtering through the oncoming traffic stream. X values are moderate – between 0.49 and 0.75, with delays below 25 seconds. The queue length of 68m for the right turn from the south can be reduced by introducing a longer or left turn lane or free-flow left slip lane on this approach.

3.1.3 North-South Collector at Midland Highway



It is expected that the afternoon peak traffic generation for precinct A can be accommodated at the highway intersection, with moderate levels of congestion (X = 0.78) and queuing (88m) for the right turn entry movement from the highway. This reaches saturation with the addition of traffic generated from precinct E. The remaining precincts to the north essentially add traffic with destinations to the west. These do not affect the critical north to/from east movements shown in the Input Diagram to the right.

It is expected that growth in highway traffic during the development stage in the Growth Area and the establishment of a commercial hub in precinct A will require installation of signals at this intersection at the stage of initial development of precinct A.

Signalisation will require a three phase operation with a fully controlled right turn from the east. X values on the two highway legs are in an acceptable range between 0.76 and 0.79. Queue lengths in the order of 126m in the northern leg can be improved with the inclusion of a left slip lane for the north to east movement but will still require provision of a separate turn lane in the order of 100m long in the north approach. Delays are expected to be around 30 seconds on all approaches.

3.1.4 *Summary of aaSIDRA Results*

Movement Summaries for the assessment of each of the above options are provided in Appendix A, with the results collated and summarised in Figure 3.2 below.

<table>
<tr><th rowspan="2">Intersection</th><th>Configuration</th><th colspan="12">Degree of Saturation (X)</th><th colspan="12">Average Delays (seconds)</th><th colspan="12">95% Queue Length (m)</th></tr>
<tr><th>Approach</th><th colspan="4">SE</th><th colspan="4">NW</th><th colspan="4">SW</th><th colspan="4">SE</th><th colspan="4">NW</th><th colspan="4">SW</th><th colspan="4">SE</th><th colspan="4">NW</th><th colspan="4">SW</th></tr>
<tr><td rowspan="3">N-S Collector at Echuca-Mooroopna Road</td><td>Give Way; AM peak Area D only</td><td colspan="4">0.18</td><td colspan="4">0.12</td><td colspan="4">1.99</td><td colspan="4">2</td><td colspan="4">2</td><td colspan="4">925</td><td colspan="4">0</td><td colspan="4">9</td><td colspan="4">1248</td></tr>
<tr><td>Give Way; AM peak All areas</td><td colspan="4">0.18</td><td colspan="4">0.17</td><td colspan="4">2.31</td><td colspan="4">11</td><td colspan="4">3</td><td colspan="4">1212</td><td colspan="4">0</td><td colspan="4">8</td><td colspan="4">1411</td></tr>
<tr><td>Signals (2 phases); AM Peak</td><td colspan="4">0.49</td><td colspan="4">0.70</td><td colspan="4">0.75</td><td colspan="4">21</td><td colspan="4">16</td><td colspan="4">25</td><td colspan="4">46</td><td colspan="4">68</td><td colspan="4">89</td></tr>
<tr><td rowspan="3">MacIsaac Road at Echuca-Mooroopna Road</td><td>Give Way; AM peak Area B only</td><td colspan="4">0.15</td><td colspan="4">0.22</td><td colspan="4">1.65</td><td colspan="4">9</td><td colspan="4">4</td><td colspan="4">623</td><td colspan="4">0</td><td colspan="4">22</td><td colspan="4">781</td></tr>
<tr><td>Give Way; AM peak All areas</td><td colspan="4">0.15</td><td colspan="4">0.2</td><td colspan="4">2.39</td><td colspan="4">9</td><td colspan="4">5</td><td colspan="4">1290</td><td colspan="4">0</td><td colspan="4">23</td><td colspan="4">1561</td></tr>
<tr><td>Signalised; AM Peak</td><td colspan="4">0.53</td><td colspan="4">0.57</td><td colspan="4">0.64</td><td colspan="4">23</td><td colspan="4">28</td><td colspan="4">18</td><td colspan="4">48</td><td colspan="4">51</td><td colspan="4">71</td></tr>
<tr><td></td><th>Approach</th><th colspan="3">S</th><th colspan="3">E</th><th colspan="3">N</th><th colspan="3">W</th><th colspan="3">S</th><th colspan="3">E</th><th colspan="3">N</th><th colspan="3">W</th><th colspan="3">S</th><th colspan="3">E</th><th colspan="3">N</th><th colspan="3">W</th></tr>
<tr><td rowspan="3">N-S Collector at Midland Highway</td><td>Give Way; PM peak Area A only</td><td colspan="3">0.13</td><td colspan="3">0.78</td><td colspan="3">0.24</td><td colspan="3">0.17</td><td colspan="3">23</td><td colspan="3">10</td><td colspan="3">23</td><td colspan="3">10</td><td colspan="3">4</td><td colspan="3">88</td><td colspan="3">8</td><td colspan="3">0</td></tr>
<tr><td>Give Way; PM peak All areas</td><td colspan="3">0.18</td><td colspan="3">1.0*</td><td colspan="3">0.87</td><td colspan="3">0.17</td><td colspan="3">31</td><td colspan="3">21</td><td colspan="3">64</td><td colspan="3">10</td><td colspan="3">6</td><td colspan="3">140</td><td colspan="3">57</td><td colspan="3">0</td></tr>
<tr><td>Signals (3 phases); PM Peak</td><td colspan="3">0.10</td><td colspan="3">0.79</td><td colspan="3">0.53</td><td colspan="3">0.76</td><td colspan="3">32</td><td colspan="3">37</td><td colspan="3">35</td><td colspan="3">36</td><td colspan="3">10</td><td colspan="3">62</td><td colspan="3">53</td><td colspan="3">93</td></tr>
</table>

Figure 3.2: Operating Characteristics at Key Intersections.

3.2 Internal Road Network

Traffic generation at full development along the North-South Collector indicates two-way traffic levels as outlined in Figure 3.3.

Road Sector	Location	Peak 2-way traffic	Indicative Road Class
South End	South end of precinct A	1250vpd	Collector Street
A to B	Between Knight St and MacIsaac Rd	290vpd	Access Street
B to C	MacIsaac Rd to Kalimna Dr	290vpd	Access Street
C to D	North of Dennison St	130vpd	Access Street
North End	North end of Precinct D	814vpd	Access Street

Figure 3.3: Traffic Volumes along the Collector Road.

The City of Greater Shepparton Planning Scheme (based on ResCode) specifies the following design parameters for the two road categories involved.

Road Type	Dwellings Served	Traffic Volume	Target Speed	Distance between 20 km/h Slow Points	Cross Section
Access Street	Prefer <100 but up to 200	1000vpd to 2000vpd	30km/h to 40km/h	75 to 100m 100m to 140m	5.0 – 5.5m (4m verges) 7.0 – 7.5m (4.5m verges)
Collector Street	Collects from Access Streets	<3000vpd	50 km/h	120 to 155m	6.0 – 6.5m (with indented parking) or 7.0 – 7.5m; 4.5m verges

Figure 3.4: Road Class Characteristics.

Based on traffic volumes only, the majority of the length of the North-South Collector Road would fall into the class of Access Street. However, considering the function performed by the road (in collecting and distributing traffic between the less significant Access Streets & Access Places and the Traffic Routes surrounding the Growth Area) and the number of dwellings served by this road (in the range of 200 to 800 lots for each precinct) this route should clearly be classed as a Collector and constructed as such in the first instance. Even though no individual development precinct on its own would require this Collector Road, in the context of the entire growth area the Collector is seen as essential in efficiently and safely distributing the internally generated traffic onto the external network.

4. SUMMARY

The following conclusions can be drawn from the analysis undertaken above:

4.1 Intersection Form and Timing:

4.1.1 North-South Collector Road at Echuca Mooroopna Road (North End):

This intersection requires signalisation at the stage where precinct D is fully developed.

The intersection configuration should comprise:

- Extension of the two lane north approach to provide a through lane and a combined through/right turn lane;
- Augmentation of the single northbound lane with a dedicated 50m long left turn lane (with preference for the introduction of a free-flow left slip lane);
- Provision of a free-flow left slip lane to cater for the significant southwest to north movement.

It is considered that the cost of this treatment should be borne by the lots in precinct D.

4.1.2 MacIsaac Road at Echuca Mooroopna Road:

This intersection requires signalisation at the stage where precinct B is fully developed.

The intersection configuration should comprise:

- Retention of the single lane north approach as a combined through/right turn lane;
- Augmentation of the single northbound lane with a dedicated 50m long left turn lane (with preference for the introduction of a free-flow left slip lane);
- Retention of the existing exit lane arrangement from MacIsaac Road.

Promotion of this access route should be accompanied by the installation of traffic calming measures in Kalimna Drive and Craigmuir Drive to reduce the amount of filtering through these residential areas from Precinct C. As such it is considered that the cost of the signalisation and traffic calming treatments should be borne by the lots in precincts B and C.

4.1.3 North-South Collector at Midland Highway (South End):

This intersection requires signalisation at the stage where precinct A is fully developed. Should precinct E be developed, further contributions to the right turn out at this intersection would make signalisation essential.

The intersection configuration should comprise:

- Retention of the single lane south approach that caters for all exit movements from Charles Street;

- Development of two right turn lanes (100m + 50m) to augment the single highway through/left turn lane from the east;

- Provision of two approach lanes from the north – a combined through and right turn lane and a dedicated left turn lane of at least 100m in length (with preference for the introduction of a free-flow left slip provision to reduce queuing);

- Augmentation of the western highway approach with a separate left turn lane (50m long) and sheltered right turn lane (30m long);

- Signals operation using 3 phases to include a separate right turn phase from the east (with bonus left turn for the exit movement).

Analysis indicates that Give Way control may operate at satisfactory levels of congestion, albeit with significant queues from the east, until precinct E comes on stream or significant traffic is generated from the commercial hub in precinct A. As such it is considered that the cost of the signalisation should be borne by the lots in precincts A (and E if development of this area proceeds).

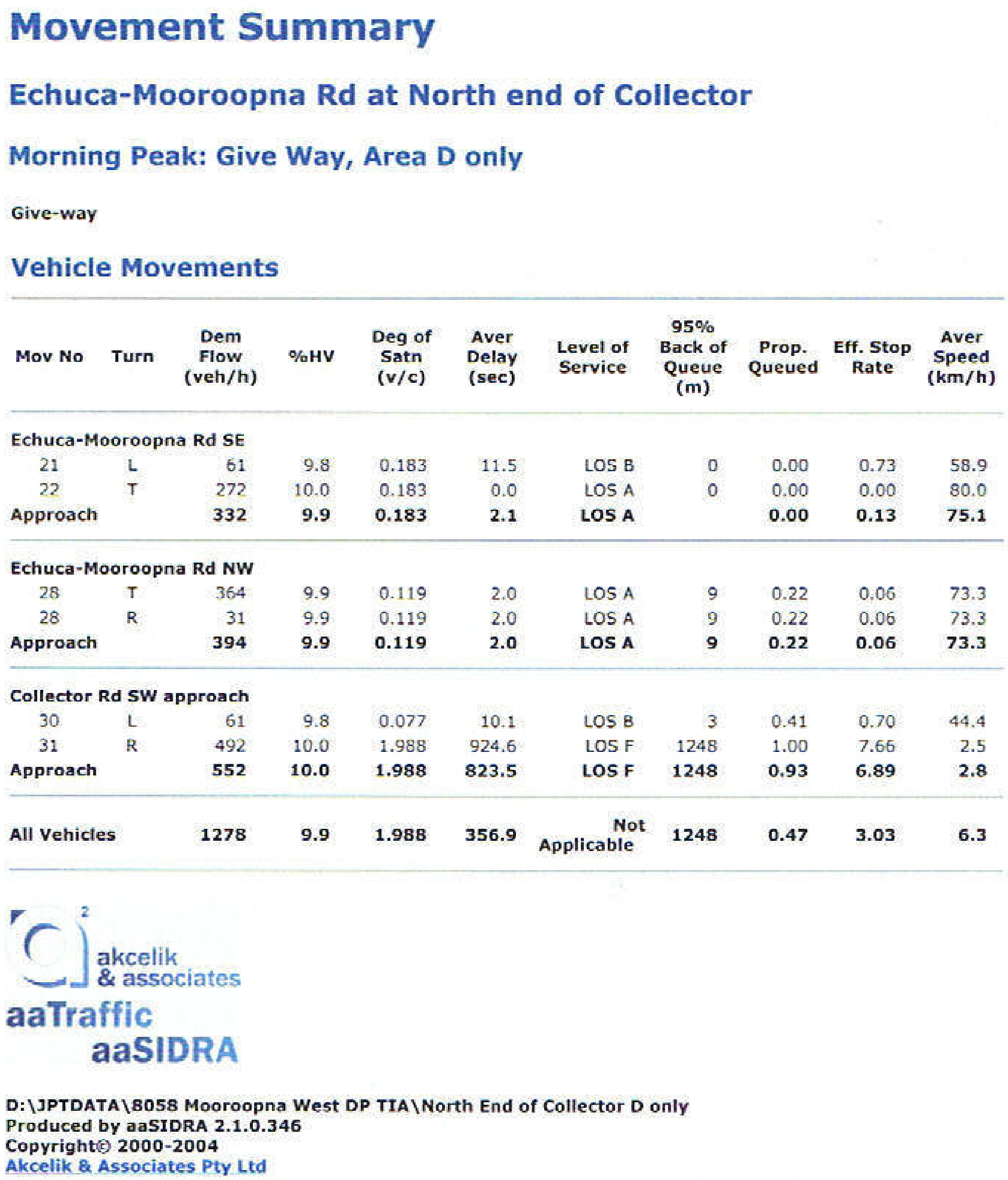
4.2 Collector Road Configuration

Traffic volumes alone indicate a need for an Access Street cross section for all but the southern end of the road length (southern end of precinct A). However, based on the objectives of Rescode, the function of the road within the entire catchment area indicates the necessity of its construction as a Collector Road for the full length, adopting the characteristics summarised in Figure 3.4. As all precincts contribute to this traffic demand by virtue of individual traffic generation levels, it is considered that 100% of the cost of constructing this spine route to the higher standard should be distributed over all lots in the entire development area.

Further, implementation of traffic management treatments along the route, including the imposition of a mass limit as recommended in the Maunsell reports, are supported to discourage use of the route by external traffic and reserve its use as primarily serving the development.

APPENDIX A

aaSIDRA SUMMARIES



Movement Summary

Echuca-Mooroopna Rd at North end of Collector

Morning Peak: Give Way, Area D only

Give-way

Vehicle Movements

Mov No	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)
Echuca-Mooroopna Rd SE										
21	L	61	9.8	0.183	11.5	LOS B	0	0.00	0.73	58.9
22	T	272	10.0	0.183	0.0	LOS A	0	0.00	0.00	80.0
Approach		**332**	**9.9**	**0.183**	**2.1**	**LOS A**		**0.00**	**0.13**	**75.1**
Echuca-Mooroopna Rd NW										
28	T	364	9.9	0.119	2.0	LOS A	9	0.22	0.06	73.3
28	R	31	9.9	0.119	2.0	LOS A	9	0.22	0.06	73.3
Approach		**394**	**9.9**	**0.119**	**2.0**	**LOS A**	**9**	**0.22**	**0.06**	**73.3**
Collector Rd SW approach										
30	L	61	9.8	0.077	10.1	LOS B	3	0.41	0.70	44.4
31	R	492	10.0	1.988	924.6	LOS F	1248	1.00	7.66	2.5
Approach		**552**	**10.0**	**1.988**	**823.5**	**LOS F**	**1248**	**0.93**	**6.89**	**2.8**
All Vehicles		**1278**	**9.9**	**1.988**	**356.9**	**Not Applicable**	**1248**	**0.47**	**3.03**	**6.3**

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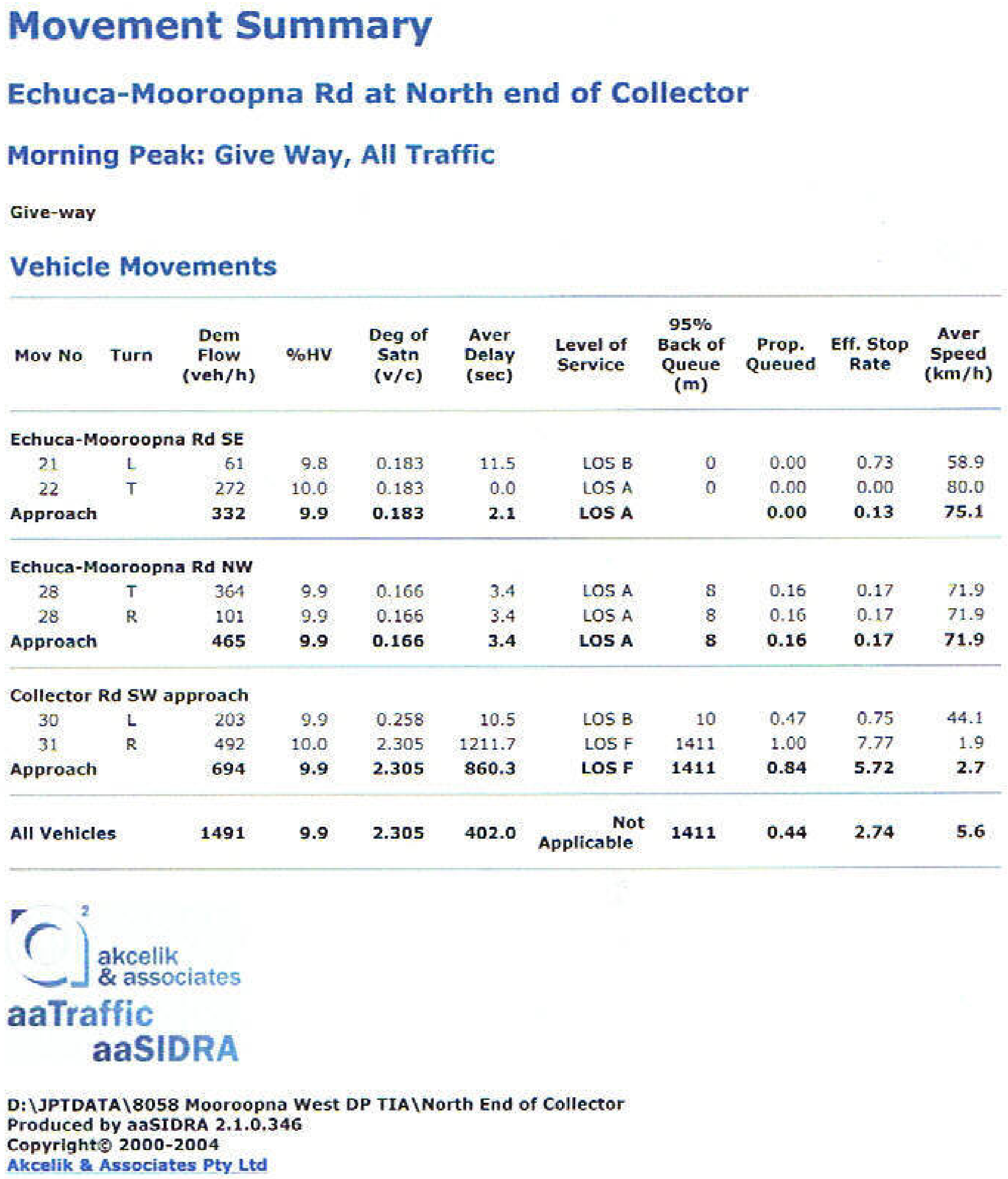

Movement Summary

Echuca-Mooroopna Rd at North end of Collector

Morning Peak: Give Way, All Traffic

Give-way

Vehicle Movements

Mov No	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)
Echuca-Mooroopna Rd SE										
21	L	61	9.8	0.183	11.5	LOS B	0	0.00	0.73	58.9
22	T	272	10.0	0.183	0.0	LOS A	0	0.00	0.00	80.0
Approach		**332**	**9.9**	**0.183**	**2.1**	**LOS A**		**0.00**	**0.13**	**75.1**
Echuca-Mooroopna Rd NW										
28	T	364	9.9	0.166	3.4	LOS A	8	0.16	0.17	71.9
28	R	101	9.9	0.166	3.4	LOS A	8	0.16	0.17	71.9
Approach		**465**	**9.9**	**0.166**	**3.4**	**LOS A**	**8**	**0.16**	**0.17**	**71.9**
Collector Rd SW approach										
30	L	203	9.9	0.258	10.5	LOS B	10	0.47	0.75	44.1
31	R	492	10.0	2.305	1211.7	LOS F	1411	1.00	7.77	1.9
Approach		**694**	**9.9**	**2.305**	**860.3**	**LOS F**	**1411**	**0.84**	**5.72**	**2.7**
All Vehicles		**1491**	**9.9**	**2.305**	**402.0**	**Not Applicable**	**1411**	**0.44**	**2.74**	**5.6**

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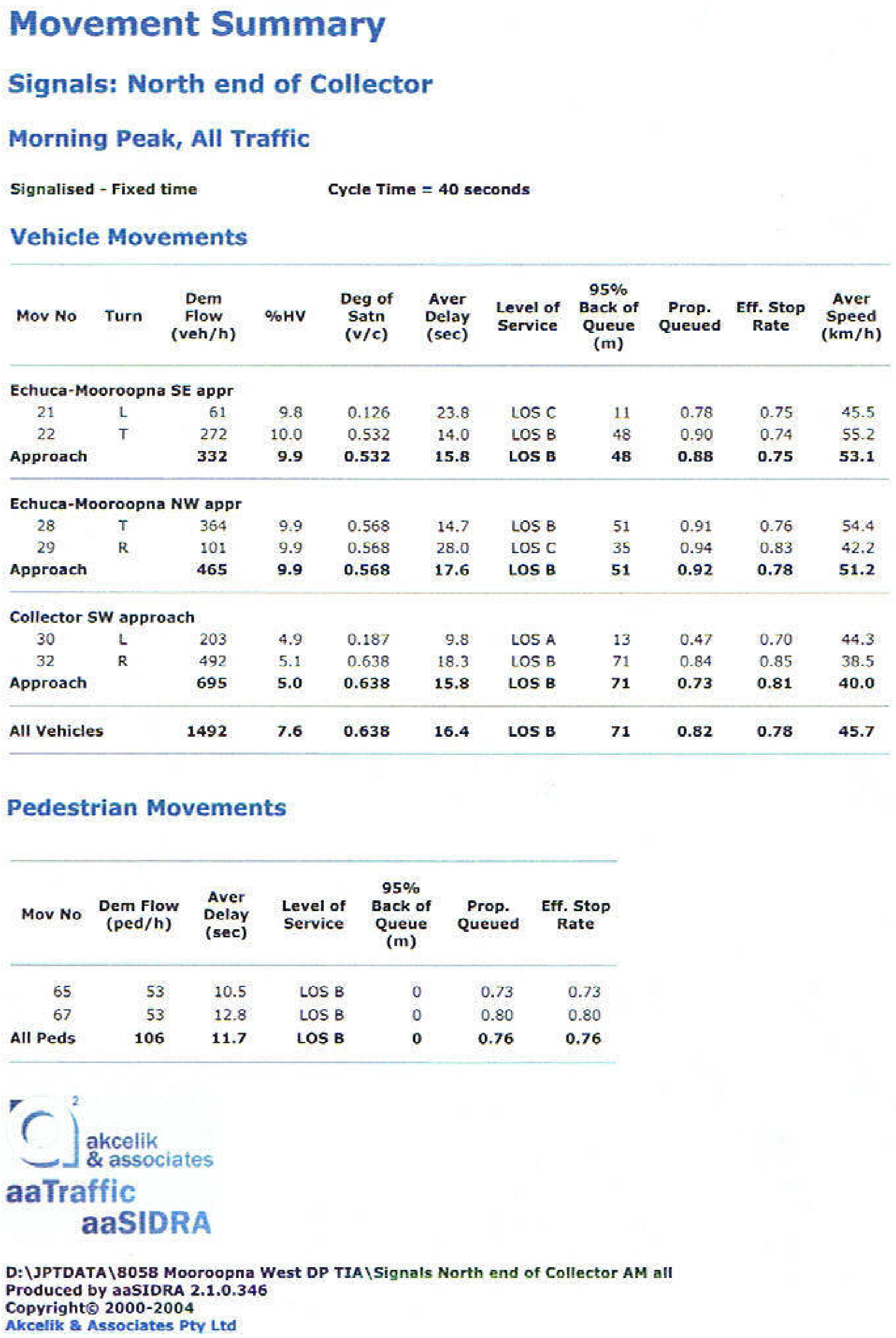

Movement Summary

Signals: North end of Collector

Morning Peak, All Traffic

Signalised - Fixed time **Cycle Time = 40 seconds**

Vehicle Movements

Mov No	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)
Echuca-Mooroopna SE appr										
21	L	61	9.8	0.126	23.8	LOS C	11	0.78	0.75	45.5
22	T	272	10.0	0.532	14.0	LOS B	48	0.90	0.74	55.2
Approach		**332**	**9.9**	**0.532**	**15.8**	**LOS B**	**48**	**0.88**	**0.75**	**53.1**
Echuca-Mooroopna NW appr										
28	T	364	9.9	0.568	14.7	LOS B	51	0.91	0.76	54.4
29	R	101	9.9	0.568	28.0	LOS C	35	0.94	0.83	42.2
Approach		**465**	**9.9**	**0.568**	**17.6**	**LOS B**	**51**	**0.92**	**0.78**	**51.2**
Collector SW approach										
30	L	203	4.9	0.187	9.8	LOS A	13	0.47	0.70	44.3
32	R	492	5.1	0.638	18.3	LOS B	71	0.84	0.85	38.5
Approach		**695**	**5.0**	**0.638**	**15.8**	**LOS B**	**71**	**0.73**	**0.81**	**40.0**
All Vehicles		**1492**	**7.6**	**0.638**	**16.4**	**LOS B**	**71**	**0.82**	**0.78**	**45.7**

Pedestrian Movements

Mov No	Dem Flow (ped/h)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate
65	53	10.5	LOS B	0	0.73	0.73
67	53	12.8	LOS B	0	0.80	0.80
All Peds	**106**	**11.7**	**LOS B**	**0**	**0.76**	**0.76**

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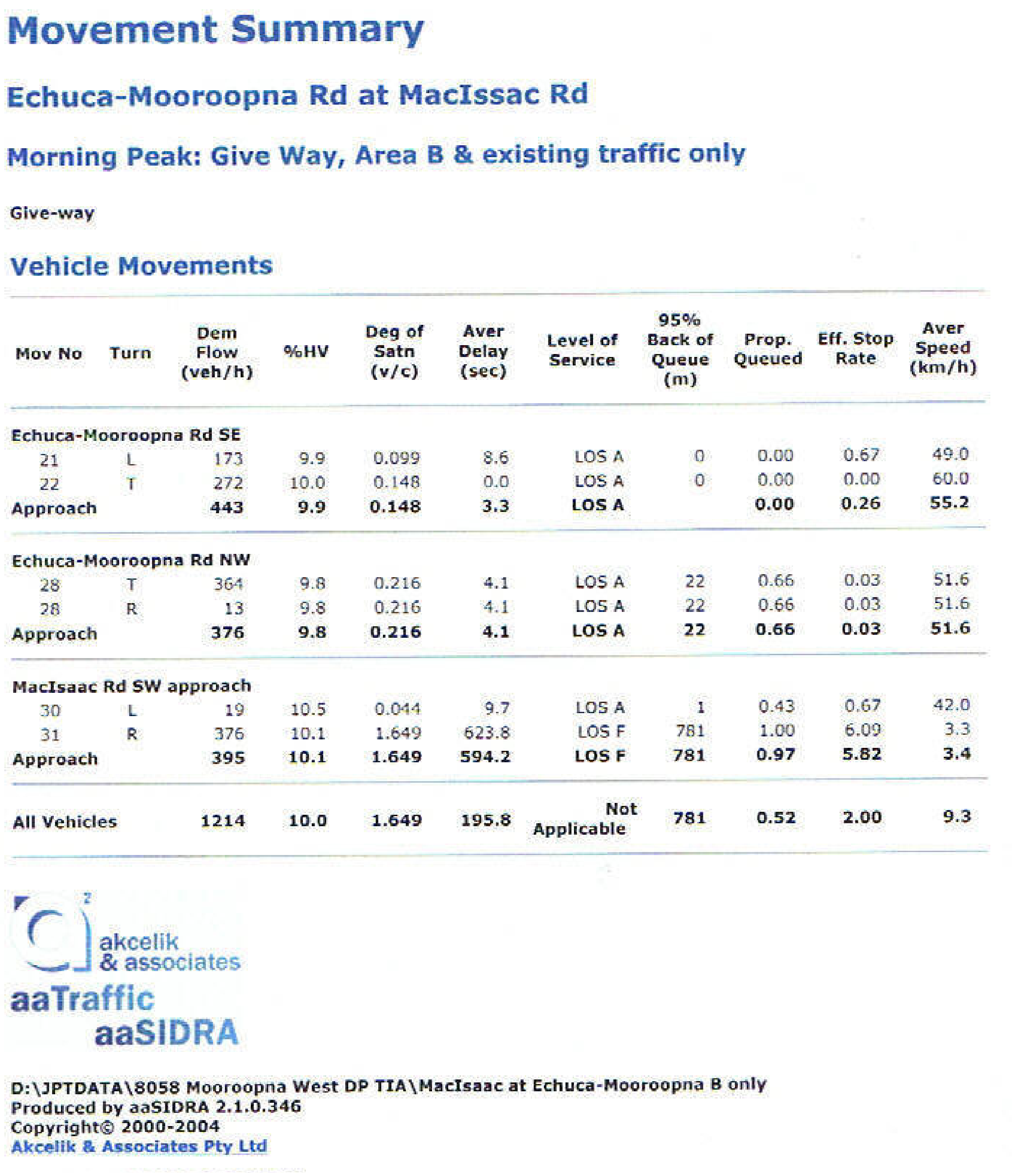

Movement Summary

Echuca-Mooroopna Rd at MacIssac Rd

Morning Peak: Give Way, Area B & existing traffic only

Give-way

Vehicle Movements

Mov No	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)
Echuca-Mooroopna Rd SE										
21	L	173	9.9	0.099	8.6	LOS A	0	0.00	0.67	49.0
22	T	272	10.0	0.148	0.0	LOS A	0	0.00	0.00	60.0
Approach		**443**	**9.9**	**0.148**	**3.3**	**LOS A**		**0.00**	**0.26**	**55.2**
Echuca-Mooroopna Rd NW										
28	T	364	9.8	0.216	4.1	LOS A	22	0.66	0.03	51.6
28	R	13	9.8	0.216	4.1	LOS A	22	0.66	0.03	51.6
Approach		**376**	**9.8**	**0.216**	**4.1**	**LOS A**	**22**	**0.66**	**0.03**	**51.6**
MacIsaac Rd SW approach										
30	L	19	10.5	0.044	9.7	LOS A	1	0.43	0.67	42.0
31	R	376	10.1	1.649	623.8	LOS F	781	1.00	6.09	3.3
Approach		**395**	**10.1**	**1.649**	**594.2**	**LOS F**	**781**	**0.97**	**5.82**	**3.4**
All Vehicles		**1214**	**10.0**	**1.649**	**195.8**	**Not Applicable**	**781**	**0.52**	**2.00**	**9.3**

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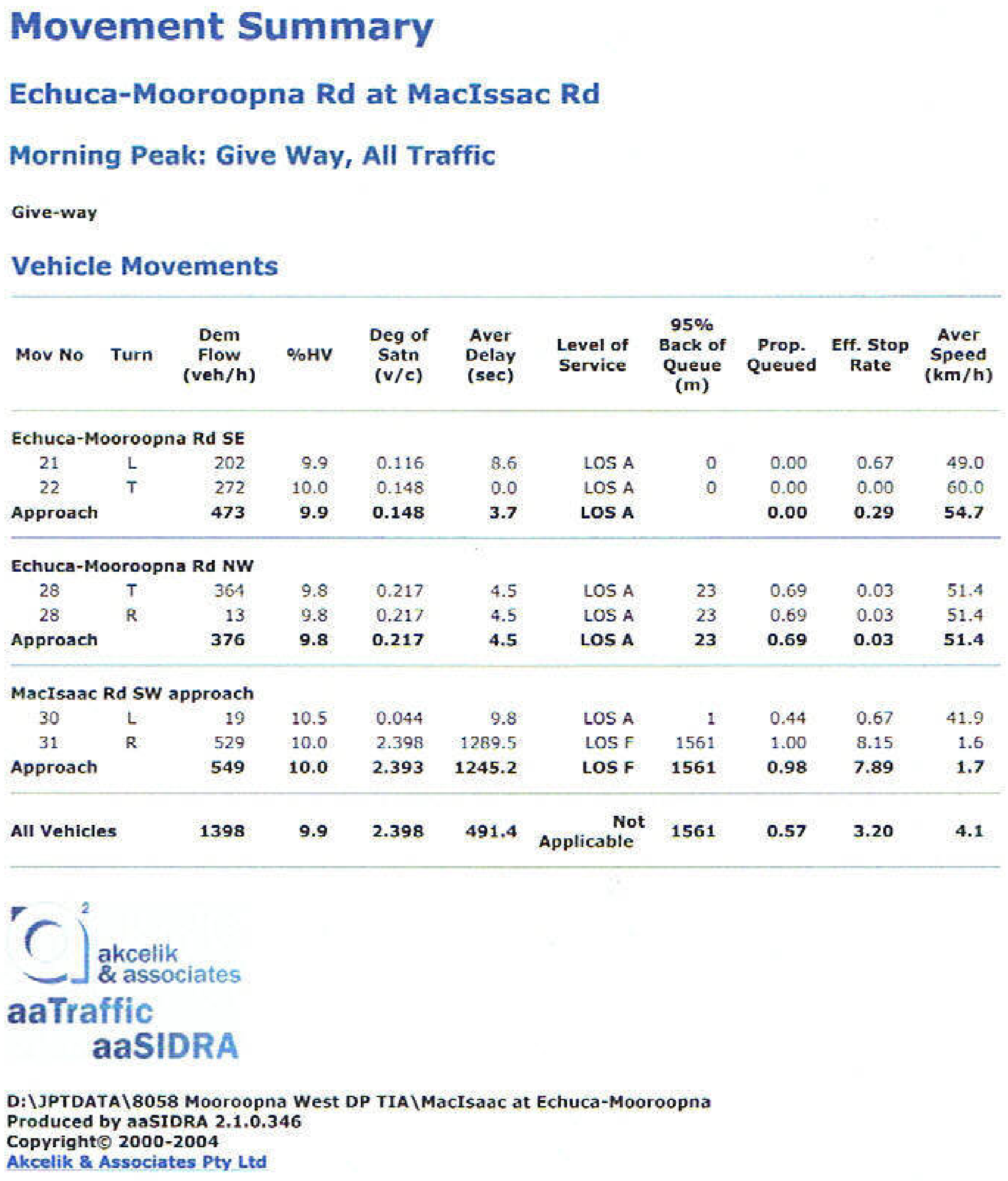

Movement Summary

Echuca-Mooroopna Rd at MacIssac Rd

Morning Peak: Give Way, All Traffic

Give-way

Vehicle Movements

Mov No	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)
Echuca-Mooroopna Rd SE										
21	L	202	9.9	0.116	8.6	LOS A	0	0.00	0.67	49.0
22	T	272	10.0	0.148	0.0	LOS A	0	0.00	0.00	60.0
Approach		**473**	**9.9**	**0.148**	**3.7**	**LOS A**		**0.00**	**0.29**	**54.7**
Echuca-Mooroopna Rd NW										
28	T	364	9.8	0.217	4.5	LOS A	23	0.69	0.03	51.4
28	R	13	9.8	0.217	4.5	LOS A	23	0.69	0.03	51.4
Approach		**376**	**9.8**	**0.217**	**4.5**	**LOS A**	**23**	**0.69**	**0.03**	**51.4**
MacIsaac Rd SW approach										
30	L	19	10.5	0.044	9.8	LOS A	1	0.44	0.67	41.9
31	R	529	10.0	2.398	1289.5	LOS F	1561	1.00	8.15	1.6
Approach		**549**	**10.0**	**2.393**	**1245.2**	**LOS F**	**1561**	**0.98**	**7.89**	**1.7**
All Vehicles		**1398**	**9.9**	**2.398**	**491.4**	**Not Applicable**	**1561**	**0.57**	**3.20**	**4.1**

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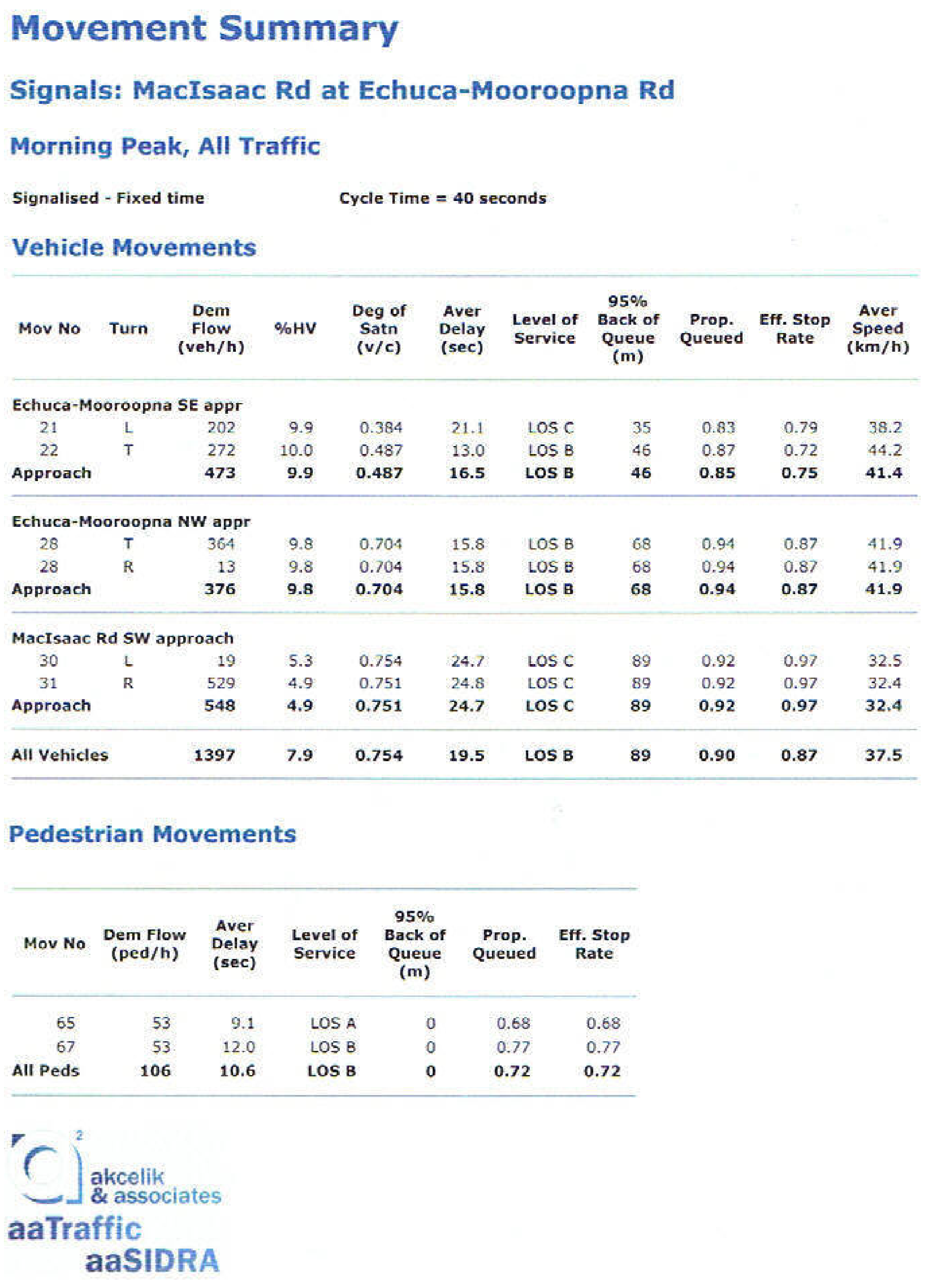

Movement Summary

Signals: MacIsaac Rd at Echuca-Mooroopna Rd

Morning Peak, All Traffic

Signalised - Fixed time Cycle Time = 40 seconds

Vehicle Movements

Mov No	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)
Echuca-Mooroopna SE appr										
21	L	202	9.9	0.384	21.1	LOS C	35	0.83	0.79	38.2
22	T	272	10.0	0.487	13.0	LOS B	46	0.87	0.72	44.2
Approach		**473**	**9.9**	**0.487**	**16.5**	**LOS B**	**46**	**0.85**	**0.75**	**41.4**
Echuca-Mooroopna NW appr										
28	T	364	9.8	0.704	15.8	LOS B	68	0.94	0.87	41.9
28	R	13	9.8	0.704	15.8	LOS B	68	0.94	0.87	41.9
Approach		**376**	**9.8**	**0.704**	**15.8**	**LOS B**	**68**	**0.94**	**0.87**	**41.9**
MacIsaac Rd SW approach										
30	L	19	5.3	0.754	24.7	LOS C	89	0.92	0.97	32.5
31	R	529	4.9	0.751	24.8	LOS C	89	0.92	0.97	32.4
Approach		**548**	**4.9**	**0.751**	**24.7**	**LOS C**	**89**	**0.92**	**0.97**	**32.4**
All Vehicles		**1397**	**7.9**	**0.754**	**19.5**	**LOS B**	**89**	**0.90**	**0.87**	**37.5**

Pedestrian Movements

Mov No	Dem Flow (ped/h)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate
65	53	9.1	LOS A	0	0.68	0.68
67	53	12.0	LOS B	0	0.77	0.77
All Peds	**106**	**10.6**	**LOS B**	**0**	**0.72**	**0.72**

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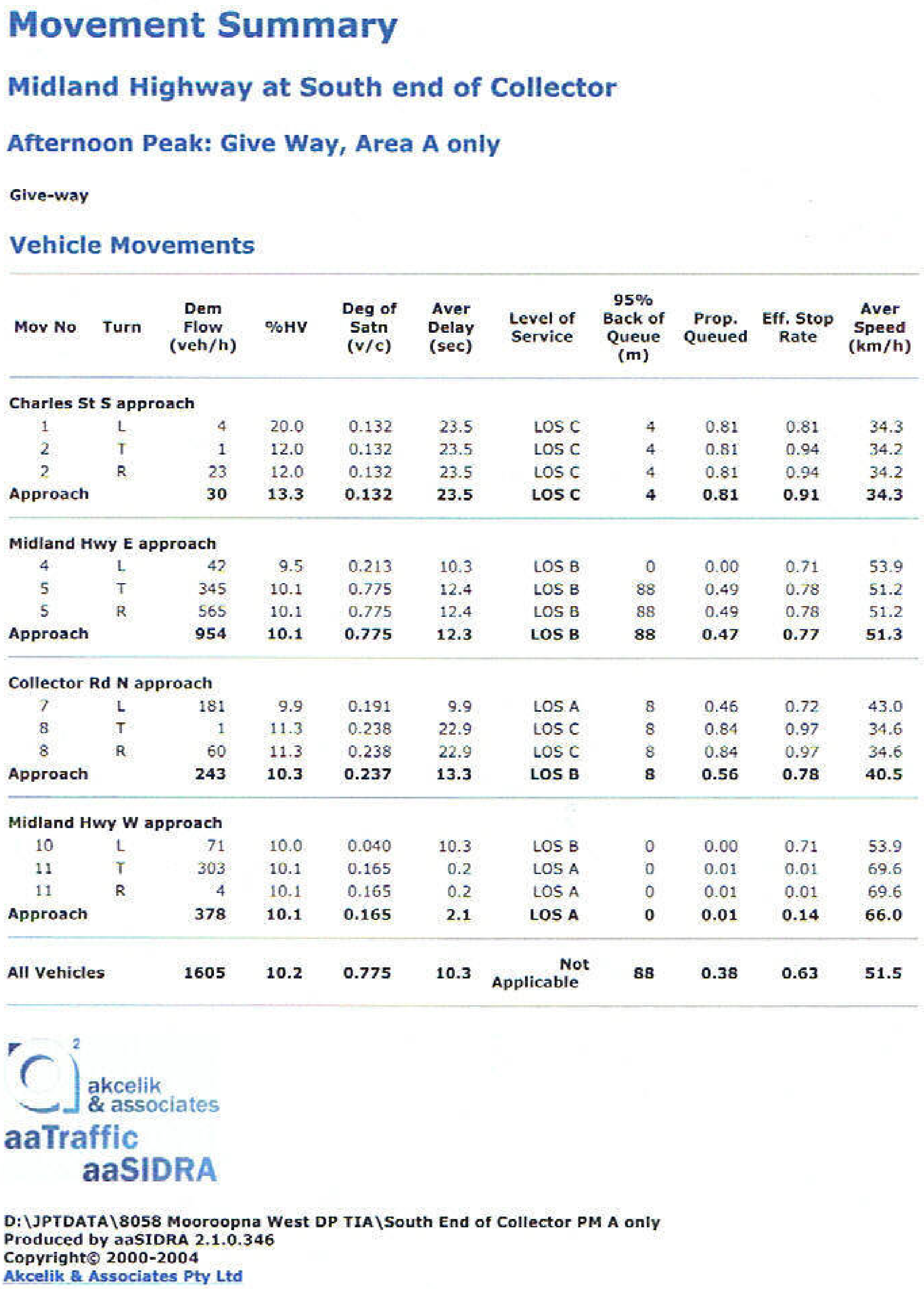

Movement Summary

Midland Highway at South end of Collector

Afternoon Peak: Give Way, Area A only

Give-way

Vehicle Movements

Mov No	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)
Charles St S approach										
1	L	4	20.0	0.132	23.5	LOS C	4	0.81	0.81	34.3
2	T	1	12.0	0.132	23.5	LOS C	4	0.81	0.94	34.2
2	R	23	12.0	0.132	23.5	LOS C	4	0.81	0.94	34.2
Approach		**30**	**13.3**	**0.132**	**23.5**	**LOS C**	**4**	**0.81**	**0.91**	**34.3**
Midland Hwy E approach										
4	L	42	9.5	0.213	10.3	LOS B	0	0.00	0.71	53.9
5	T	345	10.1	0.775	12.4	LOS B	88	0.49	0.78	51.2
5	R	565	10.1	0.775	12.4	LOS B	88	0.49	0.78	51.2
Approach		**954**	**10.1**	**0.775**	**12.3**	**LOS B**	**88**	**0.47**	**0.77**	**51.3**
Collector Rd N approach										
7	L	181	9.9	0.191	9.9	LOS A	8	0.46	0.72	43.0
8	T	1	11.3	0.238	22.9	LOS C	8	0.84	0.97	34.6
8	R	60	11.3	0.238	22.9	LOS C	8	0.84	0.97	34.6
Approach		**243**	**10.3**	**0.237**	**13.3**	**LOS B**	**8**	**0.56**	**0.78**	**40.5**
Midland Hwy W approach										
10	L	71	10.0	0.040	10.3	LOS B	0	0.00	0.71	53.9
11	T	303	10.1	0.165	0.2	LOS A	0	0.01	0.01	69.6
11	R	4	10.1	0.165	0.2	LOS A	0	0.01	0.01	69.6
Approach		**378**	**10.1**	**0.165**	**2.1**	**LOS A**	**0**	**0.01**	**0.14**	**66.0**
All Vehicles		**1605**	**10.2**	**0.775**	**10.3**	**Not Applicable**	**88**	**0.38**	**0.63**	**51.5**

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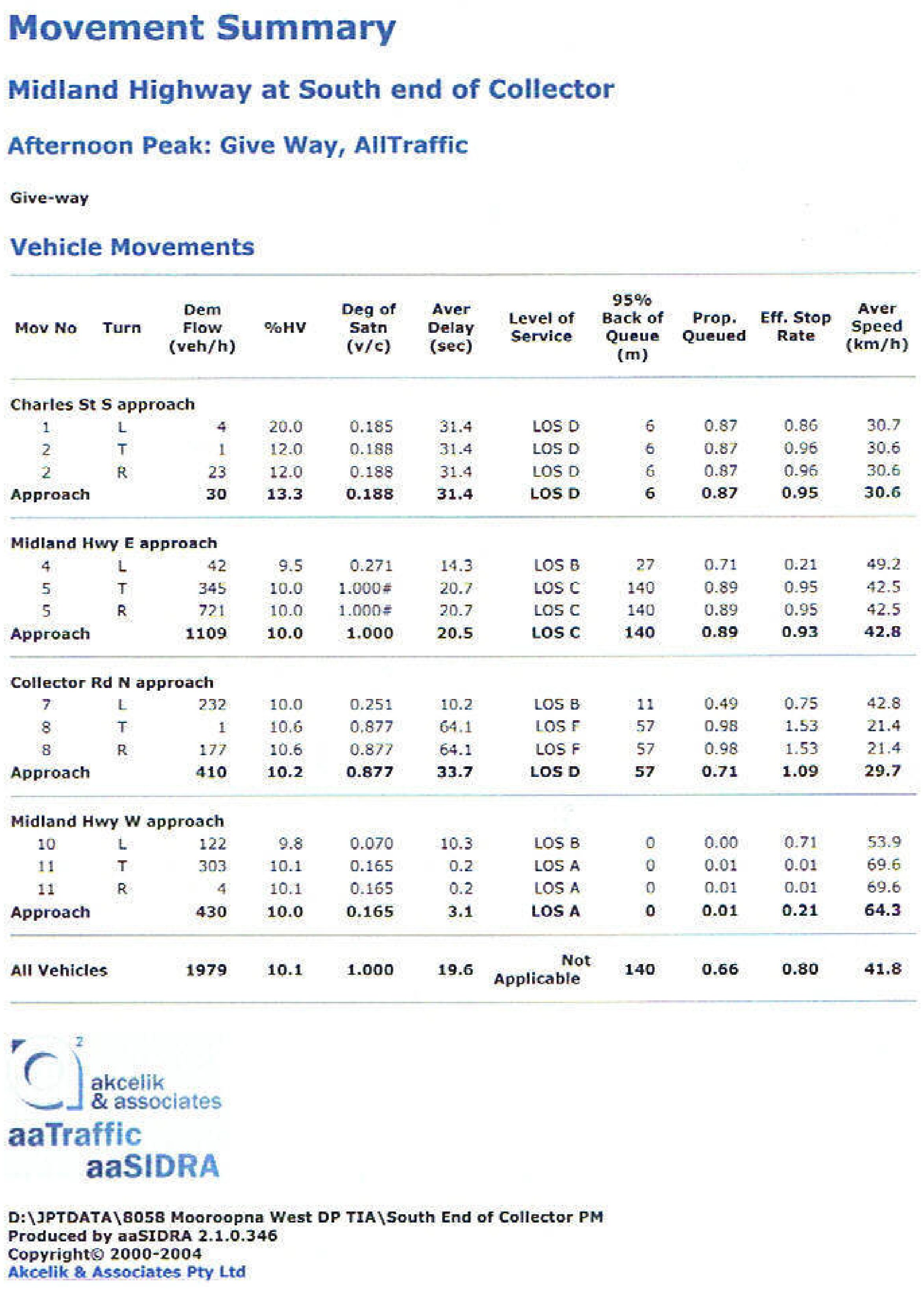

Movement Summary

Midland Highway at South end of Collector

Afternoon Peak: Give Way, AllTraffic

Give-way

Vehicle Movements

Mov No	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)
Charles St S approach										
1	L	4	20.0	0.185	31.4	LOS D	6	0.87	0.86	30.7
2	T	1	12.0	0.188	31.4	LOS D	6	0.87	0.96	30.6
2	R	23	12.0	0.188	31.4	LOS D	6	0.87	0.96	30.6
Approach		**30**	**13.3**	**0.188**	**31.4**	**LOS D**	**6**	**0.87**	**0.95**	**30.6**
Midland Hwy E approach										
4	L	42	9.5	0.271	14.3	LOS B	27	0.71	0.21	49.2
5	T	345	10.0	1.000#	20.7	LOS C	140	0.89	0.95	42.5
5	R	721	10.0	1.000#	20.7	LOS C	140	0.89	0.95	42.5
Approach		**1109**	**10.0**	**1.000**	**20.5**	**LOS C**	**140**	**0.89**	**0.93**	**42.8**
Collector Rd N approach										
7	L	232	10.0	0.251	10.2	LOS B	11	0.49	0.75	42.8
8	T	1	10.6	0.877	64.1	LOS F	57	0.98	1.53	21.4
8	R	177	10.6	0.877	64.1	LOS F	57	0.98	1.53	21.4
Approach		**410**	**10.2**	**0.877**	**33.7**	**LOS D**	**57**	**0.71**	**1.09**	**29.7**
Midland Hwy W approach										
10	L	122	9.8	0.070	10.3	LOS B	0	0.00	0.71	53.9
11	T	303	10.1	0.165	0.2	LOS A	0	0.01	0.01	69.6
11	R	4	10.1	0.165	0.2	LOS A	0	0.01	0.01	69.6
Approach		**430**	**10.0**	**0.165**	**3.1**	**LOS A**	**0**	**0.01**	**0.21**	**64.3**
All Vehicles		**1979**	**10.1**	**1.000**	**19.6**	**Not Applicable**	**140**	**0.66**	**0.80**	**41.8**

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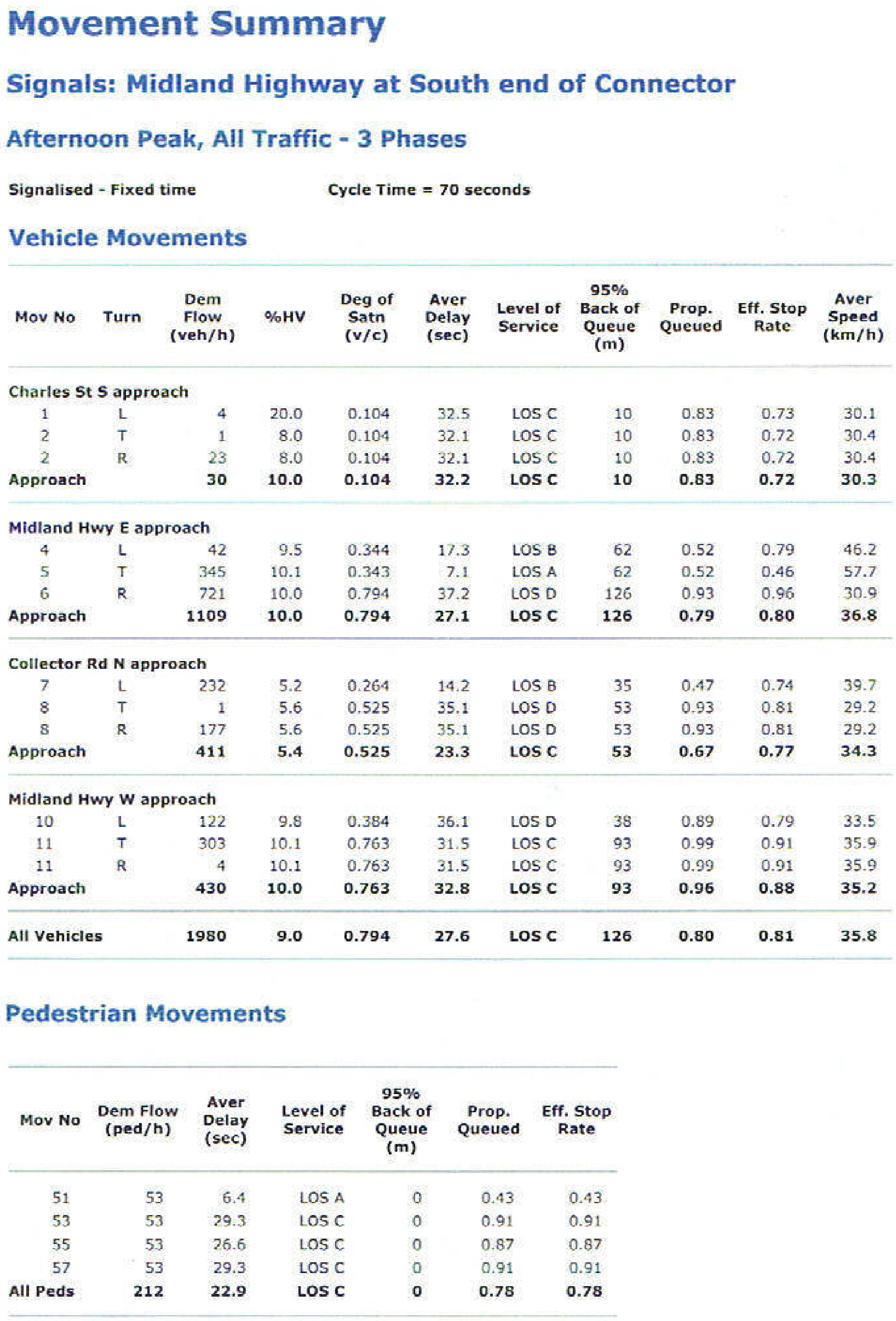

Movement Summary

Signals: Midland Highway at South end of Connector

Afternoon Peak, All Traffic - 3 Phases

Signalised - Fixed time **Cycle Time = 70 seconds**

Vehicle Movements

Mov No	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)
Charles St S approach										
1	L	4	20.0	0.104	32.5	LOS C	10	0.83	0.73	30.1
2	T	1	8.0	0.104	32.1	LOS C	10	0.83	0.72	30.4
2	R	23	8.0	0.104	32.1	LOS C	10	0.83	0.72	30.4
Approach		**30**	**10.0**	**0.104**	**32.2**	**LOS C**	**10**	**0.83**	**0.72**	**30.3**
Midland Hwy E approach										
4	L	42	9.5	0.344	17.3	LOS B	62	0.52	0.79	46.2
5	T	345	10.1	0.343	7.1	LOS A	62	0.52	0.46	57.7
6	R	721	10.0	0.794	37.2	LOS D	126	0.93	0.96	30.9
Approach		**1109**	**10.0**	**0.794**	**27.1**	**LOS C**	**126**	**0.79**	**0.80**	**36.8**
Collector Rd N approach										
7	L	232	5.2	0.264	14.2	LOS B	35	0.47	0.74	39.7
8	T	1	5.6	0.525	35.1	LOS D	53	0.93	0.81	29.2
8	R	177	5.6	0.525	35.1	LOS D	53	0.93	0.81	29.2
Approach		**411**	**5.4**	**0.525**	**23.3**	**LOS C**	**53**	**0.67**	**0.77**	**34.3**
Midland Hwy W approach										
10	L	122	9.8	0.384	36.1	LOS D	38	0.89	0.79	33.5
11	T	303	10.1	0.763	31.5	LOS C	93	0.99	0.91	35.9
11	R	4	10.1	0.763	31.5	LOS C	93	0.99	0.91	35.9
Approach		**430**	**10.0**	**0.763**	**32.8**	**LOS C**	**93**	**0.96**	**0.88**	**35.2**
All Vehicles		**1980**	**9.0**	**0.794**	**27.6**	**LOS C**	**126**	**0.80**	**0.81**	**35.8**

Pedestrian Movements

Mov No	Dem Flow (ped/h)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate
51	53	6.4	LOS A	0	0.43	0.43
53	53	29.3	LOS C	0	0.91	0.91
55	53	26.6	LOS C	0	0.87	0.87
57	53	29.3	LOS C	0	0.91	0.91
All Peds	**212**	**22.9**	**LOS C**	**0**	**0.78**	**0.78**

Appendix C JPT Addendum Traffic Report

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Mooroopna West Growth Corridor
North-South Collector Road,
Traffic Review

Addendum to Traffic Assessment Report

November 2008

CLIENT:

City of Greater Shepparton

Table of Contents

1. INTRODUCTION

Amendment C75 to the City of Greater Shepparton's Planning Scheme for the Mooroopna West Growth Corridor (MWGC) was considered during Panel hearings held at Mooroopna between 10 and 15 September 2008. In order for all parties to revise submissions aimed at resolving or narrowing issues in contention, the Panel decided to reconvene the hearing on 4 December 2008. To further assist in refining the submissions, the Panel provided its Preliminary Views in a table of issues and comments distributed with a letter from Department of Planning and Community Development dated 25 September 2008.

John Piper Traffic (JPT) initially undertook a detailed assessment of the traffic impacts of the proposed North-South Collector Road through the MWGC and presented its findings to the Panel in a report dated 10 September 2008. City of Greater Shepparton Council has now engaged JPT to undertake further investigations aimed at clarifying issues that arose during the hearing or were listed in the Panel's Preliminary Views document, specifically:

1. The ODP shows several access road connections from Precinct D to Echuca Road in addition to the proposed signalized intersection of Echuca Road with the North-South Road. The need and viability for these additional access points needed to be investigated;

2. The ODP shows a signalized intersection at the intersection of the North-South Road with Midland Highway at the current Charles Street junction. The requirement for signal control at this intersection required review;

3. The impact of traffic generated by the growth area on the operation of the existing signals at the Midland Highway/Echuca Road/Toolamba Road intersection needed to be investigated and any ameliorative actions identified;

4. Apportionment of the cost to provide new infrastructure items associated with the North-South Road needs to be reviewed, taking into consideration the projected share of usage by existing residents;

5. Access to the Archer Fields development by the Dennis Family is currently serviced by the existing local street network – primarily Kalimna Drive and Dennison Street onto Craigmuir Drive. As this development expands there will be a need to provide a connection from this area (Precinct C in MWGC) to MacIsaac Road. The trigger for this road connection needed to be identified.

1.1 Documentation

The documentation accessed for this assessment includes:

- Mooroopna West Growth Corridor North-South Road Traffic Investigation by Maunsell/AECOM dated November 2006;

- Mooroopna West Growth Corridor Outline Development Plan (ODP) by Maunsell/AECOM dated April 2007;

- Mooroopna West Growth Corridor Outline Development Contributions Plan (DCP) by Maunsell/AECOM dated April 2007;

- Mooroopna West Growth Corridor Outline Development Plan, traffic assessment by John Piper Traffic and statement to Panels Victoria dated 10 September 2008.

1.2 Technical References

The technical references used in the preparation of this assessment are:

- *Greater Shepparton Planning Scheme*, for local street design criteria;
- *ResCode,* the Victorian Government provisions governing the planning and building of residential developments dated August 2001, for local street design criteria;
- The *VicRoads Access Management Policies, May 2006 Version 1.02* for conditions relating to access to the arterial road network.

2. STATUS OF PROPOSAL

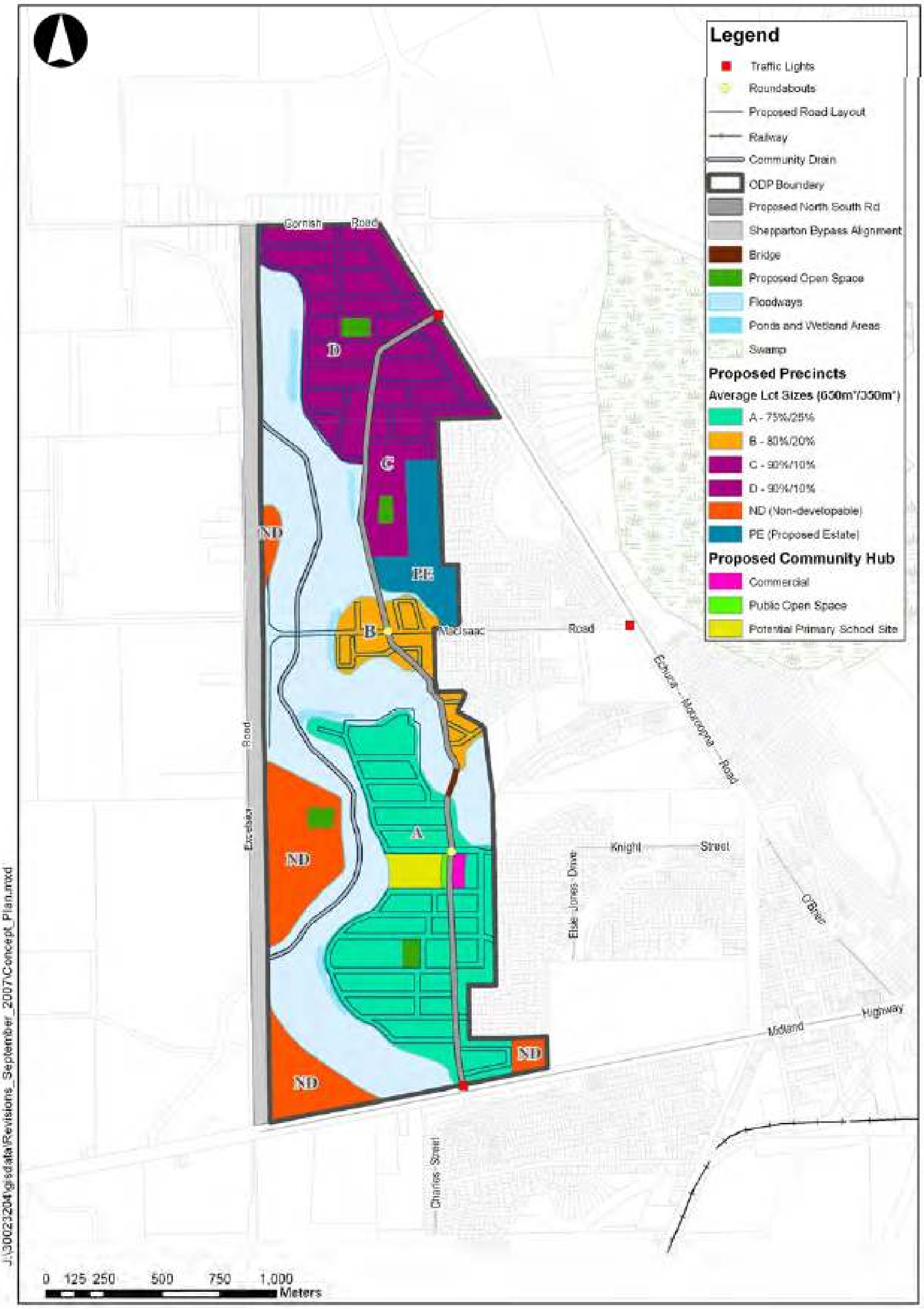


Figure 2.1: Mooroopna West Growth Corridor Outline Development Plan.

2.1 Precinct Lot Yield and Development Sequence

In setting the future development landscape for Mooroopna West, the original Maunsell report identified developable land via a series of "precincts". These precincts have been further refined to exclude non-developable land and identify the current "Archer Fields" Estate proposals (PE) within Precinct C. The precinct areas are shown in Figure 2.1 and summarized in the table in Figure 2.2 below.

Precinct	Gross Area (Ha)	Potential Lot Yield
A	67.16	798
B	15.65	197
C	16.22	190
D	51.97	608

Figure 2.2: MWGC Development Precincts.

It has also been assumed that Precincts B & C will fully develop over the next 10 years (by 2018), after which Precinct A will be progressively developed over the 10 year period to 2028. Development of Precinct D will not commence until completion of A and is expected to reach completion in about 2038.

2.2 Traffic Generation & Distribution

The above adjusted lot yield has been used to review the previous traffic generation estimates from each precinct, again using the average trip rate of 10 trips/dwelling/day and a peak hour volume approximating to 12% of the daily total.

Precinct and Access Point	AM				PM			
	IN (vph)		OUT (vph)		IN (vph)		OUT (vph)	
	Direction (to/from)		Direction (to/from)		Direction (to/from)		Direction (to/from)	
A at Midland Hwy	58 W	115 E	114 W	613 E	87 W	537 E	94 W	172 E
B & C at MacIsaac Rd	56 S	19 N	297 S	37 N	247 S	16 N	106 S	14 N
D at North-South Rd	58 S	29 N	467 S	58 N	368 S	51 N	157 S	44 N

Figure 2.3: Traffic Direction Distribution.

Other assumptions that have been made in the traffic generation modelling are:

- Negligible impact on Knight Street as it offers no trip length advantage and presents access problems at the Echuca-Mooroopna Road intersection;
- Leakage via Kalimna Drive/Craigmuir Drive minimised with traffic calming measures;
- 25 % leakage of traffic from Echuca Road through local streets in Mooroopna CBD to the east.

3. TRAFFIC ISSUES

Total specific traffic issues identified in the Introduction are discussed in the same sequence below.

3.1 Access to Echuca Road from Precinct "D"

VicRoads has verbally advised that it regards Echuca-Mooroopna Road as a limited access urban arterial road where the transportation function (safe and efficient movement of through traffic) is predominant, but where the access needs of adjacent land also require attention. As such the section of Echuca Road along Precinct D is covered by VicRoads Access Management Policy 2 (AMP 2) dated May 2006. This policy requires vehicle access to adjacent land to be limited and provided only through widely-spaced and controlled intersections (with some restricted intermediate minor local connections to streets or service roads).

The stated Performance Objectives for AMP 2 are:

- To minimise traffic flow interference and collisions associated with access movements on major urban roads;
- To provide for orderly development of, and vehicular access to, abutting land by allowing limited and well-planned minor local access connections between widely spaced controlled intersections.

Standards and Principal Characteristics include:

- Typically 80 km/h operation unimpeded by turning or crossing traffic except at nominated locations;
- Divided (or planned to be ultimately divided) cross section with a high level of control over intersections spacing, vehicle turns and crossing movements in accordance with the VicRoads drawings prepared for AMP 2 – Limited Access (Urban) Roads (reproduced below).

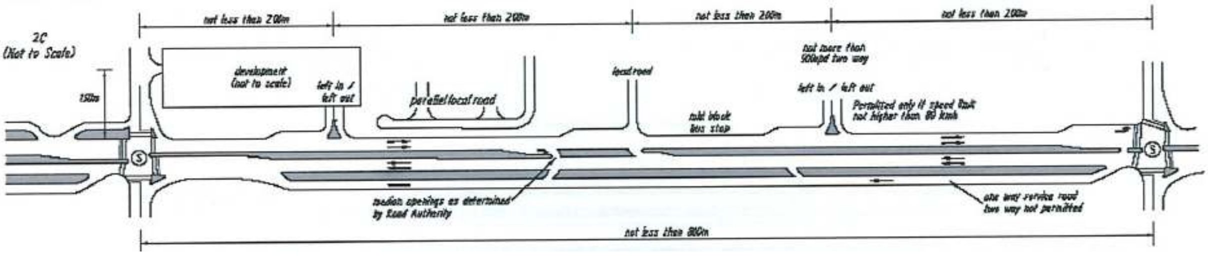


Figure 3.1 – Typical road layout for AMP 2 conditions.

The implications of the above requirements for access to/from Precinct D are as follows:

- Confirmation that the intersection treatment at the North-South Road is to be controlled by a roundabout or traffic signals and separated a minimum of 800m from nearby road junctions;
- Minor connections at not less than 200m apart and restricted to left-in left-out movements;
- No direct property access. Site access to be via one-way service roads or abutting streets;
- Should significant traffic divert via Cornish Road, it may also become necessary to signalise the intersection of Cornish Road with Echuca Road.

3.2 North-South Collector at Midland Highway

The Panel indicated support for the position of maintaining the North-South Road as a continuous route through the MWGC. As such the previously adopted traffic generation patterns have been retained and traffic estimates at the intersection of the North-South Road with Midland Highway adjusted as follows for year 2028 (anticipated completion of Precinct A):

- Peak hour estimates for the highway based on a count conducted by City of Greater Shepparton in December 2006 between Charles Street and Elsie Jones Drive (see count summary in Figure A1, Appendix A) and factored up to allow for traffic growth at 2% p.a.;
- Compared with results from a turning movement count at Midland Highway intersection with Echuca Road and Toolamba Road (see Section 3.3 below);
- Generation from the MWGC adjusted to take account of non-developable land (previous Precinct E) and no contribution from Precinct D;
- Generation from Charles Street, including full contribution from the Park Lane Estate (total of 64 lots in stages 1, 2 & 3 since 2004 to reach full development of this area).

The resultant traffic patterns, when analysed with SIDRA, indicated saturated conditions in both morning and afternoon peaks under Give Way control. The need to install signals at development of Precinct A is therefore confirmed and results in acceptable operating conditions summarised in Figure 3.2 (full Movement summaries are provided in Appendix B).

Time-frame	**Period**	**Degree of Saturation (X)**				**Average Delays (seconds)**				**95% Queue Length (m)**			
	Approach	**S**	**E**	**N**	**W**	**S**	**E**	**N**	**W**	**S**	**E**	**N**	**W**
2028 (Precincts A, B & C)	AM Peak	0.25	0.47	0.89	0.88	36	15	44	32	32	96	208	252
	PM Peak	0.20	0.86	0.40	0.86	36	27	29	31	21	169	40	203

Figure 3.2: Operation of North-South Road intersection with Midland Highway.

It is noted that the additional traffic from Stages 1, 2 & 3 of the Park Lane Estate is expected to peak at about 64vph and represents about 8% of the afternoon peak traffic generated by the MWGC at this intersection. It is suggested that this proportional traffic contribution extraneous to the MWGC could be used to adjust the DCP component for the signals cost at this site.

3.3 Impact on Midland Highway/ Echuca-Mooroopna Road Intersection

To undertake a more detailed review at this intersection, turning movement counts were conducted by JPT during the morning and afternoon peaks on 21 October 2008. The results of these counts are provided in Figure A4, Appendix A and used in the SIDRA analysis summarised in Figure 3.3 below.

The analysis has considered three time-frames, viz:

- Current conditions at 2008;
- After 10 years at 2018 assuming 2%p.a. growth in normal traffic and full development of Precincts B & C with 75% of generated traffic passing through this intersection;
- After 20 years at 2028 still assuming 2%p.a. traffic growth and full development of Precinct A.

Movement Summaries for the assessment of each of the above options are provided in Appendix B. Given the anticipated operating conditions near saturation at 2028, the scenario at 2038 (including Precinct D) was not explored.

Time-frame	Period	Degree of Saturation (X)				Average Delays (seconds)				95% Queue Length (m)			
	Approach	S	E	N	W	S	E	N	W	S	E	N	W
2008 (existing)	AM Peak	0.77	0.79	0.55	0.77	52	32	33	39	124	68	77	174
	PM Peak	0.73	0.72	0.72	0.71	46	33	34	46	92	143	47	116
2018 (with Precincts B & C)	AM Peak	0.85	0.76	0.83	0.88	53	43	43	46	156	92	169	243
	PM Peak	0.91	0.91	0.93	0.76	63	54	34	44	140	264	70	149
2028 (with A, B & C)	AM Peak	0.94	0.95	0.95	0.94	83	43	79	62	167	99	322	407
	PM Peak	0.91	0.90	0.92	0.64	74	53	51	39	148	337	105	152

Figure 3.3: Operating Characteristics at 10 year intervals.

3.3.1 Discussion

Existing Conditions:

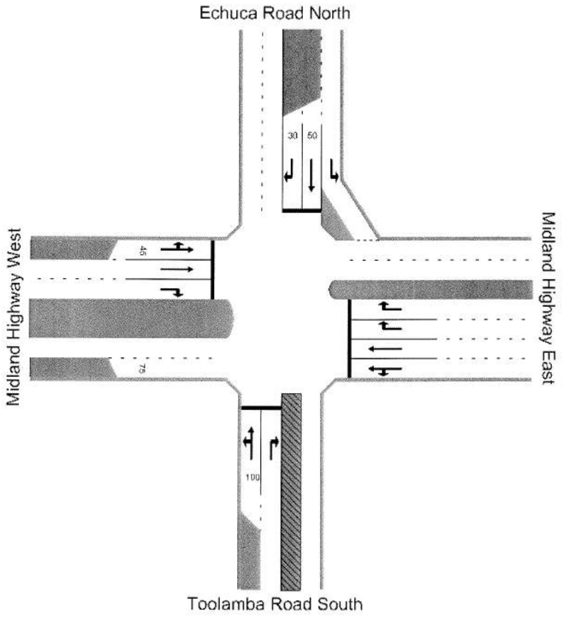
Current operating conditions are satisfactory with Degrees of Saturation below 0.8, delays under one minute and queue lengths reasonable, confining turn queues generally within existing turn lane dimensions.

Conditions at 2018:

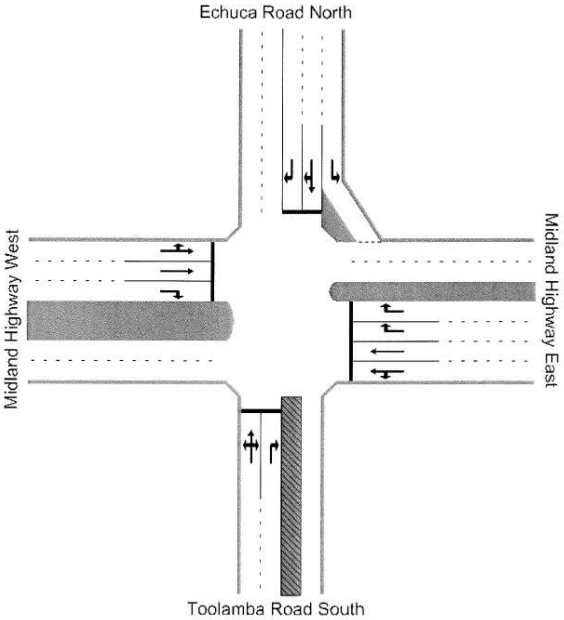
Initial analysis, adopting the current intersection layout, indicated saturated conditions in the north and east legs with the addition of traffic generated by Precincts B & C.

Intersection modifications that would need to be implemented to achieve manageable (albeit congested) operating conditions include introduction of dual turn lanes from the east (with matching dual departure lanes to the north) and realignment of the right turn lanes from the east and west through the median to create a non-conflicting fully controlled diamond turn (rather than the present overlapping right turns).

It is noted that the north approach is assumed to be directed into the left turn slip lane with provision for only short through and right turn lanes. The north approach may also require widening on the east side to accommodate the dominant queues for the left turn that will extend into the adjacent through lane.



Conditions at 2028:



Initial analysis, adopting the improved layout for 2018, indicated saturated conditions in all legs with the addition of traffic generated by Precinct A.

In order to achieve manageable operating conditions, the following changes were made to the layout:

- Widening for dual departure lanes to the west;
- Widening full length through and right turn lanes from the north, including the ability to conduct a right turn from the centre lane;
- Unrestricted dual lanes on the south approach;
- Extension of the dual right turn lanes in the east approach beyond the next median opening.

It should be noted that this model contains no short lanes (assumes all turn lanes are designed to contain the maximum 95% queue lengths) and results in Degrees of Saturation of 0.95 in the north and east legs in the AM Peak.

Conditions at 2038:

Given the elevated level of congestion at the 2028 time period, a further doubling of traffic from the north as a result of Precinct D would require a comprehensive review of this intersection and consideration of supplementary access routes to cater for anticipated traffic demands.

As many other changes to the road network are expected to have occurred in this 30 year period (construction of the Freight and Logistics Centre on Toolamba Road and the Shepparton Bypass being two major catalysts for altered traffic patterns at this intersection) it is suggested that the nature of network changes resulting from development of Precinct D should be delayed and reviewed closer to the development time frame.

3.4 Cost Apportionment for Traffic Infrastructure

3.4.1 North-South Road at Echuca Road

Discussion of the form of access in Section 3.1 indicates that VicRoads will require all traffic accessing Echuca Road from the north end of the MWGC to be concentrated at a single controlled intersection. As noted in the previous report, such an intersection would service almost exclusively traffic generated from Precinct D and all costs associated with traffic signals at this intersection should be distributed over the lots in this precinct.

3.4.2 MacIsaac Road at Echuca Road

Traffic generated by current development around MacIsaac Road would be able to safely access Echuca Road under Give Way control, with SIDRA assessments indicating that the right turn exit movement has the lowest level of service in the critical morning peak, with a Degree of Saturation of 0.92 and 95%ile queues of about 92m (or 15 cars). These conditions do not trigger congestion or crash warrants (no reported injury crashes in past 5 years) for the installation of traffic signals. Moreover, the current residential area is fully developed (no vacant lots) and the Primary School population is not expected to grow in the foreseeable future. The resultant absence of growth in traffic indicates that the area would not generate a demand for signals in the future.

As noted in the earlier report, development of Precinct B will cause saturation in the MacIsaac Road leg and require installation of signals. Precinct C will also be a major beneficiary of this traffic enhancement and it was suggested that the cost of signalisation be apportioned equally over all lots in Precincts B & C.

It may be assumed that a limited amount of dual occupancy will occur in the existing residential area through unit development and, on this basis, the total cost of signals could be discounted by a nominal 5% to allow for the extra traffic generated by this potential supplementary development in the existing residential area.

Alternatively, there are some 386 dwellings in the existing residential area serviced by MacIsaac Road. The anticipated lot yield from Precincts B & C is 387 (197 + 190 respectively). If the cost of signals is apportioned on the basis of projected share of usage (as suggested in the Panel Views document), the value of the contribution to be included in the DCP is 50% of total cost of signals. Although this is aligned with the Panel’s views, funding of the balance remains an issue as Council has no means of recouping this from existing landowners. Inclusion of 95% of the cost of this item in the DCP is recommended, to be distributed over lots in Precincts B and C.

3.4.3 Midland Highway at Echuca Road and Toolamba Road

As noted in Section 3.3, this intersection currently operates satisfactorily, with total peak traffic through-put being about 2,000vph. The SIDRA assessments indicate that this intersection is expected to require significant upgrading of the layout and signals installation to cater for the anticipated growth of traffic over the next 10 years, amounting to an increase in through-put of about 700vph in the morning and afternoon peak hours. This growth is due to:

- Natural increases in highway traffic, estimated at 2% per annum, that will contribute about 440vph;
- Completion of development in Precincts B and C that is estimated to generate about 260vph to total traffic at the site in the peak hours.

Although no estimate has been prepared for the cost of likely improvements, VicRoads has argued that any works at this intersection need to be included in the DCP for recovery from the developers.

An alternative position, again on the basis of projected share of usage, would see the cost of the improvements for the first stage being borne in the proportions 63% by VicRoads and 37% by the DCP (apportioned over the lots in Precincts B & C).

The second stage of upgrading caters for a further increase in total traffic through-put at the site over the next 10 years of 1,300vph in the peak hours, comprising contribution from:

- Natural increases in highway traffic at 2% per annum contributing approximately 600vph;
- Completion of Precinct A contributing 700vph.

Again, the share of usage would indicate a distribution of cost in the proportions 46% to VicRoads and 54% to the DCP (apportioned over lots in Precinct A).

It is recommended that the costs to be covered by the DCP adopt the above the above share of use proportions of 37% for works at stage 1 (10 years) and 54% of works at stage 2 (20 years).

3.4.4 Midland Highway at North-South Road/Charles Street

This T intersection currently operates satisfactorily, with relatively low levels of demand to/from the south. The analysis undertaken in Section 3.2 indicates that its conversion to signalised control will be required at the stage where Precinct A comes on stream. Although the MWGC is the trigger for the installation of signals and is the principal beneficiary of the treatment, there is an existing undeveloped area of the Park Lane Estate to the south that will also benefit from these works.

On the basis of projected share of usage an estimated 8% of the cost of signalisation can be ascribed to this additional traffic in Charles Street. The remainder of the cost should be included in the DCP, with 94% apportioned to Precinct A and 6% to Precincts B & C based on anticipated distribution of traffic. It is suggested that this be the basis for apportionment of this item in the DCP.

3.4.5 Connection from Archer Fields to MacIsaac Road

As noted earlier, the existing extent of the Archer Fields Development by the Dennis Family is primarily accessed along Kalimna Drive, with some traffic also filtering through Dennison Street and Craigmuir Drive. The classification of these connectors is Access Street for which the Planning Scheme (and ResCode) specifies the following limiting operating parameters:

Road Type	Dwellings Served	Traffic Volume	Target Speed	Distance between 20 km/h Slow Points	Cross Section
Access Street	Prefer <100 but up to 200	1000vpd to 2000vpd	30km/h to 40km/h	75 to 100m 100m to 140m	5.0 – 5.5m (4m verges) 7.0 – 7.5m (4.5m verges)

Figure 3.4: Access Street Characteristics.

Based on current traffic counts supplied by City of Shepparton (see count data in Figures A2 & A3, Appendix A), both Kalimna Drive and Craigmuir Drive operate towards the upper end of the preferred traffic range (i.e. 650 - 1,000vpd). This includes traffic generated within the tributary street system and by Stages 1 and 2 of the Archer Fields development that are excluded from the calculations for Precinct C.

Full development of the Archer Fields Estate (Precinct C) is expected to generate the following additional traffic:

- Stages 3, 4, 7 & part 8 and the retirement village (adopting 4 trips/unit) = 1,450vpd along Kalimna Drive;
- Stages 5, 6, 9 and part 8 = 720vpd along Dennison Street and Craigmuir Drive.

It is considered that a connection to MacIsaac Road should be constructed and traffic calming measures (slow points) installed in Kalimna Drive to discourage use of this route before traffic volumes in Kalimna Drive reach the 2,000vpd threshold value prescribed in the Planning Scheme. On the assumption that construction of the retirement village proceeds at an early stage, the noted traffic measures should be implemented before commencing Stages 7 and 8 of Archer Fields.

Even though the 2,000vpd threshold is not expected to be reached in Dennison Street and Craigmuir Drive under the above scenario, it is recommended that these streets also be included in the traffic calming program to prevent undesirable diversion of traffic between Precinct C and Echuca Road.

Although the Archer Fields Estate provides the trigger for this link to MacIsaac Road and contributes the majority of traffic, there are other areas in the MWGC that benefit from the road connection.

Based on total estimated usage, it is suggested that costs for construction of the link and traffic calming treatments be apportioned as follows:

- Precinct B: 13% (equivalent of 13 abutting lots + 15% of traffic from remaining 184 lots);
- Precinct C: 58% (traffic from 164 lots + retirement village);
- Precinct D: 29% (15% of traffic from 608 lots).

4. SUMMARY

The following conclusions are drawn from the analysis undertaken above:

4.1 Access to Echuca Road at Precinct D

In order to comply with the VicRoads Access Policy, access to Precinct D to/from Echuca Road should be confined to a single point at the connection with the North-South Road and controlled by signals (or a roundabout). Supplementary minor access points may be provided but need to be at least 200m apart and movements restricted to left-in left-out only.

4.2 Midland Highway junction with North-South Road

Updated traffic counts confirm that this intersection requires signalised control to accompany development of Precinct A.

4.3 Impact on signals at Midland Hwy/Echuca Rd/Toolamba Rd

The existing intersection layout and signals operation will require major upgrading to cater for traffic growth and anticipated additional generation from Precincts B & C over the next 10 year time frame. The works include provision of:

- Dual right turn lanes from the east;
- Dual departure lanes to the north;
- Realignment of the right turn lanes from the east and west through the median to allow a conventional diamond turn to take place;
- Possible widening of the north approach for increased left turn queue storage.

The addition of traffic from Precinct A over the following 10 years to 2028 is expected to require further upgrading of this intersection comprising:

- Widening of all carriageways to achieve two unobstructed approach and departure lanes in every leg (except the south departure);
- Additional widening of the north approach to cater for left turn queues.

Assessment of the operation of this intersection at 2038 (full development of Precinct D) was not undertaken and is recommended to be deferred.

4.4 Apportionment of External Infrastructure Costs

Signalisation of the North-South Road connection to Echuca Road is considered a cost that should be totally included in the DCP, with these costs distributed over the lots in Precinct D.

The provision of signals at MacIsaac Road should also be an inclusion in the DCP. However, there is potential for a small contribution to traffic growth from the existing residential development and the full cost could be discounted by about 5%. The remaining costs should be distributed over lots in Precincts B & C.

The majority of upgrading works at Midland Highway and Echuca Road/Toolamba Road intersection are assessed to be required as a result of normal traffic growth over the next 10 year and 20 year time-frames. As such the maximum contribution to these works from the DCP should be 37% (distributed over lots in Precincts B & C) for the first stage (by 2018) and 54% (distributed over lots in Precinct A) for the second stage of works (by 2028).

As noted in Section 3.3.1, the anticipated extremely poor operating conditions at this intersection by 2038 will be influenced by a number of major impacting factors, only one of which being traffic from Precinct D. No potential improvements or estimate of apportionment have been prepared to cater for this stage.

The provision of signals at the North-South Road connection to Midland Highway should also be an inclusion in the DCP. However, there is a small contribution to traffic growth from the currently undeveloped area of the Park Lane Estate and the full cost could be discounted by about 8% in favour of these beneficiaries. It is suggested that the remainder be distributed over lots in Precincts A (94%), B & C (6%).

4.5 Access from Archer Fields to MacIsaac Road

In order to maintain traffic levels in Kalimna Drive and Craigmuir Drive within the parameters for this class of road, it is recommended that the traffic connection to MacIsaac Road and accompanying traffic calming treatments in Kalimna and Craigmuir Drives be provided before commencement of Stage 7 of Archer Fields Estate. It is suggested that the DCP apportion the costs of constructing the connection to MacIsaac Road (and the calming treatments) to the benefiting precincts in the following proportions: B - 13%, C - 58% and D - 29%.

APPENDIX A

TRAFFIC COUNT DATA

CITY OF GREATER SHEPPARTON

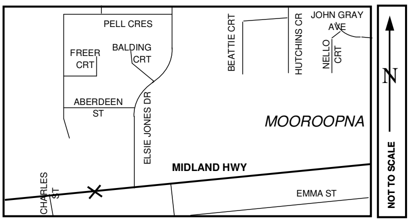
SINGLE DAY TRAFFIC COUNT SUMMARY

STREET / ROAD
Midland Hwy, Mooroopna

LOCATION
between Charles St and Elsie Jones Dr

FILENAME- **midl1912.ec6**

MAP



DATE
20 December 2006

DAY
Wednesday

SPEED ZONE
70 km/h

TOTAL VOLUMES

HOUR	West bound	East bound	Both Ways Combined
0000-0100	28	14	42
0100-0200	20	15	35
0200-0300	5	6	11
0300-0400	9	13	22
0400-0500	20	21	41
0500-0600	116	92	208
0600-0700	211	182	393
0700-0800	319	340	659
0800-0900	274	465	739
0900-1000	248	386	634
1000-1100	262	346	608
1100-1200	316	355	671
1200-1300	321	302	623
1300-1400	347	282	629
1400-1500	351	291	642
1500-1600	412	376	788
1600-1700	425	390	815
1700-1800	484	379	863
1800-1900	355	268	623
1900-2000	205	188	393
2000-2100	155	122	277
2100-2200	156	112	268
2200-2300	136	65	201
2300-2400	78	50	128
12hour (7-19)	4114	4180	8294
16hour (6-22)	4841	4784	9625
18hour (6-24)	5055	4899	9954
24hour (0-24)	**5253**	**5060**	**10313**
AM peak hour	0700-0800	0800-0900	0800-0900
volume	319	465	739
PM peak hour	1700-1800	1600-1700	1700-1800
volume	484	390	863

NOTES

SPEED ANALYSIS

HOUR	West bound		East bound		Both Ways Combined	
	MEAN	85%ile	MEAN	85%ile	MEAN	85%ile
0000-0100	70.0	79.9	69.3	77.0	69.8	79.9
0100-0200	70.8	74.2	79.7	87.1	74.6	87.1
0200-0300	71.7	0.0	81.9	0.0	77.3	82.8
0300-0400	80.4	0.0	73.1	88.6	76.1	88.6
0400-0500	74.7	81.0	73.8	81.4	74.2	81.4
0500-0600	70.7	81.4	73.3	79.6	71.9	80.6
0600-0700	71.6	82.1	73.4	81.0	72.4	81.7
0700-0800	68.0	75.6	70.7	77.0	69.4	76.7
0800-0900	70.1	76.0	67.6	73.1	68.5	74.2
0900-1000	68.5	74.9	68.4	74.5	68.4	74.5
1000-1100	70.3	76.7	70.2	75.6	70.2	76.3
1100-1200	69.5	75.2	68.7	73.8	69.1	74.5
1200-1300	69.6	76.3	68.6	75.6	69.1	76.0
1300-1400	69.5	75.2	68.5	76.3	69.1	75.6
1400-1500	68.4	74.2	69.4	75.6	68.9	74.9
1500-1600	68.6	73.8	69.1	74.5	68.8	74.2
1600-1700	67.8	74.2	68.5	75.2	68.1	74.9
1700-1800	69.3	74.5	68.6	74.5	69.0	74.5
1800-1900	71.0	76.7	69.7	76.7	70.4	76.7
1900-2000	68.2	74.5	70.1	75.2	69.1	74.9
2000-2100	68.2	73.8	69.4	77.0	68.7	74.9
2100-2200	66.4	72.0	66.7	72.0	66.5	72.0
2200-2300	66.2	73.1	65.9	72.7	66.1	73.1
2300-2400	67.0	72.4	70.1	76.3	68.2	74.5
TOTAL	69.1	75.2	69.2	75.6	**69.1**	**75.6**

SPEED VOLUMES

SPEED (km/h)	West bound		East bound		Both Ways Combined	
	VOL	%	VOL	%	VOL	%
00-40	29	0.6%	23	0.5%	52	0.5%
41-50	92	1.8%	54	1.1%	146	1.4%
51-60	297	5.7%	333	6.6%	630	6.1%
61-70	2459	46.8%	2336	46.2%	4795	46.5%
71-80	2101	40.0%	2027	40.1%	4128	40.0%
81-90	242	4.6%	257	5.1%	499	4.8%
91-100	26	0.5%	22	0.4%	48	0.5%
101-110	5	0.1%	7	0.1%	12	0.1%
111-120	2	0.0%	1	0.0%	3	0.0%
121-130	0	0.0%	0	0.0%	0	0.0%
131-140	0	0.0%	0	0.0%	0	0.0%
141-150	0	0.0%	0	0.0%	0	0.0%

CLASS VOLUMES

CLASS	West bound		East bound		Both Ways Combined		CLASS	LENGTH (m)	VEHICLE TYPE	AXLES	AXLE GROUPS
	VOL	%	VOL	%	VOL	%					
1	4734	90.1%	4461	88.2%	9195	89.2%	1	SHORT <5.5	SHORT VEHICLE	2	1 or 2
2	106	2.0%	96	1.9%	202	2.0%	2	MEDIUM 6.5 - 14.5	SHORT VEHICLE TOWING	3 - 5	3
3	167	3.2%	156	3.1%	323	3.1%	3		TWO AXLE TRUCK OR BUS	2	2
4	46	0.9%	179	3.5%	225	2.2%	4		THREE AXLE TRUCK OR BUS	3	2
5	5	0.1%	24	0.5%	29	0.3%	5		FOUR AXLE TRUCK	>3	2
6	2	0.0%	3	0.1%	5	0.0%	6	LONG 11.5 - 19.0	3 AXLE ARTICULATED VEHICLE	3	3
7	28	0.5%	19	0.4%	47	0.5%	7		4 AXLE ARTICULATED VEHICLE	4	>2
8	13	0.2%	18	0.4%	31	0.3%	8		5 AXLE ARTICULATED VEHICLE	5	>2
9	119	2.3%	92	1.8%	211	2.0%	9		6 AXLE ARTICULATED VEHICLE	>5	>2
10	33	0.6%	12	0.2%	45	0.4%	10	MEDIUM COMBINATION	B-DOUBLE	>6	4
11	0	0.0%	0	0.0%	0	0.0%	11	17.5-36.5	DOUBLE ROAD TRAIN	>6	5 or 6
12	0	0.0%	0	0.0%	0	0.0%	12	>33.0	TRIPLE ROAD TRAIN	>6	>6
13	0	0.0%	0	0.0%	0	0.0%	13	-	ALL OTHER VEHICLES	-	-
Commercial (Class 3-12)	413	7.9%	503	9.9%	916	**8.9%**					

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

Figure A1: Traffic Count for Midland Highway west of Charles Street

CITY OF GREATER SHEPPARTON

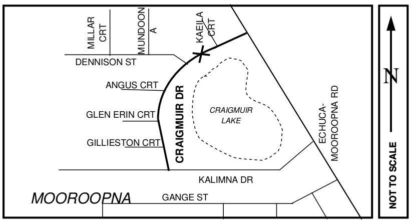
SINGLE DAY TRAFFIC COUNT SUMMARY

STREET / ROAD
Craigmuir Dr, Mooroopna

LOCATION
between Dennison St and Kaeila Crt

FILENAME- **crai0905.06**

MAP



DATE
10 May 2006

DAY
Wednesday

SPEED ZONE
50 km/h

TOTAL VOLUMES

HOUR	West bound	East bound	Both Ways Combined
0000-0100	1	0	1
0100-0200	0	0	0
0200-0300	0	1	1
0300-0400	1	0	1
0400-0500	0	2	2
0500-0600	1	6	7
0600-0700	5	18	23
0700-0800	4	28	32
0800-0900	13	53	66
0900-1000	14	20	34
1000-1100	13	21	34
1100-1200	15	15	30
1200-1300	13	12	25
1300-1400	11	10	21
1400-1500	23	13	36
1500-1600	36	31	67
1600-1700	30	21	51
1700-1800	57	24	81
1800-1900	29	23	52
1900-2000	23	14	37
2000-2100	15	8	23
2100-2200	9	8	17
2200-2300	13	9	22
2300-2400	5	1	6
12hour (7-19)	258	271	529
16hour (6-22)	310	319	629
18hour (6-24)	328	329	657
24hour (0-24)	**331**	**338**	**669**
AM peak hour	1100-1200	0800-0900	0800-0900
volume	15	53	66
PM peak hour	1700-1800	1500-1600	1700-1800
volume	57	31	81

NOTES

SPEED ANALYSIS

HOUR	West bound		East bound		Both Ways Combined	
	MEAN	85%ile	MEAN	85%ile	MEAN	85%ile
0000-0100	45.0	48.5	0.0	0.0	45.0	48.5
0100-0200	0.0	0.0	0.0	0.0	0.0	0.0
0200-0300	0.0	0.0	45.0	48.5	45.0	48.5
0300-0400	20.0	34.0	0.0	0.0	20.0	34.0
0400-0500	0.0	0.0	20.0	34.0	20.0	34.0
0500-0600	20.0	34.0	34.2	51.0	32.2	49.8
0600-0700	20.0	34.0	27.5	45.8	25.9	43.9
0700-0800	26.3	44.0	28.4	46.0	28.1	45.8
0800-0900	23.8	40.3	25.4	43.0	25.1	42.6
0900-1000	28.9	45.8	26.8	45.0	27.7	45.4
1000-1100	26.5	45.3	27.6	45.7	27.2	45.6
1100-1200	24.0	39.2	27.3	45.8	25.7	43.8
1200-1300	28.5	46.8	25.8	42.0	27.2	45.6
1300-1400	27.7	46.8	20.0	34.0	24.0	39.7
1400-1500	24.3	41.4	28.5	46.8	25.8	43.7
1500-1600	27.2	45.1	28.4	45.9	27.8	45.5
1600-1700	31.7	51.0	31.4	52.1	31.6	51.5
1700-1800	26.0	43.8	25.0	41.3	25.7	43.2
1800-1900	26.4	44.4	28.7	51.8	27.4	46.5
1900-2000	28.5	47.1	24.3	39.7	26.9	45.8
2000-2100	30.3	49.2	27.5	48.0	29.3	48.9
2100-2200	20.0	34.0	30.6	49.0	25.0	42.3
2200-2300	27.3	45.3	27.8	46.5	27.5	45.7
2300-2400	25.0	42.5	45.0	48.5	28.3	45.5
TOTAL	26.9	45.1	27.3	45.7	**27.1**	**45.4**

SPEED VOLUMES

SPEED	West bound		East bound		Both Ways Combined	
(km/h)	VOL	%	VOL	%	VOL	%
00-40	249	75.2%	250	74.0%	499	74.6%
41-50	63	19.0%	65	19.2%	128	19.1%
51-60	16	4.8%	19	5.6%	35	5.2%
61-70	3	0.9%	4	1.2%	7	1.0%
71-80	0	0.0%	0	0.0%	0	0.0%
81-90	0	0.0%	0	0.0%	0	0.0%
91-100	0	0.0%	0	0.0%	0	0.0%
101-110	0	0.0%	0	0.0%	0	0.0%
111-120	0	0.0%	0	0.0%	0	0.0%
121-130	0	0.0%	0	0.0%	0	0.0%
131-140	0	0.0%	0	0.0%	0	0.0%
141-150	0	0.0%	0	0.0%	0	0.0%

CLASS VOLUMES

CLASS	West bound		East bound		Both Ways Combined		CLASS	LENGTH (m)	VEHICLE TYPE	AXLES	AXLE GROUPS
	VOL	%	VOL	%	VOL	%					
1	309	93.4%	290	85.8%	599	89.5%	1	SHORT <5.5	SHORT VEHICLE	2	1 or 2
2	8	2.4%	7	2.1%	15	2.2%	2	MEDIUM 6.5 - 14.5	SHORT VEHICLE TOWING	3 - 5	3
3	7	2.1%	13	3.8%	20	3.0%	3		TWO AXLE TRUCK OR BUS	2	2
4	1	0.3%	17	5.0%	18	2.7%	4		THREE AXLE TRUCK OR BUS	3	2
5	2	0.6%	1	0.3%	3	0.4%	5		FOUR AXLE TRUCK	>3	2
6	0	0.0%	0	0.0%	0	0.0%	6	LONG 11.5 - 19.0	3 AXLE ARTICULATED VEHICLE	3	3
7	1	0.3%	3	0.9%	4	0.6%	7		4 AXLE ARTICULATED VEHICLE	4	>2
8	1	0.3%	0	0.0%	1	0.1%	8		5 AXLE ARTICULATED VEHICLE	5	>2
9	0	0.0%	0	0.0%	0	0.0%	9		6 AXLE ARTICULATED VEHICLE	>5	>2
10	0	0.0%	0	0.0%	0	0.0%	10	MEDIUM COMBINATION 17.5-36.5	B-DOUBLE	>6	4
11	0	0.0%	0	0.0%	0	0.0%	11		DOUBLE ROAD TRAIN	>6	5 or 6
12	0	0.0%	0	0.0%	0	0.0%	12	>33.0	TRIPLE ROAD TRAIN	>6	>6
13	2	0.6%	7	2.1%	9	1.3%	13	-	ALL OTHER VEHICLES	-	-
Commercial (Class 3-12)	12	3.6%	34	10.1%	46	**6.9%**					

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

Figure A2: Traffic Count for Craigmuir Drive

CITY OF GREATER SHEPPARTON

SINGLE DAY TRAFFIC COUNT SUMMARY

STREET / ROAD

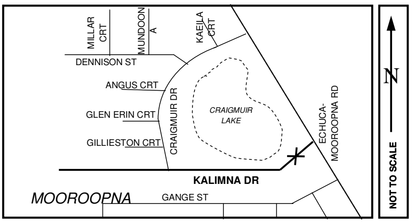
Kalimna Dr, Mooroopna

LOCATION

just west of Echuca Rd

FILENAME- **kali0905.ec6**

MAP



DATE

9 May 2006

DAY

Tuesday

SPEED ZONE

50 km/h

TOTAL VOLUMES

HOUR	West bound	East bound	Both Ways Combined
0000-0100	3	2	5
0100-0200	1	0	1
0200-0300	0	0	0
0300-0400	0	0	0
0400-0500	0	2	2
0500-0600	1	5	6
0600-0700	6	22	28
0700-0800	12	28	40
0800-0900	19	42	61
0900-1000	16	20	36
1000-1100	16	14	30
1100-1200	14	16	30
1200-1300	23	15	38
1300-1400	16	10	26
1400-1500	14	18	32
1500-1600	33	19	52
1600-1700	36	20	56
1700-1800	44	25	69
1800-1900	28	20	48
1900-2000	12	8	20
2000-2100	15	9	24
2100-2200	4	2	6
2200-2300	9	7	16
2300-2400	4	1	5
12hour (7-19)	271	247	518
16hour (6-22)	308	288	596
18hour (6-24)	321	296	617
24hour (0-24)	**326**	**305**	**631**
AM peak hour	0800-0900	0800-0900	0800-0900
volume	19	42	61
PM peak hour	1700-1800	1700-1800	1700-1800
volume	44	25	69

NOTES

SPEED ANALYSIS

HOUR	West bound		East bound		Both Ways Combined	
	MEAN	85%ile	MEAN	85%ile	MEAN	85%ile
0000-0100	46.0	0.0	45.1	0.0	45.6	0.0
0100-0200	42.5	0.0	0.0	0.0	42.5	0.0
0200-0300	0.0	0.0	0.0	0.0	0.0	0.0
0300-0400	0.0	0.0	0.0	0.0	0.0	0.0
0400-0500	0.0	0.0	42.4	0.0	42.4	0.0
0500-0600	21.4	0.0	46.0	0.0	41.9	0.0
0600-0700	37.2	0.0	43.1	49.7	41.8	48.2
0700-0800	37.1	43.9	39.9	46.4	39.1	46.4
0800-0900	34.7	38.9	42.2	47.2	39.9	46.1
0900-1000	36.4	42.1	38.2	46.1	37.4	43.9
1000-1100	33.6	39.6	36.2	40.3	34.8	40.3
1100-1200	36.1	42.5	38.1	47.2	37.2	43.9
1200-1300	38.3	42.1	44.7	49.3	40.8	46.4
1300-1400	38.9	43.6	36.3	0.0	37.9	43.2
1400-1500	33.8	42.5	43.0	47.9	39.0	47.2
1500-1600	36.4	42.1	41.0	45.7	38.1	44.3
1600-1700	37.6	41.4	43.9	49.7	39.9	46.1
1700-1800	39.4	44.6	40.9	43.6	39.9	45.0
1800-1900	39.9	45.7	43.9	49.7	41.6	46.8
1900-2000	35.5	42.8	45.3	0.0	39.4	46.4
2000-2100	42.2	46.4	47.3	0.0	44.1	49.0
2100-2200	41.5	0.0	47.7	0.0	43.6	0.0
2200-2300	42.1	0.0	45.5	0.0	43.6	47.5
2300-2400	38.9	0.0	44.6	0.0	40.0	0.0
TOTAL	37.7	43.2	41.7	48.2	**39.6**	**46.1**

SPEED VOLUMES

SPEED	West bound		East bound		Both Ways Combined	
(km/h)	VOL	%	VOL	%	VOL	%
00-40	196	60.1%	109	35.7%	305	48.3%
41-50	128	39.3%	168	55.1%	296	46.9%
51-60	2	0.6%	28	9.2%	30	4.8%
61-70	0	0.0%	0	0.0%	0	0.0%
71-80	0	0.0%	0	0.0%	0	0.0%
81-90	0	0.0%	0	0.0%	0	0.0%
91-100	0	0.0%	0	0.0%	0	0.0%
101-110	0	0.0%	0	0.0%	0	0.0%
111-120	0	0.0%	0	0.0%	0	0.0%
121-130	0	0.0%	0	0.0%	0	0.0%
131-140	0	0.0%	0	0.0%	0	0.0%
141-150	0	0.0%	0	0.0%	0	0.0%

CLASS VOLUMES

CLASS	West bound		East bound		Both Ways Combined		CLASS	LENGTH (m)	VEHICLE TYPE	AXLES	AXLE GROUPS
	VOL	%	VOL	%	VOL	%					
1	294	90.2%	284	93.1%	578	91.6%	1	SHORT <5.5	SHORT VEHICLE	2	1 or 2
2	6	1.8%	6	2.0%	12	1.9%	2		SHORT VEHICLE TOWING	3 - 5	3
3	13	4.0%	1	0.3%	14	2.2%	3	MEDIUM	TWO AXLE TRUCK OR BUS	2	2
4	12	3.7%	12	3.9%	24	3.8%	4	6.5 - 14.5	THREE AXLE TRUCK OR BUS	3	2
5	0	0.0%	0	0.0%	0	0.0%	5		FOUR AXLE TRUCK	>3	2
6	1	0.3%	2	0.7%	3	0.5%	6		3 AXLE ARTICULATED VEHICLE	3	3
7	0	0.0%	0	0.0%	0	0.0%	7	LONG	4 AXLE ARTICULATED VEHICLE	4	>2
8	0	0.0%	0	0.0%	0	0.0%	8	11.5 - 19.0	5 AXLE ARTICULATED VEHICLE	5	>2
9	0	0.0%	0	0.0%	0	0.0%	9		6 AXLE ARTICULATED VEHICLE	>5	>2
10	0	0.0%	0	0.0%	0	0.0%	10	MEDIUM COMBINATION	B-DOUBLE	>6	4
11	0	0.0%	0	0.0%	0	0.0%	11	17.5-36.5	DOUBLE ROAD TRAIN	>6	5 or 6
12	0	0.0%	0	0.0%	0	0.0%	12	>33.0	TRIPLE ROAD TRAIN	>6	>6
13	0	0.0%	0	0.0%	0	0.0%	13	-	ALL OTHER VEHICLES	-	-
Commercial (Class 3-12)	26	8.0%	15	4.9%	41	**6.5%**					

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

Figure A3: Traffic Count for Kalimna Drive

TURNING MOVEMENT COUNT: SUMMARY FOR VEHICLES

Intersection of Echuca Road and Midland Highway (McLennan Street) and Toolamba Road

Count Date : **Tuesday, 21st October 2008**

VicRoads Country v6 Map 672 Ref. F12

Count Interval(s) : **From 8:00 AM to 10:00 AM**
From 3:00 PM to 5:00 PM

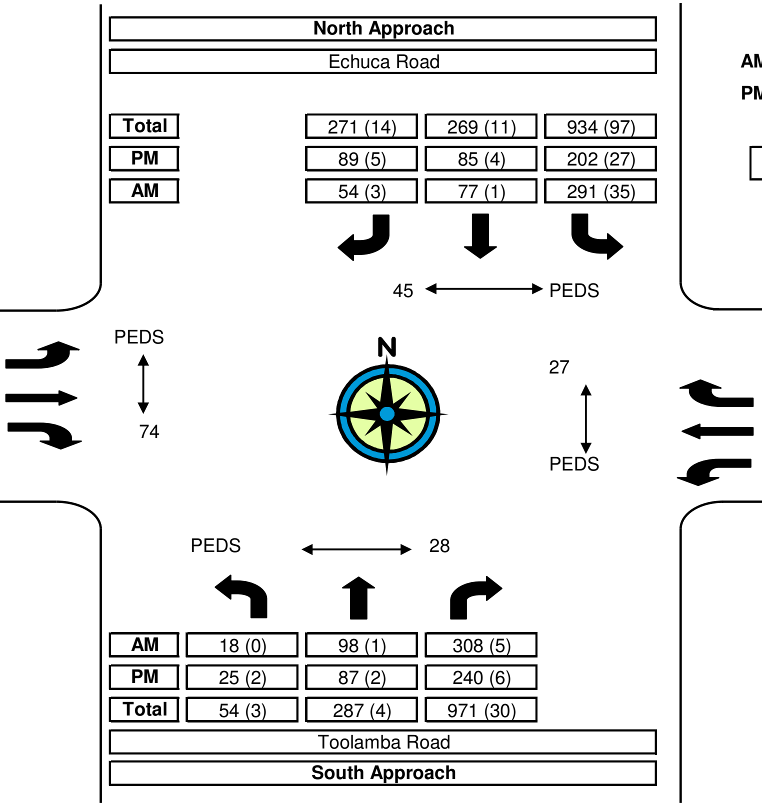
AM Peak Hour : 8:00 AM to 9:00 AM
PM Peak Hour : 3:15 PM to 4:15 PM

Total Vehicles (CV)

TOTAL ARRIVING TO APPROACH

	Total	**PM**	**AM**
North	1474 (122)	376 (36)	422 (39)
East	2759 (195)	901 (44)	469 (57)
South	1312 (37)	352 (10)	424 (6)
West	1986 (147)	437 (37)	654 (42)

Note: Totals Exclude Pedestrians



North Approach
Echuca Road

Total	271 (14)	269 (11)	934 (97)
PM	89 (5)	85 (4)	202 (27)
AM	54 (3)	77 (1)	291 (35)

West Approach
Midland Highway (McLennan Street)

Total	**PM**	**AM**
199 (17)	59 (2)	66 (10)
1748 (120)	362 (31)	578 (30)
39 (10)	16 (4)	10 (2)

Note: Totals Exclude Pedestrians

East Approach
Midland Highway (McLennan Street)

AM	**PM**	**Total**
119 (19)	186 (11)	621 (62)
211 (25)	470 (25)	1389 (101)
139 (13)	245 (8)	749 (32)

AM	18 (0)	98 (1)	308 (5)
PM	25 (2)	87 (2)	240 (6)
Total	54 (3)	287 (4)	971 (30)

Toolamba Road
South Approach

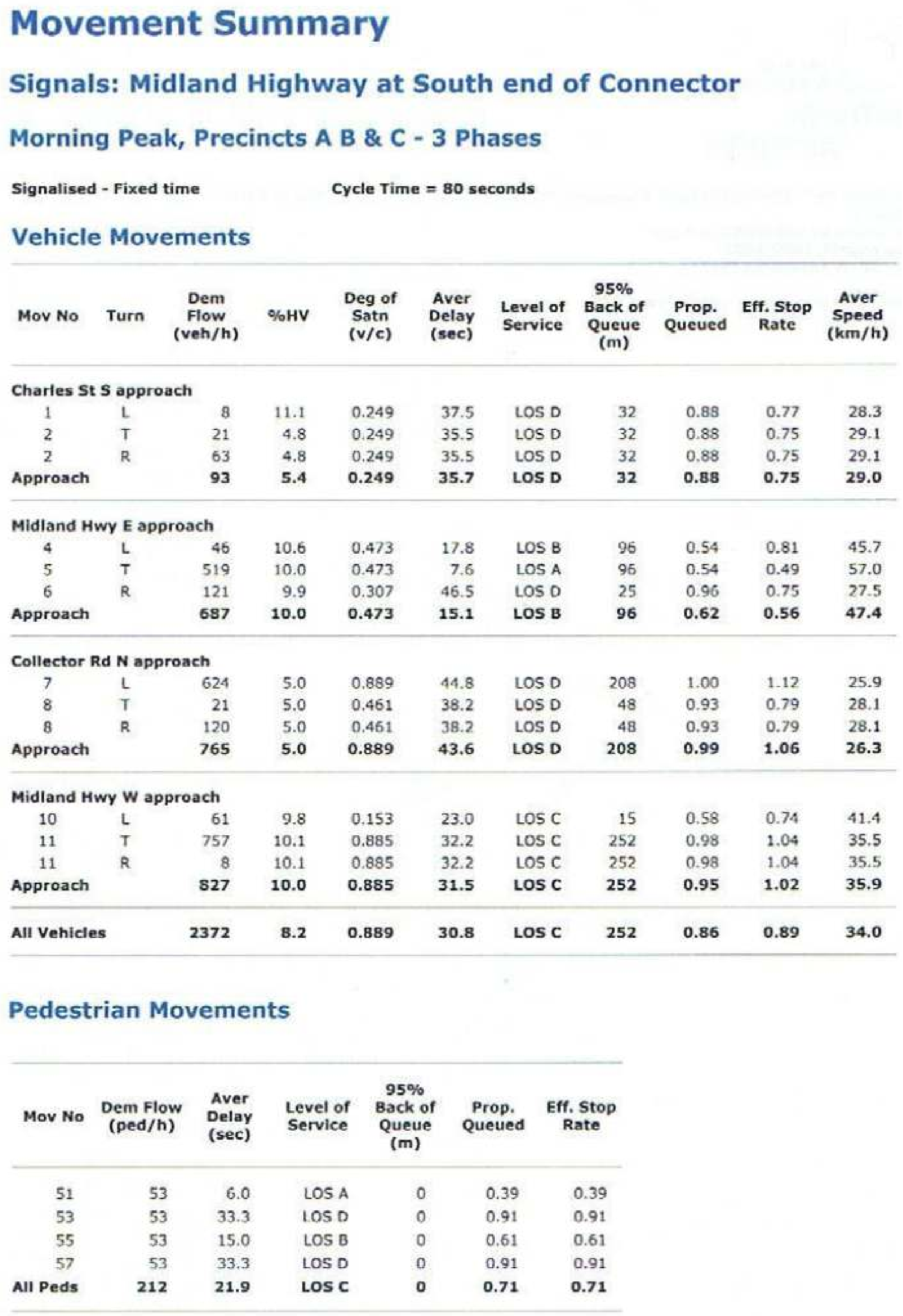
TOTAL DEPARTING FROM APPROACH

	Total	**PM**	**AM**
North	1107 (83)	332 (15)	283 (30)
East	3653 (247)	804 (64)	1177 (70)
South	1057 (53)	346 (16)	226 (16)
West	1714 (118)	584 (32)	283 (28)

Figure A4: Turning Movement Count at Midland Highway/Echuca Road/Toolamba Road

APPENDIX B

SIDRA SUMMARIES



Movement Summary

Signals: Midland Highway at South end of Connector

Morning Peak, Precincts A B & C - 3 Phases

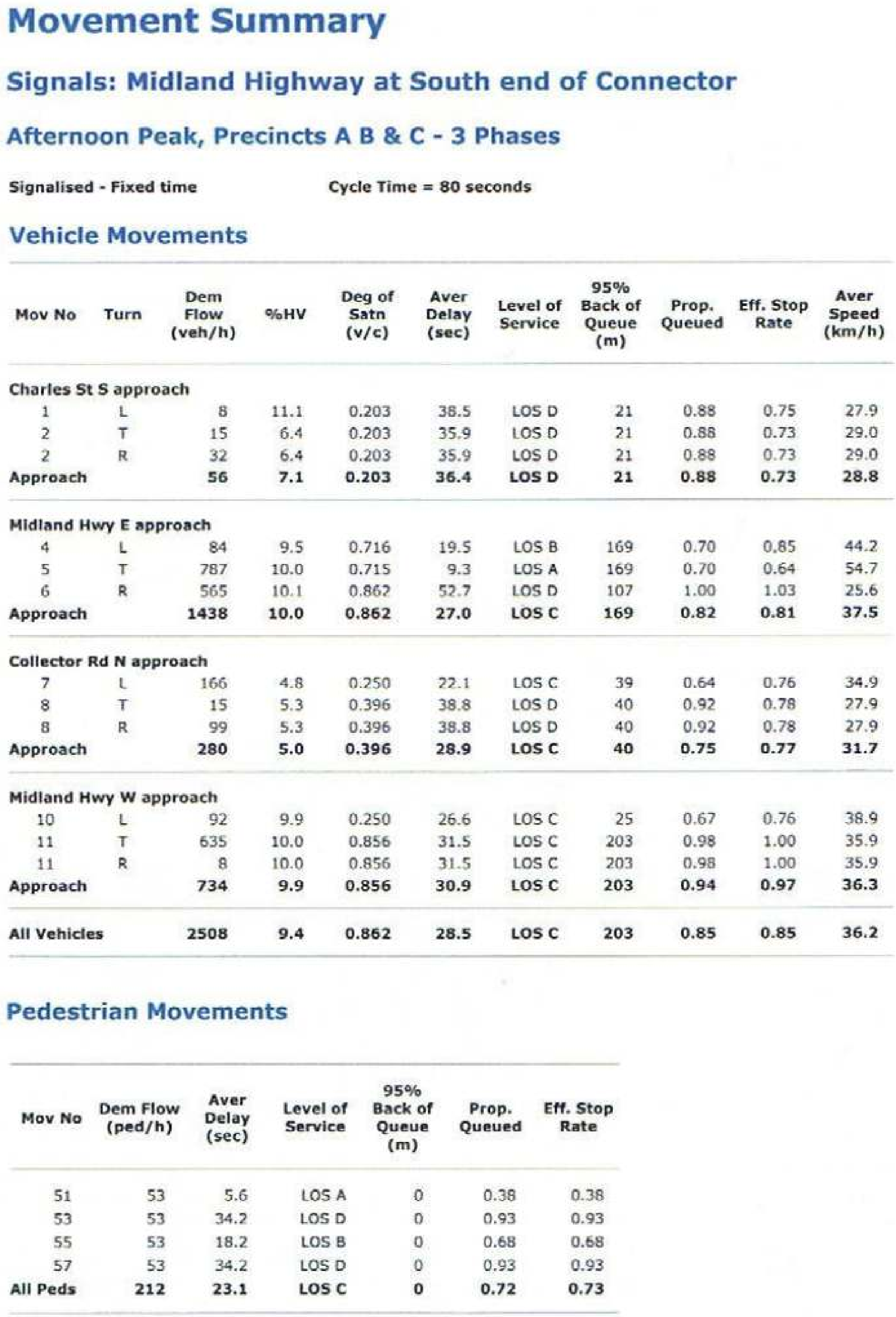
Signalised - Fixed time **Cycle Time = 80 seconds**

Vehicle Movements

Mov No	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)
Charles St S approach										
1	L	8	11.1	0.249	37.5	LOS D	32	0.88	0.77	28.3
2	T	21	4.8	0.249	35.5	LOS D	32	0.88	0.75	29.1
2	R	63	4.8	0.249	35.5	LOS D	32	0.88	0.75	29.1
Approach		**93**	**5.4**	**0.249**	**35.7**	**LOS D**	**32**	**0.88**	**0.75**	**29.0**
Midland Hwy E approach										
4	L	46	10.6	0.473	17.8	LOS B	96	0.54	0.81	45.7
5	T	519	10.0	0.473	7.6	LOS A	96	0.54	0.49	57.0
6	R	121	9.9	0.307	46.5	LOS D	25	0.96	0.75	27.5
Approach		**687**	**10.0**	**0.473**	**15.1**	**LOS B**	**96**	**0.62**	**0.56**	**47.4**
Collector Rd N approach										
7	L	624	5.0	0.889	44.8	LOS D	208	1.00	1.12	25.9
8	T	21	5.0	0.461	38.2	LOS D	48	0.93	0.79	28.1
8	R	120	5.0	0.461	38.2	LOS D	48	0.93	0.79	28.1
Approach		**765**	**5.0**	**0.889**	**43.6**	**LOS D**	**208**	**0.99**	**1.06**	**26.3**
Midland Hwy W approach										
10	L	61	9.8	0.153	23.0	LOS C	15	0.58	0.74	41.4
11	T	757	10.1	0.885	32.2	LOS C	252	0.98	1.04	35.5
11	R	8	10.1	0.885	32.2	LOS C	252	0.98	1.04	35.5
Approach		**827**	**10.0**	**0.885**	**31.5**	**LOS C**	**252**	**0.95**	**1.02**	**35.9**
All Vehicles		**2372**	**8.2**	**0.889**	**30.8**	**LOS C**	**252**	**0.86**	**0.89**	**34.0**

Pedestrian Movements

Mov No	Dem Flow (ped/h)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate
51	53	6.0	LOS A	0	0.39	0.39
53	53	33.3	LOS D	0	0.91	0.91
55	53	15.0	LOS B	0	0.61	0.61
57	53	33.3	LOS D	0	0.91	0.91
All Peds	**212**	**21.9**	**LOS C**	**0**	**0.71**	**0.71**



Movement Summary

Signals: Midland Highway at South end of Connector

Afternoon Peak, Precincts A B & C - 3 Phases

Signalised - Fixed time **Cycle Time = 80 seconds**

Vehicle Movements

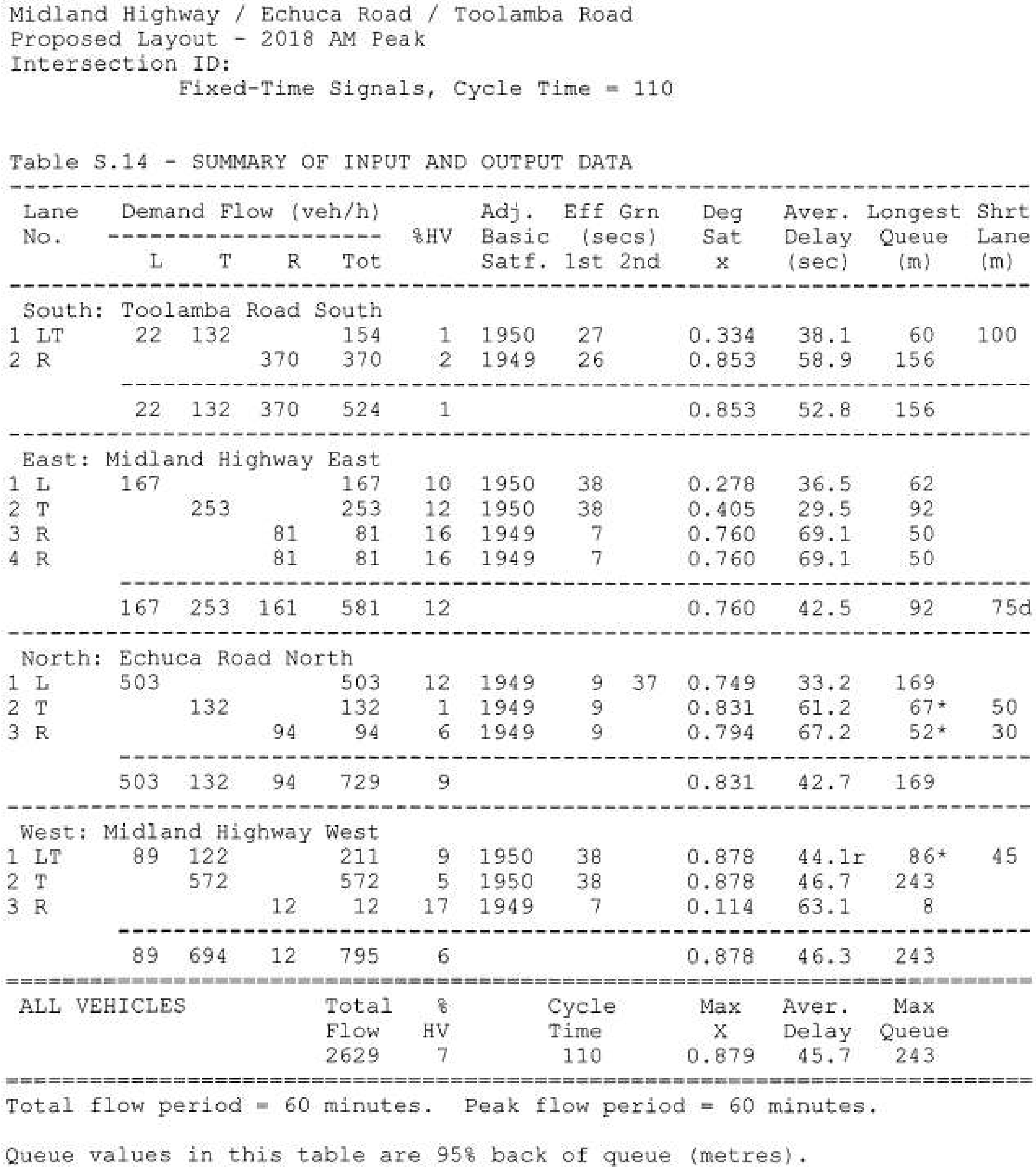
Mov No	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Charles St S approach										
1	L	8	11.1	0.203	38.5	LOS D	21	0.88	0.75	27.9
2	T	15	6.4	0.203	35.9	LOS D	21	0.88	0.73	29.0
2	R	32	6.4	0.203	35.9	LOS D	21	0.88	0.73	29.0
Approach		**56**	**7.1**	**0.203**	**36.4**	**LOS D**	**21**	**0.88**	**0.73**	**28.8**
Midland Hwy E approach										
4	L	84	9.5	0.716	19.5	LOS B	169	0.70	0.85	44.2
5	T	787	10.0	0.715	9.3	LOS A	169	0.70	0.64	54.7
6	R	565	10.1	0.862	52.7	LOS D	107	1.00	1.03	25.6
Approach		**1438**	**10.0**	**0.862**	**27.0**	**LOS C**	**169**	**0.82**	**0.81**	**37.5**
Collector Rd N approach										
7	L	166	4.8	0.250	22.1	LOS C	39	0.64	0.76	34.9
8	T	15	5.3	0.396	38.8	LOS D	40	0.92	0.78	27.9
8	R	99	5.3	0.396	38.8	LOS D	40	0.92	0.78	27.9
Approach		**280**	**5.0**	**0.396**	**28.9**	**LOS C**	**40**	**0.75**	**0.77**	**31.7**
Midland Hwy W approach										
10	L	92	9.9	0.250	26.6	LOS C	25	0.67	0.76	38.9
11	T	635	10.0	0.856	31.5	LOS C	203	0.98	1.00	35.9
11	R	8	10.0	0.856	31.5	LOS C	203	0.98	1.00	35.9
Approach		**734**	**9.9**	**0.856**	**30.9**	**LOS C**	**203**	**0.94**	**0.97**	**36.3**
All Vehicles		**2508**	**9.4**	**0.862**	**28.5**	**LOS C**	**203**	**0.85**	**0.85**	**36.2**

Pedestrian Movements

Mov No	Dem Flow (ped/h)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate
51	53	5.6	LOS A	0	0.38	0.38
53	53	34.2	LOS D	0	0.93	0.93
55	53	18.2	LOS B	0	0.68	0.68
57	53	34.2	LOS D	0	0.93	0.93
All Peds	**212**	**23.1**	**LOS C**	**0**	**0.72**	**0.73**

```
Midland Highway / Echuca Road / Toolamba Road
Existing AM Peak
Intersection ID:
            Fixed-Time Signals, Cycle Time = 110


Table S.14 - SUMMARY OF INPUT AND OUTPUT DATA
--------------------------------------------------------------------------
 Lane   Demand Flow (veh/h)       Adj.  Eff Grn   Deg    Aver. Longest Shrt
 No.   -------------------- %HV  Basic  (secs)   Sat    Delay  Queue  Lane
          L    T    R   Tot      Satf. 1st 2nd    x     (sec)   (m)   (m)
--------------------------------------------------------------------------
 South: Toolamba Road South
1 LT     18   98        116    1  1950   24      0.767   46.6    52*   30
2 R                308  308    2  1949   24      0.769   54.2   124
        ------------------------------------------------------------------
         18   98   308  424    1                 0.769   52.1   124
--------------------------------------------------------------------------
 East: Midland Highway East
1 L     139             139    9  1950   54      0.163   25.0    42
2 T          211        211   12  1950   54      0.237   17.1    62
3 R               119   119   16  1949   10      0.785   67.0    68    80
        ------------------------------------------------------------------
        139  211  119   469   12                 0.785   32.1    68   75d
--------------------------------------------------------------------------
 North: Echuca Road North
1 L     291             291   12  1949    8  49  0.363   21.5    77
2 T           77         77    1  1949    8      0.548   56.2    40    40
3 R                54    54    6  1949    8      0.416   63.3    30    30
        ------------------------------------------------------------------
        291   77   54   422    9                 0.548   33.2    77
--------------------------------------------------------------------------
 West: Midland Highway West
1 LT     66  114        180    9  1950   35      0.773   40.9    75*   45
2 T          464        464    5  1950   35      0.773   38.5   174
        ------------------------------------------------------------------
         66  578    0   644    6                 0.773   39.2   174
==========================================================================
 ALL VEHICLES             Total   %       Cycle      Max   Aver.   Max
                          Flow   HV       Time        X    Delay  Queue
                          1959    7        110     0.785   39.0   174
==========================================================================
Total flow period = 60 minutes.  Peak flow period = 60 minutes.

Queue values in this table are 95% back of queue (metres).
```

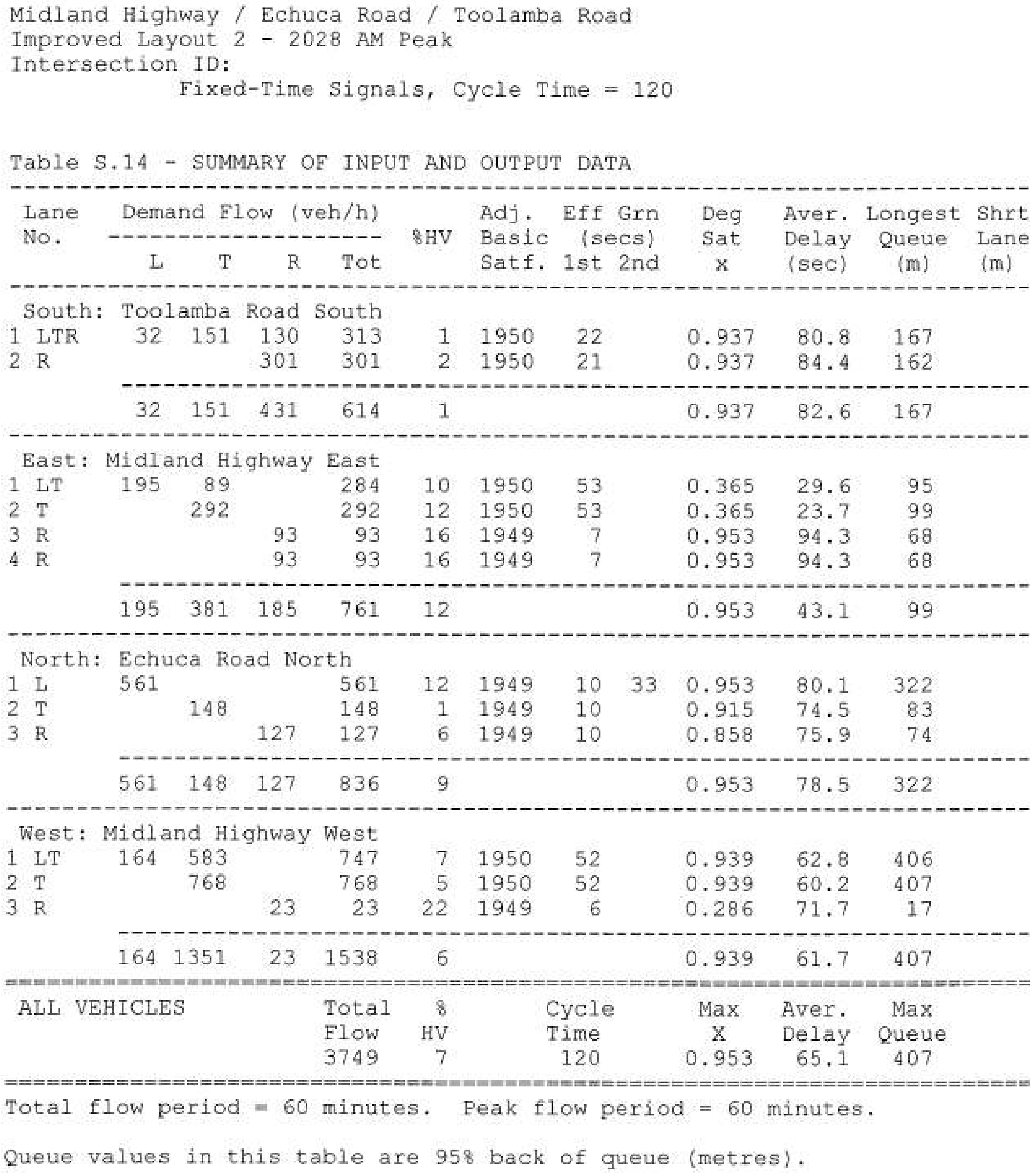
```
Midland Highway / Echuca Road / Toolamba Road
Existing PM Peak
Intersection ID:
            Fixed-Time Signals, Cycle Time = 110

Table S.14 - SUMMARY OF INPUT AND OUTPUT DATA
--------------------------------------------------------------------------
 Lane   Demand Flow (veh/h)       Adj.  Eff Grn   Deg    Aver. Longest Shrt
 No.   --------------------  %HV  Basic  (secs)   Sat    Delay  Queue  Lane
          L    T    R   Tot       Satf. 1st 2nd   x     (sec)   (m)   (m)
--------------------------------------------------------------------------
 South: Toolamba Road South
1 LT     25   87        112    4  1950   27      0.730   42.9    50*   30
2 R                240  240    3  1949   27      0.536   46.7    92
        ------------------------------------------------------------------
         25   87  240   352    3                 0.730   45.5    92
--------------------------------------------------------------------------
 East: Midland Highway East
1 L     245             245    3  1950   48      0.309   29.8    73
2 T          470        470    5  1950   48      0.571   24.9   143
3 R                186  186    6  1949   16      0.718   59.0    86*   80
        ------------------------------------------------------------------
        245  470  186   901    5                 0.718   33.3   143    75d
--------------------------------------------------------------------------
 North: Echuca Road North
1 L     202             202   13  1949   11  60  0.201   14.2    40
2 T           85         85    5  1949   11      0.522   52.3    44*   40
3 R                 89   89    6  1949   11      0.724   62.8    47*   30
        ------------------------------------------------------------------
        202   85   89   376   10                 0.724   34.3    47
--------------------------------------------------------------------------
 West: Midland Highway West
1 LT     59   87        146    6  1950   23      0.712   46.8    65*   45
2 T          275        275    9  1950   23      0.712   45.3   116
        ------------------------------------------------------------------
         59  362    0   421    8                 0.712   45.8   116
==========================================================================
 ALL VEHICLES          Total   %       Cycle      Max   Aver.   Max
                       Flow   HV       Time        X    Delay  Queue
                       2050    6        110      0.733   38.1   143
==========================================================================
Total flow period = 60 minutes.  Peak flow period = 60 minutes.

Queue values in this table are 95% back of queue (metres).
```



```
Midland Highway / Echuca Road / Toolamba Road
Proposed Layout - 2018 AM Peak
Intersection ID:
            Fixed-Time Signals, Cycle Time = 110


Table S.14 - SUMMARY OF INPUT AND OUTPUT DATA
--------------------------------------------------------------------------
 Lane   Demand Flow (veh/h)       Adj.  Eff Grn   Deg   Aver. Longest Shrt
 No.   --------------------  %HV  Basic  (secs)   Sat   Delay  Queue  Lane
          L    T    R   Tot       Satf. 1st 2nd    x    (sec)   (m)   (m)
--------------------------------------------------------------------------
 South: Toolamba Road South
1 LT     22  132        154    1  1950   27      0.334   38.1    60   100
2 R               370   370    2  1949   26      0.853   58.9   156
        ------------------------------------------------------------------
         22  132  370   524    1                 0.853   52.8   156
--------------------------------------------------------------------------
 East: Midland Highway East
1 L     167             167   10  1950   38      0.278   36.5    62
2 T          253        253   12  1950   38      0.405   29.5    92
3 R                81    81   16  1949    7      0.760   69.1    50
4 R                81    81   16  1949    7      0.760   69.1    50
        ------------------------------------------------------------------
        167  253  161   581   12                 0.760   42.5    92   75d
--------------------------------------------------------------------------
 North: Echuca Road North
1 L     503             503   12  1949    9  37  0.749   33.2   169
2 T          132        132    1  1949    9      0.831   61.2    67*   50
3 R                94    94    6  1949    9      0.794   67.2    52*   30
        ------------------------------------------------------------------
        503  132   94   729    9                 0.831   42.7   169
--------------------------------------------------------------------------
 West: Midland Highway West
1 LT     89  122        211    9  1950   38      0.878   44.1r   86*   45
2 T          572        572    5  1950   38      0.878   46.7   243
3 R                12    12   17  1949    7      0.114   63.1     8
        ------------------------------------------------------------------
         89  694   12   795    6                 0.878   46.3   243
==========================================================================
 ALL VEHICLES          Total  %       Cycle      Max   Aver.   Max
                       Flow   HV       Time        X    Delay  Queue
                       2629    7        110      0.879   45.7   243
==========================================================================
Total flow period = 60 minutes.  Peak flow period = 60 minutes.

Queue values in this table are 95% back of queue (metres).
```

```
Midland Highway / Echuca Road / Toolamba Road
Proposed Layout - 2018 PM Peak
Intersection ID:
            Fixed-Time Signals, Cycle Time = 110


Table S.14 - SUMMARY OF INPUT AND OUTPUT DATA
--------------------------------------------------------------------------
 Lane   Demand Flow (veh/h)        Adj.  Eff Grn   Deg   Aver. Longest Shrt
 No.   --------------------- %HV  Basic  (secs)    Sat   Delay Queue   Lane
          L    T    R   Tot       Satf. 1st 2nd     x    (sec)  (m)    (m)
--------------------------------------------------------------------------
 South: Toolamba Road South
1 LT     30  152         182    3  1950    20       0.544   46.3    77   100
2 R                288   288    2  1949    19       0.913   72.9   140
        ------------------------------------------------------------------
         30  152  288   470    3                    0.913   62.6   140
--------------------------------------------------------------------------
 East: Midland Highway East
1 L     294              294    3  1950    36       0.495   40.3   101
2 T          564         564    5  1950    36       0.914   56.1   264
3 R               164    164    6  1949    13       0.777   63.6    81
4 R               164    164    6  1949    13       0.777   63.6    81
        ------------------------------------------------------------------
        294  564  327   1185   5                    0.914   54.3   264    75d
--------------------------------------------------------------------------
 North: Echuca Road North
1 L     285              285   13  1949    19  42   0.312   19.1    70
2 T          120         120    5  1949    19       0.549   44.1    54*   50
3 R               126    126    6  1949    19       0.927   59.1r   61*   30
        ------------------------------------------------------------------
        285  120  126    531    9                   0.927   34.3    70
--------------------------------------------------------------------------
 West: Midland Highway West
1 LT    104   65         169    5  1950    29       0.758   45.9    71*   45
2 T          369         369    9  1950    29       0.758   42.4   149
3 R                19     19   26  1949     6       0.223   65.8    14
        ------------------------------------------------------------------
        104  434   19    557    8                   0.758   44.3   149
==========================================================================
 ALL VEHICLES          Total   %        Cycle      Max   Aver.   Max
                       Flow   HV        Time        X    Delay  Queue
                       2743    6         110      0.927   49.8   264
==========================================================================
Total flow period = 60 minutes.  Peak flow period = 60 minutes.

Queue values in this table are 95% back of queue (metres).
```

constraint



```
Midland Highway / Echuca Road / Toolamba Road
Improved Layout 2 - 2028 AM Peak
Intersection ID:
             Fixed-Time Signals, Cycle Time = 120


Table S.14 - SUMMARY OF INPUT AND OUTPUT DATA
---------------------------------------------------------------------------
 Lane   Demand Flow (veh/h)        Adj.  Eff Grn    Deg    Aver. Longest Shrt
 No.   --------------------  %HV  Basic  (secs)    Sat    Delay  Queue  Lane
          L    T    R   Tot        Satf. 1st 2nd     x     (sec)   (m)    (m)
---------------------------------------------------------------------------
 South: Toolamba Road South
1 LTR    32  151  130   313    1  1950   22       0.937    80.8   167
2 R                301   301    2  1950   21       0.937    84.4   162
         ------------------------------------------------------------------
         32  151  431   614    1                  0.937    82.6   167
---------------------------------------------------------------------------
 East: Midland Highway East
1 LT    195   89        284   10  1950   53       0.365    29.6    95
2 T          292        292   12  1950   53       0.365    23.7    99
3 R                 93   93   16  1949    7       0.953    94.3    68
4 R                 93   93   16  1949    7       0.953    94.3    68
        -------------------------------------------------------------------
        195  381  185   761   12                  0.953    43.1    99
---------------------------------------------------------------------------
 North: Echuca Road North
1 L     561             561   12  1949   10  33  0.953    80.1   322
2 T          148        148    1  1949   10       0.915    74.5    83
3 R               127   127    6  1949   10       0.858    75.9    74
        -------------------------------------------------------------------
        561  148  127   836    9                  0.953    78.5   322
---------------------------------------------------------------------------
 West: Midland Highway West
1 LT    164  583        747    7  1950   52       0.939    62.8   406
2 T          768        768    5  1950   52       0.939    60.2   407
3 R                23    23   22  1949    6       0.286    71.7    17
        -------------------------------------------------------------------
        164 1351   23  1538    6                  0.939    61.7   407
===========================================================================
 ALL VEHICLES           Total   %        Cycle      Max    Aver.   Max
                        Flow   HV        Time       X     Delay  Queue
                        3749    7         120     0.953    65.1   407
===========================================================================
Total flow period = 60 minutes.  Peak flow period = 60 minutes.

Queue values in this table are 95% back of queue (metres).
```

```
Midland Highway / Echuca Road / Toolamba Road
Improved Layout 2 - 2028 PM Peak
Intersection ID:
            Fixed-Time Signals, Cycle Time = 120

Table S.14 - SUMMARY OF INPUT AND OUTPUT DATA
--------------------------------------------------------------------------
 Lane   Demand Flow (veh/h)       Adj.  Eff Grn   Deg   Aver. Longest Shrt
 No.   --------------------  %HV  Basic  (secs)   Sat   Delay  Queue  Lane
          L    T    R   Tot       Satf. 1st 2nd    x    (sec)   (m)   (m)
--------------------------------------------------------------------------
 South: Toolamba Road South
1 LTR    58  170   61   289    3  1950   21      0.905   71.5   148
2 R               275   275    2  1950   20      0.905   76.0   141
        ------------------------------------------------------------------
         58  170  336   564    3                 0.905   73.7   148
--------------------------------------------------------------------------
 East: Midland Highway East
1 LT    343  367        710    4  1950   51      0.901   52.3   329
2 T          723        723    5  1950   51      0.901   47.9   337
3 R               182   182    6  1949   17      0.722   63.8    91
4 R               182   182    6  1949   17      0.722   63.8    91
        ------------------------------------------------------------------
        343 1090  364  1797    5                 0.901   52.8   337
--------------------------------------------------------------------------
 North: Echuca Road North
1 L     326             326   13  1949   13  57  0.381   19.4    83
2 TR         137   48   185    5  1950   13      0.920   76.8   105
3 R               178   178    6  1950   13      0.920   82.8   102
        ------------------------------------------------------------------
        326  137  226   689    9                 0.920   51.2   105
--------------------------------------------------------------------------
 West: Midland Highway West
1 LT    139  254        393    6  1950   40      0.640   39.4   149
2 T          395        395    8  1950   40      0.640   36.5   152
3 R                28    28   25  1949    6      0.355   72.3    22
        ------------------------------------------------------------------
        139  649   28   816    8                 0.640   39.1   152
==========================================================================
 ALL VEHICLES          Total   %       Cycle      Max   Aver.   Max
                       Flow   HV       Time        X    Delay  Queue
                       3866    6        120      0.920   52.7   337
==========================================================================
Total flow period = 60 minutes.  Peak flow period = 60 minutes.

Queue values in this table are 95% back of queue (metres).
```