

**Department of Transport and Main Roads  
(Darling Downs Region)**

**Review of Warwick Traffic Management Study (WTMS-2)**

**Final Report**

**December 2010**



**Bob Taylor Consulting**

76 Kersley Road  
KENMORE QLD 4069

Tel: 07 3378 4994  
Mob: 0412 048 206

## WTMS-2 Review

# Table of Contents

Foreword .....	ii
Executive Summary .....	iii
Study Outline.....	iii
Conclusions and Recommendations .....	iii
1 Introduction .....	1
1.1 Study Background.....	1
1.2 Study Outline.....	3
2 Data Collection and review .....	4
2.1 Changes since 2002 .....	4
2.2 Traffic Assessment.....	4
2.3 Parking .....	10
2.4 Public Transport .....	10
2.5 Consultation .....	10
2.6 Summary .....	13
2.7 Conclusion.....	13
3 Future Traffic Demand .....	15
3.1 Through traffic .....	15
3.2 Population .....	15
3.3 New land development.....	16
3.4 Proposed future traffic.....	16
4 Modelling .....	17
4.1 Base year model .....	17
4.2 Future year model .....	20
4.3 Model results .....	22
5 Traffic management strategies .....	24
5.1 Strategy principles.....	24
5.2 Midblock .....	28
5.3 Intersections .....	28
5.4 General.....	32
6 Strategy Implementation .....	36
7 Conclusions and Recommendations .....	39
7.1 Conclusions.....	39
7.2 Recommendations .....	39

## **Tables**

2.1 Mid block (volume/ capacity) Helene Street.....	7
2.2 Intersection Analysis .....	8
2.3 Intersection Crash Record and Ranking .....	9
3.1 Forecast population and residences .....	15
4.1 Future Traffic Demands .....	21
5.1 WTMS - 2 Review Proposed Strategies .....	25
6.1 Proposed Strategy Implementation.....	37

## **Figures**

1.1 Study Area .....	2
2.1 O-D Site Locations .....	6
4.1 Warwick Paramics Network Showing Entry/Exit Zone.....	19
4.2 Schematic Diagram.....	23

## **Appendices**

- A O-D Site Trip Distributions
- B Traffic Volumes Modelled - 2009 and 2021
- C Traffic Analysis Results
- D Model Calibration Design Note
- E References

## **Foreword**

The review of the Warwick Traffic Management Study (WTMS-2) was undertaken during the period October 2009 to April 2010 and was based on information available at the time. A draft report was prepared in May 2010. Prior to completing the final report more recent traffic data has become available, so the opportunity has been taken to update some information in the draft report where appropriate. However, the main work (including the traffic modelling and analysis) is based on the earlier data.

## **Executive Summary**

The Warwick Traffic Management Study (WTMS-2) was completed in May 2004. WTMS-2 was a comprehensive study which identified a strategy to address existing and anticipated traffic needs along the National Highway through Warwick to year 2012. Since the WTMS-2 report was published there have been a number of highway upgrade projects and some significant property redevelopments in Warwick. This current study has reviewed and updated the previous strategies by assessing the highway needs to year 2021.

The National Highway through Warwick includes sections of the Cunningham and New England Highways, and the road network covered by the study includes:

- Cunningham Highway from East Street at the Caltex truck stop (north of Glengallan Road) to the intersection with Wallace Street (containing Alexandra Drive, Helene Street, Albion Street and Wood Street); and
- New England Highway (Wallace Street) from Wood Street to south of Bracker Road.

The primary objective of this Review and Update study is to “identify traffic management and safety related issues affecting motorists, cyclists and pedestrians over a 10 year horizon, with suggested actions and time frames for implementation”.

## **Study Outline**

The study process involved a review of existing and emerging issues which would need to be considered and addressed in both revising the existing strategies and developing the proposed new traffic management strategies. The study involved three basic phases:

- Review and issues identification: This review included a comprehensive Origin – Destination (O-D) survey, site inspections and review of traffic counts and crash reports. Meetings were held with appropriate Department of Transport and Main Roads (TMR) and Southern Downs Regional Council (SDRC) officers. A Paramics microsimulation model based on the previous WTMS-2 model was developed to assist in identifying existing and future situations.
- Strategy development: The original WTMS-2 strategy principles served as a guide for developing strategies to address issues identified in the review phase and identifying the future likely traffic conditions along the highway, in order to achieve the desired study outcomes. A broad timetable for implementing the strategies was then produced, based on the likely timing of the need for and practicality of implementing each strategy. Actual programming of the recommended road infrastructure works will depend on the availability of funds, and did not form part of the study.

The strategy and notional program are contained in Table 6.1 of the report.

- Study Report: The study report is intended to serve as an addendum to the original WTMS-2 (May 2004) report.

A TMR Project Team managed the study and was involved at major decision-making milestones.

## **Conclusions and Recommendations**

### **Conclusions**

The review of the traffic situation on the National Highway through Warwick shows that the highway is experiencing areas of congestion and delays at several intersections, and safety is a problem at some intersections. With the projected growth in Warwick and the consequent increase in both local and through traffic, capacity will become a greater problem requiring road infrastructure improvements within the 2021 study design horizon.

Work undertaken as an outcome of the previous WTMS-2 study has resulted in significant improvements for accessibility and safety for vehicles and pedestrians, and control of access for proposed new developments along the corridor. However there are still a number of existing and potential issues and problem areas which will need attention. The main areas of concern are:

- Crash history mainly involving right turning traffic at intersections, especially the Percy Street and Albion Street intersection;
- Intersection capacity problems resulting in queuing and delays, causing traffic to seek alternative and less suitable routes on the local council network;
- Pedestrians and cyclists experiencing difficulty crossing the highway due to limited opportunities, thereby reducing their mobility and safety; and
- Parking on the highway causing interference with highway traffic, including large and heavy vehicles.

The proposed traffic management strategy in this report builds on the original WTMS-2 strategy, and is designed to address both the existing issues and those expected to arise as a result of future traffic growth along the corridor. This will benefit highway and local traffic, public transport, cyclists and pedestrians by providing easier and safer movement along (as well as across) the highway. The strategy is able to be implemented incrementally in response to identified needs, subject to available funding.

## **Recommendations**

It is recommended that TMR:

- (a) Adopt the proposed traffic management strategy as detailed in **Table 5.1** and **Table 6.1**, with final treatments and timing based on actual and future traffic operations (such as crash history and congestion) and proposed development along the highway. Actual programming and implementation of road infrastructure works will depend on the availability of funds;
- (b) Use the proposed strategy to update the national network program of projects, as appropriate;
- (c) Assess and place conditions on future development applications in accordance with the relevant strategy;
- (d) Request SDRC to:
  - (i) Incorporate into the town planning provisions a means of ensuring the long term integrity of the highway corridor is preserved by discouraging inappropriate development of adjoining land uses;
  - (ii) Review and update the Warwick Cycle Management Plan to take advantage of improved facilities at intersections for crossing the highway;
  - (iii) Review the road hierarchy plan for Warwick to take advantage of and reflect potential changes to traffic patterns which may arise from implementation of the traffic management strategy; and
- (e) Undertake a formal review and update of the strategy prior to the end of the study time frame (before 2021).

# **1 Introduction**

## **1.1 Study Background**

The Warwick Traffic Management Study (WTMS-2) completed in 2004 was a comprehensive study which identified a strategy to address existing and anticipated traffic needs along the National Highway through Warwick to year 2012. Since the report was published there have been a number of highway upgrade projects and property redevelopments in Warwick. This current study is designed to review and update the previous strategies by assessing the highway needs to year 2021.

The National Highway through Warwick includes sections of the Cunningham and New England Highways, and the road network covered by the study includes:

- Cunningham Highway from East Street at the Caltex truck stop (north of Glengallan Road) to the intersection with Wallace Street (containing Alexandra Drive, Helene Street, Albion Street and Wood Street); and
- New England Highway (Wallace Street) from Wood Street to south of Bracker Road.

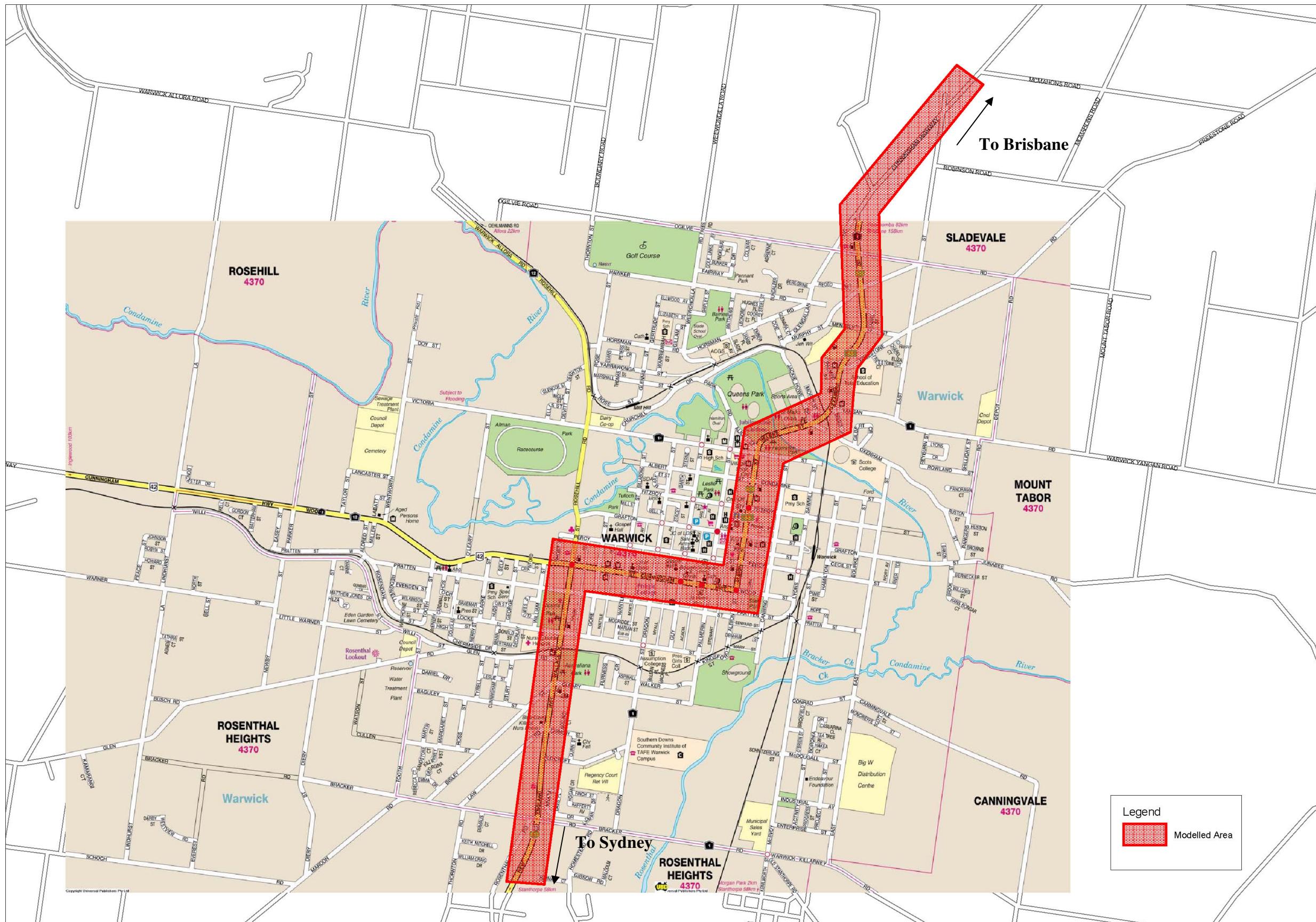
The study area is shown in **Figure 1.1**.

The objective of the Review study is to “identify traffic management and safety related issues affecting motorists, cyclists and pedestrians over a 10 year horizon, with suggested actions and time frames for implementation”.

The study brief included the following expected outcomes:

- Existing and projected traffic movements at all intersections;
- Identification of changes to local road hierarchy and consequent impacts on the highway network (e.g. to accommodate bus routes, commercial access, local traffic generators etc);
- Recommendations in relation to abutting land use on the highway network;
- Comment on appropriate criteria to manage potential transport impacts arising from abutting development and land use planning initiatives, in the vicinity of the highway network corridors;
- Identification of changes to the local area network where it intersects with the highways and any proposed changes to the adjacent local network which will result in changes at highway intersections (e.g. restrictions, one way, closures, changes in use, etc);
- Recommendations (in concept form) for highway type cross sections and traffic movements at all intersections of the local streets and the highways, in accordance with projected traffic, cyclist and pedestrian developments over a future 10 year horizon;
- A time frame for the recommended changes / upgrades to be based on triggers identified in the report; and
- Details of any consultation undertaken as part of the study.

**Figure 1.1 Study Area**



Source: [www.google.com.au](http://www.google.com.au)

## **1.2 Study Outline**

The study process involved a review of existing and emerging issues which would need to be considered and addressed in revising and developing the proposed traffic management strategies. The study involved three basic phases:

**Review and issues identification:**

This review included a comprehensive Origin – Destination (O-D) survey, site inspections and review of traffic counts and crash reports, and meetings with appropriate Department of Transport and Main Roads (TMR) and Southern Downs Regional Council (SDRC) officers. A Paramics microsimulation model based on the previous WTMS-2 model was developed to assist in identifying existing and future situations.

**Strategy development:**

The WTMS-2 strategy principles served as a guide for developing strategies to address issues identified in the review phase and the future likely traffic conditions along the highway, in order to achieve the desired study outcomes. A broad timetable for implementing the strategies was then produced based on the likely timing of the need for and practicality of introducing the strategy.

**Study Report:**

A study report intended to serve as an addendum to the original WTMS-2 report. A detailed description of the modelling development and calibration is provided as a Design Note in **Appendix D**.

**Project Team:**

A Project Team managed the study and was involved at major decision-making milestones. Members of the team were:

*Transport and Main Roads (Darling Downs Region):*

Wayne Berting, Senior Advisor (Design) and Project Manager  
Kevin Wright, Manager (Network Planning & Performance)  
Mark Agnew, Principal Designer (Civil)

*Study consultant:*

Bob Taylor, Study Manager

The microsimulation modelling component of the study was undertaken by Cardno Eppell Olsen Pty Ltd.

## **2 Data Collection and review**

The purpose of the review was to identify and update issues which may have occurred or were seen to be emerging since completion of WTMS-2.

The review of traffic and related issues involved meetings with appropriate Department of Transport and Main Roads (TMR) and Southern Downs Regional Council (SDRC) officers, site inspections and review of traffic counts and crash reports. A comprehensive Origin-Destination (O-D) survey was also undertaken using Automatic Number Plate Recognition (ANPR), supplemented by manual O-D surveys, covering 10 sites primarily to obtain information on the destination of trips entering and travelling through Warwick.

### **2.1 Changes since 2002**

The main change in Warwick since 2002 is that considerable residential development has occurred primarily in the northeast and southwest. Also, new commercial development has occurred along the route through Warwick and in the CBD, and northeast, and the industrial area is still experiencing growth. This development has and will, with further growth, increase traffic flows on the road network.

With the improvements made to the highway along Wood Street and Albion Street since WTMS-2, the main traffic focus has shifted to the sections north of the Condamine River and along Wallace Street south of the railway, although problems are still present at several intersections through Warwick.

The infrastructure improvements made to the corridor highway since WTMS-2 include:

- Improved access control on new developments fronting the highway to minimise the number of accesses and restrict turning movements.
- Upgrading the median along Albion Street (Fitzroy Street to Grafton Street) as part of the CBD Streetscape project. This has reduced on street parking space;
- Signals installed at the Albion Street / Grafton Street intersection in October 2006. This has been possibly the most significant improvement to the route;
- Woolworths Plus service station entrance from Albion Street removed with through flow direction reversed so vehicles enter from Grafton Street and only exit to Albion Street.
- Additional channelisation and direction signage at Wood Street / Albion Street intersection to improve legibility of the highway route turning west from Albion Street into Wood Street;
- Palmerin Street channelised to prevent right turns and cross movements from Palmerin Street;
- Pedestrian signals at Acacia Avenue replaced by a pedestrian underpass at Palmerin Street;
- Condamine Medical Centre reconfigured and expanded with the building entrance relocated from Wood Street side to the rear to be more accessible from the car park;
- Signs and lines at the Avenues along Wood Street upgraded (but the WTMS-2 proposed "Left Turn Only" exit requirement has not been signed except at Acacia Avenue);
- The Albion Street / Percy Street intersection upgraded as a Black Spot project with new island and lane marking treatment; and
- Traffic signal hardware upgraded and settings optimised, and linked to STREAMS.

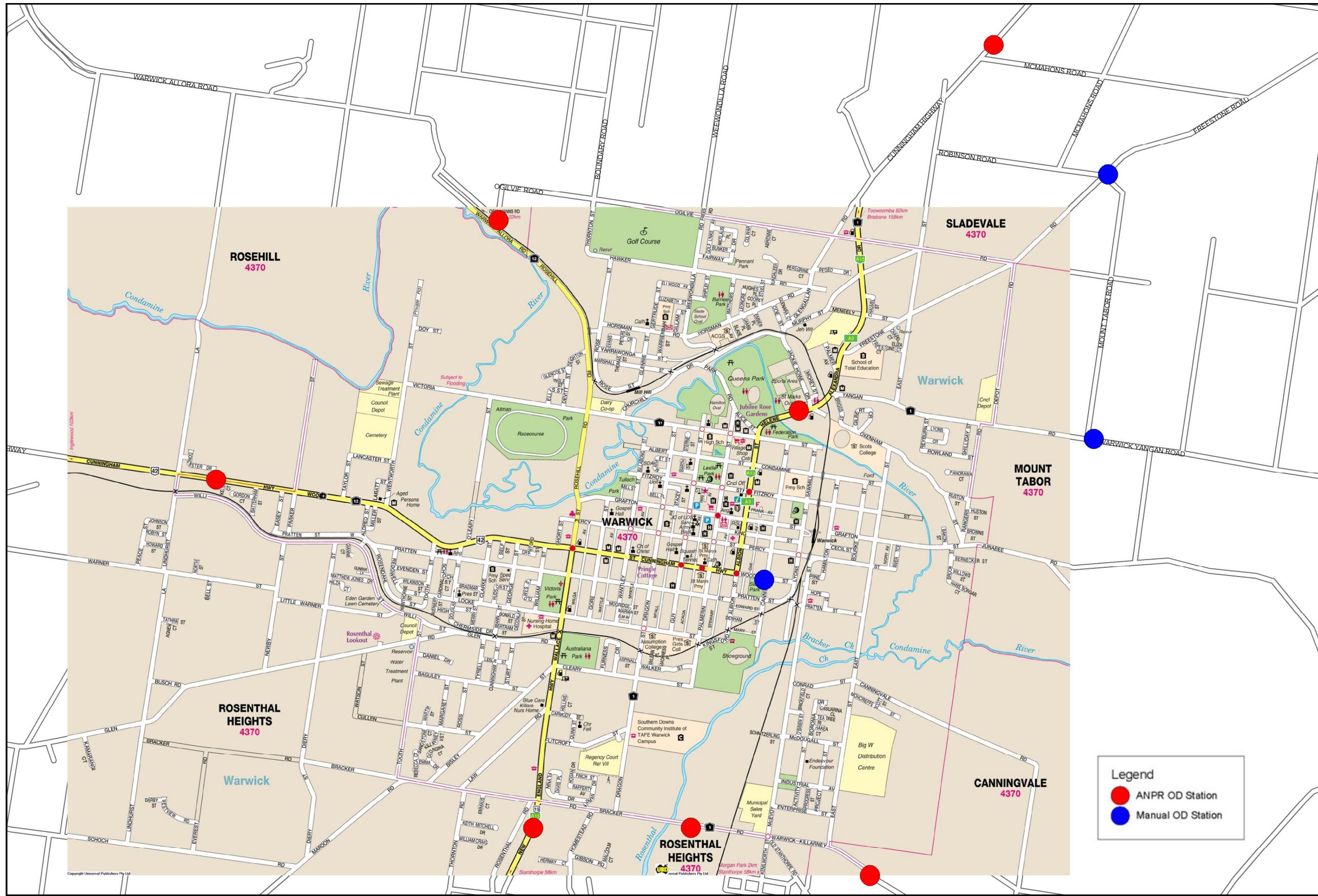
### **2.2 Traffic Assessment**

The traffic assessment has been undertaken by reviewing the following Main Roads Department reports: *Warwick Traffic Management Study (WTMS-2) Update, Traffic and Crash Data Report, August 2007*; *Warwick Traffic Management Study (WTMS-2) Update, Traffic and Crash Data Report, 2008*. Related traffic survey data including the comprehensive Origin – Destination (O-D) Automatic Number Plate Recognition (ANPR) undertaken in October 2009 has also been analysed.

The O-D Data survey was conducted by TMR over the 3 day period, Monday 12<sup>th</sup> October 2009 midnight to Thursday 15<sup>th</sup> October 2009 midnight. Locations were chosen strategically across the network to give the best coverage for vehicle movement within the defined network. The O-D survey was designed to identify vehicles making the through movements on the Cunningham Highway/New England Highway, as well as local trips having internal or external origins or destinations. The survey involved ANPR surveys at 7 sites. Manual surveys were conducted during daylight hours (12 hours) on all 3 days at 3 sites to cover three strategic local roads.

The locations of the O-D sites are shown in **Figure 2.1**.

**Figure 2.1 O-D Site Locations**



Source: [www.google.com.au](http://www.google.com.au)

## 2.2.1 Existing traffic volumes

Traffic counts from TMR permanent counters located at the approaches to Warwick and in the town, on the O O Madsen Bridge and on Wood Street near Palmerin Street, have been used to establish traffic growth trends. The 2009 Traffic Census shows that average annual traffic growth over the last 5 years was:

- 0.59% at Campbells Gully;
- 3.83% at O O Madsen Bridge;
- -1.56% at Wood Street at Palmerin Street (*see note below*);
- 4.61% east of Lyndhurst Lane; and
- 2.72% south of Flitcroft Street.

*Note: The negative growth in Wood Street at Palmerin Street is attributed largely to local traffic avoiding Wood Street because of the traffic disruptions during the recent construction of the Billy Day pedestrian underpass at Palmerin Street.*

Local trips are growing in line with population growth and reflect the effect of growth in the newly developing areas to the northeast and west of the town. The highest volumes occur on Friday (116% of AADT on O O Madsen Bridge) with the AADT exceeded on most weekdays.

A general distribution of trips from key external sites derived from the ANPR survey is shown in the figures, prepared by TMR, in **Appendix A**. Some observations are:

- A large proportion of both total and heavy vehicle trips with external origins are through trips;
- Total through trips from the north (at Campbells Gully) are mainly destined for New England Highway (south), with half the number destined for Cunningham Highway (west);
- The Industrial Estate area is also a dominant origin and destination for external trips, although involving fewer trips than those directly along the two highways;
- A large number of trips from outside Warwick have initial destinations within the town, but then subsequently continue on after stopping over for business or leisure; and
- The percentage of through trips during the peak period is less than the daily average because of the dominance of local commuter trips both within and into/out of Warwick during the peak. The modelling in the study is based on the peak hour volumes in order to assess the potential maximum traffic impacts, so through trips comprise a smaller component of the total traffic in the modelling.

The significant through movements show the importance of the highway route for both light and heavy vehicles travelling through Warwick.

## 2.2.2 Traffic Capacity

The mid block capacity analysis was carried out for the 2 lane section on Helene Street as this represents the most trafficked section per lane along the route. The result is shown in **Table 2.1** and reveals that the section of road is currently operating well within its capacity, based on an adjusted practical lane capacity of 1065 vph/lane (which allows for lane width and heavy vehicle factors).

However, sometimes a higher peak hour capacity can be accepted in urban areas. At this stage the road is considered to be operating at LOS A. On Friday, the busiest day, the southbound AM direction is about 80% of practical capacity.

**Table 2.1 Mid block (volume/ capacity) Helene Street**

Direction	AM (vph)	AM (v/c)	PM (vph)	PM (v/c)
Northbound	467	0.44	751	0.71
Southbound	628	0.59	547	0.52

The daily traffic profiles for the major intersections through the town were examined to determine the peak times. While the times vary marginally between intersections, the busiest hours were generally as shown below and represent the peak hours adopted for this analysis and the subsequent model:

- AM 0800 - 0900
- PM 1500 - 1600

This shows that the afternoon peak is more influenced by school times rather than the commuter work trips.

The performance of five intersections identified as being of concern (based on crash history, traffic delays or identified in stakeholder meetings) were examined using the aaSIDRA intersection analysis package. The results of the analysis are shown in **Table 2.2**. Wood Street/Guy Street intersection is the only one that is presently a signalised intersection.

**Table 2.2 Intersection Analysis**

<b>Location and Peak</b>	<b>Degree of saturation (DOS)</b>	<b>95%ile Queue (m)</b>	<b>Critical Delay (Sec)</b>	<b>Level of Service (LOS) based on delays</b>
<b>Yangan Road/Alexandra Drive</b>				
AM	0.50	30	55	F
PM	0.40	17	65	F
<b>Percy Street / Albion Street</b>				
AM	0.77	45	79	F
PM	0.32	12	27	D
<b>Wood Street/Guy Street</b>				
AM	0.52	103	66	E
PM	0.75	111	66	E
<b>Wood Street/Dragon Street</b>				
AM	0.26	10	29	C
PM	0.30	11	32	C
<b>Wallace /Bisley /Cleary Street</b>				
AM	0.28	13	28	C
PM	0.21	10	21	C

LOS D is generally the acceptable limit for intersections. On this basis, the Yangan Road, Percy Street and Guy Street intersections are already at capacity and may warrant treatment. Guy Street is signalised already and is currently used as the main access to the city centre from the south and west, so attracting trips away from this intersection by upgrading nearby intersections is one possible option. This would then increase traffic at other intersections such as Dragon /Wood Streets and Percy /Albion Streets.

### 2.2.3 Road safety

Traffic and Crash data reports provided by TMR show that 99 crashes have occurred during the period 2002 to 2008 along the section of highway between Campbells Gully and Bracker Road, and newspaper reports show that crashes continue to occur. The following analysis identifies changes since the original WTMS-2 and issues for this study.

#### Crash history

In the reporting period Feb 2002 to Aug 2007 for the above section of highway:

- There were 94 crashes of which 82 (92%) were directly intersection related;
- There were 14 single vehicle accidents;
- There were 8 (9%) crashes involving heavy vehicles (incl. 3 road trains with 1 out of control);
- The great majority of accidents involve turning vehicles, including mid block accidents when vehicles were manoeuvring to enter or leave a property or minor road;
- There were no fatal crashes;
- 4 crashes involved bicycles but there were no pedestrian accidents.

The most accidents occurred at Percy Street/Albion Street intersection with 13 crashes. Grafton Street/Albion Street had 10 crashes which all occurred prior to signals being installed in October 2006. The next worst was Fitzroy Street/Albion Street intersection with 8 crashes despite it being signalised for the whole reporting period. Palmerin Street/Wood Street intersection had 5 crashes in 2002, but there has only been one crash since the channelisation and turn restrictions, identified as part the WTMS-2 strategy, were implemented in 2003 as a separate Black Spot project.

In the last reporting period (Aug 2007-Dec 2008) only seven crashes have been reported. Three occurred at Wood Street/Wallace Street intersection, of which two involved articulated vehicles and one a motor cycle in single vehicle incidents. One of the other crashes occurred at Fitzroy Street/Albion Street intersection, showing this intersection continues to be represented in the statistics despite having signals. No crashes were reported at Grafton Street/Albion Street intersection, showing the improved performance since signals became operational on 23 October 2006 and the direction of traffic flow through the Woolworths Plus Petrol station was reversed. The other three crashes occurred at separate minor intersections.

The key intersections and their comparative crash exposure (annual traffic / average annual crashes) for the period 2002-2008 are shown in **Table 2.3** below. 2007 volumes have been used as approximating the average volumes for the period, and where intersection counts aren't available AADT (shown in italics) is estimated based on counts at nearby intersections.

**Table 2.3 Intersection Crash Record and Ranking**

Intersection	AADT 2007 (Numbers estimated – see note)	Total crashes 2002-2007 + (2008 in brackets)	Exposure 2002-2008 (million movements per crash per year)	Intersection ranking
Ogilvie Rd		0		
Freestone Rd		0		
Yangan Rd	9727	1	24.27	15
Jackie Howe Dr	10200	2	12.27	14
Victoria St	11228	6	4.67	7
Albert St		0		
Fitzroy St	14251	7 (1)	4.44	6
Grafton St	12734	10	3.18	2
Percy St	11978	13	2.30	1
Albion/Wood St	9792	5	4.89	9
Palmerin St	7766	6	3.23	3
Guy St	12965	4	6.47	11
Dragon St	10803	3	8.98	13
Wood/Wallace St	11691	4 (3)	4.88	8
Pratten St	9000	2	7.49	12
Locke St	8404	0		
Glen Rd	7300	3	6.07	10
Bisley – Cleary St	7100	4 (1)	4.43	5
Bracker Rd	4672	3	3.89	4

*Note: Estimated based on counts at nearby intersections.*

#### Implications of crash history for current study

The review of crash history shows that multiple vehicle crashes at intersections continue to dominate, which is typical of urban roads with high occurrences of cross and turning movements. Despite the mix of heavy through vehicles and local traffic, most crashes involve light vehicles, with most crashes involving articulated vehicles and road trains being of the single vehicle type. Heavy vehicles are not over represented in crashes compared to their component of the general traffic.

The traffic treatments at Grafton Street and Palmerin Street intersections identified as part of the WTMS-2 study have satisfactorily resolved the previous safety issues at these intersections. No crashes have been reported at Grafton Street and only one at Palmerin Street (which occurred shortly after the change in traffic conditions) following the improvements.

The crashes at the signalised Fitzroy Street/Albion Street and Guy Street/Wood Street intersections mainly comprise turning vehicles plus a few single vehicle incidents striking off-road objects. The cause of the high number of crashes at these signalised intersections is a serious issue for this study as the signals are intended to control potential conflicts.

Twelve mid-block crashes involved vehicle loss of control or striking another vehicle turning into or from a driveway or side road. These incidents were distributed along the route with 5 occurring at the outer approaches outside the 60KPH speed zone.

Of the intersections raised of being of concern in discussions with stakeholders, only Percy Street featured high in the crash analysis. Yangan Road (1) and Dragon Street (3) recorded crashes but Locke Street continued to be incident free despite the poor visibility and pedestrian traffic associated with the hospital, and adjacent shop and service station with ill defined parking.

The rate of crashes at the Wallace/Wood Streets intersection has increased with 3 single vehicle crashes (2 involving articulated vehicles), highlighting the problem with geometry (steep downhill approach in Wallace Street and tight turning radius).

The overall review shows that there has been a general reduction in the crash rate with a marked improvement in recent years. However options to address the ongoing crash history form a major component of the study.

### **2.3 Parking**

On-road parking capacity has been reduced as a consequence of parking restrictions associated with constructing the median in parts of Albion Street and Wood Street. This together with redevelopment of some frontage properties, including the Condamine Medical Centre at Dragon Street, has resulted in improved on-site parking provision, thereby reducing demand for on-road parking. Even so, some established businesses still generate on-road parking demand where on-site parking is inadequate.

The on-road parking still represents a potential hazard but the problem is not as serious as in past years.

There is a lack of suitable parking for long vehicles such as trucks and cars with caravans convenient to generators, such as fast food and tourist services. Consequently vehicles park on the shoulder or in "parking" lanes. This parking is undesirable as it interferes with general traffic flow and is a hazard for drivers and others when accessing a parked vehicle.

### **2.4 Public Transport**

No significant changes are expected to the bus routes in Warwick which might impact on the highway. Scheduled and school buses generally use the local roads as major generators such as schools and shopping centres are located away from the highway, and the grid system of local roads is easy to use. When stopping on the highway, buses often encroach into the left hand lane where the shoulders are not wide enough to store a bus.

The main issue is for buses travelling to the northeast, and in particular school buses servicing Scots College, which need to negotiate the intersection at Yangan Road, where delays and safety are issues. For other bus routes the need is to provide safe crossings of the highway at intersections.

### **2.5 Consultation**

Meetings were held with TMR and SDRC to assist the review process. No other stakeholders were consulted. The key issues raised are discussed below.

#### **2.5.1 TMR**

The following issues were identified at a meeting with a number of senior TMR Officers in November 2009, and further discussed at other times during the course of the study.

CBD Development: Several new commercial developments have occurred or are planned which will change traffic patterns and increase loads on certain intersections along the highway. For example, the IGA store in Palmerin Street will most likely increase loads on Victoria and Albert Streets intersections with Albion Street.

Access: New, existing and planned Developments along the route impact on traffic. For example:

- Various new developments have resulted in increased turning movements at intersections and into and from property.
- The popularity of a number of businesses has resulted in onstreet parking problems.
- Some established businesses require vehicles (including trucks) to reverse from the highway, into their access (and/or onto the highway, from their access).
- Some businesses have tight accesses and restricted onsite manoeuvring, which cause vehicles slowing and waiting to enter property to queue on the highway.
- Visitor information centre has very limited onstreet parking and creates problems for visitors. Relocation of the centre to a location with better (preferably off street parking) would help to overcome this problem.
- Log vehicles (including trucks) park on the highway, due to constrained/inadequate onsite parking areas, at a number of businesses.
- Numerous developments currently allow all turns into and from the property.
- Some businesses have access points located very close to the intersections.
- Australiana Park planned upgrade will increase usage and turns on highway.

Intersections: The recent and planned residential and commercial developments have increased congestion and safety impacts. While this involves most intersections, key ones are:

- Ogilvie Road with development to east and west.
- Freestone Road with development to Mt Tabor
- Yangan Road is one of the main problems due to the limited storage on the highway for right turning vehicles due to the proximity of the Railway Bridge. This problem will grow due to new residential development occurring along Yangan Road. This problem is also exacerbated by this intersection and the adjoining Yangan Road/Briggs Street intersection being the main access points for a large school campus located in Oxenham Street.
- Percy Street which is carrying more traffic following the turning restrictions at Palmerin Street at Wood Street, as predicted in WTMS-2.
- Dragon Street which is carrying more traffic following the turning restrictions at Palmerin Street at Wood Street, as predicted in WTMS-2. This intersection is considered to be one of the main concerns and signals would help relieve pressure at the Guy Street signalised intersection.
- Wood Street / Wallace Street intersection continues to be a problem due to number of heavy trucks, including Type 1 Road Trains, which use the intersection.
- Intersections along Wallace Street south from Locke Street serving developing residential areas are experiencing greater turning movements.

Amenity: Trucks continue to use Wood Street (east) as a rat run to the industrial area. However it appears this is being tolerated by SDRC and is less of a problem following the recent construction of new concrete bridges in East Street over Bracker and Rosenthal Creeks.

**Alternative Routes:** Freestone Road is becoming a popular alternative route for local residents travelling to and from Brisbane in order to avoid any potential delays that might occur along the Cunningham Highway north of Warwick. Similarly, Allora-Warwick Road is growing in use as a convenient alternative route for trips to and from Toowoomba, rather than using Cunningham and New England Highways between Allora and Warwick. This increases trips along the local streets such as Victoria Street and Rosehill Road/Wallace Street (north).

**Cyclists and pedestrians:** Residential growth is resulting in a corresponding growth in the number of cyclists. The area north of Condamine River has no convenient alternative routes to the highway which is causing safety concerns. A separate path is provided for pedestrians along Helene Street (and across the two bridges) but the path is not suitable for shared use by cyclists because of the sub standard alignment and narrow width as shown in the photos below.

**Entrance to bikeway, Briggs Street**



**Bikeway over railway bridge, Helene Street**



**Warwick Bypass:** TMR is undertaking a separate area planning study which will assess the need for a possible Warwick Bypass and, if recommended, its general form and function. The location of a corridor is beyond the scope of the WTMS-2 review, but its potential long term impact of attracting through traffic would need to be considered when developing a future strategy to manage traffic along the existing route.

## 2.5.2 SDRC

The following issues were identified at a meeting with a number of senior Council Officers in November 2009. The key issues raised are discussed below:

### Land use:

**Residential:** Warwick township has a population of about 13,800 and is said to be growing at about 1.25% per annum. However it is uncertain whether this rate will be sustained in the long term. Many new houses are for the growing population and existing residents upgrading their homes.

The main residential areas of development are occurring in the northeast and southwest of the town, with current approvals of about 640 and 300 residential lots respectively. These developments alone will cater for a population of about 2000 people or 15 years growth. The northeast has the larger areas of approved development although the southwest is more likely to grow in the long term with about 60% of the expected total new residential development.

**Industrial:** The main industrial development will be focused on the existing Warwick Industrial Area. The development will be similar to existing uses plus the likelihood of a new major distribution centre within 10 – 20 years.

Businesses in close proximity to busy intersection on the highway can result in congestion/access problems at the intersections.

The locations of some businesses cause problems with undesirable traffic movements (including trucks) on local Government roads.

No dramatic changes to land uses along the highway are expected. Commercial development along Wood Street is expected to continue, similar to existing uses such as motels. The planners were not confident that other possible developments, such as additional car dealerships along Alexandra Drive, would eventuate.

The problems which exist at the Yangan Road intersection and the adjoining Yangan Road/Briggs Street intersection may continue, despite any damages to the local road network in the vicinity of the large school campus located in Oxenham Street, which may or may not occur.

**Warwick Bypass:** While not part of this study, identifying a notional bypass corridor is required for inclusion in the new Warwick strategic plan. The link to Warwick Industrial area in the southeast is seen as an important objective for a bypass. The recent O-D study will be a useful guide as to the logical route from a traffic function perspective.

**Access:** The WTMS-2 strategy for controlling access to developments along the highway is supported. Constructing a central median through Warwick is endorsed as a key strategy from a safety and access management viewpoint. It will also reinforce the WTMS-2 strategy to restrict turns at the minor intersections, such as the Avenues along Wood Street.

**Intersections:** The key intersections are Yangan Road/Alexandra Drive and Dragon Street/Wood Street for reasons similar to those raised by TMR. Signals at Dragon Street are seen as a priority, but solving the Yangan Street problem will be more difficult and expensive due to the constraint of the railway bridge.

Percy Street is still a problem due to traffic generated by nearby businesses, but is tolerable. The low clearance of the railway underpass in Percy Street restricts its use by trucks so it does not require treatment as a major route. Wood Street (East) is a more suitable route for trucks.

Palmerin Street situation has changed with the construction of the pedestrian underpass, so the signalisation as proposed in WTMS-2 is no longer necessary. The local community has adjusted to the turn restrictions implemented as an early WTMS-2 strategy and they should be retained.

**Amenity:** The use of routes parallel to Wood Street is increasing, to avoid congestion on the highway and having to enter the highway at unsignalised intersections. This is particularly noticeable in Pratten Street. The recent construction of the pedestrian underpass at Palmerin Street could be a contributing factor but the practice is unlikely to abate when the underpass is completed.

The issue of trucks using Wood Street (East) is no longer considered to be an issue. Complaints have died away and truck use is being tolerated.

**Cyclists and pedestrians:** An extensive cyclist and pedestrian network exists or is planned. The highway route forms part of the network using footpaths for pedestrians or a shared cycle and pedestrian facility. The network north of Condamine River is more dependant on using the highway corridor as alternative opportunities are limited.

*Implications of consultation for current study:* The main need is to provide safe crossings of the highway, at Dragon Street and Yangan Road; identified as two key crossing locations requiring attention.

## 2.6 Summary

In summary, the issues raised by TMR and SDRC are similar. Warwick will continue to grow, generating more traffic and consequent traffic problems. The major areas of residential development will occur to the northeast and southwest, with industrial development mainly in the existing Warwick industrial area. Problems at Yangan Road and Dragon Street intersections will need to be addressed, as will provision for the general safe and convenient movement of traffic along the highway.

Works implemented as a result of WTMS-2 have helped improve the traffic situation. The review will assist planning of future works.

## 2.7 Conclusion

Since WTMS-2, improvements made to intersections along the highway, together with greater controls on access and parking associated with new land use, have generally improved traffic operations and safety through Warwick. Nonetheless, the Review of Issues phase has identified possible actions for investigation which are outlined below:

- a) Investigate the future performance of intersections in particular and mid-block sections to assess the effect of development and traffic growth on operating capacity;
- b) Identify appropriate traffic treatments to address safety issues at intersections having poor crash records. In particular Percy Street/Albion Street intersection requires investigation. The intersections at Grafton/Albion Streets and Palmerin/Wood Streets also have high crash rankings but causes have been addressed by existing improvements to these intersections. Wood/Wallace Streets intersection continues to be a concern because of the incidence of single large vehicle crashes.
- c) Access and parking control associated with land use has improved along the highway and needs to be maintained in response to pressure from further development.

The above review of issues provides a guide for the future year traffic modelling, investigations and development of new traffic management strategies to 2021.

### **3 Future Traffic Demand**

Traffic growth on the network will occur due to increases in population and development in Warwick (local traffic), and changes to highway traffic travelling through Warwick (through traffic). Therefore traffic growth is considered separately for trips having an origin or destination in Warwick (local traffic) and for through trips. These trips are classified into light and heavy vehicles. The key indicators for growth are described below.

#### **3.1 Through traffic**

The 2009 Traffic Census shows traffic growth over the last 5 years was:

- 0.59% at Campbells Gully;
- 3.83% at O O Madsen Bridge;
- -1.56% at Wood and Palmerin Streets;
- 4.61% east of Lyndhurst Lane;
- 5.27% west of Lyndhurst Lane;
- 2.72% south of Flitcroft Street;
- 1.22% east of 8 Mile (Cunningham Highway); and
- 2.93% to the north of 8 Mile (New England Highway).

Historical records also show that there has been a general increase in traffic since 2001 at the three main approaches to Warwick and some sites in the town. The negative growth in Wood Street at Palmerin Street is attributed to local traffic avoiding Wood Street because of the traffic disruptions during the recent construction of the Billy Day pedestrian underpass at Palmerin Street. It is reasonable to assume that the upward trend will continue for through trips although projects such as the road improvements for alternative routes, through Toowoomba (the Toowoomba Bypass) and Pacific Highway through northern NSW, and the proposed inland rail will attract some road and freight traffic from routes through Warwick.

The 2009 Traffic Census was not available when the model was being developed. The earlier traffic analysis based on the 2008 Traffic Census showed a lower growth (in fact the census showed some negative growth at several sites which was unlikely in reality). For modelling purposes, a modest growth of **1.0%** in highway traffic was assumed for both light and heavy vehicles as being more representative of the likely growth at the time. In fact a growth rate of about 3% would now seem to be more appropriate. Therefore, the model slightly underestimates this traffic but it has not been reworked because of the need to meet the study's time constraints and as the actual overall difference in volumes is relatively small.

#### **3.2 Population**

Warwick township population in 2008 was about 13,800 and is projected to grow by 1.25% per annum for the foreseeable future. Many new houses are planned to service the growing population and existing residents upgrading their homes. This would provide a population of approximately 16,000 in year 2021 based on the SDRC's current planning projections.

The population and development projections provided by SDRC are shown and summarised below in **Table 3.1**.

**Table 3.1 Forecast population and residences**

Year	Existing and Projected Population	Existing and Projected Dwellings (Single and multiple dwellings)
2006	13,340	5,960
2009	13,950	6375
2016	15,270	7355
2021	16,180	8060
Annual growth	1.25%	

*Numbers are rounded*

### **3.3 New land development**

#### ***Residential Development***

There are currently over 940 residential lots approved for development which will cater for a population of about 2,000 people or 15 years growth. The main developing residential areas are occurring in the northeast and southwest of the town with current approvals of about 640 and 300 residential lots respectively. However SDRC expects the southwest is more likely to grow in the long term with about 60% of the total new residential development. This would effectively mean development in the northeast would slow down or have lower occupancies. On the basis of current approvals and SDRC expectations it is suggested a more likely compromise will be that development is evenly distributed between the two areas.

It is acknowledged that some residential development will occur in other parts of the town but for traffic modelling purposes it is assumed the main new residential growth to 2021 will be about 1,600 residential lots distributed as follows:

- Northeast: 800 lots with access distributed between Freestone Rd (55%) and Yangan Road (45%); and
- Southwest: 800 lots with access distributed between Glen Road (10%), Bisley Street (70%), and Law Road (20%).

Internal trips will grow proportionally to population increase, assuming no significant change in travel behaviour. As the highway route becomes more congested and potential traffic delays increase (e.g. due to more traffic signals), there is a tendency for some local trips to divert away from the highway. Even so the highway will be used for many trips because it is a more direct route between many areas in Warwick.

However, it is unlikely that local trips will decline overall, so the model provides for existing local background traffic to grow at a nominal 0.5% plus trips generated from new developments.

#### ***Retail and warehousing***

Several major shopping developments such as IGA, ALDI and Hungry Jacks have opened or plan to be opened since WTMS-2 which have generated traffic and increased movements at nearby intersections. While these developments will not add appreciably to the overall trips along the route, their impact at key intersections will be accounted for based on relevant traffic reports for various developments (where available).

Provision is also made for a notional shopping development on the southeast corner of Cleary Street/Wallace Street intersection to service the growing residential area on the southwest side of Warwick.

#### ***Industry***

Industrial growth is planned primarily for the Warwick Industrial Estate, but some development is also occurring on the northeastern side of Warwick. However no known new major developments are planned at this stage which might change the growth trends, especially with respect to external trips.

### **3.4 Proposed future traffic**

The future year for the study is 2021, and for the purposes of this study the assumed traffic growths are:

- Through trips, **1.0%**;
- Local trips, **0.5%**; and
- Additional trips generated by new residential and commercial developments servicing extra population, with specific distribution based on the above discussion.

## **4 Modelling**

Cardno Eppell Olsen (CEO) was engaged to develop a Microsimulation model which reflects the existing conditions in Warwick and to be used to help assess future traffic conditions and traffic strategy options.

The model platform used was Paramics, developed by Quadstone. The program can analyse various typical traffic operations, such as signals, priority controlled intersections and parking.

### **4.1 Base year model**

#### **4.1.1 Traffic data**

##### **Traffic counts**

TMR supplied traffic counts at all major intersections in the study area. These (most recent) traffic counts were conducted in February through to April 2009. The traffic counts provided data along the whole study network, but due to intersections being counted on different days there was some discrepancies between intersections. Also, only the AM and PM peak periods for individual intersections were provided but not all the intersections had the same peak periods. Although the peak times differed, the actual counts were used, but the discrepancies meant that adjustments were required to make sure the traffic volumes going in/out of an intersection balanced.

During the model development, a considerable discrepancy was identified in the traffic counts at the intersections of Alexandra Drive/Yangan Road and Yangan Road/Briggs Street. The traffic counts identified a difference between these two closely spaced intersections of approximately 200 vehicles. This is despite there being very little potential for vehicles to exit/enter the roadway. This discrepancy has been taken into account when developing the existing traffic demand. However this resulted in a poor model volume match to traffic counts at these intersections.

##### **Origin - Destination Data**

TMR supplied CEO with Origin – Destination Data (O-D Data) to be used in the model. This data provided the number of vehicles making the through trips within the network. The data also indicated the number of vehicles stopping in the Warwick network for a short period of time before continuing the journey.

Locations were chosen strategically across the network to give the best coverage for vehicle movement within the defined network. The O-D survey was used to essentially identify vehicles making the through movements on the Cunningham Highway/New England Highway.

There was a substantial amount of information that could be obtained from the O-D data sites, but only total vehicles within the 15 minute time limit and 45 minute time limit were used to represent through trips. It was assumed that a vehicle travelling through the network without stopping for amenities would take 15 minutes or less. The total vehicles with a 15 minute time limit were used to get the through trips within the Warwick network. It was also assumed that anyone stopping for a short amount of time (e.g. at a fast food outlet or for petrol) and then continuing the journey would take 45 minutes or less. The total number of through vehicles within a 45 minute time limit was then subtracted from total volumes to obtain the number of vehicles stopping within the network. Note that after the modelling was completed it was suggested a time of up to 60 minutes may be more appropriate for identifying through trips, but the model was not reworked for the reasons outlined in Section 3.1.

#### **4.1.2 Microsimulation Model Time Periods**

Determining the times for the AM and PM peak periods in the Paramics Microsimulation model was derived from the traffic counts provided by TMR. The average peak periods were chosen as not all of the intersections had the same peak period, as mentioned above.

The time periods for the model were:

- AM Peak period between 07:00 and 10:00;
- PM Peak period between 14:00 and 17:00.

The model time period allows for a ‘warm-up’ period, which allows the network to fill with vehicles, and a ‘cool-down’ period, which allows for vehicles to leave the network. Therefore, the model run was for a simulation three hours. The evaluation periods representing the peak hour used to study the network were:

- AM Peak period between 08:00 and 09:00
- PM Peak period between 15:00 and 16:00

The evaluation peak periods do not represent the commuter peak period usually associated with cities with a large employment, but rather it is considered the PM Peak indicates the effect of the school finish times on traffic. The peak periods used in the Paramics model are consistent with traffic count data provided by TMR.

#### 4.1.3 Estimating Traffic Demands

To develop the microsimulation matrix, both the O-D Data and Traffic Counts were utilised. The network was split into 37 zones, starting with the O-D Sites (Paramics zones 1 – 6) and the rest of the external in/outs to the network were numbered (Paramics Zones 7 – 37).

The O-D data was loaded into the matrix first, as well as the known values from the traffic counts, where known values were considered to be the through movements from a local street to another local street (e.g. Dragon Street north to south across Wood Street).

The final step was to incorporate the traffic counts into the matrix. This was done by proportioning the volumes coming into the network across all the Paramics zones. The O-D Data traffic volume numbers were taken out of the traffic count numbers to avoid ‘doubling up’ on the same traffic volumes.

This process was undertaken for both the AM and PM peak periods.

The base year Paramics model represented the Warwick highway network for 2009 conditions and the traffic volumes used are shown in **Appendix B**.

#### 4.1.4 Road Network Description

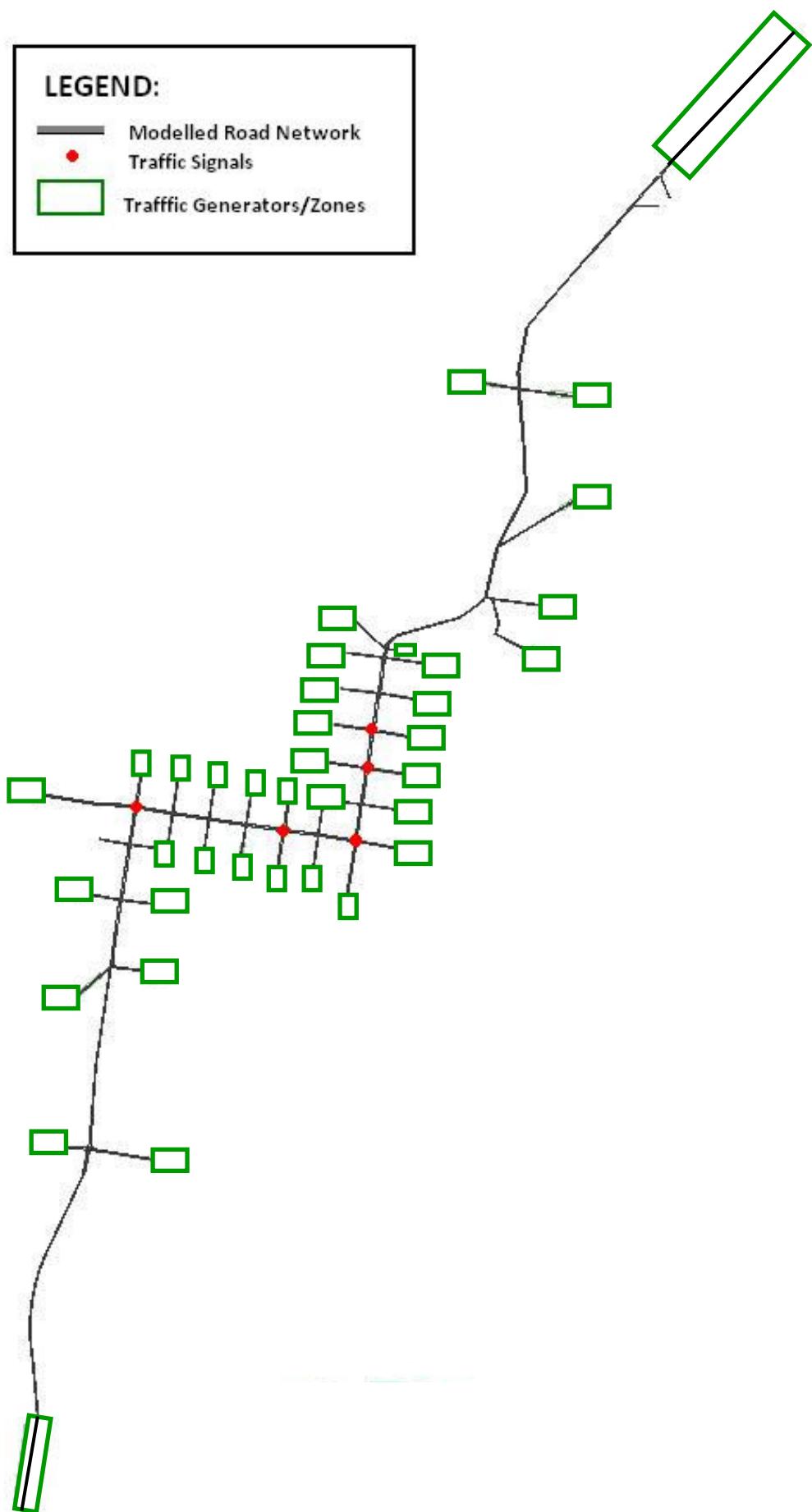
The road network modelled in Paramics is shown below on **Figure 4.1** The model was a corridor model, focusing on the state-controlled roads only. Essentially, the extents of the model were:

- North - Cunningham Highway north of the East Street intersection (truck stop);
- West - Cunningham Highway through Warwick to New England Highway;
- South - New England Highway south of Bracker Road.

The model includes all intersections of the cross streets and roads to the highway. No intersections of the laneways and avenues to the highway were included in the model as the volumes were small.

The current Paramics model is effectively the same as the previous WTMS-2 VISSUM microsimulation model of Warwick area. The only difference between the road networks of the two models is that the Paramics model has been extended to the north and south.

Figure 4.1 Warwick Paramics Network Showing Entry/Exit Zone



#### 4.1.5 Matrix and Model Calibration

The trip matrix was calibrated against all the turning movements provided from the traffic counts. Calibration of the matrix was undertaken using the GEH statistic. It is used since neither the absolute difference nor the relative difference takes into account the importance of both the volume of the flow and the size of the difference. The equation used to calculate the GEH statistic is as follows:

$$GEH = \sqrt{\frac{(V_2 - V_1)^2}{(0.5 * (V_1 + V_2))}}$$

$V_1$  and  $V_2$  are observed flows and modelled flows respectively.

As a rule of thumb in comparing assigned volumes, a GEH value of 5 or less would be considered good, while a GEH value greater than 10 would be considered unacceptable.

The matrix gave good GEH values (less than 5) throughout the network. The only exception was at Yangan Road and its two intersections with Cunningham Highway and Briggs Street, because of the traffic count discrepancy between the intersections which was discussed earlier. However this did not affect the subsequent intersection analysis and proposed strategy which used the aaSIDRA intersection analysis package.

The Paramics model was run and, as an output from the model, the traffic volumes were also calibrated against the traffic counts provided by TMR. This gave the same good GEH through the whole Warwick network, except for the Cunningham Highway/Warwick-Yangan Road intersection again.

The overall good GEH from the model means that the model is providing an accurate representation of the Warwick road network.

A detailed 2009 AM and PM Model Calibration Report is contained in the separate Design Note *Warwick Traffic Management Study – 2009 AM and PM Calibration Report* by Cardno Eppell Olsen, February 2010 in **Appendix D**.

## 4.2 Future year model

The Paramics model was used to model future year traffic network operation performance. This section explains how the matrix was updated to reflect the future traffic projections and the potential developments in the Warwick area.

### 4.2.1 Growth Rates

To model future year traffic, a growth rate was required which would be used to grow the background traffic. The future year for the study is 2021, and for the purposes of this study assumed peak hour traffic growths discussed in Section 3 are:

- through trips, **1.0%**;
- local trips, **0.5%**;
- additional trips generated by new residential and commercial developments servicing extra population with specific distribution based on the above discussion and traffic reports for various developments (where available).

Traffic Impact Assessment reports (where available) for various developments within the Warwick area provided future year traffic projections for each individual development. The trip generation and trip distribution information was used for the future year model matrix for each individual development.

## 4.2.2 Matrix Building

The process used for developing the future year matrix is shown in **Figure 4.2** and described below. The two different growth rates were applied to the background traffic within the matrix (through trips from the O-D Data and the local trips).

The traffic generated by the proposed developments within the study area was defined to have the same traffic distributions through the Paramics network as the base model. The new in/out traffic distributions for the proposed developments were also applied to the base network matrix.

This resulted in an overall future growth, for the matrix, to year 2021. The overall total vehicle volumes within the matrices are shown in **Table 4.1** below.

**Table 4.1 Future Traffic Demands**

Year	AM Peak total traffic	PM Peak total traffic
2009	4,770	4,889
2021	6,271	6,860

The Future year traffic volumes used are shown in **Appendix B**.

## 4.2.3 Network

It was intended that the future year model would be used to model the following proposed three networks in order to assess the progressive impact of the traffic on the route and assess the effect of various strategies:

Do nothing: To assess the capacity of the existing system to carry the extra traffic.

Intersection upgrades: To assess the effect of new signalised intersections:

- Albion Street/Yangan Road;
- Albion Street/Victoria Street;
- Albion Street/Percy Street;
- Wood Street/Dragon Street;
- Wallace Street/Bisley Street/Cleary Street.

Intersection upgrades plus mid block 4 lane divided: This option was planned if mid block capacity was an issue. In fact mid block capacity was not considered an issue so the 4-laning option was not undertaken.

An assessment of 4-laning of Helene Street and Alexandra Drive, based on traffic growth projections between 2009 and 2021, showed that 4-laning is not required until after 2021 based on mid block capacity. However, detailed intersection modelling for the Alexandra Drive/Yangan Road intersection has identified the need for considerably long approach and depart lanes to accommodate expected queuing as identified earlier. Essentially, it is considered appropriate for additional lanes on the highway between Freestone Road and Jackie Howe Drive resulting in a four traffic lane cross-section. This is based on an intersection requirement, so no specific four-lane model option was required to be developed.

## 4.2.4 Matrix Manipulation

The signalised intersection improvements identified above would be expected to trigger a strategic change in route choice through Warwick, in particular along Percy Street and Dragon Street as trips would divert from the congested Guy Street/Wood Street intersection.

The developed WTMS-2 Update model is unable to estimate change in the wider route choice, therefore some manual route choice changes have been applied to the 2021 model. The rationale for modifying the travel patterns/distribution at these intersections is based on the wider road network connectivity and perceived road hierarchy to the east and south.

For example, Dragon Street provides a more direct route for longer distance trips to the south, and similarly, Percy Street provides a more direct route to the east. The traditional grid road network in the town centre would result in the traffic at the proposed signals being shared with the traffic at the congested signals adjacent. There has been no overall net increase or decrease in traffic assignment.

The changes applied to the traffic assignment are:

Albion Street/Percy Street:

- 90% of the southbound and westbound traffic at the Grafton Street and Percy Street intersections with Albion Street was applied to Percy Street; and
- 90% of the northbound traffic at the Grafton Street and Percy Street intersections with Albion Street was applied to Grafton Street.

Wood Street/Dragon Street:

- 90% of the southbound and westbound traffic at the Dragon Street and Guy Street intersections with Wood Street was applied to Dragon Street; and
- 90% of the eastbound and northbound traffic at the Dragon Street and Guy Street intersections with Wood Street was applied to Dragon Street.

Victoria Street/Albion Street:

- Right turn exit trips from Alice Street were reassigned to Victoria Street.

The resultant model was valuable in demonstrating the effect of queues and delays at various locations.

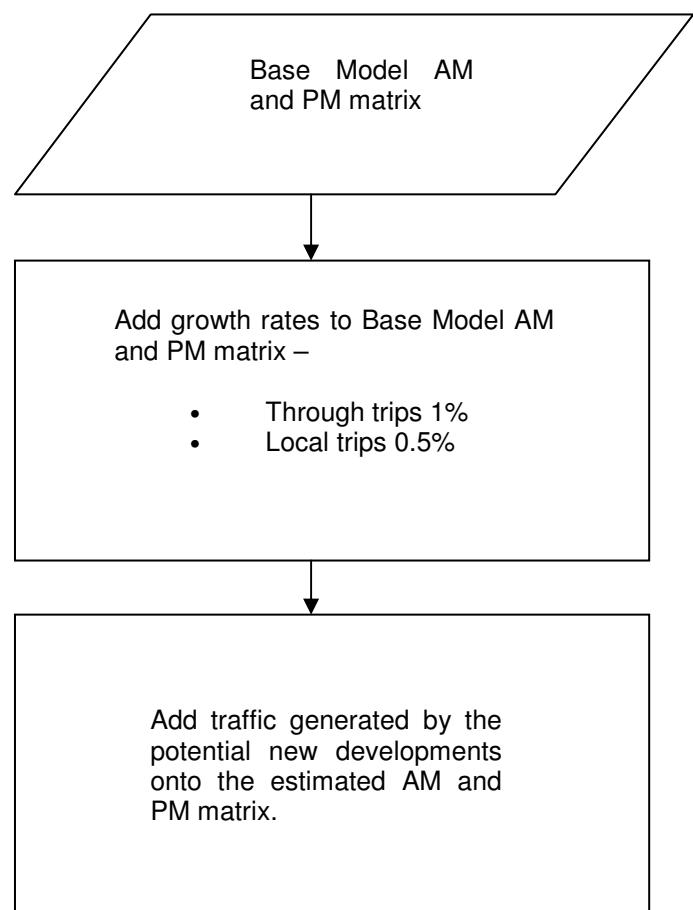
## 4.3 Model results

### 4.3.1 SIDRA Results

The key intersections were then assessed using the aaSIDRA intersection analysis package to gain a better understanding of the treatment needed to accommodate future traffic (e.g. length of right turn storage lanes).

The aaSIDRA output for the existing situation and future year model is contained in **Appendix C**.

**Figure 4.2 Schematic Diagram**



## **5 Traffic management strategies**

### **5.1 Strategy principles**

The WTMS-2 strategy which was to “provide a balanced or equitable traffic arrangement for through and local traffic, cyclists and pedestrians” is still applicable, and forms the basis for this study. The key focus is safety, while giving due consideration to reinforcing the priority for highway traffic and minimising restrictions to local mobility and access.

The main features of the strategy are to:

- Provide consistency along the highway with a minimum delay to through traffic;
- Facilitate safe crossing of the intersections for through and local traffic by providing:
  - sheltered right turn lanes at all intersections where turns are permitted;
  - new traffic signals at key intersections; and
  - thresholds at non-signalised intersections to improve awareness of the highway.
- Improve total network efficiency by increasing opportunities for local traffic to cross the highway, rather than using more circuitous routes to cross or turn at the current few signalised intersections;
- Provide medians to separate opposing traffic flows and create areas for sheltered right turn lanes;
- Reduce impedance along the route by controlling accesses to fronting properties and restricting on-road parking;
- Use intersection control to help reinforce the road hierarchy; and
- Influence land-use so that the development is appropriate to the highway location giving consideration to minimising the impact on access points and traffic environment.

The proposed traffic management strategy is presented in **Table 5.1** and additional discussion is provided in the following sections.

Table 5.1 WTMS - 2 Review Proposed Strategies

Location	Existing control	Proposed	Comment
<b>Mid block</b>			
Alexandra Drive	<ul style="list-style-type: none"> <li>2 lane (northbound) and 1 lane (southbound) undivided with sections of painted median</li> </ul>	<ul style="list-style-type: none"> <li>4 lane divided from Ogilvie Road to Freestone Road</li> <li>4 lane divided from Freestone Road to south of Yangan Road</li> <li>Required by 2015</li> </ul>	<ul style="list-style-type: none"> <li>Mid block volume does not require 4 lane capacity until after 2021</li> <li>4 lanes provides lane to overtake for slow moving vehicles</li> <li>Improve capacity and intersection definition with shelter for turning vehicles</li> <li>Required in association with Yangan Road intersection upgrade</li> <li>Reduce accesses and on road parking</li> </ul>
Helene Street	<ul style="list-style-type: none"> <li>2 lane undivided with turn lanes</li> </ul>	<ul style="list-style-type: none"> <li>4 lane divided to match north and south approaches</li> <li>Not required before 2021 (but see comments)</li> </ul>	<ul style="list-style-type: none"> <li>Mid block volume does not require 4 lane capacity until after 2021</li> <li>Requires duplication of two bridges (railway overpass and O O Madsen Bridge)</li> <li>Improve capacity and intersection definition with shelter for turning vehicles</li> <li>Required in association with Yangan Road intersection upgrade which requires widening the railway bridge</li> </ul>
Albion Street	<ul style="list-style-type: none"> <li>4 lane divided with turn lanes and sections of raised median for a considerable part of the length</li> </ul>	<ul style="list-style-type: none"> <li>Review northbound approach to O O Madsen Bridge</li> <li>Extend raised median for remaining sections, by converting existing sections of painted median and centreline</li> </ul>	<ul style="list-style-type: none"> <li>Help address safety problem of merge and sharp alignment for trucks turning across bridge</li> <li>Completes raised median treatment and reduces risk of mid-block turns</li> <li>Need to consider requirements for trucks servicing Shelleys Industries complex</li> <li>Reduce accesses and on road parking</li> </ul>
Wood Street	<ul style="list-style-type: none"> <li>4 lane divided with marked median separator and turn lanes, including some sections with raised median</li> </ul>	<ul style="list-style-type: none"> <li>Construct raised median Albion Street to Dragon Street</li> <li>Paint hatched median Dragon Street to Wallace Street</li> </ul>	<ul style="list-style-type: none"> <li>Median reinforces access control and left turn restriction at the "Lanes"</li> <li>Lose current on-road parking outside commercial areas</li> <li>Mainly residential development so minimise disruption of on-street parking and access until traffic grows</li> </ul>
Wallace Street	<ul style="list-style-type: none"> <li>4 lane undivided north of railway</li> <li>2-3 lane south of railway with painted median</li> </ul>	<ul style="list-style-type: none"> <li>4 lane divided with raised median</li> <li>Not required before 2021</li> </ul>	<ul style="list-style-type: none"> <li>Mid block volume does not require 4 lane capacity before 2021</li> <li>Improve capacity and intersection definition with shelter for turning vehicles</li> <li>2 lanes each way provides for slow trucks climbing grade</li> </ul>
<b>Intersections</b>			
<b>Cunningham Highway</b>			
East Street (Caltex Truck stop)	<ul style="list-style-type: none"> <li>Give way</li> <li>Right turn pocket and channelisation</li> </ul>	<ul style="list-style-type: none"> <li>Retain existing channelisation and restrictions</li> </ul>	<ul style="list-style-type: none"> <li>Review as part of future development impact</li> </ul>
Glengallan Road	<ul style="list-style-type: none"> <li>Give way</li> <li>Painted right turn pocket</li> </ul>	<ul style="list-style-type: none"> <li>Retain right turn entry but remove right turn exit from Glengallan Road</li> </ul>	<ul style="list-style-type: none"> <li>No crash history but preferable to reduce cross movements by relocating right turn exit to Ogilvie Road</li> </ul>
Ogilvie Road	<ul style="list-style-type: none"> <li>Give way</li> <li>Painted right turn lane</li> </ul>	<ul style="list-style-type: none"> <li>Give way</li> <li>Construct right turn lane</li> </ul>	<ul style="list-style-type: none"> <li>Construct right turn lanes as part of 4 lane upgrade</li> </ul>
Murphy Street	<ul style="list-style-type: none"> <li>Give Way</li> </ul>	<ul style="list-style-type: none"> <li>Give way with right turn lanes</li> </ul>	<ul style="list-style-type: none"> <li>Right turn lanes required to remove right turning vehicles from through lanes</li> </ul>
Meneely Street	<ul style="list-style-type: none"> <li>Give way</li> </ul>	<ul style="list-style-type: none"> <li>Restrict to left turn in and out only</li> </ul>	<ul style="list-style-type: none"> <li>Refer WTMS-2 strategy <ul style="list-style-type: none"> <li>Ban right turns from fast lane</li> <li>Low demand for right turning movement</li> </ul> </li> </ul>
Freestone Road	<ul style="list-style-type: none"> <li>Give way</li> <li>Raised right turn lane</li> </ul>	<ul style="list-style-type: none"> <li>Retain existing intersection</li> </ul>	<ul style="list-style-type: none"> <li>Priority intersection control is adequate, as model results indicate spare capacity beyond 2021</li> </ul>
Palmer Avenue	<ul style="list-style-type: none"> <li>Give way and right turn lane</li> </ul>	<ul style="list-style-type: none"> <li>Give way</li> <li>Construct raised islands at right turn lane</li> </ul>	<ul style="list-style-type: none"> <li>Low existing demand. Motel attracts non-local trips</li> <li>Construct raised island and turn lane as part of 4 lane upgrade</li> </ul>
Yangan Road	<ul style="list-style-type: none"> <li>Give way</li> </ul>	<ul style="list-style-type: none"> <li><b>New traffic signals</b></li> <li>Increase right turn lane storage</li> <li>Signals required by 2015</li> </ul>	<ul style="list-style-type: none"> <li>Priority intersection at capacity by 2015</li> <li>Traffic growth warrants signals</li> <li>Railway bridge is a major constraint (see related mid-block strategy)</li> </ul>
Jackie Howe Drive	<ul style="list-style-type: none"> <li>Give way and channelisation</li> </ul>	<ul style="list-style-type: none"> <li>Give way</li> <li>Construct islands as part of 4 lane upgrade</li> </ul>	<ul style="list-style-type: none"> <li>Traffic capacity not an issue</li> <li>Channelisation will reinforce traffic paths and improve safety</li> </ul>
<b>Albion Street</b>			
Alice Street	<ul style="list-style-type: none"> <li>Give way and raised right turn lane</li> </ul>	<ul style="list-style-type: none"> <li>Restrict from Alice Street to left turn out</li> <li>Retain right turn into Alice Street, but review it for any potential adverse impact on right turn operations at future signals at Victoria Street</li> </ul>	<ul style="list-style-type: none"> <li>Retains existing access to Alice Street from north</li> <li>Right turn out relocates to Victoria Street when signalised</li> </ul>
Victoria Street	<ul style="list-style-type: none"> <li>Give way</li> <li>Marked right turn lane into Victoria Street</li> </ul>	<ul style="list-style-type: none"> <li><b>New traffic signals</b></li> <li>Construct right turn lanes for north and south approaches</li> <li>Signals required by 2015</li> </ul>	<ul style="list-style-type: none"> <li>Increased traffic from local rat-running and high turning volumes of HV to industrial area and route to Allora</li> <li>Allows right turn from Alice Street to be removed</li> <li>Improves access to northern end of shopping precinct and high school</li> </ul>
Albert & Condamine Streets	<ul style="list-style-type: none"> <li>Give way and marked right turn lane</li> </ul>	<ul style="list-style-type: none"> <li>Give way with threshold</li> <li>Construct turn lanes both directions</li> </ul>	<ul style="list-style-type: none"> <li>Retain all movements</li> <li>Improve intersection definition and operations</li> </ul>
Fitzroy Street	<ul style="list-style-type: none"> <li><b>Traffic signals</b></li> <li>Right turn phases on highway approaches</li> </ul>	<ul style="list-style-type: none"> <li>Traffic signals</li> <li>Optimise signal timing</li> </ul>	<ul style="list-style-type: none"> <li>Intersection has poor crash record (ranking 6): <ul style="list-style-type: none"> <li>Investigate signal phasing</li> <li>May require greater police enforcement</li> </ul> </li> </ul>
Frank Avenue	<ul style="list-style-type: none"> <li>Left turn exit only</li> </ul>	<ul style="list-style-type: none"> <li>No change</li> </ul>	<ul style="list-style-type: none"> <li>Existing signage and median satisfactory</li> </ul>
Grafton Street	<ul style="list-style-type: none"> <li><b>Traffic signals</b></li> <li>Right turn phases on highway approaches</li> </ul>	<ul style="list-style-type: none"> <li>Traffic signals</li> <li>Optimise signal timing</li> </ul>	<ul style="list-style-type: none"> <li>WTMS-2 strategy has addressed previous crash issues</li> </ul>
King Street	<ul style="list-style-type: none"> <li>Give way and marked right turn lanes</li> </ul>	<ul style="list-style-type: none"> <li>Give way with threshold</li> <li>Construct turn lanes for both directions</li> </ul>	<ul style="list-style-type: none"> <li>Intersection has no traffic history</li> <li>Improve intersection definition and operations for consistency with rest of route</li> </ul>

Table 5.1 Cont...

Location	Existing control	Proposed	Comment
Percy Street	<ul style="list-style-type: none"> <li>Give way</li> <li>Painted right turn lanes in Albion Street and raised centre islands in Percy Street</li> </ul>	<ul style="list-style-type: none"> <li><b>New traffic signals</b></li> <li>Required by 2015</li> </ul>	<ul style="list-style-type: none"> <li>Address highest crash priority intersection</li> <li>Provides relief to Guy Street/Wood Street intersection by attracting trips to the more direct route</li> </ul>
Albion/Wood Streets	<ul style="list-style-type: none"> <li><b>Traffic signals</b></li> </ul>	<ul style="list-style-type: none"> <li>Traffic signals</li> <li>Optimise signal timing</li> <li>Local taper widening in Wood Street to accommodate large vehicles turning from Albion Street</li> </ul>	<ul style="list-style-type: none"> <li>Hungry Jacks development on southwest corner has left turn access lane to shops</li> <li>Improves conditions for double right turn involving large vehicles (including road trains)</li> </ul>
<b>Wood Street</b>			
Avenues - Stewart, Acacia, Myall, Myrtle, Wattle and Wilga	<ul style="list-style-type: none"> <li>Give way</li> <li>Left turn in and out intended, but still able to make right turns except at Acacia Avenue</li> </ul>	<ul style="list-style-type: none"> <li>Sign for left in and out (not needed opposite raised medians)</li> </ul>	<ul style="list-style-type: none"> <li>WTMS-2 proposed left turn in and out only to: <ul style="list-style-type: none"> <li>- discourage cross movement and</li> <li>- reinforce local road hierarchy</li> </ul> </li> </ul>
Palmerin Street	<ul style="list-style-type: none"> <li>Give Way</li> <li>Channelisation prevents through and right turn from Palmerin Street</li> </ul>	<ul style="list-style-type: none"> <li>Construct right turn lanes in Wood Street</li> </ul>	<ul style="list-style-type: none"> <li>WTMS-2 strategy provided for signals but no longer required as pedestrian underpass recently constructed and local trips have adjusted to existing situation</li> </ul>
Guy Street	<ul style="list-style-type: none"> <li><b>Traffic signals</b></li> <li>Right turn phases on highway approaches</li> </ul>	<ul style="list-style-type: none"> <li>Traffic signals</li> <li>Optimise signal timing and phasing</li> <li>Investigate increasing storage in Guy Street northern approach</li> </ul>	<ul style="list-style-type: none"> <li>Traffic volumes relieved by proposed signals at Percy/Albion Streets and Dragon/Wood Streets intersections</li> </ul>
Dragon Street	<ul style="list-style-type: none"> <li>Give way</li> </ul>	<ul style="list-style-type: none"> <li><b>New traffic signals</b></li> <li>Construct right turn lanes</li> <li>Required by 2019</li> </ul>	<ul style="list-style-type: none"> <li>Signals required by 2019, however signalise earlier to: <ul style="list-style-type: none"> <li>- Relieve congestion at Guy Street intersection</li> <li>- Reinforce hierarchy as Dragon Street is a major north-south distributor road</li> <li>- Provide safe control of intersection (although intersection crash ranking is 13)</li> <li>- Improve crossing for pedestrians and cyclists</li> </ul> </li> </ul>
Wantley Street	<ul style="list-style-type: none"> <li>Give way</li> </ul>	<ul style="list-style-type: none"> <li>Threshold treatment</li> <li>Provide right turn storage lane on highway</li> </ul>	<ul style="list-style-type: none"> <li>Improves prominence of intersection on approach to highway and reinforces intersection control</li> <li>Removes right turn traffic from through lanes</li> </ul>
Gore Street	<ul style="list-style-type: none"> <li>Give way</li> </ul>	<ul style="list-style-type: none"> <li>Threshold treatment</li> <li>Provide right turn storage lanes on highway</li> </ul>	<ul style="list-style-type: none"> <li>Improves prominence of intersection on approach to highway and reinforces intersection control</li> <li>Removes right turn traffic from through lanes</li> </ul>
Wood/Wallace Streets	<ul style="list-style-type: none"> <li><b>Traffic signals</b></li> <li>Heavy vehicle detectors on all approaches extend phase and clearance time</li> </ul>	<ul style="list-style-type: none"> <li>Traffic signals</li> <li>Optimise signal timing</li> <li>ITS for trucks (especially southern approach)</li> <li>Left turn improvements (east to south)</li> </ul>	<ul style="list-style-type: none"> <li>Improves intersection operations (capacity and delays)</li> <li>Install activated warning signal to address safety for trucks</li> <li>Improve geometry to address sub standard left turn facility</li> <li>Restrict redevelopment of old Coach terminal site to a low traffic generator use</li> </ul>
<b>Wallace Street</b>			
Pratten Street	<ul style="list-style-type: none"> <li>Give way</li> </ul>	<ul style="list-style-type: none"> <li>Threshold treatment</li> <li>Provide right turn storage lane on highway</li> </ul>	<ul style="list-style-type: none"> <li>Improves prominence of intersection on approach to highway and reinforces intersection control</li> <li>Removes right turn traffic from through lanes</li> </ul>
Locke Street	<ul style="list-style-type: none"> <li>Give way</li> <li>Painted right turn lanes</li> </ul>	<ul style="list-style-type: none"> <li><b>New traffic signals</b></li> <li>Link signals to railway crossing</li> <li>ITS for trucks (especially on southern approach)</li> <li>Required <b>post 2021</b> (capacity) but earlier for potential safety issues</li> </ul>	<ul style="list-style-type: none"> <li>Signals proposed despite good safety record and lack of capacity issues in order to: <ul style="list-style-type: none"> <li>- Address poor sight distance concern</li> <li>- Reinforce preferred crossing location for pedestrians and cyclists accessing hospital, shop and schools</li> <li>- Improve crossing opportunities and safety awareness for pedestrians crossing highway</li> <li>- ITS reduces need for trucks to stop and assists traffic to prepare to stop when required</li> <li>- Improve traffic management associated with shop and petrol outlet</li> </ul> </li> </ul>
Glen Road and entry to Australiana Park	<ul style="list-style-type: none"> <li>Give way</li> <li>Threshold</li> </ul>	<ul style="list-style-type: none"> <li>Give way</li> <li>Painted right turn lanes</li> </ul>	<ul style="list-style-type: none"> <li>Remove right turn traffic from through lanes</li> </ul>
Cleary/Bisley Streets	<ul style="list-style-type: none"> <li>Give way</li> <li>4 lane undivided with painted threshold</li> </ul>	<p><b>New traffic Signals</b></p> <ul style="list-style-type: none"> <li>Channelisation with right turn lanes</li> <li>Required by 2015</li> </ul>	<ul style="list-style-type: none"> <li>Provide safe control of highway intersection – crash ranking is 10</li> <li>Improve crossing for pedestrians and cyclists</li> <li>Possible future commercial development on southeast corner precinct may trigger signals</li> </ul>
Law Road	<ul style="list-style-type: none"> <li>Give way</li> <li>Painted threshold</li> </ul>	<ul style="list-style-type: none"> <li>Right turn storage lane</li> <li>Convert threshold to raised islands</li> </ul>	<ul style="list-style-type: none"> <li>Developing residential area</li> <li>Remove right turn traffic from through lanes</li> <li>Raised islands assist proper turning paths</li> </ul>
Carmody Street	<ul style="list-style-type: none"> <li>Give way</li> <li>Painted right turn lane</li> </ul>	<ul style="list-style-type: none"> <li>Threshold</li> </ul>	<ul style="list-style-type: none"> <li>Improve prominence of intersection on approach to highway and reinforces intersection control</li> </ul>
Flitcroft Street	<ul style="list-style-type: none"> <li>Give way</li> <li>Painted right turn lane</li> </ul>	<ul style="list-style-type: none"> <li>Threshold</li> </ul>	<ul style="list-style-type: none"> <li>Collector road to retirement village and TAFE college</li> <li>Improve prominence of intersection on approach to highway and reinforces intersection control</li> </ul>
Bracker Road	<ul style="list-style-type: none"> <li>Give way</li> <li>Painted channelisation (all approaches) with right turn lanes on highway</li> </ul>	<ul style="list-style-type: none"> <li>Channelisation with raised islands</li> <li>Street lighting</li> </ul>	<ul style="list-style-type: none"> <li>Major designated truck access to industrial area</li> <li>Improves visibility of traffic islands and promotes correct compliance</li> <li>Reinforces limit of urban area</li> </ul>

Table 5.1 Cont...

Location	Existing control	Proposed	Comment
<b>General</b>			
Traffic Signals	<ul style="list-style-type: none"> <li>Existing traffic signals linked to TMR STREAMS Traffic Management System, and controlled from Toowoomba</li> </ul>	<ul style="list-style-type: none"> <li>Optimise traffic signal timings and phasing</li> <li>Link existing and new traffic signals</li> <li>The suggested order of new traffic signals is:           <ol style="list-style-type: none"> <li>Percy Street</li> <li>Dragon Street</li> <li>Yangan Road</li> <li>Victoria Street</li> <li>Cleary/Bisley Streets</li> <li>Locke Street</li> </ol> </li> </ul>	<ul style="list-style-type: none"> <li>Increases traffic efficiency as traffic volumes change</li> <li>Coordinate existing and new traffic signals as they come on stream</li> <li>Signals reduce overloading of nearby intersections</li> <li>Increased safety for through vehicles and fewer delays in side roads. Control removes driver frustration and risk of picking inappropriate gaps</li> <li>Improves safety and access for pedestrians and cyclists crossing the highway</li> <li>Coordinate signal program with other highway improvements to reduce costs of staging upgrade works</li> </ul>
Direction Signage	<ul style="list-style-type: none"> <li>Signage provided at approaches and key intersections</li> </ul>	<ul style="list-style-type: none"> <li>Review signage to ensure it is appropriate for guiding to local places and through destinations</li> </ul>	<ul style="list-style-type: none"> <li>Improves direction guidance for visitors</li> </ul>
Heavy vehicles	<ul style="list-style-type: none"> <li>Highway and Victoria Street are designated truck routes for heavy vehicles</li> <li>Existing O-D routes have appropriate clearances</li> </ul>	<ul style="list-style-type: none"> <li>Reinforce requirements for trucks to use designated routes to access industrial areas</li> <li>Review O-D routes to ensure clearances conform to latest standards</li> <li>Investigate future bypass route</li> </ul>	<ul style="list-style-type: none"> <li>Reduce inappropriate use of town streets by heavy vehicles</li> <li>Need to address parking for long vehicles where accessing off-road parking areas is a problem</li> <li>Address changing standards to match transport industry requirements and incentives</li> <li>Bypass would improve efficiency for through trips by reducing delays and improve safety for both through and local traffic</li> <li>Possible corridor for bypass needs to be identified and protected from future development</li> </ul>
Public Transport	<ul style="list-style-type: none"> <li>Scheduled bus services operate along Alexandra Drive, Helene, Wood, and Wallace Streets</li> <li>Buses cross or turn at highway intersections along highway</li> <li>Buses stop in traffic lanes</li> </ul>	<ul style="list-style-type: none"> <li>Review bus stops to stop at optimum locations to minimise traffic conflicts</li> <li>New traffic signals at key intersections</li> <li>Widen highway to 4 lanes (2 lanes each way) to allow vehicles to pass at bus stops</li> </ul>	<ul style="list-style-type: none"> <li>Improves safety for buses and other traffic</li> <li>Improves access for passengers</li> <li>Improves safety and reduces delays for buses turning at intersections           <ul style="list-style-type: none"> <li>Yangan Road (school buses)</li> <li>Victoria Street</li> <li>Percy Street</li> <li>Dragon Street</li> <li>Locke street</li> </ul> </li> </ul>
Parking	<ul style="list-style-type: none"> <li>Limited on street parking exists</li> <li>Some indiscriminate parking outside older establishments</li> </ul>	<ul style="list-style-type: none"> <li>Undertake parking needs assessment with intention of banning parking on highway in medium term</li> <li>Upgrade problem vehicle entrances</li> <li>Review parking provisions</li> </ul>	<ul style="list-style-type: none"> <li>Review parking and identify parking needs and opportunities to reduce parking and impose restrictions where required</li> <li>Need to address parking for long vehicles where accessing off-road parking areas is a problem</li> <li>Reduction in conflict with slow manoeuvring vehicles</li> <li>Construction of raised median will reduce opportunities and areas available for parking</li> </ul>
Pedestrians and Cyclists	<ul style="list-style-type: none"> <li>Footpaths provided along highway</li> <li>Pedestrian facility provision at signals</li> <li>Pedestrian underpass at Palmerin Street links St Mary's school campuses</li> <li>Bike routes use local streets but some key highway crossings occur at uncontrolled intersections</li> </ul>	<ul style="list-style-type: none"> <li>Assess intersections and implement improvements to comply with disability guideline requirements:           <ul style="list-style-type: none"> <li>kerb ramp crossings</li> <li>signal timings for pedestrians</li> <li>comply with disability guideline requirements</li> </ul> </li> <li>Support SDRC Cycle Management Plan by:           <ul style="list-style-type: none"> <li>designating bikeways in local streets</li> <li>providing signalised crossings and</li> <li>providing bicycle lanes on approaches to intersections</li> </ul> </li> <li>Include separate bikeway as part of 4 lane upgrade of Helene Street</li> </ul>	<ul style="list-style-type: none"> <li>Compliance Design for Access and Mobility Guidelines</li> <li>Improves safety and mobility for disadvantaged people and people with disabilities</li> <li>Increases recognition of pedestrians and cyclists as valid road users</li> <li>Encourages active transport in the town</li> <li>Promotes cycle mobility and accessibility in a coordinated way</li> <li>Improves safety by discouraging cyclists riding along the highway</li> <li>Proposed signals at Victoria Street and Dragon Street are on major cycle routes to the high school and TAFE college respectively</li> <li>Increases prominence of, and safety for, cyclists crossing the highway</li> </ul>
Land use	<ul style="list-style-type: none"> <li>Parking and access controlled by SDRC planning scheme and IDAS</li> <li>Direct access to highway restricted and off-street parking requirements enforced</li> </ul>	<ul style="list-style-type: none"> <li>Continue current strategy of no access to State controlled roads without TMR approval</li> <li>Periodically review existing accesses to properties with view to changing potential problem locations by seeking alternative access or restricting movements</li> </ul>	<ul style="list-style-type: none"> <li>Discourages developments likely to detract from the character and function of the corridor</li> <li>Helps encourage mitigation of existing problem sites</li> <li>TMR has authority to control access under its powers in the Transport Infrastructure Act</li> </ul>
Environment	<ul style="list-style-type: none"> <li>Traffic and land use controls</li> </ul>	<ul style="list-style-type: none"> <li>Traffic and land use controls</li> </ul>	<ul style="list-style-type: none"> <li>Improved traffic operations reduce vehicle emissions</li> <li>Land use helps control incompatible development</li> </ul>

## **5.2 Midblock**

A divided 4 lane road with raised medians is proposed for the entire length of the highway through Warwick as a long term strategy to separate opposing traffic flows and reduce impedance to heavy vehicles travelling to and through the town. TMR is preparing concept layouts for this proposed work to assist with its future planning, in particular with assessing development applications.

Existing “medians” vary from painted separation lines, painted islands and raised medians. Converting painted lines and islands to raised islands will require the pavement to be widened in Wallace Street and north of Albion Street.

The major work will occur in Helene Street, as it includes two new bridges over the Condamine River and the Railway.

The widening could be staged but short sections of undivided road need to be avoided for safety reasons.

Upgrading Helene Street and the highway north to Freestone Road is required in association with upgrading the intersection at Yangan Road with channelisation and traffic signals. It is suggested to extend this widening to Albion Street to include upgrading the southern approach to O O Madsen Bridge to address the tight curve and merge problems, and avoid having to stage the works.

Generally it is intended to remove provision for midblock crossings of the median. However, consideration could be given to retaining some existing midblock turns to caravan parks, the service station on Helene Street and possibly some motels where convenient alternative access may be difficult or confusing. However this should be monitored and only allowed where refuge is available in the median.

Initially, raised median islands are proposed for all intersections along Albion and Wood Streets, where right turns are retained, in order to accommodate sheltered right turn lanes. Painted or raised median islands are proposed for other intersections on the northern and southern sections of the route.

## **5.3 Intersections**

The type of intersection control assists motorists to recognise the road function of the intersecting roads. Traffic signals are proposed for the major intersections and give-way at most other streets, with turn restrictions at minor side streets and avenues. The features of the proposed treatments are discussed below and aaSIDRA results for the key intersections are contained in **Appendix C**.

### ***East Street (Caltex truck stop)***

The intersection is operating satisfactorily and no changes are proposed. However consideration will need to be given to the potential impact of any future development in the area on the intersection.

### ***Glengallan Road***

The existing intersection will operate satisfactorily for the period beyond 2021. However it is proposed to remove the right turn exit from Glengallan Road due to low demand, as the turn is provided at nearby Ogilvie Road. This will remove an unnecessary crossing point. The right turn entry is retained.

### ***Ogilvie Road***

This intersection is a popular access road to the northern area of Warwick and the developing industrial area to the east. The intersection will continue to operate satisfactorily in its current form but a raised median and sheltered right turn lanes are proposed in lieu of the existing painted turn lanes.

### ***Murphy Street***

This intersection services the northern area of Warwick and the developing industrial and residential areas to the east. The intersection will continue to operate satisfactorily in its current form but painted right turn lanes are proposed to shelter turning vehicles from overtaking through traffic.

### ***Meneely Street***

Restrict to left turns in and out by extending centre barrier line across the intersection, as suitable alternative access is available for right turns.

### ***Freestone Road***

The existing channelised intersection will operate satisfactorily beyond 2021.

### ***Palmer Avenue***

Palmer Avenue serves a caravan park and motel and there is no alternative access to these establishments. While the overall traffic generation is low, a painted right turn lane is provided to shelter turning vehicles (including caravans) from overtaking through traffic. Retain right turn lane and convert the painted island to a raised median when this section of highway is upgraded.

### ***Yangan Road***

This intersection was identified for improvements in the WTMS-2 study but the extent of work was limited due to physical constraints and traffic movements at Briggs Street. The present intersection configuration will reach capacity by 2015. At this time it is proposed the intersection will need to be signalised and the highway approaches widened to 4 lanes with provision for a sheltered right turn lane.

Yangan Road approach will also require to be upgraded with consideration to realigning the Briggs Street intersection further away from the highway to increase storage. Plans to downgrade the function of Briggs Street as part of the Scots College masterplan involving relocating the main entrance away from Briggs Street would reduce traffic volumes and the need to shift the intersection.

### ***Jackie Howe Drive***

Traffic capacity is not an issue but improved channelisation will occur when Helene Street is upgraded to 4 lanes.

### ***Alice Street and Victoria Street***

The WTMS-2 strategy for these intersections to be upgraded as a pair is still appropriate. Right turns out of Alice Street would relocate to Victoria Street where the movement can occur under the control of new traffic signals. Right turns into Alice Street are retained to cater for tourist and other traffic from the north with access to the Rodeo Heritage Centre and other facilities. However this right turn movement should be monitored to ensure it doesn't interfere with the right turn storage at Victoria Street signals.

Signals at Victoria Street will improve access for trucks accessing the industries to the west, and generally provide for safer and easier access for local traffic accessing the town centre and high school.

### ***Albert and Condamine Streets***

This intersection will operate satisfactorily as a priority control to beyond 2021. The wide eastern approach carries little traffic. Even so, a threshold would improve delineation and definition of the intersection with the highway.

### ***Fitzroy Street***

This intersection has a poor crash record despite having traffic signals with a right turn phase on the highway. The signals should be investigated to identify opportunities to optimise signal timing and phasing. Failing this the Police Service should be asked to increase its surveillance of the operations.

### ***Frank Avenue***

This intersection operates satisfactorily as a priority control with left turn exit only. No change is required.

### ***Grafton Street***

The WTMS-2 strategy for improvements at this intersection and the Woolworths Plus Petrol site have been implemented and appear to have addressed the previous safety and operating problems. No action is required apart from monitoring ongoing operations to optimise signal timing and phasing.

### ***King Street***

This intersection will operate satisfactorily as a priority control to beyond 2021. A threshold treatment in King Street approaches would improve delineation and definition of the intersection with the highway.

### ***Percy Street***

Signals will improve access and generally provide for safer and easier access for local traffic accessing the town centre, thereby helping to address the poor crash record. The signals will also attract traffic from Guy Street/Wood Street intersection, thereby helping to relieve the demand on Guy Street.

### ***Albion/Wood Streets***

This major intersection has experienced changes as a result of the new Hungry Jacks shopping development on the southwest corner, with a dedicated left turn lane from Wood Street into the development. A future widening of Wood Street along the front of the development is required to allow large vehicles (including road trains) to make right turns from within the double right turn lanes, as the current paths are tight.

### ***The Avenues***

The WTMS-2 strategy to restrict right turns into and from the series of “Avenues” along Wood Street is still appropriate, similar to recent changes at Acacia Avenue, following removal of the pedestrian signals after completion of the nearby pedestrian underpass. Medians in some locations prevent cross movements but where they are not provided signage is required to enforce the turn restrictions.

### ***Palmerin Street***

Exit from Palmerin Street is restricted to left turn out only, but both right and left turn entry from the highway is allowed. Sheltered right turn lanes are required in Wood Street to remove turning traffic from the through lanes.

The WTMS- 2 strategy proposed signals at the intersection in the long term but this is no longer required due to a pedestrian underpass recently being constructed, and the community adjusting to the turn restrictions.

### ***Guy Street***

Guy Street is currently the only signalised crossing of Wood Street with direct access to schools and provides the main access to the town centre from south of the highway. As a result this intersection experiences high levels of congestion, with long queues in Guy Street north of the highway. Right turn signal phases are provided on highway approaches.

Consideration could be given to providing a right turn phase and increasing storage capacity for the northern approach to relieve queues. However a more long term solution is to reduce the demand on this intersection by providing alternative outlets and crossings of the highway at Percy Street and Dragon Street intersections, by installing signals at these locations.

### ***Dragon Street***

Dragon Street is one of only two direct north-south links between Bracker Road and Victoria Street, and provides access to the South Queensland Institute of TAFE, colleges in Locke Street, a large retirement village and growing residential area. Accordingly it is a key distributor in the road network.

Signals will improve access and generally provide for safer and easier access for local traffic crossing the highway. The signals will also attract traffic from Guy Street/Wood Street intersection, thereby helping to relieve the demand on Guy Street.

### ***Wantley and Gore Streets***

These intersections will operate satisfactorily as a priority control to beyond 2021, as the nearby signalised intersections provide a more convenient location for crossing the highway. Therefore future demand will be mainly limited to local residents. Threshold on the side streets would improve delineation and definition of the intersections with the highway. Also, provide painted right turn lanes on the highway to shelter turning vehicles.

### **Wood/Wallace Streets**

This major intersection will experience high growth as a result of new residential development in the southwest. The rate of crashes at the intersection has increased highlighting the problem with geometry (steep downhill approach in Wallace Street and tight turning radius) for trucks turning at the intersection.

A detector for trucks on the southern (downgrade) approach extends the phase to reduce the need for trucks to stop. However an advanced warning signal on the approach (activated when the lights are about to change to Stop) will assist and reassure drivers if they need to prepare to stop if the signals are about to change. The left turn from Wood to Wallace Streets is substandard and needs to be eased by encroaching into the vacant old Coach Terminal site. High traffic generating type redevelopment of the site should be strongly discouraged because of access problems.

### **Pratten Street**

This intersection will operate satisfactorily as a priority control to beyond 2021. Sheltered right turn lanes are required sooner on the highway, to remove vehicles waiting to turn from through lanes. Providing a threshold treatment in Pratten Street will improve delineation and definition of the intersection with the highway. Constructing a raised median in association with the turn lanes in the highway will provide a refuge for pedestrians and cyclists crossing the highway as Pratten Street is a bike-route and provides access to the state primary school to the west.

### **Locke Street**

This intersection will operate satisfactorily as a priority control to beyond 2021. However signals are required sooner, so as to provide a positive form of control for motorists and pedestrians negotiating the intersection. This is particularly important for pedestrians crossing between the Warwick Hospital and convenience store. The signals will have an added benefit of providing a preferred alternative route to using Pratten Street.

The signals would require a detector for trucks, similar to the one in Wallace Street at Wood Street with a link to the railway crossing.

The access and parking in Wallace Street outside the petrol station and shop interferes with southbound traffic. This area should be redesigned so that left turn entry only is available from Wallace Street and all exits to occur via Locke Street as "left turn only", due to the close proximity of the intersection.

### **Glen Road and entrance to Australiana Park**

Sheltered right turn lanes are required on the highway to remove vehicles waiting to turn from through lanes. The southbound traffic is on a descending grade making it difficult for trucks to brake, while there is only a single northbound lane so that traffic cannot overtake a vehicle waiting to enter Australiana Park.

### **Cleary Street and Bisley Street**

Traffic will increase at this intersection because of major residential and probable commercial development. As a result the present intersection will reach capacity by 2015. At this time it is proposed the intersection will need to be signalised and the highway approaches widened to 4 lanes with provision for a sheltered right turn lane.

In the interim sheltered right turn lanes are required on the highway to remove vehicles waiting to turn from through lanes, although the 4 lane configuration does allow through traffic to overtake turning vehicles.

### **Law Road, Carmody Street and Flitcroft Street**

*Law Road – A sheltered right turn lane is required on the highway to remove vehicles waiting to turn from through lanes, and the painted threshold island in Law Road replaced with a raised island to promote proper turning paths.*

*Carmody Street and Flitcroft Street - Painted centre island in the side roads will assist delineation and definition of the intersections with the highway.*

### **Bracker Road**

The treatment at this intersection is appropriate but vehicles are able to travel over the painted islands. Replacing the painted islands with raised islands will increase the prominence of the channelised intersection, improve protection for vehicles waiting to turn and promote proper use, especially by large and heavy vehicles turning into and from Bracker Road. Street lighting is required to illuminate the islands, and will help indicate the southern commencement of Warwick urban area.

## **5.4 General**

This section looks at broad strategies for the route compared to the specific sites in the previous sections.

### **5.4.1 Traffic signals**

Traffic signals operate within the TMR STREAMS traffic management system controlled from the Darling Downs regional office at Toowoomba. STREAMS optimises signals settings and coordination with traffic signals at nearby intersections. Regular site inspections and monitoring are required to ensure signals operations are adjusted for local traffic changes which occur due to such factors as new signals, land development and changes to network trip patterns.

The proposed strategy includes the following six new sets of traffic signals to be implemented at different periods, in the following order:

1. Percy Street/Albion Street
2. Dragon Street/Wood Street
3. Yangan Road/Alexandra Drive
4. Victoria Street/Albion Street
5. Cleary and Bisley Streets/Wallace Street
6. Locke Street/Wallace Street

These signals will be linked into STREAMS and the system program updated accordingly. A fully coordinated signal system endeavours to balance the competing demands of through and local cross traffic at individual intersections along the route which can lead to inefficiencies for highway traffic as it experiences stoppages and delays. However, the extra signals are required primarily to ensure the safe and efficient movement of traffic along the highway, while also assisting local traffic and pedestrians to cross the highway (so that the highway is less of a barrier to local movement).

The proposed strategy is to achieve traffic progression along the highway by minimising stoppages. The linking and closer spacing of signals will help create and maintain the traffic in platoons, resulting in fewer unnecessary delays.

### **5.4.2 Direction signage**

The highway route through Warwick changes direction at two major intersections, Albion and Wood Streets and Wood and Wallace Streets. Direction signage is provided on each of the approaches to these intersections, but the signs are located on the footpaths and can be missed due to the multi-lane situation and the visual noise of the urban environment.

It is important that motorists select the correct lane when required to turn at an intersection so signs need to be prominent. The proposed construction of medians will provide space for signs, but in the meantime cantilevering signs over the approach lanes will improve their prominence.

Consistent destinations need to be displayed so that motorists can follow the continuity of their required route through Warwick. Additional local destinations and information can be added at specific locations to assist guidance of visitors.

### **5.4.3 Heavy vehicles**

Trucks using inappropriate (local) streets to access the Industrial Estate was identified as a problem in WTMS-2. Trucks continue to use the local streets but the community concerns appear to have abated. The number of trucks using these and new routes will increase with normal growth and the tendency for traffic to “rat-run” to avoid traffic signals.

Therefore a strategy is to encourage truck operators to use the more recognised truck route along the highway and Bracker Road to access the Industrial Estate, and Victoria Street for industry to the north west. Regular monitoring of the other routes, especially Wood Street East is required to ensure trucks do not become an issue once more.

The separate area planning study which is assessing the need for a possible future bypass route, being undertaken by TMR, is consistent with the strategy to reduce the need for heavy vehicles to mix with local traffic.

### **5.4.4 Public transport**

Town and school buses travel along and across the highway, and the strategy will provide opportunities to improve bus operations (efficiency and safety).

A town bus service operates along most of the route with buses stopping at several dedicated bus stops as well as unspecified spots when hailed. These stops occur on-road (i.e. there are no marked or indented bus bays). The proposal to construct medians could reduce the available on road width. Provision will be required for buses to stop along the route by providing a safe refuge and allow general traffic to overtake the buses. This could take the form of full or partially indented bus bays where there is sufficient reserve footpath width and a long term commitment to the bus stop position, or else on the shoulder. However it is impracticable to provide for unlimited bus stops which is the case with the “hail driver” service, so this practice will need to be monitored and reviewed if buses compromise safety and efficiency.

Buses will also be assisted by:

- An increase in the number of signalised intersections to allow safer crossings of the highway for buses and passengers; and
- Provision of sheltered right turn lanes for safer turning movements.

Taxis will similarly benefit from the strategy, resulting in potentially shorter trips as there will be more safe options to cross and turn along the highway.

### **5.4.5 Parking**

The long term strategy is to remove parking along the highway to reduce interference to highway traffic and safety for those parking as well as general traffic. Existing parking spaces will be progressively removed as medians are constructed and shoulder widths reduced. New developments should provide on-site car parking as required in the SDRC planning scheme, and developments likely to generate on-street parking should be discouraged.

The lack of suitable parking for long vehicles such as trucks and cars with caravans needs to be addressed by providing convenient on-site parking which is clear to see from the highway, and creating suitable areas in the side streets. For example, it is important that establishments, such as fast food outlets, which prefer to front the highway for maximum exposure provide adequate and appropriate parking for all vehicles on-site in order to avoid the need to park on the street. The parking management strategy needs to be developed in association with SDRC.

Parking outside existing private residences can be tolerated in the short term where parking lanes are provided, as on-site visitor parking is limited and houses are not great parking generators. However the parking should be monitored with a view to phasing it out in the long term.

The WTMS-2 study report included the following list of appropriate conditions for new property development which are still relevant:

- *The applicant must demonstrate a suitable means of providing all parking spaces on the development site in accordance with the Warwick Shire Planning Scheme;*
- *Manoeuvring shall occur on-site and clear of defined on-site queue areas (such as entry aisles) so as not to disrupt operation of the accesses;*
- *The applicant must construct / maintain all internal roadways and buildings in a manner which allows operators and customers to carry out all vehicle loading and unloading operations on the site, and without affecting the operation of the accesses;*
- *The applicant must construct / maintain all internal roadways and buildings in a manner which allows all vehicles to enter and exit the site in forward gear; and*
- *All on-site parking shall be clearly visible to, or clearly signed for all vehicles entering the site.*

A new condition to add to the above list is:

- *On-site parking should be provided for all classes (sizes) of vehicles which could reasonably be expected to use the development.*

#### **5.4.6 Pedestrians & cyclists**

The highway is not generally used by cyclists because more convenient and safe routes are available by using the local streets, and the SDRC bikeway plan reinforces this concept. The strategy supports the SDRC bicycle management plan and pedestrians would similarly benefit by:

- New signalised intersections increasing opportunities to cross the highway to access major generators including South Queensland Institute of TAFE and Warwick State High School;
- Raised median islands providing refuges for staging when crossing the highway;
- Providing for an upgrade of the existing Helene Street bikeway when the highway is widened to four lanes;
- Improving facilities at intersections for people with disabilities;
- Increasing the prominence of cyclists by marking bicycle lanes on the approaches to signals where the pavement width allows; and
- Providing a framework for the future development of the SDRC cycle management plan.

#### **5.4.7 Land use**

The land use strategy is to continue the current strategy to:

- Influence the type of land uses along the highway to those that are compatible with a major state traffic corridor;
- Control future development so there is no access to state controlled roads without TMR approval; and
- Review private vehicular accesses in order to mitigate problem locations likely to impede the safe and efficient operation of the corridor.

This strategy to control land use and development is achieved through provisions in the Warwick Shire Planning Scheme for Warwick, and the development assessment processes as required by the Sustainable Planning Act (SPA), Transport Infrastructure Act (TIA) and State Development and Public Works Organisation Act.

For example, the current Warwick Shire Planning Scheme includes development controls that restrict high traffic generator developments accessing State-controlled roads in inappropriate locations. TMR approval is required for all access works on State-controlled roads, under the TIA, so the planning scheme helps to reinforce this requirement.

Private accesses need to be managed to mitigate traffic problems. For example relocating the power pole at the entrance to Supercheap store in Albion Street will help to relieve the problem of vehicles slowing to enter the property.

The land use strategy is consistent with the TMR *Guidelines for Assessment of Road Impacts of Development Proposals (GARID)*, April 2006.

In summary, the land use strategy is:

- Continue the current enforcement of the TIA in relation to limiting new access to State-controlled roads;
- Periodically review existing accesses to properties with a view to changing potential problem locations by seeking alternative access or restricting movements; and
- Request SDRC to incorporate appropriate provisions in its planning documents to protect the integrity of the highway by discouraging inappropriate development.

#### **5.4.8 Environmental issues**

Managing environmental issues relating to traffic noise and vehicle emissions will be achieved by the traffic strategy to provide a high quality corridor with fewer interruptions to traffic, resulting in less stopping and starting, and inappropriate traffic use of local streets. The land use strategy to restrict incompatible development will help to minimise environmental problems for future occupants and users of properties along the route. Social amenity in the form of access and mobility is improved by providing additional signalised intersections for crossing the highway.

However, unless the signals are managed properly through STREAMS, providing extra signals has the potential to increase stopping and starting and therefore increase environmental problems such as noise and emissions, as well as delays to through traffic leading to “rat-running” in less appropriate parts of the road network.

#### **5.4.9 Warwick Traffic Simulation Model**

The Warwick Traffic Simulation Model was developed specifically for this study, but it was also designed to be suitable to be used to investigate a possible bypass of Warwick should it be needed. The study area and network in the model can be readily extended if required and trip data updated, to take account of new and emerging traffic situations and emerging developments (such as population growth and land use).

As the model is available, it would be appropriate for use by TMR in the investigation of a future Warwick bypass route.

## 6 Strategy Implementation

A proposed program to implement the strategies is shown in **Table 6.1**. The program is based on the broad priorities as to when the real needs are expected to occur and potential lead times.

Consideration is also given to possible budget requirements, but this will ultimately depend on TMR budget constraints.

The same general principles used in WTMS-2 for determining the level of priority of a project have been adopted, which are:

- Motorist, pedestrian and cyclist safety;
- Relative timing that the element reaches its design life in terms of operating performance (eg. capacity, delay, queuing and crash history);
- Dependence between elements in the network, particularly in relation to implementing preferred intersection options that restrict existing movements, thereby diverting traffic to alternative intersections in the corridor; and
- The proximity of upgrading schemes to each other in terms of both location and timing, where there are potential cost savings and operational benefits of constructing adjacent schemes as a single project.

The program includes works identified as being required to be implemented by 2021 to address issues identified in the study. It is unrealistic though to specify a particular year for a project, so the program is based on three periods - short, medium and long term, which is intended as a guide to assist TMR with development of its future works program. However, the program should be reviewed each year to take account of any changes in traffic and development patterns which might influence traffic operations along the highway corridor, so as to maintain a safe and efficient route.

The Cunningham Highway and New England Highway through Warwick form part of the National Highway system for which the Commonwealth Government has full funding responsibility. This will have impacts on the timing and implementation of the relevant strategies.

**Table 6.1 Proposed Strategy Implementation**

Location	Short Term	Medium Term	Long Term
<b>Mid block</b>			
Alexandra Drive		<ul style="list-style-type: none"> <li>• 4 lane divided with raised median from Freestone Road south to Yangan Road</li> </ul>	<ul style="list-style-type: none"> <li>• 4 lane divided with painted median from Ogilvie Road to Freestone Road</li> </ul>
Helene Street		<ul style="list-style-type: none"> <li>• 4 lane divided (Yangan Road to south of Jackie Howe Drive), including a new railway bridge, as part of traffic signals work at Yangan Road</li> <li>• 4 Lane divided (Jackie Howe Drive to Alice Street) including duplicating O O Madsen Bridge (preferable to combine with above work)</li> </ul>	<ul style="list-style-type: none"> <li>• Optional - 4 Lane divided (Jackie Howe Drive to Alice Street)</li> </ul>
Albion Street		<ul style="list-style-type: none"> <li>• Replace existing sections of painted median and marked centre line with a raised median, similar to other sections</li> </ul>	
Wood Street	<ul style="list-style-type: none"> <li>• Construct raised median Albion Street to Dragon Street</li> </ul>		<ul style="list-style-type: none"> <li>• Construct raised median (Dragon Street to Wallace Street)</li> </ul>
Wallace Street			<ul style="list-style-type: none"> <li>• 4 lane divided with raised median</li> </ul>
<b>Intersections</b>			
<b>Cunningham Highway</b>			
East Street (Caltex Truck stop)		<ul style="list-style-type: none"> <li>• Timing of any changes dependent on future development requirements</li> </ul>	
Glengallan Road	<ul style="list-style-type: none"> <li>• Remove right turn exit from Glengallan Road (retain all other turns)</li> </ul>		
Ogilvie Road			<ul style="list-style-type: none"> <li>• Construct right turn lanes as part of 4 lane upgrade</li> </ul>
Murphy Street		<ul style="list-style-type: none"> <li>• Paint right turn lanes</li> </ul>	
Meneely Street	<ul style="list-style-type: none"> <li>• Extend barrier line on highway and provide signage to restrict to left turn in and out only</li> </ul>		
Freestone Road			
Palmer Avenue			<ul style="list-style-type: none"> <li>• Construct right turn lanes as part of 4 lane upgrade</li> </ul>
Yangan Road		<ul style="list-style-type: none"> <li>• Install traffic signals and widen highway to 4 lanes</li> <li>• Requires duplicating railway bridge</li> <li>• Required by 2015 (3rd priority for new signals)</li> </ul>	
Jackie Howe Drive		<ul style="list-style-type: none"> <li>• Convert painted channelisation to raised islands as part of 4 lane mid block upgrade</li> </ul>	
<b>Albion Street</b>			
Alice Street		<ul style="list-style-type: none"> <li>• Close right turn exit from Alice Street</li> <li>• Retain right turn into Alice Street, but review operations for any potential adverse impact on right turn operations at Victoria Street</li> </ul>	
Victoria Street		<ul style="list-style-type: none"> <li>• Install traffic signals</li> <li>• Construct right turn lanes for northbound approach as part of 4 lane upgrade of O O Madsen Bridge</li> <li>• 4th priority for new signals</li> </ul>	
Albert & Condamine Streets	<ul style="list-style-type: none"> <li>• Threshold treatment on side roads</li> </ul>	<ul style="list-style-type: none"> <li>• Construct right turn lanes in both directions in Albion Street</li> </ul>	
Fitzroy Street	<ul style="list-style-type: none"> <li>• Optimise signal timing and phasing</li> </ul>		
Frank Avenue			
Grafton Street	<ul style="list-style-type: none"> <li>• Optimise signal timing and phasing</li> </ul>		
King Street	<ul style="list-style-type: none"> <li>• Threshold treatment on side roads</li> </ul>	<ul style="list-style-type: none"> <li>• Construct right turn lanes in both directions in Albion Street</li> </ul>	
Percy Street	<ul style="list-style-type: none"> <li>• Install traffic signals</li> <li>• 1st priority for new signals</li> </ul>		
Albion/Wood	<ul style="list-style-type: none"> <li>• Optimise signal timing</li> </ul>	<ul style="list-style-type: none"> <li>• Local taper widening in Wood Street to accommodate large vehicles turning from Albion Street</li> </ul>	
<b>Wood Street</b>			
Avenues - Stewart, Acacia, Myall, Myrtle, Wattle and Wilga	<ul style="list-style-type: none"> <li>• Install signs for left in and out (not needed opposite raised medians – sign already exists in Acacia Avenue)</li> </ul>		
Palmerin Street	<ul style="list-style-type: none"> <li>• Construct right turn lanes in Wood Street</li> </ul>		
Guy Street	<ul style="list-style-type: none"> <li>• Optimise signal timing</li> <li>• Increase storage in Guy Street on northern approach</li> </ul>		
Dragon Street	<ul style="list-style-type: none"> <li>• Install traffic signals</li> <li>• Construct right turn lane on southern approach as twin to existing right turn lane</li> <li>• 2nd priority for new signals</li> </ul>		
Wantley Street	<ul style="list-style-type: none"> <li>• Threshold treatment on side roads</li> <li>• Mark right turn lane on highway</li> </ul>		
Gore Street	<ul style="list-style-type: none"> <li>• Threshold treatment</li> <li>• Mark right turn lane on highway</li> </ul>		

Table 6.1 Cont...

Location	Short Term	Medium Term	Long Term
Wood/Wallace Streets	<ul style="list-style-type: none"> <li>Optimise signal timing</li> <li>Provide ITS detector on southern approach to: <ul style="list-style-type: none"> <li>extend phase for trucks; and</li> <li>provide advance warning signal of need to stop</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Improve geometry on SE corner for left turn movement</li> </ul>	
<b>Wallace Street</b>			
Pratten Street	<ul style="list-style-type: none"> <li>Threshold treatment in side road</li> </ul>	<ul style="list-style-type: none"> <li>Mark right turn lanes on highway with raised medians</li> </ul>	
Locke Street			<ul style="list-style-type: none"> <li>Install traffic signals with link to railway crossing)</li> <li>ITS for trucks (especially southern approach)</li> <li>Construct islands to limit highway access to shop</li> <li>6th priority for new signals</li> </ul>
Glen Road and entry to Australiana Park		<ul style="list-style-type: none"> <li>Painted right turn lanes</li> </ul>	
Cleary/Bisley Streets		<ul style="list-style-type: none"> <li>Install traffic signals</li> <li>Channelisation with right turn lanes on highway</li> <li>Required by 2015 (5th priority for new signals)</li> </ul>	
Law Road	<ul style="list-style-type: none"> <li>Right turn storage lane</li> <li>Convert painted threshold to raised island treatment</li> </ul>		
Carmody Street		<ul style="list-style-type: none"> <li>Threshold treatment (painted)</li> </ul>	
Flitcroft Street		<ul style="list-style-type: none"> <li>Threshold treatment (painted)</li> </ul>	
Bracker Road	<ul style="list-style-type: none"> <li>Channelisation with raised islands</li> <li>Install intersection street lighting</li> </ul>		
<b>General</b>			
Traffic Signals	<ul style="list-style-type: none"> <li>Optimise traffic signal timings and phasing</li> <li><i>Coordinate signal program with other highway improvements to reduce costs of staging upgrade works</i></li> </ul>		
Direction Signage	<ul style="list-style-type: none"> <li>Review and upgrade major direction signage</li> </ul>		
Heavy vehicles	<ul style="list-style-type: none"> <li>Review O-D routes to ensure clearances conform to latest standards</li> <li>Investigate future bypass route</li> </ul>		
Public Transport	<ul style="list-style-type: none"> <li>Provide road width for buses at designated bus stops</li> </ul>		
Parking	<ul style="list-style-type: none"> <li>Undertake parking needs assessment with intention of banning parking on highway in medium term</li> <li>Upgrade problem vehicle entrances such as at the Supercheap store</li> <li>Remove existing on road parking provision as properties redevelop</li> </ul>	<ul style="list-style-type: none"> <li>Increase parking restrictions in accordance with needs assessment</li> </ul>	
Pedestrians and Cyclists	<ul style="list-style-type: none"> <li>Assess intersections and implement improvements to comply with disability guideline requirements <ul style="list-style-type: none"> <li>kerb ramp crossings</li> <li>signal timings for pedestrians</li> </ul> </li> <li>Support SDRC Cycle Management Plan by: <ul style="list-style-type: none"> <li>providing signalised crossings and</li> <li>providing bicycle lanes on side roads at signalised intersections</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Include separate bikeway as part of 4 lane upgrade of Helene Street</li> </ul>	
Land use	<ul style="list-style-type: none"> <li>Parking and access controlled by Warwick Shire town plan, Sustainable Planning Act and Transport Infrastructure Act</li> <li>Direct access to highway restricted and enforce off-street parking requirements</li> </ul>	<ul style="list-style-type: none"> <li>Continue current enforcement of Transport Infrastructure Act in relation to no access to State controlled roads without TMR approval</li> <li>Periodically review existing accesses to properties with view to changing potential problem locations by seeking alternative access or restricting movements</li> </ul>	
Warwick Traffic Simulation Model	<ul style="list-style-type: none"> <li>Review and update WTMS model</li> <li>Use WTMS model to determine impacts of proposed major developments and other traffic changes</li> <li>Use WTMS model in the separate TMR investigation of a future Warwick bypass route</li> </ul>		

## **7 Conclusions and Recommendations**

### **7.1 Conclusions**

The review of the traffic situation on the National Highway through Warwick shows that the highway is experiencing areas of congestion and delays at several intersections, and safety is a problem at some intersections. With the projected growth in Warwick and the consequent increase in both local and through traffic, capacity will become a greater problem requiring road infrastructure improvements within the 2021 study design horizon.

Work undertaken as an outcome of the previous WTMS-2 study has resulted in significant improvements for accessibility and safety for vehicles and pedestrians, and controlling access of proposed new developments along the corridor. However there are still a number of existing and potential problem areas which will need attention. The main areas of concern are:

- Crash history mainly involving right turning traffic at intersections, especially Percy Street /Albion Street intersection;
- Intersection capacity problems resulting in queuing and delays, causing traffic to seek alternative and less suitable routes on the local council network;
- Pedestrians and cyclists experiencing difficulty crossing the highway due to limited opportunities, thereby reducing their mobility and safety; and
- Parking on the highway causing interference with highway traffic, including large and heavy vehicles.

The proposed traffic management strategy in this report builds on the original WTMS-2 strategy, and is designed to address both the existing issues and those expected to arise as a result of future traffic growth along the corridor. This will benefit highway and local traffic, public transport, cyclists and pedestrians by providing easier and safer movement along (as well as across) the highway. The strategy is able to be implemented incrementally in response to identified needs subject to available funding.

### **7.2 Recommendations**

It is recommended that TMR:

- (a) Adopt the proposed traffic management strategy as detailed in **Table 5.1** and **Table 6.1**, with the final treatments and timing based on actual and future traffic operations (such as crash history and congestion) and proposed development along the highway. Actual programming and implementation of road infrastructure works will depend on the availability of funds;
- (b) Use the proposed strategy to update the national network program of projects as appropriate;
- (c) Assess and place conditions on future development applications in accordance with the relevant strategy;
- (d) Request SDRC to:
  - (i) Incorporate into the town planning provisions a means of ensuring the long term integrity of the highway corridor is preserved by discouraging inappropriate development of adjoining land uses;
  - (ii) Review and update the Warwick Cycle Management Plan to take advantage of improved facilities at intersections for crossing the highway;
  - (iv) Review the road hierarchy plan for Warwick to take advantage of and reflect potential changes to traffic patterns which may arise from implementation of the traffic management strategy; and
- (e) Undertake a formal review and update of the strategy prior to the end of the study time frame (before 2021).

## **APPENDIX A**

### **O-D Site Trip Distributions**

## **APPENDIX B**

### **Traffic Volumes Modelled - 2009 and 2021**

**Figure B1 Existing - 2009**

**Figure B2 Future - 2021**

## **APPENDIX C**

### **Traffic Analysis Results**

## **APPENDIX D**

### **Model Calibration Design Note**

## **APPENDIX E**

### **References**

*Warwick Traffic Management Study (WTMS-2) (A Study of the National Highway Through Warwick)  
Final Study Report, Maunsell Australia, May 2004*

*Warwick Traffic Management Study 2002 Phase A Data Collection and Review Final Report,  
Maunsell Australia, January 2003*

*Warwick Traffic Management Study (WTMS-2) Update, Traffic and Crash data report August 2007,  
Main Roads Department, 2007*

*Warwick Traffic Management Study (WTMS-2) Update, Traffic and Crash data report 2008, Main  
Roads Department, 2008*