

THURGOONA - WIRLINGA

PRECINCT STRUCTURE PLAN

Albury City Council

**TRAFFIC AND TRANSPORT STUDY**

*Prepared for:*  
Albury City Council

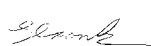
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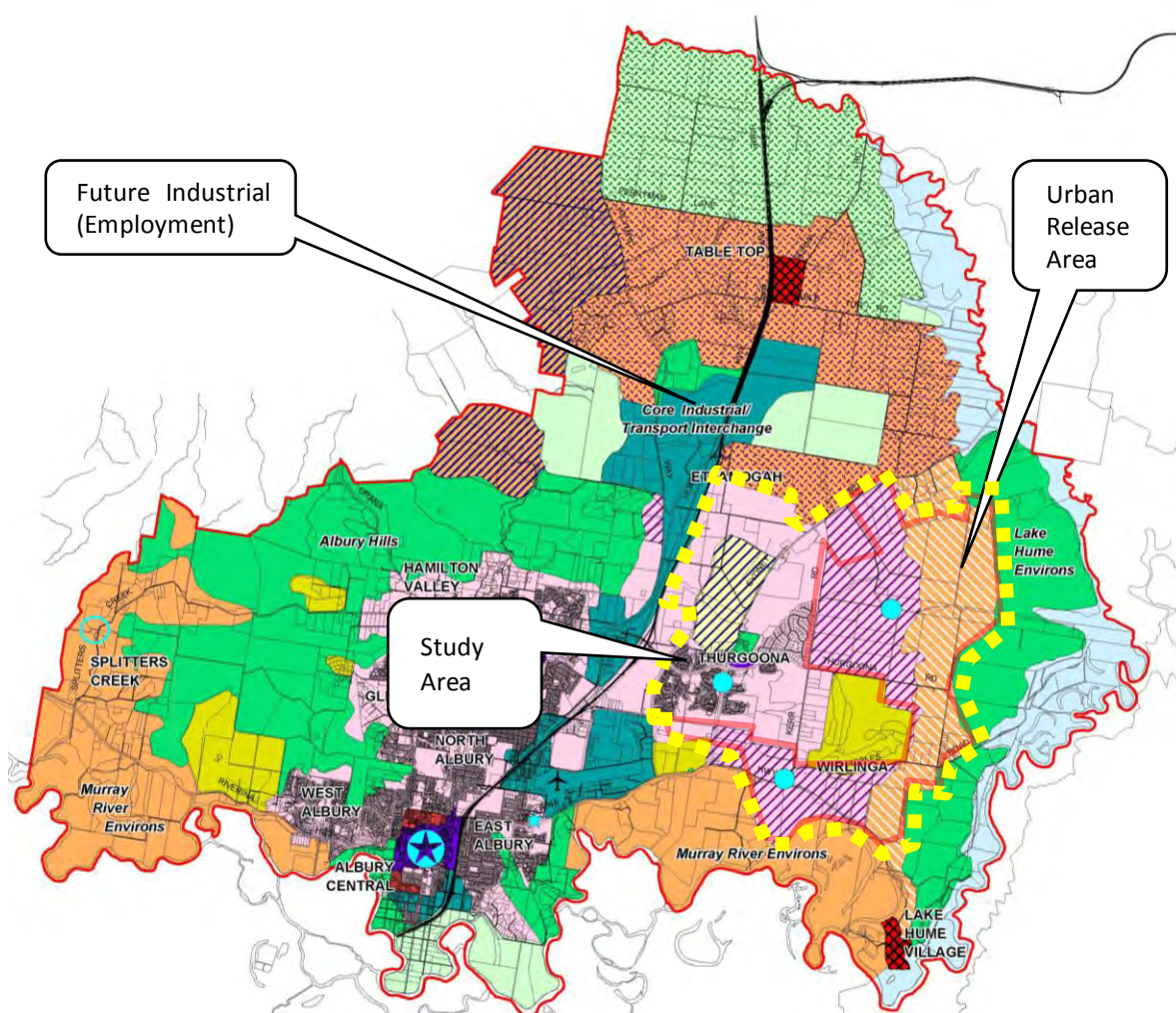
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# 1. Introduction

## 1.1 Background

TTM Consulting has joined with RPS to prepare a traffic and transport investigation as part of the Thurgoona – Wirlinga Precinct Structure Plan project. This study is being prepared for Albury City Council to investigate the potential issues and opportunities to convert recently zoned urban release area land to primarily residential and supporting uses.

This study builds on Council's 2007 Land Use Strategy, which identified the Thurgoona – Wirlinga areas as the primary areas for urban growth within the city through to 2030. The future land use plan map, with the Study Area identified, is reproduced as Figure 1.1.



**Figure 1.1: Albury City Council Land Use Strategy**

## 1.2 Scope

This report investigates the traffic transport aspects associated with converting over 2,000Ha of rural land to urban uses, as well as the development of approximately 500Ha of existing zoned residential land. TTM has been engaged as the traffic and transport specialist to review a range of transport issues associated with developing the area to higher order uses with respect to transport requirements.

In undertaking this study, TTM has reviewed the following key transport requirements for the study area:

- ▶ Higher order road hierarchy structure plan, identifying the key road links required through the study area
- ▶ General requirements for interconnecting collector road network
- ▶ Impact of the study area traffic on existing infrastructure, in particular the operation of the Hume Hwy crossings
- ▶ Mitigation works for existing infrastructure to cater for the proposed study area traffic
- ▶ Needs of all traffic types in the study area, including commuter, freight and tourism
- ▶ Access and operation of public transport, including private and community run high occupancy vehicles
- ▶ Inputs towards the preparation of a traffic movement plan covering the study area.

## 1.3 Site Description

The urban release area is generally located in the eastern portion of Albury Local Government Area, through the localities of Thurgoona and Wurlinga, as shown in Figure 1.2 (red and purple areas). The area is generally bounded by:

- ▶ Table Top Road to the north
- ▶ Kerr Road to the west
- ▶ Riverina Hwy to the south
- ▶ Ridge line to Lake Hume to the east

There are some exceptions to this, particularly in the south, where the study area crosses Kerr Road and Riverina Hwy in some locations.

There are also several significant gaps in the area, which are generally excluded from this assessment, however are to be considered, such that they can be integrated into the study area in the future. These areas include defence land, a contaminated site adjacent to the Riverina Hwy and a conservation area at the northern end of Kerr Road.

The study area expands beyond this urban release area, to include land which has previously been designated as urban land uses, but are currently under-developed. This includes:

- ▶ The Thurgoona commercial areas near the intersection of Thurgoona Dr and Table Top Road
- ▶ Educational uses between Table Top Road and Elizabeth Mitchell Drive, north of the commercial zone

- Zoned residential land surrounding the educational sites

These areas are shown in Figure 1.2 as blue, yellow and pink respectively.

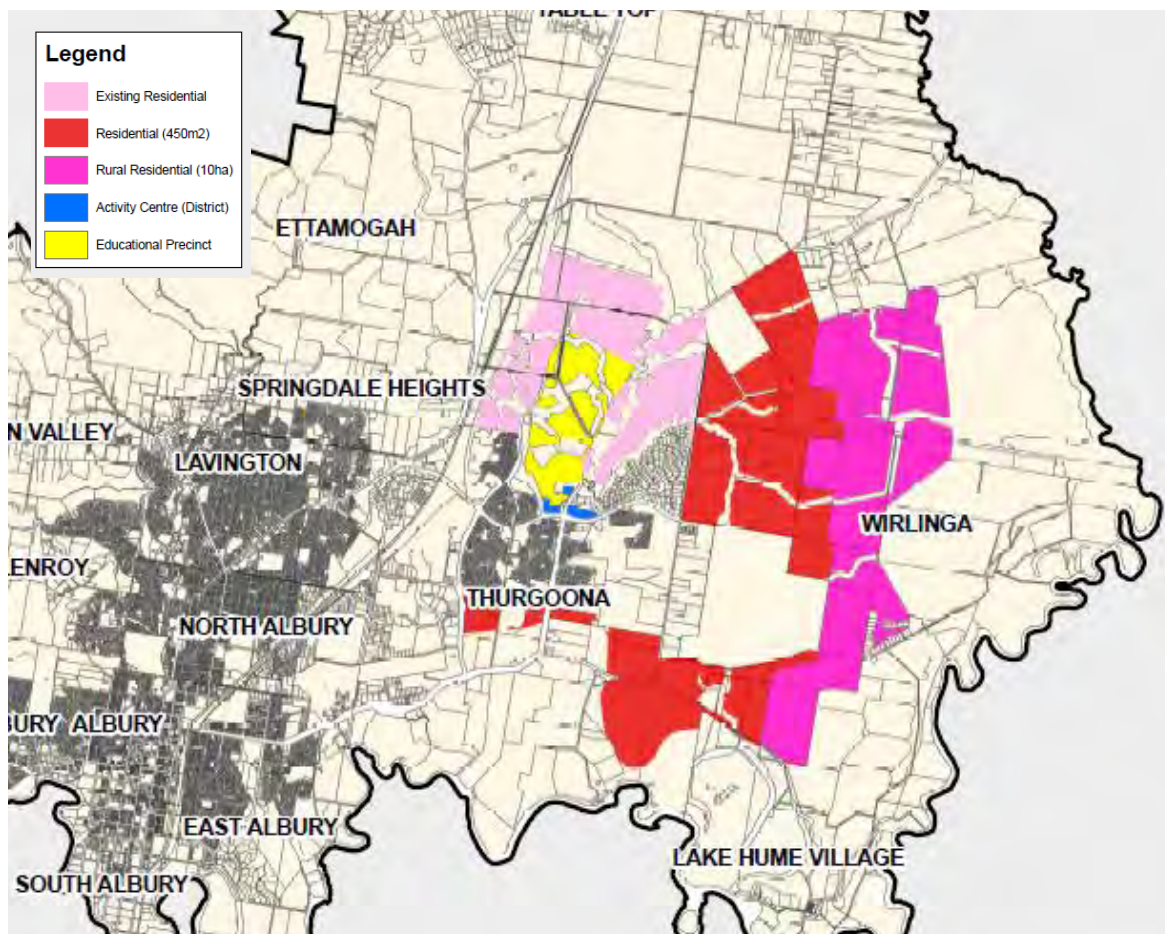


Figure 1.2: Site Location

## 1.4 Recent Land Uses

Until 2010, when the urban release land was designated, virtually all uses through the structure plan area was classified as rural, with sub categories of agricultural and conservation. As such, development is generally sparse, consisting of houses and other agriculture related structures on large rural lots.

The road network in the area is underdeveloped. East of Kerr Road, all roads are unsealed, with the exception of Knobel Road, which has a 5m wide seal to Hawksview Road. Kerr Road varies greatly, between good condition 7m wide seal to poor condition 5m wide.

## 1.5 Transport Planning Objectives

The objectives for transport within the designated study area are:

- Provide a road structure that supports a low density urban fringe development;
- Integrate the proposed road network with existing trunk infrastructure;

- ▶ Provide routing options which minimise impacts on existing and potential traffic, in particular, limiting the impact of future traffic on existing interchanges with the Hume Hwy;
- ▶ Develop an integrated and sustainable transport network that reduces dependency on the use of private vehicles, maximises access to public transport and encourages walking and cycling within and between neighbourhoods;
- ▶ Provide a road network which caters for bus movements, focussing on privately operated high occupancy vehicle transportation;
- ▶ Provide safe and efficient commuter cyclist networks and end of trip facilities to promote cycling as the primary alternative to private vehicle travel;
- ▶ Develop local walking and cycling links through the structure plan to provide for recreation and direct access to central activity nodes; and
- ▶ To ensure that all road reserves in the precinct are provided with infrastructure which is designed to cater for the safe movement of people by all modes of transport.

## 2. The Proposed Development

### 2.1 Development Profile

The study area consists of approximately 1,980Ha of rural land. Of this, approximately 1,075Ha are to be designated as urban uses. This will predominantly consist of residential uses. A target density of 12 lots per hectare is to be achieved. Allowing for 25% of land to be provided as public infrastructure (roads, recreation and parks) this results in an average lot size of approximately 625m<sup>2</sup>, and a planned minimum of 450m<sup>2</sup>. The exception to this is activity centre areas, where up to 30 dwelling per hectares may be achieved.

Up to 975Ha of urban land would be assigned to the predominant residential uses, allowing 11,700 lots to be developed. The remaining 100Ha will be available for mixed uses. This will include local retail and services, as well as community uses. This area will also provide for medium density residential, allowing up to 1,500 additional dwellings through the study area.

The remaining 905Ha of the study area will be designated as rural living. This will include lot sizes of 10Ha, allowing up to 85 lots, with allowances of some land to be assigned to public infrastructure, primarily new roads.

This will allow up to 13,500 dwellings to be established in the urban release area, sufficient to provide for in excess of the 30,000 target population for the area, based on an average household of up to 3 people.

Additionally, the plans need to accommodate the areas already designated as urban uses, which are as yet undeveloped. This includes:

- ▶ 800Ha of residential, allowing 8,250 lots
- ▶ 174Ha of educational, partially developed
- ▶ 11.2Ha of commercial land, partially developed as a neighbourhood centre

In total, the entire study area can therefore cater for up to 21,166 dwellings. At a moderate 2.5 persons per dwelling, this will allow the study area to cater for in excess of 50,000 people.

### 2.2 Access

The road network is currently partially developed to service the existing residential areas of Thurgoona. This network connects the study area to the west and south. To the south Kerr Road and Table Top Road connect to the Riverina Hwy, which then provides access to the airport, industrial areas and the Albury CBD.

To the west, Thurgoona Drive connects to the Hume Hwy at an interchange. The proposed development area will be accessed by extending and improving these roads into the study area.

The details of the existing network are further examined in section 3 below.

## 3. Existing Transport Infrastructure

### 3.1 The Road Network

The majority of roads in the immediate vicinity of the site are administered by Albury City Council, the exceptions being the Hume Hwy and Riverina Hwy, which are administered by the Roads and Maritime Services, RMS (formerly the RTA). The hierarchy and characteristics of roads in the immediate vicinity of the site are shown below in Table 3.1.

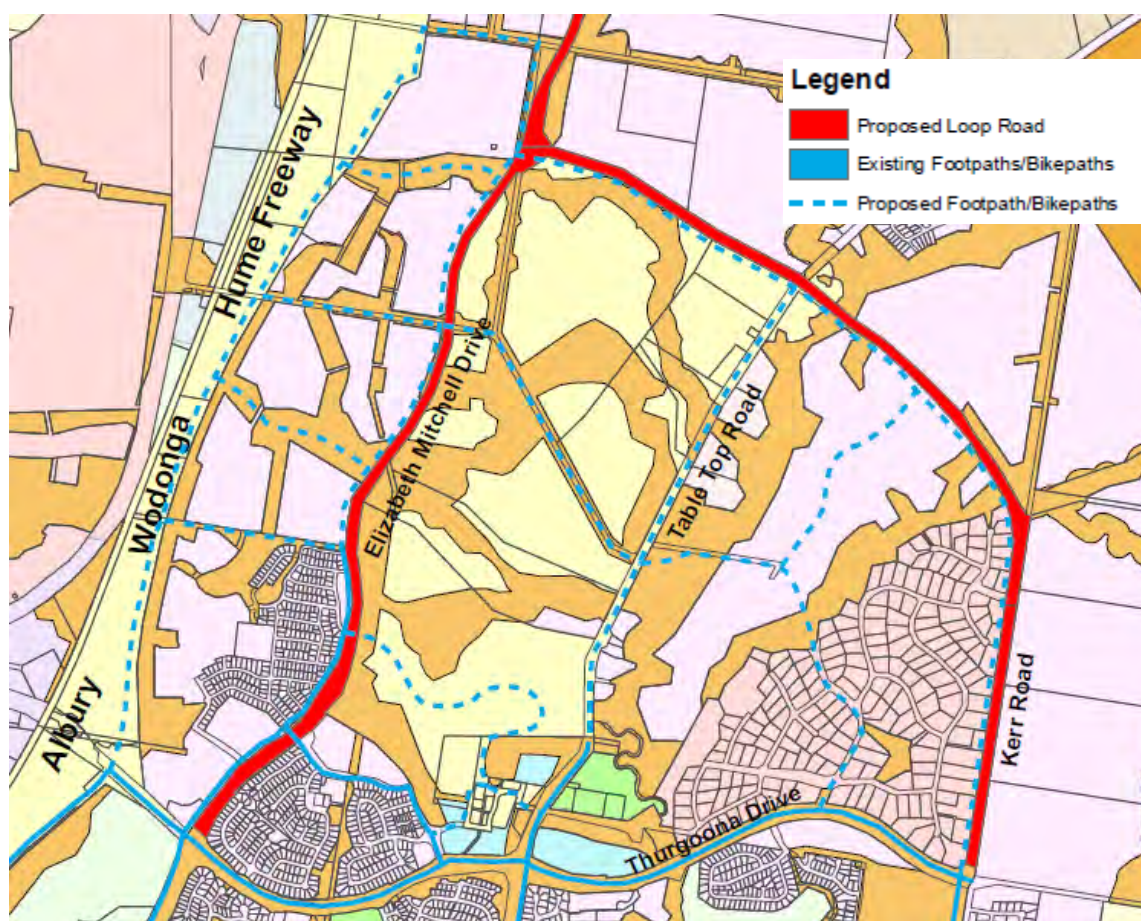
**Table 3.1: Local Road Hierarchy**

| Road                    | Speed Limit  | Carriageway |                               | Road Reserve Width | Classification    | Road Authority |
|-------------------------|--------------|-------------|-------------------------------|--------------------|-------------------|----------------|
|                         |              | Width       | Lanes                         |                    |                   |                |
| ▶ Riverina Hwy          | 80 to 100kph | 10m         | 2 (undivided, plus shoulders) | >40m               | State Highway     | RMS            |
| ▶ Hume Hwy              | 110kph       | 2×10m       | 4 (divided)                   | >60m               | National Highway  | RMS            |
| ▶ Thurgoona Dr          | 70kph        | 12.5m       | 2 (undivided, plus shoulders) | >60m               | Local Distributor | ACC            |
| ▶ Elizabeth Mitchell Dr | 70kph        | 9.5m        | 2 (undivided, plus shoulders) | >60m               | Local Distributor | ACC            |
| ▶ Table Top Road        | 70kph        | 11m         | 2 (undivided, plus shoulders) | >70m               | Local Distributor | ACC            |
| ▶ Kerr Road             | 80kph        | 5m-7m       | 2 (undivided)                 | 25m                | Local Distributor | ACC            |
| ▶ Corrys Road           | 60kph        | 12.5m       | 2 (undivided, plus shoulders) | 30m                | Local Distributor | ACC            |
| ▶ Fallon Street         | 60kph        | 12.5m       | 2 (undivided, plus shoulders) | 30m                | Local Distributor | ACC            |
| ▶ Ettamogah Road        | 50kph        | NA          | Unsealed                      | 20m                | Local Access      | ACC            |
| ▶ Knoble Road           | 100kph       | 6m          | 2 (undivided)                 | 20m                | Collector         | ACC            |

Virtually all intersections through the existing road network are configured as priority controlled t-intersections. There are however several 4-way intersections which are provided as roundabouts. There are no signalised intersections east of the Hume Hwy.

### 3.2 Transport Planning

A portion of the road network through the approved residential areas of north Thurgoona has already been identified in Council Planning. Figure 3.1 shows where these roads are to be provided, resulting in a loop road around the educational land.



**Figure 3.1: Proposed Transport Network through North Thurgoona**

### 3.3 Public Transport, Pedestrian and Cyclist Facilities

The urban release structure plan area is not currently serviced by any dedicated pedestrian, cyclist or public transport facilities. The following identifies the existing services in the existing urban areas within the study boundary, including Thurgoona and through to the Hume Hwy.

A network plan for these networks is provided as Figure 7.3, as part of the discussion regarding future requirements.

#### 3.3.1 Public Transport

The Thurgoona area is currently serviced by a single bus service (route 908). This route services Charles Sturt University, Elizabeth Mitchell Drive and the eastern section of Thurgoona Drive, as shown in Figure 3.2.

Services operate approximately hourly on weekdays and Saturday mornings between Thurgoona, Lavington and the Albury CBD. This includes an occasional (once daily) connection to the TAFE campus.

Observations by TTM at peak traffic times have noted that there is a relatively large bus component to traffic currently operating through Thurgoona. However, these are generally operated by private and community groups, including schools.



Figure 3.2: Existing Bus Route 908

### 3.3.2 Pedestrian and Cyclist

Figure 3.3 identifies the existing cyclist and shared path network through Thurgoona and connecting to the CBD. This network essentially extends to the limits of urban development within the region. In addition to this defined network there are also a number of cyclist facilities through the region, including the Hume and Hovell Track and a shared path along Elizabeth Mitchell Drive, north of Thurgoona Drive.

TTM has identified that Albury has a well established cycling culture. In addition to the well connected network of paths, recreational cycling is popular on the urban fringe and additional cyclist infrastructure, such as the CBD lockers in QEII Square are also provided. This identifies that the continued development of this network is logical to cater for the alternative transport needs of the study area.

Beyond these shared paths, the pedestrian network in Thurgoona is generally provided as off-street connections between neighbourhoods, rather than on-street facilities. As such, local streets usually have no footpaths in verges. Instead, it is common for paths to interconnect between cul-de-sac heads and green corridors, providing a separate pedestrian environment.

These connect to the main shared paths via footpaths in verges along the major collector roads, in particular those located around the schools and commercial centre.

Formal pedestrian crossings of the major road network are generally limited to school crossings. However, there are also grade separated crossings in some locations, such as under Thurgoona Drive near the commercial centre and Elizabeth Mitchell Drive north of Hartigan Street, which utilise underpasses. Additionally, suitable land is available where the Hume and Hovell Track crosses Thurgoona Drive to cater for grade separation of this crossing.



**Figure 3.3: Existing Cyclist Network**

## 4. Constraints, Opportunities and Issues

### 4.1 Constraints

The study area has already been subject to an extensive constraints mapping exercise by RPS in order to determine the limits of the available land. This included identification of issues such as flooding, conservation, unsuitable land, airport impact and topography (including outlook from Albury). As such, the areas identified as developable within the study area are generally unencumbered with respect to the development of the transport network.

Although there are few restrictions on the future road structure plan, it is still considered most appropriate to utilise existing road reserves where provided to develop the road network. This road network is to also cater for the trunk commuter cyclist network. Additionally, the pedestrian and recreational cyclist network will be focussed on the open space corridors through the site.

### 4.2 Existing Network Issues

The road network through the study area does not represent the future requirements of the community and will therefore need to develop with the urban area. As such, the transport issues which are of critical importance to this study are those affecting the road network feeding the study area.

TTM has been involved in the community consultation process for the planning study and, when combined with traffic observations by TTM, several key traffic issues for the existing road network have been identified. Several of these are specific localised issues, while others are fundamental issues with the overall configuration of the road network.

The minor issues are generally localised and as such are generally the key issues raised by the community as they are directly impacted at a similar location on a regular basis. As is a common concern with road networks, the Thurgoona community issues centre on intersections which have a lack of capacity. The two key intersections in this network are the Thurgoona Drive/Elizabeth Mitchell Drive and the Borella Road interchange with the Hume Hwy. In each of these cases the capacity of the intersections is compromised for a short time each day during peak hours on the major movements.

These minor issues then often indicate the wider issues of the road network. In this case, one of the major issues for the network is the division caused by the Hume Hwy. The road, which is immediately adjacent to a parallel rail corridor, provides a physical barrier between the Thurgoona/Wirringa region and the remainder of Albury. Crossing points over this barrier are then limited, which funnels traffic demand to several critical points. These locations are on Thurgoona Drive and Borella Road.

An additional issue created by this corridor is limited land for improvements. This is particularly true at the Borella Road and East Street interchanges. Here, the interchanges are located in a relatively narrow corridor between the rail line and existing developments long the eastern side of the corridor. As such, the signals at these interchanges are relatively closely spaced, which impacts on queue availability. The lack of queuing requires that signals are co-ordinated, which in these cases tends to negatively impact capacity, by providing excessive green times on some movements to allow coordination. The physical restrictions of the corridor do not allow a viable option to for the expansion of the interchanges to increase capacity. Therefore, all capacity increases must be provided within the existing road footprint. TTM has further explored some potential solutions in Section 7 of this report.

The issue that is therefore of most relevance to the future development of the road network is how to make the Hume Hwy less of a barrier for movements between the study area and Albury/Lavington to the west. Planning wise, there is then also a need to limit the demand for vehicle trips across the highway, were practical, especially at the existing Borella Road interchange.

### **4.3 Future Transport Planning Considerations**

The study area is essentially a “Greenfield site” allowing for a range of options with respect to the transport network. However, there are several aspects of the site, the planned density and its location which will have specific demands and limitations on transport.

Firstly, it is understood that the commercial and retail uses across the study area are to be limited to neighbourhood centre scale. This is generated by a desire to retain the CBD and Lavington at the top of the retail hierarchy. Therefore transport links to the CBD and Lavington are a key requirement for Thurgoona/Wirlunga.

Additionally, the strategic planning for Albury has identified that significant future employment will be provided through the Table Top area, to the north of the study area. This will include the provision of a range of industrial uses along both sides of the Hume Hwy. Therefore, the transport networks developed need to address connections to this future significant commuter destination.

With respect to buses, the proposed 12 lots per hectare is generally considered an insufficient density to establish a high quality public transport system. In fact, Council has provided feedback that bus take-up and utilisation through Albury has been very poor. Even when providing high frequency and heavily subsidised services.

In the study area, a further issue exists that the travel distance and number of stops required for buses, will result in bus trips taking significantly longer than private vehicle trips. As such, the prospects of providing comprehensive coverage by high frequency, publically organised bus services are considered unlikely. Despite this, there are sections of the community, typically children, the aged and disabled, who require that some level of public transport is available.

This outcome is supported by existing data sourced the 2006 census with respect to transport to work statistics. For postcode 2640, covering Thurgoona, Wirlunga and the Albury CBD, the total respondents identifying bus as part, or all, of their trip to work was 75, out of over 13,000 respondents. In comparison, over 230 rode bicycles and 750 walked to work. Over 10,500 people utilised a vehicle, either as driver, rider or passenger. Providing a larger urban area, with an equivalent or lower population density, is not expected to make bus travel any more desirable.

The densities proposed also produce challenges for the pedestrian network. The majority of standard lots will be significantly more than a walkable catchment (approximately 800m) from activity centres. As such, for many areas, pedestrian facilities could be considered to provide little more than a recreational function. To decrease dependence on private vehicle use, pedestrian paths need to provide a direct connection to activity centre and to major roads, where high occupancy vehicle services can be accessed.

For cyclist operation, two types of users are to be considered. Recreational users are generally confined to the local area and seek paths that provide high environmental amenity. Typically, these paths are provided in green corridors, meandering through the urban area.

Conversely, commuters desire paths which provide high quality, direct connections between residential and employment areas. These paths are already well represented through the wider Albury area. These paths are also well utilised, as demonstrated in the 2011 Super Tuesday Commuter Cyclist Survey. This data indicates that the busiest commuter route in the city is that between Thurgoona and the CBD, catering for up to 80 cyclists per hour. Therefore, providing an extension to this network along major road corridors is considered necessary to capitalise on this mode of transport.

## 4.4 Transport Opportunities

The major opportunity for the road network lies with the site generally being a Greenfield development area. The road network is loosely designated in a grid configuration and a lack of existing development will allow the road network to be developed as necessary.

Additionally, in areas that are developed through Thurgoona, sufficiently wide road reserves have been provided on major roads to cater for future widening. However, any future widening may need to consider competing bio diversity requirements with road reserves.

TTM has also noted that a number of opportunities exist with respect to the road network accessing and bypassing the Hume Hwy. There are a range of options for establishing a connection from the study area, north towards Table Top. This area is generally undeveloped, including adjacent to the highway and therefore will allow a number of options for future connections north of Thurgoona. TTM is also aware that a full diamond interchange is proposed at Davey Road as part of the Nexus Industrial Precinct Masterplanning. A connection to this, via the extension of Elizabeth Mitchell Drive, will provide a direct link between the study area and land uses to the north.

Furthermore, there are several existing crossings of the Hume Highway, which are currently underutilised.

Other transport opportunities relate to the pedestrian and cyclist network. The existing networks for these uses are well developed through the urban areas of Thurgoona, connecting to wider networks across Albury. As such, there are excellent opportunities to extend these networks to provide for non car transport, these are investigated in more detail in Section 7 of this report.

## 5. Existing Traffic Volumes

RMS has provided TTM with traffic volumes in the vicinity of the Hume Hwy. These are taken from 7 day count data, recorded during the weeks of 23 and 30 August 2011. These volumes focus on the operation of the Hume Hwy and its crossing points, with crossing data taken adjacent to the rail line on the western side of the highway.

A summary of these existing volumes are provided in Table 5.1 below.

**Table 5.1: Existing Daily Traffic Volumes**

| Road Section                        | Daily Volume                                 |
|-------------------------------------|----------------------------------------------|
| Hume Hwy                            |                                              |
| ▶ North of Tynan Road               | 7,500vpd                                     |
| ▶ North of Davey Road               | 11,000vpd                                    |
| ▶ South of Thurgoona Drive          | 14,900vpd                                    |
| ▶ South of Racecourse Road          | 26,000vpd                                    |
| ▶ South of Riverina Hwy             | 30,300vpd                                    |
| ▶ South of East Street              | 36,700vpd                                    |
| Thurgoona Drive                     | 13,500vpd                                    |
| Racecourse Road                     | 11,600vpd                                    |
| Fallon Street                       | 3,200vpd                                     |
| North Street                        | 7,000vpd                                     |
| Borella Road (east of Young Street) | 7,000vpd (DTMR 2009)<br>20,000vpd (ACC 2010) |

This demonstrates, as would be expected, that the Hume Hwy increases significantly in volume as it proceeds south towards the Albury CBD. The data also demonstrates that the most common locations to cross the Hume Highway are Borella Road (based on Council data) and Thurgoona Drive. Crossings further to the south, including the North Street have lower traffic volumes. In particular, traffic volumes on the Fallon Street crossing are very low, comparable to a residential collector road. It is understood that this low volume exists as Fallon Street provides only limited access to existing development areas and is bypassed by city bound traffic, with Borella Road offering a parallel route directly to the CBD.

## 6. Estimated Future Transport Demands

### 6.1 Estimated Development Traffic Generation

In the scale of this proposal it is only considered necessary to identify traffic generated by the residential uses in the catchment to estimate future traffic volumes. Trips associated with all other uses, including local shops and community facilities, will generally be the destination of trips, generated by local residents, particularly at peak times.

An exception to this will be any use in the area which draws in traffic from beyond the locality. The only proposed 'regional' scale use in the area that will draw in non-local trips, will be the educational facilities. While it is expected that the development of the study area will cater for staff and student housing needs, there will always be a portion of trips generated from across the Albury area. In particular it is noted that there is a large student population in Wodonga, as currently the cost of living is lower.

The Roads and Maritime Service's *'Guide to Traffic Generating Developments'* recommends using specific generation rates, for planning purposes for different development types. Application of these rates to the proposed study area, results in the estimate of daily traffic generation as per Table 6.1. This estimate is based on the urban release area containing approximately 11,900 dwellings and the existing residential areas in north Thurgoona providing over 8,000 dwellings.

The aged care split is estimated based on census data. The 2006 census identified that approximately 15% of the population (over 4,100 people) are over 65. It is also noted that aged care has a significantly lower density than low density housing. Generally an aged care dwelling houses one or two people, whereas low density housing is expected to average up to 3 persons per dwelling.

Based on these figures, a population growth of 50,000 people will result in 7,500 additional people over 65, ignoring the effects of an aging population. Assuming 80% of these people will be housed in aged care/retirement village accommodation and these have an average occupancy of 1.5 persons per dwelling, this will require an additional 4,000 dwellings for aged care.

Census data from 2006 also identified that 85% of households are standalone dwellings, with the remainder in apartment, unit or townhouse configuration. As such, the distributions by dwelling type are considered conservative with respect to traffic generation as it is expected the future demographics will move towards slightly higher densities and an aging population, resulting in higher portions of low traffic generating dwellings.

**Table 6.1: Expected Traffic Generation for Study Area**

| Use Type          | % of Dwellings | No. of dwellings | Generation rate | Traffic Generation |
|-------------------|----------------|------------------|-----------------|--------------------|
| Detached Dwelling | 70%            | 13,900           | 9 per day       | 125,100            |
| Medium Density    | 10%            | 2,000            | 5 per day       | 10,000             |
| Aged Care         | 20%            | 4,000            | 1.5 per day     | 6,000              |
| <b>Total</b>      |                |                  |                 | <b>141,100</b>     |

TTM has been provided with data from Albury City Council which has monitored the operation of closed residential catchments to determine the local traffic generation. These surveys identified 85<sup>th</sup> percentile daily traffic volumes of 8.9 to 9.2 vehicles per day per lot. This directly correlates with the RMS planning rates, demonstrating they are suitable to be utilised for future planning in this area.

## 6.2 Existing Development Traffic Generation

The urban release area currently includes approximately 100 rural lots. From these, it is estimated that up to 1,000 vehicles per day is currently operating on the local road network. These trips will be replaced by the proposed redevelopment of the study area.

Additionally, through the urban release land in the study area near the TAFE, the equivalent of up to 300 lots has already been developed. This includes on Table Top Road, near Williams Road and the community uses (school) west of Elizabeth Mitchell Dr, near Whitebox Circuit.

Therefore, the total daily volume of approximately 3,500 vehicles per day can be removed from the future traffic generation as it already exists in the catchment.

The critical periods for the road network occur during the morning and afternoon peak periods. It is estimated that 10% of the above daily volumes will be generated during these peak hours. As such, the proposed residential areas are expected to generate an additional 13,800 vehicles per hour. Further development of the tertiary education areas is also nominally expected to draw an additional 500 vehicles per hour to Thurgoona, from outside the study area.

As such, the additional traffic demand on the local road network, east of the Hume Hwy, is expected to be up to 14,500 vehicles per hour.

## 6.3 Estimated Development Traffic Distribution

In the first instance, traffic has been separated into local and non-local traffic. Local traffic will be contained within the study area, east of the Hume Hwy. The non-local traffic then consists of the vehicles which travel to the Hume Hwy, either accessing the highway or crossing to the areas of Albury and Lavington.

Local traffic is based on a break-down of typical daily residential trips, as follows:

- ▶ 40% work/commuter
- ▶ 20% regional retail trips
- ▶ 20% local/convenience retail trips
- ▶ 10% educational/community trips
- ▶ 10% other trips (recreation, to other residential, etc)

From these trips it is expected that the local area will be the destination for the majority of local/convenience retail trips and educational/community trips. The precinct is also expected to provide up to 30% self containment for employment (approximately 12% of total residential trips).

Therefore, in total, it is expected that 40% of all trips generated by new residential areas will be local, with the remaining 60% operating beyond the Thurgoona/Wirlinga area.

As such, the road network connecting the study area, to the wider road network will require an additional capacity of 8,700 vehicles per hour, or up to 87,000 vehicles per day. This compares to an estimated 50,000 vehicles per day currently crossing the Hume Hwy, representing a 175% increase over the coming 30 years.

Figure 6.1 identifies the potential distribution of future development traffic to the wider road network. This distribution is based on the expected future land use planning for Albury, including the intended future development of an industrial corridor, north along the Hume Hwy. These distributions are based on the traffic split above, identifying that the majority of external trips will be for employment (40%) and regional retail (20%).

Estimates are then based on a hierarchy of centres and existing traffic movements as described below.

#### **Traffic to North**

TTM has reviewed the traffic movements at several interchanges on the Hume Hwy, most notably the Thurgoona Drive interchange. This identifies that of the two way traffic flows on Thurgoona Drive east of the Highway, approximately 5% currently head northbound. These trips access areas through Table Top and further north, including rural communities. Allowing for a number of existing trips to be retained locally (i.e. east of the Highway), this equates to approximately 4% of total trips generated in the Thurgoona Drive catchment.

It is expected that this 4% distribution to areas beyond the Albury urban area will continue, plus an additional 5% to 6% of total trips to the proposed industrial area around the Davey Road interchange due to new employment opportunities. This provides a total trip distribution of approximately 10% of future additional traffic volumes.

It is noted that the combined impact of 4% of existing traffic and 10% of future traffic will result in an overall traffic distribution from Thurgoona/Wirringa of approximately 8%.

#### **Traffic to South (Wodonga)**

Council has identified that currently, approximately 18% of employment trips from Albury are to Wodonga. In total, this equates to approximately 7% of all residential trips. This distribution is expected to be retained, if not increased over the development horizon. Additionally, as with trips to the north, areas to the south, beyond Wodonga, are also expected to attract up to 5% of traffic. This will include Wangaratta, Melbourne and rural communities surrounding Wodonga. As such, approximately 15% of all residential trips are expected to be generated between the study area and the Hume Highway, south of Albury.

#### **Traffic to Lavington**

Again TTM has utilised the existing traffic distribution at the Thurgoona Drive interchange as a guide to future distribution. This identifies that of the two way traffic flows on Thurgoona Drive east of the Highway, approximately 35% cross the Highway to the west. Allowing for a number of existing trips to be retained locally (i.e. east of the Highway), this equates to between 20% and 25% of total trips generated in the Thurgoona Drive catchment.

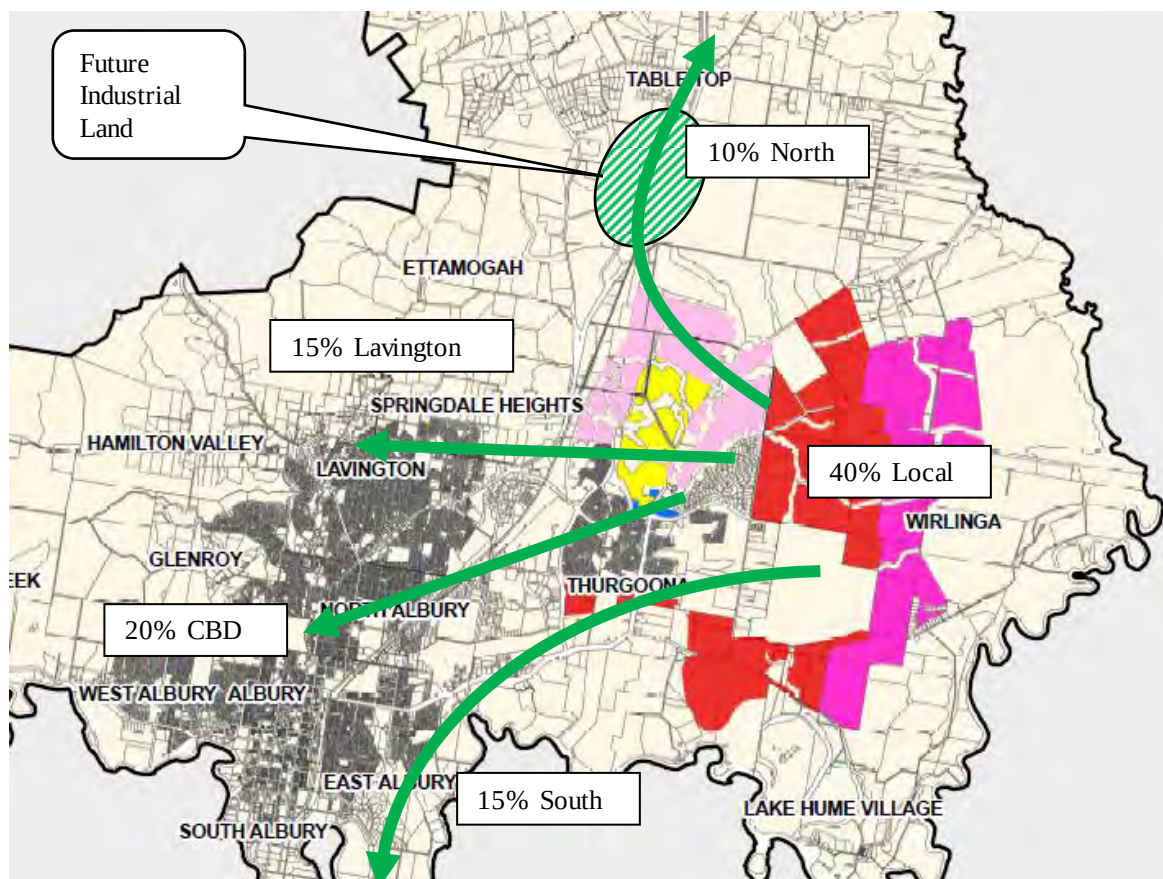
In the current environment, Lavington provides a major trip attractor for Thurgoona. Thurgoona Plaza provides basic amenity, such as a supermarket, local take away and convenience retail. However, to access other retail and commercial uses, including bulky goods, show rooms, restaurants, major take-away, homewares, medical and specialist retail, residents must travel to Lavington.

It is anticipated that as the study area develops, including the provision of several major and village centre, that some of this existing demand in Lavington will become local. This will reduce the portion of trips from the study area to Lavington. However, as Lavington will be retained as the primary centre north of the CBD, uses such as motor showrooms, homewares and bulk goods would remain in this area and not be duplicated in the study area.

As such, a lower portion of the new trips generated by the study area will be directed to the Lavington area. A rate of 15% of new trips has therefore been assigned in this direction.

### Traffic to Albury CBD

The CBD, similar to Lavington, is expected to experience a fall in traffic distribution, relative to current levels. In the case of the CBD, it will be the establishment of local opportunities in education, employment and community uses, which will generate internal trips, rather than accessing the inner areas of Albury. Saying that, it is still expected that up to 20% of new trips will be generated towards the CBD, as further development of the inner urban area provided additional employment opportunities.



**Figure 6.1: Expected Study Area Traffic Distribution**

Based on the above distribution the following additional traffic volumes are to be catered for by the road network:

- ▶ 14,500vpd and 1,450vph to the north
- ▶ 21,800vpd and 2,200vph to the south
- ▶ 21,800vpd and 2,200vph to Lavington
- ▶ 28,900vpd and 2,900vph to the CBD
- ▶ 58,000vpd and 5,800vph contained within the study area

## 7. Proposed Transport Networks

The travel demands identified in Section 6 of this report have demonstrated the following needs with respect to the road network:

- ▶ Increasing travel demands to existing employment and retail uses in Lavington and the CBD
- ▶ New road connections required to access employment opportunities to the north
- ▶ Well connected internal road network to cater for local trips and to connect new residential areas to the wider road network.

The following road network structure plan is aimed at achieving these requirements.

### 7.1 Road Network – Major Road Network

Through the study area it is generally proposed to retain the existing road structure, whereby a grid network of east-west and north-south routes is extended. This is considered the optimal road configuration as it provides the most flexibility with respect to route choice and is also easier to navigate.

The primary routes will be those from east to west, connecting the community to the Hume Hwy and the Albury CBD. Secondary routes will operate north-south through the catchment. These will largely service local movements, distribution form the major east-west routes and connect the community to employment areas to the north.

Seven key routes have been identified through the study area, including:

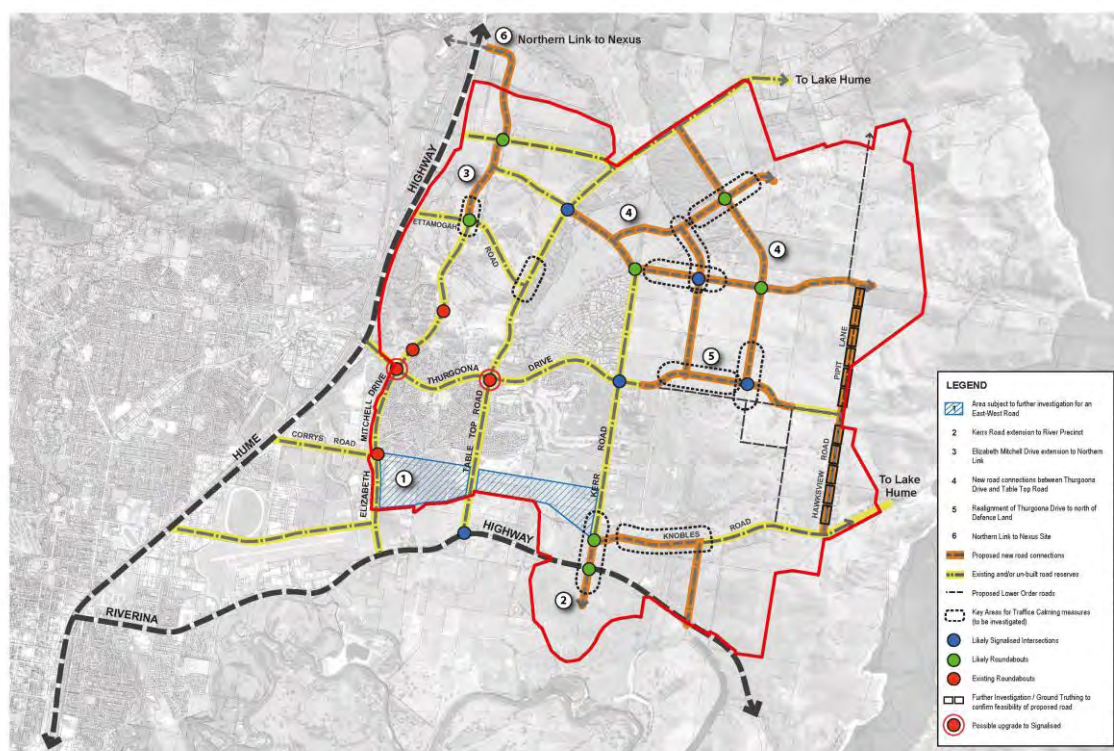
- ▶ Thurgoona Drive
- ▶ Borella Road (Riverina Hwy)
- ▶ Kerr Road
- ▶ Table Top Road
- ▶ Elizabeth Mitchell Drive
- ▶ Fallon Street
- ▶ The outer ring road (formed by a number of road separating the urban and rural densities)

Each of these routes is discussed further in the following sections. Generally, these are extensions of the existing routes through the catchment. Figure 7.1 identifies the proposed road network in reference to the study area. Typical cross sections for each of these roads are provided in Appendix A.

In general, all of these major routes will be required to provide a primary traffic movement function, as opposed to a property access function. Therefore, access to lots fronting these roads will be limited, with the potential exception of the outer ring road. Specifically, these major roads should have the following access limitations:

- ▶ No direct access to single lots or small scale residential developments
- ▶ Access to large scale residential developments to be via an intersection (into a public road), as opposed to a driveway

- ▶ Direct access to large scale developments (schools, shopping centres, etc) may be provided where appropriate
- ▶ Access to large scale developments on adjoining lots should be amalgamated where practical
- ▶ Access to large scale developments may have limited movements (such as restricted to left-in, left-out)



**Figure 7.1: Major Road Network Routes (reproduced from RPS Planning Maps)**

Figure 7.1 also identifies potential intersection upgrades (including roundabouts and traffic signals). Generally, it is preferred that all four way intersections are provided with a minimum roundabout standard. Roundabouts are very good at portioning priority to traffic flows and provide a high level of safety and functionality for vehicles. However, roundabouts are a poor solution where pedestrians and cyclists volumes are significant.

As such, signals have generally been recommended for one of two reasons. Firstly, at locations such as Thurgoona Drive/Elizabeth Mitchell Drive, signals are required due to the capacity requirements of future traffic flows. At other locations, such as near the Major Neighbourhood Centres and around Schools, signals are provided to facilitate safe pedestrian movement as well as traffic flows, essentially providing a local traffic calming solution.

There may be specific design solutions in some of these lower traffic areas where roundabouts are provided at intersections and alternative pedestrian facilities (such as underpasses, pedestrian signals or zebra crossings) are also locally available.

### **7.1.1 Thurgoona Drive**

This is currently provided as a 2 lane, 2 way sub-arterial road. It is the primary road connection from the central Thurgoona area to the Hume Hwy and on to Lavington. At Kerr Road, the urban formation of this road ends and immediately to the east it converts to an unsealed rural road.

The proposal is to retain this as a primary connection from the northern end of the study area to the Hume Hwy. To facilitate this, it is proposed that the section from the Hume Hwy to Kerr Road is ultimately upgraded to a 4 lane road. This would occur as traffic volume approach 2,000 vehicle per hour. East of Kerr Road, the road is to be formed as a 2 lane road.

To cater for the additional traffic on Thurgoona Drive it will be necessary that major intersections are also upgraded. It is envisaged that the intersections of Table Top Road, Elizabeth Mitchell Drive and Kerr Road are provided as signalised intersections. This will typically occur as roundabouts exceed an 85% degree of saturation (DoS). For comparison, Council data identifies that in 2010, the Thurgoona Drive/Elizabeth Mitchell Drive intersection operated at less than 70% DoS, indicating traffic volumes may increase by a further 15% before upgrades are required.

Additionally, the interchange with the Hume Hwy will ultimately require an upgrade. The intersections will require signalisation as traffic increases and may need to be separated further from the bridge to allow adequate queue provision in turn lanes.

Out of the two lane approaching the interchange from the east, one will provide a direct movement to the southbound on-ramp, while the second will proceed as a single lane across the overpass. Westbound, two lanes will be required to provide capacity for vehicles turning right from the off-ramp, towards Thurgoona. This 2 lane eastbound, 1 lane westbound configuration can be accommodated on the existing 14m wide bridge.

There will also be a requirement to resume land for additional road reserves east of Kerr Road.

This provision will increase the capacity of this road from the current 1,200vph to an estimated 4,000 vph.

### **7.1.2 Borella Road (Riverina Hwy)**

As with Thurgoona Drive, this is currently provided as a 2 lane, 2 way sub-arterial road, east of the airport. However, as a part of the state highway network, this formation is continuous through the study area to Lake Hume Village.

The proposal is to retain this as a primary connection from the southern end of the study area to the Hume Hwy. To facilitate this, it is proposed that the section from the Hume Hwy to Kerr Road is ultimately upgraded to a 4 lane road. This would occur as traffic volume approach 2,000 vehicle per hour. East of Kerr Road, the road is to be retained as a 2 lane road.

Suitable road reserves are provided to accommodate these requirements.

Several major intersection upgrades to signalisation or roundabouts will also be required, including Table Top Road, Elizabeth Mitchell Drive and Kerr Road. In particular, Kerr Road will be a 4 way intersection, with a southern leg accessing the southernmost section of the study area.

The issue with this corridor is the capacity at the western end. There is currently limited opportunity to provide significant upgrades to the Hume Hwy interchange, due to limited land availability. However, there are several reconfiguration options for the network which may be considered.

At the interchange, the most simplistic change is to convert the southbound off ramp to a dedicated right turn lane and one lane as shared left/through/right. This will significantly increase the capacity for southbound traffic to turn towards the CBD. TTM has reviewed the critical AM peak traffic analysis of this intersection. By providing this lane configuration and allowing optimum phasing, this intersection will perform at a better level of service in 2022, with 3% per annum growth, than it currently performs with the existing volumes, lane configuration and timing.

Similarly, the intersection of Young Street and Borella Road can be reconfigured such that the southern approach has two right turn lanes towards the highway, increasing the outbound capacity from the CBD. TTM has reviewed the critical PM peak traffic analysis of this intersection. By providing this lane configuration and allowing optimum phasing, this intersection will perform at a better level of service in 2018, with 3% per annum growth, than it currently performs with the existing volumes, lane configuration and timing.

The above the intersection treatments are considered a first stage improvement that can be implemented immediately at limited cost.

To provide further capacity at the interchange would require upgrades, such to allow additional lanes at the interchange intersections. This may include left turn slip lanes, extending right turn lanes, additional through lanes or a combination of these. This process will be difficult and expensive as the interchange intersections are located on existing bridge structures which would need to be extended.

Depending on which option is utilised, the traffic through this interchange can be increased significantly. TTM has reviewed the options of reconfiguring the lane designations at the intersection. This could potentially increase traffic capacity at the interchange by 7,000 vehicles per day.

It is also recommended that East Street is promoted as the primary route from Riverina Hwy to Wodonga. This will distribute more traffic away from the congested interchange, catering for more traffic southbound from the study area.

### **7.1.3 East-West Connection – City Access Route**

The major road recommendation of this report is to develop a new route to provide direct access from the study area to the CBD, bypassing Hume Hwy interchanges. TTM has identified that both Fallon Street and Corrys Road provide opportunities to establish this route.

The major advantage of Fallon Street is that it is adjacent to the flight path for the airport. As such funneling increased traffic volumes to the route are unlikely to have significant amenity impacts on residents.

As identified in section 5 of this report, the Fallon Street overpass caters for only 3,000 vehicles per day. This low traffic volume occurs as Fallon Street is isolated from most residential sources of traffic and only services a small, immediately adjacent catchment. This includes the eastern portion of Fallon Street being fronted by the airport (restricted access) and the Albury Race Track, both of which produce limited traffic at peak times. As such, it has a spare mid-block capacity of up to 19,000 vehicles per day.

The demand for this road can be greatly increased by providing a direct connection to residential areas. This can be achieved by extending Fallon Street to Knobel Road. This will result in Fallon Street providing a direct connection from the northern end of the CBD to the central portion of the future residential areas.

The capacity of this road is generally limited by the 2 lane bridge over the Hume Hwy. As such, it is expected that this route will generally only require a mid-block configuration of one-lane each way. This will be complimented by localised carriageway widening at intersections to provide auxiliary lanes and additional through capacity at roundabouts and signalised intersections. To provide this route, a road reserve is to be established from Elizabeth Mitchell Drive to Kerr Road.

Similarly Corrys Road has very limited lot frontage east of the highway, allowing the establishment of a priority traffic route. It is also serviced by a two lane bridge across the Hume Hwy and is generally a two lane carriageway. This option has the advantage of an alternative access to both North Albury and Lavington. There is also an access to the Hume Hwy (south side only) which may provide an alternative highway access.

The precise route for this link has not been determined in this planning study. As identified in Figure 7.1 an area for further investigation has been identified. This corridor will be subject to further investigation and reporting to determine the final route for this east-west connection.

TTM has also reviewed this proposed link's relationship to the parallel Borella Road. This new link's primary function will be to move traffic from the study area to the northern areas of the CBD. This is opposed to Borella Road which has a number of functions, including access to the airport and the Hume Hwy.

The impact of removing this east-west link from the future network would be to push up to 20,000 vehicles per day onto other routes over the Hume Fwy, predominantly Borrella Road. This would require Borella Road to be constructed to 6 lanes, with multiple additional lanes at key intersections, such as the Hume Hwy interchange. This upgrade would come at a cost far in excess of providing a road extension through a relatively greenfield area.

The parallel links will also provide alternative options for east-west traffic, such as in emergency situations.

#### **7.1.4 North-south Secondary Routes and Ring Road**

There are four proposed secondary traffic routes through the study area. This will provide Distributor routes at 1.5km to 2km spacing. These routes will provide for north-south movements, as well as the major connections between the east-west arterial routes and adjacent neighbourhoods.

These roads include the existing Elizabeth Mitchell Drive, Table Top Road and Kerr Road. The fourth route is proposed as a ring road through the eastern portion study area. This would include a road along existing road reserves, including Hawksview Road, Pipit Lane and Kywanna Road to connect with Table Top Road in the north.

Elizabeth Mitchell Drive and Table Top Road will be extended to the north as part of the urban land releases around the education precinct.

These roads will generally be lower volume as there will be less demand for the north-south movements and a greater route choice is provided with 4 roads. Therefore, each of these roads can be retained as 2 lanes in each direction. However, consideration is to be given to wider road reserves to accommodate auxiliary lanes at intersections as well as pedestrian and cyclist facilities.

The location of the Outer Ring Road is subject to further investigation, particularly the section along Hawksview Road and Pipit Lane. The topography in this location and the limited lots requiring access may result in this reverting to local collector road. This may also impact the potential for a through route to be established.

With respect to the section along Kywanna Road, this is an existing road reserve, partially fronting a conservation reserve. This road is considered appropriate within the scheme of the future road network to provide a northern connection to Table Top Road and to provide a buffer between residential and conservation uses. There may be an opportunity in long term planning to provide this as a collector road if further potential development to the north is unlikely.

## **7.2 Road Network – Local Road Requirements**

Intersections with the major east-west road network should generally be limited to every 300m to 500m along the major routes. This can be relaxed along the secondary north-south roads to 100m, where necessary.

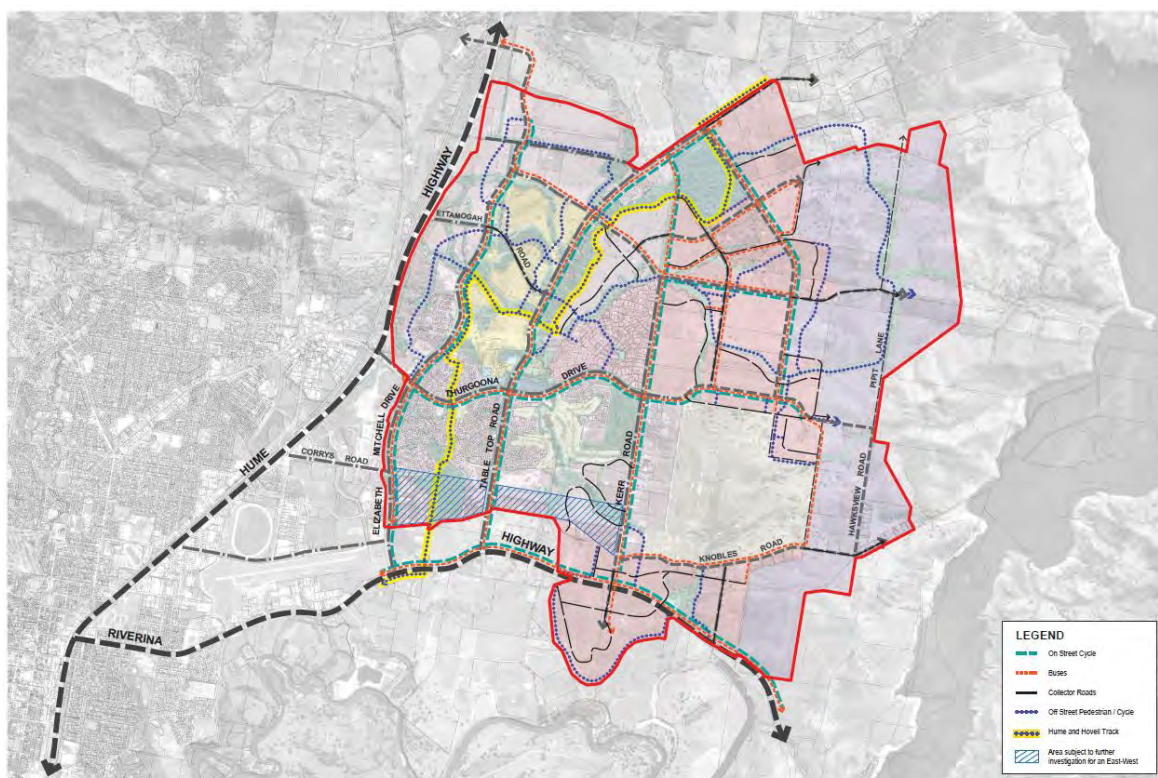
Several key guidelines with respect to the collector road network are proposed to improve the amenity of neighbourhood access.

Firstly, it is proposed that where a waterway or conservation corridor is located in a neighbourhood, collector roads should front these corridors. This will limit the access points to lots on collector roads. Additionally, the road frontage along such corridors provides for surveillance, recreation and maintenance access.

Collector roads should also be orientated to avoid rat-running. This will occur where a vehicle or traffic flow is able to bypass a major route where congestion may occur. To avoid this, collector routes should generally be orientated from the north-west to south east, such that they do not provide the most direct route towards the CBD through the respective neighbourhood.

Finally, all collector roads are to be designed to cater for buses, such that bus routes can access each neighbourhood, as demand allows. This will require minimum 11m wide pavements, within 22m wide road reserves. Localised widening of pavements may be required at corners and intersection to cater for bus movements.

The above aspects of the collector road network will ensure they operate to their required function, which is to allow direct property access, while also facilitating limit traffic carrying capacity. An indicative structure plan for these roads in accordance with the above guidance is provided in Figure 7.2.



**Figure 7.2: Secondary Movement Plan**

Based on the above assessments, TTM has identified a road hierarchy as per Table 7.1, this identifies the key characteristics of each type of road within the proposed road network. This generally aligns with Council's Engineering Development Standards, notably Table 10.2 of the Albury Development Control Plan. Where these requirements differ from the Council Standards, the higher and better standard should be adopted.

**Table 7.1: Proposed Road Hierarchy**

| Classification of Road | Arterial Road                                                                                                                                           | Sub-Arterial                                                                                                     | Local Distributor                                                                                                         | Local Collector                                                                                              | Local Access                                                                                                |
|------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|
| Examples               | Borella Rd                                                                                                                                              | Thurgoona Dr (west of Kerr Rd)                                                                                   | Table Top Rd, Kerr Rd, Fallon Rd, Elizabeth Mitchell Dr                                                                   | NA                                                                                                           | NA                                                                                                          |
| Individual Lot Access  | No (service road provided)                                                                                                                              | Generally no                                                                                                     | Large sites or amalgamated                                                                                                | Yes                                                                                                          | Yes                                                                                                         |
| Reserve Width          | 40m to 60m                                                                                                                                              | 35m to 40m                                                                                                       | 20m to 25m                                                                                                                | 22m                                                                                                          | 15m                                                                                                         |
| Carriageway            | <ul style="list-style-type: none"> <li>▶ 2 × 8m wide</li> <li>▶ 2 lanes each way</li> <li>▶ 6m median</li> <li>▶ Service road for lot access</li> </ul> | <ul style="list-style-type: none"> <li>▶ 2 × 8m wide</li> <li>▶ 2 lanes each way</li> <li>▶ 6m median</li> </ul> | <ul style="list-style-type: none"> <li>▶ Single 13m wide</li> <li>▶ 1 lane each way</li> <li>▶ Sealed Shoulder</li> </ul> | <ul style="list-style-type: none"> <li>▶ Single 11m wide</li> <li>▶ 2 Moving Intermittent Parking</li> </ul> | <ul style="list-style-type: none"> <li>▶ Single 8m wide</li> <li>▶ 2 Moving Intermittent Parking</li> </ul> |
| Traffic Volume         | 35,000vpd+                                                                                                                                              | 7,000 to 35,000vpd (or more)                                                                                     | 5,000 to 7,000vpd (or more)                                                                                               | Up to 3,000 vpd                                                                                              | Up to 1,000 vpd                                                                                             |
| Number of dwellings    | NA                                                                                                                                                      | NA                                                                                                               | 500-750                                                                                                                   | 300                                                                                                          | 100                                                                                                         |
| Design Speed           | 80km/hr                                                                                                                                                 | 70km/hr                                                                                                          | 60km/hr                                                                                                                   | 50km/hr                                                                                                      | 30km/hr                                                                                                     |
| Footway Width          | 2 x 5.5                                                                                                                                                 | 2 x 5.5                                                                                                          | 2 x 5.5                                                                                                                   | 2 x 5.5                                                                                                      | 2 x 3.5 or 2x 5.5                                                                                           |
| On Street Parking      | No                                                                                                                                                      | No                                                                                                               | Designated area only                                                                                                      | Yes                                                                                                          | Yes                                                                                                         |
| Footpath               | Both sides                                                                                                                                              | Both sides                                                                                                       | Both sides                                                                                                                | Both sides                                                                                                   | One side                                                                                                    |
| Cyclists               | Shared path in verge                                                                                                                                    | Shared path in verge                                                                                             | Shared path in verge or in sealed shoulder                                                                                | Informal on street                                                                                           | Informal on street                                                                                          |
| Buses                  | Primary route                                                                                                                                           | Primary route                                                                                                    | Primary route                                                                                                             | Potential Route                                                                                              | No                                                                                                          |
| Kerb and Channel       | 150 mm high integral barrier                                                                                                                            | 150 mm high integral barrier                                                                                     | 150 mm high integral barrier                                                                                              | 150 mm high integral barrier                                                                                 | barrier or semi mountable                                                                                   |

## 7.3 Other Transport Networks

The following transport networks are generally identified in the Secondary Movement Plan, reproduced as Figure 7.2.

### 7.3.1 Cyclists

TTM considers that the most efficient public transport mode to establish in the study area is the cyclist network. As identified in the Albury City Council Commuter Cyclist Survey, the number of people cycling from the Thurgoona area during the peak hour is up to 80. In contrast, the 2006 census revealed only 75 people in the entire 2640 postcode utilised buses for work. As such, buses are considered to be significantly underutilised and therefore currently cater for only a fraction of the cyclist demand on the same route.

Therefore, it is recommended that the cyclist network be significantly expanded through the study area. Promoting cycling is considered an ideal form of alternative transport in this location given the distance from the CBD and the relatively flat topography. In fact at this distance, it is expected that cyclist will take less time to access the CBD, than a bus which must stop regularly.

Two types of cyclist path are required, as per the current structure of the Albury cyclist network. These are to cater for commuter cyclists and recreational cyclist.

Commuter cyclist paths are generally to be provided along road corridors. In particular, paths along Borella Road, Thurgoona Drive and Table Top Road are to be extended along the full length of these roads in the study area. Kerr Road may also be developed with a cyclist route in the future. These paths are to be provided as a minimum 2.5m wide path in one verge of the respective road reserve. Typically, the verge chosen should be the one with the lowest potential road and driveway crossings to limit the conflict with vehicle movements.

Arrangements for cyclist crossings at major intersections are also to be provided. This can generally be provided at intersections where traffic signals are incorporated, however must be offset from intersections formed by roundabouts. As such, signals are typically the preferred treatment for cyclists.

Recreational trails are to be provided adjacent to waterways and conservation corridors. While ideally paths may be located within these corridors, it is understood that this is often at odds with conservation and environmental requirements. Road crossings for these paths are to be provided as underpasses where waterways are bridged by roads with suitable clearance. Alternatively, at grade cyclist crossing points should be designed where appropriate.

In addition to cyclist paths, the development scheme for the area should also promote end of trip facilities. As such, further development of education, commercial, retail and community facilities should provided allowances for cyclist, which as a minimum satisfy Austroads Guidelines. These facilities are to include cyclist parking (separate for employees and visitors), lockers and shower facilities. The provision of these facilities is often considered more critical than the provision of cyclist connections to developments.

The requirements for these facilities should extend across the Albury Local Government Area, particularly the CBD, as the primary commuter destinations for cyclists.

### 7.3.2 Pedestrians

Pedestrian movement is considered most critical within a 400m to 800m catchment of commercial and community facilities, including schools, local shops and recreation. The intention of pedestrian routes should be to provide the shortest practical route between residential areas and nearby destinations. This may include pedestrian paths which cut through neighbourhoods separate from road reserves, as well as footpaths within road verges.

The intent is to provide pedestrians routes which offer similar travel times for local trips, to reduce dependence of private vehicles around community and commercial facilities.

This requirement results in a need to provide strong pedestrian connections within an 800m catchment of activity nodes. Beyond this, walking times increase beyond 10 minutes and pedestrian access to activity nodes becomes less attractive to pedestrians.

As such, planning for pedestrians for the current process is generally limited to areas within 800m of activity nodes. Beyond this, ad hoc provisions of paths within road reserves will generally service any pedestrian demand generated by local users.

Off road pedestrian paths should be at least 1.5m wide to allow for two way pedestrian movements and occasion use by cyclists. These should be contained in reserves at least 8m wide to allow ease of maintenance and casual security surveillance.

Footpaths in road verges are to be provided in accordance with Council requirements.

### **7.3.3 Buses**

With respect to buses the proposed residential densities are not considered sufficient to justify provision of the high frequency services to all urban areas. However, to facilitate the establishment of bus routes in the future, should demand warrant, all roads and intersections of collector standard and above are to be designed as suitable for buses.

Publically operated bus networks are unlikely to be a practical high amenity alternative to cars. This is evident in the very low utilisation through the current Local Government Area. TTM has also assessed travel times offered by buses as opposed to cars. It is estimated that a bus, stopping at 40% of stops for an average of 30 seconds, will have a 40% increase in travel time with respect to private cars. This is confirmed by existing timetables which show a trip from Thurgoona Plaza to QEII Square is scheduled to take approximately 30 minutes, as opposed to a 20 to 25 minute drive time.

This excludes further time penalties that are incurred by passengers walking to and from stops and waiting for buses to arrive. Allowing up to 10 minutes for these aspects results in a 40 minute trip, door to door, for a Thurgoona to CBD journey. This is approximately double the time taken by private car and exceeds likely cycle times across much of the catchment.

Based on this assessment, it is apparent that buses will remain underutilised in the future. There are several planning options to improve the competitiveness of buses with respect to cars. This may include express routes, introducing restricted/paid parking in the CBD or bus priority zones.

However, the introduction of all of these measures is unlikely to have a major impact. In particular, it is estimated that providing a dedicated bus lane from Thurgoona to the CBD, with priority at lights and running express on the Hume Freeway, would reduce travel times to approximately 15 minutes. Allowing for the end of trip movements, this is still likely to exceed car travel times and does not have the relative convenience of cars. This would also be impractical from a cost perspective, requiring additional traffic lanes on a number of major roads and at intersections, or alternatively the dedication of a new bus corridor. Either option would cost tens to hundreds of millions of dollars, delivering only a minor improvement in bus patronage.

As such it is likely that the current system of community and private bus operators will continue into the future and service the demand for alternative motorised forms of transport other than private car. Therefore, the more appropriate approach to bus planning is to be focussed on these community and private bus operations.

These uses which can be access by communal transport include:

- ▶ schools
- ▶ community facilities
- ▶ aged care developments
- ▶ retail
- ▶ taverns

To promote the utilisation of buses through these private operators, the Council may consider providing concessions on parking rates and development transport contributions to these types of development where adequate bus facilities are provided. The types of bus facilities considered necessary at these uses includes:

- ▶ External, on road indent bays or on-site bus parking areas
- ▶ High amenity pedestrian access between bus set down and pedestrian entries
- ▶ Integration of bus facilities with taxi ranks
- ▶ Bus stop facilities, including shelters, seating and rubbish bins.

TTM has also been made aware that there are a number of locations through Thurgoona where the public road network is insufficient to cater for bus movements, denying access to existing services. Better planning is therefore required to ensure that all provided bus facilities (public and private) can be effectively and efficiently accessed in future urban area developments.

### **7.3.4 Heavy Vehicles**

Analysis of the Council intersection analysis has identified that the proportion of vehicles classified as commercial vehicles reduces as distance increased to the east of the Hume Highway. Generally, most roads and intersections through the study area operate with 5%, or less, heavy vehicles. This is despite relatively low volumes, where compared to the future case, and the requirements of larger vehicles to service existing rural and agricultural uses.

The proposed development will be largely residential, with some additional uses, such as retail, commercial and community uses. There will be no industrial uses or mining/ materials excavation through the study area and heavy vehicles currently generated by rural activities will be removed as development occurs.

In the future the traffic flows are expected to be characterised as primarily consisting of cars. Larger vehicles will be required, including refuse collection vehicles, bus services, furniture delivery vehicles, infrastructure maintenance and retail deliveries. However, these will be largely in the minority and are not expected to exceed 2% to 3% of vehicles over the course of a day, and less during peak periods.

There will be no requirement to establish haulage or heavy vehicle routes through the study area as there are no uses demanding this category of infrastructure. Therefore the proposed public road network will be required to cater for these vehicles as a general provision. Therefore, intersections and lanes should generally be designed to cater for the largest regular turning vehicle.

For the collector network, this will generally be a 12.5m long rigid vehicle. Above collector standard, the design vehicle will be a 19m articulated vehicle, generally to allow deliveries to supermarkets and movements of construction materials as the area develops.

### **7.3.5 Rail Transport**

The potential for accessibility to the study area via rail was raised in the community information sessions. Two modes were raised, the extension of the existing rail system to service the development area and the future potential for a Very Fast Train (VFT).

While idealistically, an additional station could provide alternative transport between the study area and the Albury CBD, the current purpose of the train line does not facilitate this. The existing line provides long distance freight and passenger movements between Victoria and New South Wales. Passenger trains are infrequent (2 or 3 service per day) and do not coincide with peak demand for movements. The additional station, to be effective, would require more frequent services, which simply runs between the Albury and the new station, servicing no other locations. This is inefficient and the local road network does not operate in such a manner as to make this rail journey time beneficial. It is also considered impractical to add a North Albury Station with respect to the long distance rail movements, as this would add another stop on long distance journeys, the impact of which would outweigh the convenience to locals seeking to utilise the services.

With respect to the VFT, planning for this infrastructure dates back over 30 years and it is unlikely that such a project will be undertaken in the short term. If this project progresses to a detailed investigation phase there are significant variables that need to be considered with respect to Albury, such as:

- ▶ Will the most appropriate alignment between Sydney and Melbourne be through Albury
- ▶ If so, will Albury be serviced by the rail
- ▶ If a station is to be provided, is a central or fringe location preferred.

These questions will be answered in planning studies for the VFT, taking account of all social, economic and land use patterns along the potential corridors, including Albury. As such, it is considered beyond the scope of this study to address this infrastructure.

## **7.4 Acoustic Impacts**

TTM is aware that a major impact of development through the study area from increased traffic and activity will be the acoustic impacts on residential uses. This aspect has been covered in a separate TTM report for the study area, specifically detailing the potential impacts and potential mitigation measures required to treat noise to residential areas.

The key findings of this report with respect to traffic noise are that:

1. Transport corridors generally follow existing transport routes and buffers are provided within the adjacent development areas
2. Primary transport routes are designed in detail to account for specific site requirements, which may include a range of acoustic measures, including buffers, property setbacks, noise barriers and traffic measures such as reduced speed limits.

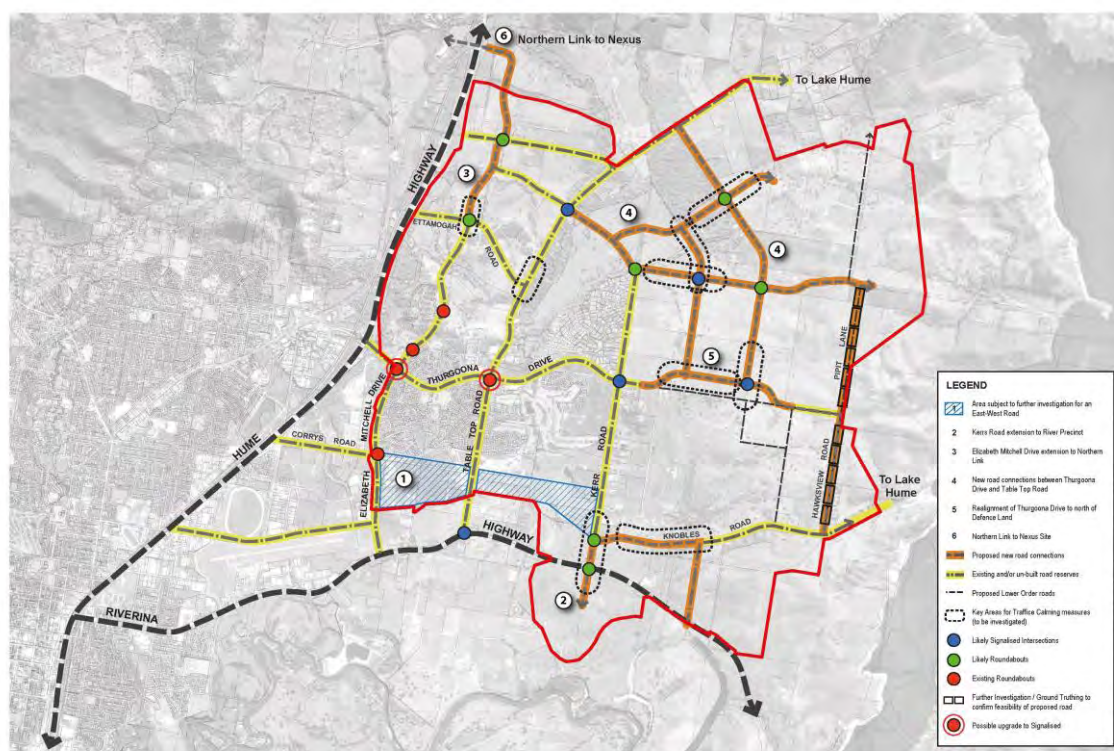
Please refer to the TTM Thurgoona/Wirlinga Acoustic report (ref 28292) for further acoustic treatment details.

## 8. Traffic Network Plan

In response to the recommendations in Section 7 of this report, TTM and RPS have prepared a Transport Network Movement Plan to identify the indicative required transport infrastructure for the study area. This plan identifies the following types of infrastructure:

- ▶ Major Roads
- ▶ Collector Roads
- ▶ Cyclist paths, separated into:
  - On street (generally commuter)
  - Off Street (Generally recreational)
- ▶ Pedestrian connections near activity nodes
- ▶ Potential Bus Routes
- ▶ Major Intersection Upgrades

The proposed infrastructure are identified below in Figure 8.1, as well as in the Secondary Movement Plan (Figure 7.2)



**Figure 8.1: Transport Network Plan**

## 8.1 Cost Assessment

Table 8.1 identifies a list of the transport infrastructure requirements noted on the Transport Network Movement Plan. These are then costed against indicative rates for the provision of such infrastructure. Note that the below costs are a guide only and generally consider only the construction of the infrastructure.

The road costs allow for the following construction requirements:

- ▶ Provision of new pavement
- ▶ Traffic management provisions to maintain current traffic flows
- ▶ Construction of drainage
- ▶ Relocation of minor services
- ▶ New lighting
- ▶ Upgrade of intersections, including signalisation where specified
- ▶ Provision of on road/in verge cyclist, pedestrian and public transport facilities.

They do not allow for additional items such as major land acquisition or relocation of major services. As such, costs may vary by  $\pm 30\%$  based on detailed site investigation and requirement. In particular, number of major structures/water corridor crossings, traffic volumes through construction areas, topography along the infrastructure alignment.

It is envisaged that some types of infrastructure, including collector roads (and therefore bus routes) and pedestrian paths will generally be included within development areas and therefore will not constitute trunk infrastructure to be provided by Council. However, the major road network and off street cyclist paths will most likely require a coordinated approach through a priority infrastructure plan. As such, these items are fully detailed below.

**Table 8.1: Transport Infrastructure Schedule**

| Infrastructure Group | Infrastructure Category | Project Title                      | Project Description                                                                                                                                                                             | Co-ordinating agency | Timing<br>S: 0-10 Years<br>M: 10-20 Years<br>L: 20+ Years | Indicative Cost<br>Cost (\$2012) |
|----------------------|-------------------------|------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|-----------------------------------------------------------|----------------------------------|
| Roads*               |                         |                                    |                                                                                                                                                                                                 |                      |                                                           |                                  |
|                      | Arterial Road           | Riverina Highway Upgrading         | Upgrade the highway to 4 lanes between East Street and Kerr Road (6.6km). This will include signalisation or roundabouts at Table Top Road, Elizabeth Mitchell Drive and Kerr Road intersection | RMS                  | Medium to Long                                            | \$100M                           |
|                      | Arterial Road           | Thurgoona Drive                    | Upgrade from 2 lanes to 4 lanes for the 3.2km between the Hume Hwy and Kerr Road. This will include signalisation at the Kerr Road intersection                                                 | ACC                  | Long                                                      | \$45M                            |
|                      | Arterial Road           | Thurgoona Drive Intersections      | Intersection Upgrade – signalise the Thurgoona Drive intersection with Elizabeth Mitchell Drive                                                                                                 | ACC                  | Short                                                     | \$4M                             |
|                      | Arterial Road           | Thurgoona Drive Intersections      | Intersection Upgrade – signalise the Thurgoona Drive intersection with Table Top Road (Signals or roundabout based on need)                                                                     | ACC                  | Medium                                                    | \$3M                             |
|                      | Sub-arterial            | Thurgoona Drive Extension          | Provide 3.2km long two-lane, single carriageway from Kerr Road to Hawksview Road, including signalised intersection near VC3 and significant road reserve widening                              | ACC                  | Long                                                      | \$20M                            |
|                      | Sub-arterial            | Elizabeth Mitchell Drive           | Carriageway improvements, including sealed shoulders, intersection upgrades, lighting and storm water. 5.2km from Borella Road to Ettamogah Road                                                | ACC                  | Medium                                                    | \$26M                            |
|                      | Sub-arterial            | Elizabeth Mitchell Drive Extension | Two-lane, single carriageway north of Ettamogah Road to Davey Road interchange (2.5km)                                                                                                          | ACC                  | Medium                                                    | \$15M                            |
|                      | Sub-arterial            | Table Top Road                     | Carriageway improvements, including sealed shoulders, intersection upgrades, lighting and                                                                                                       | ACC                  | Medium                                                    | \$15M                            |

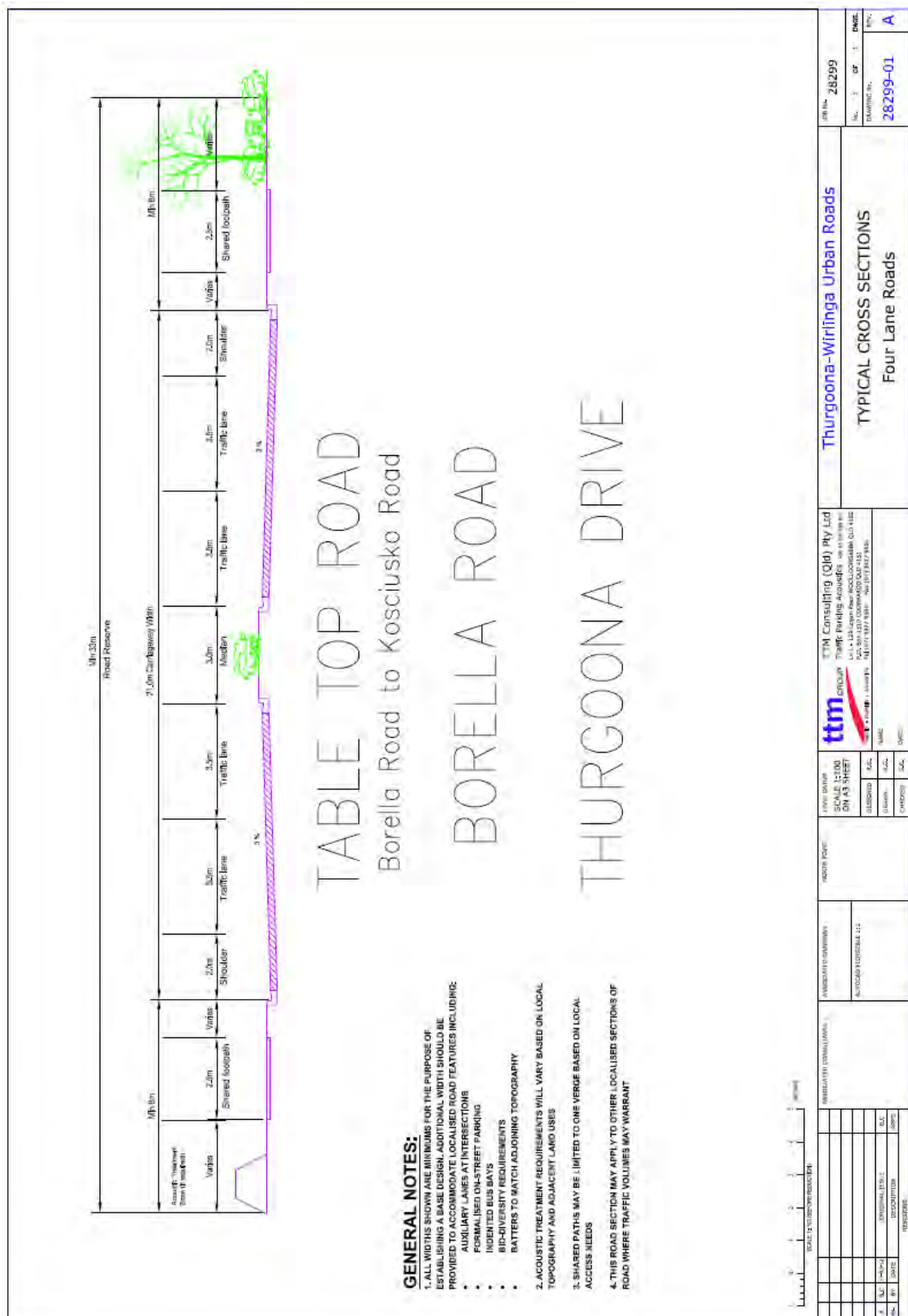
|                                                                                                                                                                                                                   |                  |                             |                                                                                                                                                                                                                                        |     |                                   |        |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|-----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----------------------------------|--------|
|                                                                                                                                                                                                                   |                  |                             | stormwater. 5.2km from Borella Road to Williams Road                                                                                                                                                                                   |     |                                   |        |
|                                                                                                                                                                                                                   | Sub-arterial     | Kerr Road                   | Carriageway improvements, including sealed shoulders, intersection upgrades, lighting and stormwater. 5.5km from Borella Road to Table Top Road                                                                                        | ACC | Long                              | \$18M  |
|                                                                                                                                                                                                                   | Sub-arterial     | Kerr Road Extension         | Provide 1.3km long 2-lane carriageway south of Borella Road                                                                                                                                                                            | ACC | Long                              | \$8M   |
|                                                                                                                                                                                                                   | Sub-arterial     | Fallon Street Extension     | Provide 3.2km long 2-lane carriageway from Elizabeth Mitchell Drive and Kerr Road, including signalised intersections with Table Top Road, Elizabeth Mitchell Drive and Kerr Road and road reserve resumptions                         | ACC | Long                              | \$25M  |
|                                                                                                                                                                                                                   | Sub-arterial     | New Ring Road               | Upgrade 12.1km of existing roads, including Knobles Road, Hawksview Road, Kywanna Road and Williams Road to provide a ring road around the study area. This will include new pavements, intersection upgrades, lighting and stormwater | ACC | Long                              | \$70M  |
|                                                                                                                                                                                                                   | Arterial Road    | Thurgoona Drive Interchange | Upgrade intersections to signals, including earthworks and lighting.                                                                                                                                                                   | RMS | Medium                            | \$20M  |
|                                                                                                                                                                                                                   | Arterial Road    | Borella Road Interchange    | Amend line markings and kerb alignments and change signal sequence/phasing to provide optimum operation                                                                                                                                | RMS | Short                             | \$0.4M |
| *Note that cost are for full development of the road carriageway, including pavement, drainage, relocate services, minor waterway crossings, pedestrian, cyclist and public transport facilities, as appropriate. |                  |                             |                                                                                                                                                                                                                                        |     |                                   |        |
| Public Transport                                                                                                                                                                                                  |                  |                             |                                                                                                                                                                                                                                        |     |                                   |        |
|                                                                                                                                                                                                                   | Public Transport | Bus Stop Facilities         | Provision of bus stops along routes including bus shelters, pavements and lighting                                                                                                                                                     | ACC | As required bus route development | \$3M   |
|                                                                                                                                                                                                                   | Public Transport | Bus Route Expansion         | Expand bus service coverage (to satisfy minimum service standards, complementing private bus operations)                                                                                                                               | RMS | Staged with development           | TBA    |

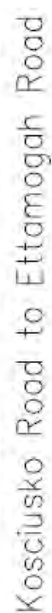
| Trails |                  |          |                                                                                                           |     |       |         |
|--------|------------------|----------|-----------------------------------------------------------------------------------------------------------|-----|-------|---------|
|        | Off Street Trail | Off St 1 | 7km trail in the north eastern section of the development area from VC1 to Kywanna Road                   | ACC | Long  | \$1.75M |
|        | Off Street Trail | Off St 2 | 5.3km trail in the north western section of the development area from Kerr Rd to Elizabeth Mitchell Drive | ACC | Short | \$1.33M |
|        | Off Street Trail | Off St 3 | 1.7km trail in the eastern development area near VC3                                                      | ACC | Long  | \$0.4M  |
|        | Off Street Trail | Off St 4 | 5km trail from MNC1 to VC3                                                                                | ACC | Short | \$1.25M |

# *Appendix A*

## *TYPICAL CROSS SECTIONS*







**GENERAL NOTES:**

- ALL WIDTHS SHOWN ARE MINIMUMS FOR THE PURPOSE OF ESTABLISHING A BASE DESIGN. ADDITIONAL WIDTH SHOULD BE PROVIDED TO ACCOMMODATE LOCALISED ROAD FEATURES INCLUDING:
  - AUXILIARY LANES AT INTERSECTIONS
  - FORMALISED ON-STREET PARKING
  - INCIDENT BUS BAYS
  - BIO-DIVERSITY REQUIREMENTS
  - BATTERS TO MATCH ADJOINING TOPOGRAPHY
- Z.A. ACOUSTIC TREATMENT REQUIREMENTS WILL VARY BASED ON TOPOGRAPHICAL AND ADJACENT LAND USES

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3. FOOTPATHS MAY BE REQUIRED IN BOTH VERGES BASED ON NEEDS OF DEVELOPMENT'S FRONTING ROADS.

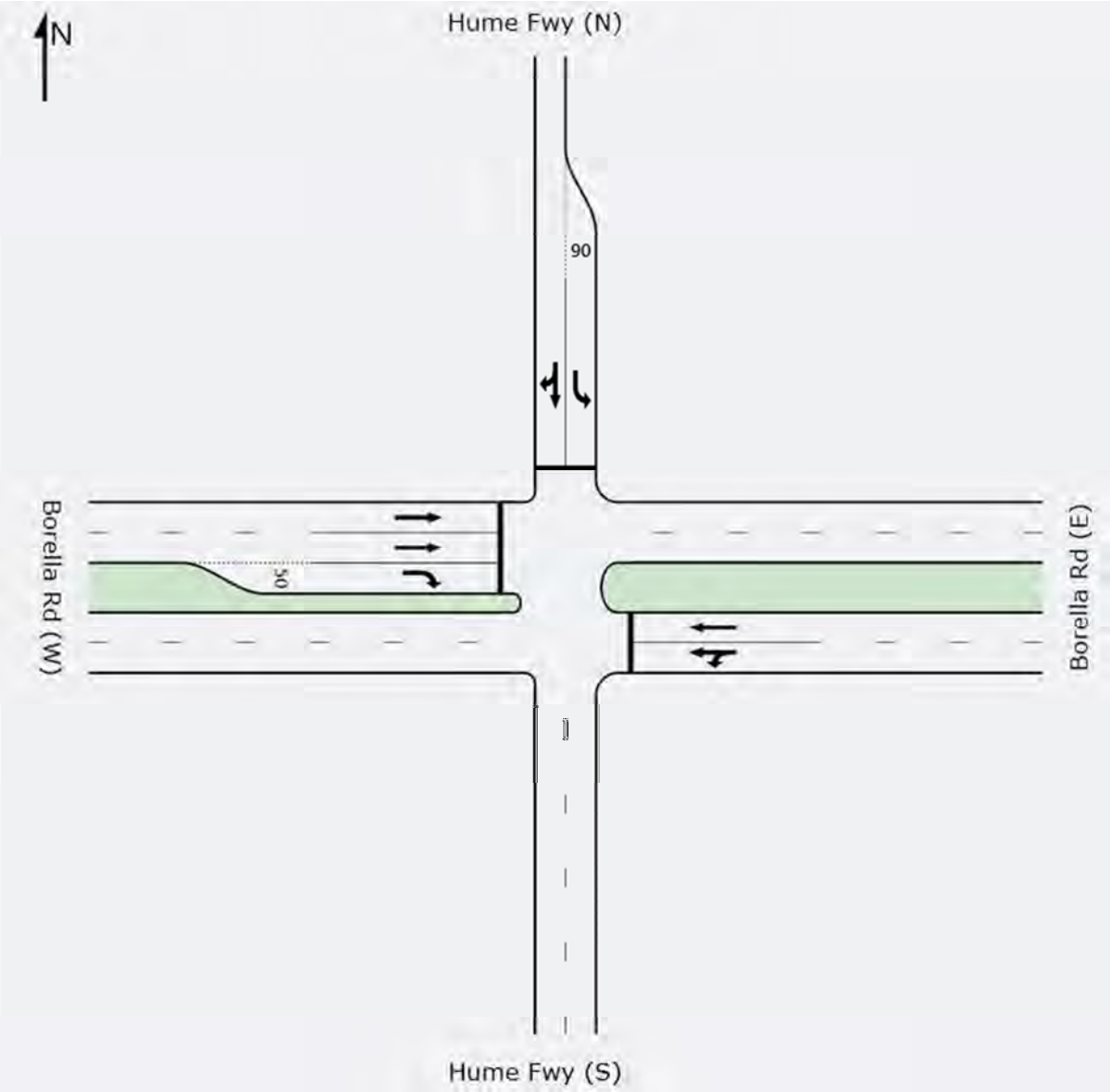
| REMARKS |      | DATE |      | BY |      | REMARKS |      |
|---------|------|------|------|----|------|---------|------|
| NO      | DATE | BY   | DATE | BY | DATE | BY      | DATE |
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# *Appendix B*

## *DETAILED SIDRA OUTPUTS*

**Borella Rd/Hume Fwy Interchange (East) - Current Layout**



## Borella Rd/Hume Fwy Interchange (East) – Current AM Performance

### MOVEMENT SUMMARY

Site: Borella Road Interchange-  
East\_AM

Borella Road Interchange - East

AM Peak Period

Signals - Fixed Time Cycle Time = 113 seconds (User-Given Phase Times)

| Movement Performance - Vehicles |      |                   |      |               |                   |                  |                                |            |              |                             |                    |
|---------------------------------|------|-------------------|------|---------------|-------------------|------------------|--------------------------------|------------|--------------|-----------------------------|--------------------|
| Mov ID                          | Turn | Demand Flow veh/h | HV % | Deg. Satn v/c | Average Delay sec | Level of Service | 95% Back of Queue Vehicles veh | Distance m | Prop. Queued | Effective Stop Rate per veh | Average Speed km/h |
| East: Borella Rd (E)            |      |                   |      |               |                   |                  |                                |            |              |                             |                    |
| 4                               | L    | 204               | 5.4  | 0.390         | 19.4              | LOS B            | 13.5                           | 99.2       | 0.53         | 0.87                        | 40.2               |
| 5                               | T    | 709               | 5.4  | 0.390         | 10.9              | LOS B            | 13.8                           | 101.1      | 0.53         | 0.47                        | 44.0               |
| Approach                        |      | 912               | 5.4  | 0.390         | 12.8              | LOS B            | 13.8                           | 101.1      | 0.53         | 0.56                        | 43.1               |
| North: Hume Fwy (N)             |      |                   |      |               |                   |                  |                                |            |              |                             |                    |
| 7                               | L    | 72                | 5.4  | 0.253         | 54.1              | LOS D            | 4.9                            | 35.9       | 0.92         | 0.77                        | 24.1               |
| 8                               | T    | 1                 | 5.4  | 0.935         | 84.1              | LOS F            | 21.5                           | 157.8      | 1.00         | 1.10                        | 17.0               |
| 9                               | R    | 277               | 5.4  | 0.973         | 92.4              | LOS F            | 21.5                           | 157.8      | 1.00         | 1.10                        | 17.0               |
| Approach                        |      | 349               | 5.4  | 0.973         | 84.5              | LOS F            | 21.5                           | 157.8      | 0.98         | 1.03                        | 18.1               |
| West: Borella Rd (W)            |      |                   |      |               |                   |                  |                                |            |              |                             |                    |
| 11                              | T    | 607               | 5.4  | 0.219         | 5.0               | LOS A            | 6.8                            | 49.5       | 0.34         | 0.29                        | 51.3               |
| 12                              | R    | 251               | 5.4  | 0.920         | 34.9              | LOS D            | 12.7                           | 93.2       | 0.78         | 0.88                        | 30.7               |
| Approach                        |      | 858               | 5.4  | 0.919         | 13.7              | LOS D            | 12.7                           | 93.2       | 0.47         | 0.47                        | 42.9               |
| All Vehicles                    |      | 2119              | 5.4  | 0.973         | 25.0              | LOS E            | 21.5                           | 157.8      | 0.58         | 0.60                        | 35.0               |

Level of Service (LOS) Method: Delay & v/c (HCM 2010).

Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.

LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).

SIDRA Standard Delay Model used.

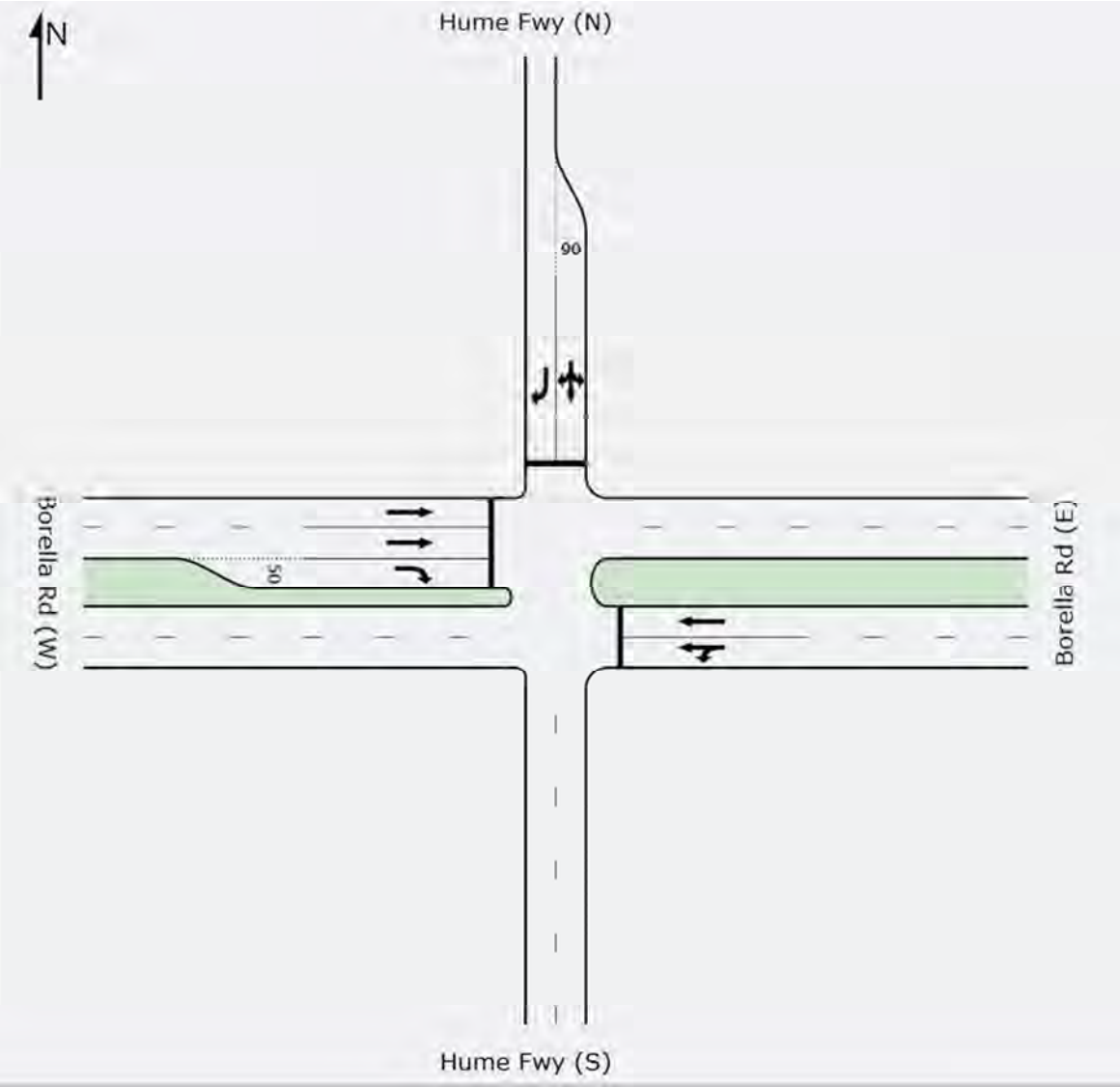
| Movement Performance - Pedestrians |                   |                   |                   |                  |                                      |            |              |                             |
|------------------------------------|-------------------|-------------------|-------------------|------------------|--------------------------------------|------------|--------------|-----------------------------|
| Mov ID                             | Description       | Demand Flow ped/h | Average Delay sec | Level of Service | Average Back of Queue Pedestrian ped | Distance m | Prop. Queued | Effective Stop Rate per ped |
| P2                                 | Across S approach | 0                 | 0.0               | X                | 0.0                                  | 0.0        | 0.00         | 0.00                        |
| All Pedestrians                    |                   | 0                 | 0.0               | NA               |                                      |            | 0.00         | 0.00                        |

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

**Borella Rd/Hume Fwy Interchange (East) - Proposed Layout**



## Borella Rd/Hume Fwy Interchange (East) – Predicted AM Performance in 2019, with optimum phasing

### MOVEMENT SUMMARY

Site: Borella Road Interchange-  
East\_AM - Alternative

Borella Road Interchange - East  
AM Peak Period (Alternative Layout)  
Signals - Fixed Time Cycle Time = 50 seconds (Practical Cycle Time)  
Design Life Analysis (Practical Capacity): Results for 9 years

| Movement Performance - Vehicles |      |                   |      |               |                   |                  |                                |                  |              |                             |                    |
|---------------------------------|------|-------------------|------|---------------|-------------------|------------------|--------------------------------|------------------|--------------|-----------------------------|--------------------|
| Mov ID                          | Turn | Demand Flow veh/h | HV % | Deg. Satn v/c | Average Delay sec | Level of Service | 95% Back of Queue Vehicles veh | Queue Distance m | Prop. Queued | Effective Stop Rate per veh | Average Speed km/h |
| East: Borella Rd (E)            |      |                   |      |               |                   |                  |                                |                  |              |                             |                    |
| 4                               | L    | 266               | 5.4  | 0.888         | 36.0              | LOS D            | 18.4                           | 134.7            | 1.00         | 1.14                        | 31.2               |
| 5                               | T    | 925               | 5.4  | 0.888         | 27.5              | LOS C            | 18.8                           | 137.4            | 1.00         | 1.14                        | 32.0               |
| Approach                        |      | 1190              | 5.4  | 0.888         | 29.4              | LOS C            | 18.8                           | 137.4            | 1.00         | 1.14                        | 31.8               |
| North: Hume Fwy (N)             |      |                   |      |               |                   |                  |                                |                  |              |                             |                    |
| 7                               | L    | 94                | 5.4  | 0.796         | 35.2              | LOS D            | 6.3                            | 46.1             | 1.00         | 0.96                        | 30.6               |
| 8                               | T    | 1                 | 5.4  | 0.796         | 26.7              | LOS C            | 6.3                            | 46.1             | 1.00         | 0.96                        | 30.7               |
| 9                               | R    | 361               | 5.4  | 0.796         | 35.1              | LOS D            | 6.3                            | 46.1             | 1.00         | 0.96                        | 30.6               |
| Approach                        |      | 456               | 5.4  | 0.796         | 35.1              | LOS D            | 6.3                            | 46.1             | 1.00         | 0.96                        | 30.6               |
| West: Borella Rd (W)            |      |                   |      |               |                   |                  |                                |                  |              |                             |                    |
| 11                              | T    | 792               | 5.4  | 0.350         | 5.5               | LOS A            | 4.9                            | 36.1             | 0.54         | 0.47                        | 49.8               |
| 12                              | R    | 327               | 5.4  | 0.880         | 36.1              | LOS D            | 8.4                            | 61.7             | 1.00         | 1.10                        | 30.1               |
| Approach                        |      | 1119              | 5.4  | 0.880         | 14.4              | LOS B            | 8.4                            | 61.7             | 0.67         | 0.65                        | 41.9               |
| All Vehicles                    |      | 2765              | 5.4  | 0.888         | 24.3              | LOS C            | 18.8                           | 137.4            | 0.87         | 0.91                        | 35.0               |

Level of Service (LOS) Method: Delay & v/c (HCM 2010).

Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.

LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).

SIDRA Standard Delay Model used.

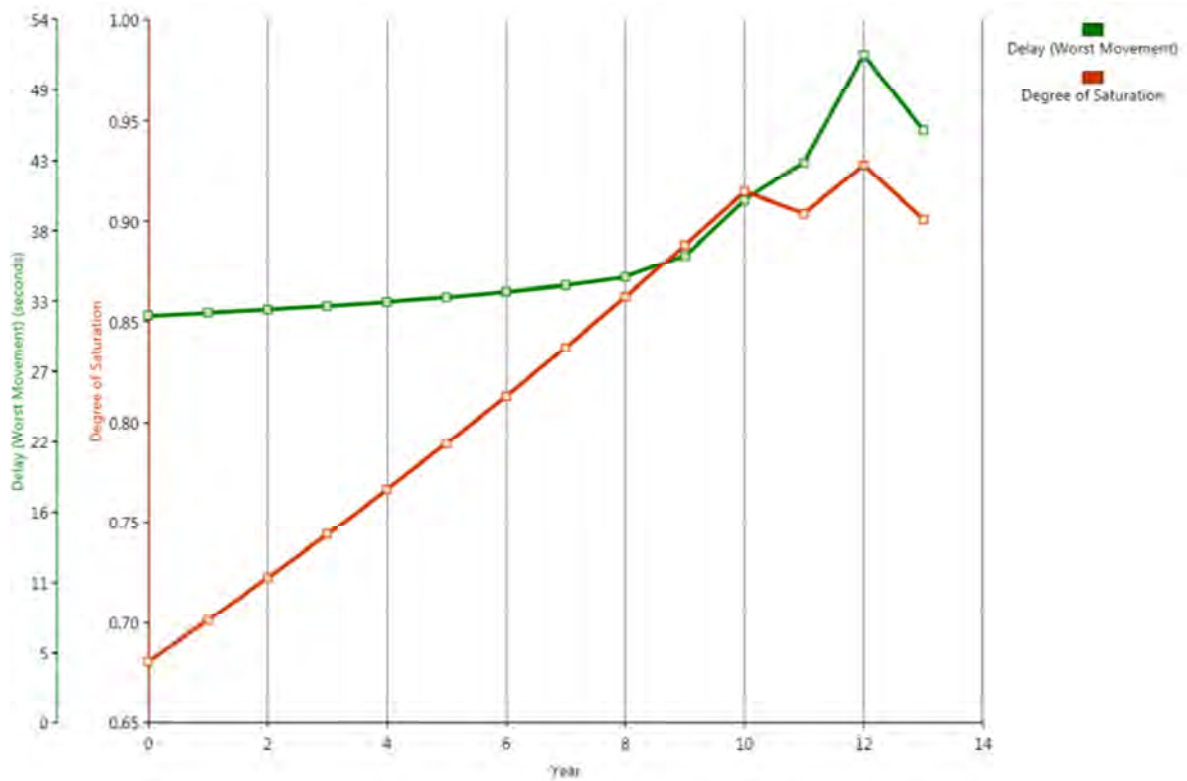
| Movement Performance - Pedestrians |                   |                      |                      |                  |                                            |                        |              |                                |
|------------------------------------|-------------------|----------------------|----------------------|------------------|--------------------------------------------|------------------------|--------------|--------------------------------|
| Mov ID                             | Description       | Demand Flow<br>ped/h | Average Delay<br>sec | Level of Service | Average Back of Queue<br>Pedestrian<br>ped | Queue<br>Distance<br>m | Prop. Queued | Effective Stop Rate<br>per ped |
| P2                                 | Across S approach | 0                    | 0.0                  | X                | 0.0                                        | 0.0                    | 0.00         | 0.00                           |
| All Pedestrians                    |                   | 0                    | 0.0                  | NA               |                                            |                        | 0.00         | 0.00                           |

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

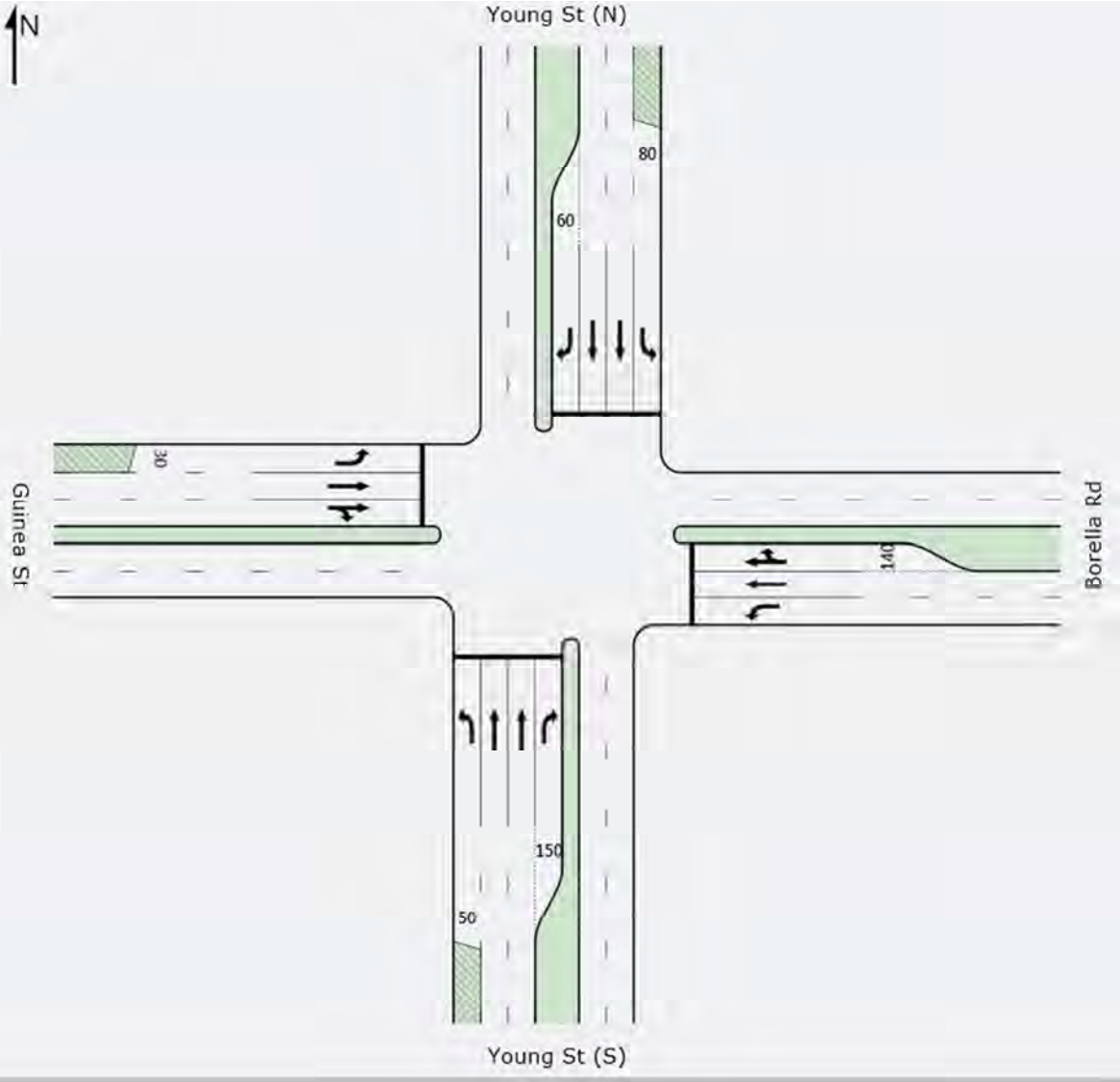
## Borella Rd/Hume Fwy Interchange (East) – Predicted AM Performance with 3% per annum Cumulative Growth – amended layout and phasing



### Notes:

- 0 year is 2010, therefore Year 14 is 2024
- Degree of saturation does not exceed the current 2010 level of 97% at any point in the assessment period.

**Borella Rd/Young St Intersection – Current Layout**



## Borella Rd/Young St Intersection – Current PM Performance

### MOVEMENT SUMMARY

Site: Guinea/Borella-Young\_PM

Borella Road/Guinea Street & Young Street, Albury

PM Peak Period

Signals - Fixed Time Cycle Time = 128 seconds (User-Given Phase Times)

| Movement Performance - Vehicles |      |                   |      |               |                   |                  |                                |            |              |                             |                    |
|---------------------------------|------|-------------------|------|---------------|-------------------|------------------|--------------------------------|------------|--------------|-----------------------------|--------------------|
| Mov ID                          | Turn | Demand Flow veh/h | HV % | Deg. Satn v/c | Average Delay sec | Level of Service | 95% Back of Queue Vehicles veh | Distance m | Prop. Queued | Effective Stop Rate per veh | Average Speed km/h |
| South: Young St (S)             |      |                   |      |               |                   |                  |                                |            |              |                             |                    |
| 1                               | L    | 49                | 1.1  | 0.226         | 47.8              | LOS D            | 3.4                            | 24.2       | 0.81         | 0.74                        | 25.9               |
| 2                               | T    | 545               | 1.1  | 0.566         | 45.3              | LOS D            | 16.3                           | 115.0      | 0.93         | 0.79                        | 25.6               |
| 3                               | R    | 455               | 1.1  | 1.018         | 99.7              | LOS F            | 34.9                           | 246.4      | 1.00         | 1.14                        | 16.1               |
| Approach                        |      | 1049              | 1.1  | 1.019         | 69.0              | LOS F            | 34.9                           | 246.4      | 0.95         | 0.94                        | 20.4               |
| East: Borella Rd                |      |                   |      |               |                   |                  |                                |            |              |                             |                    |
| 4                               | L    | 413               | 1.1  | 0.299         | 13.6              | LOS B            | 9.8                            | 69.3       | 0.35         | 0.74                        | 43.6               |
| 5                               | T    | 542               | 1.1  | 0.676         | 32.5              | LOS C            | 27.8                           | 196.2      | 0.88         | 0.78                        | 30.3               |
| 6                               | R    | 154               | 1.1  | 0.717         | 60.7              | LOS E            | 11.2                           | 79.5       | 0.97         | 0.89                        | 22.6               |
| Approach                        |      | 1110              | 1.1  | 0.717         | 29.4              | LOS C            | 27.8                           | 196.2      | 0.69         | 0.78                        | 32.4               |
| North: Young St (N)             |      |                   |      |               |                   |                  |                                |            |              |                             |                    |
| 7                               | L    | 135               | 1.1  | 0.467         | 62.1              | LOS E            | 9.5                            | 67.1       | 0.96         | 0.80                        | 22.1               |
| 8                               | T    | 345               | 1.1  | 0.570         | 54.8              | LOS D            | 11.8                           | 83.3       | 0.98         | 0.80                        | 23.1               |
| 9                               | R    | 70                | 1.1  | 0.293         | 54.5              | LOS D            | 5.1                            | 35.7       | 0.88         | 0.76                        | 24.1               |
| Approach                        |      | 549               | 1.1  | 0.570         | 56.6              | LOS E            | 11.8                           | 83.3       | 0.96         | 0.79                        | 22.9               |
| West: Guinea St                 |      |                   |      |               |                   |                  |                                |            |              |                             |                    |
| 10                              | L    | 60                | 1.1  | 0.211         | 14.6              | LOS B            | 1.9                            | 13.7       | 0.37         | 0.67                        | 37.0               |
| 11                              | T    | 597               | 1.1  | 0.483         | 30.8              | LOS C            | 16.6                           | 117.0      | 0.78         | 0.67                        | 27.7               |
| 12                              | R    | 12                | 1.1  | 0.483         | 40.0              | LOS D            | 16.6                           | 117.0      | 0.83         | 0.85                        | 26.3               |
| Approach                        |      | 668               | 1.1  | 0.483         | 29.5              | LOS C            | 16.6                           | 117.0      | 0.75         | 0.68                        | 28.3               |
| All Vehicles                    |      | 3376              | 1.1  | 1.018         | 46.1              | LOS F            | 34.9                           | 246.4      | 0.83         | 0.81                        | 25.3               |

Level of Service (LOS) Method: Delay & v/c (HCM 2010).

Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement

LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).

SIDRA Standard Delay Model used.

Processed: Friday, 23 July 2010 9:57:51 AM

SIDRA INTERSECTION 5.1.10.2009

Project: H:\Work\28299 Albury Traffic Study\Traffic Surveys\Arterial Network Review 2012.sip

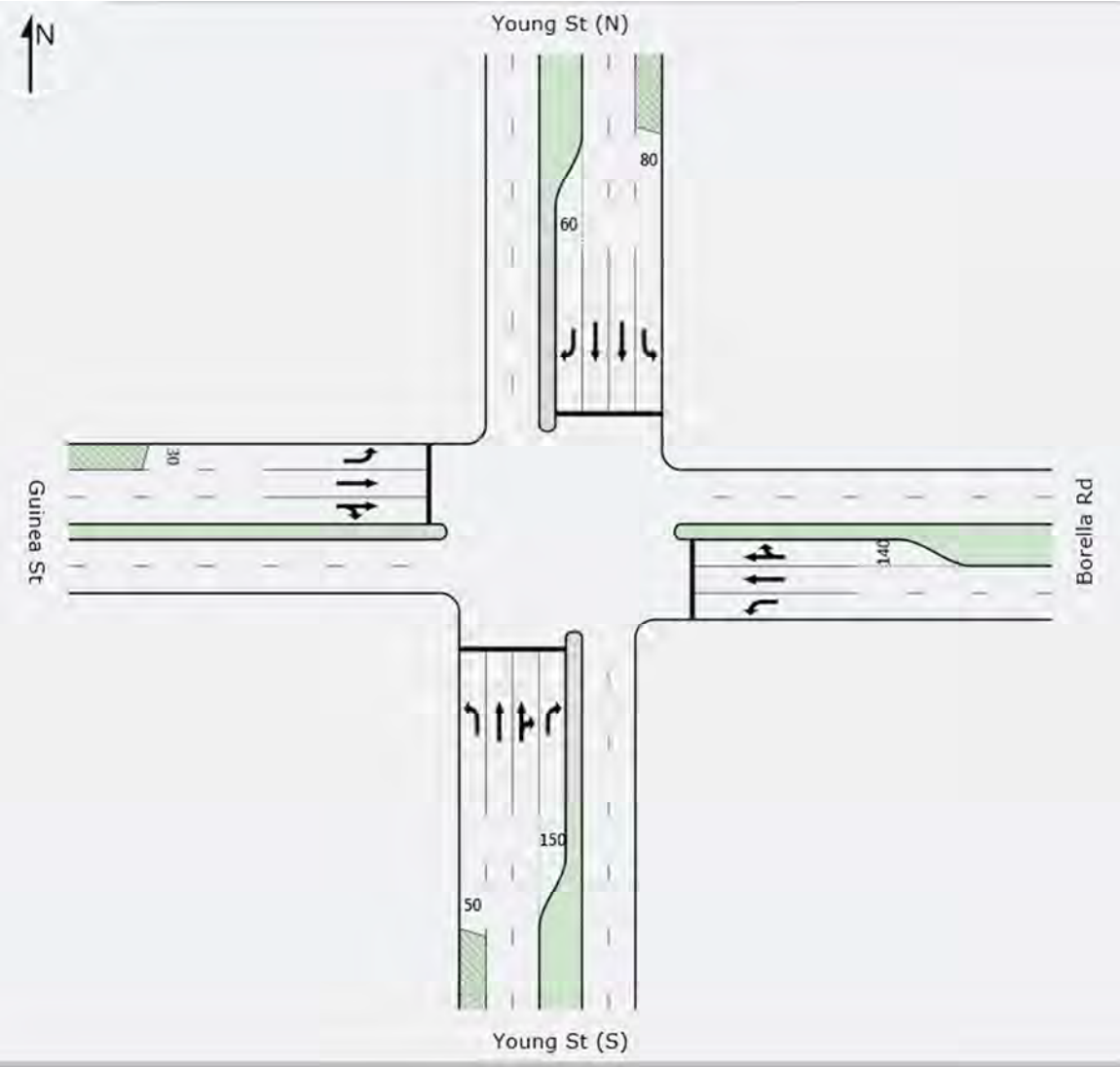
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**INTERSECTION**

Borella Rd/Young St Intersection – Proposed Layout



## Borella Rd/Young St Intersection – Predicted PM Performance in 2016, with optimum phasing

### MOVEMENT SUMMARY

Site: Guinea/Borella-Young\_PM -  
Alternative

Borella Road/Guinea Street & Young Street, Albury  
PM Peak Period (Alternative Layout)  
Signals - Fixed Time Cycle Time = 110 seconds (Practical Cycle Time)  
Design Life Analysis (Practical Capacity): Results for 6 years

| Movement Performance - Vehicles |      |                   |      |               |                   |                  |                                |            |              |                             |                    |
|---------------------------------|------|-------------------|------|---------------|-------------------|------------------|--------------------------------|------------|--------------|-----------------------------|--------------------|
| Mov ID                          | Turn | Demand Flow veh/h | HV % | Deg. Satn v/c | Average Delay sec | Level of Service | 95% Back of Queue Vehicles veh | Distance m | Prop. Queued | Effective Stop Rate per veh | Average Speed km/h |
| South: Young St (S)             |      |                   |      |               |                   |                  |                                |            |              |                             |                    |
| 1                               | L    | 59                | 1.1  | 0.215         | 35.6              | LOS D            | 2.2                            | 15.4       | 0.73         | 0.74                        | 30.3               |
| 2                               | T    | 577               | 1.1  | 0.877         | 47.4              | LOS D            | 32.3                           | 228.6      | 1.00         | 1.03                        | 25.0               |
| 3                               | R    | 616               | 1.1  | 0.877         | 58.9              | LOS E            | 14.5                           | 102.3      | 1.00         | 1.08                        | 23.0               |
| Approach                        |      | 1252              | 1.1  | 0.877         | 52.5              | LOS D            | 32.3                           | 228.6      | 0.99         | 1.04                        | 24.1               |
| East: Borella Rd                |      |                   |      |               |                   |                  |                                |            |              |                             |                    |
| 4                               | L    | 493               | 1.1  | 0.351         | 12.7              | LOS B            | 8.4                            | 59.1       | 0.35         | 0.75                        | 44.5               |
| 5                               | T    | 647               | 1.1  | 0.736         | 26.3              | LOS C            | 28.3                           | 199.9      | 0.88         | 0.80                        | 33.2               |
| 6                               | R    | 184               | 1.1  | 0.882         | 71.3              | LOS E            | 12.3                           | 86.6       | 1.00         | 1.06                        | 20.4               |
| Approach                        |      | 1325              | 1.1  | 0.882         | 27.5              | LOS C            | 28.3                           | 199.9      | 0.70         | 0.81                        | 33.4               |
| North: Young St (N)             |      |                   |      |               |                   |                  |                                |            |              |                             |                    |
| 7                               | L    | 161               | 1.1  | 0.685         | 60.4              | LOS E            | 8.7                            | 61.4       | 1.00         | 0.84                        | 22.5               |
| 8                               | T    | 412               | 1.1  | 0.835         | 57.7              | LOS E            | 12.0                           | 84.8       | 1.00         | 0.96                        | 22.4               |
| 9                               | R    | 84                | 1.1  | 0.833         | 72.1              | LOS E            | 5.0                            | 35.6       | 1.00         | 0.91                        | 20.2               |
| Approach                        |      | 656               | 1.1  | 0.835         | 60.2              | LOS E            | 12.0                           | 84.8       | 1.00         | 0.92                        | 22.1               |
| West: Guinea St                 |      |                   |      |               |                   |                  |                                |            |              |                             |                    |
| 10                              | L    | 71                | 1.1  | 0.273         | 17.9              | LOS B            | 1.7                            | 11.9       | 0.48         | 0.69                        | 34.9               |
| 11                              | T    | 713               | 1.1  | 0.533         | 24.5              | LOS C            | 15.4                           | 109.1      | 0.77         | 0.67                        | 30.3               |
| 12                              | R    | 14                | 1.1  | 0.533         | 33.6              | LOS C            | 15.4                           | 109.1      | 0.82         | 0.85                        | 28.5               |
| Approach                        |      | 798               | 1.1  | 0.533         | 24.1              | LOS C            | 15.4                           | 109.1      | 0.74         | 0.67                        | 30.6               |
| All Vehicles                    |      | 4031              | 1.1  | 0.882         | 39.9              | LOS D            | 32.3                           | 228.6      | 0.85         | 0.87                        | 27.3               |

Level of Service (LOS) Method: Delay & v/c (HCM 2010).

Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement

LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).

SIDRA Standard Delay Model used.